UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Performance: it's in our nature.

A design investigation of a botanic garden that investigates the use of change as the medium with which landscape architects design to generate form in order to highlight the performance of a landscape, drawing inspiration from the principles of another performance art: dance.

By Sunè Bos

© University of Pretoria

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

© University of Pretoria

The National Botanical Gardens of South Africa.

2 Cussonia Avenue. Pretoria. South Africa.

E28°16'19.8" S25°44'18.2"

Study leader: Graham Young

Studio master: Johan Nel Prinsloo

Course coordinator: Arthur Barker

Submitted in partial fulfilment of the requirements for the degree Magister In Landscape Architecture [Prof] Department of Landscape Architecture, Faculty of Engineering, The Built Environment and Information Technology. University of Pretoria.

Pretoria, South Africa

2015

Performance: it's in our nature

A design investigation of a botanic garden that investigates the use of change as the medium with which landscape architects design to generate form in order to highlight the performance of a landscape, drawing inspiration from the principles of another performance art: dance.

© University of Pretoria

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

© University of Pretoria

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Acknowledgments:

People inspire you, or they drain you. In such a challenging year you have to pick wisely who you choose to surround yourself with. I know that I definitely could not have picked any better. This year would not have been such a success if it was not for my endless support system. Thank you to my parents, Winand, my family and my peers for always keeping my spirits up. I would specifically like to thank Louis van Wyk, Riaan van Niekerk, Nico Bos, Paul Barnard and my dear friend Emily with her publishing skills for helping me cross the finish line. Thank you to Johan Nel Prinsloo and Graham Young for your guidance and patience throughout the year. Most of all I would like to thank Bridgette Botha for running the race with me, every step of the way. Thanks to you the amount of laughter trumps the tears by far!

Above all, I want to thank God for being my inspiration and my strength throughout this incredible journey.

© University of Pretoria

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

© University of Pretoria

Abstract

Botanic gardens have always been about plants. The design of botanic gardens offers a unique window into how we humans have used and valued plants over the past several centuries. Man's relationship with, and attitude towards nature has been directly influenced by the economical, social and environmental conditions that prevailed during that era. This in turn has greatly influenced the way landscape design, and in turn botanical garden design, has been approached and shaped throughout the centuries as well as how man experiences the landscape and plants specifically.

It became evident that man has the habit to submit control over nature, by pruning and shaping nature to be confined by manicured borders or edges. Whether these borders are created to form a romantic picture of nature or whether it is to perform certain ecological functions for the environment, these borders have the inherent ability to limit the potential of nature to grow on intuition and dampen its ability to perform as the living, changing, dynamic entity that it is. The design of most botanical gardens, including the design of the Pretoria National Botanical Garden, tend to comply with this idea of control over nature.

This dissertation investigates the relationship between people and plants, as well as people and the landscape, within the Pretoria National Botanical Gardens, and focus on the redesign of a part thereof by using the regional landscape as the link between them. This new design is approached in a way that celebrates the extraordinary qualities of plants without limiting the potential of plants to perform in its own unique way. This was done by first looking at current theories in the landscape architectural profession on how to design with change as the medium, and second to find inspiration on designing the change and movement of a living entity (nature) and the way to guide this performance, through another performance art: dance.

The landscape design of the botanical garden challenges the way we interact with nature in a landscape in order to restore the interrelationships among plants, animals and humans and clearly communicate to the audience the fact that nature is alive, flexible and changing. It also shows that nature shouldn't be submitted to full control, and that this flexibility of nature is one of its greatest assets.

Samevatting

Botaniese tuine het nog altyd gegaan oor plante. Die ontwerp van botaniese tuine bied 'n unieke venster oor hoe die mens plante gebruik en waardeer het die afgelope dekades. Die mens se verhouding met, asook houding jeens die natuur was direk beinvloed deur ekonomiese, sosiale en omgewingsfaktore wat gedurende daardie era geheers het. Dit het 'n groot invloed gehad op hoe die ontwerp van landskappe, asook botaniese tuine, benader en gevorm is deur die eeue, asook hoe die mens die landskap en spesifiek plante ervaar het.

Dit het duidelik geword dat die mens die gewoonte het om die natuur te oorheers deur dit te snoei en vorm en sodoende te beperk tot gemanikuurde rande en grense. Of hierdie grense daar gestel is om 'n romantiese prentjie van die natuur weer te gee of om sekere ekologiese funksies vir die natuur uit te voer, dit het die inherente vermoë om die potensiaal van die natuur te beperk. Dit beperk nie net die natuur om te groei op intuisie nie, maar ook om soos die lewende, veranderende, dinamiese entiteit wat hy is, op te tree. Die ontwerp van die meeste Botaniese tuine, insluitend die Pretoria Nasionale Botaniese tuin, is grootliks gebaseer op so 'n oorheersing van die natuur.

Hierdie tesis ondersoek die verhouding tussen mense en plante, asook mense en die landskap, in die Pretoria Nasionale Botaniese tuine, en fokus op die herontwerp van 'n gedeelte daarvan deur die streekslandskap te gebruik as die band tussen hulle. Die nuwe ontwerp word benader op 'n manier wat die buitengewone/uisonderlike kwaliteite van plante vier sonder om hulle potensiaal om in hul eie unieke manier op te tree, te beperk. Dit is gedoen deur eerstens te kyk na heersende teorieë in die landslapsargitektuur professie oor hoe om te ontwerp met verandering as die medium. Tweedens is daar bepaal hoe om inspirasie te kry in die ontwerp van die verandering en beweging van 'n lewende entiteit (die natuur) en die manier om hierdie uitvoering te lei deur dans.

Die landskapsontwerp van die Botaniese tuin daag die manier uit waarop ons met die natuur omgaan in 'n landskap om die verhouding tussen plante, diere en mense te herstel en duidelik met die gehoor te kommunikeer dat die natuur lewendig, buigbaar en aan die verander is. Dit wys ook dat die natuur nie onderwerp moet word aan volle kontrole/oorheersing nie en dat hierdie buigbaarheid van die natuur een van sy grootste bates is.

© University of Pretoria

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

© University of Pretoria

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table of Contents

Chapter 1 THESES SPECTACLE
An introduction to botanical gardens 1

Chapter 2 THEORETRICAL DISCOURSE
Evolution of botanic gardens within the landscape architectural discourse 5

Chapter 3 THEORETRICAL DISCOURSE
Performative landscapes 15

Chapter 4 THEORETRICAL DISCOURSE
Performance landscape 25

Chapter 5 SITE SELECTION
The Pretoria Botanical Gardens 40

Chapter 6
Manifesto 56

Chapter 7 DESIGN PROCESS
Choreographing space 65

Chapter 8 SYSTEMS
The environmental stage 75

Chapter 9 TECHNIFICATION OF TEMPORALITY
Detail design 83

Chapter 10Planting strategy
The regional landscape spectacle 96

© University of Pretoria

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

List of figures

Chapter 1

1.1 Author. 2015. Pretoria NBG Site Location.

Chapter 2

2.1 Materia Medico. n.d. *National Library of Sweden,* viewed 25 October 2015, <http://www.kb.se/samlingarna/digitala/linnes-natverk/Materia-medica-liber-I-de-plantis>.

2.2 Upper Rhenish Master (ca. 1410/20), *Little Garden of Paradise* (ca. 1410-20), mixed technique on oakwood, 26.3 x 33.4 cm, Städel Museum, Frankfurt am Main, Photo: Städel Museum – ARTOTHEK.

2.3 Author. 2015. Early Renaissance 1450.

2.4 Author. 2015. Early Renaissance 1540.

2.5 Villa Lante, 2010. *Cornell University,* viewed 6 June 2015, <https://courses.cit.cornell.edu/lanar5240/renaissance.html>.

2.6 Padua Botanical Gardens. *King Abdullah International Gardens.* 2011. Barton Willmore International, <http://www.kaig.net/00_index/0A_index.asp>.

2.7 Vaux le Vicomte. Marie-Luise Gothein. 2015. *The Garden Landsape Guide*, <http://www.gardenvisit.com/history_theory/library_online_ebooks/ml_gothein_history_garden_art_design/the_garden_vaux_le_vicomte>.

2.8 Author. 2015. Early Baroque, 1600.

2.9 Author. 2015. High Baroque, 1650.

2.10 Tulloch, R. 2011. Villa Garzoni. *Richard Tulloch's life on the road*, <http://richardtullochwriter.com/2011/07/14/collodi-tuscany-pinocchios-gardens>.

2.11 Belvedere Botanical Garden, *Cornell University*, <http://library24.library.cornell.edu:8280/luna/servlet/detail/BardBar~1~1~3597~100225:-General-plan-of-the-Villa-Aldobran>.

2.12 Author. 2015. Gardenesque & Picturesque 1790.

2.13 Castle Howard. n.d. Hendrik de Cort. Oil on canvas. *My Studios Gallery*, <http://www.mystudios.com/artgallery/H/Hendrik-Frans-de-Cort/View-from-the-North-West-of-Castle-Howard,-Yorkshire,-1800.html>.

2.14 Kew Gardens. 2015. *Wikimedia*, <https://commons.wikimedia.org/wiki/File:PSM_V50_D194_Plan_of_kew_gardens.jpg>.

2.15 Author. 2015. Arts and Crafts, Abstract style. 1900.

2.16. The Wardian Case, n.d. *Jack Wallington,* viewed 21 January 2015, <http://www.jackwallington.com/urban-legends-nathaniel-bagshaw-ward-inventor-of-the-wardian-case>.

2.17 Gardner, G. 2014. The Palm House at Kew, *BDonline,* <http://www.bdonline.co.uk/david-marks-and-julia-barfields-inspiration-palm-house-royal-botanic-gardens-kew/5054120>.

2.18 The Great Stove. 2006. *The Victorian Web,* <http://www.victorianweb.org/victorian/art/architecture/iron/21.html,>.

2.19 Author. 2015. Postmodern style. 1972.

2.20 Author. 2015. Ecological design. 1994.

2.21 Barcelona Botanical Gardens, *Office of Architecture in Barcelona*, <http://wp.ferrater.com/?oab_proyecto=1028&idioma=_en>.

2.22 The Eden Project Plan. 2011. *Cornwall Calling*, <http://www.cornwall-calling.co.uk/eden-project-cornwall.htm>.

2.23 Photos of Eden. 2001. *The Eden Project*, <https://www.edenproject.com>.

2.24 Photos of Eden. 2001. *The Eden Project*, <https://www.edenproject.com>.

Chapter 3

3.1 Author. 2015. Ecology diagram.

3.2 van Aerle. 2011. Eco-cathedral images. *Archi Prix*, <http://www.archiprix.nl/national/index.php?project=3094>.

3.3 van Aerle. 2011. Eco-cathedral images. *Archi Prix*, <http://www.archiprix.nl/national/index.php?project=3094>.

3.4 Author. 2015. Nature confined.

3.5 Raxworthy, J. 2013. Novelty in the Entropic Landscape: Landscape architecture, gardening and change. Ph.D. The University of Queensland.

3.6 Author. 2015. Nature transcending boundaries.

3.7 Raxworthy, J. 2011. *Gardening forms: landscape architecture and gardening in Sven-Ingvar Andersson's garden at Marnas. Journal of Landscape Architecture,* [online] 6(2), pp.6-19, viewed 24 October 2015, <http://www.researchgate.net/publication/271672976_Gardening_forms_landscape_architecture_and_gardening_in_Sven-Ingvar_Anderssons_garden_at_Marnas>.

3.8 Raxworthy, J. 2011. *Gardening forms: landscape architecture and gardening in Sven-Ingvar Andersson's garden at Marnas. Journal of Landscape Architecture,*

© University of Pretoria

[online] 6(2), pp.6-19, viewed 24 October 2015, <http://www.researchgate.net/publication/271672976_Gardening_forms_landscape_architecture_and_gardening_in_Sven-Ingvar_Anderssons_garden_at_Marnas>.

3.9 Heykoop, L. 2015. Andre Citroen garden. *Temporality in Designed Landscapes: the theory and its practice in works of some major landscape designers 1945-2005*. Ph.D. University of Sheffield.

3.10 Heykoop, L. 2015. Andre Citroen garden. T*emporality in Designed Landscapes: the theory and its practice in works of some major landscape designers 1945-2005*. Ph.D. University of Sheffield.

3.11 Archbabigeon. 2014. Bordeaux Botanic Garden plan. Landscapes of the grand Bordeaux. Wordpress, (online) https://paysagesdugrandbordeaux.wordpress.com/2014/09/14/le-jardin-botanique-de-bordeaux/

3.12 Raxworthy, J. 2013. Environmental gallery. Novelty in the Entropic Landscape: Landscape architecture, gardening and change. Ph.D. The University of Queensland.

3.13 Raxworthy, J. 2013. Field of Crops. Novelty in the Entropic Landscape: Landscape architecture, gardening and change. Ph.D. The University of Queensland.

3.14 Reed, P. 2005. Wetland. Groundswell. New York, N.Y.: Museum of Modern Art.

Chapter 4

4.1 Author. 2015. Dance performance vs. landscape.

4.2 Author. 2015. Research methodology diagram.

4.3 18th c dance California Ballet Company's Blog. 2010. *Ballet in the Romantic Era*, viewed 26 October 2015, <https://californiaballet.wordpress.com/2010/06/04/ballet-in-the-romantic-era>.

4.4 Bátki, J. n.d. Bauhaus Ballet, translated from *The Hungarian*. From Between Two Worlds: A Sourcebook of Central European Avant-Gardes, 1910-1930, <http://thecharnelhouse.org/2013/06/02/oskar-schlemmers-bauhaus-costume-parties-1924-1926>.

4.5 Author. 2015. Evolution of dance performance.

4.6 Renmark Dance Academy. 2015. *Technique of Contemporary dance*. Welcome to the Renmark Dance Academy, viewed 23 June 2015, <http://www.renmarkdanceacademy.com/contemporary.htm>.

4.7 Dance Styles and Genres. n.d. *Wikispace*, <https://danceguadagno.wikispaces.com/Dance+Styles+and+Genres>.

4.8 Pulumbari, O. M. 2012. Sensual spectacle, an 'experiment', *Fuerza Bruta*, Inquirer, <http://entertainment.inquirer.net/32773/sensual-spectacle-an-%E2%80%98experiment%E2%80%99>.

4.9 Hager, E. n.d. *Fuerza Bruta*, <http://www.lasplash.com/publish/Entertainment/cat_index_chicago_performances/fuerza_bruta_look_up_review.php>.

4.10 Fuerza Bruta, *Centro Cultural Recoleta*, <http://www.centroculturalrecoleta.org/nuevositio/fuerza-bruta/>.

4.11 Fuerza Bruta, *Centro Cultural Recoleta*, <http://www.centroculturalrecoleta.org/nuevositio/fuerza-bruta/>.

4.12 Greeninc. 2013. Forum Homin, *Landzine*, <http://www.landezine.com/index.php/2013/02/forum-homini-boutique-hotel-by-greeninc/greeninc-forum-homini-2>.

4.13 Greeninc. 2013. Forum Homin, *Landzine*, <http://www.landezine.com/index.php/2013/02/forum-homini-boutique-hotel-by-greeninc/greeninc-forum-homini-plan>.

4.14 - 4.17 Kurtaslan, B.O. & Brzuszek, R. 2013. Crosby Arboretum (Picayune, Mississippi): A Natural World for All, Advances in Landscape Architecture, *Intech*, <http://www.intechopen.com/books/advances-in-landscape-architecture/crosby-arboretum-picayune-mississippi-a-natural-world-for-all>.

4.18 Author. 2015. Audience: Pretoria inhabitants.

Chapter 5

5.1 Author. 2015. NBG site features.

5.2 Author. 2015. Site plan NBG.

5.3 Rainfall in Pretoria.

5.4 Author. 2015. Geology of NBG.

5.5 Author. 2015. Grassland at NBG.

5.6 Author. 2015. Zone analysis NBG.

5.7 Author. 2015. Waterfall at NBG.

5.8 Author. 2015. Wetland at NBG.

5.9 Author. 2015. Ridge routes at NBG.

5.10 Author. 2015. Movement through recreational park.

5.11 Author. 2015. Theme garden plant beds, NBG.

5.12 Author. 2015. Ridge route edging, NBG.

5.13 Author. 2015. Movement analysis NBG.

5.14 Author. 2015. NBG vs. Kisrstenbosch.

5.15 Author. 2015. Existing vegetation mapping.

5.16 Tshwane open space framework 2005

© University of Pretoria

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Chapter 6

6.1 Ebers, G. 1878. *Egypt: Descriptive, Historical, and Picturesque.* Volume 1: 112. Cassell & Company, Limited: New York.<https://upload.wikimedia.org/wikipedia/commons/a/a5/Papyrus_Plant_(1878)_-_TIMEA.jpg>.

6.2 Author. 2015. Design principles.

6.3 Author 2015. Man-landscape relationship.

6.4 Author 2015. Regional design approach.

6.5 Author. 2015. Essence of the Pretoria region.

6.6 Author 2015. Boundary vs. movement diagram.

6.7 Author 2015. Theme garden diagram.

6.8 Author 2015. Picturesque/maintenance diagram.

6.9 Author 2015. Man - plant interaction diagram.

6.10 Author 2015. Theme garden diagram.

Chapter 7

7.1 Author 2015. Site location

7.2 Author 2015. Regional landscape diagram

7.3 Author 2015. Water runoff diagram

7.4 Author 2015. Site use diagram

7.5 Author 2015. Noise pollution diagram

7.6 Author 2015. Water capture diagram

7.7 Author 2015. Movement diagram

7. 8 Author 2015. Sketch Plan

7.9 Author 2015. Gaps for nature to grow

7.10 Author 2015. Erosion wall

7.11 Author 2015. Vertical crevice garden

7.12 Author 2015. Horizontal crevice garden

7.13 Yockey 2007. Montreal Botanical garden - Crevice garden. <http://www.northerngardening.com/public_gardens/montreal/montreal-bot.htm>

7.14 Author 2015. Crevice garden

7.15 Jans, H. 2008. Horizontal crevice garden. <http://www.jansalpines.com/gallery/main.php?g2_itemId=4338>

7.16 Author 2015. Horizontal crevice garden.

7.17 Author 2015. Plant mix

7.18 Author 2015. Movement towards plants rather than past it as a border

7.19 Author 2015. Dry rock wall construction

7.20 Author 2015. Sequential movement diagram.

7.21 Author 2015. Stalok paving for primary routes

7.22 Author 2015. Regional landscape diagram.

Chapter 8

8.1 Author. 2015. Water system diagram.

8.2 Author. 2015. Water catchment on site.

8.3 Author. 2015. Water on site.

8.4 Author 2015. Water fluctuation graph

8.5 Author 2015. Water flow diagram

Chapter 9

9.1 Author. 2015. Dam wall.

9.2 Author. 2015. Temporal eroding wall.

9.3 Author. 2015. Root spectacle.

9.4 Author. 2015. Wetland.

Chapter 10

10.1 Author 2015. Planting strategy.

10.2 Author 2015. Conservation strategy

10.3 Author 2015. Design experiment

10.4 Author 2015. Contour models

10.5 Franklin, M. 2015. Exhibition

© University of Pretoria

Chapter 1

THESES SPECTACLE

An introduction to botanical gardens.

© University of Pretoria

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

1.1 Title: Performance: it's in our nature

A design investigation of a botanic garden in which the use of change is investigated as the medium with which landscape architects generate form in order to highlight the performance of a landscape, drawing inspiration from the principles of another performance art: dance.

1.2 Introduction

The main focus of botanic gardens has always been plants. The history of botanic gardens is a clear representation of how humans have used and valued plants over the centuries (Johnson 2007). In current times, botanic gardens pursue the preservation of tens of thousands of plant species before they become extinct. According to the Botanical Garden Conservation Institute (BGCI) they are becoming key players in both the conservation of plants and in the education of the people who come to see them. It is estimated that as many as two-thirds of the world's plant species "are in danger of extinction in nature during the course of the 21st century, threatened by population growth, deforestation, habitat loss, destructive development, over-consumption of resources, the spread of alien invasive species and agricultural expansion" (BGCI 2000:1).

Botanic gardens are potentially well placed as they tend to be situated in urban areas. There is beauty in the irony that the very thing that is destroying nature is creating the prime opportunity for botanic gardens to:

1 inform and encourage action against the loss of the world's plants species;
2 show the incredible diversity of the plant kingdom locally, nationally and internationally;
3 highlight the interaction of plants in ecosystems, their relationships and how they provide life support functions for a whole range of species, including humans;
4 communicate the importance of plants in our lives economically, culturally and aesthetically.

Botanic gardens are therefore regarded as ideal places to encourage exploration of the relationship between people and nature, and how people experience nature: "by their physical framing of plants, botanic gardens can act as a metaphor for the complex relationships that humanity has with the environment" (Sanders 2007:1213).

In theory, botanic gardens are the places where the most opportunies exist for truly making a difference – be it through science and research or through changing peoples' attitudes and behaviour – in the way society participates in and contributes to the fight against one of the biggest problems internationally: loss of natural resources which are vital to our existence.

Thus, in practice, the design of botanic gardens needs to focus very specifically on the plants themselves and the way that visitors experience the plants. The way in which the plants and the landscape (as representations of natural resources in general) are presented and experienced, is crucial to visitors' interpretation of the message being conveyed, their perception of nature, as well as their response to what they've experienced.

This thesis will explore conceptual and tangible ways to enhance the way visitors experience plants, and landscapes in general, by looking at current theory in landscape architecture and applying it to the design of a specific botanical garden in the South African context. The first chapter introduces the problem, the proposed site, and the focus of the dissertation.

1.3 Problem in context

Landscape design has evolved over the centuries out of man's attitude towards nature as well as the social, economic and environmental conditions during each era. Historically, the design of botanical gardens was also directly linked to this development throughout the ages. The current approach to landscape design comes down to ecological design that is sustainable, where the landscape is used as a tool to "fix" our broken environment. Designs have evolved for the better, reacting to natural processes that influence the landscape and recreating the way nature performs. Although this approach is very viable, there is still this notion of man having control over the way landscapes perform. It is also common in traditional botanical gardens to have this same approach of control over the garden through the way it is designed, limiting the potential performance of nature as well as the potential for people to interact with it. This becomes clear in the way plants are presented to visitors. In a recent study on botanic gardens and their role in society, Dodd and Jones (2010) suggest that the reason for this is that the design of most botanic gardens tends to be very formal, laid out in particular ways with plant beds and glasshouses, being places where active exploration is largely frowned upon. The designers of botanic gardens tend to be more inward looking and "purist" in their way of thinking, with plant collections being so intrinsically important that their purpose is existence only and does not have to be justified through social benefits by using the garden to connect with society, convey a message, or provide an overall experience. The manner in which traditional botanic gardens deal with restoring people's relationships with plants is mostly passive: it is believed that merely bringing people into contact with plants will make them find something special about them, despite the lack of evidence that this approach is viable (Dodd & Jones 2010). A selected few contemporary botanic gardens represent strong values and missions that

© University of Pretoria

are becoming more community focused, enabling science and art to work together in order to enrich the visitor's experience, depicting climate change as a social concern, and conveying an overall desire to make a difference in the world.

In this dissertation the author will strive to investigate the relationship between people and plants, as well as between people and the landscape, within botanical gardens, without limiting the potential of nature to perform in its own unique way. This will be done firstly through looking at current theories in the landscape architectural profession on how to design with change as the medium, and secondly to find inspiration in designing the change and movement of a living entity (nature) and guiding this performance through another performance art: dance.

This should, in turn, challenge the way we interact with nature in botanic gardens in order to restore the interrelationships among plants, animals and humans, and clearly communicate to the audience the fact that nature is alive, flexible and changing. It should also show that nature shouldn't be subjected to full control, and that this flexibility of nature is one of its greatest assets.

1.4 Site location

The study area is situated eight kilometres east of the Central Business District (CBD) of Pretoria and within the City of Tshwane Metropolitan Municipality. The Pretoria National Botanical Gardens (NBG) is the proposed site where the design intent of this dissertation will be tested.

1.5 Problem statement

The Pretoria NBG represents a "purist" traditional approach to botanical garden landscape design, where the emphasis is on plant collections within a recreational park facility rather than on a unified design that focuses on the way the visitor experiences nature and the message conveyed by this experience. The fact that the NBG functions mostly as a recreational park has shifted the focus of the gardens from nature to humans. Although there are plant collections and theme gardens with a variety of plant species on display, these are disconnected from the rest of the garden and focus merely on the existence of these precious, manicured plant collections and ignore the garden's lack of experiential quality. This is a representation of the broken relationship between man and plants. The plants on display are limited to plant beds and do not allow for species to interact with each other intuitively, but are subjected to the control of man. This also largely discourages the interaction of man with nature, a relationship which contemporary botanic gardens strive to rekindle. The main problem that will be focused on in this dissertation is the habit of landscape architects to take control over nature. This control limits the potential of nature to grow intuitively as the living, changing, dynamic entity that it is and to perform in a way that transcends the current design conditions within the Pretoria National Botanical Gardens. This situation will be investigated throughout the dissertation.

1.6 Hypothesis

How can a landscape architect use change as a medium for designing a botanical garden while allowing nature to perform, without limiting the potential of the performer to transcend conditions, and at the same time encouraging human-plant interaction?

By using change as a medium to design a landscape that allows the maximum performance of nature, the botanical garden will be enabled to provide an experience of nature to visitors that will give them an understanding and appreciation of nature and their environment on a level that is not currently existing in the Pretoria NBG. The NBG will be able to engage with ecological design in a way that would give

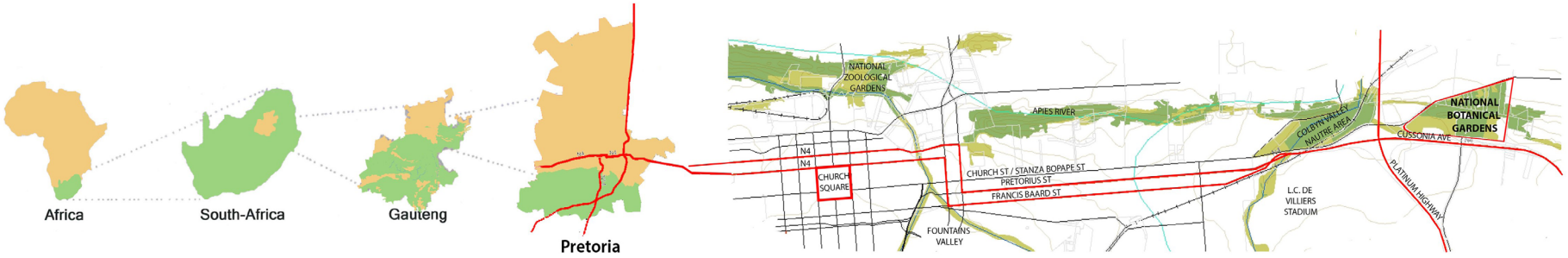


Fig 1.1: Pretoria NBG Site Location (Author 2015)

© University of Pretoria

nature the freedom that it asks for to grow and evolve intuitively, without disguising the fact that it is a designed and constructed landscape. The representation of nature will encourage exploration and invoke a new appreciation for the landscape in visitors, who will be inspired by dance performance. By using dance performance to inform the way we represent nature and guide a living being that cannot be subjected to full control, a design will emerge that allows for change in the landscape. The way this change is presented will excite, educate and engage the visitor in the beauty of the landscape.

1.7 Research questions

- How can change be used as a medium to design landscapes?
- How can performance principles be utilised to inform landscape design in botanical gardens?
- How can the presentation of nature be designed to re-establish the relationship between people and plants?
- How can landscape architects represent nature in a way that does not limit change to predefined shapes on a plan?

1.8 Aims and objectives

The aim with this dissertation is to answer the abovementioned questions and challenge the "purist" as well as some contemporary design principles of botanical gardens in order to:

- Argue that our attitudes towards nature throughout time have led to landscape analogies which influenced the way we design landscapes, and that our current attitude requires a new analogy which we can engage with in the design of nature: landscape as performance.
- Engage with dance performance principles, and especially the relationship between the performance and the audience, as a tool to inform landscape design.
- Engage with dance performance principles to determine how to guide the performance of a performer that can't and should not be subjected to full control.
- Demonstrate the changes that occur in nature through the way we design the landscape by moving away from traditional ways of representation.
- Determine whether the education that themed plant collections in a botanical garden aim for, can occur through experience and encouraged exploration of the garden rather than through the use of information boards.

1.9 Research methodology

1.9.1 Empirical research:

- Analysis of the current conditions in the NBG will be done in terms of its performative qualities and the experience provided for the audience.
- Current site problems, opportunities, brief interviews and client proposals will be used as conductive material.
- Site conditions that reveal elements of the regional landscape will be mapped and will become design informants.

1.9.2 Theoretical research:

Historical overview:

- An analysis of the history of botanic gardens in order to gain an in-depth understanding of what they consist of, how they have developed, and why this study is significant;
- Comparison of the development of landscape architecture with the development of botanic gardens to see if they relate and how;
- An analysis of the evolution of dance performance in order to see if and how it relates to the author's approach to landscape design, and also to see which type of dance can be analysed to inform her on how to design landscapes.

Literature review:

- Theoretical analysis of the norms of and deficiencies in botanical garden design.
- Investigation of landscape architecture theories and principles as a basis for informing spatial quality, the form generation process, and how to design ecologically.
- Analysis of dance performance art and how this could influence landscape design.

Case studies:

- International contemporary botanical gardens
- Local botanical gardens
- Performative landscape designs

1.10 Assumptions and delimitations:

In this dissertation it will not be attempted to redesign the full extent of the botanical garden, but the focus will rather be on an area identified within the NBG that has the most potential for development and exploration of the ideas mentioned above.

© University of Pretoria

Chapter 2

THEORETRICAL DISCOURSE

Evolution of botanic gardens within the landscape architectural discourse.



Landscape

1st Century ---------- **21st Century**



Botanical gardens

1st Century ---------- **21st Century**

Fig 2.1: Timeline diagram (Author 2015)

© University of Pretoria

THE BOTANICAL GARDEN

LANDSCAPE

PRECONCEPTION

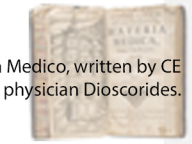
LANDSCAPE STYLE

METAPHOR

PHYSIC GARDENS: Medicinal, simple, scientific, educational focus

AGE OF EMPIRE: WEALTH

1st century



De Materia Medico, written by CE Roman physician Dioscorides.

10th century

Exotic collections were planted in Andalusian experimental gardens.

15th & 16th century

Monasteries had gardens with collections of medicinal herbs. Soon expanded collection to include other plants.

In 1534 the gardens of Pisa and Padua were specifically dedicated to the study of plants.

Late 16th & 17th century

Other gardens with the same intent as Pisa and Padua developed:

Intense rivalry sprung up between gardens to obtain the largest collections from around the world.

18th century

Development of economic botany internationally. Civilized world were now in commercial communication. Ships intercharged both goods and ideas. Apart from ideas in design, plants were now freely circulated. Wealth found in plants.

Royal Botanic Gardens, Kew, established.. Under Sir Joseph Banks it became a centre of botanical exploration and horticultural experiment unparalled before or since.

5th - 15th century: Middle Ages, Europe

Christianity was the driving force.

Garden art was confined either to the cloister garden, small enclosed domestic or castle garden. Man did not wish to project his personality over the landscape, but rather to grow from it and thus be part of it.
Emotional rather than intellectual landscape.

GROW FROM NATURE & BE APART OF IT

15th & 16th century: Renaissance, Italy

The garden was made for man and dignified him.

The proportions gave him peace: the form

GARDEN DIGNIFIED MAN

17th century: Renaissance, France

Garden no longer a mere extension of the house illution of space, give user sense of being in a heroic landscape of the gods.

ALL NATURE SHOULD CONFORM TO DIGNIGY MAN

17th century: Baroque, Italy

Man's relation to the universe as a whole. Theatrical garden designed for unfolding drama. Freedom of choice of site.
Design in perspective to give illusion of space.

MAN'S RELATION TO UNIVERSE, NOT JUST IMMEDIATE ENVIRONMENT

Western classicism

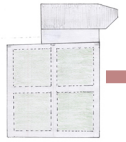
Landscape planning as an extention of parks and town-planning. Man was keenly aware of both the natural and the man-made environment, deriving pleasure from juxtaposing them, setting up tentions between them or resolving them in harmony.

Chinese Shcool

Sought to bring down scale to that of the tree. The idea that a landscape should respond to moods of awe as well as enchantment and pleasure.

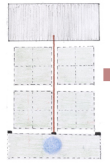
MAN-MADE VS. NATURE

Early Renaissance Style 1450

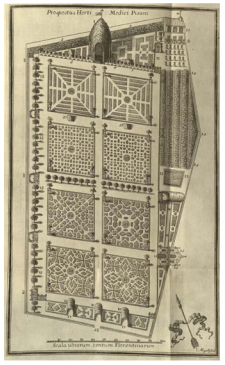


GARDEN AS CARPET

High Renaissance Style 1540

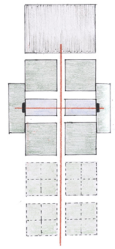


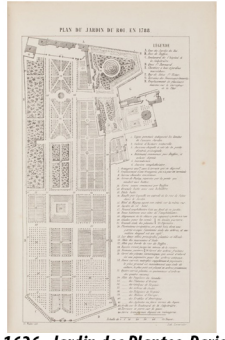
GARDEN AS SUPERNATURAL



1534 - Pisa, Italy

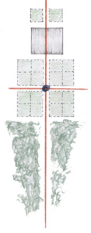
Mannerist Style 1660





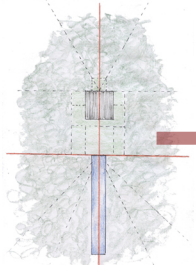
1626 - Jardin des Plantes, Paris

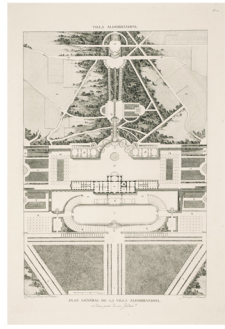
Early Baroque Style 1600



GARDEN AS THEATRE

High Baroque Style 1650





1754 - Belvedere Palace Garden, Alpine Garden and Botanical Garden, Viena

© University of Pretoria

2.1 Introduction

Botanic gardens have always been about plants. But the history of the botanic garden offers a unique window into how humans have used and valued plants in the past several centuries. Looking at how plants were viewed in a moment in history, together with how landscapes were perceived and approached over the centuries, can help us understand the role of botanic gardens and where they are placed within the profession of landscape architecture.

