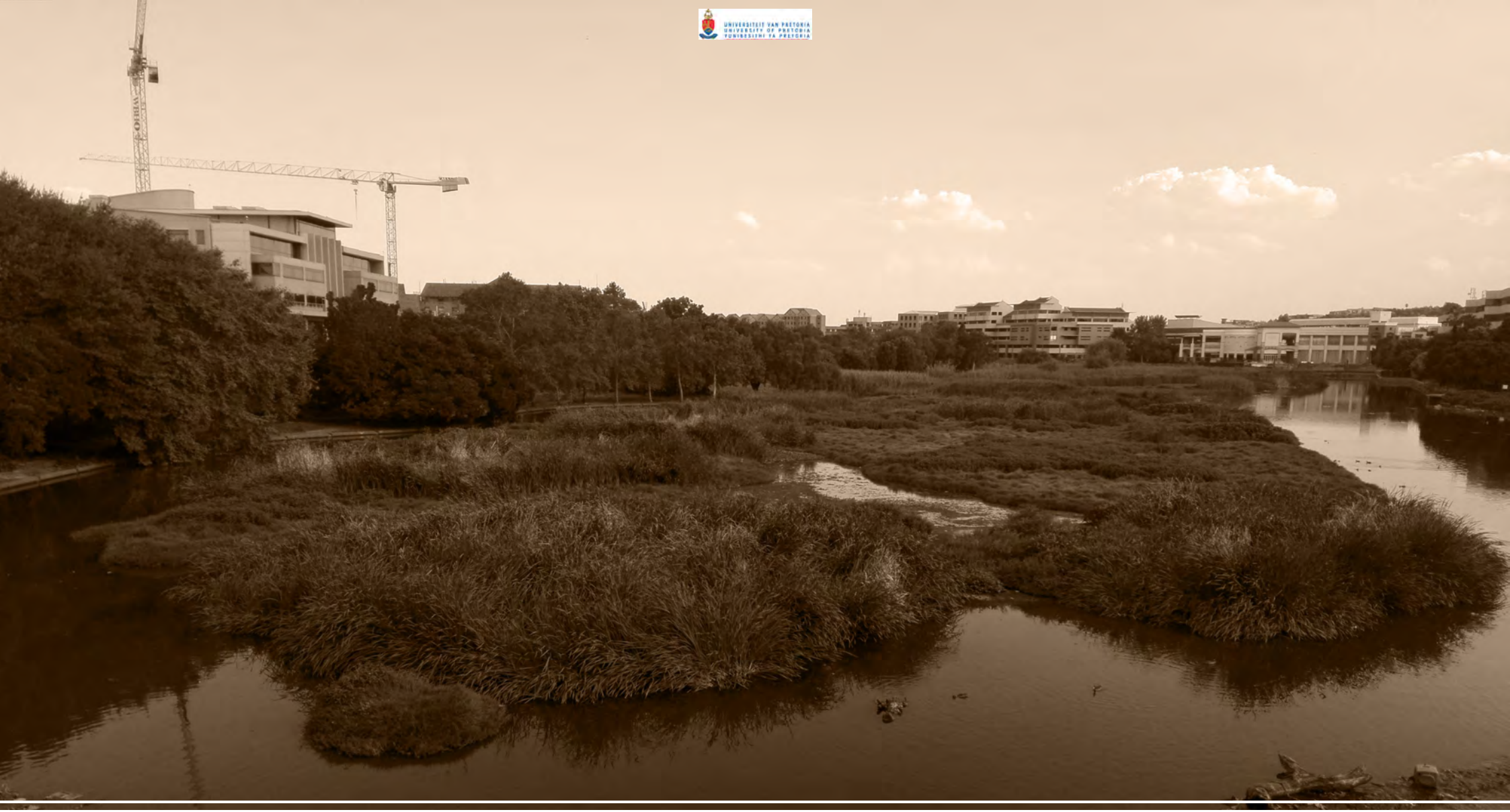

PREFACE | Project Summary, Abstract and Contents

Figure 0.1 - (Author, 2018)

THE URBAN OASIS

[RE]-Generating Centurion Lake Through Resource Exchanges

AUTHOR:
Roland Snyman

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COURSE LEADER:
Arthur Barker

STUDY FIELD:
Environmental Potential (EP)

Submitted in fulfillment of part of the requirements for the degree
Master of Architecture (Professional)
Department of Architecture
Faculty of Engineering, Built Environment and Information Technology
University of Pretoria

November 2018

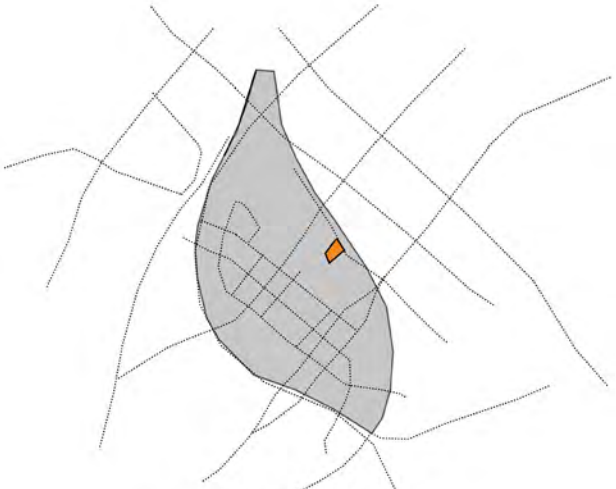
PROJECT SUMMARY

PROGRAMME:	Experiential Urban Oasis: A Compressed Plastic Furniture Factory, Vermicomposting Facility, Water Purification Plant, Distillery, and Culinary Hub, Experiential Pedestrian Promenade.
SITE LOCATION:	Erf 154, Erf 155, Section 2 OF 'DIE HOEWES 48', Littleton, Extension No. 1, CENTURION, GAUTENG.
SITE DESCRIPTION:	Bordered by Hendrik Vervoerd Drive (on the West); West Avenue (on the North); and Lenchen Avenue (on the East); with Centurion Mall on the South.
ADDRESS:	267 West Ave, Lyttleton AH, Centurion, 0157
GPS COORDINATES:	25°51'17.2" S 28°11'18.3" E; Elevation: 1415m
CLIENTS:	• Gauteng Department of Agriculture, Conservation and Environment (GDACE) • Department of Water Affairs and Forestry • Alternatively: Sponsorship from Centurion Mall; Protea Hotel; Aecon; Agricultural & Environmental Management Department; Lake Buena Vista, and Investors.
KEYWORDS:	**Regenerative Architecture, Phenomenology, Resource Harvesting as an Experience, Creating Awareness of Urban River Pollution, Biophilia (Love of Nature), Waste and Natural Resources, Human-Nature Harmonious Convergence.**
THEORETICAL APPROACH:	**Regenerative theory** will be used in conjunction with **Phenomenology** as the primary theories to formulate an appropriate theoretical premise that informs a new approach as to how we view and react to natural river systems in the urban context.
ARCHITECTURAL APPROACH:	The aim is to utilize the **resources (water, plastic waste and silt)** provided by the river system, to create **products** and generate an income in the process. The **extraction** of the resources, as well as the **processes** that govern the formation of the end products, will be made **visible** through the application of the architectural theory. The result is a **phenomenological experience** that ultimately re-connects **man** with **nature**. This new-found **transparency of processes** will instil a **sense of awareness** of the plight of the natural environment and urban river systems. Architecture then becomes the **mediator** that creates a **symbiotic** relationship between the **built environment** and the **natural environment.**

PROJECT LOCATION

South Africa

Gauteng



Centurion

Centurion Lake

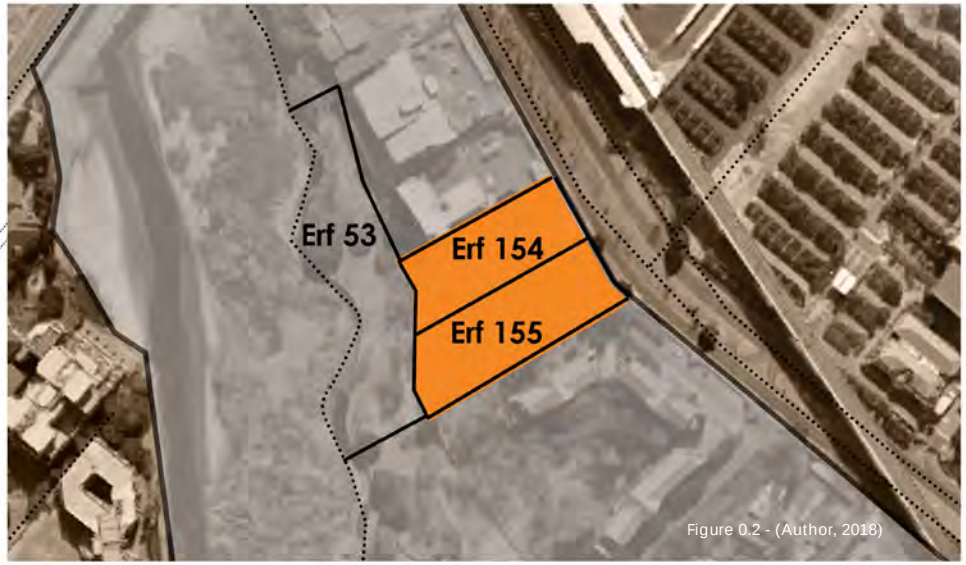


Figure 0.2 - (Author, 2018)

Erf Numbers

SITE LOCATION

Figure 0.3 - Study area indicating its exact location and proximity to the Gautrain Station and Centurion Lake (Google/maps, 2018)

In accordance with Regulation 4(e) of the General Regulations (G.57) for dissertations and theses, I declare that this thesis, which I hereby submit for the degree Master of 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 declare that this thesis 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 fully acknowledged in the text and list of references.

_____

Roland Snyman

“We abuse land because we regard it as a commodity belonging to us. When we see land as a commodity to which we belong, we may begin to use it with love and respect”.

- Aldo Leopold (iopscience, 2016)-

0.4 - The current state of the Hennops River System leading into Centurion Lake. (Photograph by Author, 2018)

ABSTRACT

A global **attitude shift** occurred during the 15th century that changed the relationship between man and its natural environment. This shift was brought by the **Renaissance world view**, where man is superior to nature and all that makes up natural systems. Only the aspects of nature that proves useful to the existence of humans are **preserved or 'protected'** (Lyle 1994: IX). The **industrial revolution** further exacerbated the shift by enabling mass production of products and machinery, leading directly to mass **degradation** of the natural environment.

John Tillman Lyle, in his book 'Regenerative design for sustainable development' (1994:8) mentions that: "The problem is not our effect on the environment so much as it is our **relationship with the environment**". In other words, to mitigate the problem it would be necessary for humans to gain a deeper understanding of **nature's complex and intricate systems**. This understanding of nature can be used to gain new knowledge to govern the manner in which man addresses his immediate context.

This dissertation attempts at highlighting the major differences that exist between man and its natural environment, by proposing alternatives to the current **mindset** of people. The aim is to uncover ways in which man and its natural environment can be merged once again, as Laugier (1755) described it, by introducing architecture to act as the **intermediary force**. Ultimately the dissertation will propose a solution as to how the **lost connection** between man and nature can be re-established, with the focus being on **urban river systems.**

This dissertation critically examines **Regenerative theory** in conjunction with **Phenomenology**; with regenerative theory acting as the main driver to **rejuvenate the site** (and governing regenerative processes) and phenomenology acting as the mediating force between man and nature through **lived experiences.** Thus, architecture will create a physical and metaphysical link between the urban construct, man and nature; reuniting the human and natural realms once again. **Centurion Lake** will provide the necessary milieu where these theories can be tested and examined in the hope to inspire **positive actions** for future interventions.

The design intervention proposes to rejuvenated the **polluted state** of Centurion Lake by incorporating a **silt trap** as an integral part of the design. The silt trap (located within the river) is used to extract valuable **'resources'** from the river, namely; plastic debris, silt/sediments, and water. **Waste** is therefore rather viewed as a **resource** and is processed and formed into a **viable product** for monitory gain.

Plastic debris is processed and formed into **plastic furniture**, sold and distributed over the land. This process is much more environmentally friendly compared to the current state of affairs; which include plastic waste being taken to landfill sites. **Sediments** in the form of silt is extracted and used as an additive to **vermicompost** or alternatively as an enriching agent to **silt bricks**- which in turn is used in the construction of the intervention. The **river-water** (free from any plastic and silt) is extracted and purified to the extent of use in **urban agriculture** and the **vermiculture beds.**

The **processes** that are used to rehabilitate Centurion Lake will be made **completely visible** via an existential experience on a **pedestrian promenade**. Phenomenology, and the aspect of visual contact, haptic materiality and touch, water and light are used to connect the users with the processes to truly enable them to engage with the processes and the issues that fuels the project.

In conclusion, this **'process transparency'** of the project aims to create a new-found **awareness** of the **neglected** and **abused state** of urban rivers and tries to **reconnect humanity** with his **natural counterpart**. The dissertation proposes **design options** that reveals ways in which river spaces interact with the riverscape and in addition indicates how **flood prevention mechanisms** could be designed to enable the users to interact with the water as opposed to avoiding the beauty that nature provides in its domain.

OORSIG

'N globale **houding verskuiwing** het plaasgevind gedurende die 15ste eeu wat die verhouding tussen **mens** en sy **natuurlike omgewing** drasties verander het. Hierdie verskuiwing is gebring deur die **'Renaissance' wêreldbeskouing**, waar mens as **beter** beskou word as alles wat natuurlik is of te doen het met **natuurlike sisteme**. Slegs die aspekte van natuur wat as **nuttig** beskou word vir die voortbestaan van mens, word **bewaar of 'beskerm'** (Lyle 1994: IX). Die **Industriële revolusie** het veroorsaak dat 'n verdere houding verskuiwing plaasgevind het deur middel van **massa produksie** en **industriële masjinerie**, wat direk verantwoordelik is vir die **agteruitgang** van die **natuurlike omgewing.**

John Tillman Lyle, in sy boek 'Regenerative Design for Sustainable Development ' (1994:8) noem dat: 'die probleem is nie ons **effek** op die omgewing so veel soos dit ons **verhouding** met die omgewing is nie'. Met ander woorde, om die probleem op te los sal dit nodig wees vir mensdom om 'n **dieper begrip** te kry van **natuur se komplekse** en ingewikkelde sisteme. Hierdie nuwe begrip van natuur kan gebruik word om nuwe kennis op te doen wat sal bepaal hoe mens met sy onmiddellike konteks sal interaksie voer.

Dié skripsie poog daarin om die grootste verskille tussen man en natuur uit te wys , deur **alternatiewe denkwyse** voor te stel om na natuur te kyk. Die doel is om maniere te ontdek waar mensdom en sy natuurlike omgewing weer **een entiteit** kan word. Soos Laugier (1755) dit beskryf; om argitektuur te skep om op te tree as 'n **tussenganger krag**. Die skripsie sal uiteindelik daarin poog om 'n oplossing voor te stel oor hoe die **verlore verband** tussen **mens** en **natuur** kan hervestig word, met die fokus op **Stedelike Rivier Stelsels**.

Dié skripsie kyk krities na **'Regeneratiewe Teorie'** as ook na aspekte van **'Fenomenologie'**; waar regeneratiewe teorie verantwoordelik is vir die **vernuwing** van die Hennops rivier en fenomenologie optree as die **tussenganger krag** van mens en natuur deur middel van spesiale ervarings. Dus, sal argitektuur gebruik word om 'n fisiese en metafisiese skakel te wees tussen die stedelike konstruksie, man en natuur om te dien as die bindingskrag tussen die elemente. **Centurion meer** sal dien as die toets terrein vir die ondersoek waar hierdie teorieë getoets kan word en ondersoek ingestel kan word, in die hoop om **positiewe aksie** vir toekomstige projekte te inspireer.

Die ontwerp voorstel adresseer die **besoedelde toestand** van Centurion Meer en stel voor dat 'n **slik val** as 'n integrale deel van die ontwerp geïnkorporeer moet word. Die slik val (geleë in die rivier) word gebruik om **waardevolle hulpbronne** te ontgin, naamlik; **plastiese rommel, slik, en water.** Rommel word dus eerder beskou as 'n waardevolle hulpbron wat omskep kan word in 'n winsgewende produkte, wat in die proses die rivier skoon maak.

Plastiese rommel word verwerk, gegiet en gevorm in plastiek meubels, waar dit verkoop en versprei word oor Suid Afrika en internasionaal. Hierdie proses is baie meer omgewingsvriendelike in vergelyking met die huidige toedrag van sake waar plastiek afval na stortingsterrein geneem word.

Slik is ontgin en gebruik as 'n toevoeg middel vir wurm-kompos of alternatiewelik as 'n verrykende agent tot slik bakstene – wat dan weer gebruik word vir die konstruksie van die gebou. Die rivierwater (vry van enige plastiek en slik) is ontgin en gesuiwer tot die mate van gebruik in stedelike Landbou en die wurm-kompos beddens.

Die **prosesse** wat gebruik word om Centurion Meer te rehabiliteer, word heeltemal **sigbaar** gemaak deur middel van 'n **eksistensiële ervaring**. Dié ervaring word gehuisves op 'n **voetgangers promenade** wat **Centurion Mall** verbind met die **Gautrein Stasie.** Fenomenologie en die aspek van visuele kontak, haptiese materialiteit, water en lig word gebruik om die prosesse te ontbloot waar die gebruikers **aktief betrokke** raak met die prosesse; waar hulle dan die belangrikheid van stedelike riviere ontdek.

Ten slotte, hierdie **'proses deursigtigheid'** van die projek het die eintdoel om mense bewus te maak van die **toestand** van stedelike riviere en poog daarin om mensdom weer met natuur te koppel. Die skripsie stel 'n paar **ontwerp opsies** voor wat aanleiding gee tot hoe mens rivier ruimtes kan benader en hoe mens **vloede** kan verminder deur geboue te ontwerp wat reënwater terug keur eerder as om al die water so gou as moontlik in die stormwater kanaal te ontlas. Die ontwerp fokus op die unieke ervaring wat mens kan ontgin gedurende 'n vloed, als met die einddoel om **bewustheid** te skep onder die jonger generasies in terme van die prag, krag, en belangrikheid van **natuur** in stedelike omgewings.

ACKNOWLEDGMENTS

• This dissertation is dedicated to the 'Real Master Architect', designer and creator of life itself.
Thank You God for lending me the gift of creativity and design

• To my life partner Danielle, thank you for helping me put my thoughts into words; my ideas into practical narratives; and making my dreams into reality.
Thank you for your unending love, support and enduring patience throughout the year

• A special thanks to my family for your encouragement and confidence in my capabilities. Thank you for your love and financial support. Without you I wouldn't have been able to accomplish so much

• Thank you, Jan Hugo, for your guidance and insight throughout the year. You have taught me valuable lessons that I can carry with me throughout my career

• Last but not least, thank you to Mpho for your encouragement when we needed it most. Your help goes beyond any unit of measurement (as we would not have a final year presentation without you)
thank you brother

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7.10 - SEMI-BASEMENT LEVEL: Typical section through the building. The section highlights the relationship between the stereotomic and tectonic structure (Author, 2018).

CHAPTER 01 | OUTLINING THE ISSUES

Introduction, Background and Problem Statement

Figure 1.1 - (Author, 2018)

Figure 1.2 - (Laugier, 1755), edited by Author.

An illustration by Charles Dominique Eisen depicting The Primitive Hut. The woman is sitting on the ruins of Classical architecture and next to her is an angelic baby. The woman represents the new architectural vision and the angelic baby represents the naive architectural society. Therefore architecture is pointing to a new structural clarity found in nature rather than the ironic ruins of the past (Laugier, 1755).

INTRODUCTION

The Disconnection Between The Built Environment and Natural Environment

"Nature is my manifestation of God. I go to nature every day for inspiration in the day's work. I follow in building the principles which nature has used in its domain".

- Frank Lloyd Write (iopscience, 2016)-

Since the beginning of time nature had occupied most of the land area on earth. It is only with the rain of humanity that the tides have turned. Humanity have always altered the natural environment to its benefit; albeit, to create shelter, cultivate the land with culinary material, or to keep live stock. However, the alterations were kept minimal with very little to none permanent effects to the natural environment. It is only later that its effect grew into a rapid spreading virus that will eventually consume the entire globe. One such concept on the origin of man's destructive nature on the environment is the concept of the Primitive Hut. However, the concept proposes that architecture has its origin within nature and therefore should coexist in harmony with nature.

THE PRIMITIVE HUT

'The Primitive Hut' is a concept that is said to be the origin of architecture (refer to figure 1.2). The concept explores the anthropological relationship between man and the natural environment as the fundamental basis for the creation of architecture. The Primitive Hut serves as a theoretical model that claims that the ideal architecture embodies that which is natural, intrinsic and part of natural processes (Laugier, 1755).

The Primitive Hut as an architectural theory was brought to life over the mid-1700s till the mid-1800s, theorized in particular by Marc-Antoine Lauger. In his book "An Essay on Architecture", Lauger describes his philosophy of architecture in the form of an allegory of man and nature. He explains man's deep desire for shelter and man's dependence on nature. Lauger's book was first published in 1753, this was during the age of Enlightenment, that was characterized by rationalist thinking through science and reason. In this time, France was predominantly defined by the Baroque style. It was known for its excessive ornamentation, however, Lauger argued for the simplicity of architecture. He explains that architecture should return to its origins namely the simplistic rustic hut (Laugier, 1755).

"Nature provides the rules for architecture"

- Marc-Antoine Lauger (iopscience, 2016)-

The Primitive Hut is not necessarily a physical hut, but rather a conceptual hut that is an abstract concept of place. It is created through man's response to the natural environment, where architecture acts as a mediator between man and nature, however, this view has changed since the 1800s and a new world-view has become the dominant view (Laugier, 1755).

THE GENERAL ISSUE | CURRENT WORLD-VIEW

"We abuse land because we regard it as a commodity belonging to us. When we see land as a commodity to which we belong, we may begin to use it with love and respect".

- Aldo Leopold (iopscience, 2016)-

Man, views nature as a resource that can be utilized and depleted without considering the

larger negative impact that it will ultimately have on the urban construct. This has escalated with the start of the industrial revolution in the 1760s, where hand production methods transitioned to machine mass production. Soon mining industries started dominating the landscape and became the new catalyst for urban settlements (Marks, 2002). Once the resource is depleted the landscape is left in ruins, scarred by human greed. The same could be said for resources such as natural river systems that were utilized and abandoned once its polluted. A comparison could be made between abandoned gold/diamond mines becoming depleted and natural river systems that are polluted. In both of these cases the natural resources were utilized to a state of depletion, till it added no more value to the urban construct and is left abandoned. In the case of natural river systems that has become polluted, it is not just the natural environment that is negatively affected but also the urban environment.

URBANIZATION

This balance is threatened by the exponential growth of urban environments. As urbanization increase, so does the natural landscape decrease as stated by Will, Nakamura, Dinetti (2004:585). The relationship between man and nature is a very fragile relationship that should be considered carefully in order to maintain the harmonious balance (refer to figure 1.3).

River systems have a large impact on the way we shape our cities. It determines the exact location of the city's origin and the shape that the city ultimately followed (Will et al, 2004:585).
Although water is predominantly seen as the source of all life, water and river systems have many other unique functions within the urban construct. To mention a few; rivers act as natural boundaries between buildings with conflicting uses, territories between socio-cultural groups, population groups, farmlands, and biological ecosystems (Will *et al*, 2004:585). Together with these important functions come a degree of understanding that these systems should be treated with respect. The developing world should incorporate the resources into the urban construct in such a way that it is to the benefit of man and nature. This can only be achieved once man critically reflects on the way that water resources are used in cities as well as the role that nature plays within the urban construct.

WATER AS A RENEWABLE RESOURCE

The root of the problem lies in the mindset of people. It is human nature to view water as a method of waste disposal and an even greater mistake to view water as a renewable resource. Water is a finite resource on Earth. Water is technically considered a renewable resource because it can be used over and over again and it has a rain cycle (refer to figure 1.5). However, it is only in the short-term that water can be thought of as a renewable resource and the sustainability of this renewable resource is questionable. In the next few centuries it is thought that there will be a severe lack of drinking water, and this effect can already be seen today; for example, the recent drought in Cape Town (Grant, 2017).

Our planet is 70% water, with the largest part of this water body being oceans, so this creates the illusion that water is abundant, however, in reality only 3% of our planet's water can be used for drinking, irrigation and other very important uses for both humans and nature (Grant, 2016). Industries uses 22% of our planet's water resources, whereas our own personal water footprint has steadily increased (Grant, 2016). As time passes, more and more water bodies become polluted. Population growth leads to an increase in the amount of people that need access to drinking water, our groundwater and surface water reserves are inching closer to total depletion. The water is being used faster than it can replenish itself, and this will inevitably lead to a water shortage in the future (Grant, 2016).

In conclusion, water should not be regarded as a renewable resource. Rather, water conservation should take main priority and we should try to reduce our water consumption in whichever way possible.

Figure 1.3 - (Garrett and Garrett, 2018).
Natural river systems that are untouched by human intervention. These rivers naturally sustain itself and the ecological network that rely on it.

Figure 1.4 - (Garrett and Garrett, 2018).
Channelized urban rivers that serves as the epitome of the human need to control nature. Ecosystems were removed and replaced by concrete channels that undermines the potential that rivers can have within the urban construct.

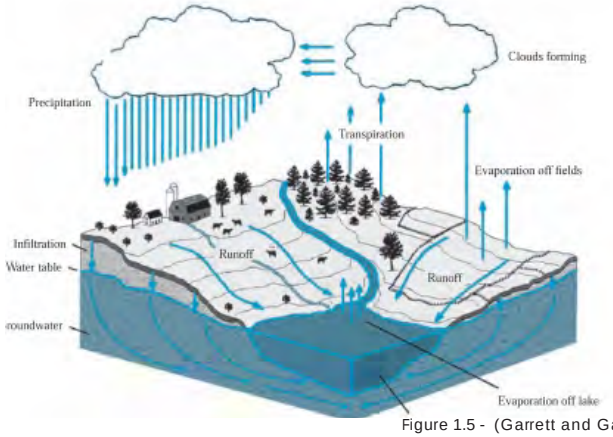


Figure 1.5 - (Garrett and Garrett, 2018).
An illustration explaining the rain-cycle.

Figure 1.6 - (Author, 2018).
Image depicting the larger river system of which Hennops River form part of.

Figure 1.7 - (Author, 2018).
Image highlighting the contrast between the natural flow-line of the river (on the right), and the more 'ridget' approach of the man-made retaining wall (on the left).

Figure 1.8 - (Author, 2018)
Photograph showing the current polluted state of the river East of Centurion Mall.

URBAN ISSUE

Centurion Lake is a typical example of a site where human intervention has disturbed the natural environment to the detriment of the landscape. Man views himself as 'above' nature as opposed to being 'part of-' nature.

THE STORY OF PLACE

Running through Centurion are a network of rivers that systematically converge to form the Hennops river that spills out into the Crocodile river located downstream, towards Hartbeespoort dam (refer to fig.1.6).

The Hennops river has its origin in Kempton park and runs past Centurion Mall. Residential communities developed next to the river. Centurion was primarily residential at this time (1930s), with very little programmatic variety in land-use patterns. With the closest groceries store in Pretoria, citizens had to travel far distances to do their weekly shopping. Town planners and developers sought the opportunity to bring a shopping center to the users, thus leading to the construction of Centurion Mall.

When Centurion Mall was first erected (1983), the developers decided to use the river as the main point of attraction by proposing that the mall be built on the foot of the river, however, it was decided that the mall should have a very large lake in front of the mall in order to accommodate water related leisure activities. To the north, a retaining wall was built according the original flow-line of the river to preserve its history. The facade of the mall, on the other hand, was pulled back and a more geometrical approach was taken (refer to fig.1.7). As a result of the mall's facade being drawn back, a large man-made lake was created (Tshwane, 2011).

The 'Centurion Lake Project' proved successful as people flushed to Centurion from as far as Johannesburg and Pretoria to experience the urban oasis. This suddenly changed when the lake became polluted with plastic waste and filled with silt from soil erosion upstream. The river's flow rate, however, was never meant to support such a large lake and problems started to emerge. Maintenance of the lake proved to be too expensive and was left abandoned. The once scenic lake slowly turned into a desolate wasteland, devoid of any human activity, slowly replaced by nature. In some sense it could be seen that nature is trying to reclaim the land that once belonged to it (Tshwane, 2011).

WATER POLLUTION

With the addition of pollutants in the river, it became an unpleasant and unbearable place for restaurant patrons. The restaurants started to close and relocate one after the other. The problem escalated with the addition of flash-floods resulting in large scale flooding; caused by an increase in hardscaping and surface area coverage upstream, which increases the amount of storm-water runoff entering the area. Industrial waste together with additional townships upstream led to the water being polluted and reaching a new level of severity (Tshwane, 2011). No longer does the river only contain silt but also plastic waste and litter. However, rather than viewing the pollution in a negative light, the addition of waste material should rather be viewed as a resource.

URBAN DISCONNECTION

Furthermore, with the addition of Centurion's Gautrain station a sudden new potential emerged with it. The train network makes it possible for people to commute from as far as Johannesburg and Pretoria to Centurion; however, the urban disconnection prevents this potential to become reality. The river creates a natural boundary between the train station and the residential- and business districts, limiting the accessibility of pedestrians, thus, encouraging vehicular movement.

CONCLUSION

Centurion on an urban level faces various problems such as natural degradation, water pollution, urban floods and urban segregation due to the state of the Hennops river flowing through Centurion. These issues are the direct result of the lost connection between man and nature. This is especially evident when looking at the man-made lake and the Mall's retaining wall with its strict geometry, that stands in strong contrast to the natural flow of natural rivers. This shows man's claim of authority above nature and nature's reluctance to adhere to the rules set by man. In the end nature will prevail.

Figure 1.9 - (Author, 2018).
A rendering of Symbio City as it proposed by the Tshwane Metropolitan Municipality, located where Centurion Lake currently.

Figure 1.10 - (Author, 2018).
Abstract depiction of the 'Nature Reserve' proposed by the Tshwane Metropolitan Municipality. It showcases the effect that the polluted river would have on the natural environment and its visitors.

ARCHITECTURAL ISSUE

"For Architecture, nature provides only indications and analogies not models to imitate".

- Leon Krier-

The disconnection between man and its natural environment will ultimately result in a series of disastrous events, for example; destruction of certain parts of ecological systems at first; and ultimately lead to large scale destruction of not only the natural environment, but also the built environment. It is evident that our perspective of our natural water systems has changed from a respected natural element to a natural resource that could be used irresponsibly, and polluted rivers all over the world serve as a testimony to this.

PROPOSED GOVERNMENTAL SOLUTIONS

Current rehabilitation strategies proposed by the Tshwane Metropolitan Council is the 'much discussed' multi-billion-rand Centurion Symbio City Development (refer to fig.1.9). It entails three skyscrapers that will cover most of the area currently occupied by Centurion lake and it is proposed that a small river should flow to the north of the towers. Three high rise buildings will be erected, the tallest one being 110 storeys tall, that will reach a total height of 447m, the tallest building in Africa (Scholtz, 2018). On the other hand, Centurion is known for its unstable ground due to the large amounts of dolomite rocks (Scholtz, 2018). In essence, it proposes to build the largest skyscrapers on the most unstable ground in Gauteng. This is not a realistic approach to the problem and it can be argued that this is an inappropriate site for this type of intervention.

The Symbio City proposal in fact does not solve the problem of siltation or pollution, nor does it ensure the longevity of the river and the ecosystems that it comprises of. The result of Symbio City will ultimately lead to the channelization and enclosure of the Hennops river within Centurion (Scholtz, 2018). Natural ecosystems will be destroyed in the process and the urban environment will become devoid of its natural connection (refer to fig.1.10).

Other proposals states that the new plant growth should be utilized as a nature reserve to attract tourists at low cost rather than building a multi-billion-rand building. This approach may be more realistic; however, it still does not propose a solution to the water pollution. The nature reserve will prove to be unsuccessful as very few people would want to see a natural river in a polluted state.

DISSERTATION PROPOSAL

The architectural intervention will aim at creating a public promenade that creates a sense of awareness in whomever uses this space. This awareness will be the driver of all future developments and instil a sense of ownership and respect to natural systems and the surrounding urban construct. Architecture could be used to connect the urban fabric and the natural environment to ensure that rivers aren't seen as a natural boundary but rather as the medium that holds the potential to stitch the urban fabric and allow man and nature to become one again.

DISSERTATION QUESTION

How can the notion of 'process transparency' be incorporated into an architectural intervention that will instill a sense of awareness in the users about its negative impact on urban river systems, that will ultimately change the mindset of the user from one where rivers are seen as a waste disposal mechanism to one where it is seen as a resource?

RESEARCH QUESTIONS

Working off of the premise that the built- and natural environment are disconnected, the aim is to intertwine the two entities to form a symbiotic relationship that functions as a holistic entity as opposed to a fragmented cluster. Architecture is the medium that needs to mediate between the two and with this comes new opportunities to introduce the public, as well as certain programmatic functions, into the equation. The following sub-questions need to be asked in order to achieve a holistic view:

• What role can architecture play in creating a link between the natural environment and the built environment?

• How can architecture facilitate the transformation of a threatening and unapproachable landscape into an accessible and productive landscape that instills a sense of stewardship in man?

• How can architecture establish an interface between the natural realm and the productive industry?

• How can architecture encourage a culture of involvement to liberate mankind from their dependence on centralized productive industries?

• How can architectural innovation lead to an intervention that can adapt to ever-changing and dynamic environments?

• Which qualities of nature could be adopted to create an architecture that uses the essence of biological systems to achieve programmatic solutions?

INTENTION OF DISSERTATION

This dissertation intends to uncover the reason for natural environments and urban constructs to be separated. Identifying the root cause of the problem will aid in finding an adequate and informed architectural solution. The architectural intervention will aim at establishing a new connection between man and nature that is to the benefit of both. The current norm is that the urban construct is a destructive force that is superimposed on a given landscape. The dissertation will uncover ways in which the built environment and natural environment can co-exist in harmony, but better yet, in a symbiotic relationship that fosters an environment that is to the benefit of both the urban and natural environment.

The intervention aims at creating spaces that contributes to the well-being of the its users by promoting social engagement and the exchange of resources. The dissertation will aim at achieving a solution that will withstand the test of time by creating spaces that can adapt to the dynamic nature of the urban construct and nature itself. This is essential to ensure the longevity and effectiveness of future developments that doesn't propose a short-term solution to current problems, but rather propose a solution that will be effective in the long term and ultimately resolve the problem in its entirety.

The dissertation focusses on strategies that creates an experiential route that showcases ecosystem services and incorporates these systems into the design to create processes that are completely open to the public. The aim is to expose these essential processes to the public in order for them to gain an understanding of nature's complexity and necessity in our lives. It educates the users on the importance of nature within urban environment with the focus on river systems and the need for clean water. Ultimately, the dissertation aims to create awareness of these essential biological processes in the hopes of inspiring positive and proactive change. This change in the mindset of people will (in the long run) lead to healthy natural and man-made environments.

RESEARCH METHODOLOGY

The research methodology will aim at creating a platform of investigation in order to answer the thesis statement as well as the research questions set out previously. The following system of methods were utilized in this dissertation in order to support the dissertation question and develop an appropriate architectural response:

PRIMARY DATA ANALYSIS

Primary data will be obtained from the immediate study area. The lost connection between man and nature could be tested by analyzing the physical construct of the urban environment, to identify spaces that are completely deprived of nature. The extent of ecosystem services could be investigated to establish whether or not the urban construct has permanently altered the natural landscape.

SECONDARY DATA ANALYSIS

Once a theoretical direction is established, secondary data will be collected so that a broader understanding of the issues could be achieved. The secondary data will investigate a wide range of similar scenarios and enable the study to compare the issues as well as the results of the investigation. In other words, the secondary data will showcase similar problem and the solutions thereof that were conducted by previous researchers.

MAPPING

The entire study area as well as its surrounding precinct will be mapped to create a better understanding of the site and its constituents. It is important to know as much as possible about the site before attempting to propose a design solution for it.

The first step was to identify the exact perimeters of the site in order to focus the mapping and narrow the results down to that specific area, however, larger connections

was also considered. Mapping included the river system and its origin, larger programmatic connections, the land-use patterns currently present on site, vegetation on site, topographical information as well as micro-climatic information.

More user-centric information was gathered to establish the current social trend in the study area. The social aspects include: The user intensity in certain spaces; sound intensity on site; as well as existing social structures and usage of spaces. The mapping phase attempted to identify the zones, thresholds and vistas that were most suitable to implement rehabilitation processes and methods as to how these processes could be exposed to the public.

SWOT ANALYSIS

Following from the mapping, a SWOT-analysis was conducted to establish the strengths, weaknesses, opportunities and threats on site. The purpose of the SWOT-analysis is to tap into the issues of the site and find the most viable solution to the problem by exploiting its strengths and opportunities.

CONTENT ANALYSIS

This research technique will be used to interpret all the data in form of photographic documentation or graphite sketches in a journal. Content analysis allows the researcher to convert qualitative data into quantitative data. This method of data gathering will prove useful for data that is not in the form of a written piece. The data will be analyzed, interpret and compared with one another to establish it validity, thereafter it will be supported and strengthened by secondary data.

DESCRIPTIVE INTERPRETATION

This form of data gathering concerns itself with statistic data. These are for example all the Acts that are applicable to the line of study namely the NEMA-, and Water Act, as well as SANS 10400 (South African National Standard) and NBR (National Building Regulations). Investigating the standards will allow the study to set boundaries to the project that is in line with the governmental standards and in doing so create a solution that is well informed and practical.

ARCHIVE/ HISTORICAL STUDIES

The archive will deliver information on the history of place as well as reveal the development of the site over time. Venturing into the archive documents will allow the researcher to place the project within the time continuum of architecture. If the researcher can predict the outcome of the future urban construct, he will be able to design a building that is 'future-proof'; in other words, the building will truly be resilient and adapt to the ever changing urban and natural environment. Historical photographs have been used to investigate Centurion and more specifically the development of Centurion Lake over time. The information reveals interesting discoveries about the initial construction of the lake. Archival documents also revealed important information on previous strategies used to mitigate the pollution and siltation problems at Centurion Lake.

PRECEDENT STUDIES/ CASE STUDIES

Interdisciplinary research will allow the researcher to compare the design intervention with those who have designed similar buildings or have tried to resolve similar issues through architecture. Case studies will unlock the hidden potential within the issues and create a platform on which the issues and its solution can be compared with the work of other designers in order to find a viable solution.

DELIMITATIONS

The following delimitations will set the boundaries for the study and highlight the aspects of the project that will not be addressed in the study:
The study will focus on the integration of natural systems into architecture as previously mentioned. Architecture will in some way become an extension of natural systems that can adapt to changes, create intuitive solutions to complex problems and function optimally by decreasing its Eco footprint.

THE RIVER SYSTEM

- Only a small segment of the Hennops river will be addressed (where it flows through Centurion Lake) as the larger river system is mostly natural and this dissertation focusses on urban rivers
- The dissertation will focus mainly of the integration of the users with the processes proposed and does not focus on the actual cleaning of the river system as this will result in a landscape architecture proposal (with constructed wetlands)
- The intervention merely proposes a possible solution to a segment of the larger river and acknowledges that multiple interventions (similar to this one) would be necessary to clean the river. The intervention is merely intended as a prototype to investigate possible solutions

ASSUMPTIONS

- With part of the study focusing on regenerative theory and sustainability (especially reducing the transportation hierarchy and promoting a walkable city on urban scale) it is assumed that the neighboring buildings, especially Centurion Mall, will provide the necessary parking area for this intervention. The pedestrian promenade that stretches over the river and connection the urban fabric will thus not have any parking bays in front of it as it will prevent the free flow of people into the site

WATER SHORTAGES

- Currently water shortages occur on an infrequent basis but it is assumed that the availability of water will decrease drastically in the future due to population growth and water recourses will be in great demand. Furthermore, the need for agricultural products will also drastically increase due to agrarian reform.

CONCLUSION

It became clear from the investigation that history hints at the notion that architecture originated from nature and that the ideal architecture embodies that which is natural, intrinsic and part of natural processes. The current world view differs from this notion as architecture has become an entity that is separate from its natural environment. Architecture has become a destructive force that harms the landscape rather than respecting the landscape. The built- and natural environment is far removed from a harmonious relationship that is to the detriment of both.

The current norm is to view nature as a resource that could be disposed of without considering the long-term effect that it may cause. When problems start to emerge, the river is abandoned and left in a state that it would not necessarily have been in, had humans not intervened.

Nature has shaped the way our cities looks and functions for centuries, but is now becoming more disconnect from the urban fabric. Some cities were specifically chosen to be located close to natural springs in order to serve the city's inhabitants. The roads conformed to the shape of the river systems and the buildings were designed to respect the natural waterway, however, today it becomes clear that many of these rivers are being channelized. The once scenic natural setting now completely replaced by concrete channels. The same river systems that were used for leisure activities that brought the community together, is now used as a waste disposal mechanism.

The general misconception that water is a renewable resource is the same reason why river systems are mistreated and polluted. Water is a finite resource and not a renewable resource and should therefore be respected. On the other hand, rivers should not be seen as urban dividers but rather as the point of congregation for the city dwellers. Architecture and nature should be in a harmonious relationship that is to the benefit of both.

CHAPTER 02 | THEORETICAL DEPARTURE

Regenerative Theory and Phenomenology

Figure 2.1 - Photograph of Centurion Lake and Hotel (Author, 2018)

THEORETICAL DEPARTURE |

In the previous chapter, the project issues were identified to define the boundaries of the project and limit the scope of the study. These issues are used to choose the relevant architectural theories that needs to be investigted in order to solve the issues.

CHAPTER TWO BREAKDOWN

This chapter frames the argument of the dissertation from a theoretical point of view. It attempts at highlighting the major differences that exist between man and its natural environment, by proposing alternatives to the current mindset of people. Its aim is to uncover ways in which man and its natural environment can be merged once again, as Laugier (1755) described it, by introducing architecture to act as the intermediary force.

This chapter will critically examine Regenerative theory in conjunction with Phenomenology; with regenerative theory acting as the main driver to rejuvenate the site and phenomenology acting as the mediating force between man and nature through lived experiences. Thus, architecture will create a physical and metaphysical link between the urban construct, man and nature; reuniting the human and natural realms once again. Centurion Lake will provide the necessary milieu where these theories can be tested and examined in the hope to inspire positive actions for future interventions.

INTRODUCTION

"We abuse land because we regard it as a commodity belonging to us. When we see land as a commodity to which we belong, we may begin to use it with love and respect".
- Aldo Leopold (iopscience, 2016)-

The built environment1 and natural environment2 coexist in a dichotomous relationship3. This may be the current case; however, it can be argued that architecture has its origin in nature and therefore should coexist in harmony with one another. This concept was first visualized by Marc-Antoine Lauger (1755) in his book 'An Essay on Architecture', where he explains that the fundamental aspects of architecture is derived from the natural environment. He argues that the ideal architecture is not apart from, but rather part of, the natural processes that make up the complex natural world (Laugier, 1755). Working off of the premise that architecture is the direct result of human intervention, it can be argued that the dichotomous relationship is rather between man and its natural environment, implying that man sees himself superior to nature.

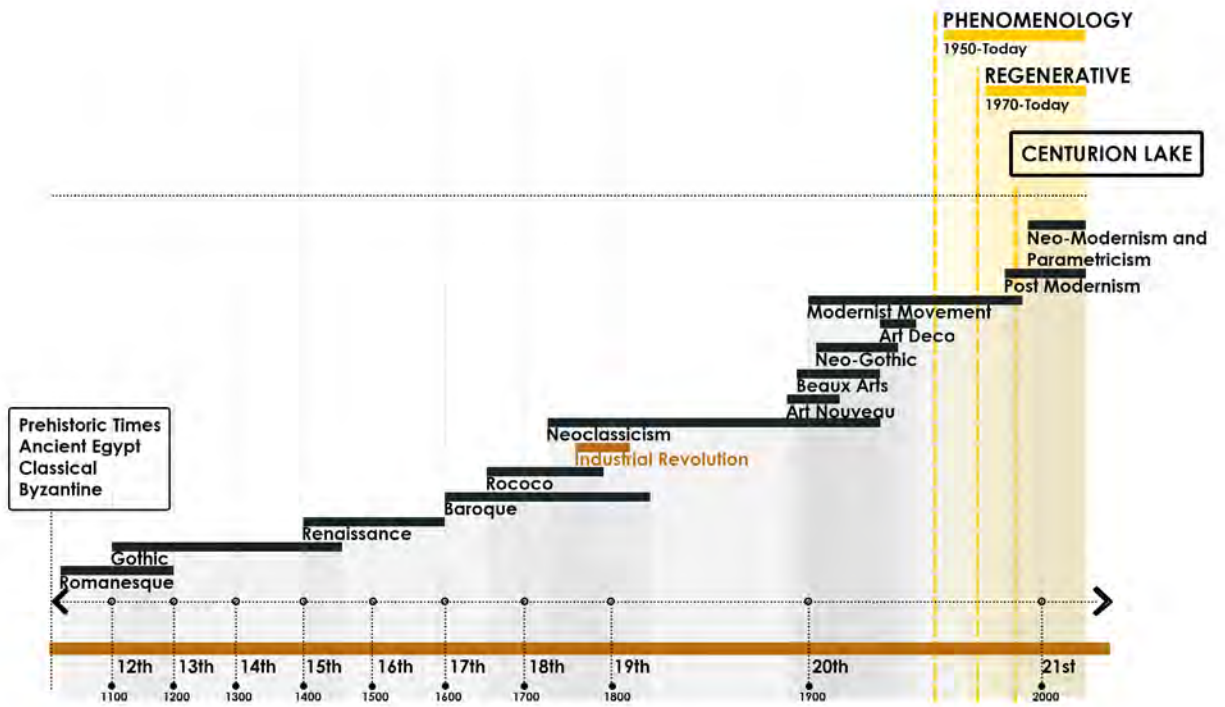


Figure 2.2 - Diagram indicating the theoretical position in the continuum of architectural thinking (Author, 2018).

John Tillman Lyle, in his book 'Regenerative design for sustainable development' (1994:8) mentions that: "The problem is not our effect on the environment so much as it is our relationship with the environment". In other words, to mitigate the problem it would be necessary for humans to gain a deeper understanding of nature's complex and intricate systems. This understanding of nature can be used to gain new knowledge to govern the manner in which man addresses his immediate context.

THE LOST CONNECTION

A global attitude shift has emerged that changed the relationship that man has with its natural environment. This attitude shift lead to man permanently altering the landscape behaviour patterns that once supported and established a mutual relationship between them. This shift was brought by the Renaissance world view, where man is superior to nature and all that makes up natural systems. Only the aspects of nature that proves useful to the existence of humans are preserved or 'protected' (Lyle 1994: IX).

Lyle (1994) states that: "Much of our difficulty in dealing with resources and environmental issues is brought on by the fact that the human landscape (our cities) was shaped according to a concept of nature that grew out of the Renaissance notion that humans are the measure of all things" (Lyle 1994:20). Renaissance architecture and landscape design places humans firmly in the central position of all ordering of the environment. The axial layout and strict geometry of Renaissance gardens testifies to this new relationship between humans and nature (Jellicoe 1975).

Du Plessis & Hes (2014:10) supports this notion by stating that; a number of discoveries during the Renaissance has lead scientists to believe that humans are in the centre of

Figure 2.3 - Image depicting the negative effect that the industrial revolution had on the natural environment (Author, 2018).

the cosmos. Copernicus and Galileo's beliefs were focussed on the observable universe as opposed to the divine; implying that gods do not exist and therefore man has the highest status in nature. Rene Descartes believed in separating mind from matter, subjective from objective. He believed that the only true knowledge is gained by objectively observing and actively measuring aspects of reality, with no room for speculating the unmeasurable and intangible (Du Plessis & Hes 2014:11).

The Renaissance view of nature stays true till the present day where man views nature as a resource that can be utilized and depleted without considering the larger negative impact that it will ultimately have on a global scale. This has escalated with the start of the industrial revolution in the 1760s, where hand production methods transitioned to machine mass production. Soon mining industries started dominating the landscape and became the new catalyst for urban settlements (Marks, 2002).

INDUSTRIALIZATION

"With the advent of industrial technology, we have created a monster beyond our control, a monster that might very well end up destroying us" (Lyle 1994:12).

The dichotomous relationship between man and nature was finally exacerbated with the advent of the industrial revolution that took place between the 18th and 19th centuries (Marks, 2002:14). Lyle (1994) explains that during the industrial era, technology caused a split not only between humans and technology, but also between man and natural processes. This sudden shift in technological manufacturing processes lead to inventions (vehicular transportation) that scarred the landscape and continued to do so to the present day.

New technologies brought new possibilities as well as new dangers; machines that replaced the work of man. Suddenly it was possible to produce more products at a fraction of the cost and speed. Mass production resulted in a surplus of products, each with its own packaging, creating excessive waste in materials. Due to the lack of proper maintenance, the waste material entered urban rivers, directly and indirectly causing the die-off of many biological organisms (Register 2006:31). Du Plessis & Hes (2014) in their book 'Designing for Hope', explains that the current worldview is to blame for natural disturbances, and therefore the mindset of people must change to achieve a harmonious state.

THE CURRENT WORLDVIEW

The current destructive worldview manifests itself in the form of ***rapid urbanization***, ***urban disconnection*** and ***global pollution***. Natural systems all over the world suffers the consequences of human action. Richard Register (2006:21) in his book 'Ecocities', compares urban sprawl to that of an 'Urban Comet'; that destroys nature as far as it goes. In describing the effects of urbanization, Register mentions that humanity is "ripping patches out of the fabric of life" (Register 2006:20). He explains that the biggest problem lies in the superimposition of cities onto the natural landscape, without considering the long-term effect that it might bring. He elaborates by stating that cities are not designed in harmony with their landscapes.

The result of the superimposition of cities is seen, more specifically, at the point of intersection between the urban construct and river systems. Highway construction over rivers causes an increase in the flow velocity, resulting in soil erosion, flood disturbances and many other problems. Ultimately, human interventions are destructive forces that does little to prevent its effect on the natural realm. Had man known the negative impact that his inventions would have on the earth, he would have done things differently.

Lyle (1994) states that "Technology became something physically separate, emotionally remote, hardly under human control, something inherently ugly". Although technological advancements may seem like a major step towards a greater future, the contrary proves to be true. The general misconception is that all technology contributes to the well-being of humans and the world at large; however, it rarely improves the ecological condition and benefits are normally only limited to the immediate needs of the

human population (Lyle 1994:27). As technology grows, so does cities. The industrial revolution brought with it the possibility to build larger buildings at a fraction of the time and costs. With 'costs' being the operative word, it becomes clear that we live in a world driven by a financial motive, without considering the potential negative effects it would have on the ecology; one such example is rapid urbanization.

URBANIZATION

Lyle (1994) states: "Though the purpose of development is usually economic and it always produces economic results, the essential physical reality of development is change in the ecology of the landscape" (Lyle 1994:19).

He goes on to elaborate on the meaning of development as the main driver of change. When man first decided to alter the landscape to provide some form of shelter, or when he started cultivating the natural landscape with agricultural crops, or when man first cut down trees to provide heat at night alongside a camp fire, he altered and adapted the landscape for human benefit. Any such alterations creating a disturbance of the ecological systems that were present on site (Jellicoe 1975:56). Viewing alterations with a systemic lens, makes it difficult to see development as a non-destructive force; however, development doesn't necessarily have to be destructive. The inevitable fact is that a considerable level of development will have to occur to meet the current needs of the world's growing population. This form of human development is called urbanization (Will, Nakamura, Dinetti 2004:585).

Urbanization or urban sprawl is the expansion of human population, normally away from the city center, into low-density and monofunctional areas, that are car dependent (Register 2006:54).
The relationship between man and nature is a very fragile relationship, that should be considered carefully, in order to maintain the harmonious balance between the two 'entities' (Du Plessis & Hes 2014:33). This balance is threatened by the exponential growth of urban environment. As urbanization increase, so does the natural landscape decrease (Will et al 2004:585).

Du Plessis & Hes (2014) explains it by saying that; "One of the central narratives of modernity is to control nature for the benefit of mankind, leading to the two guiding principles of the past two centuries: modernization and development. These principles manifested as large-scale urbanization, industrialization and increased focus on the rights and freedoms of the individual" (Du Plessis & Hes 2014:14). Pamela Mang best describes this notion of power with her theoretical models of nature.

THE TWO MODELS OF NATURE

In the past 50 years, two distinct models of nature have dominated sustainability debates. The first model explains the capitalization of nature to the benefit of humans specifically. The second model of nature is much more holistic and is in strong contrast to the first model. The second model is drawn from insights of ecological systems that are interconnected, and functions within a dynamic organic web. Each entity is interdependent on another. Within the web, information and energy is constantly exchanged to enable the entities to evolve in harmony with their local environments (Mang et al. 2016: XXIII).

These two models are further clarified by Lyle's (1994) two concepts that he calls; the Paleotechnic and Neotechnic period. The Paleotechnic period he defines as the period of industrial development marked by the predominance of complex industries based on the use of non-renewable fossil fuels.
Lyle (1994) defines the Neotechnic period as the most recent period of industrial development characterized by the use of electricity and alloys, sparking the 'green' movement (Lyle 1994:7).

TOWARDS A POSITIVE FUTURE

The world view adopted during the Renaissance and further exacerbated by industrialization have left the natural environment scared. A new world view is needed that considers all living things in its entirety; a holistic system that is not to the benefit of only humanity (as was the case in the Renaissance period), but rather tries to integrate and establish a relationship between all living and non-living entities, to create a web of life, in a state of mutualism (Mang et al. 2016:21).

What's needed is an ecological worldview much in line with the Neotechnic way of thinking. Du Plessis & Hes (2014:21) describes an ecological world view as considering humans part of a larger community of life. If humans are viewed in the light of an all-encompassing ecological realm, then it is not only the natural environment that suffers as a result of industrialization and urbanization, but also humans. Air and water pollution are not considered to affect only the creatures that exist within them, but ultimately affects humans directly in the process.

To ensure that all the ecological processes function optimally and human existence have a strong and prosperous future, we need reduce the degenerative effect that man

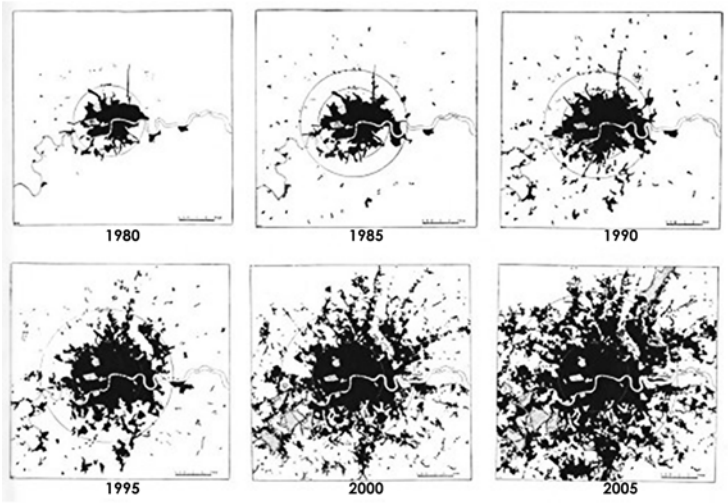


Figure 2.4 - Series of depictions that shows the effect of rapid urbanization on the natural environment (Will, Nakamura, Dinetti 2004:585).

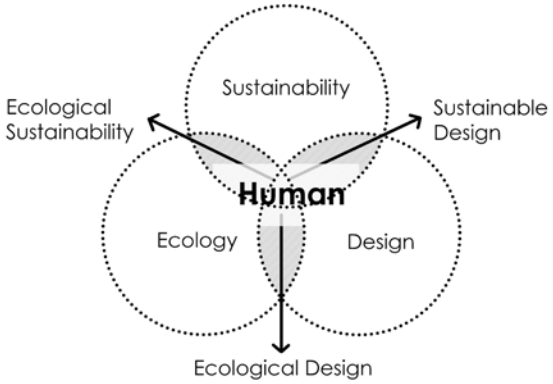


Figure 2.5 - Diagram explaining the ecological sustainability matrix (Author, 2018). Humans function where design, ecology and sustainability meet. The aim of ecological design is to merge human processes with that of the ecology in a sustainable manner.

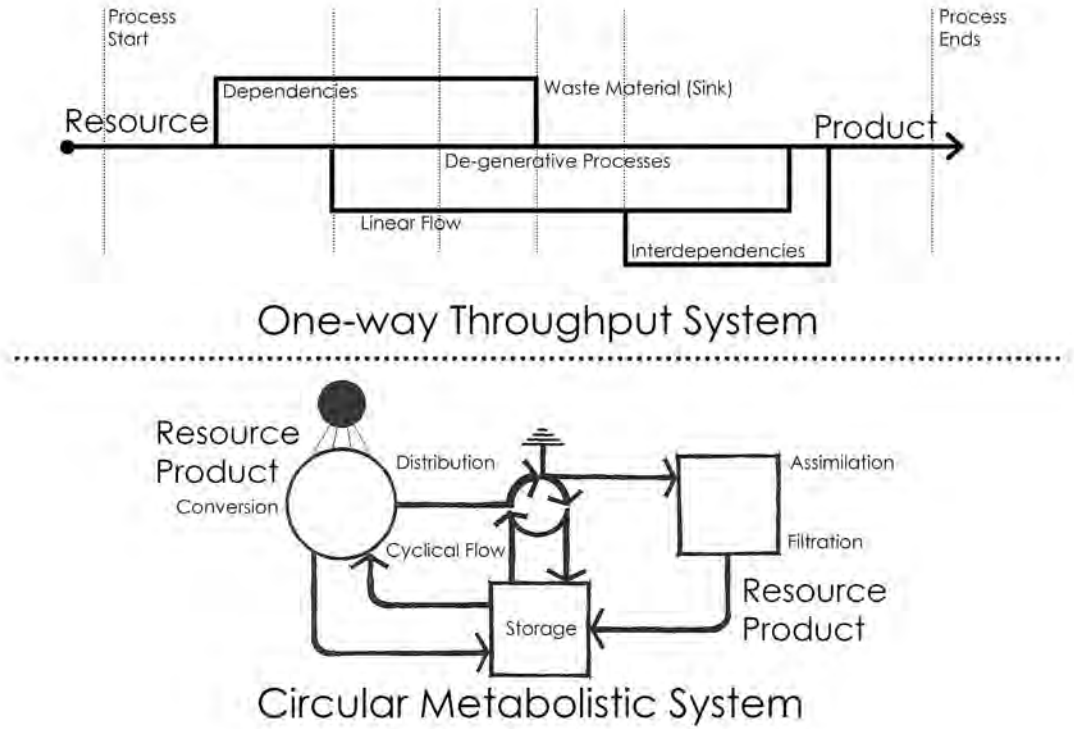


Figure 2.6 - Diagram highlighting the major differences between a one-way throughput system of industrial technology; and the cyclical system described by Lyle (1994) (Author, 2018).

has on natural processes. Darko Radovic (2009) in his book 'Eco-Urbanism: Towards well-mannered built environments', calls this process of natural conservation, Ecological sustainability.

THE DEGENERATIVE NATURE OF LINEAR FLOWS

"Where nature evolved an ever varying, endlessly complex network of unique places adapted to local conditions, human ingenuity has replaced it with a system of relatively simple forms and processes repeated with bold and consistent regularity" (Lyle 1994:4).

Lyle (1994) elaborates on the notion of complex natural systems that stands in stark contrast to the mechanized world. He explains that nature evolved to a level of infinite diversity in structures, species, processes and systems; whereas human endeavors struggles to design readily manageable uniformity. Nature's endless re-cycling systems of materials and wastes (processes that are fundamental to the operating of biological systems) are replaced with a system of one-way flows. These materials that support life now reduced to nothing but a waste product in what Lyle (1994) calls 'the sink'. In other words, humanity artificially mimics natural processes in a hope of achieving the complexity needed to sustain life. Nature's complex systems are then reduced to it essence and used in isolation, never achieving the complexity that nature has in its domain. Thus, wasting material and destroying essential parts of the ecosystems.

These artificial processes treat materials as if there is an endless supply available; however, most of these materials have limited resources available. The rate at which materials are taken from the earth are far greater than the rate at which they can be replaced; therefore, the sources must eventually diminish. Lyle (1994) states that this overwhelming extraction of resources, that cannot be replaced, is where the modern crisis of resource depletion and degradation lies (Lyle 1994:4).

Global problems such as soil erosion, deforestation and habitat loss testify to the degenerative processes of one-way throughput systems. After being used by consumers, the materials return to the sink side of the sequence in even greater quantity, with the sinks being rivers systems, lakes, and groundwater; thus, leading to a surplus of materials in the sink creating pollution.

Lyle (1994) states that the one-way throughput systems has a linear time dimension built in with a descending curve; in other words, the one-way system destroys the landscape on which it depends over time. Natural systems, however, can assimilate the waste materials back into the circular metabolistic system to be used again in the processes. Nature has a way of using materials to its full potential whilst creating as little as possible waste in the process. The waste that is created are quickly re-assimilated back into the ground or source where it came from. Nature uses solar energy to power its processes and all energy is conservatively used and never wasted.

FROM A SUSTAINABLE TO A REGENERATIVE APPROACH

In light of the first law of thermodynamics that energy cannot be created or destroyed, merely transformed from one state to another (Lyle 1994:10). All processes use energy to extract materials out of the ground, or to convert the materials from one state to another. Each material is the sum of all its processes and the energy needed for the processes to occur. This energy manifests itself in the form of embodied energy7. Therefore, to truly be sustainable, the embodied energy and materials within the system must be continually self-renewing in their operation. Materials with a low embodied energy must be used and the materials should be sourced locally in a sustainable way. For example; timber pole construction should occur at the same rate at which the local forest can produce timber.

Lyle (1994:11) defines Regenerative design as a system that replaces the present linear one-way throughput flows, with systems that incorporate cyclical flows during the entire process of sources, con-

sumption centres and sinks. Regenerative systems continuously replace the energy and materials through its own functional processes. These cyclical processes occur in nature naturally where resources are used sparingly and wastes are kept minimal. In other words, nature only takes what it needs for each process and creates as little as possible waste in return.

REGENERATIVE SYSTEMS CHARATERISTICS

Lyle (1994) explains the characteristics of regenerative systems as follows:

- Regenerative systems incorporate its operations with the functions of natural processes, together with social processes
- It attempts to concern itself as little as possible with the use of fossil fuels and man-made chemicals
- The use of non-renewable resources is strongly discouraged unless these resources can be reused or recycled
- Renewable resources are used with care by using the resources within their capacities of their renewal
- All waste is regulated in order to ensure that the environment maintains its capacity to assimilate it without damaging the system

Comparing the major industries of the modern world and its use of inanimate machines to process resources; and those of living systems, it becomes clear that the former lacks the ability of self-renewal. John Dowey (1916) explains it well with his concept of self-renewable systems. He states that: "the most notable distinction between living and inanimate things is that the former maintains themselves by renewal" (Lyle 1994:11). Regenerative theories and technologies have to do with the rebirth of life itself, therefore designing in such a manner to express hope for the future.

On the polar opposite of regenerate practice is degenerative practice. Unfortunately, most man-made processes on earth is governed by these degenerative practices and technologies as can be seen with industrial mines, power stations and even the mass influx of vehicle production.

"To become sustainable, the world will have to move from simple, highly mechanized technological base, to one of great complexity, rooted in natural processes" (Lyle 1994:11).

TOWARDS A HOLISTIC APPROACH

The regenerative state of any given construct cannot function in isolation as it is dependent on holistic systems (Knox 2013:87). Nature does not work in isolation, one system's waste is considered a resource in another system, and so the cycle goes on to form a fully integrated web of life. Knox and Mayer (2013) argues that the common mistake in planning for sustainability is to pursue environmental efforts on a project-to-project basis or to address only one issue, isolated from the broader context (Knox 2013:33).

Although a project-to-project approach might not change the immediate future, it will create new opportunities and insights into the possibilities of sustainable technology. Before we can design suitable solutions to living systems we need to understand the fundamental principles that it consists of.

THE FOUR FUNDAMENTALS OF LIVING SYSTEMS

1. Change
2. Diversity
3. Value
4. Holistic view

Mang et al. (2016:13) states that the only constant is change. Living systems, unlike the paleotechnic industrial machines, change on a regular basis and designers must allow for the constant flux. Mang (2016) argues that designers can treat change as a source of creative endeavour, it need not be a bland pragmatic or immutable solution (Mang et al. 2016:13).

Diversity is about exchanging values. Diversity in systems need to be encouraged to such an extent that it contributes to the beneficial exchanges of resources, energy and materials between the building and the natural landscape (Mang et al 2016:13).

Value enhances viability. One of the functions of a tree is to strengthen and build soil in a forest. It also catches leaves, protect other plants from strong winds, acts as a buffer of the sun and enables the establishment of new life. Each organism extends and elaborates the storage capacity of the soil, thus supports the growth of the original tree (Mang et al. 2016:13).

Adding value is a nested phenomenon; living systems are always part of some larger system, where each system contributes to the value-adding processes of the entire system. Radovic (2009:142) calls this phenomenon 'Holism'. Du Plessis & Hes (2014:37) supports this phenomenon by mentioning that one small change in input at one point of the system can cause a profound effect at another point. This is also generally known as the 'Butterfly Effect'.

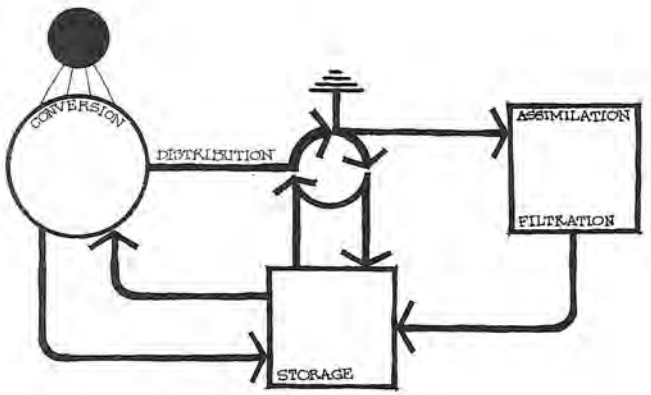


Figure 2.7 - John Tillman Lyle's Regenerative System Diagram (Lyle 1994); explaining the cyclical flow that occurs in nature automatically. Conversion, storage, distribution, filtration, and assimilation.

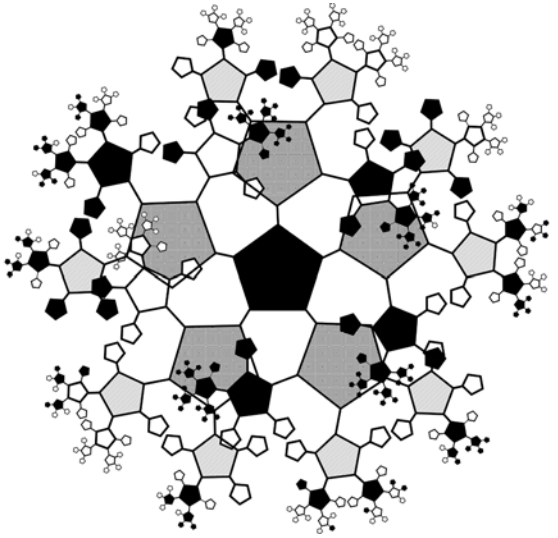


Figure 2.8 - Diagram explaining the concept of holistic systems (Author, 2018). Each aspect of a system is interconnected with another system.

WHERE REGENERATIVE THEORY AND PHENOMENOLOGY MEETS

Ecosystems are defined by three modes of order; each mode has basic implications for regenerative design. The three orders of nature carry a close resemblance to that of buildings. The first is the structural order; second, the functional order; and third, locational order (Girard et al 2011:56).

The locational order places emphasis on **the importance of place** in ecosystemic design. Mang (2016) explains that regenerative practice should not be treated as a generic model but rather respond to the specific place. Mang et al. (2016:36) states that co-evolution needs to happen on a place-to-place basis, creating solutions that are specific rather than generic (Mang et al. 2016:36). Du Plessis & Hes (2014:27) calls this co-evolution of humans and nature 'social-ecological systems'.

Du Plessis & Hes (2014:27) states that social-ecological systems have two essential aspects connected with it. The first being the tangible 'exterior' systems and the benefits it has to man; and the second is the 'interior' that is created by human thought and the experience gained by humans being part of these processes. The world comprises of three distinct spheres of existence; the Geosphere (all matter), Biosphere (all life) and the Noosphere (human thought). The Noosphere is the human mind and conscious thought, the phenomenological experiences, the motivations, feelings, worldviews and creativity. It also contains in a broader sense, collective motivations, cultural norms, value systems and community identity (Du Plessis & Hes 2014:27). The Noosphere is where the tangible world meets the intangible; where the physical merges with the metaphysical realm; where flux of changes are condensed into phenomenological experiences.

Figure 2.9 - Image exaggerating the current state of Centurion Lake (Author, 2018). The character of place is currently seen as a negative experience; however, the site presents great potential for phenomenological experiences.

ARCHITECTURE AND PLACE

The **existential**[8] purpose of architecture is to make a site become a place, that is, to uncover the meanings present in the given environment. A place may be interpreted in different ways. To protect and conserve the genius loci in fact means to concretize its essence in ever new historical contexts.

Architecture comes into being when a 'total environment is made visible'. To concretize the genius loci. The role of architecture is to gather the properties of the place and bring them close to man. The basic act of architecture is therefore to understand the 'vocation' of place. In doing so, architecture supports life-giving processes and man becomes part of a comprehensive totality. Only then, we recognize the fact that man is an integral part of the environment, and that it can only lead to human alienation and environmental disruption if he forgets it.

Norberg-Schulz (1980:121) mentions that architecture can promote environmental visibility by its degree of 'openness' by manipulating its boundary condition. The solidity or transparency of the boundaries make the space appear isolated or as part of a more comprehensive totality. He calls this the 'inside-outside relationship', which constitutes the very essence of architecture. Zones of transition or thresholds relate the internal structure of the place to the structure of the natural or man-made environment. Existential spaces are perceived by humans in different ways, Pallasmaa (1996) elaborates on the different ways of perceiving spaces and the experiences connected to each.

ARCHITECTURAL PHENOMENOLOGY

Christian Norberg-Schulz (1980) explains in his book 'Genius Loci: Towards a phenomenology of architecture' that our everyday life-world consists of concrete 'phenomena'. It consists of tangible and intangible aspects of life. He argues that the tangible aspects of life such as buildings, motor vehicles, technology and products take priority in today's world. The intangible aspects are ignored; this includes the life-world or phenomenological experiences. However, he explains that the tangible and intangible realms are interconnected, interrelated and inseparable. Both require a physical environment or place to latch onto. Norberg-Schulz (1980:6) states that nothing can happen without reference to a locality and that place is an integral part of existence. He explains that the word 'place' means more than an abstract location. "Place is a 'total phenomenon', which cannot be reduced to any of its properties" (Norberg-Schulz 1980:7).

Norberg-Schulz (1980:17) explains the importance of the character of place; he mentions that when we visit a city, we are usually struck by its particular character, which becomes an important part of the experience. The character of place is a function of time that changes with the seasons, the course of the day, and the weather. The change of character manifests itself in the form of light, texture and other physical qualities. Architects should therefore carefully consider the boundaries which define the place and how the building rests on the ground, and how it rises towards the sky, and how it frames space. Phenomenology of place considers the basic modes of construction and its relationship to formal articulation.

Everyday experience tells us that different actions need different environments, as a consequence, cities consists of a multitude of particular places. Different functions demand places with a different character. For example, a dwelling has to be 'protective', an office 'practical', a ball-room 'festive', and a church 'solemn' (Norberg-Schulz 1980:17).

ARCHITECTURE OF THE SENSES

Various architectures can be distinguished on the basis of the sense modality they tend to emphasise. The architecture of Le Corbusier and Richard Meyer clearly favours sight. On the other hand, the architecture of the Expressionist orientation, beginning with Erich Mendelsohn and Hans Scharoun, favours

muscular and haptic plasticity as a consequence of the suppression of ocular perspectival dominance (Pallasmaa 1996:70). Frank Lloyd Wright's and Alvar Aalto's architecture are based on a full recognition of the embodied human condition. In today's architecture, the multitude of sensory experiences is heightened in the work of Glenn Murcutt, Steven Holl and Peter Zumthor (Pallasmaa 1996:70).

Juhani Uolevi Pallasmaa (1996) in his book 'The eyes of the skin', explains that humanity have always given preference to sight above all the senses. He elaborates by saying that in Western culture, sight has historically been regarded as the noblest of senses. In classical Greek thought, certainty was based on vision and visibility "seeing is believing". Plato regarded vision as humanity's greatest gift. Aristotle considered sight as the most noble of senses. Greek philosophical writings use the metaphors of clear vision and light as truth" Pallasmaa (1996:15).

During the Renaissance, the five senses were understood to form a hierarchical system from the highest sense being vision and the lowest is touch (Pallasmaa 1996:16). In the past, the invention of perspectival representation made the eyes the centre point of the perceptual world. And more recently with the advent of the industrial revolution, our technological culture has ordered and separated the senses even more distinctly. Vision and hearing are now the privileged sociable senses, whereas the other three are considered as archaic sensory remnants with a merely private function (Pallasmaa 1996:16).

Pallasmaa (1996:17) explains that our senses enable us to perceive the world around us; it is the only connection we have to the physical and metaphysical realms, space and place. Furthermore, he explains that architecture is our primary instrument in relating us to space, place and time; giving these dimensions a human measure. "Architecture domesticates limitless space and endless time to be tolerated, inhabited and understood by humankind" (Pallasmaa 1996:17).

The inhumanity of contemporary architecture and cities can be understood as the consequence of the negligence of the body and the senses, and an imbalance in our sensory system. The dominance of the eye and the suppression of the other senses tends to push us into detachment, isolation and exteriority (Pallasmaa 1996:19).

Martin Heidegger, Michel Foucault and Jaques Derrida have all argued that the hegemony of vision has been reinforced in our time by a multitude of technological inventions and the endless multiplication and production of

Figure 2.10 - Architecture of the senses: full recognition of the embodied human condition (Author, 2018).

Figure 2.11 - Photograph showing the contrast in spaces; shadow and light. Architecture indicating the passing of time (Lyle 1994:27).

Figure 2.12 - Diagram indicating the theoretical position in the continuum of architectural thinking (Lyle 1994:34).

images. The only sense that is fast enough to keep pace with the astounding increase of speed in the technological world is sight. But the world of the eye is causing us to live increasingly in a perpetual present, flattened by speed and simultaneity.

TOWARDS A MULTI-SENSORY EXPERIENCE

Merleau-Ponty's philosophy makes the human body the centre of the experiential world. Our bodies and movements are in constant interaction with the environment; 'the world' and 'the self' inform and redefine each other constantly (Pallasmaa 1996:40).

A walk through a forest is invigorating and healing due to the constant interaction of all sense modalities. Architecture is essentially an extension of nature into the man-made realm, providing the ground for perception and the horizon of experiencing and understanding the world.

Architecture gives a conceptual and material structure to conditions of our daily lives. It concretises the cycle of the year, the course of the sun and the passing of the hours of the day. Every touching experience of architecture is multi-sensory qualities of space. Matter and scale are measured equally by the eye, ear, nose, skin, tongue, skeleton, and muscles.

An architectural work is not experienced as a collection of isolated visual pictures, but in its fully embodied material and spiritual presence. The visual frontality of the architectural drawing is lost in the real experience of architecture.

THE EYES: SIGHT AND SHADOW

Previously it was mentioned that architecture of today is ocular centric and only creates flat images that mostly have a negative connotation to it. Pallasmaa (2009:39) explains that in some cases sight should become the prevalent sense, it is only when architecture concerns itself completely with the sense of sight, where it becomes a problem.

In our time, light has turned into mere quantitative matter and the window has lost its significance as a mediator between two worlds; between enclosed and open, private and public, shadow and light. In great architectural spaces, there is a constant, deep breathing of shadow and light; the shadow inhales and illumination exhales light. Pallasmaa (1996:40) states that homogenous bright light paralyses the imagination in the same way that homogenisation of space weakens the experience of being, and wipes away the sense of place.

The eye is the organ of distance and separation, whereas touch is the sense of nearness, intimacy and affection. The eye surveys and investigates, whereas touch approaches and caresses.

THE SKIN: TACTILITY AND TEXTURE

"Hands are the sculptor's eyes" (Pallasmaa 1996:56). The skin reads the texture, weight, density and temperature of matter. He explains that the door handle is the handshake of the building, welcoming us into the space. He states that a pebble polished by waves is pleasurable to the hand, not only because of its soothing shape, but because it expresses the slow process of its formation.

Pallasmaa (1995) explains that our skin can trace temperature spaces with precision, the cool and invigorating shadow under a tree, or the caressing sphere of warmth in a spot of sun, turn into experiences of space and place (Pallasmaa 1996:56).

THE EARS: THE INTIMACY OF SOUND

Sight isolates, whereas sound incorporates; vision is directional, whereas sound is omni-directional. The sense of sight implies exteriority, but sound creates an experience of interiority. "I regard an object, but sound approaches me; the eye reaches, but the ear receives. Buildings do not react to our gaze, but they do return our sound back to our ears" (Pallasmaa 1996:71).

Hearing, structures and articulates, the experience and understanding of space. Pallasmaa (2009:45) explains that a dripping sound in a dark cave has the extraordinary capacity of the ear to carve out a volume into the void of darkness. A space is understood and appreciated through its echo as much as through its visual shape, but the acoustic precept usually remains as an unconscious background experience.

The echo of steps on a paved street puts us in direct interaction with space; the sound measures space and makes its scale comprehensible. We stroke the boundaries of the space with our ears (Pallasmaa

1996:49). Every city has its echo which depends on the pattern, scale, architectural style and materiality. The wide, open spaces of contemporary streets do not return sound, and in the interiors of today's buildings echoes are absorbed and censored. Our ears have been blinded.

THE NOSE: THE PERSISTENCE OF SMELL

The most persistent memory of any space is often its smell. Wood surfaces. A particular smell makes us unknowingly re-enter a space completely forgotten by the retinal memory. Every city has a wide spectrum of smells (Pallasmaa 1996:54). It manifests itself in the form of irregular and short moments; the smell of rain as it hits the hot surface of the road, the smell of timber at an old bar counter, the smell of flowers in the spring breeze, and the smell of water as it trickles in a stream.

THE TASK OF ARCHITECTURE

The task of architecture is to create embodied and lived existential metaphors that concretize and structure our being in the world. Architecture reflects, materialises and eternalises ideas and images of ideal life.

Buildings and cities enable us to structure, understand and remember the shapeless flow of reality (Norberg-Schulz 1980:67). Architecture enables us to perceive and understand the dialectics of permanence and change, to settle ourselves in the world, and to place ourselves in the continuum of culture and time.

