# Regenerative Design: a multi-functional river landscape for *Mamelodi*

Dissertation title: Regenerative Design: a multi-functional river landscape for *Mamelodi*

Site description: Pienaars River, east of Mamelodi

Project address: Mamelodi East

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University: University of Pretoria
Faculty: Faculty of Engineering, Built Environment and Information Technology
Department: Department of Architecture

Study leader: Dr. C.A (Ida) Breed

Clients:

- Department of Water and Forestry (DWAF)
- NGO – Earth Keeper
- JNF Walter Sisulu Environmental Centre
- Adopt Moreletaspruit
- Private companies (Woolworths)
- Several schools in the area that will use the park as playgrounds

Research field: Environmental Potential

Submitted in fulfillment of the partial requirements for the degree of Masters in Landscape Architecture (Professional) in the Department of Architecture, Faculty of Engineering, Built Environment and Information Technology, University of Pretoria.

In accordance with Regulation 4(e) of the General Regulations (G.57) for dissertations and thesis, I declare that this dissertation, which I hereby submit for the degree Master of Landscape Architecture (Professional) at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at this or any other tertiary institution. I further state that no part of my dissertation has already been, or is currently being, submitted for any such degree, diploma or other qualification. I further declare that this dissertation is substantially my own work. Where reference is made to the works of others, the extent to which that work has been used is indicated and acknowledges in the text and list of references.

University of Pretoria
2018

_____
E. Smit

# Abstract

The dissertation investigated community connection to rivers in urban regions and the environmental design of a multi-functional river landscape. It is about the investigation of community connection, use, and appreciation to rivers in urban regions.

Worldwide there is constant growth and expansion of urban regions and a rapid increase in urban populations. This leads to a demand for more clean and sustainable water sources in urban regions upon which the people depend and can benefit from. The existing natural water sources in urban regions are further challenged by issues such as water pollution. The restoration, preservation, purification, and sustainable use of rivers are critical to ensure future water services and environmental survival (Art.net, 2018).

An area east of Mamelodi next to a tributary of the Pienaars River, Hatherley Spruit, is selected as the site for testing the hypothesis that the natural rivers in our urban regions can be used to provide multi-functional river landscapes along the river for the community to physically and psychological reconnect, use, and appreciate the rivers in urban regions by using the concept of water as the binding factor and regenerative design theory.

Throughout the theory and design the approach was to introduce the challenges we face regarding rivers in our urban regions using three different lenses to look at rivers, which are: River as a functional system, river as a resource, and river as place. This led to the design and investigation of an off stream water filter system that addresses a global problem but the progam alongside the off stream water filter system is site and community specific.

The theory of regenerative design promotes the inclusion of the community in the design process at different stages and levels of involvement. By means of the three lenses of resource, function and place is viewed as interdependent parts of the design system. These three powerful lenses guide the solutions to the challenges and provoke opportunities regarding the design.

# Acknowledgements

*'Do not fear (anything), for I am with you; Do not be afraid, for I am your God. I will strenghten you, be assured I will help you; I will certainly take hold of you with My righteous right hand (a hand of justice, of power, of victory, of salvation).'* - Isaiah 41:10

Thank you to the One who strengthened me, guided me, and gave me everything.

I would like to thank the following people:

Ida Breed: thank you for your advice and guidance. This year would not have been such a success without you.

My family: Dad, Mom, Roselle and Nico. Thank you for all your support, love, patience, motivation, and encouragement during the year.

My fiance: Christo, thank you so much for your love, encouragement, site visit trips, advice, support, and thank you for believing in me.

# Bedankings

*'Wees nie bevrees nie, want Ek is met jou; kyk nie angstig rond nie, want Ek is jou God. Ek versterk jou, ook help Ek jou, ook ondersteun Ek jou met my reddende regterhand.' - Jesaja 41:10*

*Dankie aan die Een wat my versterk (want ek kry my krag van U vreugde) my voetstappe lei, en aan my alles gee.*

Ek wil graag die volgende bedank:

Ida Breed: dankie vir al jou advies en leiding. Die jaar sou nie 'n sukses gewees het sonder jou nie.

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# Introduction

Chapter 1

## Chapter overview

This chapter will discuss the introduction to the site and problem, research question, hypothesis, sub-questions, delimitations and assumptions of the study.

# 1.1 Introduction to the problem

The expansion of urban life and regions is a powerful symbol of social and economic development and progress. The other side of this reality is that urban expansion provokes degradation of natural resources such as the pollution of natural rivers, decrease and loss of biodiversity due to habitat fragmentation, flooding, and erosion in urban regions (Petts, et al. 2002).

The approach to urban region developments in general has been unfortunately driven by short-term visions and not by the desire to provide for nature and well-being but rather to control the natural environment and exploit natural resources in urban regions for economic gain. The problem is that what remains of natural resources in urban regions often become isolated. The consequence is a lack of social interaction with nature. People become unaware of nature and become disconnected from local natural resources in the urban regions (Petts, et al. 2002), making them unaware of what their life dependency rests on.

Today 1% of the earth's surface is covered by urban regions and the expansion and process of urbanization is accelerating faster than at any other time in history (Petts, Heathcote and Martin, 2002). In the 1990's most of the people in the world lived in rural areas, but by 2020, which is around the corner, about 65% are likely to live in urban regions across the world (Petts, et al. 2002). This underlines the importance the preservation and rehabilitation of urban natural resources such as rivers, the natural environment, and clean available life sources such as water in urban regions.

In the last 25 years huge progress has been made to provide people all over the world with clean water, as of 2010 over 6 billion of the world's population has access to improved drinking water sources. Although this is praiseworthy, over 1.1 billion individuals still lack access to clean water; over 5 million people in South Africa today still lacks access to clean water which is safe for consumption. The primary cause is the contamination of water and water-borne diseases (Unhabitat.org, 2018).

Fig. 1.1 Erosion alongside natural river (Pinterest, 2018)

Fig. 1.2 Urban water pollution (Pinterest, 2018)

Fig. 1.3 Urban river chanalised (Pinterest, 2018)

Fig. 1.4 Urban river waste pollution (Pinterest, 2018)

Challenges related to clean water in urban regions will enlarge in the future due to the ever growing population needing to share insufficient and poorly managed resources. The distribution of urban water systems in South-Africa is unable to keep up with the growing demographics, and many of the urban poor are excluded from these services. Low-income urban dwellers have to pay high prices for clean water, sometimes up to 50 times the price paid by higher income groups (Unhabitat.org, 2018).

Better understanding by the community of urban water problems can lead to a new vision of urban rivers, now urban rivers is perceived as symbols of decay and pollution but urban rivers could be a catalyst for urban regeneration (Petts, Heathcote and Martin, 2002). As rivers in Africa are greatly associated with agricultural practices and food security, which will become more important in the future of cities, urban rivers also holds that potential in South Africa.

The problem around urban river pollution and the lack of easy accessible water is a global problem (Art.net, 2018). There is a need for landscape design around urban region rivers to be more sustainable. The smaller water sources in the urban regions have a big influence on their surroundings and the nearby communities. Urban rivers can provide much more for the surrounding community than just to transfer storm water to the nearest dam or bigger water body. These smaller areas can create an impact on the larger area. Nabeel Hamdi's (2010) approach on urban region upgrades shows how small interventions and small upgrades can have a big influence on the greater picture.

According to France (2008), the problem and solution regarding urban rivers is a social one. The people of the community around urban rivers are often not aware of the benefits urban rivers can provide them (France, 2008). As Craig Rimmerman (2011) notes it is important for the people of the community to recognize their responsibilities and roles as citizens within the larger community. It is important to educate the community about rivers in urban regions and to make the people of the community understand the need of restoration and preservation of urban rivers not only to the benefit of the environment but also to the benefit of the community themselves (France, 2008).

As rivers are often surrounded by open green space, due to no development in the flood line area, they also offer a particular opportunity to landscape designers.

There are two aspects designers need to address to achieve the vision of sustainable urban rivers, first the planning of the land use to make the best use of the river, and second the planning of the river itself, so that it is seen as an asset to the community (Petts, Heathcote and Martin, 2002).

## 1.2 Significance of the research

### 1.2.1 Disconnection between communities and rivers in infromal settlements within Urban Regions

The Landscape design focus is open space design around rivers in urban regions, specifically in Mamelodi East on a site where there is a disconnection between the community and the urban river, Hatherley Spruit.

In densely populated areas, such as Mamelodi East, the absence of proper sanitation facilities leads to the pollution and contamination of the available water sources and natural streams in the nearby area of the urban poor.

Mamelodi started with just a handful of houses, today it is home to 334 577 people (Gauteng.net, 2018). The fast growth of Mamelodi's population influenced the effective upgrade and infrastructure of

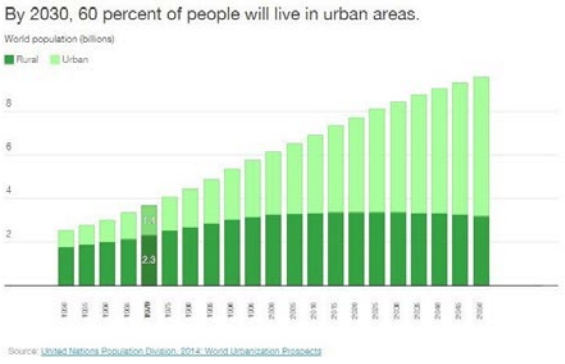



Fig. 1.5 Graphic of percentage people living in urban areas yearly (United Nations, 2018)

clean accessible water to all household's. The growth of service infrastructure does not match the growth of the population density of Mamelodi. Mamelodi can still be seen as a dormitory settlement, with most people working in other regions of the city. People need access to basic services and to quality environments for health and well-being.

Prioritizing water issues and urban rivers is therefore a crucial matter in the overall urban development effort of Mamelodi East and in the field of Landscape Architecture in South-Africa.

As statistics from statistics South Africa show in table 1, only 35, 9% of people in Mamelodi have piped water inside their dwellings (Africa, 2018). The upgrades and implementation of water and service infrastructure is therefore critical. This is one of the most influential issues found in Mamelodi, but also creates opportunity to look at alternative and innovative design aspects to react to the issue.

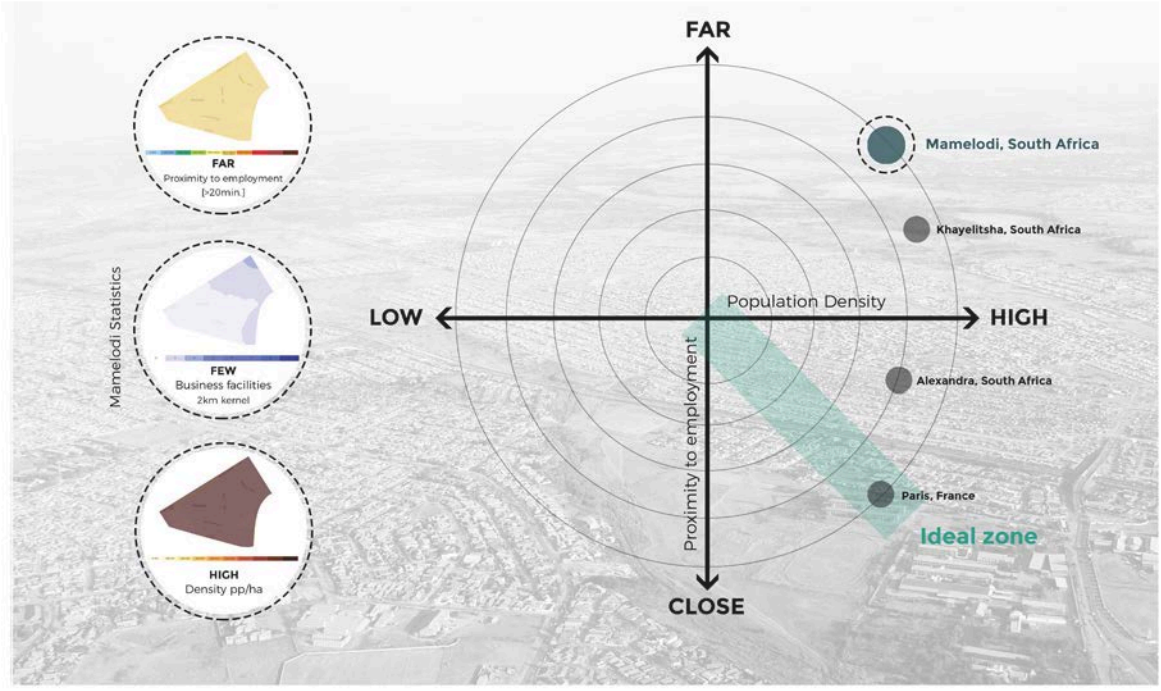



Fig. 1.5 Dormitary settlement diagram (Group work, 2018)

## Statistics of Mamelodi Community

Table 1 - Showing % of people with piped water in Mamelodi

| | |
|---|---|
| Total population | 334,577 |
| Young (0-14) | 23,3% |
| Working Age (15-64) | 73,7% |
| Elderly (65+) | 3% |
| Dependency ratio | 35,7 |
| Sex ratio | 108,2 |
| Population density | 7403 persons/km2 |
| No schooling aged 20+ | 4,3% |
| Higher education aged 20+ | 9,5% |
| Matric aged 20+ | 38,4% |
| Number of households | 110,703 |
| Average household size | 2,9 |
| Female headed households | 33% |
| Formal dwellings | 61% |
| Housing owned/paying off | 40,5% |
| Flush toilet connected to sewerage | 70,4% |
| Weekly refuse removal | 75,6% |
| **Piped water inside dwelling** | **35,9%** |
| Electricity for lighting | 69,3% |

## Mamelodi Community source of water

Table 2 - Indicating the source of water for Mamelodi community

| Source of water | Percentage |
|---|---|
| Regional/Local water scheme | 94,4% |
| Borehole | 0,4% |
| Spring | 0,1% |
| Rain water tank | 0,1% |
| Dam/Pool/Stagnant water | 0,5% |
| **River/Stream** | **0%** |
| Water vendor | 0,4% |
| Water tanker | 1,4% |
| Other | 2,7% |

### 1.2.2 The disconnection in Mamelodi East between urban rivers and the community

The disconnection in Mamelodi East between urban rivers and the community exist due to the following issues that are traced through site analysis and observation:

o The landscape around the urban rivers is undeveloped and lacks infrastructure that accommodates the community of Mamelodi East.
o The lack of infrastructure around the urban rivers transforms the rivers and their landscape to unsafe and forgotten places in Mamelodi East.
o The forgotten urban rivers in Mamelodi East have poor amenities for the community; and there is a lack of comfort and artistic qualities around these rivers.

The conditions explained above prevent the community to willfully interact with the urban rivers and the opportunities they present in urban area. This further leads to disconnection between urban dwellers and nature. Landscape design can assist to alleviate these issues by introducing green infrastructure and regenerative design principles that provide access, use and mutual benefits. This challenge includes the balance to combine soft bio-engineering works, enhance the social context and accommodate ecosystem services to connect communities and rivers in urban regions.

## 1.3 The idea of green infrastructure in Mamelodi East

Open space such in Mamelodi alongside the river can be multi-functional and should be appreciated and supported for the diverse contribution it holds to the urban region. At the scale of human experience, green infrastructure or open space needs to contribute a meaningful part to the lives of the people of the community in order for them to value and appreciate it. Multi-functional landscape spaces can be the most enduring public works of our time if we can connect people to them (France, 2008, pg. 246).

The study will focus on how water can be used as the binding factor to re-establish connection between the community and urban rivers. To re-establish appreciation from the community's side for urban rivers and to introduce new ways in which the community can use the urban rivers as source of water that can provide multiple benefits and reciprocity between the community and nature.

## 1.4 Site location

The site is situated east of Mamelodi alongside one of the Pienaars River's tributaries, Hatherley Spruit. The site consists of the natural stream surrounded by a strip of vast landscape with veldgrass and invasive species. The site is surrounded by Mamelodi Hospital, Mandela Park Peace Garden, Nelson Mandela Park, JNF Walter Sisulu Environmental Centre, Pateng Secondary School, Tlakukani Primary School, and Mveledzo Primary School and has the potential to become a multi-functional river landscape in Mamelodi where the community can coexist with and benefits from the river.

Issues exist on site such as unsafe spaces, water pollution, unused open space, and rubble disposure alongside the river. The river is not used as a resource by the people of Mamelodi, and the landscape around the river is only used for rubble disposal and as a gateway from the residential area to the commercial areas.

Please refer to fig. 1.6 and 1.7

## 1.5 Research Question

How can communities and rivers in urban regions be connected through landscape (design)?

## 1.6 Thesis statement / Hypothesis

The landscape design of a multifunctional river landscape that restores the river and addresses the recognition of mutual dependencies between humans and nature can foster this reconnection by using water as the item of codependency.

## 1.7 Sub-Questions

1. What are the processes of human driven regeneration/ restoration of rivers in urban regions?
2. What are the dependencies of people on nature?
3. What are the dependencies of people on water?
4. What are the dependencies of people on rivers (in Mamelodi)?
a) How do communities interact and respond to the rivers in urban regions?
b) How do communities use water on a daily basis (activities, rituals, survival)
c) What can rivers in urban regions provide for the surrounding community?
5. How can the codependencies between the community and rivers be recognized in a design?
6. How can reconnection between people and nature be fostered in design?
7.How can multi-functionality be promoted in design?

## 1.8 Definition of terms.

o Landscape design – Landscape design is the integration of a wide variety of elements to achieve functional and beautiful landscape spaces. Landscape design is design and art tradition, combining nature and culture.

o Environmental Restoration – Renewing and restoring degraded, damaged, or destroyed ecosystems and habitats in the environment by active human intervention and action (France, 2008).

o Regenerative Landscape – The incorporation of elements such as environmental engineering, ecological restoration, low impact development (LID), and sustainable development and balancing the need of both nature and people (France, 2008, pg. 427).

o Green infrastructure - A Landscape Approach. It is an inter-connected network of green open spaces that provide a range of ecosystem services — from clean air and water to wildlife habitat. Small-scale green systems designed to be urban storm water management infrastructure. In either definition, green infrastructure is about bringing together "natural and built environments" and using the "landscape as infrastructure" (Rouse and Bunster-Ossa, 2013).

o Sustainable development – Sustainable development meets the current needs of the people of today and for the people of the future. Sustainability requires recognition of the value of clean water and earth; of wildlife and natural ecosystems. It is much about improving our quality of life as it is about environmental protection (Petts,


Fig. 1.6 Site locality (Author, 2018)

Heathcote and Martin, 2002, pg. 74).

## 1.9 Methodology

The approach is to investigate the theory of regeneration design to enhance the environment around as well as the natural river stream, to enable a clean and healthy urban environment specifically as applied to Mamelodi East. The approach will also investigate how multi-functional landscapes can assist in accommodating the community of Mamelodi East and ultimately create reconnection between the urban river and the community of Mamelodi East. The study will investigate in what manner the community can interact with the river and use the river to its full potential using water as the binding factor.

The approach is to introduce the challenge and opportunity we face regarding rivers in our urban region using three interdependent lenses to look at rivers.

The first lens would be river as a resource and life source that provides water to support the community and the

Fig. 1.7 Site locality diagram (Author, 2018)

environment in urban regions. Rivers hold water which is a common need for communities, not only for survival but for tasks such as washing of clothes and cultural activities such as rituals. The rivers in urban regions can provide facilities to implement activities as such but it is polluted and in some cases un-safe to interact with. The benefits of urban rivers are not being experienced directly through the community because of water pollution. How can we use the urban rivers as a resource for the community but also for nature by enhancing the biodiversity and river ecosystem?

The second lens will be rivers as functional system. In our urban regions we should avoid environmental hazards and use resources sustainably. Functional problems (e.g. erosion) have traditionally been solved technically through engineering works without looking at the social and environmental context (Ison, Roling, & Watson, 2007). The engineering solution to rivers in our cities improved navigability, land reclamation and flood protection, but led to degradation of wildlife, landscape and amenity value of urban rivers (Petts et al. 2002), and larger alterations in environmental processes (Promonski et al. 2012).

How do you prevent this from happening to rivers in urban regions from the beginning, how do you treat the natural river to accommodate people of the community as well as nature, and use the urban river to its utter best potential?

The third lens builds on the other two and sees a river as place where the community can receive psychological well-being, and the sense of identity and belonging. Around urban rivers, spaces and activities start to occur that create social rituals and interaction spaces. In some areas of Mamelodi East, there is a lack of safe spaces, water pollution, and rubble disposal alongside the river. These issues result in rivers becoming forgotten places, the community turns its back on the river.

To understand the local communities' attitudes, belief systems and collective behaviors around urban rivers may result in project durability and instigating a process of cultural adaptation (Pahl-Wostl et al.2008).

These three powerful lenses can be viewed as interdependent parts of the same system

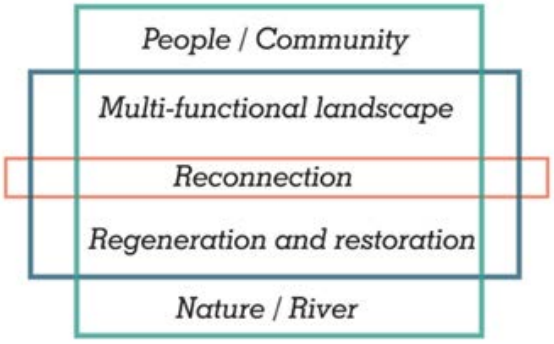



Fig. 1.8 Methodology diagram (Author, 2018)

in a multi-functional river landscape.

## 1.10 Data collection methods

As part of the study data was compiled by means of using the landscape as medium to investigate local knowledge for the purpose of ecological design. Using an integrated mixed-methods approach to conduct information around the three lenses: river as resource, river as functional system; river as place includes:

River as resource: Semi- structured interview; 9 people of Mamelodi East community were interviewed. The interviews were done through informal conversations asking people of the community of different genders and ages questions regarding their views, interaction, and needs regarding the urban rivers and water in their community. Each interview lasted +- 15min.

Ethical clearance was obtained from the EBIT faculty. Please see Ethical Clearance letter in Appendix A.

The type of questions that were asked includes:
1. How often do you pass by this area?
2. Why do you pass by this area?
3. How often do you cross the urban river?
4. Do you use the water in the urban river for any personal need?
5. Do you think the water of the urban river is polluted?
6. Would you make use of the water if it is not polluted?
7. Would you come to the urban river for

recreational purposes?

Conclusions drawn from the semi-structured interviews will be discussed in the context chapter (see Chapter 2).

River as functional system: Spatial mapping through drawings and images of the site, Hatherley Spruit, movement patterns of the community through the site, intervention nodes around the site, and existing features on the site were mapped to understand the existing system of the environment and community of Mamelodi East.

River as place: Range based modeling was conducted to map the site, investigate the topography of the site, and to understand the site context and how the community responds to the site as a place. The interviews also added in shedding light on this matter.

## 1.11 Research objectives

The research study will investigate the theory of regenerative landscape and rivers in urban regions and how this differs from the ecological restoration theory of urban rivers. The goal is to combine these two theories to achieve sustainable urban rivers to the benefit of the environment and to the benefit of the people of the community.

The research study includes to the theory and application of wetlands and filter systems to clean the water of the urban river. Specifically how wetlands can be used to filter the quality of water in the Pienaars River to the extend where the water can be use by the community for different activities such as rituals, washing of clothes, irrigation of crops and for drinking. The study will also investigate different plant species to be used in the filtration of wetlands appropriate to Mamelodi.

The research study will investigate urban rivers as place. How to foster a reconnection between the community and urban rivers and how social interventions can be activated around urban rivers, through multi-functional landscape explored in design.

## 1.12 Aims of the study

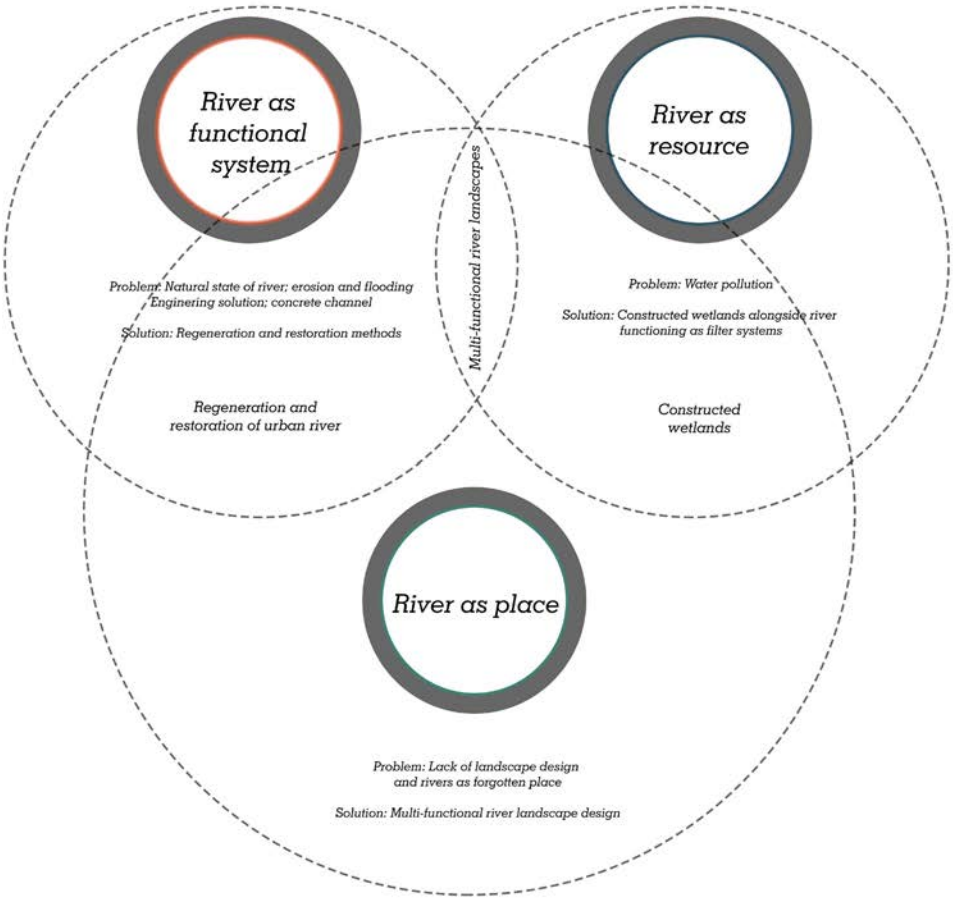



Fig. 1.9 Data collection methods (Author, 2018)

o Create awareness of the benefits urban rivers can provide to the surrounding community in Africa.
o To create a sustainable river landscape design.
o To change the perception of rivers and the traditional neglect of rivers in urban regions.
o To create a design proposal for a multifunction river landscape where the community is connected to the river in the urban region and using the water in multiple ways.
o To create a design proposal for wetlands alongside the urban river functioning as filter systems to clean the water of the river.
o To design an urban river landscape that combines engineering works, enhance the social context and accommodate ecosystem services to connect communities and rivers in urban regions.
o To create a design proposal for green infrastructure that enables the functioning of ecosystems and the provision of ecosystem services as a meaningful part of the lives of the people in the community in order for them to value and appreciate the river.

## 1.13 Research strategy

The research strategy is inspired by the regenerative design theory. The research strategy is as follow: a desktop study to gain all the data necessary. Followed by site analysis and mapping of the site and existing. Followed by semi-structures interviews asking the people of the community from different ages and genders questions about their interaction, beliefs, needs, and uses of the urban river to gain more personal and relevant data to the community. Followed by a concept generation based on the findings regarding the needs, beliefs and uses of the community, as well as the environmental and functional system needed for design success. Followed by system analysis and perfection in order for the form and program of the design to develop. Then followed by the stitching and implementation of the program to the system of the project. This will activate the social and economic aspects to the project as well. Followed by the technification of the project to ensure that the system and program work well together. Then followed by the detailing of the system and components to the system and program.

## 1.14 Limitations

The study results are only applicable to Mamelodi East Pretoria.

## 1.15 Delineation

It was necessary for the study to investigate the whole catchment area of the Pienaars River to understand the context and know the factors that have an influence on the Pienaars River and the Pienaars Rivers tributary where the design proposal was made.

The boundary where the design proposal is situated: The vast green strip of wasted land alongside the Pienaars River vessel, starting from the intersection of the Pienaars River and vessel, stretching over Tsamaya avenue (M8) between Tsakane and White city area, stretching down between Mamelodi Hosital and Khutsong across Serapeng avenue, south until the Metrorail.

## 1.16 Assumptions

The data received from Adopt Moreletaspruit regarding the quality of the Pienaars River water were used to inform design decisions and are assumed to be accurate and complete.

## 1.17 Clients

o Department of Water and Forestry (DWAF):

DWAF is the guardian of South Africa's water and forestry resources. DWAF will help with the formulation and implementation of the water and sanitation of the project. They will also help promote effective and efficient water resources management to ensure sustainable economic and social development in the project.

- Directorate of Water Conservation, Catchment Management and Water Quality Management
- Directorate of Water Utilization
- Directorate of Working for Water

o NGO (Earth Keeper) – They will assist in

the facilitation of environmental action and support environmental training and learning.

o JNF Walter Sisulu Environmental Centre – Working with them to make the community aware of the river and the potential the river has and what it can provide for the surrounding community. JNF Walter Sisulu Environmental Centre has existing programs regarding agriculture and river clean-up session that will contribute to the study project.

o Adopt Moreletaspruit – Using this organization as a source for data regarding the status of the Pienaars River's water quality and they are also part of urban river awareness programs.

o Private companies that works towards the conservation of water and the promotion of appropriate green technologies.

o Schools in the area that will use the park as playgrounds.

o UN-Habitat – established the Water and Sanitation Trust Fund (WSTF) which currently supports water and sanitation projects in 27 countries involving a wide range of partners, including families, communities, governments, and organizations. The main focus of the fund is currently improving delivery of water and sanitation in Africa and Asia through two programs; Water for African Cities, and Water for Asia Cities. These initiatives sponsor policy dialogue, information exchange, water education, and awareness rising.

## 1.18 Conclusion

The study investigates in what manner the community of Mamelodi East can interact with the river and use the river to its full potential using water as the binding factor. From the literature it is derived that:

Regenerative landscape design is a multi-layered strategy that recognizes the need for humans to exist in livable, environmentally healthy communities and urban regions and it only can be achieved by direct public engagement. The focus is thereof on a 'bottom-up' process of community engagement (France, 2008, pg. 429). It is possible to use public participation in the implementation of ecological restoration projects and this will foster ownership and ownership fosters preservation.

Restoration design is the creative combination of science and art. It considers both cultural and ecological/nature aspects, and lastly it also has a sense of community-based design.

It is important for the restoration design and community involvement in urban rivers because there are three ways we depend on it. The first is as a life source, secondly as a basis to site development and thirdly as a place for human psychological well-being. Water is the life source for all living things. The people in Mamelodi Easts' dependencies on water are quite essential for survival, everyday household activities, irrigation, and for religion practices. It is crucial as a designer to address and incorporate new ways to make clean accessible water available to communities in every day landscapes.

From the interviews it is evident that the people of the community are not aware of the benefits Hatherley Spruit or any other urban river close by the residential and commercial areas, holds. The use of water in a functional system is not active in the lives of the community because of no infrastructure available for the community to access and use the water. Although there are quite evident water points in the informal settlement area in Mamelodi East where the community gathers around to practice their daily water activities.
In Mamelodi currently there is an interest from the community to engage with the rivers if the water is safe for use. Current activities around water include:

o Rituals such as baptism and prayer performed alongside and in the spruit
o Washing of clothes
The rehabilitation of rivers and natural streams in our cities can be improved by an ecosystem service approach, where human societies understand what benefits natural ecosystems provide, and are encourage to understand and request these benefits.

The implementation of the concept of green corridors as part of the urban Green

Infrastructure is an important theory that fosters reconnection of nature in design.

# Theory and research

Chapter 2

## Chapter overview

In this Chapter the research questions in Chapter 1 will be discussed and answered through theory and research applicable to each question, and through the information gathered by the semi-structured interviews mentioned in Chapter 1.

## 2.1 What are the processes of human driven regeneration/ restoration of rivers in urban regions?

### 2.1.1 Regeneration of rivers in urban regions

Regeneration is the incorporation of elements such as environmental engineering, ecological restoration, low impact development (LID), and sustainable development and balancing the need of both nature and people (France, 2008, pg. 427). Regenerative landscape design has a developing theoretical basis.

Regenerative landscape design is a multi-layered strategy that recognizes the need for humans to exist in livable, environmentally healthy communities and urban regions. Regenerative landscape design is focused on the environment and nature; and can be a technological pursuit to sustainable development. According to France (2008) this can only be achieved by the direct public engagement in many phases of the overall environmental reparation process. The focus is therefore on a 'bottom-up' process of community engagement (France, 2008, pg. 429). (See case study a, b and c)

### 2.1.2 Ecological restoration

Traditionally, ecological restoration is focused on repairing nature, with no regard paid toward the human inhabitants, of damaged or soon-to-be repaired landscape. It is possible to use public participation in the implementation of ecological restoration projects. An exemplary case study of ecological restoration is that of the Florida Everglades, in the USA, which in 1999 became the largest and most expensive ecosystem in the world containing agriculture, housing development and water management manipulations. This study shows that community participation can greatly improve the success of the project and preservation of ecological restoration. (See case study a, b and c)

### Regenerative design projects

#### a. Las Vegas, Wash restoration Project

A case study that represents regenerative design is that of the Las Vegas Wash River restoration. Las Vegas is the fastest growing city in the USA and with that its runoff has increased to such that it erodes the riverbed. Part of the project was to restore the natural wetlands and to transform the area into the Clark Country Wetlands Park.
The success of the project was due to two reasons: the landscape architects made use of highly engineered installations and included an active program of directly engaging the public in all stages of the process.

The result of the project covered the benefit of people with significant attention being paid to a complete watershed management program focused on improving the quality of human life and developments which included a healthy urban environment, a clean and rehabilitated urban river, and the increase in biodiversity in the urban environment (France, 2008, pg. 429).

Fig. 2.1 Regenerative case study - Las Vegas, Wash (France, 2008)

b. Howard Park Project, West Palm Beach, Florida (2002-2009)

Howard Park is a historic community park in one of the main streets in the city, West Palm Beach along Okeechobee Boulevard, and a gateway into the downtown. Michael Singer has the privileged in 2002 to receive this project (Michaelsinger.com, 2018).

Singer implemented a creative exercise involving a community participant group involving regional artists, design and planning professionals, historians, anthropologists, students, and members of the public. This resulted in an exhibition of all the explorations found through the community participation group regarding social, historic, commercial, cultural and environmental characteristics and opportunities of the site (Michaelsinger.com, 2018).

The development of the opportunities created a sense of place specific to South Florida by transforming the existing park into a place that celebrated the subtropical environment and the diverse population. (Michaelsinger.com, 2018)

The key component of the design is the massive re-vegetation of the site with native plants with the goal to regenerate the land and create distinct spaces for recreational activities. The design also included concepts such as urban gardening, a native plant nursery, generating power with solar canopies, a water filtering retaining wall, and interconnected trails for pedestrians, bikes, and canoes (Michaelsinger.com, 2018).

The first phase of Howard Park was completed in 2010, the first phase of work replaced large unutilized lawn with a waterscape of interconnected ponds edged with native vegetation and to reshape a highly visible retention pond as a gateway to the City. The expanded pond now retains storm water to reduce flooding. After the completion of the project, the waterscape will serve as an educational tool to show the extraordinary Renaissance Project for storm water recycling that is connected through Howard Park and the retention pond (Michaelsinger.com, 2018).

Artist/Designer: Michael Singer
Singer Studio Project Team
Landscape Architecture: Rosenberg Gardner Design

Fig. 2.2 Regenerative case study - Howard Park, West Palm Beach (Michaelsinger.com, 2018)

### c. The Aire River Project, Geneva

The Aire River Project in Geneva based their concept on designing a river garden. The Aire River flows through valleys which were previously devoted to farming. In the late 19th century the river was progressively canalized (Landezine.com, 2018), like many urban rivers are being treated these days. The state of Geneva held a competition with the idea to restoring the river to its original state by destroying the canal (Landezine.com, 2018).

Group Superposition instead proposed to combine the canal with a vast divagation space for the river and in the process the canal became the pointer for transformations, a guiding or reference line giving the possibility to understand the before and after. Group Superposition attempted to propose the concept where the ecological shifts are incorporated into the larger cultural changes. The result of the design became a linear garden, where linear series of gardens in the canal links with the new river space (Landezine.com, 2018).

The footprint of the canal is an important aspect for creating necessary calm and interiority without which there is no real garden. It is a permanent trace which introduces a complex temporality, both past and future, memory and desire (Landezine.com, 2018).

The team focused on the idea that a river loves to design itself freely, they proposed a launching pattern whose form addresses the play between the river flow and the prepared terrain. These pattern/ form resulted in a diamond shape and open a complex series of undetermined channels for the flows (Landezine.com, 2018).

Architecture: Group Superpositions

Fig. 2.3 Regenerative case study - The Aire River (Landezine.com, 2018)

Community participation foster ownership and ownership fosters preservation.

## 2.1.3 Restoration design and environmental restoration

According to France (2008) people has the mindset of disseverance from nature, to be separate from nature, and desperately need to find positive ways in which to reconnect to the environment. It is important to reconnect to the environment because humans depend on the resources the environment provides such as food, materials, water, and health. One of the ways one can accomplish this is to physically engage in the process of ecological restoration. The act of restoring degraded landscapes is an act of mutuality where it is important to improve the quality of the outside environment of nature, but also to improve the human nature¬ relationship (France, 2008).