2.2 The evolution landscapes

2.2.1 1st – 15th Century

During the first 15 centuries AD Christianity was the driving force in landscape design. Garden art was confined either to the cloister garden, small enclosed domestic garden or castle garden. Man did not wish to project his personality onto the landscape, but rather to grow from it and thus be part of it. The landscape arts during these ages were intuitive rather than conscious design, with underlying messages of symbolism which had reference to religion. It was the age of emotional rather than intellectual landscape reasoning, which influenced the future in two ways: as an inspiration for the romanticism of the 18th and 19th century and as an aesthetic standard or guide for asymmetrical composition (Jellicoe & Jellicoe 2006).



Fig 2.1: Dioscorides (Materia Medica)

During these ages the first herbal manuscripts were written, most notably De Materia Medica by CE Roman physician Dioscorides (Rogers 2007:12). Several exotic collections were planted in Andalusian experimental gardens, which were typical of that time. Other cultivated gardens, mainly of vegetables and medicinal plants, only existed within the precincts of buildings. During this time physicians and botanists wrote on the medicinal and nutritional value of plants in books such as The Ultimate in Materia Medico and Simple Medicaments and Nutritional Items (Rogers 2007:12). The gardens they created came the closest to botanic gardens during this time. Their design and layout had an approach very similar to most other landscapes during that century, i.e. as enclosed gardens. Garden art was very much their own and they grew from it.

2.2.2 15th & 16th Century

The garden was made for man and dignified him. The proportions gave him peace: the form was crucial. These gardens included box parterres, clipped hedges, the dark cypress and groves of ilex, sculpture, stairways, pergolas and arbours, and water in repose and in fountains.

The landscape design style was of the early Renaissance, which developed more or less during the 1450s from the medieval enclosed castle garden. Gardens were ornamental and mostly used for social gatherings, for discussions and entertaining friends. Forms were mostly square and rectangular and were designed to be viewed from the upper windows of a house to show unity, order and regularity, rather than for entering and experiencing first-hand. These shapes viewed from above can be likened to carpets; Jellicoe and Jellicoe (2006) refer to them as 'garden carpets'.

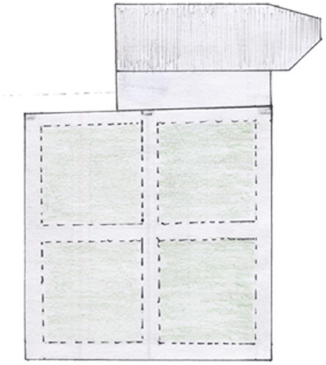


Fig 2.3: Early Renaissance 1450. (Author 2015)

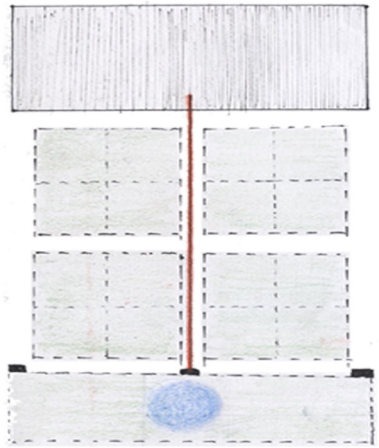
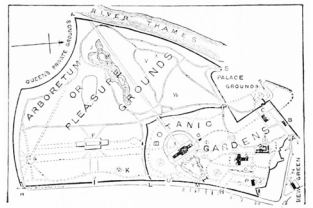


Fig 2.4: Early Renaissance 1540 (Author 2015)

Vignola (1507-1573) lifted landscape design into the sublime at Villa Lante, subordinating it to cosmology. It was quite common in this era for design to refer to astrological, cosmological and religious notions. This can also be seen in the Renaissance botanic gardens of Pisa and Padua that were established in 1534. They were based on geometric arrangements of astrologically resonant forms such as circles, squares and triangles. The intent was to channel the positive energy radiating from the planets and the stars into objects on earth, thereby increasing the healing power of the garden of simples. These cosmological powers influenced the plans of

© University of Pretoria

THE BOTANICAL GARDEN	LANDSCAPE	PRECONCEPTION	LANDSCAPE STYLE	METAPHOR
18th century				
	Romantisism England was the revolt of classicism in landscape. Hard edged to soft. Nature was an equal and friendly partner to man which could provide inexhaustible interest, refreshment and moral upliftment.	***NATURE EQUAL TO MAN***	***Picturesque and Gardenesque 1790***	***GARDEN AS PAINTING***
19th century				
European botanic gardens sent botanists on plant-hunting expeditions. Colonial botanic gardens established as outposts to hold and propagate plants. Numerous famous explorers made exiting discoveries, leading to botanical gardens becoming horticultural showcases, stimulating growth of the nursery industry and the introduction of exotic plants into private gardens. Simultaneous advances in the manufacture of iron and glass, enabling construction of large scale conservatories **1836** 'The Great Stove' constructed. **1844** Palm House at Kew constructed	Mass production of iron, invention of steel and steam-engine, transforming communications and reduced the globe to a measurable size. Contrast between industrial landscape and romantic landscapes. French capital remained the world centre of classicism. Cities layd out in classical planning, becoming semi-military for the control of mob violence, but a romantic park system as an antidote. Collective public park popular, derived from the eighteenth century aristocratic park. The phenomenon of the age was an excessive urge for escape into romance, excited by literature and travel.	***GARDEN USED TO ESCAPE INTO ROMANCE***	***Arts and Crafts ; Abstract Style 1900***	***GARDEN AS FORM OF ART***
20th century	***First half:*** The Human species had roughly doubled in number. Wild life was threatened with extinction. Industrial Revolution left scars on the landscape, cities expanded beyond the size that could be supported. **Europe** - Ecology and constructivism were in opposition. This paralleled the Garden Cities movement, people resolving the relation of architecture to landscape. In **America** landscape design remained detached from Europe. Landscape was transforming into a new way of thought. ***Second half:*** No longer did man fear his environment. Capacity of the earth to sustain life was not unlimited; natural resources must be conserved and not wasted; science of ecology developed.	***MAN NO LONGER FEARS ENVIRONMENT: SUSTAIN BALANCE***	***Postmodern Style 1972***	
Botanical gardens as a place to study the medicinal properties of plants persist in a world where 80% of the population still uses herbal remedies. Ethnobotony became an important branch of botanical gardens, wedding sociology with plant science.				
21st century			***Ecological design: 1994***	***GARDEN AS INSTRUMENT***
Global conservation of endangered plant and ecological niches in which they grow. Educational programmes by botanic gardens to stress the role of plants as primary biological unit upon which all life depends. Propagating endangered plants and re-establishing them in their natural habitat.	Sustainable landscapes that are responsive to the environment, re-generative, and contribute to the development of healthy communities. Sustainable landscapes that sequester carbon, clean the air and water, increase energy efficiency, restore habitats, and create value through significant economic, social and, environmental benefits.	***CONSERVATION OF NATURE***		



1757 - Kew Gardens, London



1820 - Jardin des Plantes, Paris



2005- The Australian Garden, Victoria



1999 - Jardi Botanic de Barcelona

GOLDEN AGE OF BOTANY: INDUSTRIAL REVOLUTION: EXOTIC PLANTS CULTIVATION

CONSERVATION

© University of Pretoria

botanic gardens before the Enlightenment. The religious reference that occurred in botanic gardens was the arrangement of plants collected from the four corners of the earth, intended to indicate the re-gathering of the paradisiacal bounty of Eden that was scattered at the time of the Fall (Rogers 2007:13). Here we can make the analogy that landscapes were seen as supernatural, as opposed to the previous era in which landscapes were seen as carpets.

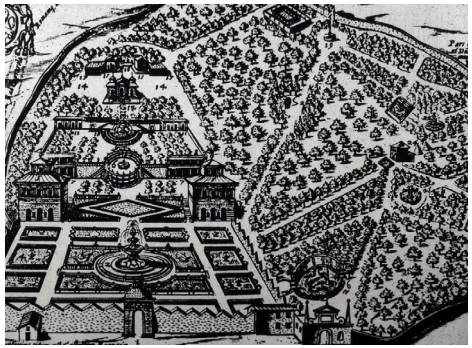


Fig 2.5: Villa Lante 1540 (Cornell University)



Fig 2.6: Padua Botanic Garden 1534 (*King Abdullah International Gardens)*

The rise of physic gardens demonstrates the importance of plants as medicine. Soon collections expanded to include other plants: "in botanic gardens not only medicinal herbs were cultivated but also other plants, especially rare ones for the purpose of observing and admiring nature," as noted by a writer in 1561 (Johnson 2007:67).

André Le Nôtre (1613-1700) revolutionised French garden design: the garden was no longer a mere extension of the house. The use of geometry became solid as opposed to 2D geometry, the organisation of which was based on axiality. The shape of the landscape design was carved out of the woodlands. Baroque designs offered a quality of unity with the sky and the surroundings. The scale expanded as it receded from the house, with sculptures and fountains implemented throughout the garden to create the illusion of space, and to give the user a sense of being in a heroic landscape of the gods. These ideas were based on the principles of the High Renaissance in France, with the general approach to landscape design being that all nature needs to conform to dignify man (Jellicoe & Jellicoe 2006).

2.2.3 17th Century France

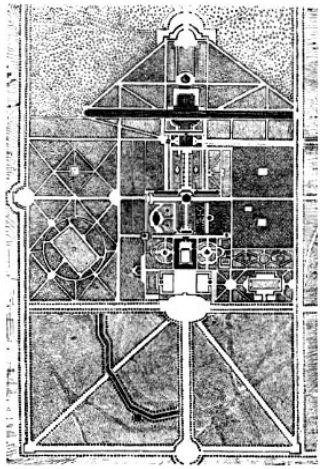


Fig 2.7: Andre Le Notre (Vaux-le-Vicomte 2015)

In Italy, during this same period, the garden started to depict man's relation to the universe as a whole, instead of merely the immediate environment, as seen in the design of Vaux-le-Vicomte, shown in Fig. 1.9. The gardens were designed theatrically and set the stage for the unfolding of drama. There was a freedom of choice when it came to sites, which inspired very original designs. These unique sites determined the axis of the composition of the garden, which led the eye into infinity. Strong compositions were paramount and the details often coarse. Land was used in a lyrical and experimental way that was based on a sense of movement and expansion beyond the finite boundaries that governed space design during the Renaissance. Designs were now done in perspective to give an illusion of space. A

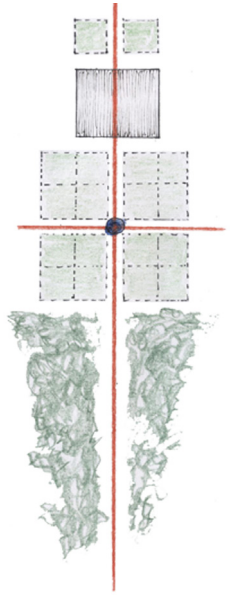


Fig 2.8: Early Baroque, 1600 (Author 2015)

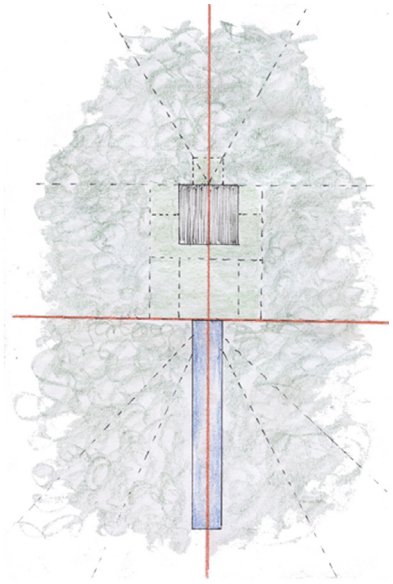


Fig 2.9: High Baroque, 1650 (Author 2015)

few different styles emerged from 17th century Italy, including Mannerism and Baroque. These could be described with the analogy that gardens can be seen as theatres, because of the fact that they were used as gathering places for high society

© University of Pretoria

to admire and participate in the theatricality of the garden. Like a play, the garden was incomplete without an audience.

This type of theatrical design can also be seen at the Villa Garzoni, depicted in Fig. 1.10, and the Belvedere Palace Garden, shown in Fig. 1.11, which were also the first botanical gardens in Vienna. The strong relationship between botanical gardens and landscape architecture, and how these developed over time and influenced each other, together with the existing world views on nature, are clearly demonstrated.



Fig 2.10: Villa Garzoni, Callodi, 1652. (Tulloch 2011)

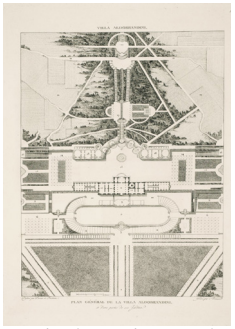


Fig 2.11: Belvedere Palace Garden Alpine garden and Botanical garden, Viena (Cornell University)

Other gardens with the same intent as those of Pisa and Padua developed. Intense rivalry sprung up between garden directors to obtain the largest collections from around the world, yet there was little impetus to create botanic gardens as ordered collections of plants (Johnson 2007:67). At the end of this century, the first mention was made of activities other than medicine as its primary focus: namely of gardens as places of national prestige and personal pleasure.

2.2.4 18th Century The Age of Empire

Three main ideas motivated landscape design:

1 Western classicism: Man-made vs. Nature. Landscape planning as an extension of parks and town-planning. Man was keenly aware of both the natural and the man-made environment, deriving pleasure from juxtaposing them, setting up tensions between them, or resolving them in harmony (Jellicoe & Jellicoe 2006.

2 The Chinese School: it sought to bring down the scale of a design to that of the tree, and was based on the idea that a landscape should respond to moods of awe as well as enchantment and pleasure (Jellicoe & Jellicoe 2006).

3 Romanticism: Nature as equal to man. In England there was the revolt against classicism in landscape in favour of the expression of a totally new and liberal age. The balance of man's subconscious relation to his environment permanently changed from hard-edged to soft. Nature was an equal and friendly partner to man, which could provide inexhaustible interest, refreshment and moral upliftment, as seen in the painting of a typical romantic landscape at Castle Howard (Fig. 1.13). At the end of the century, the English landscape consisted of a sequence of immense green parks set in an agricultural pattern (Jellicoe & Jellicoe 2006).

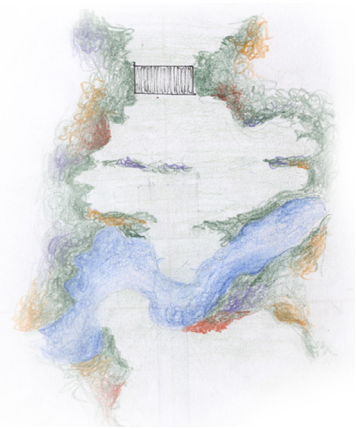


Fig 2.12: Gardenesque & Picturesque 1790 (Author 2015)



Fig 2.13: Picturesque landscacpe: Castle Howard. Hendrik de Cort. Oil on canvas (n.d.)

During this era explorers fostered the development of economic botany internationally. The civilized world was now in commercial communication. Discoveries of sea routes around the Cape of Good Hope in South Africa had opened up trade between Europe and the East, and colonies were lodged everywhere. Ships interchanged both goods and ideas. Apart from ideas in design, plants were now freely circulated, in due time to multiply, mix with indigenous species, and enrich local scenery

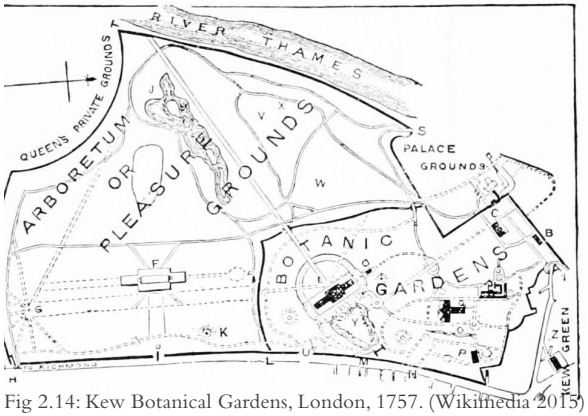


Fig 2.14: Kew Botanical Gardens, London, 1757. (Wikimedia 2015)

© University of Pretoria

beyond the power of their natural distribution to achieve. Wealth was found in the cultivation of sugarcane, tobacco and plant-related dyes. The Dutch discovered coffee, and plantations were established and spread throughout Europe. Within this trading industry, the exchange of economic plants from colony to colony became common (Rogers 2007:14).

In 1772 King George III combined the gardens at Kew with the Palace of Richmond to form the Royal Botanic Gardens, Kew. Under Sir Joseph Banks it became a centre of botanical exploration and horticultural experiment unparalleled before or since (Johnson 2007:70). Thereafter botanic gardens in the Americas, Asia and Africa came to be established. The design of Kew was very much exemplary within that paradigm. The Romantic idea of designing in the picturesque style had a great influence on the design of the garden, and gave rise to the analogy to view gardens as paintings.

2.2.5 19th Century Industrial Revolution - Golden Age of Botany

The Industrial Revolution brought with it the mass production of iron, and the invention of steel and steam-engines, and transformed communications which conveniently reduced the globe to a measurable size. Among other goods, plants from the remotest foreign parts now flowed into England. A contrast existed between the industrial landscape and romantic landscapes, which gave way to a change in the economy from agriculture to manufacture (Jellicoe & Jellicoe 2006).

The design style that came with the machine was created through movements such as Art and Crafts and abstract style, which drew inspiration from the shapes of the abstract arts. The garden became an exercise ground for machinery such as motor mowers, concrete mixers, electric pumps, cultivators, sprays and other gadgets. Although the garden was beginning to be seen as a form of art, the phenomenon of the age was still defined by an excessive urge to escape into romance, excited by literature and travel. The interweaving of the classical and romantic continued. The



Fig 2.15: Arts and Crafts; Abstract style. 1900 (Author 2015)

middle class created suburbs of villas, and sought with their modest gardens not only to emulate the traditional park, but to encompass the infinite variety of plants now available (Jellicoe & Jellicoe 2006).

European botanic gardens, most notably the Royal Botanic Gardens at Kew, sent botanists on plant-hunting expeditions. Colonial botanic gardens were established as outposts to hold and propagate plants destined to be sent back to parent institutions. Numerous famous explorers such as Douglas Fir, Joseph Hooker, William Forsyth and Charles Darwin made exciting discoveries, leading to botanical gardens becoming horticultural showcases, stimulating the growth of the nursery industry and the introduction of exotic plants into private gardens such as in the suburbs of villas mentioned above (Rogers 2007:15).

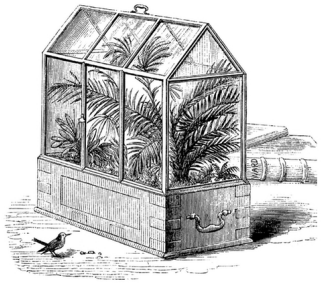


Fig 2.16: The Wardian Case, to transport plants by sea (Wallings n.d.)

Advances in the manufacture of iron and glass enabled the construction of large-scale conservatories with curving sides and glass roofs, which allowed the housing of tropical plants in northern latitudes. In 1836 the Palm House at Kew was constructed. Such architecturally striking structures soon became the centre-pieces of many botanical gardens and parks (especially in America) (Johnson 2007:76). Not long after, in 1844, 'The Great Stove' was constructed, a 20 metre high conservatory at Chatsworth which became the model for Paxton's Crystal Palace in London (Rogers 2007:16). Botanical gardens coincided with the growth of the public parks movement and became places of recreation as well as learning institutions, and their collections began to be arranged and displayed within the picturesque park-like nature, although all of the new botanic gardens that started to become established throughout Europe were mainly pleasure gardens, with few of them having scientific programs (Johnson 2007:76). The redesign of the grounds of botanic gardens stemmed from the urge during this century to escape into romance, although the industrial influence can be seen in their manicured lawns and glass houses. The irony is that the very thing coming from the appalling conditions of the Industrial Revolution became an escape into paradise. Botanic gardens today still aim to be a source of inspiration, wonder and relaxation for visitors.

© University of Pretoria

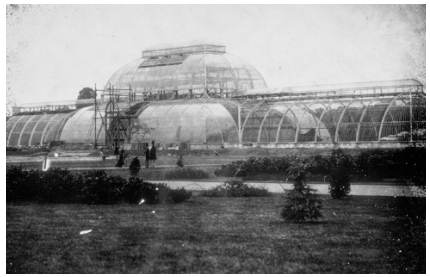


Fig 2.17: Palm House. Kew. 1836 (Gardner 2014)

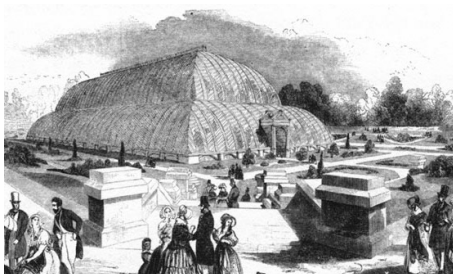


Fig 2.18: The Great Stove. 1844. (The Vicrorian Web 2006)

2.2.6 20th Century Conservation

The Human species roughly doubled in number during the nineteenth century. Wildlife became threatened with extinction. The Industrial Revolution left scars on the landscape, cities expanded beyond a size that could be regionally supported, and the air about them was permanently polluted. In Europe, Patrick Geddes came up with the idea of an ecology that comprehended the arts of civilised life and the sciences. This paralleled the Garden Cities movement, which included the resolution of the relation of architecture to landscape. The profession of landscape architecture was established. Throughout the period, the twin forces of ecology and constructivism were in opposition. Landscape was being transformed by a new way of thinking through a collective movement of landscape architects. During this era the ruling authority changed from monarchy to democracy; the great private garden had passed and became replaced by countless individual gardens and collective parks in a postmodern style.

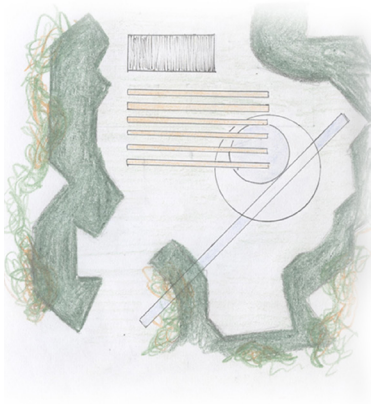


Fig 2.19: Postmodern style. 1972 (Author 2015)

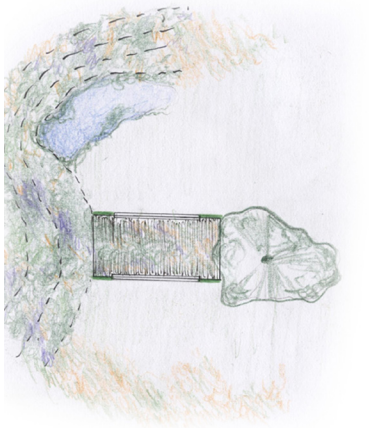


Fig 2.20: Ecological design. 1994 (Author 2015)

By the second half of the century, man no longer feared his environment. The realisation surfaced that the capacity of the earth to sustain life was not unlimited and that natural resources must be conserved and not wasted. The population of a place must be related to the amount of food available in the area. This led to further development of the science of ecology, wherein all biological things were approached in relation to others to sustain a balance.

This knowledge on the subject of ecology gave way to an ecological design approach, which started around roughly 1994. This design approach broke away from the designs of the past centuries, when humans had forced their natural environments to conform to their wants and desires. Now, man seeks to conform to the environment. This includes the incorporation of design into the natural flow of the land as an aesthetic quality, and the use of less energy to control microclimatic conditions and rather allowing design to do so. Sun power is incorporated in design, rather than the excessive use of electricity. The materiality of designs are starting to be considered carefully in order to choose sustainable materials that minimally affect the environment. An active attempt is made to conform the landscaped area to the natural landscape. This is done in several ways, of which the incorporation of indigenous plants into landscape design has become a major part. This approach to landscape design can be defined through the analogy of landscape as tool, and places emphasis on the fact that the landscape is used by man in order to "fix" the broken ecology, the lack of biodiversity, and the polluted environment.

Botanical gardens in the 20th century were at the core of the ecological movement. Botanists estimate that 100 000 plant species around the world, a third of the total known global flora, are threatened with extinction, making plants the most endangered species on the planet. Habitat loss, invasive species, wild collections and climate change are all contributing to this global decline in plant diversity and plant populations (Johnson 2007:77). Conservation work is now the main driver of botanic gardens all around the world, as stated in the Botanic Gardens Conservation International (BGCI) public awareness campaign. The conservation agendas of botanic gardens differ according to the local environment, funding, government support and cultural considerations, amongst other factors. Most botanic gardens do participate in conservation in some way under each of the following topics: environmental education; science and research; and ex situ conservation projects. An example of such a botanical garden is the Barcelona Botanical Garden, as seen in Fig. 1.21, focusing on the conservation and environmental education of the five Mediterranean regions and the plants and communities from those areas of the world (Aixart 2015).

The role of botanic gardens as a place to study the medicinal properties of plants persists in a world where 80% of the population still uses herbal remedies. Ethnobotany has become an important branch of botanical gardens, wedding sociology with plant

© University of Pretoria



Fig 2.21: Barcelona Botanical garden (OAB Architects 1999)

science, and linking to the educational role of botanic gardens that still persists from the early physic gardens, which were in essence 'teaching gardens'. Today the most important message that they focus on passing along to visitors is the importance of plants and the need for their conservation. Other objectives of botanic gardens include the scientific research of plants, such as studying growth patterns and genetic variations of plant species, researching adaptability of introduced plant species, and assessing the economic value of species. Researchers attempt to continue to contribute to our understanding of the world's flora (Johnson 2007:78).

2.2.7 21st Century

In the current era, the movements for the conservation of nature and sustainable landscapes are still the strongest leading influences. Designs are responsive to the environment and re-generative, and can actively contribute to the development of healthy communities. Sustainable landscapes sequester carbon, clean the air and water, increase energy efficiency, restore habitats, and create value through significant economic, social and environmental benefits. The type of projects landscape architects deal with today include those ranging from large-scale sustainable master plans and housing communities to small-scale green streets, wastelands, parking lots, and private yards. Landscape designs aim to be innovative models that outline a path to a sustainable future practice. These designs respond to climate change, urbanisation, population growth and densification, to make future cities liveable, workable and beautiful.

So where does this leave botanical gardens today? As our knowledge of ecology evolves, botanic gardens will continue to be important sources of information about the world's plants, which forms the backbone of our ecosystems. No matter how they have changed over the years, they will always be humanity's main scientific, aesthetic and social link to plants. They serve to educate, to explore, to fascinate and to discover. They will continue to reflect our evolving relationship with plants and the rest of the natural world.

Case Study The Eden Project

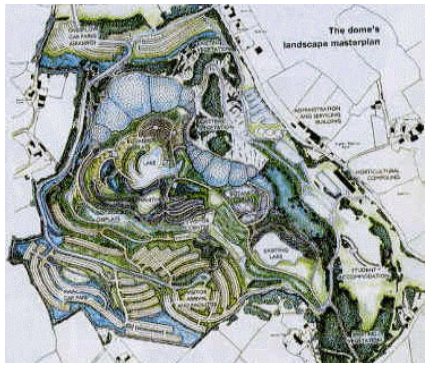


Fig 2.22: Eden project plan (Corbnwall Calling 2001)

The Eden Project is a Millennium project built in a former Cornish clay pit in the south-west of the United Kingdom. Eden's mission is: "To promote the understanding and responsible management of the vital relationship between plants, people and resources leading to a sustainable future for all" (Alistair 2008). Eden's aim is to present, to the widest possible audience, the need for environmental care through celebrating what nature gives to us. Eden's education programme comprises major themes such as energy and climate change, food, nutrition, health and well-being, biodiversity and sustainable use of plants.



Fig 2.23: Eden project perspective (The Eden Prject 2001)



Fig 2.24: Eden project biomes(The Eden Prject 2001)

© University of Pretoria

The Eden Project communicates its story in the "Living Theatre of Plants and People", based in a large crater in which nestle two vast greenhouses (Biomes) (Alistair 2008). The project tells the story of people's dependence on the natural world, and of regeneration and what people can achieve when they work together and with nature.

2.3 Conclusion

After the in-depth study of how landscapes, together with botanical gardens, have developed over the years, a few conclusions can be made:

- Man's relationship with and attitude towards nature has been directly influenced by the world views and the economic, social and environmental conditions that prevailed during certain times.
- This in turn has greatly influenced the way landscape design has been approached and shaped throughout the centuries.
- Stemming from the first two conclusions, man's relationship with, attitude towards and experience of nature can be described with certain analogies demonstrating clearly those parts of nature that were focused on most during each era (this idea will be discussed further in Chapter 4.)
- Botanic garden designs are directly relatable to the landscape design that was popular during each era.
- The main use and focus of botanic gardens are directly relatable to the world views as well as economic, social and environmental conditions prevalent in each era.

It can now safely be assumed that there is a definite role for the landscape architect in the design of botanical gardens. Since there is such a wide variety of uses and approaches to the design of a botanical garden, a contemporary approach will rely greatly on the specific conditions of where it is located and the economic, social and environmental conditions of the community. In order to ensure good design, it is necessary to research theories on landscape architectural designs that are most appropriate for the present era and how (or whether) they can be applied to the design of botanical gardens.

© University of Pretoria

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Chapter 3

THEORETRICAL DISCOURSE

Performative landscapes.

© University of Pretoria

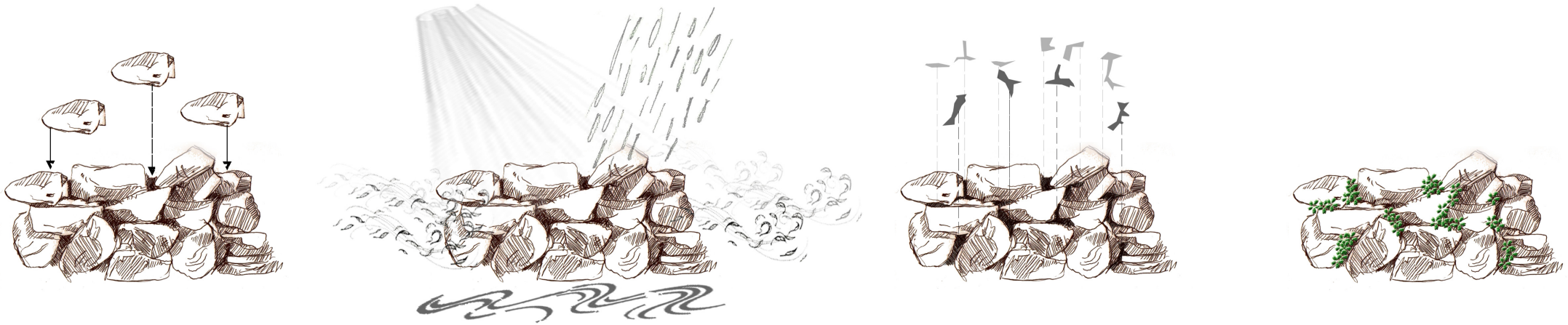


Fig 3.1: Ecology diagram (Author 2015)

© University of Pretoria

3.1 Introduction

A new paradigm within the rethinking and conceptualizing of the field of landscape architecture has started to manifest itself at an increasing rate. These new theories are based on change in landscapes – change being the medium used by landscape architects rather than them simply operating in an environment dictated by change (Raxworthy 2003). Change is a vital part of life. Something that does not change, that is static, is not a living entity.

Life is defined by the HAT dictionary as: "'n Toestand van gedurige verandering en funksionele bedrywigheid kenmerkend vir georganiseerde stof, veral vir daardie deel daarvan wat 'n mens, dier of plant vorm voordat dit dood is" [A state of constant change and functional activity characteristic for organised matter, especially for the part thereof that a human, animal or plant forms before it dies].

In this definition it is clear that, where there is change, there is life. How does change manifest itself within a landscape? What are the factors that influence change? How do we, as landscape architects, work with change as a medium to design landscapes? These are the questions that will be discussed in the following chapter. To get answers to these questions, we need to understand the role of ecology in the decision-making process, as well as the humble profession of gardening and its influence on designing landscapes, to understand change and how this in turn starts to influence forms in landscape design.

3.2 Ecology

Ecology has been at the core of landscape architecture since the 1970s, forming the basis of knowledge on which all decision making, design and otherwise should be based. As Ian McHarg (1995) stated:

"I believe that ecology provides the single indispensible basis for landscape architecture and regional planning ... Where the landscape architect commands ecology he is only the bridge between the natural sciences and the planning and design professions, the proprietor of the most perceptive view of the natural world which science or art has provided."

This quote makes it clear that the profession of landscape architecture is in the ideal position to orchestrate this ecological imperative. McHarg's interest in ecology is literal and aesthetically driven by a romantic nature. How this changes in the reconceptualising of landscape architecture is that the focus is now on the notion of "commanding ecologically" (Raxworthy 2003). Ecology is seen as an interdependent system of the action and reaction between things. This implicates using the relationships between things in order to engage with them. Consequently, landscape architects should use ecology as a tool and define a place for it in the design profession that is closer to systems engineering than to science or art.

This notion of cause and effect that is present in ecology can be more commonly understood as change. Change is important here as it is the form of ecology. The context in which change occurs is defined by Anne Whiston Spirn (1998) as "a place where processes happen, a setting of dynamic relationships not a collection of static states". We cannot ignore context; we need to react to contextual expressions and guide them. Spirn (1998:96) further states that: "Material, form and space are sensed and shaped by processes ... neglecting pertinent processes can lead not only to failure of expression and function, but even to destruction and death." In these terms, change is something that needs to be considered in order for a design project to perform.

In this act of engaging with processes and form, Spirn (1998) notes: "Shaping the context in which landscape is shaped is an act of design."

Case Study The Ecocathedral, Louis le Roy

The Ecokathedraal [Ecocathedral] at Mildam in The Netherlands began when Le Roy arranged for recycled bricks to be dumped on his premises. He started stacking these bricks into a series of piles, without the help of any tools or mechanisms, and merely using human labour and a module. The bricks are laid out similar to a dry brick wall construction, without mortar. The bricks are loose and can move; this aids the process for he is, as Le Roy puts it: "leaving gaps for nature" (Boukema & McIntyre 2002). These gaps allow for silt and soil movement and it creates microclimatic conditions for plants and weeds to start growing spontaneously. This dynamic interaction between human actions, organic growth as a reaction, and the material of the bricks forms the basis of the Ecocathedral process.