CONCLUSION

We live in a time of transition, where the shift is from selfishly harvesting ecological processes for the 'benefit' of mankind; to a time where man is seen as part of nature and its processes, directly influenced by our actions. The dichotomous relationship is fading to its demise and a new world view is emerging.

The paleotechnic world that shaped the industrialized community and destroyed ecology is slowly transitioning to a neotechnic world where natural processes are regenerated and restored to pre-industrial conditions. Architecture is showcasing a new respect for nature by considering the impact that it has on the existing ecology of the site and understands the role and responsibility that it has within the natural realm.

Using the processes that nature provides and working with it to create an architecture that facilitate rather than contradicts it, aids in establishing a better relationship between the urban construct and the natural environment. Circular metabolistic systems that integrated into architecture will improve the well being of its users, whilst simultaneously healing the biosphere.

The project hopes to make a contribution in regenerating socio-economic systems in Centurion. It aims to improve the connectivity between man and nature, by truly making the public part of its processes, by introducing programs that mimic natural cycles of conversion, distribution, filtration, assimilation, storage, and human thought (Lyle 1994:27).

In conclusion, through the application of regenerative theory in conjunction with phenomenology and the latent potentials of Centurion Lake, it has the potential to create a new architype that could be implemented at various locations along the river to improve ecological conditions while re-establishing the lost connection between man and nature.

Figure 2.13 Image depicting Centurion Lake (Author, 2018).

CHAPTER 2

CHAPTER 03 | UNDERSTANDING THE CONTEXT

Context and Site Analysis

Figure 3.1-Satillite photograph of the entire Centurion district (Google Earth,2018)

CONTEXT AND SITE ANALYSIS|

In chapter two the theoretical argument of the dissertation were framed. It defined regenerative theory and phenomenology as it applies to the dissertation question.

CHAPTER THREE BREAKDOWN

The relevant river systems will be investigated and analyzed as a point of departure seeing as it is the largest relevant connection to the project intention. Thereafter the scope will be narrowed down to the Hennops River specifically, situated and forming part of Centurion Lake (the study area). Macro- and Micro Analysis will follow that will investigate the demarcated region of Centurion and the smaller scale Centurion Lake respectively.

INTRODUCTION

Running through Centurion are a network of rivers that systematically converge to form the Hennops river. In turn they spill out into the Crocodile river downstream located towards Hartbeespoort dam.

In order to truly understand the Hennops river and the effect it has on Centurion Lake, the larger river systems needs to be considered. Any problems that are currently present at Centurion Lake are the direct result of alterations made to the river upstream. Thus, any alterations made at Centurion Lake should be very carefully considered as it would in turn directly affect the river situation downstream.

Centurion Lake faces two major problems; the first being large scale siltation process caused by the Kaalspruit in the south-east; and the second being Eutrophication due to mineral rich effluent that is dumped into the river from the Tembisa township. The result is that Centurion Lake has a large sandy deposit that is overgrown by various species of water thriving plants (Tshwane, 2018).

The intention of the dissertation is to take a holistic approach to design that considers the larger network that directly influences the smaller scale study area. In some cases, it is impossible to solve a problem merely through the investigation of the immediate context. The solutions will be one dimensional and will only result in a temporary solution. The idea is to propose a solution that will be a potential permanent solution and ultimately eliminate the problem in its totality.

Figure 3.2- Image depicting the 'man-made' Centurion lake with emphasis on the contrast between the natural flow of the original riverbank and the constructed retaining wall (Author, 2018).

Centurion Lake as it was transformed from a natural river to a man-made lake. The river plane was expanded and pulled back towards Centurion Mall when it was first constructed in 1983 (Tshwane, 2011). On the left side of the image it shows the man-made retaining wall that is constructed using straight lines; on the right-hand side the river displays a natural flow that is in contrast to the man-made retaining wall.

Currently the lake acts as a large silt trap as well as a retention pond for when flooding occurs. This could be seen as a problem or as a solution. The problem poses that the intentions of the Lake's design did not achieve its original goal (to be an urban oasis filled with public vibrancy). On the other hand, the lake traps silt and other harmful substances that in turn partially prevent problems down-stream. As a sub-investigation the dissertation will try to uncover whether or not the river was meant to be turned into a lake and also seek new design solutions to the problems posed in this section.

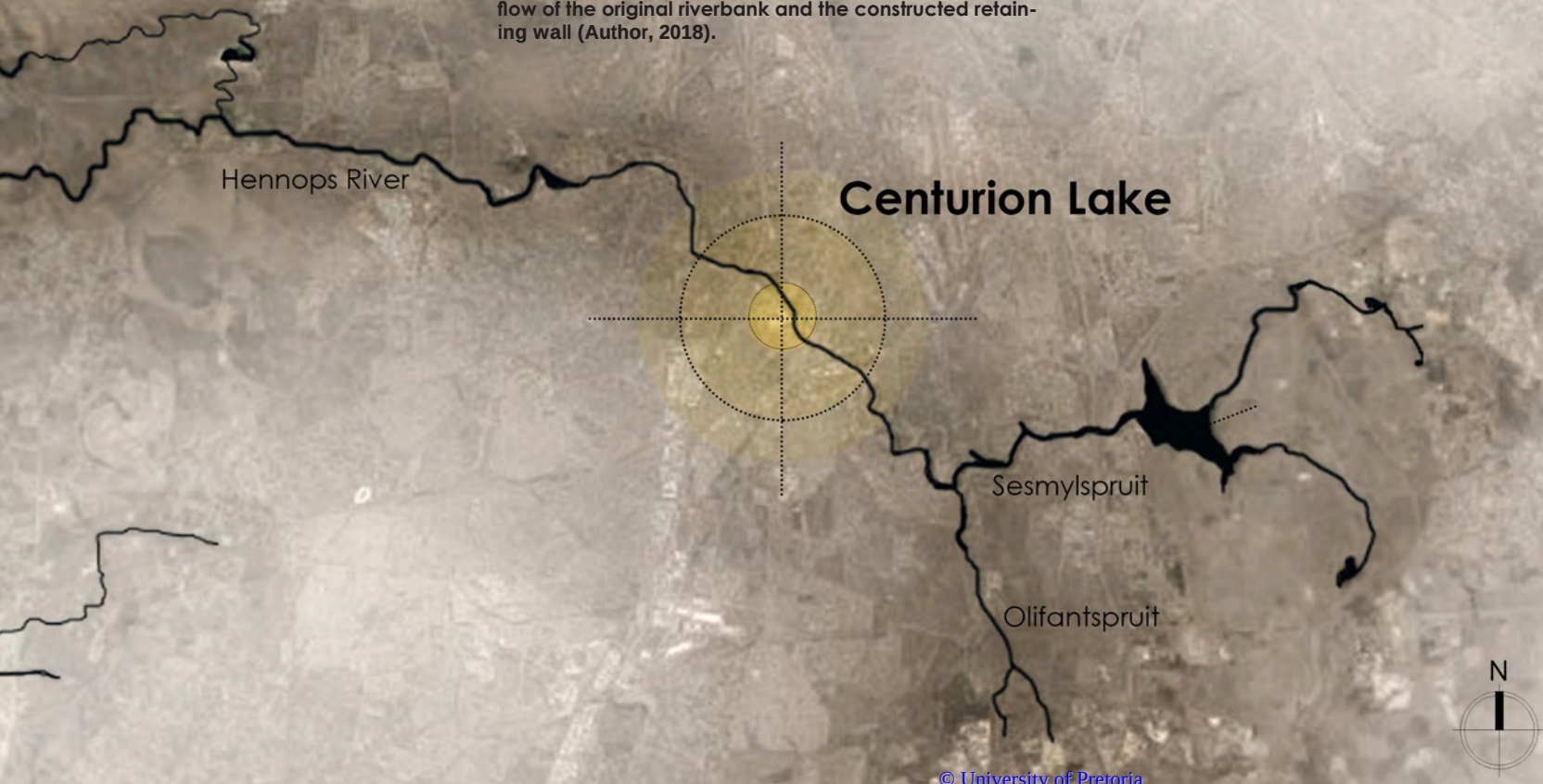


Figure 3.3 - Image depicting the exact location of Centurion Lake in relation to the origin of the water catchment area and the final destination of the water mass namely Hartbeespoort dam (Google/Maps,2018).

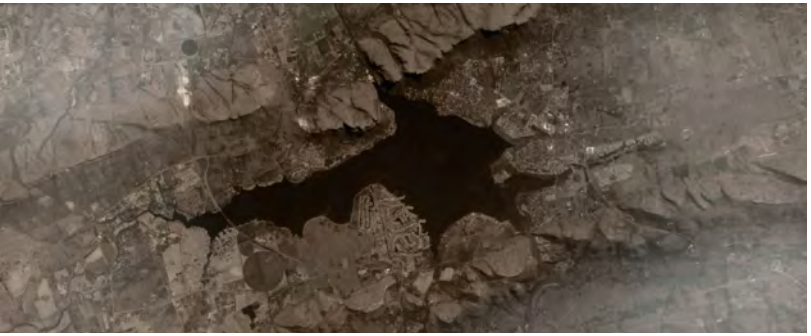
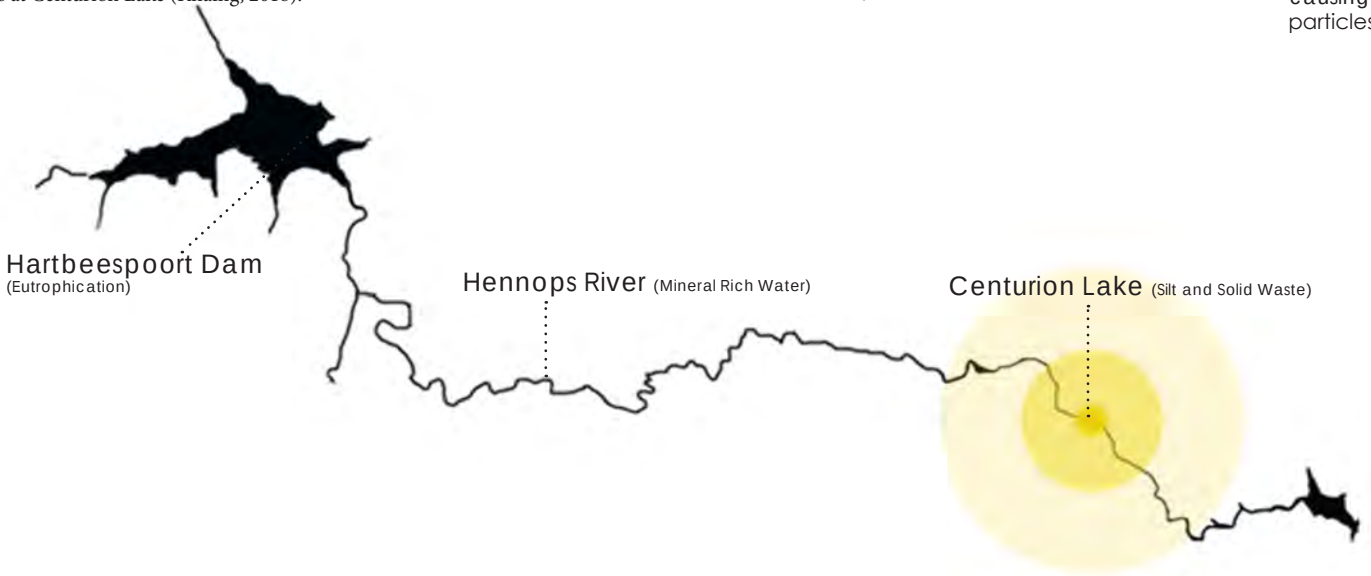


Figure 3.4 - Hartbeespoort Dam- The mineral rich water from the Hennops River causes large scale eutrophication at Hartbeespoort Dam (Harties.net, 2018).

Figure 3.6 - Riverbank Erosion along the Kaal River- The soil erosion causes siltation deposits at Centurion Lake (Khaing, 2018).

Figure 3.5 - Euthrophication (Harties.net, 2018).

Figure 3.7 - Siltation (Photograph by Author, 2018).



LARGE ISSUES, LARGER IMPACT|

EUTHROPICATION AND SILTATION

Very few river systems are in its optimal condition worldwide, many of which faces the same common problems such as bank erosion and a large influx of mineral rich effluent. In this chapter it will become clear that nature has systems in place to deal with these major issues and that human interferance is what largely contributes to the escalation of the problems.

DEFINITIONS

Eutrification -

Eutrification is the process in which water bodies become overly enriched with minerals and cuases large scale plant growth as well as algue bloom in dams.

The degradation of river banks on the one side, and mineral rich effluent carelessly deposited into river systems on the other side are the two main contributors to the euthrophication process. In both these scenareos human interferance is the culporate. Bank erotion is caused when a high velocity water body slowly erode the edges of riverbanks, thus widening and deepening the riverbed. The question is; How are humans to blame? With the addition of highways and bridges over natural rivers very little consideration was given to the floodplanes. Essentially the bridge construction narrowed down the natural flow of the water, thus increasing the flow velocity and ultimately causing the water to eat away into the topography and causing river bank erotion. The bank erotion breaks down the soil particles into very fine silt that gets washed away downstream.

Siltation -

Siltation is caused as a result of the process where mineral particles polute water. It is caused by river bank erotion that deposits large quantity of fine grained particles that is absorbed by water run-off and carried vast distances in river channels.

Siltation poses a risk for all fresh water quatic life and can cuase the die-off of fish if they are exposed to the silt for long periods of time. The silt can form sandy deposits that blocks off segments of river systems and lead to the influx of a wide variety of water thrieving flora. The additional flora poses a threat for the plants currently on site as it imposes into its territory and drains it from its water resources.

Industrial Consequences

The ecological assessment report sanctioned by the Tshwane Metropolitan Municipality revealed that large scale soil erosion is currently occurring on the banks of the Kaal river located to the east of the Tembisa township. North of the township is an industrial area that may be responsible for further water pollution in this area (Tshwane, 2011).

With the advent of the industrial revolution, mass production and large scale warehouses started to emerge. The warehouses are located close to river systems as its industrial use requires a large amount of water to sustain its processes such as power stations, warehouses and factories. These warehouses need an outlet area for the waste water and uses the river as a waste disposal mechanism.

The NEMA (National Environmental Management Act) and National Water Act requires that all outlet water must be inspected and aptproved after the water was purified to an extent, before it can be released into natural river systems. Due to all the pollution currently present in the river system it became clear that these inspections and filtration systems are not being regulated in the manner that the national standards requires it to be.

Riverbank Erosion in the Kaal River

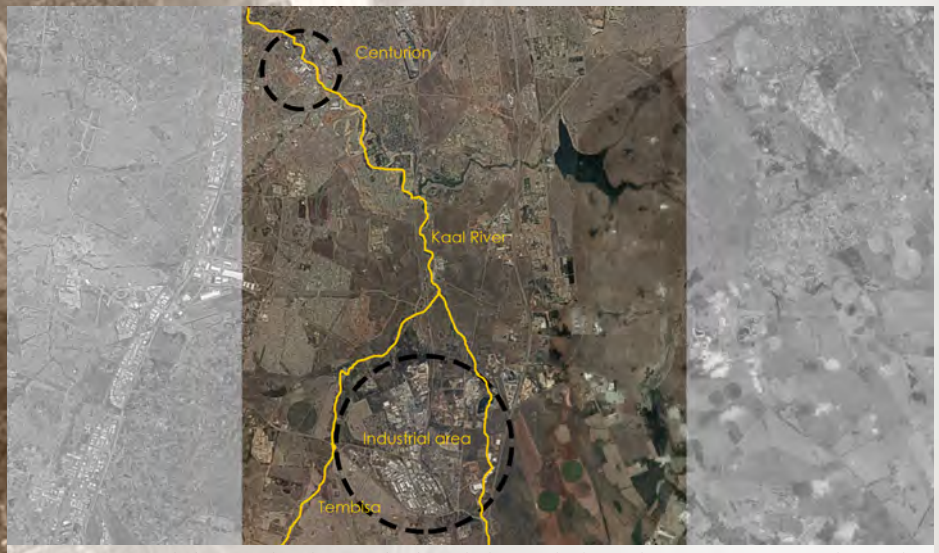


Figure 3.8 - Aerial photograph indicating the direct link, namely the Kaal river, connecting Tembisa and the industrial area to Centurion Lake (Khaing, 2018).

CENTURION | SITE ANALYSIS AND MAPPING

The large scale issues such as siltation and Euthrophication is evident at various segments of the Hennops river; Centurion Lake being a prime example of such an instance.

SITE JUSTIFICATION

Centurion will be the focus of this dissertation as it presents not only many problems but also many opportunities. Viewed in the light of the problem statement, Centurion is seen as a typical example of the disconnection culminating between man and nature in terms of the riverfront that the urban construct have with the river. The Hennops River could be seen as a scar in the landscape as it creates a barrier within the urban condition; or the river could be seen as a possible point of congregation. The site analysis and mapping of the site will reveal that the former is not necessarily true.

WHAT WILL BE ANALYZED?

In order to understand the context a thorough analysis had to be conducted. The site proved to be large in scale and an analysis matrix had to be formulated to narrow down the elements that needs to be analyzed, however, some pragmatic topics were added to gain a deeper insight into the dynamics of the site on a programmatic level.

Primarily the analysis will focus on the wider Urban Context to uncover the larger influences that the context have on the site; thereafter a site specific analysis will be conducted to create a more in-depth investigation of the site. The context analysis is on 'Macro Scale' and the site analysis is on 'Micro Scale'.

The macro scale will enable the author to create relevant connections in the broader context in order to create a responsive proposal. Any proposal that merely considers the site itself is bound to fail the test of time. Larger connections will strengthen the project intention and ensure a holistic approach to design.

On Macro scale, larger relevant connections will be investigated in order to understand how the proposal could tie in with the larger context. Thereafter the immediate context will the analyzed in terms of its theoretical and pragmatic elements. Theoretical analysis will include the historical development of place; and a critique of existing biophilic, regenerative and resilient elements on site.
The pragmatic elements will then be investigated in order to compare it to the theoretical premise.

UNDERSTANDING THE CONTEXT

ANALYSIS STRATEGY

Mapping is a process used to gather as much as possible information about a particular situation or site that will be used to make in-formed decisions when proposing a design on the site. The scope will start out as broad as possible indicating the largest relevant con-nections to the site, thereafter the scope will focus on the urban construct and finally zoom into the site-specific situation.

On urban level the mapping process is further divided into smaller elements. As a point of departure, the historic development of the urban fabric will be to investigated to gain some insight into the original intentions of the site as well as uncovering the story of the place. Knowing the history of the site and how the site developed over time will reveal critical information that will be used to predict how the context will develop in the future. After the historic information is gathered a design strategy could be developed that will be applied to the site-specific circumstances. The existing urban fabric will be analyzed by comparing the old developments to the new developments in order to reveal a potential shift in the architectural continuum. Thereafter, the haptic quality of the site will be inves-tigated to understand the materiality of the existing urban construct. This will allow for a design solution that responds to the urban fabric of the site by designing accordingly.

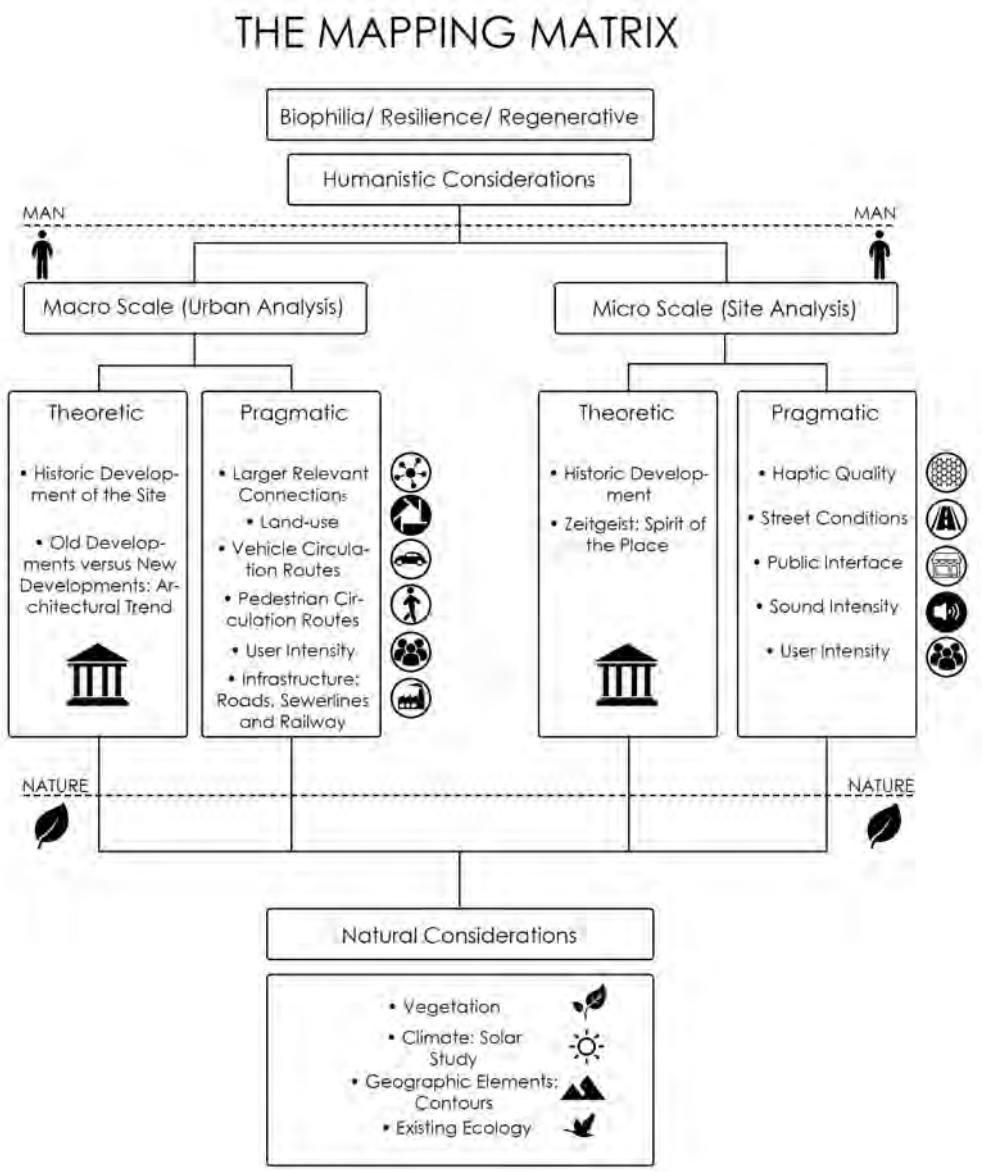
Once the story of place is established the individual buildings are addressed; this include the Land-use patterns and ownership of the buildings. Thereafter the user intensity, the car circulation paths and all necessary infrastructure is mapped.

After the existing infrastructure is mapped, a better sense of the natural elements are considered. Natural elements include the existing ecology, the geographic considerations such as the lay of the land in the form of contours, a solar study and existing vegetation on site.

All these mapped elements contribute to the overall knowledge of site and the data will be used to make informed decisions to exist-ing problems. Conclusion will be drawn from the collected data to be synthesized with the project intentions and theoretical back-ground in order to create a series of solutions of which the most appropriate solution will be explored to a greater extent.

THE MAPPING MATRIX

Figure 3.9 - The following diagram explains the mapping process that was followed in order to achieve the sought after and relevant results:



MACRO ANALYSIS | THE LARGER RELEVANT CONNECTIONS

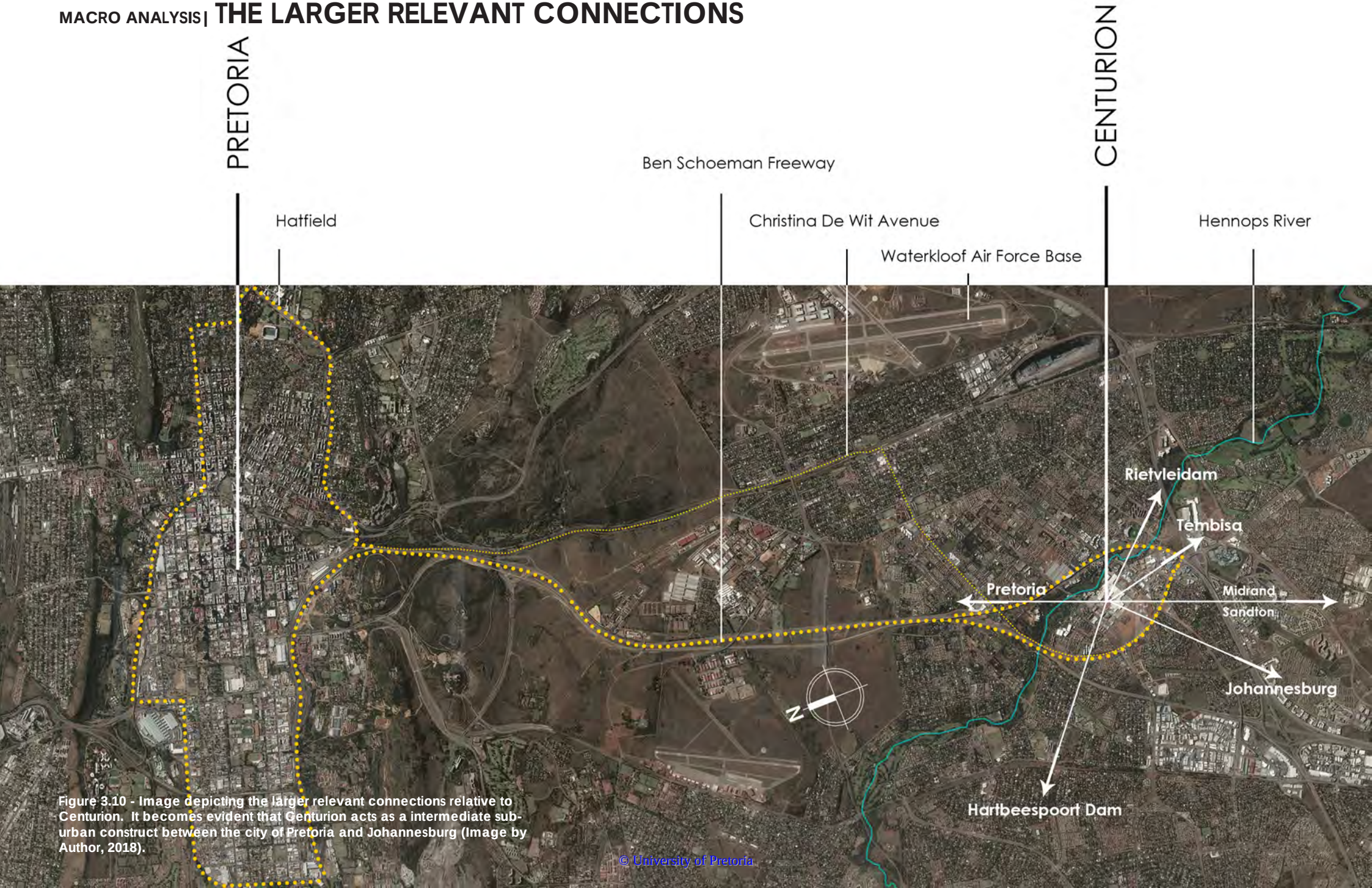
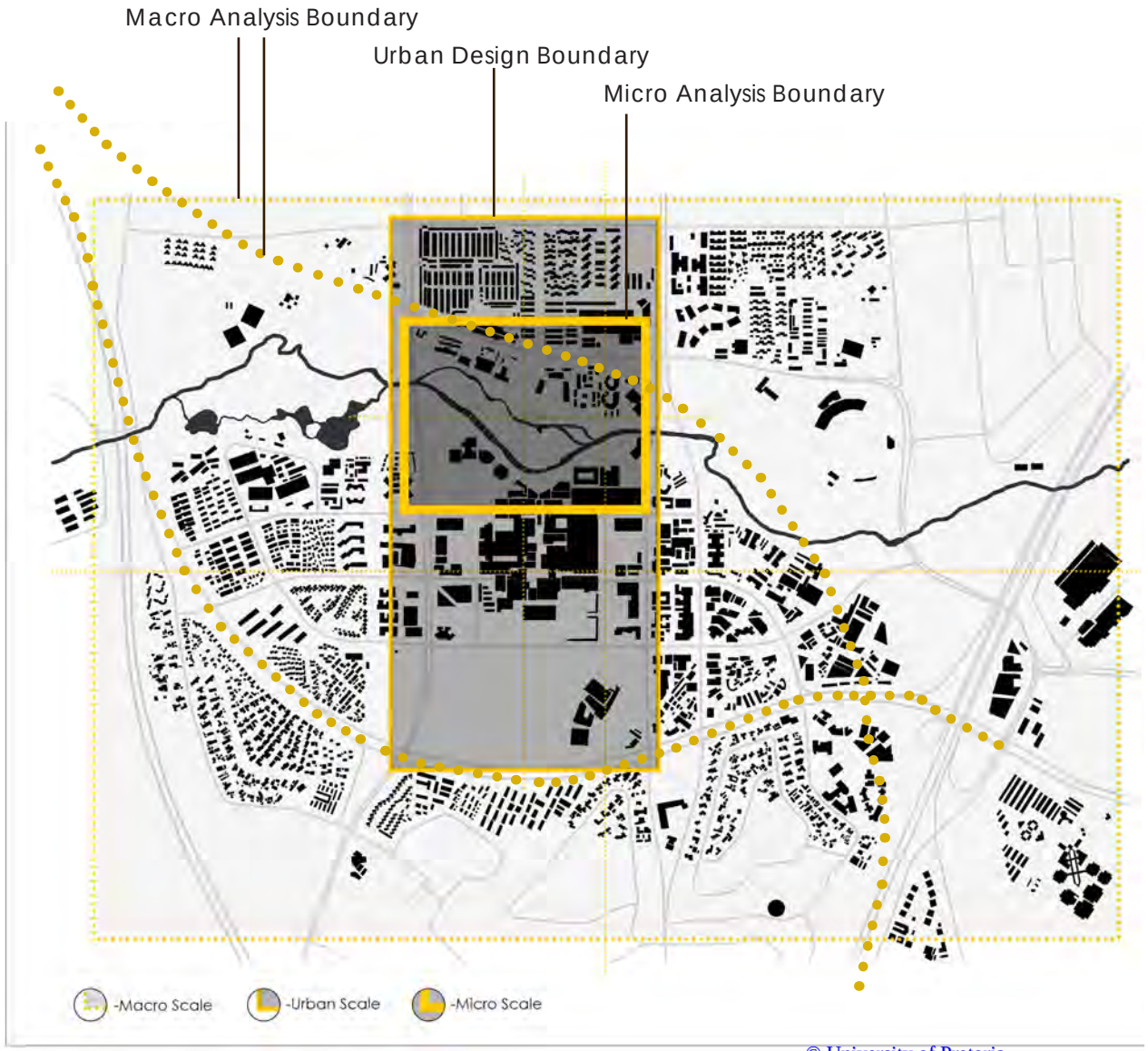


Figure 3.10 - Image depicting the larger relevant connections relative to Centurion. It becomes evident that Centurion acts as a intermediate sub-urban construct between the city of Pretoria and Johannesburg (Image by Author, 2018).

MACRO ANALYSIS (URBAN SCALE)| STUDY AREAS/ANALYSIS BOUNDARIES

Figure 3.11- The mapping layer explains the different scale of investigation. Three scale are apparent; the first is the macro scale that includes most of the Centurion district, the second is the urban scale that includes a portion that is relevant to the urban design, and the last scale is the micro scale that zooms into the functions of the Centurion Lake region.



SITE LOCATION

In order to understand the larger context for the purpose of mapping, strategic study boundaries were identified:

2.1 Macro Scale
2.2 Urban Scale
2.3 Micro Scale

The **Macro Scale** boundary stretches to the peripheries of Centurion CBD so that a larger understanding could be gained as well as an understanding of the effects it has on the smaller micro scaled boundaries.

The macro scaled context proved to be too large for the urban design scheme to be conducted as it loses its intensity, therefore an **Urban Scaled** context was chosen. On this scale individual buildings could be investigated to understand its relationship to its surroundings.

The **micro scale** will be the location where the architectural design intervention will take place. This site was strategically chosen as the site with the most potential to create this type of intervention. The site is effectively the 'Centurion Lake' region including the existing buildings surrounding the lake, located on the riverbeds.

THE STORY OF PLACE

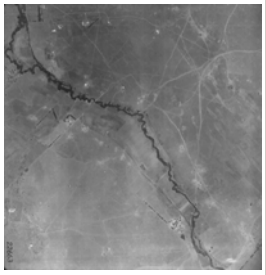
Each city has a story to tell that makes it unique from any other given city. The story of place speaks about a series of events, the clash of cultures and the making of a new. It is the story of place that will give us an insight into the way the citizens were thinking and the influences that shaped their world and ultimately shaped them.

The knowledge of the past will make it possible to predict the future. We can decide to follow in the footsteps of their influences or choose to oppose it as it may not necessarily be relevant with the constant changing environment, albeit natural-, social- or cultural environment.

MACRO ANALYSIS (URBAN SCALE) | HISTORICAL BACKGROUND

1937

Prior to 1937 the river was in its natural state, unchanged by human intervention. Due to the simultanious development of Pretoria (to the north) and Johannesburg (to the south). With the arrival of the first car in South Africa (1897), roads started intersepting rivers (Jhmt.org.za, 2018).



1958

The town of Irene was established in 1902 when 337 plots were laid out on the farm Doornkloof, however,Verwoerdburg Stad (Centurion) developed from the initial Lyttelton Township that was marked out on the farm Droogegrond in 1904 (Anton Heydenrych, 2001).

1964

The classical grid system was used to lay out the first erven and was mostly located to the north of the Hennops River. Here the river can be seen as a natural barrier that divides the urban construct and prohibits its development. Small scale farming also occured along the banks of the river.

1968

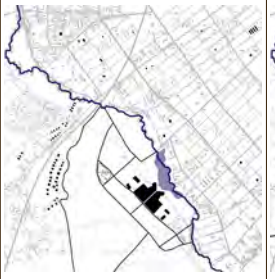
Rising interest in the connection between various surrounding districts lead to an influx of freeways and intricate vehicle circulation networks forming. The first being the Ben Schoeman freeway, constructed in 1966. Freeways causes additional boundaries in the urban construct.

Name change in 1967: Littleton to Verwoerdburg Stad (named after Dr. Hendrik Verwoerd) was a politician, academic and journalist who served as prime minister of South Africa from 1958 (Anton Heydenrych, 2001).

1976

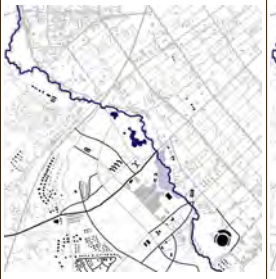
Development within Centurion was limited only to access roads at this time, however, a large cluster of moslty residential units and single storey houses developed on the peripheries with the river and the freeway acting as a barrier to development to enter the center area.

1984

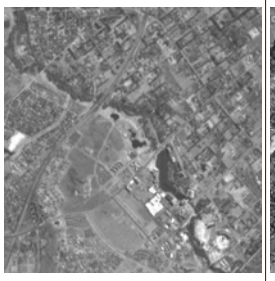


With the invention of the first 'Mall' by Victor Gruen in 1956 Minnesota (Southdale Mall), thousands of malls sprawled accross the world. Developers saw the opportunity and built Centurion Mall. It was the only shopping centre with the standard big-name retailers of that time in Centurion.

1991



The mall attracted a lot of interest and acted as a catalyst for larger developments such as the SuperSport Park Stadium, large residential complexes and businesses.



Name change in 1995: Verwoerdburg Stad to Centurion. Centurion was used as a neutral name, chosen by the residents, after appartheid in 1994 and named after Centurion Park today known as SuperSport Park (the stadium) (Anton Heydenrych, 2001).

2002

In 2000, the Centurion local government became part of the newly created City of Tshwane Metropolitan Municipality, which also includes Pretoria, and the town ceased to have its own Town Council (Anton Heydenrych, 2001).

MACRO ANALYSIS

Figure 3.12 - The figure ground images depict the development of Centurion over time and highlights the events that lead to Centurion transforming from the 'sleepy southern suburb of Pretoria', to the vibrant and rich-with-potential Centurion of today.

2004	2005	2008	2011	2013	2017	2018
						
In 2003, the mall underwent its first major revamp which was estimated at around 250 million ZAR. 29,760 m2 of retail space was added to the mall bringing the mall's total size to 105,000 m2, making it the second largest shopping centre in the Tshwane metropolitan area (Anton Heydenrych, 2001).	The mall's redevelopment encouraged denser urban development in the form of residential units.	Some parts of the original single storey houses were replaced by larger businesses and shopping complexes.	Although the initial works for the Gautrain station commenced in 2006, the railway line was only visible in Centurion around 2010-2011. The project was completed with the opening on 7 June 2012 where the first passanger train passed Centurion stattion (Anton Heydenrych, 2001).	With the addition of the Gautrain station, new development and new possibilities emerged.	Many businesses have relocated to Centurion and property development is boosting the ever-expanding city limits.	Today, Centurion holds the greatest potential for being the next business district of Gauteng. The harmony between man and nature is currently in imbalance and an intervention is still needed to bring the residents to nature as the possiblility exists and have exististed for a long time.
						

In conclusion, Centurion had a slow start as it was always seen as a district of Pretoria and never as a city on its own. It acted as a thoroughfare region, connecting Pretoria to Johannesburg, and consisted mainly of residential pockets with no economic drive itself. The development emerged gracefully around the river as to deny any claims of permanence. It is only after the innovation of 'The Mall' and the development of Centurion Mall, that acted as a catalyst for economic development and the emergence of the Gautrain station, that Centurion truly became a significant region filled with potentials for new innovations.

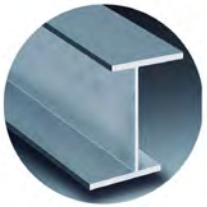
MACRO ANALYSIS (URBAN SCALE) | THE ARCHITECTURAL SHIFT

Brickwork

Concrete

Glass

Steel



Ceramics

Where is the architectural shift in building material most evident?

•Residential single storey dwellings and large residential complexes is mostly constructed out of face brick.

• Businesses after the year 2003 as well as the Gautrain Station has concrete elements.

• Developments after the year 2009 shows elements of glass facades.

• Most recent developments (2012-2018) such as PPS building and the Gautrain Station shows steel details.

• The BCX building is constructed with concrete and cladded with ceramic tiles (built in 2016).

THEY BUILT, WE RESPOND

The investigation juxtapose the first developments to the latest developments to identify a potential shift in architectural trend. It seeks to uncover hidden knowledge about building materials and technologies that were used to form the urban construct. Knowing the general school of thought that was present in the past will provide a clear indication of the appraoch that should be implemented in the future.

The comparitive study between the initial urban fabrick and the new developments, reveal a great difference in the typology and materiality of the precinct that is worth pointing out.

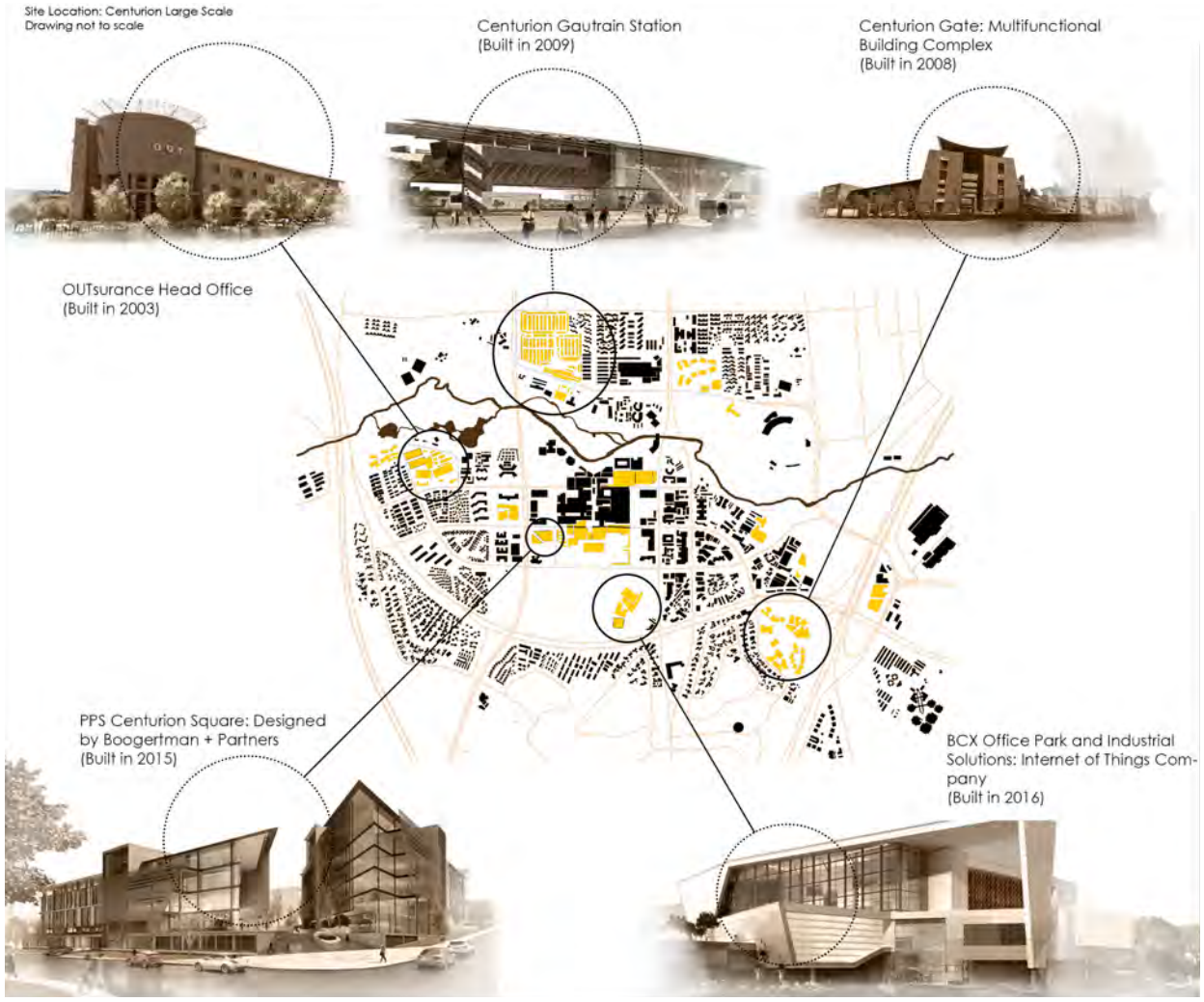
THE EARLY DEVELOPMENTS

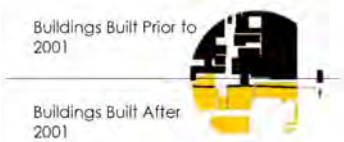
Most of the early buildings are constructed purely out of face brick with the roof being Spanish S-curve clay tiles. The Meerendal residential complex is a typical example of the type of structures that were built during the 1940's. The houses were built with a central courtyard for private space and the arranged around a large communal park that acted as a public gathering space. Nature is present in both the private courtyards as well as the semi-public park. Here man and nature lives in harmony and the nature provides to the residents a biophilic psychological stimuli as they are surrounded by nature in the of their own home.

Figure 3.13 - Photograph indicating the excessive use of facebrick in Centurion (Photograph taken and edited by author, 2018)

MACRO ANALYSIS (URBAN SCALE)| THE ARCHITECTURAL SHIFT

Figure 3.14 - The diagram compares the older developments to the more recent development in order to highlight the architectural shift that occurred (Author, 2018).





Note: Google Earth's Timeline setting only offer the user access to photos from 2001 and onwards.

RELEVANT FINDINGS

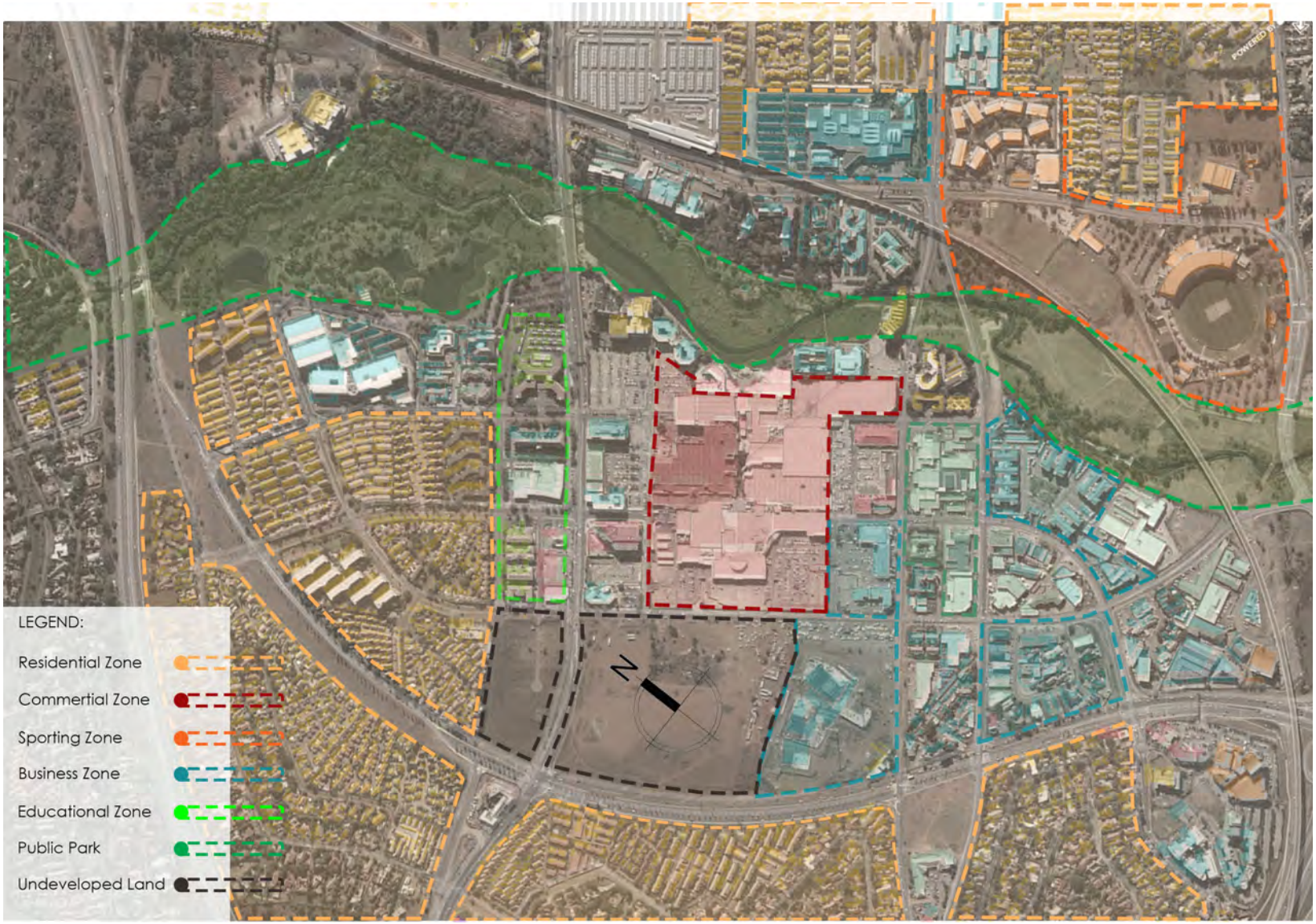
The first developments in Centurion was mostly residential with hints of commercial developments in Centurion central. At this time most of the buildings consisted of brickwork (mostly face-brick facades) and occasionally plastered to a smooth finish. This could be due to the very limited technology of the time, economic feasibility or the availability of bricks, more so than other material.

In the diagram it shows the OUTsurance building that was erected in 2003. The buildings displays a stone masonry facade that is already contrary to the excessive use of brickwork. Centurion Gate, that was erected in 2008 displays a different approach to materiality. The major shift comes in the years later than 2009 where the building materiality, technology and form completely changes. This could have been sparked by the Gautrain Project that aimed at creating an architectural language that speaks to multiple contexts all across Gauteng.

The shift could also be a result of the particular zone that the building is located within. Various zones can be identified that simplifies the urban construct. The main zones that are present include the residential-, industrial -, commertial- and educational zone. Other area include public parks and sporting facilities.

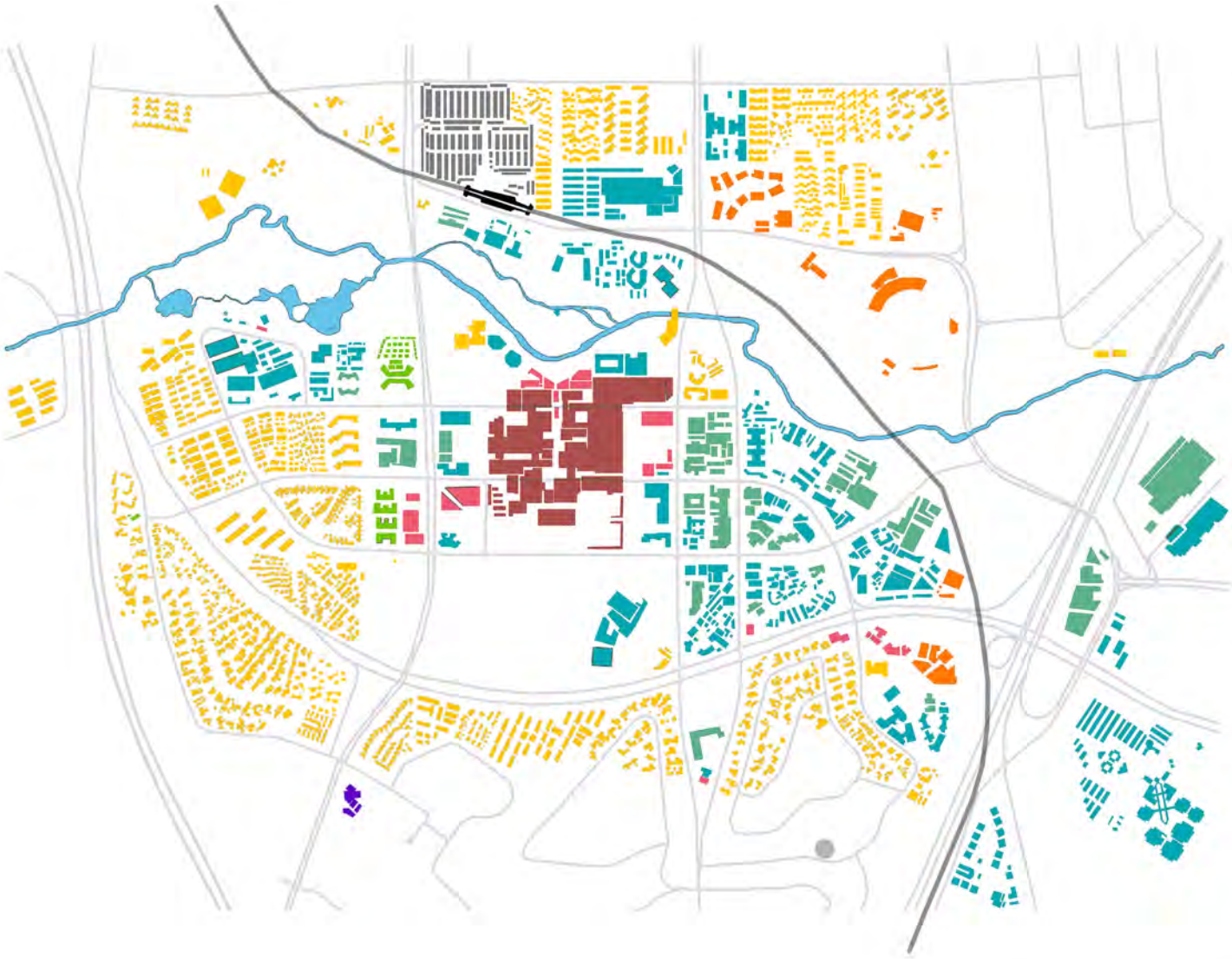
MACRO ANALYSIS (URBAN SCALE) | THE EXISTING URBAN CONDITION (ZONING)

Figure 3.15 - Diagram highlighting the different zones currently present in Centurion as well as the proportional relationship between the various zones. It is important to note the current attitude of the urban construct towards the river indicated in dark green (Author, 2018).



MACRO ANALYSIS (URBAN SCALE)| THE EXISTING LAND-USE PATTERN

Figure 3.16 - Diagram highlighting the current land-use patterns that are present on site (Author, 2018).



Offices
Car Dealerships
Educational
Residential
Sport
Fast Food and Restaurants
Shops
Religious
Transport

DESCRIPTION

Centurion Mall is strategically placed alongside the Hennops river and surrounded by businesses and car dealerships. The residential districts are situated on the peripheries of the CBD. Secondary activities such as religious buildings and sporting facilities are located in the residential areas where it is easily accessible.

RELEVANCE

The overall distribution of land-use is relatively successful as it caters for a wide variety of people, however, leisure activities are not present. Centurion accompanies first and second spaces ,such as business parks to work at, and residential districts to live in, but does not provide public parks or recreational spaces other than shops, restaurants and the cinema.

MACRO ANALYSIS (URBAN SCALE) | VEHICULAR CIRCULATION ROUTES

Figure 2.17 - Diagram highlighting the current vehicular movement patterns as well as the Gautrain bus stops (indicated in red) and other forms of public transportation such as private company bus stops and uber drivers (marked in black and blue respectively) (Author, 2018).

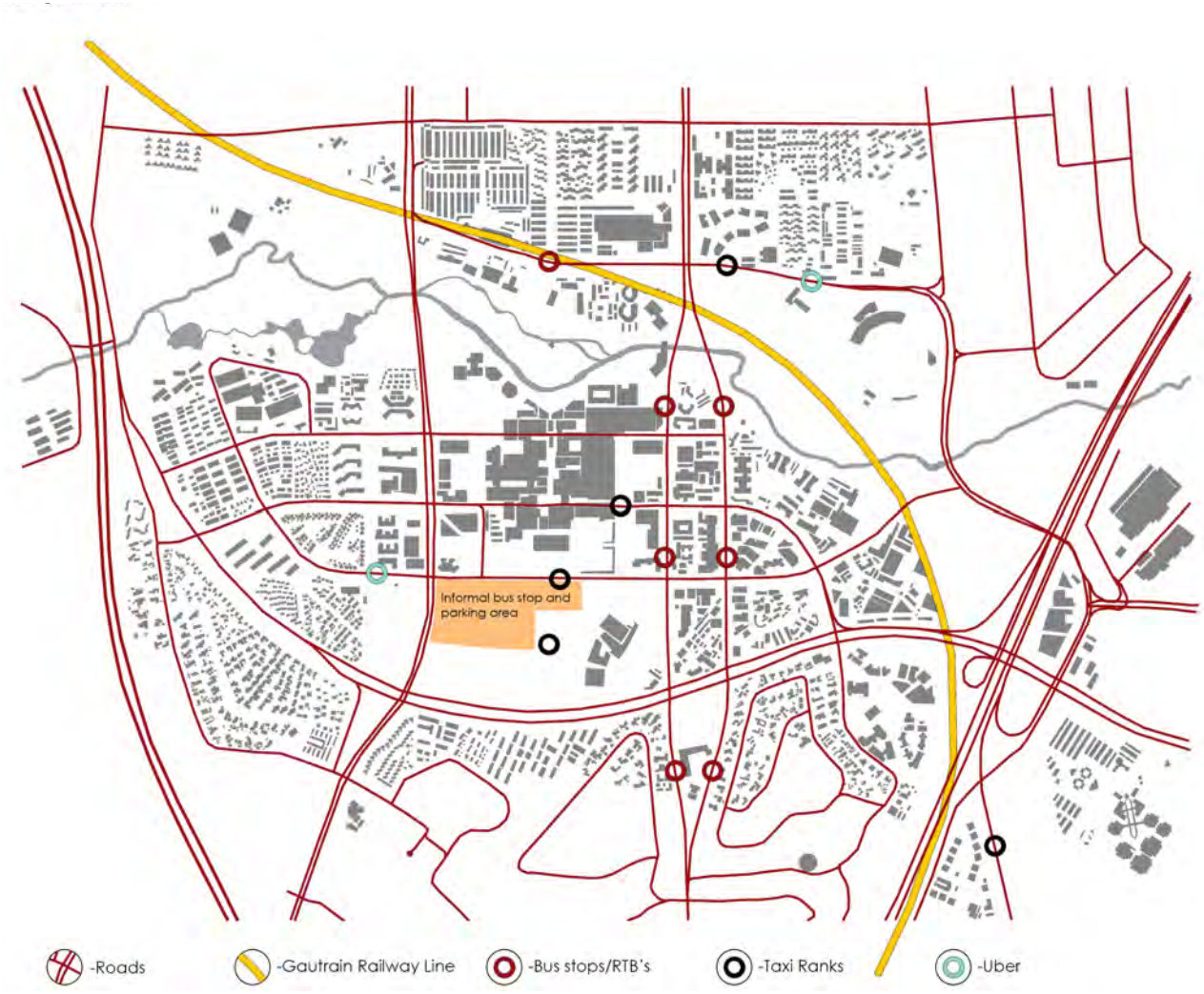


Figure 3.17 Photograph indicating the excessive use of facebrick in Centurion (Photograph taken and edited by author, 2018)

TRANSPORATION, WALKABILITY AND VIBRANCY

" Like any living system, the city should be compact; and should be designed primarily for a population of living things, rather than machines like cars" (Register 2006:183).

Mapping the roads and other forms of transportation systems will enable us to link certain existing networks with other relevant connection, as well as connect Centurion to other cities and districts such as Hatfield, Pretoria, Midrand, Sandton, Rosebank and Johannesburg. The road and railways connect vast regions locally as well as connecting Gauteng with places internationally, considering the Gautrain connecting all the nodes to O.R Thambo International Airport.

On a smaller scale, public transport systems are diverse and functioning optimally within Centurion. These systems are the systems that the author propose to be utilized to a greater extent, as opposed to private mean of transportation.

The ultimate urban goal revolves around transport and addresses the means in which it could be better implemented. Two aspects take priority; firstly, creating an urban environment where walking is the primary form of transportation. Secondly, encouraging public transportation above private transportation.

Richard Register states that *" What we build creates possibilities for, and limitations on, the way we live"*. He goes on by saying *" Developments accessible virtually only by car, have replaced towns and neighbourhood centres, shifting social spaces from public to private control"*. He argues for a city that is built for pedestrians and not for vehicles (Register 2006:8)

The result is a city that contains pedestrain friendly sidewalks; reduced vehiclular congestion on the roads; reduced parking areas that could otherwise be used to increase essential economic developments to improve the vibrancy of the city; and truly create streets for people by pedestrianising certain streets or make use of public transportation devices such as the Gautrain or busses.

CENTURION GAUTRAIN STATION

With the advent of the Gautrain Railway System, transportation within Gauteng became significantly easier and more accessible for the every-day pedestrian. For the first time it is possible for pedestrians to broaden their travel distance to various parts of Gauteng without being dependent on multiple forms of transportation to reach their destination. In the past the traveler had to make use of multiple stages of taxi and bus systems in order to reach their destination, with each trip adding significantly to the travel costs and time spent traveling. The Guatrain on the other hand makes it possible to reach the same distance with reduced travel time and costs.

Figure 3.18 - Photograph of the Gautrain at Centurion station (Gautrain Centurion, 2018).

INFORMAL BUS STOPS

Located to the south of Centurion Mall on a large vacant piece of land, an informal bus stop and bus storage phenomenon has occurred (indicated in orange in figure 2.10). Prior to date (2018) the buses made use of other pieces of land to use as parking grounds; these include smaller vacant lands that are located closer to the homes of the bus owners as well as the grounds of the bus company itself. An increase in the need for public transportation led to the influx of buses that need to be stored. These storage areas proved insufficient for the number of buses active in these areas and led to illegal storage on any available open land parcels.

Another major contributing factor is that the owners of these buses live outside Centurion on the peripheries of Gauteng (Sandfontein and Daspoort) and the traveling costs from those areas to the desired destination of the buses (Centurion) are seen as unnecessary costs. Most of these buses are used for public transportation within Centurion and its suburbs during the day (school children and pedestrians) and stored on this site, illigally, in order to cut traveling costs to the far reaches of Gauteng's peripheries.

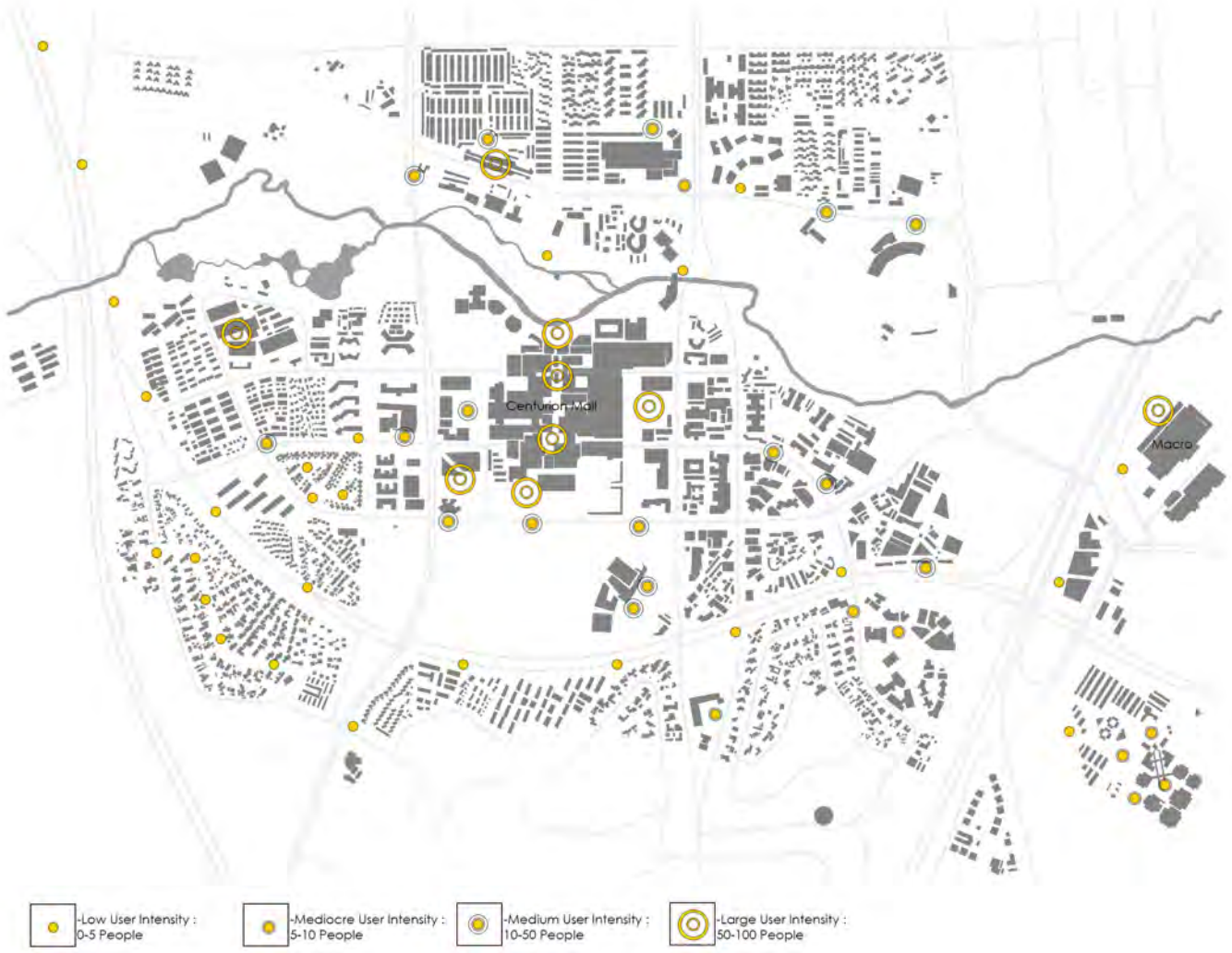
Mapping the buses and where they prefer to stop gives a clear indication that bus terminals and storage facilities are in great demand and lacking within Centurion. This aspect should be considered within the urban design framework to ensure that all needs are satisfied.

Figure 3.19 - Public transport systems and the potential of BRT systems (Photograph taken and edited by author, 2018).

Figure 3.20 - Photograph indicating the excessive illegal parking of busses on vacant land within Centurion (Photograph taken and edited by author, 2018).

MACRO ANALYSIS (URBAN SCALE) | USER INTENSITY

Figure 3.21 - Diagram highlighting the pedestrian circulation paths and user intensity of the study area. The diameter of the yellow circles is directly proportionate to the intensity of the users. In other words, the larger the circles, the more user intense the site is (Author, 2018).



WHERE ARE THE USERS MOST ACTIVE?

It is the author's opinion that one of the greatest architectural informant is the people. Architects designs for people and therefor one should investigate where the most people in the study area lingering and why they choose to use those spaces above all others.

It is evident that the user intensity is most concentrated at the large scaled commercial buildings such as Centurion Mall and Macro. Register states that *"Investment potential is very high where many people congregate. More people per square meter equals more money per square meter"*. This could be the reason for the user intensity to be high at these places as these facilities caters for the larger community and their needs, however, Centurion Mall is successful in terms of its open public promenade that creates a comfortable and scenic space.

Other popular spaces that has a high user intensity is the newer developments as they offer a wide variety of services to the public. Looking at the historic development of Centurion it reveals that the residential districts emerged first on the pheripheries and were later supplimented with commertial activity in the core. This is contrary to most city development that is establised by creating a strong commertial and communitycore that encourages residential development around the core.

USER CONCENTRATION IN RESIDENTIAL AREAS

"As we build, so shall we live. As we live, so shall we become" (Register 2006:2).

The mapping revealed that there are very little public spaces for the community to gather. The only proper public space is the mall's green promenade and a small food hub in Heawel street(east of the mall). This limits socio-cultural interaction and the sosial well-being of the citizens. The buildings turn its pack to social interaction and so will the citizens become.

CENTURION MALL PROMENADE

Built in 1983, the original intention of the promenade was to connect the urban construct to the man-made lake.

The promenade were designed in such a way as to gradually lead the public from the residential districts (on the south), to the man-made lake on the northern side of the Mall. Along the promonade are a series of storefronts and restaurants that acts as 'pause-spaces' and constitute the 'third-space or leisure spaces' currently present in the study area.

A CRITIQUE ON 'THE MALL'

'Mall' is a term used predominantly in North America. Before the mall, a cluster of retail shops were refered to as shopping centres. These centres were usully arrange in long thin structures with parking bays located just past the walkway, in other words it was completely open aired. The fully enclosed shopping mall did not appear until the mid-1950s with the first being Southdale Mall in Edina, Minnesota, designed by Victor Gruen (an Autralia-born Architect). He was seen as the pioneer for the invetion of the mall in this enclosed form. It is extremely odd that only thirty years later (1982) Centurion Mall was built as an open-aired 'shopping centre' in some areas and enclosed in others. Centurion Mall then acts as a hybrid version of a mall and a shopping centre. The return to open-aired shopping centres are encouraged in this dissertation and coinsides with the theory of 'Ecocity design' that will be discussed in the theory section to come. Nature should be allowed to integrate with architectural spaces. Register (2006:2) states " We build environments that help build us".

Figure 3.22 - The intimate promenade of central Centurion Mall showing small public spaces, natural features and comfortable 'pause spaces' (Photograph taken and edited by author, 2018).

TOWARDS AN INTEGRATED PUBLIC REALM

Located to the East of the mall are small commertial zones that consists mostly of unique restaurants, aparel stores, tech shops and small kiosks. A recent addition to Centurion is a small craft beer restaurant called Carlsberg, originating from Copenhagen, Denmark. This scheme, together with other creative innitiatives revitilized a section of Heawel street. As more spaces need this kind of revitilization of public spaces, it becomes clear that more creative innitiatives need to be established.

On urban design level, the aim is to join the public spaces that has a high user intensity that is to the convenience of the users. For instance if the Gautrain station and Centurion Mall could be joined with a path, it would be to the benefit of both.

Figure 3.23 - Photograph indicating the new 'Little Britain Pub' that opened in the beginning of 2018. The pub contributes greatly to the vibrancy on street level, however, there are a lack of public spaces in Centurion of a similar nature (Photograph taken and edited by author, 2018).

MACRO ANALYSIS| PHOTOGRAPHIC STUDY

Figure 3.24 - Diagram explaining the movement logic of the photographic series to follow (Author, 2018).

Figure 3.25 - Photograph showing the southern elevation of the urban construct clearly indicating Centurion Mall and the Gautrain station (Photograph taken and edited by author, 2018).

Figure 3.26 - The new (2017) BCX head office, built on a vacant land parcel to the south of Centurion mall (Photograph taken and edited by author, 2018).

Photographs indicating the existing BCX head office building; Centurion Mall south entrance and South street respectively.

Figure 3.27 - The new (2017) BCX building surrounded by informal markets and taxi ranks (Photograph taken and edited by author, 2018).

Figure 3.28 - The southern entrance and exit of Centurion Mall built in 2017 (Photograph taken and edited by author, 2018).

South street is a one-way street that runs from East to West through Centurion and is used as the main circulation artery of the mall. Vehicles move between 60-80km/h on this street. Centurion Mall's south parking exists onto south street. The sidewalks are paved on the side adjacent to Centurion Mall; and bare ground is used as paving across the road. The pedestrian's experience is uncomfortable and potentially dangerous ,caused by high speed vehicles passing by, when crossing south street. The original entrance to Centurion Mall is closed off by a large retail structure (refer to figure 2.28). The addition of the structure was to inprove the edge conditions of the mall's exit, however, the opposite was achieved as the structure creates a dead interface with the vast parking area.

Figure 3.29 - Panorama photograph indicating the existing street condition of South Street. One will notice a strong contrast between the streetscape on the left of the photograph compared to that from across the road (Author, 2018).

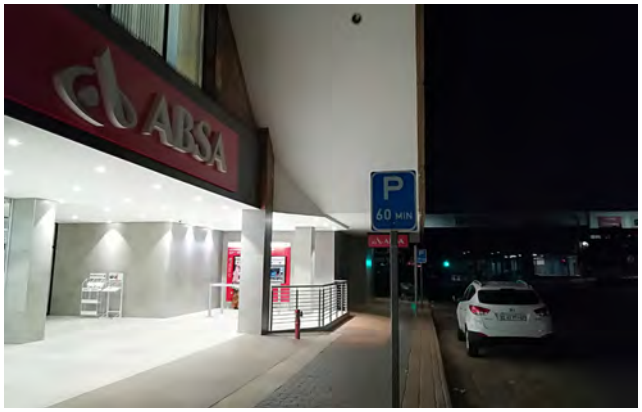
MACRO ANALYSIS| PHOTOGRAPHIC STUDY

Figure 3.30 - Panorama photograph of the 'dead-end' interface created by the new entrance structure of Centurion Mall. The unpleasant nature of this space is further exacerbated by the presence of an obstruction barrier, that serves the function of providing ventilation to the basement parking, followed by a wall (left of photograph).

Figure 3.31 - Two photographs of the relatively new (2016) PPS office located in Heuwel road (Photograph taken and edited by author, 2018).

OLD VERSUS NEW DEVELOPMENT

Mapping the new developments and comparing it to the older developments can give a clue as to how the design trend of Centurion has changed, abeit for the better or worse. In Heuwel street such a comparison can be made by contrasting the nature of the PPS head office with the older ABSA office. Built in the 1980's the ABSA building opened up its ground level to the street for pedestrians to be 'scooped-up' into the building, no boudaries prevent access. The new PPS building (built in 2017), rises its ground floor onto a plinth-like structure, removing itself from the street but connects again by a flight of stairs leading up to a restaurant creating in essence a 'new' ground level. In terms of facade materiality, the older buildings are mostly bricks and aggregate; and the new developments moslty steel and glass.



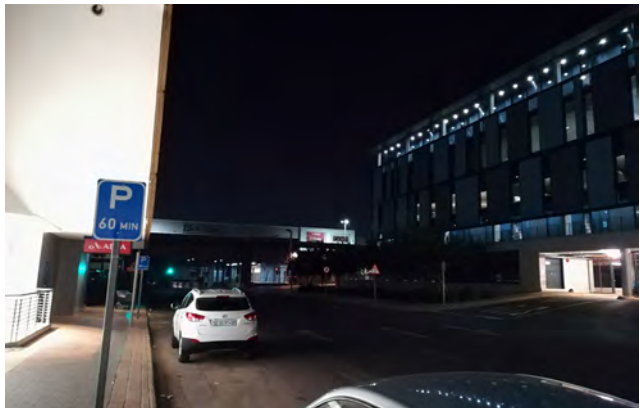


Figure 3.32 - Three successive images showing the current night-time atmosphere in Heawel Road. The new PPS building houses a restaurant called 'Industrial Coffee Works' on its ground floor that improves the night time vibrancy on street level. Withdrawing money from the ABSA ATM feels much safer at night due to the passive surveillance offered by the restaurant patrons lending their eyes to the streets (Photograph taken and edited by author, 2018).

SHORT-TERM SOLUTION; LONG-TERM EFFECT

Between the years 2002 and 2004, Centurion Mall underwent its second major renovation (refer to the timeline on page 21and 22). Back then the mall's business bloomed due to the very unique nature of the lake and all that it has to offer. The mall urgently needed more floors space to accommodate the new retail opportunites presented to them, thus leading to a major contruction project to erect a two storey structure, adding 29,760 m^2 to the rentable floor area. However, there was a problem with adding the area as it would enfringe on Heuwel road (the main road that lead to the main entrance of the mall). One solution was to place the structure over the road to avoid any conflict with the vehicle circulation (refer to figure 2.33 below), creating a dark and extremely unpleasant and potentially dangerous space underneath the retail spaces. In an attempt to solve complicated stormwater drainage problems, they decided to excavate into the ground and create a tunnel of some sort, leading the water down the alley into storm water channels. Over time the channels seized to function as it should, leading the tunnel to fill up with storm water, ultimately leading to traffic conjestion or total closure of the underground vehiclar circulation artery.

PUBLIC SPACE IN A SOUTH AFRICAN CONTEXT

It is no secret that there is a severe lack of public space within South Africa. It is important to note that the definition of a public space refer to that originating from European cities. Spaces that are truly public space are owned in a sense by the public. Access to these spaces are open to litterally anyone and does not belong to a certain income class that monitors access. It is intimate spaces that create vibrant and safe space that promotes human interaction. Centurion's open aired promenade (refer to figure 2.35 below) constitutes such a public space, however, it isolated location and the fact that its owned by one central body takes away form its inclusiveness. Nontheless, it is the closest to the European definition of a public space that South Africa has to offer and may be the reason for the mall's success.

Figure 3.33 - Extension to the mall creating a tunnel road underneath it. The tunnel is aesthetically unpleasing and occasionally floods (Author, 2018).

Figure 3.34 - New 'Little Britain Pub' that improved the street condition significantly (Author, 2018).

Figure 3.35 - Central open-aired promenade cutting through Centurion Mall. Introducing nature within its scar, connecting man with nature once again (Photograph taken and edited by author, 2018).

Figure 3.36 - The relatively small portion of Centurion Mall that is two storeys in hight; creates a dead-end as opposed to a closed-loop, thus is mostly inactive (Photograph taken and edited by author, 2018).

Figure 3.37 - The promenade exists onto Centurion Lake with a large amphitheatre to view the water fountains (Photograph taken and edited by author, 2018).

Figure 3.38 - New (2018) office development across Centurion Lake. The erf is the perfect location for a link between the Mall and the train station (Photograph taken and edited by author, 2018).

MICRO ANALYSIS (AREA OF FOCUS) | HISTORICAL BACKGROUND

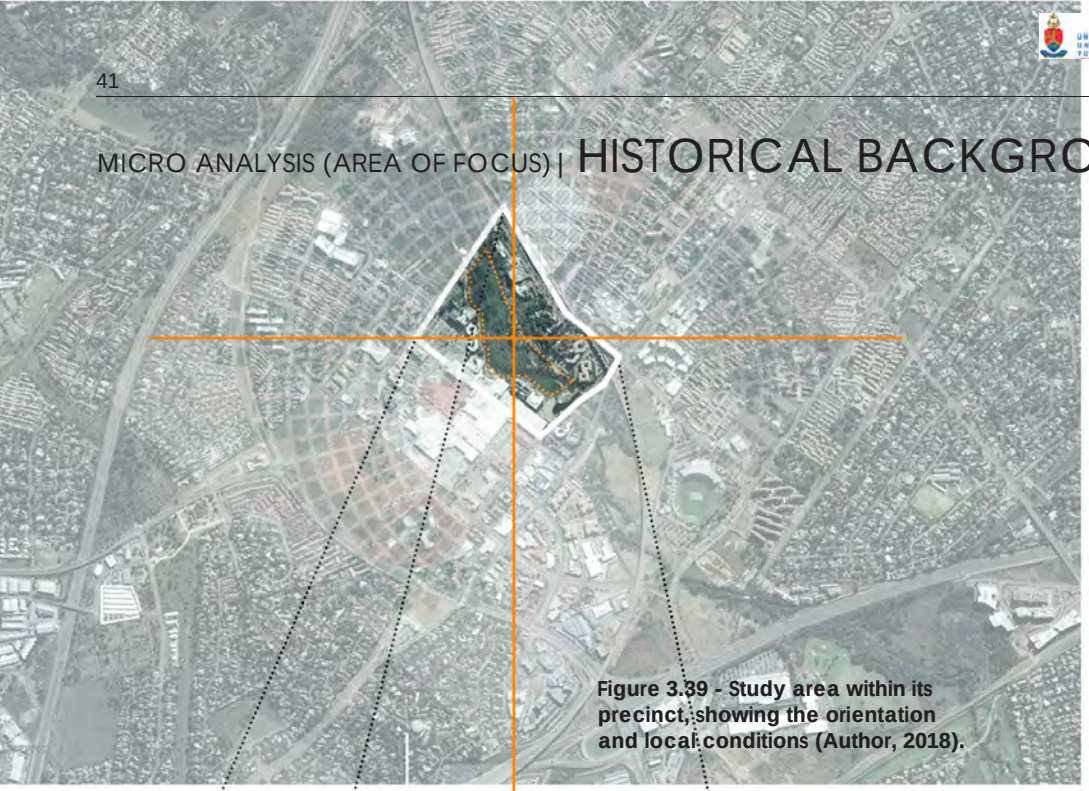


Figure 3.39 - Study area within its precinct, showing the orientation and local conditions (Author, 2018).

Figure 3.40 - Close-up of the study area showing the precinct buildings located on the riverbank as well as its orientation (Author,2018).