The process where participants creatively develop physical and conceptual relationships to connect to repaired nature through the architectural transformation of their inhabited ecological space and internal realization can be defined as restoration design (France, 2008).

Restoration design has a rich history back to the time of the work of Law Olmsted in the 19th century in Boston, where Frederick Olmsted designed a linear system of parks to connect Boston Common, dating from the colonial period, and Public Gardens (1837) to Franklin Park, known as the 'Great country park'. This idea can be linked with the idea of green infrastructure in urban regions.

In all environmental disciplines restoration design is one of the most integrative because it combines two or more things to form an effective unit or system (France, 2008). In relation to the project, the two or more things that will be integrated are: nature and its ecosystems services, wildlife habitat, and ecology integrated with social and economic development that is linked to the beliefs and needs of the community.

According to Petts et al. (2002) there are five important elements of urban river restoration: the improvement of the water quality, the regulation of run-off to prevent erosion, removal of invasive species, wildlife conservation, and the control of litter around the riverbeds. It is important to require the education and the involvement of the people of the community to ensure that the focus for urban revival is moving the urban rivers from the 'backyard' to the 'front garden' in urban regions (Petts, et al. 2002). (See case study d)

In summary restoration design is the creative combination of science and art. It considers both cultural and ecological/ nature aspects, and lastly it has a sense of community-based design. Environmental restoration is the renewing and restoring of degraded, damaged, or destroyed ecosystems and habitats in the environment by active human intervention and action. (See case study d).

Fig. 2.4 Restoration case study - The River Skerne, England (Petts, et al. 2002)

## Restoration design project

### d. The River Skerne Project, Darlington, England

A case study that represents restoration of rivers is The River Skerne in Darlington project in England, UK. In this restoration project the designers together with the community transferred a visually unattractive channel of low ecological value into an attractive leisure feature of ecological interest.

The floodplain had been raised by old industrial waste tipping, containing gas, and sewer pipes running alongside the river. This resulted in constraints, and restoration opportunities were limited – typical of urban rivers elsewhere.

The participation of the community was crucial for the project scheme and went beyond consultations and interviews. The community groups and schools actively helped to plant and with other physical work. This resulted in ownership of and pride in what has been achieved during and at the completion of this project (Petts, Heathcote and Martin, 2002). The main aim om the project was to promote further river restoration and to demonstrate how urban river restoration could provide multiple benefits such as; enhancement in wildlife, landscape recreation, enhancement of water quality, fisheries, amenities, and other community interests.

## 2.2 What are the dependencies of people on nature?

The biophysical environment, nature as we know it, is our life-support system and there are three ways we depend on it. The first way is as a life source of clean air, water, food, energy, and materials to support human settlements. Secondly as a basis to site development, avoiding environmental hazards that can be a risk to human settlements and sustainable use of the natural resources that is provided by nature. The third way is as a place for human psychological well-being, and the sense of identity and belonging, to find our place in the region and in nature (Oberholzer, 2014).

These three ways of dependence were linked to the three lenses mentioned in Chapter one; Nature is a life source for the community that provides water, food, and materials to support the community and the environment in urban regions. Nature as a functional system and as a basis to site development to avoid any environmental hazards and the sustainable use of the natural resources that it provides through nature, and lastly nature as place where the community can receive psychological well-being and the sense of identity and belonging.

The increase in investment in tourism for economic purposes also depends on nature for cultural and aesthetic value of an area (Guo, Zhang and Li, 2010). The ecosystem services: cultural, regulating, supporting and provisioning also include tourism and aesthetics (cultural)

## 2.3 What are the dependencies of people on water (in Mamelodi)?

Water is the life source for all living things. The dependencies of people on water are quite widespread. Two thirds of the earth's surface is covered by water and the human body consists of 75% of water. It is evidently clear that water is one of the prime elements responsible for life on earth (Laleva.cc, 2018).

Water circulates through the land transporting, dissolving, and replenishing nutrients and organic matter, while carrying away waste material. Water circulates through the human body just as it does through the earth, regulating activities of fluids, tissues, cells, lymph, blood and glandular secretions (Laleva.cc, 2018).

People depend on water for survival. Cities have been built around the location of pure drinking water, and places of gathering were around wells. Water also has a powerful and central place in belief practices of many religions because of its symbolism of purifying (Laleva.cc, 2018).

The people in Mamelodi Easts' dependencies on water are quite essential for survival, everyday household activities, irrigation, and for religion practices. It is crucial as a designer to address and incorporate new ways to make clean accessible water available to communities in every day landscapes. (See also 2.4.2)

## 2.4 What are the dependencies of people on rivers (in Mamelodi)?

The value of urban rivers as a basis for planning open space has been recognized by urban designers and is an attraction for people although the water quality plays a big role in the interaction and value for the community.

Urban rivers provide qualities such as aesthetics to the urban environment, amenity value for bankside recreation in urban regions, and it brings nature to urban regions. Attractive urban rivers attract economic regeneration and thus the value of the water in urban rivers is increasingly being recognized (Petts, et al. 2002).

A healthy and sustainable urban river is widely recognized and acceptable as a social desire in urban regions. It is a reflection of the quality of life of the people in the nearby community. Environmental enhancement that includes healthy urban rivers will arise economic and social benefits, it will improve the public health, provide greater amenity and recreational opportunities (Petts, et al. 2002).

To establish the specific relationship of the Mamelodi community with their urban river, 9 informal interviews were conducted in Mamelodi East along the Hatherley Spruit

during May 2018. From the interviews the following became clear:

The community of Mamelodi East mostly uses the site as a gateway from the residential area (eastern side of the site) to the more commercial areas (western side of the site); Mamelodi Hospital, Schools etc. The pathways can be traced clearly on site and is an important element.

o The community does not use the water of the urban river to drink from, but some of the interviews indicated that people do use the water from the urban river upstream for washing of clothes because of poor infrastructure in the more informal settlement areas.
o The interviews indicated that a small group of the community uses the urban river to pray at and perform rituals further downstream.
o The answers regarding the pollution of the water from all interviews indicated that the water is polluted and hinders people from interacting with the urban river.
o The interviewees confirmed that they will be more interactive with the urban river if the water is not polluted and is safe to use.
o A minority of interviewees responded positively to the question about recreational purposes, although there is a lack of good healthy social and environmental spaces in Mamelodi East.

From the interviews it is evident that the people of the community are not aware of the benefits Hatherley Spruit or any other urban river close by the residential and commercial areas holds.

### 2.4.1 How do communities interact and respond to the rivers in urban regions?

The community of Mamelodi East interaction and response to the urban rivers is quite careless and unappreciative. From the interviews it is clear the community does not appreciate the urban river for what it is in its natural state or the benefits they can gain from the urban river after and during the processes of restoration and regeneration.

Answers drawn from the informal interviews with the community: the river is not at use for them because of the pollution in the river; at the site specifily the people pass by and walk over the Hatherley Spruit but do not pay much attention to interact with the river and draw water from it.

Landscape design can assist to alleviate these issues by the implementation of green infrastructure, a program, and services to bring easy access, safety, comfort, and artistic qualities to urban rivers and create a more positive interaction and response from the community towards the river.

### 2.4.2 How do communities use water on a daily basis (activities, rituals, survival)

**Water as a resource:** the use of water in Mamelodi community is the same as in any suburb setting. The people of Mamelodi use water for drinking household activities such as washing of clothes, for cooking, washing of dishes, irrigation for their gardens and vegetable gardens, and other outdoor activities for example car wash.

There is the romantic historical traditions of African cultures where mostly women and children would each carry an empty bucket on their head, walk the path to the river, collect water, wash themselves, wash clothes, and wash their children, and then walk back to the village with the buckets of water for drinking and cooking purposes (Olugbenga. 1997). Although this implies hard work and time which are valuable commodities in an urban environment, many positive rituals and social practices were and could still be formed around this tradition.

Around these water points cultural factors are taught and developed. Innovative

Fig. 2.5 Traditions of African cultures (Pinterest, 2018)

ideas are received and adopted or valuable indigenous knowledge passed on. Personality characteristics like trust, security, and value orientation are developed as well. In this way the collecting of water is a beautiful part of African culture. This forms part of the romantic idea of collecting water from the river that was not only part of the daily life of people but part of their traditional values (Olugbenga. 1997).

There is still some of this rich culture aspects found in Mamelodi, the goal would be to acknowledge this rich African culture into the program.

A lot of small car wash businesses are found in the Mamelodi community, where the people provide services to wash the taxis at nearby taxi ranks and bus stops. A small car wash business is found on the site nearby the urban river, but the water in the river is not being used for the car wash services, only municipality water is used.

**Water as functional system:** the use of water in a functional system is not active in the lives of the community of Mamelodi. The reason for this is that there is no infrastructure available for the community to access and use water in such manner. There is no filter systems implemented in their homes to catch storm and rain water to harvest and use, there is no innovation or motivation to recycle water or use some sort of system to pump water from the river, use it and recycle it. This creates the opportunity to invest and encourage such systems to reuse water for daily activities, social and economic values; the access to enough clean water is after all a problem in Mamelodi.

**Water as place:** there are quite evident water points in the informal settlement area in Mamelodi East where the community could gather around to practice their daily water activities, such as the collection of drinking water and cooking water, to rinse off their vegetables harvested from their private backyard food gardens, and to sit down and socialize. The concept of water as the binding factor to create place becomes very relevant and real for the community of Mamelodi.

### 2.4.3 What can rivers in urban regions provide for the surrounding community?

Rivers in urban regions is a valuable element for the urban environment and for the people in the urban regions. According to Petts et al. (2002), there are many benefits urban rivers can offer us such as clean water, productive fisheries, diverse range of plants and wildlife in and out of the water, flood storage reservoirs, irrigation for agriculture, water for drinking, to do rituals and create a healthy environment in urban regions, but these benefits are lost because of alterations caused through urbanization (Petts, et al. 2002) and no attention and provision for nature made during these processes of urbanization.
Ecological services can be connected to the value of rivers, as mentioned above.

People's physical, culture, social and economic lives are dependent upon ecological services that include: clean air, fresh water, food, and nutrients derived from plants and animals. Ecosystem services also include cultural aspects such as aesthetics, recreation and tourism.

Ecological services can be linked to the three lenses: River as a life source that provides fresh water to support the community and the environment in urban regions, river as a functional system as a basis to site development to avoid any environmental hazards and the sustainable use of the natural resources that is provides through nature, food and nutrients; and river as place where the community can receive psychological well-being, cultural, social, and economic value and the sense of identity and belonging.

Fig. 2.6 Site photo of spruit currently not being used to the benefit of the community (Author, 2018)

## 2.5 How can the (co)dependencies between the community and rivers be recognized in a design?

The (co)dependencies in a design can be recognized by using the ecological wisdom principles to develop ecologically wise resolutions to a practical problem.

What is ecological wisdom? Originally, Naess (1973, p99) explained ecosophy as philosophy of ecological harmony or equilibrium which is a kind of wisdom referred to by Plato as sophia or theoretical wisdom. It is concerned about "how to live on Earth enjoying and respecting the full richness and diversity of life-forms of the ecosphere" (Naess, 1989, p.185). Xiang (2014, 2016) revives the concept of ecological wisdom in relevance to ecological practice. Xiang (2014, p.67) says that ecological wisdom is both individual and collective and that it not only implies sophia, Plato's philosophical wisdom, but also practical wisdom (Liao and Chan, 2016).

The practical part of ecological wisdom Xiang (2016) defines as "the master skill par excellence of moral improvisation to make, and act well upon, right choices in any given circumstance of ecological practice". This leads to the question what is the right thing in ecological practice? Ecological wisdom is argued as a context-dependent capacity (Xinag, 2014, p.67; Xinag, 2016), an ecological wise resolution should be place specific.

To do the right thing the designer could work wisely with the unique particulars of any practical situation. This could be the guide or regulation the wise practitioner sets out to design for the human-nature relationship (Liao and Chan, 2016).

Fig. 2.7 Site photo of spruit which lies close to the residential area but there is no connection (Author, 2018)

Throughout history there have been different proposals regarding the human-nature relationships. The Chinese scholar Laozi (571BC – 471BC) argued that "humans follow the laws of Earth; Earth follows the laws of Heaven; Heaven follows the universal laws, which are the laws of nature" However philosophical guidance remains abstract. To make ecological wisdom practical it requires ecological wisdom principles for clear direction for designers to follow to develop ecological wise resolution to a practical problem (Liao and Chan, 2016). In the field of ecological design a number of studies have provided directions such as 'Design with nature' from the late landscape architect Ian Mcharg (1969), which provides a systematic land development approach that avoids environmental sensitive areas and works with natural dynamics.

Another book Ecological Design, Van der Ryn and Cowan (1996) talks about the "five principles of ecological design process", which includes elements of solutions grown from place, the local conditions and the surrounding matters, ecological accounting informs design, design with nature; which utilize ecosystem services beneficially, everyone is a designer; ubiquity of the design impulse, and to make nature visible by revealing ecological processes in structures (Liao and Chan, 2016).

## 2.6 How can reconnection between people and nature be fostered in design?

The implementation of restoration of degrade rivers raise the recognition of the value of urban rivers and river corridors for amenity; the re-creation of nature in urban regions and the conservation of nature; and through these, enhancing the quality of urban living for the community and fostering reconnection between the community and urban rivers (Petts, Heathcote and Martin, 2002, pg.67).

The design of rivers in urban regions can hold back flood waters, restore flood plains

and create suitably designed flood and balancing areas with an interlinked green network of river corridors. These corridors serve to connect different areas of the community but also to connect people to rivers in urban regions (Petts, Heathcote and Martin, 2002, pg. 67).

The implementation of the concept of green corridors as part of the urban Green Infrastructure is an important theory that fosters reconnection of nature in design. Green corridors are an attempt to ease negative effects of the built environment in urban regions.

The green corridors act as conservation for development of urban regions. The most important element of green corridors is the functional connection that enables dispersal movement for wildlife within urban regions (Iopscience.iop.org, 2018). A green corridor is typically a green strip of land in urban regions that provides sufficient habitats to support movement of species in the natural environment and habitat for wildlife (Iopscience.iop.org, 2018).

The reconnection can be fostered in a design by implementing infrastructure and sustainable design mimicking nature, biomimicry. This could be a visual implementation of ecological principles and the replication of the precision in which nature completes certain functions as evidence of our dependence on nature, for example bees as pollinators of human food supply (Marvel, 2018).

The message of biomimicry and dependence on nature could improve human practices and protect natural systems in urban regions. This heightened appreciation evolving from the community can help the people to grasp the value of nature in urban regions to assure protection of global and local natural resources, foster reconnection between the community and nature, and conserve natural resources (Marvel, 2018).

Fig. 2.8 Site photo of fence between the spruit and the residential area (Author, 2018)

## 2.7 How can multi-functionality be promoted in design?

Multi-functional design in urban regions is important because it improves and enhances wildlife habitats. The implementation of chain wetlands will be proposed to the design to increase the biodiversity. This will foster diverse plant and animal communities alongside the Spruit, control flooding and increase biodiversity. This will also enhance the environment for the community, and add to their life value in an urban region.

One of the most important aspects to ensure ongoing success of the multi-functional design and programs is to include the local community to preserve and enhance the wildlife habitat (Petts, Heathcote and Martin, 2002, pg.65-66). The project could be a success if the landscape provide multi-functional aspects and usages for the community to take ownership in, that satisfy their needs and interest, and enhance cultural, social, and economic value. (See case study e)

## 2.8 Conclusion

The rehabilitation of rivers and natural streams in our cities can be improved by an ecosystem service approach, where human societies understands what benefits natural ecosystems provide, can encourage people to understand and request these benefits.

According to Petts et al. (2002) there are five important elements of urban river restoration: the improvement of the water quality, the regulation of run-off to prevent erosion, removal of invasive species, wildlife conservation, and the control of litter around the riverbeds. It is important to require the education and the involvement of the people of the community to ensure

that the focus for urban revival is moving the urban rivers from the 'backyard' to the 'front garden' in urban regions (Petts, Heathcote and Martin, 2002). These five important elements will play an important role in the development of the design.

In the beginning of the 20th century the best solution or practice in urban drainage reasoned to cover all drains, putting many streams and small rivers underground, and because of the expansion of impermeable surfaces it increased runoff during storms and this resulted in the canalization of rivers through urban areas (Petts, Heathcote and Martin, 2002). To prevent erosion and flooding the channels were lined by concrete and the bankside vegetation was removed to further accelerate flood runoff. In the end everything was done to get water off the land and down the channel into a dam or sea as fast as possible. This created the problem of 'backyard' river where rivers in urban regions became neglected and used as dumping grounds for wastes (Petts, Heathcote and Martin, 2002), for example the Apies River.

The landscape design of rivers in urban regions is just as much about the people of the community as it is about the nonhuman environment. Landscape design alongside rivers in urban regions needs to incorporate responsibilities and services to others and to the environment to provide opportunities rather than burdens for future generations (France, 2008). Too often professionals make choices without the regard for the cost to the community, to do what is easy, or what's been done before because it works. We need to ask what could help the people of the community to create lives of abundance, lives of access to rivers in urban regions, and opportunities that refill and restore nature rather than degrade it (France, 2008).

The approach of multi-functional river landscapes, the combination of restoration and regeneration of urban rivers and wetlands as filter systems, can resolve the problematic aspects of the river and provoke accessibility for the surrounding community, creating river as place. To understand the local communities' attitudes, belief systems and collective behaviors around urban rivers may result in project durability and instigating a process of cultural adaptation (Pahl-Wostl et al., 2008).

# Multi-functional river landscape design project

## e. Chiveve River Project, Beira, Mozambique

The intent of the Chiveve River project in Beira, Mozambique, is to create a park that realizes the values offered by large public parks to the City. This includes climate change improvements, education, and recreation. This intent is realized through series of activities which are related to the improvement of ecosystem functioning, improving educational values, accessibility, permeability, and a sense of place (Earthworks Landscape Architects, 2018).

The Chiveve River was a small tidal inlet stretching from the coast in Beira, up to 5km through the city centre to Goto informal settlement where is originates at Goto wetland (Earthworks Landscape Architects, 2018).

Earthworks Landscape Architects, South Africa, have the privilege to design this intent; implementation is expected to start in 2018. After project completion it will be one of the largest urban parks in post-colonial Africa, to date. Earthworks Landscape Architects proposed passive and active recreational activities, art installations, and activation nodes located along the river length to encourage people to use and value the park and the river system (Earthworks Landscape Architects, 2018).

These activation nodes respond to the surrounding urban context and the existing social patterns and needs, this provide an exciting and suitable program for the park. The team proposed an additional 20 pedestrian bridges to cross the river, as well as a cycle route network which provides linear connection to the harbour through to Goto wetland; this will improve the access across the river (Earthworks Landscape Architects, 2018).

A key aspect to the success of the project is through understanding the river, and the park as part of the City's urban fabric. Each basin of the design has a unique programmatic focus that is based on the outcome of the site analysis, and responding to the surrounding urban fabric and context. Design elements are proposed to link different spaces of the park; gateways to define thresholds and outline different spaces, information and education on the natural processes occurring on site, to make the community aware of the value of these processes (Earthworks Landscape Architects, 2018).

Pedestrian connectivity and movement is vital to the success of the design project, boardwalks and bridges are proposed to provide access through and across the wetlands and the river. Along these pedestrian connectivity's outdoor playground, sport facilities, trim parks, space for commercial interventions, cultural practices and events, picnic areas, nature walks and a water park have been planned (Earthworks Landscape Architects, 2018).

The challenges of this project are to ensure the community to value the park. Before the redevelopment of the park, it was a rubbish dump and rubble was dumped into the river. The team convinced the client to change the perspective of the people though design, rather than to fence it off, with the idea if they can use it, they will value it (Earthworks Landscape Architects, 2018).

Fig. 2.9 Multi-functional river landscape case study - Chiveve River, Mozambique (Earthwaorks Landscape Architects, 2018)

# Context, history, site analysis

Chapter 3

## Chapter overview

In this Chapter the context, history, mapping of the site will be discussed and elaborated on.

First the context of the site is explained followed by a bit of history of Mamelodi. Then follows a zoom to the site specific aspects and the mapping relevant to the site and project.

## 3.1 Context

The site is situated east of Mamelodi alongside one of the Pienaars River's tributaries, Hatherley Spruit. The site consists of the natural stream surrounded by a strip of vast landscape with veldgrass and invasive species. The site is surrounded by Mamelodi Hospital, Mandela Park Peace Garden, Nelson Mandela Park, JNF Walter Sisulu Environmental Centre, Pateng Secondary School, Tlakukani Primary School, and Mveledzo Primary School and has the potential to become a multi-functional river landscape in Mamelodi where the community can harvest from the river.

Issues exist on site such as unsafe spaces, water pollution, unused open space, and rubble disposure alongside the river. The river is not used by the people of Mamelodi, and the landscape around the river is only used for rubble disposure and as a gateway from the residential area to the commercial areas.

The theory and case studies in Chapter 2 and the understanding of the river and the landscape around the river was an important key to a well thought through design proposal. Urban designs that respond to the site and the environment around the site are more economical in the long term, because the design will sit more comfortably in the landscape, as if it belong there (Oberholzer, 2014).

## 3.2 History

Mamelodi meaning the mother of melodies was established in 1951 by the Apartheid government and it was first known as Vlakfontein and was renamed Mamelodi in 1962. (GPS coordinates: 25.7159 S, 28.3932 E). It is located 21km Pretoria CBD. 16 Houses were originally built on the Vlakfontein farm. It was established as a black's only town ship. Since then and specifically since 1991 it has rapidly grown into a town with a large and more diverse population.


Fig. 3.1 Site photo's showing the current state of the site: 1. the current condition of Hatherley Spruit, 2. no preservation or maintenance applied to the spruit 3. rubbel disposure at varies points on site, and 4. vast open landscape (Author, 2018)


Fig. 3.2 Site locality in urban context (Author, 2018)

## 3.3 Site analysis technique

Inspired by Ian McHarg'S ecological planning method, the study's site analysis took identifiable existing values and elements and combined them with an overlaying mapping technique to create design goals that showed ecological and social advantages. McHarg(1969) also advocates that one should avoid environmentally sensitive areas when implementing design.

This method was helpful to examine and explain important characteristics of the site with an aim to identify solutions that are most beneficial to the community and nature. The method is a simple successive examination of the site in order to understand it and its context. This understanding reveals the site as a system of interaction and of social and ecological values.


Fig. 3.3 Site locality and urban context (Author, 2018)

## 3.4 Reading the landscape

Site analysis was done to understanding the land and the surrounding environment around the site. The inspiration drawn from Ian McHarg's ecological planning method was used to do site analysis and bridging it to the design proposal. It is an elegantly, simple and practical idea, built on working with nature and the surrounding environment. It is a powerful tool where the designer can interpret natural and cultural patterns to determine the best fit for a particular land use (Oberholzer, 2014). (See fig. 3.4).

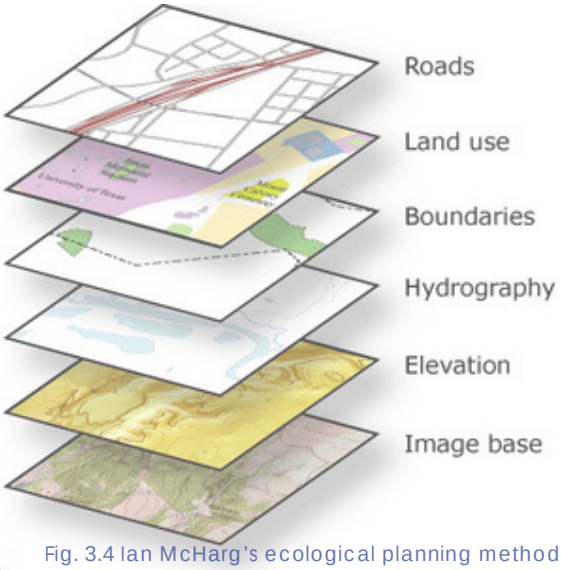



Fig. 3.4 Ian McHarg's ecological planning method (Oberholzer, 2014)

## 3.5 Linking the three lenses to the three ways we depend on nature

The three ways we depend on nature is linked with the three lenses the study introduces to look at rivers in urban regions. (See Chapter 1 and 2). The first lens is river as functional system which includes sustainable use of natural resources that are provided by rivers in urban regions. The second lens is river as resource where water is seen as a life source to support the community of Mamelodi East. The third lens is river as place where rivers in urban regions becomes a place for human psychological well-being, to find our place in nature, recreation and food production.

## 3.6 Mapping of site analysis

Site analysis was done through contextualizing the site within its larger setting to see how it fits and interlinks with the surrounding environment, and to understand the natural processes taking place on the site and how it relates to the river and the landscape around the river (Oberholzer, 2014).

Hydrology: the analysis of the hydrology of Mamelodi East is important to the study to determine and examine the different influences on the urban river. The main urban rivers in Mamelodi East are the Pienaars River, Edendal Spruit, and Vlakfontein Spruit, which forms part of Roodeplaat Dam's catchment area. The site is located next to the tributary, Hatherley Spruit, of the Pienaars River. (See fig. 3.6)

Rainfall: The rainfall statistics in Mamelodi, Pretoria, on average 732mm of rainfall per year, and 61mm per month. (See fig. 3.5)

## 3.7 Understanding the river

Urban river landscapes fulfill a wide range of requirements; such as flood control, open space design, and ecology. The urban river must be seen and understood as a process, such as changing water levels, shifting seasons, and erosion. The urban river and its environment are not static but are constantly changing, thus the design must be flexible and need to absorb and adapt to the change of the river environment (Petts, Heathcote and Martin, 2002).

Figure 3.7 shows the influences on the Hatherley Spruit; the Hatherley Spruit is a tributary of the Pienaars River and flows through informal settlements, open landscape areas, past schools and

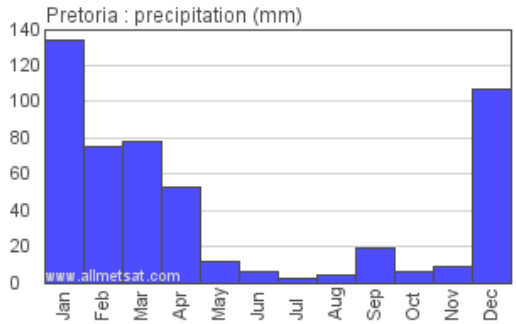



Fig. 3.5 Rainfall statistics of Pretoria (News24weather.com, 2018)


Fig. 3.6 Hydrology map, understanding the river within the larger context (Author, 2018)


Fig. 3.7 Influences on Hatherley Spruit (Author, 2018)

commercial areas, and underneath roads, all this adds to the pollution of the river. Influences and pollutants that were detected along the spruit include; litter disposal, erosion caused by excavations near the spruit, sewage entering the spruit because of poor drainage and sanitary infrastructure in the informal settlements, and chemicals from the road, sport fields and the existing vegetable garden next to the Walter Sizulu Environmental Centre entering the river.

Research was done on the Ecological Importance and Sensitivity (EI&S) of the Pienaars River and its atributary, Hatherley Spruit. EI&S provides an indication from an ecological perspective whether a river should receive a high level of protection or not. There is various measures that plays a role in the EI&S assessment of a river, please see fig 3.8.

o The ecological importance of the river refers to the diversity, rarity, or uniqueness of the wilflife habitats and biota. It reflects how important the protection of these ecological qualities are from as local to a national perspective.
o The ecological sensitivity refers to the ability of the ecosystem to tolerate disturbance and to recover from certain impacts.

Through the integration of the above mentioned measure, the EI&S categories of rivers are summarized in the following table; The health of a river is quite complex to categorise because of the complex processes and assessment of EcoStatus of a river. The Department of Water Affairs and Forestry presented a user-friendly key to categorise the health of a river in a more simple way shown in fig 3.9.

Based on the the information provided in fig. 3.8 and 3.9 the Hatherley Spruit:

The water quality of the river: The overall EcoStatus for Pienaars River / Haterley Spruit is poor mainly because of the flow and bed modifications upstream caused by land-use activities such as small holdings. The normal flows in the summer is increased by urban return flows, which contribute to the flows. Illegal dumping of garden refuse

| EI&S Category | Description |
|---|---|
| VERY HIGH | A high or very high EI&S indicates that there is strong ecological motivation for awarding a high level of protection to the associated river, and such rivers should ideally be maintained in a natural or good river health category. |
| HIGH | |
| MODERATE | A low/marginal or moderate EI&S denotes that a river has relatively lower conservation value and that such a catchment is more suited to development than one where a river has a higher EI&S. |
| LOW / MARGINAL | |

Fig. 3.8 EI&S assessment of a river (Department of Water Affairs and Forestry, 2018)

| River Health Categorisation | | Water Resource Classification System (National Water Resource Strategy, 2004) | |
|---|---|---|---|
| Category | Description | Proposed Class | Description |
| Natural | No or negligible modification of instream and riparian habitats and biota. | Natural | Human activity has caused no or minimal changes to the historically natural structure and functioning of biological communities, hydrological characteristics, chemical concentrations and the bed, banks and channel of the resource. |
| Good | Ecosystem essentially in good state; biodiversity largely intact. | Moderately used or impacted | Resource conditions are slightly to moderately altered from the Natural class due to the impact of human activity and water use. |
| Fair | Sensitive species may be lost, with tolerant or opportunistic species dominating. | Heavily used or impacted | Resource conditions are significantly changed from the Natural class due to human activity and water use, but are nonetheless ecologically sustainable. |
| Poor | Mainly tolerant species present or alien species invasion; disrupted population dynamics; species are often diseased. | Unacceptably degraded resources | Due to over-exploitation, these rivers are already in a state that is ecologically unsustainable. |

Fig. 3.9 user-friendly key to categorising the health of a river (Department of Water Affairs and Forestry, 2018)

and waste materials on unoccupied land is problematic along the Hatherley Spruit, because it influences the water quality.

The Riparian Zone Habitat of the Pienaars River / Hatherley Spruit: The inegrity is poor, urban flood waters cause bank erosion and there is quite a lot of sedimentation. Riparian vegetation in many areas has been cleared along the river for development down stream, but site specific there is still riparian vegetation, but also alien invasive vegetation such as *Solanum mauritianum*, Nemba cat, must be removed.

The water quality is fair, flows have intermediate levels of nutrients but have no significant organic pollution. The main source of pollution include urban return flows and sewage spills. The increase in urbanisation has resulted in the increase than normal peak flows, especially in summer season.

Drivers for positive change (for landscape design proposal):

o The increase of more impervious surfaces to lower the peak flow in summer season.
o Remove alien vegetation and increase/ protect riparian vegetation and habitat zone by rehabilitating the Spruit (Please refer to Chapter 2 on how the Spruit will be rehabilitated)
o Improve and manage the water quality that is currently impacting on aquatic fauna and flora.
o Increase solid waste disposal facilities to reduce dumping, and educate the community of the impacts of littering on the environment.
o Stabilise the river banks to prevent erosion.
o Identify and reduce the influence of sources of pollution that have an impact on the water quality.

## 3.8 Urban context

Figure 3.11 shows a map of the urban context; the site is surrounded by commercial areas, informal settlements, and residential areas. Although there are many commercial and social activities and interventions around the border of the site, the site remains an unsafe and forgotten place absent of social activities or cultural and economic interventions.

See figure 3.11 for a map of the influences and activities within the urban context; the site mainly consists of open landscape covered by veldgrass and pedestrian pathways. Some erosion and sewage pipes are spotted along the spruit. There is quite a lot of litter disposal along the spruit and along the residential boundary. On the one side of the site commercial areas occur such as; Walter Sizulu Environmental Centre, Mandela's Peace Garden, Patheng Primary

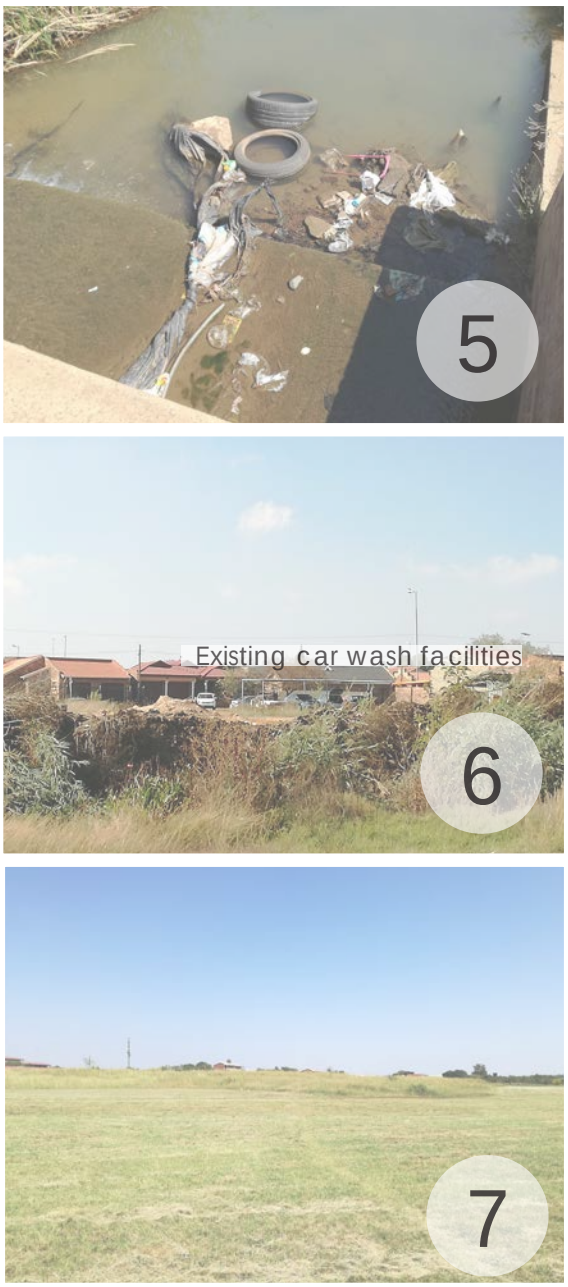



Fig. 3.10 Site photo's showing the current state of the site: 5. Waste disposal in the spruit, no preservation, 6. Erosion and degraded spruit close to the residential area and car wash facilities, and 7. vast open landscape with no infrastructure.


Fig. 3.11 Urban context analysis, understanding the site within its context (Author, 2018)

School, and Mamelodi Hospital. Adjacent to the commercial area the residential areas occur where a diverse set of community amenities with social and economic value exist such as; tuck shops, taxi ranks, and car wash areas.

See figure 3.12 for a map of the informal settlements, commercial areas, residential areas, and open landscape areas in the urban context; the site is surrounded by a diverse set of land uses and amenities that have social and economic value as discussed earlier. Although there are many commercial and social activities and interventions around the border of the site, the site remains empty with no social activities or cultural and economic amenities.

See figure 3.13 that shows a map of the existing movement patterns; over the open landscape site covered with veld grass. Pedestrian walkways are traced along the spruit and small bridges over the spruit. Although there is no social or economic amenity on the site, it is still used as a shortcut for the community to walk from the residential and informal settlements to the commercial areas, Mandela's Park, and Mamelodi Hospital. There is great opportunity on site to create a green corridor link with amenities between these different areas within the larger urban setting. See figure 3.15.

See figure 3.14 that shows a sensitivity map of the urban context. It was compiled by information from previous mapping done by students of the University of Pretoria, and the information was confirmed on site; the high sensitivity areas occur along the rivers, ecological strip, mountain, and spruit in Mamelodi East, most of the area consists of built up areas, informal settlements, and disturbed land. The open landscape areas have medium sensitivity and consist 8.5% - 12% of invasive species, whereas the low sensitivity areas are the built up areas and highly disturbed land because of urban infrastructure.

See figure 3.15. The high sensitivity areas of the site consist of; undisturbed land, riparian zones, existing habitats for flora and wildlife alongside Hatherley Spruit. The medium


Fig. 3.12 Urban context analysis, the mapping of different land uses within the site context (Author, 2018)


Fig. 3.13 Existing movement patterns, site within the context (Author, 2018)


Fig. 3.14 Sensitivity map, urban context (Author, 2018)


Fig. 3.15 Sensitivity map, green corridors (Author, 2018)

sensitivity areas consist of; steep slopes, semi disturbed land, and 8.5% - 12% of invasive species. Where the low sensitivity areas consist of; highly disturbed land, built up areas, and hard surfaces.

The restoration, preservation, purification, and sustainable use of the rivers and spruit are critical habitats that could help ensure environmental well-being and an increased biodiversity in Mamelodi East.

## 3.9 Key issues identified on site

o Water pollution from sewer and litter disposal into spruit, storm water, ground water, runoff, litter, and illegal dumping.
o Erosion, ruined land, and degraded spruit, wildlife habitats and biodiversity.
o Unsafe conditions/lack of safety.
o Alien invasive species.

## 3.10 SWOT Analysis

### 3.10.1 Strengths

o The site's locality is found within a centralized area surrounded by different land uses such as; commercial areas, residential areas, and informal settlements. This aims to keep the site as a link and gateway for the community between these different land uses.
o The Walter Sizulu Environmental Centre is located next to the site already actively engaging in river activities and river awareness strategies that strengthens the proposed design goals.
o The Hatherley Spruit creates wildlife habitat and a healthier environment for the community.

### 3.10.2 Weaknesses

o The site and the spruit are polluted by sewer and litter disposal and this provokes no engagement from the community with the spruit or using the landscape around the spruit for social and economic amenities.
o The lack of infrastructure on site and in or around the Hatherley Spruit flowing through the site, makes the area unsafe for the people of the community because it is unmaintained and shabby, and no interaction or connection to the Hatherley Spruit physically or physiologically.

