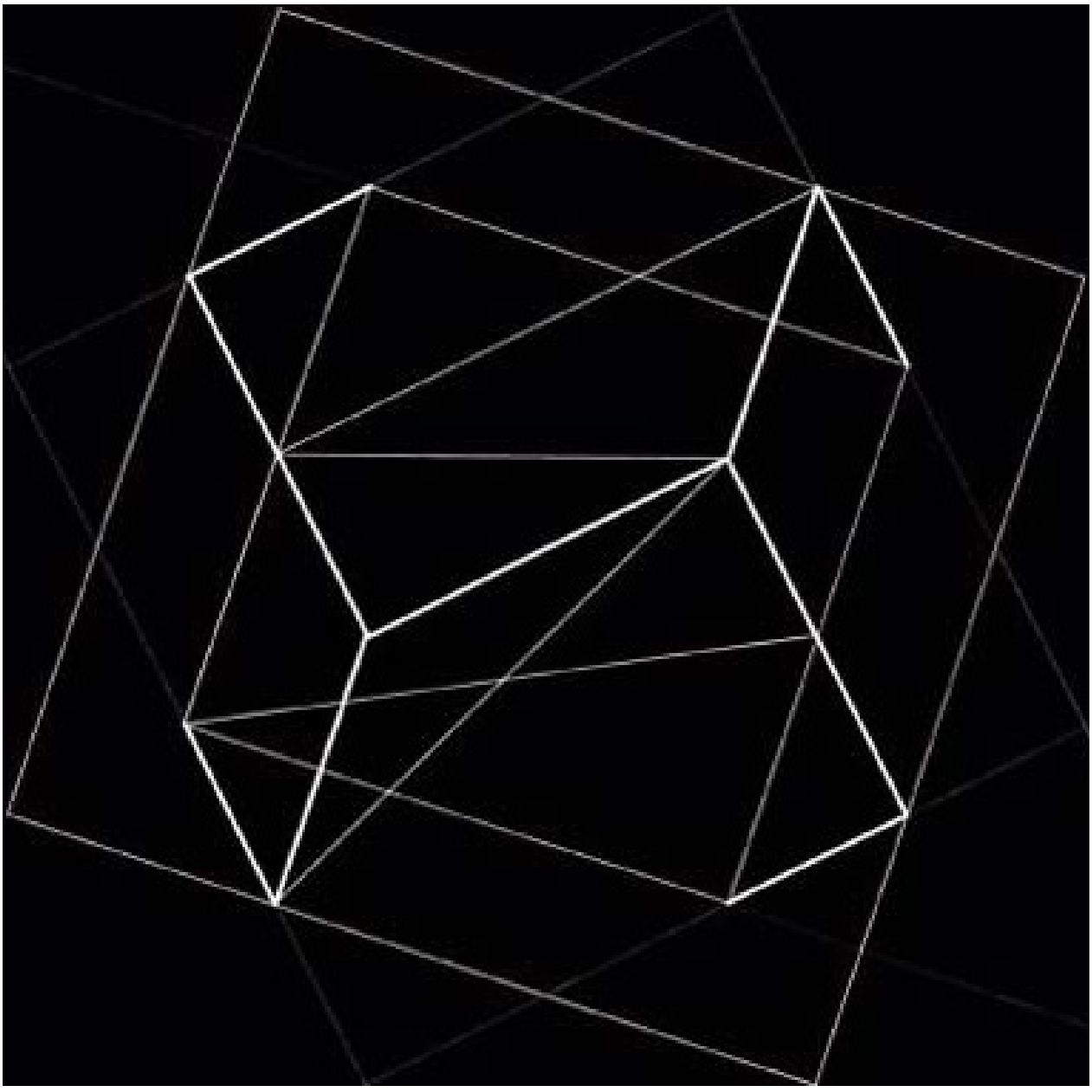
Upcycling Post-Industrial Landscapes

Repowering Haarlems gasfabriek terrain



Dirco Kok

Supervisor Kevin Raaphorst MSc **Examinor** Prof. dr. ir. Adri van den Brink **Coordinator** Dr. ing. Sven Stremke

COLOPHON

Author: Dirco Kok

Student number: 960413-455-040

Supervisor: Kevin Raaphorst MSc

Examinor: Prof. dr. ir. Adri van den Brink

Supervisor: Dr. ing. Sven Stremke

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Image front page:

Transformation of a Scheme No.23 by Josef Albers, 1951

An appreciated Bauhaus artist of the author

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Introduction

This thesis is the final design project for my Bachelor studies in Landscape Architecture at Wageningen University. The Bachelor thesis consists of scientific research in landscape related domains, combined with design skills. This way, it combines both worlds we touched upon in this Bachelor study. A set of four research questions will be answered, where after a design will follow, based on this foundation. The research area of this thesis course was within the Metropolitan Region of Amsterdam (MRA). This is a collaborative platform consisting out of 33 municipalities, including Amsterdam itself, two provinces and the Vervoersregio Amsterdam. The platform consists out of diverse regions, however, on a metropolitan level they share the same challenges and chances. These then are the domains where cooperation and a shared policy agenda is attempted.

Context

Due to economic prosperity and talent attraction, the Metropolitan Region of Amsterdam (MRA) deals with an increasing number of inhabitants of 2,8 million to 3,2 million in 2040. Thereby, the pressure on space for all land-uses is increasing (Metropoolregio Amsterdam, 2008). The most important reason for people to live or work in the MRA is the good quality of life (Metropoolregio Amsterdam, 2008), which raises the question on how to keep the metropolitan region attractive. Here, the concept 'smart restructuration' (Metropoolregio Amsterdam, 2008) can be introduced. This is related with the vision of the previous state's master builder (Rijksbouwmeester), Frits van Dongen. He states that the focus in urban development shifted from urban expansion towards infill development (Dongen, 2015). Hereby, the areas within the city boundaries that are not in use anymore, could be approached for infill developments. In the project area of the MRA, a part of these areas are brownfields; post-industrial vacant or derelict land. Those plots are often characterised by contaminated soil, which makes it hard to directly redevelop them for other land-uses than industry (Kirkwood, 2001). This obstructs the restructuration of those plots, which could be solved by environmentally polluting and high-cost, off-site soil remediation. Kirkwoord (2001) proposes a new approach to combine phytoremediation technologies with creating new functions on brownfields. Reichenauer & Germida (2008) define phytoremediation as an emerging technology for cleaning up sites that are contaminated with hazardous chemicals.

Location

Haarlem is charaterised by the river Spaarne that flows through the city. Between 1896 and 1902, a big complex of buildings arose along the banks of the Spaarne in the Waarderpolder for the municipal gasworks. The gasworks operated until the sixties, when natural gas was found in the north of The Netherlands. Due to its historical land-use, the area deals with contaminated soil (Hoofdafdeling Stadszaken Afdeling Ruimtelijk Beleid, 2010). For other land-uses than industry, the area needs to be rehabilitated. Today, the area houses some cultural functions in the former gasworks buildings. Furthermore, the area consists of left-over spaces, which give it a cluttered appearance. In the rest of Haarlem, new housing developments will take place (Gemeente Haarlem, 2017). This area has not been assigned for housing and thus has potential to offer a new green space inside the city fabric, while improving the cluttered appearance of the area. The aim is to combine phytoremediation with new functions on this brownfield.

GRQ: recycling industrial landscapes
How can we design the transformation of the Gasfabriek terrain into post-industrial landscape park, while incorporating sustainable soil remediation principles into the design?

Knowledge questions

SRQ: location
What are the spatial characteristics and the site-specific problems of the location regarding soil contamination and the 'as found' in-situ, and how do they relate to one another?

Knowledge gathered through a thorough analysis of maps, literature and site visits

SRQ: post-industrial landscapes
What characterises a successful post-industrial landscape transformation regarding the aspect of contaminated sites?

Literature research

SRQ: phytoremediation
What phytoremediation principles would fit to the site of the Gasfabriek area?

Literature research

SRQ: landscape park
What charaterises a succesful landscape park and phytoremediation park, and how could these aesthetics and charecteristics be combined?

Two small case studies on landscape park and two case studies on phytoremediation parks.

Design question:
How can the interventions for a successful post-industrial transformation and the requirements of sustainable soil remediation be combined into a coherent design?

fig. 01 - Research and design questions within this thesis

Thesis statement/objective

The research presented in this proposal aims to form a design strategy for the transformation of the Gasfabriek terrain into a post-industrial landscape park, by identifying the way in which sustainable soil remediation could be integrated in the design. It asks which soil remediation methods could be applied in the case of the Gasfabriek terrain, how they could be applied in combination with new functions on-site and how the aesthetics of the transformation will look like. This all will then be tested in a design for Haarlems Gasfabriek terrain.

Research questions

Following from the research objective of this thesis, the General Research Question (GRQ) is: 'How can we design the transformation of the Gasfabriek terrain into post-industrial landscape park, while incorporating sustainable soil remediation principles into the design?' To answer this GRQ, it is supported by one design question and four Specific Research Questions (SRQ) consisting out of knowledge questions. They are presented in figure 1.

Method

To accomplish this objective, the research-by-design method will be used. This means I will answer my research questions for evidence and knowledge. The design question will be answered by means of a landscape design. However, before I start designing, I need to compile the required knowledge to deepen into the domain of research and to incorporate this afterwards in a design that will answer my design question. This means that in the design process, I will be switching back and forth between the gathered knowledge, the landscape analysis and the landscape design. To further specify this, I will use the basics of the research by design concept by Hevner (2007) (Hevner, 2007) and modify it to my specific theme and research questions. See figure 4 for a detailed structure plan. In this figure, the literature and case studies will provide design guidelines regarding applying phytoremediation, transformation into a landscape park. The location will provide site specific design guidelines after analysing the opportunities of the site.

The reliability of phytoremediation in the design will be built upon tested principles provided by literature. However, the reliability of the transformation of post-industrial landscapes is related to the designer and harsh to be performed repeatedly. This is linked to the personal way of interpreting the pre-existing of the site. The validity will be controlled by using various sources during the literature research; this triangulation increases the validity. Besides, I will not only use site-visits to gather information in the location part of the research method, but also lean upon maps, reports and municipal archives.

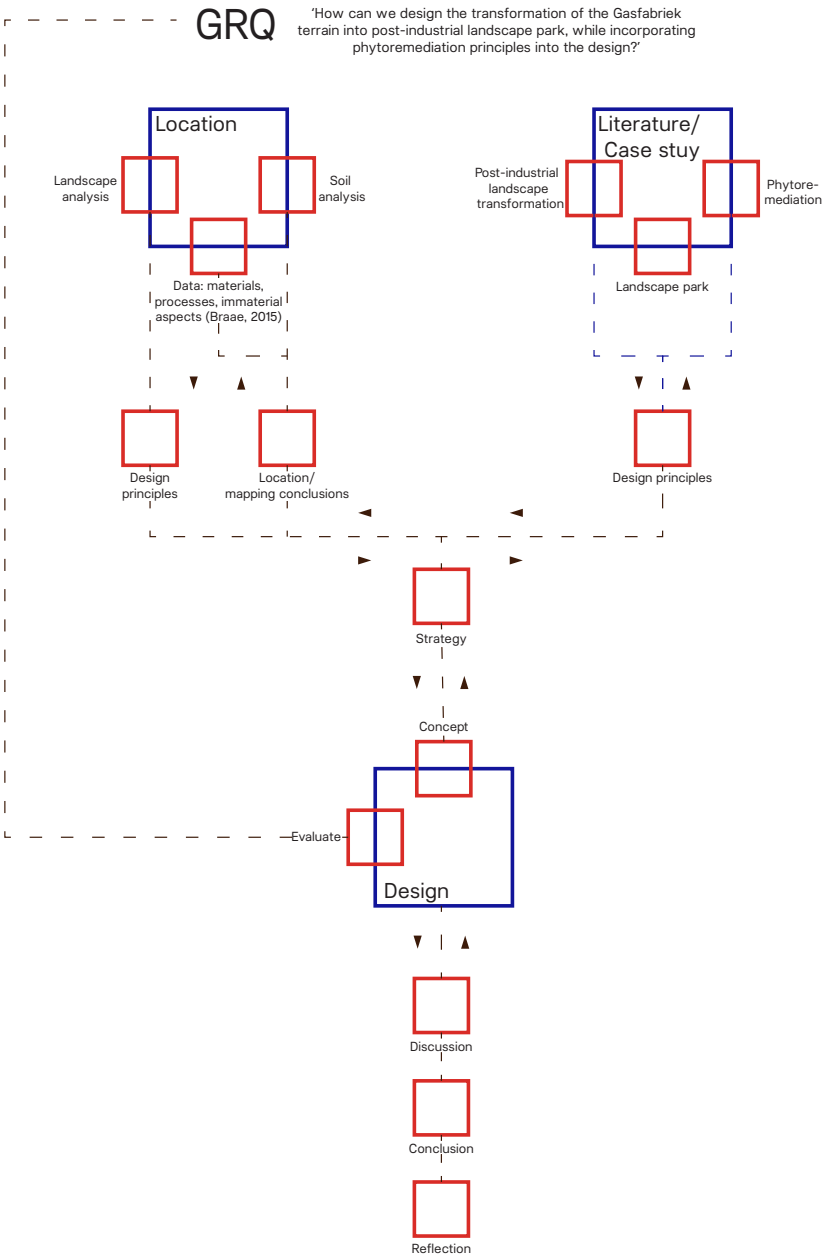


fig. 02 - Method structure plan

Operationalisation of concepts

The used concepts are complex and have different meanings, so definitions are given in the context of this research. With the concept of the post-industrial landscape park, I will refer to the definition of Braae (2015): brownfield transformed into a park, where industrial relics were not demolished but perceived as integral parts of the overall concept and then imbued with new meaning and use. Regarding the concept of phytoremediation, I will refer to the definition of Kirkwood (2001): the use of plants for the uptake, removal or mitigation of on-site pollutants. Contaminated sites will be approached as sites dealing with soil polution.

Part of the objective of this thesis is to transform the Gasfabriek terrain into a post-industrial landscape park. What is meant with the concept 'transformation of a post-industrial landscape' is stated above, but still open is what is referred to as a 'landscape park'.

The aim of this thesis is to combine a sustainable way of cleaning up contaminated soil with the transformation of a brownfield. The sustainable way of cleaning up contaminated soil will then be linked to the transformation of a brownfield by means of a design. The expected outcome, by mean of a design, is a post-industrial landscape park. In order to establish the combination, we need to know how a landscape park is built up, the program for such a park and what its aesthetics are. For the definition of a successful landscape park I will refer to the definition stated by Harnik (2006): a park that provides recreation, natural beauty, and distinctive open spaces for people.

Location

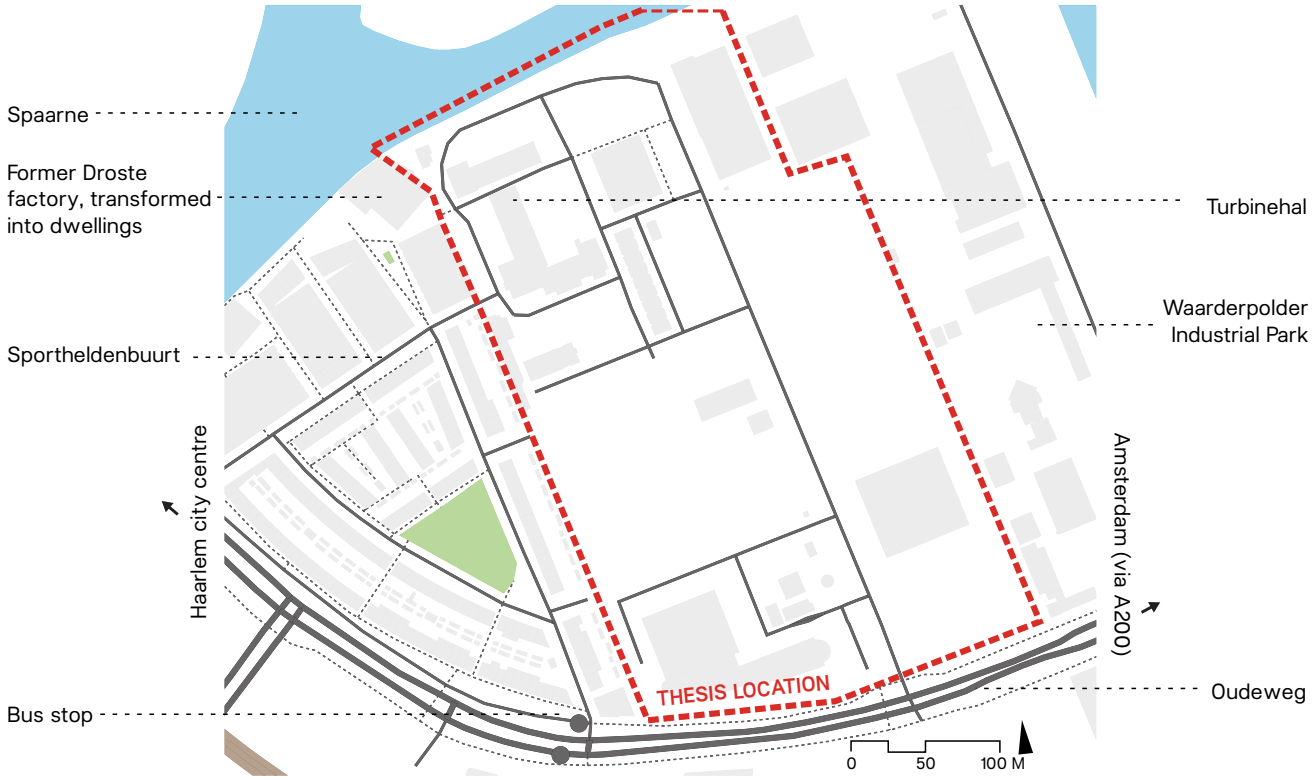


fig. 03 - General location overview

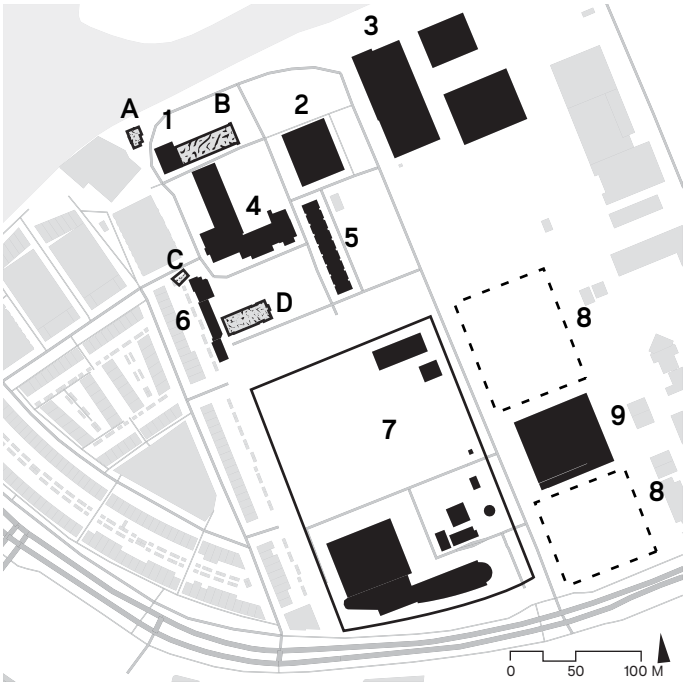
Before we make a design for the former Gasfabriek area of Haarlem, we need to analyse the site itself and its surroundings. The result is a conclusion, the diagnosis, that shows the opportunities and challenges of the site. Besides, the analysis is essential as well to put the design in its original context.