Fig 3.2: Ecocathedral, Louis le Roy (van Aerle 2011)



Fig 3.3: Evocathedral: growth over time, Louis le Roy (van Aerle 2011)

© University of Pretoria



Fig 3.4: Nature confined (Author 2015)

© University of Pretoria

The Ecocathedral directly influences the microclimatic conditions of the site by increasing soil water, reducing evaporation and erosion and the drying out of soils. It also increases the types of habitats present for animals, plants and insects to thrive in, leading to an overall increase in biodiversity. After these processes start to take place, it will lead to indirect influences such as organic matter of the plants that improves the soil structure, which in turn leads to the reduction of soil erosion and the conservation of soils (Boukema & McIntyre 2002).

3.3 Forms

Landscape architectural form does not seem to get to grips with the truly complex nature of landscape, making any project seem potentially simplistic. Potentially this is because it has inherited languages from architecture which are based on the design of an object, rather than taking into account that the systems dealt with are unavoidable and much larger than the site itself (Raxworthy 2008:66).

An analysis of the precedent discussed in the previous sub-category shows that form is generated though personal labour and the action and reaction between nature, man and material. It is this interaction with nature, the intuitive way in which the design of the Ecocathedral develops, that is most interesting about this project. Form is generated by observation and reaction to what is observed, rather than by preconceived ideas on a plan that confine and limit nature, preventing it from reaching its true potential.

When designing in an office, there are constraints that might limit the engagement with the productivity of change as form-making device. Forms can be catalytic strategically. Thus this theory is based on designing frameworks that direct and regulate natural processes. These processes then in turn respond by producing new form. The design of a landscape would then be influencing this process of action and reaction. The change and movements that occur over time and influence the shape of the landscape can be guided to a degree so as to create variable spatial qualities to experience (Raxworthy 2008).

Elizabeth Grosz expresses well how time "… disappears into events, processes, movements, things, as the mode of their becoming. And it disappears into our representations, where it is tied to, bound up in, and represented by means of space and spatiality. It suffers a double displacement: from becoming to being, and from temporal to spatial. Time is understood as the neutral "medium" in which matter and life are framed rather than as a dynamic force in their framing" (Grosz 1999:2.

Allowing for change to occur spontaneously requires one to take unpredictability into account. This unpredictability of the reaction to an action is a chance that one will have to take when designing with change. But just because it is unpredictable does not mean one cannot influence the outcome. Each reaction will differ depending on the executed action; thus it all depends on how we react to what nature offers to determine what the outcome of our actions will be. Architects are quite scared of this notion of releasing control to uncontrolled or unintentional transformations. But in landscape architecture there is more potential to engage with this notion due to our main precedent operating in the same way: ecology.

Form comes out of process. This can be seen on a large scale when one looks at the forms of a river system, generated by the processes that play a part in the forming of the river due to the forces of water, gravity, plant growth, etc. But form can also direct process. An example of process directed by form is seen in a intervention done by Gustav Lange in a courtyard in Berlin.

Case Study Gustav Lange, Friedrichshain Courtyards, Berlin, 1995

Lange cut a piece of limestone into a perfect cube, configured in such a way that it showed several of its material qualities on the edge. The cut face of the limestone revealed the changes in texture and pockets forming in the cube. Over time and due to weathering, water and freezing, expanding gaps started to form in the cube. The solid limestone became soil, which eventually supported plant growth. Within two to three years the rock was gone.

Because the limestone was cut in a cube and not left in a natural shape, the form forced specific outcomes to occur related to the processes that influenced it. The fact that it was in the shape of a perfect cube accentuated the process of disintegration. The cube made the transformation visible (Raxworthy 2013).



Fig 3.5: Limestone cube, Gustav Lange, 1995 (Raxworthy 2013)

3.4 Gardening

The Oxford English Dictionary's definition of maintenance is quite contradictory, meaning both "[to] continue, persevere" and "[to] hold (a place, position, possession) against hostility or attack" (Stevenson 2010). The first refers more to the work of a landscape architect when doing a project, where he/she needs to ensure that plant

© University of Pretoria

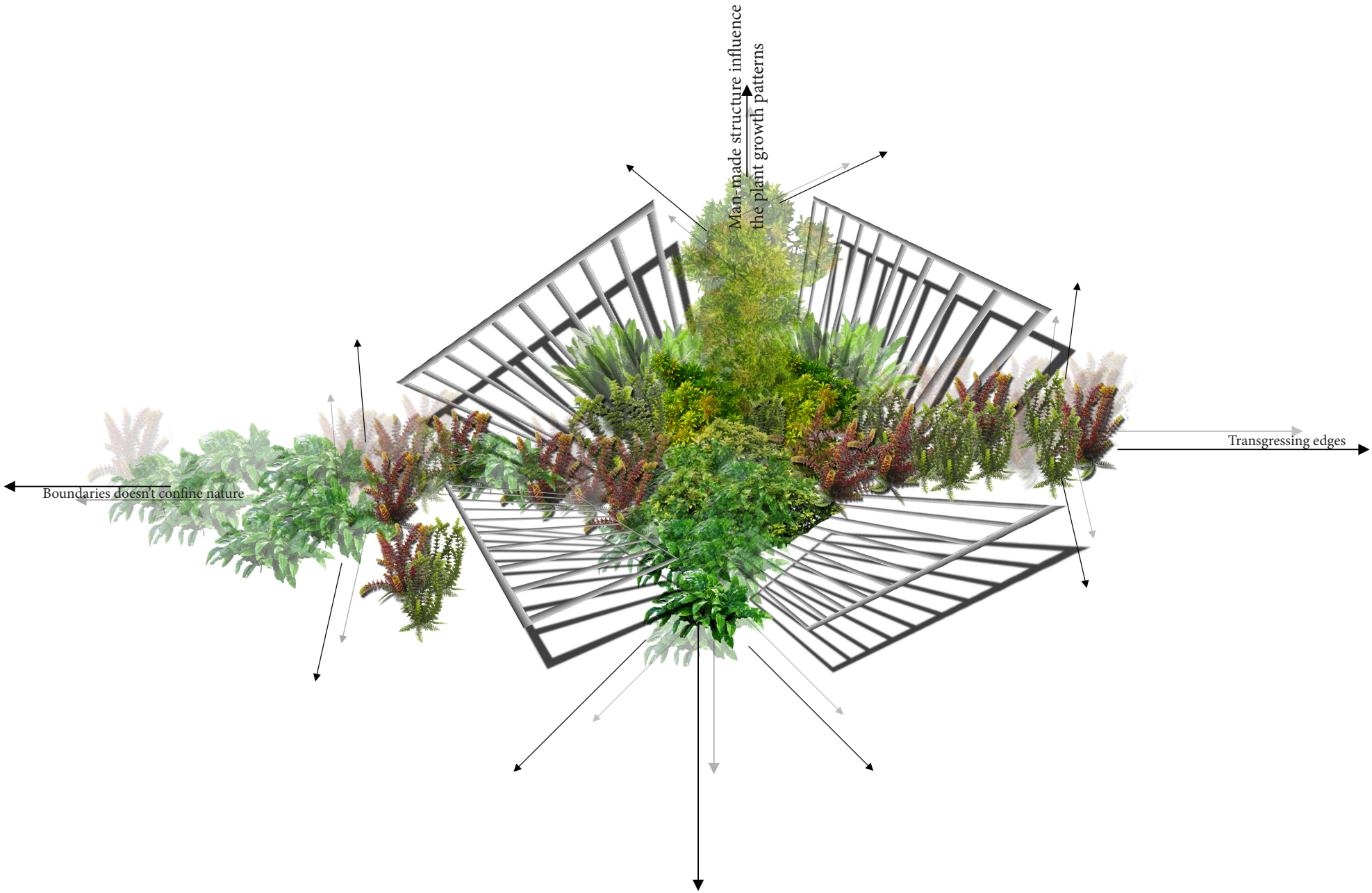


Fig 3.6: Nature transcending boundaries (Author 2015)

© University of Pretoria

growth will continue after construction. The second refers to architecture, where the structure needs to remain unchanged after construction. The Latin phrase from which the word is derived means "[to] hold in one's hand" (Stevenson 2010). Thus this seems like the more dominant definition, which is quite contradictory to the essence of landscape architecture, which thrives in its ability to engage with change. For gardeners, change is something that rewards their efforts and that they can look forward to. Change is the productivity of the garden.

In this act of working with change in landscapes, theorists like Raxworthy and Clément suggest that we need to turn to landscape architectures' poor cousin, gardening (Raxworthy 2003). To truly seize ecology, we need to engage with it in a way different from how it has been utilized conventionally in landscape architecture. We are used to dealing with landscape architecture projects in practice in the same way as we deal with architectural projects. Practise is defined by the Oxford English dictionary as "the habitual doing or carrying out of something; action as opposed to profession." Thus the way we practise landscape architecture is due to habit, and might not be the best possible way to do it. Representation is the tool used to create the link between the profession and practice. If we look at all the other disciplines that landscape architecture draws from, each with its own tensions and contradictions and ways that it is practised, one might be able to propose alternative ways of working for the discipline.

If landscape architects work with ecological systems based on the architectural model, but they are not able to engage with them properly, it is because this model includes a practice that does not enable active exploration within the systems. This is clear when one looks at the representation of a tree on plan as opposed to its change over time and its varying spatial and microclimatic effects. Yet, a creative involvement with the tree would be represented by the gardener that prunes and shapes it into a form according to its recent growth developments (Raxworthy 2003). That would represent the definition of engaging with change rather than a landscape architect in an office, trying to predict the unpredictable and control something that can never be fully controlled.

Furthermore, Spirn (1998) notes that: "As a material, 'change' seems to be vaguely delimited by a potential of a will inherent in the medium, and perhaps engagement with change is characterised by an appreciation of the variables of flexibility within the material designed."

The landscape architect might be able to draw a landscape at any point in time, but it is the reaction of the gardener that makes it ecological and the form specific, as the gardener observes the plant and then the plant reacts to the gardener in return, with its new growth habit. Thus in considering change, the medium of gardens should be in the hands of the humble and amateur pursuits of the gardener, where it is able to wax and wane in a way that the preconceptions of the plan will never allow (Raxworthy 2003).

But now, where does this leave the landscape architect? Spirn (1998) rightfully asked a similar question: "How can we find a balance between planning and flexibility, between stability on the one hand and freedom, growth and individual development on the other?"

Her answer is simple: The resolution of these questions is to "... establish a structure and let the details evolve ... The structure establishes the order: time and circumstance contribute complexity" (Spirn 1998). Thus landscape architects need to move away from confining nature with pre-conceived shapes on a plan. They need to rather focus on establishing a structure, guiding nature and ecological processes, and allowing nature to fill in the blanks. This allows for the appreciation of the variability and flexibility within nature that we so often try to suppress.

Case Study

Sven Ingvar Anderson's Garden at Marnas, Sweden.

Anderson used his own garden to experiment with the idea of form and effect. He planted trees to form rooms in the garden. The different edges of the rooms were planted with exactly the same plants, the only difference being that the one edge was pruned while the other was left natural. Anderson did this in order to see how the plants would interact with one another, compete for light, grow into each other and shade each other. The difference between the pruned and the natural edges becomes clear in the way that they evolve. This is a long-term investment that Anderson has in his garden. A planting plan could not determine what the outcome was going to be. Thus, for Anderson it is not about the prediction of what the plant will turn into, but appreciating the plant as it develops over time. It is not about the initial configuration of the garden, but what comes after that. Anderson is giving the gardener rather than the designer the dominant role in form production, and is anchoring that form in time by the constant or long-term action of the gardener (Raxworthy 2011).



Fig 3.7: Prunned versus natural edges: Garden at Marnas (Raxworthy 2011)

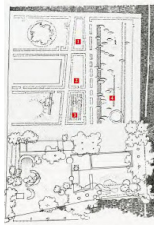


Fig 3.8: Garden plan, Anderson (Raxworthy 2011)

© University of Pretoria

3.4.1 Gardens in Motion

French landscape architect Gilles Clemént has created a similar theory for landscape design, called Gardens in Motion. The inspiration for this idea comes from neglected land that is left behind and becomes an environment where plants start to settle and flourish with unhindered succession. Thus, these plants do not encounter any obstacles whilst growing, struggling, shifting and exchanging. Usually landscapes are being controlled in terms of yielding to geometry, tidiness, or any other cultural principles. It comes down to the gardener whose advantage is to shape the garden without altering its dynamics: thus to do as much as possible for and as little as possible against it. The gardener has to observe and interpret the interactions between elements in the garden, and decide from there what needs to be maintained or shaped and what not. This includes the balance between shadow and light, how species adjust to the conditions, how this adjustment insures an increase in biodiversity, and allowing species to decide where they want to grow (i.e. when a flower starts to grow in a pathway, it must be decided whether to maintain the pathway or the flower), to name a few. Such a state of mind leads the gardener to observe more and garden less, in order to become more closely acquainted with the species and their behaviour in order to make more efficient use of their natural capacities without the input of unnecessary energy and time. Ultimately, as mentioned above by Raxworthy as well, the garden's outcome will be defined by its caretaker, rather than by pre-conceived ideas on a drawing board (Clément n.d.).

3.4.2 Case Study Parc André Citroen, Gilles Clement, Paris

Clément designs by letting go of the designer's almighty control: he designs to allow plants, 'nature' and people to be treated as equal contenders; all are respected participants in his designs, "where man is a visitor amongst other living visitors, plants and animals" (Rocca 2008:42). His work provokes people's involvement in and interpretations of the sophisticated orchestration of his designs and their temporal characteristics.

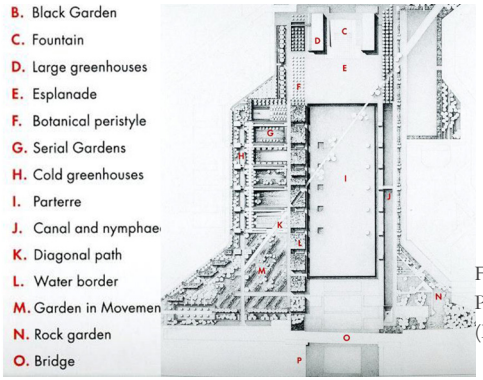


Fig 3.9: Parc André Citroen Plan, Gilles Clement (Heykoop 2015)



Fig 3.10: Parc André Citroen, Gilles Clement (Heykoop 2015)

The Garden in Movement at Parc André Citroen has an open-ended character. It is described by Rocca (2008:44) as the "dynamic management of spontaneous vegetation" leading to an unfinished, unpredictable nature for the garden. This clearly shows the leap taken from a popular fixed maintenance system to one of contingency so that "appearance is determined by chance, to a strict temporality" (Rocca 2008:44). The behaviour of living things in the garden is expected to be unexpected, to follow the spontaneity of the vegetation. The garden changes its configuration from one year to the next, according to people's usage of the spaces. Responsiveness and change is a key aspect of the Garden in Movement.

Rocca (2008:36) quotes Clément:

"The idea is not to create the illusion of nature, as in the Romantic garden, but to take part in a vital flux that is already present and active in that place."

3.5 Case study The Bordeaux Botanic Gardens, Catherine Mosbach

The Bordeaux Botanic Gardens is situated in Bordeaux, a port city in the south-west of France, 200 kms from the Spanish border. It is in the Aquitaine region, and is the capital of the Gironde prefecture, located on the banks of the Garonne River, that leads off the Bay of Biscay. The site for the botanic gardens is located directly adjacent to the Garonne, on the left bank, running perpendicular to the river, in the centre of an urban area. The brief for the project was for a Botanic Garden that exhibited the particular characteristics of the natural and cultural character of the Aquitaine bioregion. Mosbach's response to the brief is effectively a scaled model, or a diorama

© University of Pretoria

of the region. The Bordeaux Botanic Gardens is effectively based around the use of materials that will weather, and during that weathering, provide growing media, and material niches for other species to colonise. and as they weather. (Raxworthy 2013)



Fig 3.11: Bordeaux Botanic Garden plan (Archbabigeon 2014)

5.5.1 Niches:

- Created in the surrounding walls of the garden, and along the paths/ramps.
- Composed of trunks of pine of different sizes that are stacked lengthways and perpendicularly, forming "dry timber walls" with lots of deliberate gaps and without noticeable fixings.
- Gaps or "moulds" are niches: encouraging degradation and colonisation. The wall is regarded as a geological or geographical form, affecting and being affected by the ecological systems.
- Two particular models: the wall as a form interacting with wind; and the wall as plant growth medium. (Raxworthy 2013)

5.5.2 The "Environment Gallery":

- A series of mounds, as elevated simulations of the geomorphological strata and soil profiles of the Aquitane region, are placed in two rows, representing the two banks of the river:
- The five mounds in the north representing the right bank are comprised of clay, gravel and sandstone, with a heath of a moor floristic constitution.
- The six in the south represent the left bank, and are largely different types of sand of a dune character.


Fig 3.12: Environmental gallery (Raxworthy 2013)

- A space for existing landscape processes of the region is established. The form, growth media and propagative mechanisms of the mounds attempt to engage the landscape processes themselves in the implementation process.
- They create conditions for the natural regeneration of the species in the referenced ecologies rather than simply using standard horticultural practices applied to endemic species.
- The mounds are effectively exhibits, objects that interpret the indigenous flora of the region, as well as their foundation – the soil media and the geology.
- The design allows, even encourages, a completeness of degradation and transformation that is outside what might be regarded as allowable change in a landscape design. This scheme establishes conditions for change to occur.
- Vegetation affecting the shape of the mounds is unusual because edging form is generally seen as static, and as constraining vegetation or natural processes. Should vegetation encroach too far over an edge, it normally gets cut back to that edge. By using similar material next to the mounds, the mounds can "move" without seeming out of control. (Raxworthy 2013)



5.5.3 "The Field of Crops":

- Comprised of 49 elevated beds in six rows growing agricultural species from the region.
- Irrigated by flood inundation from the tank – a method that is also used by farmers in the Aquitaine.
- Greenhouses for horticultural purposes.

Fig 3.13: Field of Crops (Raxworthy 2013)

© University of Pretoria

- Species used for agricultural crops all have ethnobotanical uses, and can be eaten, used as cut flowers, or have medicinal uses, and indeed this is encouraged, with information locating species in the matrix provided on signage. (Raxworthy 2013)

New formal language for landscape design:

- Erosion as a formal element in the design.
- Encouragement of interaction between elements to affect form.
- Based not on binary oppositions of growth and control, but on differential periods of transformation and the juxtaposition of one time period with another, and is much closer to the real agency of the natural world where, regardless of what you measure it against, nothing is permanent.
- Brief for landscape architecture: accommodate growth. Rather than resist these forces (of nature, physics, entropy and energy transfer) outright, Mosbach's approach is to work with the productive, form making results of those processes and to influence them to create new forms. (Raxworthy 2013).
-



Fig 3.14: Wetland (Reed 2005)

5 Conclusion

Working with change as a medium for landscape architects to design with, will have a great effect on the way that landscapes are represented in practice. We need to design in a way that does not limit the potential outcome of the landscape. What we design needs to guide the landscape and work with ecological processes, allowing it to flourish, to utilize the freedom it possesses within itself, to transcend what we have put down on paper and reveal itself as the living, changing, flexible entity that it is.

© University of Pretoria

Chapter 4

THEORETICAL DISCOURSE

Performance landscape.

© University of Pretoria



Dance and landscape acrchitectrure are both art forms which are subject to expression, are restricted by gravity and defined by an underlying structure. They share a special relationship in that they both define and use space as main medium for creative interpretation.

Landscape architecture shares a similar creative process with other art forms: the conception of ideas, the development of the ideas, the making of the product and the emotional and intellectual experience the work evokes from the user/observer.

This is not a linear process, there is no definite method.

Fig 4.1: Dance performance vs. landscape (Author 2015)

© University of Pretoria

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

4.1 Introduction

Looking at the theory discussed in the previous chapter, landscape can be recognised as a changing and dynamic entity that develops intuitively and grows where it deems appropriate and satisfactory for its needs. Landscape architects should work with this change as a medium to design landscapes that allow for the variation and expression that comes from within nature itself. The lingering question that is still vague within the profession of landscape architecture is how to guide this change in the landscape without suppressing its unique ability to be flexible. As mentioned, landscape architecture practice stems from a lot of different fields, such as science, art, gardening, etc. Seeing landscape as a performance, something that has become evident from the research, we can now possibly look at another type of performance in order to gain knowledge of how to deal with this living, changing, moving entity called nature.

According to Funk & Wagnalls Standard Dictionary, to perform, means: "To carry out in action; execute; do. To act in accord with the requirements or obligations of; fulfill; as a duty or command." In this context, the performer will be defined as "one who carries out his promise or does his duty" (McMillan et al. 1965:937). When referring to the performance of landscape, this goes against what was discussed in the previous chapter. One can try to command nature to grow, but if the conditions are not right, a very poor performance will inevitably be the result. Thus, landscape architects need to "command ecologically" (McHarg 1967), as stated in Chapter 3, rather than command nature and confine it to predefined borders, limiting its potential. Although nature carries out an action as it has the inherent ability to do, it is the ecological processes that influence the performance of nature.

Where does this leave nature in terms of performance? A further definition by Funk & Wagnalls Standard Dictionary states that performance means: "A representation before spectators; an exhibition of feats (an act or accomplishment of great skill); any entertainment" (McMillan et al. 1965:937). In this definition the meaning of representation would be to "serve as a symbol, expression or designation of; symbolize" (McMillan et al. 1965:1069). Here the main goal of the performer is to entertain an audience through the expression of something. If nature is the performer in this scenario, it would express its inherent skill to change, grow and react to the ecological conditions that are shaping its context. Now, if we see ecology as the thing that we are commanding to perform in a certain way, can we not look at nature as the performance artist that expresses this performance of ecology? The question is though, what type of performance art is appropriate to study for this investigation?

When dealing with theatre, art or environmental tools, as in the analogies in Chapter 2, we are always using the principle of creator versus created. In art, the painter paints a picture to their liking. This picture may give the illusion of life, change and movement, but it remains essentially static. The painter is in control of the outcome. When we use ecology as a tool to fix the broken environment, even though we take into account the natural processes influencing it, we still perceive nature as something that we control and command to do what we intend it to do, disregarding the fact that nature is alive and has a will and personality of its own. Even in theatre, the director is mostly in control of the outcome of the performance through the script and through directing, even though the actor has their own personality, it is still to a degree controlled. But there is one performance art that does not confine itself to the above statement: dance performance. In most performance arts, the separation between the creator and the created is clear: the painter is not the painting itself, the actor is not completely the character being performed, but the dancer IS the dance (Salwa 2014). This is the one performance art where the performer is a unique, changing, dynamic entity that can never be subjected to full control. Every performance is unique and every dancer has their own variations to bring to the performance. It is the same in nature. The thing we are looking to control and design is a living, changing, unique entity that can never be subjected to full control. By looking at dance performance studies, landscape architects can be informed on how to choreograph the movement of this unique, individual, living entity.

Dance performance and landscape architecture are connected in the sense that both define and use space as the medium for creative interpretation. Thus we can explore ideas of choreographing the movement in the landscape in landscape architecture through the ideas of another creative discipline, dance. Although all artistic fields are different in their conventions and mediums, there is a connection between them in the creative process that is followed:

By participating in them, we immerse ourselves in them.

Gardens are not static, they change over the years, decades and seasons, according to rhythms and biological processes regulating annual growth and decay; therefore it is impossible to decide what the finished shape of the garden will be.

Gardens have a conspicuous phenomenal dimension: light, temperature and weather play a role and are part of the garden.

Gardens are to a large extent unpredictable because of the presence of nature and cannot be subjected to full control.

Gardens should be treated as co-creators and not as mediums for human expression.

(Salwa 2014:47)

The above-mentioned facts clearly show the undeniable similarities between landscapes and dance performance. More than anything, they are based on the

© University of Pretoria

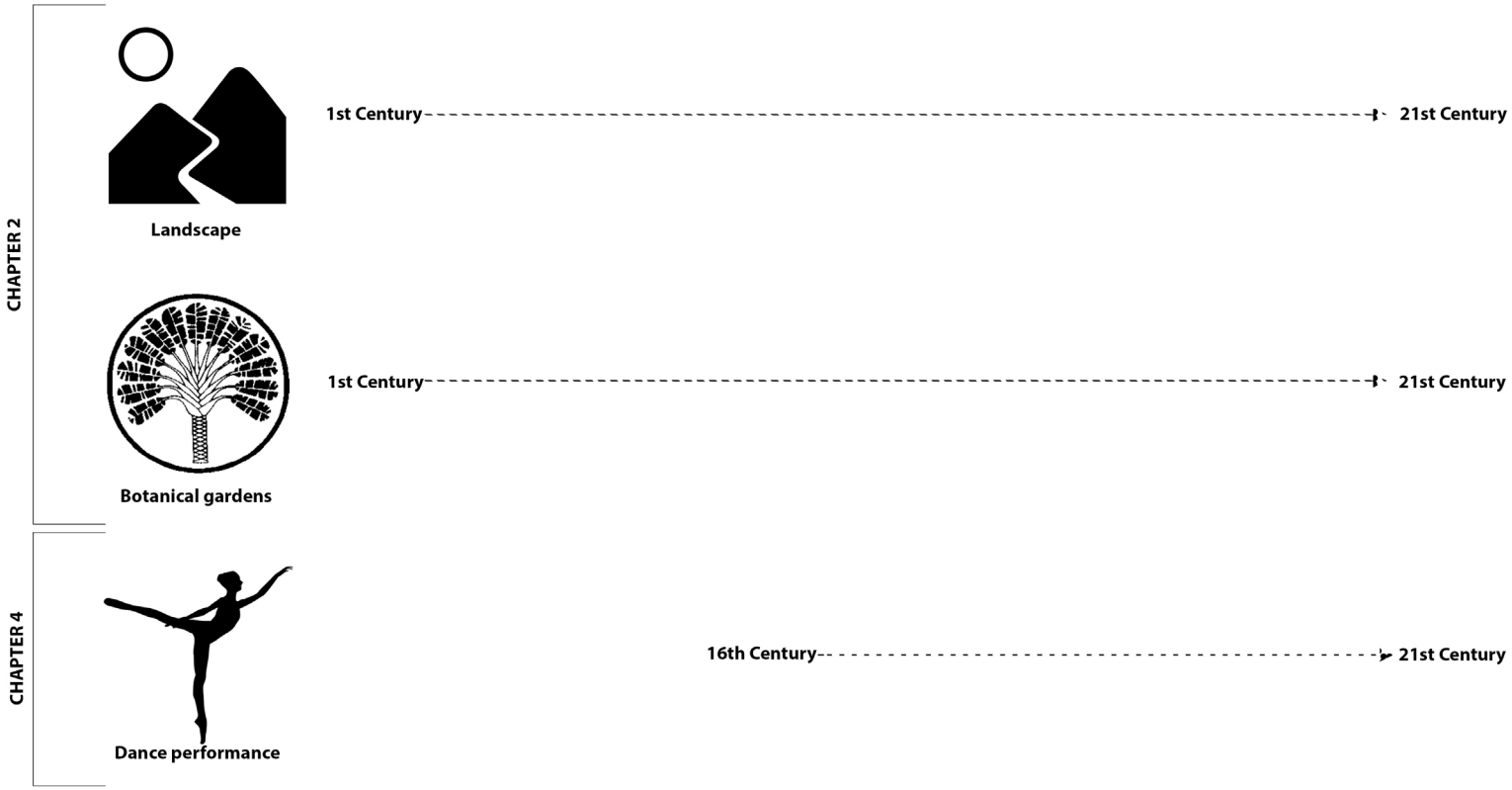


Fig 4.2: Research methodology diagram (Author 2015)

© University of Pretoria

principles of dance and the principles of what landscapes consist of, the essence of what makes dance, dance and what makes a landscape a landscape. But, as the principles of landscape design have evolved over the centuries, as discussed in Chapter 3, dance principles have also evolved along with changing world views, redefining the definition of what a dance performance is in the present. Now, can this new approach to dance performance teach us something about the way that we design landscapes? To answer this question we need to see whether there is a direct relationship between the way dance has developed over the centuries and the world views that influenced the way we designed landscapes. This will confirm the validity of using the analogy of landscape as a dance performance to see how contemporary dance principles can start to influence the way we approach landscape design.

4.2 The Evolution of Performance

Many different forms of dance performance exist, such as ballet, hip-hop, freestyle, etc. This study will focus on the evolution of performance and the formal dance styles originating in Europe, during the same period that landscape design started to develop. When one looks at how landscape design has evolved over time together with world views and the change in paradigms, as mentioned previously in this thesis, one can extend this to see how dance has evolved during the same periods and learn something from what it has become.



Fig 4.3: 19th Century dance (California Ballet company 2010)

4.2.1 18th and 19th centuries: Renaissance to Romanticism

Ballet developed throughout Europe, from a courtly arrangement of moving images used as part of a larger spectacle, to a performance art in its own right, the ballet d'action. This new form swept away much of the artificiality of the court dance and strove towards "the concept that art should aspire to imitate nature" (Laurson 2012:45). This ultimately resulted in costuming and choreography that was much more liberating to the dancer, and conducive to a fuller use of the expressive capacity of the body. The ballet now focused more on the emotions, the fantasy and the spiritual worlds, which heralded the beginning of true pointe-work. Now on her toes, the deified ballerina seemed to magically skim the surface of the stage, an ethereal being never quite touching the ground (Comte 2004:94).

This has a close relation to landscape design during the same period. Landscape design during the Renaissance was based on control over nature in order to dignify man. Similarly, dance during the Renaissance was largely based on formal, courtly dances used to dignify the elite. As a paradigm shift moved into the Romantic era, landscape design changed drastically into the romantic idea of nature, where man was seen to be equal to nature rather than above it. Here again we can relate dance to this world view as it changed into imitating nature and being equal to it, as opposed to the artificial dance of the previous era.

4.2.2 Early 20th century: Modernist



Fig 4.4: Bauhaus ballet in 1920's (Bátki 2002)

It was during the explosion of new thinking and exploration in the early 20th century that dance artists began to appreciate the qualities of the individual, the necessities of ritual and religion, the primitive, the expressive and the emotional (Comte 2004:101). In this atmosphere modern dance underwent an explosion of growth. Suddenly there was a new freedom in what was considered acceptable, what

© University of Pretoria

ERA	LANDSCAPE PARADIGM	METAPHOR	DANCE PARADIGM
18TH & 19TH CENTURY	RENAISSANCE: ALL NATURE SHOULD CONFORM TO DIGNIGY MAN; MAN-MADE VS. NATURE	GARDEN AS SUPERNATURAL; GARDEN AS THEATRE	COURTLY DANCE: LARGE SPECTACLE
	ROMANTICISM: GARDEN USED TO ESCAPE INTO ROMANCE; NATURE EQUAL TO MAN	GARDEN AS PAINTING	BALLET D'ACTION: IMITATE NATURE
20TH CENTURY	ARTS AND CRAFT / ABSTRCT: NATURE TAMED BY MACHINE, INSPIRED BY ABSTRACT ART	GARDEN AS FORM OF ART	CONTEMPORARY DANCE: REVOLUTION IN THE LINE OF THINKING ABOUT WHAT IS CONSIDERED ART.
LATE 20TH - 21ST CENTURY	POSTMODERNISM: MAN NO LONGER FEARS ENVIRONMENT: SUSTAIN BALANCE	GARDEN AS FORM OF ART	POSTMODERNIST DANCE STYLE: SIMPLICITY, UNSOPHISTICATED MOVEMENT, "NO" MANIFESTO (NO COSTUMES, STORIES OR OUTER TRAPPINGS; TECHNIQUE HAS PROGRESSED TO HIGHEST THAN EVER BEFORE IN HISTORY.
	ECOLOGICAL/CONSERVATION ERA: MAN SHOULD CONFORM TO SUSTAIN AND CONSERVE NATURE	GARDEN AS INSTRUMENT	
CURRENT CENTURY PROPOSAL	21st CENTURY: NATURE SHOULD TRANSCEND TO REACH ITS FULL POTENTIAL	GARDEN AS PERFORMANCE	AVANT GARDE DANCE: REBELLIOUS, PUSHING BOUNDARIES, WELL ORGANISED CHAOS.



Fig 4.5: Evolution of dance performance (Author 2015)

© University of Pretoria

was considered art, and what people wanted to create. The 20th century was indeed a period of breaking away from everything that ballet stood for. It was a time of unprecedented creative growth, for dancers and choreographers. It was also a time of shock, surprise and broadening of minds for the public, in terms of their definition of what dance was. It was a revolution in the truest sense (Laurson 2012:45).

This development in dance went hand in hand with architecture and world views, as a time was entered when the machine became a big influence and designs were largely influenced by art, such as in Le Corbusier's works, in a way that was unprecedented at the time.



Fig 4.6: 20th Century dance (Renmark Dance Academy 2015)

4.2.3 The late 20th and early 21st centuries: Post Modernism and Conservation

After the explosion of modern dance in the early 20th century, the 1960s saw the growth of postmodernism. Postmodernism veered towards simplicity, the beauty of small things, the beauty of the untrained body, and unsophisticated movement. The famous "No" manifesto rejecting all costumes, stories and outer trappings in favour of raw and unpolished movement was perhaps the extreme of this wave of thinking. There are glimpses of beauty to be had of much incredible dancing in an age when dance technique progressed further in expertise, strength and flexibility than ever before in history (Comte 2004:105).

A clear link between dance styles and landscape design during this period is the "No" manifesto, as mentioned above. As dance became more raw, concentrating on the purity of the human body and what it has to give to the dance in a most honest way, landscape design was also stripped of excessive design endeavours and went



Fig 4.7: 21th Century Post Modernist dance (Wikispace n.d.)

back to nature in its purity, to focus on what it is that nature wants to be, rather than shaping it into something we want it to be.

As man evolves, he gains knowledge on several subjects. Endless precedents exist on how things have been done throughout the years and we learn from them, keeping some aspects and drastically changing others. In doing so, our technique progresses to new levels never reached before, becoming better and more informed and complex with each passing year. This process can be seen when looking at most things in life. Specific to this dissertation, we can clearly see how dance and landscape architecture have evolved over the years into a state that possesses more knowledge, understanding, skills and creativity than ever before. Thus, can we now turn to performance art principles and learn from them to inform the way we design landscapes? To do this we need to take a detailed look at the principles of contemporary performance art.