### 3.10.3 Opportunities

o The Hatherley Spruit creates the opportunity to rehabilitate and preserve the natural river and showcase it as a learning tool for the community on how it is done, and how natural river systems work.
o The site is currently used as a gateway for the community to travel from the residential areas to the commercial areas by foot, which creates the opportunity to enhance the site for environmental health and social use that accommodates pedestrians and people of the community. The site must have amenities that are used for more specific reasons than just a gateway from one area to another. This also ensures a lot of people that pass by and through the site which creates visual surveillance and safety.
o The extended proposed food gardens create opportunity for the Walter Sizulu Environmental Centre to expand their existing food garden program.
o The site has the opportunity to create a green corridor for wildlife habitat, a healthier environment for the community, and an entertainment/productive landscape for the people of Mamelodi, there is the lack of such spaces in Mamelodi.

### 3.10.4 Threats

o The river is unsafe for children to play around, although there are no recorded cases of drowning in the river, as soon as the site gets activated with the amenities, this might become a problem.
o The protection of the food garden from any vandalism or abuse should be considered.
o The people of the community must be involved in the process and adapt to the new infrastructure and take ownership of some areas, such as the food garden proposal.

The strengths and opportunities are assets to the project. The weaknesses and threats will be addressed in the design process to make it positive and good design possibilities.

## 3.11 Design proposal goals

o Protection of valuable ecosystems in and around the spruit for their life-support function.
o Conservation of scarce regional resources

such as water and agriculture soils.
o Safety and health of residents remove unnecessary risks or hazards.
o Respect for the natural and cultural heritage of the area.
o Recognition of the values and needs of the community, and not only those of the developer.
o Involvement of the community in the regeneration of the river and in all proposed activities.

## 3.12 Conclusion

Conclusions drawn from the mapping method; the site is mainly used by the community as a gateway from the residential areas and informal settlements to the commercial areas; Mamelodi Hospital, Mandela's Park, and the schools. The pedestrian movement through the site keeps the site active and attracts the community. There is no interaction or connection between the community and the Spruit, although the people of the community walk along and over the Spruit.

The site mostly consists of disturbed land and litter disposal and has no social or economic interventions or values although a lot of interventions are happening around the site. The site has a big opportunity to become a green corridor to interlink the different areas around the boundary of the site; residential, commercial, environmental and informal settlement areas. This opportunity can create awareness of the Spruit and the value it holds for the community. The Spruit, water, once again can be used to connect the community to urban rivers and to interlink surrounding elements in the urban context. However, water cleansing and restoration is essential as part of the process.

# Urban vision and concept

Chapter 4

## Chapter overview

In this Chapter the proposed Urban vision will be discusses followed by the conceptual ideas of the theory. The conceptual generators and the conceptual approach will be discussed in more detail.

It will conclude with the final landscape architectural concept. A concept is comprised from the three lenses, river as resource, river as functional system, and river as place.

## 4.1 Urban vision

### 4.1.1 Group mapping

The urban vision compiled by Emerike Smit, Simone Senekal, and Caitlin Jade Porter considered the following aspects:

o The access and movement of pedestrians. Please refer to fig. 4.1.
o The taxi ranks, bus stops, and the train station. Most of Mamelodi community depends on public transport to the city for work.
o The healthcare and schools in the area to pin point important nodes. Please refer to fig. 4.2.
o A sensitivity map that indicates the natural to less natural open landscape spaces in the area. Most of the natural open spaces occur around the natural rivers in the area, but are un-safe and not maintained. Please refer back to fig. 3.14 in chapter 3, page 40.
o The Hydrology of the area; we focused on the main water sources running through the area. Please refer back to fig. 3.6 in chapter 3, page 35.

There is a lot of potential to rehabilitate the natural rivers by overlaying a technological system. Looking at the infrastructure, there are spheres of influence that can greatly contribute to the urban vision. Mamelodi can be classified as a dormitory settlement since it is very dense and removed from the greater economic activity.

### 4.1.2 The Proposed Urban Vision

Mamelodi is constantly evolving within its inherited spatial legacy of Apartheid. This spatial legacy still impacts the way the city functions today.

The street in Mamelodi has become a place of celebration. Small gatherings emerge, the school children chatter on their way home from school, cars are washed and services and small spaza shops dot the side of the road. The busier streets are usually perceived as being safe for children and the community spirit is alive here.

Steyn (2005) recommends that a good African neighborhood is compact, walkable, mixed use with a high level of economic self-sufficiency.

An opportunity exists within Mamelodi to transform existing open spaces into usable space with multiple and mixed uses. In parallel these spaces must encourage residents to utilize them and take ownership. From the mapping, as well as the theory, the team developed a hypothesis and set of principles on which the urban vision is based.

### 4.1.3 Group Hypothesis

The hypothesis states that urban civic upgrade could occur through architecture that is diverse, celebrates a sense of space, is resilient and this would contribute to a community that is more integrated and independent.

### 4.1.4 Group Intention

The intention is for urban civic upgrades through architecture that is diverse and adds value to the community.

### 4.1.5 Group Aim

The aim is to implement a nodal development process, over time, to enhance, revitalize and repair urban civic space to improve the consequences of the spatial legacy left behind in Mamelodi.

### 4.1.6 The urban vision principles

o Density and Diversity [Creating resilient environments through variety and choice]
onRepair [Revisiting bad planning aspects within Mamelodi]
o Connectivity [Strengthening existing networks]
o Infrastructure upgrade [Infrastructure that contributes to the public realm]
o Identity [Preserve a sense of place]

Please refer to fig. 4.5 on page 46.

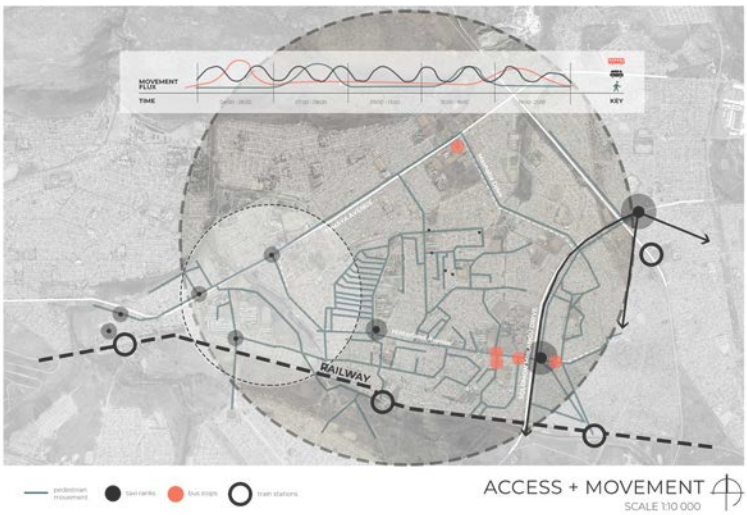



Fig. 4.1 Access and movement (Group work, 2018)

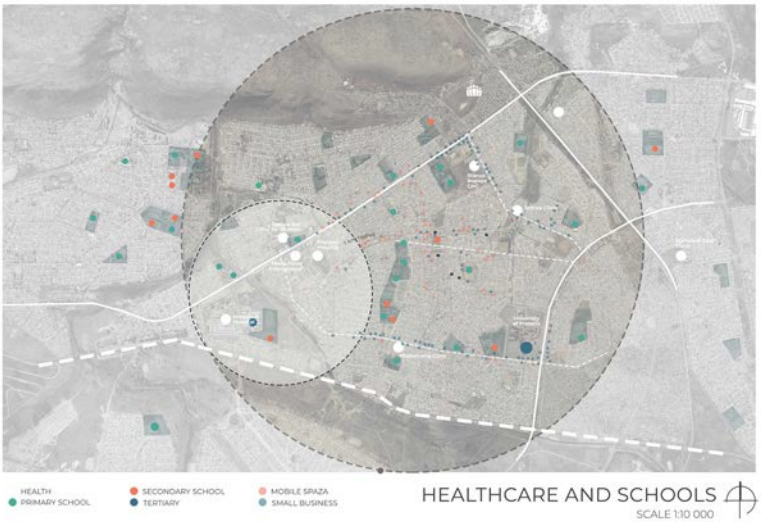



Fig. 4.2 Healthcare and schools (Group work, 2018)


Fig. 4.3 Density map (Group work, 2018)

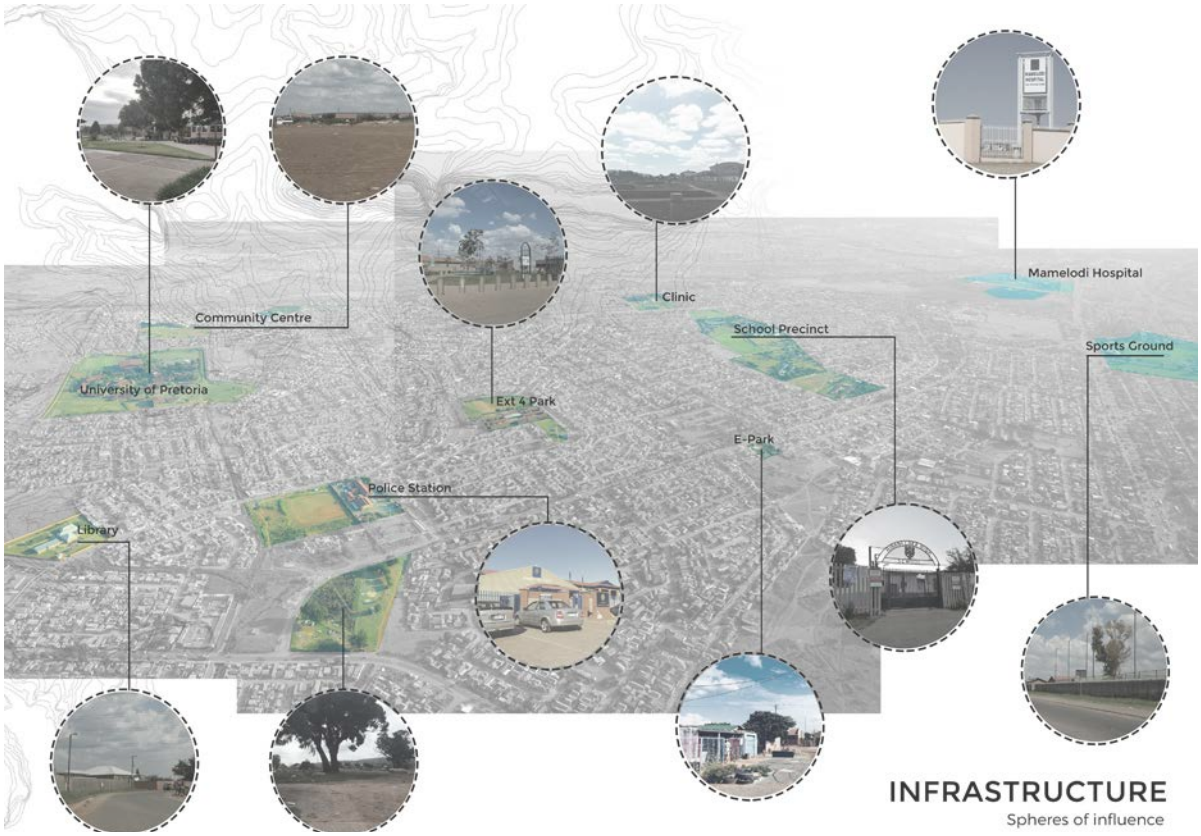
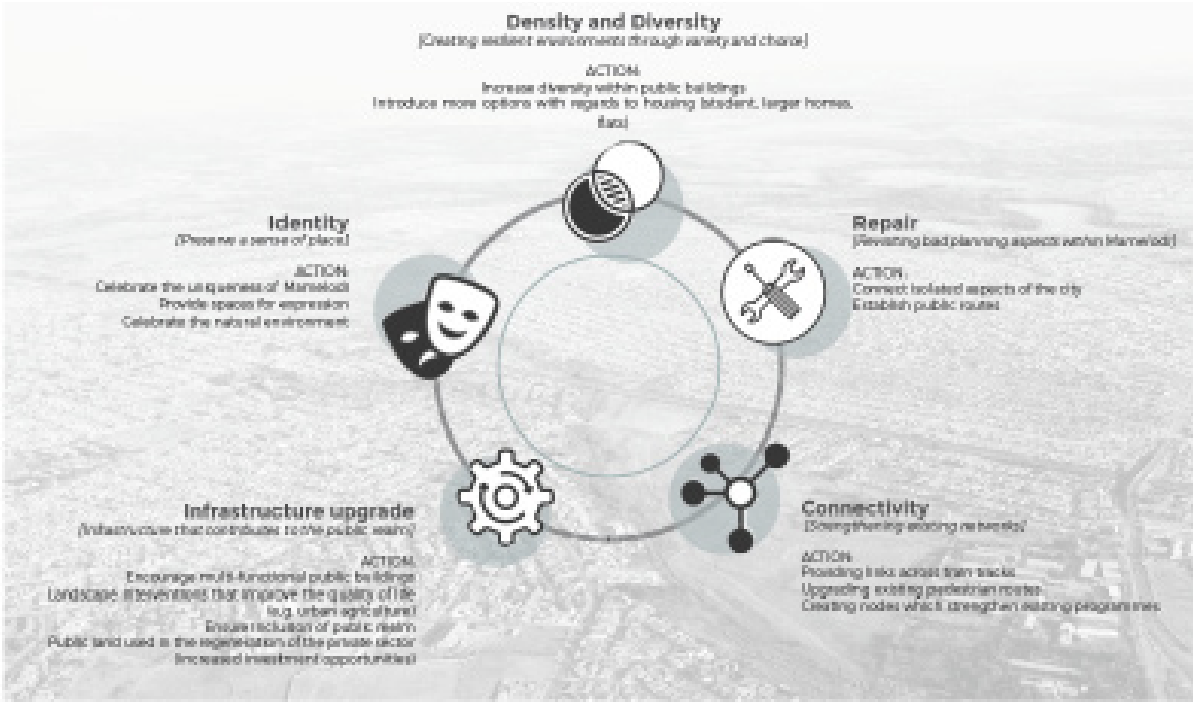



Fig.4.4 Infrastructure spheres of influence (Group work, 2018)




URBAN VISION PRINCIPLE

Fig. 4.5 Urban vision principles (Group work, 2018)

### 4.1.7 Concept

The concept is based on slime mold which is an adaptable system that interacts as an intelligent organism by learning, adapting and solving problems.

Faced with the consequences of spatial legacy in our cities, principles learned from biological growth can be useful tools for transforming our future cities into more integrated and sustainable settings. It inspires the re-building of positive spatial legacy in Mamelodi through planning for future growth.

Please refer to fig. 4.6.

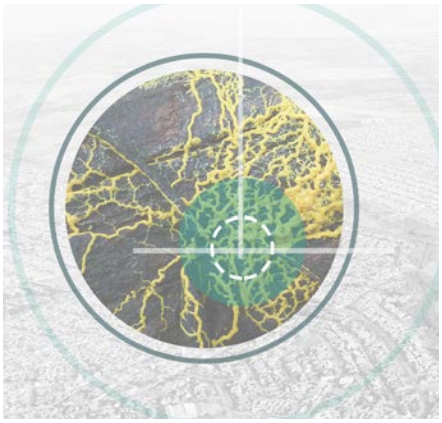


Fig. 4.6 Slime mold concept (Group work, 2018)

### 4.1.8 Proposed Precinct Plan

The team proposes an integrated network of nodes consisting of;

o A community node, an educational node, a wellness nodes, a mixed used node and a transport node and series of linking nodes.
o The linking of these nodes is done through public infrastructure upgrade along the connecting routes.
o We implemented the principles through densifying, celebrating identity, creating diversity, connecting and repairing the inherited spatial legacy.
o Our block vision is developed using the same principles on a more detailed scale that focuses on our potential sites of intervention.
o Our proposed sites and programs focus on the public infrastructure upgrade within the wellness, educational and community node.

"Imagination is the only weapon in the war against reality" – Lewis Carroll (1865)

### 4.1.9 Envisioned conditions

o Creating activation nodes that strengthen existing networks through revitalizing unwanted open space.
o Creating mix-use activation nodes through densification and diversification that creates a sense of place and community
o Creating multi-functional public infrastructure that contributes to a meaningful public realm for the community.
o Connecting natural systems and the community
o Rehabilitating the river and riverbed, activating the vast landscape spaces to function as a recreational social and interactive area in Mamelodi, providing common needs to the community and enhancing the relationship between human and nature.
o Upgrading natural spaces to contribute towards a meaningful public realm.

The development strategy encourages growth through planning for it but acknowledging that growth cannot be controlled. It creates a platform for the community to participate in the in-situ upgrade of their own city through nodal development.

We urge that a sustainable implementation strategy for the urban proposal is to create a nodal development process that is activated with smaller scale projects. This will create emergence that consequently develop into larger networks that revitalize and enhance current conditions within Mamelodi. The development strategy encourages growth through planning for it but acknowledging that growth cannot be controlled. It creates a platform for the community to participate in the in-situ upgrade of their own city. (See fig. 4.9)

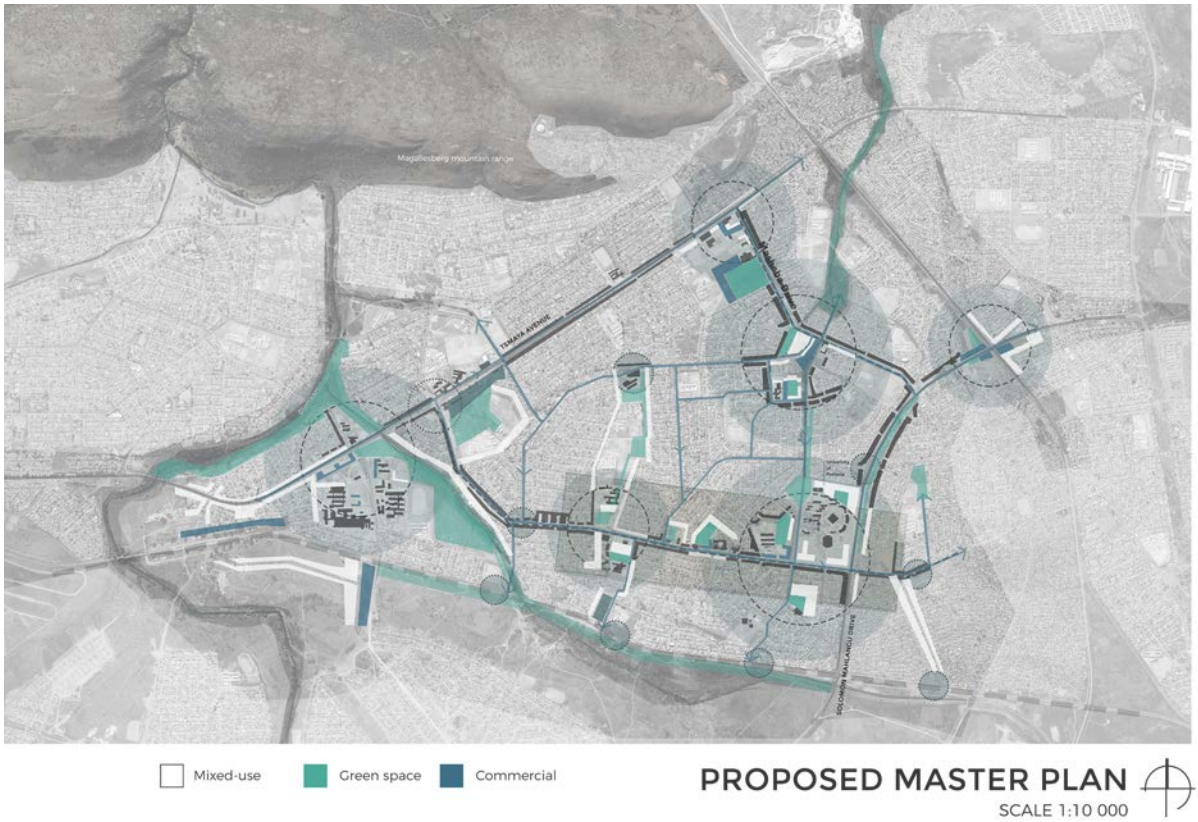



Fig. 4.7 Proposed Master Plan (Group work, 2018)

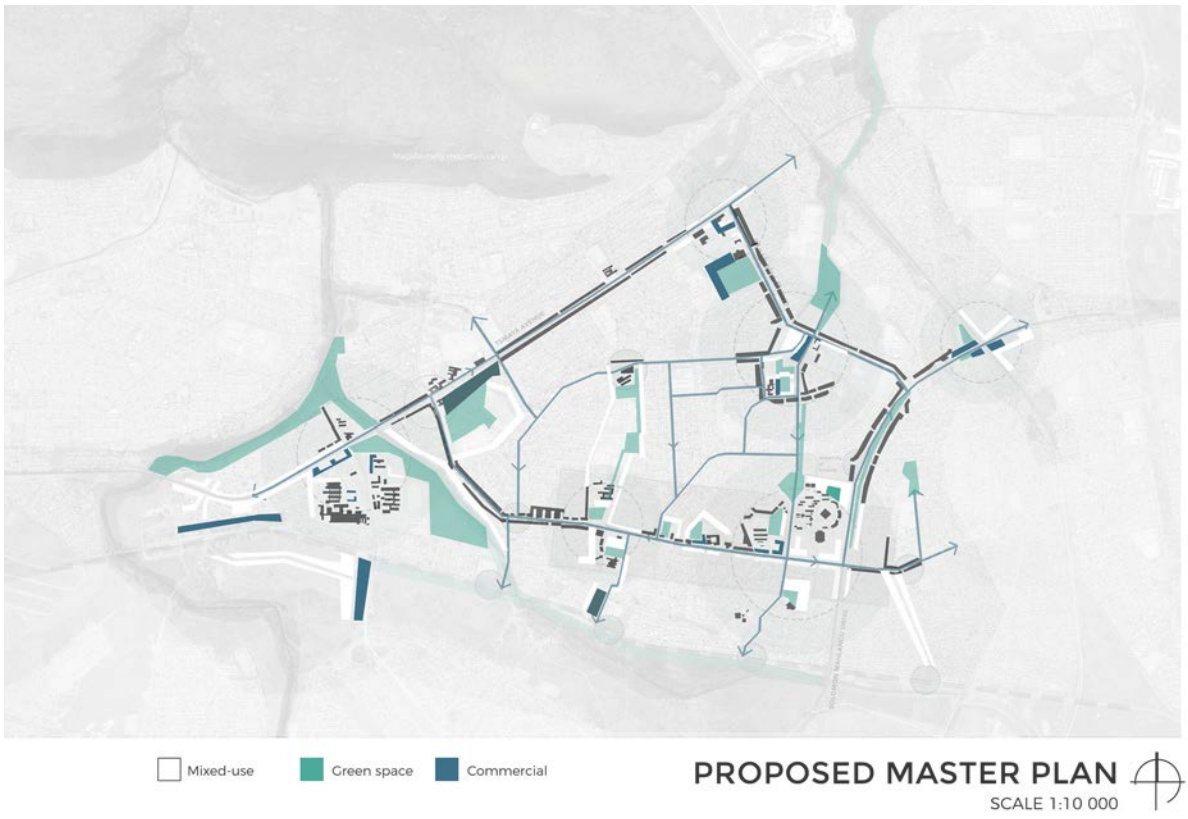



Fig. 4.8 Proposed Master Plan (Group work, 2018)

The following principles are proposed by Hamdi (2004) for incremental change:

"Ignorance is liberating
Start where you can: never say can't
Imagine first: reason later
Be reflective: waste time
Embrace serendipity: get muddled
Play games, serious games
Challenge consensus
Look for multipliers
Work backwards, move forwards
Feel good" - (Hamdi 2004: xxvi)

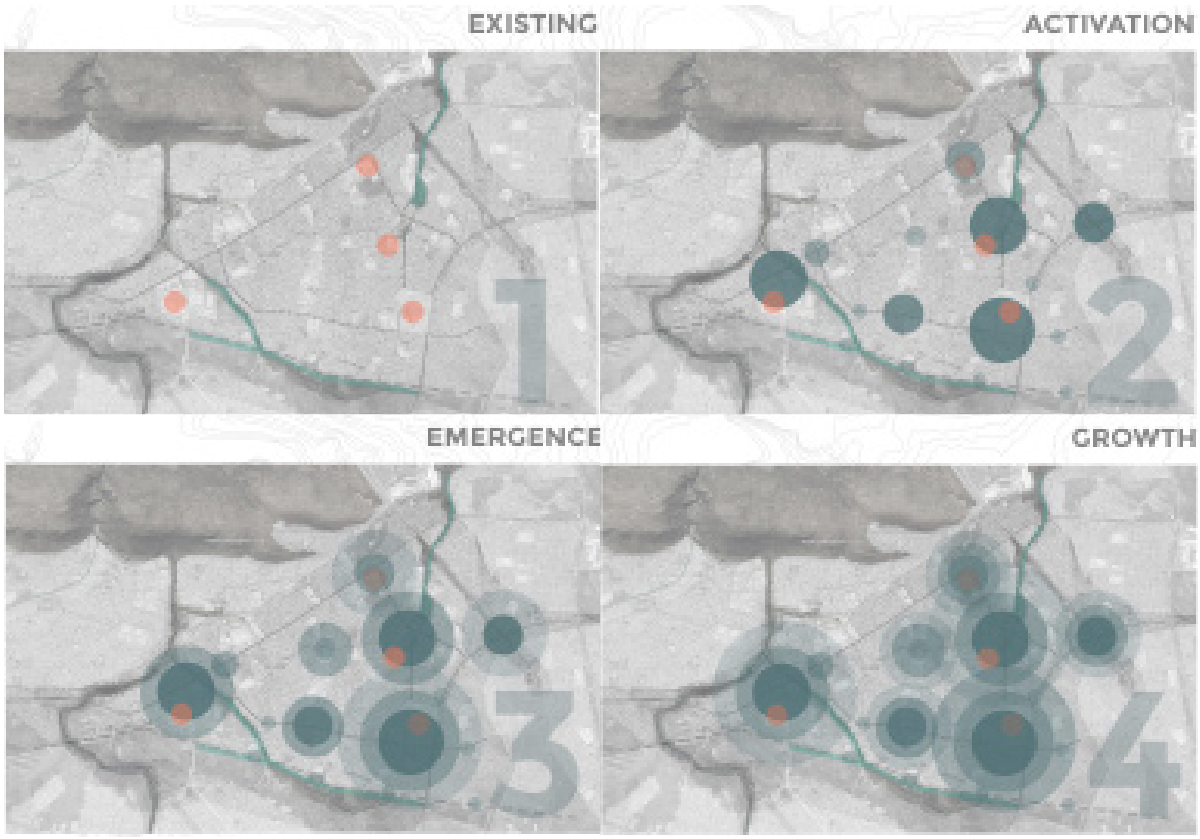



Fig.4.9 Implementation strategy nodal development (Group work, 2018)

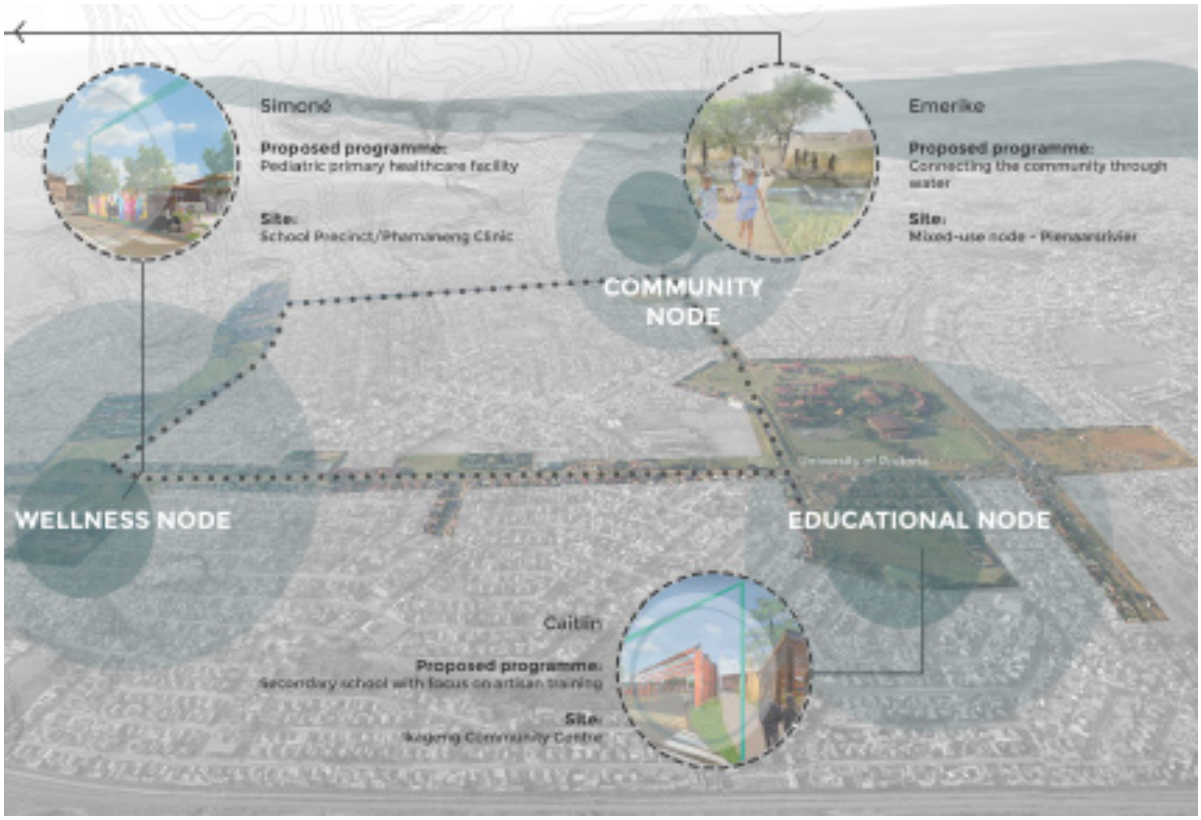



Fig. 4.10 Proposed block vision (Group work, 2018)

Fig. 4.11 Connectivity, connecting natural systems and the community (Author, 2018)

## 4.2 Theory and conceptual triggers

The concept development elaborated on the group work and urban vision. The idea of slime mold which is an adaptable system that interacts as an intelligent organism by learning, adapting and solving problems, is explored through the three lenses which form part of the theory and ongoing design process.

The three lenses helped by organizing the conceptual generators and choosing the most influential concept for the design project. The three lenses are river as resource, river as functional system, and river as place. The concept development went through phases and explorations in order to find and create form, make it functional, and to make it available as a resource.

The project focuses on water as the binding factor and the recreation of urban rivers. The idea and theory of water as binding factor and because the project focuses on urban rivers, the concept development is built on the concept of rivers and water, and expands on the theory of form follows function and regenerative design.

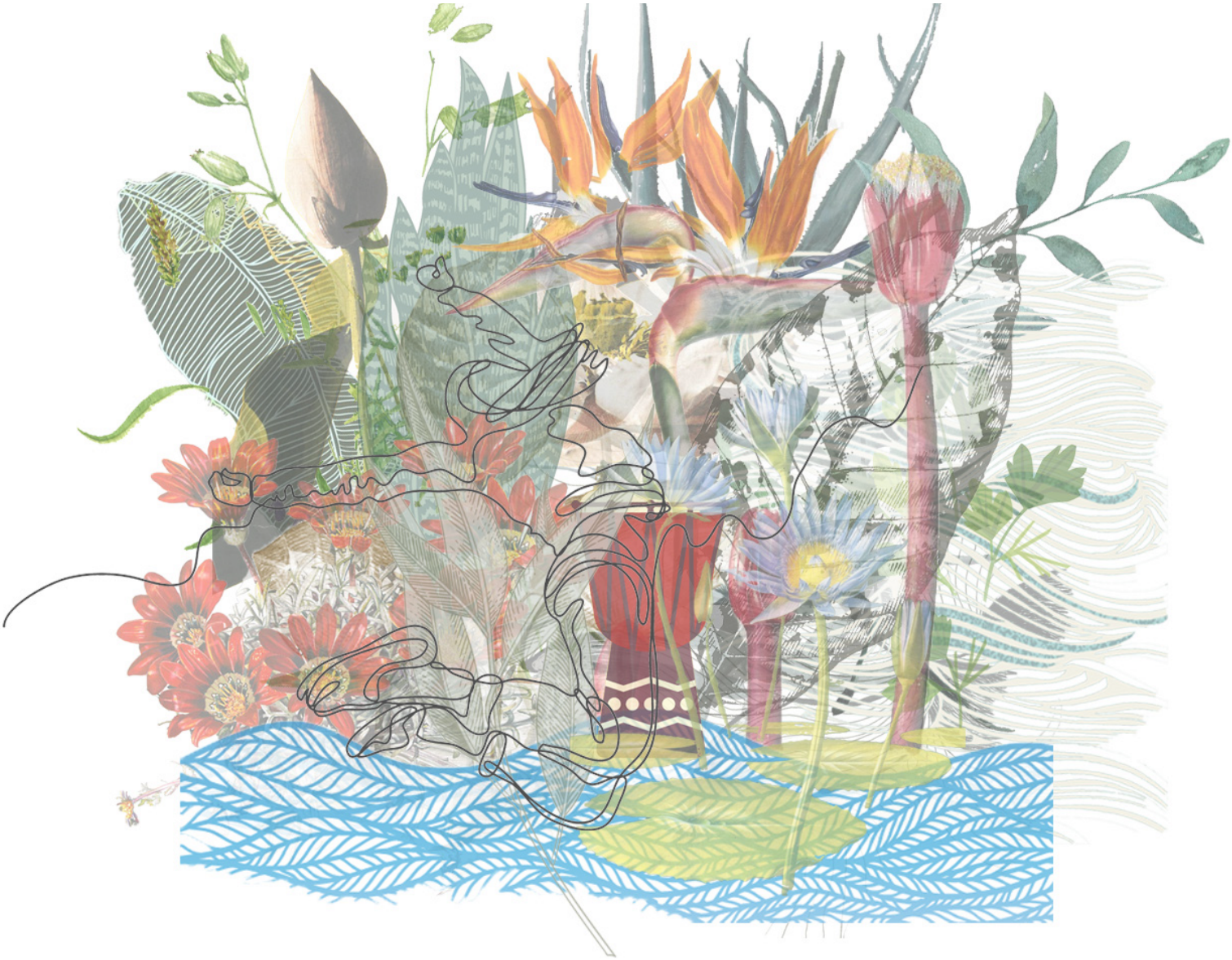


Fig. 4.12 Concept collage (Author, 2018)

## 4.3 Explorations

The site is a vast open landscape with veld grass and lacks any buildings, structures or vocal points (please refer back to Chapter 1 and 3 for site photos). This usually makes it difficult to generate form from the existing or from any specific point. The following explorations focused on water and natural rivers as the concept, and how these two elements can give a concept that accommodates the three lenses.

### 4.3.1 The exploration of natural rivers and water flow

The following images of natural rivers in landscapes inspired the form generation in the design process. Water is very powerful, it follows its own path and destroys anything that is in it way, because of this it creates this beautiful form of weaving and organic forms. The river is the main source and from the river water flows out cutting through the landscape and finds its way back to the river.

Explorations and drawings were done by overlapping pictures and structures of water in different forms and elements, such as water in the form of ice, water molecules, rivers, and the flow of water over soil. The same form and organic shapes were created than what is seen in fig. 4.15.