MICRO ANALYSIS

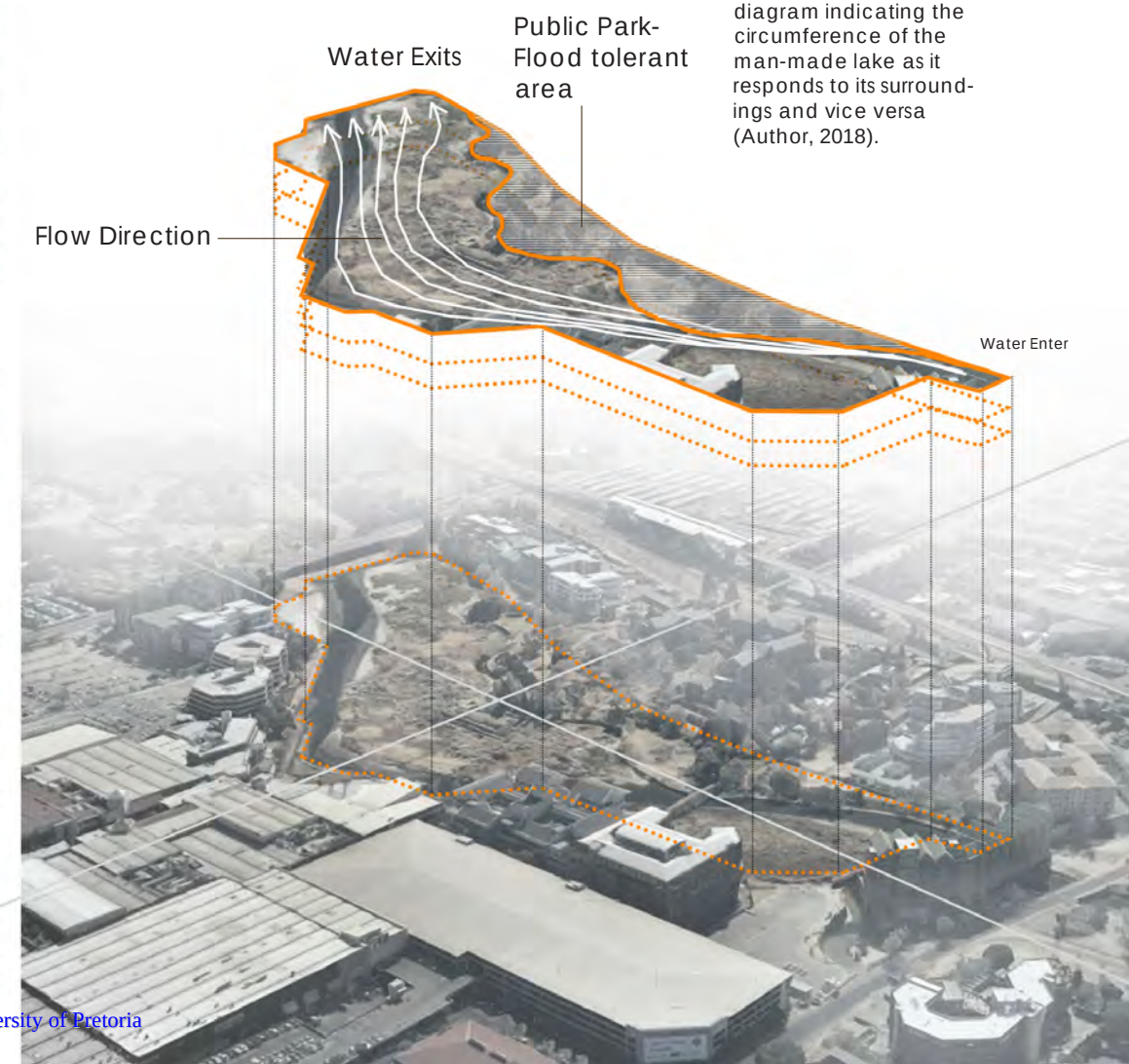


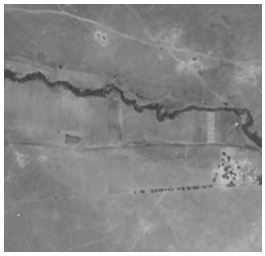
Figure 3.41 - Explosion diagram indicating the circumference of the man-made lake as it responds to its surround-ings and vice versa (Author, 2018).

Figure 3.42 - The image highlights the neighbouring buildings in relation to Centurion Lake as well as a list of programmes connected to each building as it exists currently on site (Author, 2018).

MICRO ANALYSIS | HISTORICAL DEVELOPMENT

1937

Prior to 1937 the river was in its natural state, unchanged by human intervention. Due to the simultanious development of Pretoria (to the north) and Johannesburg (to the south). With the arrival of the first car in South Africa (1897), roads started intersepting rivers (Jhmt.org.za, 2018).



1958

The town of Irene was established in 1902 when 337 plots were laid out on the farm Doornkloof, however,Verwoerdburg Stad (Centurion) developed from the initial Lyttelton Township that was marked out on the farm Droogegrond in 1904 (Anton Heydenrych, 2001).

1964

The classical grid system was used to lay out the first erven and was mostly located to the north of the Hennops River. Here the river can be seen as a natural barrier that divides the urban construct and prohibits its development. Small scale farming also occured along the banks of the river.

1968

Rising interest in the connection between various surrounding districts lead to an influx of freeways and intricate vehicle circulation networks forming. The first being the Ben Schoeman freeway, constructed in 1966. Freeways causes additional boundaries in the urban construct.

Name change in 1967: Littleton to Verwoerdburg Stad (named after Dr. Hendrik Verwoerd) was a politician, academic and journalist who served as prime minister of South Africa from 1958 (Anton Heydenrych, 2001).

1976

Development within Centurion was limited only to access roads at this time, however, a large cluster of moslty residential units and single storey houses developed on the peripheries with the river and the freeway acting as a barrier to development to enter the center area.

1984

With the invention of the first 'Mall' by Victor Gruen in 1956 Minnesota (Southdale Mall), thousands of malls sprawled accross the world. Developers saw the opportunity and built Centurion Mall. It was the only shopping centre with the standard big-name retailers of that time in Centurion.

1991

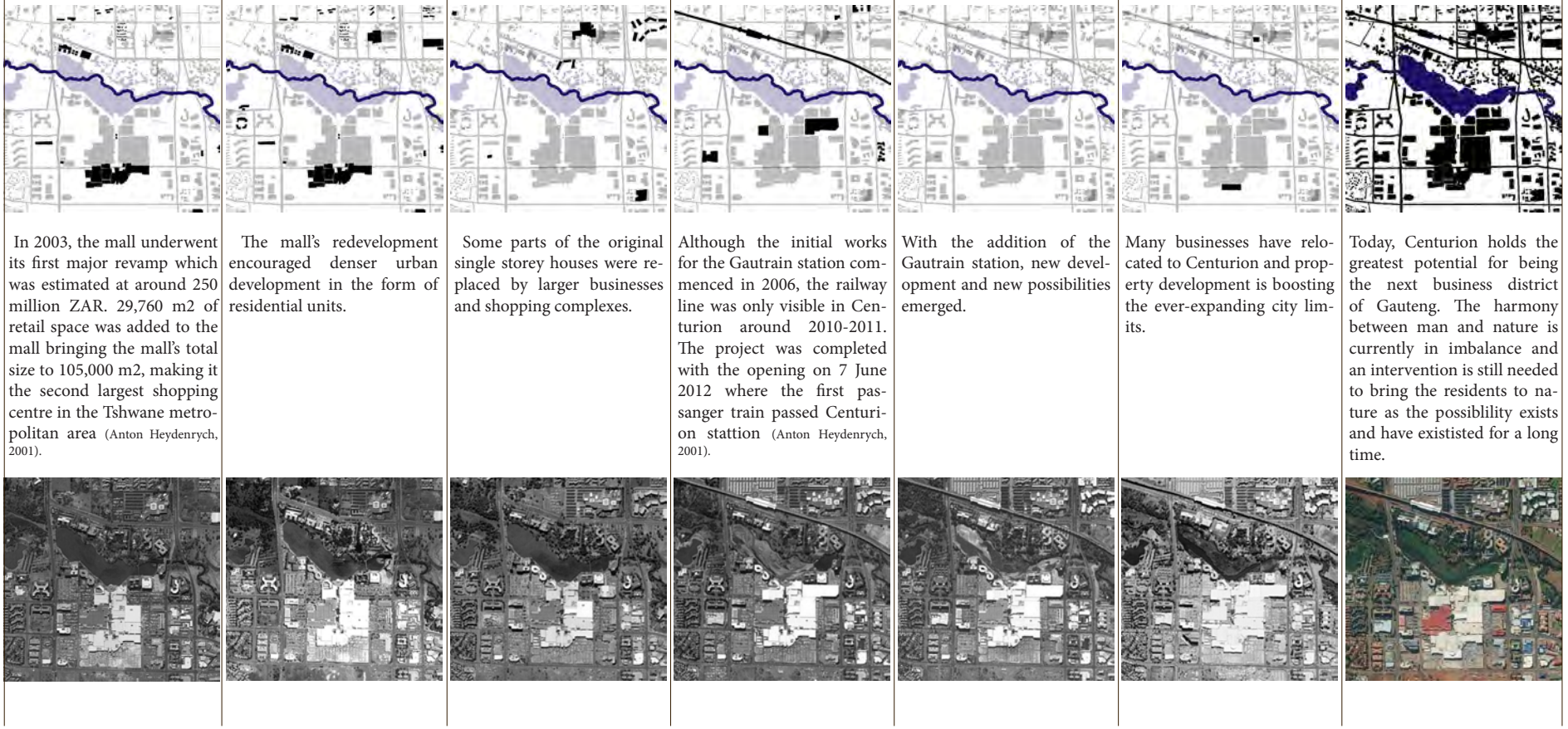
The mall attracted a lot of interest and acted as a catalyst for larger developments such as the SuperSport Park Stadium, large residential complexes and businesses.

Name change in 1995: Verwoerdburg Stad to Centurion. Centurion was used as a neutral name, chosen by the residents, after appartheid in 1994 and named after Centurion Park today known as SuperSport Park (the stadium) (Anton Heydenrych, 2001).

2002

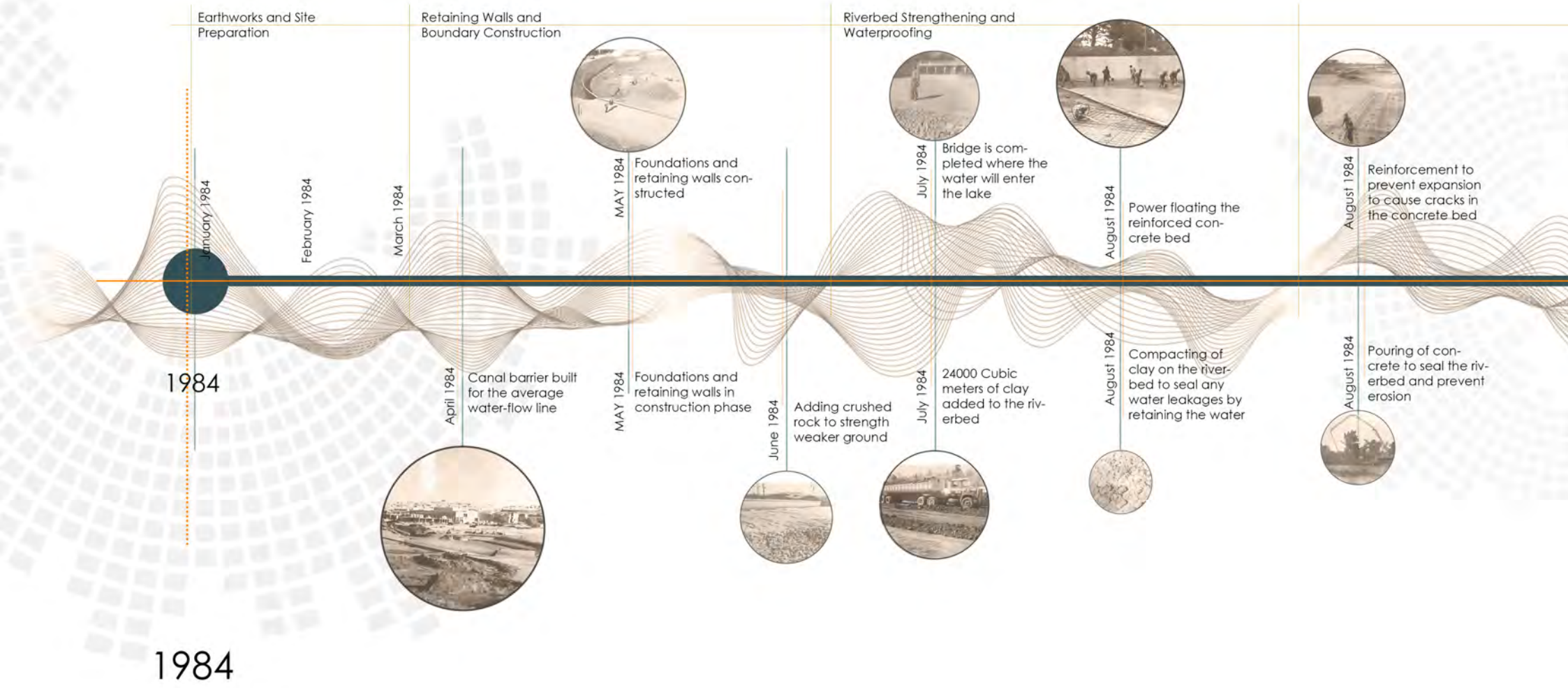
In 2000, the Centurion local government became part of the newly created City of Tshwane Metropolitan Municipality, which also includes Pretoria, and the town ceased to have its own Town Council (Anton Heydenrych, 2001).

Figure 3.43 - The figure ground images depict the development of the micro scale site over time and highlights the events that lead the Hennops river transforming from a natural river to an urban wasteland (Author, 2018).



The timeline explains how the natural river slowly changed into a man-made lake; destroying the ecological functions of the river and leading to its demise. In conclusion, developer saw the opportunity to utilize the aesthetic value of the natural river in order to create a public space that is not only enticing to look at but also used for water activities where families can enjoy the river over weekends. In 1983, Centurion Mall was constructed with a large amphitheater connecting the public to the river by incorporating an open-air promenade. In 2011, large scale siltation started to emerge and continued to exists till the present day. Today, the Centurion Lake is nothing but a wasteland with restaurants closest to the river relocating to escape the polluted river.

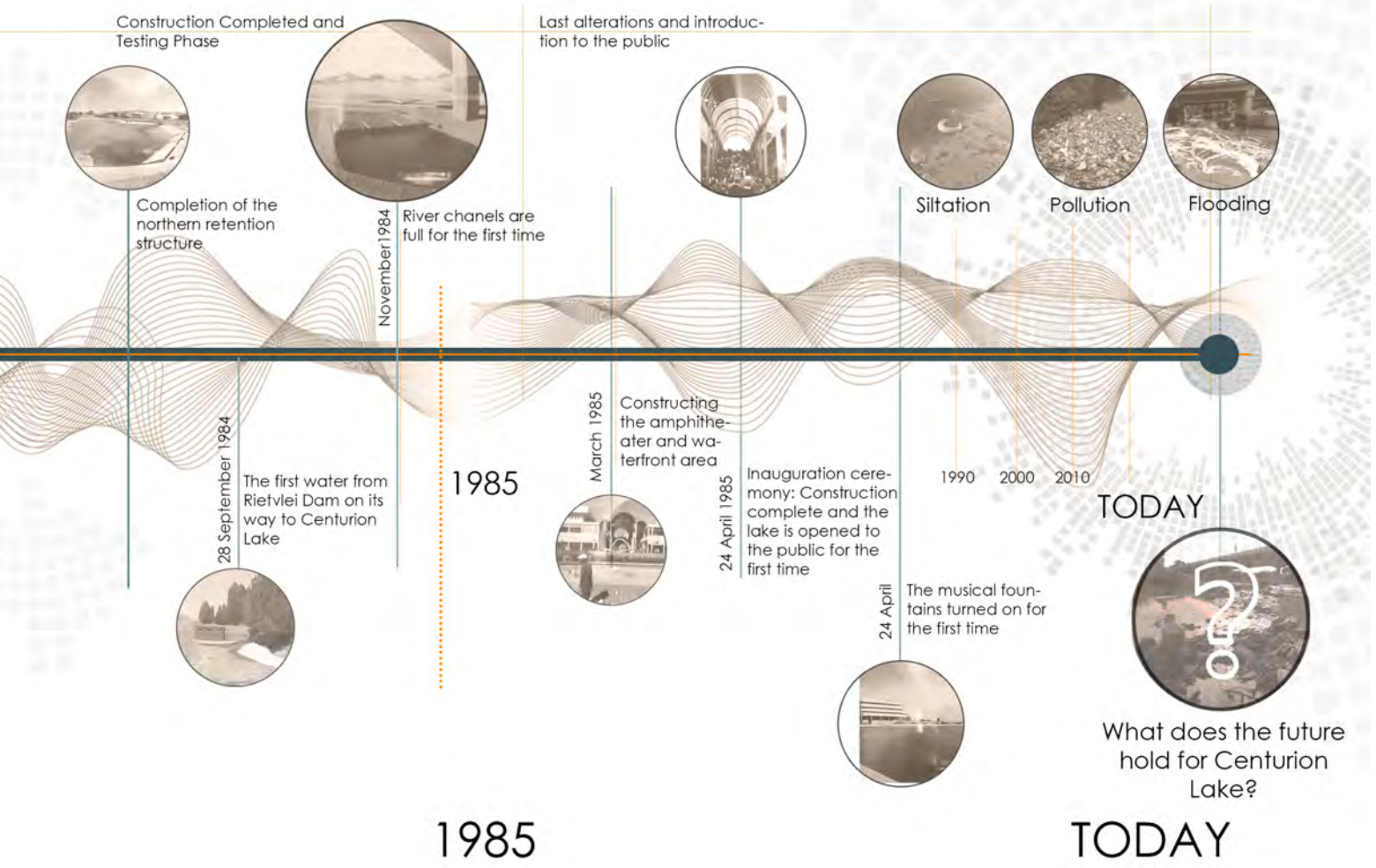
MICRO ANALYSIS (AREA OF FOCUS) | HISTORICAL BACKGROUND



CENTURION LAKE

Construction Timeline

Figure 3.44 - The timeline explains the construction process of Centurion Lake (a man-made lake that is located to the north of Centurion Mall). It shows the life and death of the lake. This is a typical example of how human intervention shaped the landscape and how the landscape starts to shape mankind (Author, 2018).



FROM A NATURAL OASIS TO A MAN-MADE WASTELAND

As previously mentioned, the Hennops river was chosen for its aesthetic appeal to the general public. Developers realized the economic potential that the natural resource had to offer and Centurion Mall was built as a result. The designers of the Mall decided to add a large lake next to the river to provide the mall with watersport activities as well as a public park to bring the community as close as possible to the lake.

The construction of the Centurion Lake started with earthworks and site preparation. Four phases followed immedi-ately after the site was prepared. The first phase was to construct the retaining walls and carefully consider the lake's boundary conditions. The second phase was to conduct soil tests and strengthen the soil where needed, fol-lowed by waterproofing. The third phase was to complete the dam wall and to conduct tests on the structure. The last phase included the last alterations and introducing the lake to the public.

FROM MAN-MADE WASTELAND TO URBAN OASIS

In an attempt to eradicate the problem, the possibility exists to once again alter the river-scape, but this time return-ing it to its natural state. The idea is to regenerate the ecological processes that occurred naturally before human intervention destroyed it. The public park can be redesigned to allow easier access into the park from Centurion Mall and a pedestrian bridge can link Centurion Mall with the Gautrain station, leading to the benefit of both enti-ties. Lastly, the waste can be seen as resources that could be utilized and extracted to ultimately clean the river and create an economic incentive to drive future projects of similar nature.

MICRO ANALYSIS | PHOTOGRAPHIC STUDY

Figure 3.45 - Diagram highlighting Centurion Lake in context to its surrounding buildings. The diagram also points out the relevant structures and orientation of the site. 'N' marks North and 'S' marks South (Author, 2018).

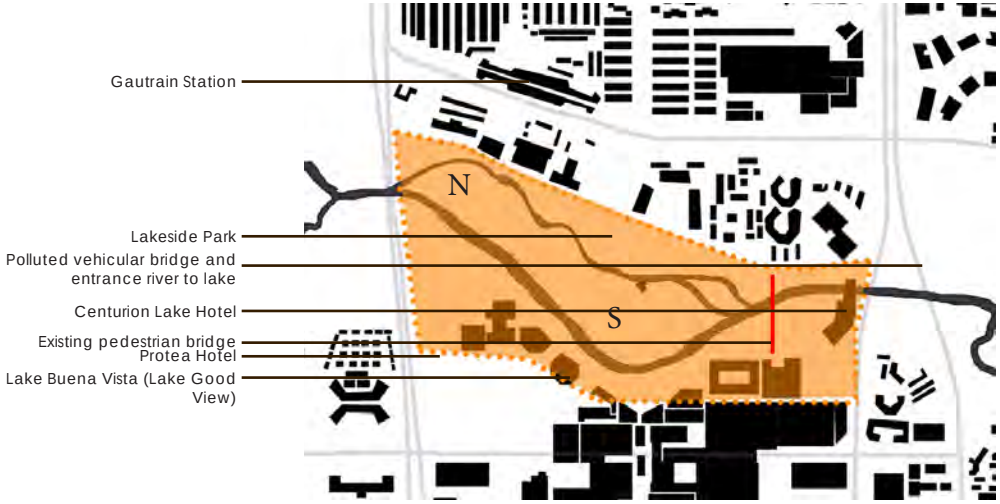


Figure 3.46 - The promenade spills out onto the amphitheater that in turn looks over Centurion Lake (Photograph taken and edited by author, 2018).

Figure 3.47 - Picture of Centurion Lake in the past. The lake is surrounded by restaurants spread over two levels. The musical fountains still active with a vibrant atmosphere as a result (Langner, 2018).

Figure 3.48 - Existing retaining structures and flood prevention mechanisms in the form of terraced walkways (Author, 2018).

Figure 3.49 - A Chess board imprinted on the park furniture. The bottle caps serve as evidence that it is still in use by the community (Author, 2018).

DISCOVERING THE SITE'S HIDDEN MYSTERIES

Upon exiting the public promenade of Centurion Mall towards the lake, immediately to the right one would find interesting street furniture. The idea was to create public seating area next to the lake as one moves from the hotel to the mall and vice versa. The degradation of the lake caused these spaces to become completely unused and forgotton. However, it does still serve the purpose of creating flood protection barriers to prevent water from reaching the mall. The possibility exist to regenerate these spaces to contribute once again to the river space as it did in the past.

Figure 3.50 - Brickwork furniture and planter boxes creating a pleasant outdoor space next to the river. It creates a green buffer zone between the buildings and the Lake, acting as a mediator between the built fabric and nature (Photograph taken and edited by author, 2018).

MACRO ANALYSIS| PHOTOGRAPHIC STUDY

A CRITIQUE ON THE PEDESTRIAN CONNECTION

Soon after the construction of Centurion Lake a pedestrain connection was established that joined the mall with the public park. Today, the connection still exists in the form of a suspention bridge constructed out of steel beams and timber decking (refer to figure 2.48). The bridge stretches from the park and ends suddenly at the foot of one of the office buildings. It was constructed at this location as it is the narrowest part of the lake, proving more feasible than to implement a larger bridge.

During multiple site visits and at different intervals of the day, the bridge was observed by the author to gain some insight into the dynamics of the bridge and how it is being used. The findings are that on a daily basis people use the bridge, with the majortiy using it in the evening when returning from work or heading to the train station. It is clear that the bridge has lost it original purpose of connecting the community from the mall to the public park. Pedestrain using the bridge does not wonder into the park as it is higly unsafe and overgrown by vegetation. The bridge was also constructed to connect people from Centurion Lake Hotel to the public park to enjoy a late sunday evening stroll through the scenic gardens while looking at people canoeing on the water (refer to figure 2.51). This all changed when the river became polluted and the lake turned into a wasteland. The businesses that once utilized the river front for its scenic properties is now sueing the municipality for 'damages' due to the state that the lake is in. The hotel is currently loosing business due the lake. One municipal proposal suggests that the lake be converted into a concrete channel. If this proposal become reality, then Centurion Lake Hotel must undergo an extremely expensive name change, as it will be inappropriate to continue to call it Centurion 'Lake' Hotel.

The dissertation hopes to create a public public park that addresses its current state and attempt at proposing a park that will bring back the vibrancy that it used to have, this time in a much more sustainable way.

Figure 3.51 - Centurion Lake with office buildings in the background (Author, 2018).

Figure 3.52 - Pedestrian suspension bridge connecting the businesses with the public park (Author, 2018).

Figure 3.53 - Pedestrian suspension bridge indicating the public park in the background, overgrown by vegetation due to a lack of maintenance (Author, 2018).

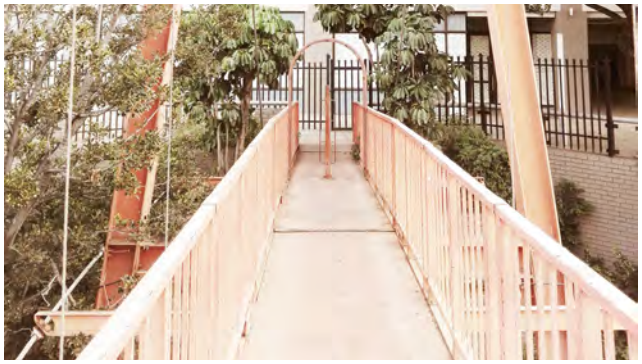


Figure 3.54 - Picture indicating the end condition of the pedestrian bridge as it abruptly ends at the office building, reaching no point of importance (Author, 2018).

Figure 3.55 - Centurion Lake Hotel; suspended over the Hennops river by using large concrete beams (Author, 2018).

Figure 3.56 - Centurion Lake Hotel's entrance facing south, away from the Centurion Lake to the north (Author, 2018).

Figure 3.57 - The result of siltation and pollution within Centurion Lake. The photograph was taken underneath the suspended section of Centurion Lake Hotel (Author, 2018).

Figure 3.58 - Vehicular bridge with Lenchen Road running over the river. The bridge's structure creates the entrance channels for incoming water to the lake (Author, 2018).

Figure 3.59 - Pollution, in the form of plastic waste, trapped behind the vehicular bridge (Author, 2018).

Figure 3.60 - Entrance notice board that explains which activities are or are not allowed in the lake (Author, 2018).

Figure 3.61 - Centurion Lake; overgrown by grass and alien invasive plant species due to a lack of maintenance (Author, 2018).

Figure 3.62 - Centurion Lake (photograph taken from Hendrik Verwoerd Drive) during a flooding event (Author, 2018).

Figure 3.63 - Photograph taken from Buena Vista Offices that show the view of Centurion Lake as one ascends up the stairs (Author, 2018).

ECOLOGICAL CONDITION| EXISTING VEGETATION (FLORA)

Figure 3.64 - Diagram highlighting the existing vegetation on macro scale of the entire Centurion. Four distinct layers are identified namely; Large tree zones, small tree zones, grasses + shrubs, and areas with minimal vegetative ground cover (mostly soil) (Author, 2018).

DESCRIPTION

The reason for identifying the existing natural systems is to understand the current situation in terms of the relationship between the built environment and nature. The study tries to uncover whether or not the landscape had been removed or damaged in the process of constructing the buildings.

The study was done by superimposing the most recent orthographic photograph available and highlighting the natural systems in order to show the density of natural systems in relation to the density of the built environment.

RELEVANCE

The findings were that vegetation growth is most concentrated alongside the river banks. Centurion Mall capitalized on the once scenic experience of the landscape, but did not anticipate the scale of pollution that would follow in the years to come. Today the mall faces a major problem with the polluted river system as it achieves the opposite of what it was intended for, namely; to get man in touch with nature again as well as creating a safe space for the community to come together.
Large scale buildings and infrastructure takes away from the natural environment but at the same time there exists large open grounds that has the potential for further development and lead to a more vibrant and successful city (refer to the brown areas in figure 2.15).

Type 1: Has open land and vegetation and provides the ideal circumstances for future developments or green spaces.
Type 2: Shows the impact of the built environment on vegetation and natural systems. Only a few trees are present in these areas. This mostly occurs at the residential districts where hardscaping dominates the total land area.
Type 3: Provides the ideal condition where the built environment and nature co-exists in a symbiotic relationship. This creates the ideal model of future cities that is to the benefit of man and nature.

ECOLOGICAL CONDITION | VEGETATION AND WETLAND REPORT

BACKGROUND

The Spatial Ecological Consulting CC (SPEC) group was approached by TGM Environmental Services CC to conduct a vegetation and wetland assessment for the proposed sediment control in the Hennops River and the Olifantspruit feeding into Centurion Lake. The site description states that Centurion Lake falls under the Carltonville Dolomite Grassland vegetation type. According to Mucina and Rutherford (2006) the vegetation type is Vulnerable, but not listed as threatened under the NEMBE list (2011). Furthermore, the wetland is dominated by Pennisetum clandestinum (Kikuyu grass) and Mellilotis alba (Honey clover). From a vegetation point of view, this area is of low conservation importance.

VEGRAI

Riparian Vegetation Response Assessment Index (VEGRAI) is a manual that was formulated by experienced riparian vegetation specialists under the Department of Water Affairs. They distinguish between two relevant definitions; Riparian habitat and Wetland:

Riparian vegetation is described in the Water Act (Act No 36 of 1998) as follows: "riparian habitat'' includes the physical structure and vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas.

The definition of wetlands to distinguish with that of riparian vegetation habitat or zone is provided in the Act as follows: "wetland'' means land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.

Centurion Lake was evaluated as a whole, with reference to the VEGRAI manual, and the Ecological Condition score for the Centurion Lake section was E/F.

Ecological Category (E) (20-39% remains) - Seriously modified ecological condition. The loss of natural habitat, biota[2] and basic ecosystem functions is extensive.

Ecological Category (F) (0-19% remains) – Critically modifications have reached a critical level and the lotic[1] system has been modified completely with an almost complete loss of natural ecosystem functions. These functions have been destroyed with the loss of habitat and biota.

In the worst case the effects are irreversible.

Therefor the alterations made to the riparian area back in 1982, when the man-made detention pond was constructed, critically modified the ecological systems that were present before human intervention. Ecological functions have been destroyed to such an extent that nature alone cannot repair the damages. The only way to restore these systems would be by actively pursuing ecological system functions through design.

CENTURION 'WETLAND'

Although the wetlands on site are very weedy all wetlands in Gauteng are considered to be of high conservation importance and must be protected. In terms of wetlands within the Gauteng region, legislation states that a 30m buffer zone around wetlands inside the urban edge and a 50m buffer around wetland outside the urban edge is required. For riparian areas a 32m buffer zone is applicable inside the urban edge and a 100m buffer zone outside the urban edge (GDACE 2007). These buffer zones imply that urban development may not occur within these parameters as it may have a large destructive impact on the riparian landscape and thus the ecological functions in general.

SOIL QUALITY TEST

The soil at Centurion Lake is reddish-brown in colour, with black mottles present starting at various depts (mostly between 15 and 50cm), with the mottles becoming more and darker with depth. In some portions the soil appears to be alluvial that is characterized by having a deposit of clay, silt, and sand left by flowing floodwater in a river valley or delta, typically producing fertile soil.

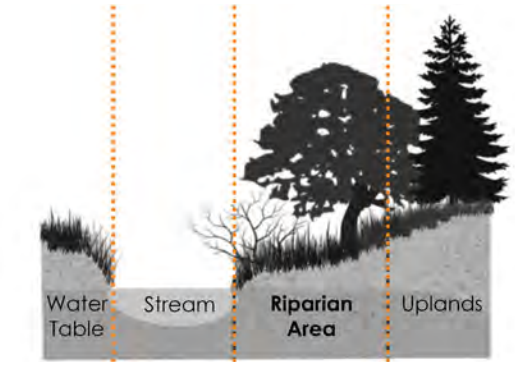


Figure 3.65 - Image explaining the location of riparian zones (Author, 2018).

Figure 3.66 - Photo showing the wetland situation that emerged naturally. Silt deposits were no longer being removed from Centurion Lake due to financial reasons (Author, 2018).

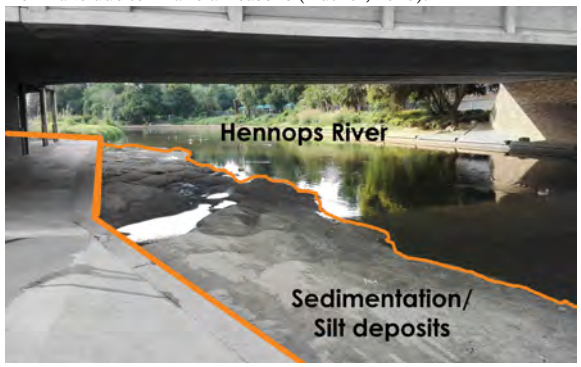


Figure 3.67 - Image explaining the location of riparian zones (Author, 2018).

1. Lotic definition - Organisms or habitats situated in rapidly moving fresh water
2. Biota definition - The animal and plant life of a particular region, habitat, or geological period (Tswhane Municipality, 2007)

ECOLOGICAL CONDITIONS | VEGETATION AND WETLAND REPORT

SEDIMENT TRAP

In order to utilize the resources that the site has to offer in abundance, namely large silt deposits, a sediment trap needs to be incorpo-rated into the design. A sediment trap is a temporary containment area that allows sediment in collected storm water to settle out during infiltration or before the runoff is discharged through a stabilized spillway.
The wetland report states that the sediment traps should not be located in any primary grassland area but must be confined to areas that are already disturbed. Considering the fact that Centurion Lake is a man-made lake, the primary grassland that naturally oc-curred on the site before construction does not exist anymore and therefor the grassland currently present on site is in essence dis-turbed in total.

INVASIVE PLANT SPECIES

Invasive plant species are listed under the conservation of Agricultural Resource Act (CARA). According to CARA all category 1 spe-cies must be removed. Category 2 species may only remain if a permit has been obtained from the Department of Agriculture. If no permit has been obtained the plants must be removed. Listed species may also not occur in a wetland or within 10m of a wetland. The wetland report by SPEC states that the riparian and wetland vegetation of Centurion Lake are invaded by alien and invasive species, including numerous large trees. This provides the perfect opportunity to improve the riparian area by removing the invasive species and replacing it with indigenous vegetation that is to the benefit of ecological processes and productive landscapes.

RED DATA PLANT SPECIES (IUCN RED LIST CATEGORY)

GDARD (Gauteng Department of Agricultural and Rural Development) indicated that red listed plant species may potentially be present on site. These species were searched for when the vegetation and wetland report was conducted and categorized as being of high importance, however, none of the species were observed on site.

CENTURION LAKE SITE OPPORTUNITIES

1. The site is very flat and is adapted to receive flooding and trap sediment.

2. There are several areas upstream, and on site, that can resume the natural sediment trapping functions with some careful rehabili-tation and alien invasive clearing.

3. There exist several upstream pollution sources that can be rehabilitated to reduce the pollution load. These include eroding wet-lands, townships with little or no vegetation cover and alien invasive plant infestations.

4. Locating the outflows of the sediment traps/aerobic wetlands in a diffuse manner on the riparian zone will likely improve the riparian functioning and quality, as well as water quality.

CENTURION LAKE SITE CONSTRAINTS

1. It will be difficult to get authorization for activities within the riparian zone.

2. The dolomitic rock below the site might be a 'no-go' to the project due to the off-channel water storage on sediments that are more permeable than the riparian zone, depending on whether the site is disturbed.

3. Capturing sediment with plants will reduce the utility of the sediment to other industries.

4. The close proximity of the office blocks and other buildings adjacent the Centurion Lake site constrains the amount that flood lines may be altered with.

5. Creating sediment traps which are set within the landscape will generate a significant amount of sediment that must be disposed of.

Although the large amount of sedimentation that occurs on site is seen as a site constraint, it could be argued that it may be viewed in the light of a larger opportunity. Silt can be utilized in many ways; it can be used as an additive material to the construction of pre-cast concrete pavers, bricks or sandbags in eco-beam technology.

DURING CONSTRUCTION PHASE

- Any construction inside the riparian zone or wetland must take place in the winter or dry season.
- Ground works must be reduced in volume as much as is feasible.
- Soil stabilization must take place at the same time as construction, and outside of the rainy season to ensure stable conditions when the rain progress.

During the construction of Centurion Lake, the soil strength was tested at various points to ensure soil stability. As a result, two main ar-eas were strengthened with compacted clay and reinforced concrete beds to ensure that as little as possible water will filter through the ground and destabilize to a greater extent.

THE SILT TRAP PROCESS

The silt trap diagram on the next page explains the first of three processes that occurs in order to purify the Hennops river's water from any solid waste material and suspended solids1. The first process only focuses on removing any solid waste and separating it from the water. The second process removes the suspended solids from the water by slowly flowing into the stilling basin where the suspended solids settle at the bottom of the basin and the 'clean' water flows over the rim of the retaining wall. The third process joins the water back to the natural river channel.

THE FIRST PROCESS

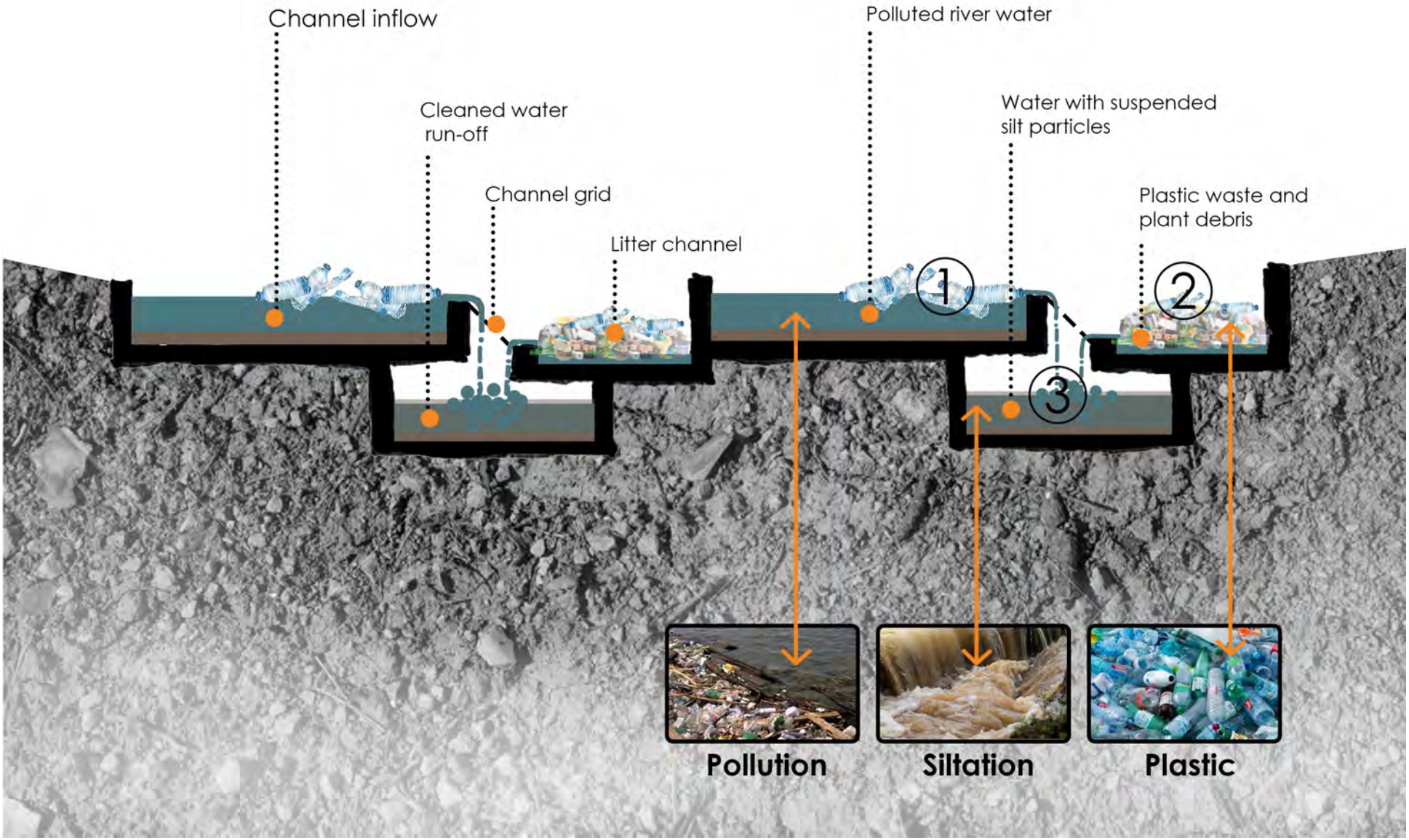
All processes will be discussed in detail with the chapters that follows. Only the first process will be explained in this chapter.

In the first process, all solids are removed from the moving water body. The water enters the silt trap using the channel inflow basin. At this stage the basin contains plastic waste, water polluted with suspended solids and larger particles of sand and rocks. As the water level rises, it eventually reaches the basin's capacity and spill over the lowest edge. The water, together with all the pollutants washes over a channel grid that captures as the solid debris into the litter channel. Once the litter channel has reached its water capacity, the water flows over the edge and into the run-off channel. This channel now contains only water and suspended solids, all the solid debris are removed (Refer to figure 2.5).

1. Suspended solids - Small solid particles which remain in suspension in water as a colloid or due to the motion of the water. It is used as one indicator of water quality.

ECOLOGICAL CONDITIONS| SEDIMENT TRAP

Figure 3.68 - Diagram explaining the first stage process of a sediment trap, with byproducts gained as new resources (Author, 2018).



ECOLOGICAL CONDITIONS | EXISTING VEGETATION (FLORA)

Figure 3.69 - A series of photos that indicates the existing natural ecological state of Centurion Lake as it exists currently. The photos contain native as well as alien invasive plant species that exists on site. All photos were taken by the author of the thesis during the initial site visit (Author, 2018).

VEGETATION AT CENTURION LAKE

Invasive alien plant species (IAP) are species whose introduction to an environment outside their natural distribution threaten biological diversity. They are non-native to an ecosystem, and may cause economic or environmental harm.

As mentioned previously, Centurion Lake is dominated by invasive plant species that consists of foreign trees and alien shrubs. This poses a large threat for the surrounding ecosystem and native plants species.

The risk of keeping the invasive species on site is that it may cuase the die-off of native species, reducing the biodiversity on site and ultimately desturbing the balance of the ecosystem and all the functions accociated with it. An example of this is the presence of water-borne shrubs and weeds. These types of weeds are charaterized by their thurst for water, leading to native species dying due to water depravation.

In an attempt to restore the native biodiversity of Centurion Lake, it is proposed that all catagory one invasive species be removed and replaced by native species to re-establish the loss in biodiversity and ecological functions of the natural environment to a state that existed before human intervention altered the landscape.

Datura stramonium
Jimsonweed or devil's snare; Native to South Africa

Amaranthus retroflexus L.
Redroot Pigweed
Alien Invasive

Senecio Auarine
'Mount Everest'
Alien Invasive

Festuca arundinacea
Tall Fescue Weedgrass
Alien Invasive

Quercus alba
White oak; Native to North America

Quercus alba
White oak; Native to North America

Acacia galpinii
Apiesdoring; Zambia

Acacia galpinii
Apiesdoring; Zambia

Passiflora incarnata
Purple passionflower; Native to America
Alien Invasive

Calystegia sepium
Hedge Bindweed

Calystegia sepium
Hedge Bindweed

Caprifoliaceae
Abelia grandiflora
Native to North America

ECOLOGICAL CONDITIONS | EXISTING VEGETATION (FLORA)

Figure 3.70 - A series of photos that indicates the existing natural ecological state of Centurion Lake as it exists currently (Author, 2018).

Celtis africana
White stinkwood; Native to South Africa

Liquidambar styraciflua
American sweetgum; Native to America

Acer rubrum
Red maple; Native to North America

Callistemon
Red bottlebrush; Native to Australia

Quercus petraea
Sessile Oak; Native to Europe

Carya cordiformis
Bitter Hickory
Native to East Asia

Rodale Red Leaf Grain Amaranth
Native to America

Typhaceae
Cattail Reed

Platanus occidentalis
American sycamore; Central United States

Platanus occidentalis
American sycamore; Central United States

Eucalyptus regnans
Native to Australia

Caprifoliaceae
Abelia grandiflora
Native to North America

ECOLOGICAL CONDITIONS | CLIMATE AND MICRO-CLIMATES

" Micro climates are dynamic things. As your site changes through maturation of planting, siting of artificial structures, and even contouring of the land, so the microclimates will alter."

There exists predominantly five factors that can influence the micro climate in on this site.:

1. The soil
2. The water
3. The vegetation
4. The topography
5. Artificial structures

1. The soil

The mineral composition of soil can play a large role in altering the micro climate. A soil that has a large portoin of clay retains more moisture than one that is predominantly sand. The degree to which a soil retains moisture affects the humidity and temperature of the air above it. In other words, soil that retains moisture will be cooler than soil that releases moisture.

Ground coverage also play a significant role in the temperature fluxuation of soil. On the other hand, bare soil reflects more light and heat than those covered by plants or mulch.

2. The water

The presence of waterbodies on site could have a significant effect on the micro climate of the site and its surroundings. Water gains and loses heat more slowly than soil. So in the evening the land will lose heat much quicker than the waterbody thus creating a heated micro climate above the water, drawing in the cooler air from the land. During the day, the waterbody also sends moisture into the air throught evaporation, this atmospheric moisture captures heat from the sun , making the air around the water body warmer than areas further away. The air above the water is potentially warmer, however, the water body itself is between 2-6 degrees celcius cooler than the land.

3. The vegetation

Vegetation prevents heat loss on ground surfaces as well as preventing the soil from heating up, thus creating a cooler micro climate where vegetation grows. In the case that the soil gained heat, the vegetation will regulate the heat and distribute it equally by holding the heat in the soil for longer peroids than soil without vegetation. Another advantage of vegetation is its capability to capture and filter dust and soil particles from the air, thus preventing dust from traveling into nearby buildings. Vegetation also acts as a wind break mechanism in areas that has a high wind velocity.

4. The topography

The direction that a slope faces is called the 'aspect' of the slope. In the southern hemiphere, north facing slopes gets more direct sunlight. The southern aspect, however, receives very little direct sunlight and causes cooler air to flow towards lower lying lands or water bodies and in turn create frost pockets. The frost pockets refers to the collection points for cold air.

Slopes- The steeper the slope the fater the wind will travel uphill or downhill and have a negative effect on the veetation on the windward side. Trees and vegetation could be used a wind breaks to slow down wind velocity as mentions previously. A steeper slope can slo cuase the wind turbulance to increase on th leeward side of the slope.

Water- The steeper the slope the fater water will rush down causing soil erosion. The rushing water also doesn't perculate into the ground increasing rain water runoff and flood occurances.

5. Artificial structures

Microclimates are mostly formed by the built construct of cities that absorbes heat in the day and releases it at night causing cooler environments in the day and warmer climates at night. These structures also deflect wind currents and reflect sunlight. Infrastructure such as roads and paving also causes warmer micro climates.

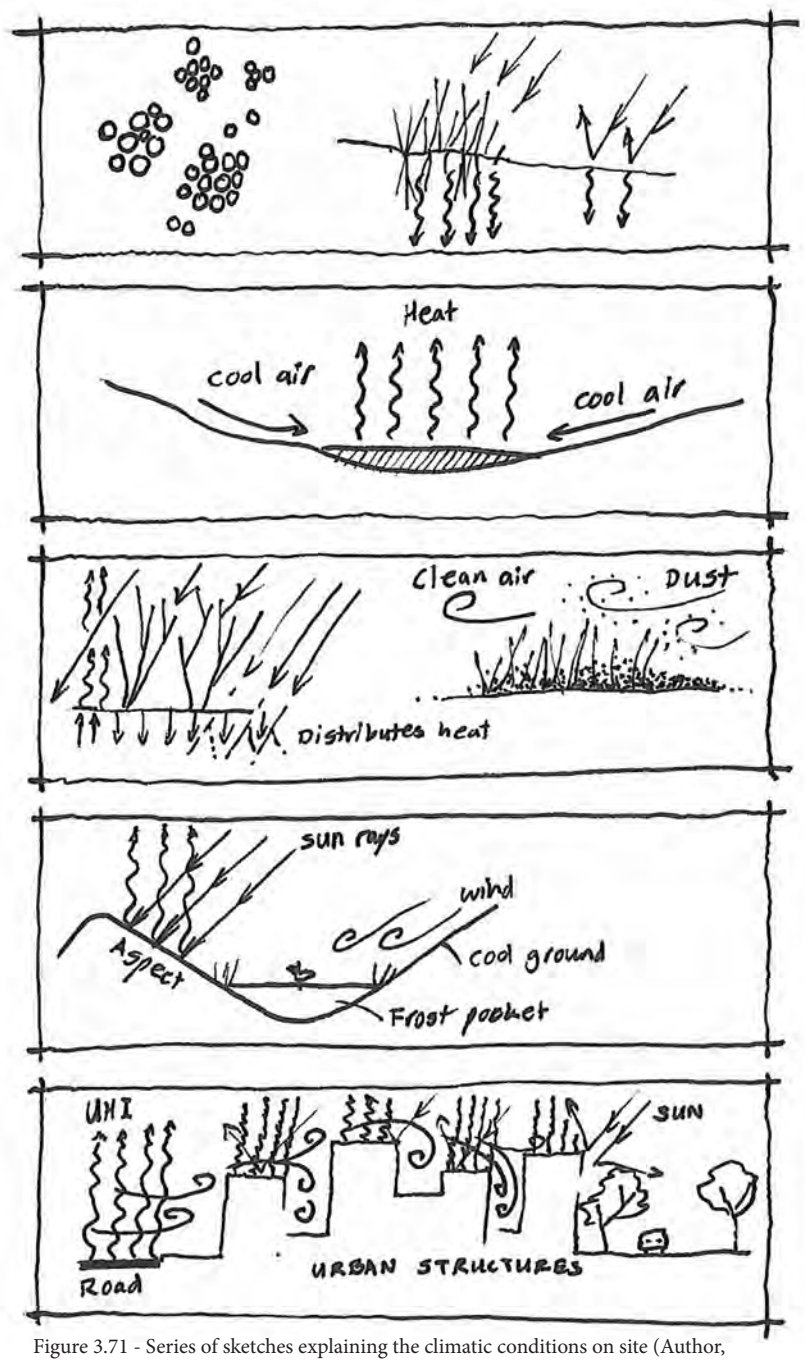
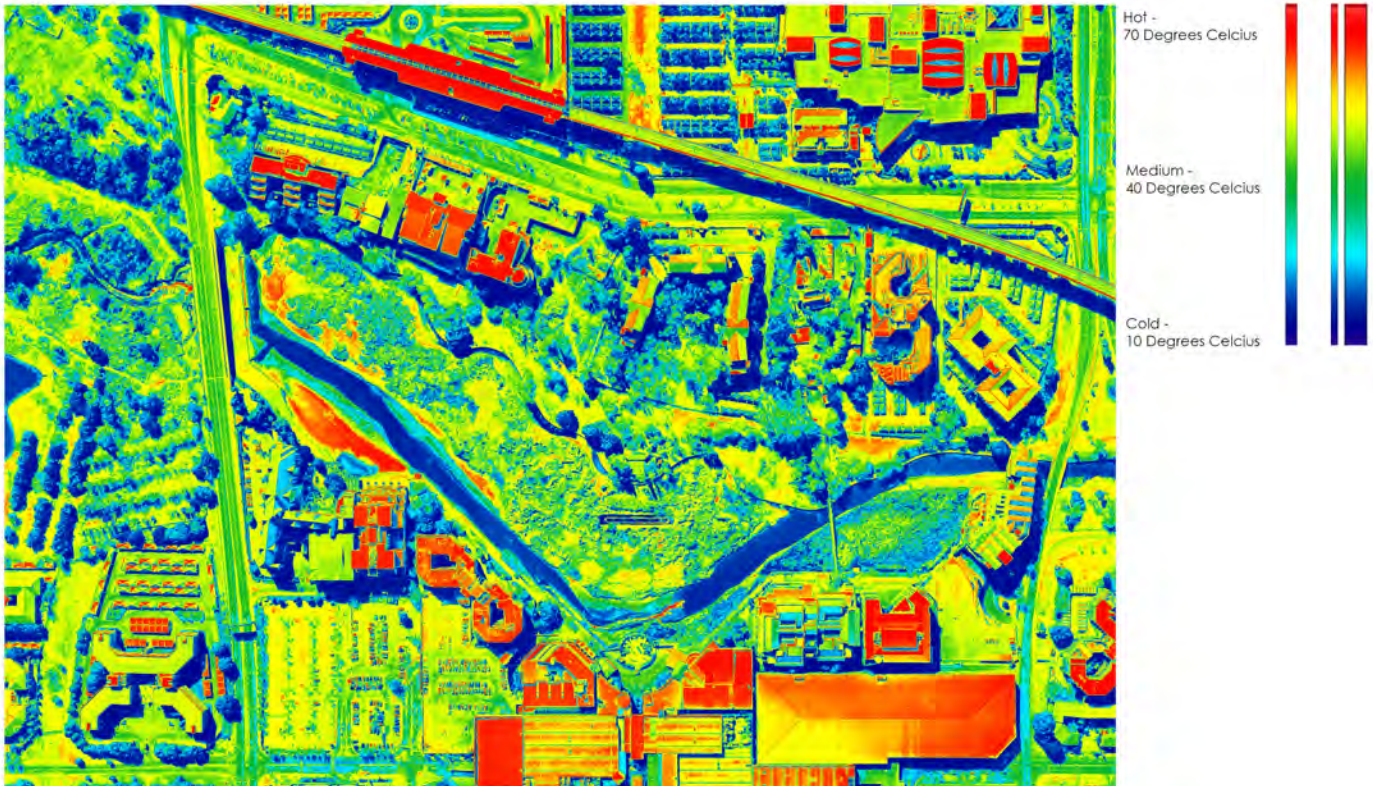


Figure 3.71 - Series of sketches explaining the climatic conditions on site (Author, 2018).

ECOLOGICAL CONDITIONS | HEATMAP

Figure 3.72 - Heatmap in the form of an aerial photograph indicating the hotter zones in red and cooler zones in blue (Photograph taken and edited by author, 2018).



HEATMAP OF STUDY AREA

The heatmap of the study area reveals and justified the five points of micro climate mentioned in the previous section. Here one can identify soil, water, vegetation, topography and infrastructure as it has a thermal effect on its surroundings.

The definition of a thermal map is a map that shows the surface temperature of a given region measured by a thermometer. This captures the heat of an object in real-time and reveals something about the thermodynamics of a site that would never have been revealed by average temperature forecasts. This map can then be used to understand the thermal dynamics of a site in order to design accordingly.

FINDINGS

The map indicates that the roof areas of most of the buildings are heat zones that can potentially negatively impact its surroundings by heating up a zone in the middle of summer, creating unbearable circumstances. Large parking areas and streets also contribute to the UHI (Urban Heat-Island effect) by absorbing heat and slowly releasing it, causing sidewalks to be warmer than usual.

Nature does a good job in maintaining a relatively cool environment especially the river system that reaches close to only ten degrees Celsius. This notion could shape the way in which we design our future buildings; green roofs could reduce the heat gain factor in buildings, and additional trees and landscapes could significantly change thermal comfort of spaces.

ECOLOGICAL CONDITIONS | FLOODLINES

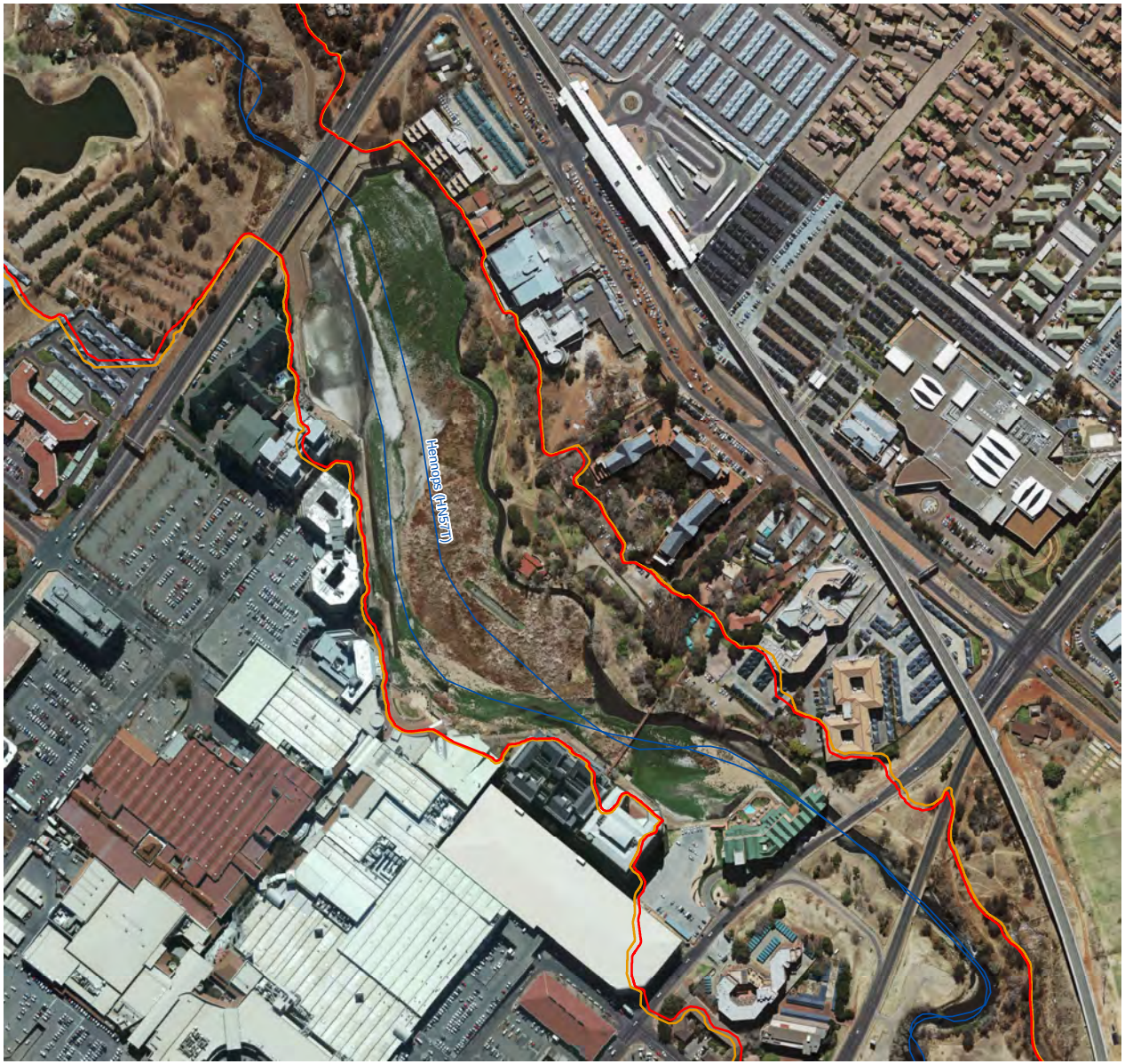


Figure 3.73 - Image highlighting two flood line scenarios; the red line indicates the 50-year flood line and the orange line marks the 100-year flood line (Tshwane Municipality, 2018).

CENTURION'S CLIMATIC CONDITION

Centurion's climate is mostly dry with sunny winters and hot summers characteristic to the highveld regions. In winter the daytime temperature rises up to 20 degrees celcius and can drop to an average minimum of five degrees. In summer (October to April) the temperature rises to its mid-20s and 30s. Rainfall usually occurs in the form of late-afternoon showers accompanied by spectacular thunder and lightning storms. These storms happens suddenly and dramtically, in the form of flash-floods, whereby the water level rises to such an extent that it reaches extremely close to the entrance level of the existing buildings on site and occasionally enters and flood buildings that were built within the floodline parameter; an example of this can be seen at Centurion Lake Hotel, where the water enters into the main lobby, flooding the entire ground floor.

FLOOD HAZARD MAPPING

Figure 2.X indicates the 1-50 year (red line) and 1-100 year (orange line) floodlines. The general misconception is that a flood will only occur one in every fifty years, where in actual fact the value refers to a probability. The probability of a certain region to flood when concidering the 1-50 and 1-100 year floodline is 0.02 (2%)and 0.01 (1%) respectively. Thus, a 1-50 year region is more likely to flood than a 1-100 year region.

Figure 3.74 - Series of photos that compares the pre-flood conditions with the post-flood conditions. All photos were taken by the author of this thesis (Author, 2018).


Centurion Lake Hotel; The photo shows Clementime and Lenchen Street completely flooded by a heavy storm


South Street located downstream to the north-west of Centurion Lake


Centurion Lake Hotel; Built in the 1980s before water related regulations prohibited the construction of buildings within the floodlines of rivers


Residential community park located adjacent to South Street; The water reaches dangerously close to the foot of the residential buildings


Public Park adjasent to Centurion Lake Hotel; The park is completely flooded as it lies within the floodlines of the river


Residential community park located adjacent to South Street


Corner of South- and End Street; The junction crosses the Hennops Rivers and therefor it is of no surprise to see the road completely flooded during a heavy storm

FLOODING IN CENTURION

Flooding of Centurion mostly happens with rainstorms that has a duration of more than three days. This implies that flooding occurs mostly in summer, during the rainy season, and is limited to between 3-6 flooding events annually.

Many measures have been taken to ensure that the flood event does not damage the buildings and other property located within the flood lines. These measures include 'flood warning signs' next to any road that crossed the river. Buildings next to the river are constructed on plinth-like structures that acts as flood prevention barriers. Considering the fact that the riparian zone and topography makes up an extremely flat area around the river, limits the amount of structures that are located in this zone. Legislation prohibits the construction of any building within the flood lines and careful consideration should be given to structures located close to flood lines.

ECOLOGICAL CONDITIONS | TOPOGRAPHY

Figfure 3.75 - Explains the dynamic topography of the site. The buildings are most concentrated alongside the river on the river banks, with Centurion Mall initially creating the benchmark location for future development to follow (Author, 2018).

DESCRIPTION

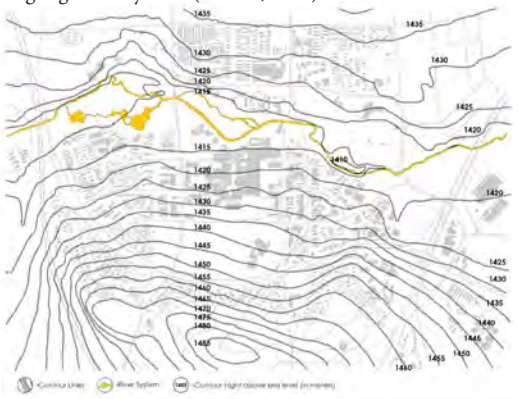
The importance of knowing the contours of a site is to be enable oneself to utilize the land parcel to its full potential. It gives an indication of hierarchy in land-use as well as identifying places of topographical importance.
It can be used to predict the storm-water flow path and in doing so, help the designer to work accordingly.

RELEVANCE

The findings present a topography that elevates from Centurion Lake in both the north and south direction, thus causing the river system and lake to be the lowest point in Centurion, as is to be expected.

The gradient of the topography did not prevent initial development in this area and creates very interesting landscapes for the residents and businesses. It is also evident that the businesses utilized the scenic riverside to their advantage, whereas the residential areas are placed further away from the river for unknown reasons.

Figure 3.76 - Topography of Centurion central. The river is highlighted in yellow (Author, 2018).



CONCLUSION | EXPLAINING, ANALYSING AND DRAWING CONCLUSIONS FROM CONTEXTUAL INFLUENCES

THE LARGER RELEVANT CONNECTIONS

This chapter started off by introducing Centurion Lake with reference to its larger connections. These connections include the Tembisa catchment area, Rietvlei dam, the Kaal river and the Sesmyl Spruit converging to form the Hennops river that flows past Centurion Mall (forming Centurion Lake) and joins the Crokodile river that eventually spills out into Hartbeespoort Dam. These larger river connections are extremely important to consider as any alterations made to the river at any given point, may have a profound effect on the situation downstream. An Example of this effect can be seen with large scale Eutrophication at Hartbeespoort Dam due to the mineral rich effluent water that spills into it.

AN HISTORIC OVERVIEW

Centurion had a slow start as it was always seen as a district of Pretoria and never as a city on its own. It acted as a thoroughfare region, connecting Pretoria to Johannesburg, and consisted mainly of residential pockets with no economic drive itself. Past development emerged gracefully around the river as to deny any claims of permanence. It is only after the advent of 'The Mall' in American history and the development of Centurion Mall that acted as a catalyst for economic development, that Centurion truly became a significant region filled with potentials for new development.

CONSTRUCTION OF CENTURION LAKE

The main purpose of Centurion Lake was to create a place where the community could gather and enjoy a natural resource in the form of the Hennops river. When the construction of Centurion Mall began in the 1980s the designers envisioned not just a thin stream passing Centurion Mall, but rather envisioned a large lake that could be used for water sports and other water related activities. What they didn't concider was the effect that the lake would have on the existing ecological functions of the Lake. The Lake slowly degraded to a wasteland as siltation occured due to river bank erosion in the Kaal Spruit near the Tembisa township catchment area. At first the lake was maintained by removing the silt and dumping it at Highveld Technopark located to the south of the lake. Later the clean-up of the river proved too expensive to maintain and was left to decay.

The construction of the lake have cuased many problems, however, Centurion has many new opportunities due to its ever changing characteristic.

OPPORTUNITES

Considering the land-use pattern of Centurion, it consists of three destinct zones. The first zone is the commertial zone, it includes Centurion Mall as the main anchor, with small scale industries surrounding the Mall to the south-eastern border of the suburb. The second zones are the business zones; these zones surround Centurion Lake and some businesses are located directly next to the commertial zone. The thrid zone is the residential zone that is located on the peripheries of Centurion.

As one can see Centurion has a very limited land-use pattern which may be the cause of its lack of vibrancy. The siltation of Centurion Lake is another contributing factor to its loss of vibrancy, however, many other factors are slowly contributing to its rise again. The Gautrain station, BRT systems, the third major renovation project of Centurion Mall and new business development is gradually boosting its status again as a viable district node. Densification of the identified vacant land parcels into mixed-used land could create an anchor point to which a connection could be made from the Gautrain station, through Centurion Mall, towards the new mixed-use hub.

The opportunity exists to turn Centurion Lake into a natural river again and establishing a pedestrian link between Centurion Mall and the Gautrain Sation, creating a large community park that will potentially attract the attention of many Centurion residents.

In order for Centurion to turn into a vibrant suburb, Centurion Lake has to be addressed. There are four proposal that were formulated by the Tshwane Municipality to rehabilitate the lake, these proposals will be discussed in the chapters to come.

CHAPTER 04 | REGENERATING CENTURION

Proposed Framework

Figure 4.1- Satellite Photograph of Centurion (Google Maps, 2018).

URBAN THEORY AND SITE DESIGN |

In chapter three an extensive site analysis was conducted investigating the Macro, Urban and Micro scale contexts. The analysis was conducted in order to create design informants that are relevant to the context. It revealed many missed opportunities that culminated due to the initial development of Centurion (or the lack thereof).

CHAPTER FOUR BREAKDOWN

In this chapter, relevant urban theories in conjunction with existing urban proposals will be used as an informative premise and driving force to guide the urban framework . The design informants of the mapping process (Chapter 3), together with the relevant theory will be used to propose a new vision for Centurion.

INTRODUCTION

Since the scientific discovery of the effect that development and the use of fossil fuels have on the global climate, architecture and many other professions have changed the way in which they function in the hopes of mitigating the problem. Sustainable architecture and 'Green Building Design' emerged with only a few buildings contributing to the sustainability of the city; Richard Register speaks out against this:

SUSTAINABLE CITIES: What are the problems associated with 'Sustainable Cities'?

As a point of departure, the 2006 book of *Richard Register (Theorist, Architect, Urbanist and Writer) titled 'Ecocities: Rebuilding Cities in Balance with Nature'*, were investigated to gain an understanding of what a sustainable city comprises of. This new knowledge of sustainable cities will then be used as a 'Design Lens' to test the extent to which Centurion is a 'Sustainable City'.

The current 'Green trend' is to propose strategies for urban designs which are not based on a holistic system but rather as an application tool applied to individual buildings. Register (2006:34) makes a clear distinction between 'Green building design' and that of Ecocity principles. Register (2006:34) mentions that there are a few fundamental problems associated with 'Green Building Design'. He starts off by saying that *"Each building stood like an independent entity, separate from the other functions of society and the economy"* (Register 2006:35). In other words, buildings only considered their own energy consumption patterns and their own 'Green Star' rating (Refer to Figure 4.2).

Register (2006) argues, however, that for 'Green' technology to be effective, it has to be design with the concept of **'Holism'** in mind; Acknowledging that a city functions like a living organism, where each singular part contributes to the larger web of life. For example; one green-roof in the middle of the city won't have a large effect on its environment, however, an entire city with solar cells, rainwater harvesting technology, and green roofs will certainly change the environment around it; albeit, changing the micro-climate, reducing the heat-Island effect or reduce urban floods.

Register (2006) goes on by saying that green buildings are only one or two storeys high, thus they address neither higher-density urban problems nor transit and pedestrian solutions. In

Figure 4.2 - Sketch depicting the current state of 'Green Building Design', that stands isolated as opposed to being part of a more holistic approach (Author, 2018).

many cases the optimal goal is to increase the density of the urban construct in order to increase its efficiency; For example, a higher density contributes to the 'proximity consciousness' of a city. Suddenly, it is possible to 'live, work and play' all in one walkable community.

A more fundamental problem with green building design is that they do not physically knit together the life of the community. Register (2006) envisions a city that is interwoven with nature and that these exact elements are the binding force that knit the community together, in what he calls 'The Ecocity' (Register 2006:37).

ECOCITY DESIGN: What is an Ecocity?

Register's normative stance is to create cities that is in harmony with its natural environment. He argues that cities are slowly destroying the very landscape that it depends on. On the other hand, he acknowledges that development is inevitable to maintain the current rate of our growing population, however, he proposes a more sensitive approach to development where cities are more compact and nature is fully integrated into the urban fabric (Register 2006:18).

Ecocities (Refer to Figure 4.3),are about re-building our cities based on ecological principles to ensure long term sustainability, cultural vitality and health of the Earth's biosphere. Ecocities proposes a more efficient way of living where food production happens at a smaller scale; for example, in your own back yard. Ecocities harvests every possible natural renewable resource and produce as little waste as possible.

The ecocity principle concerns itself specifically with accessibility and transportation. Register (2006:14) explains that with the advent of industrial technology, cities completely transformed from friendly neighbourhoods to machine driven mechanical mega-structures. He argues that cities are completely designed with the automobiles in mind. Gone are the days of walking to your local supermarket (Register 2006:). With the streets for vehicles becoming wider, the pedestrian walkways become narrower. The city dweller's comfort has become less of a priority when compare to that of automobiles.

CITIES DESIGNED FOR CARS

Register (2006: 8) elaborates on the impact that cars and road construction have on the environment. He mentions seven distinct points;

1. Habitation loss – Road construction replaces very valuable habitats without considering the effect it may have on the ecosystem in the long run.
2. Roadkill – a large contributing factor to the loss of animal lives are due to roadkill.
3. Noise – Roads and the influx of high-speed vehicles creates noise disruptions where there were non-before in that particular zone.
4. Toxicity – Chemicals, oil and other harmful substances are washed into natural river systems during a storm. These chemicals threaten aquatic life in rivers as well as various plant species.
5. Air pollution – With the influx of vehicles came an increased level of carbon dioxide emissions polluting the air.
6. Climate change – Air pollution accelerates the greenhouse effect leading to global temperature fluctuations.
7. Safety – The mere act of driving a vehicle at extremely high speeds might be the most dangerous common activity that law allows (Register 2006:8).

Figure 4.3 - Image depicting what an 'Ecocity' can potentially look like. The natural environment and human construct is shown in a state of mutualism (Register, 2006).

Figure 4.4 - City designed for cars; the image shows humanity's dependency on the car as well as the negative effect it has on the natural environment. Very little of the original landscape is still present where roads dominate (Author, 2018).

REPLACING MACHINES WITH FEET: THE WALKABLE CITY

Working on the premise of the negative effect that 'cities for cars' have on its natural environment, a new initiative is investigated to combat these effects.

'The Walkable City'- Is the act of designing a city in such a way as to enable free and pleasant circulation to the city's key attractions.

Walkability concerns the provision of healthy, safe, secure and pleasant pedestrian walkways. Walkability improves community health, economy and the overall dynamic of cities. It doesn't merely concern itself with being physically able to walk somewhere, but rather is about all the things that influences a user's choice to perform daily activities by foot (Bentley, 1985).

In order for a city's walkability to improve, a few aspects need to be carefully considered, these include;

1. **The general access and safety of the rout**
2. **The proximity to anchor activities**
3. **The aesthetic experience of the rout**
4. **The overall connectedness to important destinations and other paths**

If all of the aspects above are met it still does not ensure a pleasant walking experience if the path is too extensive. In general, the average person can walk 400 meters in approximately five minutes. If the trip becomes more extensive, people will choose a more convenient way of travelling and revert back to using fuel consuming vehicles.

Bentley (1985) explains that there are a few factors that influences the quality of the walking experience; namely, the overall size of the blocks; the land-use patterns; the street interface; and block arrangements. He explains that weak street interfaces usually lead to unsafe and dull experiences (Bentley, 1985:21).

By changing the way our neighbourhoods and towns are built, they can become more pedestrian friendly. The first step would be to arrange the land uses so that people are able to get to many of them by foot. "Neighbourhood convenience stores, day-care centres and parks should exist within the heart of residential areas and be connected to main down-town commercial districts" (Wells, 1981:42). The second step is focused on place-making. Place-making refers to making places more people oriented and interesting by incorporating a variety of uses that caters for diverse user groups (Bentley, 1985:82).

The third step should focus on the people's experience when moving through the city. If it is pleasant for people to walk through the city, it will result in more people doing so. The streets, landscapes, building facades and public spaces must all be designed with the user in mind (Bentley, 1985). Some guidelines include; placing buildings close to the streets, avoiding blank walls, and including street trees along sidewalks. These are some of the most universally effective ways to make a community more pedestrian friendly.

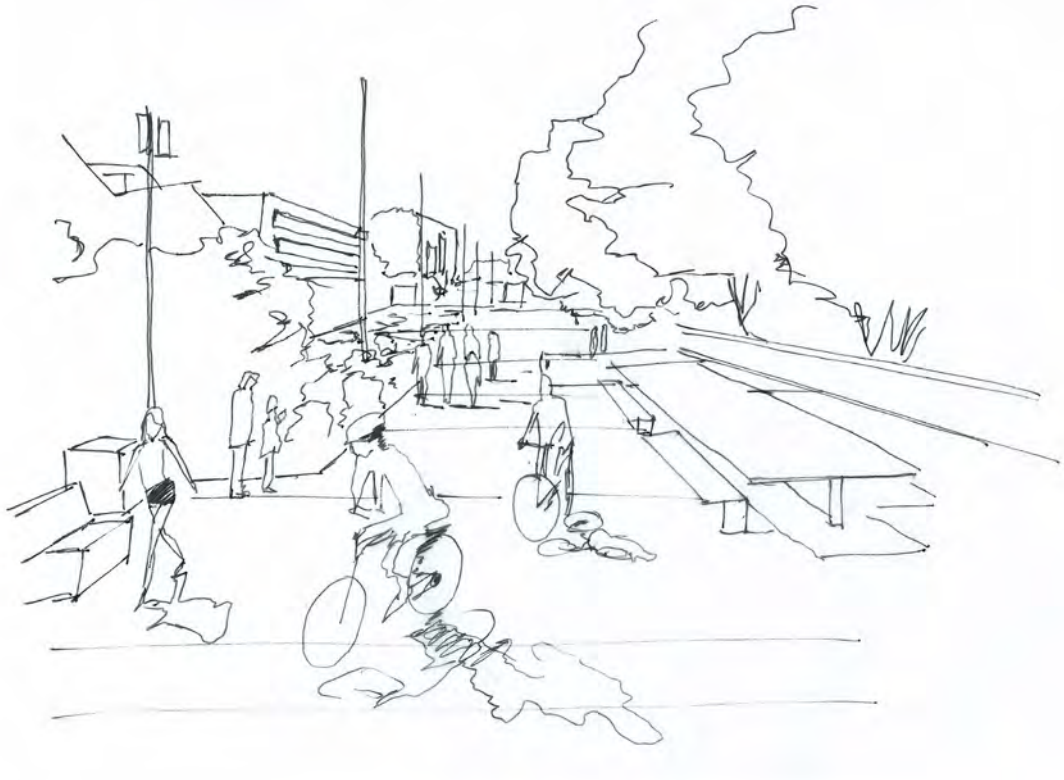


Figure 4.5 - City designed for people; the image above depicts a city where the transportation hierarchy is reversed, where pedestrians and cyclists dominate the roads leading to a vibrant environment (Author, 2018).

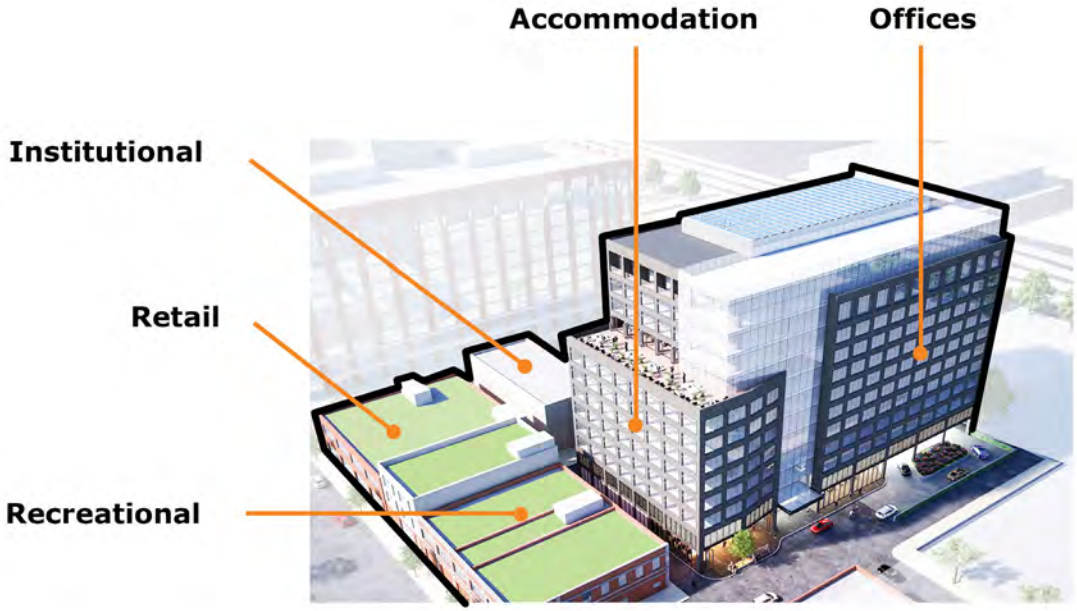


Figure 4.6 - Image showing how many supplementary programmes could be grouped together to form a 'proximity conscious' building (Author, 2018).