4.2.4 21st Century

During the Renaissance nature needed to conform to dignify man. In the 21st century the roles have switched. Now, man should conform to sustain and conserve nature. Design has started to take a turn for the better, working with nature rather than against it (McHarg 1995). The new theory on change in landscapes has taken this relationship with nature to a new level, one which also has many similarities to the present principles of dance performance.

What has performance turned into? The latest development on this line of dance is the Postmodern dance, which started in the late 20th century and is still developing with the passing of time. Thus postmodern dance principles will be discussed in

© University of Pretoria

more detail in the following table to get to the very essence of postmodern dance and the principles it is based on. These principles are then compared to those of landscape design and what these refer to in terms of the analogy of landscape as performance and landscape theory.

In the table above, one can clearly understand the essence of postmodern dance, as well as the essence of landscape design (as proposed in Chapter 3), and how postmodern dance principles can start to influence the way we design landscapes.

	Performance principles: (Naranjo 2015)	**Landscape design principles:**
1	"Anything goes" (time of subjectivism), which means that everything proposed is valid.	Allowing nature to grow where it wants.
2	Any person is a dancer (with or without training), exploration of daily life movement as a sufficient aesthetical experience.	Not using exotic plants to impress audiences, but rather showing the beauty in nature that occurs regionally.
3	Keeping technical virtuosity as basis on which any movement is based.	Basing design on ecological principles in order to create 'technically correct' grounds on which nature can perform.
4	Substitution of aesthetic judgment by observation and analysis (notions of good and bad loose importance).	Not seeing groomed and well maintained landscapes as the only good aesthetic, but seeing the beauty in raw untamed nature.
5	Intention of approaching dance to life and big audiences (dance in the streets, performers that are not dancers…).	Not seeing weeds as bad, but allowing them to establish where they want in order for them to create conditions where other species can start to establish, leading to a higher biodiversity.
6	Identification of social and ideological marks in the body and its movement.	Seeing the individuality and uniqueness of each plant and embracing that difference.
7	Refusal of the pretention of creating a vocabulary, repertory or style.	Refusal to create a pre-conceived plan, narrative or set way of movement.
8	Questioning of the value of the notion of 'author' of an art piece.	Redefining the role of the landscape architect and the way the representation of landscapes is portrayed.
9	Performance: doing something more than representing it. Dancers, actors, musicians and visual artists have the same status within it. Frontiers between artistic genres become undefined.	Not completely allowing nature to be in its original state, such as the Romantic idea of nature, but doing something more than representing it.
10	Importance of improvisation.	The importance of allowing variation in the garden.
11	Exploration of repetition as a compositional method.	Repetition/pattern used to compose spaces in the landscape.

© University of Pretoria

Case Study Fuerza Bruta The call of the wild

A precedent of how postmodern dance has evolved by transcending the norm in the profession of dance performance, as well as whether this approach to dance can influence landscape design in any way, will be discussed in the following paragraphs. A precedent of postmodern dance performance that is ahead of its time, is "Fuerza Bruta: The call of the wild". It encompasses the principles mentioned above, but pushes the boundaries thereof even further. t



Fig 4.8: Fuerza bruta: pool spectacle (Pulumbarit 2012)



Fig 4.9: Fuerza bruta: running man (Hager n.d.)



Fig 4.10: Fuerza bruta (Centro Cultural Recoleta n.d.)



Fig 4.11: Fuerza bruta: interactive audience (Centro Cultural Recoleta n.d.)

- "Visual feast of action, surprise and dance that lead the audience through an interactive world of well organised chaos." Julian Rudd, dance director.
- Exploration of more unusual, abstract and artistic ideas away from the mainstream.
- It is intrigued by a sense of difference and rebellion against what other people are doing and celebrates individuality and uniqueness.
- Aerial, experimental theatre that connects with the most primitive of emotions.
- Spectators are both audience and participants.
- "Fuerza Bruta" has a universal language capable of moving audiences the world over.
- Spectators remain standing, trying to guess where the set will emerge or descend from.
- Unpredictability causes an adrenaline rush that lasts throughout the whole show.

(Pulumbarit 2012)

This performance is focused on movement and the dance itself, but the way it is represented is exciting and unique; it surprises and it interacts; it is unpredictable and captivating. These aspects can definitely play an important role in the way we design landscapes.

There is definitely value in looking at dance principles to help inform the design of landscapes in motion. Some of these principles are already present in the theory of change in landscapes as discussed by Raxworthy, Spirn, Clément and others. Some aspects are however mentioned in the principles of postmodern dance that have not yet been specified, and which can add great value to the expansion of this theory and the outcome of the design. These will be discussed in the following paragraphs.

The German performance theoretician Erika Fischer-Lichte points out that:

"... there are no contemplative spectators, only immersed participants; performances are not stable: every time a performance is performed it is different. They have a strong phenomenal aspect, because of such factors as light, space, and time are decisive for what the audience participates in, this means that they are not merely external or accessory, Performances are multisensory, for they stress bodily interactions and reactions, and this is one of the ways their meanings are produced. What is more, they blur the traditional distinction between author and actor or creator and audience, since all of them co-create and re-create the performance time and again. It is therefore wrong to treat the dancers as vehicles of the author's ideas. As a result, performances are rather unpredictable and have no fixed meaning."

(Salwa 2012, p. 378)

© University of Pretoria

4.3 Extended theory

4.3.1 Principle 2:

Any person is a dancer (with or without training); exploration of movement in daily life as a sufficient aesthetic experience.	Not using exotic plants to impress audiences, but rather showing the beauty in nature that occurs regionally..

This principle states that there is beauty in the norm; thus what we do and see every day can be an aesthetic experience as well, and shouldn't be overlooked. It doesn't have to be foreign or beyond our own capabilities. Thus in landscape terms it can mean that our regional landscape has a beauty to it that should be appreciated. We should be able to enjoy the beauty of our regional landscape since we are more ecologically equipped to reproduce it rather than to create conditions to grow exotic plants. This is a phenomenon that has already started to take root in design all over South Africa, such as at Forum Homini, designed by Green Inc Landscape Architects.



Fig 4.12: Forum Homini (Greeninc 2013)

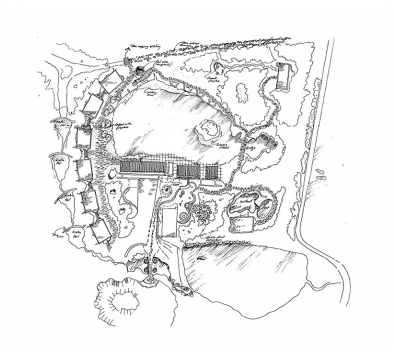


Fig 4.13: Forum Homini Plan (Greeninc 2013)

Regionalism is defined as the "[d]evotion to the interest of one's own region" (Mielcarek 2000:49). Geographic research has confirmed the validity of 'region' as a unifying theme or identity to which local inhabitants relate. This leads to regional pride amongst these locals, which is necessary for the appreciation and understanding of that place. This type of design emphasizes the area's unique, natural features, and the importance of being responsive to the region (Mielcarek 2000:49). Specific to botanical gardens, using regional plants rather than exotic plants can enhance a community's relationship with the local environment. This becomes a crucial resource for researchers as well as inhabitants, as regional plant collections can show people how to manage and treat local landscapes such as scenic recreation areas, neglected urban areas and designed open space. This type of design as well as the change over time is largely based on ecological design.

Case study Crosby Arboretum, Edward L. Blake

The Crosby Arboretum in Picayune, United States, is the premier native plant conservatory of that region. It allows for the study of plants and plant products so that these can be utilized to their best advantage, and also ensures their continuous propagation in the future. Through the Crosby Arboretum, aesthetic, agricultural, scientific and industrial contributions of native plant species and ecosystems can be examined in a real-life setting. The mission of the arboretum is preserving, protecting and displaying plants native to the Pearl River Drainage Basin ecosystem, providing environmental and botanical research opportunities, and offering cultural, scientific, and recreational programs.

The Arboretum was designed to be an evolving landscape that abstracts the natural habitats of plants and animals within the Pearl River Basin. Each exhibit illustrates a combination of past human influences and natural succession that reveals the drama and beauty of the regional flora. The pond, slough, pathways, bridges, landscape features and pavilion weave together into a seamless whole, fortifying each other's presence.

The Schematic Master Plan outlines the following design principles for the Arboretum's Interpretive Center (Pinecote) site development:

1 Displaying habitats as well as flora
2 Creating displays that enhance the character of the native landscape
3 Fostering a sense of place appropriate to the Piney Woods region of Mississippi
4 Interpreting how perceptions of landscape by industry, agriculture and forestry have resulted in changes in landscape appearance and land use patterns
5 Developing a holistic approach to interpreting what we see
6 Encouraging a synthesis to develop between the arts, sciences and humanities
7 Focusing on doing a few things well and emphasizing quality
8 Interpreting the role of fire as a major determinant of landscape form
9 Displaying the arboretum landscape as a process rather than a product

(Kurtaslan & Brzuszek 2013: 356)

The designers enabled the site to "express itself" by introducing periodic fire to maintain the savanna exhibit which displays native plants in the context of regionally occurring native plant communities. At the Arboretum, each exhibit is modelled

© University of Pretoria

after natural habitats found and oriented at appropriate locations. Predominant plant species found in these habitats are then planted among the existing vegetation structure of Pinecote. These "introduced" species are located with scientific accuracy and a designer's eye so that visitors have an opportunity to understand the processes that shape plant communities as well as experience the heightened drama and beauty of the Piney Woods. Pinecote has no irrigation lines or other artificial life support systems, thus the existing site hydrology plays a crucial role in the survival and management of all plant community exhibits.

Gardener William Robinson (1838-1935) was one of the first to abstract nature in garden designs. Within natural environments, Robinson was very sensitive to landscape design characteristics, including vegetation colors, forms, and textures. He advocated studying the spatial composition of a natural landscape in his book The Wild Garden (1870) by observing how the boundaries of a space are contained by the trees and shrubs. Similarly, Anne Whiston Spirn (1998) stipulates that landscape architects play a role in creating the "conspicuous expression and visible interpretation" of landscape, and that the use of artistic interpretation plays an important role. Whiston Spirn (1998) states that "the current understanding of nature and culture as comprising interwoven processes that exhibit a complex, underlying order which holds across vast scales of space and time, not only demands a new aesthetic, new forms, and new modes of design, construction, and cultivation, but also prompts a fresh appreciation for the forms of the past and the processes by which they were created."

Water exhibits can also be found in the Crosby Arboretum. For ecosystems that feature riparian or wetland systems, water is an important element in the interpretation of ecological design. Its surface, colour, form, reflectiveness and movement are landscape elements in terms of bio-physical perspectives. It creates a sense of a place. For developing relationships of people with water, every form of land use must be based upon a clear understanding of the ??relationships with the water within the physical characteristics unique to each place.

4.3.2 Principle 11

Exploration of repetition as a compositional method.	Repetition/pattern used to compose spaces in the landscape.

Patterns are found in nature across all scales. Patterns represent a way for man to find order in the chaos that is nature. As M'Closkey (2013) explains, "... pattern is the structure of nature without looking like 'nature', that is, without looking like the scenic view of nature that many expect of our landscapes."



Fig 4.16: Crosby arboretum: Gum pond exhibit (Kurtaslan & Brzuszek 2013)



Fig 4.17:Crosby arboretum: annual burning (Kurtaslan & Brzuszek 2013)

© University of Pretoria

According to M'Closkey (2013), the reason why the use of pattern in landscape architecture as a design strategy is frowned upon comes down to the following arguments:

1 Pattern is associated with uniform geometries and flat surfaces. Because of this, patterns are considered excessively visual and pictorial (that is, superficial).

2 A pattern involves repetition, and repetition implies monotony.

3 Some patterns are easily generated, thus lending themselves to uncritical adoption (cut and paste).

4 Applied geometrical patterns are autonomous; their logic is accounted for in and of themselves, which goes against the notion of 'site-specificity'.

5 Patterns are static. They are too controlling and suppress the mutable material of landscape. Therefore they do not represent our current understanding of nature as dynamic and prone to fluctuation and disturbance.

Looking at this head-on explanation of why patterns should not be a design generator, it becomes questionable how the author can even consider to look at patterns in a design strategy that aims to be the opposite of what is described above. The design needs to react to the dynamics of nature, it needs to break away from the picturesque landscape, it needs to have complexity, and it needs to take ecological factors into account. So why turn to repetition and pattern?

Pattern needs to be understood more broadly as a technique for creating order, rhythm, frequency and cadence. It is the technique of repetition, rather than any particular geometry, that characterizes pattern (M'Closkey 2013). This idea goes back to the design principles of Simonds, who stated that space modulation consists of a sequence of transitions from one space to another. If sequence is marked with the rhythmic recurrence of one or more spatial qualities – size, shape, colour, lighting – a cadence soon becomes evident, which can have a considerable emotional impact on the moving observer – cadence being a rhythm, tempo, beat or pulse (Simonds 1983).

This repetition, the patterns in the landscape, can be more than surface deep, and they do not necessary have to be static. Some patterns act as a recording of the changes in environmental conditions by being intermittent and appearing only under particular circumstances. "The pattern can offer a framework that is layered with information and draws attention to functions that a landscape assists with such as water absorption and capture, without forsaking formal and perceptual coherency" (M'Closkey 2013). They can be implemented to reveal the processes that have created them, as natural patterns do. By revealing these processes in the form of patterns and repetition, we do not try to conceal the fact that the landscape is constructed. Instead of distilling nature, we should rather celebrate our technical ability to reproduce nature. This technique of revelation with patterns can also make a process legible whilst allowing for a high level of diversity. Introducing patterns onto a site, instead of merely mapping what is existing, allows for the natural systems to expand into an organized form.

These patterns can be used to convey different rhythms and manifestations in the landscape such as: lighting (daily), blooming (seasonally) and watering (intermittent and stratified) (M'Closkey 2013).

M'Closkey (2013) concludes in rightfully stating that: "Patterns, as diagrams of process, carry the potential to bind together oppositional categories that still seem to plague discussions in landscape architecture — system versus composition, representation versus performance, matter versus symbol, vision (distance) versus immersion (multi-sensory)." The design approach of this thesis project will attempt to make the presence of processes known as ordering systems in landscape design which, according to Walker (1997), are necessary in order for them to be expressive. For man to design with nature, he needs not to camouflage the fact that it is man-made, and that it has been remade to support new uses and habitats. We can be creative in the way that we deal with sites in order for them to function the way we intend them to, by guiding flows, growth and energy in overt displays of patterns so as to reveal our understanding of landscapes today.

4.4 Landscape as Performance

After a more in-depth study of the evolution of dance, one can clearly see the relationship that exists between dance performance and the world views of each particular paradigm. This makes it relevant to look at postmodern dance principles to inform the way we design landscapes.

The aim of looking at dance performance as a means to design is to suggest a different way in which to view landscape. Thus, to move away from previous analogies such as landscape as theatre, painting or tool, as mentioned in Chapter 2, we should be viewing it for what it is and what has become clear when looking at the theory regarding change in landscape – which is landscape as performance, drawing inspiration from another type of performance: dance.

In this analogy the different parties involved can be defined as follows:

- Performance: Includes creators, performers and an audience (as opposed to art, having only creator and beholder).
- Creator/choreographer: Landscape Architect (not the creator of the garden itself but of its project or plan).

© University of Pretoria

- Performers: Natural elements; dancers acting in the way intended by the designer but still remaining autonomous in the sense that the principle of their activity is hidden in them and that the designer has to refer to it.
- Audience: Visitors, being the co-creators of the garden in the same sense in which an audience co-creates the performance, for example, by their reactions and interpretations.

Through using analogies in landscape architecture, such as garden as painting or garden as theatre, we grasp some aspects of gardens which would otherwise remain unnoticed. We are given an informative comparison which suppresses other aspects that then seem to be quite irrelevant (Salwa 2014:50). An example would be garden as painting, focusing one's attention on the visual, a perfect picture of nature, manicured to a desired image and framed. This analogy focuses on the visual, what is seen constantly, the vistas, and keeping up this picture throughout the years. Comparing gardens to architecture gives one the idea that gardens are places to inhabit. Gardens as poems would suggest that we try to decode their hidden meanings. Opposed to these analogies, this author suggests that a garden can be perceived as performance, meaning nature as a living, changing thing that exists in context to its surroundings and responds to and develops out of the ecological processes taking place around it. Now, comparing gardens to performances follows in the footsteps of older perspectives, but changes the point of reference. The task of the metaphor is to allow one to better come to terms with the essence of the garden.

4.5 Conclusion

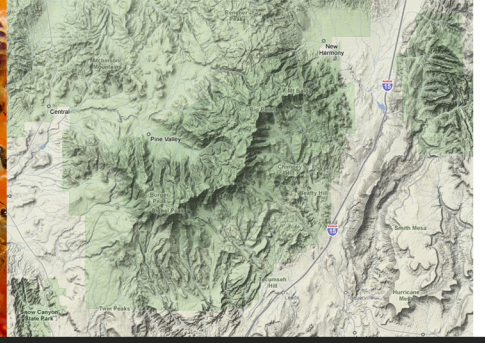
Out of the research methodology that was followed, it is clear that a lot can be learned from the performance arts in order to guide the performance of the landscape. These ideas have manifested themselves in the works and writings of several landscape architectural geniuses, and have merely been compacted into an easily understandable analogy and evolved further in order to get to a design approach. These manifestations will be compacted into a design manifesto in order to clearly state what it is that will be taken from the research and allowed to influence the design approach of this dissertation.

© University of Pretoria

A shift to a new paradigm has offered a creative opportunity to recover landscape as a primary focus of cultural production, and the patterns of landscape architecture that have emerged over the past two decades.

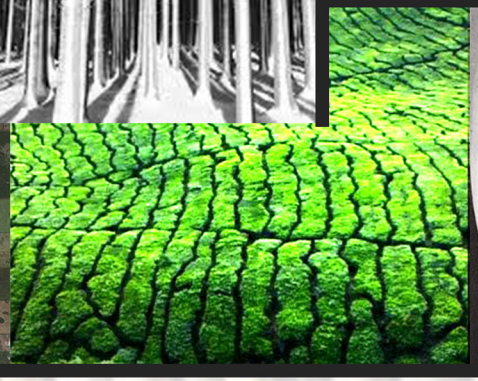






Beneath patterns lies the process that c
There is a complex interdependancy be

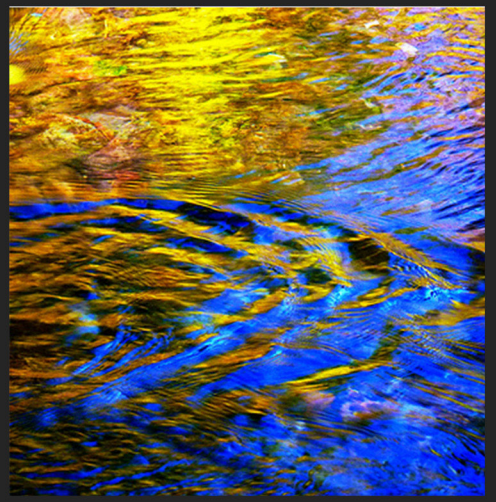






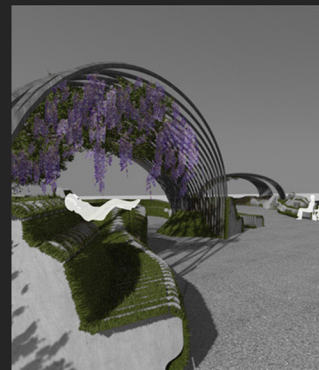
Conciously or unconciously we seek order out of chaos.

We tend to look for patterns which seem to make sense out of the knowledge that we have about our world, whilst being aesthetically satisfied by the relationship of each part of a whole.



Duisburg-N
combination of
light a



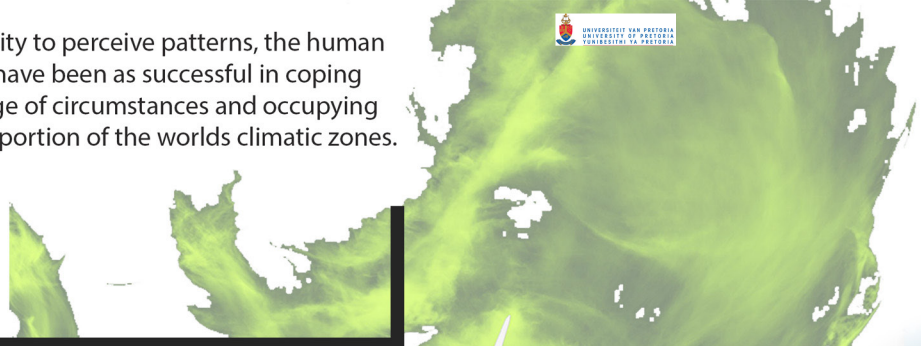


The refocus on process highlights the phenomenomlogical and performative role of landscape, and a contemporary reclaiming of site creates palimpsest-like patterns in which earlier site histories are excavated, reinvented and reinscribed.

© University of Pretoria

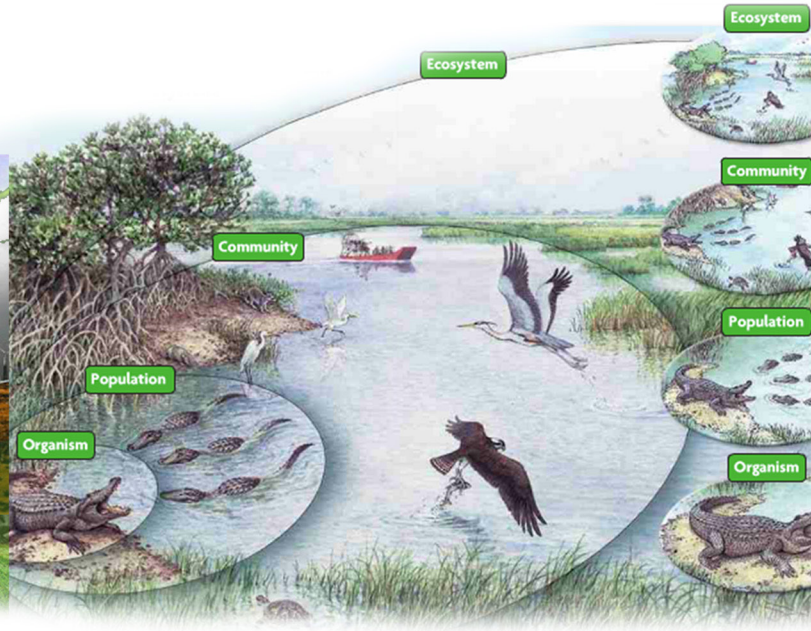
eated them.
ween processes.

Without the ability to perceive patterns, the human race would not have been as successful in coping with a wide range of circumstances and occupying a significant proportion of the worlds climatic zones.



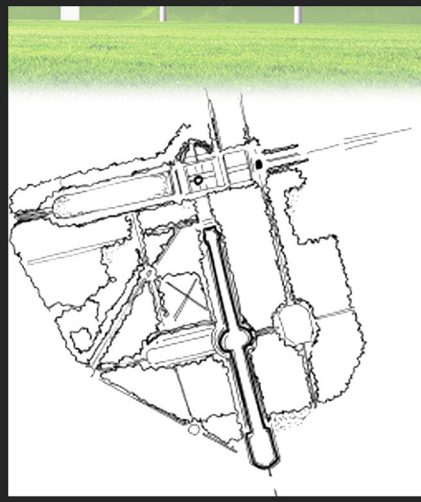


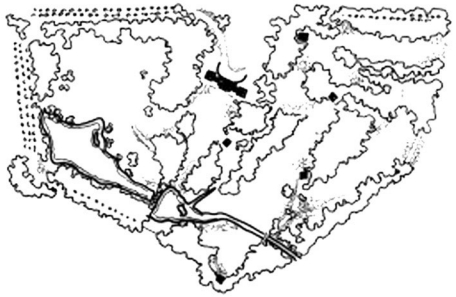


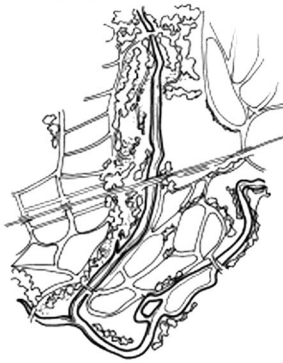


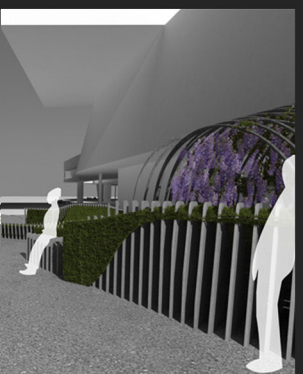
ord at night showing the
elict industrial geometry,
nd organic regeneration.















The Renaissance palace gardens of André Le Nôtre are notable for the way they explored the infinite potential of the Cartesian grid, extending conceptually and literally to the horizon and beyond. In these landscapes, the technologies of surveying and perspective are combined with advanced hydraulics to create a vast stage for the display of 'natural' and political order.

Fig 4.18: Pattern language collage (Author 2015)

© University of Pretoria

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

© University of Pretoria

Chapter 5

SITE SELECTION

The Pretoria Botanical Gardens.

© University of Pretoria

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA



Fig 5.1: NBG site features (Author 2015)

© University of Pretoria

5.1 Introduction

Stemming from the research in the theoretical discourse, a site had to be chosen where the design approach based on the author's Landscape Architecture Manifesto could be applied. The Pretoria National Botanical Garden was chosen for this purpose. In this chapter, the chosen site will be analyzed according to the design principles that apply to landscape performance to see whether the site is performing, where it fits in according to the development of botanical gardens over the centuries, and how this designer needs to approach it to increase its performative abilities and bring it up to the standard of contemporary best practice in botanical gardens. Local and international botanical gardens will be discussed to assist in this analysis.

5.2 Brief history

The Pretoria National Botanical Garden is located in the eastern suburbs of South Africa's administrative capital, the City of Tshwane. The Garden has delivered nearly six decades of conservation, research, exploration, development and service to the greater Pretoria community. Although formal approval was granted by the University of Pretoria for the development of the area as a botanical garden in 1946, the Garden was only officially opened by the Minister of Agriculture, Mr P.K. le Roux, in 1958. Before it's proclamation, the Garden formed part of the University of Pretoria's Experimental Farm. The main reason for the transfer of land from the University of Pretoria was that the land had been found to be unsuitable for experimental agricultural purposes, owing partly to its isolation and also to the presence of an abundance of Poison Leaf (Gifblaar; Dichapetalum cymosum), a plant which is poisonous to livestock and can form extensive colonies in grasslands, particularly in sandy soils (Dyer 1960:11).

The first trees were planted in the Garden in 1946. Up until 1989 the Garden was managed by the Department of Agriculture's Botanical Research Institute (BRI), which was established in 1903. Construction of the National Herbarium building was started in 1970, and it was formally opened in 1973 as the new head office building for the BRI. During 1989, with the formation of the parastatal National Botanical Institute (NBI) through the amalgamation of the BRI with the National Botanic Gardens of South Africa, the Garden joined the other seven national botanical gardens as part of South Africa's network of eight national botanical gardens, managed by a single institution. In the mid-2000s, the Garden became the Head Office of the South African National Biodiversity Institute (SANBI), after the proclamation of the National Environmental Management: Biodiversity Act (NEMBA) in September 2004.

5.3 Pretoria Garden declared a national monument

On 25 October 1979 the Pretoria National Botanical Garden was declared a National Monument. Although the Government Gazette cites the scientific interest of the Garden as "containing one of the most important and comprehensive collections of indigenous flora in the country", correspondence between various parties indicates the primary reason for the site to be declared was to prevent the further alienation of land for road building (the N1 Freeway) and the erection of other government buildings. With the proclamation of the National Heritage Resources Act (NHRA), No. 25 of 1999, all National Monuments became Provincial Heritage Sites reporting to the Provincial Heritage Resources Authority (PHRA) under the South African Heritage Resources Agency (SAHRA).

5.4 The Garden's animal biodiversity

Since the formation of the SANBI, the Garden has been active in documenting and exploring the biodiversity riches within its boundaries. Several biodiversity surveys have been conducted, including an insect diversity survey and preliminary survey of butterflies.

5.5 International agenda

In 2003 the Pretoria Garden committed itself to implementing the International Agenda for Botanic Gardens in Conservation, an international initiative led by Botanic Gardens Conservation International (BGCI) and linked to the Global Strategy for Plant Conservation. By the end of 2005, five years since its development, 443 organisations in 82 countries, including the SANBI, had registered their commitment to use the International Agenda as a framework for developing institutional policies and programs for plant conservation. The Pretoria Garden plays an important role in conserving one of the last remaining patches of natural grassland in the eastern suburbs of Pretoria, as well as providing a natural corridor for animal movement along the Silverton Ridge.

5.6 Botanic Garden Conservation International (BGCI)

BGCI
Plants for the Planet

The goal of BGCI is to re-evaluate the philosophies, values and practices of botanical gardens in order to create social and environmental awareness and change. It highlights the importance of understanding plant diversity and the need for conservation. It focuses on unlocking the potential of botanical

© University of Pretoria

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA



Fig 5.2: Site plan NBG (Author 2015)

© University of Pretoria

gardens to help educate and reconnect local communities with the world of plants, as well as showcase models for sustainable living (BGCI).

5.7 Site analysis

5.7.1 Area, climate and seasonal variation

The 76 ha garden incorporates part of the Silverton Ridge, and receives rainfall mostly during the summer months, from November to March. Most of the rainfall is associated with summer thunderstorms. Of the total area of the garden, an area of 43 ha is regarded as landscaped, with the remaining 33 ha being either natural or low-maintenance areas.

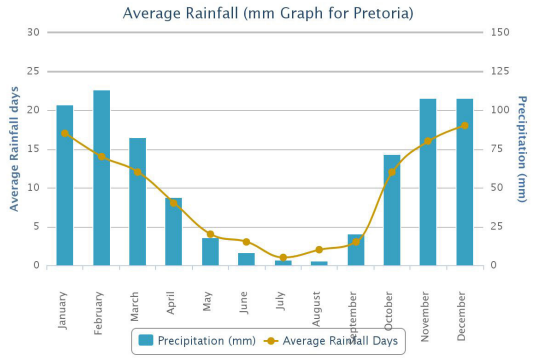


Fig 5.3: Rainfall in Pretoria

Situated on the highveld, the garden experiences frost in winter, particularly visible in the early mornings on the lawns on the southern side of the garden. Black frost does occur infrequently in the garden, usually about once every few years during the winter months.

Similar to other botanical gardens situated on the highveld, namely the Walter Sisulu and Free State National Botanical Gardens, seasonal changes are quite noticeable in the garden. In winter the grass turns brown, with colour being added to the garden by various species of flowering aloes and other succulents, such as Cotyledon orbiculata with its drooping red flowers. During spring/summer the garden becomes transformed with new spring growth and the first summer rains seem to turn it into a green oasis.

5.7.2 Altitudinal/topographical variation, rainfall and geology

The garden is situated at an altitude of 1,350 m above sea level (with the highest point recorded at 1,385 m), and receives on average 750 mm rainfall per annum.

A 35 m high east-west running quartzitic sandstone ridge divides the garden into a cooler southern and warmer northern section. The ridge forms part of the Daspoort range (separated from the Magaliesberg range by the shales of the Silverton Formation) that extends from Botswana in the west to Delmas (Mpumalanga) in the east. Most of the natural areas are restricted to the ridge, which comprises relatively hard quartzitic sandstone of the Daspoort Formation (deposited some 2,200 million years ago), and the natural grassland areas south-east of the ridge. Areas north and south of the central ridge are relatively flat.

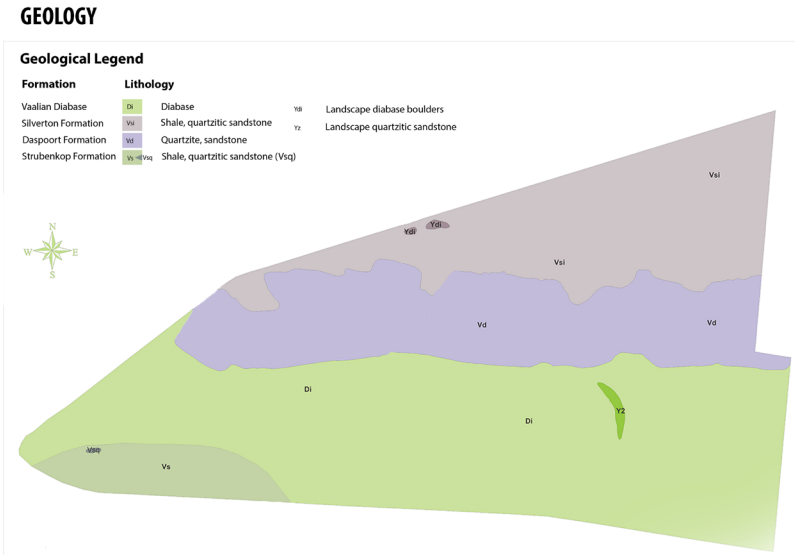


Fig 5.4: Geology of NBG (Author 2015)

5.7.3 Fauna and flora



Fig 5.5: Grassland at NBG (Author 2015)

The garden comprises various different habitats. These include the ridge, natural grasslands, a landscaped section and the savanna area north of the ridge. Almost 200 bird species have been recorded in the garden, each associated with a variety of different habitats in the garden.