Location

The Gasfabriek terrain is an area of 7 ha and located on the east bank of the Spaarne which seperates the area from the city centre of Haarlem. In the south, the area is bordered by the Oudeweg which connects the area to the city centre and the highway to Amsterdam. The eastern border is formed by the neighbourhood Sportheldenbuurt and on the western border the area melts into the bigger industrial park of Waarderpolder.

Industrialisation

Because of its location along the banks of the Spaarne the Waarderpolder was very suitable to serve as a harbour and industrial area. With the introduction of the Amsterdam-Haarlem rail line in 1838, the industrialisation of Haarlem got an impulse. Because of the improved accessibility of Haarlem, industrial companies could transform into important industrial complexes, such as chocolate factory Droste that neighbours the Gasfabriek terrain. Followed by this, the number of inhabitants exploded, whereby outside the demolished Medieval city wall new workers districts popped up. This was the start of Haarlem's jump to the east bank of the river, as the city on the west bank got full. The real conquering of the area started between 1896 and 1902, when Haarlem's Lichtfabriek was built to cater the increasing demand for gas and electricity (figure 11). It was the municipal gas plant and power plant, with 'licht' referring to the Dutch word for light, the primary purpose this factory had been built for. In the 1960s, when natural gas was found in Groningen, the gasworks got into disuse and closed its doors. The Gasfabriek terrain was left abandoned. Contrary to this, from 1961, the industrial park of Waarderpolder grew exponentially fuelled by the rise of the automobile as the area was a good base of operation near main roads. As the Waarderpolder was on the edge of an old dune and peat polder, sand and debris was used to elevate the soil level for



Occupied:

1. Het Meterhuis (restaurant/bar)
2. Mixed-use offices and start-ups
3. Municipal waste and recycling services HQ (no 'Milieuplein')
4. Creative studios, start-ups and event location
5. Business units
6. Studio ateliers and eexhibition centre
7. Liander electricity services
9. Development parcels
9. Post-NL distribution centre

Derilict building:

A. Office gaswacht
B. Zuiveringshal
C. Porter's house
D. Directiegebouw

fig. 04 - Current land and building occupation

At the moment, a few roads for cars pass through the area. These all begin and end at the Oudeweg. When new functions are added to the area, accesibility is something to take into account as there is one single access in the south dor cars. Furthermore, the connection for slow traffic between the neighbouring city and the site could be improved, as the current transitions are abrupt or even do not exist as they are overgrown or fenced of. This is the case for black arrow 1 and 2 on the left.

On the moment, the accesibility is primarily focussed on automobiles. Compare the dense pedestrian infrastructure (pink dashed lines) in the Sportheldenbuurt compared to the site and we can conclude that a pedestrian friendly infrastructure is lacking.

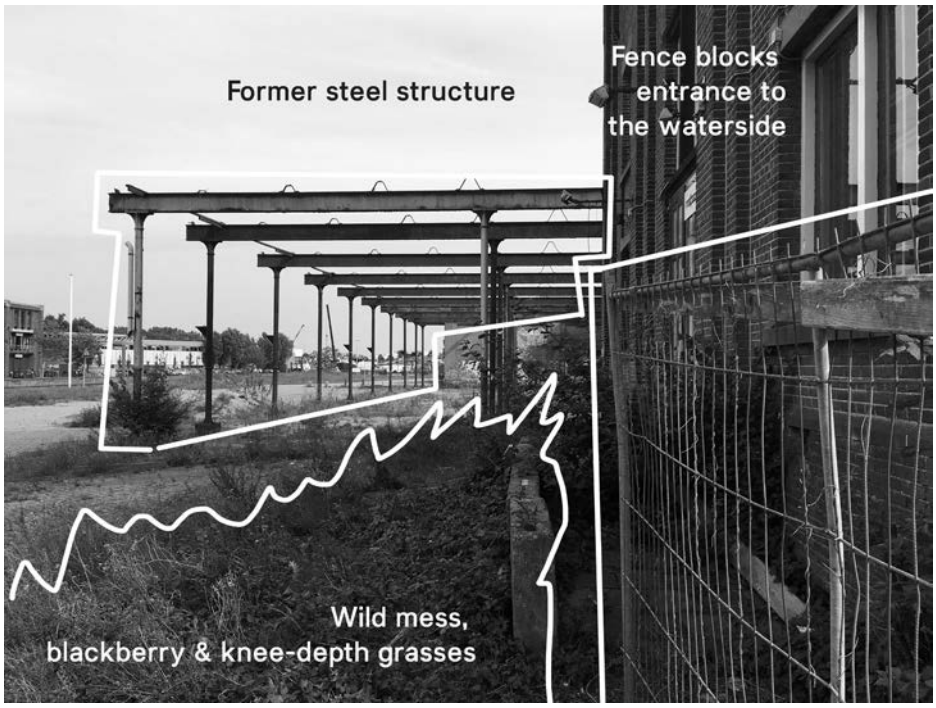
fig. 05 - Current connectivity

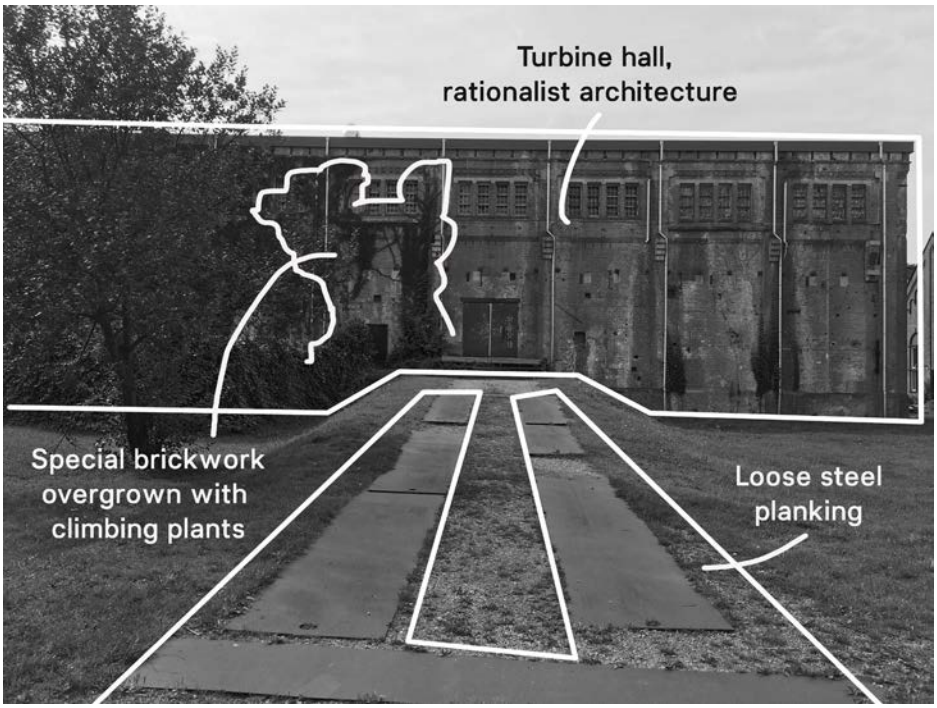
all developments in the area. In 1988 the Waarderpolder had grown in its spatial form as we know it now. Of the large-scale industry that was putting a stamp on Haarlem in the twentieth century, nothing much has been left. Gradually, the city is increasingly focussing on public and business services.

Current situation

Zooming in on the Gasfabriek terrain again, the area has been encapsulated by new urban fabric of Haarlem. Industrial activities moved further from the city centre where they found more space and better connectivity and the increased focus on the service economy has not yet given a full answer for the future of this brownfield. It is characterised as a large area with a low density of activities spread out over the total area.

Because of its past land-use the area is left-over with the polluted soil caused by the activities of the gasworks and power plant. The level of soil pollution exceeds the legal value for the land-use of housing, however it allows industry and leisure related land-use functions. With its location close to the city centre, the area has been discovered as an experimental area with a variety of ateliers, small businesses, an event hall and cafes that have been settling down. See figure 4 for the current occupation of the built environment on-site. The 'Turbinehal', number 4 in figure 4, has a monumental status as it is a well preserved example of industrial heritage that expresses rationalism (Rijksdienst voor het Cultureel Erfgoed). One could state that with the occupation of the





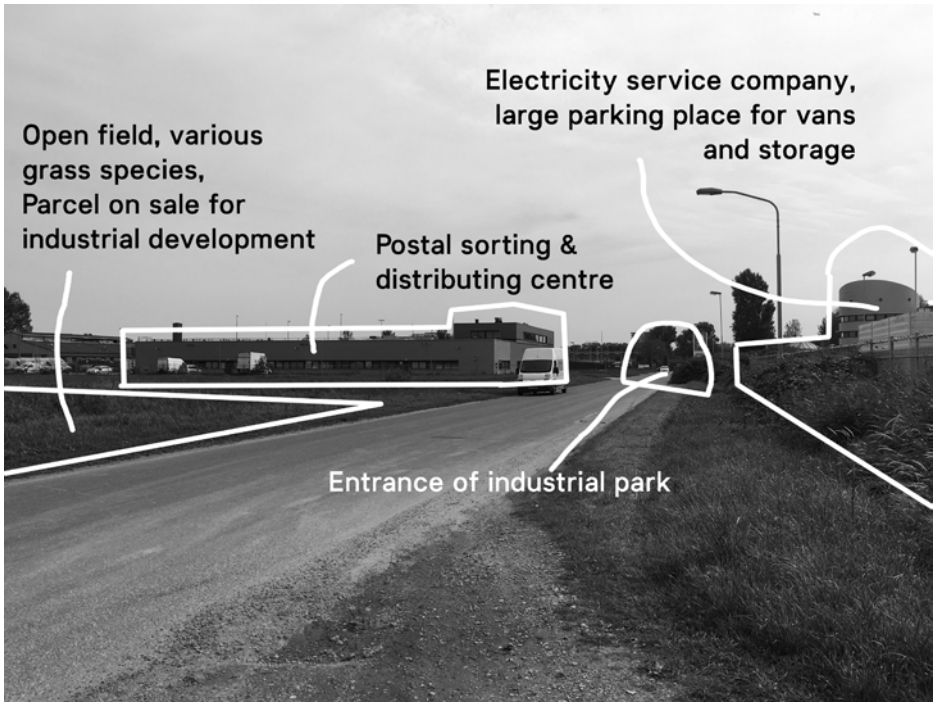
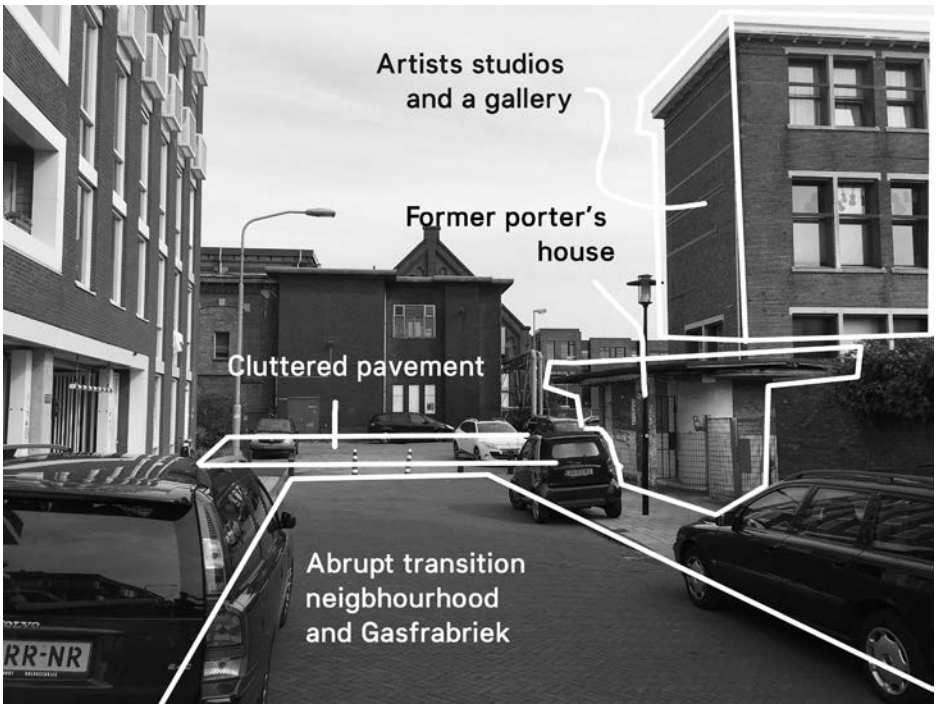


fig. 06 - Location #1

fig. 07 - Location #2

fig. 08 - Location #3



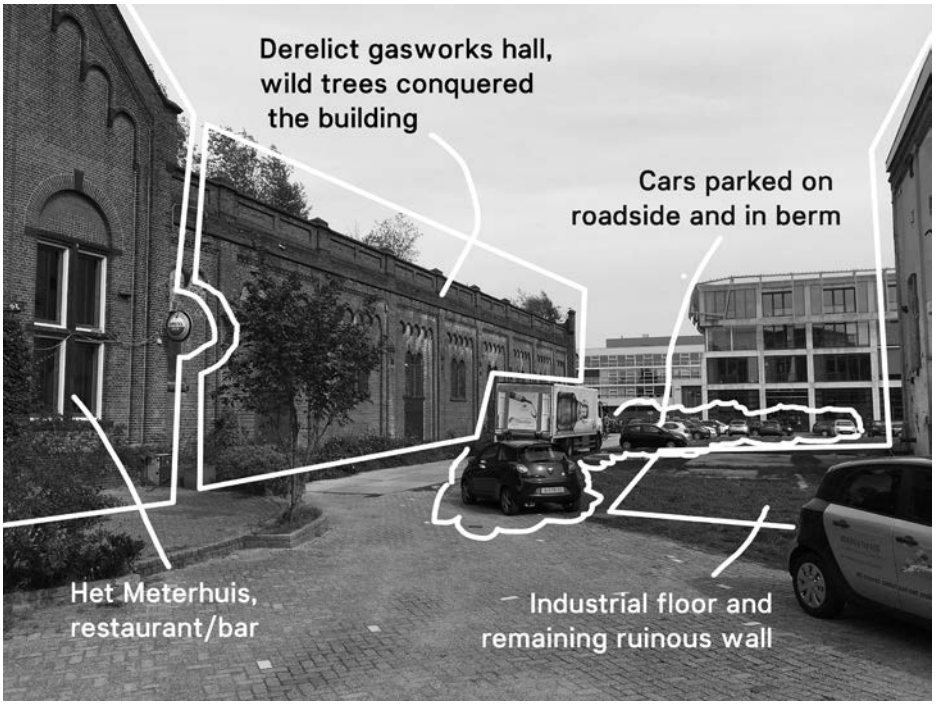


fig. 09 - Location #4

fig. 10 - Location #5

majority of industrial buildings and 2 newly added blocks, the potential of the site has already been discovered.
The ingredients for further developments on the site are already there, but the Gasfabriek terrain deals with a cluttered appearance and lacks on quality of public space. This statement is worked out in figure 6-10.
Furthermore, figure 5-10 contain a further analysis of the area.

Problem statement

As stated above, a full answer for the re-use of this brownfield has not been found yet. In the rest of Haarlem, new housing developments will take place (Gemeente Haarlem, 2017). The reason for this is that once again the population and economic activities of the Metropolitan Region of Amsterdam are increasing, whereby new space for businesses and housing is needed in the metropolitan region (Bureau Metropoolregio Amsterdam, 2017; Metropoolregio Amsterdam, 2008).
The expectation is that the number of inhabitants will increase with at least 10% by 2040 (Gemeente Haarlem, 2015). Amsterdam, as the centre of the metropolitan region, deals with an overstrained housing market. Through this, Haarlem has become an overspill town of Amsterdam on the housing market, as housing prices are below the average in Amsterdam while offering comparable urban living conditions. In the past, urban expansion of Haarlem has been rolled out as an urban tapestry on top of the polder landscape, image 12 for the neighbourhood of Schalwijk (Noord-Hollands Archief).

The practice of urban expansion by rolling out the urban tapestry over the countryside is seen as undesirable by the public and planning agencies nowadays. There is a public awareness that eating up bits of the countryside landscape for housing is not how we should manage the Randstad landscape. This societal trend has been picked up by the former states building master, Frits van Dongen, who advocated for urban infill developments instead of urban expansion and put this topic even bigger on the spatial agenda. (Dongen, 2015) In his work he argues for the importance of urban brownfields transformation into new neighbourhoods to accommodate this tendency of urban infill developments.

For these redevelopments to take place, the polluted soil of the Gasfebriek terrain needs remediation, as the level of soil pollution exceeds the legal value for the land-use of housing. Historical land-uses have had a polluting effect on the soil of the Gasfabriek terrain. In the past, the issue of soil pollution has been dealt with by simply topping up a layer of clean soil on the polluted soil, thereby leaving the pollution in the ground. Another option that is used a lot nowadays is off-site soil remediation by transporting the soil by trucks to a remediation factory. Here the soil receives an engineering-based treatment resulting in clean soil. However, this treating technique is expensive and has a high negative environmental impact (Cappuyns, 2013). But why not clean the Gasfabriek terrains soil in a more environmental friendly way within this

fig. 11 - Gasfabriek terrain back in the days of production

fig. 12 - Haarlem Schalkwijk, with the polders on the left

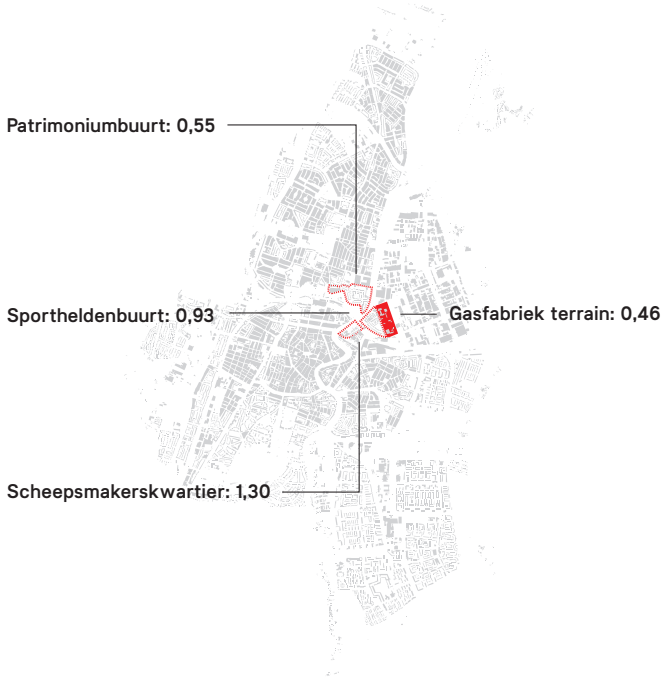


fig. 13 - Floor Space Index in the neighbourhoods surrounding the gasfabriek terrain and the Gasfabriek terrain itself

new transformation phase? Hereby we could combine 'work with work'.