### 4.3.2 Circular form follows function

Exploring circular forms alongside the river functioning as constructed wetlands to filter the water of the river and make it available to the community of Mamelodi and the

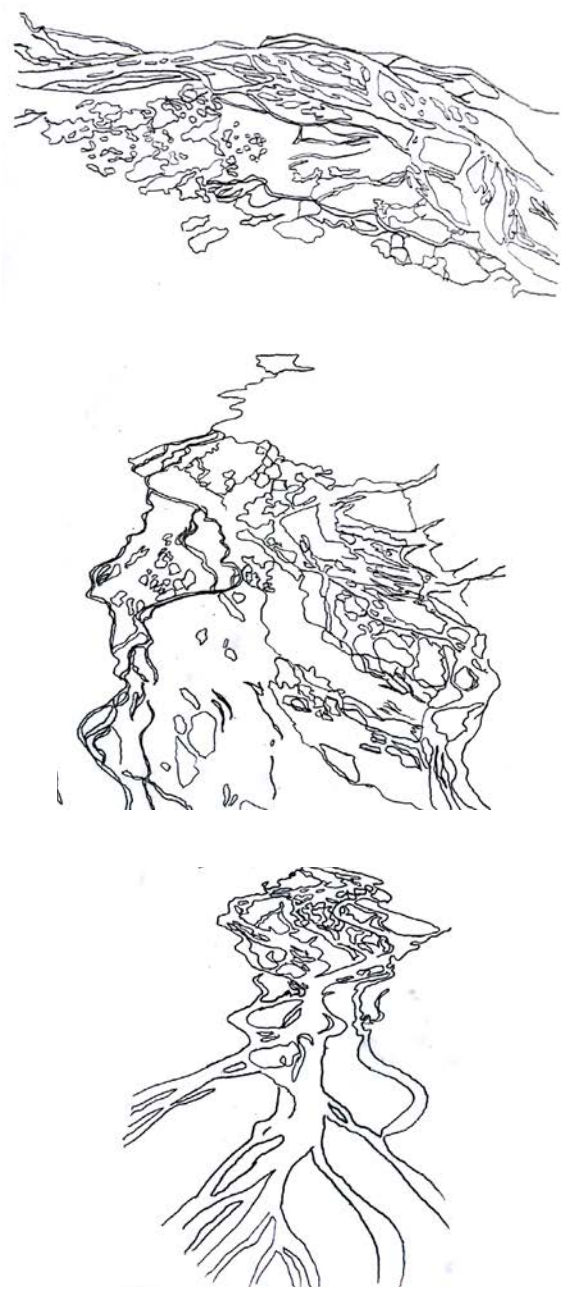


Fig. 4.13 Exploration drawings of natural rivers (Author, 2018)

Fig. 4.14 Inspirational pictures of natural rivers (Pinterest,2018)

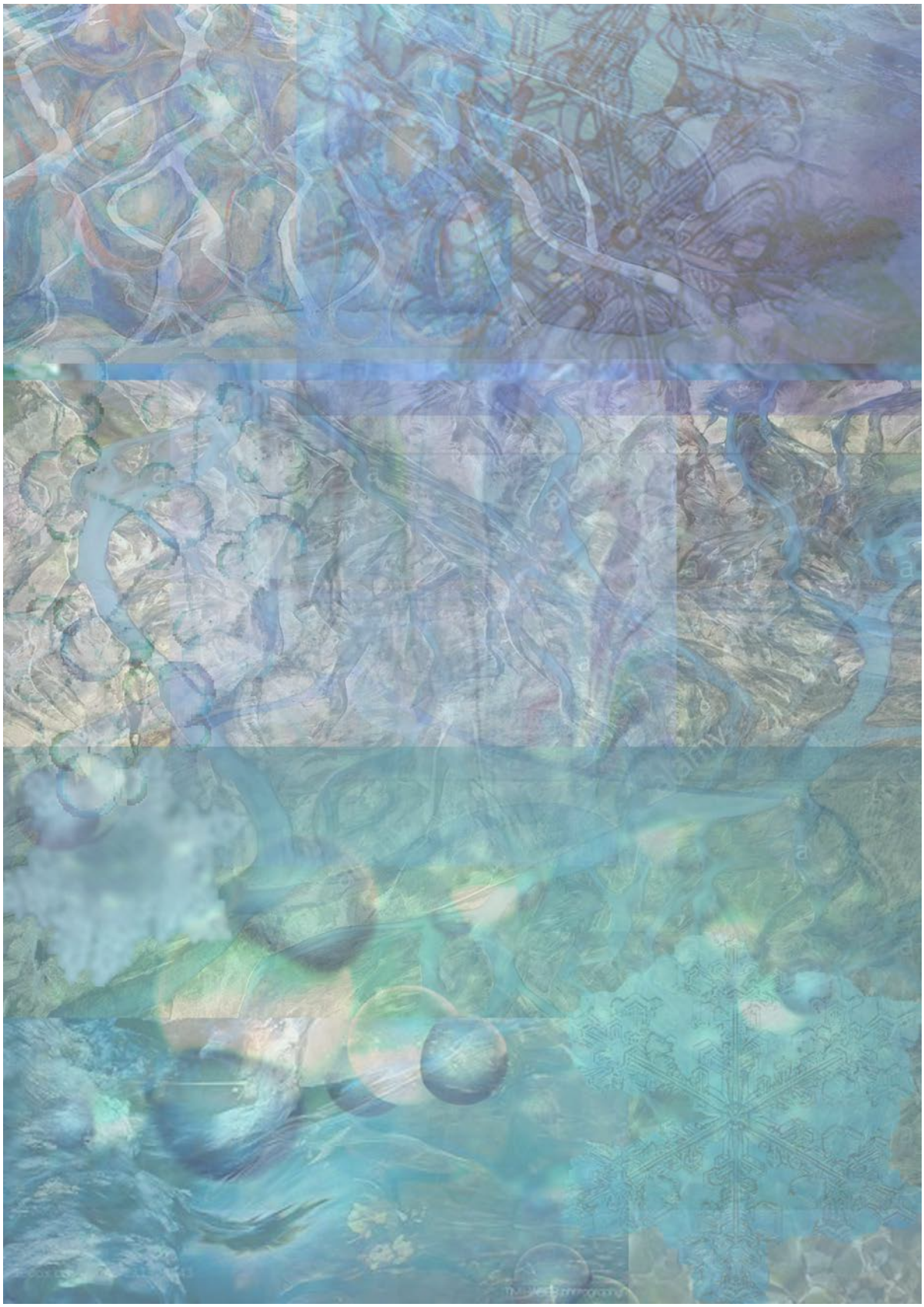


Fig. 4.15 Exploration collage of water in various forms (Author, 2018)

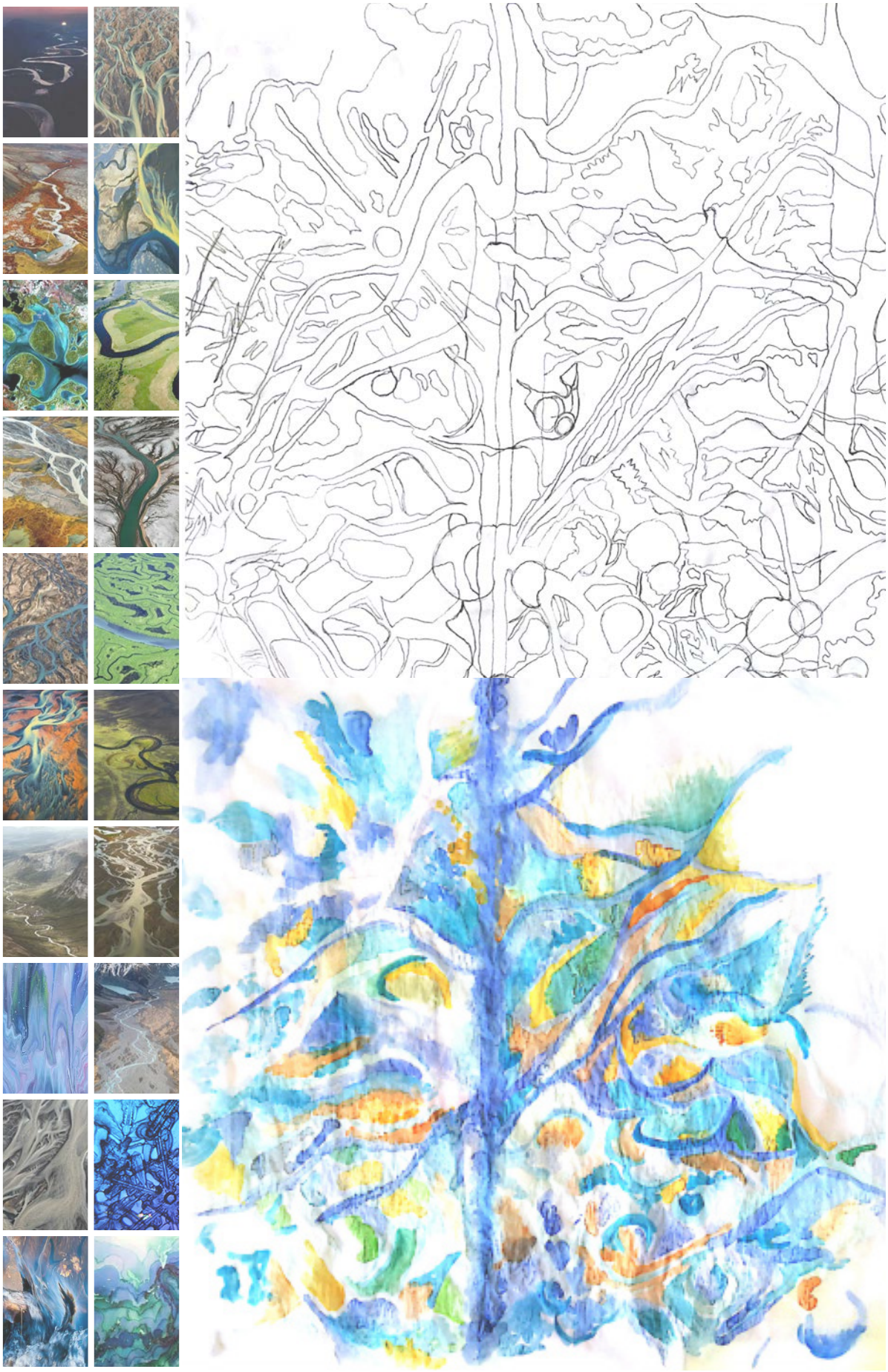


Fig. 4.16 Explorations of natural rivers and water flow (Author, 2018)

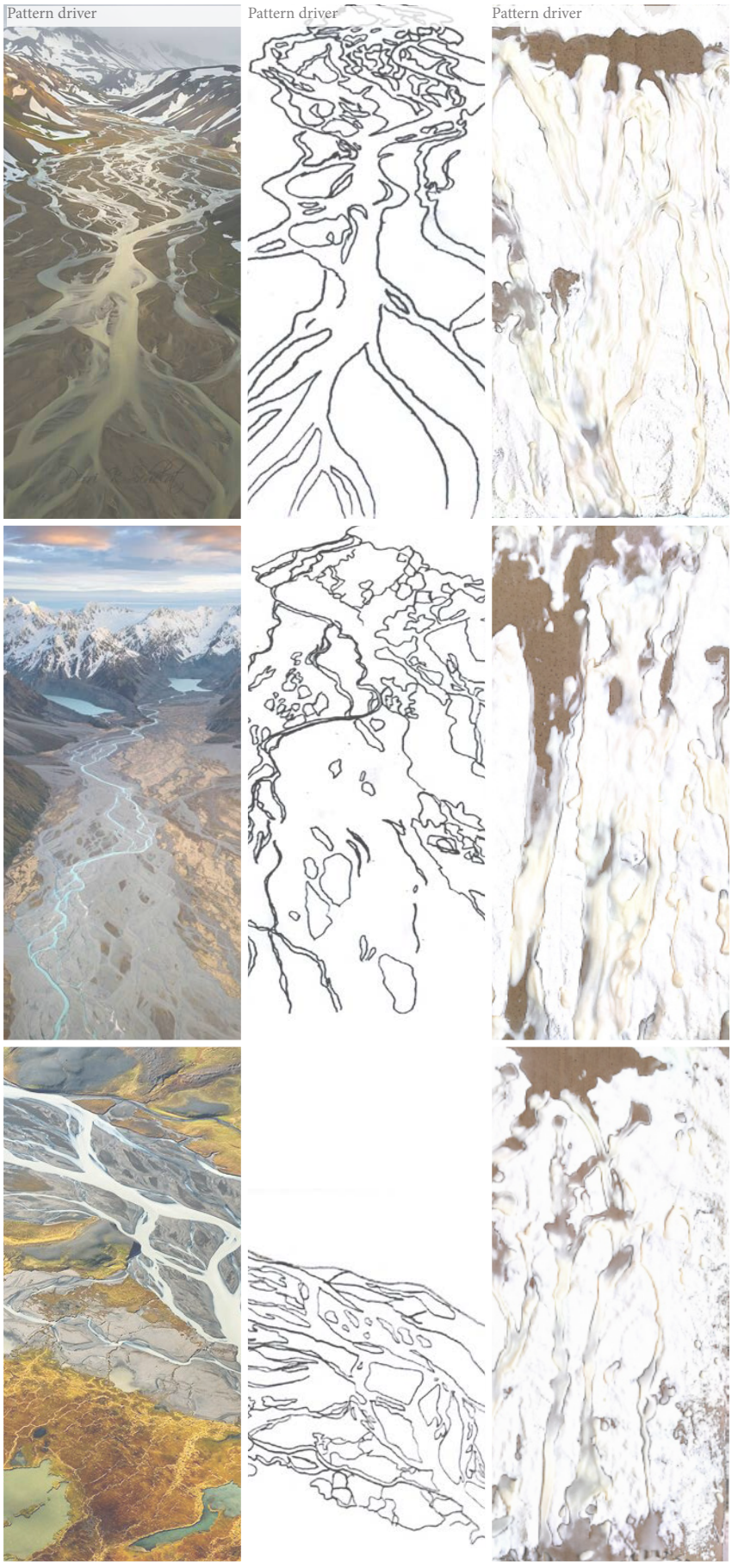



Fig. 4.17 Explorations and experiments of natural rivers and water flow (Author, 2018)

Fig. 4.18 Exploration drawing of crop field circular fomrs alongside rivers (Author, 2018)

exploration of circular patterns inspired by crop field implemented alongside rivers. In fig.... the exploration between circular form and linear lines were tested and experimented with to create form, and to create a sense of place for the community if Mamelodi.

### 4.3.3 Exploration through layering

Exploration through layering design elements such as existing movement patterns, proposed movement patterns, circular constructed wetlands functioning as multi-functional river landscape were done to generate form and design. Please refer to fig...

After the exploration the drawings were tested on the site to see how they respond to the existing and if the organic forms will communicate the three lenses, river as resource, river as place and river as functional system.

### 4.3.4 The conclusion drawn from the explorations

The organic form create a sense of place and can still be a resource to the community of Mamelodi, but the functional aspect to it does not work. The system of the design, discussed in Chapter 5, does not work and does not function best in this form on the specific site.

This is mainly due to the lie of the land, contours and topography, which is critical to consider in terms of the proposed wetland system that also relies on gravity and needs to clean the water.

Another important consideration was access to the area by the community and existing routes and activities that needed to be respected.

This form, fig.., does not work with the context and site specific. After this conclusion more explorations started regarding concept and form. The theory of form follows functions started to play an important role in the form and concept of the design.

The wetland cleansing system, discussed in Chapter 5, plays a very important role in the success of the project. If the system doesn't work, the project will not be successful. This statement lead to form follows function and regenerative theory.

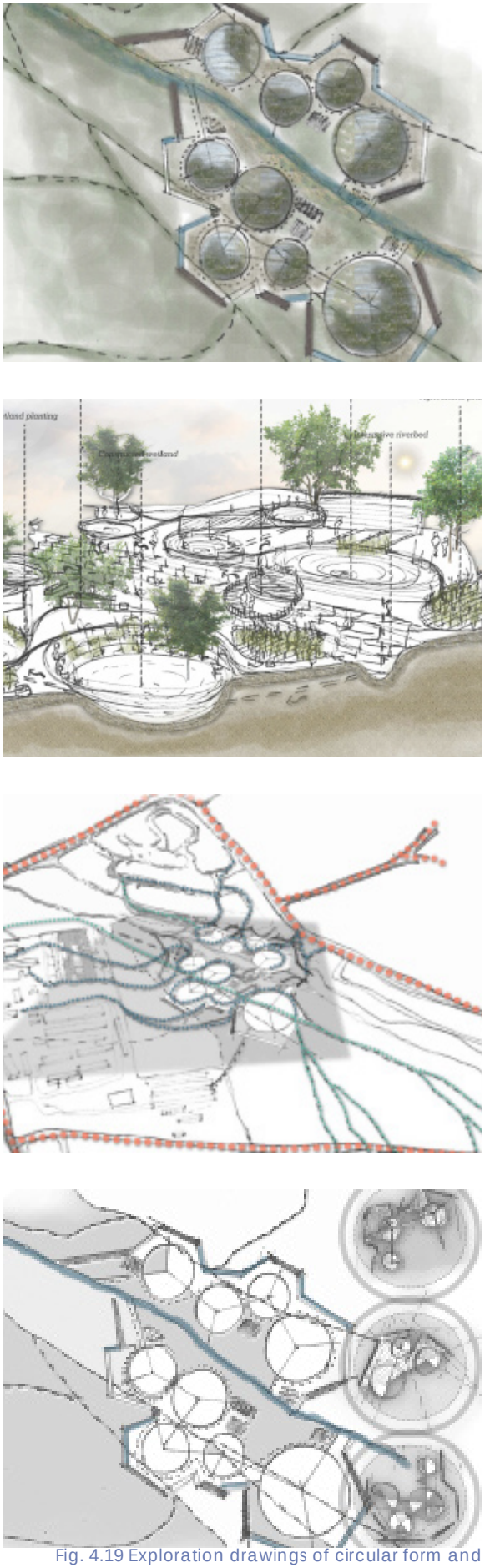


Fig. 4.19 Exploration drawings of circular form and linera fomr layering (Author, 2018)

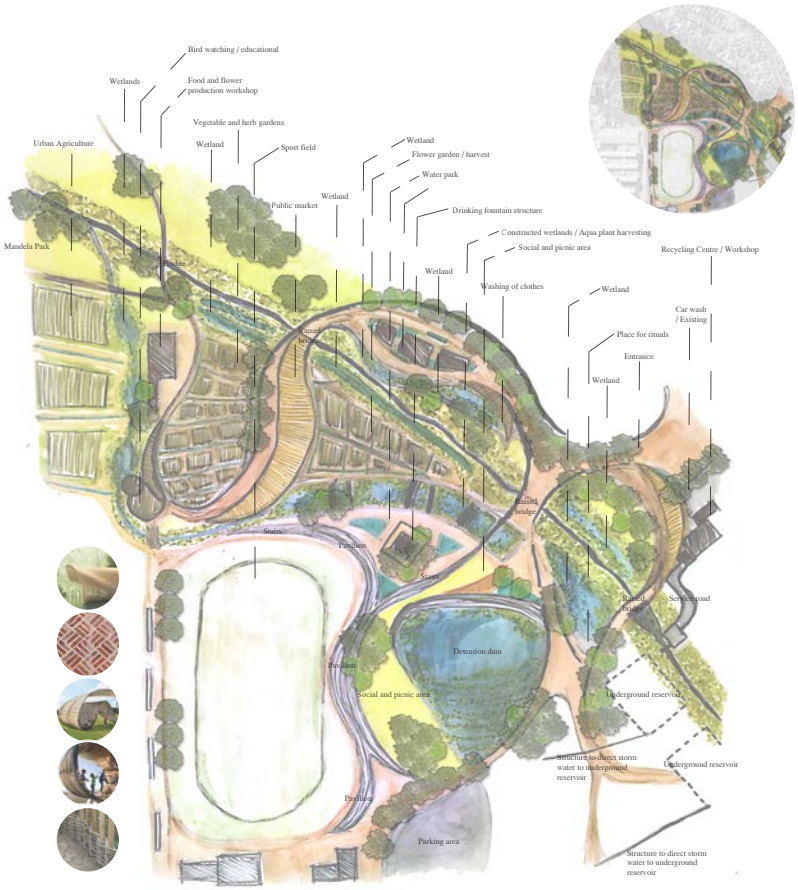
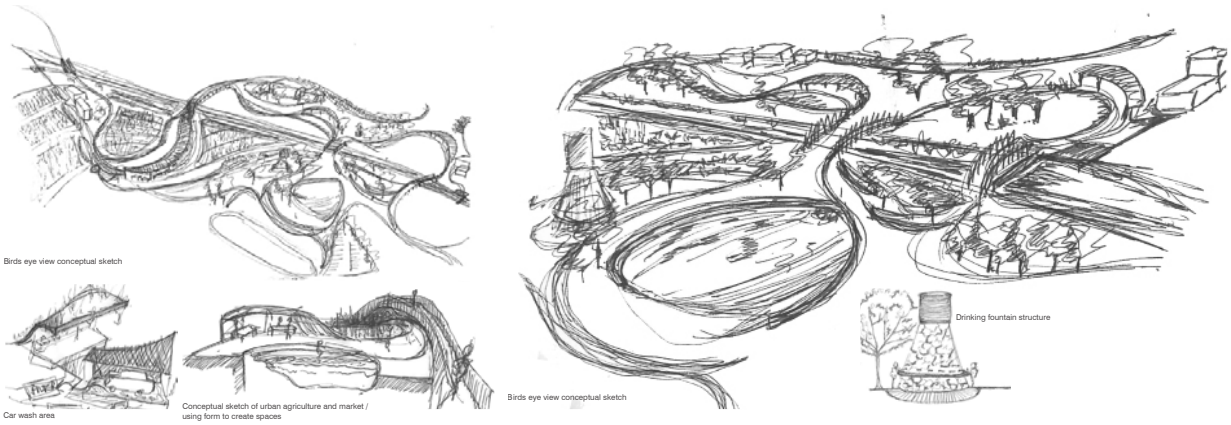



Fig. 4.20 Mid-term proposed Master Plan (Author, 2018)



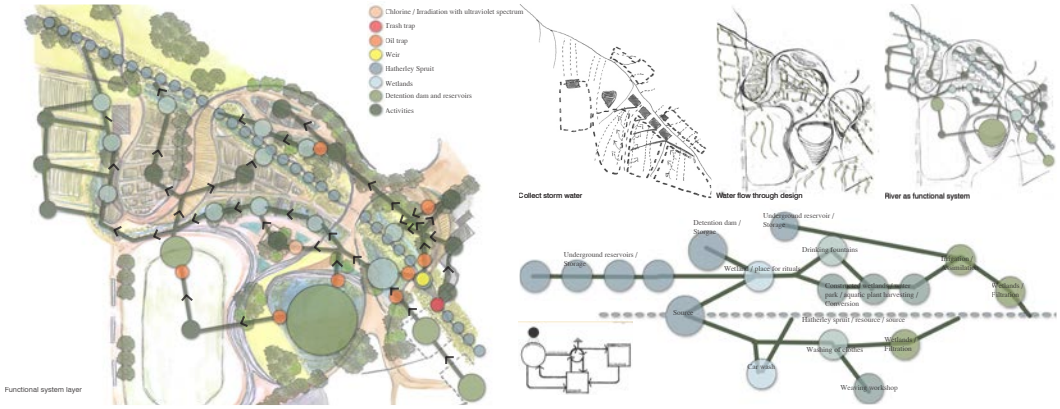




Fig. 4.21 Mid-term design proposal perspectives and system design(Author, 2018)

## 4.4 River as functional system and resource in the past

Fig. 4.23 the Egyptians used irrigation as well as the natural flood plain of the Nile to farm effectively. To make best use of the waters of the Nile River, the Egyptians developed systems of irrigation. Irrigation allowed the Egyptians to use the Nile's waters for a variety of purposes. Notably, irrigation granted them greater control over their agricultural practices. Irrigation was also used to provide drinking water to Egyptians.

Fig. 4.23 Drawing of Egyptian irrigation method (Pinterest, 2018)

Fig. 4.24 indigenous American crops were introduced in colonies around the world. But the farmers' innovative production methods were shunned and, for the most part, lost to the world for 500 years. Serious efforts to rediscover these methods have only begun during the last few decades. Sophisticated hydraulic engineering projects can be found, on a massive scale, in the Andes Mountains and along the Pacific Coast of South America, developed by people who had no metal tools. Using only simple devices and their own manual labor, these farmers built thousands of hectares of terraces in the mountains and thousands of giant water-trapping depressions.

Fig. 4.24 Indigenous American crops (Pinterest, 2018)

## 4.5 Rivers as functional system and resource today

Fig. 4.25 and 4.26 the farmers in the Free State use the river to pump water for irrigation for their crop fields. This system creates this beautiful green strip alongside the river in detailed circle patterns. Why circles? It is the most effective way to irrigate the crop fields. The water in the river is used as a medium to feed the surrounding landscape, in this case crop fields. The farmers use the river as a resource.


Fig. 4.25 An aerial photo of the crop fields along the Vaal River (Googlemaps, 2018)

The concept of the design focused on rivers in function and in form in their natural setting. The function of the river creates habitat for wildlife, it preserves the plant species and creates micro and macro ecological systems. The natural plant material and topography of the river cleans and aerate the water as it flows over rocks and pebbles.

Fig. 4.26 An aerial photo of the crop fields along the Vaal River (Googlemaps, 2018)

## 4.6 Form follows function theory

The theory investigated regarding the concept is known as form follows function. This was inspired by natural flows of rivers in landscape, because rivers form regimes from their function.

The theory form follows function is a principle that is associated with 20th-century modernist architecture and industrial design. The principle states that the shape/design of a building, landscape or object should relate to its intended function or purpose.

Form follows function architectural history: Louise Sullivan invented the maxim, he admired rationalist thinkers such as Thoreau, Emerson, Whitman, and Greenough. Horatio Greenough (1805-1852), was a sculptor whose thinking predates the functionalist approach to architecture. Sullivan was Greenough's much younger compatriot. In 1896 Sullivan invented the phrase in an article titled The Tall Office Building Artistically Constructed. He later credited the idea to the Roman architect Marcus Vitruvius Pollio who first stated in his book, De architectura, that a structure must exhibit the three qualities: firmitas, utilitas, and venustas – that is, it must be solid, useful, and beautiful. (Leslie, 2010)

Linking the three lenses to Pollio's firmitas, utilitas, and venustas: the concept inspired by river as a resource, in a solid form to be used as a resource for the community, river as functional system, to be used in a useful and functional way for the community as an educational tool, and river as a place, to be beautiful for the community to willfully interact, take ownership, and develop social and economic values in the design. Sullivan wrote "form ever follows function" derived from the full quote:
"Whether it be the sweeping eagle in his flight, or the open apple-blossom, the toiling work-horse, the blithe swan, the branching oak, the winding stream at its base, the drifting clouds, over all the coursing sun, form ever follows function, and this is the law. Where function does not change, form does not change. The granite rocks, the ever-brooding hills, remain for ages; the lightning lives, comes into shape, and dies, in a twinkling. It is the pervading law of all things organic and inorganic, of all things physical and metaphysical, of all things human and all things superhuman, of all true manifestations of the head, of the heart, of the soul, that the life is recognizable in its expression, that form ever follows function. This is the law". – Louise Sullivan (1896)

Frank Lloyd Wright was Sullivan's assistant and professed the same principle in a slightly different form.


Fig. 4.27 The wainwright Building in St. Louise, Missouri, designed by Louise Sullivan (Pinterest, 2018).

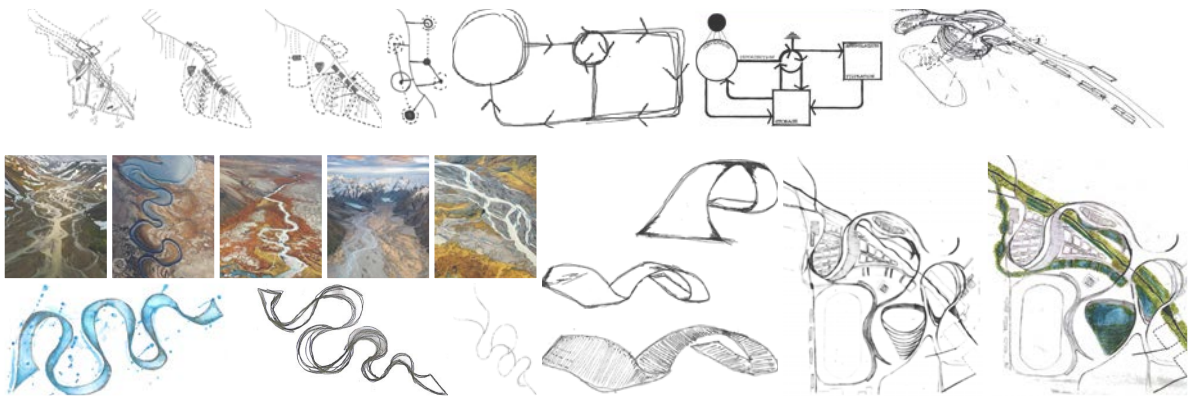


Fig. 4.28 Form follows function explorations (Author, 2018)

## 4.7 Description of conceptual generators

The conceptual generator investigated for this project consists of the three lenses, namely:

o River as a resource. How can the concept help to achieve the river to be used as a resource? Analysis of water: COLLECT, CLEAN, USE, RESTORE.
o River as functional system. How does it function as a system?
The analysis of land: CONTOURS, LAND USE, LAND QUALITY AND QUANTITY.
o River as place. How can the river create place for the community?
Analysis of community: CULTURE, BELIEFS, NEEDS, INTEREST, EXISTING PROGRAMME.

### 4.7.1 Existing aspects of the site

The existing aspects of the site and the design elements of the system were derived from the given/existing on site. The river as a resource, the existing pathways on site that creates a sense of place, and the energy of the landscape which forms part of the functional system of the existing on site. Please refer to fig. 4.30.

### 4.7.2 River as resource

Analysis of water; COLLECT, CLEAN, USE, RESTORE (River as a resource)

The collection of the storm water through storm water channels and contour analysis and the storage of the water in underground reservoirs to feed the system during dry seasons will be critical for the project to provide resources for the community. The concept is to provide a multi-functional purposes landscape that creates wildlife habitat, a healthier environment for the community and amenity.

The cleaning of the storm water and water from the spruit through the installation of a separate wetland system off stream that will not interfere with the natural ecological environment of the spruit, and the installation of facilities for the community to make use of the clean water for their needs, interests, and beliefs.

The return of the water that is used in the off stream system to the spruit will add to the value of the ecological system and regenerative design theory. Before the water is returned to the spruit, it will be filtered again through a constructed wetland.

### 4.7.3 River as functional system

The analysis of land, which includes the sites contours, the land use, the land quality and quantity form part of the functional system of the design concept.

The concept is to use the contours on site to inform the constructed system layout and design, and to feed the system with water as far as possible with gravity.

The use of the land could be productive and multi-functional. The land will be used to grow food, provide facilities and be of value to the people of the community of Mamelodi, and not just an open veldgrass area.

The land quantity and quality will be beneficial for both nature and human (regenerative design). The quality of the land will let nature still function on its own, and where the community can use the land for their needs and beliefs. The land is structured to prevent interference with natural systems and wildlife habitat (Off stream system).

### 4.7.4 River as place

Analysis of community; CULTURE, BELIEFS, NEEDS, INTEREST, EXISTING PROGRAMME

The culture and beliefs of the community of Mamelodi plays a big role in the structure and development of the activities and program on site. Mamelodi is rich in culture. Their culture and beliefs are reflected in the program and activities to create a multi-functional landscape. This could ensure project durability and provoke ownership.

The needs and interest of the community are important for the project durability, and for the community to take ownership of the multi-functional river landscape park. The river landscape park will provide facilities to grow and buy food and make water available for different activities, and

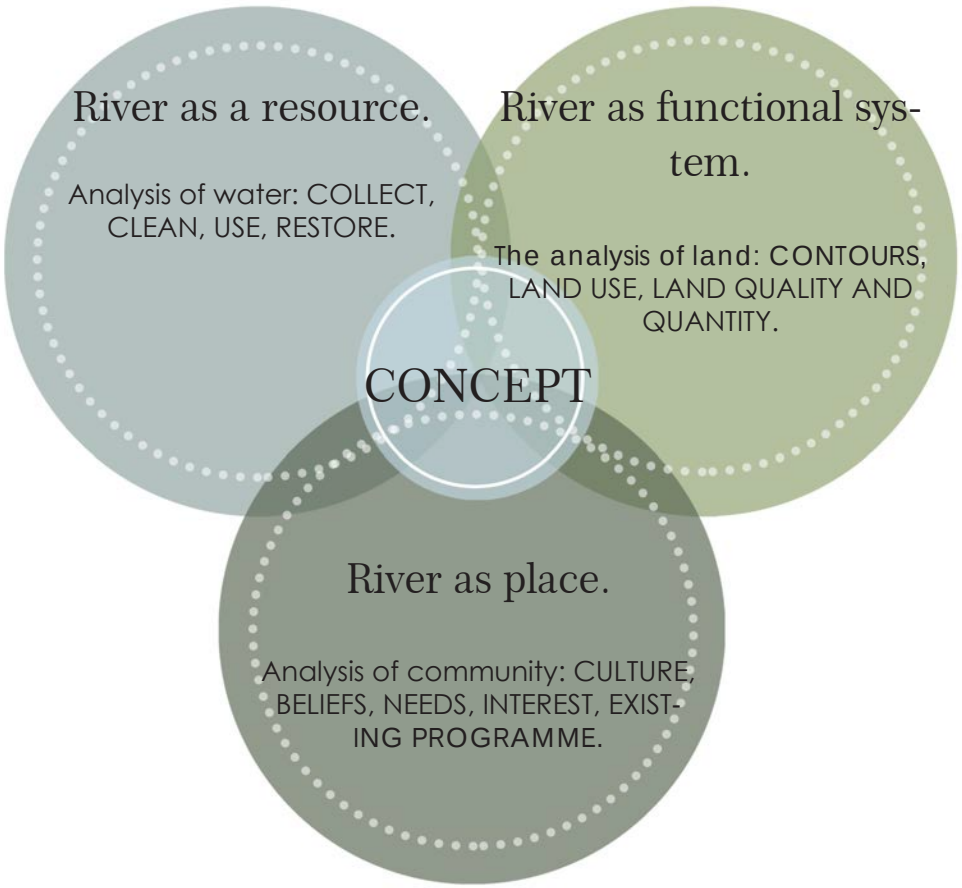



Fig. 4.29 Conceptual generators diagram
(Author, 2018)


Fig. 4.30 Existing aspects on site
(Author, 2018)

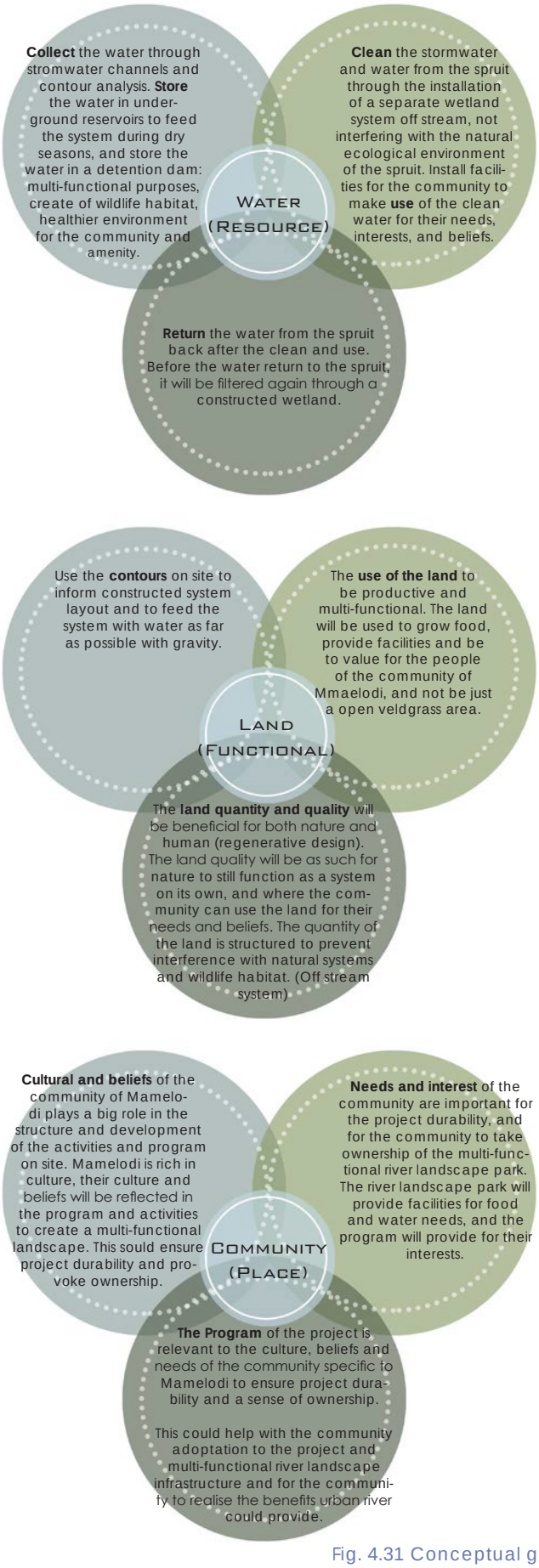



Fig. 4.31 Conceptual generators: water, land, and community diagrams (Author, 2018)

the program must provide for the community's interests.

## 4.8 Conclusion

The conceptual generator included river as resource, river as functional system, and river as place. These three lenses guided the concept explorations and design elements that are necessary for the design to work as a multi-functional river landscape.