© University of Pretoria

SILVERTON RIDGE: Bankenveld vegetation
Discription: (-+) 40% slope
Conservation of natural ridge vegetation
Botanical use: Scientific: Herbarium & Biodiversity Centre
Ecological: Conservation
Economic: Research
Users experience: Recreation: Exploring/walking trails
Didactic: Plant collections

Description: (-+) 3.9% slope
Lawn with scattered trees
Empty pond
Borders wetland and restaurant
Undeveloped
Underused area
Users experience: Didactic: Tree route/Wetlands
Recreation: Picnic/Restaurant
Economic: Exhibitions/Functions

Discription: (-+) 4,5% slope
Most active central area of Pretoria NBG
Economic: Entrance
Point of dispersion
Users experience: Recreational: Urban park/Picnic/Tea garden
Didactic: Pockets of themed plant gardens

Discription: (-+) 2,9% slope
Grassland
Botanical use: Ecological: Conservation
Economic: Environmental Education Centre
Users experience: Didactic: Grassland/Environmental Education

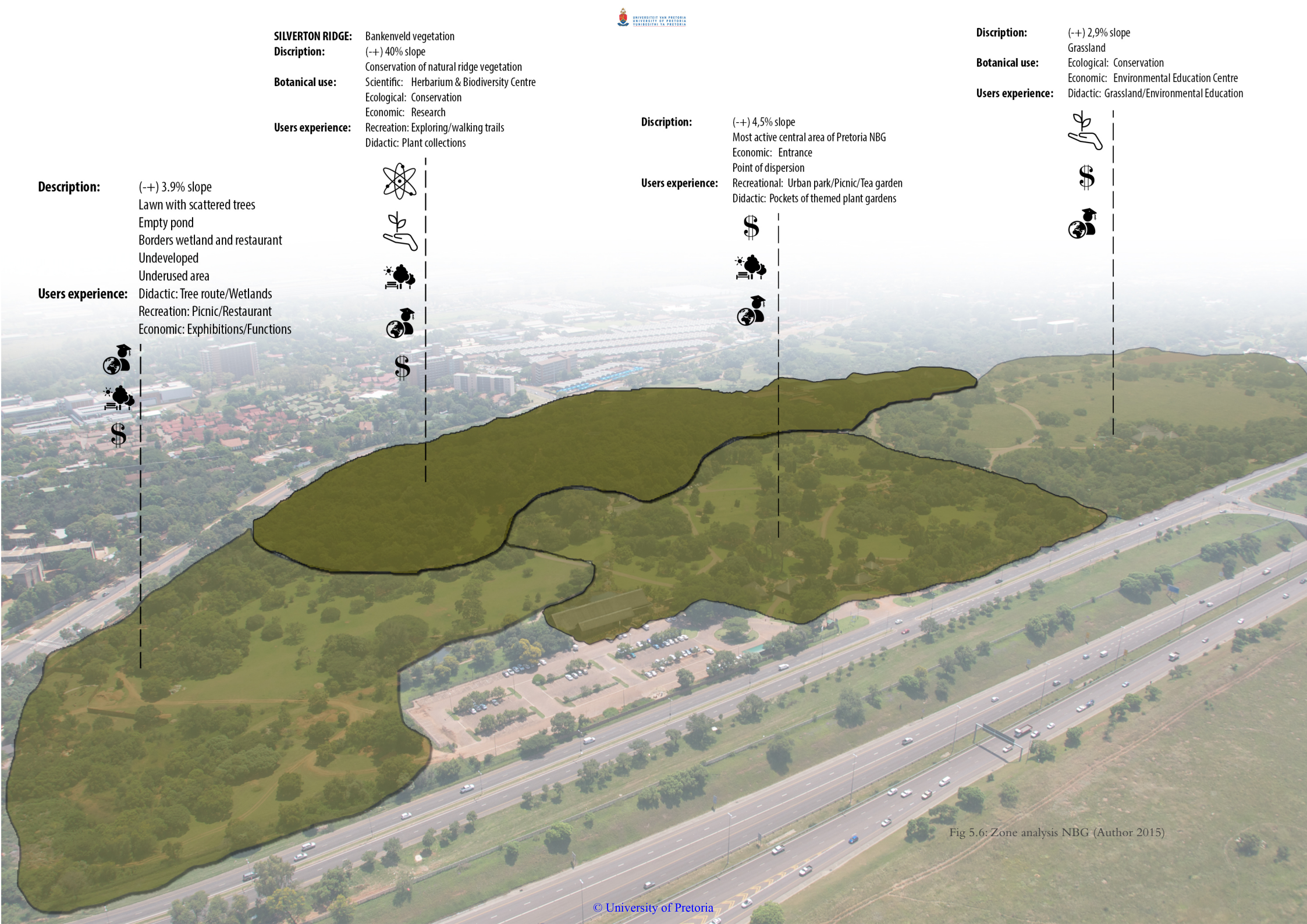


Fig 5.6: Zone analysis NBG (Author 2015)

© University of Pretoria

5.7.4 Water in the garden

No perennial water flows through the garden, and most of the water used for irrigation purposes originates from boreholes, mostly sunk in 1946, situated to the north of the ridge. There are seven boreholes on the site. These provide a total of 1 529 186 million litres of borehole water. Artificial water features that have been created in the garden include a waterfall in the middle of the garden (1992), a few ponds situated west of the Tea Garden and in the north-western corner of the garden, as well as a wetland completed as part of the restaurant development in 2004. The water from the wetland overflows into a depression (±30-40 metres away at the south-east corner of the site) when flood rains occur. Several birds can be observed in the ponds near the Cycad Garden.



Fig 5.7: Waterfall at NBG (Author 2015)



Fig 5.8: Wetland at NBG (Author 2015)

5.7.5 Walking trails

An interpretive trail known as the Dassie Trail has been laid out along the length of the ridge, and was named after the rock dassies frequently found on the ridge. The trail starts at the waterfall next to the Tea Garden and meanders along the ridge in the centre of the garden.



Fig 5.9: Ridge routes at NBG (Author 2015)

5.7.6 Vegetation types

The vegetation type naturally occurring in the garden is Marikana Thornveld.

5.7.7 Special collections

The garden incorporates South Africa's National Herbarium, housing over 1.2 million pressed plant specimens from southern and tropical Africa. The herbarium building in the centre of the garden incorporates the Mary Gunn Library, generally regarded as the most comprehensive and largest botanical library in Africa.

West of the Tea Garden is a planted special collection of cycads (Encephalartos spp.) indigenous to southern Africa.

5.8 Conservation activities

5.8.1 Alien invasive plants

Alien invasive plants that have been recorded in the garden, all originating from South America and which need to be continually monitored, include Lantana (Lantana camara, a proclaimed noxious weed), the Moth Catcher (Araujia sericifera), Bugweed (Solanum mauritianum), the Potato Creeper (Solanum seaforthianum), recorded as a climber on trees along the ridge, and the grassland-associated Pom-pom Weed (Campuloclinium macrocephalum) with its pink flowers that invades grasslands and roadsides. Lantana is difficult to eradicate because of the ease with which the seeds are distributed in bird droppings. Illness and death in children have been reported after eating green lantana fruits, but ripe fruits are reported to be edible. Lantana and the two solanum species are all bird-dispersed plants, whereas both the pom-pom weed and moth catcher are wind-dispersed.

Other weeds known to occur in the garden include the Madagascar Periwinkle (Catharanthus roseus; drought resistant and common on disturbed sites, such as along pathways and roadways), Jacaranda (Jacaranda mimosifolia), Cat's Claw Creeper (Macfadyena unguis-cati), Syringa (Melia azedarach), various privet species (Ligustrum spp.), the Inkberry (Cestrum laevigatum), and the succulent Queen of the Night (Cereus jamacaru).

5.8.2 Silverton Seismological Station

The Council for Geoscience has established the Silverton Seismological Station on the northern side of the garden, below the Silverton Ridge. Excavated to bedrock, this station that was built in 1981 is currently used to record seismic events worldwide. The Silverton Seismological Station is a duplicate of the system used by the Council for Geoscience in Antarctica, and together with another five seismological stations

© University of Pretoria

around the country, is used to supply continuous data from South Africa to the Indian Ocean Tsunami Warning System based in Mauritius.

5.9 Movement analysis

According to Johnson (2007), some of the main functions of a botanical garden is to provide recreational and didactic experiences to the visitor. Movement through the garden, as well as the way visitors interact with the plants and what they learn on their visit, has a big influence on the experience a visitor has. The main critique would be that the botanical garden is very much "purist" in its composition. In the landscaped area the plants are confined to plant beds, which form borders along which movement takes place. Thus, plants become a means to define pathways for one to get to a destination, which in most cases is recreational. The focus is not on the plants, as it should be in a botanical garden, but on the romantic idea of a park.

However, some plant collections are concentrated at specific points in the garden. The visitor is drawn onto more intimate pathways that explode on either side with a variety of plant species, all relating to a similar theme. Strong borders are kept in place to confine plants to their beds and cause a separation between man and plant. These borders give the message quite clearly that interaction between visitors and nature is largely frowned upon. Also, these collections focus mostly on horticultural activities, but the way the information is conveyed to the user is merely through information boards throughout the garden. The plant collections themselves do not care much for the way man experiences them. Can these themed plant collections be designed in such a way that they actually start to teach the visitor something about nature without physically having to spell it out?

The ridge is covered with trails that meander throughout the northern and southern slopes. Here one can already start to get a better idea of the essence of nature, as the visitor becomes immersed in it rather that viewing it from the side. However, one must keep in mind that this is a botanical garden and not a nature reserve. Thus, how can the visitor be presented with the essence of nature in a way that allows him to perceive its beauty on every possible level and allows nature to perform in its intuitive way without confining it, but also design in a way that tells visitors that it is the plants that they should be focusing on and appreciating?



Fig 5.10: Movement through recreational park (Author 2015)



Fig 5.11: Theme garden plant beds, NBG (Author 2015)



Fig 5.12: Ridge route edging, NBG (Author 2015)

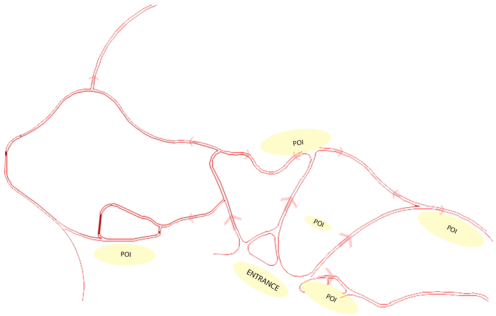
© University of Pretoria

EXISTING MOVEMENT SYSTEMS

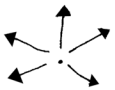
MOVEMENT ANALYSIS (SIMMONDS 1983)

SPATIAL EXPERIENCE

SPATIAL ANALYSIS



RECREATIONAL PARK



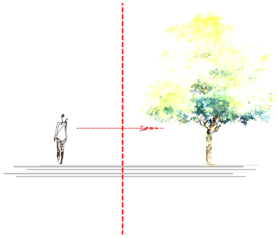
DISPERSING

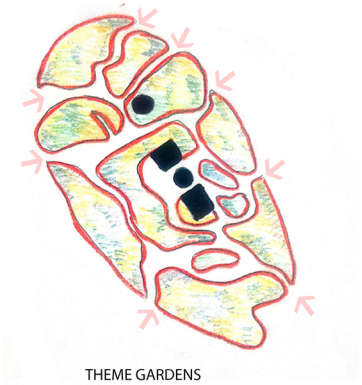


CURVILINEAR

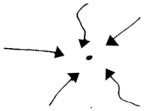


Prospect ive views over the garden. Recreational. Minimum interaction with plants. Movement defined by plant beds, plant are not the main focus.

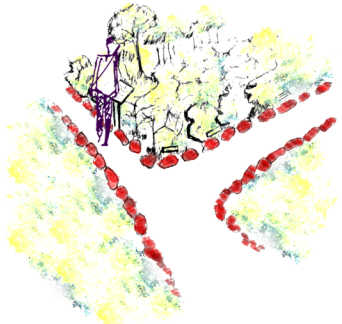




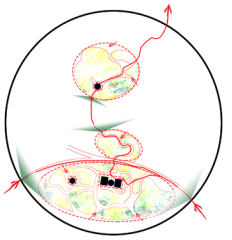
THEME GARDENS

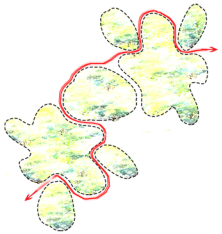


ASSEMBLE



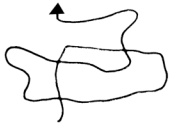
Themed gardens pull you in from vast open spaces to more intimate spaces. Plants are confined to strong borders and do not allow for active exploration.







RIDGE TRAILS



MEANDERING



Exploratory trails trough the Silverton ridge immerse the audience in nature. however, experience similar to a nature reserve rather that a botanical garden.

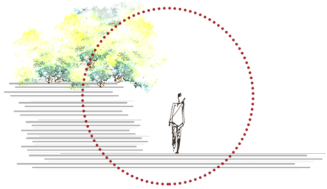
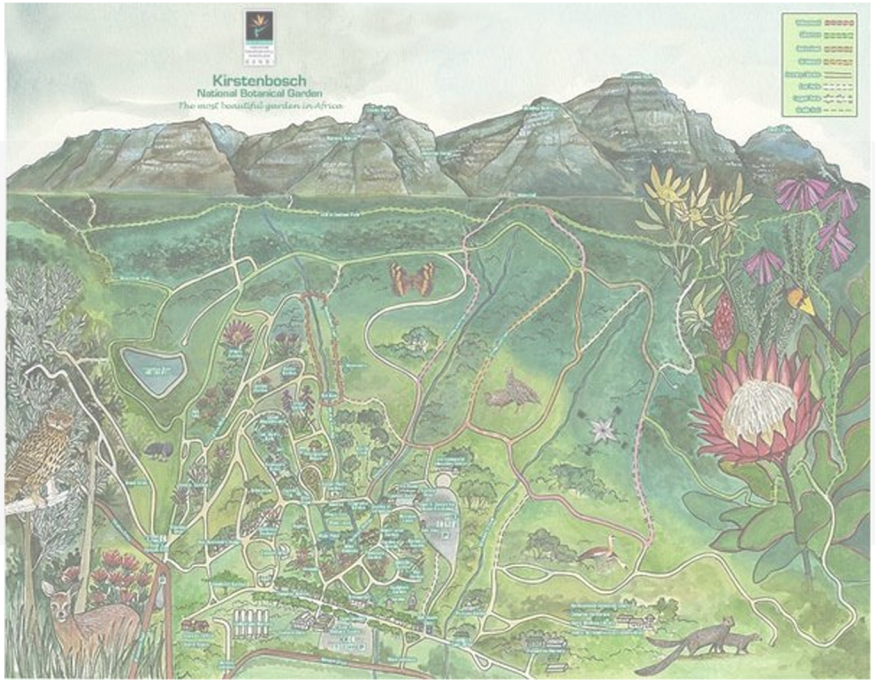


Fig 5.13: Movement analysis NBG (Author 2015)

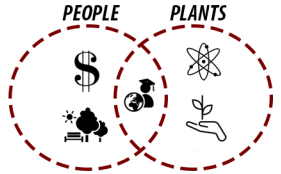
© University of Pretoria

PRECEDENT STUDIES

KIRSTENBOSCH NATIONAL BOTANICAL GARDENS



ASPECTS OF BOTANICAL GARDENS:








"They serve to educate, to explore, to fascinate, and to discover. They will continue to reflect our e relationship with plants and the rest of the natural world, and they will continue to remind us of wonders of life here on earth."

Brian Johnson (2007)

PRETORIA NATIONAL BOTANICAL GARDENS









© University of Pretoria

SCIENTIFIC	ECOLOGICAL	DIDACTI	RECREATION	ECONOMIC
-Research *-Environment specific gardens* *-Medicinal advances* *-Botanical exploration* *-Assessing economic value of species* *-Relationships of plants and growth patterns*	*-Plant genetics* *-Biodiversity* *-Conservation of plants, diversity and habitats*	*-Exotic/Rare plant collections* *-Library* *-Environmental & specie education* *-Horticultural experiments: Theme gardens*	*-Aesthetic enjoyment* *-Public leisure* *-Restaurants* *-Commercial* *-Social spaces* *-Excercise* *-Escape from city*	*-Plant nursery* *-Cultivation* *-Event spaces* *-Stage*
- Research: Local and regional - Study relationships between plants - Name and describe new plant species - Millennium Seed Bank Partnership - Document plant diversity of Cape Floristic Region	- Conservation of natural vegetation of Kirstenbosch: Fynbos (Restio, Protea, Fynbos, Buchu and Erica garden) and Forest. - Xerophytic plants from the arid regions of South Africa - Conservation of succulent Karoo Biome - Conservation of Cape Peninsula vegetation. - Vlei gardens, pond biodiversity, stream, natural spring at dell.	- Plant collection gardens (Cycad Amphitheatre, Protea garden, Erica garden, Arboretum, vygies, Pelargonium) - Historic collections: Camphor Avenue, Van Riebeeck's hedge, Magic tree - Library - Conservation programs - Theme demonstration gardens: Fragrance garden, Garden of Extinction, Water-Wise, Garden of Weeds, Wildlife, Useful Plants, Annuals.	- Stage - Three restaurants - Multiple shops - Lawn for picnics - Green civic escape - Trails and walks - Childrens play areas - Attractions (tree canopy walkway) - Sculpture/Art	- Conference and exhibition centre - Function venue, - Lecture halls - Concert stage - Kirstenbosch Guesthouse - Restaurants - Tree canopy walk - Various shops and art sales - Wholesale Plant sales

volving
the many

"....botanic gardens will continue to be humanity's main scientific, aesthetic and social link to plants."

Brian Johnson (2007)

- Research - Collect plants to fill the gaps in distribution data of southern African plants - Study relationships between plants - Name and describe new plant species - Millennium Seed Bank Partnership	- Plant collection which represents the flora of the country as accurately as possible. - Madagascar Plant Collection, Grasland, Wetland, Succulents, Cycads	- Houses the Mary Gunn Library, which is the largest botanical library in Africa. - Theme demonstration gardens (Water-wise, Enabling, Medicinal, Succulent, Wetland, Grassland, Traditional plant use). - Workshops	- Stage - Tea garden and restaurant - Shop - Lawn for picnic - Boot camp and park run - Green civic escape - Trails (Dassie trail, tree route) - Lapa - Sculptures/Art	- Adventure Boot Camp for Women, - Concerts, - Picnics, - Natural history courses, - Private functions, - Expos (e.g. Gardener Live) - Restaurant

Fig 5.14: NBG vs. Kisrstenbosch (Author 2015)

© University of Pretoria

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

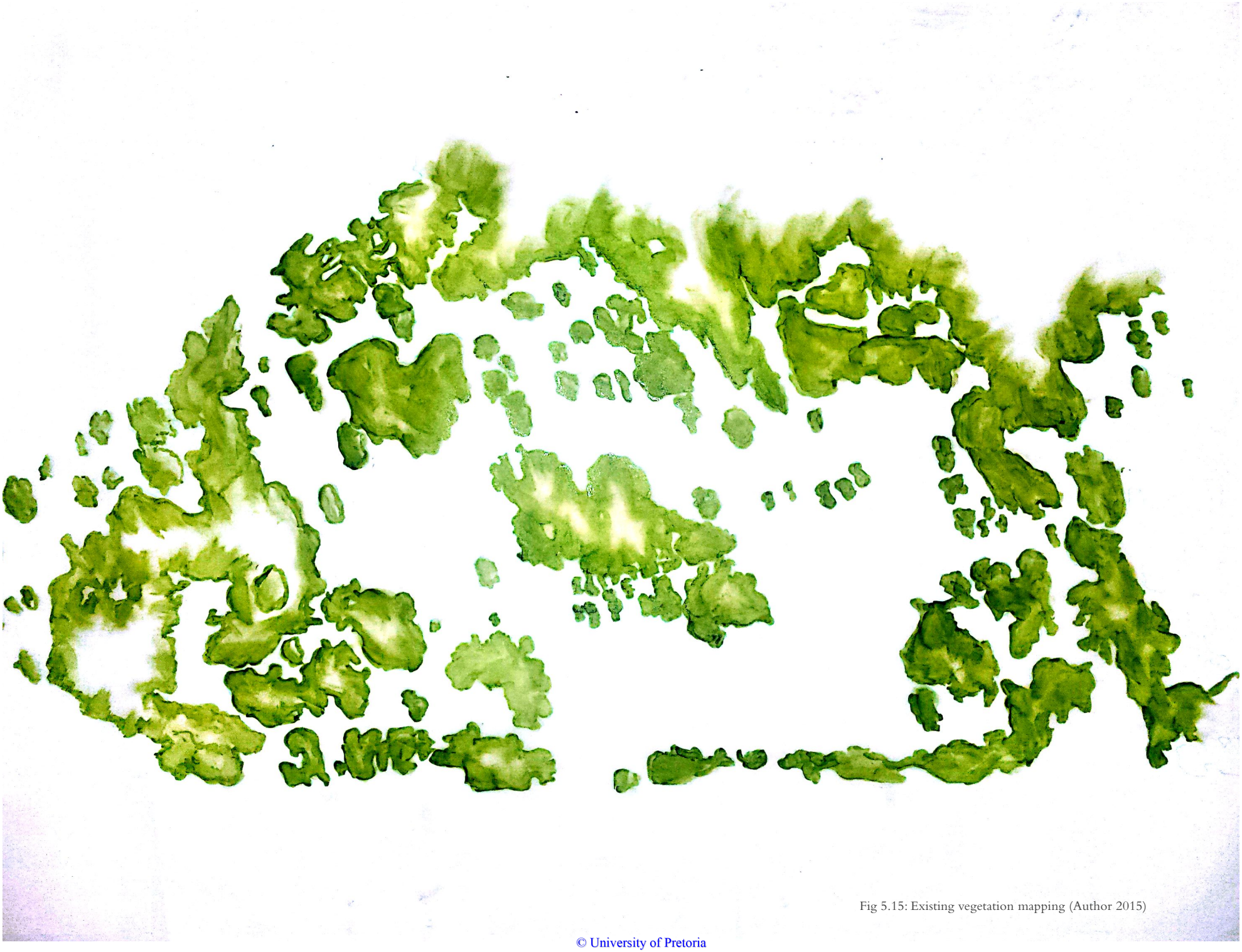


Fig 5.15: Existing vegetation mapping (Author 2015)

© University of Pretoria

The precedent in fig 5.14 on p. 46-47, shows a clear comparison between the best practice in South Africa regarding botanical gardens, Kirstenbosch National Botanical Gardens, and the chosen botanical garden where the design project is focussed on. Through this comparison one can start noticing in which areas the Pretoria NBG is lacking. Noticeably the ecological and didactic qualities of Pretoria NBG is lacking and would be ideal to use as a focus point in the design to improve on.

5.10 Framework

Regioal Context: Tshwane Spatial Development Framework (Region 6)

The Spatial Planning and Land Use Management Act (2013) and Gauteng Planning and Development Act (2003) determined that a municipality must formulate a spatial framework. The City of Tshwane (CoT) embarked on processes to compile seven Regional Spatial Development Frameworks (RSDFs). The Tshwane National Botanical Garden falls within Region 6 for administrative and planning purposes.

An important element of the spatial development framework is the 'environmental structuring concept'. Tshwane's urban form and identity is closely linked to the influence of its natural and cultural elements. The developed areas are intimately intertwined with open spaces, creating a city with an unique character. The spatial development of the city intends to continue to value the role and prominence of the natural environment that sustains and informs the city. The natural structuring elements of Tshwane are those physical features that have to a great extent influenced the historical growth and settlement development pattern and that have an important ecological role to play in the ecological integrity of the metropolitan area.

A well-defined open space network is an important part of the Spatial Development Concept of the MSDF. The Tshwane Open Space Framework (2005) informed the SDF with regard to open spaces and conservation areas. The development of an open space network is an integral part of shaping the city. Ecological resources are irreplaceable and should thus be one of the major structuring elements guiding the development of the city instead of unplanned urban growth taking precedence and open space becoming merely land that is not desirable for urban development and thus 'left over' space. An important step in shaping urban form is thus the determination of an open space network, which contains natural; processes and systems. The Tshwane open space network is concerned with the spatial structure of green areas in the urban landscape and with all planning activities that are essential to create conditions for green areas to perform ecological services and to contribute to the quality of urban life. It is thus used to indicate the position of green areas in the urban landscape. As such it has spatial, social and technical dimensions. An open space network is also a planning concept, indicating the intention to develop planning and management tools for the structuring role of green areas in the urban fabric and the urban organization.

An open space network contains not only the elements that constitute the open space itself (vegetation, water, animals, natural materials, etc.), but above all how the various open spaces are shaped in relation to the concepts of distribution and organization, to form a system of open spaces. An open space network incorporates a wide variety of open spaces into one system. Open spaces cease to be discreet elements within the city but together form a network in which each component contributes to the whole.

It must be stressed that an open space network does not focus only on 'green' spaces, but also on more urban or 'brown' spaces as well as spaces that contribute to the place-making of the city. (Tshwane SDF: Region 6: 2013)

The Tshwane Open Space Network is developed on the basis of a lattice concept of soft (natural, green) and hard (urban, brown) linear spaces crossing each other to form a range of soft and hard nodes. The National Botanical Gardens is categorized in terms of this as a 'green node'.

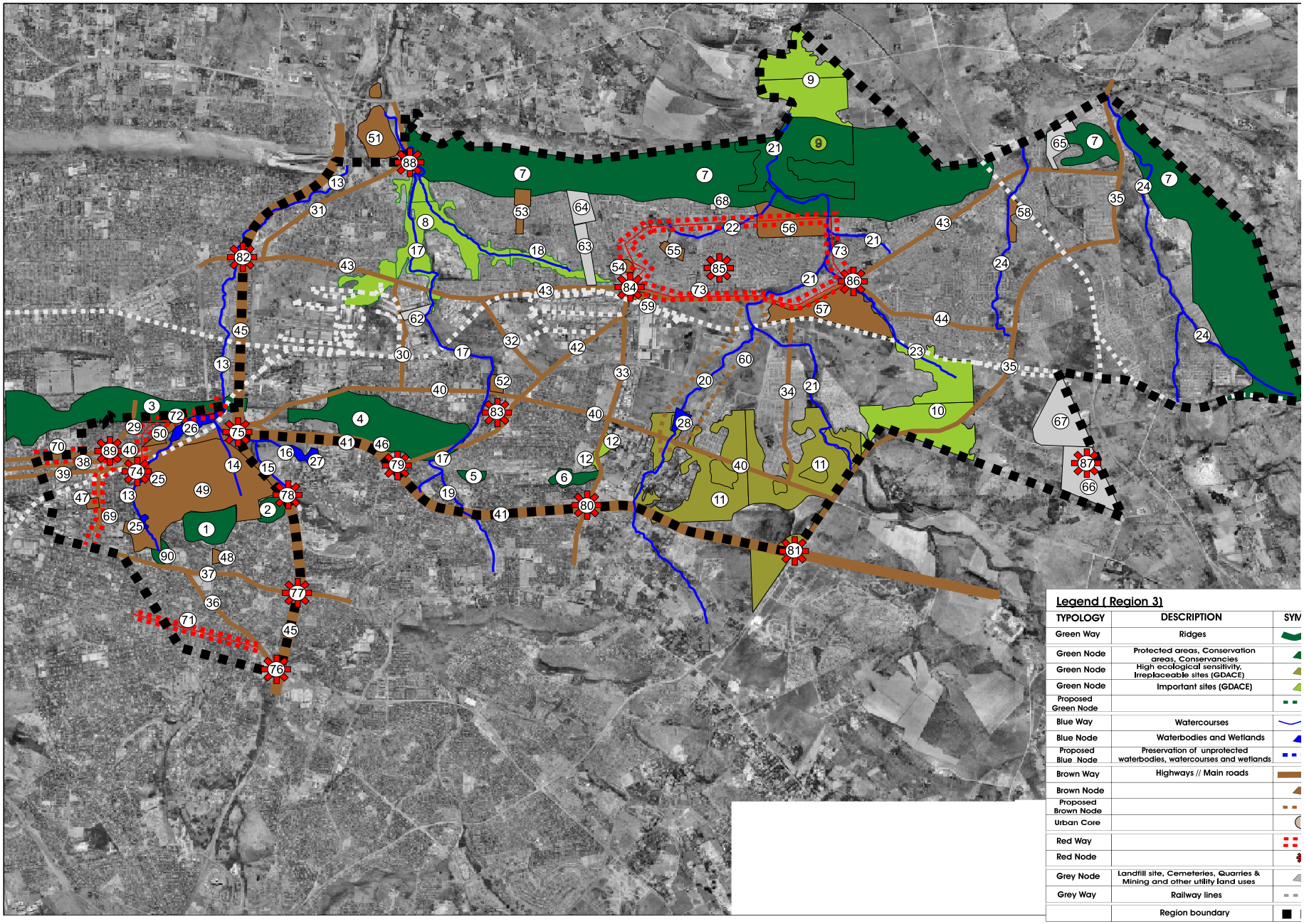
Green Nodes are areas within which ecological systems, processes and value are concentrated. They include important habitats for fauna and flora, and areas representative of local biomes, vegetation types and high ecological sensitivity such as Protected Areas, GDACE irreplaceable and important sites. Green Nodes are the most important elements in the provisioning of environmental goods and services, the protection of biodiversity, endangered species and ecological systems, as well as eco-based activity. Green Nodes must be protected for conservation purposes.

Green Nodes can occur in a pristine or natural state, but are generally characterised as natural. Every attempt must be made to retain Green Nodes in as pristine a state as possible. As little as possible human intervention must be allowed: Human intervention must be sensitively located with a minimum footprint (cluster and space principle). A network of low impact movement between human interventions can be allowed. Activities must focus on ecological research, education, conservation of biodiversity, ecotourism, trails, guided walks.

According to the open space framework, only endemic vegetation must be allowed. It can be complemented with a network of trails. Strict control of development and invader species must be practiced. Rehabilitation of disturbed areas must be sougth at all times. (Tshwane Open Space Framework, 2005:24)

The surrounding area of the National Botanic Garden is characterised by the following environmental aspects:

© University of Pretoria



© University of Pretoria

- Significant ridge systems in the northern parts, notably the Magaliesberg system;
- Significant water cource systems throughout most notably the Pienaars Rivier, Moreleta,Vlakfontein, Hatherly and Hartbeest Spruite;
- Significant wetlands systems at the University of Pretoria Sport Grounds, Colbyn, Cussiona Spruit, Nelmapius;
- The Frank Struben Bird Sanctuary.
- Ecological sensitive areas associated with ridge and watercourse systems and at Hatherley;
- Limited CTMM (City of Tshwane Metropolitan Municipality) maintenance actions around the ridge system;
- Limited CTMM maintenance data on all types o open space resources;
- Low ratio of developed open space, especially in the eastern most extent of the region;
- Various regional recreational open space facilities such as Moretele Park, Derdepoort and regional sport facilities such as HM Pitse, Silverton, Eersterust, Stanza Bopape;
- Potential Placemaking opportunities around the N$, N1 and at the Urban Core for Eerste Fabrieke.

POLICY STATEMENTS FOR DEVELOPMENT/MANAGEMENT OF GREEN NODES

- Protected areas are strategically important Ecological Structuring Elements within the Tshwane Open Space network and must be conserved.
- CTMM managed conservation areas, designated by GDACE as Protected Areas, need to be formally declared as Protected Areas
- The management of Protected Areas must aim to maximise ecological functioning and environmental goods and services rendering and must facilitate the improved utilisation and exposure of such Open Space resources.
- The Gauteng Department of Agriculture, Conservation and Environment (GDACE) Departmental Policy on Red Data Plants, 2004 must be used as a decision making and decision support tool in the evaluation of development applications. However, the site specific relaxation of the required buffer area can be considered by the CTMM if supported by the outcomes of an Environmental Impact Assessment.
- The Gauteng Department of Agriculture, Conservation and Environment (GDACE), Departmental Policy on Ridges, 2004 must be used as a decision making and decision relaxation of the required buffer area can be considered by the CTMM if supported by the outcomes of the Environmental Impact Assessment.
- Alternative Service Delivery Partnerships within Protected Areas will only be considered after and in accordance with the outcomes of an SEA and/or EMF.
- Integrated Environmental Management Plans must be drafted for each Protected Area, managed and maintained in line with such plans.
- Proposed green nodes as indicated on the Regional Open Space network are created at the confluence of green and blue typologies. Development interventions can be considered here if responsive towards high and medium-high site specific Open Space integration of such sensitivities within the Open Space network is facilitated and if the creation of such node is enabled.

On the Open Space Framework map on pg. 50, the green node no. 4 is the Pretoria NBG. The design will be done in accordance with the spatial framework of Tshwane and integrated into the design approach. Also noticeable on the map, is the wetland adjacent to the botanical gardens. This can be utilised as a green link within the city to create a green belt that connects the ecosystems of the fragmented sites to ultimately create a higher biodiversity within the city.

© University of Pretoria

© University of Pretoria

Chapter 6

Manifesto.

© University of Pretoria

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

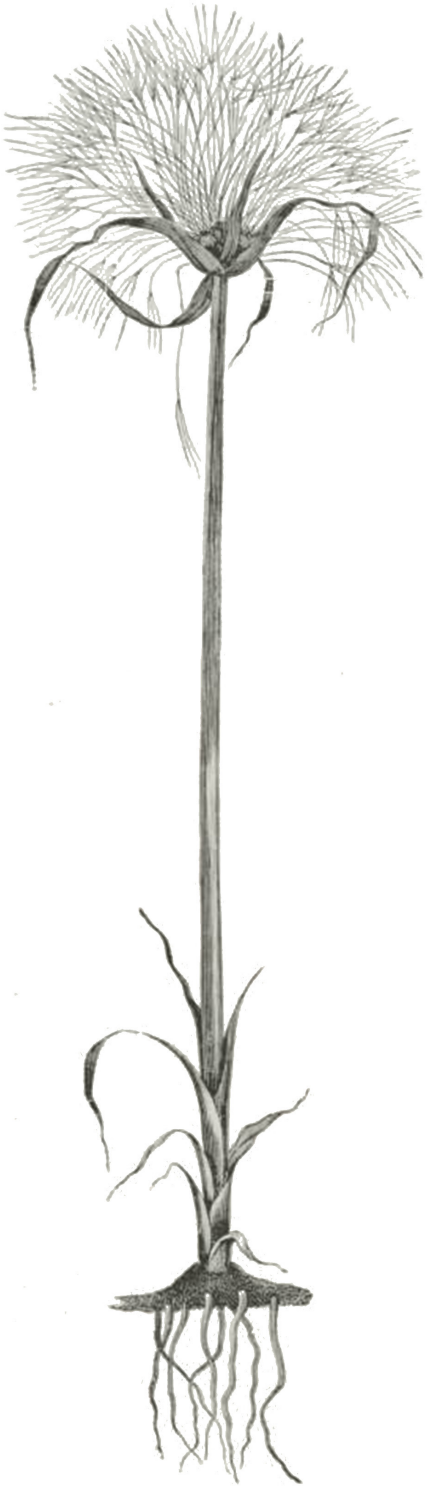


Fig 6.1: Papyrus Grass; botanical art (Ebers 1878)

© University of Pretoria

6.1 Manifesto.

The term "manifesto" is derived from the Latin word manifestum, meaning clear or conspicuous (Turner 2014). After the theoretical discourse several conclusions were reached. These conclusions all hint towards what the design intent of this thesis is, but a lack of clarity still lingers. The practice of issuing art and design manifestos became widespread in the 20th century (Turner 2014), which the author feels is a helpful tool to clearly state what the design decisions will be based on, and which summarizes the most important elements of the research that need to be kept in mind when looking at the design. Herewith the author's Landscape Architecture Manifesto:

1 Our understanding of nature should be made visible through ecological design. Ecological processes need to be visible in order for them to be expressive.