PROXIMITY CONSCIOUSNESS

Register mentions Michael David Lipkan (Register 2006:167), that speaks about proximity consciousness within cities. "Being there instead of getting there".

Proximity consciousness is strategically arranging and developing a city to achieve convenience, compactness, density, and efficiency unlike any other city. "Being there instead of getting there" refers to being able to walk to the closest grocery store as opposed to climbing in the car and driving there. Fortunately, the expansion of local convenience store has emerged, however, proximity conscious design is yet to happen over a large area of interest.

Proximity consciousness is the awareness that access can be delivered by building and arranging a diversity of experiences, services, products, environments, people, and natural features close together. Proximity power is the power of choice and convenience. It reduces the need for energy resources while it saves us time and frustration. It is a feasible solution and alternative to fossil fuel consumption. It is the power of complexity and the richness of being close to opportunities. Proximity power lets us spend less time getting to our lives and more time living them.

WHAT SHOULD AN ECOCITY AIM TO ACHIEVE?

1. Clarity/ Permeability

Permeability is an essential factor in any given ecocity. Register (2006:128) explains that with footpaths cutting through streets, the whole town becomes permeable and pleasantly accessible regardless of the street arrangement.

Ecocities are like dense islands with narrow streets for people. Buildings are connected in midair to create a continuous surface to enable a steady flow of people. Allowing permeability increases the access to places, which in turn enhances the user experience of the place, which creates new opportunities for investment and place creation. Investment potential is very high where many people congregate (Newman 2008:84).

The permeability contributes to the overall clarity of place. An Ecocity must be comprehensive and easy to read (Newman 2008:70). Cities are in general very intricate and complex creations; however, it maintains a form of structure that makes it comprehensible. It should be complex without being complicated. A simple way of achieving this is to create vistas, landmark buildings or orientation beacons. Buildings and streets could guide the users to certain points of importance by gradually guiding the users at smaller intervals. Another point of clarity should be the user's boundaries; the user should be able to understand which places are allowed access and which are not.

2. Density/ Diversity

An Ecocity is much more compact than a city one would find today. It rolls back urban sprawl and create a dense and lively core. Access by proximity is the key concept that drives development. Citizens should be able to walk to work or the local grocery store (access by proximity) (Register 2006:38).

In order to satisfy the needs of the users and prevent them to travel far distances to other parts of the city, diversity needs to increase (Breaste 1998: 15). Mixed-use building should replace monofunctional buildings. It should become possible to live where you work and to work where you live.

3. Infrastructure

An Ecocity embraces narrow streets for cars, and wider streets for people that are design with the user in mind. The city shifts its priority from one where cars are the dominant figure on the street, to one where pedestrians are dominant (Prominksi et al, 2012:34). Envisioning a city where pedestrians have the upper hand may seem ideal, however, in some instances it may prove impractical. Therefore, highways should only be used by public transportation devices and should link dense urban pockets with one another. Railway lines should be the main device to reach towards more distant destinations. Within the city, bicycles and pedestrians should flourish (Knox 2013:90).

4. Vibrancy

Ecocities applies a fine grain density to the streets in the form of weather arcades. Ecocities cleverly stitch together a wide range of programmes that work in mutualism, directly improving the vibrancy of place. This allows a new density of population and intensity of activity that sparks a vital economy, healthy ecology and involved community (Breaste 1998: 12).

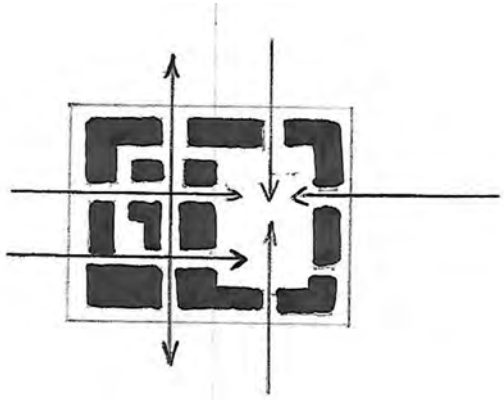


Figure 4.7 - Diagram explaining the importance of permeability within the urban construct; allowing easy access and enriching the user-experience (Author, 2018).

Figure 4.8 - Diagram explaining the need for cities to increase its density and diversity in order to improve its vibrancy and convenience (Author, 2018).

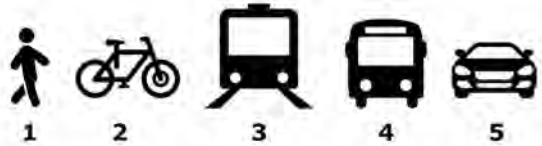


Figure 4.9 - Series of images explaining the ideal transportation hierarchy, with (1) being the highest priority and (5) being the least important (Author, 2018).

Figure 4.10 - City designed for people; the image above depicts a city where the transportation hierarchy is reversed, where pedestrians and cyclists dominate the roads leading to a vibrant environment (Author, 2018).

5. Water Management

Ecocities' water management strategies work contrary to that of contemporary cities. Cities of today try to dispose of rainwater as quickly as possible by channelling it away from the city as fast as possible. Ecocities, on the other hand, follows the rules of nature by incorporating permeable ground or paving strategies to recharge the water table. In the processes of the water filtering through the ground, it purifies the water naturally and stores it for later use.

We can catch rainwater for our own uses in cisterns and rooftop and ground-level temporary ponds and lakes to gather water in dry areas and prevent flooding in wetter seasons. Waters can create beautiful scenes, reflecting city and sky, mountains and stars in these ephemeral waters (Register 2006:15). There are many benefits to storing water; local water tables can be recharged and dried up springs brought back to life. Storing water during a rainstorm, or retaining the water in retention ponds, or even implementing permeable paving so that the water can slowly drain away back into the ground, is already a large improvement to the current condition.

6. Nature and the city

"Many of our city dwellers show a deep appreciation for nature. This could be from nostalgia from nature loss or be caused by the city itself" (Kibel 2007:47).

HES, D. & Du Plessis, C. (2015:46) mentions in their book, Designing for Hope, "Harvard biologist Edward O. Wilson proposed that humans have an evolutionary based affinity for nature and an innate need to affiliate with life and lifelike processes" (HES, D. & Du Plessis, C. 2015:46).

This is also known as 'The Biophilic Hypothesis'. It is an emotional response to life and living organisms. It is the co-evolution with nature over time to create a natural instinct that guides our decision making or the influences the way we feel about nature. "Biophilia is therefore more than just the positive physical experience of green space in the city or building" (HES, D. & Du Plessis, C. 2015:46).

Biophilia contributes to the well-being of people in a number of ways; research have shown that biophilia improves physical and mental health, for example, reducing headaches, colds, Sick Building Syndrome (SBS) and Cabin Fever (HES, D. & Du Plessis, C. 2015:46). Other studies show that it increases productivity and reduces absenteeism.

The mere act of being surrounded by nature enhances the healing process of the sick. Many hospitals around the world have started to incorporate Biophilic principles to speed up the recovery time of their patients. Other benefits include healthy maturation and development of the young; improved intuition and connectedness. Most importantly, Biophilia improves the quality of life and the sense of place (Girard et al. 2011:15).

Nature within the city can also manifest in the form of urban agriculture. The cities of tomorrow will use space much more effectively to produce the culinary products needed for human consumption and sustenance. Cities and building of today leaves roofs as an afterthought in the design process, especially that of high-rise buildings. Ecocities realises the potential of lost surface area and sees the roof level as a new ground level (Rodovic 2009:21). Just as the ground connect horizontal planes, so too does ecocity buildings connect in mid-air, allowing easy access and free movement to the surrounding buildings. In the Ecocity world, the rooftops become the most desired and pleasurable spaces.

Figure 4.11 - Image showing a retention pond that is used to store rainwater to be used as greywater in the adjacent building and irrigation water for the surrounding landscape (Plummy-fashions.com, 2018).

Figure 4.12 - What is nature's role within the city? The image shows how the urban construct and the natural environment supplements each other (ArchDaily Brasil, 2018).

THEORETICAL SUMMARY

The body of knowledge above can be summarized under a few short points:

1. A city is essentially a **living organism** that needs to be viewed in its entirety (Holistically).
2. The built environment should reduce its **negative effect** on the natural environment and allow for the integration of nature and ecosystem services.
3. The **transportation hierarchy** ought to be reversed in order to mitigate its carbon footprint; and promoting alternative forms of transportation and energy use.
4. A city should promote a pleasant **user-experience** and be convenient by strategically locating relevant programmes together (proximity consciousness).

EXISTING URBAN FRAMEWORKS FOR CENTURION

The Spatial Development Framework (SPDF) of the Tshwane Municipality mentions that there is still potential in turning Centurion into a high-quality metropolitan business destination and high-performance urban living area. The framework proposes two major interventions; firstly, African Gateway and secondly Symbio City.

Symbio City

Symbio City (refer to figure 4.13) is a privately driven intervention of a multi-billion-rand building that proposes a 'solution' to the Hennops river situation. It entails three skyscrapers that will cover most of the area currently occupied by Centurion lake and it is proposed that a small river would flow to the north of the towers. Three high rise buildings will be erected, the tallest one being 110 storeys tall, that will reach a total height of 447m, the tallest building in Africa (Scholtz, 2018). The Symbio City proposal currently faces problems with its feasibility and the actual realization of the proposal is unknown.

African Gateway

African Gateway comprises of the development of a large undeveloped land area, located to the south of Centurion CBD, into a new business district. It also proposed the development of the Tshwane International Convention Centre and Governmental Precinct.

The aim of African Gateway is to create a new business node within the existing economic triangle of Gauteng (Johannesburg – Ekurhuleni - Pretoria). The Municipality have recognized the potential and high locational advantages of Centurion; it includes recent development of high technology and logistics industry (New businesses such as PPS and BCX). As a result, higher density residential development is emerging as well as large impact infrastructural interventions (Gautrain, BRT systems, housing, environmental management, and spatial restructuring).

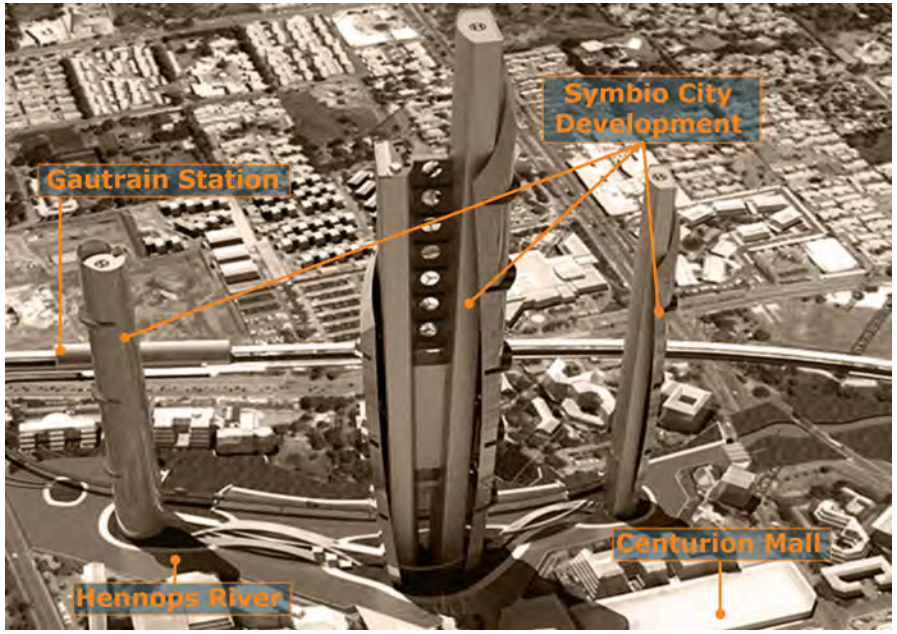


Figure 4.13 - Image depicting the Symbio City proposal for Centurion Lake (Author, 2018).

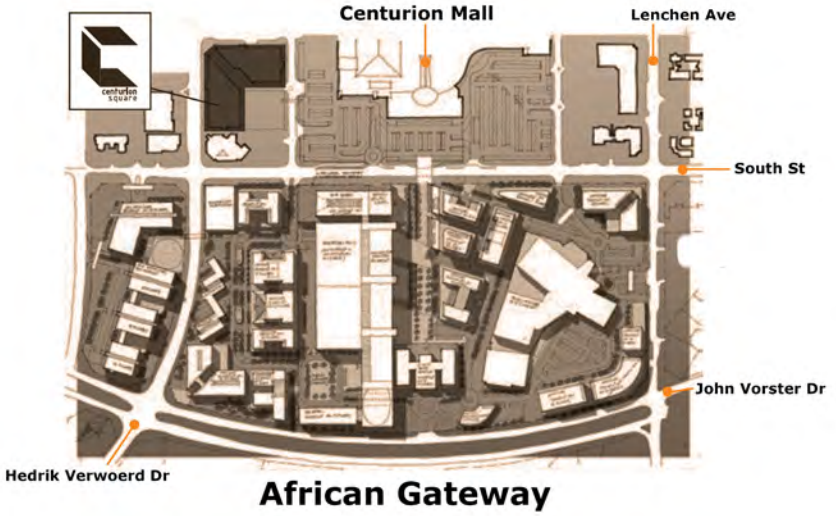


Figure 4.14 - African Gateway proposal done by Boogertman + Partners (Architects) (Boogertman, 2018).

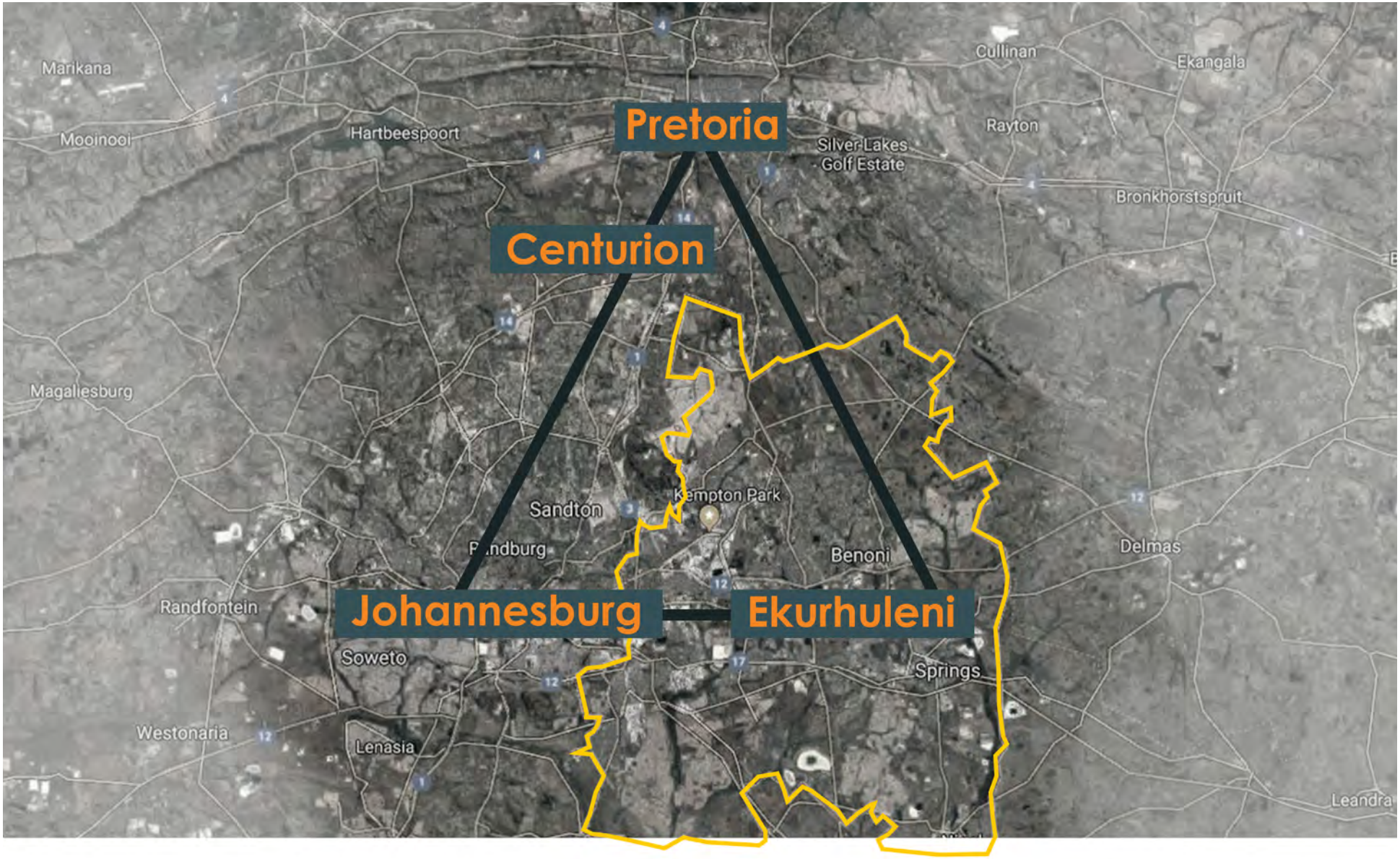


Figure 4.15 - 'The Economic Triangle'- As proposed by the Tshwane Municipality, consisting of Pretoria-Johannesburg-Ekurhuleni. Centurion falls within the Economic Triangle (Author, 2018).

Spatial Development Framework for Centurion

Tshwane Municipality (SPDF)

With the addition of the Gautrain within Centurion, it confirmed Centurion's importance as a node. The Municipal framework recognizes the potential that the Gautrain has within the context of Centurion. It proposes to create a pedestrian link between the train station, through Centurion Mall and finally the African Gateway precinct. This will enable citizens to commute by train and BRT systems from all over Gauteng to conduct business at African Gateway, thus contributing financially to Centurion's business district, resulting in the development and transformation of the city into an economic core.

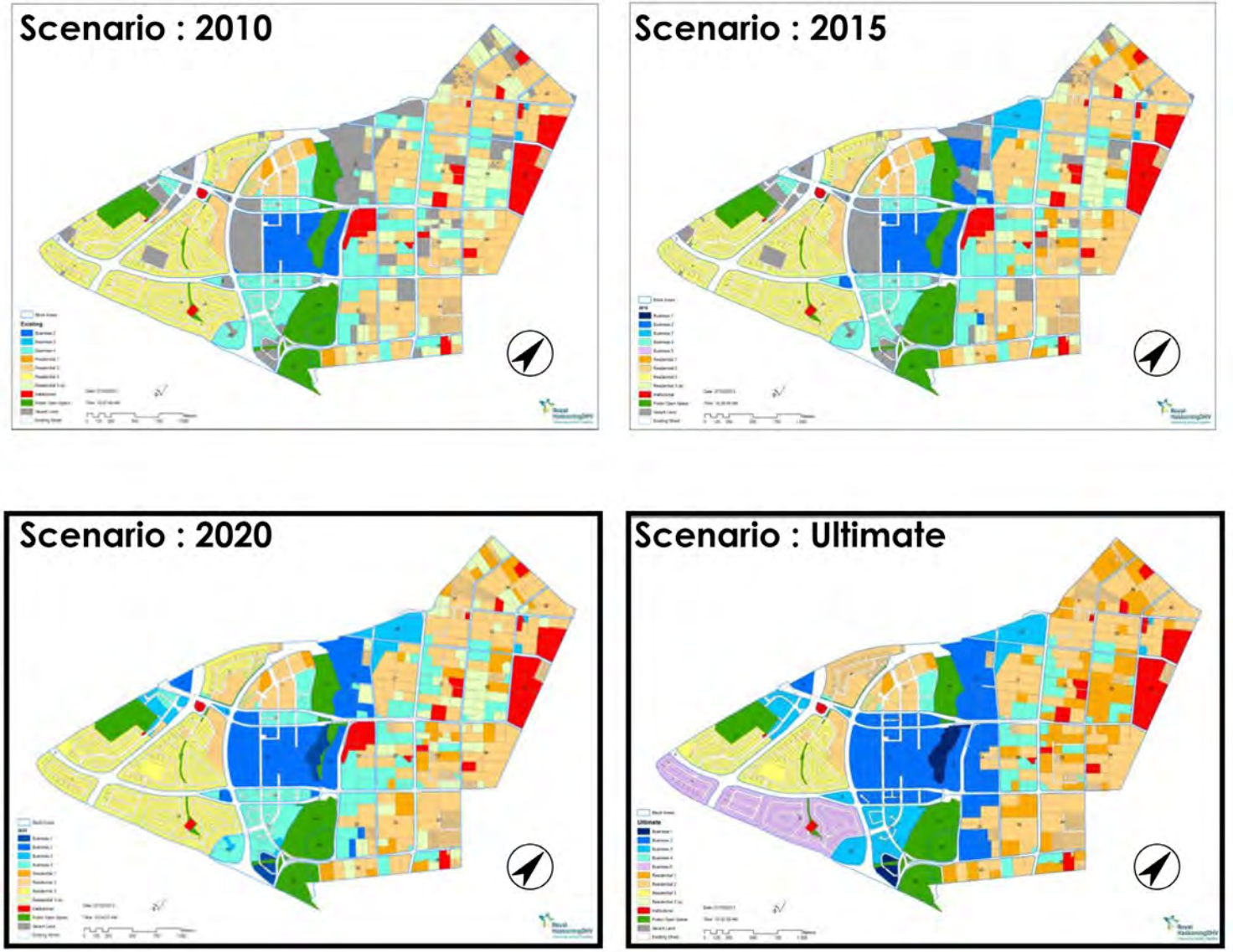


Figure 4.16 - Series of images showing the Spatial Development Framework of the CoT, with its vision for Centurion in the year 2055 (Tshwane SPDF, 2011).

Figure 4.17 - The Final Master-plan of the CoT Municipality SPDF (Tshwane SPDF, 2011).

URBAN VISION

I envision a city that is fully integrated with nature and nature processes in mind. A holistic organism where one process supplements the other in a mutually beneficial manner. I envision a city that is completely pedestrian friendly and is a place that people want to visit for its convenience and prestige design to the finest detail. Each element, regardless of how small it is, should contribute to the whole experience of place. I envision the city to have a logical hierarchy of spaces that promotes legibility and be able to draw the user to certain nodes of importance by using landmarks and vistas. I envision a city that aims at reducing its carbon footprint by using alternative sources of energy and transportation. I envision a city that always keep all its stakeholders in mind, albeit, man or nature.

URBAN STRATEGIES

The main strategies can be grouped under the following headings:

1. Connect
2. Develop
3. Transport
4. Proximity
5. Vibrancy
6. Nature

Connect

• Create a strong pedestrian link that connect the Gautrain Station with the newly proposed business district via Centurion Mall
• Establish connections, in the form of pedestrian friendly networks, from the surrounding suburbs to the main pedestrian artery
• Create access paths where there are none and where it is most needed
• Differentiate between where the public is allowed to circulate and where not
• Incorporate a street network that allows many routes instead of a singular route. Provide a variety of streets as opposed to merely one type of street. For example; incorporate streets for people, bicycles, cars and busses. The users can then decide which form of transportation works best for them. "Like any good framework, such structures give the individual a possibility of choice" (Newman 2008:21).

Develop

• Identify the most important development that should take place at the relevant connection points in order to improve the vibrancy of place
• Promote a balanced mix of complimentary activities (balanced community)
• Provide for a range of housing types and costs
• Promote higher density residential development

Transport

• Reverse the transportation hierarchy
- 1. Pedestrians
- 2. Bicycles
- 3. Rail transit
- 4. Flexible transit (busses)
- 5. Lastly cars
- (Register 2006:87)

• Develop high quality transit and Bus Rapid Transit (BRT) systems that are affordable and easily accessible.

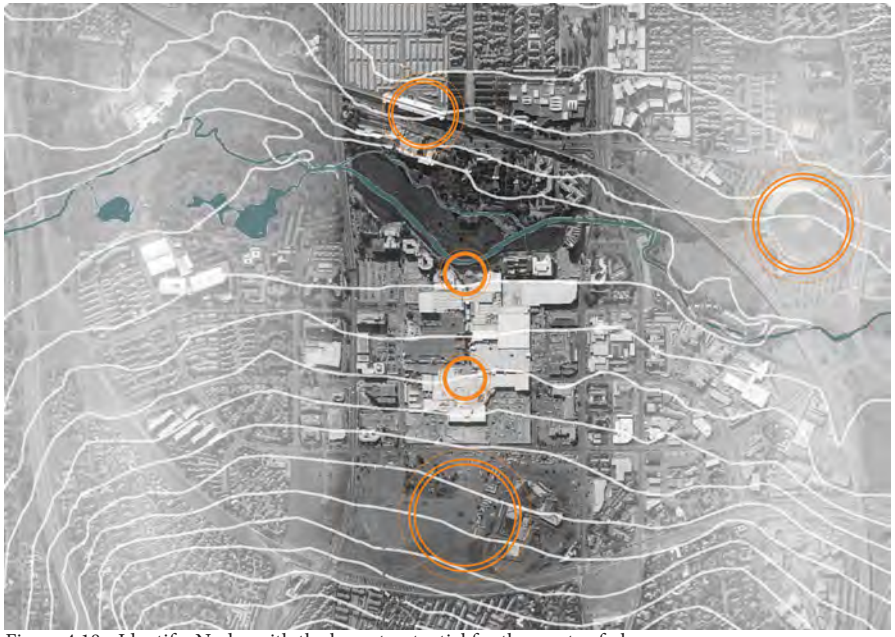


Figure 4.18 - Identify: Nodes with the largest potential for the create of place (Author, 2018).

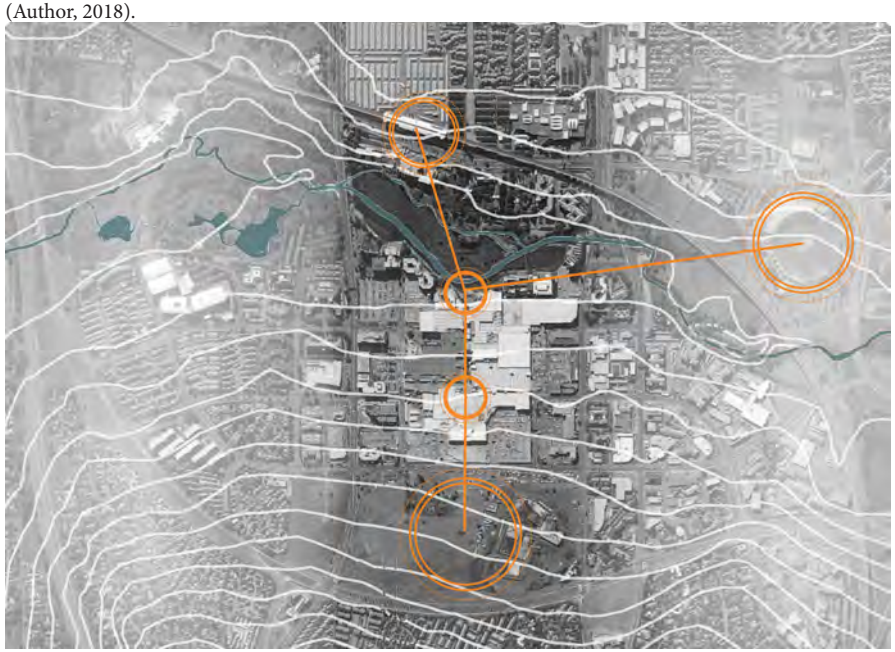


Figure 4.19 - Connect: Create a strong link between the nodes in order to improve its accessibility (Author, 2018).

• Enhance the functional and visual quality of streets and public spaces

Proximity
• Create a complex living system of places located closely together
• Make it easy for people to walk from one destination to the next
• Build cities on a three-dimensional, integral, complex model
• Not flat, random, uniform or simple (Register 2006:89)

Vibrancy
• Create mixed-use and mixed income neighbourhoods (Rodovic 2009:56)
• Increase the density and diversity of land-use pattern within Centurion to improve the vibrancy of place in return
• Incorporate a wide range of activities to reach the interest of the general public, thus, improving the social condition of the city
• Make the city's function fit with the patterns of evolution, not just be sustainable but rather regenerate natural systems and support creativity
• Increase supply of functional public space
• Increase social facilities; recreational spaces

Nature
• Create a city that functions like an inter-connected living organism (living system)
• Apply Biophilic design principles to existing buildings within Centurion
• Bring nature back into the city in the form of urban agriculture, street trees, designed landscapes, and public open green spaces
• Preserve the natural environment, natural ecologies, agrarian landscapes and cultural heritage sites (Jellicoe 1975:201)
• Create a link between the Gautrain Station and SuperSport Park; thus, using the river system as a green strip that links rather than divides
• Create a public park that re-establishes the lost connection between man and nature
• Build soils, prevent soil erosion, and enhance biodiversity
• Regenerate Centurion Lake by implementing water rehabilitation and purification mechanisms.
• Create a public park that re-establishes the lost connection between man and nature.
• Promote environmental management training and education

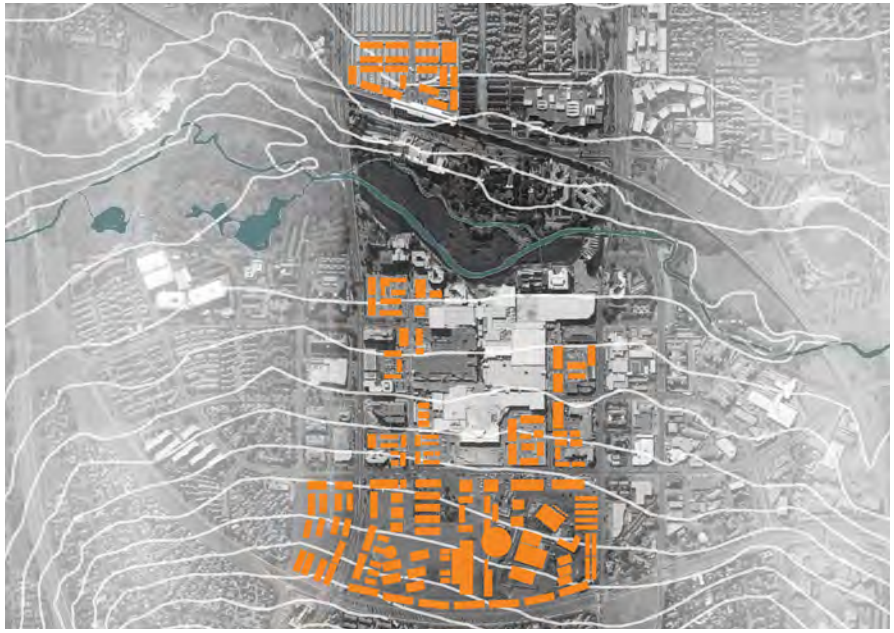


Figure 4.20 - Develop: Areas where development should take place (Author, 2018).

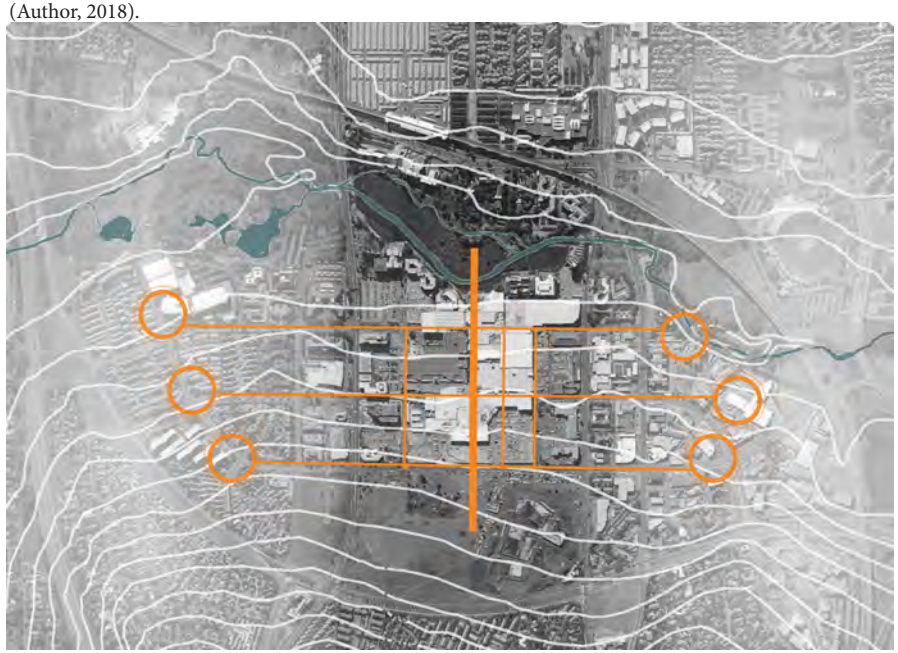


Figure 4.21 - Integrate: Zones of integration towards the pedestrian promenade (Author, 2018).

URBAN FRAMEWORK RENDERINGS |

IDENTIFY THE PLACES OF SIGNIFICANCE

In figure 4.22, it become evident that permeability, circulation and transportation plays an extremely important role in the urban framework; as a result, the Gautrain was identified as one of the most important node within Centurion.

Currently, the Gautrain Station is surrounded by grossly oversized parking zones that is built on, arguably, the most important ground in the vicinity. Working off of the premise of Transport Oriented Design (TOD-systems), it is proposed that significant development will occur around the Gautrain Station, replacing the parking areas with basement parking and implementing high impact businesses around the station.

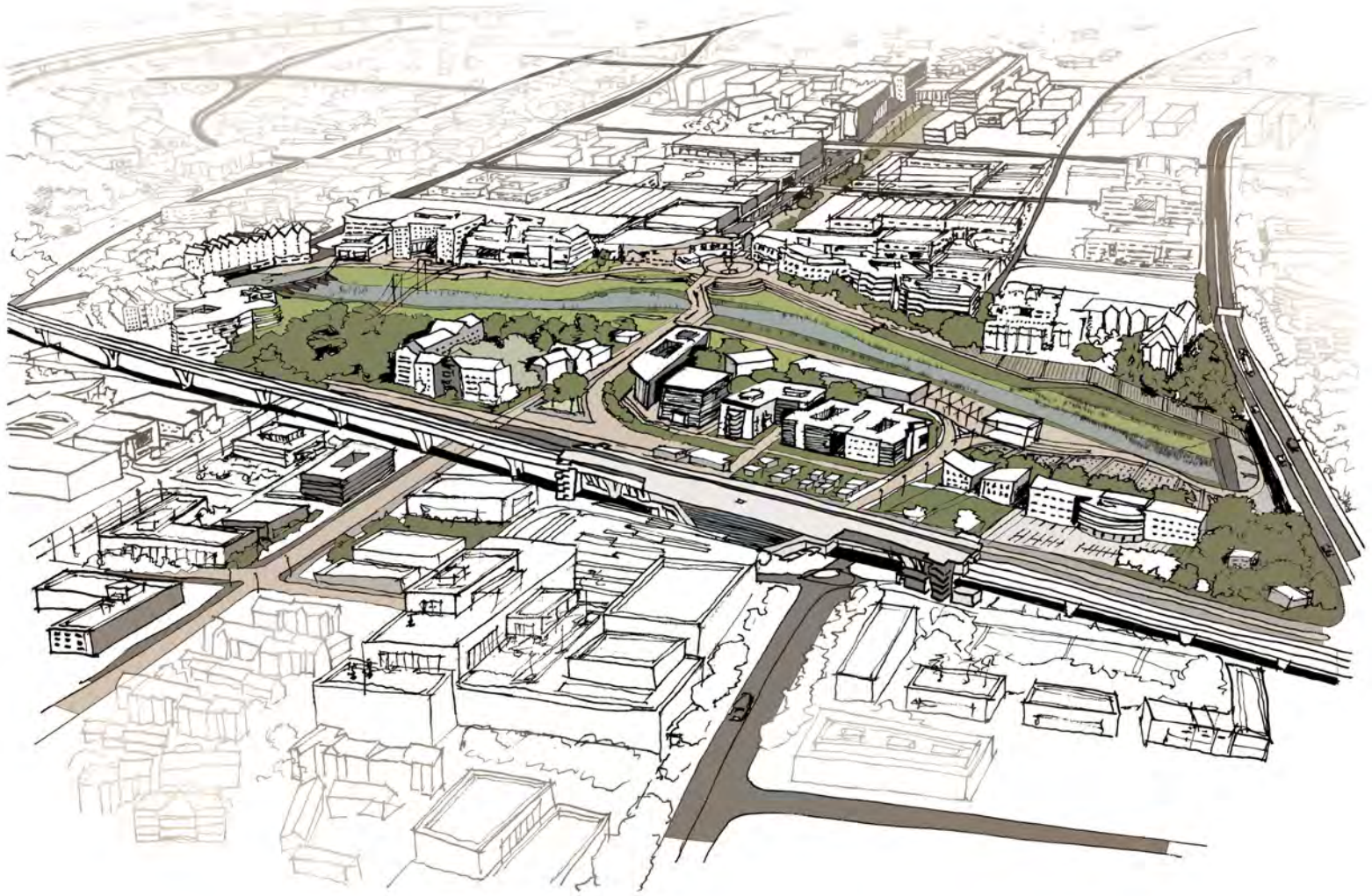
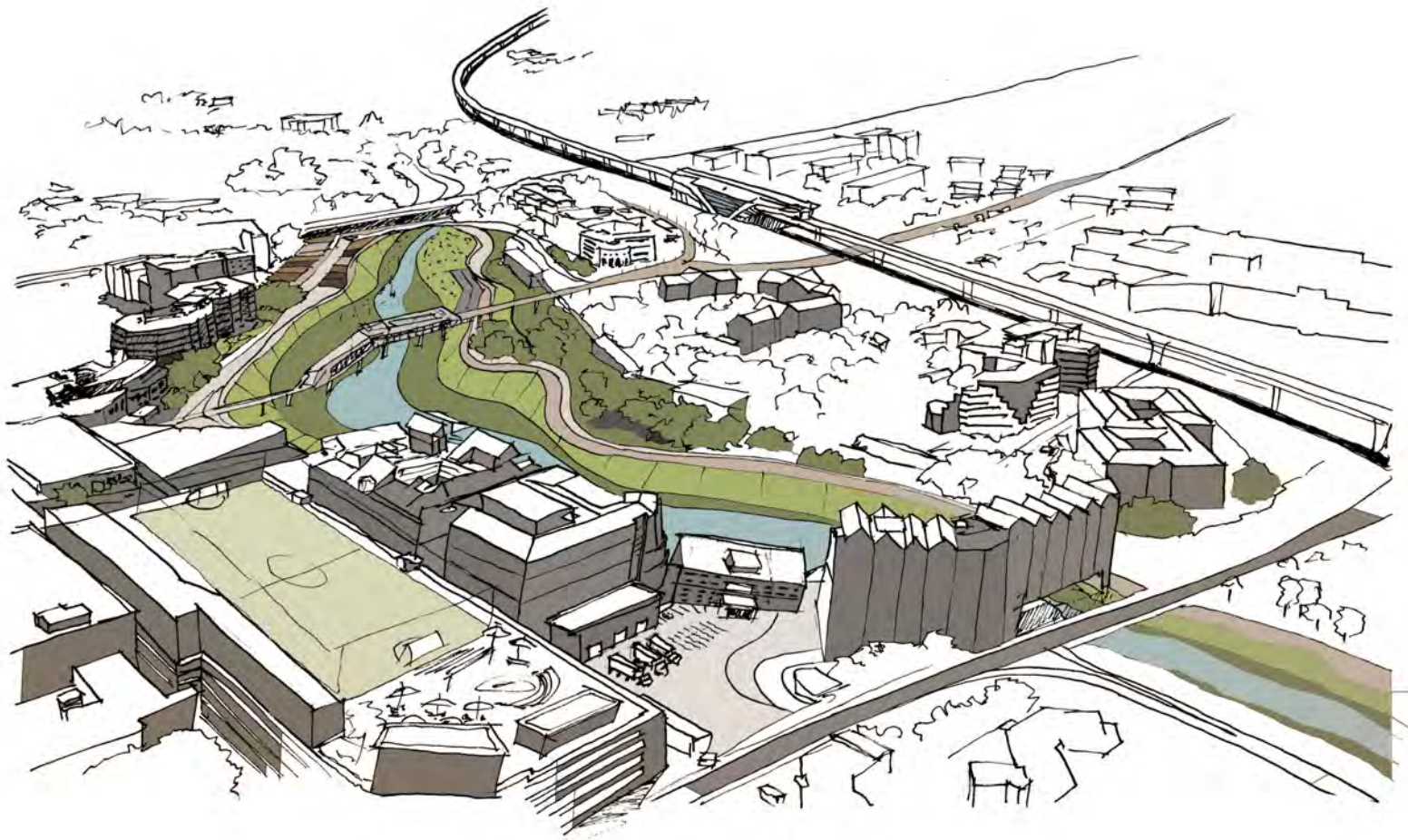


Figure 4.22 - Connect: Create a strong link between the nodes in order to improve its accessibility (Author, 2018).



CONNECTING THE NODES

In figure 4.23, one would notice a pedestrian circulation path that connects the Gautrain Station with Centurion Mall. Currently (2018), no such connection exists and pedestrians uses the vehicular highways (Lenchen Dr and Hendrik Verwoerd Dr) to cross over to the station.

The aim of the link is to re-establish the lost connection between Centurion Mall and the Gautrain Station. In doing so, the urban fabric becomes more permeable and allows for easy access.

CREATING A GREEN LINK

The current trend is to use river systems as waste disposal mechanisms by polluting it with factory and other effluent. Rivers can play a far more important role within urban environments such as the disposal of storm water, the purification of water, growing of urban agriculture, ecological linkages and accommodation recreational activities.

It is proposed that river systems should be used as 'green-links' between the different zones within a city. These links become the new public open spaces and recreational areas that re-establishes the connection between the citizens and its natural environment.

Figure 4.23 - Integrate: Zones of integration towards the pedestrian promenade (Author, 2018).

DENSITY AND DIVERSITY

Earlier in this chapter, Register (2006) mentions that the catalytic core of cities should be developed to 'role back urban sprawl' and create complex living, working, and recreational activities.

Furthermore, Phenomenology speaks about creating places with diversity to increase the vibrancy of place. With these two aspect considered, it was proposed to develop Centurion Mall vertically upwards as opposed to horizontally outwards. Centurion Mall, due to its initial development and form, becomes monotonous at certain points. The Mall is also mostly enclosed, with the promenade being the dominant open public space. Access in general is restricted and hidden when approaching the mall form the east and the west.

It is therefore proposed that the mall display some form of transparency and legibility by opening up its facades and creating vibrant public spaces. It is proposed that development happens vertically by adding more levels to its existing area.

Opening up the mall creates the possibility to allow nature in and establish itself as an integral part of the built fabric, enhancing the life-quality of its inhabitants.

Figure 4.24 - Develop: Areas where development should take place (Author, 2018).

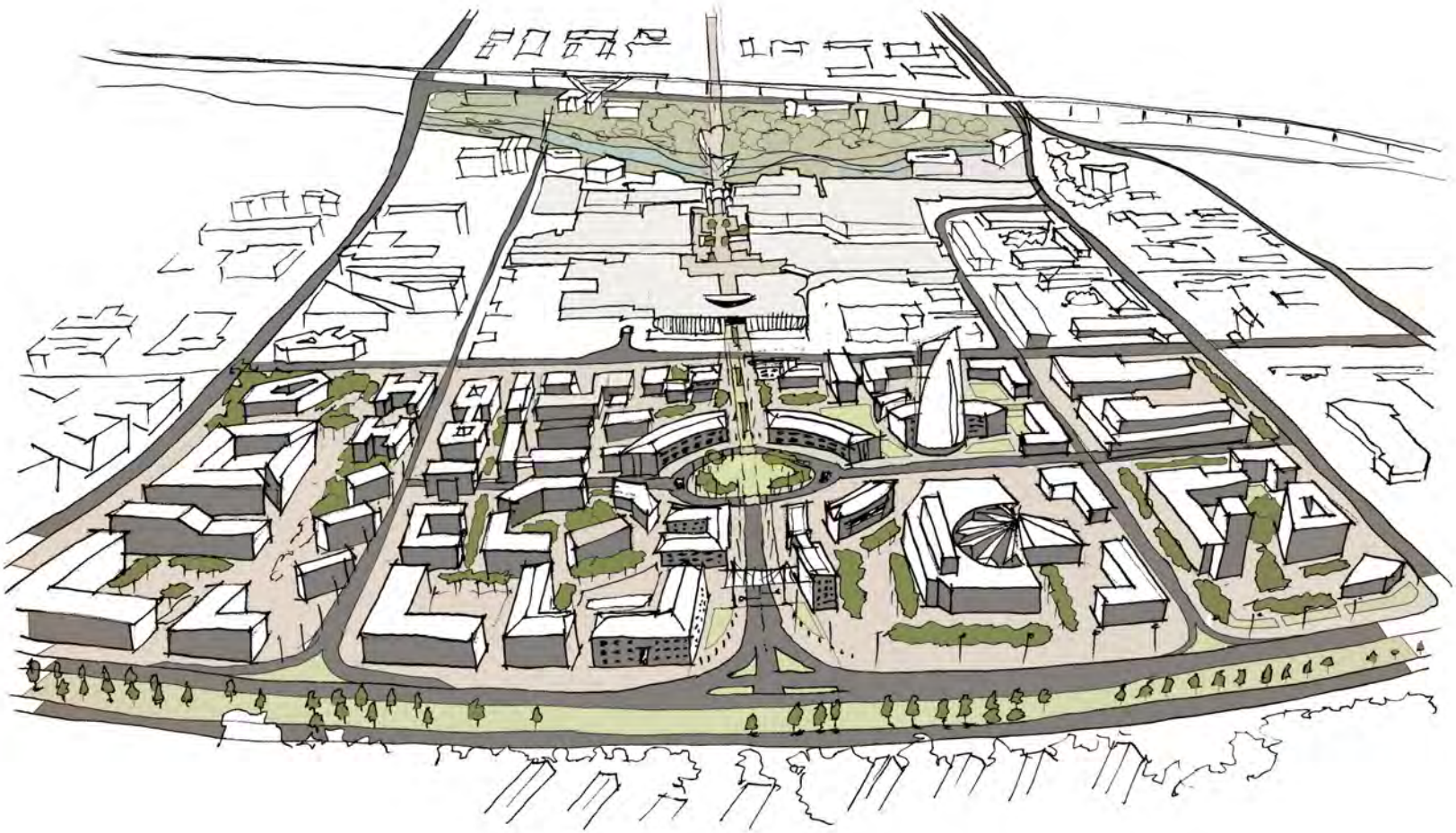


Figure 4.25 - Image depicting the new 'African Gateway' precinct as envisioned by the Author. The pedestrian 'Eco-promenade' leads from the Gautrain Station directly into the new business core (Author, 2018).

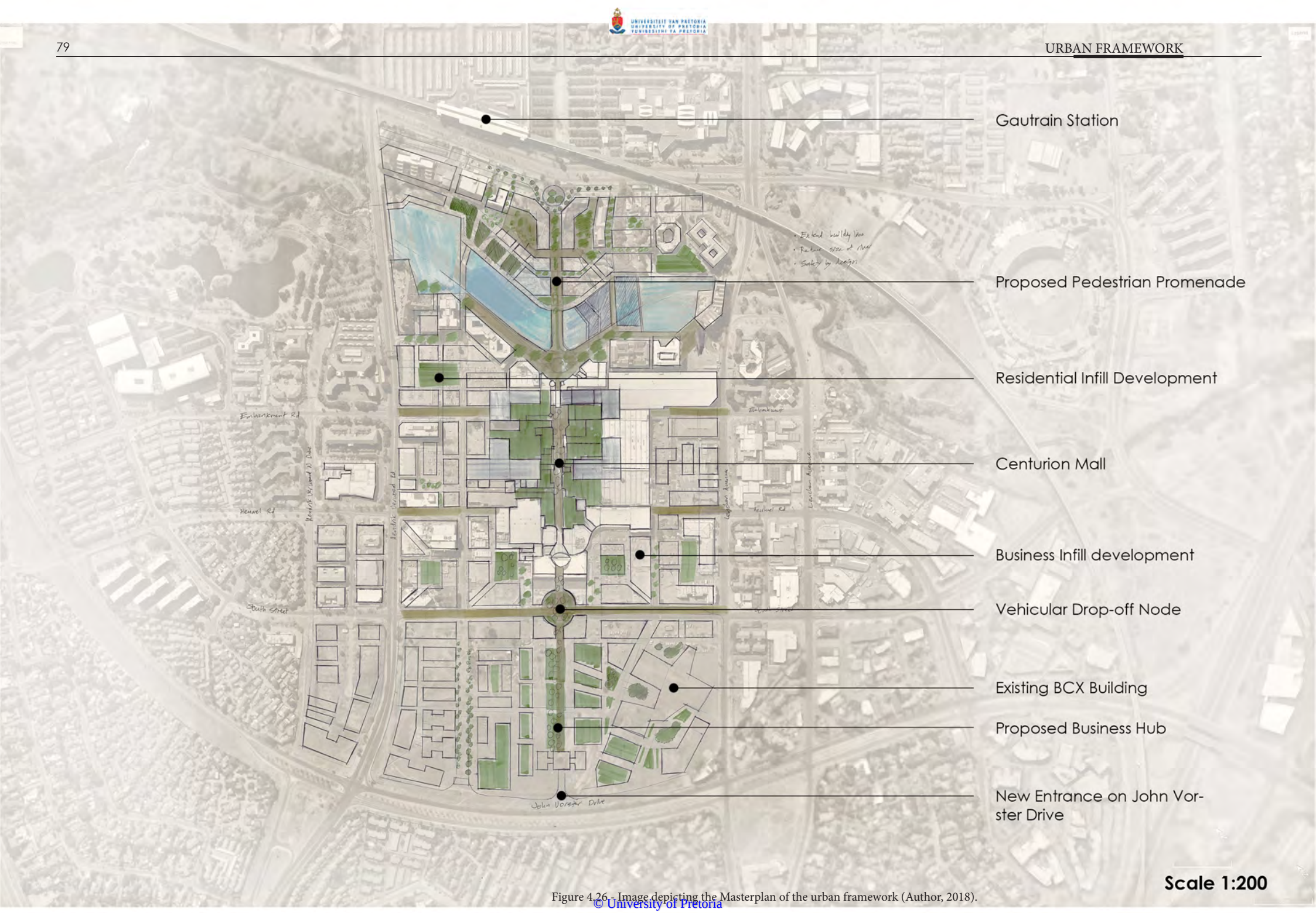


Figure 4.26 - Image depicting the Masterplan of the urban framework (Author, 2018).

CONCLUSION

The initial lack of development of Centurion has led to Centurion's potential to rise more and more as the years passed. Today, Centurion has one of the most under-developed CBD's in Gauteng with the largest potential of development in the near future (Tshwane, 2015).

Richard Register (2006) explains the concept of 'proximity consciousness' where the land-use pattern is strategically arranged close together, in doing so, it is possible to use alternative means of transportation, such as, walking and cycling. "Be there rather than to get there" (Register 2006:54). Alternative means of transportation will reduce our carbon footprint and slowly restore the ecological state of the world.

With the concept of 'proximity consciousness', each building becomes as diverse as an entire city, each building becomes a small community in its own right. This will improve the resilience of cities.

The Spatial Development Framework of the City of Tshwane recognizes Centurion's significance within the 'Economic Triangle' (framed by Pretoria, Johannesburg and Ekurhuleni), and mentions that large scale development of technology buildings within Centurion is inevitable. The SPDF proposes that Centurion be developed, with mostly businesses and large-scale residential units, together with the Gautrain that enables business people to commute from all across Gauteng.

Furthermore, it seems unclear what role Centurion Lake plays in the future development of Centurion. Proposals such as the privately driven initiative 'Symbio City' emerge that proposes skyscrapers to be placed within Centurion Lake. The polluted state of the river remains in question. Some proposals completely cover the lake or channelize the water, thus avoiding the problem and distributing it downstream.

It is for this reason that the dissertation proposes to rehabilitate the lake by converting it back into a natural flowing river, "letting nature do the work" (Register, 2006).

The proposed framework strategies include; to identify the most significant destinations (Gautrain Station, Centurion Mall, and Undeveloped African Gateway Precinct), and proposes to connect these places with pedestrian and cycling networks.

Centurion then becomes an environmentally friendly city, with a vibrancy unmatched by any other city in South Africa. It becomes a safe, walkable and vibrant environment that incorporates ecological functions into the lives of the citizens; a place where one can escape from the busy 'concrete jungle' by stepping into an Urban Oasis and see the purification process that nature holds in its domain.

Centurion then becomes a truly sustainable city that creates vibrant livelihoods for its people, opportunities for young graduates and a home for its citizens.

CHAPTER 05 | FROM WASTE TO RESOURCE TO PRODUCT

Programme, Sub Programmes and Precedents

Figure 5.1- (www.thedistiller.com, 2018) Edited by Author.

PROGRAMMES AND SUB PROGRAMMES |

In the previous chapter, urban theories and existing urban proposals were investigated to gain a deeper understanding of the context and the possibilities it presents. Design informants from the mapping process were used to propose a new vision for Centurion

CHAPTER FIVE BREAKDOWN

This chapter will explore relevant programmes as it applies to theory and the context. Each process will be explained in terms of its relevance and its contribution to the site.

INTRODUCTION

-River pollution, Siltation and the lost connection between man and nature -

Since the advent of the industrial revolution many environmental problems emerged, one of the most dangerous being river pollution. Industries located close to or next to rivers systems uses the river as a waste disposal mechanism leading directly to environmental degradation. The mass production of food lead to the need for effective packaging of the products. These packages create another large-scale problem as it needs to be disposed of. The costs and effort to rid the city of all the extra material proves to be unfeasible and an easier alternative is used, namely landfill or dumping the waste in industrial areas - unseen by public eye. The endless incline of waste together with negligent supervision and noncompliance of legislation lead to rivers being polluted with plastic and other waste.

On the other side of the spectrum, the industrial revolution caused an influx of development in the built industry. Cities became larger and nature were replaced with concrete directly leading to a major disconnection between industrial processes and natural processes. The degradation of trees and shrubs, specifically, along riverbanks causes soil instability and ultimately soil erosion. Riverbank erosion leads to suspended solids forming in the water and negatively effects aquatic life within river systems.

The proposed programmes will aim to address river pollution in urban environments by creating a sense of awareness of the threats that it poses as well as the hidden potential benefit it could bring to urban environments. Architecture then becomes a mediator between the man and nature that recognizes waste not as pollution but rather as an important resource. The programmes that are implemented must therefore regenerate Centurion Lake and once again reconnect its citizens to the natural environment, to the benefit of both the natural realm and human construct (refer to figure 5.2).

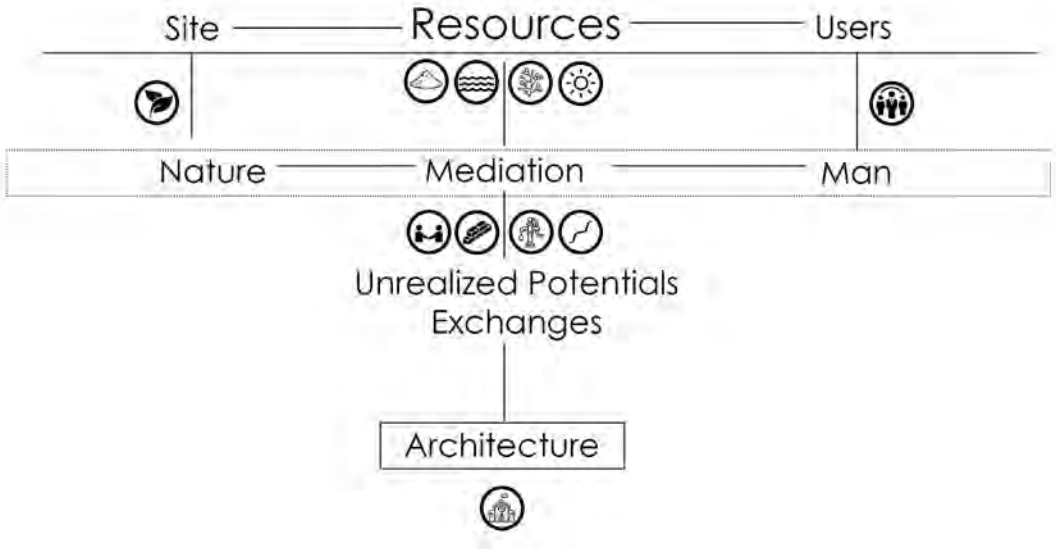


Figure 5.2 - Diagram highlighting the importance of architecture to re-establish the connection between man and nature within the urban realm, and in doing so, extract resources from urban rivers which ultimately improves the quality of the water (Author, 2018).

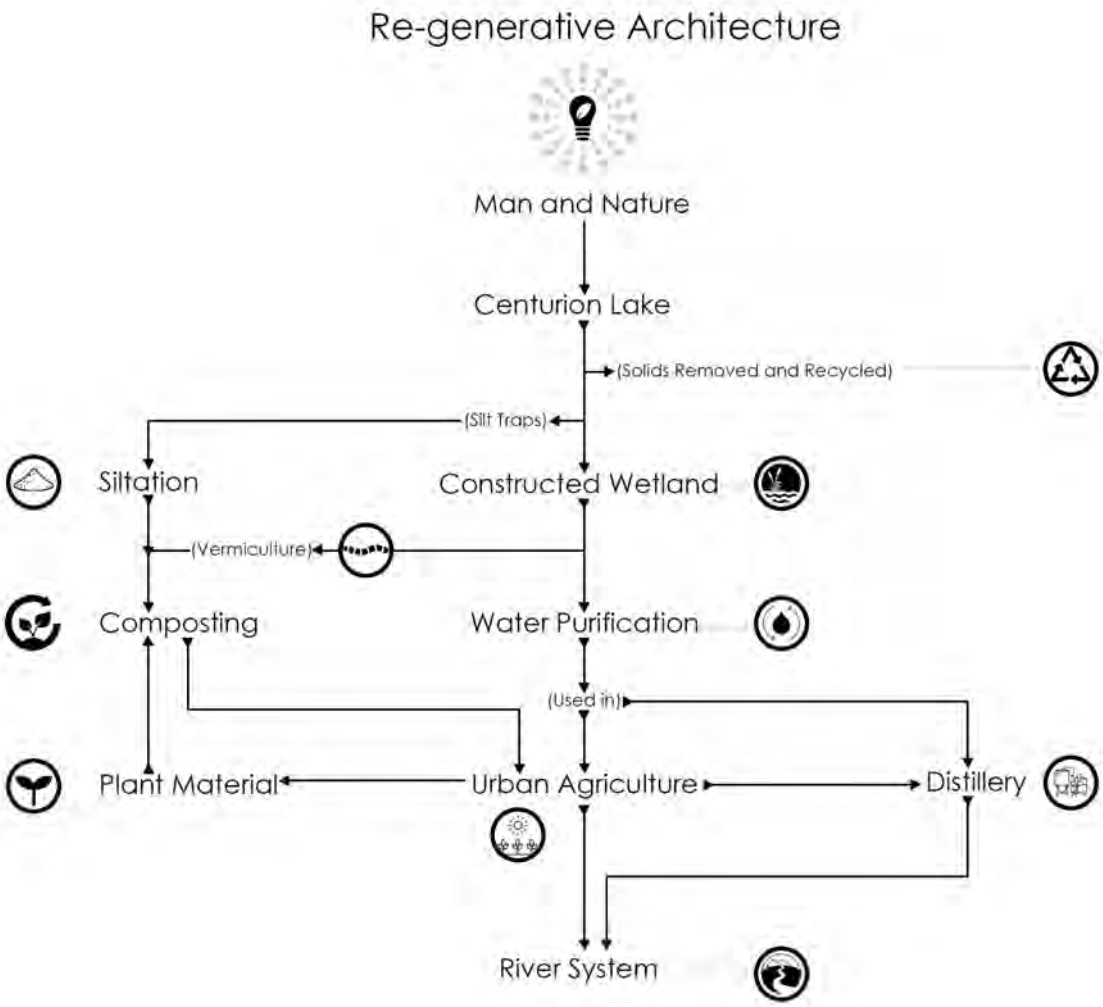


Figure 5.3 - Diagram highlighting and summarizing the entire programmatic process that was implemented in this dissertation. It showcases the closed-loop systems or circular metabolistic systems. Each step of the process is interdependent on the other (Author, 2018).

PROGRAMMATIC INFORMANTS|

Regenerative theory mentions that the state of any given construct cannot function in isolation as it is dependent on holistic systems (Knox 2013:87). Nature does not work in isolation, one system's waste is considered a resource in another system, and so the cycle goes on to form a fully integrated web of life.

Lyle (1994) elaborates on the notion of complex natural systems that stands in stark contrast to the mechanized world.
He explains that nature inherently has a level of infinite diversity in structures, species, processes and systems. This intricate level is difficult, if not impossible, to achieve by human endeavors. Man tries to mimic natural systems by creating systems with a linear flow. These linear systems produce a considerable amount of waste and is degenerative. A more regenerative approach is to create cyclical flow or circular metabolistic processes.

Architecture needs to reconsider its lasting impact on the environment by facilitating natural processes. It needs to allow nature to be an integral part of its functions and construction regardless of its programme. The architectural intervention therefore proposes that cyclical systems be incorporated in the design process. A holistic approach to architecture is taken that considers natural process as a first priority.

Lyle (1994), in discussing his cyclical model of nature, explains that nature works on five basic principles, namely; Conversion, Storage, Distribution, Filtration, and Assimilation. In response to regenerative theory, programmes were chosen based on its potential to incorporate natural systems that can converge resources, filter and assimilate, store and distribute, and re-assimilate the materials back into nature.

SUMMARIZING THE PROCESSES

The first point of connection would be to address the state of the polluted Hennops river that leads into Centurion Lake. Silt trap technology is used to capture the plastic waste, and then settles out suspended solids in the water due to siltation. This 'waste' then becomes resources in form of; water without suspended solids, recyclable plastic, and fertile ground. The water is purified, the plastic is melted and cast into plastic furniture to be sold (waste into product). The silt is used as an additive to vermicompost to enrich its nutrient value. Vermiculture beds are used to assimilate all biomass produced on site. This cyclical cycle contributes to the regenerative quality of the site.

All these processes should be experienced by the users of Centurion and therefore, as part of the urban framework, a multifunctional bridge structure is proposed that connect the Gautrain to Centurion Mall (refer to chapter 4). The processes, governed by phenomenological experiences, reintroduces nature back into the 'city' by various means of connection (sight, smell, sound, taste, and touch). A Gin Distillery is used due to its natural transparency of processes. The users can follow the process of gin distilling, from where the botanicals grows, all the way to the end product.

ELABORATING ON THE PROCESSES |

THE ORIGIN OF SILTATION AT CENTURION LAKE

Since the transformation of the Hennops river into Centurion lake in 1983, it posed siltation problems. Development upstream towards Kaal River accelerated the process in the form of riverbank erosion, which in turn naturally polluted the water with suspended solids leading to the die-off of many aquatic life (according to the Vegetation and Wetland Report CoT, 2012). Past reports show that the silt was dredged, piped and disposed of into a silt dam located in the Highveld Techno Park (close to Centurion Lake) (Feasibility Report, 2008).

The siltation problem will continue to exist unless the lake's retaining wall is removed and the river is restored to its natural state. Feasibility reports of the CoT (City of Tswhane Municipality, 2008) have proposed three solutions to the siltation issue namely;

1. Option One: "Do Nothing" (CoT Feasibility Report, 2008) where Centurion Lake is allowed to silt up, forming its own natural wetland of reeds and exotic plant species – resulting in some cleaning effect on the water.

2. Option Two: "Keep on Dredging" (CoT Feasibility Report, 2008) The dredged silt is treated with lime to eliminate the heavy metals (Manganese). The silt is then trucked to an appropriate (permitted) landfill site or to a private buyer. Or alternatively, a new site (such as Highveld Techno Park) is used to create a new silt dam. Previous studies, however, have found that there are no such sites within CTMM (City of Tshwane Metropolitan Municipality). Thus, the new silt dam must be located 80-100km form Centurion Lake, which proves highly unfeasible.

3. Option 3: "Restoration of the Natural River through Centurion Lake" (CoT Feasibility Report, 2008) Construction of a water conveyance structure, or 'channel' to restore the natural flow of the river. It is also proposed to construct a diversion weir to catch the silt. The riparian area is then used as a public park and a wetland system that purifies the water with natural means.

Figure 5.4 - Diagram showing the effect of siltation on site. The photo was taken where the water enters Centurion Lake, underneath Centurion Lake Hotel. Sediment and sand deposits are present at the river's point of least resistance. These sediments are valuable and fertile ground that can be extracted and used in many ways (Author, 2018).

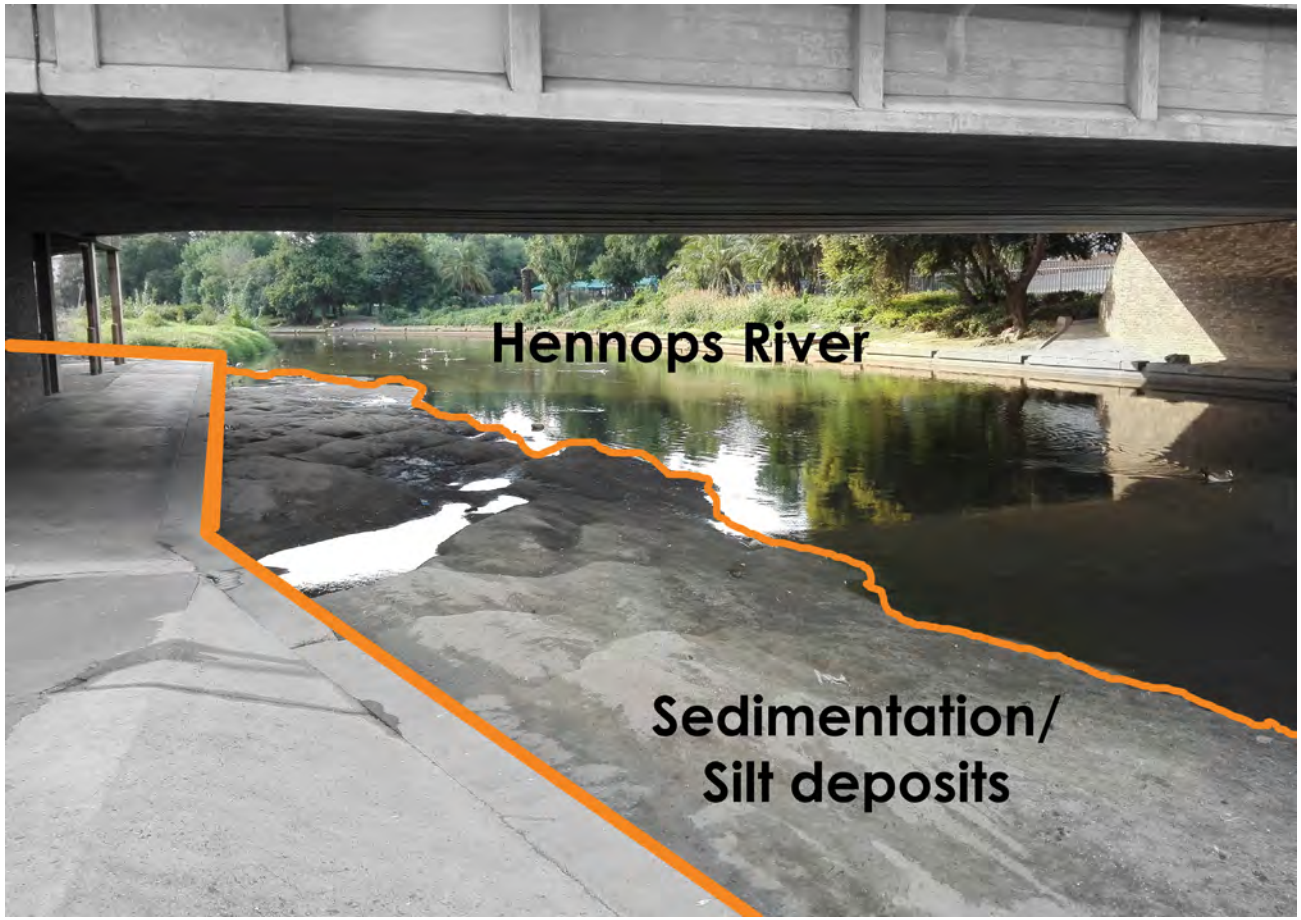
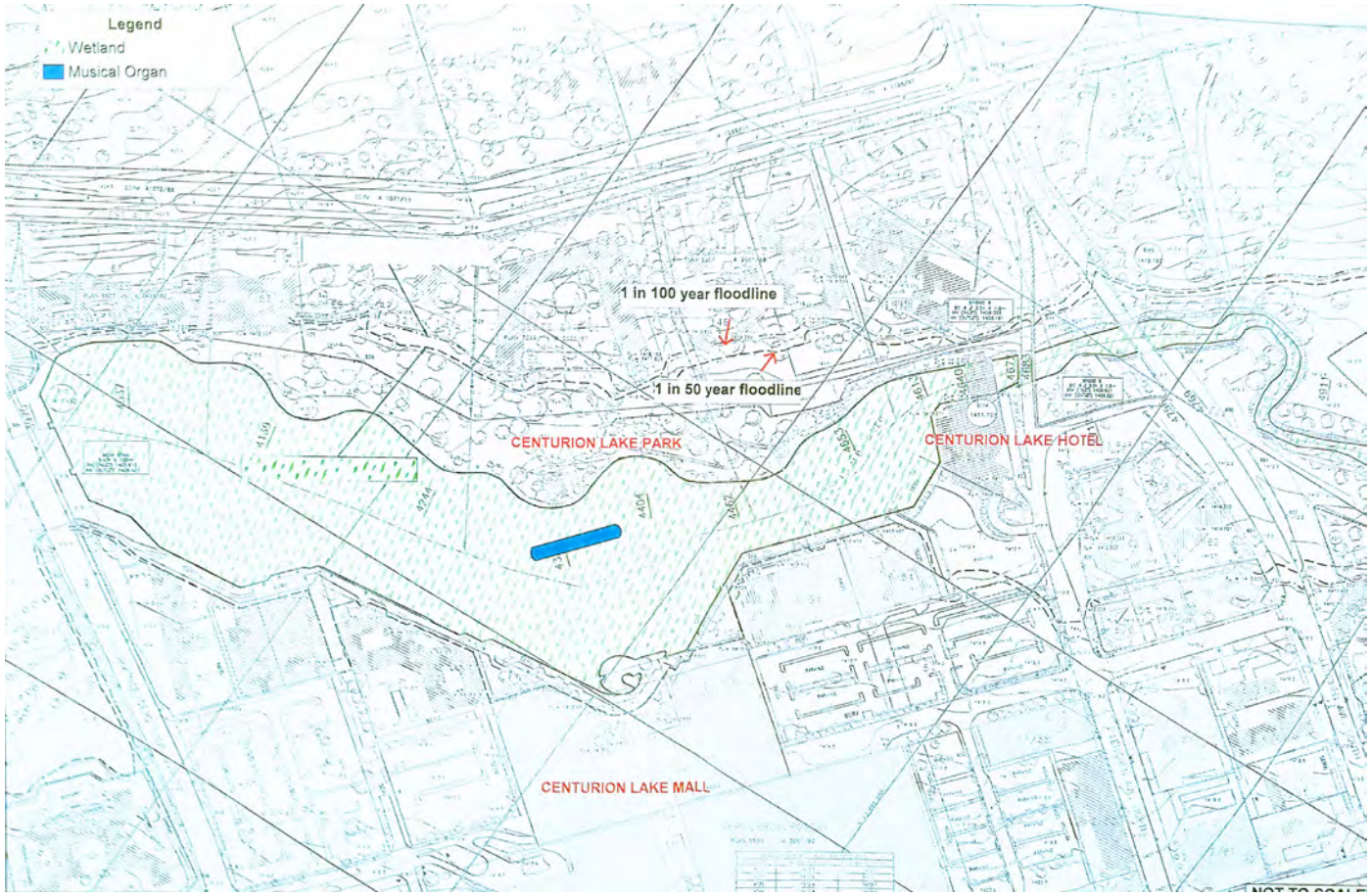


Figure 5.5 - Image indicating Option 1 of the Long-Term Management Plan for Centurion Lake (CoT Feasibility Report, 2008).



OPTION 1

The first option proposes that the lake should remain a lake, in other words, the retaining wall retains in tact and the mass of water is still present.

Applying this option will lead Centurion Lake to be filled with silt until the entire retention basin is completely covered in sediments. The advantages in doing so is that very little costs have to be made, and the lake will turn into a wetland - that will purify the water to some extent.

There will also be less deposition of silt further downstream as it would be captured in the wetland. The strongest advantage is that with no lake, there is no silt dam to maintain, and therefore no dredging.

Disadvantages include, the establishment of alien invasive plant species.

OPTION 2

The second option is to close Centurion Lake for the duration of its rehabilitation period and to dredge the silt out of the lake.

The benefit of this option is that Centurion Lake would have an aesthetically pleasing lake that could be used for recreational activities once again. However, the pollution problem will persist and therefore continue to repel the general public.

The difficulty lies in finding a new site to store the silt. No such site could be found and this option were marked as unfeasible (CoT Feasibility Report, 2008).

Figure 5.6 - Image indicating Option 2 of the Long-Term Management Plan for Centurion Lake (CoT Feasibility Report, 2008).

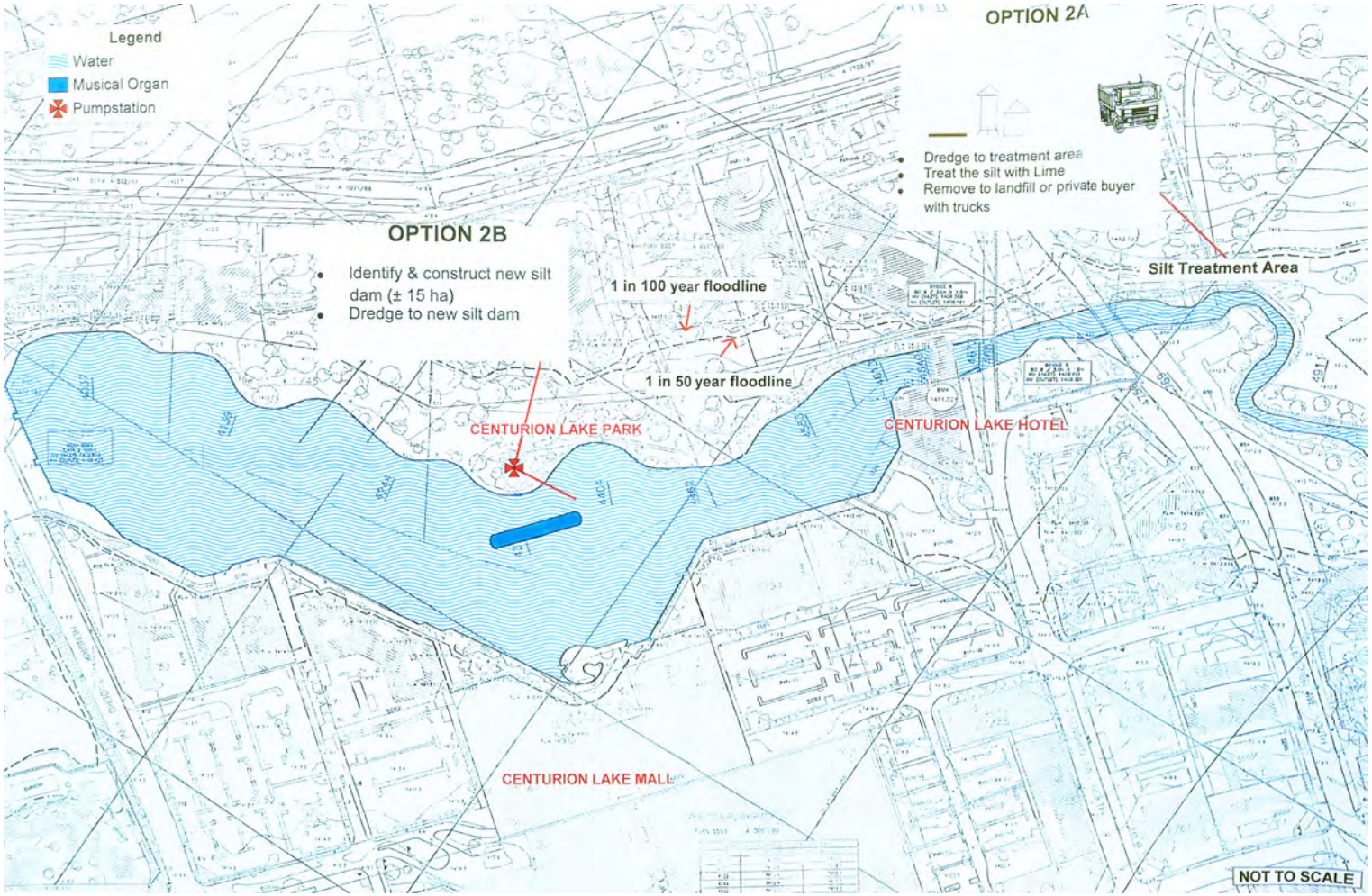
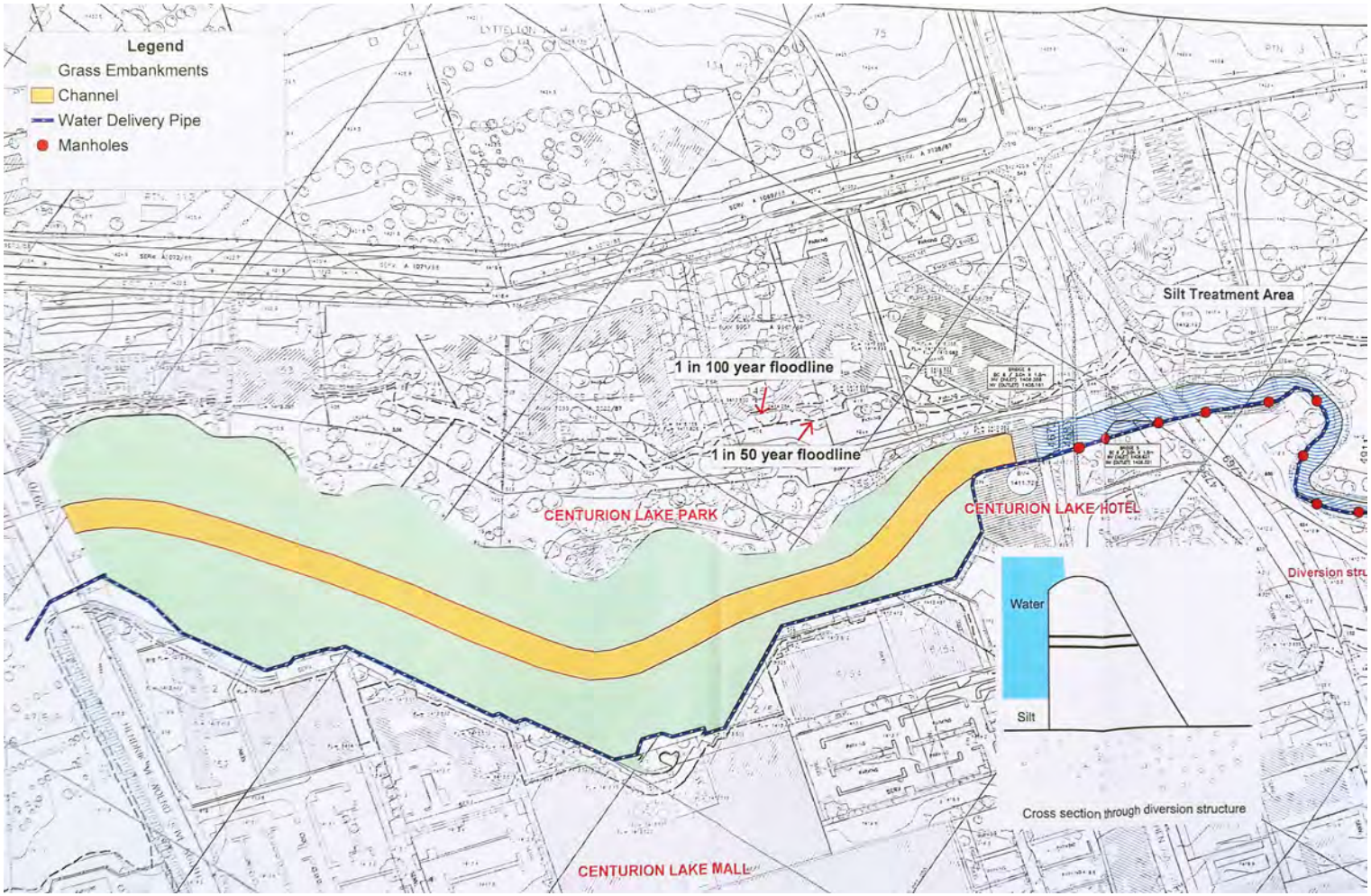


Figure 5.7 - Image indicating Option 3 of the Long-Term Management Plan for Centurion Lake (CoT Feasibility Report, 2008).