Specification on Haarlem's urbanisation

Haarlem's demand for new housing especially applies to elderly (65+) and single-person households; the number of family households will not increase. When looking at the demand side, the core for Haarlem is to focus on affordable and medium-priced apartments, both rental and buy options. (Gemeente Haarlem, 2015) The municipality of Haarlem anticipates to the regional housing demands. Furthermore, the municipality of Haarlem has set the goal to make effort on realising ground-floor apartments, which is linked to the increase of housing intended for elderly.
The Gasfabriek terrain of Haarlem has not been assigned for housing development by the municaplity (Gemeente Haarlem, 2015). It has the potential to offer a new green space inside this densifying urban tissue around. As stated in the introduction, the objective of this thesis is to form a design strategy for the transformation of the Gasfabriek terrain into a post-industrial landscape park, while solving the environmental problem of polluted soil. Hereby the spatial qualities of the area will improve, whereby the overall attractively will increase.

Regarding contemporary urban development, Mandanipour (2013) states that the ascendency of the market paradigm has had a clear impact on how urban design and developments may be influenced. After the financial crisis, municipal resources shrank, which created the need for public-private cooperation to be able to finance new urban developments. Hereby, public-private collaboration becomes an incentive in urban development with the possibility to bring the overall plan further from a holistic point of view. Public space, urban regeneration and economic development are closely intertwined (Madanipour, 2013). Once the improvements in the public space of the Gasfabriek area, integrated with a sustainable solution for the polluted soil, starts, the hypothesis is that the attractiveness for other activities in the area, such as leisure or living, will increase as well. Thus, it would be naive to not include new space for housing and leisure in the regeneration of the Gasfabriek terrain. Within the research framework of this thesis it is not relevant to dive deeper into the land-use functions envisioned to the newly added built environment, but for example, one could link this to the municipal goal of providing affordable and medium-priced apartments.
To get to know the potential and assignment for the site according to the above stated hypothesis, a density inventory of the surrounding neighbourhoods has been executed. Figure 13 shows that the average density of the surrounding neighbourhoods is a Floor Space Index (FSI) of 0,93. At the moment, the Gasfabriek terrain has a FSI of 0,46. In this thesis, the average FSI of 0,93 in the surrounding neighbourhoods will be taken as a requirement in the program. For the Gasfabriek terrain this equals to an addition of 24.610 square meter floor area.

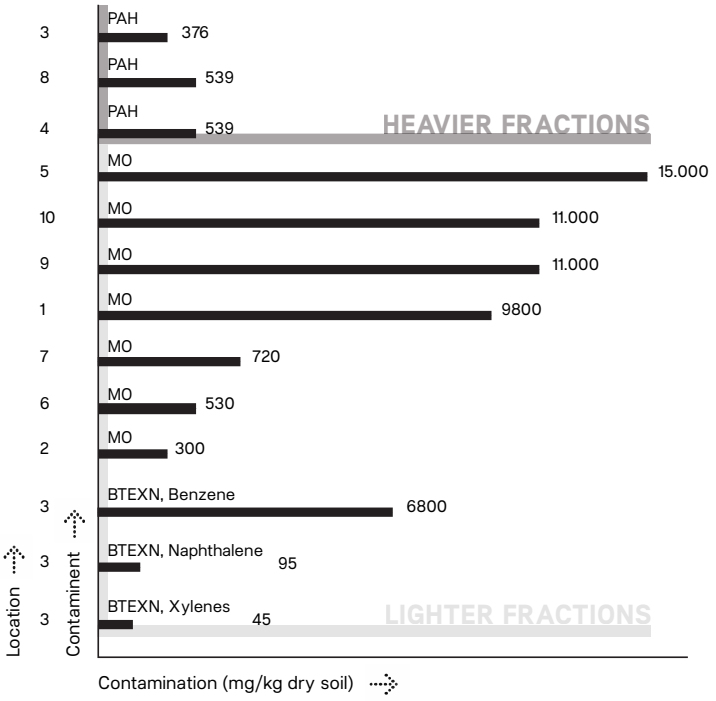
Specification on soil quality

The geological cross-section of Haarlems Gasfabriek terrain is formed by a 10 meters thick alternation of Holocene sand, clay and peat. It was formed in a time of varying water levels and fluctuating sea and river deposits. The basis under the Holocene deposits is formed by a Pleistocene riverbed sand that was supplied by rivers that flowed out in the Dutch delta (Jongmans, Van den Berg, & Sonneveld, 2012). On top of the Holocene layer, a man-made layer of 2,5 meters of debris sand and clay is found. This is related to the establishments of industrial activities whereby the soil was adapted and topped up with a uniform mix in order to create a uniform and stabilized the soil. Due to the industrial activities, this top layer became polluted, as shown in figure 15. (Witteveen+Bos, 2005) The sublayer of peat and clay is generally impervious with here and there exceptions.

The location has a history of partial soil remediation projects, however residual contaminants are still present. These contaminants are located in the top layer, shown in figure 15. The pollutants on-site are petroleum contaminants. The locations of the pollution are mapped in figure 14 to make it spatially.

Conclusion and task

For the transformation of the Gasfabriek terrain into a post-industrial landscape park, with the land-use function of living included, remediation of the polluted soil is needed. As stated above, conventional engineering-based remediation techniques are expensive and unsustainable. Since the area is not assigned as a location for housing or other developments by the municipality within a short time frame, including a sustainable soil cleaning technology within the redevelopment of the Gafrabriek terrain could be a feasible option for the remediation of the contaminants present in the soil.
Furthermore, we can conclude that introducing new building volumes as answer to the local housing demand makes the place more realistic. Besides, it could be an incentive to bring the overall plan further than without including this element. Within the design, I will take into account the history of the area and the spatial problems encountered in this analysis; for example, the connection with the adjacent neighbourhood and the poorly representative entrance of the southern industrial area.
The overall task is to make a new, iconic piece of Haarlem that fits into the urban fabric and is an added value for this latter.



PAH: Polycyclic aromatic hydrocarbon

MO: Mineral oil

BTEXN: Benzene, Toluene, Ethylbenzene, Xylenes and Naphthalene

(Ingenieursbureau Oranjewoud, 1992, 1994; Witteveen+Bos, 2005)

fig. 14 - Locations of soil pollution and corresponding values

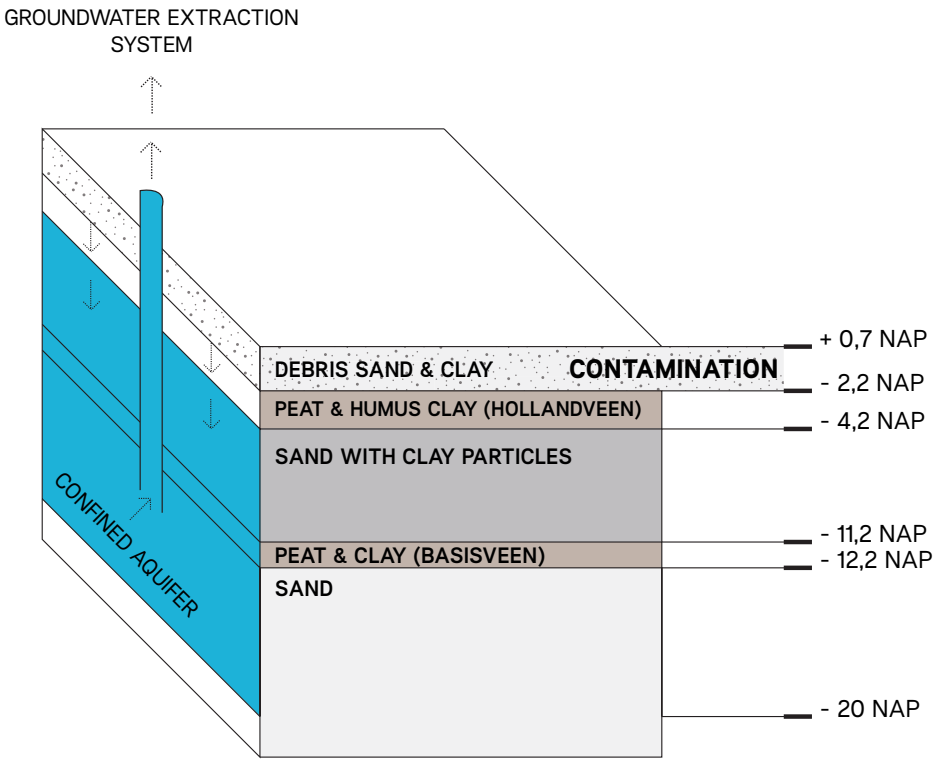


fig. 15 - Soil profile

Phytoremediation

Phytoremediation, from the Ancient Greek 'phyto' meaning plant and Latin 'remedium' meaning medicine or cure, refers to the use of plant mechanisms to take up and remediate contaminated soil, sediments and water. Phytoremediation technologies include storage, accumulation, degradation or hydraulic control of contaminants. The use of plants is known as cost-effective and sustainable compared to regular ways of cleaning contaminates sites (Gerhardt, Huang, Glick, & Greenberg, 2009).

Since more than two decades, there are successful applications of phytoremediation to clean up contaminated soils (Salt, Smith, & Raskin, 1998). However, the integration of phytoremediation in landscape architecture stays behind the benefits it could offer in landscape designs. From this starting point, I join Kirkwood who argues that 'projects may benefit from a closer integration of these often-desperate fields (red. Landscape Architecture and Phytoremediation), and not all sites need to be completely remediated before reuse, especially if part of the reuse helps clean the site' (Kirkwood, 2001)

Principles

Phytotechnology can be divided according to the physical and biological processes in the plant itself and around in its rhizosphere; the region around the plants roots which the chemistry and microbiological exchange of nutrients and exudates takes place. We can distinguish three basic principles of phytoremediation: principles based on the breakdown of contaminants in the rhizosphere, principes based on the breakdown of pollutants in the plant itself and principles based on stabilising pollutants in the soil (Kennen & Kirkwood, 2015; Pilon-Smits, 2005; U.S. Enivronmental Protection Agency, 2001). In Appendix I, a further specification is made on phytotechnology principles.

Types of phytoremediation

All contaminants in the soil of the Gasfabriek terrain fall in the category of petroleum contaminants. This subchapter provides a summary of the current status of phytotechnology research per contaminant type that are present on the Gasfabriek terrain. It contains the specific contaminants the type encounters, why it is dangerous to the environment

and the phytomechanisms that could possibly be utilized in this research by design. Furthermore, it contains planting specifics and phytotechnology planting types. This latter will be derived from the extensive research of Kennen and Kirkwood (2015) on the concepts of phytotechnology and the benefits from a design point of view.

On-site contaminants: Mineral oils, Polycyclic Aromatic Hydrocarbons (PAH), BTEXN (Bezene, Tolune, Ethyle bezene, Napthalene and Xylene: VOCs found in gasoline)
Environmental danger: Petroleum hydrocarbons are some of the most common contaminants in soils globally. They are generally found near industrial activities and many of these petroleum hydrocarbons have the potential to be carcinogens; capable of causing cancer.

According to Kennen & Kirkwood (2015), petroleum contaminants should be divided into two categories:

1. **Petroleum hydrocarbons, lighter fractions**: Easily degradable petroleum contaminants that easily dissolve in water stored between the soil particles and therefore are well available for uptake by the plant's roots. The average degradation time for this category is 0-5 years (Kennen & Kirkwood, 2015). The pollutants of this category on the Gasfabriek terrain include mineral oils and BTEXN (Benzene, Toluene, Ethylbenzene, Xylenes and Naphthalene)
2. **Petroleum hydrocarbons, heavier fractions**: Persistent, harder to degrade petroleum contaminants. These petroleum particles include heavier fractions of petroleum that are more likely to bind to soil particles and not dissolve in water in pore spaces between soil particles. The average degradation time for this category is 5-20+ years. The pollutants of this category on the Gasfabriek terrain include the PAHs (Poly Aromatic Hydrocarbons).

Petroleum hydrocarbons of both categories have been remediation successfully with phytotechnology and can be accounted for many success stories on phytoremediation(Collins, 2007). Because these pollutants have an organic chemical structure, they can be completely degraded by plants and microbes, for example by transforming and then using them for their photosynthesis or growth.

1. Petroleum hydrocarbons: lighter fractions
Mechanisms: Rhizodegradation, phytohydraulics, phytovolatilization, phytodegradation The easiest contaminant category to treat with a plant-based treatment. Here, plants can access, contain and treat the fractions that have been mobilized into the groundwater and water in between soil particles above the water table. Besides, natural attenuation is generated by natural microbial activity as well as exposure to sun, wind and humidity will volatilize or degrade the contaminants.

Here, plants are utilized in two ways. Firstly, they speed up the natural attenuation process by introducing oxygen, sugars, enzymes and other root exudates into the soil (Kennen & Kirkwood, 2015). This then promotes the soil microbiomes to break down the contamination particles; a process called rhizodegradation in the principles paragraph of this chapter. According to Robson (2003), fast-growing plants with a high biomass-producing capacity should be introduced. Since lighter petroleum fractions are easy to break down, the plant can thus process and transform them into new biomass.
Secondly, plants control, degrade and volatilize hydrocarbons in groundwater (Kennen & Kirkwood, 2015). Lighter fractions of petroleum contaminants dissolve easily in water. From there, they can quickly run off into the groundwater. As groundwater has the habit to flow, the contaminants could spread into a plume and leak off-site. By planting phreatophyte trees, that penetrate their roots near/into the groundwater, the trees are able of countering this plume and attract the polluted groundwater in the desired direction.

2. Petroleum hydrocarbons: heavier fractions
Mechanisms: Rhizodegradation
This contaminant catergory is more challenging to degrade with a plant-based system. These contaminants have more rings in the petroleum compound (chemical structure) and the more rings in the compound, the harder to break down and the more time it will cost (White & Newman, 2011). These contaminats tend not to dissolve in water, but stick to the soil particles. Therefore, it is less likely it is available for uptake by plants. Here, degradation is most successfully in the rhizosphere of certain plant species as a result of increased levels of oxygen and root exudates released by the plants root system which support degradation by soil microbes.

Here, plants are utilized in two ways. Firstly, by creating an environment where microbes could thrive (Kennen & Kirkwood, 2015). The plants roots deliver oxygen and sugar to enhance microbial activity within the petroleum polluted soil (Reilley, Banks, & Schwab, 1996). Thereupon, the soil biology destroys the contaminant; rhizodegradation mechanisms become effective. Plants should be chosen that will tolerate the high levels of contamination. Besides, fibrous root production and above average growth rates correlates with better degradation in the soil (Robson et al., 2003).
Secondly, plants create an environment for favourable degradation. Every plant releases its very own root exudates. According to Pilon-Smits (2005) this root exudates can attract different kinds of microbes that target degradation of a particular type of compound. Some plants exudate small parts of acids or enzymes. Kennen and Kirkwood (2015) propose to select specific plants for their typical exudates to create a tailor-made environment to supplement the thrive of microbes.

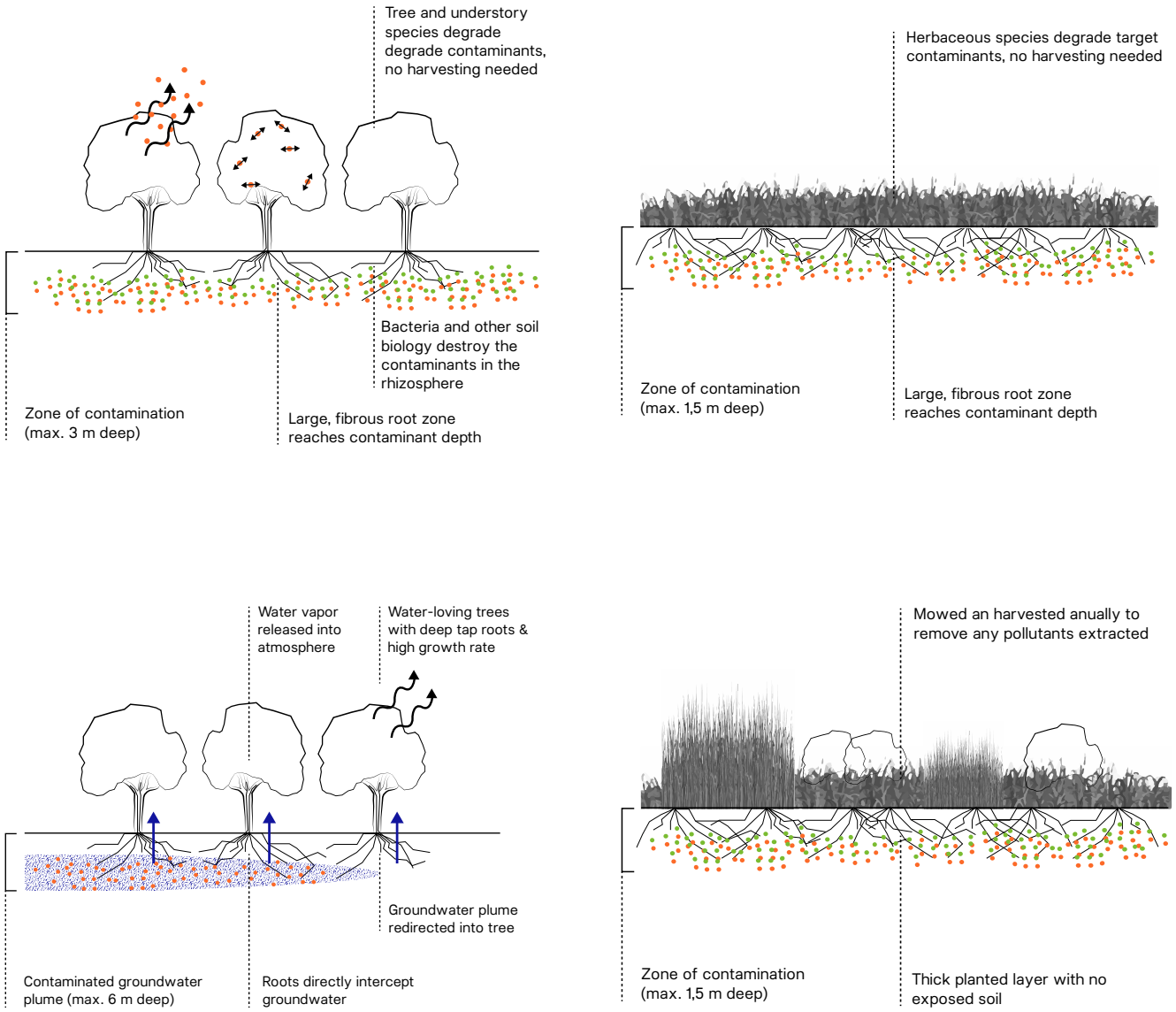


fig. 16 - Four planting typologies, clockwise starting top left: Degradation Bosque (DB), Degradation Cover (DC), Groundwater migration tree stand (GMTS) Multi-Mechanism-Mat (MMM), Kennen and Kirkwood (2015)

Planting specifics

According to Cook and Hesterberg (2013) trees with long roots that can reach the groundwater tend to be planted for BTEX remediation as lighter hydrocarbons tend to mobilize quickly, where grasses with a fibrous root system are commonly used for the remediation of heavier fractions petroleum such as PAHs that tend to stick to the upper level of the soils. An overview of plant varieties that could be applied is given under the subheading 'Plant List'.