2 Refuse to create boundaries that confine nature and define movement. We should allow edges to transgress, merely guide energies, and design with change as medium.

3 Set a stage for the performance of nature through the creation of environmental conditions for plant habitats, but allow nature to grow and evolve intuitively and improvise and transcend through its inherent potential to embrace change.

4 The view of plants as groups of interrelated species modifying and interacting with each other, rather than as separate and fixed, demonstrates flexibility — a main motif of landscape form.

5 Plants should be the main focus and attraction in botanical gardens and not merely what we pass by in order to get to a destination.

6 Allow landscape to be unpredictable. Maintenance does not determine whether the garden is aesthetically pleasing.

7 Do more than represent nature; allow nature to represent itself. Redefine the role of the landscape architect and the way that landscapes are represented.

8 The sequential spatial experience of the landscape should immerse the audience in nature and confront, excite and captivate the visitor. This can be done by using repetition/ pattern to compose and order the landscape.

9 Refuse to create a pre-conceived plan, narrative or set way of movement.

10 'Region' is a unifying theme or identity to which local inhabitants relate.

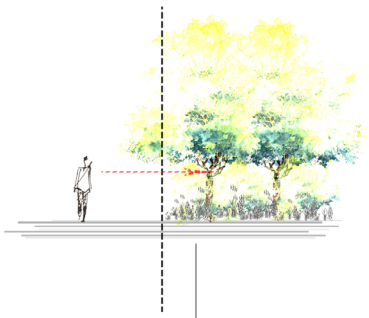
© University of Pretoria

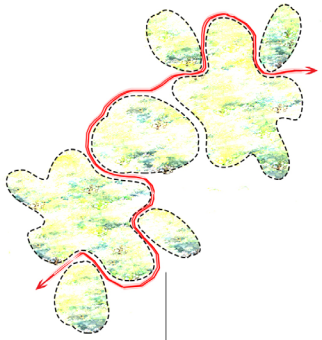
MAN-LANDSCAPE RELATIONSHIP

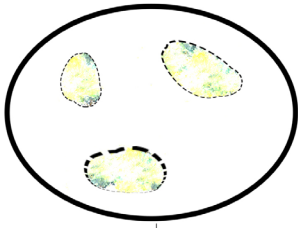
BOUNDARY VS. MOVEMENT

THEME GARDEN EXPERIENCE

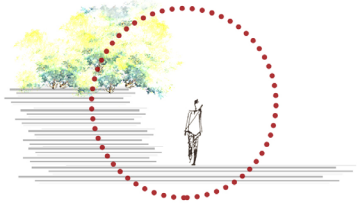
EXISTING CONDITIONS

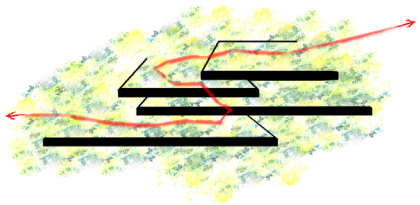


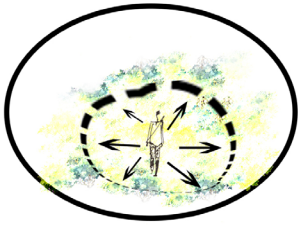




PROPOSED CONDITIONS







© University of Pretoria

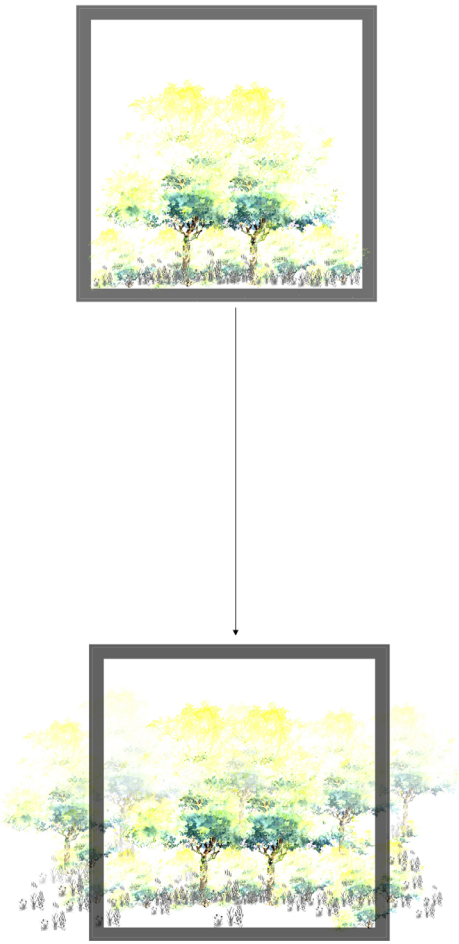


Fig 6.2: Design principles (Author 2015)

© University of Pretoria

6.2 Design principles

Stemming from the manifesto, there are certain design principles that developed from it that will be carried out and pulled through the entirety of this design dissertation. These principles include:

6.2.1 Man-landscape relationship

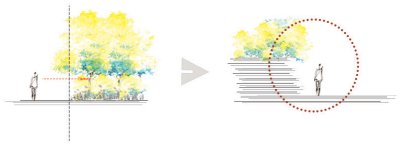


Fig 6.3: Man-landscape relationship (Author 2015)

This entails embracing our ability and knowledge to "command ecologically", as Ian McHarg (1995) stated, setting the stage for nature to perform and to transcend the everyday. In the landscape architectural profession this would mean to work with topography as design medium to create varied microclimates that help to form habitats that support plant growth and ecological processes. It also speaks about man's relationship with the larger landscape. It is currently a common theme in landscape architecture, as mentioned in Chapter 4, to refer to the regional landscape as a unifying theme that people can identify and relate with. This type of design emphasizes the area's unique, natural features, and the importance of being responsive to the region.

The ecological stage will focus on the abstraction of the essence of the Pretoria landscape, and thus the exploitation and representation of the geology and vegetation occurring in the region. Also, it would allow people to relate to the larger landscape and experience it more intensely and immediately than would usually be the case.

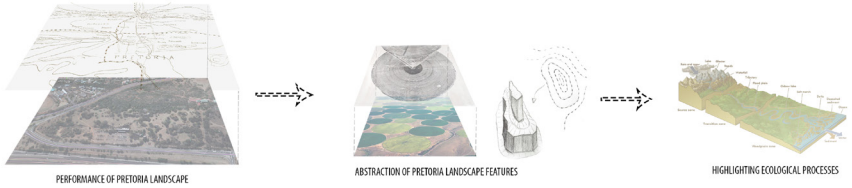


Fig 6.4: Regional design approach (Author 2015)

After an analysis of the regional landscape, five essences were identified which capture the essence of the Pretoria landscape and define the features that make Pretoria the beautiful city that it is today. These essences are water, ridges, ridge pass/poort, urban and argricultural landscapes, which can be seen in figure 6.4 below. The design will incorporate the natural landsape including the ridges, water and ridge pass, rather than the man-made landscape as the botanical garden is situated in an urban environment. Agriculture is not included in the design as there is already agricultural research grounds right across the street from the botanical gardens on the University of Pretoria's experimental farm (proef-plaas). As mentioned in chapter 5 the botanical garden grounds were under ownership of the University, but they sold the land due to toxic soils making it impossible to farm naturally on that specific piece of land.

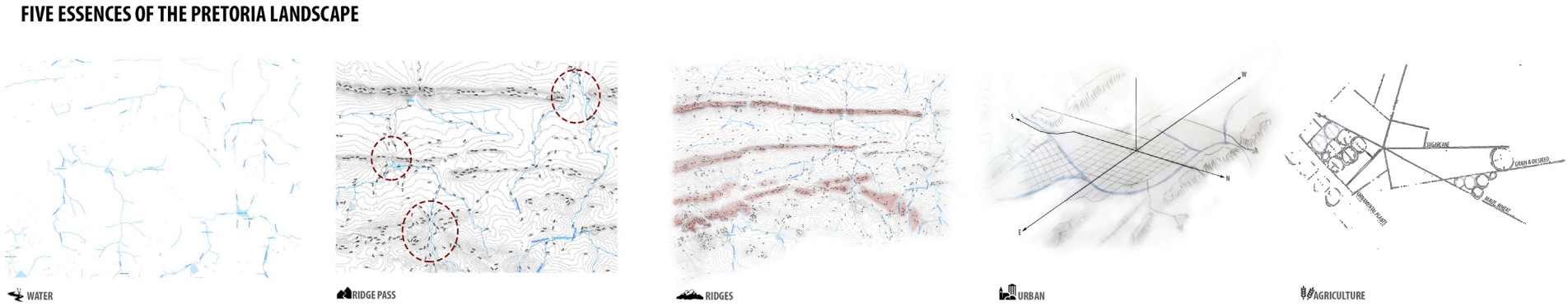


Fig 6.5: Essence of the Pretoria region (Author 2015)

© University of Pretoria

6.2.2 Boundary vs. movement

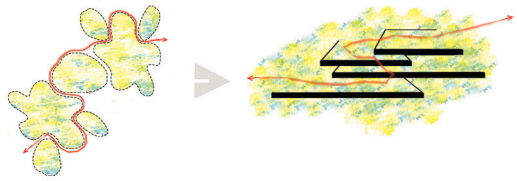


Fig 6.6: Boundary vs. movement diagram (Author 2015)

This refers to the refusal to create boundaries that confine nature and define movement. Edges should be allowed to transgress limits; one should merely guide energies and design with change as medium. Plants should remain the main focus of a botanical garden; thus the design should excite visitors so that they move spontaneously towards nature and not pass it by as a side matter. The ecological stage will become the structure that guides the energies of movement of people through the site as well as the energies of plants. This structure will not confine either of these energies but rather celebrate them, so that nature and the experience thereof can be transcendent.

6.2.3 Theme garden experience

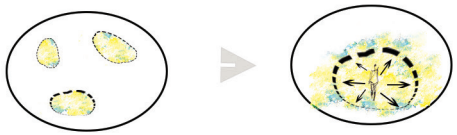


Fig 6.7: Theme garden diagram (Author 2015)

Theme gardens in botanical gardens is a very valid way of showing the unique qualities of nature to the audience. Botanic gardens are regarded as ideal places to encourage exploration of the relationship of nature to culture: by their physical framing of the plant collections, botanic gardens can act as a metaphor for the complex relationships that humanity has with the environment (Sanders 2007:1213). The informal atmosphere of many botanic gardens and their relaxing, aesthetic environments are also seen by Ballantyne, Packer and Hughes (2007) as effective contexts in which to present to visitors the interrelationships among plants, animals and humans and to explain how the different components are inextricably linked and interdependent. Although, currently, theme displays in botanical gardens focus more on having a diverse collection of plants rather than allowing the landscape and the plants to be experienced by man in such a way as to rekindle their interest and respect towards the awe that is nature. Theme gardens should focus on the experience thereof and what the visitors can learn out of it rather than merely displaying plants in manicured plant beds.

6.2.4 Picturesque / Maintenance

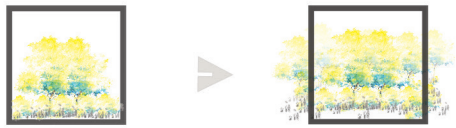


Fig 6.8: Picturesque/maintenance diagram (Author 2015)

Landscape architecture can support the principle that maintenance does not determine whether the garden is aesthetically pleasing. This does not mean that we need to completely remove ourselves from interfering with nature and return to the concept of wild nature. It merely means that we need to highlight beauty in a temporal landscape that changes with the changing of seasons. This would also refer to the fact that we cannot confine nature to preconceived ideas on a plan, trimming it to define perfectly groomed edges. We need to return to the humble approach of gardeners, who have an observe and react relationship with nature and respond to what nature tells them it wants to be. The gardener does not, as in the picturesque paradigm, focus on creating a romanticized image of landscape that is captured as a perfectly composed viewpoint; he is rather interested in what happens outside the frame of this picture: what influences nature, forms it and interacts with it and how nature reacts in return.

6.2.5 Man - plant interaction

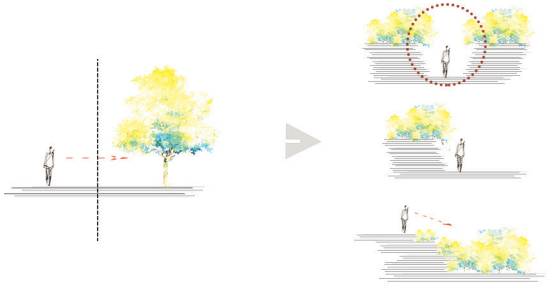


Fig 6.9: Man - plant interaction diagram (Author 2015)

This principle is closely related to the man – landscape relationship principle; however, there is a scale difference. Thus, through building onto the first principle as well as through doing research for this thesis, the realization dawned that the ecological stage needs to be designed in such a way that the main focus falls on

© University of Pretoria

nature in all its glory, in other words, drawing people's attention to parts of a plant or the landscape that might go unnoticed in a natural environment. We need not remove design from landscape in order for it to perform ecologically. We can utilise design to make an ecological feature an experience in its own right. Also, in most landscapes the conditions are such that interaction is largely frowned upon. We need to design landscapes so that interaction is welcomed, whether by plants, humans or any other living being.

6.2.6 Sequence of experience / pattern

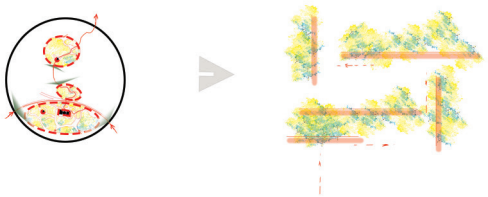


Fig 6.10: Theme garden diagram (Author 2015)

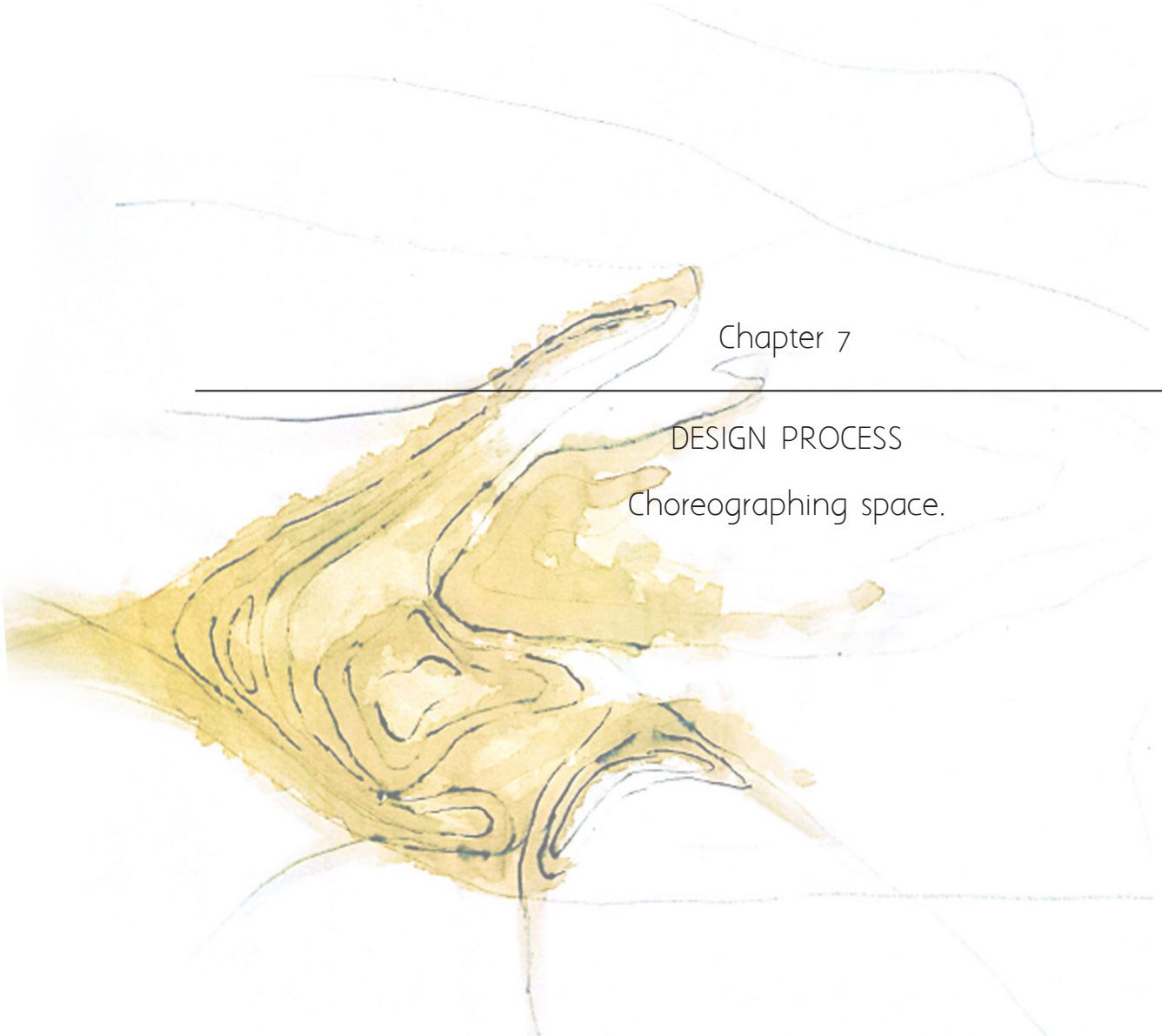
Meyer (2008) instructs the designer to replicate the natural process rather than the natural form. This principle can be applied through a pattern language as a way to make ecological processes visible and guide change in a landscape, with dance performance as a precedent of this idea. This pattern can order the landscape and attempt to create organised chaos within nature, thus still allowing unpredictability. The forms of the patterns needs provide a sequence of spatial experiences within the garden, even if this landscape approach is not a narrative. The form of the pattern should be based on what implications it will have on the ecological stage and how this influences the conditions withing which landscape performs.

Conclusion

These design principles will be applied to the design of the Pretoria National Botanical Gardens and be discussed in more detail in the chapters that follow.

© University of Pretoria

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA



Chapter 7

DESIGN PROCESS

Choreographing space.

© University of Pretoria

7.1 Design approach

This dissertation is largely theory based and strongly relies on the theory discussed within the previous chapters to make the final design a success. This theory is summed up in a landscape manifesto, which will be used to explain the design response accordingly throughout this chapter. Before this is done, it is important to note that there were several outcomes that clearly influenced the design approach stemming from the site analysis.



Fig. 7.1: Site location (Author 2015)

Response to site analysis:

The main design generators is the following:

1 The main use and focus of botanic gardens are directly relateable to the world views as well as economical, social and environmental conditions during that era. As mentioned in this chapter, conditions of the current era is still focused most strongly on the movement for the conservation of nature and sustainable landscapes. The regional landscape is thus of concern when conservation comes to mind. The Gauteng region has a very specific natural environment, being a combination of the grassland and Savannah biome. Within this environment there are several ecosystems that are critically endangered, including critically endangered plants dependent on these ecosystems. The conservation of these plants and creating the ecosystem conditions that they favour in order to grow successfully is a main design generator in this project. The social need during the current era is mostly focused on the didactic aspect of teaching the public about the regional landscape and why this regional landscape is important to protect as well as why they personally would have an interest in doing so.

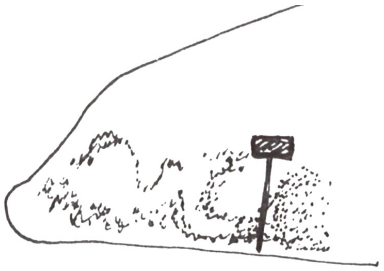


Fig. 7.2 Regional landscape diagram (Author 2015)

2 According to the site analysis, one of the main issues of the botanical gardens is the fact that all the water runoff from the ridge gets lost into the urban water system, which is a very big waste due to the size of the catchment area coming from a mostly natural surface area and can be used more efficiently within the botanical gardens than losing it to a polluted urban water system.

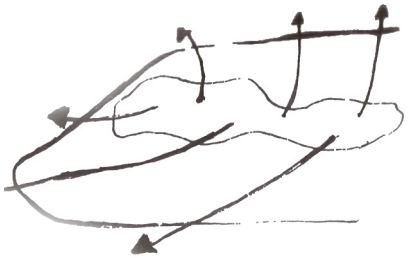


Fig. 7.3: Water runoff diagram (Author 2015)

3 The site can largely be classified according to use currently. This includes a park space, the conserved grassland and the natural ridge, interrupted with theme gardens throughout. An area was chosen within the botanical garden which was in the optimal position to capture the water runoff on site and design this space into a botanical experience that can actually be used as such and not merely written off as unusable land.

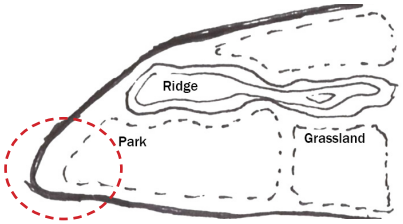


Fig. 7.4: Site use diagram (Author 2015)

© University of Pretoria

4 This specific chosen space was also the most disturbed in terms of invasive species, soil and public utilization, thus most desperately in need of a landscape architectural intervention.

5 The chosen site is situated adjacent to a very busy intersection. This is an advantage as well as a disadvantage. In the bigger picture, the prime location of the botanical garden leads to more visitors during the year as well as the opportunity to lure passers by into the botanical garden. The disadvantage being that there is a large amount of noise coming from the busy roads, making this space unpleasant. Thus a barrier is needed if this space was to become a lingering and enjoyable space.

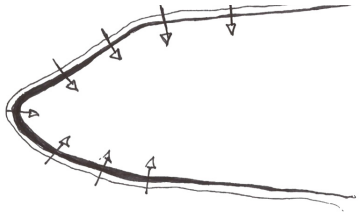


Fig. 7.5: Noise pollution diagram (Author 2015)

6 The wetland across the road makes the specific location within the botanical garden an opportunity to be utilised as a link to serve its purpose as a green node within the city of Tshwane and enable an increase in species biodiversity due to an ease in species reproduction.



Fig. 7.6: Water capture diagram (Author 2015)

7 From the movement analysis came the conclusion that plants must not be a side matter that one moves past to get to another destination, plants is the destination. Thus the movement should be approach in such a way as to guide the audience towards interesting plant performances rather that merely past it.

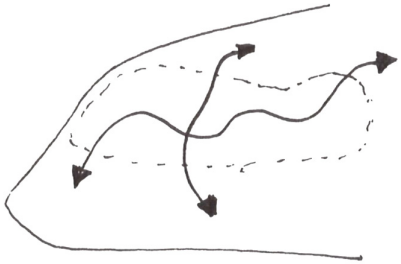


Fig. 7.7: Movement diagram (Author 2015)

8 There are theme displays in the current botanical garden. These focus more on having a wide variety of plants rather then how people experience them and what they can learn from the plants without even having to read it. Thus a regional theme garden is designed that is focused on the experience the audience gets rather than manicured plant beds.

Deliverables:

A series of explorations has been done, which is aiming to create a structure or an ecological stage which will assist with habitat creation and on which the performances will be choreographed. To get to this structure, a number of overlay methods have been used to get to a site plan which will guide the energies on site. To be more clear, a list of deliverables follows:

1 Plan that specifies the landscape "stage", construction guiding the fl ow of energy on site.

2 Suggest pattern onto landscape of where plants will be introduced.

3 Create conditions that might determine what the plants would do, but not defining this by a static boundary. Represent this in an abstract way through perspectives, plans, models, process diagrams that show reciprocity (influence-outcome interactions). These must capture the intended feel rather than a definite end result.

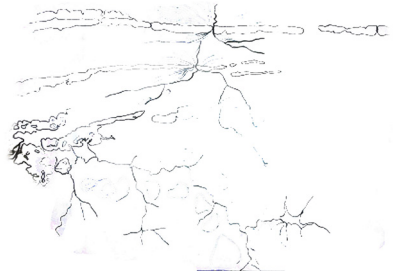
4 Habitat creation, such as microclimatic conditions, ecological conditions and social conditions.

© University of Pretoria

Design development process

Exploration with overlaying different patterns onto the site, from agricultural (man-made) patterns, to the contours of the Pretoria (regional) landscape, to using hatching as a means to define surfaces in stead of lines. All of these have in some way or another influenced the way of thinking that lead to the final design. This overlay process was mostly to create order within chaos which had lead to an ecological stage on a site that is quite seperated from the context, due to the fact that it is a private garden. These explorations can be seen in the following pages.

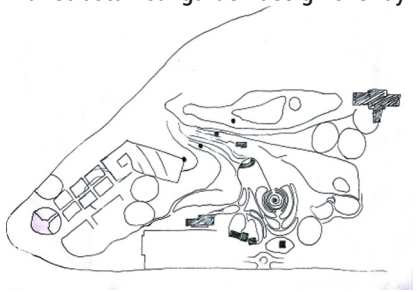
Pretoria contours



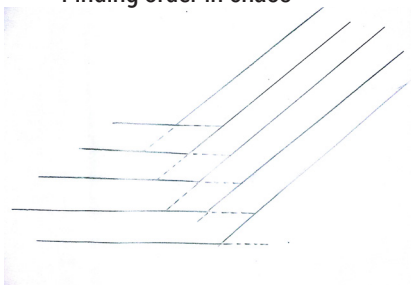
Pretoria contours ovelay



Purist botanical garden design overlay



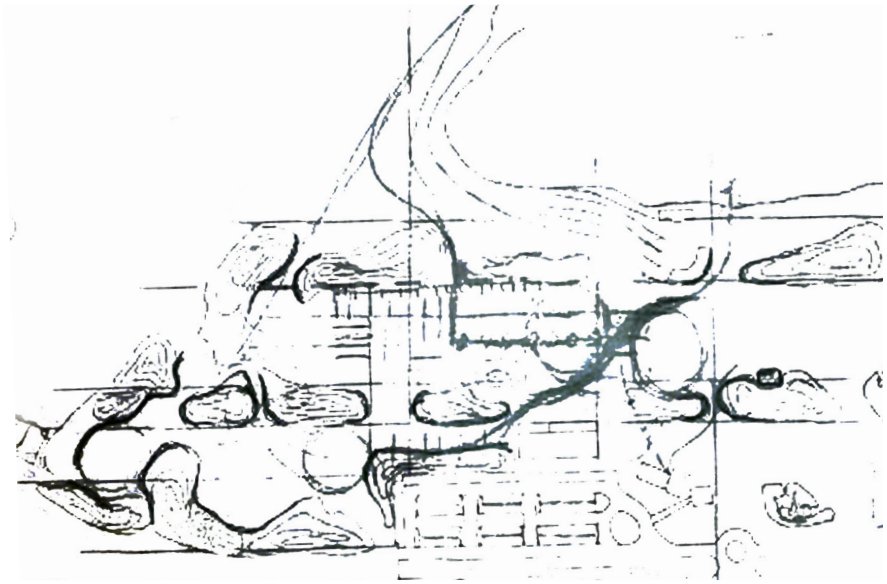
Finding order in chaos



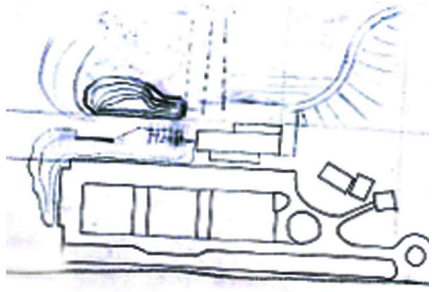
Hatching as means to define surfaces, instead of lines.

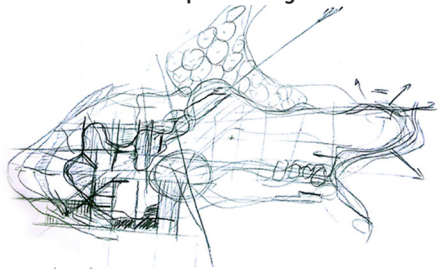


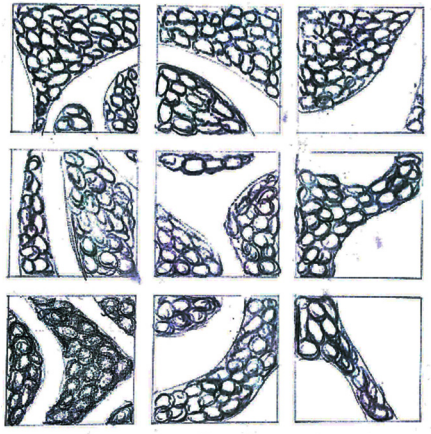
Exploring micro representation of pretoria landscape



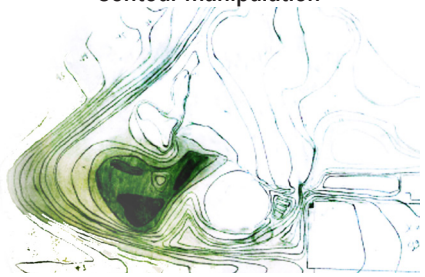
Conceptual images







Contour manipulation

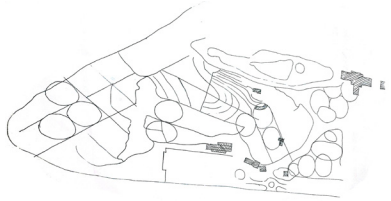


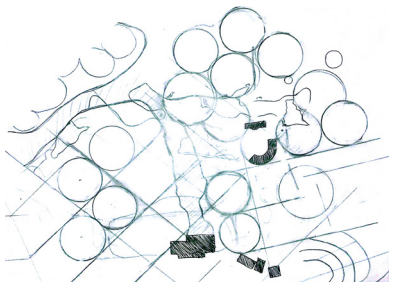
Designing with contours, creating landscape stage.

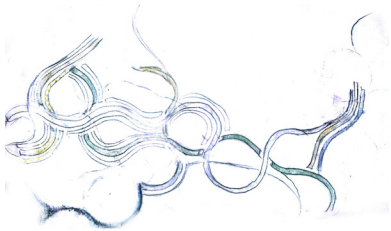
© University of Pretoria

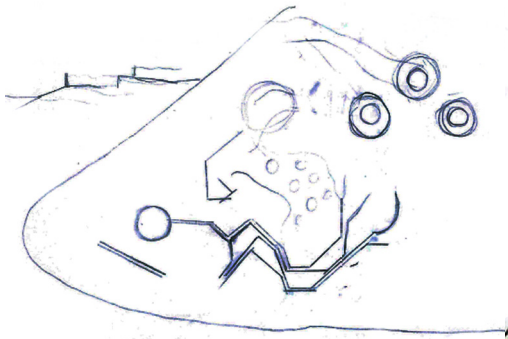
EXPLORATION WITH AGRICULTURAL PATTERN AS BASIS



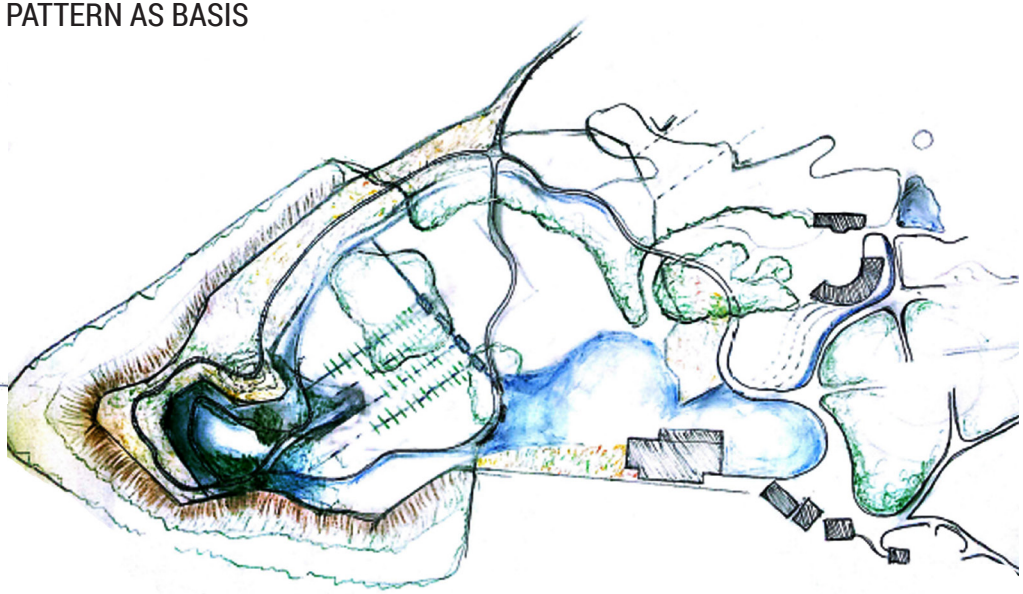




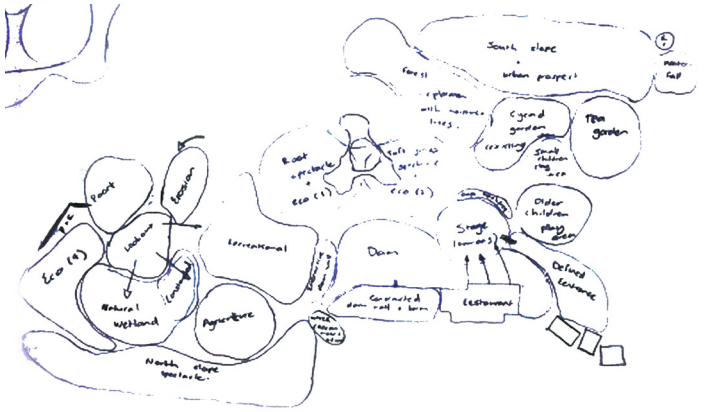


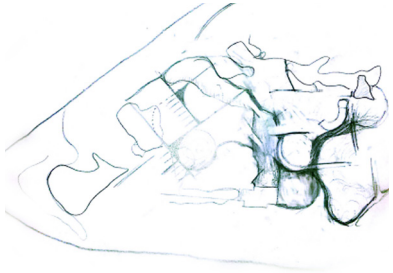


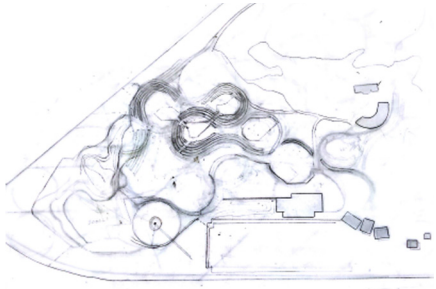
Agriculture overlay pattern symbolizes the human patterns on landscape causing pretoria grassland to be critically endangered.