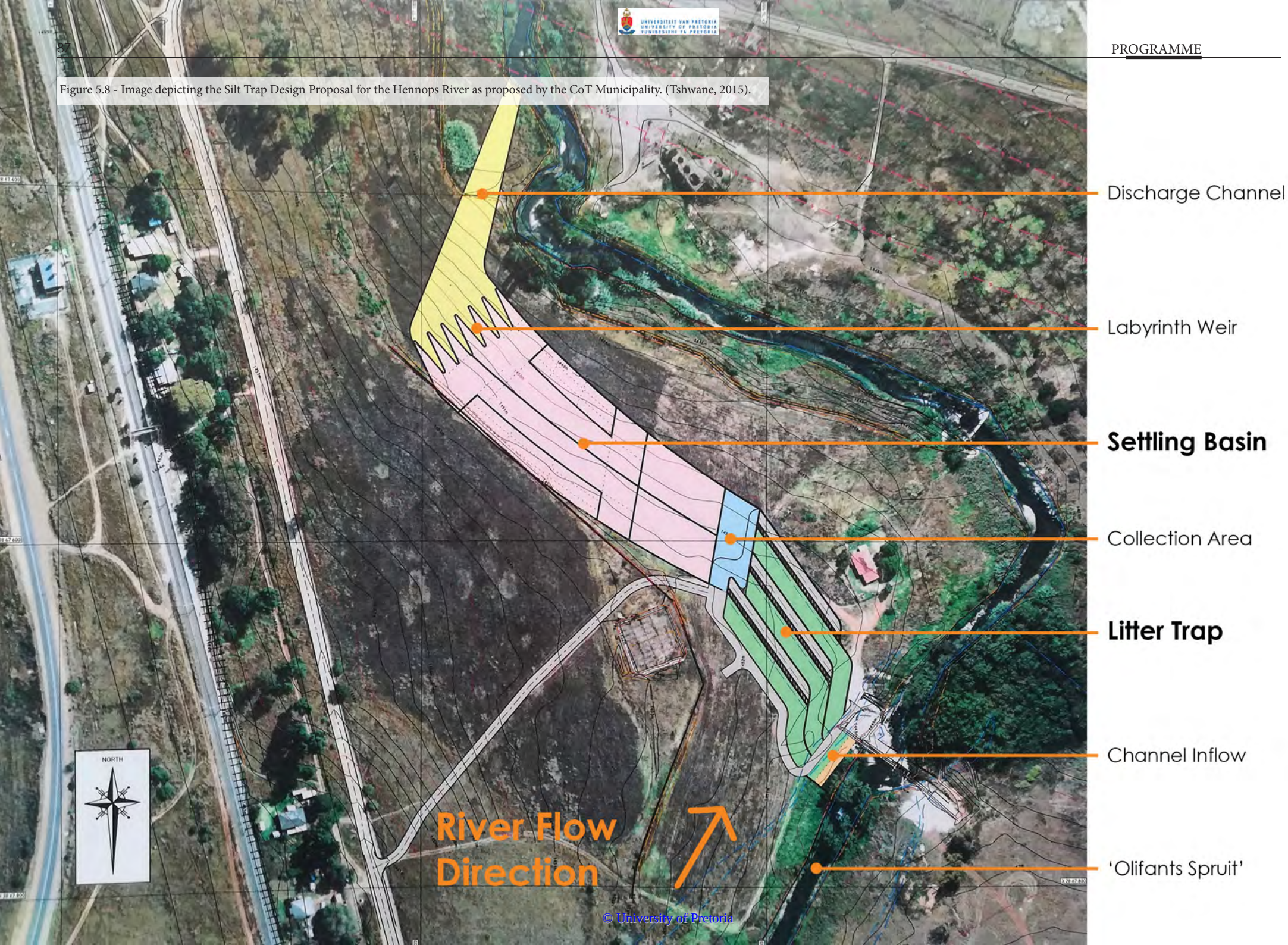
OPTION 3

The third option is to restore the river that used to be where Centurion Lake is now. In doing so, siltation will only occur in flooding events.

This option is the chosen option to explore in this dissertation as it proves to be the most feasible option and have the added benefit of rejuvenating the site and rid it of pollution. The proposal include a water diversion structure that prevents regulates the water flow and prevent silt from entering 'Centurion Lake'.

"Impeding or diverting the flow in a watercourse (lake) requires a Water Use License Application (WULA) form DWAF (Department of Water Affairs and Forestry). Any changes in the 1:10 year flood line (including a water conveyance structure) requires a Basic Assessment Report (BAR) from GDACE (Gauteng Department of Agriculture, Conservation and Environment)" (CoT Feasibility Report 2008:50).

Figure 5.8 - Image depicting the Silt Trap Design Proposal for the Hennops River as proposed by the CoT Municipality. (Tshwane, 2015).



ARC WEIR (CoT PROPOSAL)

A silt trap proposal has already been put in place by the CoT Municipality (refer to figure 5.8). The location of the proposal is a few kilometers upstream from Centurion Lake. The aim of the structure is to trap litter and settle out the suspended solids before it reached Centurion Lake.

A feasibility study has been done and it was concluded that the project would not be executed. The silt trap proved to be unfeasible due to its sheer size.

This dissertation aims at using the basic principles of silt trap design in order to design a small-scale silt trap within Centurion Lake, so that the users can engage with the processes that govern the rehabilitation of the river's water.

CRITIQUE ON THE ARC PROPOSAL

Regenerative theory advocates holistic thinking in design. Just as one 'green' building among many fossil-fuel-consuming buildings won't make a significant change, so too will a large scale silt trap not make a significant difference to the polluted state of a river.

It is rather proposed in this dissertation that many smaller traps should be implemented along the river at a regular interval, thus, gradually cleaning the river.

HOW DOES A SILT TRAP WORK?

The ARC Weir proposal combined the functions of a litter trap and that of a sediment settling basin.

The process starts by designing the silt trap with the contours in mind, thus, using gravity to feed the water into the structure's inlet.

The first step would be to clean the water of any solid floating debris. The river water gets diverted into the channel inflow (refer to figure 5.8) and passes over a steel grid; the floating debris is captured in the litter channel (refer to figure 5.9) and the water seeps through the grating into the water channel.

The second step is to cleans the water from any suspended solids caused by soil erosion of river banks. The water travel down the water channel into the settling basins. The water moves relatively slow and the sediments settle to the bottom of the basins. The water inlet is then closed and all material is removed from the basins via the collection area.

Currently, trucks are used and the material is removed through manual labor; however, the dissertation proposes to have stations close to each basin that will utilize the resources and turn it into a product on site, therefor providing economic income and reduces the embodied energy to transport the resources.

CONCLUSION

In this dissertation a silt trap is proposed that is designed and strategically located close to the silt processing facility. The plastic debris and silt that enters Centurion Lake will be captured in the trap and all material will then be manually removed from the trap.

The silt and litter trap are intentionally designed to be completely open to contribute to the 'process transparency' of these processes.

The aim is to educate the users about the importance of clean rivers and to create an awareness that rivers are essentially life giving and life supporting networks that needs to be treated with care. Failure to do so will not only influence life within the water but also the environment around it. In other words, sick rivers will lead to sick citizens.

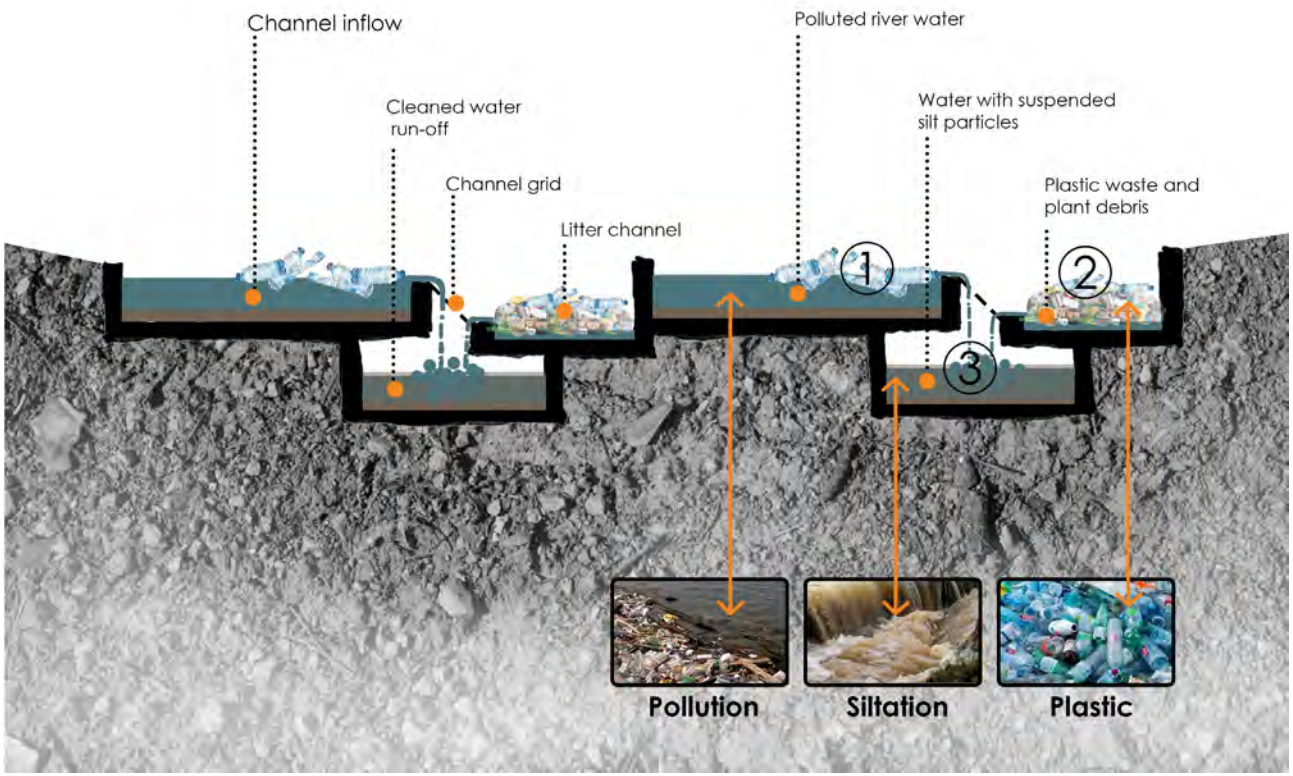
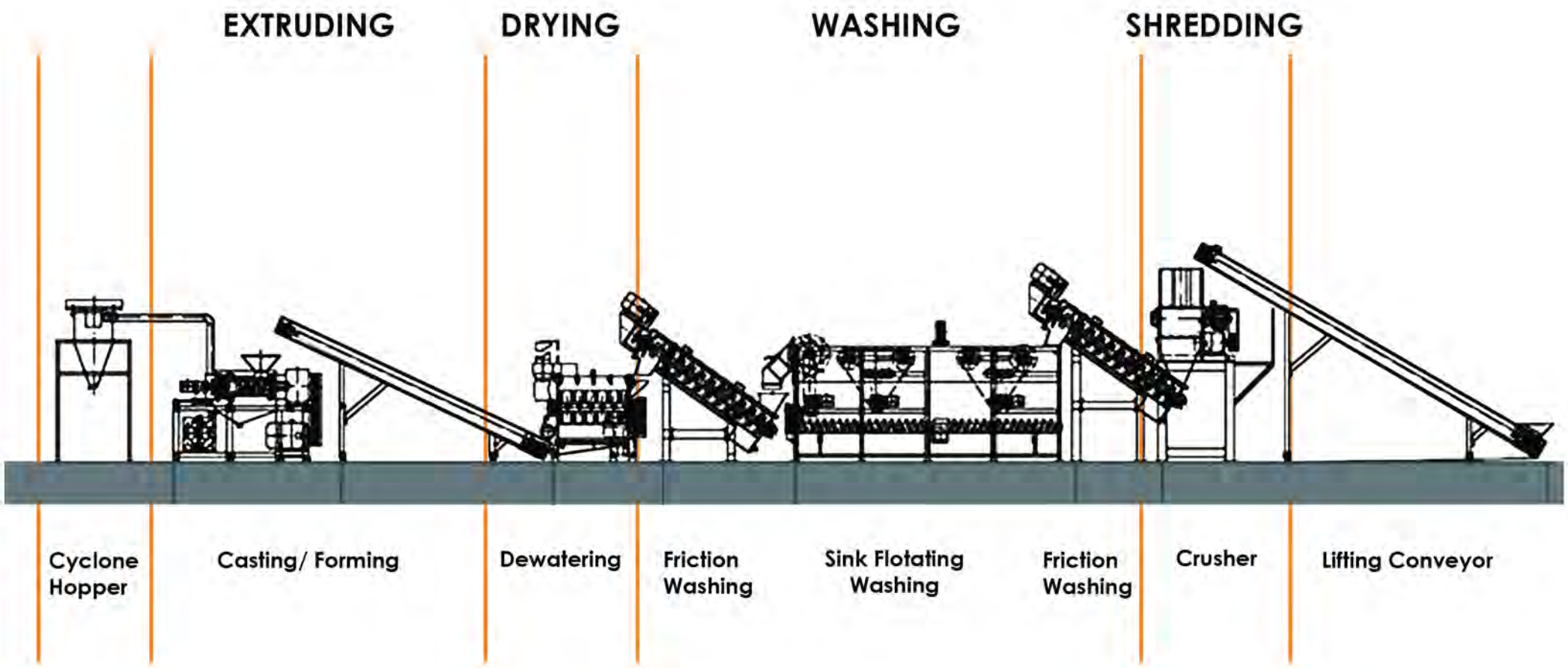


Figure 5.9 - Diagram showing a cross section through a typical litter trap. It indicates its structure and function of each structure (Author, 2018).

1. Resource Extraction: Plastic



Plastic Harvesting

The first step in the silt trap is to harvest floating debris. Plastic waste passes over a channel grid where the water (containing silt) drops through and the plastic debris remains in the litter channel. The plastic is then manually harvested and taken to the plastic processing facility. At the facility, the plastics are washed and temporarily stored. The plastic then enters a chain of processing machines (refer to figure 5.10). The plastic is transported via a conveyor belt to the crusher machine that breaks down and shreds the plastic into thin strands. From the crushers it enters the washing phase that removes any dirt from the plastic. It then moves to a dewatering vat and is stored. The plastic is now ready to be casted into moulds.

Figure 5.10 - The Plastic Extrusion Process; the diagram indicates the machines that are used to convert plastic waste into plastic beams, that in turn can be used to construct plastic furniture (Author, 2018).

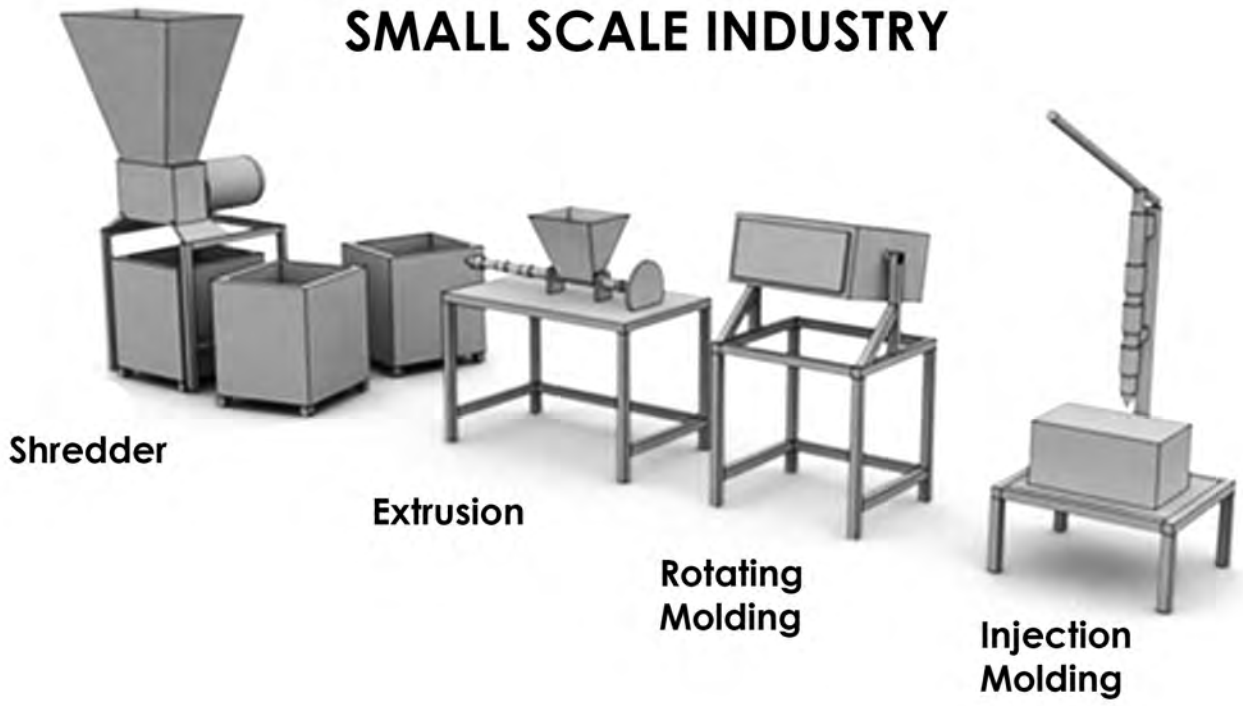


Figure 5.11 - Diagram indicating the different types of plastic forming devices after the extrusion process. Once the material exists the shredding phase it could either be extruded, cast in a rotating mold or injected into a mould (Author, 2018).

THE CASTING/MOULDING PROCESS

The plastic strands from the dewatering vat enters the extrusion machine that essentially melts and compress the plastic into a liquid sludge.

The liquid plastic is then either extruded into long plastic beams that can be used the same way as timber is used; by cutting it into pieces and assembled into multiple products.

An alternative option would be to place the liquid plastic into a rotating mould. This mechanism rotates the plastic till it cools down and takes the shape of the mould inside.

The last option is called 'Injection Moulding'; where the liquid plastic is pressed into a mould. This mould could contain any shape to which the plastic could set.

The difference between the rotating mould and the injection mould is that, the rotating mould's objects comes out hollow on the inside, perfect for making pots or mugs. The injection mould, on the other hand, injects plastic and allows it to set into a solid form, this is perfect for creating solid objects such as children's toys or an ornament.

This dissertation focusses mainly on the formation of plastic furniture as a product of the plastic waste, some examples are shown on the next page.

Figure 5.12- Examples of different types of plastic furniture. It is also possible to cast plastic waste into a clear resin and formed into furniture (Plasticon, 2017).

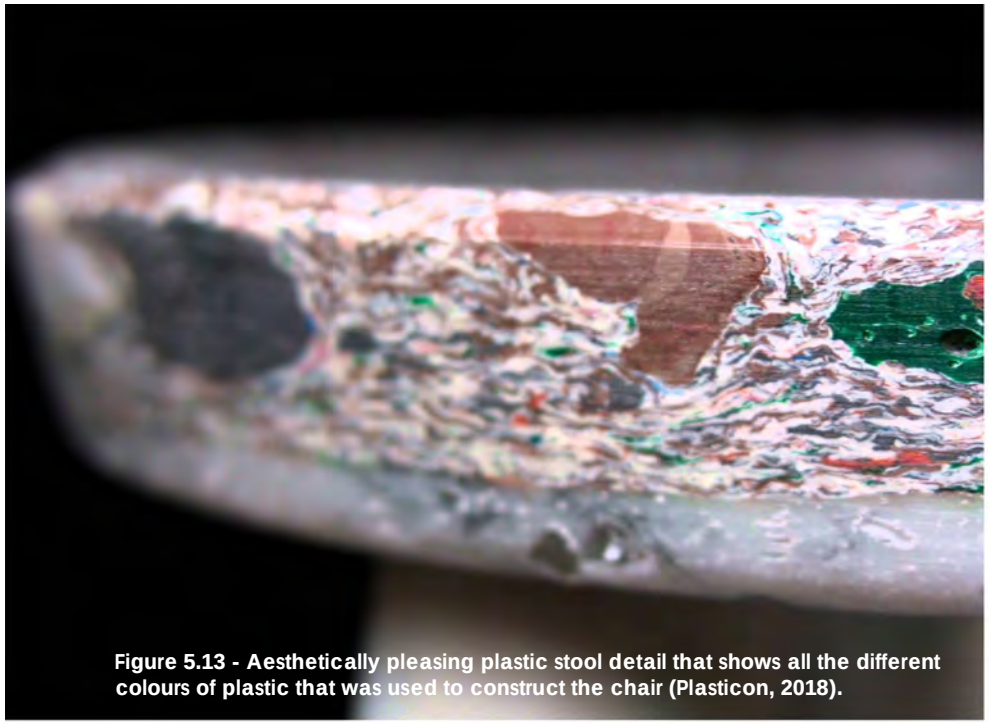


Figure 5.13 - Aesthetically pleasing plastic stool detail that shows all the different colours of plastic that was used to construct the chair (Plasticon, 2018).

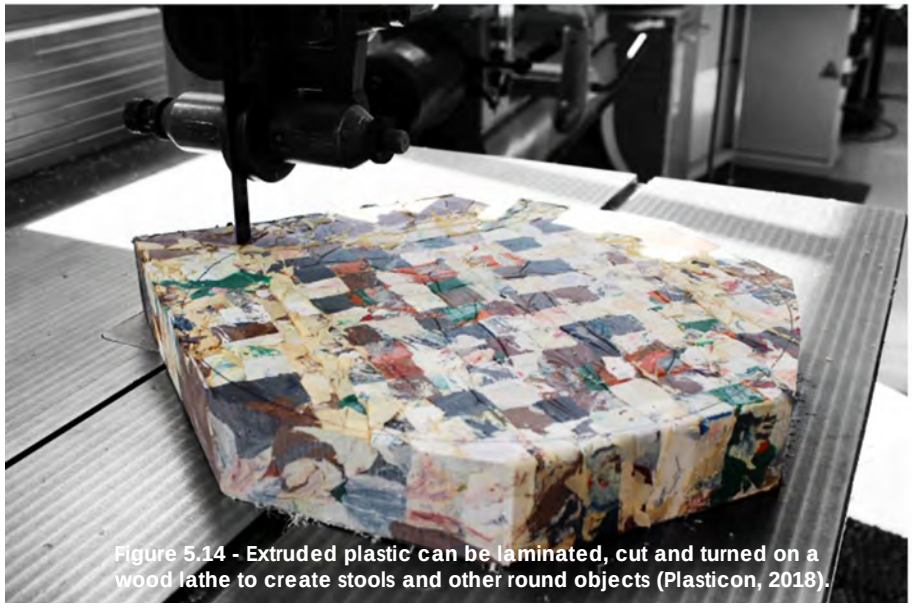
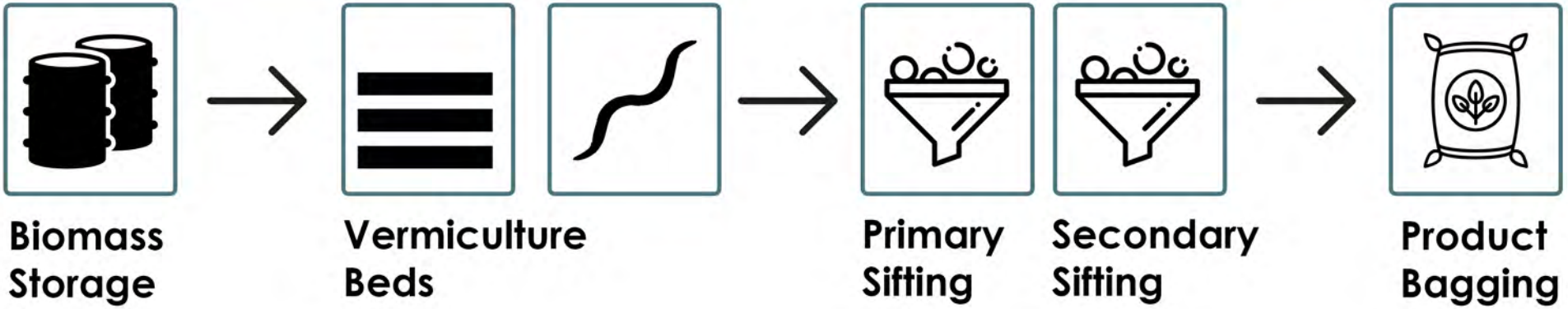


Figure 5.14 - Extruded plastic can be laminated, cut and turned on a wood lathe to create stools and other round objects (Plasticon, 2018).

Figure 5.15 - Laminated plastic placed on a wood lathe. Plastic is softer than wood and therefore it is possible to treat plastic in a similar fashion as wood (Plasticon, 2018).

2. Resource Extraction: **Silt + Vermiculture**



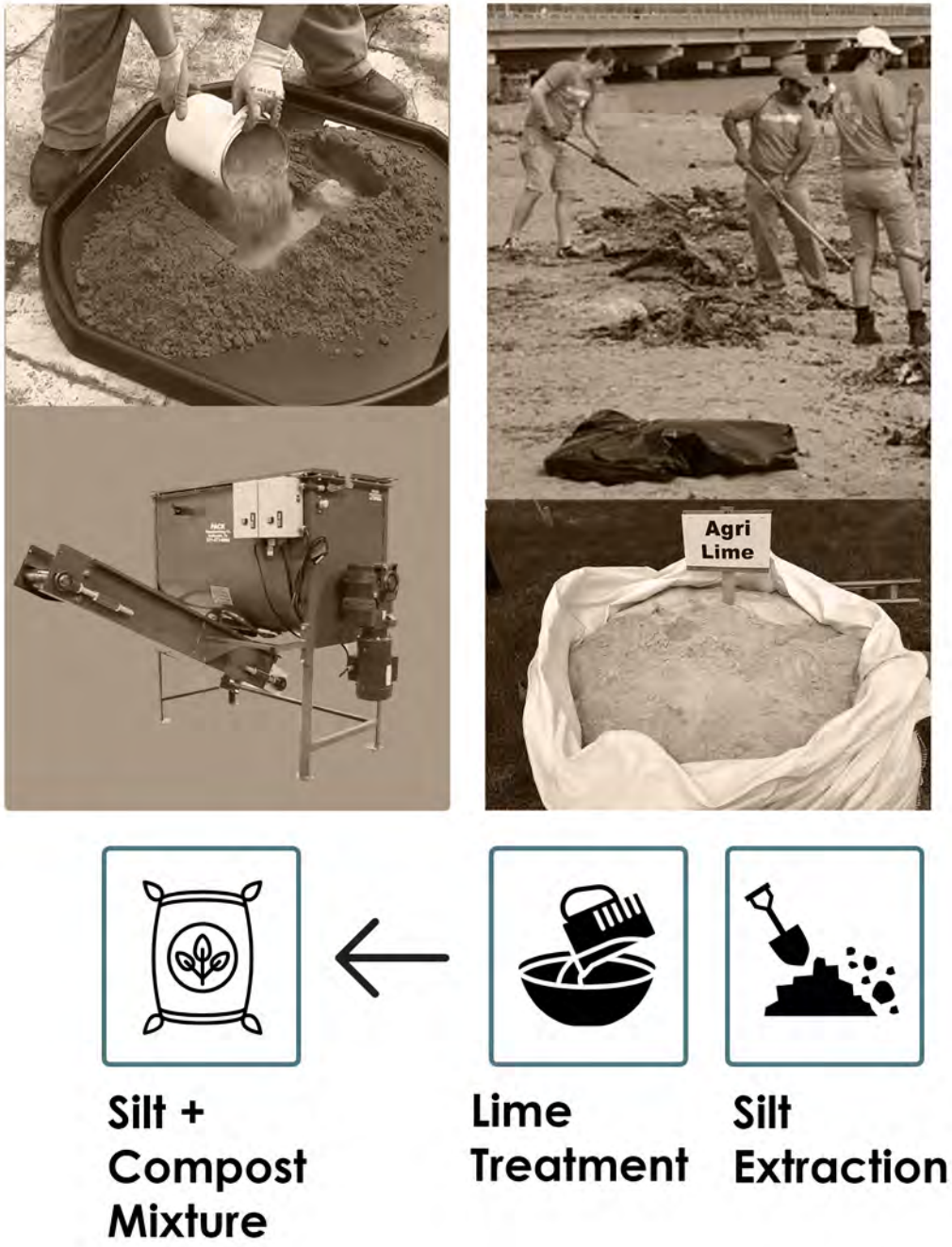


Figure 5.16 - A series of images and diagrams showing the production of vermi-compost using the silt that is harvested from the river. In addition, it also indicates the treatment of the silt with lime and packaging it for the production of silt bricks (Author, 2018).

THE SILT HARVESTING PROCESS

The second stage of the silt trap are large settling basins. These basins allow the water (containing suspended solids and no plastic debris) to flow into the basin and settle out any suspended solids from the water.

The water in the settling basins moves slow and gradually spill out at the end of the silt trap. All the sediments drop to the bottom of the basin and the 'clean water' (devoid of any silt) spills over the edge of the retaining structure at the end of the silt trap.

The watercourse is then redirected and the silt harvested manually or mechanically from these basins. It is then taken to the processing facility that is designed as part of the intervention.

The silt is treated with lime and temporarily stored till it can be used as an additive to vermi-compost or as an enriching agent to silt bricks.

VERMI-COMPOSTING

The silt trap will harvest any floatables from the river, this includes floating biomass or plant material that is flushed down the Hennops river. The biomass is harvested and taken to the vermiculture beds where it can biodegrade and be consumed by red-worms.

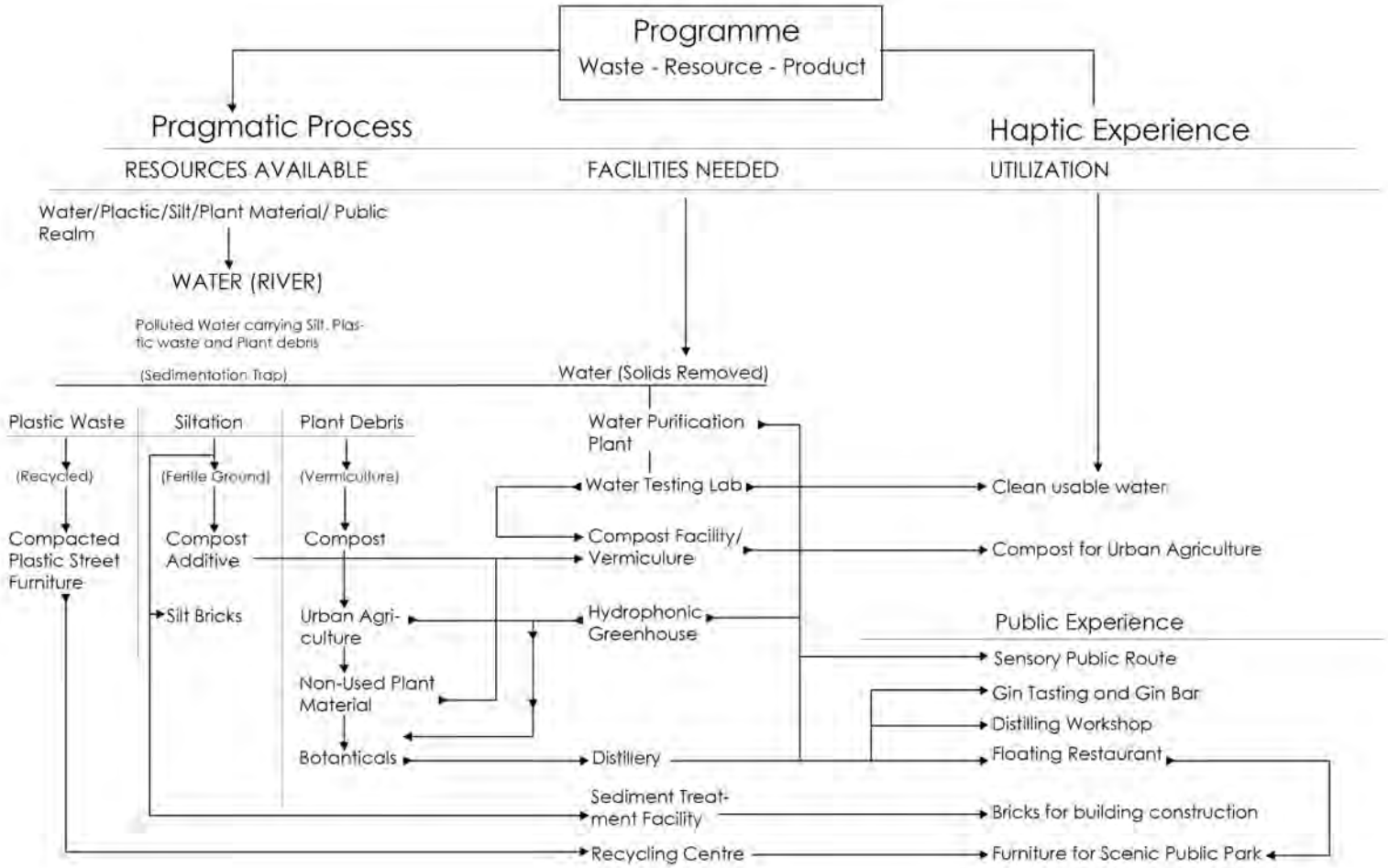
The intervention proposes many deciduous trees that will provide additional biomass to the vermiculture beds. The secretions of the worms are harvested, processed and used as compost.

The process is extremely simple; plant material is placed on the vermiculture beds and kept moist by using the rainwater that is harvested in galvanized tanks. The worms consume the plant material (micro-organisms also aids in breaking down the organic material) and secretes a highly fertile substance. The vermi-beds are rotated or flipped regularly to ensure that the worms access all the organic material.

The material is then removed from the vermi-beds and put into a barrel-sifting-machine. The machine can be electrically powered using the energy harvested from the sun or it can be manually turned. There is a two-stage sifting process, with the first removing any larger plant material; and the second sifting phase ensures a very fine grained end product.

The previously harvested silt is then mixed into the compost batch, packed and distributed to closely located nurseries.

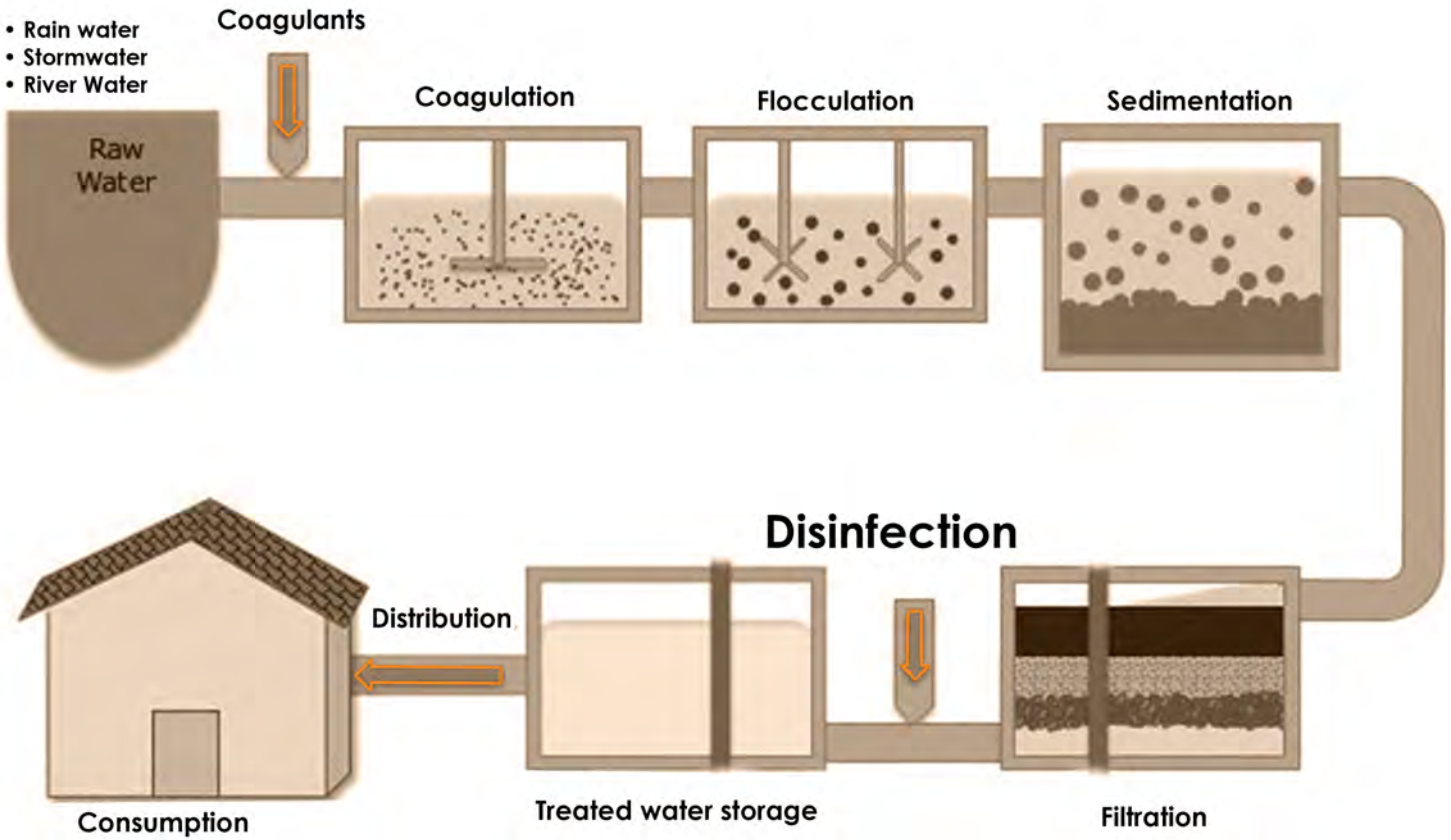
3. Resource Extraction: Water



ADDITIONAL PROGRAMMES

The circular metabolistic diagram (previously indicated) is expanded to show the complex nature of the project. The diagram shows the programmes, the facilities needed and the potential experience that the user may gain within the space. It is worth noticing that the intervention include a water purification plant (situated above the river), a water testing lab to ensure the quality of the water is safe to use; a distillery that will enable the users to engage with the processes by actively participating in the process via a gin distillery workshop; and a recycling centre that enables the public to connect with the intervention by providing it with their plastic waste (Checkers, Pick n Pay and other large scale shop).

Figure 5.17- Diagram indicating a detailed illustration of the intricate detail of programmes and its interdependence on one another (Author, 2018).



WATER PURIFICATION PLANT

The last phase of the silt trap provides a large reservoir full of river water that is devoid of any suspended solids or plastic waste. The pedestrian promenade incorporates a water purification plant in its design that harvest the 'clean' water and purifies it to the extent of use. River water, harvested rainwater and stormwater is channeled to the purification plant and undergoes a few phases of transformation; The first phase is coagulation that uses coagulants that causes finer particles to cling to them en settle down. The second phase is flocculation that removes these finer particles. The third phase is sedimentation where heavier particles drop to the bottom. The fourth phase filter the water by using different grains of sand. The water then moves through the disinfection phase where it pases through an ultraviolet light that kills microscopic pathogens. The water is then stored and distributed for use.

Figure 5.18 - Water Purification Diagram; Image shows how rainwater, river water and storm-water can be purified for the use in other processes such as Vermiculture beds (Author, 2018).

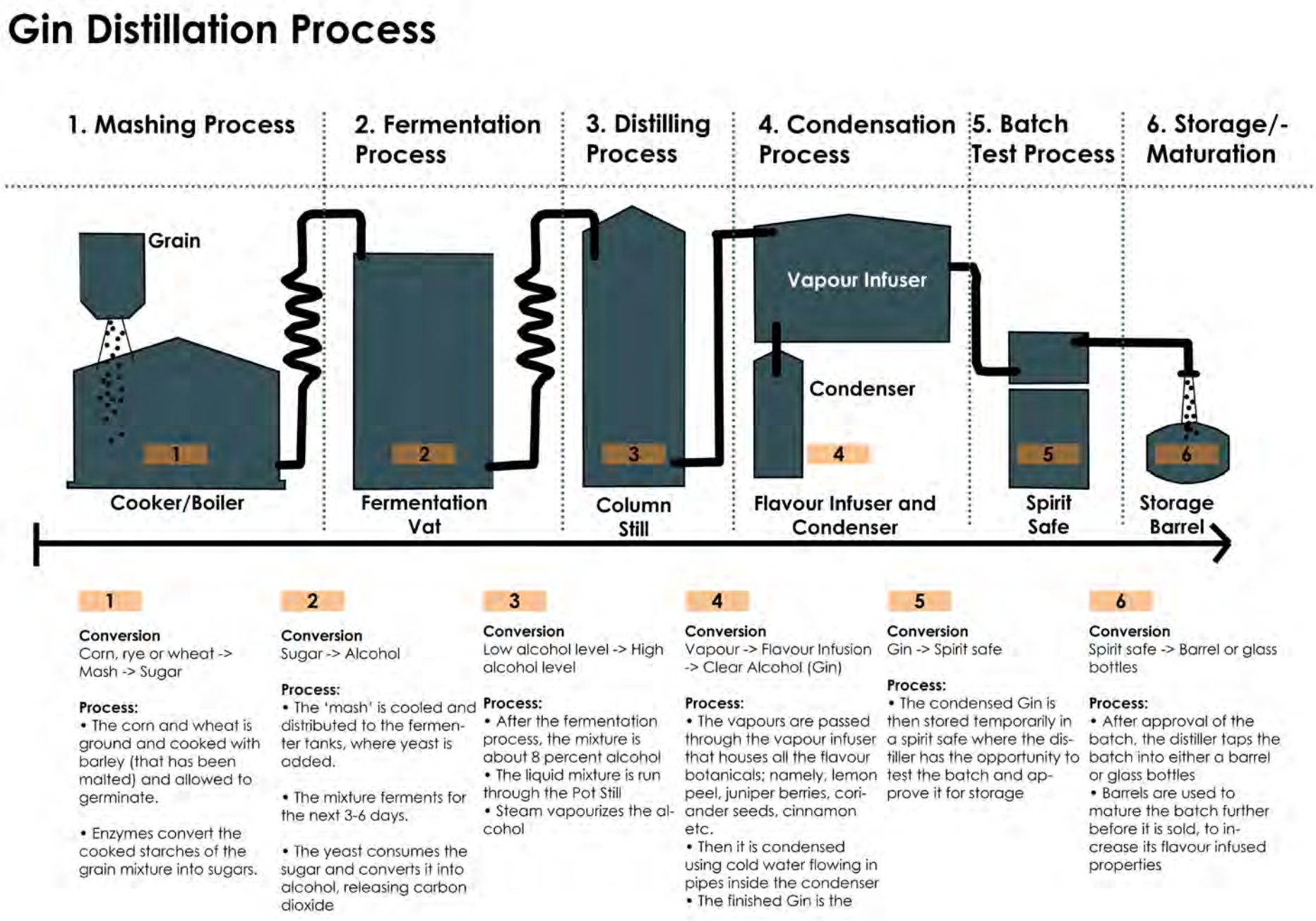


Figure 5.19 - Diagram showing the process flow of the typical Gin Distillation Process; also indicating the equipment that is used in each stage of the process (Author, 2018).

GIN DISTILLATION

Gin distilling has recently (2016-2018) become more and more popular with newly emerging distilleries opening up all across the globe (TheDistiller, 2017). In South Africa in particular, gin distillery flourish with the public showing a great interest in the process.

The intervention of this dissertation is proposing to implement a gin distillery. The aim of the distillery is to showcase the process to the public domain and get them actively participating in the rehabilitation process of Centurion Lake.

The idea to incorporate a distillery comes from the study into regenerative theory and phenomenology. The dilemma was to find a programme that incorporates biological processes that could simultaneously be used to create a process transparency. The aim was to incorporate a programme where the users can actively participate in the process. In order for people to become aware of the issue that the hennops river, as well as river systems all over the world is facing, it needs to showcase the issues and propose potential solutions to the problems.

Phenomenology speaks about existential experiences that include all the bodily senses; namely sound, sight, smell, taste, touch. The distillery creates these existential experiences by involving the public in its process. The users can smell the botanicals, taste the different types of gin, touch the botanical seeds and plants, hear the still roar with yeast, and see the beautiful copper stills.

The distillery is designed in such a way so that the users become part of the entire distillation process; from where the botanicals grow in the form of urban agriculture, where the botanicals are processes and gin is made. At the end of the journey, the users sit back and celebrate the gin on a green terrace overlooking the natural river (see chapter 6).

THE GIN DISTILLATION PROCESS

The gin distillation process consists essentially of six main phases; namely, mashing, fermentation, distilling, condensation, batch testing, and maturation.

The process is described in detail on the previous page. Distilling requires a large surface area and a building with a high enough roof. Furthermore, these phases usually runs in one linear cycle and therefore needs to be arranged in a line within the space.

In terms of ventilation the roof must allow for the extraction of hot gases produced by die distillation process; alternatively, rooms can incorporate heat exchanging mechanisms to harness the heat and use it at other parts of the building.

In conclusion, the gin distillery contributes to the aught after 'process transparency' to educate citizens of our interdependence on nature and natural processes, with urban rivers playing a crucial part to the existence of cities and mankind.

Figure 5.20 - Photograph of gin distillery stills that is set up for display. The stills and pipes are designed in such a way as to showcase the process in its entirety and is open to the public (Author, 2018).

PRECEDENT: BOMBAY SAPPHIRE DISTILLERY

- **Laverstoke Mill; Hampshire, UK**
- **Originally a paper mill for bank notes**
- **Part of a multi-million pound restoration project**

A CRITIQUE ON THE RE-APPROPRIATION OF THE MILL

The mill was never designed to house a distillery and therefor the building form does is not influenced by its function. The spaces has to be designed with great care as water vapor and heat, from the distillation process, can cause the roof beams to sag and collapse. An extremely innovative design incorporates a large glass 'greenhouse' outside the distillery that extracts the hot air and moisture, thus creating a micro-climate that is used to grow the botanicals.

Figure 5.21 - Laverstoke Mill after the completion of the restoration project to convert the mill into a gin distillery for Bombay Sapphire Gin (Bombay, 2014).

BOMBAY SAPPHIRE BACKGROUND

Bombay Sapphire Gin Distillery was designed by Thomas Heatherwick. The building serves the purpose of a distillery and visitors center for the iconic gin brand Bombay Sapphire Gin.

Bombay Sapphire® gin, the world's number one premium gin by value1, unveils plans for its distillery in Laverstoke Mill, Hampshire. The project is a multi-million-pound restoration of the historic buildings which housed one of England's most significant bank note paper making facilities. The design imagined for the site is headed by acclaimed London designer Thomas Heatherwick and his team at Heatherwick Studio.

The site was completely renovated from a derelict mill into a state-of-the-art premium gin distillery and visitor center encompassing the highest standards in design, functionality and sustainability. The distillery will be built on a two-hectare brownfield site, near the grounds of Laverstoke Park, just 60 miles from London.

For 200 years, the site produced high quality paper for the bank notes of India and the British Empire. The site is steeped in natural beauty, astride the crystal-clear River Test - and historically associated with producing the finest quality product through the care and skill of those who owned it and worked there.

THE GLASS HOUSE

The ambition for the project restores the buildings and grounds and its heritage while introducing a new structure that will complement the existing buildings as a showcase of the brand's intrinsic quality that reflects the aspirations of the Bombay Sapphire brand. The highlight of the complex build is the glass house for Bombay Sapphire gin's 10 botanicals. As a major feature of Laverstoke Mill, the glass house is a symbol of the brand's careful, skillful and imaginative approach to gin making.

Heatherwick comments on the design: "As the particular flavours of Bombay Sapphire gin are derived from ten botanicals, the centerpiece of the site is a glass house, within which visitors will experience the specific horticultural specimens infused in the spirit. The glass house, influenced by Britain's rich heritage of glass house structures, will be two separate structures providing both a humid environment for spices that originate from the tropics, as well as a dry temperate zone for Mediterranean plants. We are thrilled to have the chance to take this historic site, and turn it from its current derelict state into a new industrial facility with national significance."

Figure 5.22 - Rendering showing the initial vision for the extraction vent and greenhouse design (Bombay, 2014).

Figure 5.23 - Rendering indicating that the greenhouse be the centerpiece and main point of public attraction (Bombay, 2014).

HEAT EXCHANGES

The design of the Glass-House is extremely innovative by itself. Heat produced from the distillation processes rises into the uppermost space of the building and is then distributed to the glass house.

A natural river flows through the site and the distillery uses the water in some of its processes. The Glass House is strategically placed what may appear as on top of the river. Cool air is drawn in from the river side and the hot air from the distillery creates a drought through the glass house, thus replacing the air and proving ample oxygen for the botanical vegetation to flourish.

NATURAL VENTILATION

The intervention seeks ways in which natural ventilation can occur can understanding the principle that were used in the Bombay precedent. Hot air is extracted from the distillery and used to heat spaces that require heat to function such as the vermicompost facility.

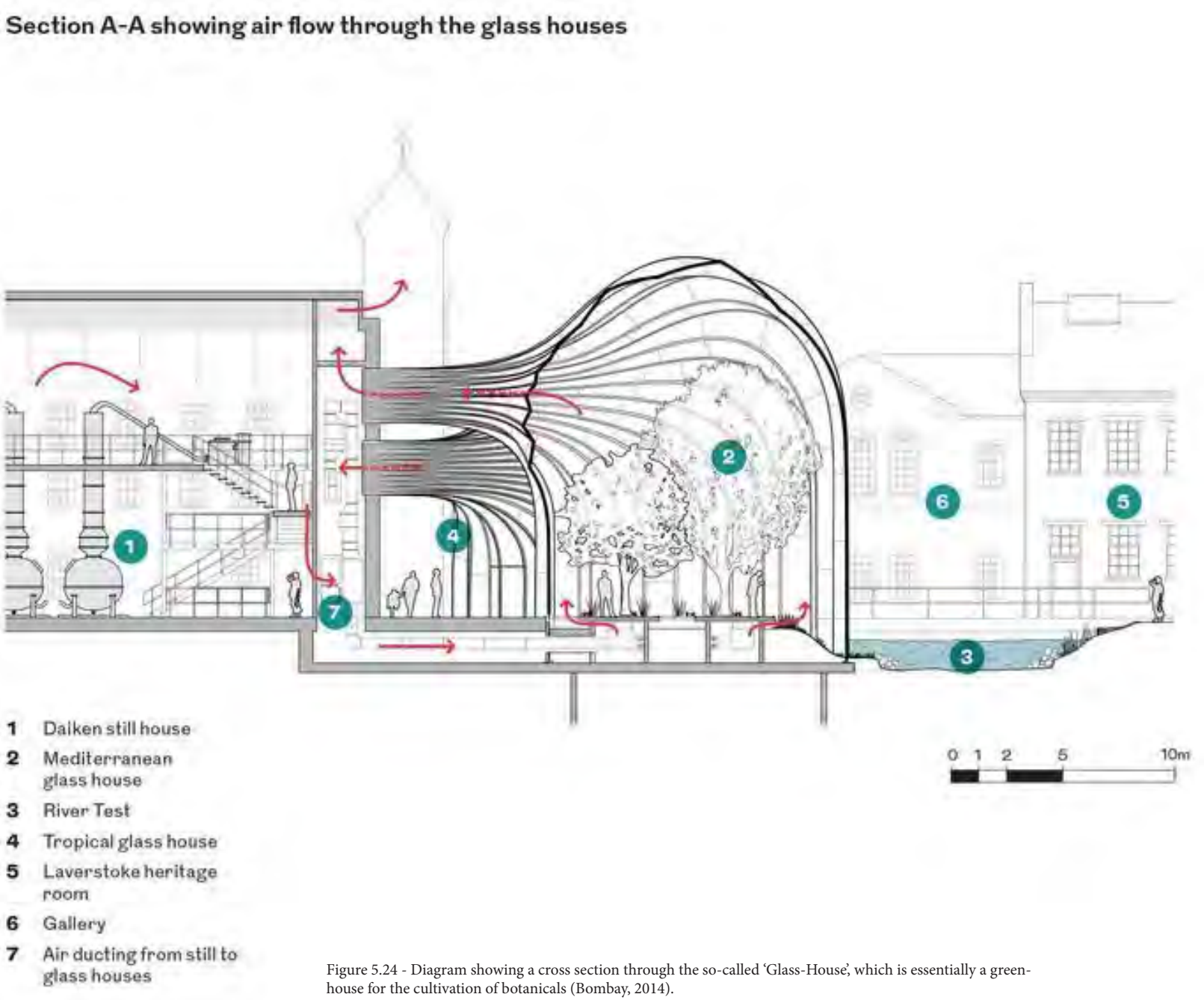


Figure 5.24 - Diagram showing a cross section through the so-called 'Glass-House', which is essentially a greenhouse for the cultivation of botanicals (Bombay, 2014).

PROCESS AS A TOURIST ATTRACTION

Since its inauguration, Bombay Sapphire Distillery have been one of the most successful regenerative projects in the world. It has become a valuable tourist attraction with its Glass House and transparent processes.

Although Laverstoke Mill is know for its distillery, it does not limit itself to this title. In essence it is an event space that houses events such as end-year functions, weddings, ballroom dances and many other. The space was design for adaptability and multi-functionality with its open spaces and movable walls (not visible in the pictures).

Figure 5.25 - Final Architectural Model of the Glass House; showing it in relation to the old paper mill buildings and infrastructure (Bombay, 2014).

Figure 5.26 - Photograph explaining the user's experience as one enters the Glass Houses (Bombay, 2014).

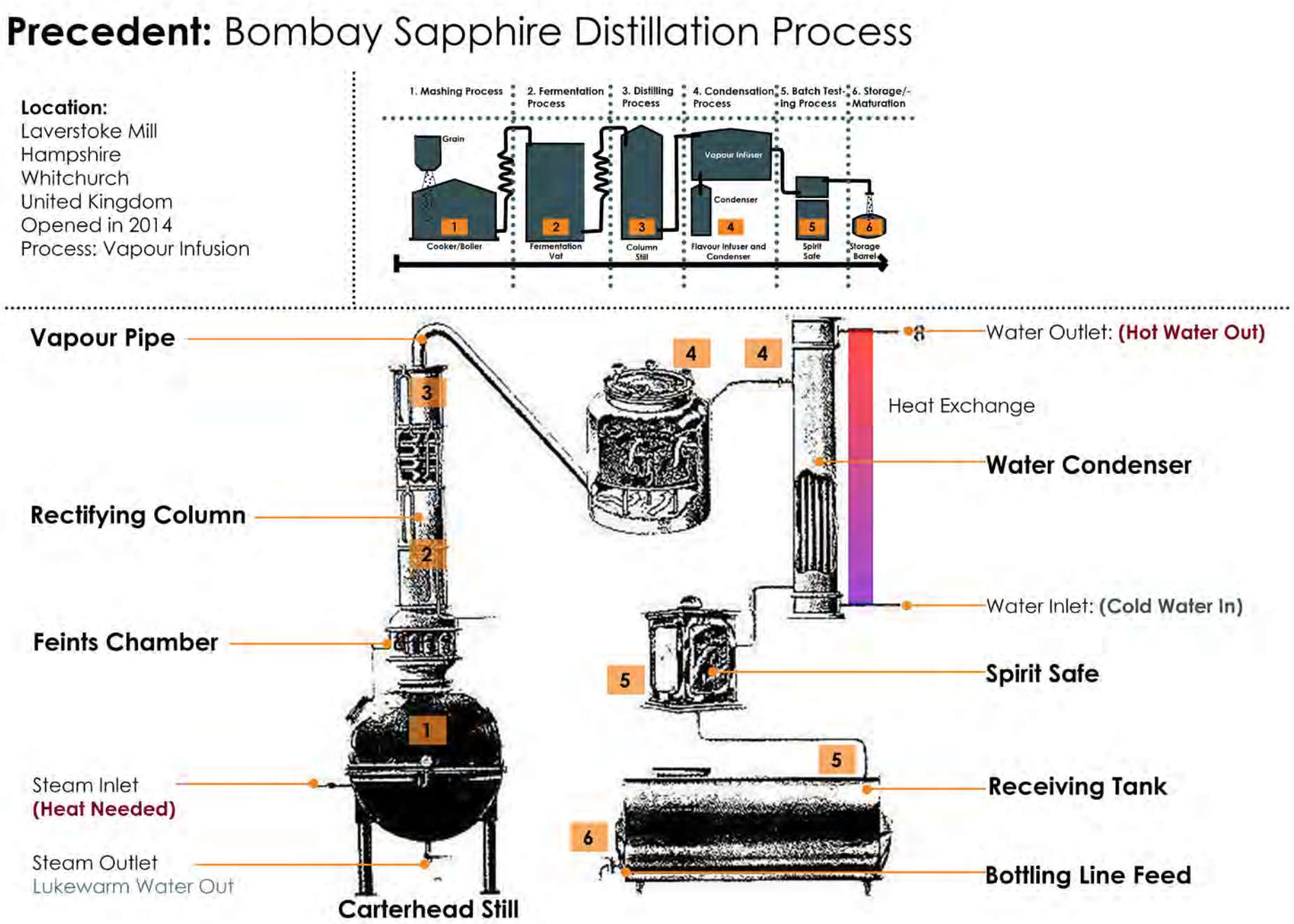


Figure 5.27 - Diagram showing the Carterhead Still as well as the process flow of making gin (Bombay, 2014).

Energy input needed

Water input needed

Wheat and Barley

Water and neutral grain spirit added to still

1 Cartenhead Still:
Mashing and boiling process

• As the spirit is heated it turns to vapour and passes up through the column

2 Rectifying Column:
Fermentation process

• The columns controles the flow rate as it passes though each section
• The column's sub sections contains a different spirit alchohol concentration

3 Rectifying Column:
Distilling process

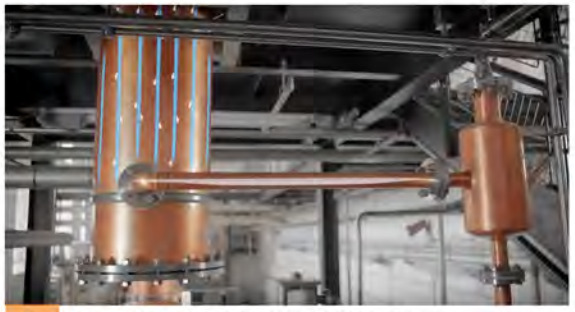
• The botanicals aren't boiled directly in the spirit
• Instead, the spirit vapour passed though the copper baskets, infusing the botanicals to extract and capture the aromatic flavour and aromas

4 Vapour Infuser and Condenser:
Vapour Infusion and condensation processes

Botanicals needed

• Perforated copper baskets

4 Botanical Copper Baskets:
Flavour Infution Process



Cold water needed

Byproduct - Hot water

• The vapour then moves to the condensing column
• Cold water passed through the column, returning the vapour to a liquid

5 Condenser and Spirit Safe:
Condensation and Storage Process

Figure 5.28 - Series of images that shows the gin making process of Bombay Sapphire Distillery (Bombay, 2014).

Precedent: Bombay Sapphire Botanicals

Vapour Infusion Process

In this process, the botanicals never come into direct contact with the neutral base spirit. Instead, they're placed into baskets in the still, above the base spirit, which when boiled, vaporises and rises up and infuses with the botanicals. The infused vapour then condenses into a liquid, and finally, water is added to reduce the alcohol to its bottled strength.

Botanicals:

Juniper berries from Italy	Lemon peel from Spain	Coriander seeds from Moroco	Grains of Paradise from West Africa	Almonds from Spain	Orris Root from Italy	Angelica from Saxony	Liquorice from China	Cassia Bark from China	Cubeb Berries from Java
									
									
• Evergreen • Grows on mountians • Height of 6m • Northern Hemisphere	• Evergreen • Grows in warm climates • Height of 2-5m • Native to South Asia	• Seasonal • Grows in mild climates • Height of 45-60cm • Native to North Africa	• Seasonal • Tropical Plant • Height of 2m • Native to tropical Western Africa	• Deciduous • Tropical Plant • Height of 4-10m • Native to the Mediterranean	• Evergreen • Tropical Plant • Height of 50cm • Native to Southern Europe	• Seasonal • Temperate • Height of 1-3m • Northern Hemisphere	• Annual • Subtropical • Height of 1-1.5 • Native to Europe/ Asia	• Evergreen • Tropical • Height of 10-15m • Native to Asia	• Evergreen • Tropical • Height of 5m • Native to Indonesia

Figure 5.29 - Perforated copper basket and the typical botanicals used in the gin making process as well as the place where the botanicals grow naturally (Bombay, 2014).

Figure 5.30- Image showing the perforated copper baskets used in the vapor infusion process (Bombay, 2014).

Figure 5.31 -Image showing the different types of botanicals used to produce gin (Bombay, 2014).

THE VAPOR INFUSION PROCESS

Each of the precious botanicals are carefully placed into perforated copper baskets. The size and quantity of the botanicals are only know to the master distiller. Unlike other distillation processes the botanicals are not directly boiled into the spirit, instead the spirit vapor passes through the copper basket, infusing the botanicals to extract and capture the aromatic flavour and aromas.

THE AVAILABILITY OF THE BOTANICALS

Bombay Sapphire Distillery prouds itself with importing botanicals from all over the world; Juniper Berries from Italy, Lemon peel from Spain, Coriander seeds from Morocco, Grains of Paradise from West Africa etc. However, importing all these botanicals results in a large carbon footprint and the embodied energy that it took to get it here.

TOWARDS DECREASING THE EMBODIED ENERGY

Establishing micro-climates where the botanicals could be grown in might be a feasible solution in the near future. Therefore, the intervention proposes to incorporate the botanical species, that can be grown in Centurion's climate, into the urban agriculture strategy. In doing so it will decrease the embodies energy that it takes to import the botanicals, thus creating a more sustainable strategy to distilling.

SPATIAL REQUIREMENTS

The interior space of the distillery must be designed with great care. Looking at the Bombay Sapphire precedent it becomes clear that adequate space needs to be incorporated into the design to allow for the high copper stills as well as the heat that the stills exude. Furthermore, the circulation space of the general public is separate from the circulation space of the master distiller, this ensures that the distiller can move between the vats with ease. In a sense arranging the circulation paths in this manner constitutes the principle of 'safety by design'. In other words, the stills are protected from theft in a very innovative way, whilst allowing the showcasing of the still to the general public.

Figure 5.32 - Photographs of the majestic copper stills at Bombay Sapphire Distillery. The stills are on display as it can be viewed from the gin workshop where the public enters (Bombay, 2014).

SPATIAL REQUIREMENTS

The interior space of the distillery requires little to no direst sunlight, only indirect southern sunlight (if located in the Southern Hemisphere). The only lighting requirement is that the space must be well lit naturally, however, the possibility exists to design the building so that light falls mostly on the stills -highlighting the copper colour and illuminating it throughout the space.

In terms of materiality, complimentary textures and materials could be incorporated to create a certain achievable ambiance; for example, using facebrick with dark timber framed windows will give the space and industrial feel to it. In the image below, the interior space is completely white giving the space a clinical feel to it, not ideal for a distillery.

Figure 5.33- View from within the distillery workshop. The stills are not directly accessible by the public as it could lead to injuries as the stills are gas headed, however, the entire process is made visible by incorporating a glass wall into the design (Bombay, 2014).

Figure 5.34 - Photograph showing Black Horse Distillery. The building is surrounded by nature and uses natural services to re-assimilate water back into the ground (Author, 2018).

PRECEDENT: BLACK HORSE DISTILLERY

- **Zeekoeihoek road; Magaliesburg, South Africa**
- **Distillery, Brewery, Restaurant, Game Lodge**

Black Horse Estate offers an artisanal craft brewery & distillery as well as a quaint restaurant. Black Horse has a magnificent banquet hall for weddings and conferences with in-house catering and a variety of accommodation.

The brewery is just an hour's scenic drive outside Johannesburg and is situated on the edge of the Magalies River with lush green fields and majestic black horses. Overlooking the breathtaking Zeekoe-ihoek valley guests can relax and enjoy an afternoon under their magnificent Pecan nut trees. Black Horse also hosts special functions and guest artists on a regular basis

Figure 5.35 - Photograph of the main still that is used for all the brewing and distilling at Black Horse (Author, 2018).

Figure 5.36 - Photography hinting at the placement and general layout of the stills, boilers, mashing tuns, and fermentation vats. Note that the vats are placed on a concrete plinth to distribute the weight across the floor (Author, 2018).

STILLS AND MATERIALITY

Copper is the preferred material in the construction of a still to impart flavor into the distilled spirits. According to Broadslab Distillery, both stainless steel and copper are excellent conductors of heat: dispersing the heat evenly across the entire surface of the metal and creating a more even distillation (Broadslab, 2018).

Figure 5.37 - Photograph of the boilers used at Black Horse Distillery; one would notice the copper and stainless steel details used on the boilers to ensure that the flavor infuses with the spirit (Author, 2018).

DESIGNING THE DETAILS

The distillery's floor incorporates drainage channels for two reasons; the first is to ensure that any leakages or water that is used in the stills themselves have a water channel to guide the water out of the work space.

Secondly, it is there to capture all the water during the washing phase. Due to the fact that these stills are exposed to the public, it needs to be kept clean. These stills are thoroughly washed once a week.

Figure 5.38 - Photograph of the recessed gutter, located within the distillery to ensure that any leakages are removed from the space (Author, 2018).

Figure 5.39 - Black Horse Distillery bar; that mostly sell the products that is produced on site such as Gin, Beers and Whiskeys (Author, 2018).

Figure 5.40 - Steel structure used to create additional space for stills (Author, 2018).

Figure 5.41- Barrel storage; used for the maturation process of gin (Author, 2018).

STORAGE AND DISTRIBUTION

After the last phase of the gin-making process, the gin is stored to mature for a few days. It is place in storage barrels that enhances its flavor.

As part of every craft distillery, a bar is incorporated for the public to sit and enjoy its produce. The gin is taken directly from the storage barrels and served in various creative ways to the restaurant patrons.

Figure 5.42 - Photograph of vintage brewing tanks used as a display strategy to attract tourists attention (Author, 2018).

CONCLUSION

The proposed programmes will aim to address river pollution in urban environments by creating a sense of awareness of the threats that it poses as well as the hidden potential benefit it could bring to urban environments. Architecture then becomes a mediator between the man and nature that recognizes waste not as pollution but rather as an important resource. The programmes that are implemented must therefore regenerate Centurion Lake and once again reconnect its citizens to the natural environment, to the benefit of both the natural realm and human construct.

Regenerative theory mentions that the state of any given construct cannot function in isolation as it is dependent on holistic systems (Knox 2013:87). Nature does not work in isolation, one system's waste is considered a resource in another system, and so the cycle goes on to form a fully integrated web of life.

Lyle (1994) elaborates on the notion of complex natural systems that stands in stark contrast to the mechanized world.
He explains that nature inherently has a level of infinite diversity in structures, species, processes and systems. This intricate level is difficult, if not impossible, to achieve by human endeavors. Man tries to mimic natural systems by creating systems with a linear flow. These linear systems produce a considerable amount of waste and is degenerative. A more regenerative approach is to create cyclical flow or circular metabolistic processes.

Architecture needs to reconsider its lasting impact on the environment by facilitating natural processes. It needs to allow nature to be an integral part of its functions and construction regardless of its programme. The architectural intervention therefore proposes that cyclical systems be incorporated in the design process. A holistic approach to architecture is taken that considers natural process as a first priority.

Lyle (1994), in discussing his cyclical model of nature, explains that nature works on five basic principles, namely; Conversion, Storage, Distribution, Filtration, and Assimilation. In response to regenerative theory, programmes were chosen based on its potential to incorporate natural systems that can converge resources, filter and assimilate, store and distribute, and re-assimilate the materials back into nature.

The first point of connection would be to address the state of the polluted Hennops river that leads into Centurion Lake. Silt trap technology is used to capture the plastic waste, and then settles out suspended solids in the water due to siltation. This 'waste' then becomes resources in form of; water without suspended solids, recyclable plastic, and fertile ground. The water is purified, the plastic is melted and cast into plastic furniture to be sold (waste into product). The silt is used as an additive to vermicompost to enrich its nutrient value. Vermiculture beds are used to assimilate all biomass produced on site. This cyclical cycle contributes to the regenerative quality of the site.

All these processes should be experienced by the users of Centurion and therefore, as part of the urban framework, a multifunctional bridge structure is proposed that connect the Gautrain to Centurion Mall (refer to chapter 4). The processes, governed by phenomenological experiences, reintroduces nature back into the 'city' by various means of connection (sight, smell, sound, taste, and touch). A Gin Distillery is used due to its natural transparency of processes. The users can follow the process of gin distilling, from where the botanicals grows, all the way to the end product.

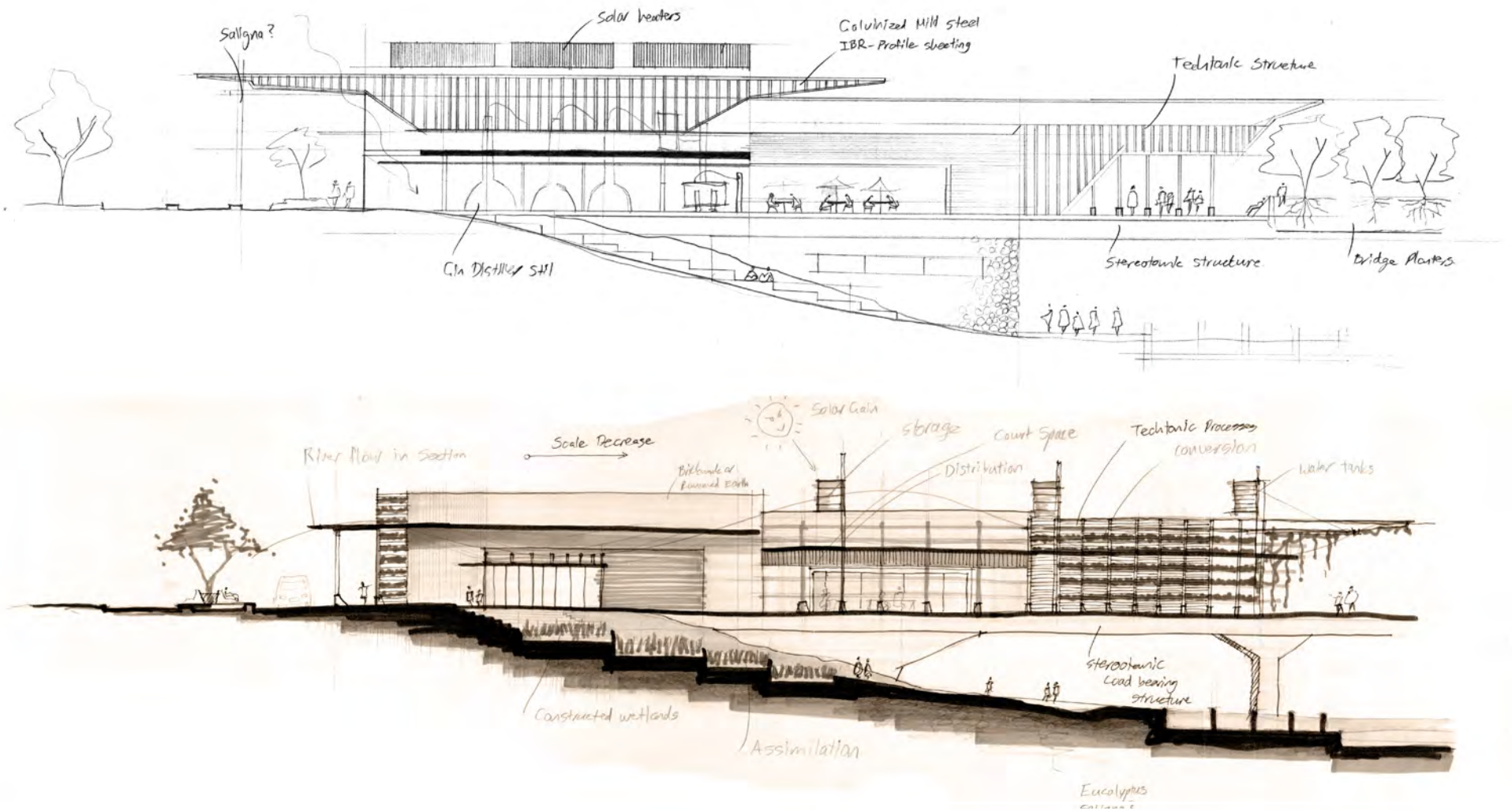


Figure 6.1 - (Author, 2018)

DEVELOPING A NEW APPROACH TO URBAN RIVER SPACE DESIGN |

In the previous chapte, the project intention was further defined by elaborating on the processes that takes place in and around the structure. The programmes were used to create a list of spatial and functional requirements for each process, this is then used to arrange spaces in a logical manner and to create an architecture that is in line with the concept.

CHAPTER TWO BREAKDOWN

Chapter 6 will explore the project intentions as set out by the theory, context, programmes and concept. A series of sketches and designs will explain the thinking behind design decisions and show the design development as it progressed over time.

INTRODUCTION

There exists a disconnection between man and its natural environment, and polluted rivers all over the world acts as a testimony of this. Nature and man are in a dichotomous relationship as opposed to one of harmonious balance. This is due to the way in which we view the world and its processes.

Our current world view is to treat urban river systems as waste disposal mechanisms and not realizing the negative impact it has on the urban and natural ecology. Moreover, systems such as food production, water purification and other processes are hidden from the public eyes. It can be argued that 'system transparency' could instill a new appreciation for natural processes, thus minimizing the negative impact on the environment.

Architecture then becomes the mediator between the natural processes and consumers, by harvesting the resources provided by nature to produce the products consumed by humans. The architecture will also attempt at creating a physical and metaphysical connection that will 'stitch' the urban fabric due to the scar created by man's response to river systems within the urban construct – and the response is to avoid urban rivers rather than engaging with it due to its polluted state.

The intervention will attempt to restore the disconnection between the natural environment and the urban construct. This will be achieved by creating a physical bridge structure that incorporates phenomenological experiences that exposes natural processes of production and consumption, creating the platform for food transparency whilst instilling a new sense of appreciation for natural systems.

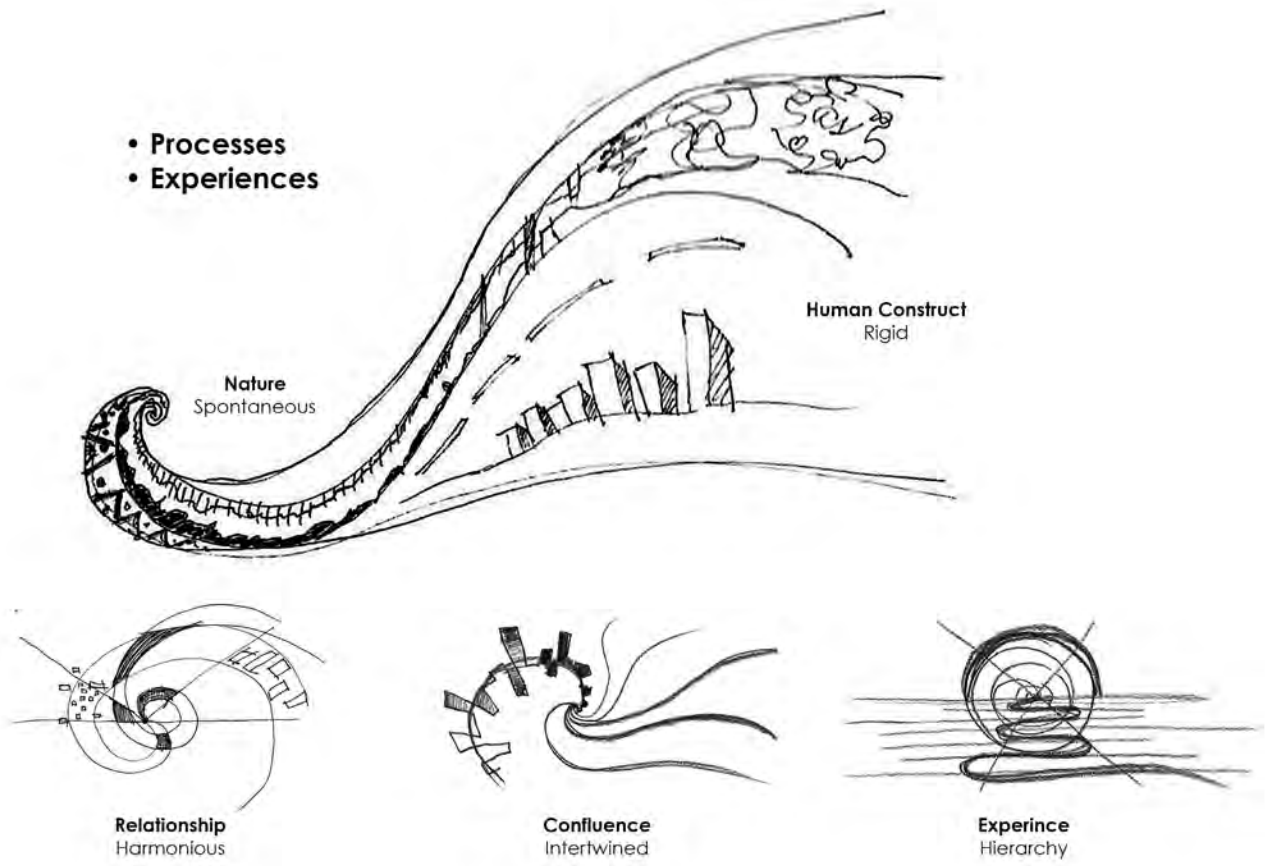


Figure 6.2 - Parti diagrammes that depicts the true nature of the relationship between the urban fabric and the natural realm, which is that the urban environment cannot exist with its natural counterpart. In reality all man-made objects are derived from natural elements. It shows the ideal vision of the intertwined connection between man and nature that the dissertation investigates and aim to achieve (Author, 2018).