Planting typologies

Derived from Kennen and Kirkwood (2015), the following planting typologies will be applied for the degradation of petroleum in soil. See figure 16 for a schematic overview.

- **Degradation Bosque:** Degradation bosques can be installed to break up petroleum contaminants in their rhizosphere and slowly degrade them over time. Contaminants are removed without the need for harvesting the plant.
- **Degradation Cover:** Under a 'Degradation Bosques' as undergrowth or where sight lines must be maintained, shorter plants can be chosen to create a so called 'Degradation Cover'. This typology uses thick, deep-rooted herbaceous species to remove contaminants in the surface soil.
- **Multi-Mechanism Mat:** Multi-Mechanism mats can be installed on-site to stabilize petroleum contaminants of the category 'heavier fractions'. This typology stabilizes the contaminant while at the same time slowly degrading PAH petroleum contaminants.

As lighter fractions of petroleum easily dissolve in water and

tend to mobilize quickly, the following planting typologies could be applied to stop the contamination from mitigating:

- **Groundwater migration tree stand:** Trees with deep tap roots towards the groundwater and a high evatranspiration rate are planted to change the groundwater streams and keep the contaminants on-site and stop them from migrating. Through their pull up of water, trees can counter or stop a groundwater plume that is with dissolved contaminants. On the Gasfabriek terrain, a mechanic groundwater extraction system is already installed to control the out-flow of contaminants, but the introduction of a groundwater migration tree stand could supplement the facilities already in operation. Petroleum contaminants of the category 'lighter fractions' can be remediated within the biomass of the tree.

Plant List

For the application of phytotechnology to remediate polluted soils, we need to select plants that target specific contaminants. Appendix II gives an overview of the plant selection that is used within this thesis. It specifies the botanical name, common name in English and Dutch, the plant height, the contaminants it targets .
The plants have been selected on their ability to grow in the climate of The Netherlands, the desired level of groundwater and according to the contaminants they tackle. Within the design for the Gasfabriek terrain in Haarlem, the plants selected and presented in the plant list will be used for planting schemes.

Conclusion & assignment

Phytoremediation technology is built around using the functional characteristics that plants could offer regarding soil contamination. It includes the storage, accumulation, degradation or hydraulic control of contaminants. Examples have shown successful application of phytotechnologies whereas they also showed it is a cost-efficient and sustainable way of remediating soil.
In this chapter, an overview is given on the phytotechnology options for the soil contamination the Gasfabriek terrain deals with. This results in the four given planting typologies that will be taken into account during the design process.

Post-industrial landscape transformation

Increasing emphasis is given to the regeneration of brownfields in the last two decades (Ruelle, Halleux, & Teller, 2013). The revitalisation of landscape park Duisburg-North by Latz + Partner was the turning point when the regeneration of post-industrial landscapes came into favour. In the competition for the redevelopment of this area Peter Latz discovered the values of the post-industrial landscape that its concurrent did not see. Latz transformation included several sustainable aspects that were outstanding regarding reusing derelict land. Instead of demolishing the site and create a tabula rasa, the things already in-situ (in-site) were mapped and given a consideration on reuse. The structure of the area was seen as something to build further upon. This way of dealing with post-industrial land can be seen to as a new kind of sustainability (Braae, 2015). The more things in-situ could be re-used, the les new resources have to be introduced. From a financial point of view demolishing could be more rewarding, but seen from a sustainable point of view this is not the way to go. Linking this argument to an increasing governmental interest in sustainability, one can understand the increasing emphasis on regeneration of brownfields and for example the attention paid to it by the former state's building master.

Industrial areas are also increasingly seen as a new form of cultural heritage in Europe and Northern America (Leary & Sholes, 2000). As a physical artefact, they function as mirrors of past society and place and express an industrial culture that we are relinquishing and replace with something new. In the past two centuries, industrial areas were segregated from society in a geographical and cultural sense. By placing these industrial on the outskirts of the city, they were geographically placed far from the city centre as if a non-existing black, shameful spot. That also caused a cultural distance, by detaching industry from society. Today, we are moving into a third wave of industrialisation concerning high-tech and robotization. At the same time by urban expansion those industrial relicts have been incorporated into the city fabric. This leaves us with the question how to deal with this mirror of the past in our society of the service economy and high-tech developments.

This chapter will introduce a framework for the consideration of post-industrial sites regarding transformation of those sites. It will help me to deal with the Gasfabriek terrain in Haarlem by theorizing on the relicts found on a post-industrial site. This will give me handles on how to deal with the situation concluded in the analysis. Secondly, it will provide me with a framework of possible philosophies on how to design further upon industrial heritage.

The research field on regeneration of post-industrial sites is quite young, but promising with a growing scientific interest. In this chapter I will first explore the concepts that deal with what is found in-situ: the materials, processes and immaterial aspects already in-situ. Then I will continue with four transformation paradigms according to Braae's (2015) transformation theory: difference transformation, continuity transformation, cultivation transformation and optimisation transformation. These transformation paradigms explicate the transformation narratives played out in a design. It reveals how the discipline of landscape architecture deal with change in transformation projects. In appendix III, four examples are presented on the four transformation paradigms.

Data

Materials

Material organisation is a clearly conspicuous point in post-industrial landscape transformation (Braae, 2015). Attention should be paid to materials through on-site observations and a bigger structure through abstraction.

Firstly, there is a way of working with materials for their own sake. This is related to the re-use of materials that are present

on-site or the continuation of the local athmosphere by expressing this with materialisation. For example, by creating a path with concrete driving plates that are already present on the Gasfabriek terrain, the material itself is reused and at the same time expresses the industrial past.

Secondly, we could work with the form of material organisation and thereby creating a structure that could tell a story. For example, a pre-existing map of the former building outline or cadastral structure could be expressed to remember to the past. In the case of the Gasfabriek terrain we could seek to reuse one of the fundaments of the ruinous buildings and reuse them in an exciting new way, for example a play garden in and on top of it.

Processes

Processes are understood as 'nature-bound cycles and applications and forms of action played out on the site' (Braae, 2015). The process refers to the replacement of the site into its ecological dimension. The aim of a regeneration is to replace the site into an ecological cycle, which is often done by introducing nature on-site. Here, a combination with phytoremediation can be the seek. By incorporating people in the perspective of ecological cycles, we could also state that the reintroduction of people is included in this data category. For example, by introducing new or better connection to the Gasfabriek terrain, the processes of people's movements can be incorporated.

Immaterial aspects

This category deals with non-physical aspects such as atmosphere, memory and meaning (Braae, 2015). This category exists of hybrids of our perception of the place and the physical place itself. It is influenced by an individual and his or her personal emotional experiences. Here, Schroeder (1991) makes a distinction between preference and meaning. He defines preference as 'the degree of liking for one landscape compared to another' and meaning as 'the thoughts, feelings, memories and interpretations evoked by a landscape' (Schroeder, 1991). Because of globalisation and increased mobility, this connection to preferable places we give meaning to have become fragile, resulting in a detachment to the places that are important to us (Scannell & Gifford, 2010). Therefore, the inclusion of this aspect to a certain extent important, given that on the other hand it is hard to measure this and thereby including it into a new design. In the Gasfabriek terrain we could continue the industrial character the Gasfabriek offers by using elements that remember of the past of the area. The concepts of 'Materials' and 'Processes' give us tools to materialize the inclusion of immaterial aspects. For example, by applying rough and raw materials, one offspring whoms father used to work at the Gasfabriek, can go back to the location and relive the stories he used to hear from his father workspot.

Paradigms

Difference transformation

Difference transformation is based on the contrast between the 'new' and the 'old'; stated as something visibly new and that what existed before. The past and present are fundamentally different; however, they exist in the same space. As the presence is materialised in a distancing way from the past, the two contrasts and thereby strengthen each other. Fractures and contrast are central aesthetics in this paradigm. (fig. 34)

Continuity transformation

Continuity transformation extends the past into the present. In the present, we seek to find a relationship to that what was there before and giving it a new meaning in the future to come. This paradigm connects the past with the present and future and seeks to preserve the past for the generations to come. It actually heals the breaks of the past and interventions are respectfully done and contribute to the manifestation of the past. Continuity in forms, materials and atmosphere are the central aesthetics in this paradigm. (fig. 35)

Cultivation transformation

Cultivation transformation encourages the changes taking place as a dialogue between the interventions and the data in-situ. The interventions weave themselves over and through the objects already there. The transformation is carried out with a varying degree of change to objects in-situ. The situation today is the starting point for the future and there is a dynamic between continuity and further development. The aesthetics of this paradigm relate to 'post-production' with what is already there. (fig. 36)

Optimisation transformation

Optimisation transformation is eternal in the sense that there are constants through the past, present and future that stand out as undiscussable values in a transformation design. For example, the conservation of a structural building unit or the idea that everyone should be able to move freely in the urban landscape could be one of these constants. These values are regarded as universal and absolute. Proposed interventions must give priority to these values to allow these factors to progress. This ideas on transformation could for example be found among restorers of nature or buildings.

Those four transformation paradigms are not mutually exclusive. They can be applied interchangeably and form a mix of different attitudes on dealing with post-industrial heritage. … and … are two examples that illustrate how several transformation paradigms can function side by side in one design. While the paradigms are used next to each other, they offer very different aesthetics. The use of several transformation in one design could open ways to show different approaches to the same heritage and in the end result in a stronger design than sticking to a single paradigm for the total design (Braae, 2015). (fig. 37)

Designing an urban park

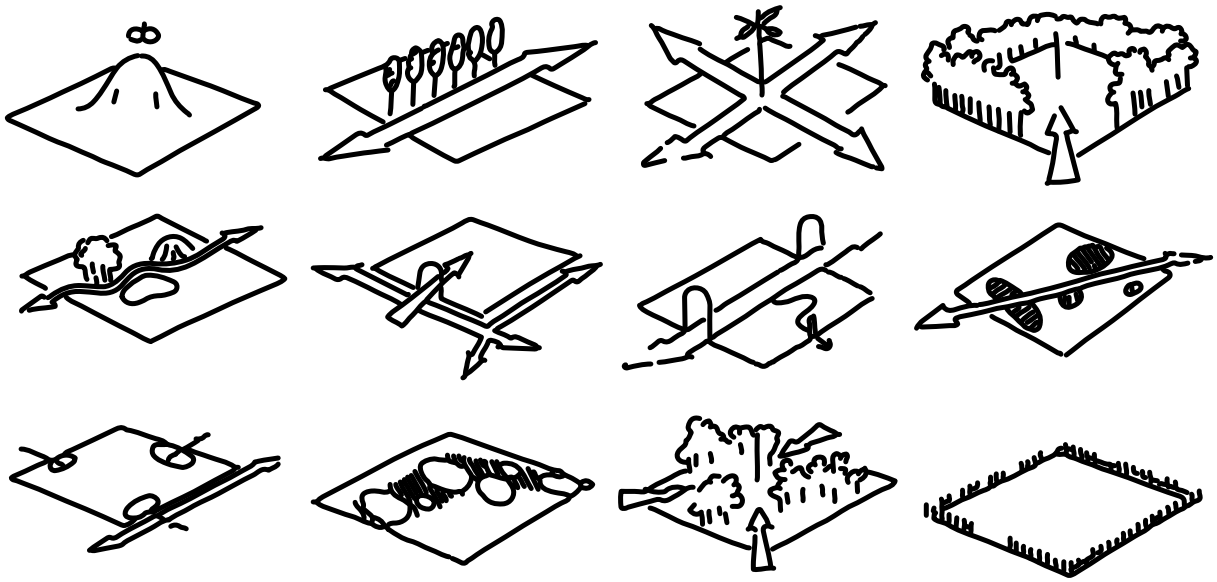


fig. 17 - Selection of design tools from 'The urban park as phenomenon' by Birris and Elshof (2010)

Urban parks are the green lungs of a city. They offer psychological, physiological and general health benefits. Urban green spaces attract people for relaxation, outdoor activities, a walk or just function as slow-traffic routes through the city.
Urban green spaces and parks have a big scope of target groups and their corresponding preferences which make it complex to design such urban spaces. However, extensive research has been done on urban public spaces and parks, that I will briefly explore in this chapter. I will explicate the characteristics and aesthetics of urban landscape parks. Furthermore, by mean of a short case study there will be a discussion on the program for such parks and the design philosophy in urban transformations resulting in mixed-use green spaces.

Experience and characteristics of parks

Increasing evidence points out that the presence of green spaces in the city fabric contribute to the quality of life in various ways. Urban parks provide environmental and ecological benefits. Besides, they enrich human life with new meanings and emotions by providing important psychological and social benefits. The motives for people to visit urban green spaces are wide-ranged, from a morning run to an evening pick-nick in the sun. Chiesura concludes that the experience of nature (this concept of nature referring to the 'green' people find in urban parks) is 'a source of positive feelings and beneficial services, which fulfill important immaterial and non-consumptive human needs' (Chiesura, 2004).
Building upon the motive for people to visit a park, we can distinguish five different groups regarding the reason to visit a park. Based on the studies of sociologist Cohen, Elands en Lengkeek (2000) derived five modalities on the experience of parks: amusement, change of scene, interest, rapture and devotion.

In the report 'The city park as a phenomenon', Biris and Elshoff (2010) define the characteristics of a successful urban park and sum up the tools we have as landscape architects to shape urban parks. The concepts and aesthetics that shape urban parks could also be applied to the Gasfabriek terrain, as this area will function as a green space in the city fabric. The only difference is that the pieces of park will be segregated by building at some points, but that will not conflict the general design approach of an urban park.
According to Biris and Elshoff (2010), the first characteristics of an urban park is variation; a concept that should be carried through in routes, (architectural and green) mass, sides and functions. The variations should be considered in line with the size of the park. In the planting design, a variation on types and shapes of planting should be altered to arouse the curiosity of visitors.
Secondly, green is important but so is water as well. The experience and exposure to water is especially important; make it enjoyable.
Thirdly, a clear structure is essential for overview and routing, but a balance should be considered between tension and overview, as the position to not have an overview is a stimulation for exploration. Functions in the park should be walkable from each other and the program is diverse and offers several recreation possibilities for a broad target group. Furthermore, a typical urban park has clear entrances with a distinctive appearance and the opening up of the park toward the city is of importance.

Design tools for parks

In the design for a park, design tools are a critical element for

a landscape architect to transform the raw material, by means of a design, into new spaces that appeal to the imagination. Vroom (2005) defines a design tool as 'tangible and concrete materials and elements and the way in which they are applied in a to be design space.' Figure 17 shows the design tools for an urban park as elaborated by Biris and Elshoff (2010). The design tools deduced in their research can be classified in four categories:

1. Optimal opening up of a park. These tools are focused on accessibility.
2. Optimal circulation through a park. These tools are focused on routes, routing and the experience during movement in the park.
3. Large-scale functions of a park. These tools are focused on the placement and coherence of the functions and the relationship of one function towards the others.
4. Experience of a park. These tools are focused on that what influences and shapes the experience of a park.

(Biris & Elshof, 2010)

Now, I will apply the four presented tools on the design assignment of this thesis. Regarding category 1, the optimal opening up of a park, we have to conclude that the area lacks a recognizable entrance, as showed in the analysis chapter. Furthermore, the link between the adjacent neighbourhood 'Sportheldenbuurt' and the Gasfabriek terrain is not strong and merge abrupt over into each other. More continuous routes could add life to the area by inviting a big scope of people to pass through all day long. The area will get several entrances which should be ranged on their importance. Clear and valuable main entrances are needed, which will improve the image of the area while entering and improve accessibility. Here, the analysis can help in making design choices.
Category 2 on circulation through a park gives insight in routes through the park. An important asset herein is the spatial quality of the routes one walks and the experience while moving on-site. The local qualities like the waterscape in the north of the site or the wide street from the Oudeweg to the north should be taken into consideration. Furthermore, a mix of direct and indirect routes has to be introduced.
Category 3 is about the distribution of functions and program over the site. The outcome of the reference study later on in this chapter should be linked to this design tools offered by this category.
In Category 4 the experience of the park plays a central role. As the waterscape is a central element in the northern part of the area, routes along the water can be established and a better connection with the water can be sought by way of lowered quays, contrary to continuous inaccessible quay there is at the moment. Furthermore, a play with mass and openness is important in long stretching routes. If we relate this to the introduction of phytoremediation bosques and covers, we can seek for an optimal variation in degradation cover and bosque (mass) and openness (lawns).

Reference study on design philosophy and program

This small reference study has been executed to explore the different options on design philosophies and program of urban parks and transformed post-industrial areas. The design philosophy determines the ambition during the transformation of a post-industrial area. The program of an urban park or post-industrial transformation impacts the succeeding or failure of such an area. Within this reference study we refer to design philosophy as 'the level of ambition to bring the area to a higher level and the level to which extent there is a willingness to do interventions to accomplish this goal'. The term program is meant as 'that what could be done in a park and the possible activities which one can undertake'. The methods used to conduct research on the references are studying maps complementary with Google Street View, studying photos, read descriptions on the park/ post-industrial landscape and read reviews if available.
The parks and post-industrial landscapes selected for this reference study had at least one thing in common with the Gasfabriek terrain:

1. centrality of industrial heritage; program built around industrial heritage
2. phytoremediation is included in the project

Besides, all locations share the characteristics that they are located in an urban context. The reference studies could be found in appendix IV. The goal of this reference study is to give a short overview of options on design philosophies and programs of urban parks and transformed post-industrial areas. The reference study is not carried to give a judgement on form or functions; it rather explores the options there are regarding program and design philosophy.