Through explorations regarding form making the conclusion was drawn that the best theory to work from is form follow function. The function of the project was identified as the key element of the project's success. If the function of the system does not work, the project will not be successful. After overlapping the three lenses, river as resource, river as functional system, and river as place, the form and design was generated as a response to place (please refer to Chapter 5 and 6 regarding the system and design of the project)

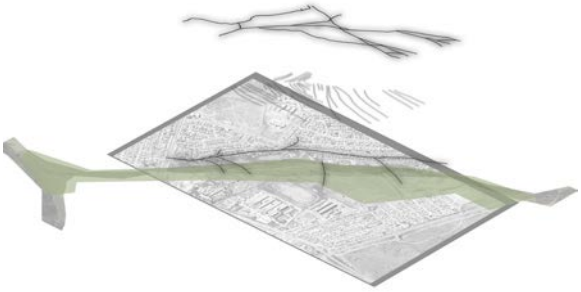
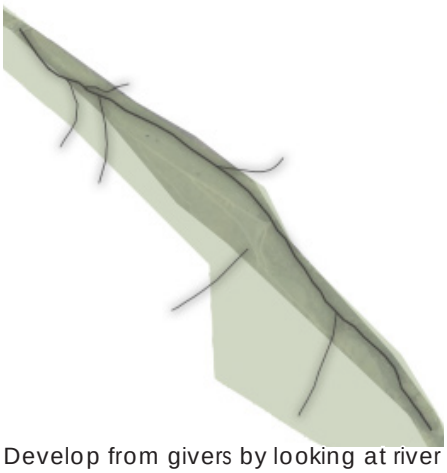
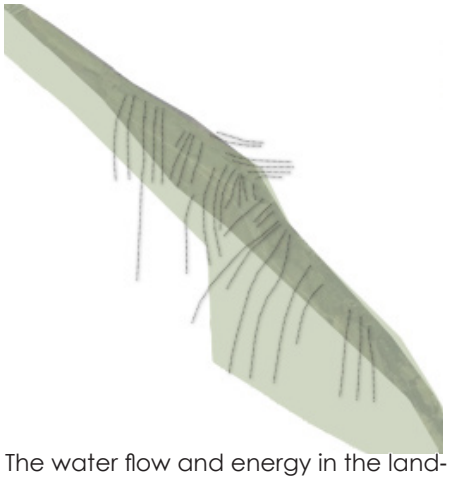


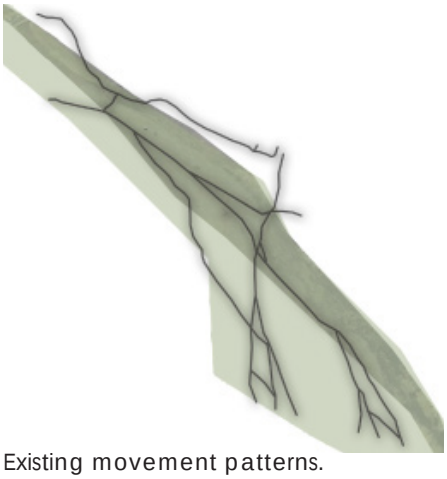
Fig. 4.32 Layering of existing aspects in site (Author, 2018)



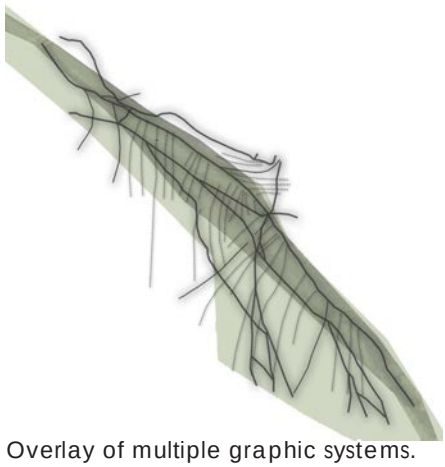
Develop from givers by looking at river as system.



The water flow and energy in the landscape.



Existing movement patterns.



Overlay of multiple graphic systems.

Fig. 4.33 Layering of existing aspects in site (Author, 2018)

# Design system and program

Chapter 5

## Chapter overview

This chapter focuses on the system of the design and the proposed program. How the system evolved and implemented into the design will be discussed and how the system drives the program placement will also be discussed.

The overall program of the design will follow in this chapter which includes the phasing of the proposed program, activities and development for the strengthening of community identity.

## 5.1 The system

### 5.1.1 The off-stream filtration system

The system of the design consists of a off stream water filtration system that will filter the water of the spruit in the hope to use the water. The goal is to filter the water through the necessary phases of filtration to provide water for the community to interact with and even to drink from.

The main problem to address is to control the water chemistry. There are three major sources of water pollution, the two largest are agriculture and industry, and these two can only be controlled at the source, before the pollutants they produce enter the water-flow system. Water from the third source will be urban run-off and is best treated by filtration and assimilation integrated with the water-flow system (Lyle, 1994).

At site specific there is no agriculture or industry that pollutes the storm water, only oil and grease from the roads and urban development.

After each stage of filtration the specific program that are applicable for the specific water quality are implemented at the specific point alongside the off-stream filter system. Please refer to fig. 5.3. The system consist of the following phases:

Phase 1:
REMOVAL OF WATER POLLUTION - Removal of floating debris such as plastic bags, bottles, cans, etc.
FILTRATION SYSTEM - Removed from the water in a trash trap.
PROGRAM - In phase one the water can be used for activities such as; recycling of waste materials caught by the trash trap is applicable and possible.

Phase 2:
REMOVAL OF WATER POLLUTION - Removal of contaminants lighter than water; hydrocarbons such as petrol, diesel, oil, etc.
FILTRATION SYSTEM - Removed from water separate in an oil trap.
PROGRAM - In phase two the water can be used for activities such as; irrigation of planting and sport fields, and the harvesting of wetland plants (reed beds) are applicable and possible.

Phase 3:
REMOVAL OF WATER POLLUTION - Removal of contaminants heavier than water, for example dirt and other sediments.
FILTRATION SYSTEM - These will settle out in any structure where the water is allowed to be stilled such as sedimentation and detention ponds.
PROGRAM - In phase three the water can be used for activities such as; car wash, washing of clothes, and irrigation of planting, sport fields, and food gardens.

Phase 4:
REMOVAL OF WATER POLLUTION - The removal of dissolved minerals. Mostly nitrates, sulphates and phosphates as well as other minerals which are in essence plant nutrients. These are removed to prevent eutrophication of the water bodies.
FILTRATION SYSTEM – Removed through nutrient uptake by wetland plant species. The plant species will be implemented in the off stream filter system which consists of constructed wetlands which forms part of the design and system.
PROGRAM - In phase four the water can be used for activities such as; washing of clothes and irrigation of food gardens.

Phase 5:
REMOVAL OF WATER POLLUTION - Removal of microbes such as pathogens and bacteria that cause sicknesses.
FILTRATION SYSTEM - Removed through chemical application such as chlorine or through irradiation with ultra-violet spectrum lights.
PROGRAM - In phase five the water can be used for activities such as; drinking fountains, Water Park, place for rituals, and any activity that requires human contact with the water.

### 5.1.2 Water calculations

Baseflow calculation: $m^2$ x m/s = $m^3/s$

Area:
Depth (d) = 0.4m
Width (w) = 2m
$m^2$ = 0.8$m^2$

m/s (V)
Distance = 10m
Seconds ave = 8.2 sec

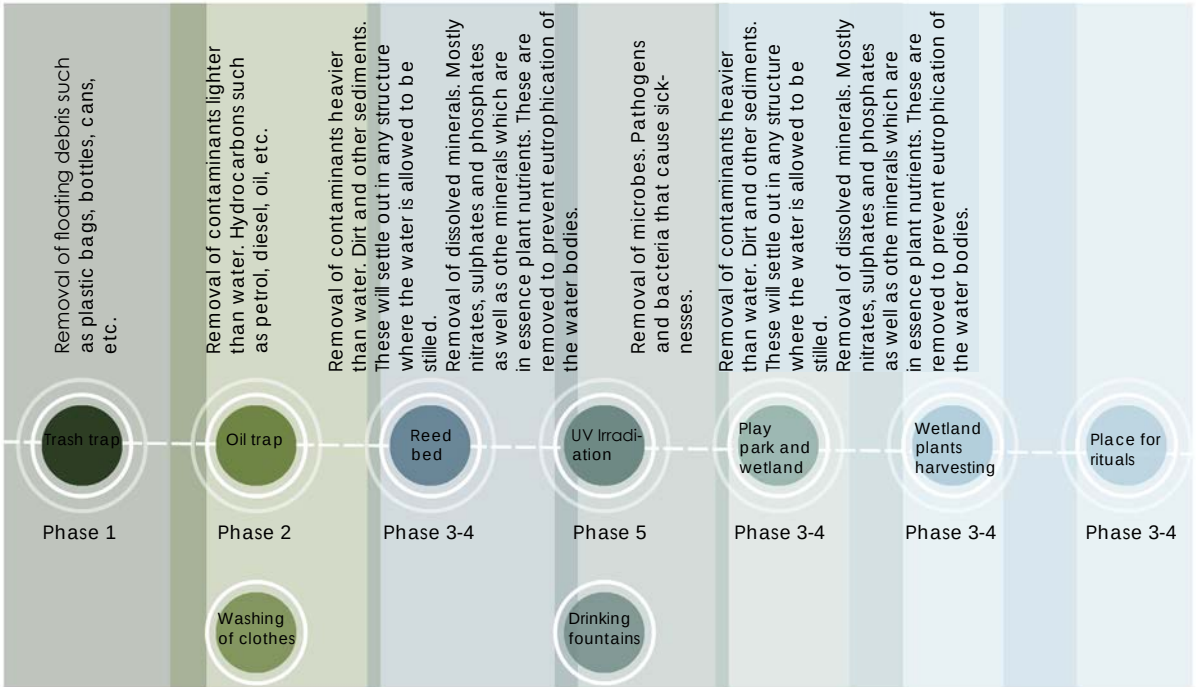



Fig. 5.1 The five phase off-stream filtration system diagram (Author, 2018)

| FILTRATION | | | |
|---|---|---|---|
| **PHASE** | **REMOVAL OF WATER POLLUTION** | **FILTRATION SYSTEM** | **PROGRAMME** |
| **1** | Removal of floating debris such as plastic bags, bottles, cans, etc. | Removed from the water in a trash trap. | In phase one the water can be used for activities such as; recycling of waste materials caught by the trsh trap are applicable and possible. |
| **2** | Removal of contaminants lighter than water. Hydrocarbons such as petrol, diesel, oil, etc. | Removed from water separate in a oil trap. | In phase two the water can be used for activities such as; irrigation of planting and sport fields, and the harvesting of wetland plants (Reed beds) are applicable and possible. |
| **3** | Removal of contaminants heavier than water. Dirt and other sediments. These will settle out in any structure where the water is allowed to be stilled. | Removed from water through sedimentation and detention ponds. | In phase three the water can be used for activitities such as; car wash, washing of clothes, and irrigation of planting, sport fields, and food gardens. |
| **4** | Removal of dissolved minerals. Mostly nitrates, sulphates and phosphates as well as othe minerals which are in essence plant nutrients. These are removed to prevent eutrophication of the water bodies. | Removed through nutrient uptake by wetland plant species. Constructed wetlands. | In phase four the water can be used for activities such as; washing of clothes and irrigation of food gardens. |
| **5** | Removal of microbes. Pathogens and bacteria that cause sicknesses. | Removed through chemical application such as chlorine or through irradiation with ultra-violet spectrum lights. | In phase fvie the water can be used for activities such as; drinking fountains, water park, place for rituals, and any activity that requires human contact with the water. |

Fig. 5.2 A table that explains the five phase off-stream filtration system(Author, 2018)

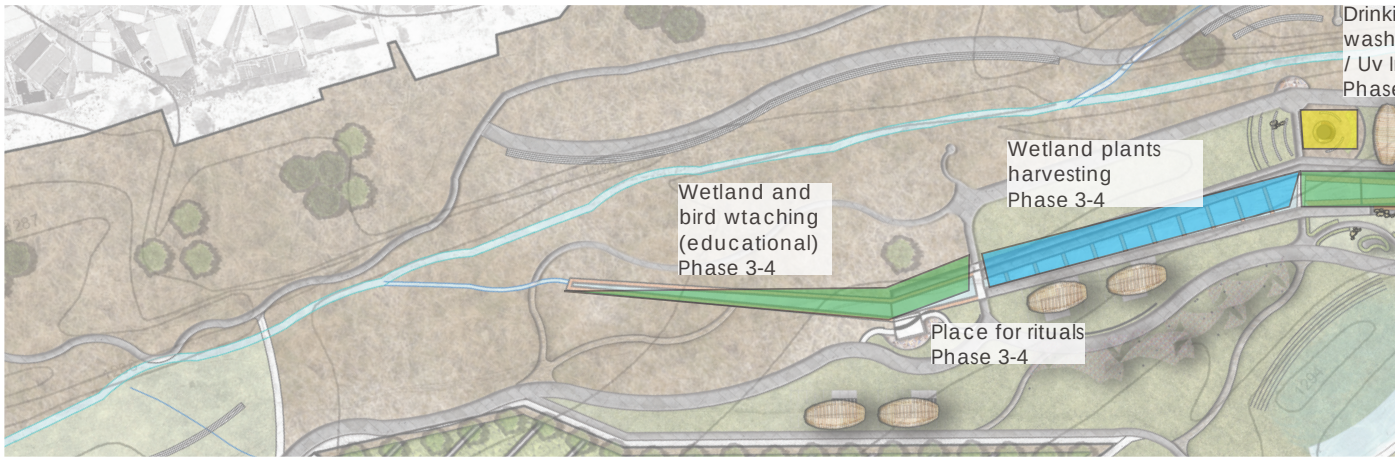
(V) m/s = 1.2195122

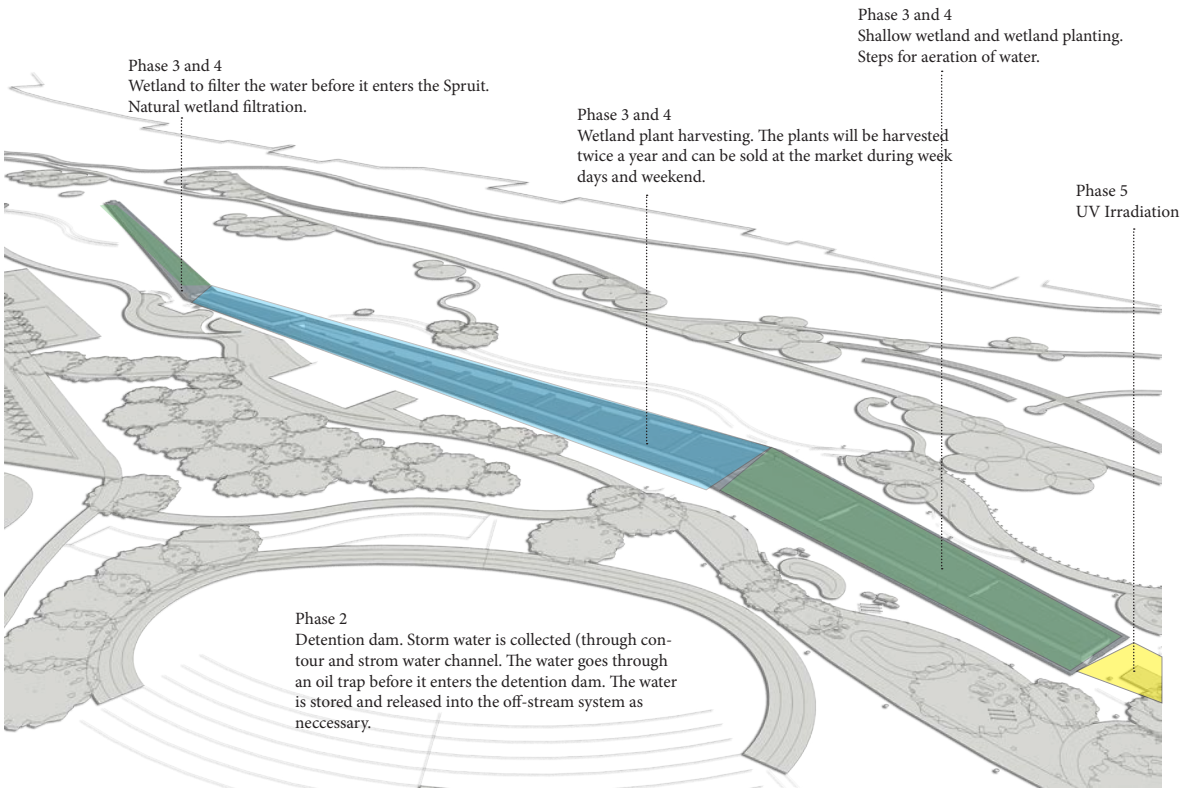
Baseflow in channel

Area (a) = 0.8m²
(V) m/s = 1.2195122

m² x m/s = m³/s
m³/s = 0.97560976 (Basic)

A (area) = 0.8m²
P (w +(8d²/3w) = 2.21
S (Vn / 1,486r0,67 ) ² = 4.12077
n = 0.019
R (A/P) = 0.454545



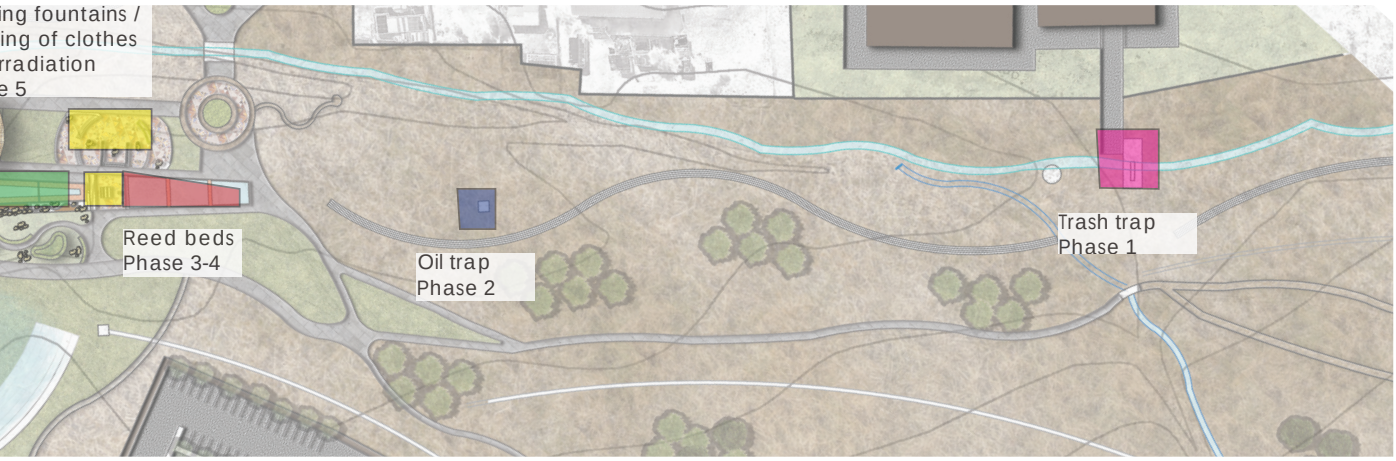



Fig. 5.3 The off-stream filtration system in plan view and in 3D view (Author, 2018)

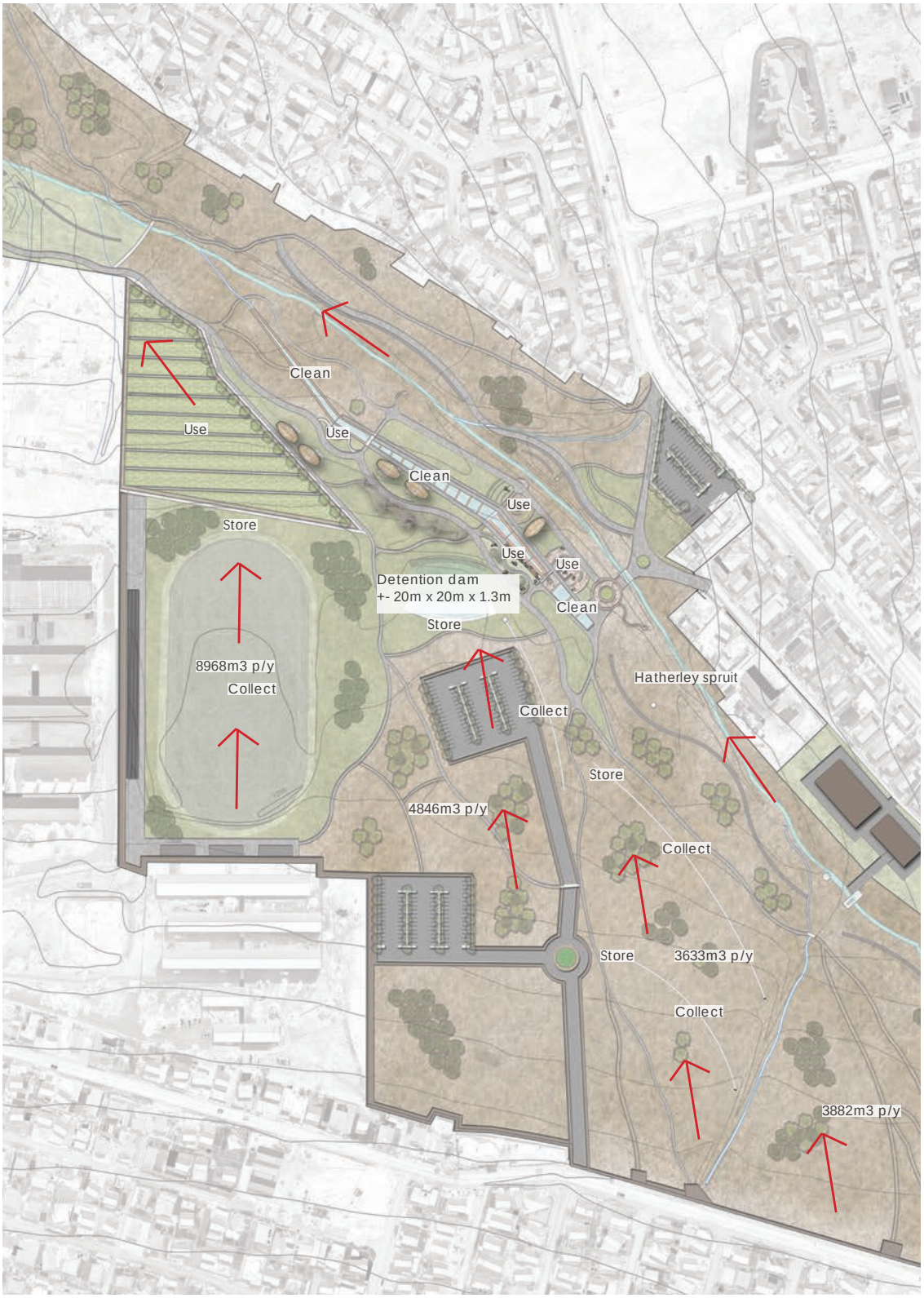



Fig. 5.4 Gravity flow on site and method to collect strom water into the filtration system (Author, 2018)

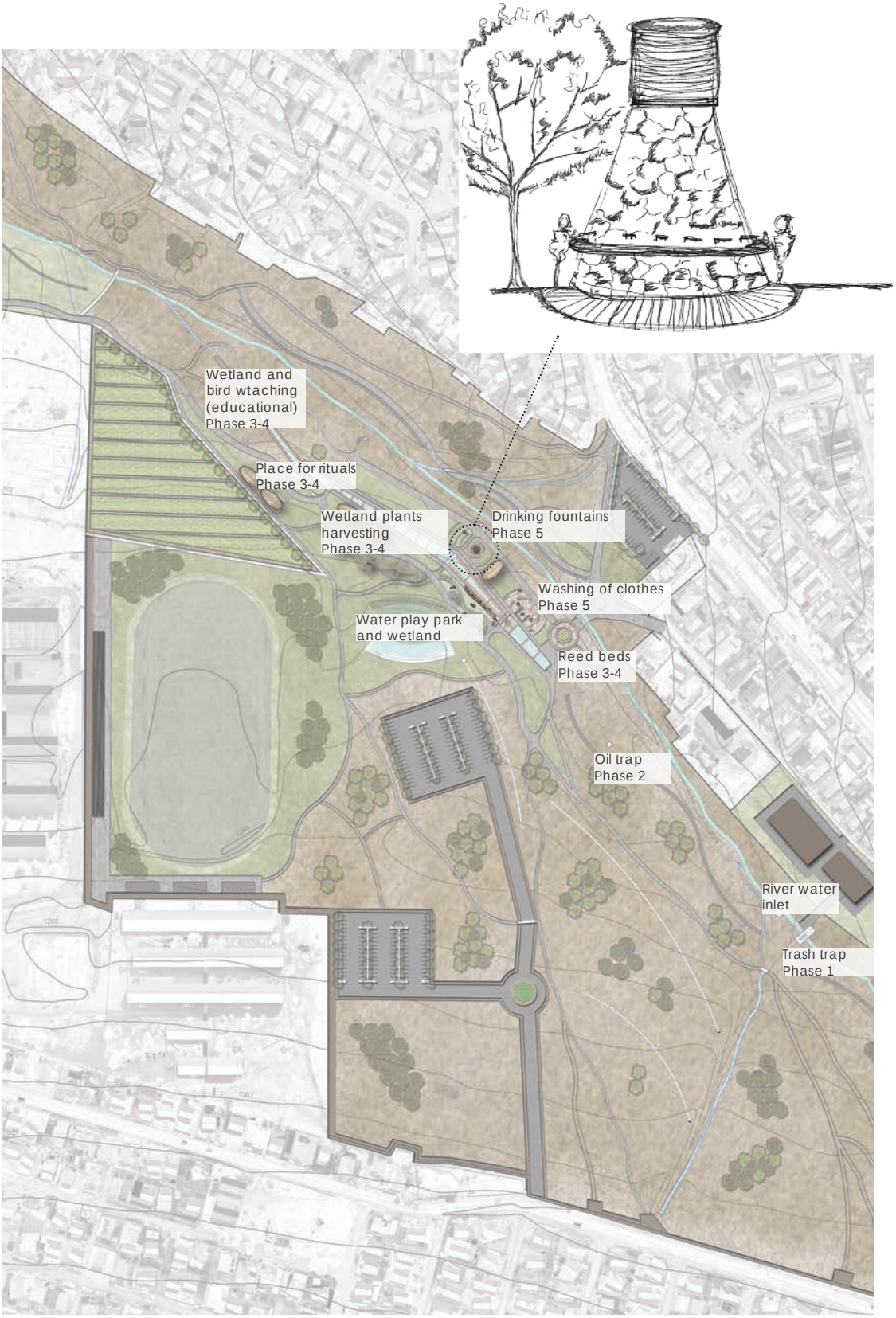



Fig. 5.5 The flow of water through the off-stream filtrations system
(See five phases as discussed in section 5.1.1)
(Author, 2018)

### 5.1.3 Living filter system

Storm water in urban rivers flow over urban surfaces and is usually laden with grease, oil, organic matter, and other debris (Lyle, 1994).

All this pollutants are dealt with in the off stream filtration system. It will be controlled and maintained, it is possible to control since it is constructed with a pump system. The rest of the site's storm water hand will be managed by living filter system in the form of natural swales and a detention dam (also being used as an above ground reservoir).

When storm water flows through landscapes that are planted in turf and dense ground covers the materials suspended in water tend to be assimilated by the landscape. They settle out or attache themselves to the leaves and roots of the plants. The materials then will decompose into a substance that is assimilated by the soil and the plant materials (Lyle, 1994). Thus if urban run-off travel over a long distance through vegetation, it is soon treated to a high level of quality, and natural swales can work in this way (Lyle, 1994).

The swales will function as vegetative filter strips across the site. These strips slow down run-off and removes suspended materials by filtration, absorption, and gravity sedimentation (Lyle, 1994).

### 5.1.4 Water and wildlife

Water is a very important element to wildlife habitat; the more water in the landscape, the larger and more diverse the wildlife community (Lyle, 1994). The potentials of using storm-water or waste water in different ways to shape wildlife habitat are many. The off-stream filter system exists out of many constructed ponds and constructed wetlands. The system does not just create amenities for the community but also creates wildlife habitat.

### 5.1.5 Regenerative system theory

The system is inspired by the theory of regenerative design. Layle (1994) talks about the six basic phases of ecosystem functioning. This theory was used and implemented to stitch the program and system together and drive the technification of the design. The technification of the design is discussed in Chapter 7.

Layle states: "Environmental design is where the earth and its processes join with human culture and behavior to create form. Design in this sense requires reestablishing some connections that began coming loose in the Renaissance and were entirely severed by industrialization. The first connection to be reestablished is that between people and nature; and next is that between art and science. At its best, environmental design is where people and nature meet, where art and science join (Lyle, 1994)."

### 5.1.6 The six basic phases of ecosystem functioning

1. Conversion - Collect storm water and water from the river.
2. Distribution - Distribution of the water through storm water pipes, wetlands and channels.
3. Filtration - Filtration of river water through five phases.

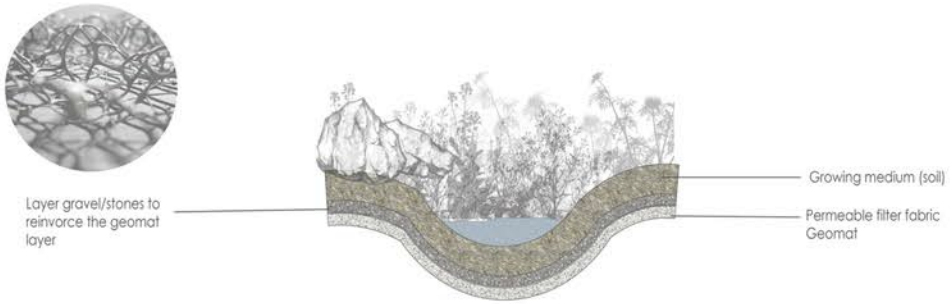



Fig. 5.6 A section of the living filter system (bio-swale) (Author, 2018)

4. Assimilation - For example using the water for irrigation purposes.
5. Storage - Underground water reservoirs and a detention pond.
6. Human thought - Human infrastructure and implementation of amenities stitched to the functional system.

### 5.1.7 Values and functions of the stream

Not only has the stream heritage value of its great biodiversity, but also ecosystems that stand out for the function and services they render to society/the community (Worldcat. org, 2018).Through its role in regulating hydrologic systems, biogeochemical cycles and primary and secondary productivity and exchanges of genes and micro-organisms, it can be credited with the following functions:

o The production of plant species such as reeds, wood, fodder, and wildlife.
o Smoothing peak flood levels by retaining part of the flood water.
o Delayed release of water stored during times of flood.
o Physical cleaning by retention of suspended matter, and chemical purification such as denitrification, recycling of phosphorus, trapping of heavy metals and micro organic pollutants.
o The replenishment of the ground water with purified water.
o The stabilization of banks and embankments.
o The enhancement of the quality of the landscape.
o The setting for leisure activities. (Worldcat. org, 2018)

### 5.1.8 Why the implementation of wetlands for the system to function?

o Wetlands purify water; they trap sediments in the water and remove chemical pollutants through wetland plant roots.
o Wetlands store water and slowly release the water to ensure supply during dry periods.
o Wetlands can prevent floods by storing the excess water and by slowing it down so it distributes more evenly over the floodplain, and the vegetation also helps slow the speed of the flood waters.
o Wetlands recharge ground water by soaking the water into the ground, and replenish the natural groundwater supply.
o Wetlands help to control erosion by trapping sediments before the sediment-laden water joins the river or stream and just washes away.
o Wetlands provide habitat for juvenile fish and other wildlife species. Biodiversity is high around wetlands and it protects the biodiversity by providing food for the different wildlife and fish in the wetland habitat.
o Wetlands provide opportunities for recreation where the people of the community are able to visit the wetlands and enjoy nature walks, picnics, and bird watching. As more people move to cities, these recreational nature spaces in cities become even more valuable.
o Wetlands provide plants that can be harvested for crafts, weaving of product, thatch for roofing, fiber for textiles and paper making.

The recognition of the values wetlands have in urban regions can help greatly with the water-quality problems in urban region rivers. By restoring the rivers in urban regions and improving the quality of the water entering the streams, fewer water quality problems are encountered and everyone is able to live in a healthier environment (Aquarium.co.za, 2018).

## 5.2 Program

Mamelodi may not be as well-known as Soweto and Alexandria but it shares the same pulsing vitality and some of their struggle history. The community of Mamelodi loves the sport soccer. Their famous team, Mamelodi Sundowns (The Brazilians) is one of the top soccer teams in South Africa's Premier Soccer League. (Gauteng.net, 2018)

To understand the local community's attitudes, belief systems and collective behaviors around urban rivers could result in project durability and instigating a process of cultural adaptation.

The program of the design is mainly influenced and relevant to the culture, beliefs, needs, and interest of the Mamelodi community, and the programs activities each interact, use, or celebrate water, because the concept is to use water as the binding factor.

This could help with the community adaptation to the project and multi-functional river landscape infrastructure and for the community to realise the benefits urban rivers can provide for the community's needs and entertainment.

The program consist of existing interventions by the community such as: a sport field, car wash facilities, urban agriculture and existing activities such as rituals that happens more upstream alongside the urban river, although it is in minority.

The rest of the proposed program strengthens the community identity, add to the value of the site (in quantity and quality), create work opportunities, and are relevant to the community's beliefs, interests, and needs.

### 5.2.1 Program as resource

Programs that will provide resources to the community are as follow:

o Food gardens that forms part of the existing Walter Sizulu Environmental Centre which has existing food garden programs and river awareness programs.


Fig. 5.7 Program diagram (Author, 2018)

o Wetland plant harvesting incorporated into the off-stream filter system available to the community to harvest under the control of the Walter Sizulu Environmental Centre program.
o Drinking fountains alongside the off-stream filter system available to the community to drink from and fill up household water bottles.
o The river habitat is a resource for biodiversity.

### 5.2.2 Program as functional system

Programs that will add to the functional system of the design are as follow:

o Recycling center, the waste that is captured in the trash trap will be collected and recycled at the center to make materials available for the community to create and produce products they can sell at the market. The recycling center is maintained and managed by Walter Sizulu Environmental Centre.
o Weaving workshop, the recycled materials from the recycling center will be made available to the community to purchase from and make products at the weaving center in order to sell at the market during the week and on weekends. The Walter Sizulu Environmental Centre will also manage and maintain of the weaving workshop.
o The continued cleansing of the water through the system for the variety of uses.

### 5.2.3 Program as place

Programs that will add to create place:

o Sport field. The sport field is an existing field and is currently being used for after school activities (mainly soccer). The sport field will be available to the community and to any organization who wants to host a sports game. The sport field will be multi-functional and bring excitement to the area during the week and over the weekends.
o Water playpark. The water playpark is part of the off-stream filter system and will make use of the water from the system. The water play park creates opportunity to entertain all ages of the community. The water play park will have streams and play equipment that encourage the community to play, interact, appreciate, and experience the water (see, feel, collect, and hear). The water play park has an area for children at the ages of 1-6, and an area for children at the ages of 7-16.
o The place for rituals. As mentioned there is minority of people in the community practicing rituals (baptism, and prayer) alongside the natural stream. This is implemented alongside the off-stream filter system to assist and add value to the community's beliefs.
o The market, will add to the leisure and recreation of the site. The market space will be surrounded by trees and the detention dam (amenity). Around the market picnic areas and lawn with shade and cultural sculptures will add to the community's identity and creating a sense of place for the people of Mamelodi.
o Bird watching areas will be created alongside the natural spruit to add health and educational value to the design and the community.
o Ultimately the protected and restored river can connect people to nature.

# Design development

Chapter 6

## Chapter overview

The final design of the project, Master plan and the Sketch plan is a unification of the applied theory, research, concept, explorations, the various group drawings and the consideration of the context, the community, the system, and the program.

The application of the principles applied to the design project will be discussed. The design development of the project will be discussed and lead to the Master plan and Sketch plan of the project.

## 6.1 Development of the Master Plan

The development of the Master Plan must develop the precinct as a resource to the community, as a functional system according to regenerative design theory, and to create a place that will strengthen the identity of the Mamelodi community. The following are a set of aims (from Chapter 1) that will support and drive the development of the Master Plan:

o Create awareness of the benefits urban rivers can provide to the surrounding community in Africa.
o To create a sustainable river landscape design.
o To change the perception of rivers and the traditional neglect of rivers in urban regions.
o To create a design proposal for a multifunction river landscape where the community is connected to the river in the urban region and using the water in multiple ways.
o To create a design proposal for wetlands alongside the urban river functioning as filter systems to clean the water of the river.
o To design an urban river landscape that combines engineering works, enhance the social context and accommodate ecosystem services to connect communities and rivers in urban regions.
o To create a design proposal for green infrastructure that enables the functioning of ecosystems and the provision of ecosystem services as a meaningful part of the lives of the people in the community in order for them to value and appreciate the river.

The development of the Master Plan startegy was derived from the Master Plan inspiration, Master Plan informants, and the information regarding the system design and programs relevant to the system as discussed in Chapter 5.

### 6.1.1 Master Plan informants

The informants to the Master Plan is the degraded spruit that flows through the precinct that has so much potential and benefits it can provide as a multi-functional landscape but is not being used for any community interventions or economic and social value development. The spruit is in a natural state and has the potential to develop wildlife habitat and a healthy environment for the community.

The open landscape around the spruit informed the opportunity for green infrastructure, and the implementation of the system design and program (as discussed in Chapter 5). The vast open landscape also provides the opportunity to catch the necessary amount of storm water to feed the system and make the precinct usable and available to the community throughout the year and informs how the storm water can be collected and stored.

### 6.1.2 Master Plan inspirations

The existing aspects of the site and the design elements of the system and the programs (see Chapter 5) inspired the Master Plan. The existing elements on site are the river as resource, the pathways already creating a sense of place, and the energy of the landscape as functional system, these three elements inspired the development of the Master Plan. (Please see fig 6.7 and 6.8).

Please refer to Chapter 4 (Description of conceptual generators). The inspiration to the development of the Master Plan further consists of the three lenses as mentioned above, namely:

o River as a resource. How can the concept help to achieve the river to be used as a resource? Analysis of water: COLLECT, CLEAN, USE, RESTORE.
o River as functional system. How does it

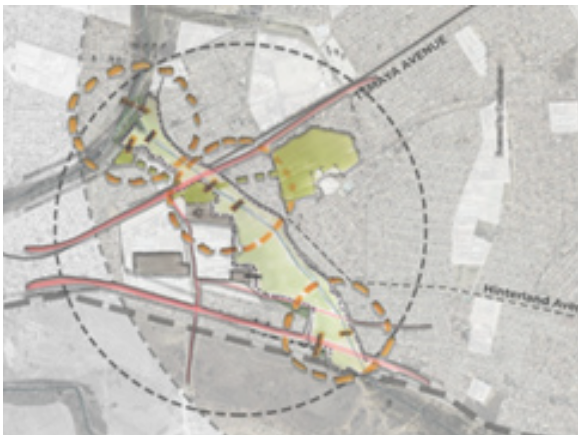



Fig. 6.1 Existing aspects and important nodes (Author, 2018)

function as a system?
The analysis of land: CONTOURS, LAND USE, LAND QUALITY AND QUANTITY.
o River as place. How can the river create place for the community?
Analysis of community: CULTURE, BELIEFS, NEEDS, INTEREST, EXISTING PROGRAMME.