ARCHITECTURE AS:
- Urban connector
- Experiential infrastructure
- Resource harvesting mechanism

The dissertation hopes to create transparent natural processes *that will involve rather than exclude the consumer and ultimately change the world view form viewing urban rivers as an asset as opposed to a liability.*

CONCEPT DEVELOPMENT |

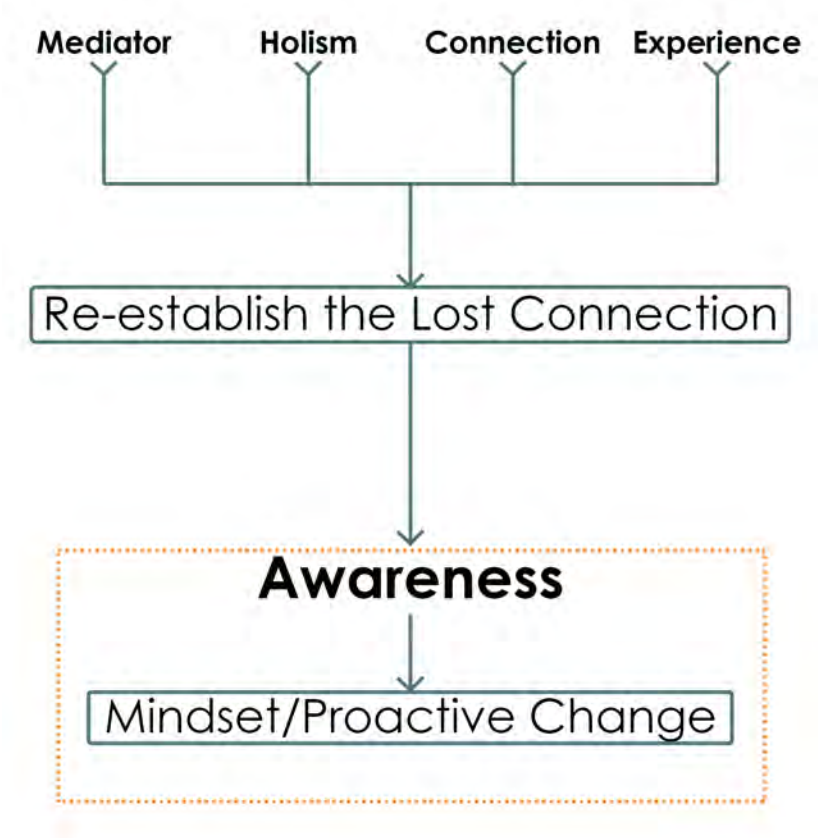


Figure 6.3 - Diagramme showing the conceptual approach. The concept models are used as conceptual drivers in order to create an awareness among the users as to highlight the negative impact that development and man has on , specifically, river systems within the urban environment. The goal is to change the mindset of people and promote proactive change(Author, 2018).

CONCEPT SUMMARY

The four main concepts are;

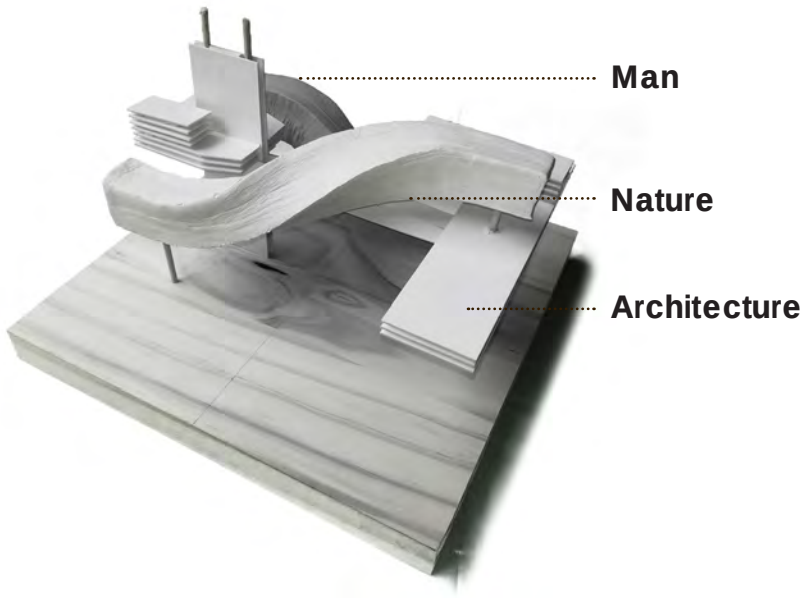
1. Architecture as a mediator between the natural environment,
2. Architecture that accommodate a holistic approach to design,
3. Architecture as an urban connector, as well as a connector between the natural and man-made realms, and
4. Architecture as an experience,

These concepts are used as the drivers towards creating architecture that re-establises the lost conncetion between the natural and man-made realm. Polluted urban rivers all over the world serves as a testemony to this lost connection. The city's inhabitants are removed from nature due to many 'side effects' that the industrial revelolution caused. Entertainment in the form of television leads to people spending much more of their leisure time indoors, whereas in the pre-industrial period, people would spend their time pondering over the beauty of nature. This had a profound positive effect on the people, physically as well as metaphysically. This 'inner love for nature' is called Biophilia (see Chapter two).

Today it is clear with the pollution of urban rivers that the Biophilic connection is lost and therefore rivers have become urban dividers as opposed to urban connectors. In an attempt to rectify the lost connection between man and its natural environment, architecture is used to re-introduce the these two entities once again. The architecture attempts to challange the current mindset of the people from one where rivers are seen as a waste disposal mechanism, to one where it actively involves the user into nature's natural processes.

The processes is dedactic in nature and will, over time, create a new sense of awereness about our responsibility towards natural environments within cities. The architecture will attempt to highlight the importance of natural resources as well as a proper responce to natural events (urban floods).

In responce to the new found knowledge and importance of urban rivers/resources, it is assumed that a state of proactive change will occur. Thus, leading to the natural environment and the urban environment in a harmonious balance once again and potentially for generations to come.



MEDIATOR

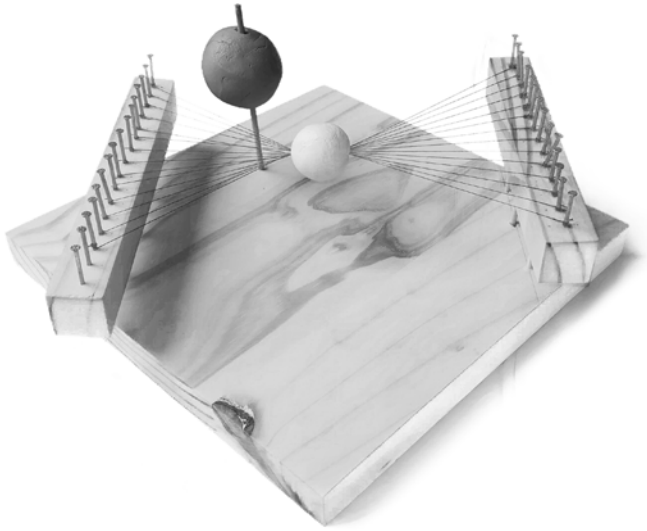
- **Dynamic (movement)**
- **Adaptable**

Architecture is nothing but the extension of nature into a solid and functional form that can be utilized by man; however, nature in its true form is often removed from architecture and therefore feels disconnected.

The aim of this concept is to re-establish architecture as the mediator between man and its natural environment once again by physically blurring the boundaries between inside and outside.

Norberg-Schulz (1980:121) mentions that architecture can promote environmental visibility by its degree of 'openness' by manipulating its boundary condition. The solidity or transparency of the boundaries make the space appear isolated or as part of a more comprehensive totality. He calls this the 'inside-outside relationship', which constitutes the very essence of architecture.

Figure 6.4 - Concept model explaining the intertwined relationship between man and nature, with architecture acting as the mediator between the two realms (Author, 2018).



CONCEPT

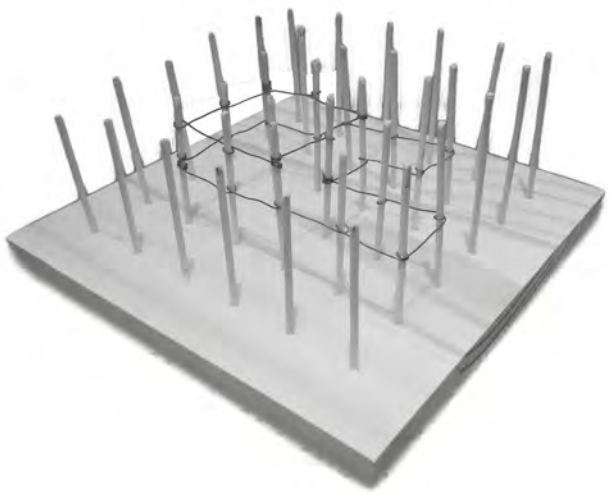
HOLISM

- **Holistic Architecture**
- **Circular Metabolistic**
- **Interconnected Web of Life**

The regenerative state of any given construct cannot function in isolation as it is dependent on holistic systems (Knox 2013:87). Nature does not work in isolation, one system's waste is considered a resource in another system, and so the cycle goes on to form a fully integrated web of life.

The aim of the intervention is to create functions within the building that links with systems happening on adjacent sites or buildings. The intervention should consider ecosystem services as an integral part of its functions. One system should supplement the next, to the benefit of both. The architecture should aim to bind all aspects (process and experience; man and nature) into one element that functions in unison. Nature should be considered in all cases as an extension of design and should be fully integrated into its passive functions; for example, trees should be used as shading devices, or as place creators, or used as a threshold between the street and the building's entrance, or used as a noise and wind barrier.

Figure 6.5 - Concept model explaining the ideal state of the relationship between man and nature, where both entities are in a harmonious balance (Author, 2018).

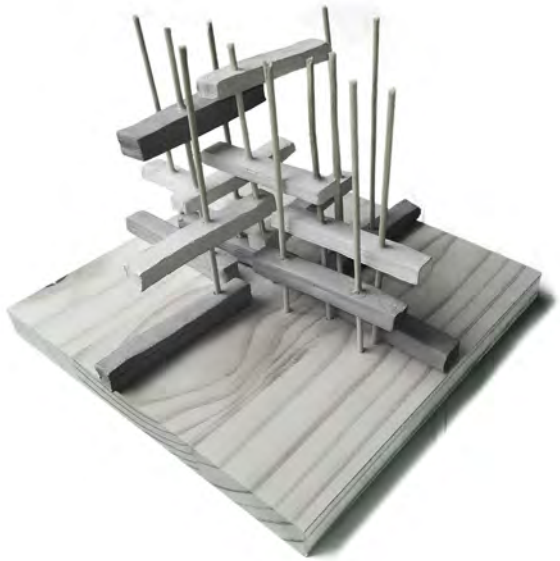


CONNECTION

- **Impact**
- **Physical Connection to Landscape**

The concept model aims at explaining the connection of the architectural intervention to the physical landscape. The architecture should touch the landscape lightly in order to have as little impact on it as possible, especially when building over the river itself. The connection could be described as being a soft connection that gracefully floats above the landscape that is part of but also apart from nature.

Figure 6.6 - Concept model explaining the physical as well as the metaphysical relationship between architecture and the landscape that it interacts with (Author, 2018).



EXPERIENCE

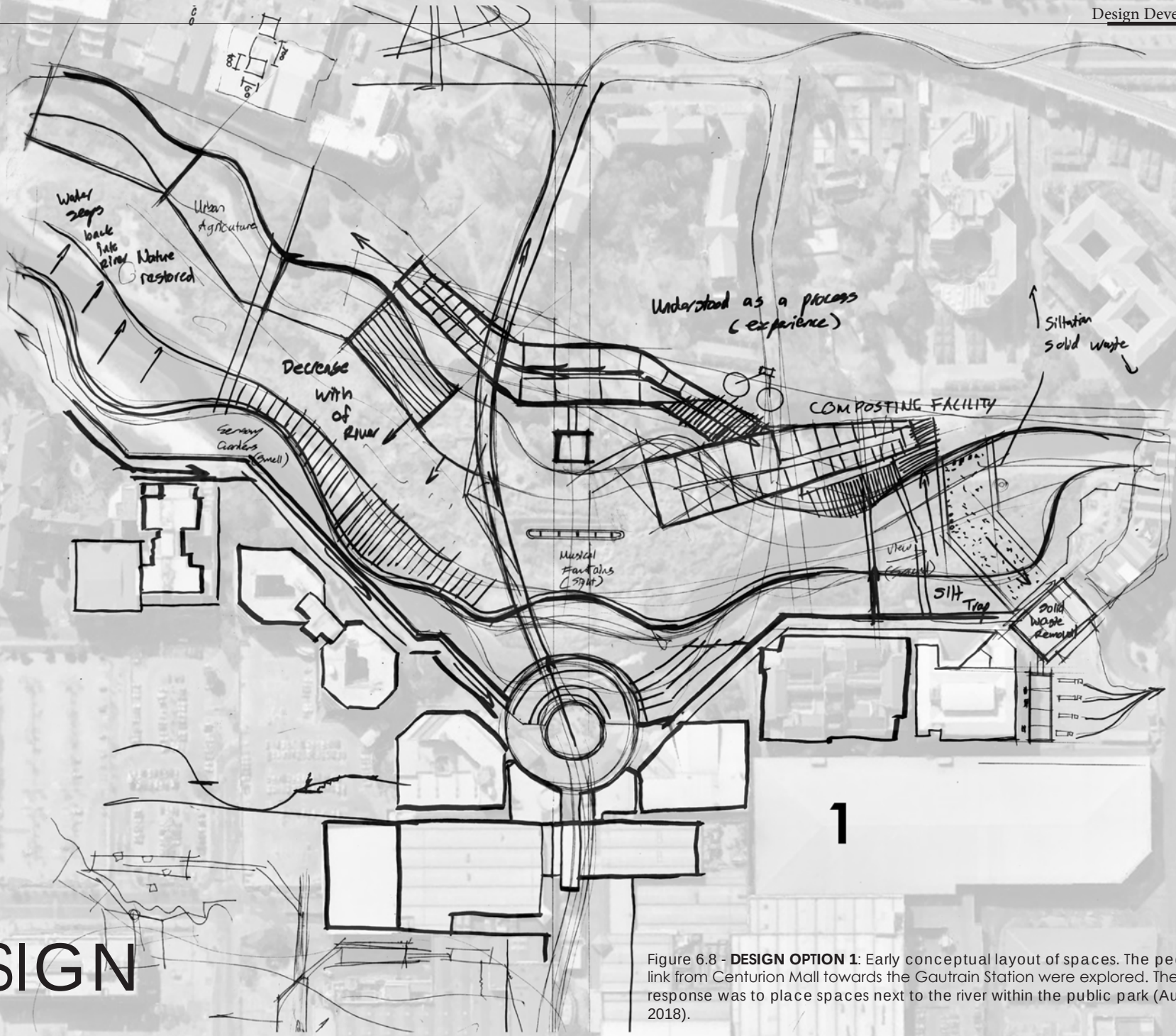
- **Diversity of spaces**
- **Series of event**
- **Different levels of experiences**

The intervention will try to act as a mediator between man and nature by incorporating a series of events and processional experiences. The purpose of these experiences are to evoke some form of awareness by the user about the importance and power of nature. It is there to enlighten the user to the forces of nature.

The concept model implies that these experiences happen on multiple levels; albeit it physical or metaphysical levels. The grounded levels represent the changing quality of nature, where the white layers above proposes an architectural response. The architecture allows the nature to change without being effected by it. Some parts of the architecture may also change in the process, just as some elements of nature could be made ridged.

In a sense the architecture should co-evolve with nature causing the intervention to heal nature in the process.

Figure 6.7 - Concept model highlighting the fact that nature is ever-changing and therefor architecture must be able to accommodate the changing environment (Author, 2018).



DESIGN

Figure 6.8 - **DESIGN OPTION 1**: Early conceptual layout of spaces. The pedestrian link from Centurion Mall towards the Gautrain Station were explored. The first response was to place spaces next to the river within the public park (Author, 2018).

DEVELOPING A NEW APPROACH TO URBAN RIVER SPACES: **DESIGN DEVELOPMENT**

DESIGN OPTION 1 (Left)

The Gautrain Station, Centurion Mall and the CoT (City of Tshwane) proposed 'African Gateway' led the design to place emphasis of the pedestrian connection between the station and Centurion Mall.

Other major influences include the implementation of a silt and litter trap as was proposed by the CoT (ARC weir). However, the ARC Weir is much lager in scale and proved unfeasible. This dissertation proposes to decrease the scale of the silt trap and implement a series of weirs along the river over time, thus leading to a feasible solution to urban river rehabilitation.

Iteration 1 indicates the necessary facilities that needs to accommodate the rehabilitation processes (vermi-composting and plastic furniture production; see chapter 5). The most appropriate location for the processes were investigated throughout all iterations.

The sketch explains the exploration of pedestrian circulation, access to municipal services, the location of urban agriculture, and the establishment of berms as a flood prevention mechanism.

DESIGN OPTION 2 (Right)

The second iterations identifies the existing pump house and the 'musical fountains' (currently inactive), as an important point of attraction as one approach Centurion Lake.

The possibility of filtering or purifying the river water for agricultural use was investigated with additional diagrams.

Iteration 2 also started to explore the concept of processes as an experience by determining the experiential route that the users might use. Furthermore, it was important to locate the resource extraction space as close as possible to ensure convenient processing and transportation of the end product.

ITERATION 3 (Right)

It is evident in iteration 3 that the flood-lines are present (marked in red). The lines represents the 1:100 and 1:50 year flood-lines, however, due to the man-made retaining wall (adjacent to Centurion Mall) as well as the steep slope of the river bank (across the lake), causes the flood-lines to be located close together.

The iteration explores the possibility of condensing the programmes into a single structure that, in the form of a 'multifunction bridge'. The form giving lends itself to the strict geometry of the surrounding site. The design attempts to create experiential vistas to guide the users at certain points along the route, and in turn making the extended walk more pleasurable.

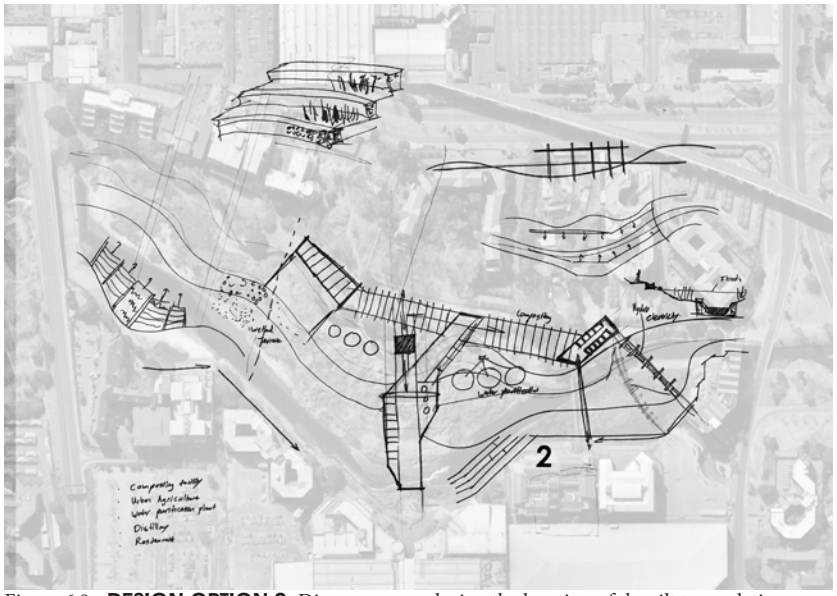


Figure 6.9 - **DESIGN OPTION 2**: Diagramme exploring the location of the silt trap relative to the intervention. Moreover, water purification as a possibility was investigated as well as the coconcept of 'process as an experience' (Author, 2018).

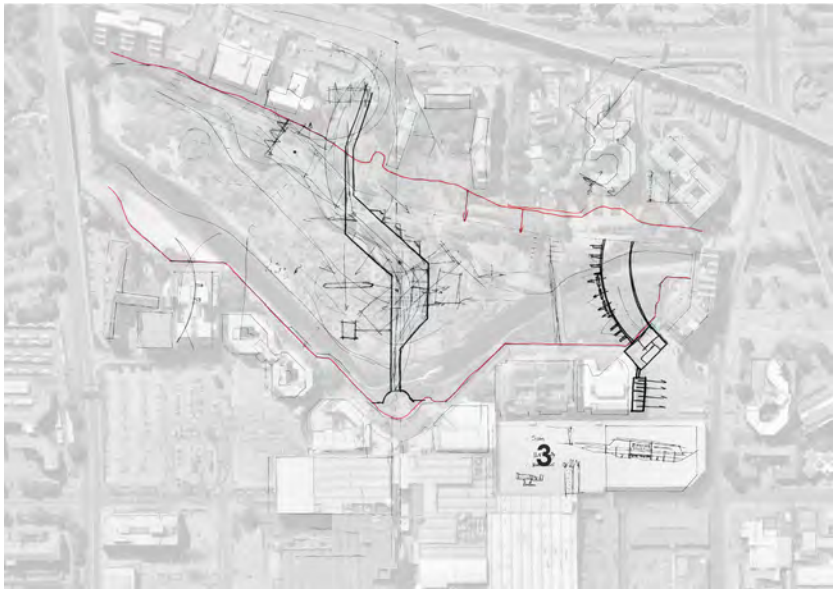


Figure 6.10 - **DESIGN OPTION 3**: Diagramme that explains the exact location of the 1:100 and 1:50 year flood-lines. The iteration explores the possibility of the pedestrian route and process facility as one structure, taking the form of a 'multi-functional bridge' over the lake (Author, 2018).

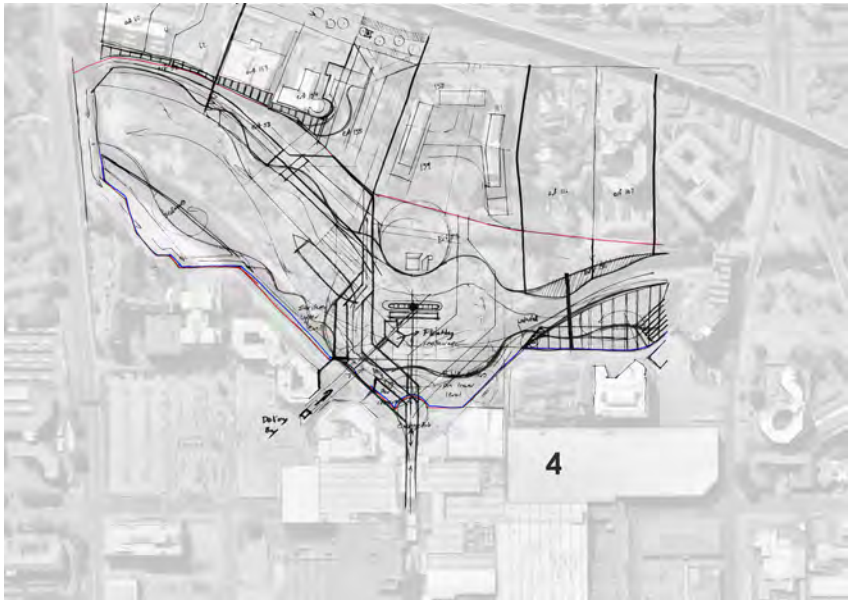


Figure 6.11- **DESIGN OPTION 4**: Sketch that shows how the design attempts to tap into the existing infrastructure as a supplementary source. (Author, 2018).

DESIGN OPTION 4

The proposal explores the possibility to attach the proposed pedestrian bridge to an existing vacant erf that is located close to Centurion Gautrain Station; in doing so, it becomes possible to use West Avenue as a potential service access route for the transportation of products, and joining existing municipal service.

The potential of using the existing pedestrian promenade extension (branching to the left of Centurion Mall) were investigated as a viable connection point towards the Gautrain Station.

Possibilities

- Sign a notice agreement with Centurion Mall to share existing parking infrastructure
- Create a silt trap and resource harvesting facility that is separate from the proposed intervention (not ideal), by utilizing a vacant piece of land located next to Centurion Lake Hotel

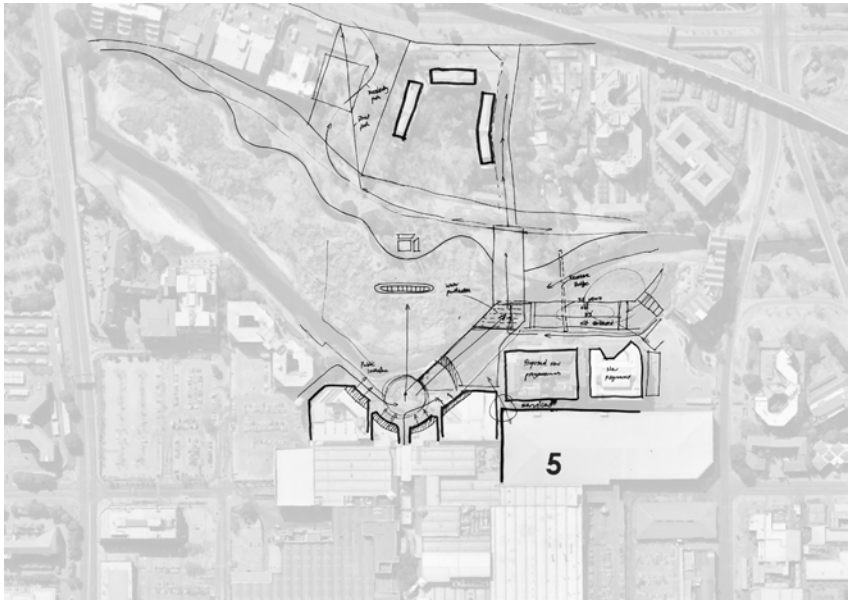


Figure 6.12 - **DESIGN OPTION 5**: Sketch indicating an alternative route to West Avenue (Author, 2018).

DESIGN OPTION 5

The previous options presents the problem that the silt trap facility and the proposed intervention are separate, thus creating issues related to resource loading and unloading. Design option five addresses these issues by proposing an alternative circulation route. The new route makes it possible to harvest and remove the silt and litter using the vacant land next to the Hotel.

This design option makes it possible to also connect to the existing culinary hub that is located along the lake's edge; the problem however, is that the silt and litter trap may encroach on the hotel's and culinary hub's aesthetic assets (potentially the reason for investing into development along a lake in the first place).

DESIGN OPTION 6

[The river is in all cases seen as the most important point of connection]; this might have been true in the past, however, the lake is currently (2018) seen as Centurion's biggest liability.

When developers first proposed to utilize the aesthetic appeal of the Hennops river, the grid orientation did not take priority; rather, Centurion's typography (including the river) played the largest role as to the exact location of Centurion Mall and other businesses. The Mall was place where it stands today due to the relatively level ground area. The devastating result of this initial mistake is that 90% of Centurion's buildings are oriented incorrectly/ inefficiently when considering only solar angles.

Design option six tries to correct past mistakes by shifting the building's orientation correctly and effectively in terms of solar angles; however, the buildings compromises the aesthetic appeal of the lake. The user experience of this option is also one of compartments/ segments and may prove to be ineffective.

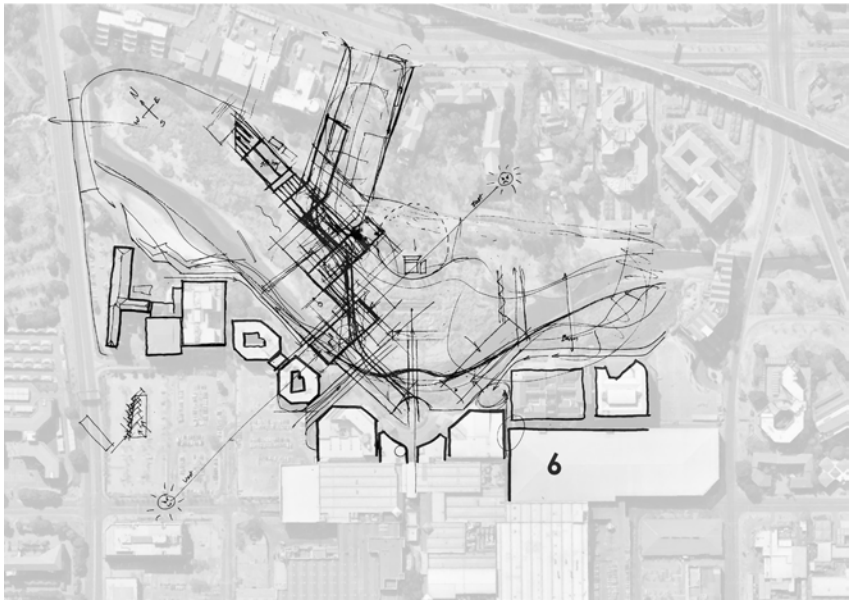


Figure 6.13 - **DESIGN OPTION 6**: Diagramme explaining solar angle considerations and the difficulty associated with Centurion's initial grid layout (Author, 2018).

DESIGN OPTION 7

This proposal, regardless of its simplicity, showcases how the correct solar angle can be achieved whilst creating a strong connection to the train station and public park. Silt trap facilities are located relatively close, making it possible to harvest the resources and processing it simultaneously. An access route have also been identified as a means to transport products from and to the extraction facility.

Once again the problem arises with the silt trap being located too close to the mall's culinary hub.

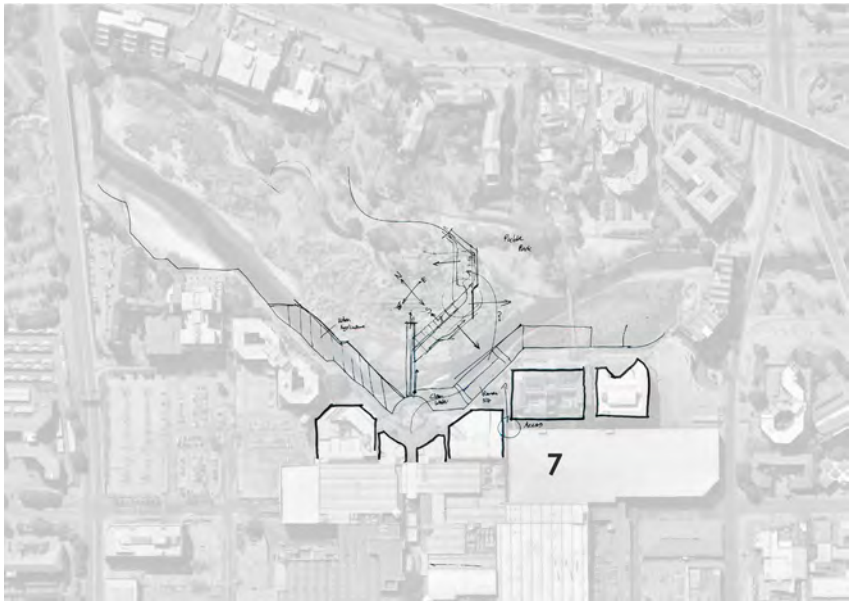


Figure 6.14 - **DESIGN OPTION 7**: Diagramme that proposes a building that incorporates the correct solar angle as well as a viable connection point to the public park and the train station (Author, 2018).

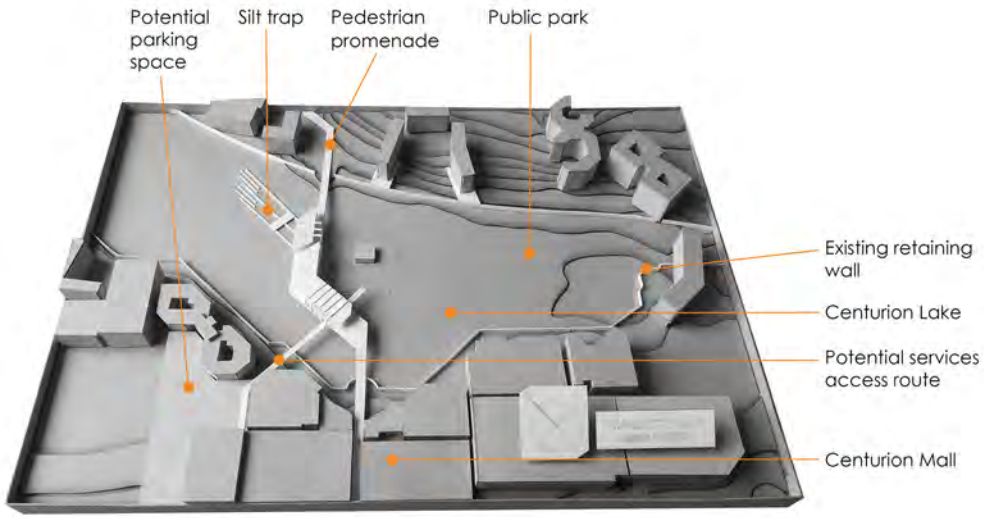


Figure 6.15 - **MAQUETTE NO.1** (Author, 2018).

MAQUETTE OF DESIGN OPTION 3

Advantages to the proposal:

• The pedestrian promenade reaches from Centurion Mall to the Gatrain Station in one continuous line
• An existing service access route is present in the form of a large parking platform
• The silt trap is an integral part of the design, making it possible to easily extract the essential resources from the river and make it into a product

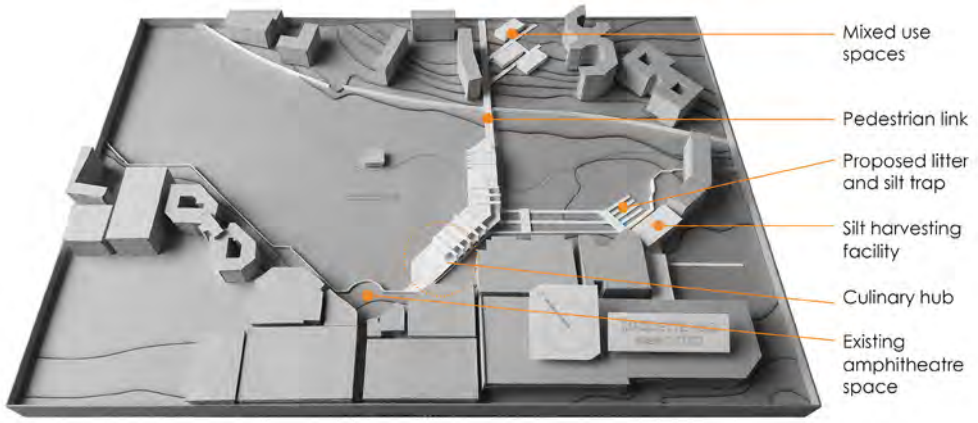


Figure 6.16 - **MAQUETTE NO.2** (Author, 2018).

MAQUETTE OF DESIGN OPTION 5

Advantages to the proposal:

• Solar orientation of the building is correct
• The silt trap and its processes facilities have full access to a public road
• The silt trap and intervention is an integrated design

Disadvantages to the proposal:

• The silt trap might be aesthetically unpleasing to the restaurant patrons and hotel residents
• The end condition to the pedestrian promenade needs to be defined (see annotation 'Mixed used spaces'
• The pedestrian link does not stretch directly towards the train station, but rather diverts away

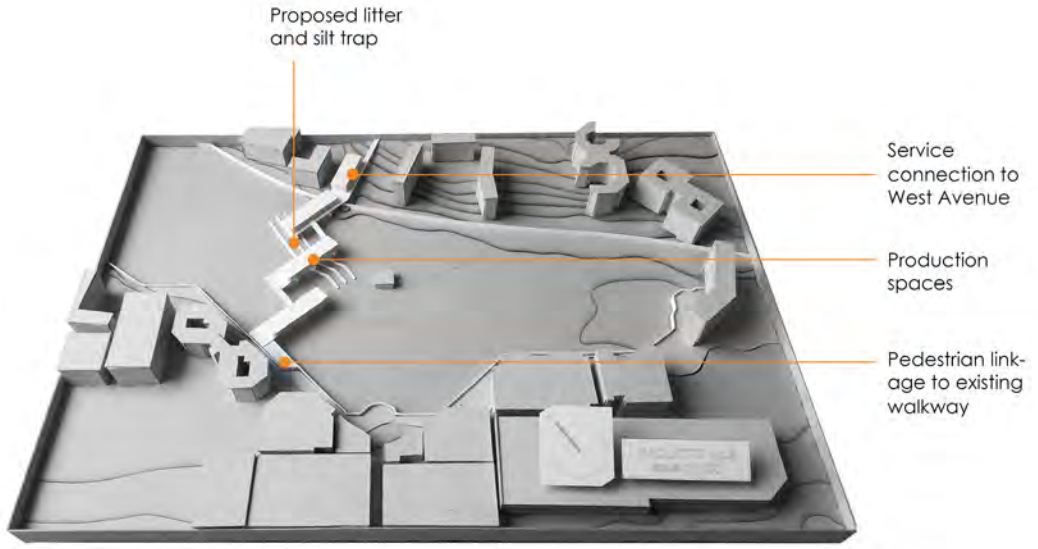


Figure 6.17 - **MAQUETTE NO.3** (Author, 2018).

MAQUETTE OF DESIGN OPTION 6

Advantages to the proposal:

• The solar orientation of the proposed buildings (East-West orientation) is achieved
• The silt is fully integrated into the design
• The promenade reaches directly from Centurion Mall towards the Gautrain station
• The existing pedestrian link is utilized, potentially saving on building expenses

Disadvantages to proposal:

• The overall experience of the users might be compromised as the buildings are fragmented

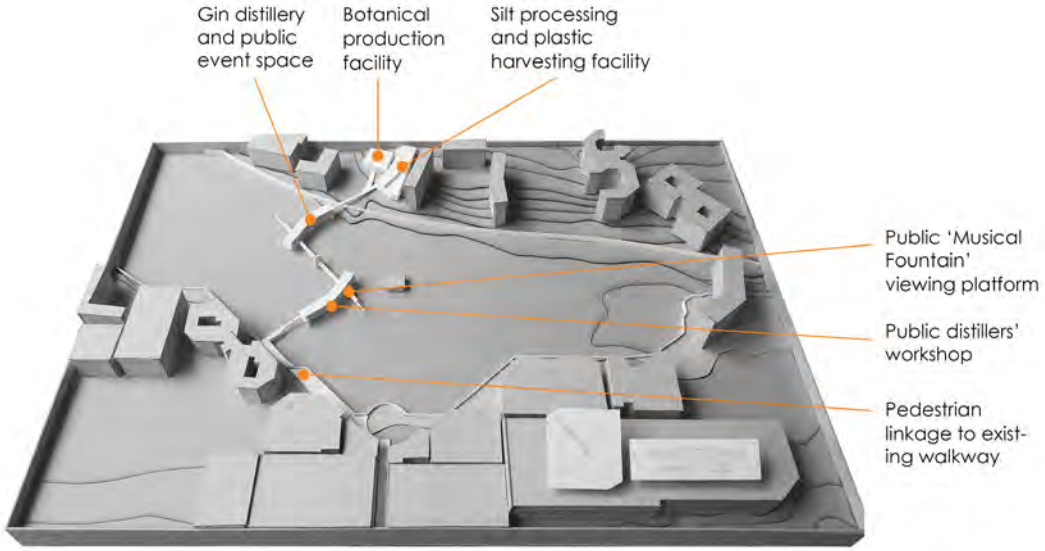


Figure 6.18 - **MAQUETTE NO.4** (Author, 2018).

MAQUETTE OF DESIGN OPTION 8 (Not shown above)

Advantages to the proposal:

• The design is compact and 'elegant' when compared to the previous designs
• The design utilizes the existing promenade
• The building is anchored to the erf across the lake which makes it possible to tap into the municipal infrastructure (sewage, water and electricity)
• Effective solar angle is achieved, creatively

Disadvantages to the proposal:

• The pedestrian experience is compromised due to the thin connecting ele-ments that reaches from the one building to the next
• The buildings are too slender for the sheer size of the lake and therefore looks out of place

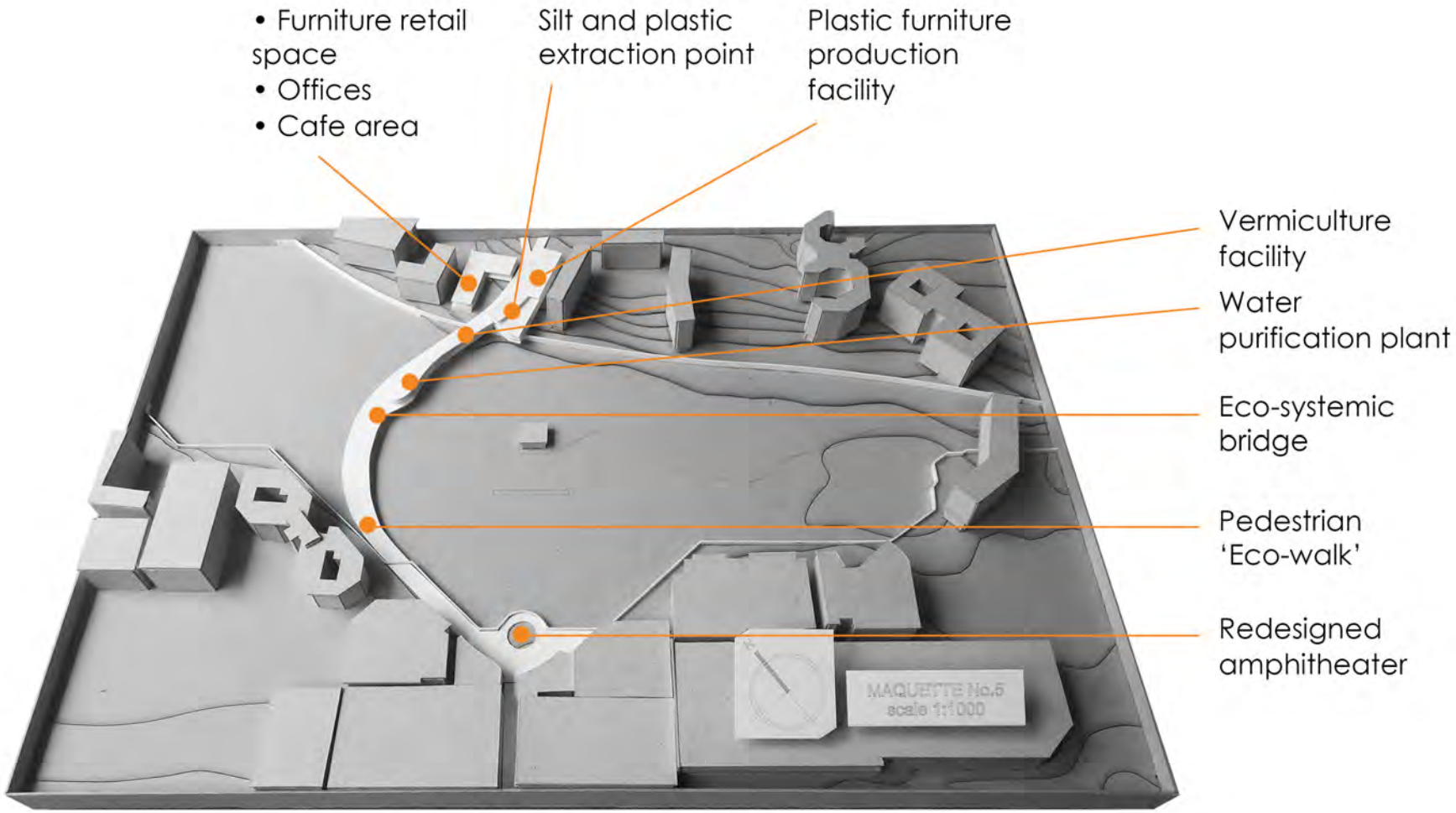
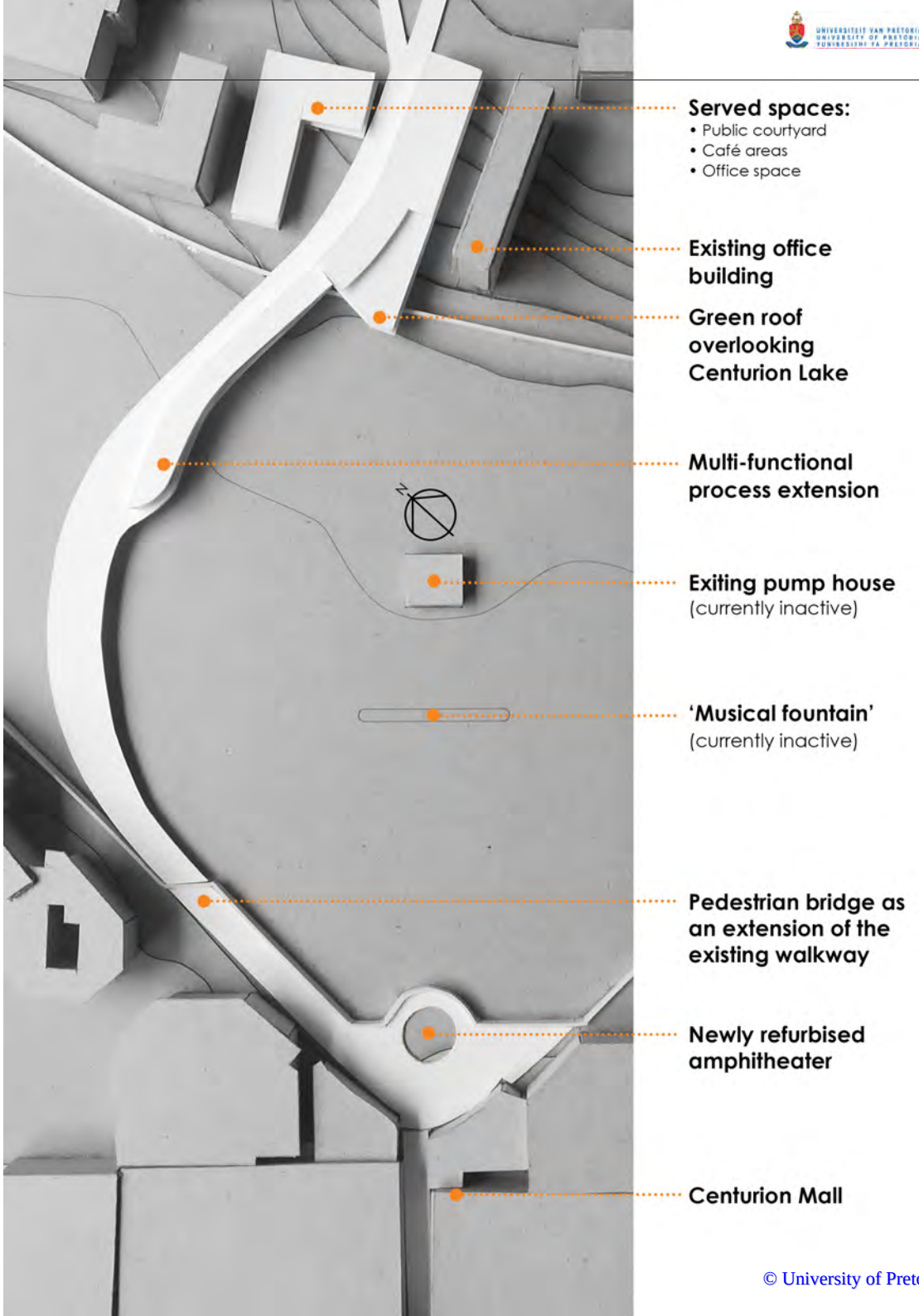


Figure 6.19 - **MAQUETTE NO.5: Final Design Proposal;** This model indicates the proposal that was chosen to further investigate (Author, 2018).



FINAL DESIGN MAQUETTE

Reflecting back on the previous design options it becomes clear that there are many design challenges that emerged which includes;

1. General access to municipal services and connections; this includes water connections, electricity, sewage lines, and storm water connections.

2. Physically extending Centurion Mall's promenade across the lake; buildings becomes intrusive on the landscape and mostly appear out of place.

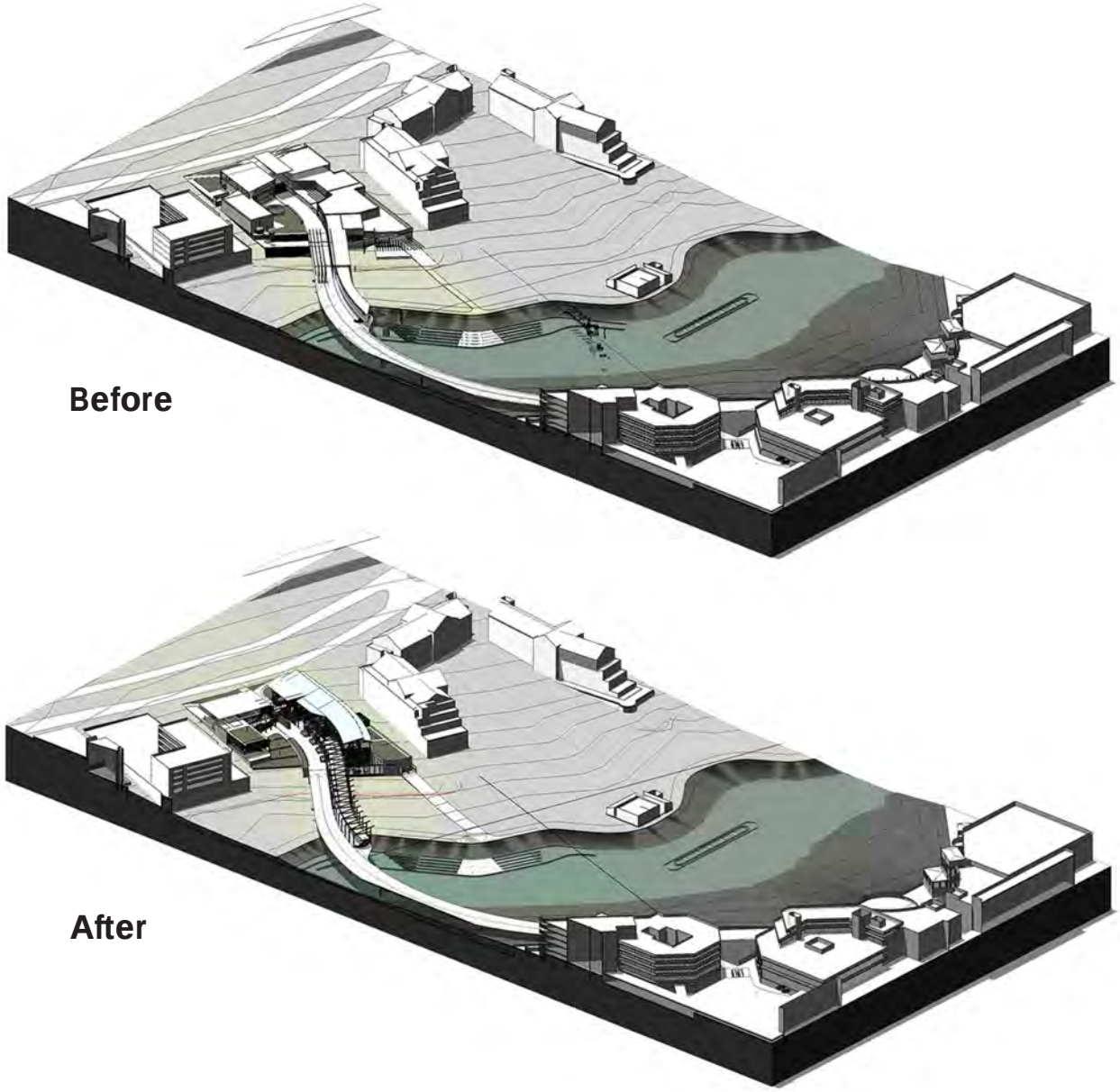
3. The pedestrian experience becomes confusing and in some cases unsafe, due to narrow walkways that lacks simplicity

In response to the issues mentioned above, a more simplistic approach was undertaken. The pedestrian bridge then became a softer element that tries to connected the urban fabric elegantly. The bridge's walking area also became a wider element, compared to previous proposals, to allow easy, open, convenient and safe travel across the lake.

In terms of services, it is proposed to create and anchor point where all the processes are concentrated into one structure. This allows the functions to be fully integrated with one another and create a holistic approach to design where one system's waste is seen as a resource of another system (Regenerative Theory: see chapter 2).

The ecosystem services are integrated into the design by allowing nature to take over some parts of the bridge and building itself. These services govern many essential processes that contribute to the environment as well as services required by man; for example storm water management, urban floods, river erosion that block channels, passive heating and cooling of buildings by using trees. In many ways nature can help solve fundamental problems of man and vice versa.

Figure 6.20 - **MAQUETTE NO.5** Model showing the final proposal that will be investigated to a greater extent. The model shows a more simplistic approach to urban connectivity by proposing a bridge structure that considers the landscape and responds with a design that is sensitive to its landscape (Author, 2018).



DESIGN DEVELOPMENT : Establishing The Connection

The main design driver at a larger scale is governed by circulation and movement. The images indicate the ease of access across the Hennops river towards the Gautrain Station. The architecture on the other hand tries to incorporate the users into its processes by allowing people to engage with the building on different levels (phenomenology; existential experiences, see Chapter 2).

The circulation path is used as the central point of the design from which the spaces gradually become more dense and intimate as one moves closer to the building's interior. In other words, the main circulation path is seen as the most private space, and as the users enter the building it become more private.

The top figure attempts to create a space at the end of the bridge to frame/enclose the space and create a significant place. This space takes the form of a courtyard in a sense, and allows for the space to become appropriated by the users.

The top proposal displays a very stereotomic 'block-like' form whereas the bottom proposal is more elegant and refined. The second proposal tries to incorporate tectonic elements in order to allow nature to infiltrate the built fabric. Regenerative theory speaks of the three fundamental orders of nature and buildings namely; locational order, functional order, structural order. Buildings and nature works on these same principles/orders.

If nature is incorporated into the design it become easier compare the two entities; for example the stem of a tree carries and distributes loads in the same way as columns of a building. By 'blurring the boundaries' of building and nature, this similarity become more clear.

The importance of this transparency is to create a society that understands fundamental principles such as gravity, forces, action and reaction, cause and effect, and most importantly the impact that it will have if the harmony of man and nature is in a state of disorder.

Figure 6.21- Three dimensional diagrams that indicates the design intentions for the bridge structure in terms of its response to the design intervention (Author, 2018).

DESIGN DEVELOPMENT: The Power of Nature

Theory

Pamela Mang and Reed mentions the four fundamentals to living systems

1. Change
2. Diversity
3. Value
4. Holistic view

Mang et al. (2016:13) states that the only constant is change. Living systems, unlike the paleotechnic industrial machines, change on a regular basis and designers must allow for the constant flux of a changing world.

The proposal recognizes the potentials of changing environments and therefore proposes to enhance the human-experience of natural phenomena such as storms and urban floods.

The design incorporates a structure that allows man to come closer to the river and floods in the event of a storm. "Arguably, the most exciting and dramatic experience is the moment right after a storm where the forces of nature move the mass of water down the river, encroaching on property boundaries and moving anything that stands in its way" Lyle (1994:62).

The proposed bridge is designed so that the users can experience this moment that Lyle describes above. It will become possible for the user to stand right above the mass of water as it comes rushing down the river in full force.

The aim is to make the users aware of the power of nature and to show directly the negative effect that paved surfaces has on the water management of cities; as well as the incorrect and correct way of designing for riverfront spaces. Ultimately, the experience will instill an awareness in the user to promote proactive change for future developments.

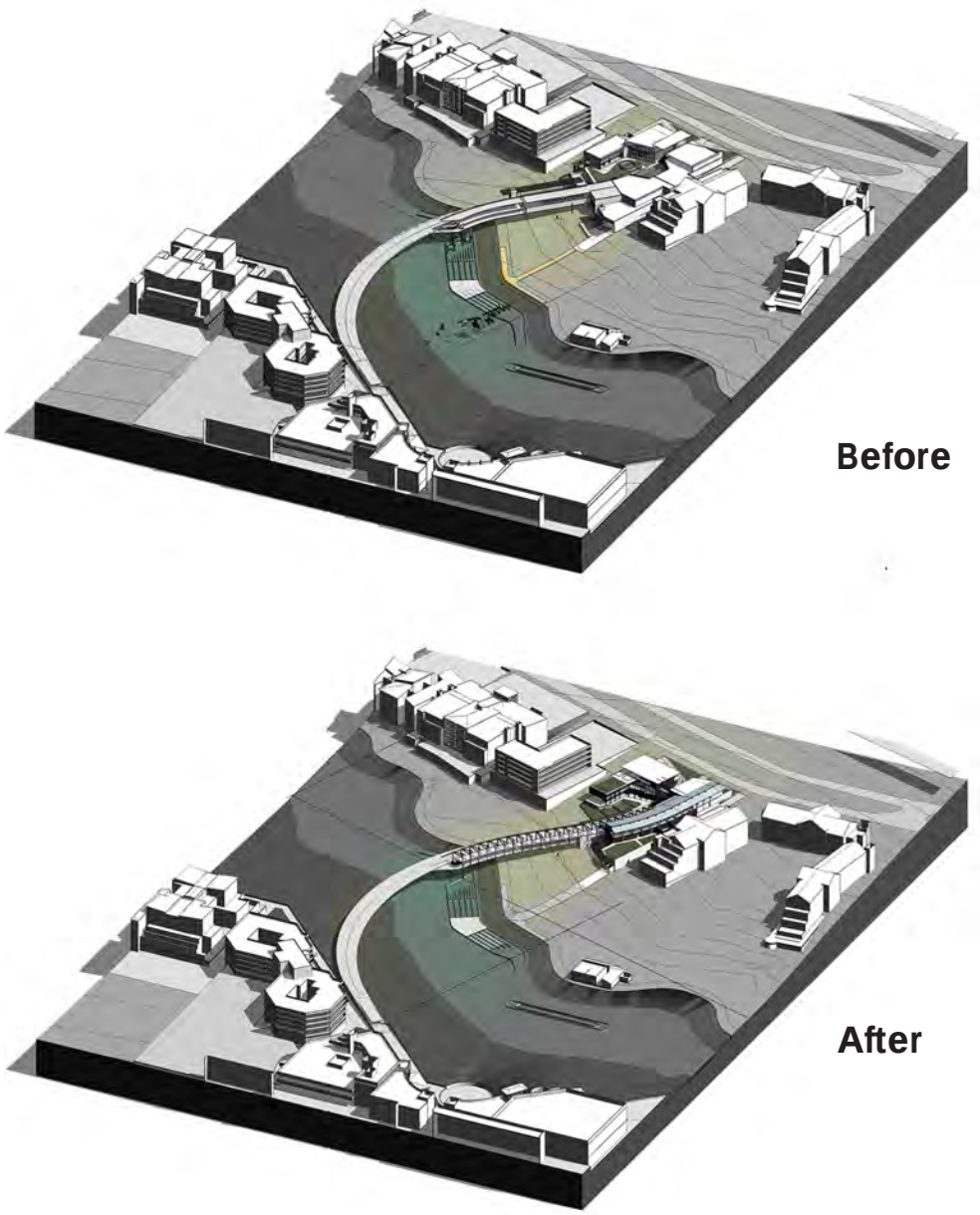


Figure 6.22 - Three dimensional diagrams that indicates the design intentions for the bridge structure in terms of its response to the design intervention (Author, 2018).

DESIGN DEVELOPMENT: Processes and Experiences

The design proposes that the users gain access to the existing public part and newly proposed silt trap, in order to engage with the process of silt and plastic extraction from the river. The access point to the park takes the form of a terraced walkway, supported by a wheelchair ramp.

The first proposal shows two large terraces that can be utilized for future events, using the levels it creates to its benefit. The second proposal challenges this notion by creating multiple levels that gradually shifts the users down towards the park. The gradual 'stepping' of the ground level also requires less excavation and less stairs to be implemented. Thus, leading to a more sustainable approach to design.

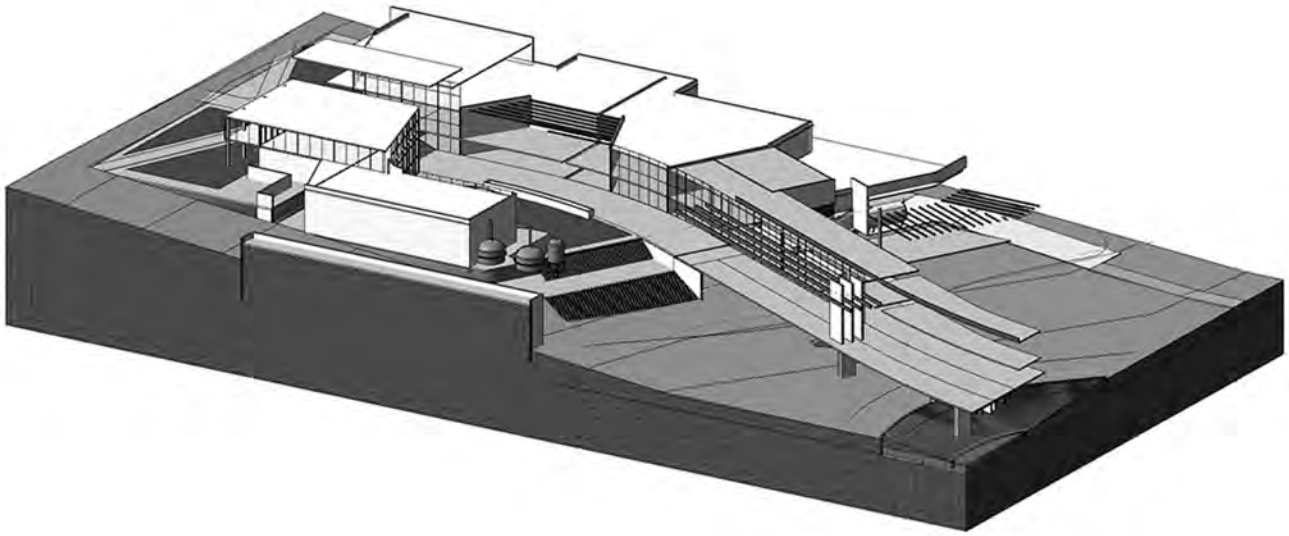


Figure 6.23 - **DESIGN PROPOSAL:** Three dimensional rendering of the early stages of BIM development. The design displays the spacial organizing and basic form giving to the proposal. (Author, 2018).

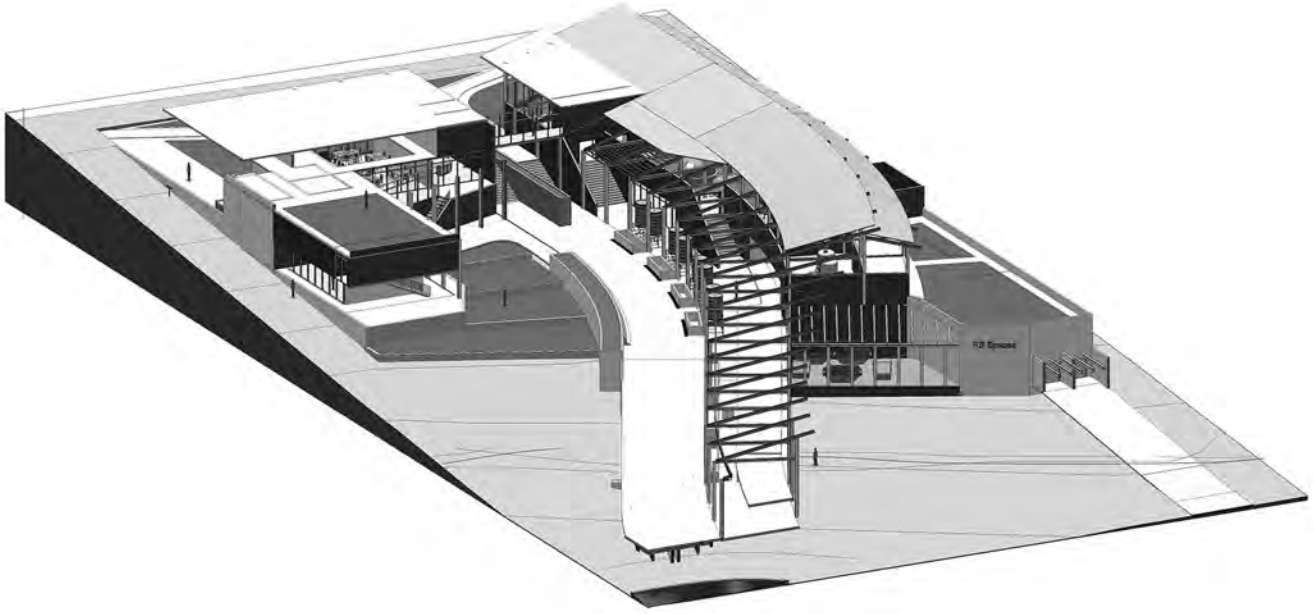


Figure 6.24 - Design iteration that indicates the exploration of the roof as an extension to the building's structure. The roof breaks away to expose the structure and the processes that governs its form(Rainwater harvesting) (Author, 2018).

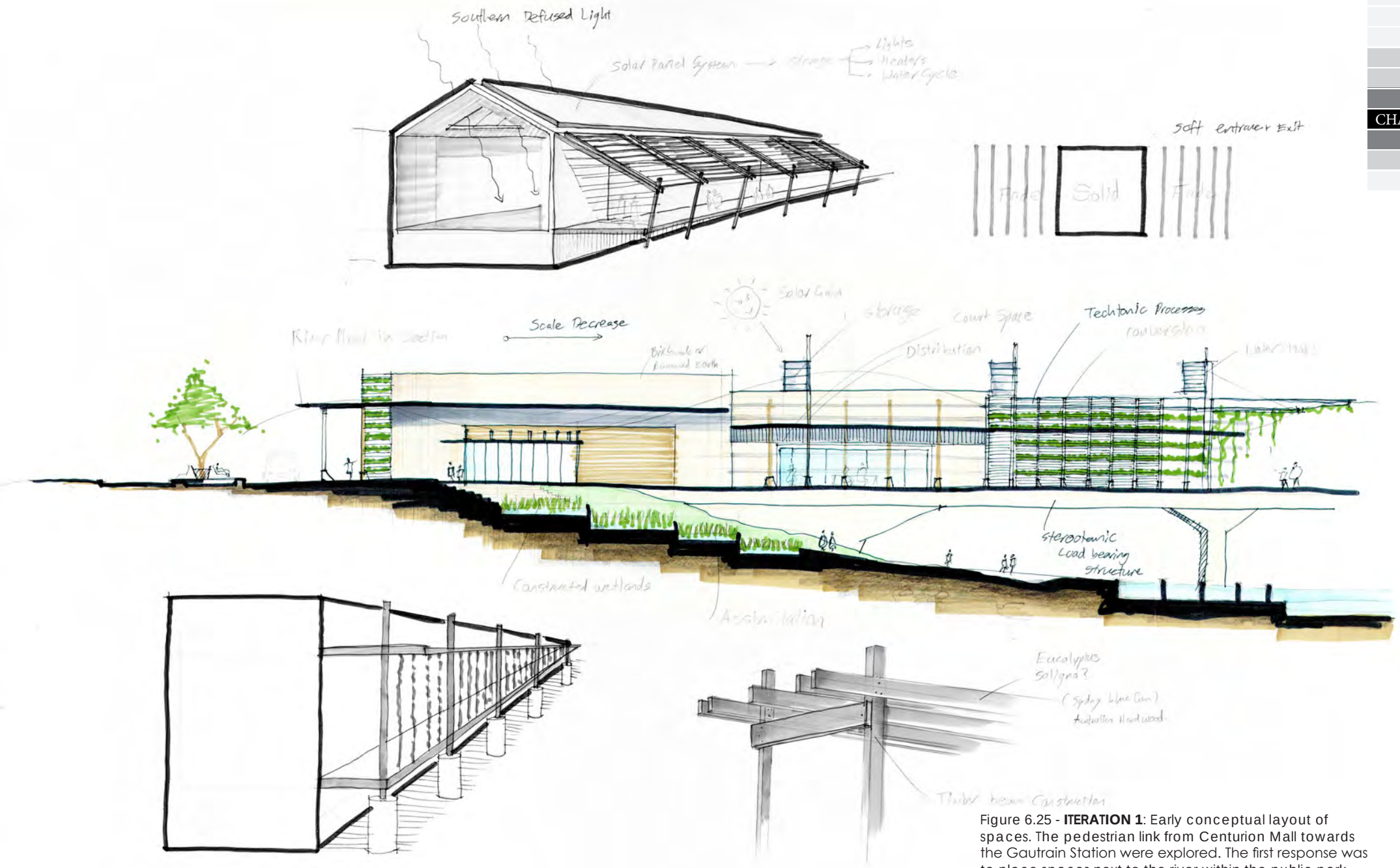


Figure 6.25 - **ITERATION 1**: Early conceptual layout of spaces. The pedestrian link from Centurion Mall towards the Gautrain Station were explored. The first response was to place spaces next to the river within the public park (Author, 2018).

Pedestrian bridge (from the Gautrain towards Centurion Mall)

Vermicomposting line

Main pedestrian artery

Resource extraction point linking the silt and litter trap to the processes facility

Service vehicle access point

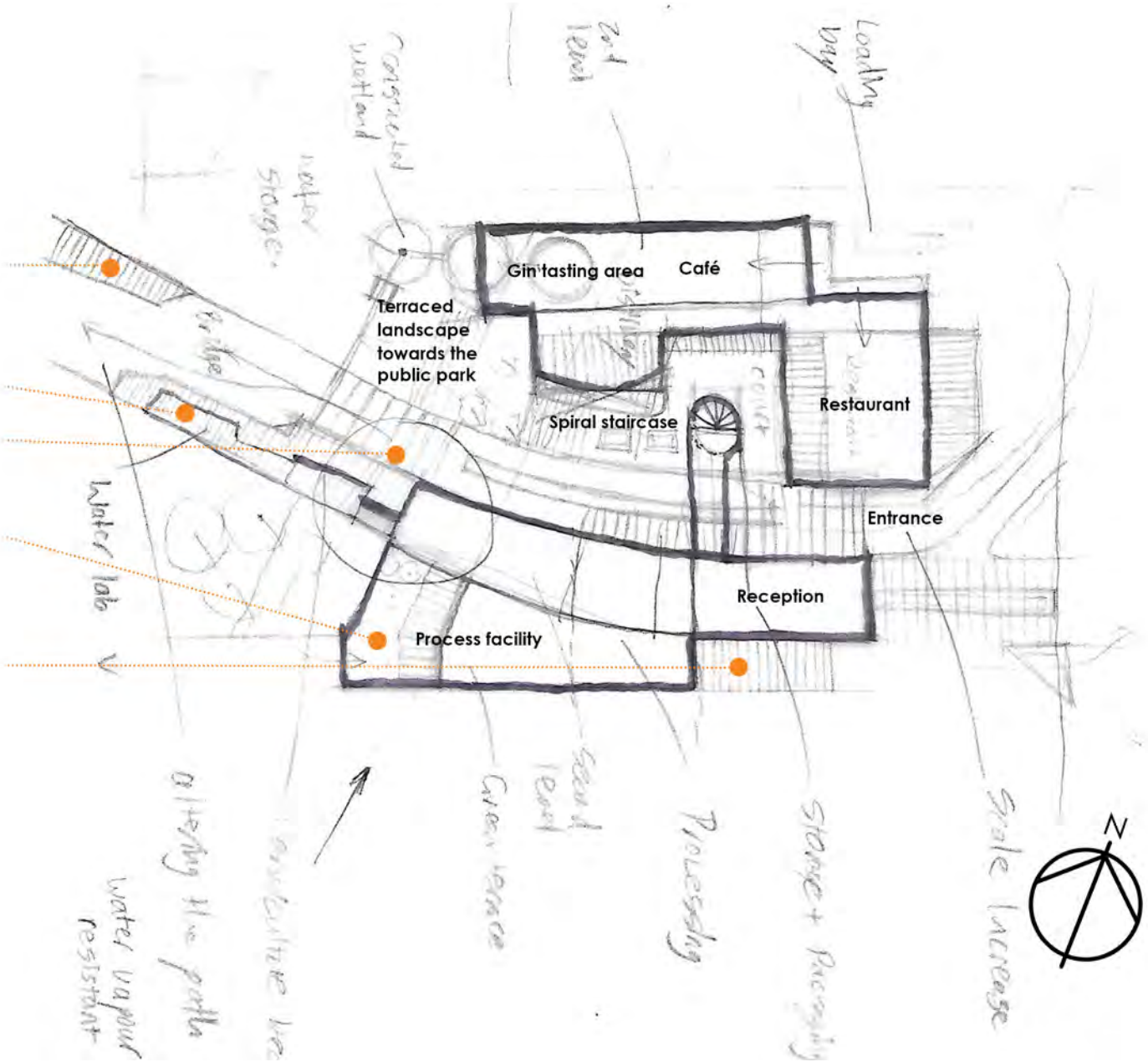


Figure 6.26 - Early spacial layout and process organization (Author, 2018).

- Retail space
- Offices
- Café areas

Open public courtyard

Main pedestrian artery

Rain water sotrage tanks

Gin distillery

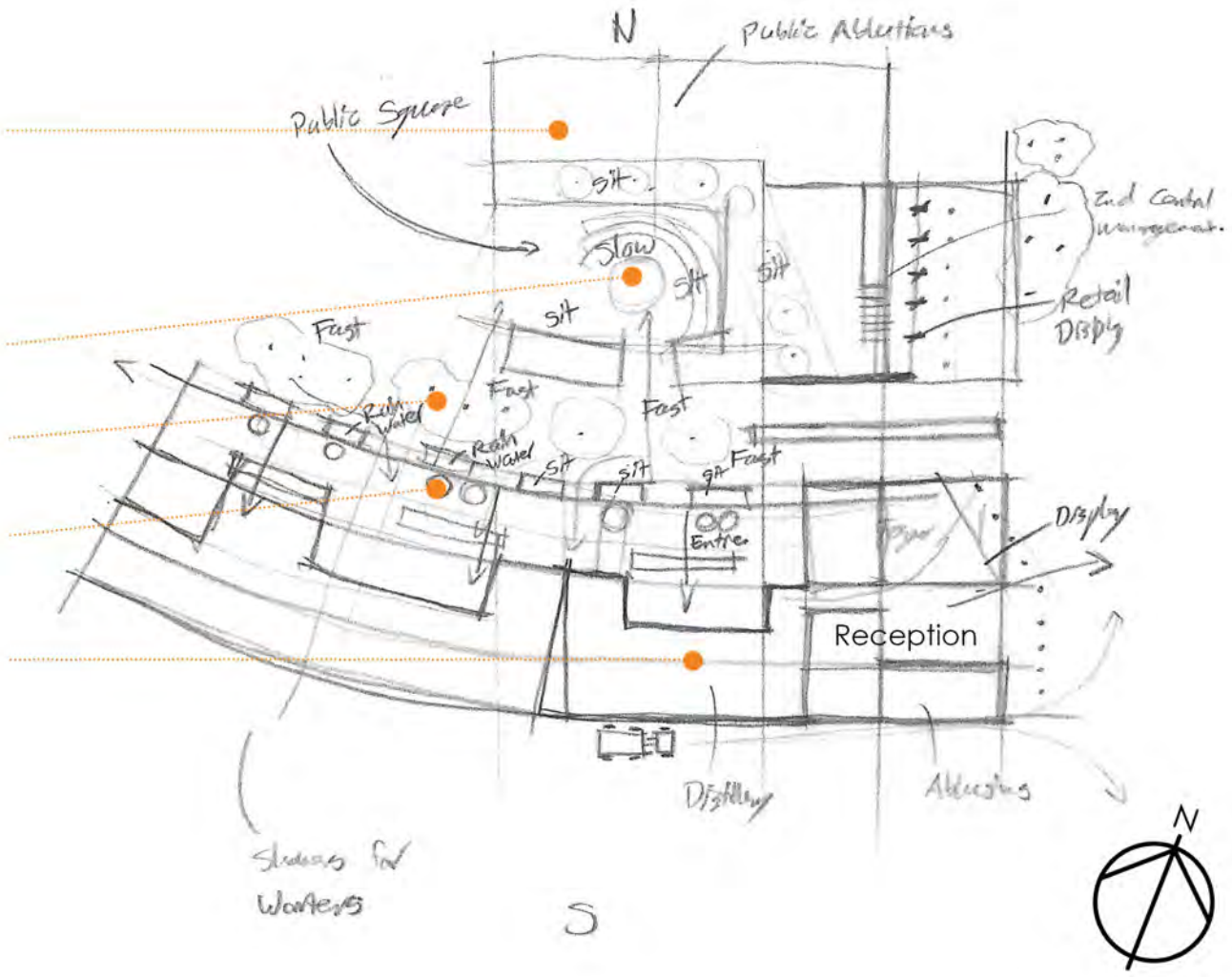


Figure 6.27 - Spacial layout hinting at the process of rain water storage and the integration of nature into the building's structure (Author, 2018).

Figure 6.28 - **DESIGN RENDER 1**: The pedestrian bridge is shown as it connects Centurion Mall to the Gautrain Station (top right corner). The intervention aims at integrating nature with the urban construct by proposing that nature takes over part of the structure (Author, 2018).

Figure 6.29 - **DESIGN RENDER 2**: The render indicates the approach of the typical Gautrain user towards the intervention (Author, 2018).