First, I will elaborate on the parks sharing the characteristic of a program built around industrial heritage. These include the projects of Kleefse Waard, Strijp-S and Haute-Deule river banks.
Regarding the industrial relicts present on site, all three projects show a philosophy wherein they only include the cultural-historically valuable buildings. By this, they show to prioritize renewal in their philosophy, but maintaining the character of the area by keeping the more iconic buildings. Furthermore, all three projects are developed as a mixed-used area where businesses and leisure destinations such as restaurants and cafes are included. In Strijp-S we see on top of this housing included as well. The landscape is here approached as connecter of all bits and pieces of the area. By giving it a connecting role, it facilitates cross pollination between the start-ups and other businesses in the area. In the case of Kleefse Waard, the philosophy is really to create a community by means of a connecting landscape. This also strokes with nowadays vision on innovation ecosystems where cross-polination is known as 'wisdom of the crowds' in which meeting and encountering takes a central place

(Surowiecki, 2004).
Regarding the connection to its surroundings, Strijp-S only touches the surrounding neighbourhoods but seeks for a continuation of sightlines and infrastructural lines. Haute Deule river banks really penetrates into the surrounding neighbourhoods via the introduced parkways. Contrary, Kleefse Waard is closed off to its surroundings by a gateway which blocks citizens of using the amenities found at the industrial park and is the least visited park of all three.
When we look closer to the program of the parks around the industrial heritage, we can observe that the industrial heritage is the centre of the projects and the program unfolds itself around it. It stands out that Strijp-S has the most extensive program and the other two have a smaller program and less variation between the spaces. Strijp-S and Haute-Deule river banks are both being visited a lot. The proximity of both towards the city centre could be a factor and Strijp-S include event spaces which host activities through the year which could be a good reason to visit the park. All three parks offer spaces that people could give their own functions such as lawns and offer good seating possibilities.
In this reference study, Strijp-S is the most visited place offering a wide program. The downside of a big program is that a larger amount of space is needed. This will reduce the more informal spaces and open spaces people can assign their own functions to; such as a football game or sunbathing.

The two parks that include phytoremediation in the project are Haute-Deule river banks and Grorudparken. Both parks had the ambition to clean up polluted soil and water, but at the same time to make a 'regular' park. The design philosophies emphasize on implementing phytoremediation technologies in the design, but at the same not make phytoremediation principles dominating the design process and create a monotonous park with just all 'optimum' for soil remediation put together. The parks show that a good design is not subordinated when phytoremediation is applied. The planting schemes in both parks is given a 'natural' look. In a visual way, the 'natural' approach in remediating soil is expressed through the planting scheme.
Regarding program, Grorudparken offers a program as diverse as the cultural backgrounds of the neighbourhood it cuts through: athletics, play, recreation, youth programmes, social interaction, and cultural activities are programmed. The reason to visit this park is for all-day long activities. These different types of activities are spread out over the park, alternated with lawns, boardwalks with views on the water and stretches of woods. Hereby, while visiting the park you can have the idea of 'your own world' inside the city.

This reference study shows that there are different design philosophies possible in regenerating post-industrial areas. As the former industrial buildings in on the Gasfabriek terrain vary in maintenance state, it could be wise to learn from this case study to only include the cultural-historical valuable buildings and buildings in a good state of maintenance. Furthermore, from the cases of Strijp-S and Kleefse Waard strongly emerges the ambition of the concept 'landscape as a connecter'. Condition to accomplish this ambition is to put effort on realising a high-end landscape as a stage for meeting and encountaring with different typologies of spaces to stay. In the case of Strijp-S and Haute-Deule river banks, one of the ambitions as well was to embed the newly ceted area into its surroundings so all people could easily share in the amenities provided by the design. A lesson for the project area of this thesis could be to learn from Strijp-S where the continuation of existing roads, cycling lanes and pedestrian routes is sought.
This reference study also gives insight how a program is built up spatially in a park. What we see in all three examples including industrial heritage, is that the program of the park is suspended from the functions in the industrial heritage. For example, a building with a café or bar is complemented by a square with possibilities for a sidewalk café or seating to enjoy the purchase.
This reference study furthermore gives an overview of the space that is needed for program components. The size of the program impacts the number of visitors, but a big program requires a lot of space that can impact space left more open-ended programmed space. There should be a balance between the amount of program and space left for planting, traffic flows and more unspoilt, open-ended programmed spaces that people can assign their own function to.

Conclusion and task

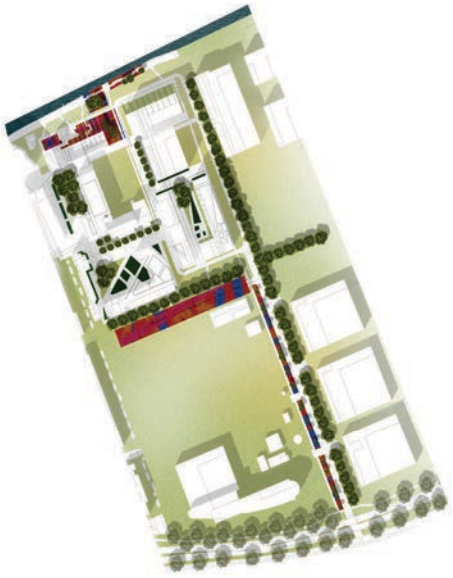
The unicity of every park is different; it is the combination of program, functions and location. The appearance of every park is unique and the use of nearby elements that other urban parks do not share can make the park unique. For the Gasfabriek terrain, we have the big amenity of the Spaarne river flowing along. This is an amenity unique for a Haarlems park which should be valued and opened up to its visitors. Furthermore, the qualities the post-industrial landscape offers, should be explored by means of designing over and over to open up these qualities and give them a place in the design for this post-industrial park.
The overall experience of the park can be enhanced by applying characteristics of urban parks such as routing, variation in openness and mass/planting density, structure and program. The design tool as discussed earlier in this chapter can be helpful to give these characteristics a place in the design.
Furthermore, in the design, I will have to make a balance on the ambition that will be set for the transformation of the Gasfabriek terrain. Furthermore, the program offers a range of options on programming, however, here I have to make a balance between programmed space and open-ended programmed spaces towards which people could assign their own function.

Design concept

PHYTOTECHNOLOGY AS
ANSWER TO CONTAMINATION

RECYCLING HAARLEMS
GASWORKS

PARK AS SPATIAL
CONNECTER

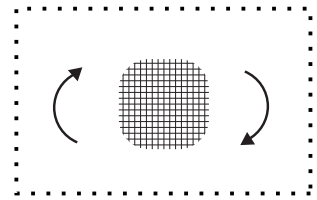


GASFRABRIEK TERREIN:
ICONIC PLACE ALONG THE SPAARNE

fig. 18 - Design concept

As explained in the paragraph on urban infill developments (Introduction), brownfields in urban areas will be needed to facilitate the demand for urban expansion that is linked to a growing demand on space for housing or businesses. This applies to the Gasfabriek terrain in Haarlem, but an extra obstacle for the regeneration of the Gasfabriek terrain is the soil quality that is above the legal level for the land-use of 'living'. The intention of the design concept is to include the soil remediation of the Gasfabriek terrain in an environmental friendly way by means of phytoremediation within the transformation phase of the area.
To combine these two components, a landscape park will be the spatial connecter between those two components. By mean of a park design, the three components will be combined. The concept is displayed in figure 18.

Design principles

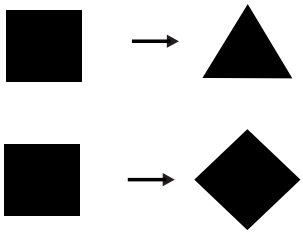


MANAGE CONTAMINATED SOIL WITHIN THE SITE ITSELF

> SEE TRANSLATION TO DESIGN

> Remediate at same place if possible

> Transfer polluted soil to somewhere else if needed, but keep it on site

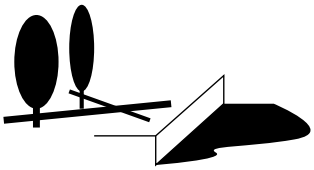


COMBINE DIFFERENT TRANSFORMATION PARADIGMS & USE OF 'DATA IN-SITU'

> Continuity of industrial character by using raw materials, big mass, unpolished fnishes and sharp, coarse shapes

> Contrast by using high-tech lamp posts andsome bright colors to distinguish the 'new' and the 'past'

> Cultivate disused building by transformorming it into a hortus conclusus



CREATE A PARK BY USING THE DESIGN PRINCIPLES FOR URBAN GREEN SPACES

> As specifed in the report

fig. 19 - Design principles

The design principles used for the design of the Gasfabriek terrain can be divided in three categories. This division matches with the three separate layers in the concept in figure 19.
The first principle relates to the physical problem of a certain amount of soil that needs a chemical solution.
The second principle relate to the idea that using several transformation paradigms combined in one design will result in a stronger and more convincing landscape transformation.
Regarding the third design principle; a lot of research has already been done on the design principles for urban parks and could be derived from literature. See chapter X, and especially figure X, for an overview.

Applicable design principles which combine the three aspects of phytotechnology, transformation and park design at the same time will need to be generated during the design process. An example is the design choise for the boulevard:

A good park needs routes close to the water, where direct contact with the water is possible (Biris & Elshof, 2010)
+
We continue the industrial character of the area by using big, raw materials
+
We remediate polluted soil at the same place

This then results in the proposal of a boulevard like quay along the Spaarne. We use concrete driving plates of 1x1 meter for the pavement of the quay. Along the quay we find two teerspots containing contaminated soil. These will then be densely planted with a phytotechnology border. Then we directly touch upon the principle of 'routes through mass and open space' (Biris & Elshof, 2010) where we create an alternation of open and closed along a walking route. This way demonstrates how different aspects involved in the transformation of the Gasfabriek terrain will be dealt with.

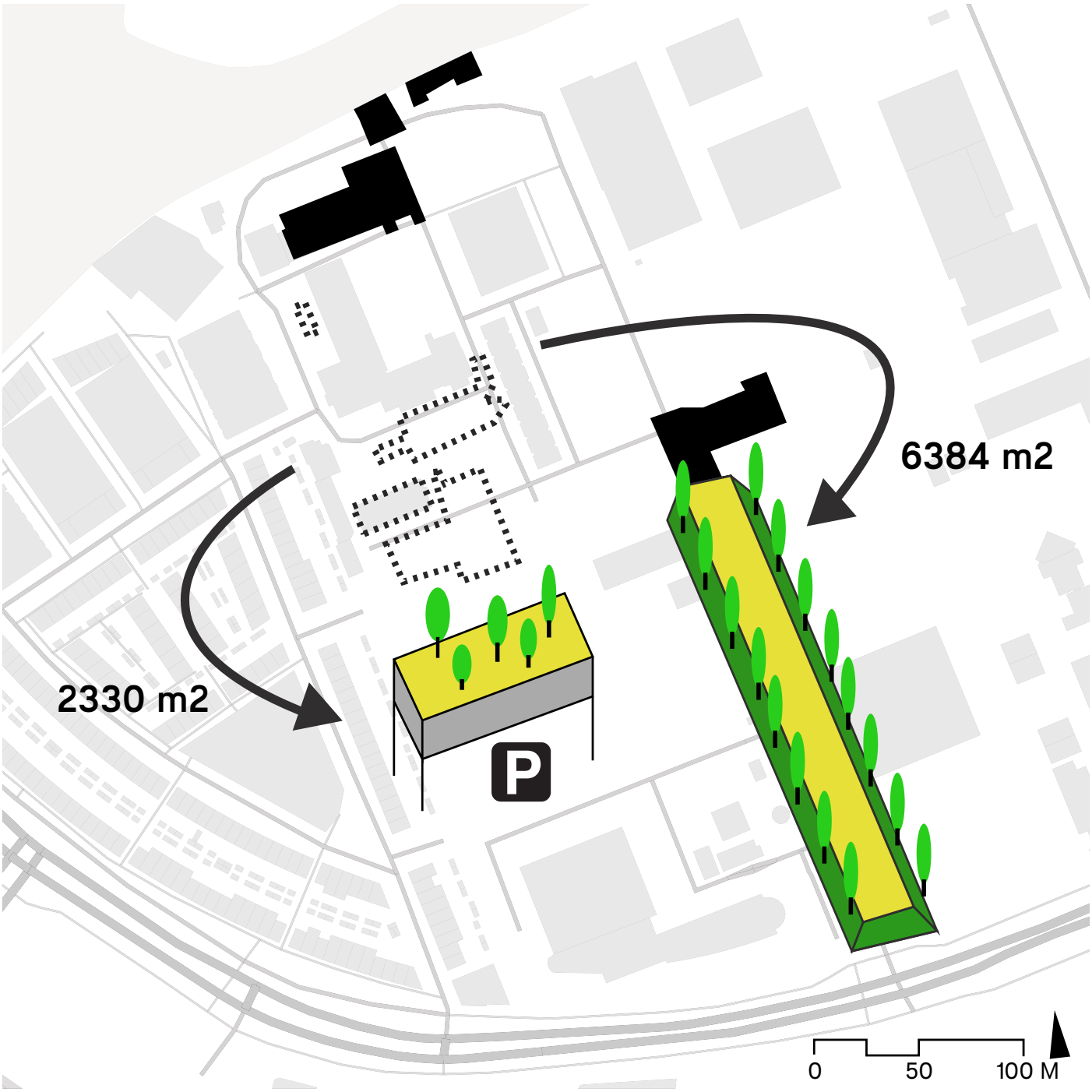


fig. 20 - Principle translated to conceptual design

Due to interventions at places where contaminated soil is found, we have to transfer soil within the site to find another spot to remediate this soil. This is done according to the flows in figure 20. A parking garage with phytoremediation roof is introduced, as well as a small dike that is a phytoboulevard. Those two interventions are detailed in the 'Design' chapter of this thesis.

Design

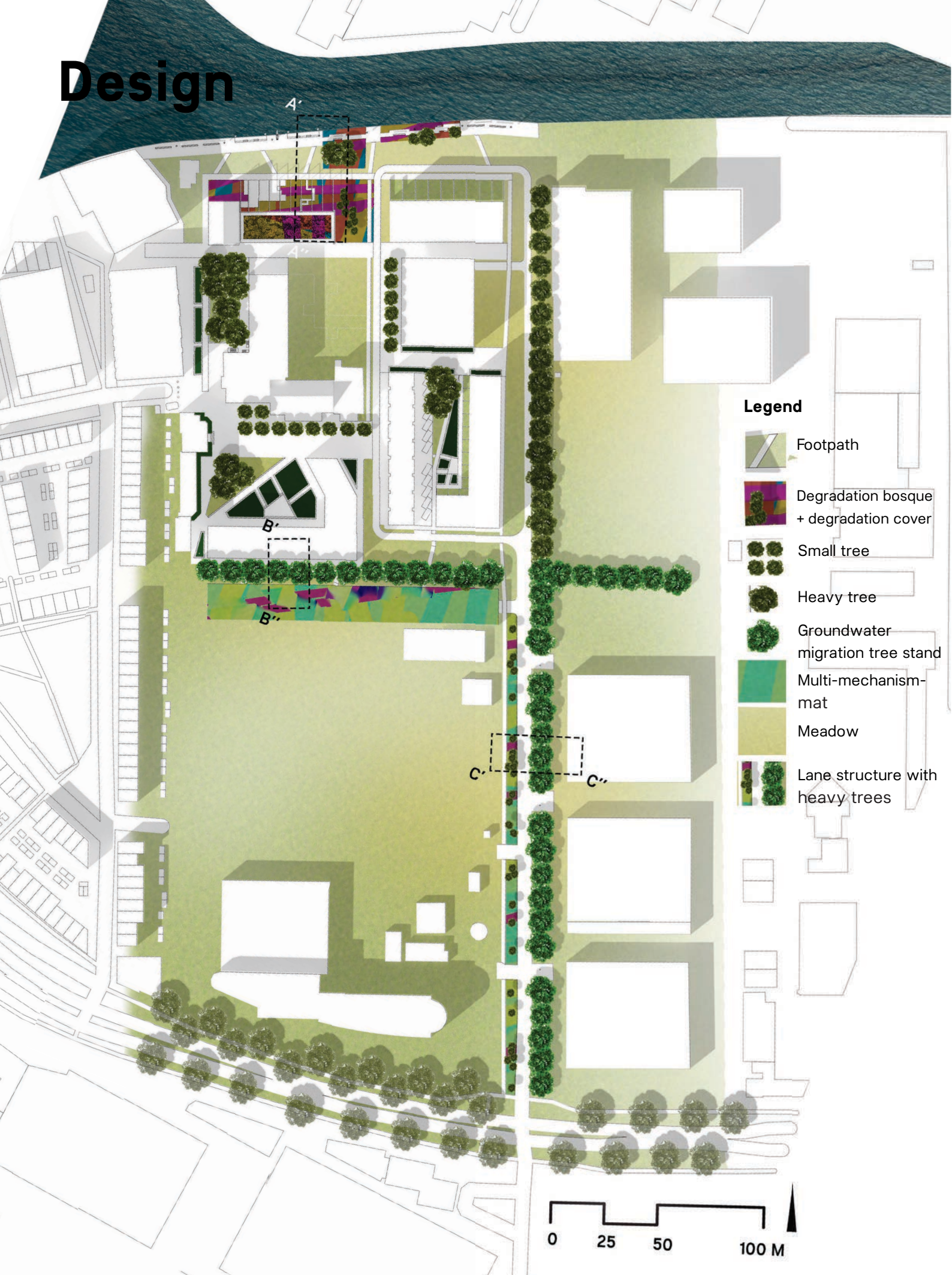


fig. 21 - Masterplan

Masterplan

The masterplan for the Gasfabriek terrain consists out of a northern and southern part. The northern part is the place where the industrial heritage is clustered. Here a mixed area develops with space for living, small businesses and leisure.
In the southern part we find the industrial park with two large development parcels added. The growth of the businesses we find on this location is a development that will continue and where extra space needs to be reservated for.
In between those identies a green corridor is proposed which will function as a division between the two areas. An open corridor consisting of meadow already exsists and this axis will be developped futher on. To aim for a car-free neighbourhood and solve the parking problem as found in the analysis, the green corridor will facilitate a car park with space for 140 cars. This car park has a special featare as it will contain a steel frame whereon a box will rest. Herein, contaminated soil is treated by means of the multi-mechanism-mat phytotechnology principle. This is worked out further in figure 27.