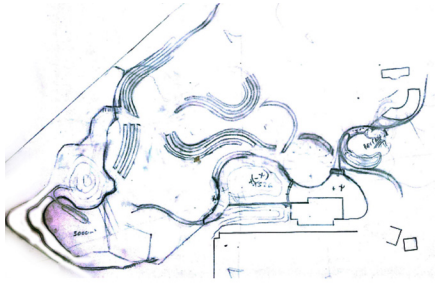




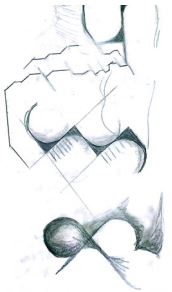






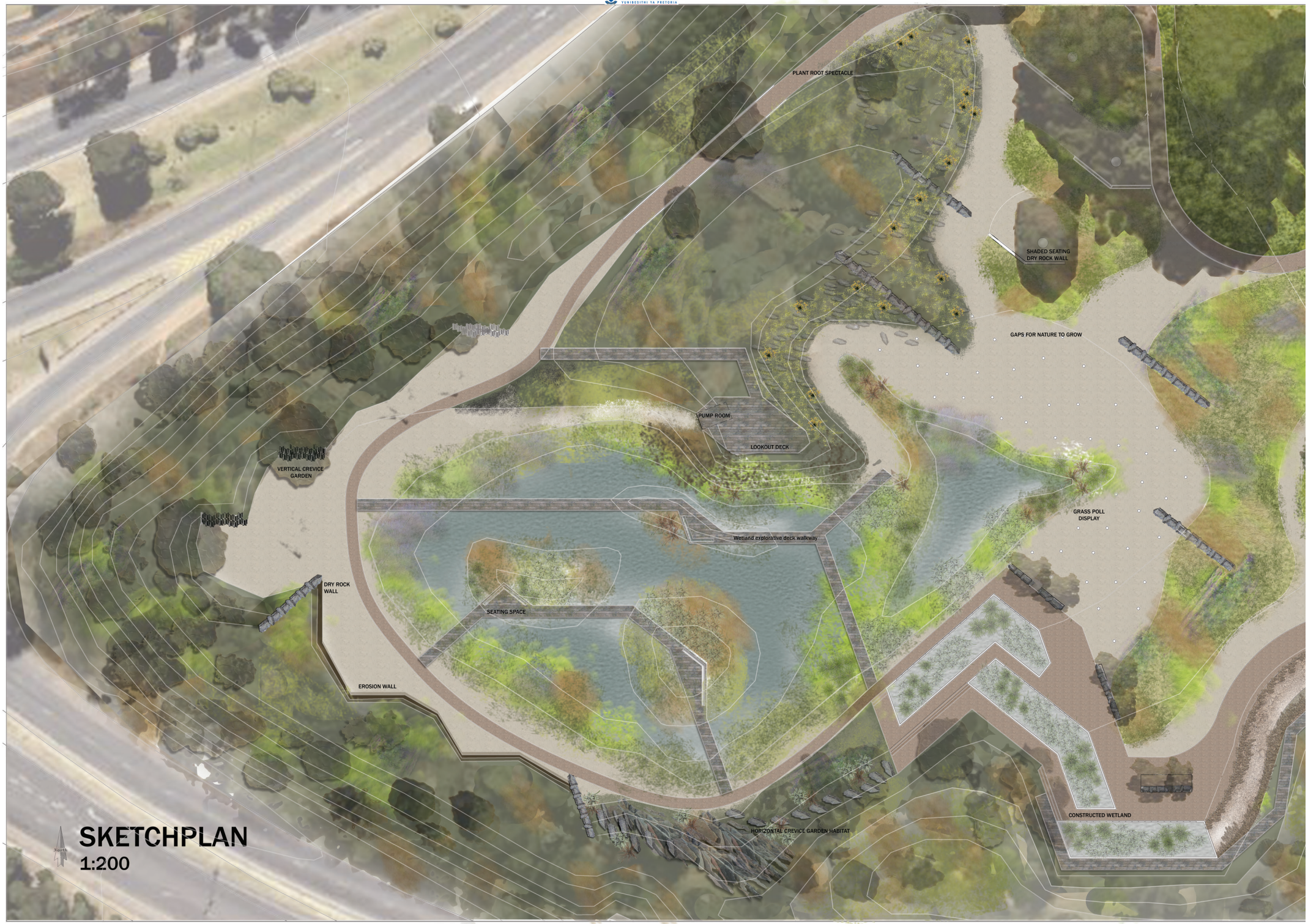






© University of Pretoria

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA



SKETCHPLAN

1:200

© University of Pretoria

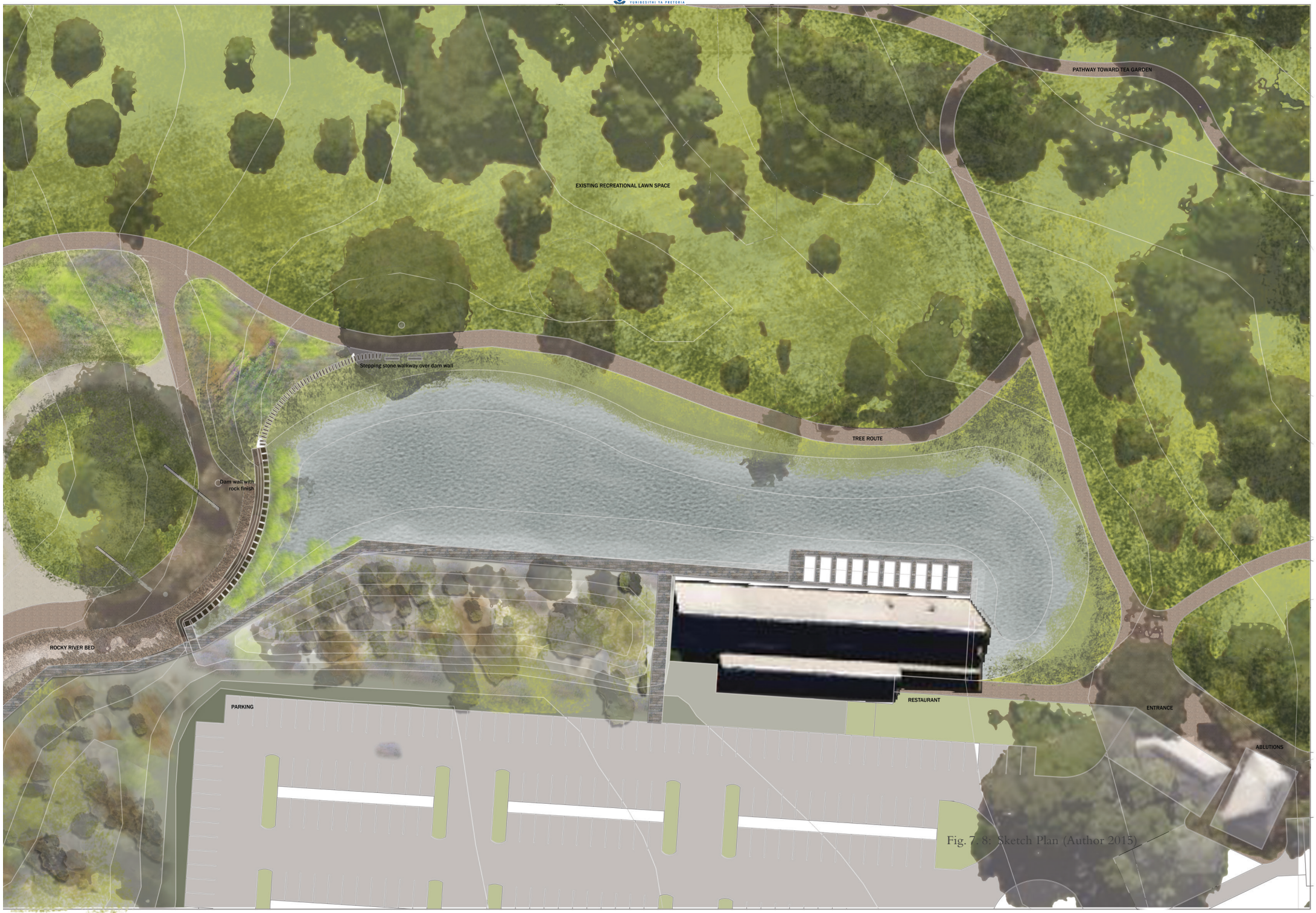


Fig. 7.8: Sketch Plan (Author 2015)

© University of Pretoria

Design outcomes:

The landscape architecture manifesto has been used to inform the design of the botanical garden.

1 Our understanding of nature should be made visible through ecological design. Ecological processes need to be visible in order for them to be expressive.



Fig 7.9: Gaps for nature to grow (Author 2015)

Through an understanding of the endangered ecosystems being protected, the different vegetation types are separated into their specific habitats, making these different habitats visible through isolating them and leaving "gaps for nature to grow" as Giles Clement puts it. These gaps are intended to draw people in from the primary routes in order to encourage interaction and exploration instead of "purist" manicured plant beds. The gaps is merely compacted earth, which will allow plants to transgress into areas not used by the audience. This also allows for a garden - gardener relationship with nature where nature performs and the gardener reacts according to what the garden is delivering, thus allowing change over time. The habitats are further extruded by using the elements of the ecological basis that defines the habitat and shaping them into a pattern in order to make the ecological elements visible. These elements (rock walls constructed as a dry wall using the specific rock type that supports plant growth within that habitat) also extend into the "gaps" which interrupts the movement of people thus drawing their attention to interesting plants instead of having the plants merely as a side matter.

2 Refuse to create boundaries that confine nature and define movement. We should allow edges to transgress, merely guide energies, and design with change as medium.

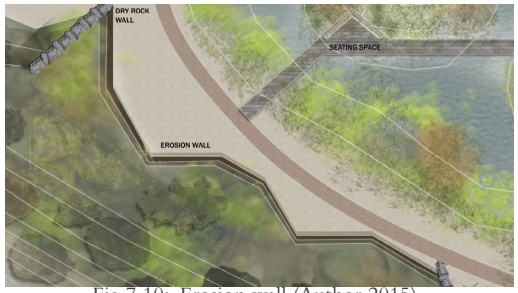


Fig 7.10: Erosion wall (Author 2015)

This statement is clearly visible in the gaps that is left between the different habitats as mentioned in statement 1 above. Another design element that shows this statement quite dramatically is the erosion wall:

The eroding wall exposes soil profiles to the elements as well as to the human eye. The wall changes over time, which ensures that the visitor will have a different experience each time they visit the garden. The soil profile will be inverted over time, disposing the top soil at the bottom first. This will create a different stage on which different species will eventually start to perform on. The edge of this eroding will transgress constantly, showing the dynamic aspect of nature.

3 Set a stage for the performance of nature through the creation of environmental conditions for plant habitats, but allow nature to grow and evolve intuitively and improvise and transcend through its inherent potential to embrace change.

Each habitat is created specifically to support plant growth and create the desired microclimate for the endangered plant species. These crucial geological and ecological elements is not necessarily used in a way that it occurs naturally but rather used to create patterns in the garden to draw attention to the uniqueness of each habitat. This can be seen in the use of dry rock walls and also in the crevice gardens, both vertical and horizontal.

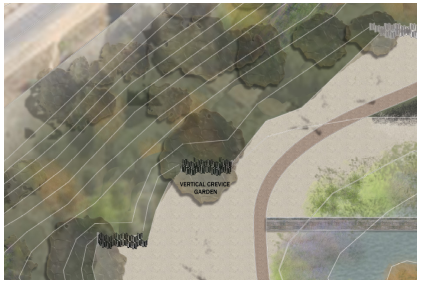


Fig 7.11: Vertical crevice garden (Author 2015)

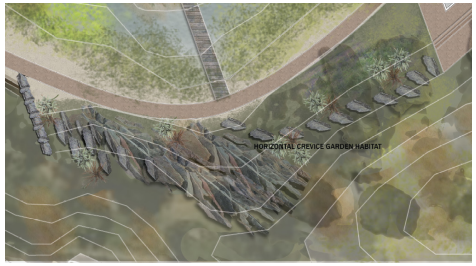


Fig 7.12: Horizontal crevice garden (Author 2015)

© University of Pretoria



Fig 7.13: Montreal Botanical garden - Crevice garden (Yockey 2007)

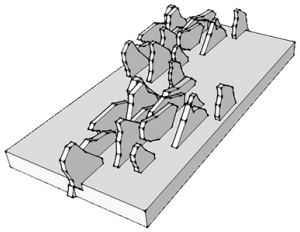


Fig 7.14: Crevice garden (Author 2015)



Fig 7.15: Horizontal crevice garden (Jans 2008)

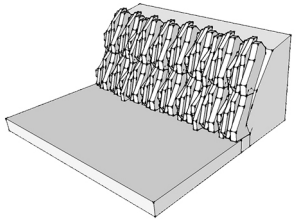


Fig 7.16: Horizontal crevice garden (Author 2015)

4 The view of plants as groups of interrelated species modifying and interacting with each other, rather than as separate and fixed, demonstrates flexibility — a main motif of landscape form.

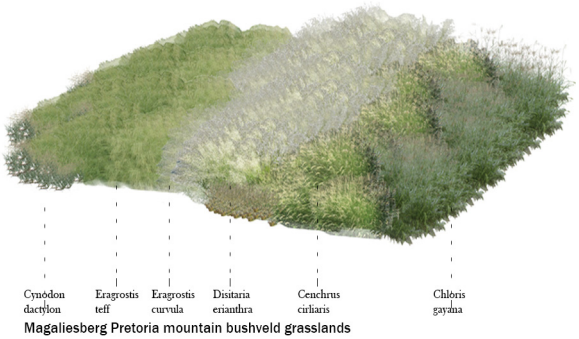


Fig 7.17: Plant mix (Author 2015)

5 Plants should be the main focus and attraction in botanical gardens and not merely what we pass by in order to get to a destination.

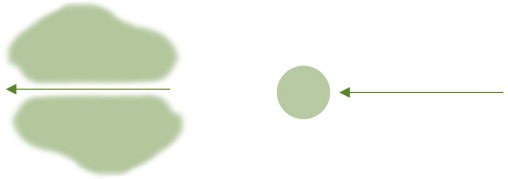
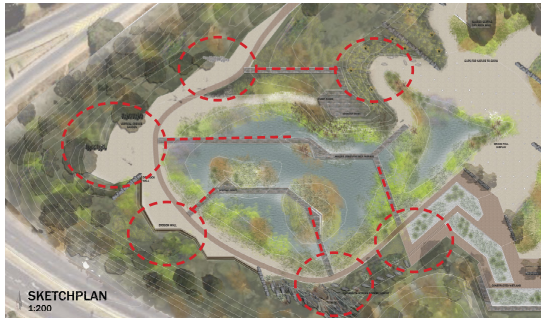


Fig 7.18: Movement towards plants rather than past it as a border(Author 2015)



6 Allow landscape to be unpredictable. Maintenance does not determine whether the garden is aesthetically pleasing.

This statement sounds quite bold, but what is being said is that when there is left over spaces in the garden, such as in between rocks in niches, if plants start to establish themselves in these spaces, it is worth so much more for the biodiversity of the garden to leave these plants to grow. Even if it is weeds that is establishing first, if they are not invasive weeds, they will create environment for more plants to start establishing, again leading to a higher biodiversity. It is necessary to start seeing this as the real beauty, rather that clean manicured edges.

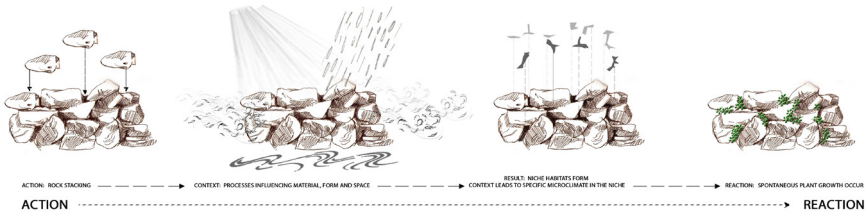


Fig 7.19: Dry rock wall construction (Author 2015)

© University of Pretoria

7 Do more than represent nature; allow nature to represent itself. Redefine the role of the landscape architect and the way that landscapes are represented.

As is seen on the sketch plan in fig. 7.8, the plan is merely a suggestion of where the plants will be introduced, it does not represent the final shape of the garden. The garden will determine the final shape, not the landscape architect. The patterns will merely guide where people will most likely move and where plants will start to grow, but how it actually happens will only be determined over time.

8 The sequential spatial experience of the landscape should immerse the audience in nature and confront, excite and captivate the visitor. This can be done by using repetition/pattern to compose and order the landscape.

The movement through the garden is designed to be as free as possible, whilst keeping it interesting with set points of interest along any chosen route. Thus, the sequence of experience works any way the audience chooses to experience it. The pathways that are quite direct, aim to move people towards interesting parts of the garden that would be found interesting. This movement also creates pattern in the landscape, giving unity within the garden. These points of interest, as well as patterns interrupt the audience in their movement, confront them and aim to show them something exiting about nature that would capture their interest and immerse them in nature, such as the eroding wall, the root spectacle, the wetland and the dam wall.

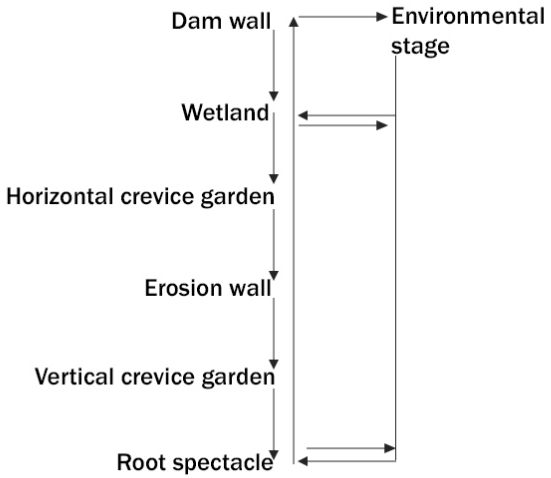


Fig 7.20: Sequential movement diagram. (Author 2015)

9 Refuse to create a preconceived plan, narrative or set way of movement.

Although a set plan is created, the shapes one sees on this plan is not set. There is no clear borders, but merely a vision of how it could look. The movement is defined by having primary routes and secondary routes. The primary routes are not your usual paved pathways but rather a material that makes compacted earth waterproof (Stalok paving). Thus, the primary route blends in completely with the secondary routes (open areas left as exposed compacted earth). This encourages people to stroll off the set out path and explore the garden, discovering the beauties of nature for themselves. Also the movement now stays completely free, in the sense that the audience can decide where they want to walk, not the landscape architect.



Fig 7.21: Stalok paving for primary routes (Author 2015)

10 'Region' is a unifying theme or identity to which local inhabitants relate.

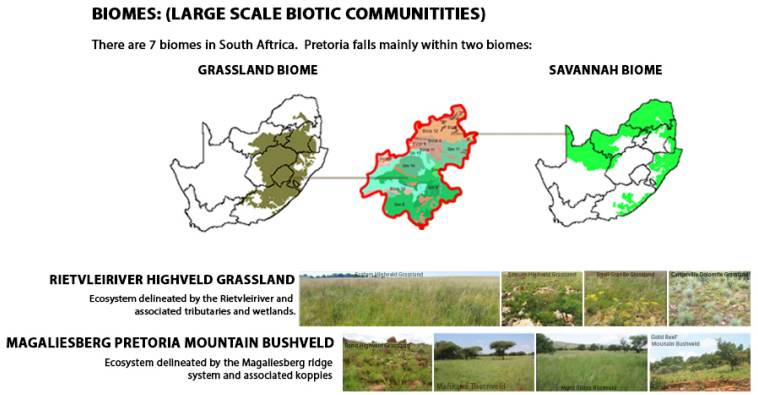


Fig 7.22: Regional landscape diagram. (Author 2015)

© University of Pretoria

Chapter 8

SYSTEMS

The environmental stage.

© University of Pretoria

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

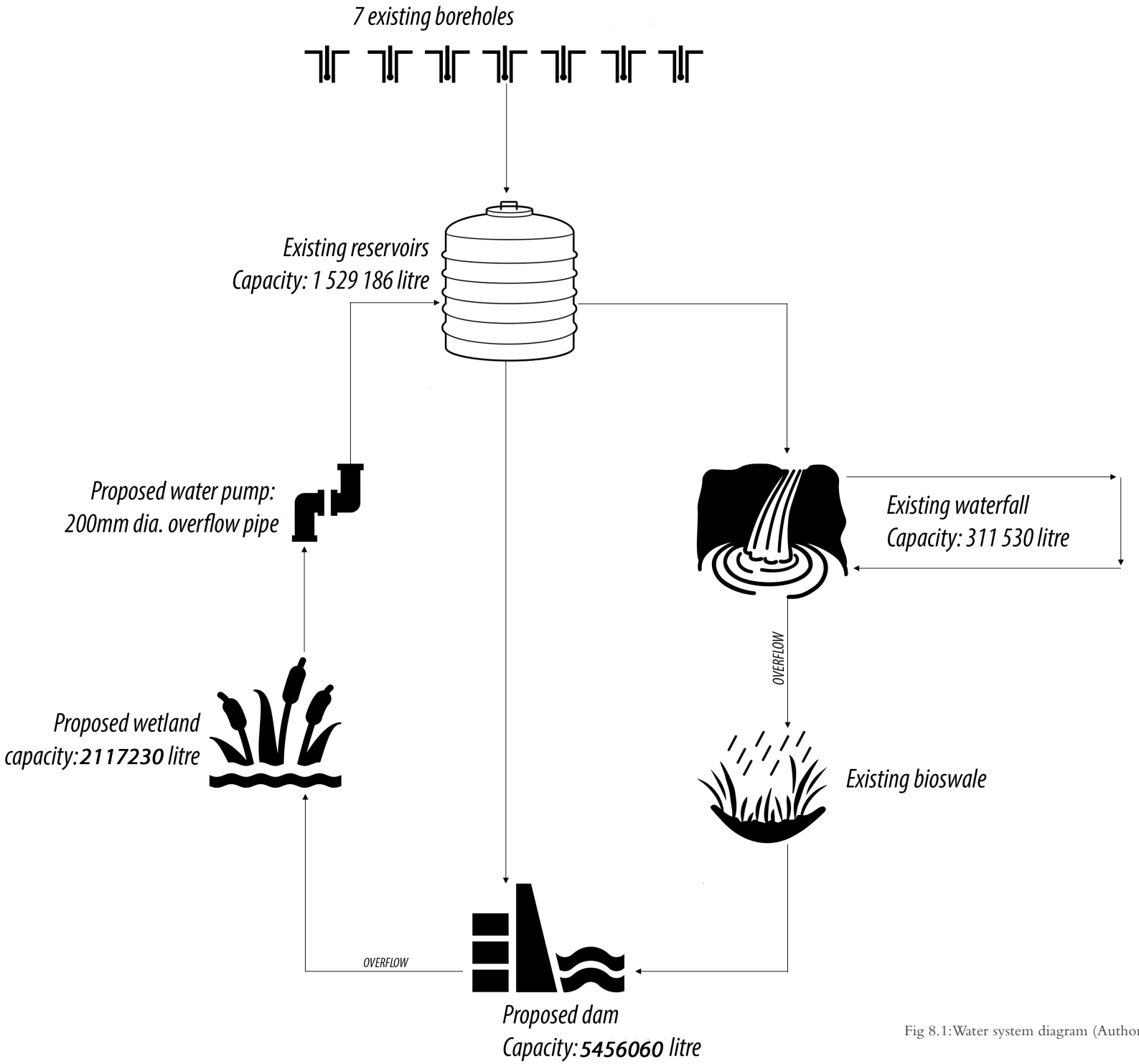


Fig 8.1:Water system diagram (Author 2015)

© University of Pretoria

8.1 Water systems:

The Pretoria NBG has an existing water system that pumps water out of seven boreholes. This is used to keep the waterfall running, irrigation as well as domestic use. My aim in the design is to catch all the water runoff coming from the site and to utilise this for water demand on site. According to the calculations that follows it shows that this is in fact possible, however, the dam and wetland created will be kept full with water coming from the borehole. The reason for this is that water in a botanical garden play a big role within the creation of habitats and influencing microclimate. The usage of the water from the boreholes will eventually get less as system stabilizes over the years.

Water yield into dam:

Area of (Per surface)	Area (m^2)	Run-off Coefficient
Roofing	4 766,80 m^2	0,9
l Landscaping	29 709,20 m^2	0,8
Landscaping :	36 236,75 m^2	0,45
Lawn	75 190,00 m^2	0,2
Grassland	18 062,00 m^2	0,35
e south slope	24 454,50 m^2	0,2
TOTAL:	**188 419,25 m^2**	14,81

8.2 Proposed dam calculations:

The dam will be filled up to start off with and will be kept full with the water coming from the reservoir. The overflow, which is necessary for the dam wall design to be effective, will be seasonal. The yield from site runoff will overflow into the wetland and cause fluctuating water levels in the wetland, however the dam levels will remain effectively full for aesthetical reasons.

MONTH	Precipitation Average Monthly (m)	Roofing **P(m) x A(m^2) x C**	Hard landscaping Yield **P(m) x A(m^2) x C**	Soft landscaping Yield **P(m) x A(m^2) x C**	Lawn Yield **P(m) x A(m^2) x C**	Grassland Yield **P(m) x A(m^2) x C**	Ridge south slope Yield **P(m) x A(m^2) x C**	Total yield
January	0,154	1020, 68 m^3	3660, 17 m^3	2511, 21 m^3	2315, 85 m^3	3704, 52 m^3	753, 2 m^3	264 240 m^3
February	0,102	456, 94 m^3	2424, 27 m^3	1663, 27 m^3	1533, 88 m^3	644, 81 m^3	498, 87 m^3	134 460 m^3
March	0,078	353, 98 m^3	1853, 85 m^3	1271, 91 m^3	1172, 96 m^3	493, 09 m^3	381, 49 m^3	102 920 m^3
April	0,055	255, 31 m^3	1307, 2 m^3	896, 86 m^3	827, 09 m^3	347, 69 m^3	269, m^3	72 680 m^3
May	0,013	75, 12 m^3	308, 98 m^3	211, 98 m^3	195, 49 m^3	82, 18 m^3	63, 58 m^3	17 480 m^3
June	0,007	49, 38 m^3	166, 37 m^3	114, 15 m^3	105, 27 m^3	44, 25 m^3	34, 24 m^3	9 580 m^3
July	0,003	32, 22 m^3	71, 3 m^3	48, 92 m^3	45, 11 m^3	18, 97 m^3	14, 67 m^3	4 340 m^3
August	0,006	45, 09 m^3	142, 6 m^3	97, 84 m^3	90, 23 m^3	37, 93 m^3	29, 35 m^3	8 280 m^3
September	0,022	113, 73 m^3	522, 88 m^3	358, 74 m^3	330, 84 m^3	139, 08 m^3	107, 6 m^3	29 300 m^3
October	0,073	332, 53 m^3	1735, 02 m^3	1190, 38 m^3	1097, 77 m^3	461, 48 m^3	357, 04 m^3	96 340 m^3
November	0,102	456, 94 m^3	2424, 27 m^3	1663, 27 m^3	1533, 88 m^3	644, 81 m^3	498, 87 m^3	134 460 m^3
December	0,125	555, 62 m^3	2970, 92 m^3	2038, 32 m^3	1879, 75 m^3	790, 21 m^3	611, 36 m^3	164 700 m^3
		3747, 54 m^3	**17587, 85 m^3**	**12066, 84 m^3**	**11128, 12 m^3**	**7409, 03 m^3**	**3619, 27 m^3**	**1038 780 m^3**

© University of Pretoria

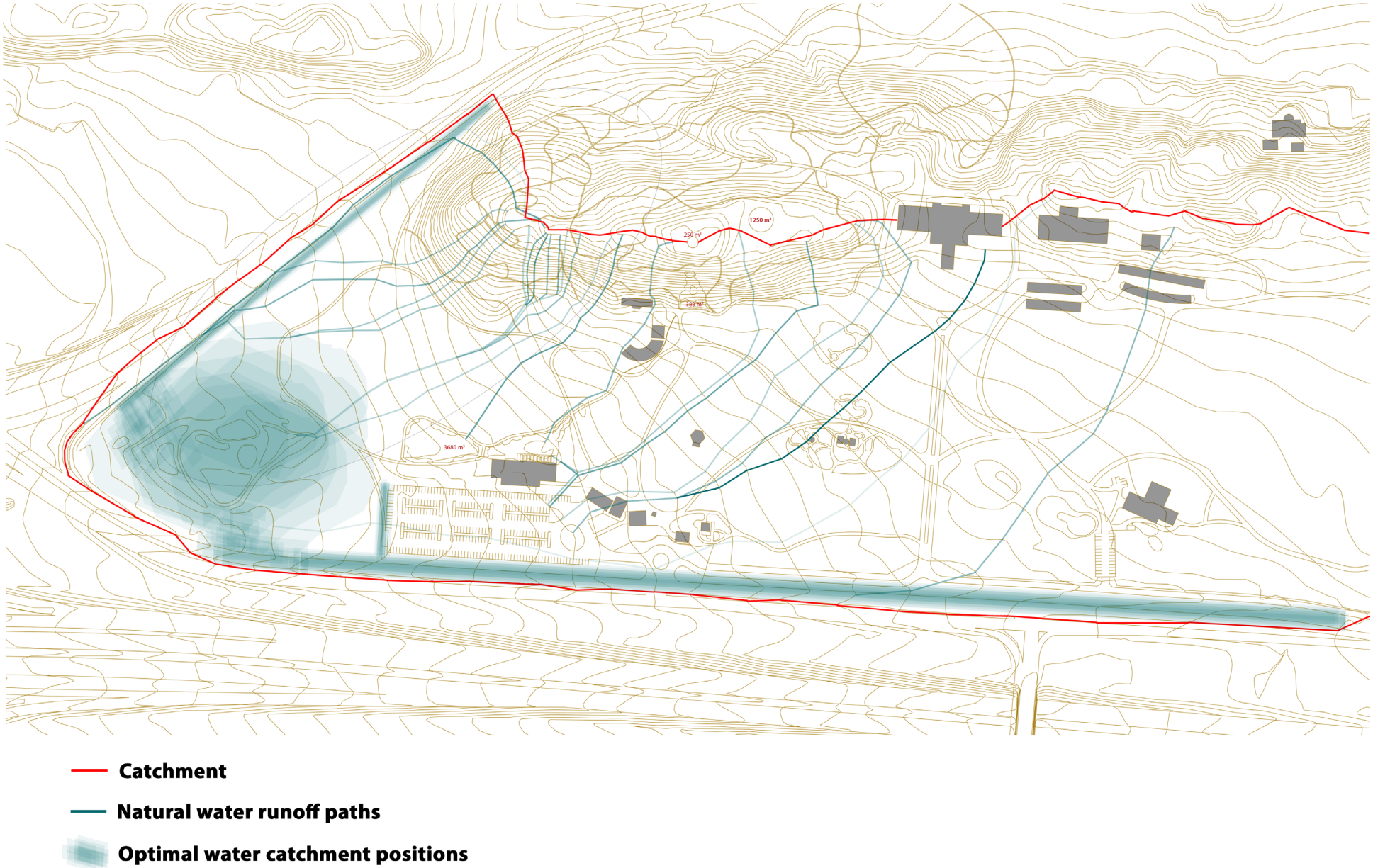


Fig 8.2: Water catchment on site (Author 2015)

© University of Pretoria

Water budget:

MONTH	Dam volume - evaporation = Fluctuating water volume (l)	Volume required to fill up dam (l)	Full dam overflow (l) [YIELD FROM RAIN]	Liters left in resovoir after filling dam	Demand	Liters left after Demand	Evaporation Coefficient	Evaporation cubic meters	Evaporation in liters
January	4865180,00	590880,00	264240,00	938306,00	416,81	937889,19	0,16	590,88	590880,00
February	4939040,00	517020,00	134460,00	1012166,00	387,81	1011778,19	0,14	517,02	517020,00
March	5086760,00	369300,00	102920,00	1159886,00	416,81	1159469,19	0,10	369,30	369300,00
April	5160620,00	295440,00	72680,00	1233746,00	310,81	1233435,19	0,08	295,44	295440,00
May	5234480,00	221580,00	17480,00	1307606,00	217,81	1307388,19	0,06	221,58	221580,00
June	5308340,00	147720,00	9580,00	1381466,00	213,81	1381252,19	0,04	147,72	147720,00
July	5308340,00	147720,00	4340,00	1381466,00	213,81	1381252,19	0,04	147,72	147720,00
August	5160620,00	295440,00	8280,00	1233746,00	217,81	1233528,19	0,08	295,44	295440,00
September	5012900,00	443160,00	29300,00	1086026,00	310,81	1085715,19	0,12	443,16	443160,00
October	4939040,00	517020,00	96340,00	1012166,00	416,81	1011749,19	0,14	517,02	517020,00
November	4939040,00	517020,00	134460,00	1012166,00	406,81	1011759,19	0,14	517,02	517020,00
December	4865180,00	590880,00	164700,00	938306,00	416,81	937889,19	0,16	590,88	590880,00

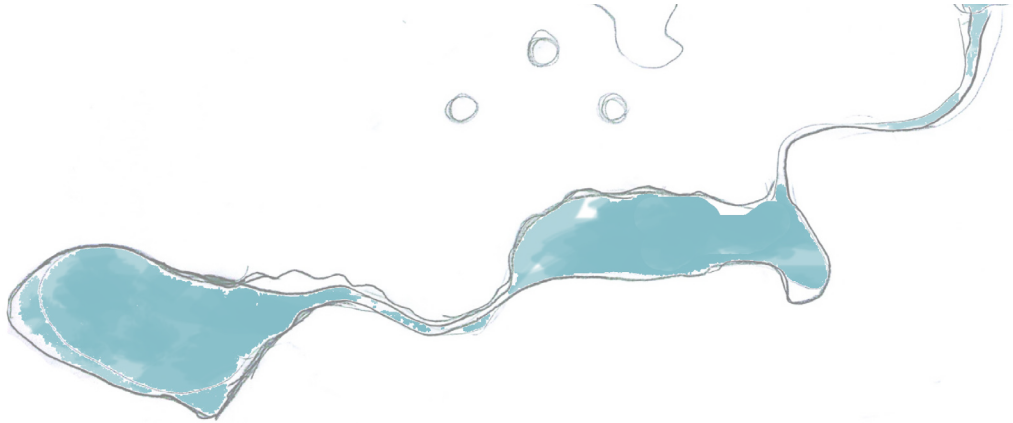


Fig 8.3: Water on site (Author 2015)

© University of Pretoria

Water yield for wetland:

Area of Catchment: (Per surface)	Area (m^2)	Run-off Coefficient
Roofing	4 766,80 m^2	0,9
Hard Landscaping	29 709,20 m^2	0,8
Soft Landscaping :	38 200,25 m^2	0,45
Lawn	37 595,00 m^2	0,2
Grassland	49 960,80 m^2	0,35
Ridge south slope	24 454,50 m^2	0,2
TOTAL:	**184 686,55 m^2**	15,76

Wetland calculations:

Water overflows from the dam into the wetland. The wetland consists of two parts: a constructed wetland and a natural wetland. Since this is a closed system, the capacity for the wetland is taken as one volume. The constructed wetland will be kept full together with the dam, for aesthetical reasons, thus all the yield from rainwater on site will cause fluctuations in the water level of the wetland. This ensures a natural wetland process occurrence, supporting plant growth as well.