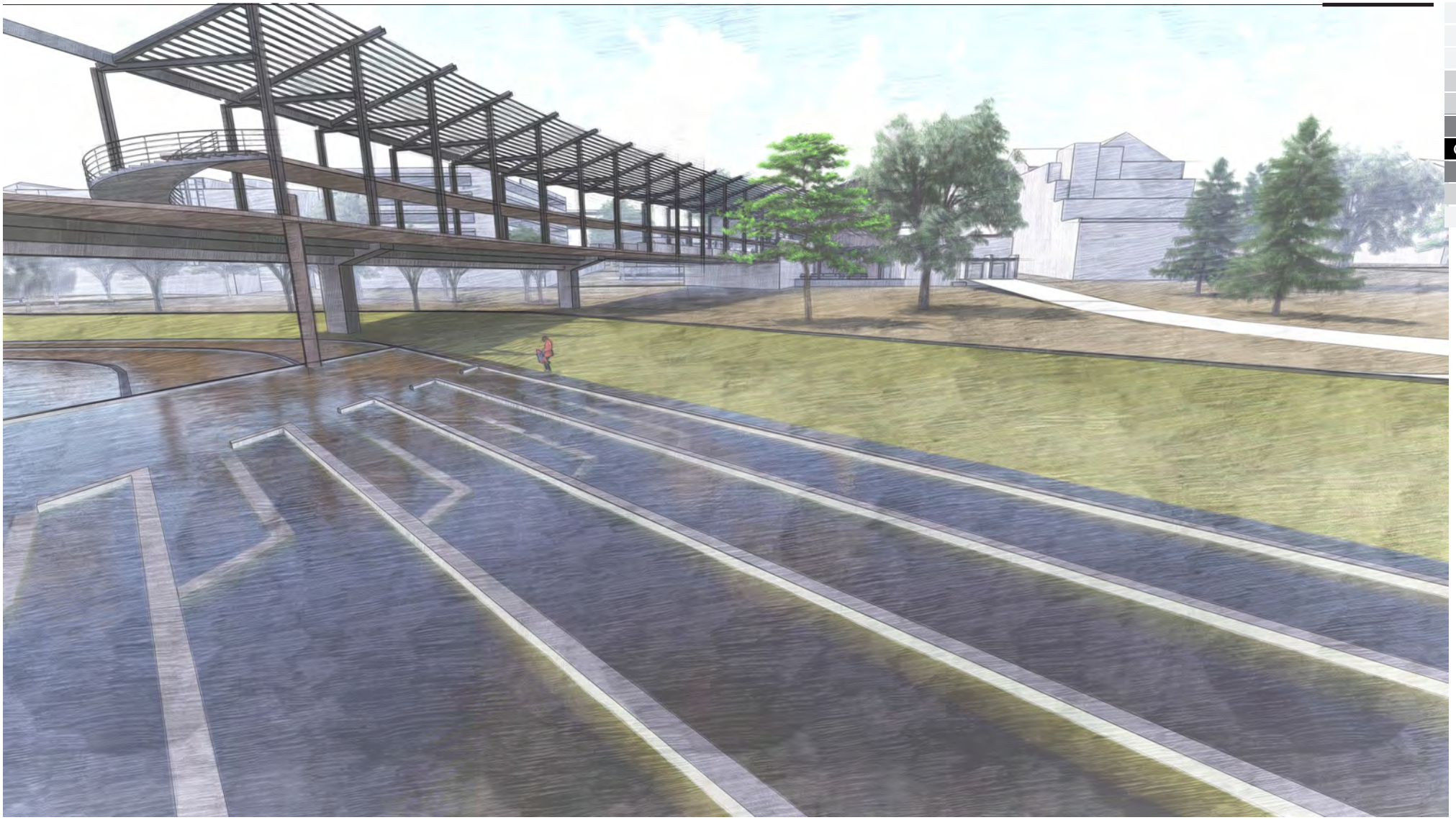
Figure 6.30 - **DESIGN RENDER 3**: Upon entering the space, gradual zones of transitions are used to blur the boundaries between inside and outside spaces. Also noticeable is the exposure of the user to a diverse set of texture to enrich their existential experience (Author, 2018).

Figure 6.31 - **DESIGN RENDER 4**: The structure pulls back to expose the structure of the building, and in doing so it also exposes the processes that is integrated into the design (Author, 2018).

Figure 6.32 - **DESIGN RENDER 5**: Pedestrian promenade that leads the user to the open restaurant and vermiculture bed further on (Author, 2018).

Figure 6.33 - **DESIGN RENDER 6**: Image showing the gin bar and gin tasting spaces. Processes are strategically place in a linear process so that the users can understand the processes as they move through the space; for example fro where the botanicals are grown for the gin distillery, to the finished gin product (Author, 2018).

Figure 6.34 - **DESIGN RENDER 7**: Image showing the majestic Gin Mashing Tun.
(Author, 2018).



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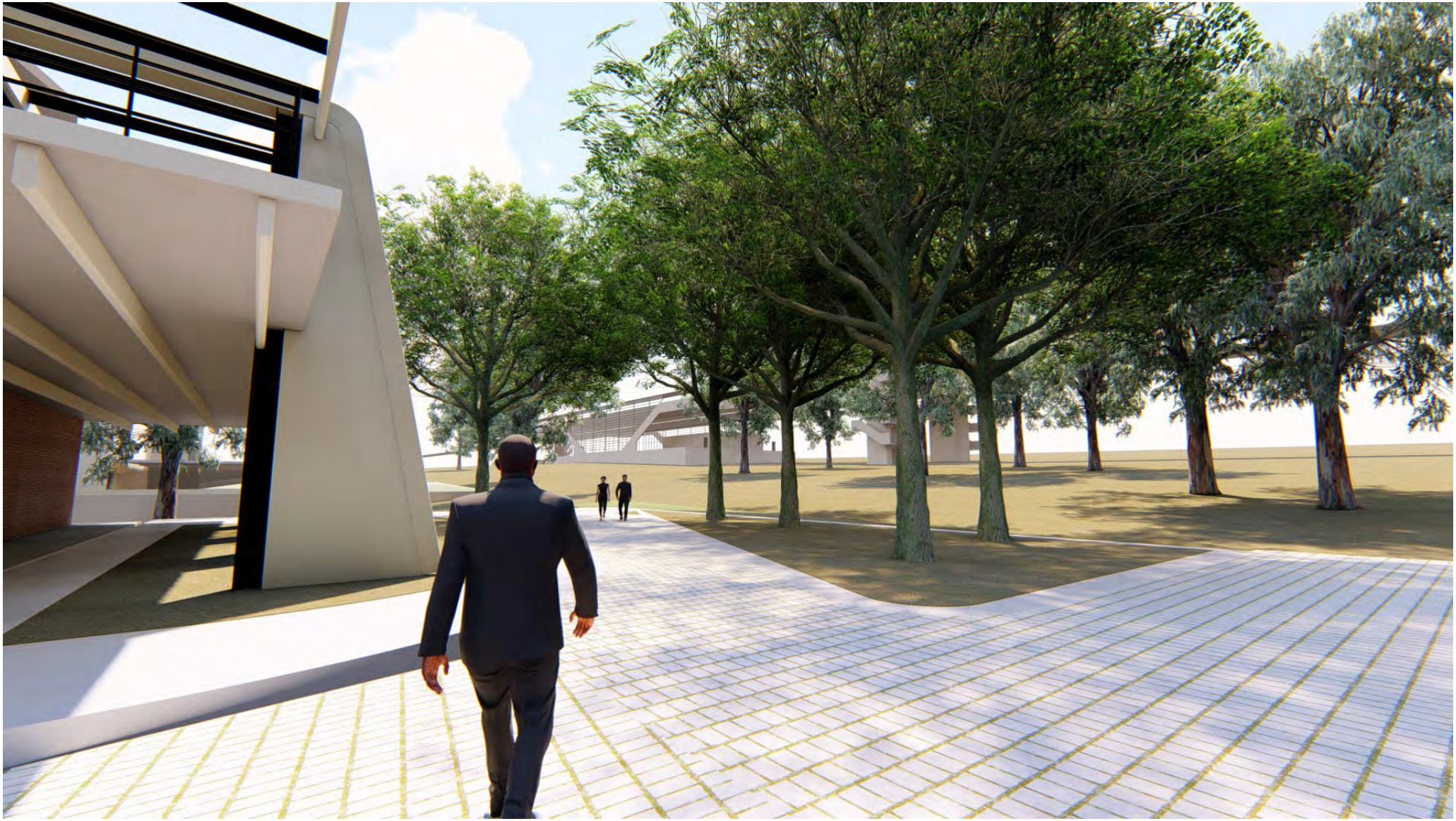

Figure 6.34 - **DESIGN RENDER 7**: Image showing the majestic Gin Mashing Tun. (Author, 2018).

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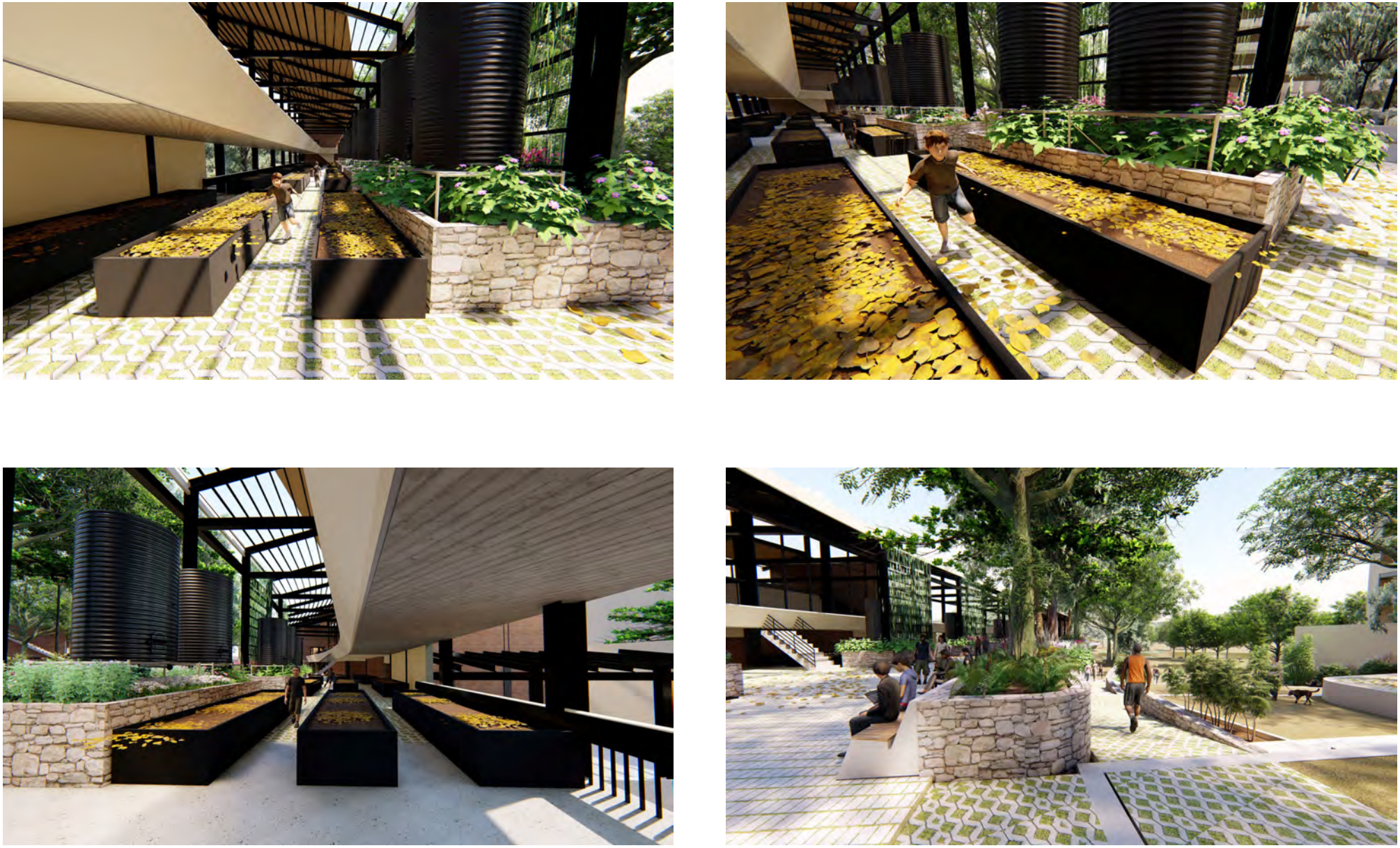

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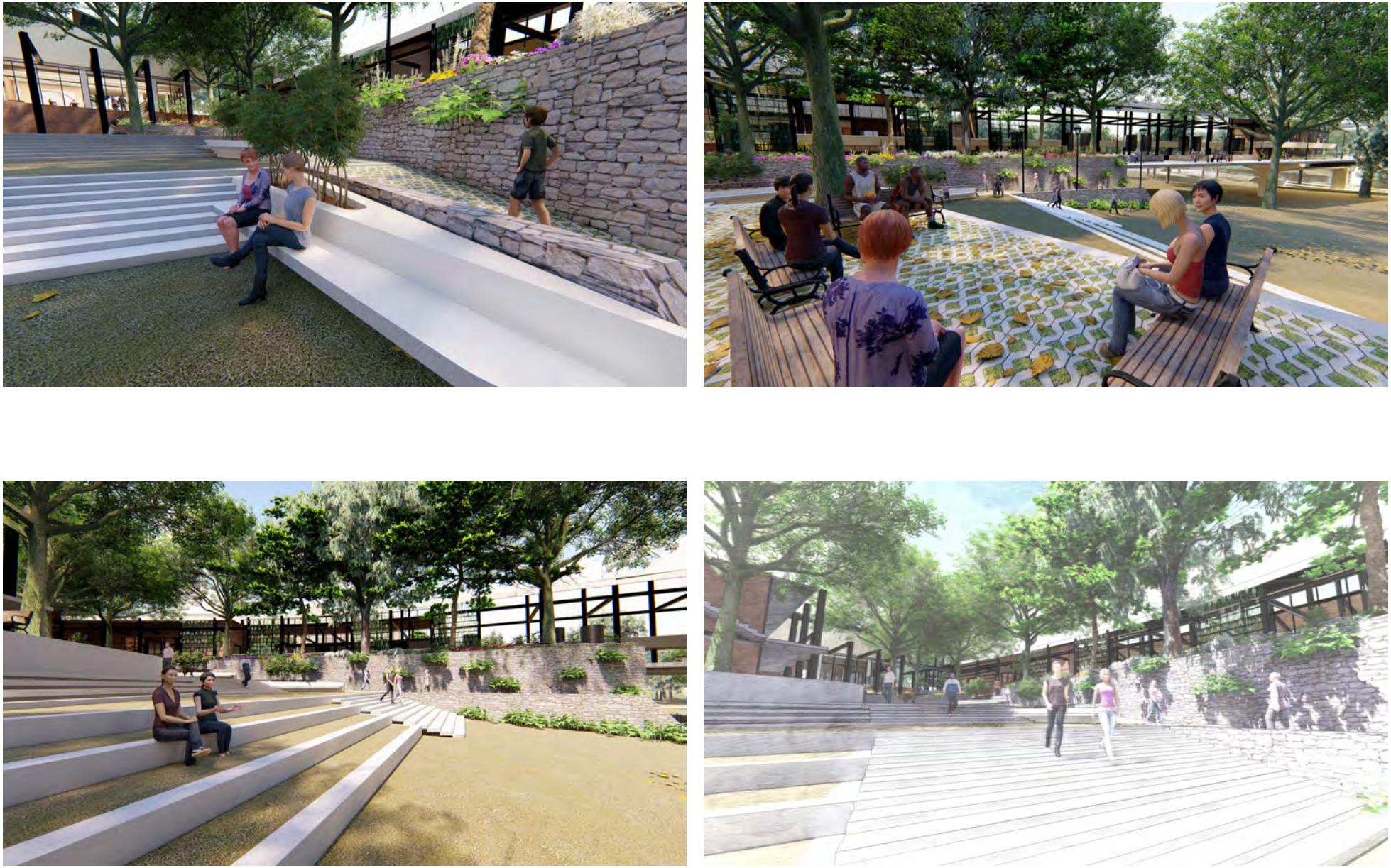

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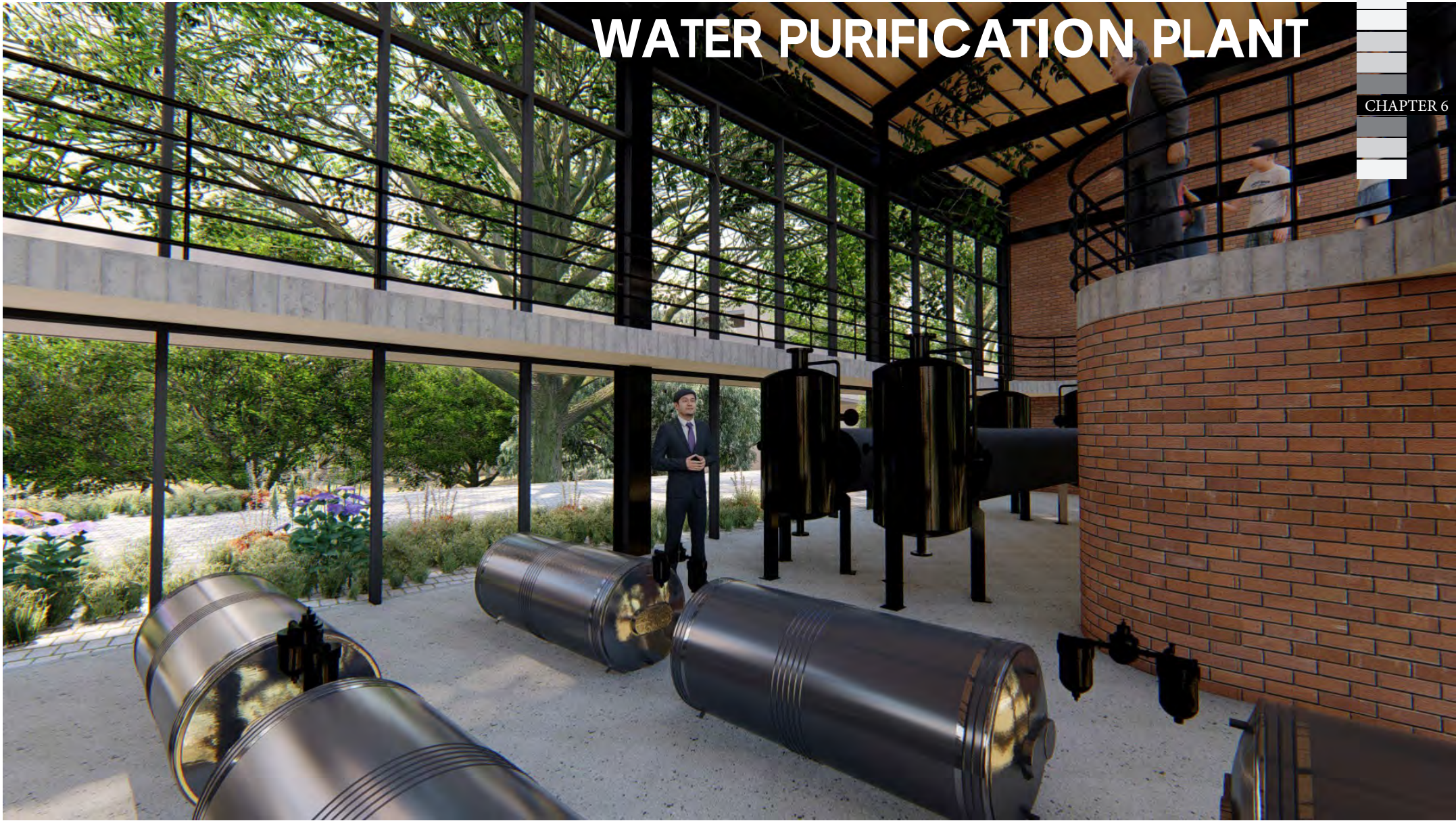

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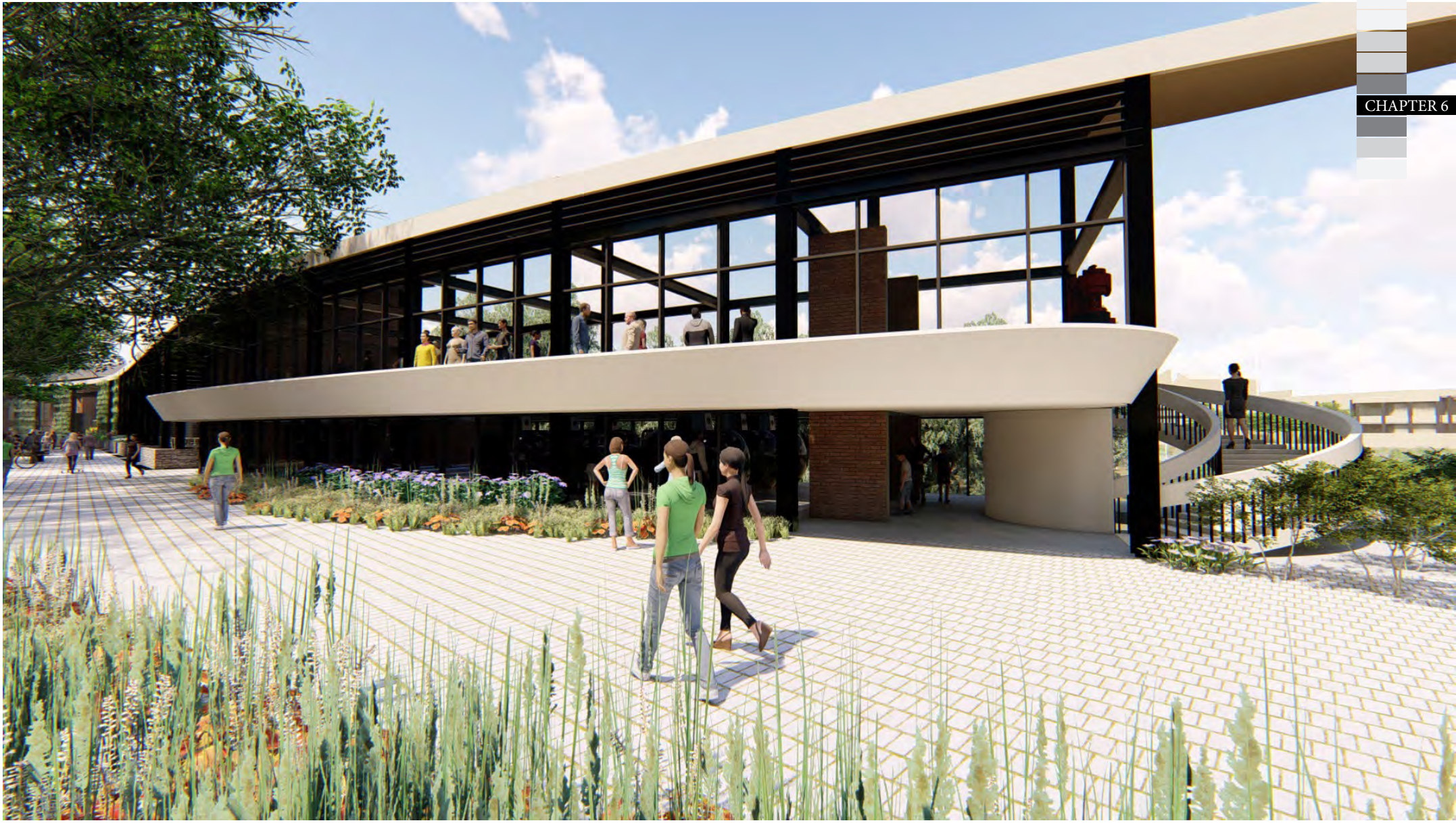

Figure 6.34 - **DESIGN RENDER 7**: Image showing the majestic Gin Mashing Tun. (Author, 2018).

Figure 6.34 - **DESIGN RENDER 7**: Image showing the majestic Gin Mashing Tun. (Author, 2018).

PLASTIC FURNITURE RETAIL SPACE

Figure 6.34 - **DESIGN RENDER 7**: Image showing the majestic Gin Mashing Tun. (Author, 2018).

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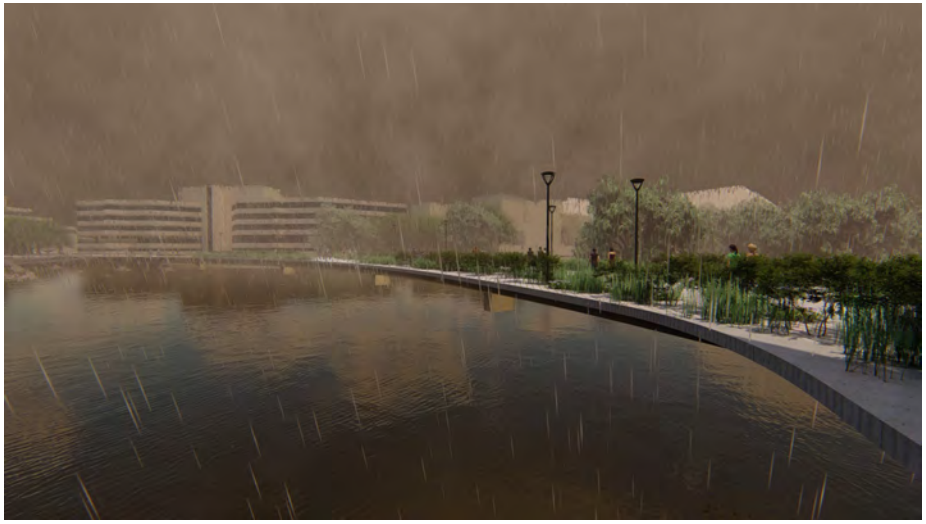

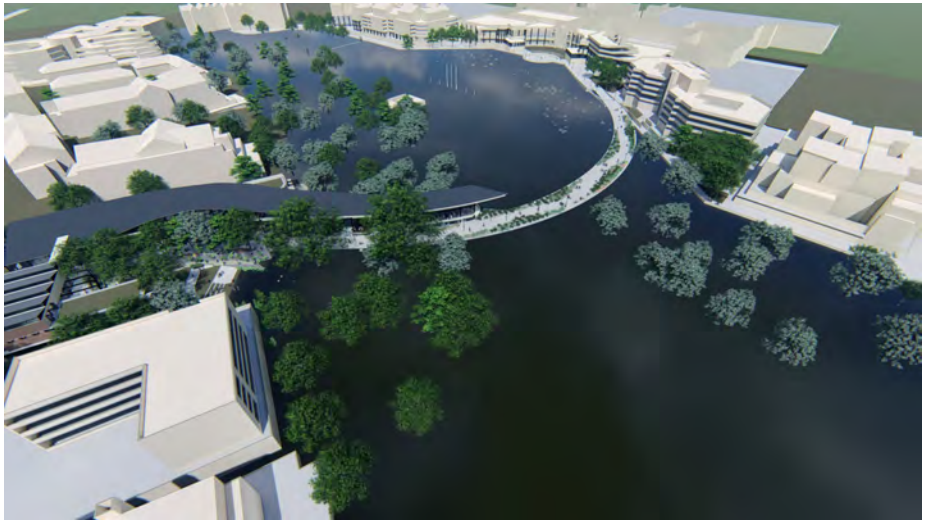

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Figure 6.34 - **DESIGN RENDER 7**: Image showing the majestic Gin Mashing Tun. (Author, 2018).

CONCLUSION

The design set out to reconnect the lost connection physically and metaphysically between the urban environment and natural environment.

The design proposal also addressed issues of urban dis-connectivity, river pollution and under utilized resources by create a link that stitches the urban construct. Rivers are used as waste disposal mechanism, the design proposes processes that aid in rejuvenating the scarred landscape by utilizing its resources (see Chapter 5).

The resources are provided by the river in the form of waste (plastic, silt and biomass). The processes that governs the clean-up of the river is made completely transparent to the general public in order to show the severe effect that the wrong mindset has to the natural environment.

The design promotes 'process-transparency' where each step of the process is accessible to the users, albeit a visual connection or physical connection.

CHAPTER 07 | THE CULMINATION OF TECHNOLOGY AND NATURE

Technification

Figure 7.1- (Author, 2018)

TECHNIFICATION |

In the previous chapter the project issues were addressed using appropriate design iterations in order to find a suitable alternative to river space design. Design was expressed as an extension of the context, theory, opportunities, program and technology.

CHAPTER SEVEN BREAKDOWN

In this chapter, design will be further investigated through the lens of technology. Appropriate building material will be chosen based on its ability to expresses the design and technological concepts.

INTRODUCTION

Working off of the premise and, in the hopes of, changing the mindset of people from one where rivers are seen as a waste disposal mechanism, to one where river supports life; the structure needs to needs to be constructed in such a way as to incorporate processes as an experience.

An example of this would be to create public circulation paths that enable the users to interact with the natural processes that are housed in the building. The building need to open up to the natural environment as well as create the perfect circumstances for nature to inhabit the structure.

STRUCTURE

The existing buildings that make up the urban construct of Centurion consists predominantly of face-brick facades and corrugated double pitched roofs. The project intention is to continue this trend that incorporating a solid brick façade on street level, slowly transitioning to a more tectonic structure as one moves closer to the river.

The initial heaviness anchors the building to the street, telling the story of place; and the tectonic elements responds to the constant flux in movement and temporality of the river.

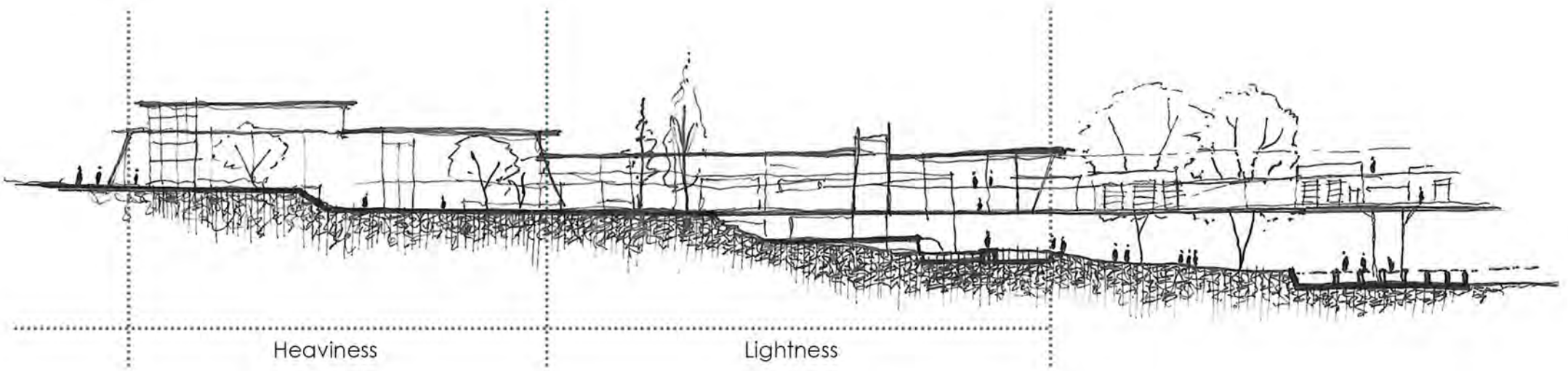


Figure 7.2 - **TECHNICAL PARTI DIAGRAM**: The linear progression through space exhibiting resource extraction as an experience (Author, 2018).

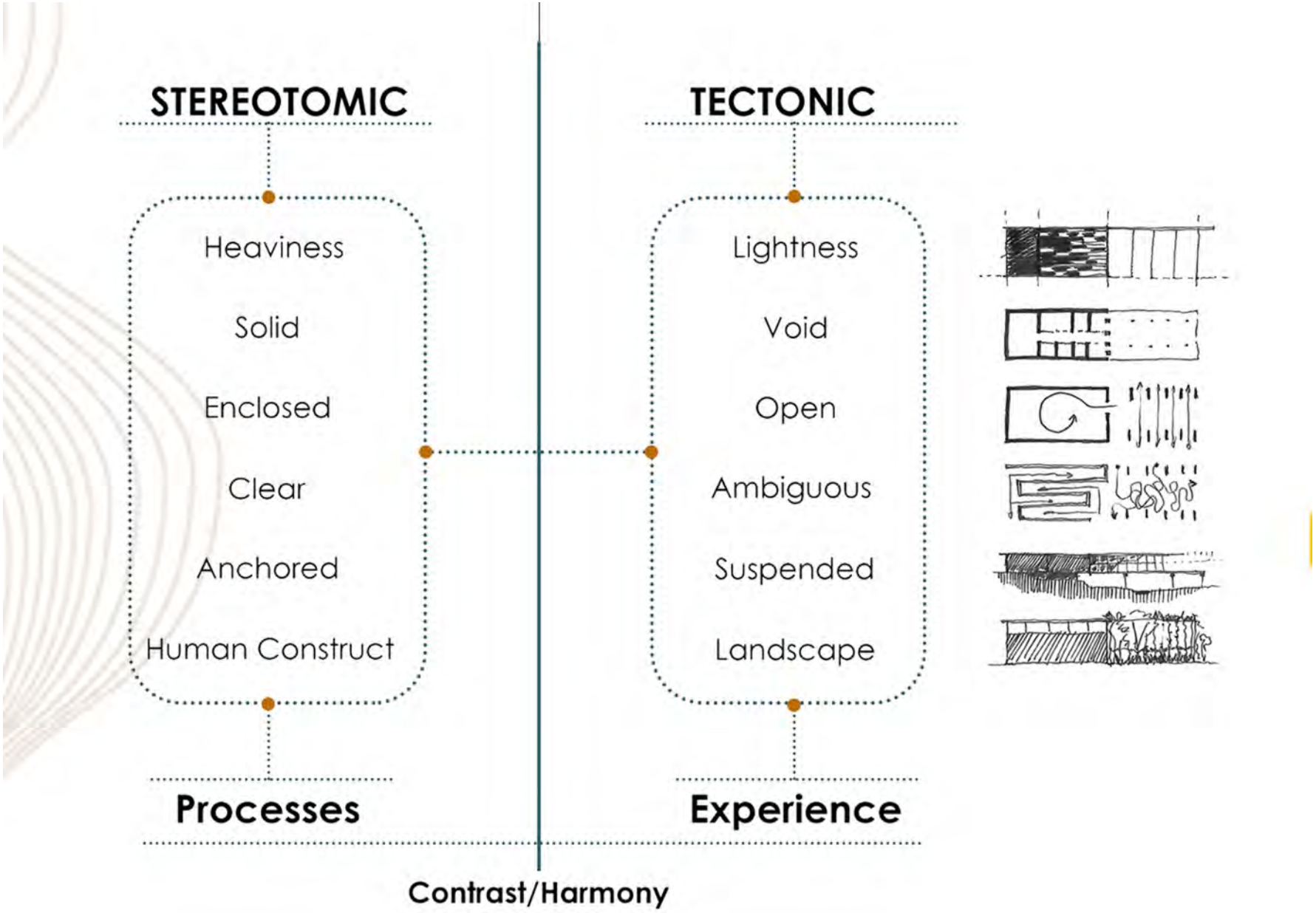


Figure 7.3 - **TECHNICAL CONCEPT**: Diagram explaining the stereotomic and tectonic condition of the intervention. The stereotomic structure supports the processes and the tectonic structure governs the experience (Author, 2018).

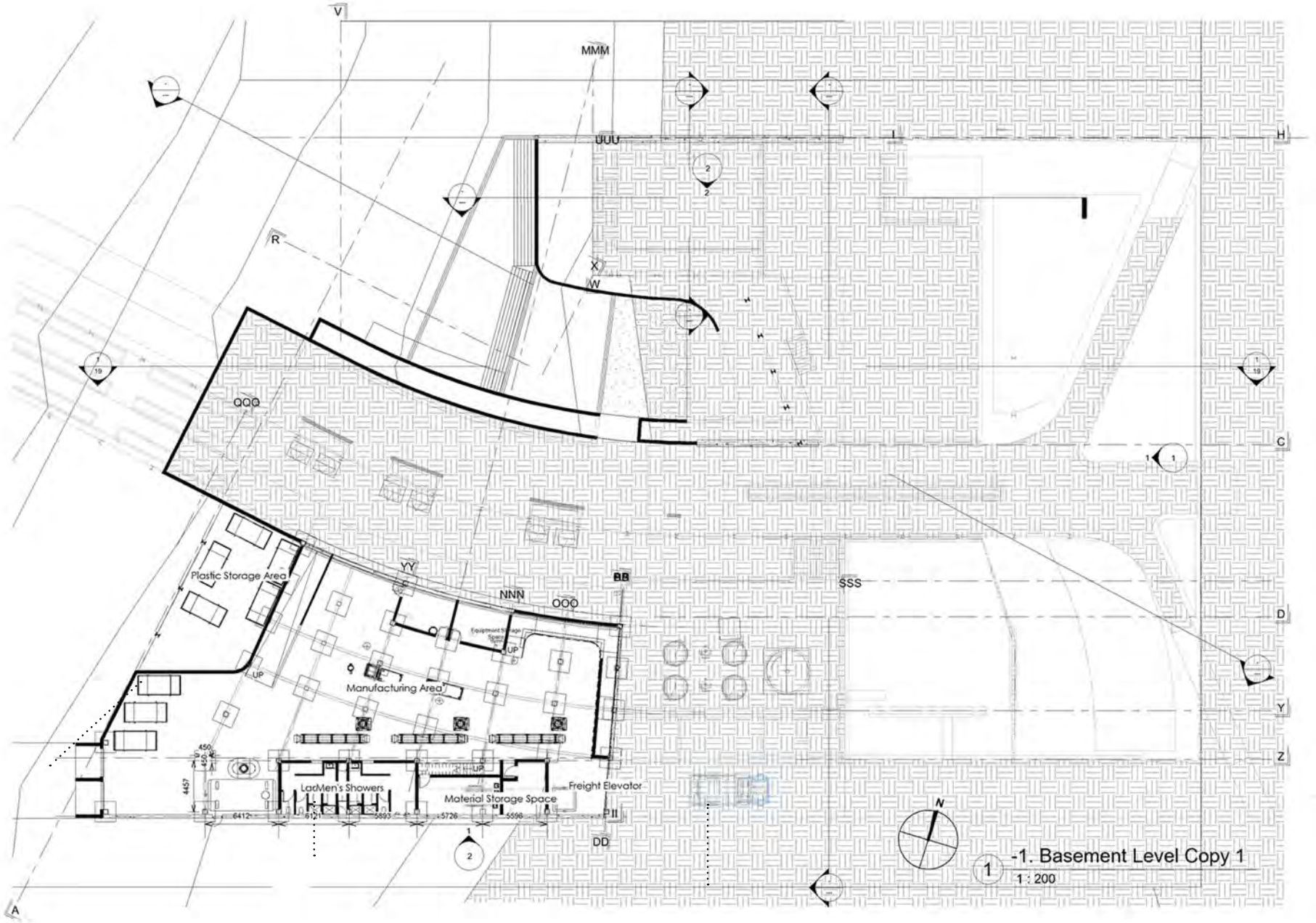


Figure 7.4 - **SEMI-BASEMENT LEVEL**: The basement houses all processes related to the resource extraction of the river. The basement is located the closest to the river on the lowest level (Author, 2018).

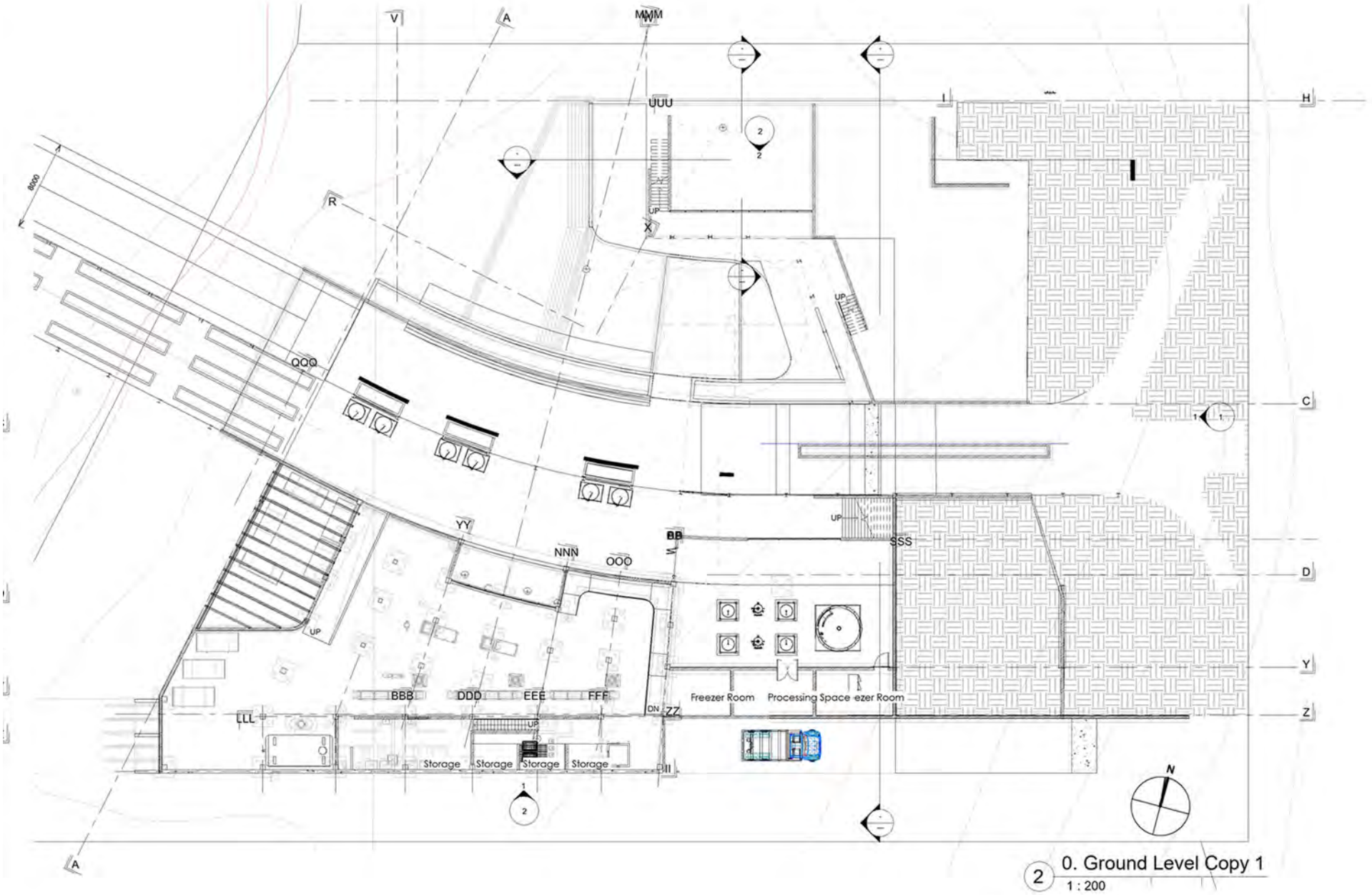


Figure 7.5 - **GROUND LEVEL**: The basement level is a double volume space to allow ease of movement during the process phases. The ground level is the largest continuous level to ease circulation to all parts of the intervention (Author, 2018).

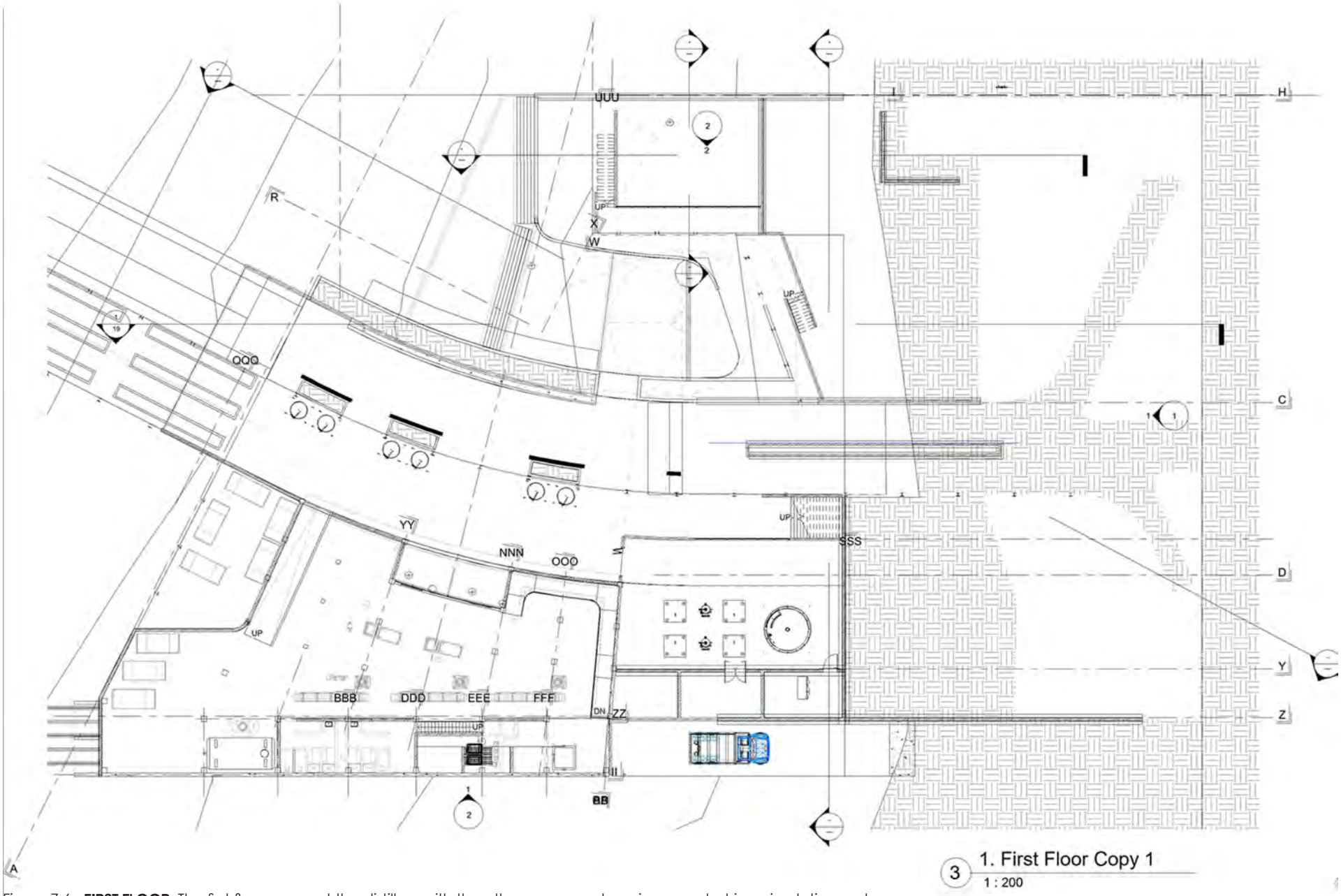


Figure 7.6 - **FIRST FLOOR**: The first floor connect the distillery with the other processes by using a pedestrian circulation route (Author, 2018).

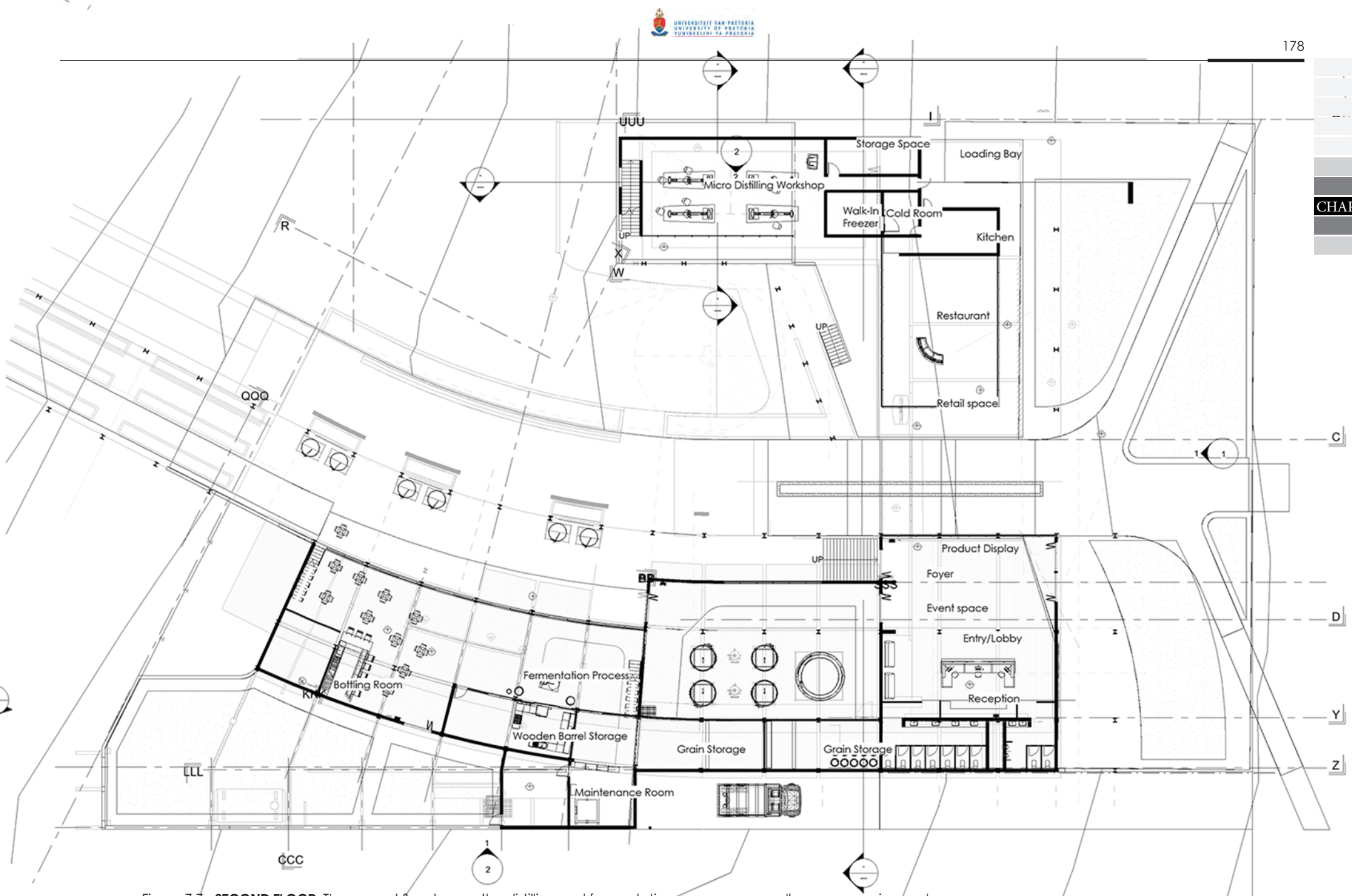
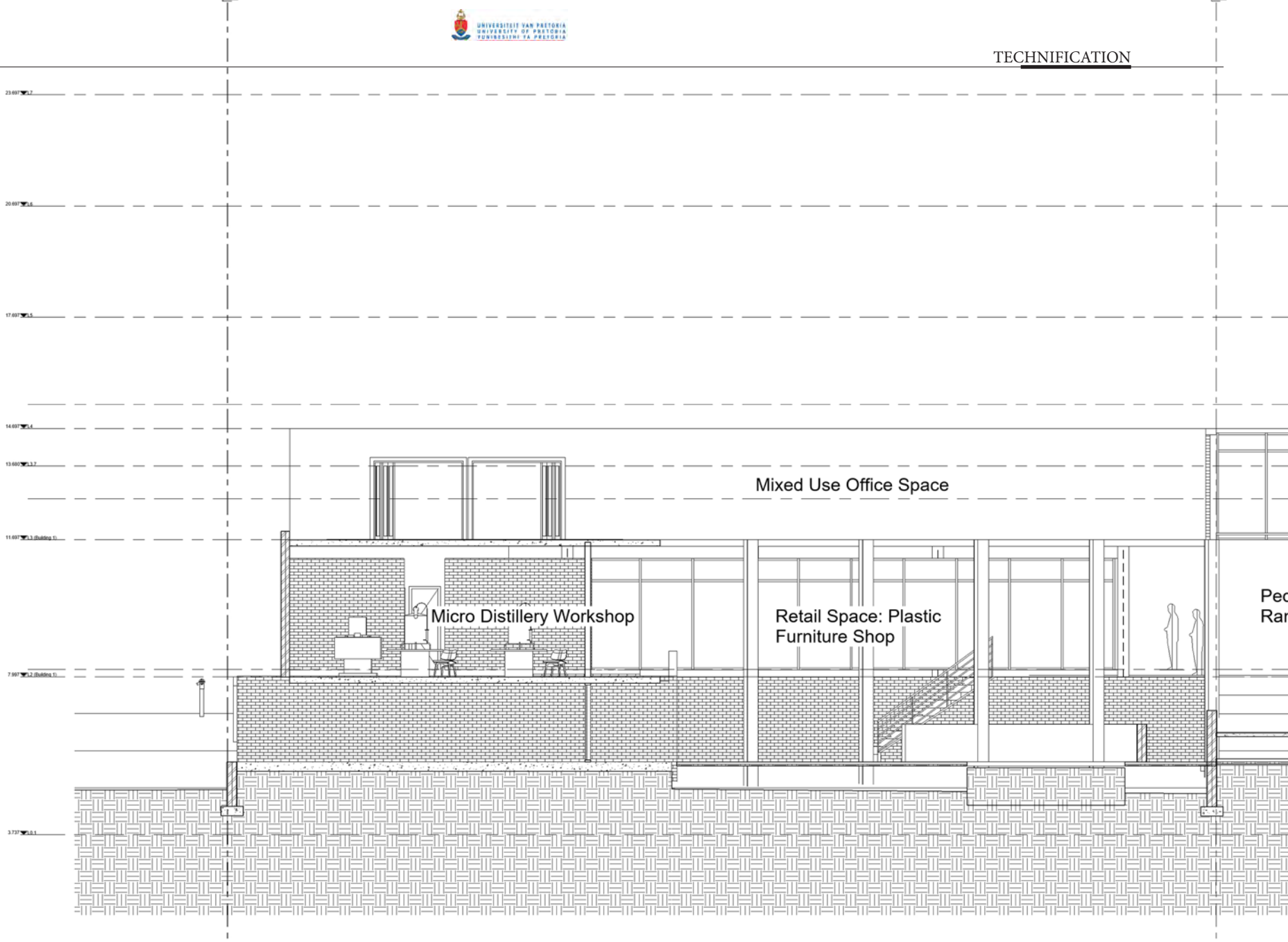


Figure 7.7 - **SECOND FLOOR:** The second floor houses the distilling and fermentation processes, as well as many service and storage spaces (Author, 2018).



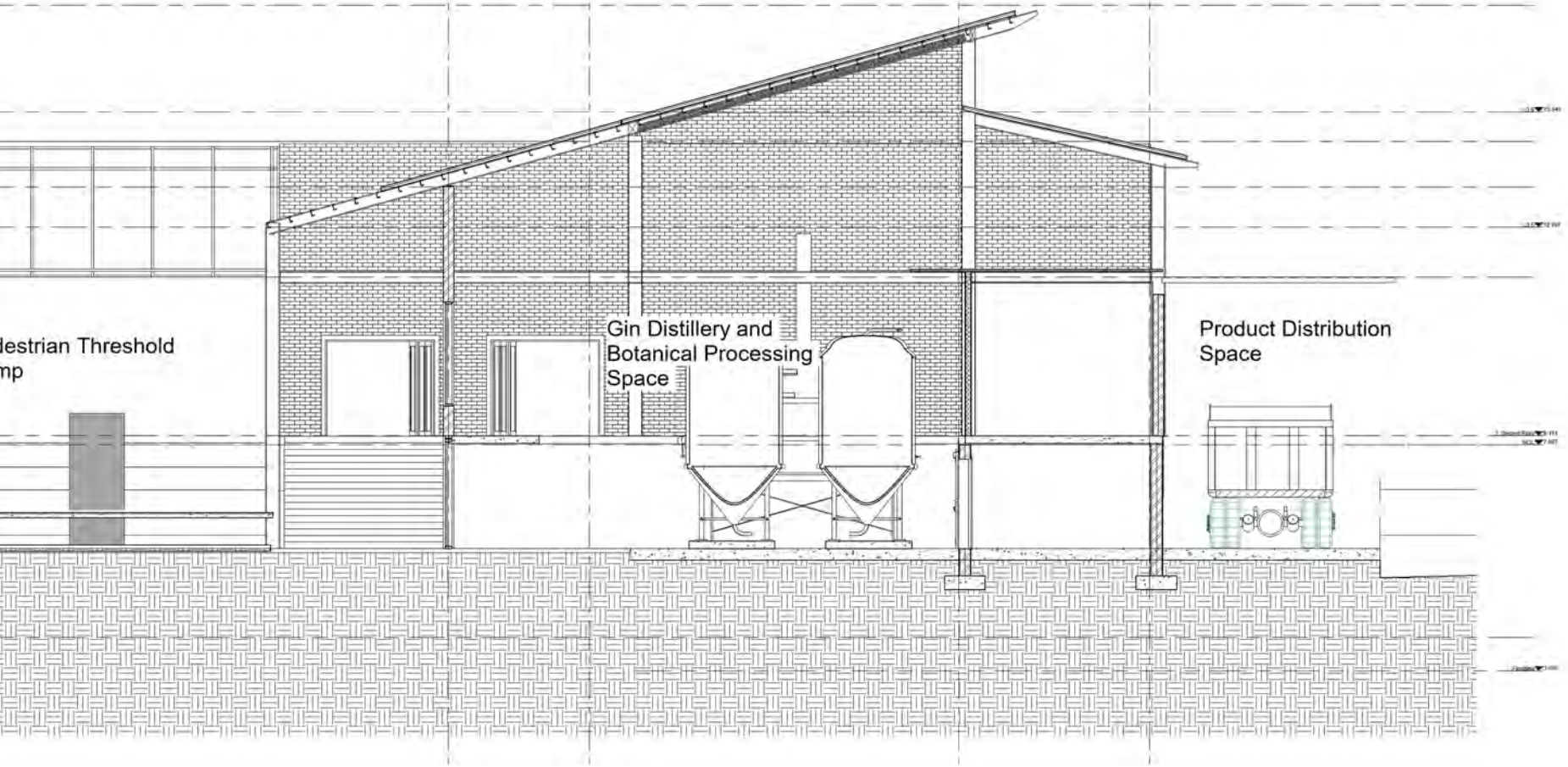
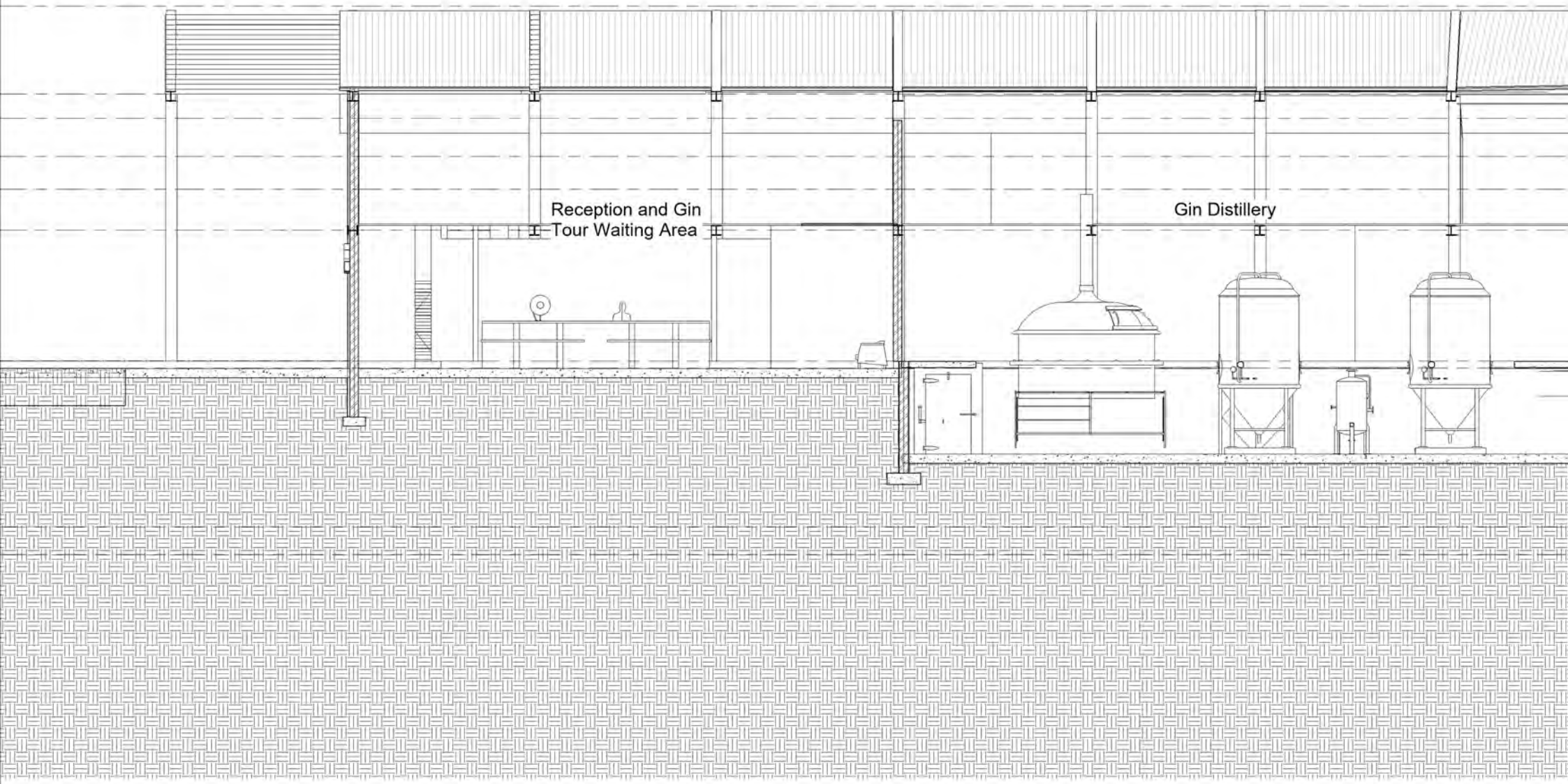


Figure 7.8 - Section indicating the relationship between the processes building and the supplementary spaces that frames the public square (Author, 2018).



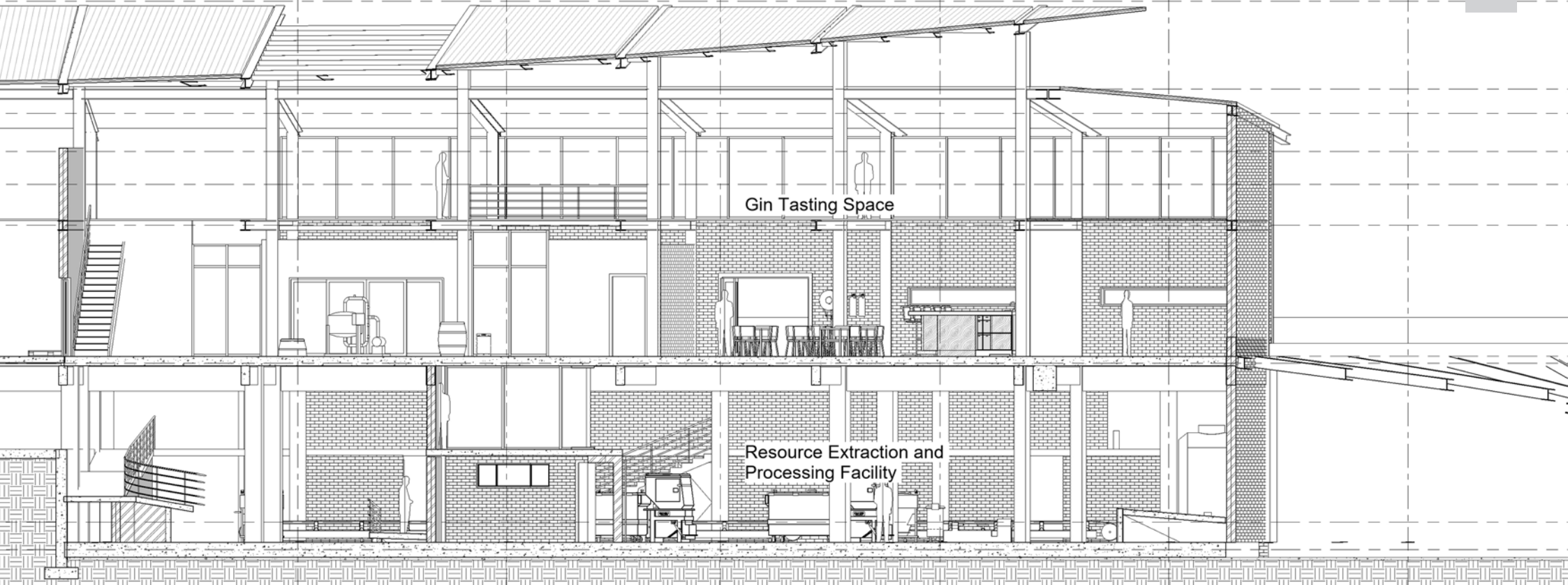


Figure 7.9 Section indicating the process spaces in its lenght, as a pedestrain would experience it when walking on the promenade towards Centurion Mall (Author, 2018).

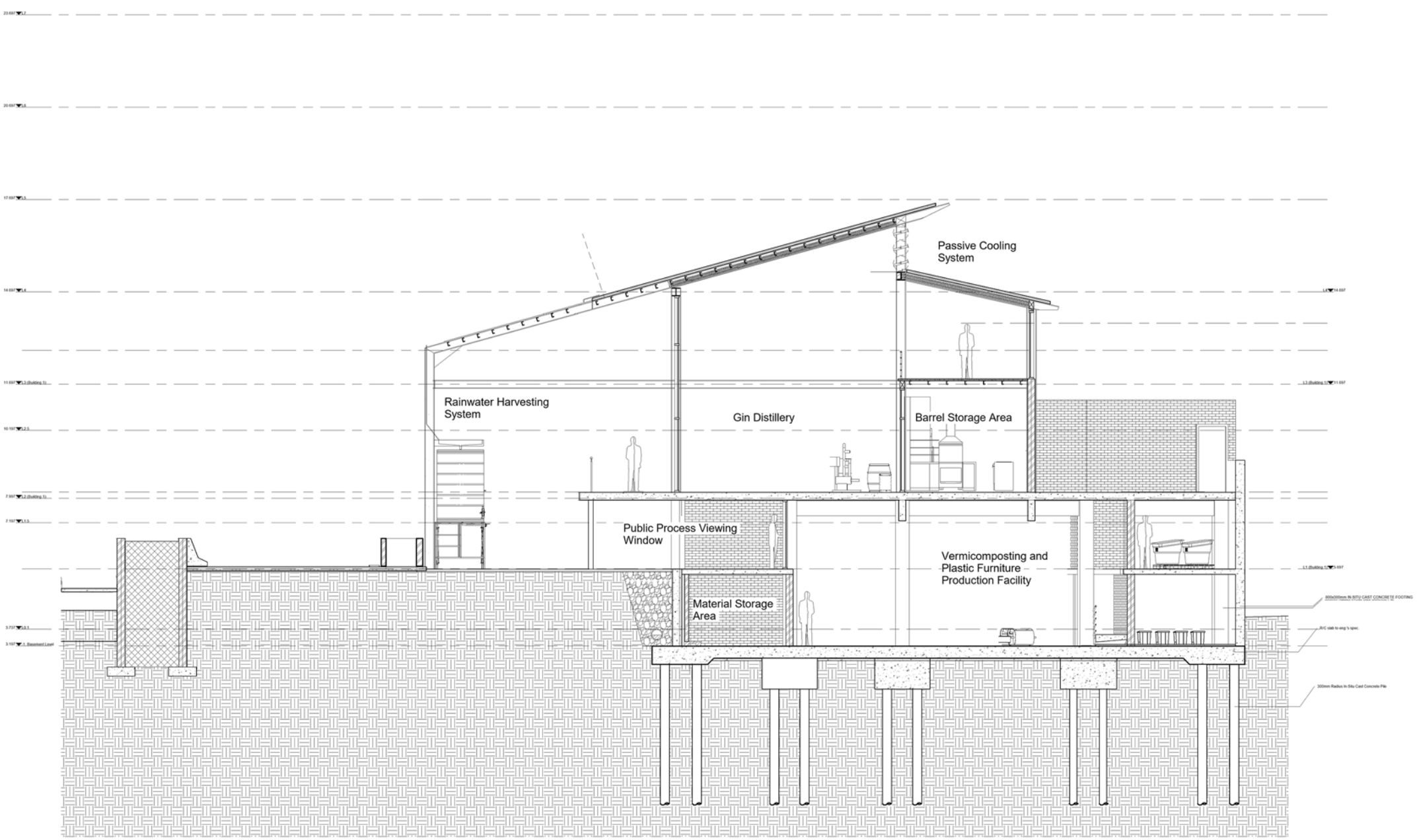


Figure 7.10 - **SEMI-BASEMENT LEVEL**: Typical section through the building. The section highlights the relationship between the stereotomic and tectonic structure (Author, 2018).

Figure 7.11 **SEMI-BASEMENT LEVEL**: Typical section through the building. The section highlights the relationship between the stereotomic and tectonic structure (Author, 2018).

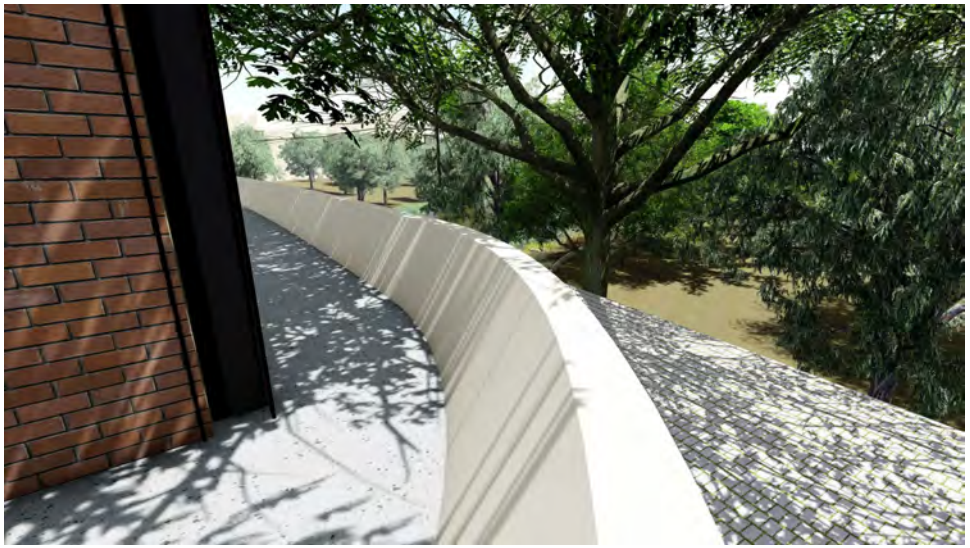


Figure 7.13 - **SEMI-BASEMENT LEVEL**: Typical section through the building. The section highlights the relationship between the stereotomic and tectonic structure (Author, 2018).

Figure 7.12 - **SEMI-BASEMENT LEVEL**: Typical section through the building. The section highlights the relationship between the stereotomic and tectonic structure (Author, 2018).

Figure 7.14 - **SEMI-BASEMENT LEVEL**: Typical section through the building. The section highlights the relationship between the stereotomic and tectonic structure (Author, 2018).

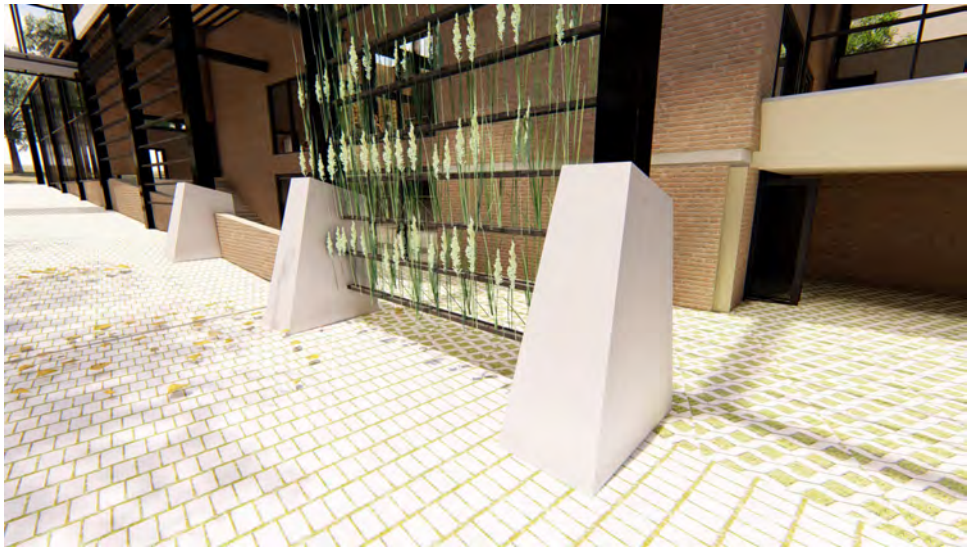
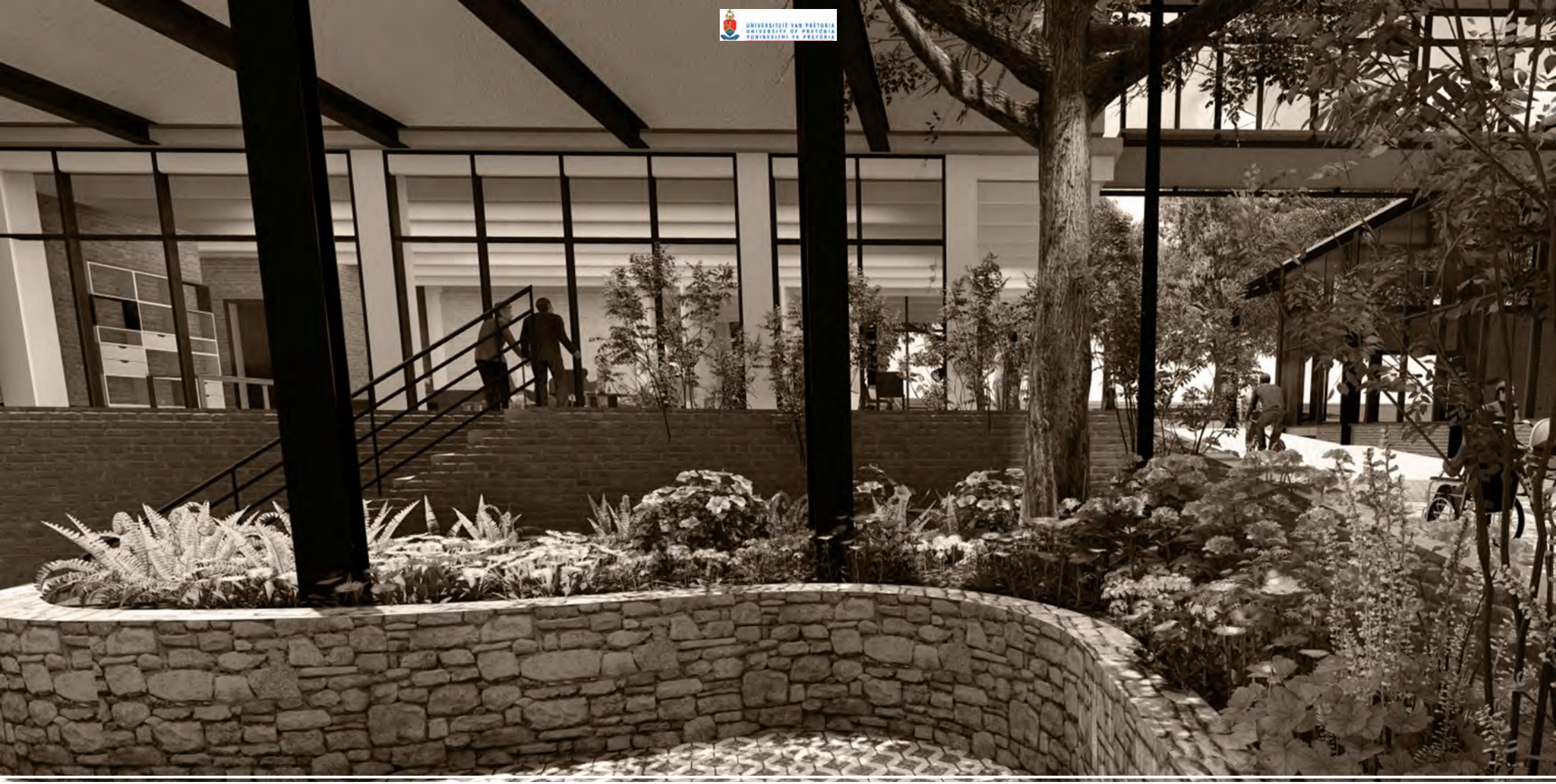


Figure 7.15 - **SEMI-BASEMENT LEVEL**: Typical section through the building. The section highlights the relationship between the stereotomic and tectonic structure (Author, 2018).

Figure 7.16 - **SEMI-BASEMENT LEVEL**: Typical section through the building. The section highlights the relationship between the stereotomic and tectonic structure (Author, 2018).



CHAPTER 08 | APPENDICES

Final Exam Documentation, Literature Paper

Figure 8.1- (Author, 2018)

FINAL EXAM DOCUMENTATION |

Figure 8.2 - **Final Presentation** (Author, 2018).

Figure 8.3 - **Final Presentation** (Author, 2018).

Figure 4.[illegible] **Final Presentation** (Author, 2018).

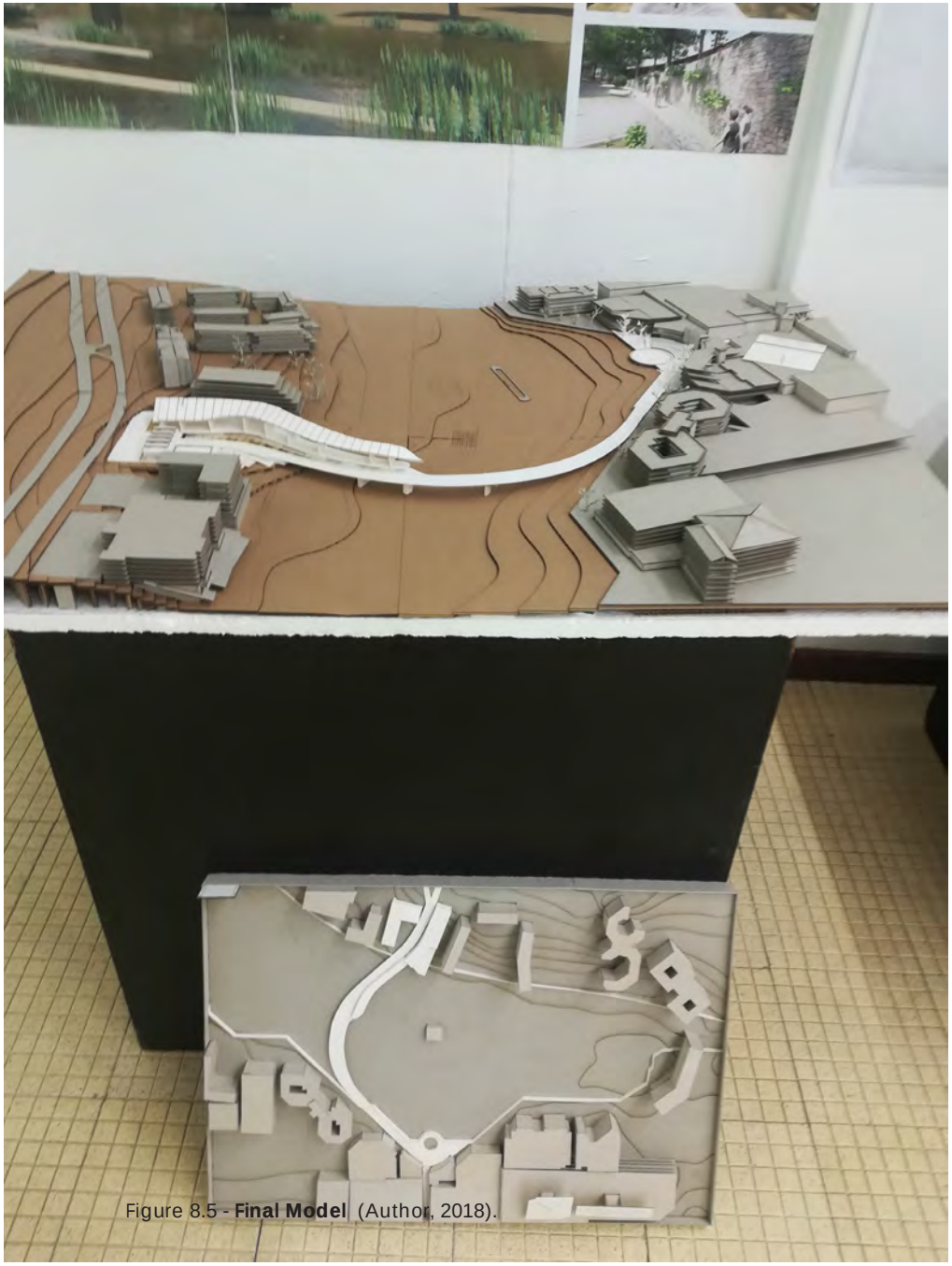


Figure 8.5 - **Final Model** (Author, 2018).