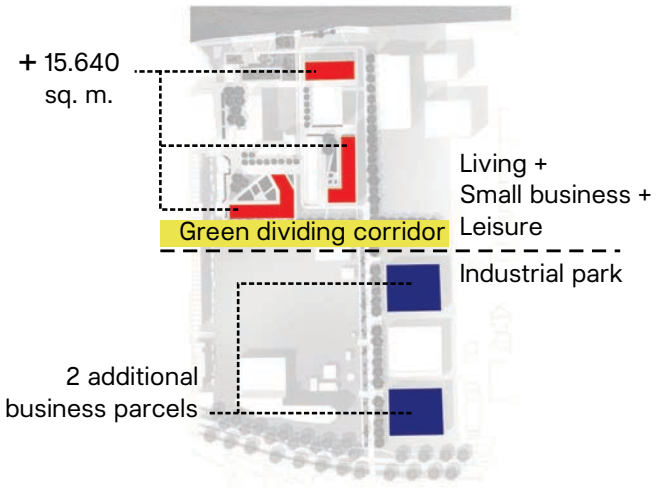


fig. 22 - Schematic simplification of masterplan

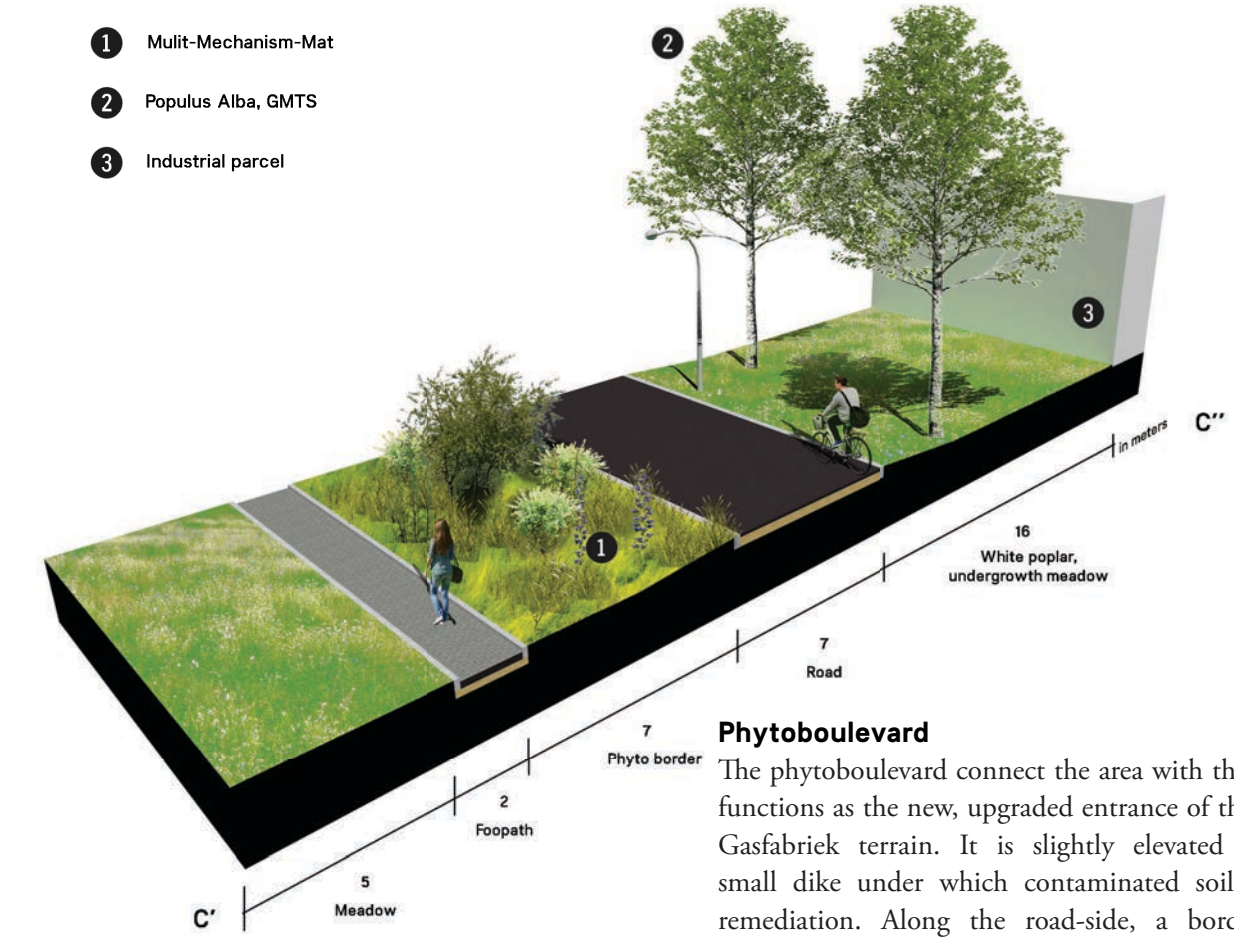
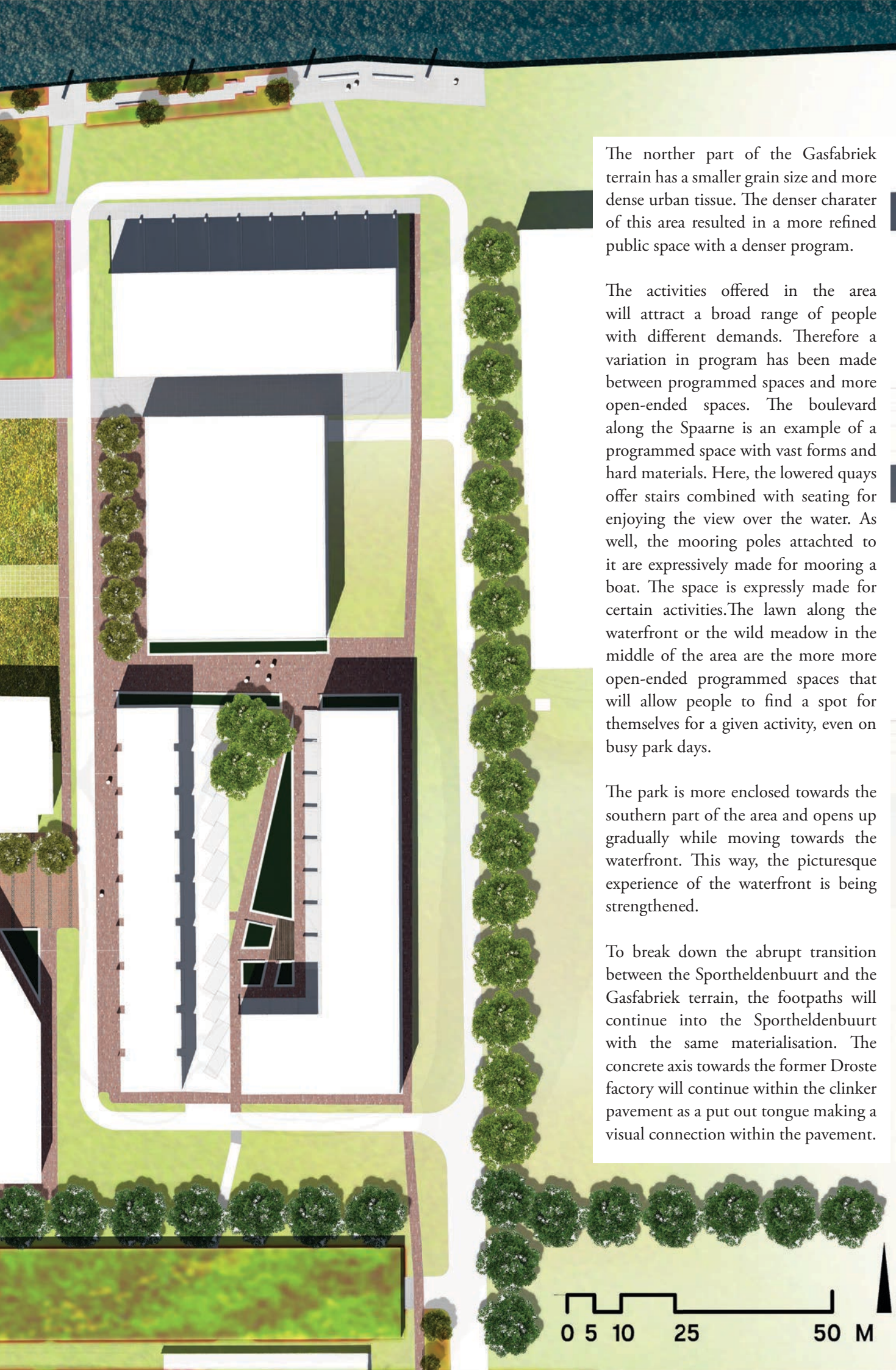


fig. 23 - 3D-section of Phytoboulevard

Phytoboulevard

The phytoboulevard connect the area with the Oudeweg. It functions as the new, upgraded entrance of the transformed Gasfabriek terrain. It is slightly elevated and forms a small dike under which contaminated soil is stored for remediation. Along the road-side, a border of phyto-extraction is is installed by means of a Multi-Mechanism-Mat. The phyto border is used to separate pedestrians from car traffic, preventing conflicts between them and make, beautify the entrance towards the area and thereby include the phytoremediation visibly into daily life. On the east side of the lane, a Groundwater Migration Tree Stand prevents the dumped contaminants from run-off.

fig. 24 - Detailed plan northern area



The norther part of the Gasfabriek terrain has a smaller grain size and more dense urban tissue. The denser charater of this area resulted in a more refined public space with a denser program.

The activities offered in the area will attract a broad range of people with different demands. Therefore a variation in program has been made between programmed spaces and more open-ended spaces. The boulevard along the Spaarne is an example of a programmed space with vast forms and hard materials. Here, the lowered quays offer stairs combined with seating for enjoying the view over the water. As well, the mooring poles attachted to it are expressively made for mooring a boat. The space is expressly made for certain activities.The lawn along the waterfront or the wild meadow in the middle of the area are the more more open-ended programmed spaces that will allow people to find a spot for themselves for a given activity, even on busy park days.

The park is more enclosed towards the southern part of the area and opens up gradually while moving towards the waterfront. This way, the picturesque experience of the waterfront is being strengthened.

To break down the abrupt transition between the Sportheldenbuurt and the Gasfabriek terrain, the footpaths will continue into the Sportheldenbuurt with the same materialisation. The concrete axis towards the former Droste factory will continue within the clinker pavement as a put out tongue making a visual connection within the pavement.

1

The rationalistic architecture style we find in the facade of the Turbinehal, has been the inspiration for the paving plan around this building. Hereby, we emphasize and continue the character of the site by using materials in a pattern that in a playful way refers to the past. The paving plan consist of red tumbled clinkers. The pattern is differentiated by strokes of black tumbled clinkers. This relates to the small details of glazed and black stones in the rationalistic brickwork of the Turbinehal's wall. The used clinkers are 'waalformaat' and laid in broken bond pattern.

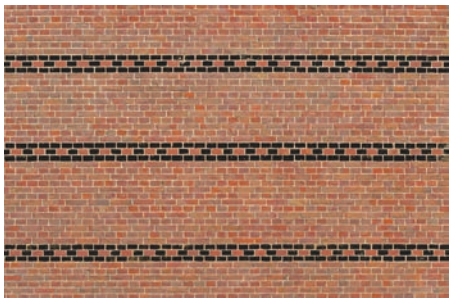
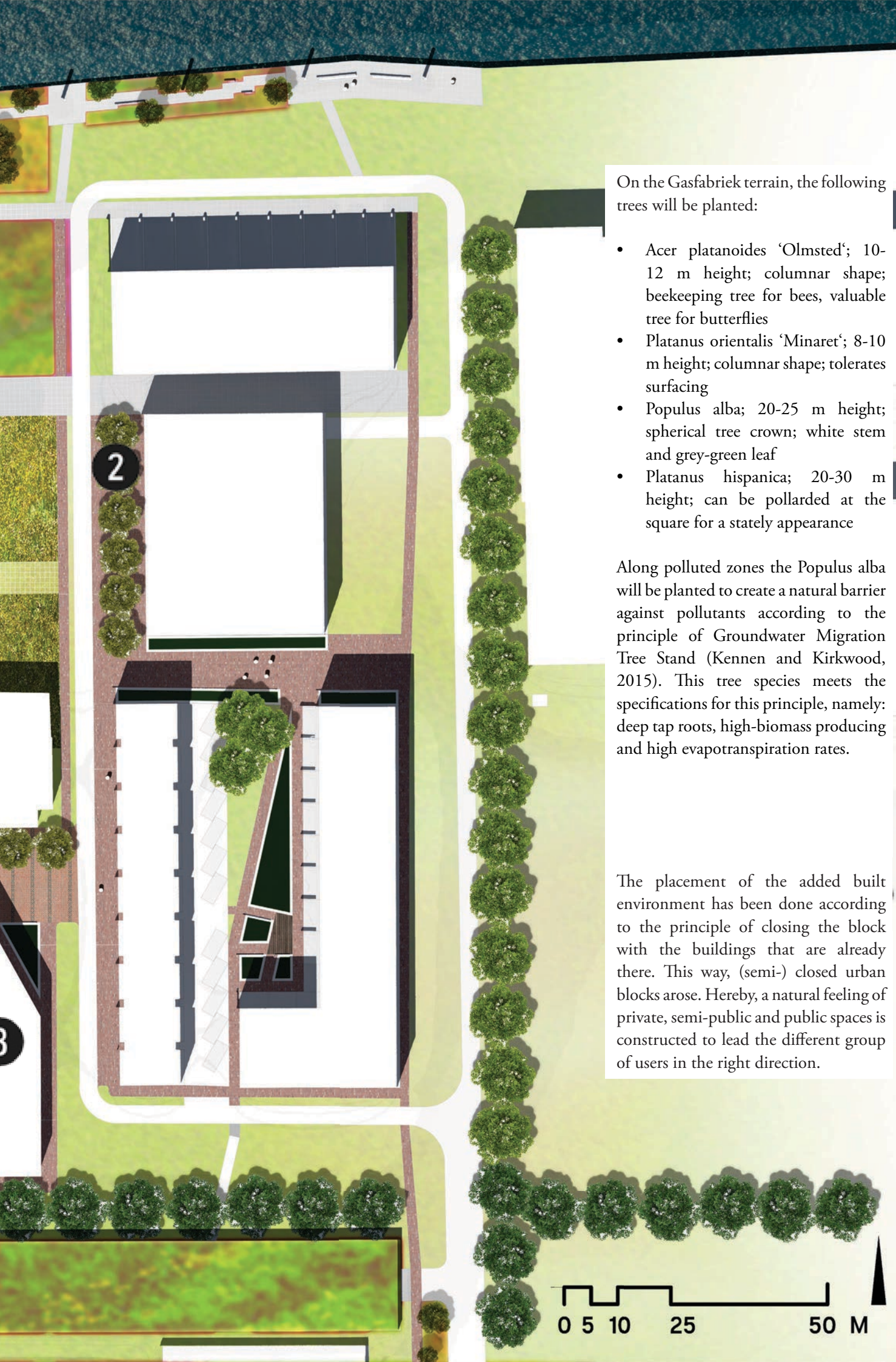


fig. 25 - Pavement pattern with a subtle reference to the Turbinehal

fig. 26 - The Turbinehal and its brickwork



On the Gasfabriek terrain, the following trees will be planted:

- Acer platanoides 'Olmsted'; 10-12 m height; columnar shape; beekeeping tree for bees, valuable tree for butterflies
- Platanus orientalis 'Minaret'; 8-10 m height; columnar shape; tolerates surfacing
- Populus alba; 20-25 m height; spherical tree crown; white stem and grey-green leaf
- Platanus hispanica; 20-30 m height; can be pollarded at the square for a stately appearance

Along polluted zones the Populus alba will be planted to create a natural barrier against pollutants according to the principle of Groundwater Migration Tree Stand (Kennen and Kirkwood, 2015). This tree species meets the specifications for this principle, namely: deep tap roots, high-biomass producing and high evapotranspiration rates.

The placement of the added built environment has been done according to the principle of closing the block with the buildings that are already there. This way, (semi-) closed urban blocks arose. Hereby, a natural feeling of private, semi-public and public spaces is constructed to lead the different group of users in the right direction.