### 6.1.2.1 River as resource

Please also refer to Chapter 4

The first imporatant aspects to the design was about the collection, storage, usage and cleansing of water, and the use of the water to foster reconnection between the community and nature. It is proposed water will be collected from the spruit through a drop inlet pipe that will feed the system with gravity at 1:100 slope through a 110D water pipe. Please refer to Chapter 7 for the technicality of the system in more detail.

Water will also be collected from the storm water on site, redirecting the storm water through contour manipulation and the construction of channels on site to the under ground reservoirs and to the detention dam where the water will be stored up until needed in the dry months. The detention dam forms part of the recreational aspect to the design. Around the detention dam the market will be developed, lawn areas, and trees for shade will provide picnic and social gathering spaces around the market and the detention dam, connecting to the off-stream filter system. (Please see fig. 6.6).

The cleaning of the storm water and the water from the spruit will be through the phases of the off-stream filter system and through the living system (natural storm water channels stretching over a distance), as discussed in Chapter 5.

The water will then be returned to the spruit after it went through all the phases of filtration (it will be a continous system). An exception is the water from the washing of clothes area, that will be pumped up to the beginning of the off-stream filter system to the oil trap at phase 2, based on regenerative design theory.

### 6.1.2.2 River as functional system

Please refer to Chapter 4

The functional system as discussed in Chapter 4 plays an important role in the development of the Master Plan. The off-stream filter system is the most important element to the design. The position and the form of the off-stream filter system was determined by the existing contours on site. Contour manipulation was necessary in order for the system and the levels to work, but because the design of the system was done according to the existing contours, it was not necessary for heavy contour manipulation, cut, and fill.

The theory of regenerative design informed the development of the Master Plan quite a lot regarding the system flow and process. The use of the land was split in two: the land quality and the land quantity. The aim is to develop the precinct into a multi-functional landscape, thus the use of the land is multi-functional, and the land quality and quantity is for nature providing wildlife habitat and rehabilitation of the spruit, and to strengthen the identity of the community. The existing food gardens next to the Walter Sizulu Environmental Center created a great opportunity to expand the food garden program on site to provide a productive landscape.

### 6.1.2.3 River as place

Please refer to Chapter 4

Another important element to the development of the Master Plan is the community and their culture, beliefs, needs, interest, and existing programs. This informed the program development (please see Chapter 4), and the facilities that will assist to accommodate for the community according their specific identity. This also strengthens the community identity, where the concept of the system is global; the program is site and community specific.

The vibrant culture of Mamelodi community in the Master Plan development is communicated through the built structures, such as the walls, sculptures, and overhead structures. The built structures are vibrant in colour and the material of the overhead structure is from the weaving products produced at the weaving workshop. The walls are transparent and made of wooden and stainless steel upright elements spaced from each other to create the transparency


Fig. 6.2 Design development of Master Plan (Author, 2018)

Fig. 6.3 Design development of Master Plan (Author, 2018)

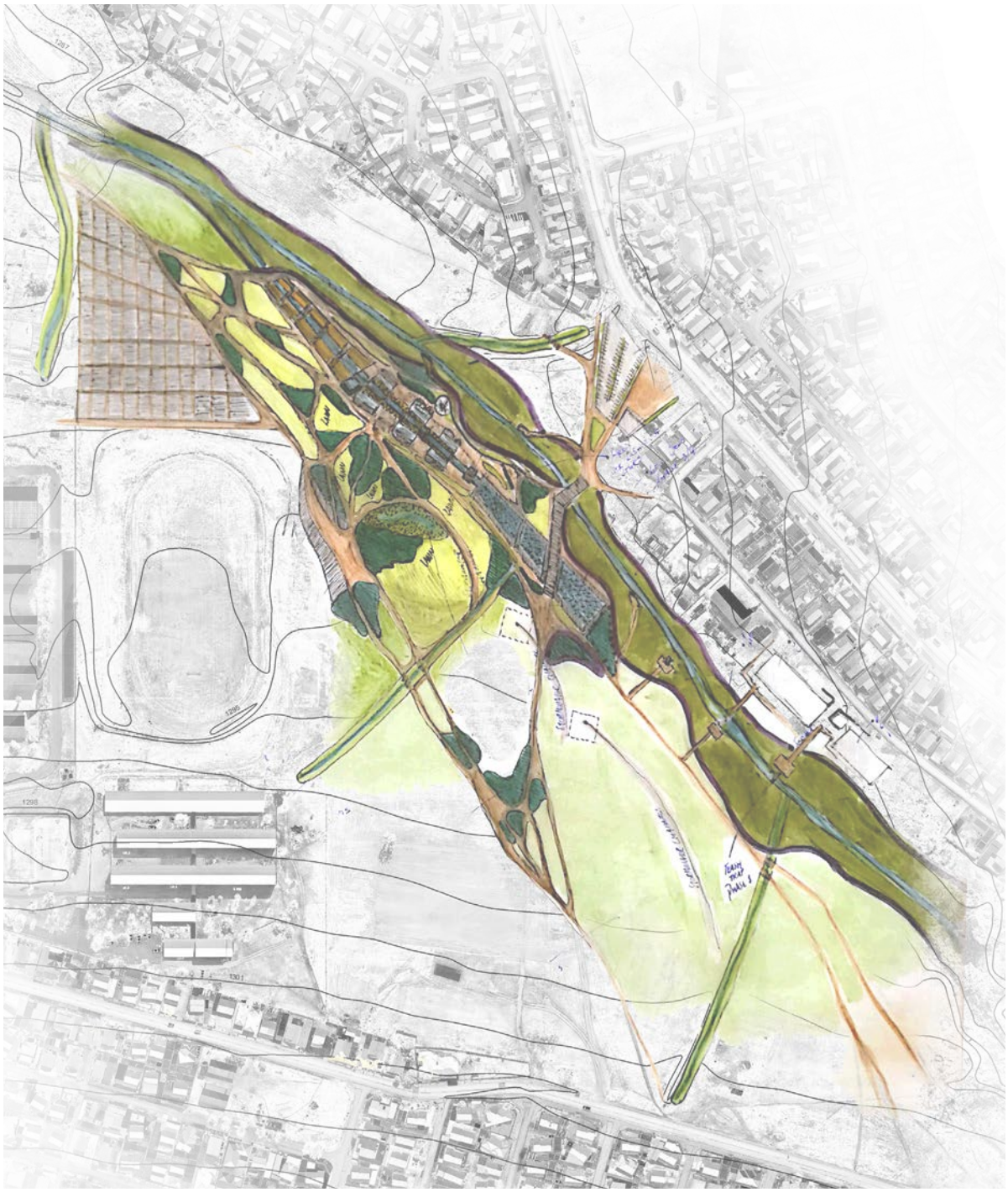


Fig. 6.4 Design development of Master Plan (Author, 2018)

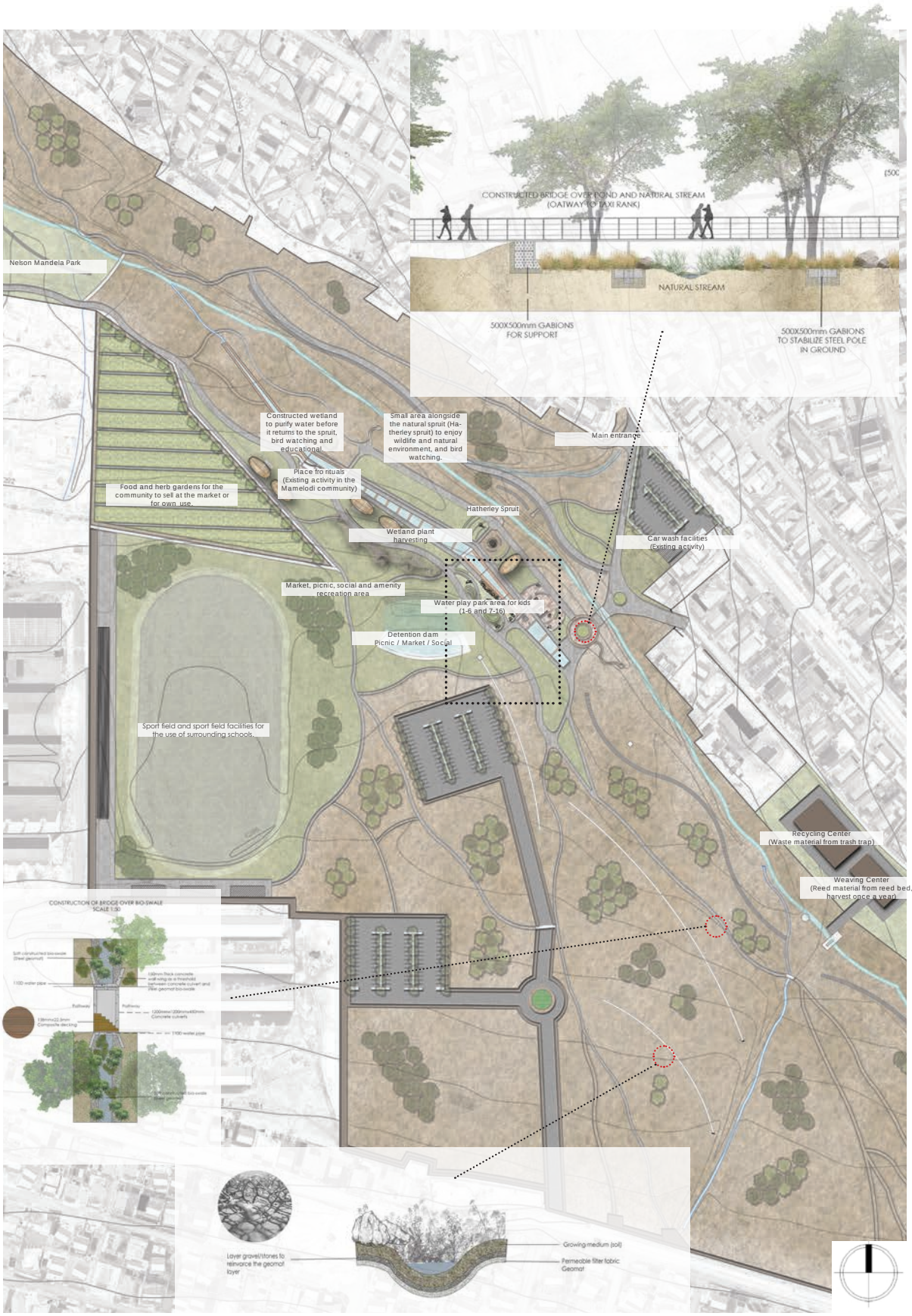



Fig. 6.5 Master Plan (Author, 2018) 84

(Please see Chapter 7 regarding the technicality of this). This symbolizes the romantic old African traditional cattle enclosures.

The place of rituals are part of the off-stream filter system and provides facilities for the people of the community who wants to perform rituals according to their beliefs, such as baptism and prayer next to the water. The space will also tell stories of old African traditions and stories about the water snake and rituals performed alongside water courses, this adds to the beliefs and culture of the community, and is educational for the younger generation.

The existing sport field adds to the interest of the community. The community appreciates soccer and the social aspects around the sport. This facility will be open to soccer clubs, and to the surrounding schools. There is a few existing programs such as the car wash facilities and washing of clothes, this also informed the development of the Master Plan. The car wash facilities will stay where they are currently and be upgraded and also make use of the water in the system. The washing of clothes area is part of the off-stream filtration system and will be discussed in more detail in the Sketch Plan section.

### 6.1.3 Master Plan stages

The site specific choice was inspired by Nabeel Hamdi's (2010) approach regarding urban region upgrades believing in small interventions and small upgrades having a big influence on the bigger picture. Due to this, the project will be developed according to phases over a certain period of time. Sustainability must be seen as a journey based on a character that shapes and forms the behavior and mindsets of individuals, institutions and the community as a whole.

Stage 1 (Year 1) – Cleanup, rehabilitation and contour manipulation: The cleanup of all rubbish and solid waste found on site. The manipulation of the contours and construction of the channels to catch and store storm water and to be made available as soon as the off-stream system is implemented. The construction of the detention dam will also be implemented in stage 1 followed by the installation of the underground reservoirs that will store the necessary water for the off-stream system to work.

The rehabilitation of the spruit will also be active in stage 1. Removing all alien invasive species, all solid waste around the riverbed and the planting of riverbed species to stabilize the riverbed and prevent erosion (see Chapter 7)

Stage 2 (Year 2) – The implementation of the off-stream filter system, and the development of all the buildings and facilities necessary for the programs in this stage. The development and construction of the off-stream filter system: the reed beds will be installed in this stage as well as the wetland plant harvesting phase. The rest of the programs relevant to the off-stream filter system will only be implemented in stage 3. The cleanup of waste in stage 1 will be recycled at the recycling center and weaving workshop for the community to make products to sell at the market. The second stage will provide economic and social value to the precinct.

Fig. 6.6 Water as resource diagrams: the collection of storm water on site development (Author, 2018)

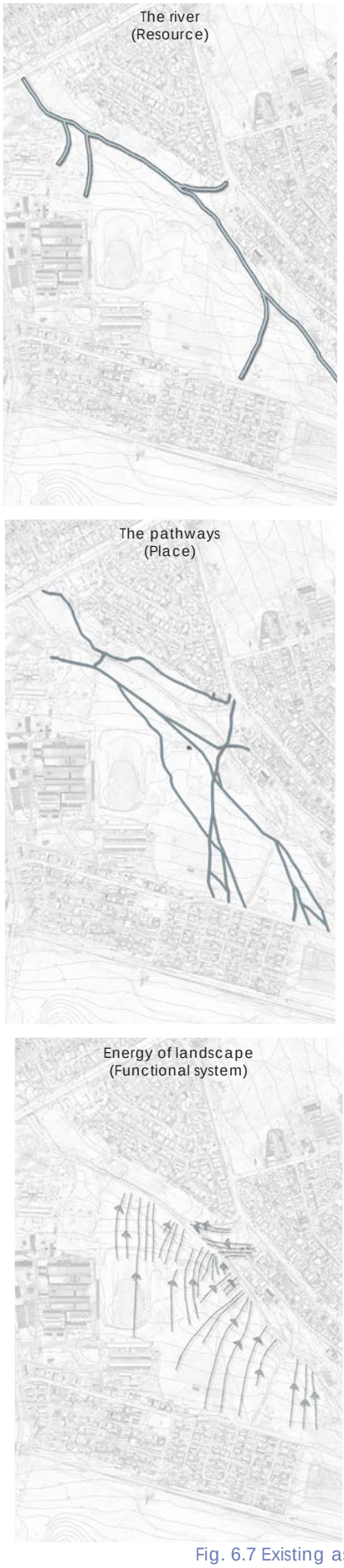



Fig. 6.7 Existing aspects on site diagrams (Author, 2018)

The existing food garden will be an ongoing process and the expansion of the food garden will be implemented which will also provide food product to sell at the market. The development of the recycling center, weaving workshop, market, and the food production facilities will be part of stage 2.

Stage 3 (Year 3) – The implementation of the rest of the off-stream filter system programs and the development of the leisure and recreational areas of the Master Plan will happen in stage 3. The establishment of all vegetation and ongoing processes of stage 1 and 2 will form part of the establishment of stage 3.

Although the implementation could be completed in a 3 year period the stages also provide the option for parcial installation if budget and funding requires this.

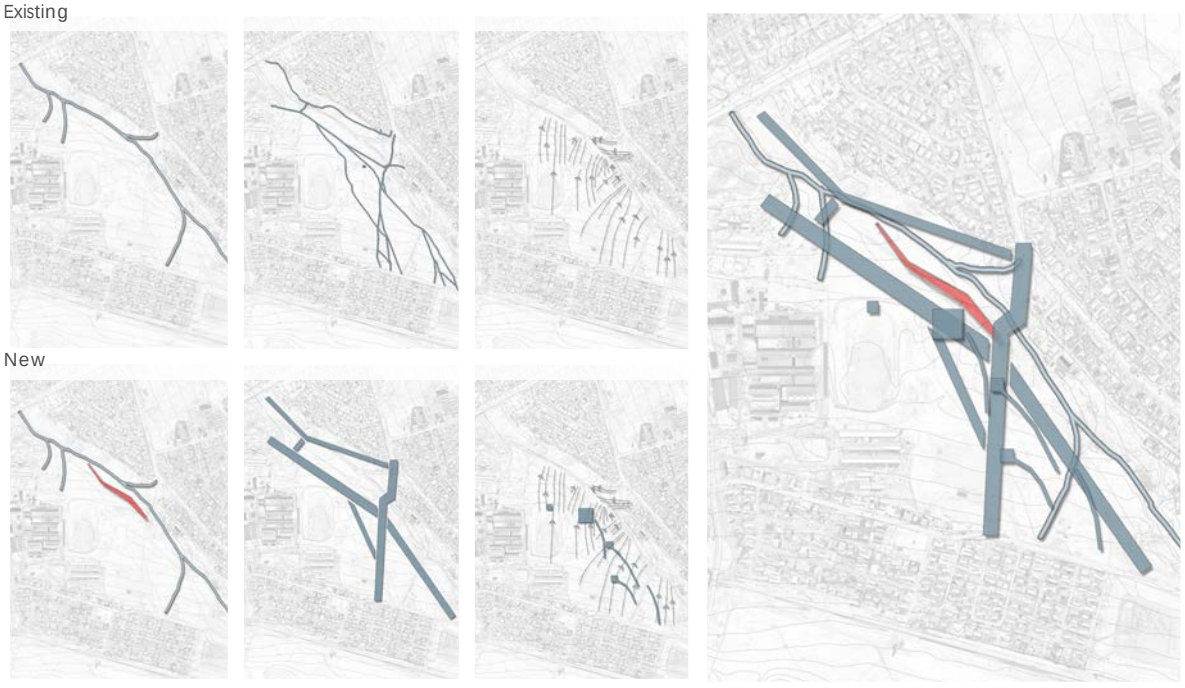



Fig. 6.8 Existing and new aspects layering diagrams (Author, 2018)

### 6.1.4 The development of the river

The existing spruit is a very important element in the development of the Master Plan and it is part of the Master Plan informants.

According to Petts et al. (2002) there are five important elements of urban river restoration: the improvement of the water quality, the regulation of run-off to prevent erosion, removal of invasive species, wildlife conservation, and the control of litter around the riverbeds. It is important to facilitate the education and the involvement of the people of the community to ensure that the focus for urban revival is moving the urban rivers from the 'backyard' to the 'front garden' in urban regions (Petts, Heathcote and Martin, 2002).

All of this mentioned above is addressed in the development of the Master Plan. In stage 1 the rehabilitation of the spruit will be implemented. The water quality of the river is not detrimental (please refer to Chapter 3 regarding the water quality), but contains a lot of solid waste materials. The removal of the solid waste materials, the removal of all alien invasive species, and the prevention of erosion alongside the riverbeds will first be dealt must in stage 1.

The riverbed will be stabilized by plant species with aggressive and strong root systems and gabions will be used in some areas to stabilize the soil, as well as creating some social areas alongside the natural spruit and provide space for bird watching. The natural spruit will be conserved, and only have small pockets where the people can enter and enjoy bird watching and the spruit in its natural state. The existing programs Walter Sizulu Environmental Center will be used to foster education and the involvement of the community to ensure urban river awareness and conservation.

### 6.1.5 Spatial organization

The spatial organization of the Master Plan is influenced by the off-stream system and the programs relevant to the system (please see Chapter 5). The existing elements such as the food gardens, sport field, pathways, natural spruit and the car wash formed a datum to organize spatial elements and activities relevant to the development of the Master Plan.

#### 6.1.5.1 Vehicular/Pedestrian access

Parking areas are provides at the main entrance (North-west of the precinct, next to the car wash) and the other parking area is close to the sport fields to accommodate vehicles attending sport games. Both parking areas can be used for the community to attend the market and other programs.

Pedestrian access and walkways are available over the entire Master Plan. Pedestrian access at the main entrance, at the southern side of the precinct and at the Northern (Tsamaya Avenue) and North-eastern side (Nelson Mandela Park) of the precinct. The food gardens are enclosed and the pedestrian access is controlled. There is also pedestrian access over the off-stream filtration system provided through bridges.

#### 6.1.5.2 Public transport

A bus lay bye is provided at the main entrance at Hinterland Avenue, and at the Southern side of the precinct at Serapeng Avenue.

#### 6.1.5.3 Services access

Services entrances are required for delivery and loading at the various programs. An entrance is provided mainly for the transport of the harvested reeds to the weaving workshop. This entrance is at X11 Rd 2 St (please see fig..) This service access road link with the main entrance pedestrian road leading to the reed beds across a bridge over the natural spruit.

#### 6.1.5.4 Residential access

Residential complexes are proposed at the North-eastern edge of the precinct. There are residential access points at the North-eastern and Southern side of the precinct. At the North-eastern side there will be access points at Buffalo street, and at the Southern side there will be access points at Serapeng Avenue. Also providing access to all existing residential areas along the site.

### 6.1.5.5 Planting strategy

The planting design will be discussed in detail in Chapter 7. The planting strategy is developed from the three lenses: resource, functional system and place. The planting design is very important in the place making of the Master Plan development. Through planting, trees and see through walls, space is created according to private, semi-private, and public spaces. The public spaces will have more trees and open landscape planting, semi-private spaces are created by hedges and trees creating more structured spaces, and private spaces (such as place of rituals) will have the see through walls (max 1.5m in height for security reasons).

The planting design strategy is as follows:

o Resource - Planting that provide food and resources for the community.
o Functional system - Planting that assist in habitat creation, rehabilitation of the spruit, purification of water, and other functional aspects such as security and water wise planting.
o Place - Planting that creates place and space, creates intimacy, privacy, cultural and social aspects, that is aesthetically pleasing, and water wise ornamental planting. (Please see fig. 6.9)

The tree design strategy is as follow:

o Functional system - Trees that can assist in providing shade, wildlife habitat, and trees that protect the food and herb garden from the north-west wind, and prevent Typha capensis (reed beds) seeds to spread. Alongside swales, spruit, picnic area, and constructed reed bed area.
o Resource - Trees that provide edible fruits for the community to sell at the market (economic value) or for own use. In the food and herb garden, and in the play park for the kids.
o Place - Trees that will create structure, add to cultural value, create private and intimate areas, and create amenity (aesthetical reasons). Play area, social and picnic area: Large and small trees providing shade, structure, and scale of intimacy. (Please see fig. 6.10).

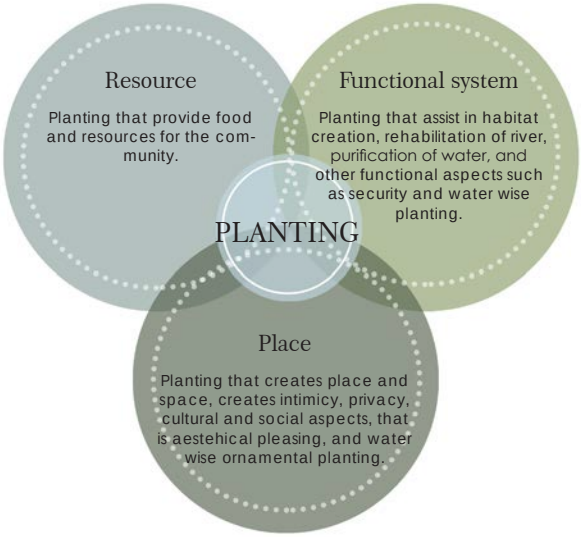



Fig. 6.9 Planting design strategy diagram (Author, 2018)

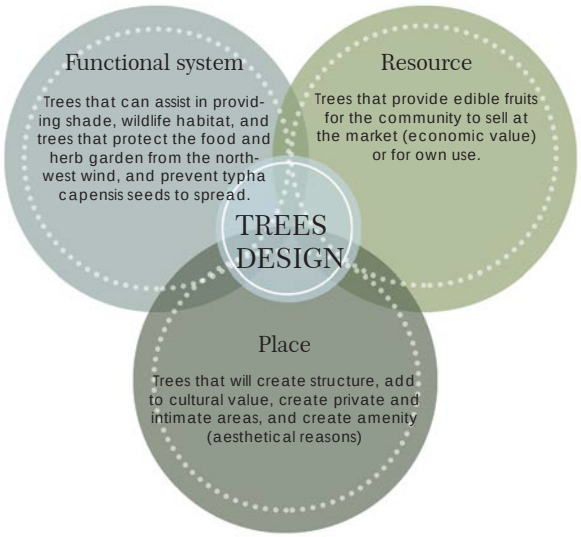



Fig. 6.10 Tree design strategy diagram (Author, 2018)

### 6.1.5.6 Various users of the activities and functions provided in the design

**Daily use:** The people of the community can use any of the programs available on the precinct; residents; business people; people who sell products from the market; management of the water filtration system; management of the wetland plant harvesting, and the food gardens; school children using the sport fields.

**Weekday use:** The people of the community can use any of the programs available on the precinct; residents; business people; people who sell products from the market; management of the water filtration system; management of the wetland plant harvesting, and the food gardens; school children using the sport fields.

**Weekend use:** The same as in during the week, and people who are exhibiting their weaving products and sculptures at the market. There will be more formal sport-related activities on weekends as well.

## 6.2 Development of the Sketch Plan

### 6.2.1 Introduction

The area for the Sketch Plan develoment was selected for the following reasons:

- It contains the main bridge over the natural spruit and the main access route into the precinct.
- It contains the beginning of the off-stream filtration system (the reed beds) which is one of the main products that will be used at the weaving workshop.
- It contains the following programs: washing of clothes area, water play park area, and the drinking fountains. Al three programs contain elements which are relevant to the three lenses.
- It contains a large part of the off-stream filtration system which is important to understand the different phases of filtration and the programs relevant to the specific phase of filtration.

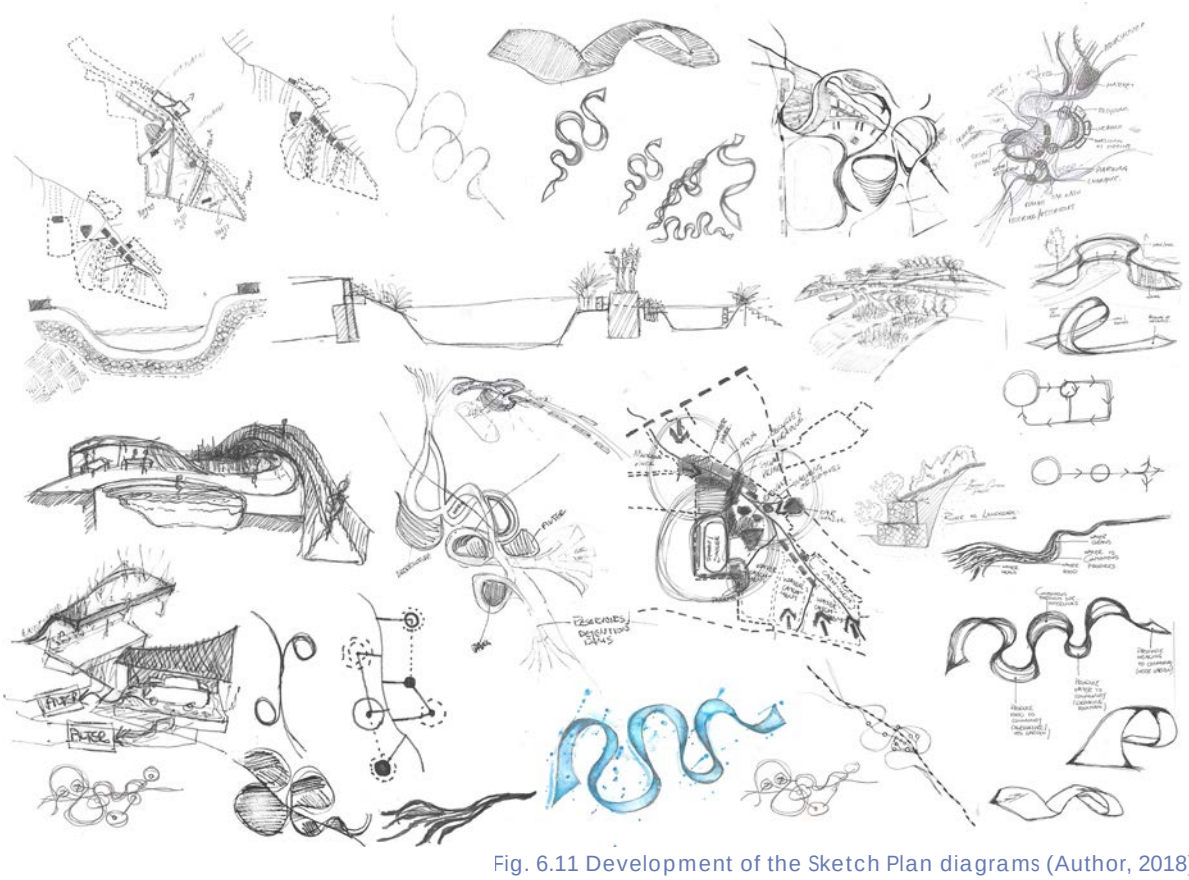


Fig. 6.11 Development of the Sketch Plan diagrams (Author, 2018)

## 6.2.2 Sketch Plan development

The Sketch Plan development was driven by the three lenses; river as a resource, river as functional system, and river as place, just as the Master Plan development. The Sketch Plan is on a scale of 1:200 and contains three important programs namely; washing of clothes area, the drinking fountains, and the water play park. The Sketch Plan contains a large part of the off-stream filtration system.

The main entrance of the precinct is at the North-eastern side as shown earlier.

The main entrance pedestrian pathway links up with the main bridge that cross the natural spruit and leads to the second phase, the reed beds, of the off-stream filtration system. The reed beds are the second phase of filtration where it will absorb all the chemicals and sedimentation in the water from the spruit (Please refer to Chapter 5).

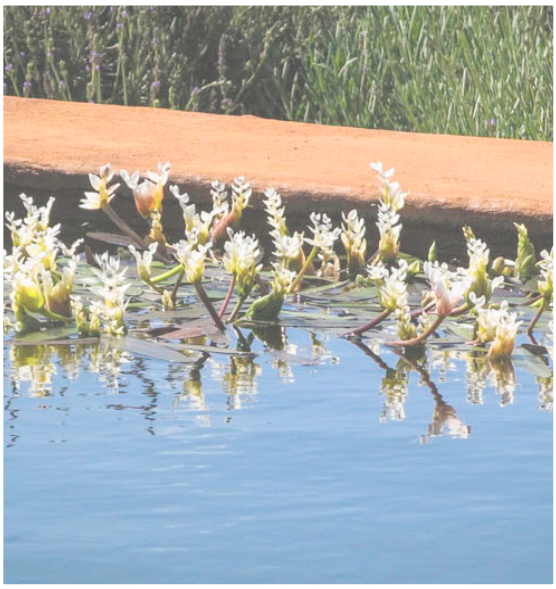
The reeds will be harvested once a year and transported to the weaving workshop for the community to make products to sell at the market. The reed beds grow fast and will be green even when harvested, although it is constructed specific for functional reasons, there will be no specific social rituals in this area but the harvesting and growth time will be experienced from the pedestrian pathways parallel to the off-stream filtration system as peopl move through the site.

The washing of clothes area is an existing program in the community of Mamelodi, although it is in minority, there is a romantic historical African tradition to the act of woman washing clothes in a group at the 'river'. In this space the facilities will be made available for the people of the community to wash their clothes and socialize. Around this space will be multi-functional walls where clothes can be hanged to make the space semi-private. In this space stories will also be told on the walls of the washing basin about the romantic tradition of African cultures related to water (please see Chapter 2 elaborating on this).

The idea of the drinking fountains developed from the off-stream filtration system. The fact that the water from the

Fig. 6.12

Fig. 6.13



spruit is drinkable after the filtration phases and the fact that all people need to drink water is the reason why the program exists. The drinking fountains in a way celebrate the success of the off- stream filtration system and makes clean water accessible to the community of Mamelodi reminding and connecting them to the river. The drinking fountains are installed attached to a vertical structure with the water tank placed on top and function with a trigger pump. The drinking fountain structure is surrounded by seating stairs and trees and shade structure to create a more intimate space.

The other program in the Sketch Plan is the water play park for the younger generation of the community. This play park has different play equipment that encourages the children to play, interact, appreciate, and experience the water. The water play park is also part of the off-stream filtration system and makes use of the filtered water. The water play park accommodates for children between the ages of 1-7, and the ages 7-16. (Please refer to fig. 6.15, 6.16, and 6.17).

Bringing the functional and place making aspects of the river together, provides for awareness and education about water and the environment to the community. It expose people to activities, rituals and harvesting practices that can change their perceptions and values in a positive way, connecting them to their resources and to nature and each other.