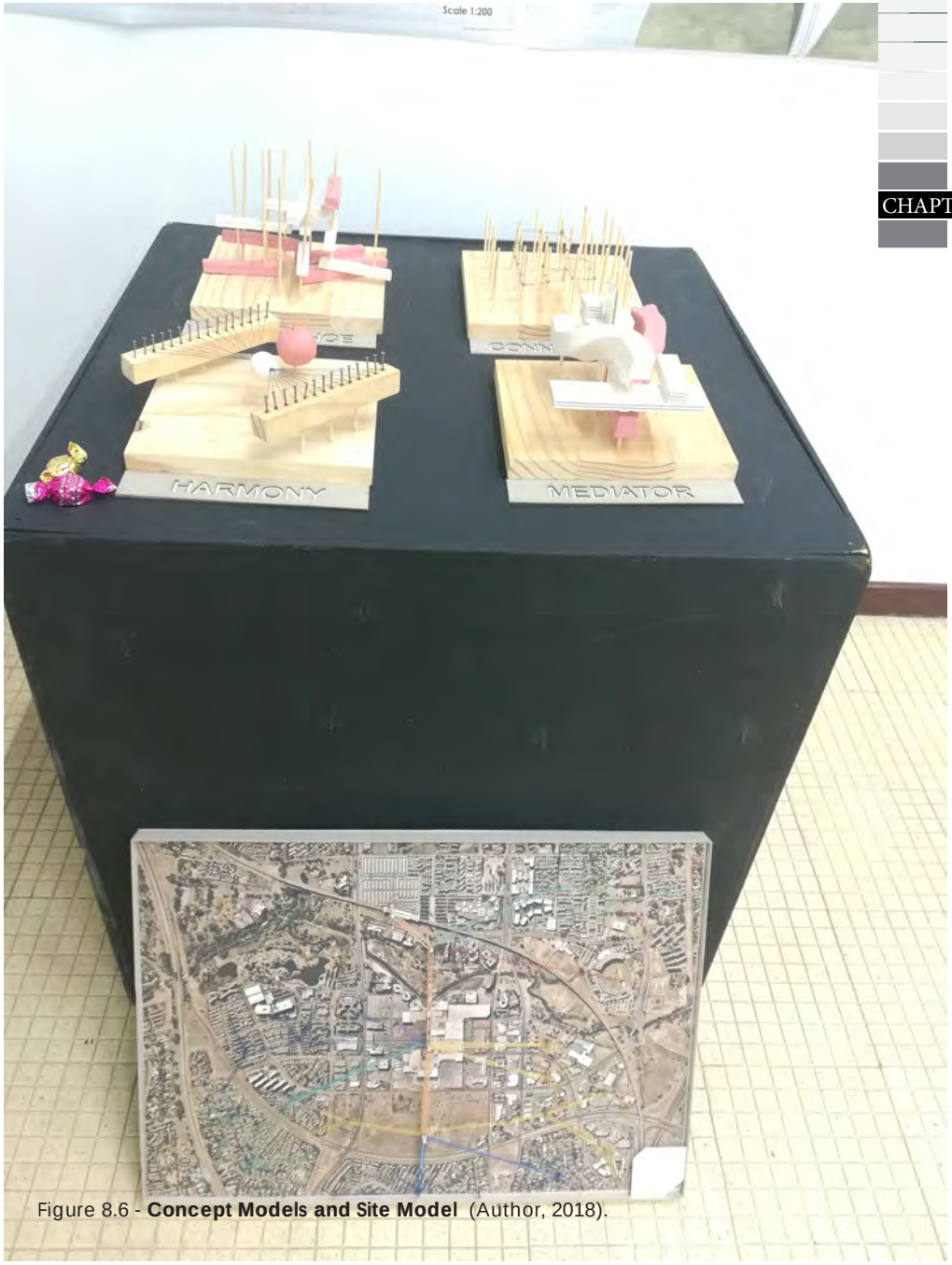


Figure 8.6 - **Concept Models and Site Model** (Author, 2018).

Figure 8.7 - **Final Model** (Author, 2018).

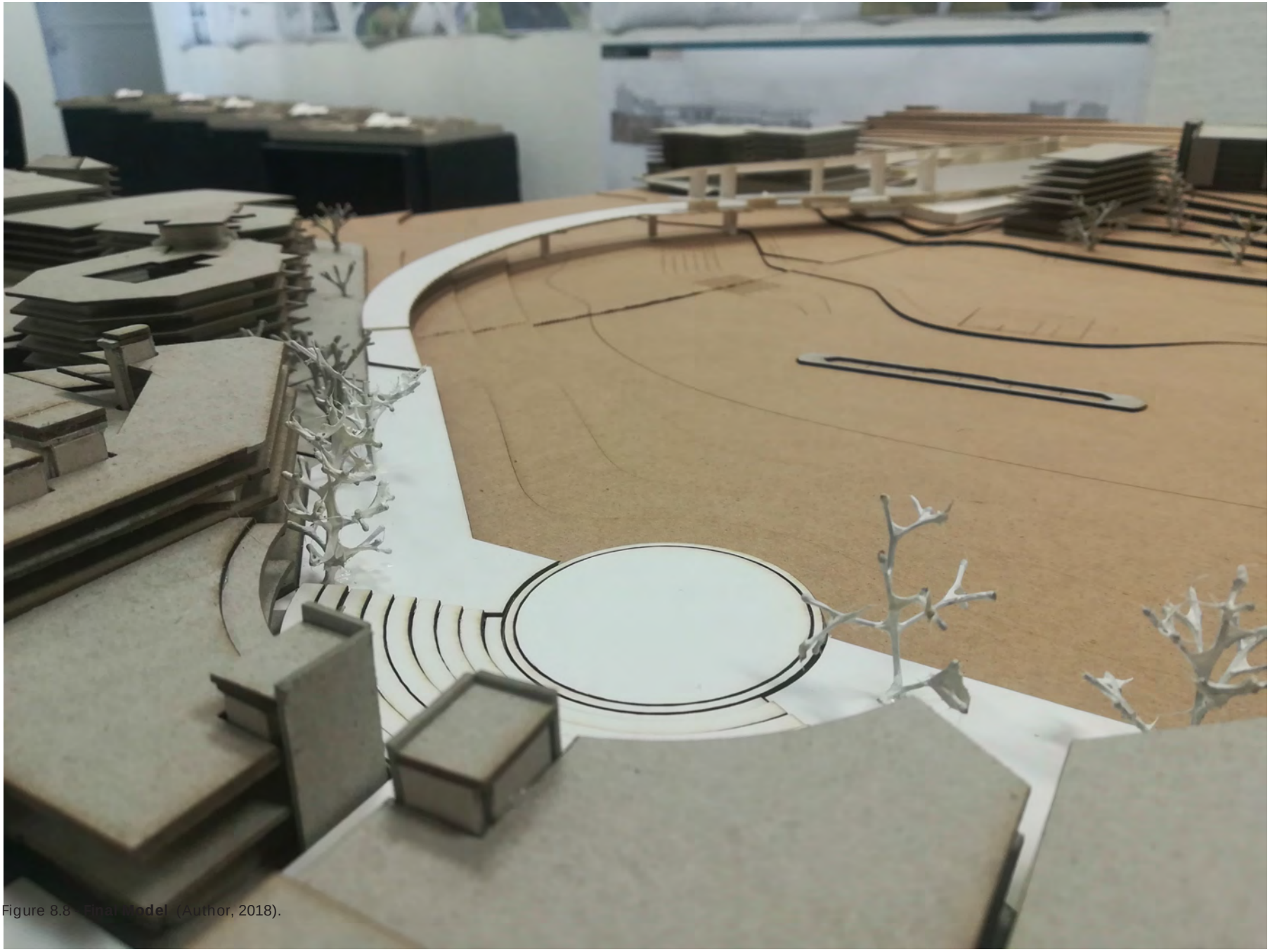


Figure 8.8: **Final model** (Author, 2018).

Figure 8.9 - **Final Presentation** (Author, 2018).

Figure 8.10 - **Final Presentation** (Author, 2018).

Figure 8.11 - **Final Presentation** (Author, 2018).

Figure 8.12- **Final Presentation** (Author, 2018).

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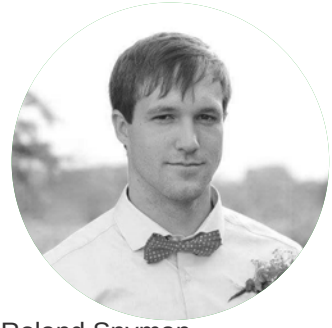

Roland Snyman

THE URBAN OASIS

[RE]-Thinking Urban River Space Design
Exploring Processes as an Experience with an Architectural Intervention at Centurion Lake

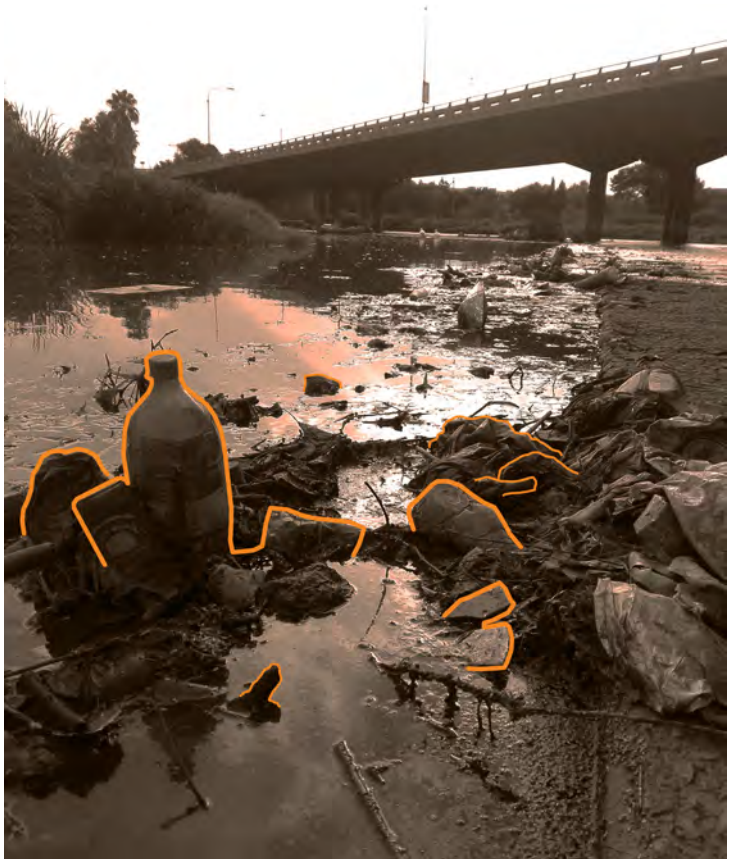

Fig. 01. Current state of Centurion Lake. The pollution, however, could rather be seen as a resource that is yet to be utilized, as opposed to merely pollution (Author, 2018)

THE URBAN OASIS
[RE]-Thinking Urban River Space Design

ARTICLE STRUCTURE
Part 1: Introduction
Part 2: Issues
Part 3: Regenerative Theory
Part 4: Phenomenology
Part 5: Implementation of Strategies

PART 1: INTRODUCTION
"We abuse land because we regard it as a commodity belonging to us. When we see land as a commodity to which we belong, we may begin to use it with love and respect".
- Aldo Leopold (iopscience, 2016)-

The **built environment**[1] and **natural environment**[2] coexist in a dichotomous **relationship**[3]. This may be the current case; however, it can be argued that architecture has its origin in nature and therefore should coexist in harmony with one another. This concept was first visualized by Marc-Antoine Lauger (1755) in his book 'An Essay on Architecture', where he explains that the fundamental aspects of architecture is derived from the natural environment. He argues that the ideal architecture is not apart from, but rather part of, the natural processes that make up the complex natural world (Laugier, 1755). Working off of the premise that architecture is the direct result of human intervention, it can be argued that the dichotomous relationship is rather between man and its natural environment, implying that man sees himself superior to nature.

John Tillman Lyle, in his book 'Regenerative design for sustainable development' (1994:8) mentions that: "The problem is not our effect on the environment so much as it is our relationship with the environment". In other words, to mitigate the problem it would be necessary for humans to gain a deeper understanding of nature's complex and intricate systems. This understanding of nature can be used to gain new knowledge to govern the manner in which man addresses his immediate context.

This article attempts at highlighting the major differences that exist between man and its natural environment, by proposing alternatives to the current mindset of people. Its aim

Fig. 02. Left; Image that depicts the highly mechanistic industrial world that we life in, governed and ruled by machines that destroys ecological systems (Author, 2018).

is to uncover ways in which man and its natural environment can be merged once again, as Laugier (1755) described it, by introducing architecture to act as the intermediary force. Ultimately the article will propose a solution as to how the lost connection between man and nature can be re-established.

This article will critically examine Regenerative theory in conjunction with Phenomenology; with regenerative theory acting as the main driver to rejuvenate the site (and governing regenerative processes) and phenomenology acting as the mediating force between man and nature through **lived experiences**[4]. Thus, architecture will create a physical and metaphysical link between the urban construct, man and nature; reuniting the human and natural realms once again. Centurion Lake will provide the necessary milieu where these theories can be tested and examined in the hope to inspire positive actions for future interventions.

PART 2: THE LOST CONNECTION

a global attitude shift has emerged that changed the relationship that man has with its natural environment. This attitude shift lead to man permanently altering the landscape behaviour patterns that once supported and established a mutual relationship between them. This shift was brought by the Renaissance world view, where man is superior to nature and all that makes up natural systems. Only the aspects of nature that proves useful to the existence of humans are preserved or 'protected' (Lyle 1994: IX).

Lyle (1994) states that: "Much of our difficulty in dealing with resources and environmental issues, is brought on by the fact that the human landscape i.e. our cities, was shaped according to a concept of nature that grew out of the Renaissance notion that humans are the measure of all things" (Lyle 1994:20). Renaissance architecture and landscape design places humans firmly in the central position of all ordering of the environment. The axial layout and strict geometry of Renaissance gardens testifies to this new relationship between humans and nature (Jellicoe 1975).

Du Plessis & Hes (2014:10) supports this notion by stating that; a number of discoveries during the Renaissance has lead scientists to believe that humans are in the centre of the cosmos. Copernicus and Galileo's beliefs were focussed on the observable universe as opposed to the divine; implying that gods do not exist and therefore man has the highest status in nature. Rene Descartes believed in separating mind from matter, subjective from objective. He believed that the only true knowledge is gained by objectively observing and actively measuring aspects of reality, with no room for speculating the unmeasurable and intangible (Du Plessis & Hes 2014:11).

The Renaissance view of nature stays true till the present day where man views nature as a resource that can be utilized and depleted without considering the larger negative impact that it will ultimately have on a global scale. This has escalated with the start of the industrial revolution in the 1760s, where hand production methods transitioned to machine mass production. Soon mining industries started dominating the landscape and became the new catalyst for urban settlements (Marks, 2002).

INDUSTRIALIZATION

"With the advent of industrial technology, we have created a monster beyond our control, a monster that might very well end up destroying us" (Lyle 1994:12).

The dichotomous relationship between man and nature was finally exacerbated with the advent of the industrial revolution that took place between the 18th and 19th centuries (Marks, 2002:14). Lyle (1994) explains that during the industrial era, technology caused a split not only between humans and technology, but also between man and natural processes. This sudden shift in technological manufacturing processes lead to inventions that scarred the landscape and continued to do so to the present day (Refer to Fig.02).

New technologies brought new possibilities as well as new dangers; machines that replaced the work of man. Suddenly it was possible to produce more products at a fraction of the cost and speed. Mass production resulted in a surplus of products, each with its own packaging, creating

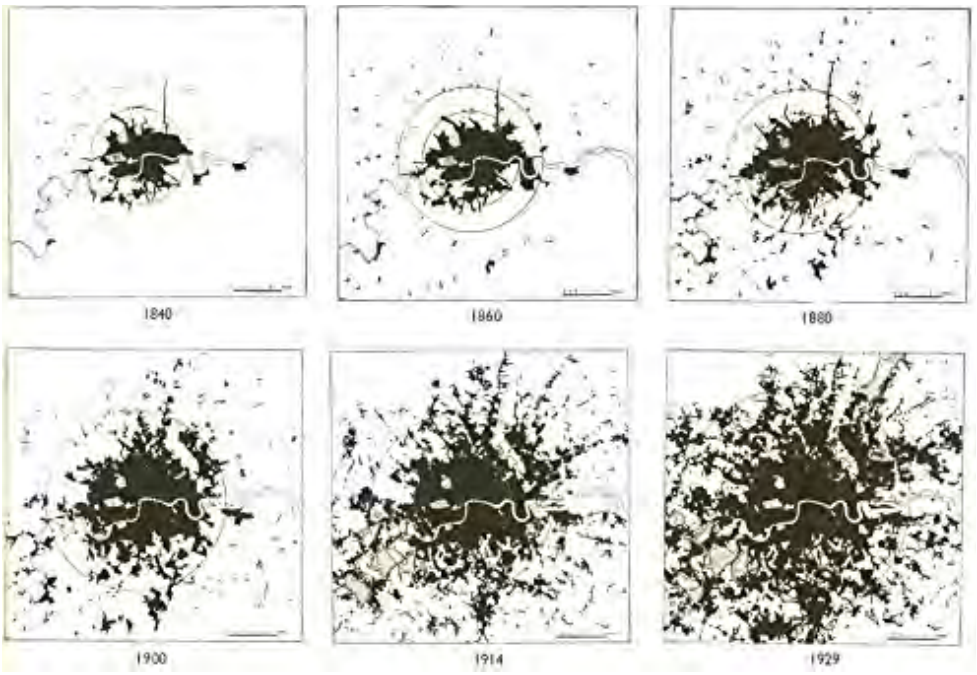

Fig. 03. Left; Series of depictions that shows the effect of rapid urbanization or urban sprawl (Will, Nakamura, Dinetti 2004:585)

excessive waste in materials. Due to the lack of proper maintenance, the waste material entered urban rivers, directly and indirectly causing the die-off of many biological organisms (Register 2006:31). Du Plessis & Hes (2014) in their book 'Designing for Hope', explains that the current worldview is to blame for natural disturbances, and therefore the mindset of people must change to achieve a harmonious state.

THE CURRENT WORLDVIEW

The current destructive worldview manifests itself in the form of rapid urbanization, urban disconnection and global pollution. Natural systems all over the world suffers the consequences of human action. Richard Register (2006:21) in his book 'Ecocities', compares urban sprawl to that of an 'Urban Comet'; that destroys nature as far as it goes. In describing the effects of urbanization, Register mentions that humanity is "ripping patches out of the fabric of life" (Register 2006:20). He explains that the biggest problem lies in the superimposition of cities onto the natural landscape, without considering the long-term effect that it might bring. He elaborates by stating that cities are not designed in harmony with their landscapes.

The result of the superimposition of cities is seen, more specifically, at the point of intersection between the urban construct and river systems. Highway construction over rivers causes an increase in the flow velocity, resulting in soil erosion, flood disturbances and many other problems. Ultimately, human interventions are destructive forces that does little to prevent its effect on the natural realm. Had man known the negative impact that his inventions would have on the earth, he would have done things differently.

Lyle (1994) states that "Technology became something physically separate, emotionally remote, hardly under human control, something inherently ugly". Although technological advancements may seem like a major step towards a greater future, the contrary proves to be true. The general misconception is that all technology contributes to the well being of humans and the world at large; however, it rarely improves the ecological condition and benefits are normally only limited to the immediate needs of the human population (Lyle 1994:27). As technology grows, so does cities. The industrial revolution brought with it the possibility to build larger buildings at a fraction of the time and costs. With 'costs' being the operative word, it becomes clear that we live in a world driven by a financial motive, without considering the potential negative effects it would have on the ecology; one such example is rapid urbanization.

URBANIZATION

Lyle (1994) states: "Though the purpose of development is usually economic and it always produces economic results, the essential physical reality of development is change in the ecology of the landscape" (Lyle 1994:19).

He goes on to elaborate on the meaning of development as the main driver of change. When man first decided to alter the landscape to provide some form of shelter, or when he started cultivating the natural landscape with agricultural crops, or when man first cut down trees to provide heat at night alongside a camp fire, he altered and adapted the landscape for human benefit. Any such alterations creating a disturbance of the ecological systems that were present on site (Jellicoe 1975:56). Viewing alterations with a systemic lens, makes it difficult to see development as a non-destructive force; however, development doesn't necessarily have to be destructive. Urban development can for instance allow for the ecology to attach itself to the built fabric, thus creating a harmonious balance between the built environment and nature. In some instances, nature may find it much easier to thrive where human stewardship is applied, than to try to survive in its natural and hostile environment. The inevitable fact is that a considerable level of development will have to occur to meet the current needs of the world's growing population. This form of development is called urbanization (Will, Nakamura, Dinetti 2004:585).

Urbanization (Refer to Fig.03) or urban sprawl is the expansion of human population, usually away from the city center, into low-density and monofunctional areas, that are car

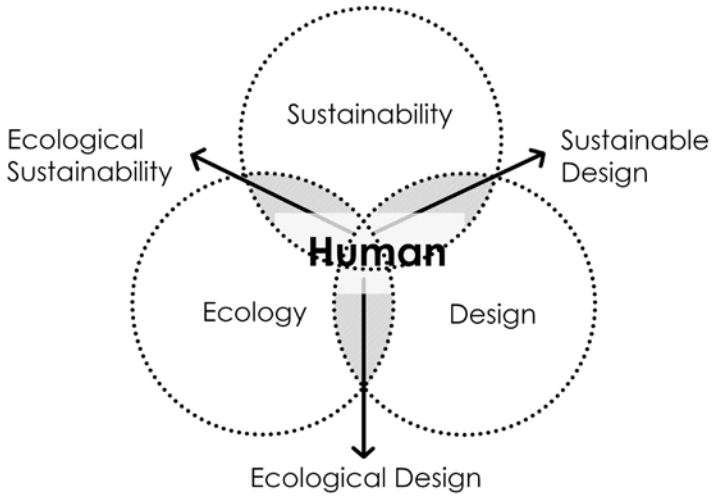

Fig. 04. Left; Diagram explaining the ecological sustainability matrix (Author, 2018). Humans function where design, ecology and sustainability meets. The aim of ecological design is to merge human processes with that of the ecology in a sustainable manner.

dependent (Register 2006:54). The relationship between man and nature is a very fragile relationship, that should be considered carefully, in order to maintain the harmonious balance between the two 'entities' (Du Plessis & Hes 2014:33). This balance is threatened by the exponential growth of urban environment. As urbanization increase, so does the natural landscape decrease (Will et al 2004:585).

Every alteration made by human development has a profound effect on the well-being of natural ecosystems. Lyle (1994) describes this as a dilemma; where development is inevitable and necessary to provide habitat for the rapidly expanding population and sustenance for society; unfortunately, development alters natural systems for the worse.

Du Plessis & Hes (2014) explains it by saying that; "One of the central narratives of modernity is to control nature for the benefit of mankind, leading to the two guiding principles of the past two centuries: modernization and development. These principles manifested as large-scale urbanization, industrialization and increased focus on the rights and freedoms of the individual" (Du Plessis & Hes 2014:14). Pamela Mang (2016), best describes this notion of power with her theoretical models of nature.

THE TWO MODELS OF NATURE

In the past 50 years, two distinct models of nature have dominated sustainability debates. The first model explains the capitalization of nature to the benefit of humans specifically. The second model of nature is much more holistic and is in strong contrast to the first model. The second model is drawn from insights of ecological systems that are interconnected, and functions within a dynamic organic web. Each entity is interdependent on another. Within the web, information and energy is constantly exchanged to enable the entities to evolve in harmony with their local environments (Mang et al. 2016: XXIII).

These two models are further clarified by Lyle's (1994) two concepts that he calls; the Paleotechnic (or Mang's first model) and Neotechnic period (or Mang's second model). The Paleotechnic period he defines as the period of industrial development marked by the predominance of complex industries based on the use of non-renewable fossil fuels. Lyle (1994) defines the Neotechnic period as the most recent period of industrial development characterized by the use of electricity and alloys; thus, new solar harvesting technology sparking the 'green' movement (Lyle 1994:7).

PART 3: TOWARDS A POSITIVE FUTURE

The world view adopted during the Renaissance and further exacerbated by industrialization have left the natural environment scared. A new world view is needed that considers all living things in its entirety; a holistic system that is not to the benefit of only humanity (as was the case in the Renaissance period), but rather tries to integrate and establish a relationship between all living and non-living entities, to create a web of life, in a state of mutualism (Mang et al. 2016:21).

What's needed is an ecological worldview (Refer to Fig.04) much in line with the Neotechnic way of thinking. Du Plessis & Hes (2014:21) describes an ecological world view as considering humans part of a larger community of life. If humans are viewed in the light of an all encompassing ecological realm, then it is not only the natural environment that suffers as a result of industrialization and urbanization, but also humans. Air and water pollution is not considered to affect only the creatures that exist within them, but ultimately affects humans directly in the process. Our impact on the natural environment has a profound impact on us directly.

To ensure that all the ecological processes function optimally and human existence have a strong and prosperous future, we need reduce the degenerative effect that man has on natural processes. Darko Radovic (2009) in his book 'Eco-Urbanism: Towards well-mannered built environments', calls this process of natural conservation, Ecological sustainability.

ECOLOGICAL SUSTAINABILITY

Radovic (2009) defines ecological sustainability as; "The ability of a society, ecosystem, or any such

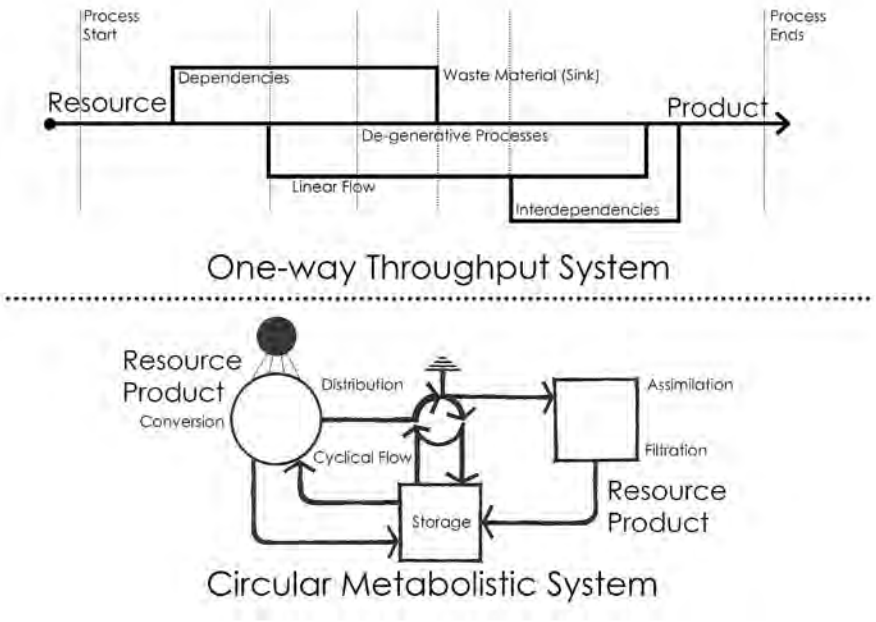

Fig. 05. Left; Diagram highlighting the major differences between a one-way throughput system of industrial technology; and the cyclical system described by Lyle (1994) (Author, 2018).

ongoing system to continue functioning into the indefinite future, without being forced into decline through the exhaustion or overloading of key resources, on which that system depends" (Rodovic 2009:12).

He argues that sustainability is a dynamic process that does not only protect the Earth's life-supporting systems but at the same time also enable people to realise their creative potential to improve the quality of their life (Rodovic 2009:12). Emphasis should be placed on 'dynamic processes'; sustainability is not by far the pursuit of a steady state, but rather complex and dynamic processes. Sustainable development has a main goal of preserving nature, ensuring fresh air, clean water and fertile ground for generations to come.

Embodied in sustainability is the concept of equity – to the natural life-supporting processes and all species dependant on the processes. Du Plessis & Hes (2014:14) argues that the ecological world view extends its boundaries from the self to the non-self. Each system has an intrinsic worth and should therefore be treated with respect and consideration. The key to sustainability is reducing the degenerative process flows and increasing the regenerative flow to ensure that the landscape or urban construct survives the forces of entropy.

EVOLUTION AND ENTROPY

Evolution[5] and **entropy**[6] are polar opposites but essential to the harmonious balance of natural systems. All living things have evolved and adapted to meet the requirements they needed to survive, however, evolution can only ensure their immediate existence and thereafter a force is needed to break it down in order to facilitate the re-assimilation processes.

Mang et al. (2016) describes evolution as the possibility of living systems to move to a new level of order, differentiation, and organization. Thus, creating more complex structures that act to the benefit of the living system. Entropy on the other hand, breaks the system down into its essential components, in a sense it is the gradual decline of a living organism into a state of disorder.

The evolutionary process is essential to the success of regenerative systems, with each evolution contributing to the well-being of living organism's dependant on them. Mang et al. (2016) argues that designers should consider the evolution of living systems when designing for them. This might manifest itself in the form of changing environments. Designers must design for the re-appropriation of spaces and building materials. They must design to allow change to happen. Failure to take it into account will put systems in conflict with one another and disturb the balance within the system.

Evolutionary Biologist, Elisabet Sahtouris states that: "The best life insurance for any species in an ecosystem is to contribute usefully to sustaining the lives of other species, a lesson we are only beginning to learn as humans" (Rodovic 2009:25). In order to sustain natural processes, man-made processes need to reach the level of complexity that exists in nature without making the processes complicated.

COMPLEXITY VERSUS COMPLICATEDNESS

Natural ecosystems inherently have extreme complexity connected to its functions. To replicate these systems or try to respond to it in design interventions, these complex and intricate systems have to be understood. When considering sustainability in the built environment, the processes aren't merely complex in the sense that they are technically difficult to grasp; rather, they are complex to the extent that humans are yet to discover all aspects of it (Rodovic 2009:14).

On the other hand, human interventions try to mimic natural processes - that resulted from thousands of years of evolution. The complexity of these systems cannot always be fully realised, leading professionals to simplify the systems in order to create a more manageable model that works independently from the larger network. Rodovic (2009) calls this process of simplification 'complicatedness', which stands in direct contrast to the true complexity of the system. The result of these simplified processes is a highly mechanized world that consists mostly of degenerative one-way throughput

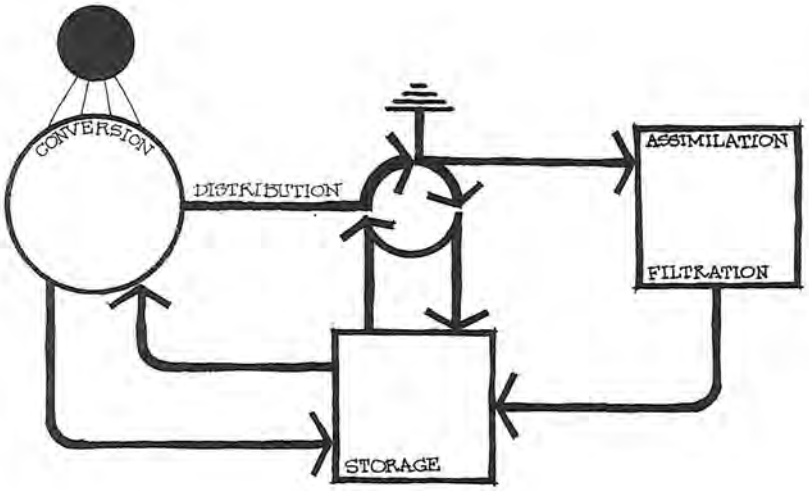

Fig. 06. Left; John Tillman Lyle's Regenerative System Diagram (Lyle 1994); explaining the cyclical flow that occurs in nature automatically. Conversion, storage, distribution, filtration, and assimilation.

systems.

THE DEGENERATIVE NATURE OF LINEAR FLOWS

"Where nature evolved an ever varying, endlessly complex network of unique places adapted to local conditions, human ingenuity has replaced it with a system of relatively simple forms and processes repeated with bold and consistent regularity" (Lyle 1994:4).

Lyle (1994) elaborates on the notion of complex natural systems that stands in stark contrast to the mechanized world. He explains that nature evolved to a level of infinite diversity in structures, species, processes and systems; whereas human endeavours struggles to design readily manageable uniformity. Nature's endless re-cycling systems of materials and wastes (processes that are fundamental to the operating of biological systems) are replaced with a system of one-way flows. These materials that support life now reduced to nothing but a waste product in what Lyle (1994) calls 'the sink'. In other words, humanity artificially mimics natural processes in a hope of achieving the complexity needed to sustain life. Nature's complex systems are then reduced to it essence and used in isolation, never achieving the complexity that nature has in its domain. Thus, wasting material and destroying essential part of the ecosystems.

These artificial processes treat materials as if there is an endless supply available; however, most of these materials have limited resources available. The rate at which materials are taken from the earth are far greater than the rate at which they can be replaced; therefore, the sources must eventually diminish. Lyle (1994) states that this overwhelming extraction of resources, are where the modern crisis of resource depletion and degradation lies (Lyle 1994:4).

Global problems such as soil erosion, deforestation and habitat loss testify to the degenerative processes of one-way throughput systems. After being used by consumers, the materials return to the sink side of the sequence in even greater quantity, with the sinks being rivers systems, lakes, and groundwater; thus, leading to a surplus of materials in the sink creating pollution.

Lyle (1994) states that the one-way throughput system destroys the landscape on which it depends over time (Refer to Fig.05). Nature, on the other hand, preserves and builds the landscape. Nature uses solar energy to power its processes and all energy is conservatively used and never wasted, only transformed. Nature has a way of using materials to its full potential whilst creating as little as possible waste in the process. The waste that is created is quickly re-assimilated back into the ground (Refer to Fig.06).

FROM A SUSTAINABLE TO A REGENERATIVE APPROACH

In light of the first law of thermodynamics that energy cannot be created or destroyed, merely transformed from one state to another (Lyle 1994:10). All processes use energy to extract materials out of the ground, or to convert the materials from one state to another. Each material is the sum of all its processes and the energy needed for the processes to occur. This energy manifests itself in the form of **embodied energy**[7]. Therefore, to truly be sustainable, the embodied energy and materials within the system must be continually self-renewing in their operation. Materials with a low embodied energy must be used and the materials should be sourced locally in a sustainable way. For example; timber pole construction should occur at the same rate at which the local forest can produce timber.

In other words, sustainability requires ongoing regeneration. Scientist and other professionals came to realise that sustainability is just not enough, as it does not correct past mistakes made; the regenerative approach therefore tries to correct past mistakes (Knox 2013:7)

The term 'Regenerative' has its origin in organic farming, used by Robert Rodale to symbolize the expansion of his work in farming. He used the word with reference to the continuing organic renewal of soil in the absence of agricultural chemicals or artificial stimulators. This concept of self-renewal was taken and applied to all systems that support life, including sustainable development in architecture. For the first time in the history of the built environment,

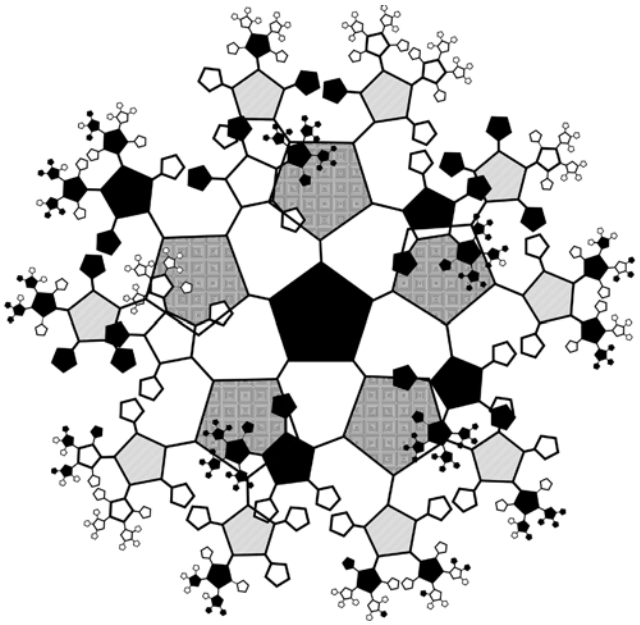

Fig. 07. Diagram explaining the concept of holistic systems (Author, 2018). Each aspect of a system is interconnected with another system.

principles were formulated and intertwined with the mundane act of construction, to form a structure that isn't lifeless, but rather a living structure.

Lyle (1994:11) defines Regenerative design as a system that replaces the present linear one-way throughput flows, with systems that incorporate cyclical flows during the entire process of sources, consumption centres and sinks. Regenerative systems continuously replace the energy and materials through its own functional processes.

REGENERATIVE SYSTEMS CHARATERISTICS

Lyle (1994) explains the characteristics of regenerative systems as follows:

- Regenerative systems incorporate its operations with the functions of natural processes, together with social processes
- The use of non-renewable resources is strongly discouraged unless these resources can be reused or recycled
- Renewable resources are used with care by using the resources within their capacities of their renewal
- All waste is regulated in order to ensure that the environment maintains its capacity to assimilate it without damaging the system

Comparing the major industries of the modern world and its use of inanimate machines to process resources; and those of living systems, it becomes clear that the former lacks the ability of self-renewal. John Dowey (1916) explains it well with his concept of self-renewable systems. He states that: "the most notable distinction between living and inanimate things is that the former maintains themselves by renewal" (Lyle 1994:11). Regenerative theories and technologies have to do with the rebirth of life itself, therefore designing in such a manner to express hope for the future.

"To become sustainable, the world will have to move from simple, highly mechanized technological base, to one of great complexity, rooted in natural processes" (Lyle 1994:11).

TOWARDS A HOLISTIC APPROACH

The general misconception is that humans would have to return to a preindustrial level of technology in order to be a sustainable community. Research have shown that returning to a primitive state of technology may not necessarily be the answer to the problems.

Following the oil crisis of the 1970's, humans were in quite a disarray about the situation, with a widespread tendency to assume that the depletion of petroleum means returning to preindustrial levels of technology (Lyle 1994:11). Lyle (1994) argues that scientific knowledge and technological skills are even more applicable to regenerative systems than to industrial technology. Sustainable technology will have to replace the industrial technology in due time. This process may take centuries before it is completely realised.

The regenerative state of any given construct cannot function in isolation as it is dependent on holistic systems (Knox 2013:87). Nature does not work in isolation, one system's waste is considered a resource in another system, and so the cycle goes on to form a fully integrated web of life (Refer to Fig.07). Knox and Mayer (2013) argues that the common mistake in planning for sustainability is to pursue environmental efforts on a project-to-project basis or to address only one issue, isolated from the broader context (Knox 2013:33).

Although a project-to-project approach might not change the immediate future, it will create new opportunities and insights into the possibilities of sustainable technology. Before we can design suitable solutions to living systems we need to understand the fundamental principles that it consists of.

THE FOUR FUNDAMENTALS OF LIVING SYSTEMS

1. Change
2. Diversity
3. Value
4. Holistic view

Mang et al. (2016:13) states that the only constant is change. Living systems (unlike the paleotechnic industrial machines) change on a regular basis and designers must allow for the constant flux. Mang (2016) argues that designers can treat change as a source

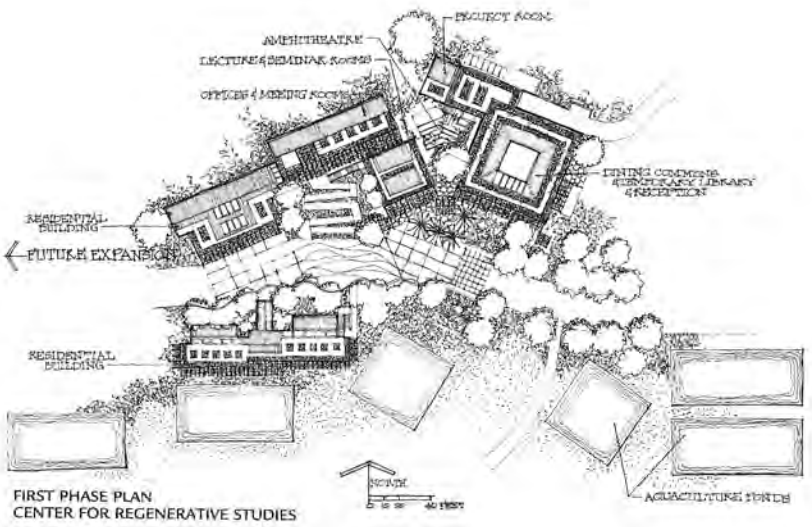

Fig. 08. The first phase of the Centre for Regenerative Studies (Lyle 1994:303)

of creative endeavour, it need not be a bland pragmatic or immutable solution (Mang et al. 2016:13).

Diversity is about exchanging values. Diversity in systems need to be encouraged to such an extent that it contributes to the beneficial exchanges of resources, energy and materials between the building and the natural landscape; for example, in the forest the species actively nourish and shelter one another. In the case of a downtown shopping district, it is more likely to foster a vibrant city economy when it is filled with local businesses that rely on local manufacturers, rather than with national chains (Mang et al 2016:13).

Value enhances viability. One of the functions of a tree is to strengthen and build soil in a forest. It also catches leaves, protect other plants from strong winds, acts as a buffer of the sun and enables the establishment of new life. Each organism extends and elaborates the storage capacity of the soil, thus supports the growth of the original tree (Mang et al. 2016:13).

Adding value is a nested phenomenon; living systems are always part of some larger system, where each system contributes to the value-adding processes of the entire system. Radovic (2009:142) calls this phenomenon ‘Holism’. Du Plessis & Hes (2014:37) supports this phenomenon by mentioning that one small change in input at one point of the system can cause a profound effect at another point. This is also generally known as the ‘Butterfly Effect’.

ECOSYSTEMIC THINKING TO PRACTICAL APPLICATION

John Tillman Lyle (1994:14) explains the practical application of regenerative design by cross-referencing to ‘The Centre for Regenerative studies’ (Refer to Fig.08).

Located on a five-hectare site on the campus of the California State Polytechnic University in Pomona, the centre attempts at incorporating regenerative design principles and applying it to practice. The main purpose of the Centre is to educate, demonstrate and advance regenerative studies. The Centre houses 60-90 individuals on its premise in order to replicate the daily rituals of living and therefore students work with regenerative technologies as an integral part of their daily lives, experiencing natural processes as it changes over time.

Here, the students incorporate facilities of a broad range of practices and technologies dealing with shelter, water, food, waste, energy and other aspects. Each regenerative topic is built, tested, altered and observed over time to gain an understanding of the biological complexity integral to each system (Lyle 1994:15).

The relationship between regenerative practices and human attitudes are a very important aspect to the Centre’s success. The main reason for the studies is to find a way to implement regenerative practices into the daily functions of future cities, therefore the connection between the natural systems and the human interaction is almost as important as the technological functions itself (Lyle 1994:15).

Some of the functions that the Centre for Regenerative Studies implement are:

- Growing organic food that are devoid of artificial chemicals
- Harvesting the natural processes that nature provides to generate energy
- Designing buildings that responds to the context and climate to such an extent that only passive heating and cooling is needed to regulate the thermal environment
- The Centre recycles its own waste as well as keeping waste to a minimal

The Centre occasionally demonstrate their progress in regenerative studies to the general public which serves as the Centre’s second major purpose. The demonstrations are used as a tool to create awareness of the potentials of ecological design as public knowledge of these technologies are very limited. The success of regenerative systems depends on the widespread acceptance and application of these systems within our urban construct. The Centre’s third major purpose is to conduct experiments to advance its research (Lyle 1994:15).

Lyle (1994:15) explains that the Centre’s physical order and visible form of its buildings in relation to the

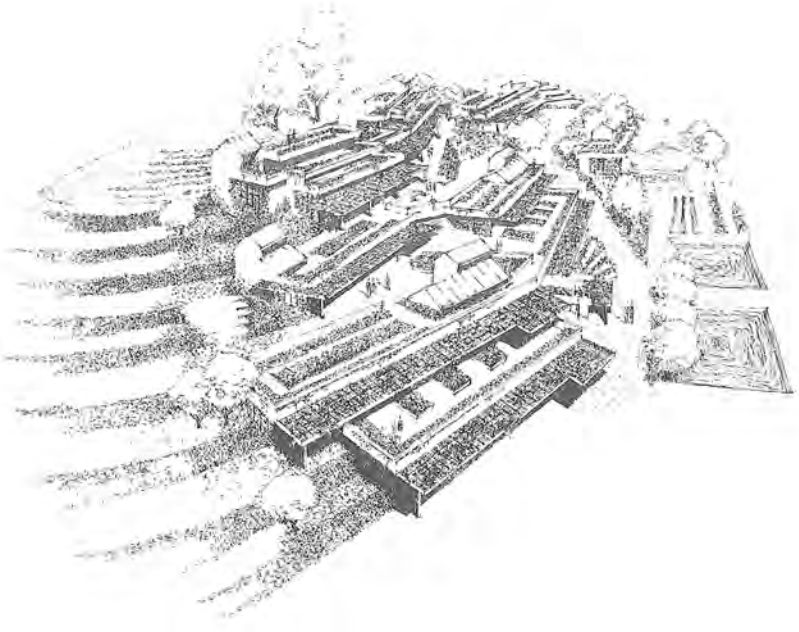

Fig. 09. Depiction showing a perspective of The Centre for Regenerative Studies (Lyle 1994:279).

landscape is responsible for its great success. He compares the Centre to that of industrial technologies that ignore the interactive relationship between the physical form and the environment.
"By adapting to the diverse conditions of the environment, landscape and architecture can give visible expression to fundamental relationships between humans and nature implicit in regenerating practices" (Lyle 1994:20).

WHERE REGENERATIVE THEORY AND PHENOMENOLOGY MEETS
In explaining the fundamentals of natural processes, Girard (2011:57) mentions three modes of order that applies both to nature and architecture. The first is the structural order (tree trunks / columns), the second is the functional order (energy flow / electricity) and the third is the locational order (natural context / site).

The locational order places emphasis on the importance of place in ecosystemic design. Mang (2016) explains that regenerative practice should not be treated as a generic model but rather respond to the specific place. Mang et al. (2016:36) states that co-evolution needs to happen on a place-to-place basis, creating solutions that are specific rather than generic (Mang et al. 2016:36). Du Plessis & Hes (2014:27) calls this co-evolution of humans and nature 'social-ecological systems'.

Du Plessis & Hes (2014:27) states that social-ecological systems have two essential aspects connected with it. The first being the tangible 'exterior' systems and the benefits it has to man; and the second is the 'interior' that is created by human thought and the experience gained by humans being part of these processes. The world comprises of three distinct spheres of existence; the Geosphere (all matter), Biosphere (all life) and the Noosphere (human thought). The Noosphere is the human mind and conscious thought, the phenomenological experiences, the motivations, feelings, worldviews and creativity. It also contains in a broader sense, collective motivations, cultural norms, value systems and community identity (Du Plessis & Hes 2014:27). The Noosphere is where the tangible world meets the intangible; where the physical merges with the metaphysical realm; where flux of changes are condensed into phenomenological experiences.

PART 4: PHENOMENOLOGY, PLACE AND ARCHITECTURE
Christian Norberg-Schulz (1980) explains in his book 'Genius Loci: Towards a phenomenology of architecture' that our everyday life-world consists of concrete 'phenomena'. It consists of tangible and intangible aspects of life. He argues that the tangible aspects of life such as buildings, motor vehicles, technology and products take priority in today's world. The intangible aspects are ignored; this includes the life-world or phenomenological experiences. However, he explains that the tangible and intangible realms are interconnected, interrelated and inseparable. Both require a physical environment or place to latch onto. Norberg-Schulz (1980:6) states that nothing can happen without reference to a locality and that place is an integral part of existence. He explains that the word 'place' means more than an abstract location. "Place is a 'total phenomenon', which cannot be reduced to any of its properties" (Norberg-Schulz 1980:7).

As a result, the **existential**[8] purpose of architecture is to make a site become a place, that is, to uncover the meanings present in the given environment. A place may be interpreted in different ways. To protect and conserve the genius loci in fact means to concretize its essence in ever new historical contexts.

Architecture comes into being when a 'total environment is made visible'. To concretize the genius loci. The role of architecture is to gather the properties of the place and bring them close to man. The basic act of architecture is therefore to understand the 'vocation' of place, albeit man-made or natural. In doing so, architecture supports life-giving processes and man becomes part of a comprehensive totality. Only then, we recognize the fact that man is an integral part of the environment, and that it can only lead to human alienation and environmental disruption if he forgets it.

Norberg-Schulz (1980:17) explains the importance of the character of

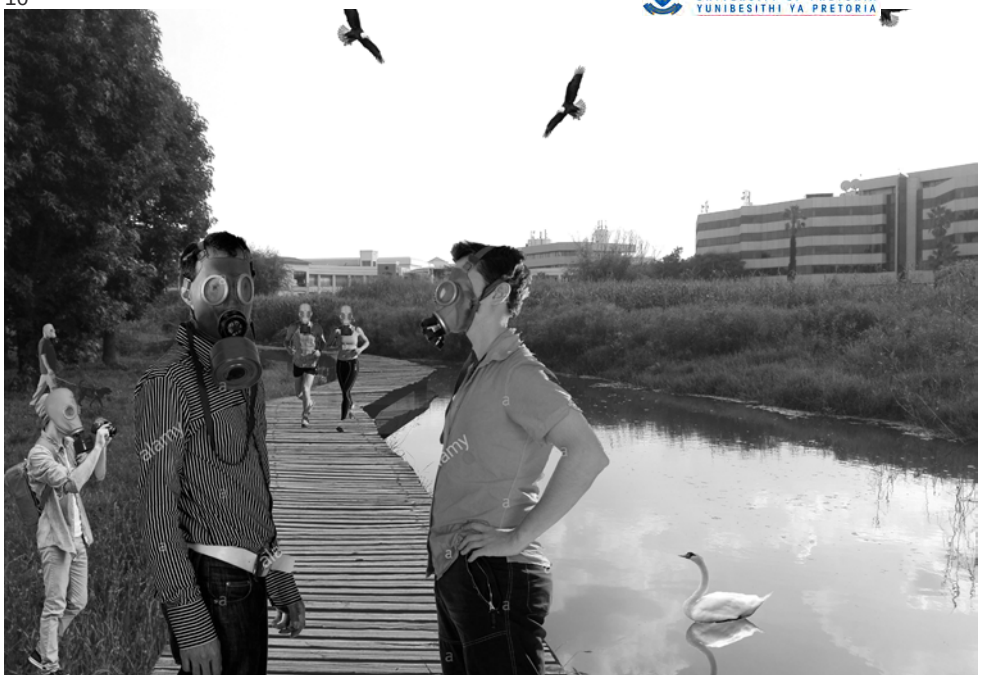

Fig. 10. Left; Image exaggerating the current state of Centurion Lake (Author, 2018). The character of place is currently seen as a negative experience, however, the site presents great potential for phenomenological experiences.

place; he mentions that when we visit a city, we are usually struck by its particular character, which becomes an important part of the experience. The character of place is a function of time that changes with the seasons, the course of the day, and the weather. The change of character manifests itself in the form of light, texture and other physical qualities. Architects should therefore carefully consider the boundaries which define the place and how the building rests on the ground, and how it rises towards the sky, and how it frames space. Phenomenology of place considers the basic modes of construction and its relationship to formal articulation.

Norberg-Schulz (1980:121) mentions that architecture can promote environmental visibility by its degree of 'openness' by manipulating its boundary condition. The solidity or transparency of the boundaries make the space appear isolated or as part of a more comprehensive totality. He calls this the 'inside-outside relationship', which constitutes the very essence of architecture. Zones of transition or thresholds relate the internal structure of the place to the structure of the natural or man-made environment.

Everyday experience tells us that different actions need different environments, as a consequence, cities consists of a multitude of particular places. Different functions demand places with a different character. For example, a dwelling has to be 'protective', an office 'practical', a ball-room 'festive', and a church 'solemn' (Norberg-Schulz 1980:17). Existential spaces are perceived by humans in different ways, Pallasmaa (1996) elaborates on the different ways of perceiving spaces and the experiences connected to each.

ARCHITECTURE OF THE SENSES

Various architectures can be distinguished on the basis of the sense modality they tend to emphasise. The architecture of Le Corbusier and Richard Meyer clearly favours sight. On the other hand, the architecture of the Expressionist orientation, beginning with Erich Mendelsohn and Hans Scharoun, favours muscular and haptic plasticity as a consequence of the suppression of ocular perspectival dominance (Pallasmaa 1996:70). Frank Lloyd Wright's and Alvar Aalto's architecture are based on a full recognition of the embodied human condition (Refer to Fig.11). In today's architecture, the multitude of sensory experiences is heightened in the work of Glenn Murcutt, Steven Holl and Peter Zumthor (Pallasmaa 1996:70).

Juhani Uolevi Pallasmaa (1996) in his book 'The eyes of the skin', explains that humanity have always given preference to sight above all the senses. He elaborates by saying that in Western culture, sight has historically been regarded as the noblest of senses. In classical Greek thought, certainty was based on vision and visibility "seeing is believing". Plato regarded vision as humanity's greatest gift. Aristotle considered sight as the most noble of senses. Greek philosophical writings use the metaphors of clear vision and light as truth" Pallasmaa (1996:15).

Pallasmaa (1996:17) explains that our senses enable us to perceive the world around us; it is the only connection we have to the physical and metaphysical realms, space and place. Furthermore, he explains that architecture is our primary instrument in relating us to space, place and time; giving these dimensions a human measure. "Architecture domesticates limitless space and endless time to be tolerated, inhabited and understood by humankind" (Pallasmaa 1996:17).

The inhumanity of contemporary architecture and cities can be understood as the consequence of the negligence of the body and the senses, and an imbalance in our sensory system. The dominance of the eye and the suppression of the other senses tends to push us into detachment, isolation and exteriority (Pallasmaa 1996:19).

Martin Heidegger, Michel Foucault and Jacques Derrida have all argued that the hegemony of vision has been reinforced in our time by a multitude of technological inventions and the endless multiplication and production of images. The only sense that is fast enough to keep pace with the astounding increase of speed in the technological world is sight. But the world of the eye is causing us to live increasingly in a perpetual present,

Fig. 11. Left; Architecture of the senses: full recognition of the embodied human condition (Author, 2018)

flattened by speed and simultaneity.

MATERIALITY AND TIME

The flatness of today's standard construction is strengthened by a weakened sense of materiality. Natural materials – stone, brick and wood – allow our vision to penetrate their surfaces and enable us to become convinced of their veracity of matter. Natural materials express their age and history, as well as the story of their origins and their history of human use. All matter exists in the continuum of time; wear and tear of the materials adds the enriching experience of time to the materials of construction.

TOWARDS A MULTI-SENSORY EXPERIENCE

Merleau-Ponty's philosophy makes the human body the centre of the experiential world. Our bodies and movements are in constant interaction with the environment; 'the world' and 'the self' inform and redefine each other constantly (Pallasmaa 1996:40).

A walk through a forest is invigorating and healing due to the constant interaction of all sense modalities. Architecture is essentially an extension of nature into the man-made realm, providing the ground for perception and the horizon of experiencing and understanding the world.

Architecture gives a conceptual and material structure to conditions of our daily lives. It concretises the cycle of the year, the course of the sun and the passing of the hours of the day. Every touching experience of architecture is multi-sensory qualities of space. Matter and scale are measured equally by the eye, ear, nose, skin, tongue, skeleton, and muscles.

An architectural work is not experienced as a collection of isolated visual pictures, but in its fully embodied material and spiritual presence. The visual frontality of the architectural drawing is lost in the real experience of architecture.

THE EYES: SIGHT AND SHADOW

Previously it was mentioned that architecture of today is ocular centric and only creates flat images that mostly have a negative connotation to it. Pallasmaa (2009:39) explains that in some cases sight should become the prevalent sense, it is only when architecture concerns itself completely with the sense of sight, where it becomes a problem (Refer to Fig.12).

In our time, light has turned into mere quantitative matter and the window has lost its significance as a mediator between two worlds; between enclosed and open, private and public, shadow and light. In great architectural spaces, there is a constant, deep breathing of shadow and light; the shadow inhales and illumination exhales light. Pallasmaa (1996:40) states that homogenous bright light paralyses the imagination in the same way that homogenisation of space weakens the experience of being, and wipes away the sense of place.

The eye is the organ of distance and separation, whereas touch is the sense of nearness, intimacy and affection. The eye surveys and investigates, whereas touch approaches and caresses.

THE SKIN: TACTILITY AND TEXTURE

"Hands are the sculptor's eyes" (Pallasmaa 1996:56).
The skin reads the texture, weight, density and temperature of matter. He explains that the door handle is the handshake of the building, welcoming us into the space. He states that a pebble polished by waves is pleasurable to the hand, not only because of its soothing shape, but because it expresses the slow process of its formation.

Pallasmaa (1995) explains that our skin can trace temperature spaces with precision, the cool and invigorating shadow under a tree, or the caressing sphere of warmth in a spot of sun, turn into experiences of space and place (Pallasmaa 1996:56).

THE EARS: THE INTIMACY OF SOUND

Sight isolates, whereas sound incorporates; vision is directional, whereas sound is omni-directional. The sense of sight implies exteriority, but sound creates an experience of interiority." I regard an object, but sound approaches me; the eye reaches, but the ear receives. Buildings do not react to our gaze, but they do return our sound back to our ears" (Pallasmaa 1996:71).

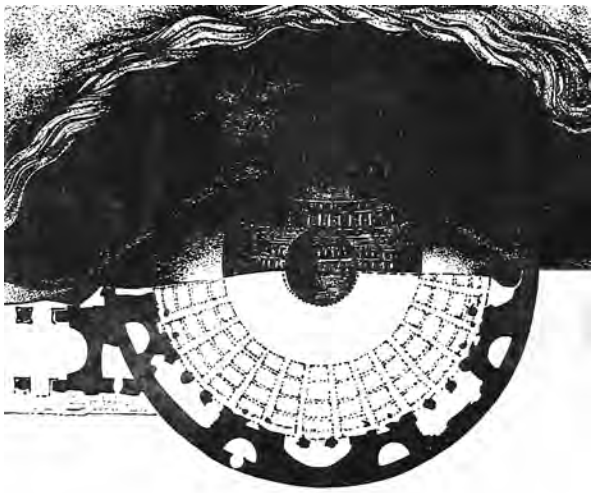

Fig. 12. Left; Image depicting the humanity's 'Ocular Bias' in contemporary architecture (Fisher, 1992).

Hearing structures articulates the experience and understanding of space. Pallasmaa (2009:45) explains that a dripping sound in a dark cave has the extraordinary capacity of the ear to carve out a volume into the void of darkness. A space is understood and appreciated through its echo as much as through its visual shape, but the acoustic precept usually remains as an unconscious background experience.

The echo of steps on a paved street puts us in direct interaction with space; the sound measures space and makes its scale comprehensible. We stroke the boundaries of the space with our ears (Pallasmaa 1996:49). Every city has its echo which depends on the pattern, scale, architectural style and materiality. The wide, open spaces of contemporary streets do not return sound, and in the interiors of today's buildings echoes are absorbed and censored. "Our ears have been blinded" Pallasmaa (2009:45).

THE NOSE: THE PERSISTENCE OF SMELL

The most persistent memory of any space is often its smell. Wood surfaces. A particular smell makes us unknowingly re-enter a space completely forgotten by the retinal memory. Every city has a wide spectrum of smells (Pallasmaa 1996:54). It manifests itself in the form of irregular and short moments; the smell of rain as it hits the hot surface of the road, the smell of timber at an old bar counter, the smell of flowers in the spring breeze, and the smell of water as it trickles in a stream.

THE TASK OF ARCHITECTURE

The task of architecture is to create embodied and lived existential metaphors that concretize and structure our being in the world. Architecture reflects, materialises and eternalises ideas and images of ideal life.

Buildings and cities enable us to structure, understand and remember the shapeless flow of reality (Norberg-Schulz 1980:67). Architecture enables us to perceive and understand the dialectics of permanence and change, to settle ourselves in the world, and to place ourselves in the continuum of culture and time.

PART 5: CENTURION LAKE: THE STORY OF PLACE

Centurion is a small suburb located outside the city of Pretoria (Gauteng). Running through Centurion are a network of rivers that systematically converge to form the Hennops river. In turn they spill out into the Crocodile river downstream located towards Hartbeespoort dam.

Centurion Lake faces two major problems; the first being large scale **siltation**[9] caused by the Kaalspruit in the south-east; and the second being **eutrophication**[10] due to mineral rich effluent that is dumped into the river from the Tembisa township (Tshwane Municipality 2008). The result is that Centurion Lake has a large sandy deposit that is overgrown by various species of water thriving plants.

Centurion Lake is situated adjacent to Centurion Mall and both were constructed in 1983.The main reason for the construction of Centurion Lake was to capitalise on the aesthetic value of the Hennops river (untouched by human intervention at the time). The project was a huge success and the mall boomed with activity. Water sport activities included canoeing and water cycling, all in the backdrop of musical fountains. This all changed when siltation issues started to emerge. In as little as eight years the lake was a complete wasteland that lost its original purpose as an aesthetically pleasing leisure park.

The problems started when man first decided to alter the natural state of the river and replace it with a concrete structure, thus destroying the natural ecology that was present on site. Mang (2016:13) explains that: "humans have the potential to make unique contributions to the ongoing evolution of living systems by consciously participating in them. Unfortunately, for the most part we are fighting evolution rather than aligning with it".

Developers at Centurion Lake had the opportunity to participate in the natural systems and establish a connection with the natural ecosystem, but decided to alter the course of nature instead. It can be argued that the initial lost connection between man and nature lead to the alteration of the river in this manner. Had they understood the

Fig. 13. Left; Image showing architecture as mediator between the natural and man-made (Author, 2018).

consequences that the alterations of the river would have, they would have done it differently.

In an attempt to re-establish the lost connection between man and natural processes regenerative theory is applied in conjunction with phenomenology. It was stated in the very beginning that the article will attempt to create awareness of the disconnection between man and its natural environment. This will be done by firstly regenerating the scarred landscape (polluted river) by incorporating ecological processes, and then create phenomenological experiences that reintroduces man to the natural processes. Thus, instilling in man, a new-found appreciation for nature that will ultimately change the way we treat natural resources and design for a prosperous future.

REGENERATION OF CENTURION LAKE

The site offers a wide variety of resources that can be utilized to the benefit of the ecology and socio-economic sectors. These resources include the river's water, siltation of the river, ecological biomass, vast open land, the presence of full solar radiation, and the vibrancy of human presence on either side of the river.

The programmes will attempt to reintegrate the inherent rituals of man and nature. In other words, humans will have the opportunity to become part of natural processes as described above to gain a new awareness and appreciation of the delicate nature of ecological functions.

Lyle (1994:27) explains six basic phases of ecologic functioning that would contribute to the sustainability and regeneration of the lake and its natural processes. The functions are; Conversion, storage, filtration, distribution, assimilation, and human thought.

In an attempt to regenerate Centurion Lake, the six phases of ecologic functioning will be applied to the site. The aim is to challenge past mistakes and incorporate new ideas onto a landscape that has lost its ecological integrity. Design strategies will follow for each aspect, in order to restore and improve the ecological processes that existed naturally before the construction of the lake. What's needed is human thought, intelligent design of processes to facilitate the ecological functions to regenerate the site.

IMPLEMENTATION OF THE STRATEGIES

Conversion

In conversion one element becomes something else. An example of conversion is the process of photosynthesis where solar rays becomes a life-supporting element in all green plants (Lyle 1994:31). Thereafter oxygen and food are produced by the plants that serves as resources for other living organisms. The intervention will use this knowledge to formulate three strategies of conversion. The first is to capture and use solar energy, secondly, rainwater and thirdly is to capture and use the resources that the river offers.

Firstly, solar energy makes it possible to incorporate passive solar and ventilation mechanisms that will reduce the energy cost as much as possible. However, total passive design will be difficult to achieve and therefore a hybrid system will be used. Thus, active and passive systems will function interchangeably. Solar energy will be used as captured energy in the building, as well as for growing botanicals. Secondly, rainwater will be harvested from the roofs and surface areas of the intervention and be used for urban agriculture and as grey water in cisterns.

Thirdly, the Hennops river contains plastic waste, siltation, and plant debris. The first step in the process will be to remove these solids from the water with the use of a silt trap. The trap first removes the plastic waste and then collects the silt in large settling basins. The plastic waste is recycled and the silt is used as an additive to vermiculture composting, on the one hand, and additive to silt bricks on the other. The end result of the conversion stage is new resources in the form of plastic waste, silt and water.

Storage

In natural systems, during the ongoing circular metabolistic systems, some materials are stored to be used and reused at a later stage, this is nature's

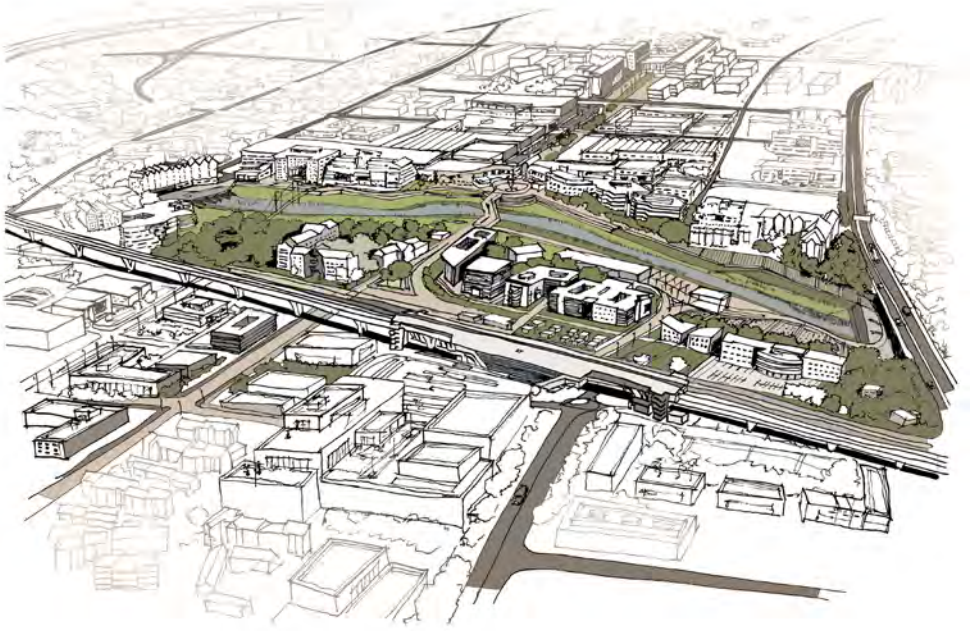

Fig. 14. Left; Sketch showing the natural processes in place, fully integrated into the urban landscape (Author, 2018).

way of producing as little as possible waste. An example of natural storage is the watersheds, rivers, dams and retention ponds.

All the resources that was converted (in the intervention) is then stored. Solar energy is stored in battery cells, water in tanks, silt and plastic in containers.

Filtration
Earth has a natural filtration system built into its very fabric. Plant and soil act as filters by removing materials that has been dissolved by either water or air molecules. Lyle (1994:27) mentions that trees are excellent filters of polluted air particles as it captures it on their leaves and nature washes it off of the leaves when it rains, restoring it back to the soil where it came from. These natural filtration mechanisms restore the relative purity of the water and air. This is nature's waste treatment system (Lyle 1994:27).

In terms of the intervention, the 'filtration phase' is where all the processes happen. The plastic waste is hand-sorted and either packaged or processes into plastic products. The silt is 'harvested' and treated with lime to neutralize any hazardous metals. The water is filtered through a series of constructed wetland systems that uses specific water born plants to remove any hazardous metals from the water.

Distribution
After the materials are filtered or processed, it can either be stored again or distributed to be used. These processes of distribution naturally occur in river systems, the hydrological cycle and wind that moves water mass and minerals all over the globe; however, in the case of the intervention, the resources would have to be distributed manually, thus, creating job opportunities for the local community.

Assimilation
In the natural process of assimilation, everything that was produced during the conversion phase returns back to the landscape after it was filtered/ processed. Only a small portion of the materials are used by living organisms, thus a large portion of the materials are returned to the earth for re-assimilation. The resultant dead biomass is labelled as waste. It is important to note that what is classified as waste for one organism may be seen as essential food for smaller decomposing organisms such as insects, worms, bacteria, and fungi. Lyle (1994:29) states that: "Microorganisms are the essential work horses of regeneration. Decomposition enriches the soil with detritus and humus and provides nutrients for new plant growth". These are the basic principles of revitalizing the earth.

In the case of the intervention, the natural process of decomposition is utilized by implementing vermi-composting beds. All organic material is broken down to be re-assimilated into the soil and at a later stage be used in urban agriculture. The purified water from the filtration phase is also used to facilitate plant growth in the urban agriculture. Once the water passed through the system a few times, the 'used' water is re-assimilated back into the river (Refer to Fig.15).

Human thought
Lyle (1994:27) mentions that most of the natural processes on earth is in some way altered and guided by human activity. This creates an environment where human processes are joined with natural processes governed by conscious humanistic thought. "The human intellect has become a dominant force in the global landscape" (Lyle 1994:27). Bill McKibbon (1989) wrote:" We have deprived nature of its independence, and that is fatal to its meaning" (Lyle 1994:27). From a historic point of view 'anima mundi' means the soul of the world mentioned by Plato, he explains how man has now taken over the soul, placed himself in the centre position and provides the mind of nature. Referring back to Francis Bacon, his world view was one of control over nature as the soul purpose of the existence of mankind.

However, we are entering a new age where the relationship between man and nature governs the processes, man and nature is in a harmonious state of balance. The paleotechnic way of thinking is slowly fading and a new thought is rising, the neotechnic thought that advocates the joint partnership between man and his natural environment. "The human mind is nature's consciousness, not its master" (Lyle 1994:27).

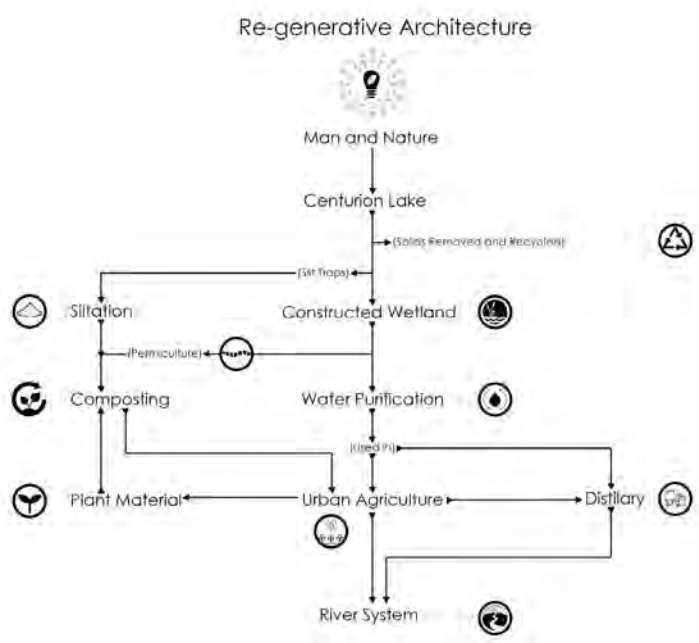

Fig. 15. Left; Image showing architecture as mediator between the natural and man-made (Author, 2018).

PROCESSES AS AN EXPERIENCE

A gin distillery, as a secondary programme, was chosen due to its simple and transparent processes. Every stage of the process can easily be followed by the users; from where the botanicals grow, to where it is processed and distilled, and made into a product. Regenerative theory advocates the intertwined relationship between man and nature as well as the transparency of production. During the entire process, the users of the space are exposed to natural process associated with distilling by use of design elements. The building is designed in such a way as to slowly guide the users through the space, gradually stimulating each of the five senses, creating a multi-sensory experience (Refer to Fig.16).

Each process uniquely contributes to the experience by linking a sense to the process. For example; the approach of the user forms the Gautrain Station, is firstly drawn by sight. The transparent processes of the gin distillery, vermiculture and urban agriculture further entice the sensory stimuli.

Tactile experience manifests itself in the form of; the materiality of the re-used concrete paving, the height of the entrance, the transition between the exterior and the interior, the intimacy of the lower ceiling, the smooth surface of the copper stills, the touch of the rain water - falling from the roof.

The growing botanicals (to be used in distilling) each have its own unique smell. Incorporating sub programmes such as gin tasting will contribute to the taste and smell experience.

The sound of people discussing and sharing their own experience with one another, the sound of the processes happening the background, the train rushing from one station to another, the sound of the birds in the sky and the wind through the trees. And the sound of the river underneath your feet. All these sounds contribute to the aural experience of the place.

With all these experiences incorporated into the design, architecture then truly becomes the mediator between natural process and man-made processes. The architectural intervention's main goal is to house these processes in an appropriate but yet transparent manner. Each process being explained by a series of experiences that highlights each element and engages with the public realm, to create a new-found awareness that will potentially trigger a deeper respect for nature and its ecological processes.

CONCLUSION

We live in a time of transition, where the shift is from selfishly harvesting ecological processes for the 'benefit' of mankind; to a time where man is seen as part of nature and its processes, directly influenced by our actions. The dichotomous relationship is fading to its demise and a new world view is emerging.

The paleotechnic world that shaped the industrialized community and destroyed ecology is slowly transitioning to a neotechnic world where natural processes are regenerated and restored to pre-industrial conditions. Architecture is showcasing a new respect for nature by considering the impact that it has on the existing ecology of the site and understands the role and responsibility that it has within the natural realm.

Using the processes that nature provides and working with it to create an architecture that facilitate rather than contradicts it, aids in establishing a better relationship between the urban construct and the natural environment. Circular metabolistic systems that integrated into architecture will improve the well being of its users, whilst simultaneously healing the biosphere.

The project hopes to make a contribution in regenerating socio-economic systems in Centurion. It aims to improve the connectivity between man and nature, by truly making the public part of its processes, by introducing programs that mimic natural cycles of conversion, distribution, filtration, assimilation, storage, and human thought (Lyle 1994:27).

In conclusion, through the application of regenerative theory in conjunction with phenomenology and the latent potentials of Centurion Lake, it has the potential to create a new architype that could be implemented at various locations along the river to

Fig. 16. Left; Processes as a phenomenological experience (Author, 2018)

improve ecological conditions while re-establishing the lost connection between man and nature.

ENDNOTES

1. Built environment - All structures that are the direct result of human construction
2. Natural environment - The biological nature that is untouched by human development
3. Relationship - The physical interaction or attitude between two entities
4. Lived Experiences – Knowledge gained about the world by direct experiences of its phenomena.
5. Evolution – The gradual development of an organism, from a simple to a more complex state.
6. Entropy - The gradual decay of biological organisms to a state of disorder (Mang et al 2016)
7. Embodied energy – The word 'energy' refers to renewable or non-renewable forms of energy used to make the product (for example the solar energy or fossil fuels).
The definition of embodied energy is: the sum of all the energy that is used to produce materials or services. It is considered to be 'embodied' or 'part of' the energy used to manufacture the product, therefor, the total energy used to make a product; this can include the energy used for excavation, manufacturing processes, packaging, and transportation of materials.
8. Existential – Affirming the true existence of a thing (Norberg-Schulz 1980:17).
9. Siltation – Is a form of water pollution where river bank erosion and small dust particles causes the water to become saturated with suspended solids.
10. Eutrophication – Excessive plant growth in water bodies due to the high nutrient level in the water. The resultant effect is water with a low oxygen level that causes the die-off of fish and other water organisms.

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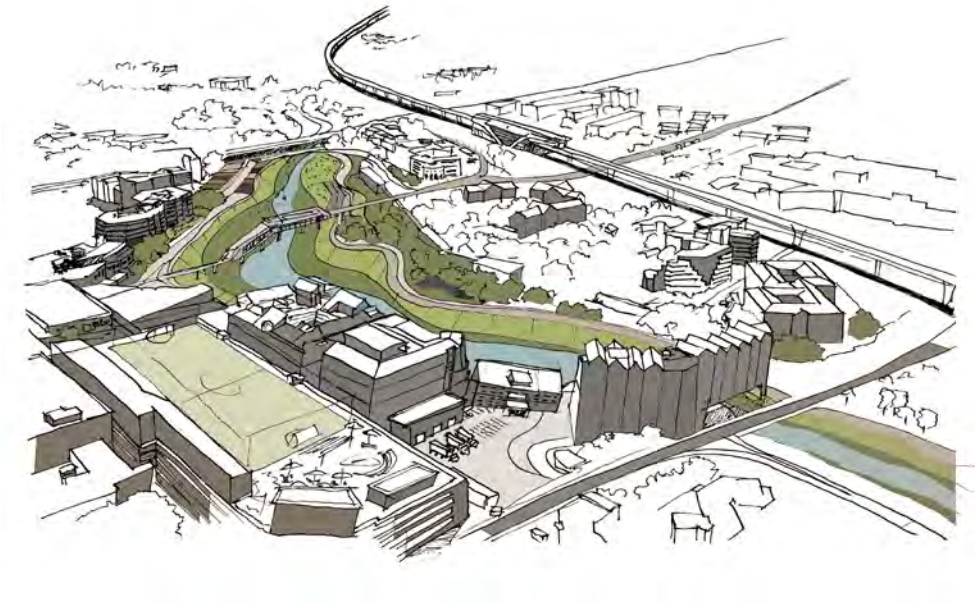

Fig. 17. Left; Image showing architecture as mediator between the natural and man-made (Author, 2018)

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