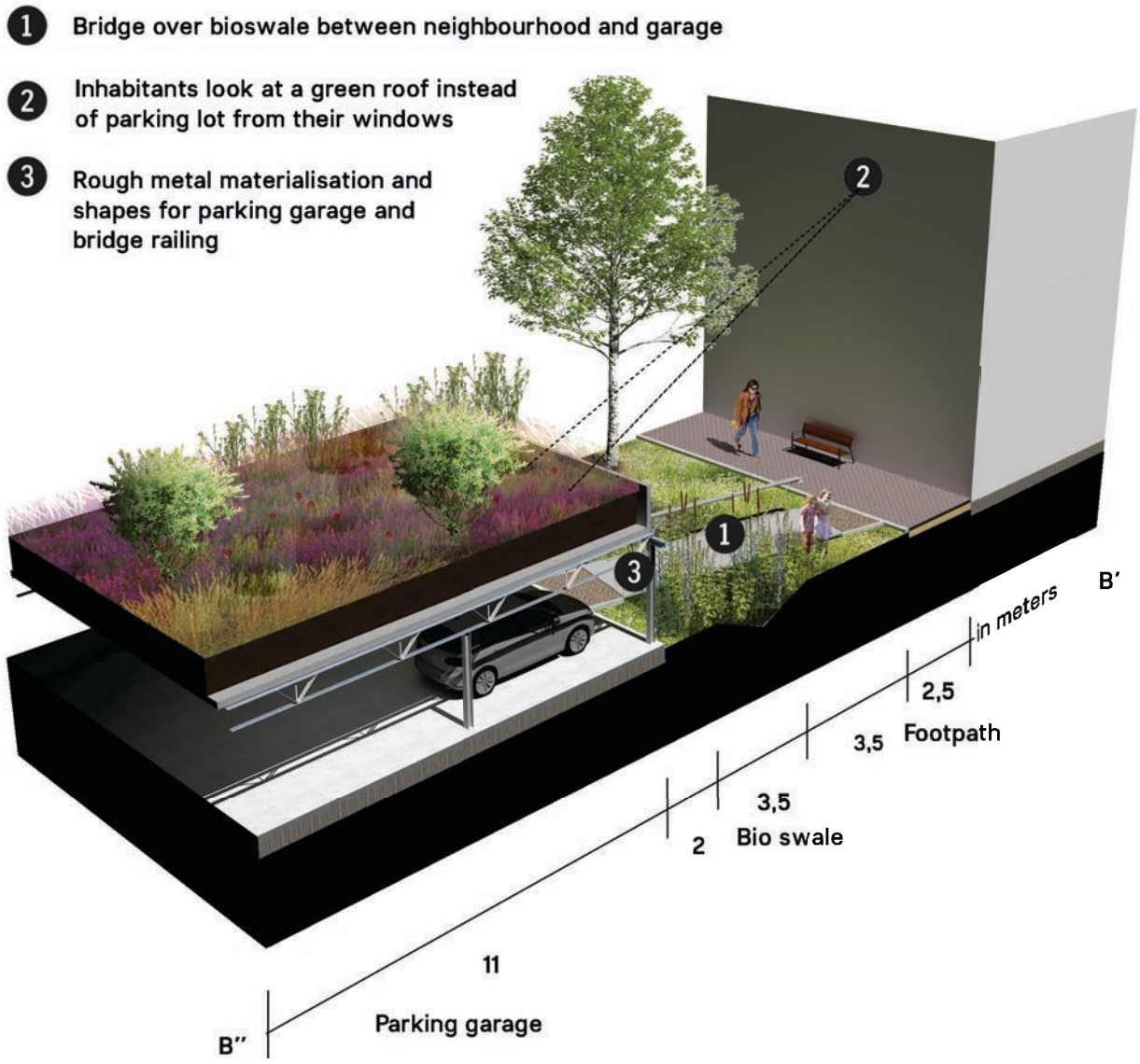


fig. 27 - 3D-section of the parking garage and the paralel bioswale

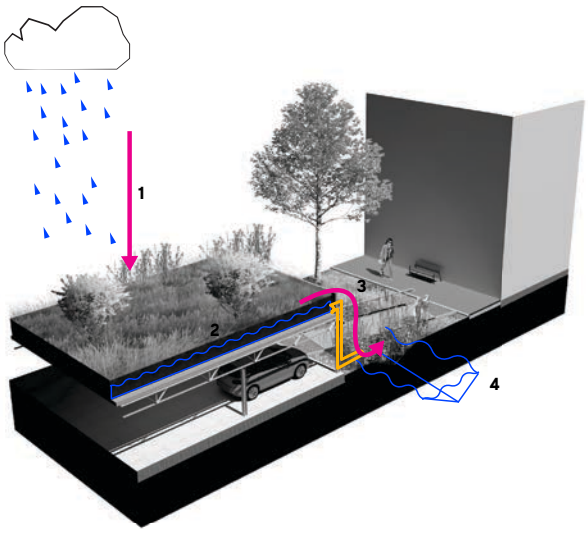
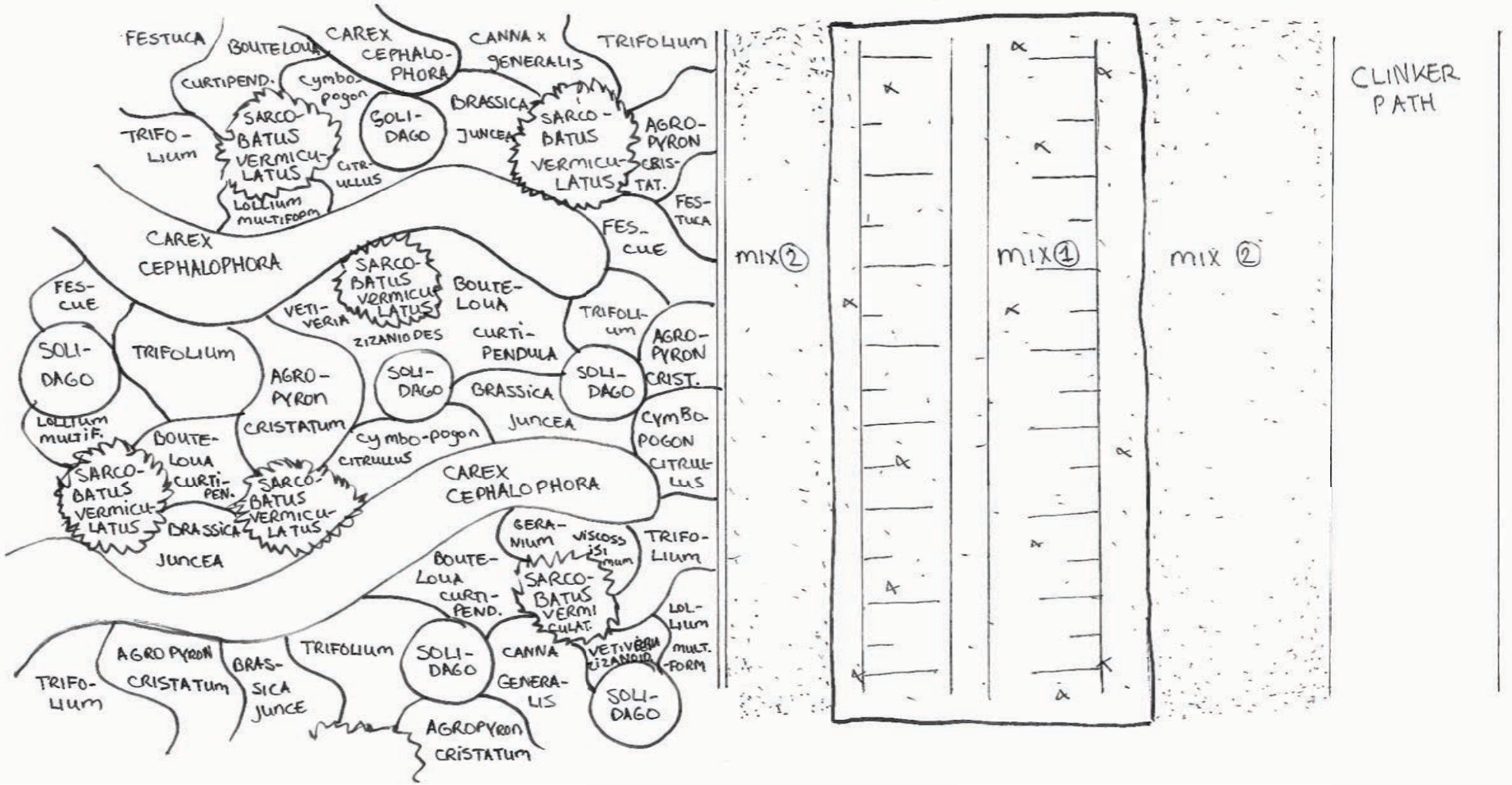


fig. 28 - Conceptual overview of watermanagement

The parking garage and the paralel open strip along are design according to a stepwise system. This parking garage has a special featare as it will contain a steel frame whereon a box will rest. Herein, contaminated soil is treated by means of the multi-mechanism-mat phytotechnology principle. However, when it rains (1) the box will start filling up with rainwater (2). When the level of rainwater in the box will reach a certain level, rain pipes (3) will gradually release surplus water bit by bit. This rain water can be polluted with pollutants of the contaminated soil within the box. Therefore, the strip besides the garage contains a paralel bioswale (4) planted according to the degradation cover (Kennen & Kirkwood, 2015) to remove the contaminants by treating the water from the roof. The planting scheme for the garaage roof and bioswale can be found in figure 29.



mix ① BOUTELOUA CURTIPENDULA 20 %
DACTYLIS GLOMERATA 15 %
GERANIUM VISCOSISSIMUM 15 %
LOLLIUM MULTIFORM 20 %
PHALARIUM ARUNDINACEA 15 %
TRIFOLIUM 15 %

mix ② GENERAL PURPOSE LAWN MIX

fig. 29 - Planting scheme garage roof and paralel meadow + bioswale

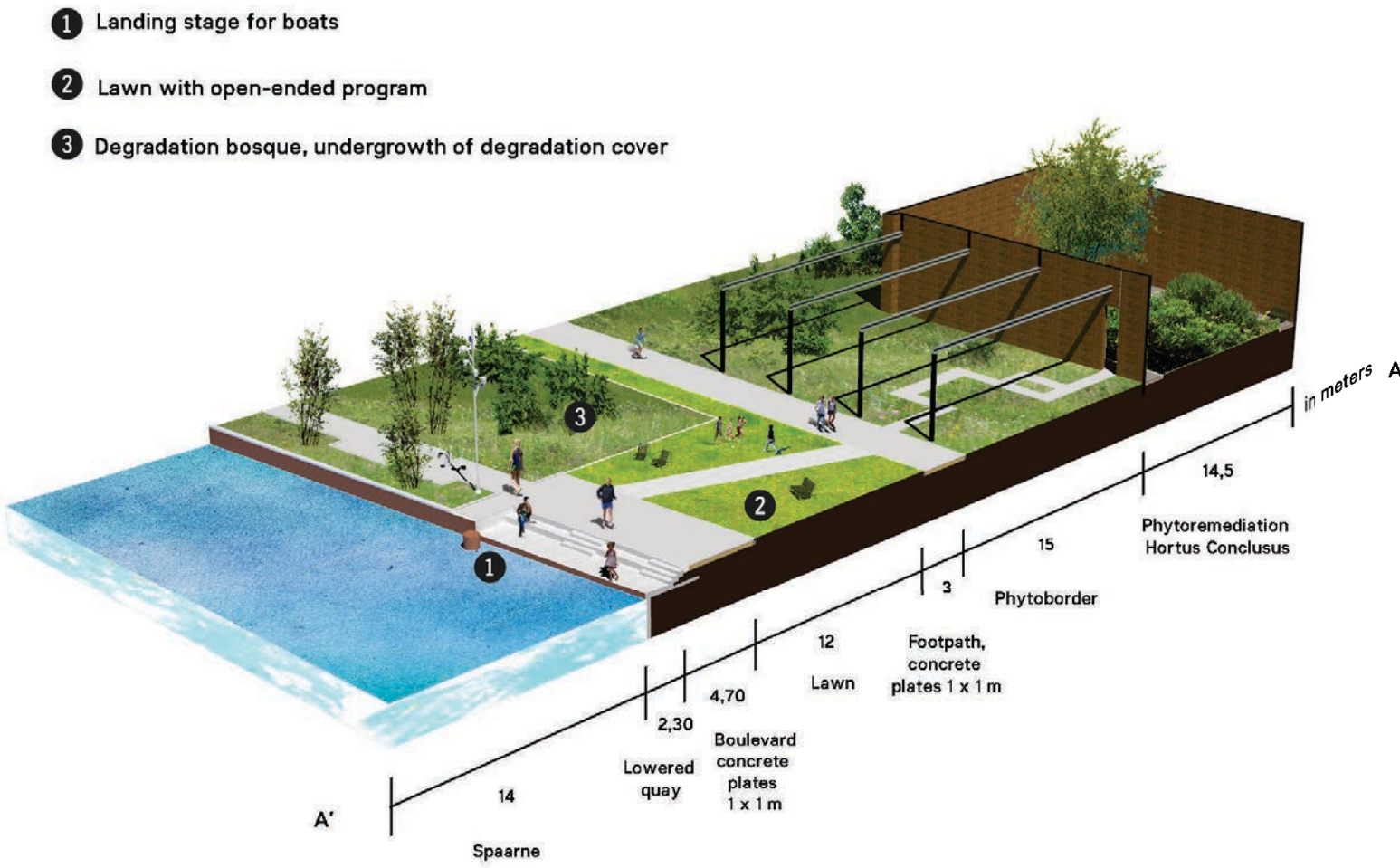


fig. 30 - 3D-section waterfront along the Spaarne

fig. 31 - By using street furniture with bright colours and high-tech lamp posts, the contrast paradigm is establish in the plan. Hereby, the 'new' and the 'old' will be better visible due to the contrast. The lamps and belonging posts are from the Olivio series of Selux.

fig. 32 - Serpentine Pavilion 2011 by Peter Zumthor and Piet Oudolf

In a strinking way, the derilict Zuiveringshal has been crowned with an intimate garden: the hortus conclusus of the new Gasfabriek terrain. The outerwalls of the building is let intact, while the rest is demolished. Between the outerwall and border lies a path from which the garden can be accesed and looked at. Benches are placed against the wall as a place for contemplation. Figure 32 shows a reference project as inspiration for this hortus conclusus. This way, we cultivate the post-industrial heritage and interweave a new layer with that what is already in-situ. It is a kind of dialogue between the data in-situ, materials and immaterial aspects, and the design intervention.

Discussion

This chapter will touch upon the critics that arose after the design. I will discuss them and try to show multiple critical perspective upon the design presented in the previous chapter.

First of all, this design assignment was not started with a tabula rasa to design on. From the analysis and reference study on program, a possible program, including a certain number of square meters of floor space, arose. In the design, not everything has been given a place, e.g. the number of square meters of floor space was not met. The desired program to load on the site was therefore not achieved. This can be traced back to the fact that I am confronted with a situation of a set of buildings already in the site and placed unhandy. Hereby, I could not place the building volumes optimally according to nowadays urbanism practices. Relicts form an industrial past had to be encountered within the project area. It became clear that designing around industrial relicts should be dealt with in a sensible way. By means of intensive form studies I have tried to approach this correctly.

This brings us to the next point. I think it has been wise to not consider everything of the post-industrial landscape as holy, but encounter this place pragmatic and flexible. To speak in line with Braae: 'only preserve that what is valuable to extend within the future', e.g. monumental buildings or trees on-site (Braae, 2015). Within the project, the 'Directiegebouw' has not been conservated, whereas the office of the 'gaswacht' has been conserved by keeping its fundaments and propose to make a playing area in and around it. This have been pragmatic choices as the gaswacht his office was located along a boulevard where no building blocks have been proposed and a new function as a playing area could be complementary to this spot. In the case of the 'Directiegebouw', the volume stood in the way of creating (semi-) closed building blocks out of the existing blocks already there. The choice for demolishment then, was a pragmatic way of realizing this design principle on urban blocks.

Regarding permanence and temporality, the remediation will take approximately 20 years; then the last PAH in the soil is remediated and we could think of new developments. A scenario for gradual developments of the chapter after phytoremediation has not been touched upon in this research. However, a vision of interventions after the chapter of phytoremediation could be interesting to think upon. For example, the desired density, in floor area, could be realised then, as on the phytoremediation plots along the waterfront, new space becomes available .

Furthermore, within this thesis I did not touch upon ecological consequences of phytoremediation planting on species that will use this plants for their food. As the phytoremediation applied in this thesis was concerned on petroleum contaminants, I assume the impact on the natural food cycle is limited. However, if the main purpose is the treatment of heavy metals that won't be degraded and be accumulated within the biomass, this could form a certain concern before further application.

Overall, the combination of phytoremediation, post-industrial transformation and a park landscape add bold new qualities to the area. Spatial qualities that are not found in Haarlem, yet. Big developments on the Gasfabriek terrain have been suspended for half a decade now. With this plan, an enormous upcycling of the ingredients already on site is established. Here I refer to the component 'upcycling' in the thesis title, as I take position that with this proposed plan for the Gasfabriek terrain, we are converting the medium-value ingredients already in-situ into a high-valued, desirable product; namely a business park with allure in the south of the project area, and a mixed-used, green neighbourhood in the north of the project area.

Conclusion

After the outcome of this thesis, I take the view that phytoremediation and transformation of post-industrial sites for sure have a field of tension, but in a more philosophical way complement each other. Post-industrial sites often contain a large number of hard surfaces and structures. Implementing the 'soft' layer of planting then is a contrasting intervention within the data of the landscape as it is at hand. Here, we have the 'grey', or call it 'brown', industrial history that contrasts with a new green layer sending a message of rebirth and healing nature.

The general research question of this thesis reads as follows: 'How can we design the transformation of the Gasfabriek terrain into post-industrial landscape park, while incorporating sustainable soil remediation principles into the design?'

The answer to this question could be generalized towards the conclusion that the park design aspect was a mediator between these two concepts during the design choices. Besides, design principles derived from the aspect of park design helped giving shape to the application of the phytotechnology principles and transformation of the industrial heritage by providing guidelines on the use of planting in parks, e.g. dense and open areas.

Furthermore, including theory on park design and performing reference studies, results in guidelines for the distribution of the park program. This then results in an interaction between shaping phytoremediation and giving form to the further program of the park during the design process. This interaction works vice versa, and could be a tool for following design on phytoremediation within post-industrial landscapes.

Overall, in the design for the Gasfabriek terrain, the organisation of the area is done through designing the landscape as a park first, instead of first designing the built

environment. We can relate this approach to a bigger theoretical picture: theories on landscape urbanism. This field of research in landscape architecture and urbanism assumes that organising cities through the design of the urban landscape, rather than through the design of its built volumes, is the best way to organise the design process of a city. Traditionally, existing built structure, such as roads or other buildings, guided the development of a design. Green spaces were used as ornaments or shredded into small pieces on the left-over spaces. According to Steiner (2011) 'cultural and natural processes help the designer to organize form.' This is the approach we took as well in the case of the Gasfabriek terrain: the post-industrial relicts containing the cultural objects and processes, and the introduction of phytoremediation within an existing contaminated environmental system as the natural object and process.

Reflection

Now I am writing this chapter at the end of my Bachelor thesis, I can say that I am confident and proud about the design I have made. I chose the topic of post-industrial transformation because it is a common practice for landscape architecture firms to design within this field, however, during the Bachelor program at the university we did not touch upon this topic. Therefore, I decided it could be an interesting topic for this thesis. To make the research more complex, I decided to combine it with phytotechnology and park design. After all, I think this combination was successful and led to a logical and well applicable design for in real-life.

During the first weeks of this thesis, I was mainly focussing on the analysis of the area and to answer the research questions. Hereby, I was well prepared when starting the design halfway in the timeframe. With a lot of knowledge about transformation, phytoremediation and park design in my pocket, I could make well-considered design decisions.

One of my learning goals for this thesis was learning to render images for my representation. I had never done this before, so I did some try outs in the seventh week of the thesis which was pretty successful. With this knowledge of how the trick works, I started producing quickly three shot that could later on be used for 3D-slices. These can be found in the 'Design' chapter.

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Image references

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Appendix I: Phytoremediation Principles

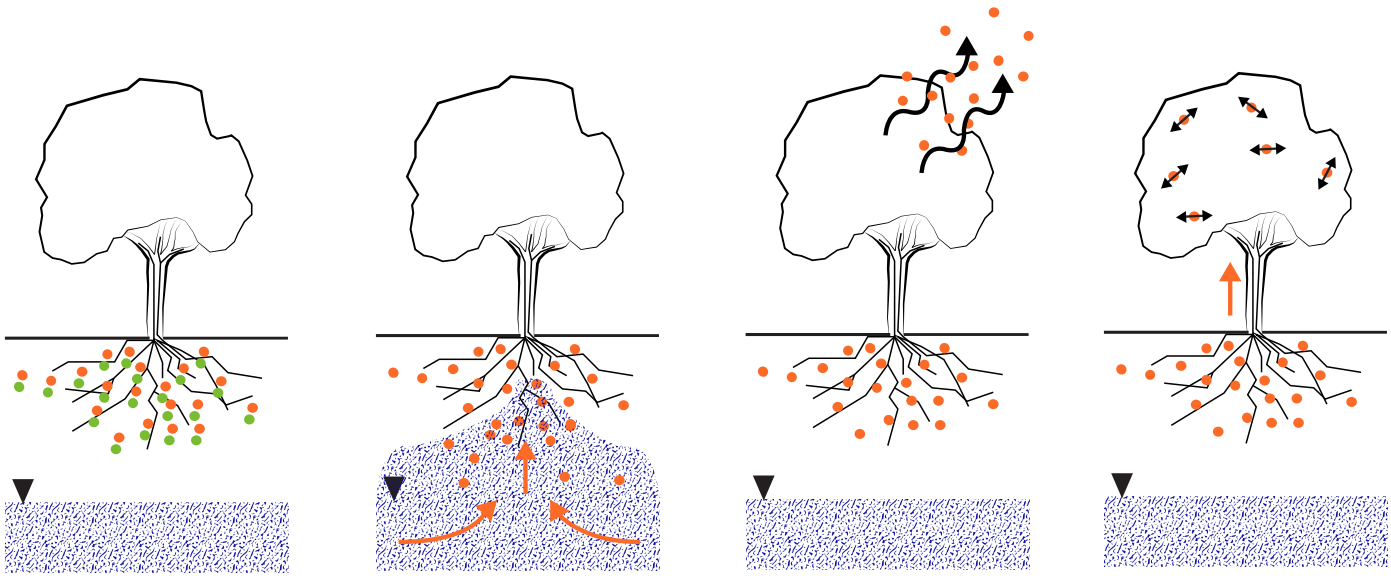

fig. 33 - Phytoremediation principles, from left to right: rhizodegradation, phytohydraulics, phytovolatisation and phytodegradation

Based on the breakdown of contaminant in the rhizosphere:

- Rhizodegradation:
Microbes in the soil destroy the contaminant. The root exudates released by the plant and the soil biology in the rhizosphere break down the contaminant.

Based on the breakdown of contaminants in the plant itself:

- Phytodegradation:
The plant itself destroy the contaminant. Here, via the uptake of contaminant by the plant, the plant destroys the contaminant by breaking it down into smaller parts by metabolic processes.