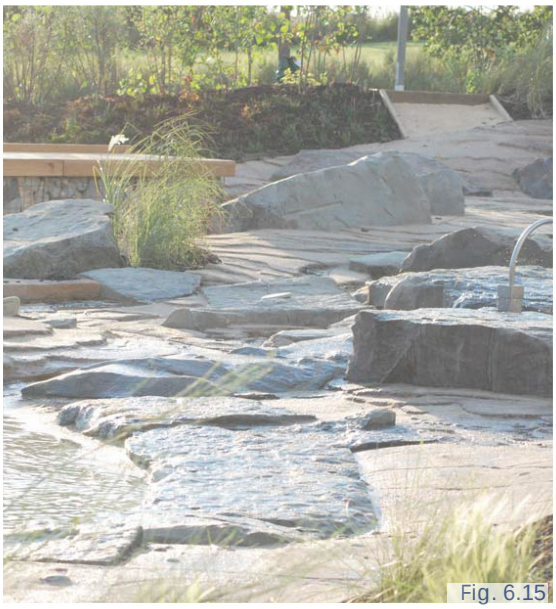


Fig. 6.15


Fig. 6.16


Fig. 6.17

Fig. 6.12 The section of the off=stream filtration system at the water play park (Pinterest, 2018)

Fig. 6.13 The wetland plant harvesting section of the off-stream filtration system (Pinterest, 2018)

Fig. 6.14 Waterblommetjies - one of the wetland plants that will be harvested (see Chapter 7, planting design) (Pinterest, 2018)

Fig. 6.15 Rocky water channel that cuts through the water play park (Pinterest, 2018)

Fig.6.16 Water play park area for children between the ages of 1-7 (Pinterest, 2018)

Fig.6.17 Water play park area for children between the ages of 7-16 (Pinterest, 2018)

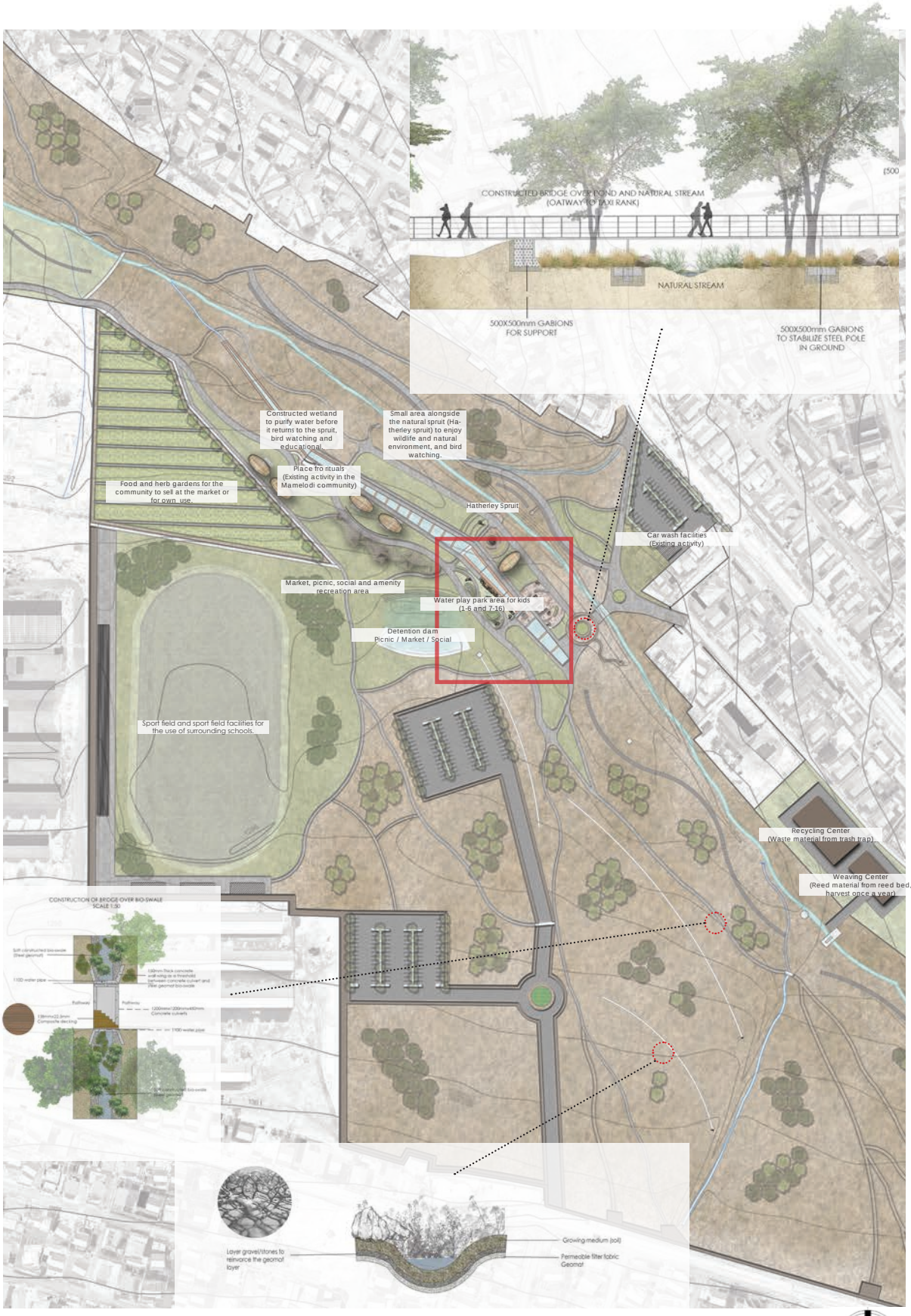



Fig. 6.18 Master Plan (Author, 2018)

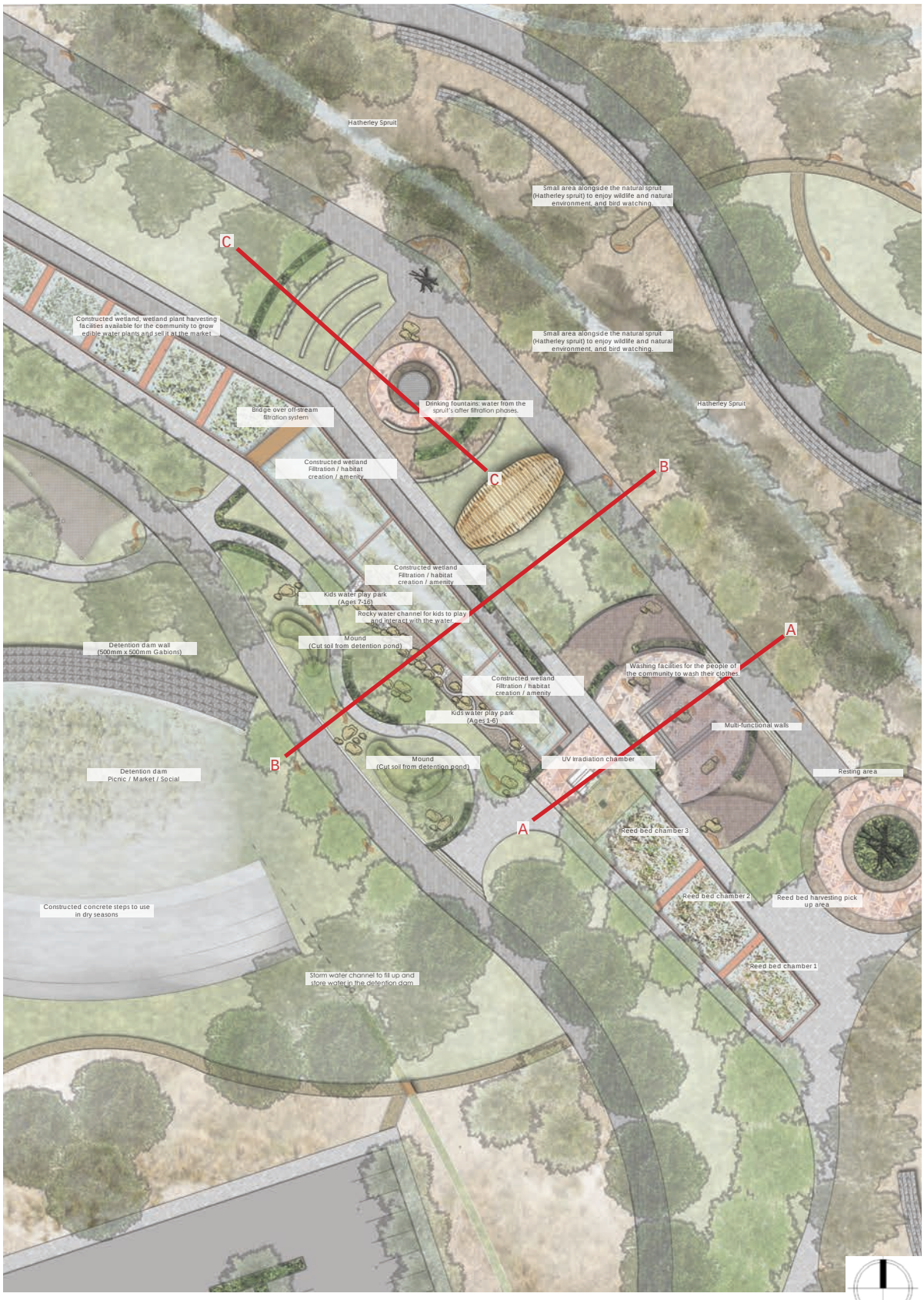



Fig. 6.19 Sketch Plan (Author, 2018)

Fig. 6.20 Perspective of washing of clothes area (Author, 2018)

Fig. 6.21 Perspective of drinking fountain area

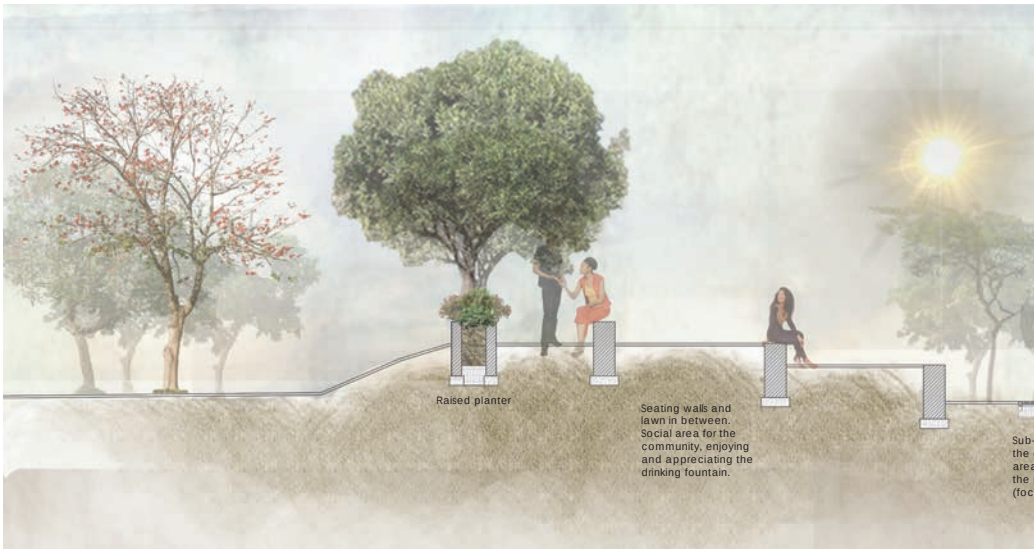




Fig. 6.22 Section A (Author, 2018)


Fig. 6.23 Section B (Author, 2018)


Fig. 6.24 Section C (Author, 2018)

# Technical resolution

Chapter 7

## Chapter overview

In this Chapter the technification of the off-stream filtration system, the planting strategy, the conceptual approach to technification, materials and details will be discussed.

The conceptual approach to technification was derived from aspects of the site and the design leading to design elements inspired by the three lenses, river as a functional system, river as a resource, and river as place and how the technification can assist to develop these three lenses. At the end the technification must help the system to function by using the land as an asset.

## 7.1 The technification of the off-stream filtration system

The system is a 5 phase filter system in order to clean the water from the spruit and make it available for the people of the community to use according to the program. The program is derived from the specific community's needs, beliefs, interest, and culture. The function of the system first needed to be in place before the social aspects were stitched onto the system. Existing aspects on site helped with the design and development of the layout of the system which were: The spruit as resource, the existing pathways that created a sense of place, and the energy of the landscape as the functional system. These three givens informed the system design.

In order for the system and the design to function as a multi-functional river landscape the following were considered:

o Analysis of water; COLLECT, STORE, CLEAN, USE, RETURN
o Analysis of land; CONTOURS, LAND USE, LAND QUALITY AND QUANTITY
o Analysis of community; CULTURE, BELIEFS, NEEDS, INTEREST, EXISTING PROGRAM

## 7.2 The conceptual approach to technification

The conceptual approach to technification is inspired by the term land making and technification follows system.

The conceptual approach to technification was derived from aspects of the site and the design leading to design elements inspired by the three lenses, river as a functional system, river as a resource, and river as place and how the technification can assist to develop these three lenses. At the end the technification must help the system to function by using the land as an asset.

**Resource** - The technification makes it possible for the people of the community to use the system as a resource and use the resources of the system for economic value, social value, and for own use.

**Functional system** - The technification as a functional system is relevant at the off stream constructed filtration system. The technification derived from the practical aspect of the system to work as a functional system.

**Place** - Through the technification value is added to the system regarding the social aspect. Through the technification by using the design elements, the site aspects, and the system as a reference in order to stitch the social interaction to the system, and to create place along the system.

## 7.3 The technification functioning

In Chapter 5 the six basic phase of ecosystem functioning of Layle (1994) were discussed briefly. The six basic phases of ecosystem functioning inspired the approach to technification in order to assist in developing the three lenses: river as a resource, river as functional system, and river as place.

### 7.3.1 The development of the technification through the six basic phases of ecosystem functioning:

1. **Conversion** – The conversion is about the collection of water. The technification of the design assists in the collection of the storm water on site and in the collection of water from the river. As discussed in Chapter 6, channels are constructed over the precinct to catch the necessary storm water through gravity flow to store and use for the system. The technicality of the process is getting water from the spruit to the off-stream system through a drop inlet pipe in the spruit, transporting the water to the oil trap by gravity at 1:100 slope in a 110D water pipe. (See fig. 7.1 and 7.2)

**2. Distribution** – The distribution for example is about the distribution of the water from one point to another and the distribution of: food products, the harvested reeds, and harvested wetland plants. The distribution of the water is through 110 D water pipes at 1:100 slopes, through wetlands, and storm water channels. (See fig. 7.3)

**3. Filtration** – The filtration is the five phase off-stream filtration system which cleans the water from the spruit. Living filter systems (please see Chapter 5) and the detention

dam collect, store, and clean the storm water before it enters the system or return back to the spruit. (See fig. 7.4)

**4. Assimilation** – The assimilation is using the water for irrigation purposes. The irrigation for the landscape, lawn, and sport field is micro irrigation working with a pump system under control and maintained by the Walter Sizulu Environmental Center. The irrigation for the food gardens work with water channels and each person will pump water from the water channels to irrigate their portion of food garden. (See fig. 7.5)

**5. Storage of water** – The water is stored in underground water reservoirs (please see fig..) and will be used during the dry months. During the dry months the water play park will be closed, but the off-stream filter system will be ongoing proses to keep the reed beds, drinking fountains, washing of clothes, and wetland harvesting plants in production. Please see fig. 5.4 (page 72) and fig. 5.5 (page 73) in Chapter 5. (See fig. 7.6)

**6. Human thought** – The human thought is the implementation of human infrastructure and amenities stitched to the off-stream filtration system. The technification of the infrastructure in the design adds cultural value to the design through the detailing, materials, and colour. (See fig. 7.7)

At the end the technification of the design is derived from the practical aspects of the system to make the system work as a functional system.

The technification of the design will make it possible for the community to use the system as a resource and use the resources of the system for economic value, social value, and for own use.

Through the technification of the design, the design elements, the site aspects, and the system as a whole, value will be added to the amenities and integrated into the system and value added to land makes it a place for the people of the community and creates a sense of ownership.

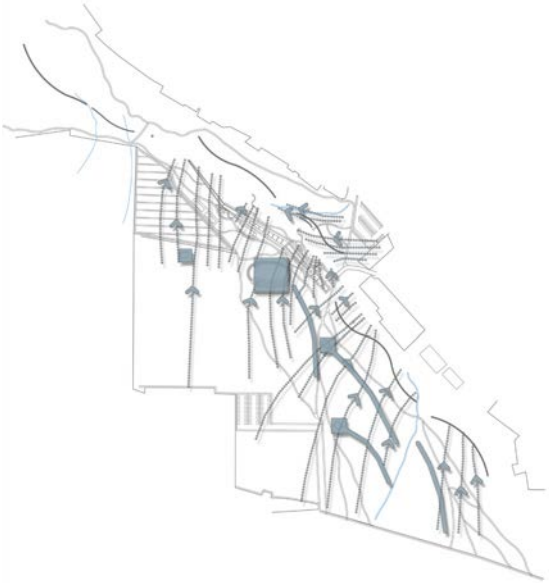


Fig. 7.1 Conversion and storage diagram - storm water is collected from the site and stored (Author, 2018)

Fig. 7.2 Conversion diagram - the spruit is a source to collect water for the system (Author, 2018)

Fig. 7.3 Distribution diagram - the paths water follow to distribute the water through the site (Author, 2018)

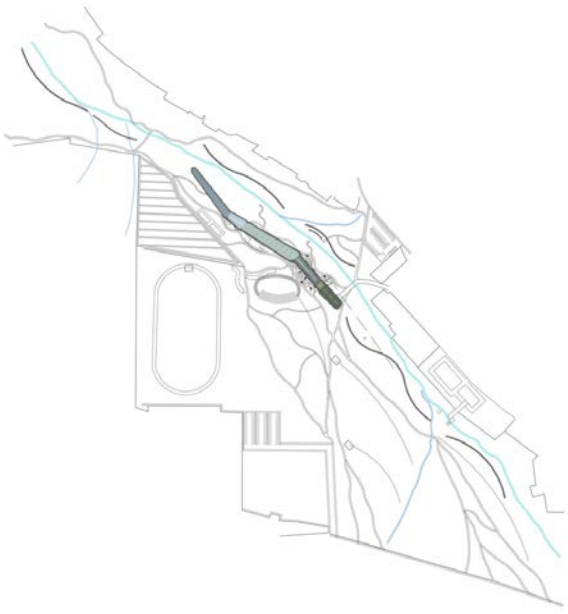


Fig. 7.4 Filtration diagram - the area where water is filtered in the design (Author, 2018)

Fig. 7.5 Assimilation diagram - the areas where water are used for assimilation in the design (Author, 2018)

Fig. 7.6 Storage diagram - the areas where water are stored in the design (Author, 2018)

Fig. 7.7 Human thought diagram - the areas where human thought are implemented (Author, 2018)

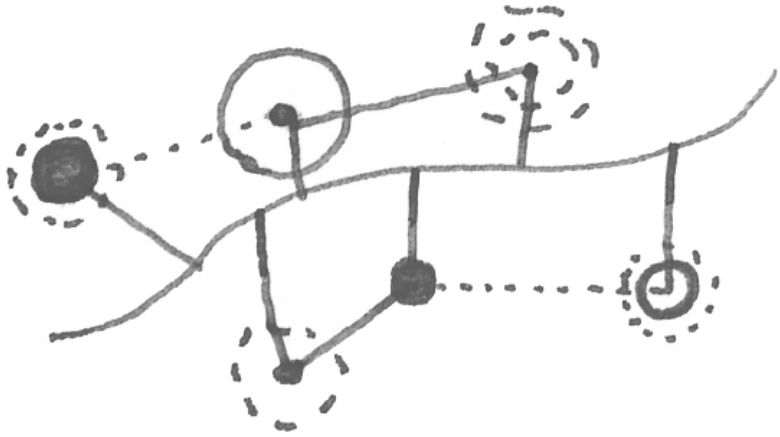


Fig. 7.8 Concept drawing of water system (Author, 2018)

## 7.4 Planting Strategy

The planting strategy is developed from the three lenses: resource, functional system and place. Mostly indigenous species were selected with some other species which serves specific functions.

**The planting design strategy is as follows:**

o **Resource** - Planting that provide food and resources for the community.

o **Functional system** - Planting that assist in habitat creation, rehabilitation of the spruit, purification of water, and other functional aspects such as security and water wise planting.

o **Place** - Planting that creates place and space, creates intimacy, privacy, cultural and social aspects, that is aesthetical pleasing, and water wise ornamental planting.


Fig. 7.9 Planting design strategy diagram (Author, 2018)

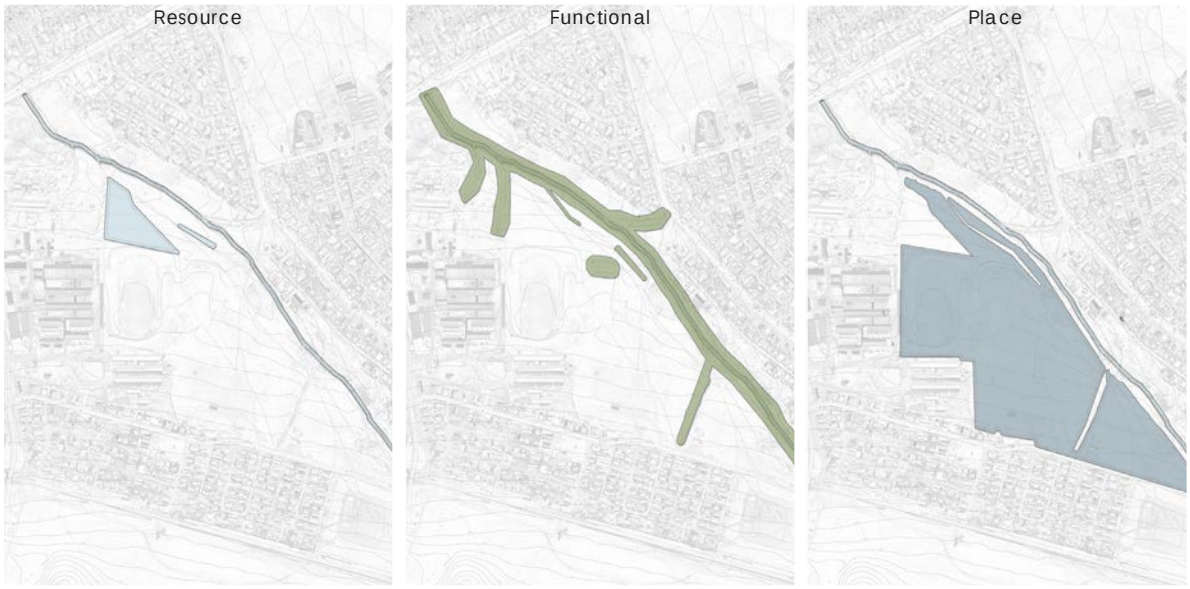



Fig. 7.10 Diagrams showing the areas where, planting as resource, functional planting and plating as place are implemented in the design (Author, 2018)

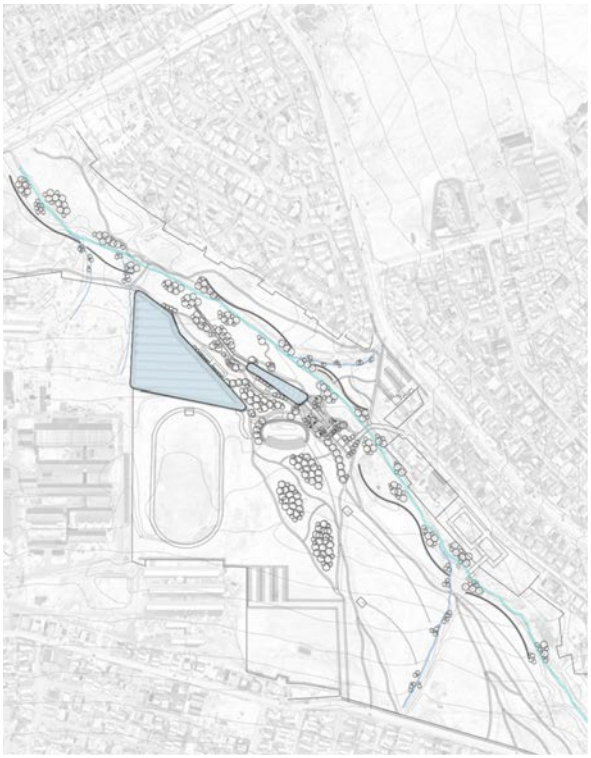


Fig. 7.11 Diagram showing the areas where planting as resource are implemented in the design (Author, 2018)

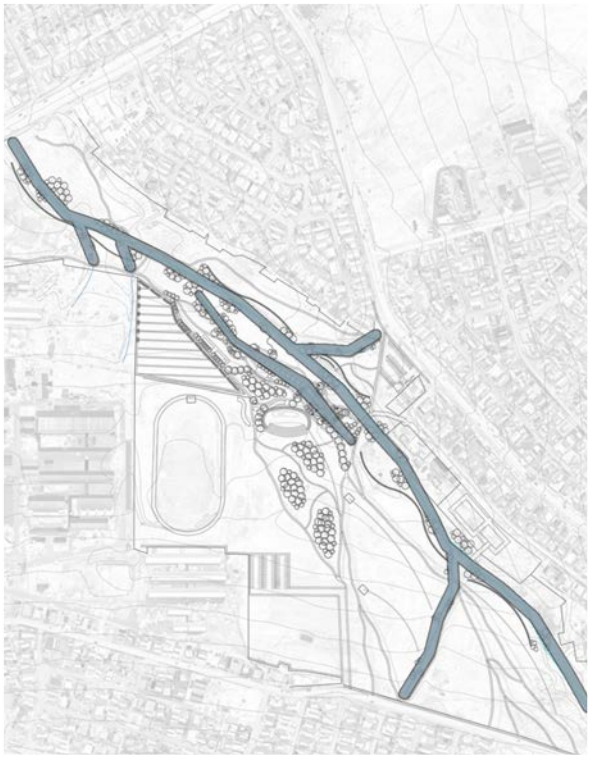


Fig. 7.12 Diagram shwoing the areas where functional planting are implemented in the design (Author, 2018)

Fig. 7.13 Diagram shwoing the areas where planting as place are implemented in the design (Author, 2018)

## 7.4.1 Functional planting

### 7.4.1.1 Habitat creation plants (Wildlife)

Marginal rush (Constructed wetlands and rehabilitation of river)

*Cyperus marginatus*
Desert sedge

*Juncus glaucus*
Blue rush

*Isolepis prolifera*
Vlei grass

Marginal grass creeping (Stabilise riverbed)

*Setaria sphacelata*
African bristle grass

*Leersia hexandra*
Southern cutgrass

*Paspalum distichum*
Knotgrass

Marginal grass (Rehabilitation of river)

*Melinis nerviglumis*
Ruby grass

*Scleria poiformis*
Nutrushes

### 7.4.1.2 Rehabilitation plants (Biodiversity)

Marginal grass creeping (Stabilise riverbed)

*Setaria sphacelata*
African bristle grass

*Leersia hexandra*
Southern cutgrass

*Paspalum distichum*
Knotgrass

Marginal shrublet (Constructed wetlands and rehabilitation of river)

*Gomphostigma virgatum*
River star

*Lippia javanica*
Lemon bush

Marginal grass (Rehabilitation of river)

*Melinis nerviglumis*
Ruby grass

*Scleria poiformis*
Nutrushes

### 7.4.1.3 Purification plants
### (Water purification)

Wetands are natural filters which improve water quality. Wetland plants are used for this purpose in reed filtration beds, open storm water channels and detention ponds. Wetlands add textural interest and are real magnet for wildlife.

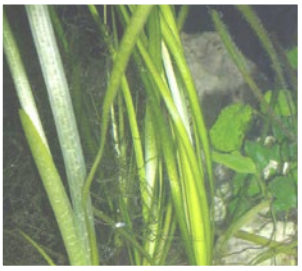
Emergent (Constructed wetland)

*Marsilea schelpiana*
(Harvested)

*Nymphoides nauchali*
Water snowflake

*Nymphoides thunbergiana*
Nymphoides

Submergent (Constructed wetland)



*Vallisneria aethiopica*
(One of the best submergent plants for purification of water)

## 7.4.2 Plants as resource

### 7.4.2.1 Edible plants

#### Wetland plant harvesting

*Oryza glaberrima*
(African rice)

*Oryza sativa*
(Basmati rice)

*Eleocharis dulcis*
(Chinese water chestnut)

*Aponogeton distachyos*
(Waterblommetjie)

*Madumbis esculent*
(Taro)

#### Food gardens (Sandy soil)

*Daucus carota subsp. sativus*
(Carrots)

*Beta vulgaris*
(Beetroot)

*Allium cepa*
(Onion)

*Allium sativum*
(Garlic)

*Solanum tuberosum*
(Potato)

*Asparagus officinalis*
(Asparagus)

#### Herb gardens (Water wise)

*Rosmarinus officinalis*
(Rosemary)

*Salvia officinalis*
(Sage)

*Thymus vulgaris*
(Thyme)

*Origanum vulgare*
(Oregano)

### 7.4.2.2 Plant material as resource

Marginal reed (Reed beds)

*Typha capensis*
Bulrush
(Needs to be contained)

## 7.4.3 Plants to create place - water wise ornamental species

### 7.4.3.1 Cultural and communal plants
(Bright colours, large shrubs, smaller shrubs, succulents, and ground covers)

Large shrubs

*Strelitzia reginae*
(Bird of paradise)

*Agapanthus africanus*
(White agapanthus)

*Dietes grandiflora*
(Wild iris)

Succulents

*Portulacaria afra "prostrata"*
(Porkbush)

*Sedum Mexicana*
*(Mexican stonecrop)*

Smaller shrubs

*Tulbaghia violacea*
(Wild garlic)

*Bulbine frutecens*
(Cat tail)

Ground covers

*Asparagus densifloris*
(Asparagus fern)

*Helichryssum petiolare*
(Everlasting)

*Hypoxis setosa*
(Yellow stars)

### 7.4.3.2 Plants to create space, intimicy, and privacy

**Grassy effects:** Add texture, movement and grace. They attract seed-eating birds, such as waxbills, mannikins, finches and widowbirds. Grasses work well in informal natural settings and contemporary landscapes. Best to plant them in large drifts in a border, around water, or let them flourish in a wild patterns.

*Melinis repens*
(Natal red top)
25-50cm

*Dactyloctenium australe*
(LM grass)
10cm x spreading

*Aristida junciformis*
(Bristle grass)
40cm x 40cm

*Melinis nerviglumis*
(Bristle-leaved red top)
25-50cm

*Chlorophytum saundersiae*
(Weeping anthericum)
50cm x 25cm

*Aristida junciformis*
(Ngongoni three-awn)

*Eragrostis curvula*
(Weeping love grass)

*Asparagus virgatus*
(African boom fern)

*Elegia tectorum*
(Cape dutch reed)

*Heteropogon contortus*
(Tanglehead)

## 7.5 Tree strategy

**The tree design strategy is as follows:**

o **Resource** - Trees that provide edible fruits for the community to sell at the market (economic value) or for own use. At the food and herb garden, and in the play park for the kids.

o **Functional system** - Trees that can assist in providing shade, wildlife habitat, and trees that protect the food and herb garden from the north-west wind, and prevent Typha capensis (reed beds) seeds to spread. Alongside swales, spruit, picnic area, and constructed reed bed area.

o **Place** - Trees that will create structure, add to cultural value, create private and intimate areas, and create amenity (aesthetical reasons). At play area, social and picnic area: Large and small trees providing shade, structure, and scale of intimacy.

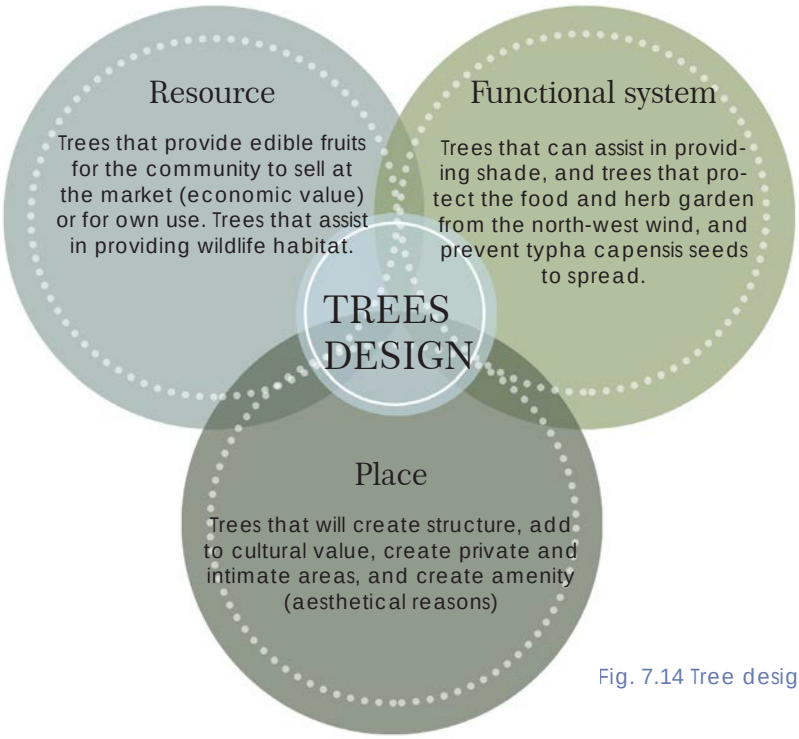



Fig. 7.14 Tree design startegy diagram (Author, 2018)

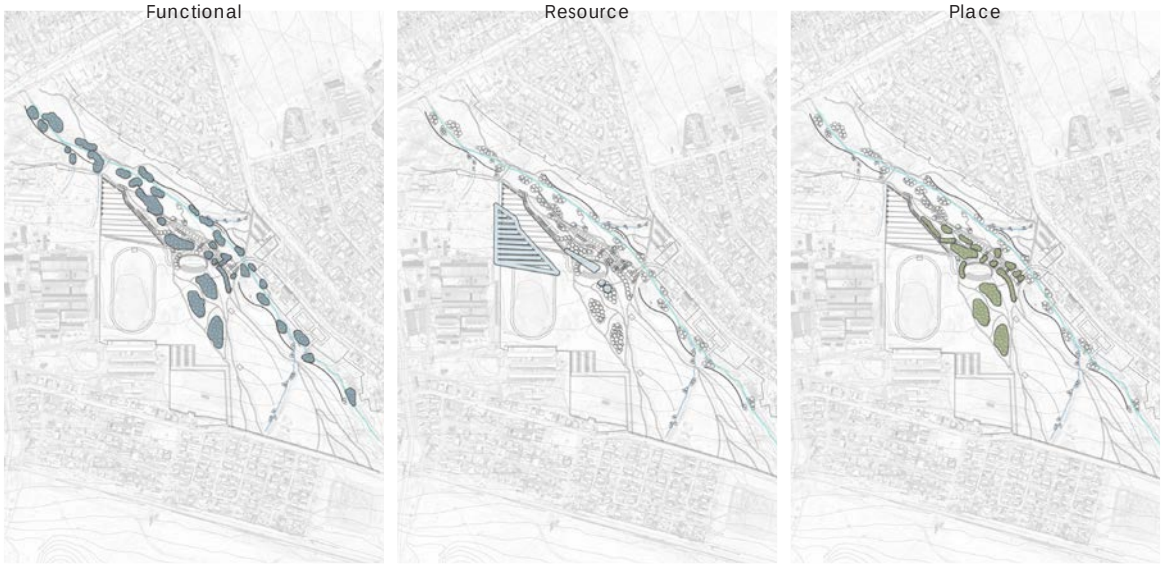



Fig. 7.15 Diagrams that show the areas where trees as resource, functional trees, and trees as place are implemented (Author, 2018)

## 7.5.1 Functional system
(Shade, habitat creation, and for wind protection)

Area: Alongside swales, spruit, picnic area, and constructed reed bed area:

*Halleria lucida*
(Fuchsia tree)

*Combretum erythrophyllum*
(Riverbush willow)

*Celtis africana*
(White stinkwood)

*Schotia brachypetala*
(Weeping boer-bean)

*Kiggelaria africana*
(Wild peach)

*Searsia pendulina*
(White karee)

*Buddleja saligna*
(False olive)

*Vachellia robusta*
(Splendid thorn)

*Vachellia caffra*
(Hoofthorn)

*Vachellia karroo*
(Sweet thorn)

## 7.5.2 Resource
(Edible fruits for economic values, resources for the community.)

Area: In the food and herb garden, and in the play park for the kids.

*Harpephyllum caffrum*
(Wild plum)
12m x 11m

*Syzigium cordatum*
(Waterberry)
11m x 11m

*Dovyalis caffra*
(Kei apple)
4m x 3m

## 7.5.3 Place

(For structure, cultural values, privacy, and aesthetical reasons.)

Area: Play area, social and picnic area: Large and small trees providing shade, structure, and scale of intimacy.

Ziziphus mucronata
(Buffalo thorn)

Erythrina lysistemon
(Coral tree)

Celtis africana
(White stinkwood)

Buddleja saligna
(False olive)

Halleria lucida
(Fuchsia tree)

Pappea capensis
(Jacket plum)

Olea europaea subsp. africana
(Wild olive)

Fig. 7.16 Planting design strategy - resource, functional, and place mapping (Author, 2018)

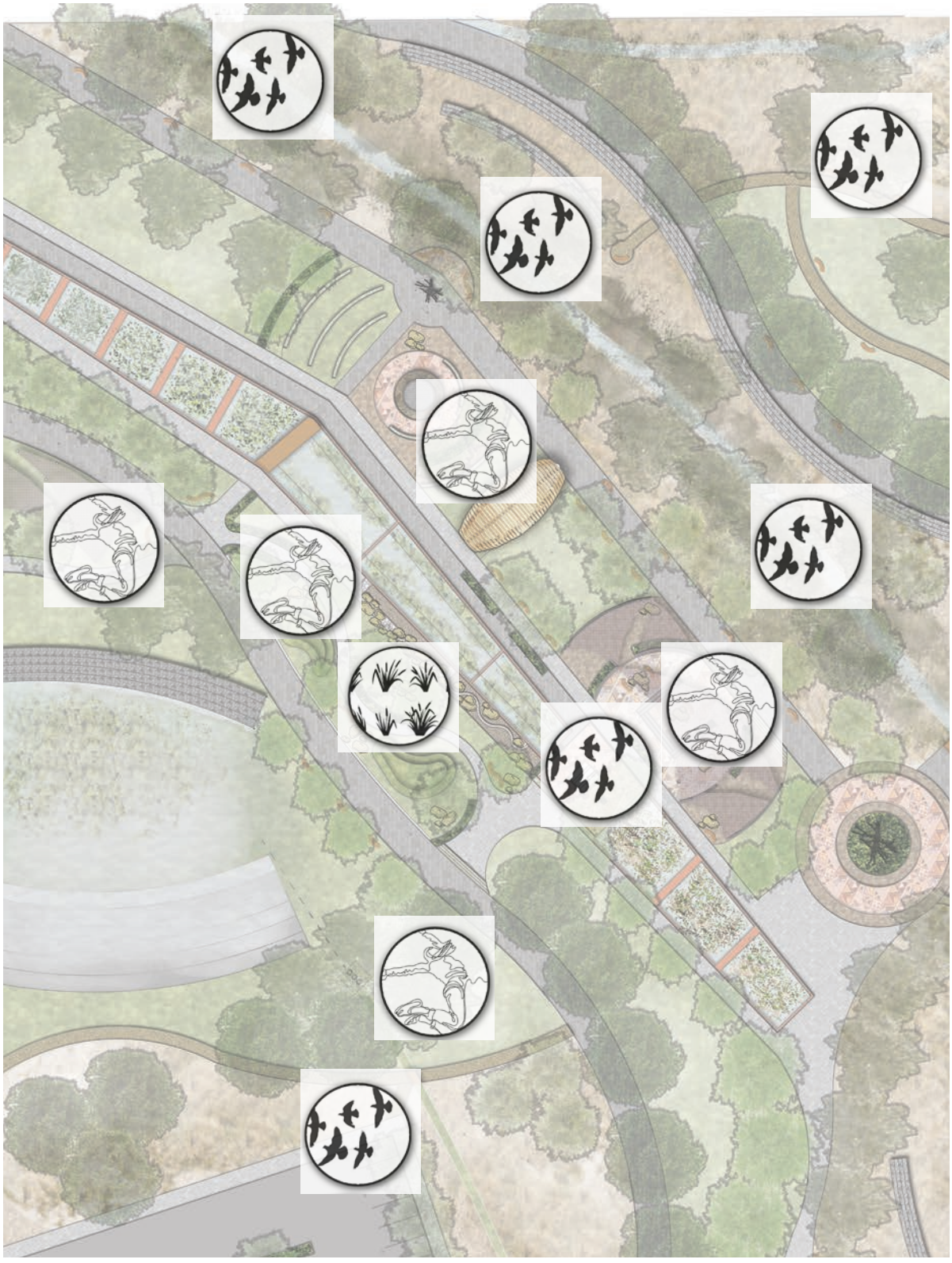


Fig. 7.17 Tree design strategy - resource, functional, and place mapping (Author, 2018)

## 7.6 Materials

The material selection was based on materials that can be used from the recycling and weaving center, as well as materials that will be durable, and add to the cultural value of the community of Mamelodi. The material selection is functional, can be use as resource, and creates well defined, and detailed spaces.

The chosen material palette consists of the following materials:

o Stainless steel wire rope
o Stainless steel poles (walls)
o Wood
o Permeable concrete paver
o Geomat
o Geosynthetic clay liner
o Recycled weaving materials
A short description of each material will follow.

### 7.6.1 Stainless steel wire rope

This material was selected for its durability, tension, and strength. The stainless steel wire rope is used at the washing of clothes area's multi-functional wall structure. The people can hang their washed clothes to dry on the wire which create art on its own relevant to the specific function of the space.