- Phytovolatization:
The plant releases the contaminant via its breathing leaves and stem. Here, the plant extracts the pollutant from the soil into its metabolism and volatilises it as a gas through the leaves and stem.
Based on stabilizing pollutants in the soil so that they do not mobilize within ground water flows or rain infiltration:

- Phytohydraulics:
The plant takes up water, whereby it creates an upward water flow in its own direction. Hereby, a contamination plume that is running off-site can be overcome.

These different techniques are not mutually exclusive and can be used in combination. For example, phytovolatization and phytodegradation can be combined where phytovolatization trees are varied with an undergrowth of phytodegradation grasses. By using several phyto-species simultaneously, different phytotechniques could be applied at the same place and at the same time General characteristics of phyto plants are tolerance to pollution, a deep or wide-spread root structure, high-biomass production and high evapotranspiration-rate.

Appendix II: Plant List

Botanical name	Common name (English)	Common name (Dutch)	Plant height, in meters	Contaminant	Phytotechnology typology
Trees					
Betula nigra multistem	River Birch	Rode/Zwarte berk	10-15		GMTS
Celtis occidentalis	Hackberry	Zwepenboom	8-15	BTEXN, MO, PAH	DB
Populus Alba	White Poplar	Witter abeel	20-25	BTEXN, MO, PAH	GMTS
Salix viminalis	Basket Willow	Katwilg	7, pollarded	PAH	DB, GMTS
Shrubs					
Sarcobatus vermiculatus	Greasewood	Sarcobataceae	2		GMTS, MMM
Herbaceous					
Agropyron cristatum	Crested Wheatgrass	Agropyron	1	MO	DC, MMM
Bouteloua curtipendula	Side Oats Grass	Muskietgras	0,5	BTEXN, MO, PAH	DC, MMM
Brassica juncea	Indian Mustard	Sareptamosterd	1,5	MO, PAH	DC, MMM
Canna x generalis	Canna	Bloemriet	1	BTEXN, MO	DC, MMM
Carex cephalophora	Ovalhead Sedge	Zegge	0,5	PAH	DC, MMM
Cymbopogon citrullus	Lemon-Scented Grass	Citroengras	1	MO	DC, MMM
Dactylis glomerata	Orchardgrass	Kropaar	0,5	MO, PAH	DC, MMM
Festuca spp.	Fescue	Blauw schapegras	0,5	BTEXN, MO, PAH	DC, MMM
Geranium viscosissimum	Sticky Geranium	Geranium	0,5	PAH	DC, MMM
Kochia scoparia	Burningbush	Zomercyprus	0,5	MO	DC, MMM
Lollium multiform	Annual Rye	Italiaans raaigras	1	MO, PAH	DC, MMM
Microlaena stipoides	Weeping Grass	Microleana	0,5	MO	DC, MMM
Phalaris arundinacea	Reed Canary Grass	Kanariegras	1	PAH	DC, MMM
Solidago spp.	Goldenrod	Guldenroede	1	MO, PAH	DC, MMM
Trifolium spp.	Clover	Klaver	0,5	BTEXN, MO, PAH	DC, MMM
Vetiveria zizaniodes	Vetivier Grass	Vetiver	1,5	MO	DC, MMM

Contaminant

BTEXN: Benzene Toluene Ethylbenzene Xylenes and Naphthalene
MO: Mineral oil
PAH: Polycyclic aromatic hydrocarbon

Phytotechnology typology

GMTS: Groundwater migration tree stand
MMM: Multi-Mechanism Mat
DB: Degradation Bosque
DC: Degradation Cover

Sources:

Kennen, K., & Kirkwood, N. (2015). Phyto: principles and resources for site remediation and landscape design: Routledge.

Theuws, P. A. W., & Wilschut, M. (2009). Healing urban landscapes : phytoremediation in post-industrial urban design. [S.l.: s.n.].

Appendix III: Examples transformation paradigms

fig. 34 - A new elevated footbridge has been painted birght blue to distinguish the newly introduced from the surroundings, Landscape Park Duisburg-Nord by Latz+Partner

fig. 35 - By means of recycling the data in-situ, a continuuity of both materials and athmosphere is extended into the future, Urban Outfitters HQ by D.I.R.T. Studio

fig. 36 - The acceptance of impermanence of things is expressed in the dynamic use and open-ended program of the ‘as found‘ in-situ, Ile de Nantes by Atelier de l’Ile de Nantes by Alexandre Chemtoff

fig. 37 - Construction of wetlands at Parque de Tejo e Trancao shows a way of optimisation in transformation on how is dealt with natural water systems, by Hargreaves Associates and Joao Nunes, PROAP

Appendix IV: Reference Study on Program & Design Ambition

Name: Kleefse Waard

Architect: West 8

Location: Arnhem, The Netherlands

Year of completion: 2008 and ongoing

Short introduction: Kleefse Waard aims to offer the best business climate for sustainable campanies that focus on clean technology; 'cleantech' developments for a sustainable future. The cluttered area was transformed based on West 8's masterplan to become a continuous and connected terrain. The area consists of clean, austere and univocal forms.

Program: Heavy tree lanes give structure to the area and an old elevated pipeline is a continuous element in the landscape. Buildings are alternated with open spaces such as meadows and squares. The cultural-historical valuable buildings are saved with the preservation of their historical character. In the middle of the park the businesses are mixed with a conference centre and a café and restaurant. It is possible to sit outside on a small square in the front. Through the whole plan, we find wide street profiles that give the area an airy and open appearance. Furthermore, an experimental field for wind turbines and hemp cultivation field are placed on the outskirts of the park, complementing the sustainable character of the area.

Design ambition/philosophy: The design aims to create a 'community' of 'cleantech' companies by investing in facilities and activities in collarboration with the companies who have taken up residence in the business park. The landscape is the connecter in this environment of start-up and larger businesses. They inspire each other through the exchange of knowledge. The design is functional and austere, which fits the activities taking place on the site. The finish is a little rough here and there which fits the character of the former factory terrain and the given fact that there is no housing on site. Regarding the old buildings already there they made the decision to only keep the cultural-historical valuable buildings.

Embedment in its surroundings: The area has a gateway building through which you enter the area. The entrance is intended for the employees working on the business park users and people having a reason to visit the site, for example a conference or activity. This gives the area an inward appearance for the rest of Arnhem.

Target group: The program is intentioned for a select target group; employees of the businesses and start-ups located in-site. Furthermore, visitors with a reason to visit the site.

Positive: Simple design elements as a heavy tree lane and old elevated pipeline tie together the area and give a coherent impression. Furthermore, the wide street profiles in the masterplan give the area an airy appearance and enables exiting new ways of usage such as picnic tables for lunch or a café along the sidewalk.

Negative: The wide street profiles offers much space for several ways of transportation. However, through the whole plan the car is given all space and sometimes pedestrians have to live with a sidewalk at just one side of the road or even none at all. Given the amount of space, also slow transportation could have been developed further.

Name: Strijp S

Architect: West 8

Location: Eindhoven, The Netherlands

Year of completion: 2001 and ongoing

Short introduction: The revitalization of the former Philips industrial and headquarter complex is transforming the area into a new public place to work, live and play. The combination of existing buildings with new estates is a strong characteristic for the area. The centre of Strijp S is formed by a sixty-meter wide axis, which links all facets of the area. The former industrial site close to the city centre was closed for the public before, and with this regeneration it was intended to add a new accessible part to the city. As the identity and visual aesthetics are opposite to the one found in the city centre, the intention was to create a new centre that is complementary to the existing city centre.

Program: The central axis of Strijp S, Torenallee, is densely planted with straight rows of lane trees. The axis includes iconic lightning (refering to the Philips lamp manufacturing), ornamental kiosks and two sculptural buildings as visual accents. Parallel to this axis is an urban boulevard with a wide profile and again containing straight rows of lane trees.
Parallel to the Torenallee are two urban boulevards, with wide profiles and a thick canopy of trees, which serve as high quality addresses for the new housing developments. Alongside one of the boulevards is an intimate square, surrounded by various restaurants and bars, a skate park, event square and a multi-purpose lawn field. All over the area, several plazas and lawns have a more open-end program that give people the opportunity to perform an activity in the space in their own way. In the area, there are spaces with a more open or more closed appearance due to vegetation or enclosed by buildings. This allows the human habit of 'seen and be seen' to be performed.

Design ambition/philosophy: The materialisation and detailing of the central axis design is high-end executed. It shows the contrast between the 'new' and the 'old'. This could be linked to the new housing developments taking place along the axis, which is intended to be mid-range and high-end rent and buy. Contrary to this main axis, some spots have been left more or some shabby and untouched. Here, the contrast between 'new' and 'old' exposed in the same space supports the presence of one and another.
The location is indented to be a complementary second centre for Eindhoven with a 24-hour program to give Eindhoven a new kind of urbanity. Many ambitious events take place here, for example the Dutch Design Week. This ambition requires a steering and far-reaching design in order to accomplish this ambition. Regarding the object already in-situ, the design has chosen to only keep the iconic Philips buildings and make free space available for new developments elsewhere.

Embedment in its surroundings: The continuation of existing roads, bus lanes and cycling lanes has been applied on all sides of the area, except for the side of the railway track that passes along. At the north side, the straight rows of lane trees along the urban boulevard continues inside the neighbourhood opposite of Strijp S. Here, the materialisation of Strijp S also penetrates inside the neighbourhood. At other parts in the design, we see a continuation of roads, bikepaths and sidewalks, but the materialisation changes from concrete paving stone and edge beams in clinkers and bluestone edge beams.

Target group: The program for this area is diverse and offers options for all ages. The boulevard is programmed with more intimate spaces along or behind the buildings and caters the public with countless options. The program provides activities all day long, all year round with its mix of work, leisure, shopping and living. Concerning the open squares and lawns, the program opens up possibilities for all target groups to fill it in with their own activity.

Positive: The central axis of Strijp S defines a clear subdivision of spaces and is the backbone in structuring the spaces in the area. As this allee is densely planted with straight rows of lane trees, an atmosphere of seen and being seen develops. The iconic lightning and kiosks add value to the areas identity.

Negative: Because of the strong emphasis on the Torenallee, the attention to the Ketelhuisplein could be overshadowed when moving around on site. On the other hand, this division creates two different athmosphere which strengthens both in the end.

Name: Grorudparken

Architect: LINK Landscap

Location: Oslo, Norway

Year of completion: 2013

Short introduction: The Grorudparken is a linear park that cuts through the Groruddalen neighbourhood. The surrounding urban fabric is connected to the park by footpaths. The river Alna is the continuous element through the park. Halfway in the park, a highway fly-over crosses the park. Improvement of water quality in the river was one of the project goals. The soil has been polluted by polluted (rain)water. By various soil cleansing techniques, the soil and the water filtering through the soil is remediated. The project is a pilot project in Norway and incorporates phytoremediation, reducing carbon emissions associated with transporting soil for off-site remediation.

Program: Spread out proportionally, the park introduces facilities for athletics, play, recreation, youth programmes, social interaction, and cultural activities for the diverse local population. There are small squares along the river that allow contact with the water by quays and jetties, many seating and long stairs that also function as seating tribune. The design offers more densely and more open planted areas. Along the river we find a combination of paths close to the river without trees around and paths further from the river that are more densely planted.

Design ambition/philosophy: The ambition was to make the application of phytoremediation not leading in the design process. The planting scheme chosen is diverse and give it a natural appearance. According to its ambition, the park shows that a good design is not subordinated when phytoremediation is applied. Overall, the materialisation and form language is chosen to contrast with its surrounding. The materialisation of steel, concrete and bluestone has been applied in sharp and clean shapes, contrasting with its natural surroundings.

Embedment in its surroundings: The public park is freely accessible all-day long. The routing of the park attaches to the existing routes in the surrounding and flows through as a spider in the web. Accessibility and safety placed significant demands on outdoor lighting within the project. LINK Landskap developed a site-specific lighting concept to increase the attractiveness of densely planted areas, bridges and tunnels. Thereby it has created an exciting extra spatial dimension to the park.

Target group: The program of the park has been established for all ages and a wide variety of cultural backgrounds. For elderly, some parts of the park could be inaccessible due to height differences.

Positive: The way in which the phytoremediation is integrated in the planting plan is done with a full effort on integration. The park shows that the application of phytoremediation is complementary to a good design. The phytoremediation is approached as an enrichment of the plan, which add extra values to the already well-designed planting. The contrast of the materialisation and form add power to both the natural and man-made elements.

Negative: The core of the design is the largest square along the river with a deckfloor added to it to enable a connection with the water. The square is next to the highway fly-over. Hereby, the vistas on the linear park and its waterscape are not the best I would say.

Name: Haute Deule River Banks

Architect: Atelier des paysages Bruel-Delmar

Location: Lille, France

Year of completion: 2009

Short introduction: Haute Deule River Banks is a sustainably developed district along the Deule River. The old textile mill of Le Blan-Lafont, now the Euratechnologies building, forms the focal point of the area through its dimensions and its central place in the quarter. It houses technology related businesses inside this former industrial building. In the design, the memories of the past industrial times are expressed. As a former industrial site, the area dealt with polluted soil and water. Phytoremediation was introduced in the design as a treatment to counter the contamination. Here, the vegetation improves every year and the young willow trees contribute to the establishment of a dynamic ecosystem.

Program: The core of the project is the old textile mill which brings together all program around it; a square, large lawn, water garden with stepping stones and the quay along the river. With the diverse program around Euratechnologies, an interactivity is created between the building dedicated to hi-tech companies and the public spaces open to the larger public. A redesigned parkway links the site to the district of Le Marais. This 'Avenue of the Willows' is a densely planted green strip with grasses and willow to execute phytoremediation. The wide avenue has broad footpaths with many seating opportunities along the path and at crossings.

Design ambition/philosophy: The development of the Haute Deûle River Banksleans leans on the recognition of on the memory of the past industrial times expressed in the new public spaces. The continuity of the industrial atmosphere is sought by materialising the pavements out of big concrete blocks and applying weathering steel with a rusty look. This park and its parkways function as green spaces and soil remediating mechanism on a neighbourhood level. They clean the soil locally and offer a green space on a local scale. This ambition is recognisable in the design: the program offers nothing outstanding compared to other neighbourhood parks. The most attention in the design has been paid to the area surrounding the Euratechnologies building, which has a higher ambition in its design and offers the majority of amenities like seating and bike stands.

Embedment in its surroundings: Via the implemented parkways in the design, the new park around Euratechnologies is well connected with the neighbourhood via a 'green finger' concept. Across the Deule river, a new bridge is introduced that links the area to the city centre. It is possible to touch at the quay by boat.

Target group: community of Bois Blanc, the local neighbourhood. Futhermore, the visitors and employers of Euratechnologies are a target group which is catered with spots for having an outdoor lunch or making a small lunch break walk.

Positive: The finger concept, newly introduced bridge and the possibility to touch at the quay by boat boost excellent connectivity to the area.

Negative: The big open spaces around the old textile mill is perhaps a bit out of proportions. Big lawns and squares surround the building which, according to me, create a certain detachment and feeling of being lost in space. The proportions of variation in open and close are too big for a city park.

fig. 38 - Kleefse waard, at the central crossing of the area


fig. 39 - Torenallee, Strjp S

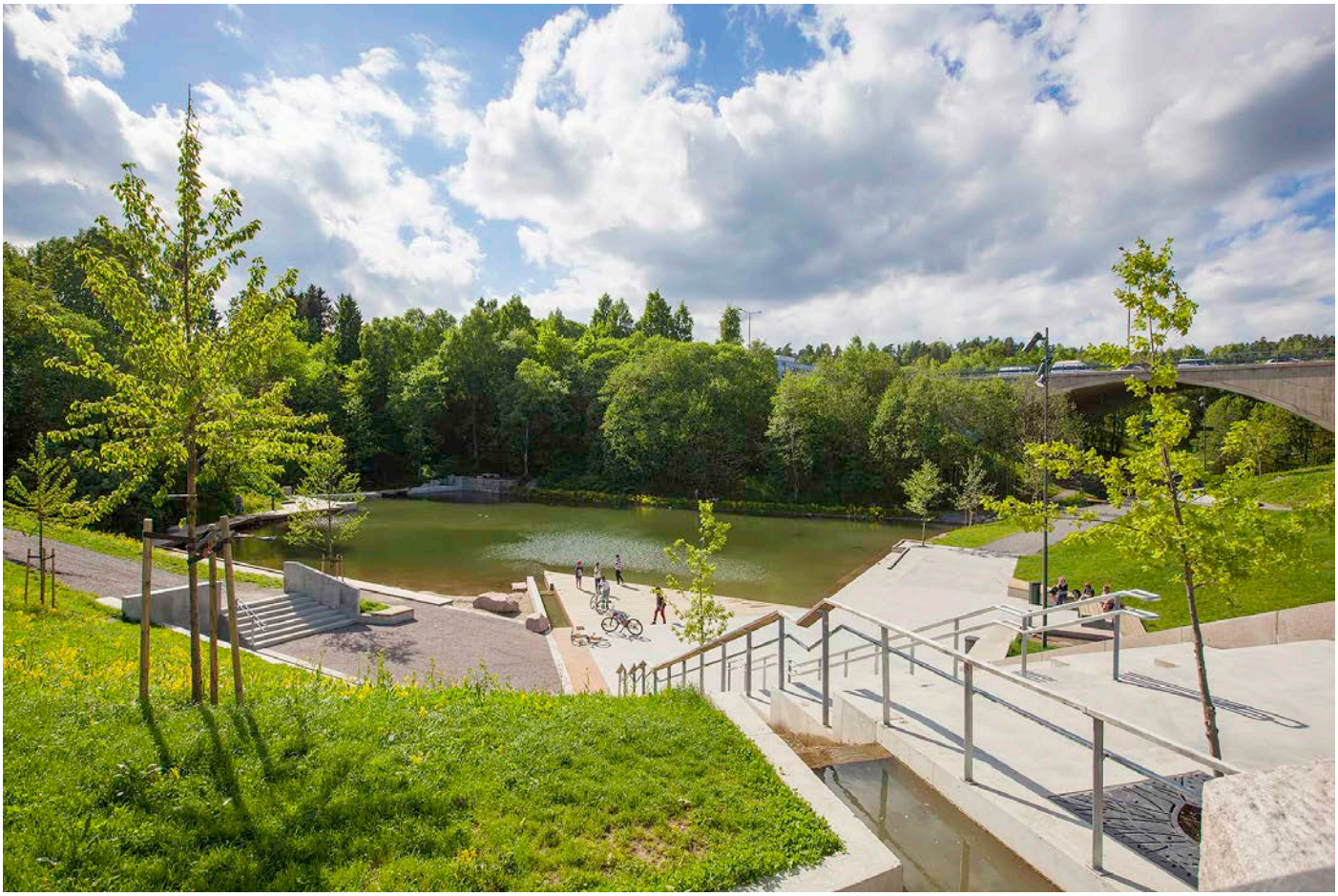

fig. 40 - Accesible waterfront and stairs that function as tribune as well, Grorudparken

fig. 41 - Newly developped waterfront, Haute Deule River Park