### 7.6.2 Stainless steel poles

This material was selected for it durability and strength. The stainless steel poles mixed with wooden poles is used to enclose the private places (e.g. place of ritual). These poles are spaced 100mm (max 1.5m in height) from each other to create see through wall (security reasons, yet privacy).

### 7.6.3 Wood

This material was selected for its texture and colour to add to the trademark of the design. Wood is used in the transparent walls to enclose private spaces, also in the benches and water play park structures (play equipment).

### 7.6.4 Permeable concrete paver

The permeable concrete paver is used at the parking areas and in some areas around the off-stream filtration system. This concrete paver is available from Bosun in Gauteng and it can assist in water filtration and erosion control.

### 7.6.5 Geomat and geo-synthetic clay liner

These two materials were selected for functional solutions to keep water in the storm water channels and in the detention dam.

### 7.6.6 Recycled weaving materials

These materials are from the weaving workshop hand made by the community of Mamelodi and from the reed beds which are harvested once a year (*Typha capensis*). The recycled materials are from the trash trap which are collected and recycled at the recycling center. This involves the community with the build of structure and maintenance to create a sense of ownership.

Fig. 7.18 Wood material (Pinterest, 2018)

Fig. 7.19 Weaving material (Pinterest, 2018)

Fig. 7.20 Stainless steel wire rope material (Pinterest, 2018)

Fig. 7.21 Bosun permeable paving (Bosun.com, 2018)

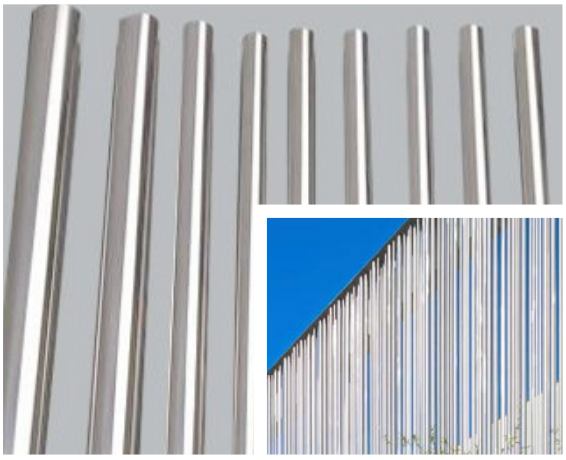


Fig. 7.22 Stainless steel poles (Pinterest, 2018)

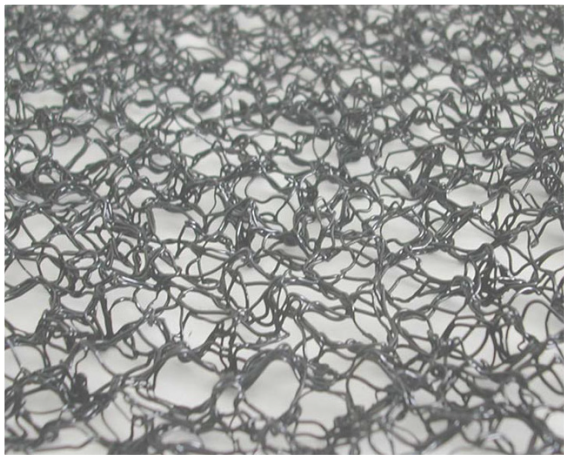


Fig. 7.23 Geomat material (Pinterest, 2018)

## 7.7 Details

The technical details are indicated on section. The sections cut through most of the prominent landscape structures. The details will indicate material use, fastening measures, levels, sub-soil layers and dimensions.

Section A-A: Off-stream filtration system
Section B-B: Place for rituals
Sections C-C: Detention dam
Section D-D: Main bridge over Hatherley Spruit

Detail section a: Bridge
Detail section b: Living system (Bio-swale)
Detail section c: Compacted ground-sub-pathways.
Detail section d: Storm water outlet
Detail section e: Gabions

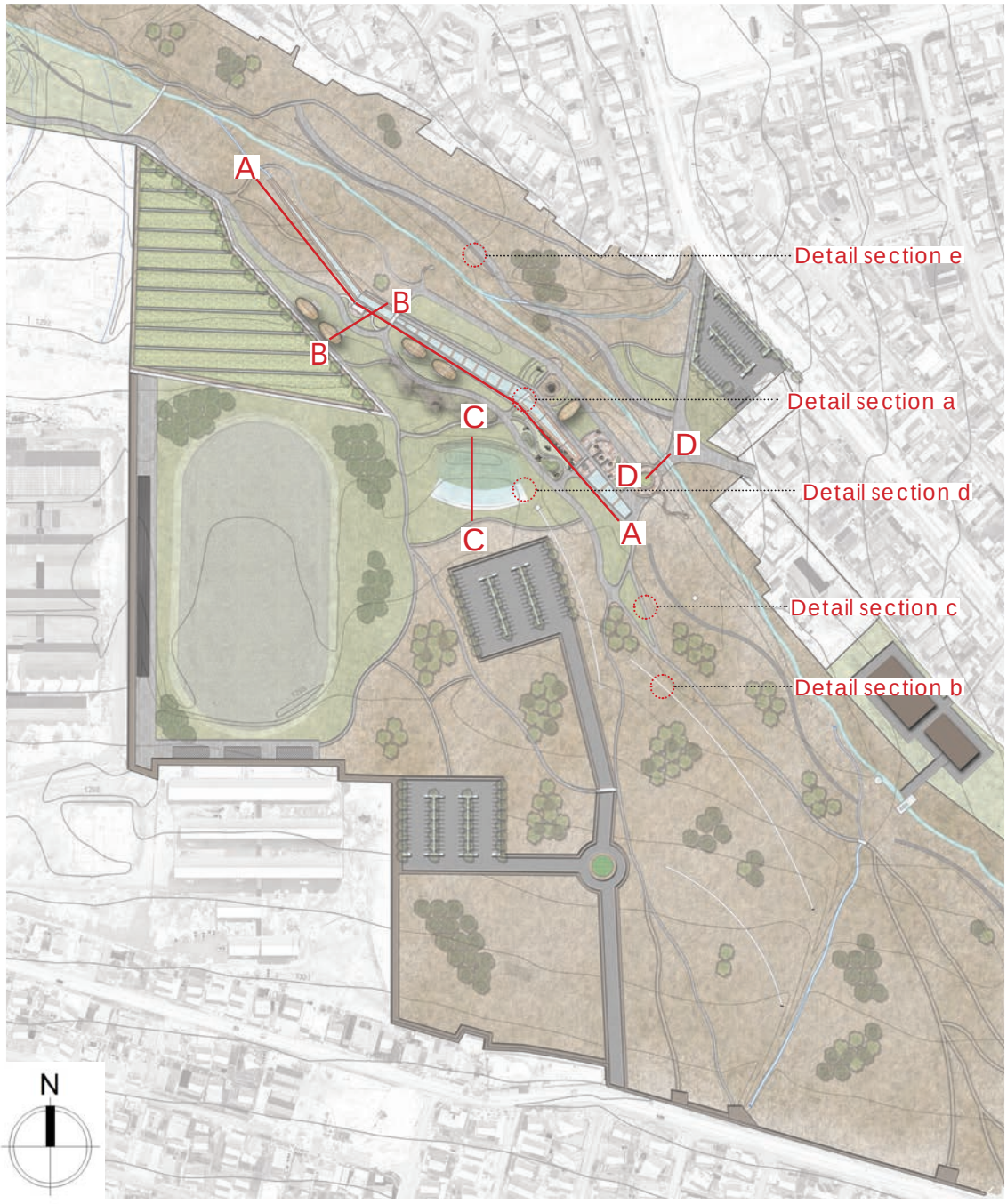



Fig. 7.24 Master Plan indicating section lines and sections details (Author, 2018)

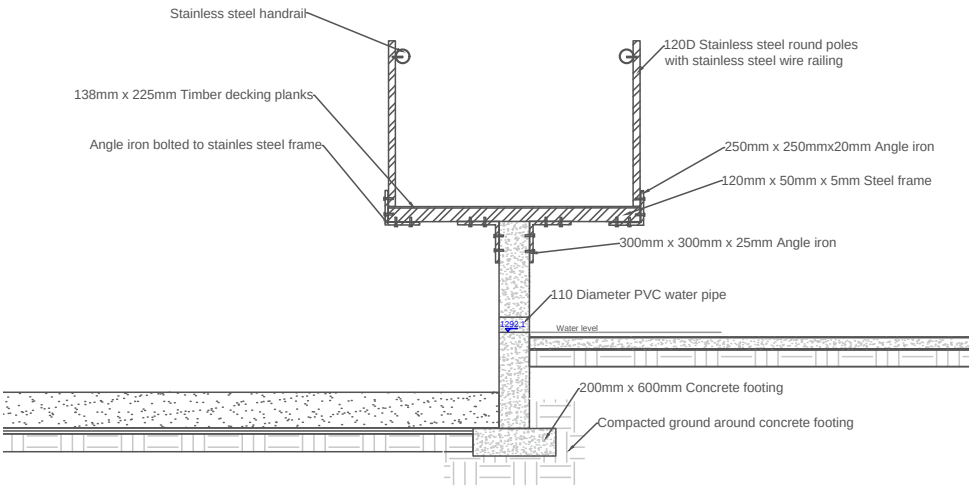
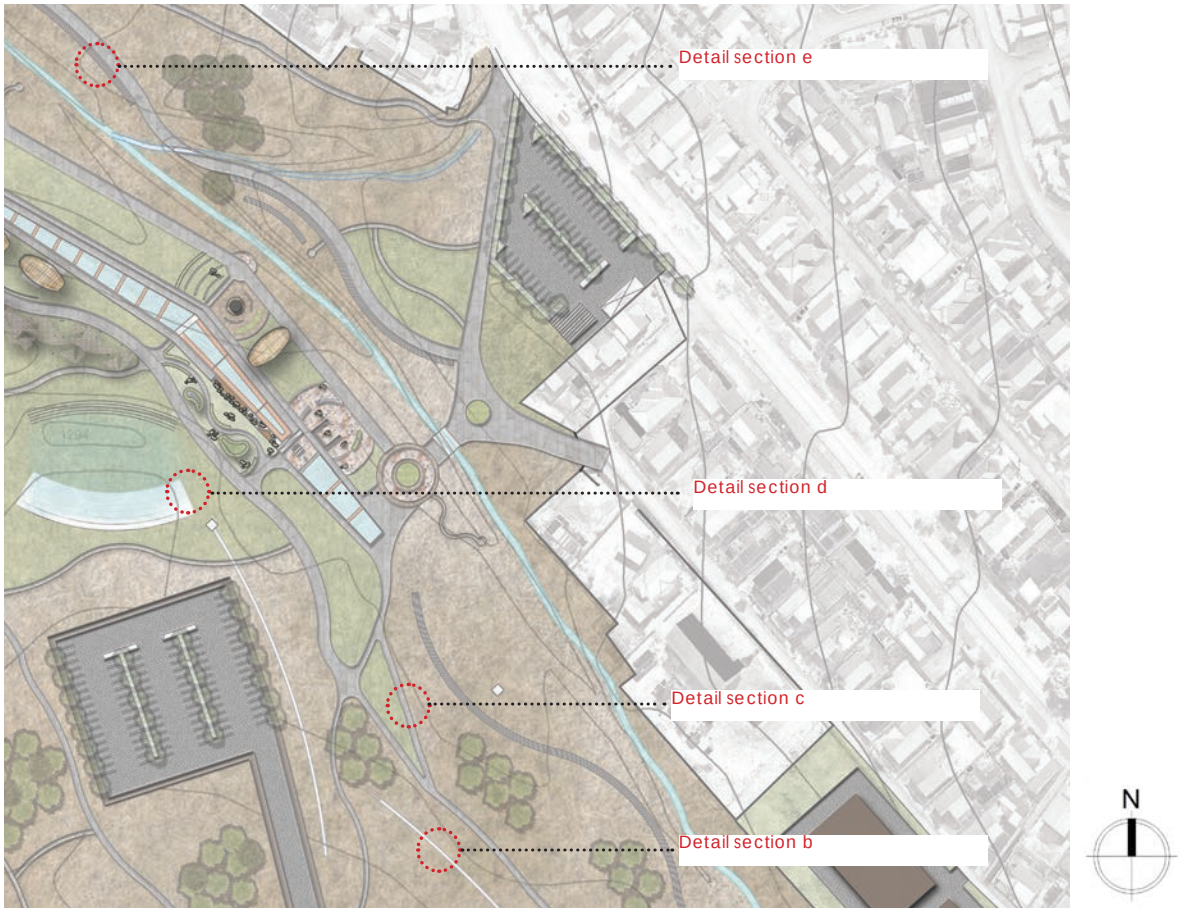




Fig. 7.25 Detail section a - 2m wide pedestrian bridge across the off stream filter system (Author, 2018)

Fig. 7.26 3D sketch of 2m wide pedestrian bridge across the off stream filter system (Author, 2018)



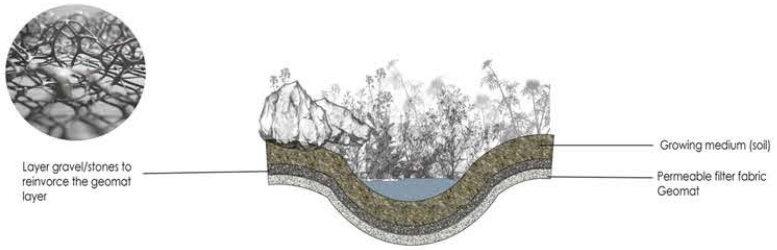




Fig. 7.27 Detail section b - Living system (Bio-swale)
(Author, 2018)

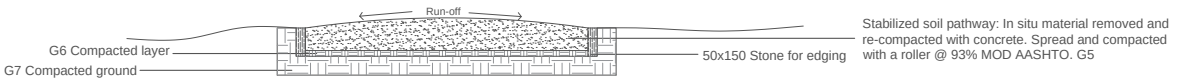



Fig. 7.28 Detail section c - compacted ground sub-pathways
(Author, 2018)

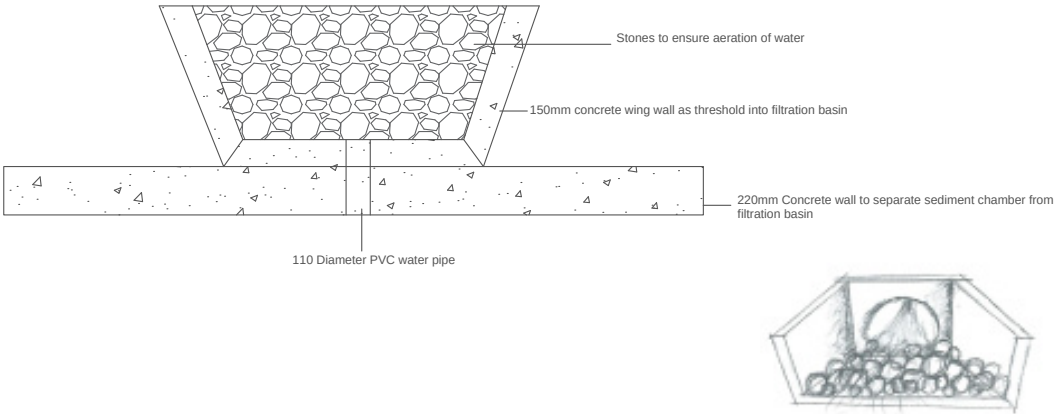



Fig. 7.29 Detail section d - storm water outlet into detention dam (Author, 2018)

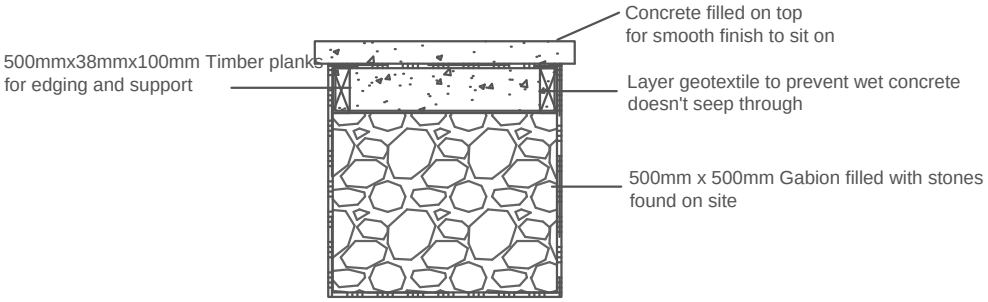
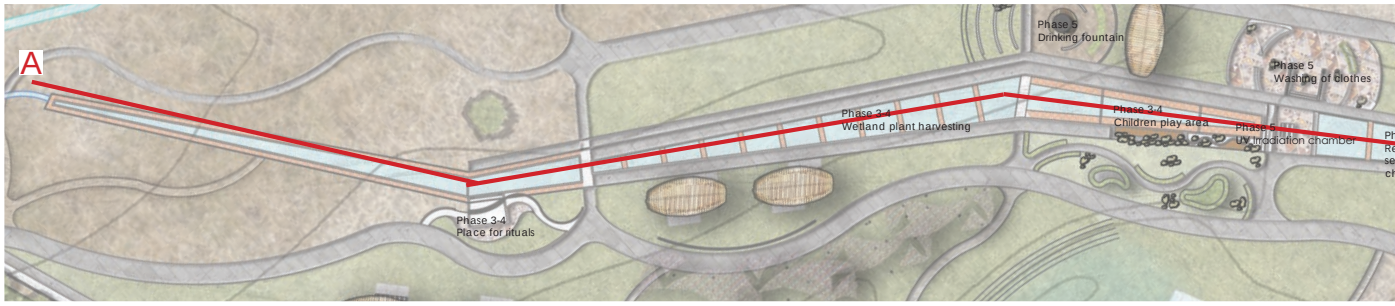
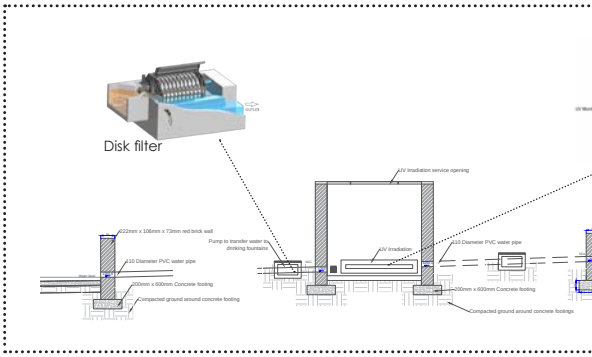


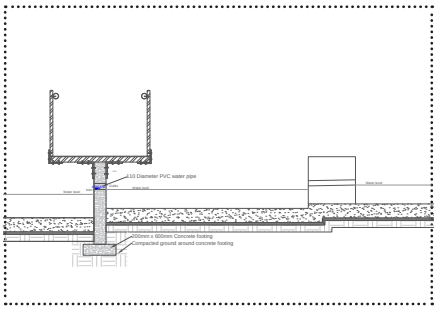

Fig. 7.30 Detail section e - 500mm x 500mm gabions for erosion control and seating (Author, 2018)



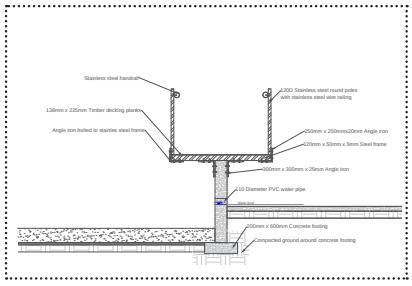

Section A-A: Off-stream filtration system



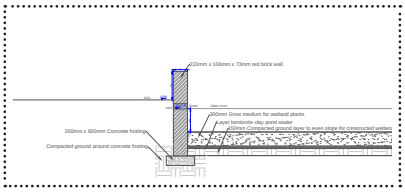

Uv Irradiation chamber
Scale 1:50



2m Pedestrian bridge acroos system
Scale 1:50



2m Pedestrian bridge across system off-stream filtration system
Scale 1:50



Red brick wall detail section
Scale 1:50

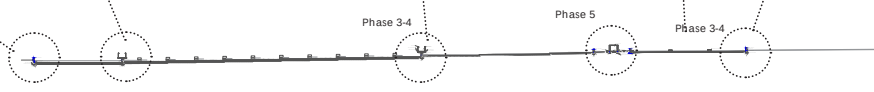
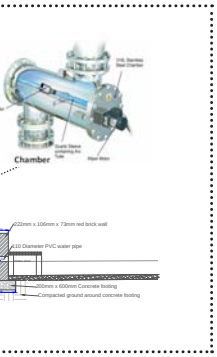
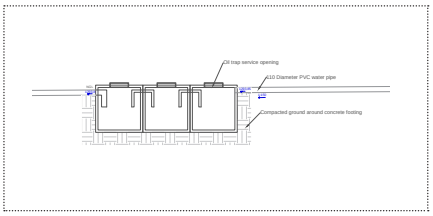


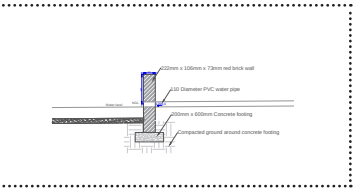

Fig. 7.31 Section A-A - Plan vie of off stream filtration system
(Author, 2018)



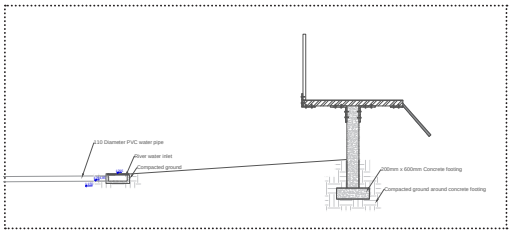



Three chamber oil trap detail section
Scale 1:50



ed brick wall detail section
cale 1:50




Trash trap and spruit water outlet to off stream system
Scale 1:50

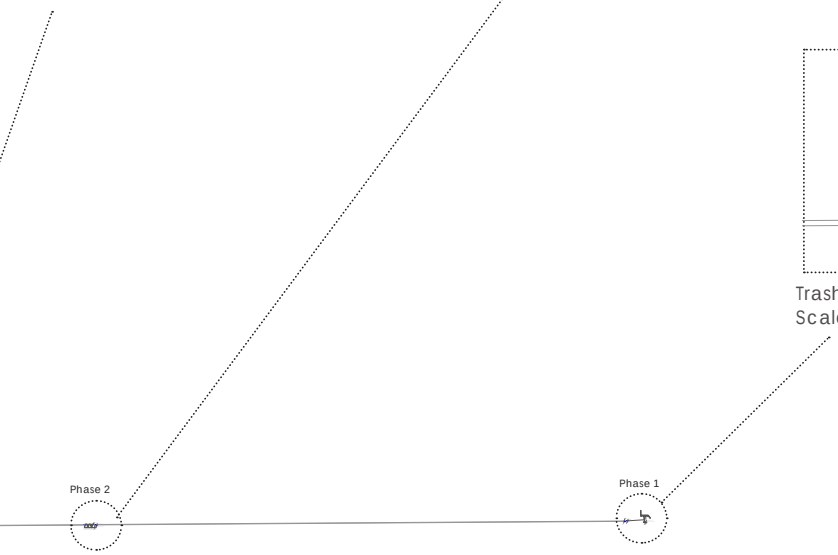
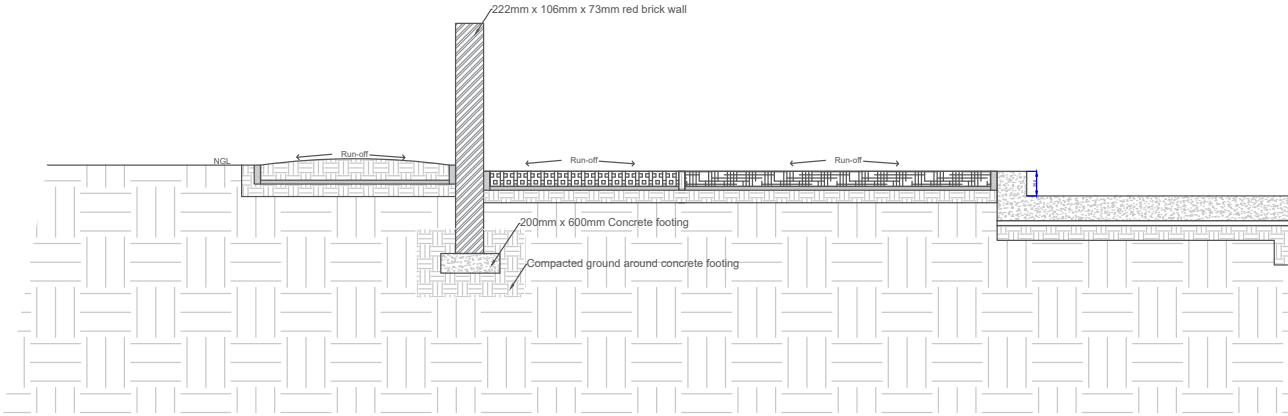
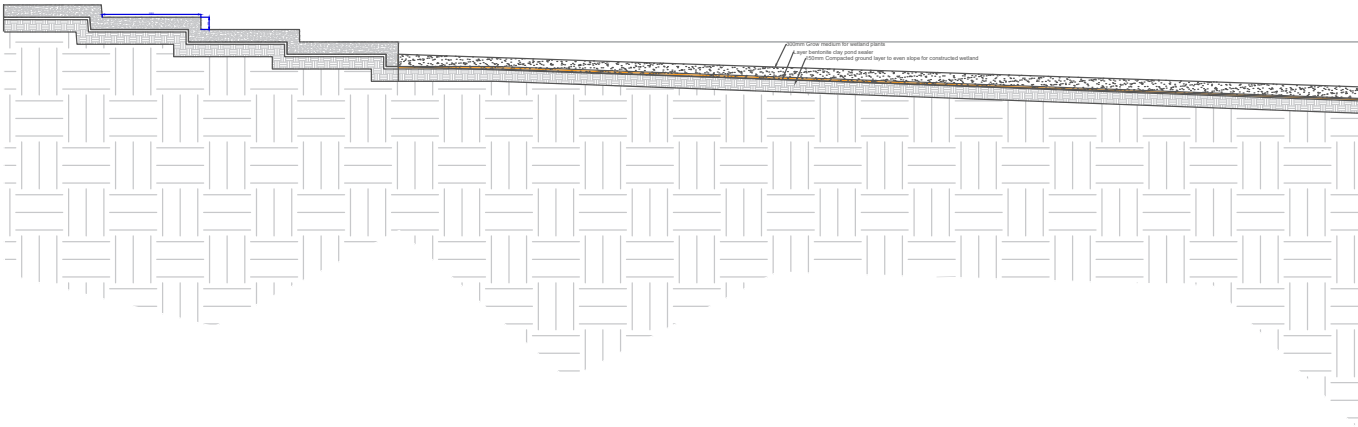
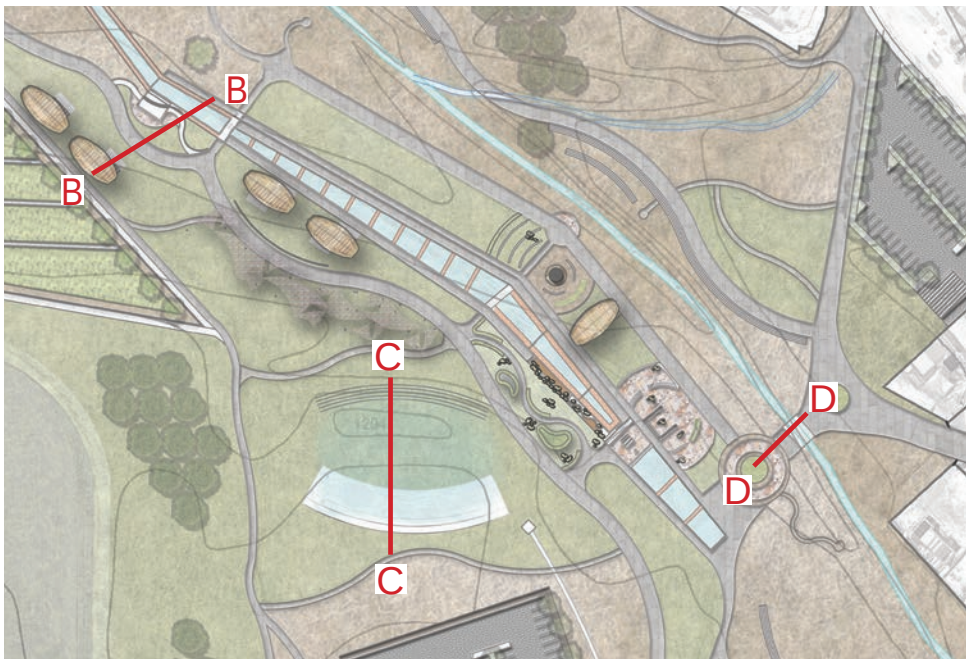



Fig. 7.32 Section A-A - Off stream filtration system
(Author, 2018)





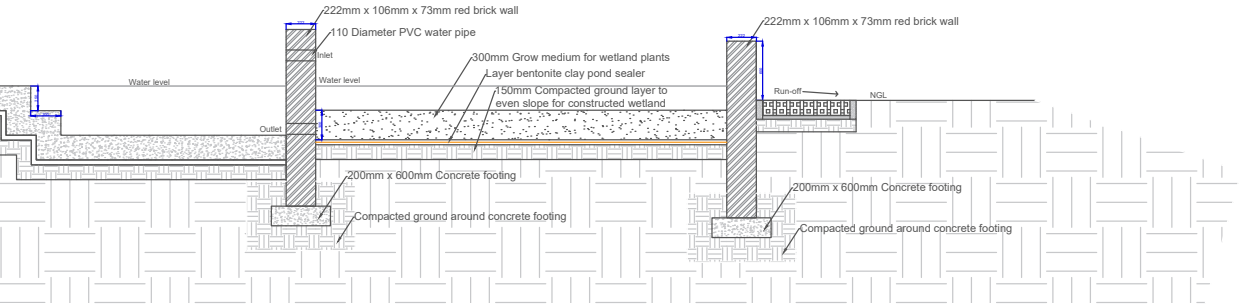



Fig. 7.33 Section B-B - Place for rituals
(Author, 2018)

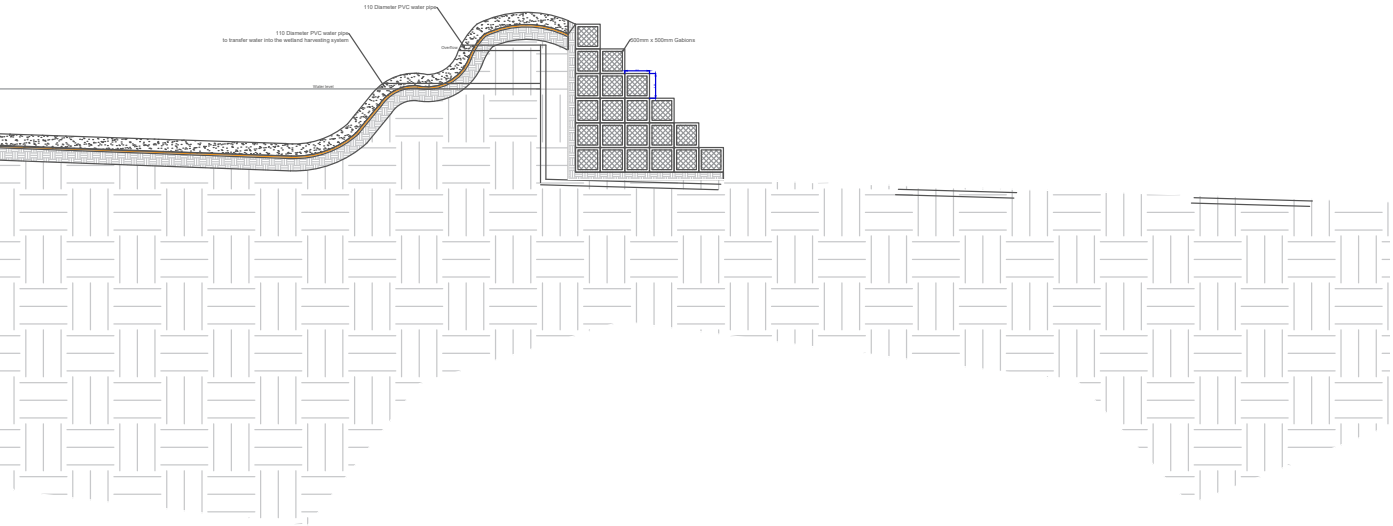



Fig. 7.34 Section C-C - Detention dam
(Author, 2018)

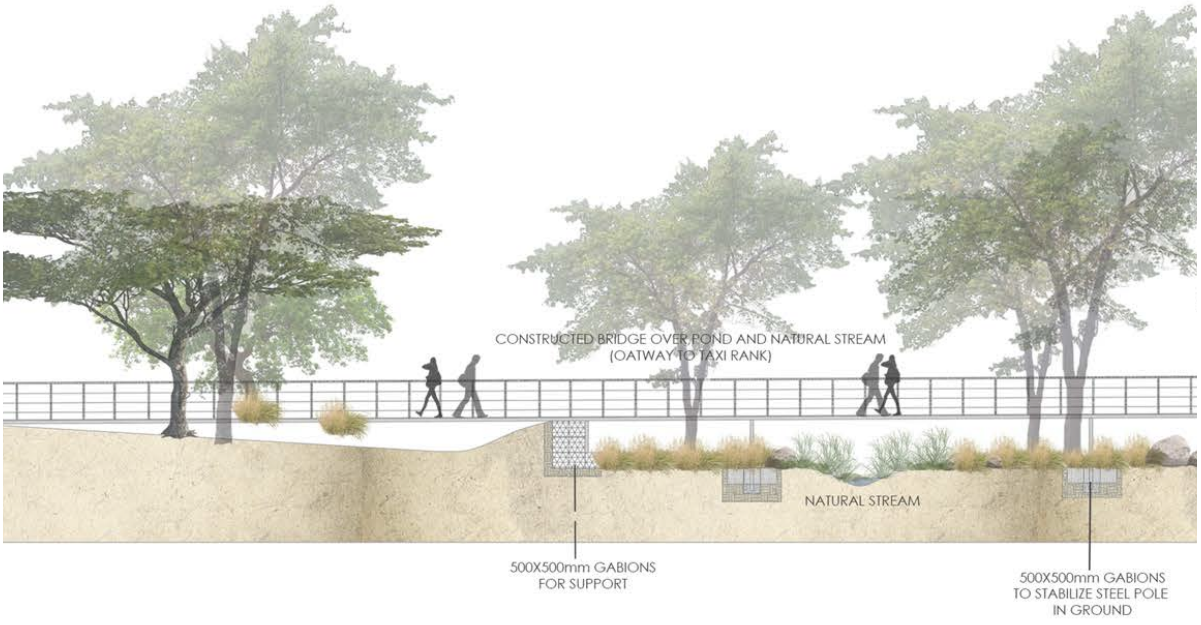



Fig. 7.35 Section D-D - Main Bridge over Hatherley Spruit
(Author, 2018)

# Conclusion

Chapter 8

## Chapter overview

In this Chapter the concluding factors will be discussed as a reflection on the hypothesis and the research questions stated in Chapter 1.

## 8.1 Conclusion

There is a constant growth and expansion of urban regions and a rapid increase in population (Art.net, 2018). There is a demand for more clean and sustainable water sources in urban regions upon which the people depend and can benefit from. The existing natural water sources in urban regions are further challenged by issues such as water pollution. The restoration, preservation, purification, and sustainable use of rivers are critical to ensure future water services and environmental survival (Art.net, 2018).

The site mostly consists of disturbed land and litter disposal and has no social or economic interventions or values although a lot of interventions are happening around the site. The site has a big opportunity to become a green corridor to interlink the different areas around the boundary of the site; residential, commercial, environmental and informal settlement areas. This opportunity can create awareness of the Spruit and the value it holds for the community. The Spruit, water, once again can be used to connect the community to urban rivers and to interlink surrounding elements in the urban context.

The research question of the study asked: How can communities and rivers in urban regions be connected through landscape (design)?

The hypothesis stated: The landscape design of a multifunctional river landscape that restore the river and addresses the recognition of mutual dependencies between humans and nature can foster this reconnection by using water as the item of codependency.

The approach of multi-functional river landscapes, the combination of restoration and regeneration of urban rivers and wetlands as filter systems, can resolve the problematic aspects of the river and provoke accessibility for the surrounding community, creating river as place. To understand the local communities' attitudes, belief systems and collective behaviors around urban rivers may result in project durability and instigating a process of cultural adaptation (Pahl-Wostl et al., 2008).

The theory of regenerative design promotes the inclusion of the community in the design process at different stages and levels of involvement. By means of the three lenses of resource, function and place are viewed as interdependent parts of the design system. These three powerful lenses guide the solutions to the challenges and provoke opportunities regarding the design.

By making use of the five elements for urban river restoration by Petts et al. (2002): the improvement of the water quality, the regulation of run-off to prevent erosion, removal of invasive species, wildlife conservation, and the control of litter around the riverbeds. It is important to require the education and the involvement of the people of the community to ensure that the focus for urban revival is moving the urban rivers from the 'backyard' to the 'front garden' in urban regions (Petts, Heathcote and Martin, 2002).

By making use of the six basic phases of ecosystem functioning of Lyle (1994) the implementation of the system of the design was made accordingly and promotes regenerative design. The technification of the design and the system is also based on the six phases of ecosystem functioning.

A 5 phase filtration system is proposed for the Hatherley Spruit that can be implemented in 3 phases and provide resource, function, and place specific for the site and community needs in Mamelodi.

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