MONTH	Precipitation Average Monthly (m)	Roofing Yield P(m) x A(m^2) x C	Hard landscaping Yield P(m) x A(m^2) x C	Soft landscaping Yield P(m) x A(m^2) x C	Lawn Yield P(m) x A(m^2) x C	Grassland Yield P(m) x A(m^2) x C	Rige south slope Yield P(m) x A(m^2) x C	Total yield
January	0,154	1020, 68 m^3	3660, 17 m^3	2647, 28 m^3	1157, 93 m^3	10246, 96 m^3	753, 2 m^3	91160, m^3
February	0,102	456, 94 m^3	2424, 27 m^3	1753, 39 m^3	766, 94 m^3	1783, 6 m^3	498, 87 m^3	60380, m^3
March	0,078	353, 98 m^3	1853, 85 m^3	1340, 83 m^3	586, 48 m^3	1363, 93 m^3	381, 49 m^3	46180, m^3
April	0,055	255, 31 m^3	1307, 2 m^3	945, 46 m^3	413, 55 m^3	961, 75 m^3	269, m^3	32560, m^3
May	0,013	75, 12 m^3	308, 98 m^3	223, 47 m^3	97, 75 m^3	227, 32 m^3	63, 58 m^3	7700, m^3
June	0,007	49, 38 m^3	166, 37 m^3	120, 33 m^3	52, 63 m^3	122, 4 m^3	34, 24 m^3	4140, m^3
July	0,003	32, 22 m^3	71, 3 m^3	51, 57 m^3	22, 56 m^3	52, 46 m^3	14, 67 m^3	1780, m^3
August	0,006	45, 09 m^3	142, 6 m^3	103, 14 m^3	45, 11 m^3	104, 92 m^3	29, 35 m^3	3560, m^3
September	0,022	113, 73 m^3	522, 88 m^3	378, 18 m^3	165, 42 m^3	384, 7 m^3	107, 6 m^3	13020, m^3
October	0,073	332, 53 m^3	1735, 02 m^3	1254, 88 m^3	548, 89 m^3	1276, 5 m^3	357, 04 m^3	43220, m^3
November	0,102	456, 94 m^3	2424, 27 m^3	1753, 39 m^3	766, 94 m^3	1783, 6 m^3	498, 87 m^3	60380, m^3
December	0,125	555, 62 m^3	2970, 92 m^3	2148, 76 m^3	939, 88 m^3	2185, 79 m^3	611, 36 m^3	74000, m^3
PER ANNUM		**3747, 54 m^3**	**17587, 85 m^3**	**12720, 68 m^3**	**5564, 06 m^3**	**20493, 92 m^3**	**3619, 27 m^3**	**438080, m^3**

© University of Pretoria

Water Budget:

MONTH	Dam volume - evaporation = Fluctuating water volume (l)	Volume required to fill up dam (l)	Reservoir liters left after fillig big damn and using demand	Water left in reservoir after filling small dam	RAIN YIELD [FOR SMALL DAMN]	Total water from overflow from big damn	Total water saved from using YIELD WATER	Water fluctuation over small damn (FULL WETLAND) from YIELD
January	1778473,20	338756,80	937889,19	599132,39	91160,00	264240,00	355400,00	0,07
February	1820817,80	296412,20	1011778,19	715365,99	60380,00	134460,00	194840,00	0,04
March	1905507,00	211723,00	1159469,19	947746,19	46180,00	102920,00	149100,00	0,03
April	1947851,60	169378,40	1233435,19	1064056,79	32560,00	72680,00	105240,00	0,02
May	1990196,20	127033,80	1307388,19	1180354,39	7700,00	17480,00	25180,00	0,01
June	2032540,80	84689,20	1381252,19	1296562,99	4140,00	9580,00	13720,00	0,00
July	2032540,80	84689,20	1381252,19	1296562,99	1780,00	4340,00	6120,00	0,00
August	1947851,60	169378,40	1233528,19	1064149,79	3560,00	8280,00	11840,00	0,00
September	1863162,40	254067,60	1085715,19	831647,59	13020,00	29300,00	42320,00	0,01
October	1820817,80	296412,20	1011749,19	715336,99	43220,00	96340,00	139560,00	0,03
November	1820817,80	296412,20	1011759,19	715346,99	60380,00	134460,00	194840,00	0,04
December	1778473,20	338756,80	937889,19	599132,39	74000,00	164700,00	238700,00	0,05

EVAPORATION		
Evaporation constant	Evaporation (square meters)	Evaporation (Liters)
0,16	338,76	338756,80
0,14	296,41	296412,20
0,10	211,72	211723,00
0,08	169,38	169378,40
0,06	127,03	127033,80
0,04	84,69	84689,20
0,04	84,69	84689,20
0,08	169,38	169378,40
0,12	254,07	254067,60
0,14	296,41	296412,20
0,14	296,41	296412,20
0,16	338,76	338756,80

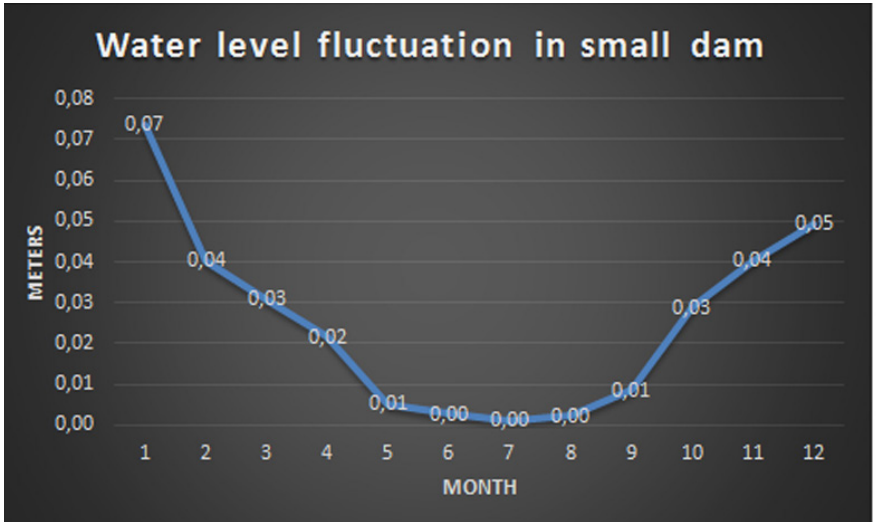


Fig 8.4: Water fluctuation graph(Author 2015)

© University of Pretoria

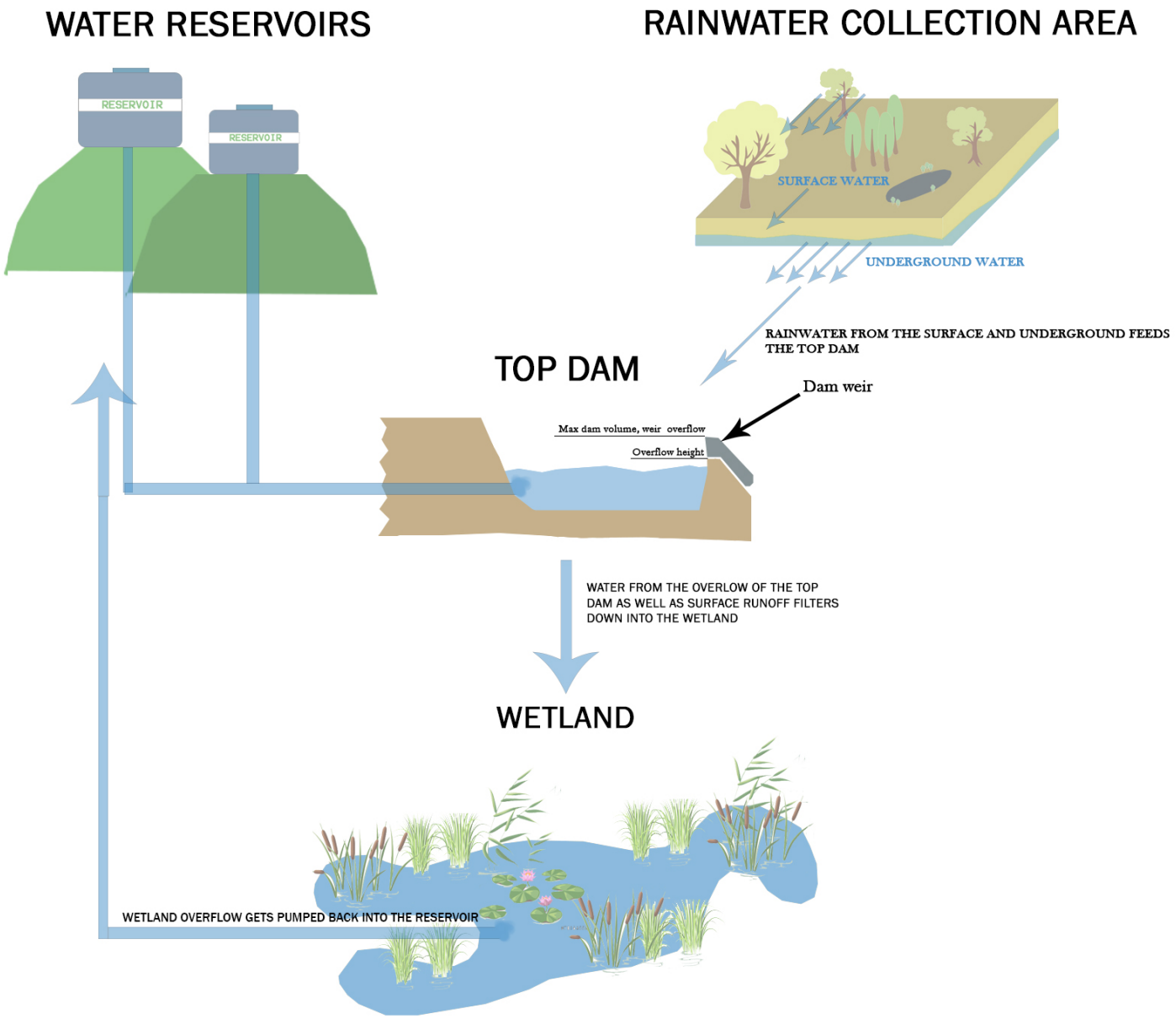


Fig 8.5: Water flow diagram (Author 2015)

© University of Pretoria

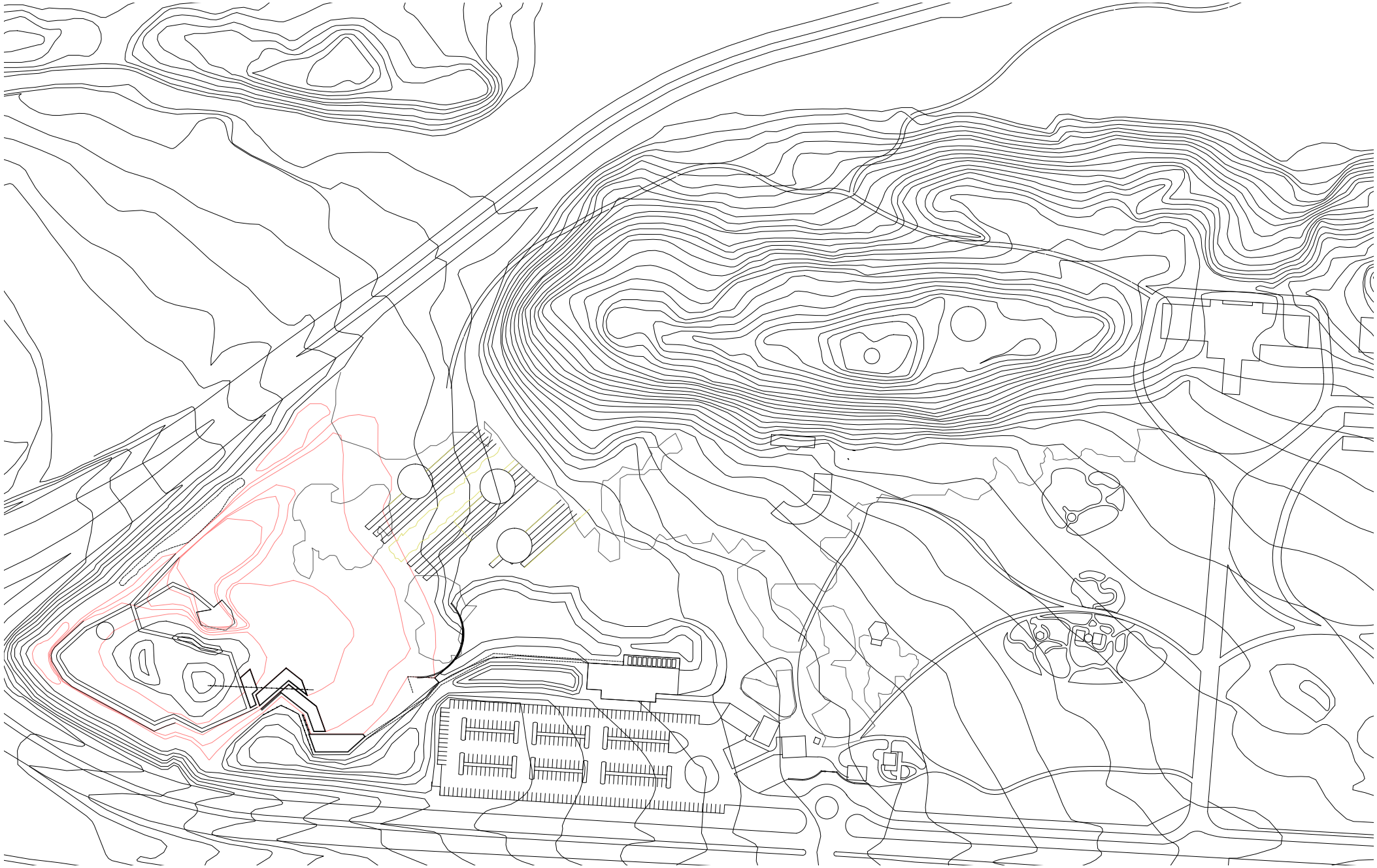
Chapter 9

TECHNIFICATION OF TEMPORALITY

Detail design

© University of Pretoria

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA



© University of Pretoria

9.1 Technical approach

According to the research of this dissertation, the constructed landscape needs to be designed in order to influence ecological processes. In a botanical garden this has largely got to do with habitat creation to support growth of plants. Specific to my temporal design approach this structure should do one of two things: firstly to choreograph change in the landscape and secondly to represent the botanical plants in such a way that grabs the audience's attention, that reveals something about the plants that one does not necessarily notice when experiencing untamed nature, that enables the plant to impress the audience.

This has been executed in four main construction details, shaped by working with patterns in landscape as well as topographic manipulations to get a desired outcome.

1 Dam wall: The purpose of the dam wall in the design is firstly to support the dam construction to create an aesthetic entrance into the NBG as well as for the users of the restaurant. Secondly, the wall in itself leads the visitor into the proposed regional theme garden experience. Thirdly, the wall has a temporal quality to it as the materiality thereof is natural stone and is spaced in such a way as to leave gaps for nature to start establishing in the niches and in the long run increase biodiversity.

2 Eroding wall: The eroding wall insures that the audience is immersed in nature, rather that spectators from afar. Soil profiles are exposed to the elements, which are usually buried under our feet, invisible to the naked eye. This allows the audience to experience more than what is usually experienced, and creates an urge within them to learn more about nature. The eroding wall changes over time, which ensures that the visitor will have a different experience each time they visit the garden. After all, one can never enter the same garden twice,one can only enter the same grounds upon which nature has establishes itself. The soil profile will be inverted over time, disposing the top soil at the bottom first. This will create a different stage on which different species will eventually start to perform on.

3 Root spectacle: Here a poort is created that leads the visitor into the themed regional garden design. The audience moves through a space that exposes the grass roots on both sides of the pathway. The roots once again are intended to entertain the visitor in exploring the reproduction of grasslands and the different types of roots.

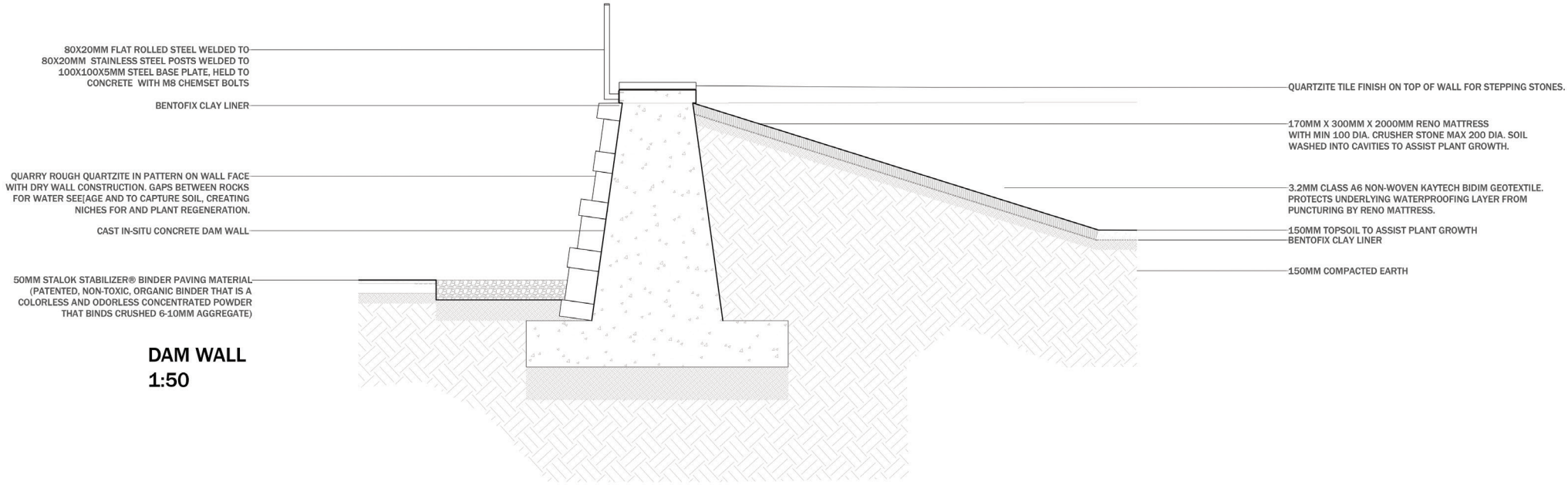
4 Horizontal wetland: The wetland has very much the same approach as the root spectacle. Here it allows the visitor to explore how wetlands work and see what is usually not visible to the audience in nature. The wetland is designed to filter the audience through the wetland, putting them right where the performance is happening. Front row seats.

© University of Pretoria

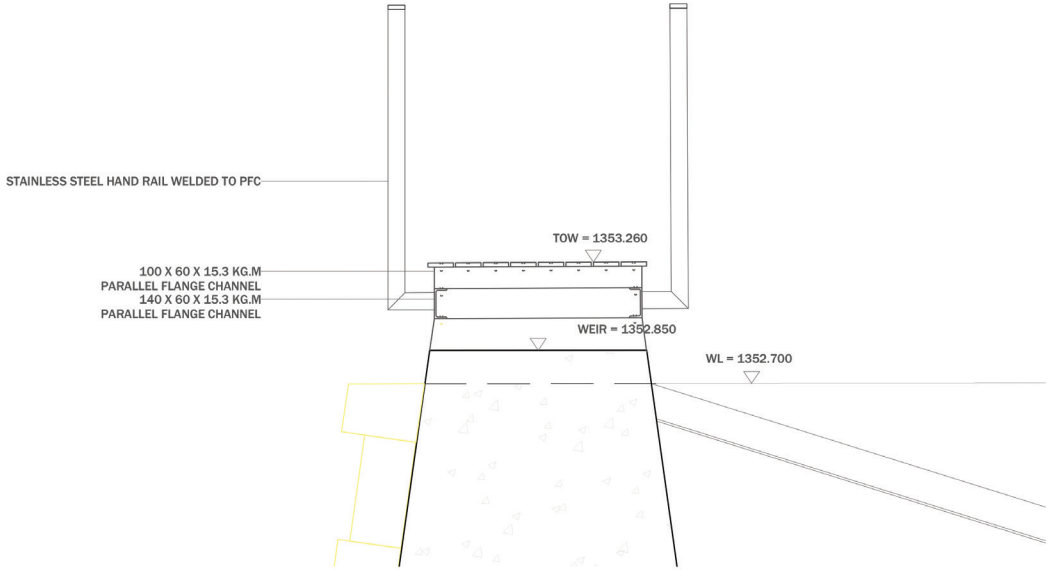


Fig 9.1: Dam wall (Author 2015)

© University of Pretoria



DAM WALL
1:50



Weir
1:20

Panicum maximum



Peltophorum africanum



Ficus sur



Dovyalis caffra



Ziziphus macronata



Stainless steel frame

* Durable and weather resistant



QUARTZITE STONE

* Microclimatic influence
* Habitat creation
* Geological support for plants
* Aesthetics
* Dry-construction: non-obtrusive to nature



StaLok Paving

* Innovative StaLok Waterless technology transforms natural decomposed granite and crushed stone into a unique natural paving material.
* Polymer technology gives increased strength, resulting in increased traffic resistance, but also maintains flexibility.
* Resist weathering from water.
* Simply needs compaction.



© University of Pretoria

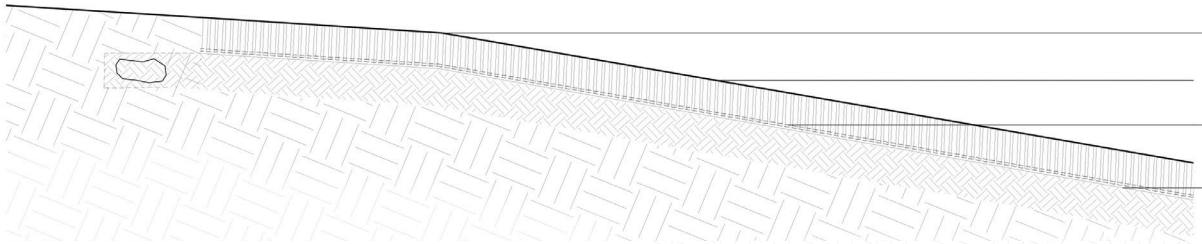


Fig 9.2: Temporal eroding wall (Author 2015)

© University of Pretoria



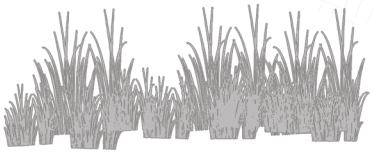
SCALE 1:100

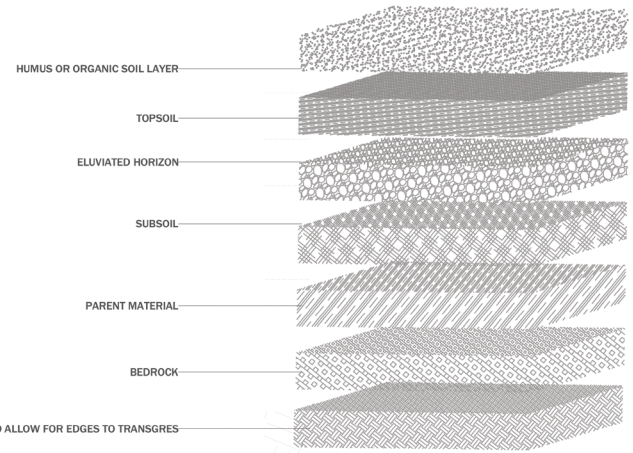


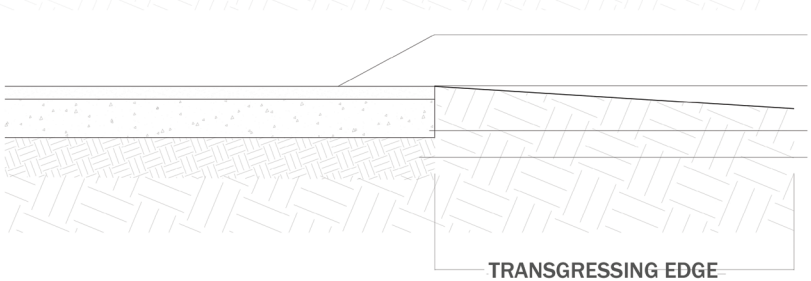
170MM X 300MM X 2000MM RENO MATTRESS WITH MIN 100 DIA. CRUSHER STONE MAX 200 DIA. SOIL WASHED INTO CAVITIES TO ASSIST PLANT GROWTH.

3.2MM CLASS A6 NON-WOVEN KAYTECH BIDIM GEOTEXTILE. PROTECTS UNDERLYING WATERPROOFING LAYER FROM PUNCTURING BY RENO MATTRESS.

10MM KAYTECH ENVIROFIX GEOSYNTHETIC CLAY LINER LAYED ON 150MM COMPACTED SOIL







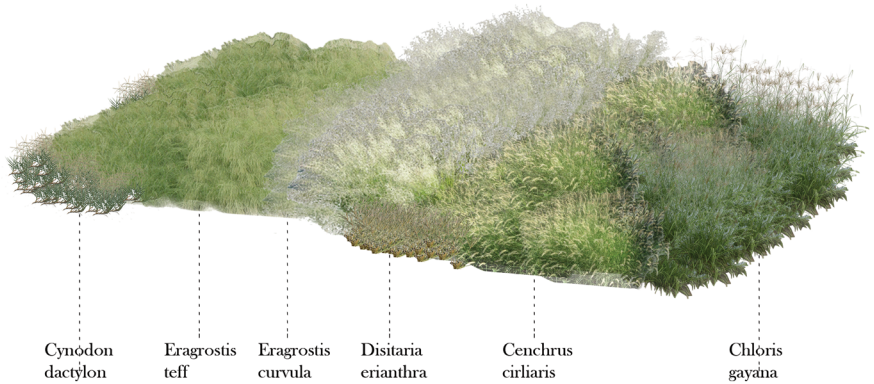
50MM STALOK STABILIZER® BINDER PAVING MATERIAL (PATENTED, NON-TOXIC, ORGANIC BINDER THAT IS A COLORLESS AND ODORLESS CONCENTRATED POWDER THAT BINDS CRUSHED 6-10MM AGGREGATE)

70% CRUSHED AGGREGATE 6-10MM ,30% TOPSOIL

150MM THICK 6-10MM CRUSHED AGGREGATE ON 150MM COMPA

150MM COMPACTED SOIL

TRANSGRESSING EDGE



Cynodon dactylon | Eragrostis teff | Eragrostis curvula | Disitaria erianthra | Cenchrus cirliaris | Chloris gayana

Magaliesberg Pretoria mountain bushveld grasslands

StaLok Paving

* Innovative StaLok Waterless technology transforms natural decomposed granite and crushed stone into a unique natural paving material.
* Polymer technology gives increased strength, resulting in increased traffic resistance, but also maintains flexibility.
* Resist weathering from water.
* Simply needs compaction.



QUARTZITE STONE

* Microclimatic influence
* Habitat creation
* Geological support for plants
* Aesthetics
* Dry-construction: non-obtrusive to nature

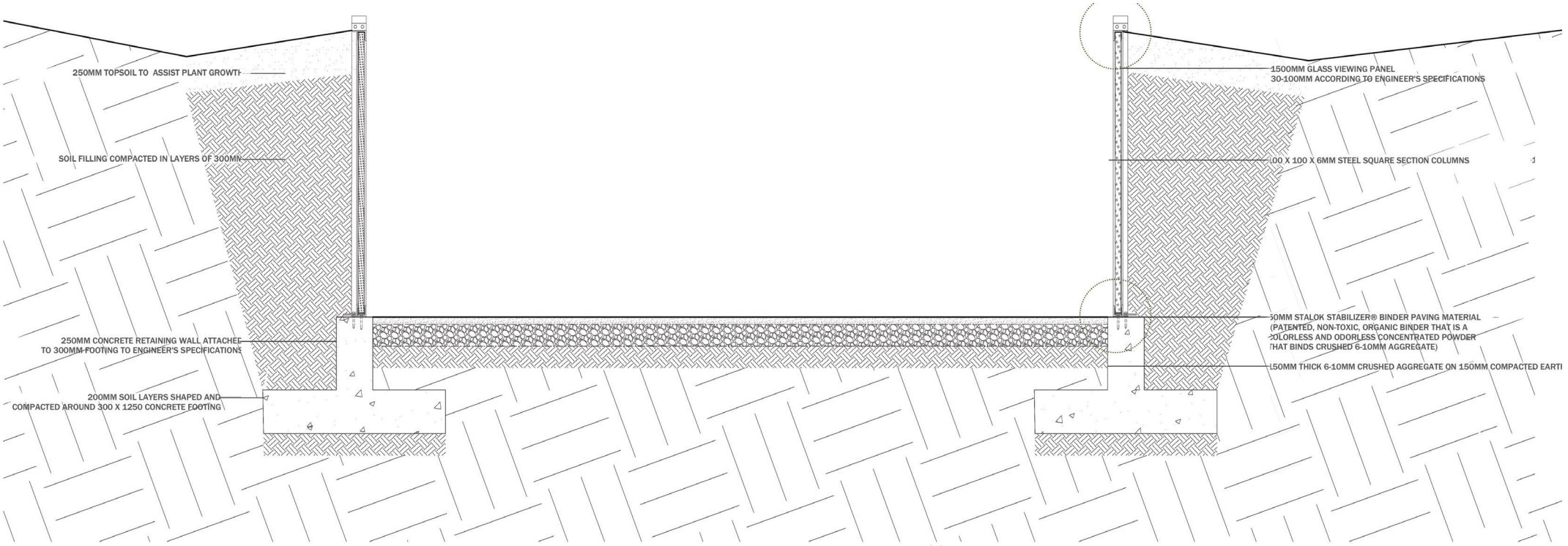


© University of Pretoria

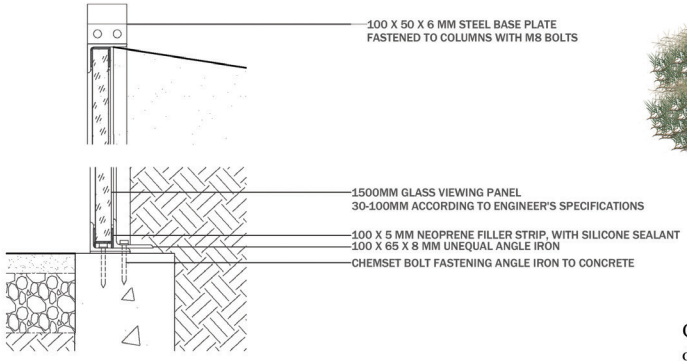


Fig 9.3: Root spectacle (Author 2015)

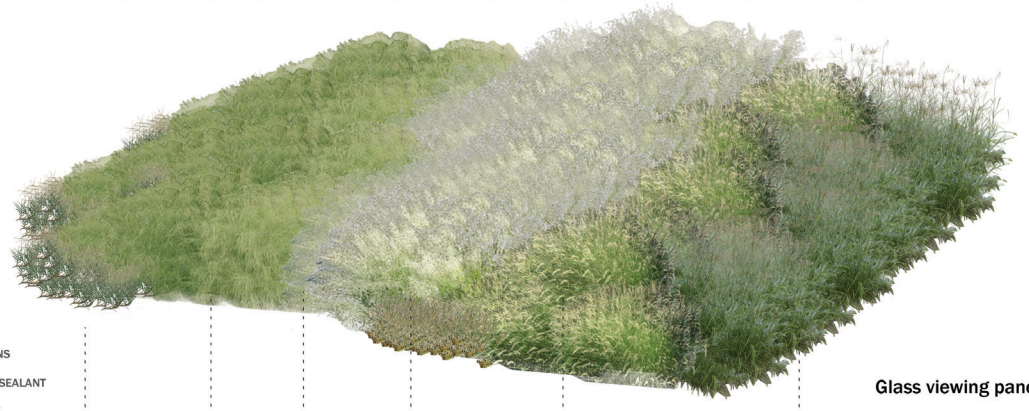
© University of Pretoria



SCALE 1:20



SCALE 1:10



Magaliesberg Pretoria mountain bushveld grasslands

Glass viewing panels



Stainless steel frame

* Durable and weather resistant



StaLok Paving

* Innovative StaLok Waterless technology transforms natural decomposed granite and crushed stone into a unique natural paving material.
* Polymer technology gives increased strength, resulting in increased traffic resistance, but also maintains flexibility.
* Resist weathering from water.
* Simply needs compaction.

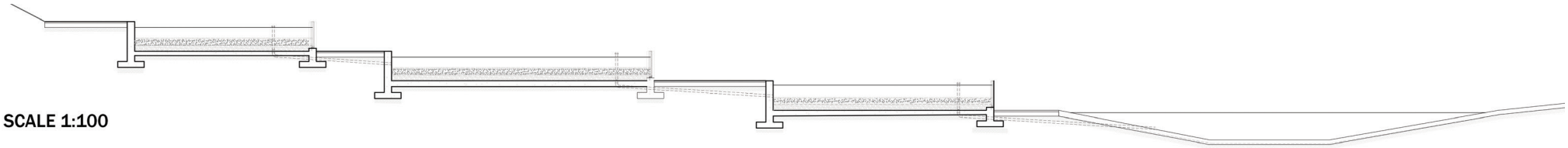


© University of Pretoria

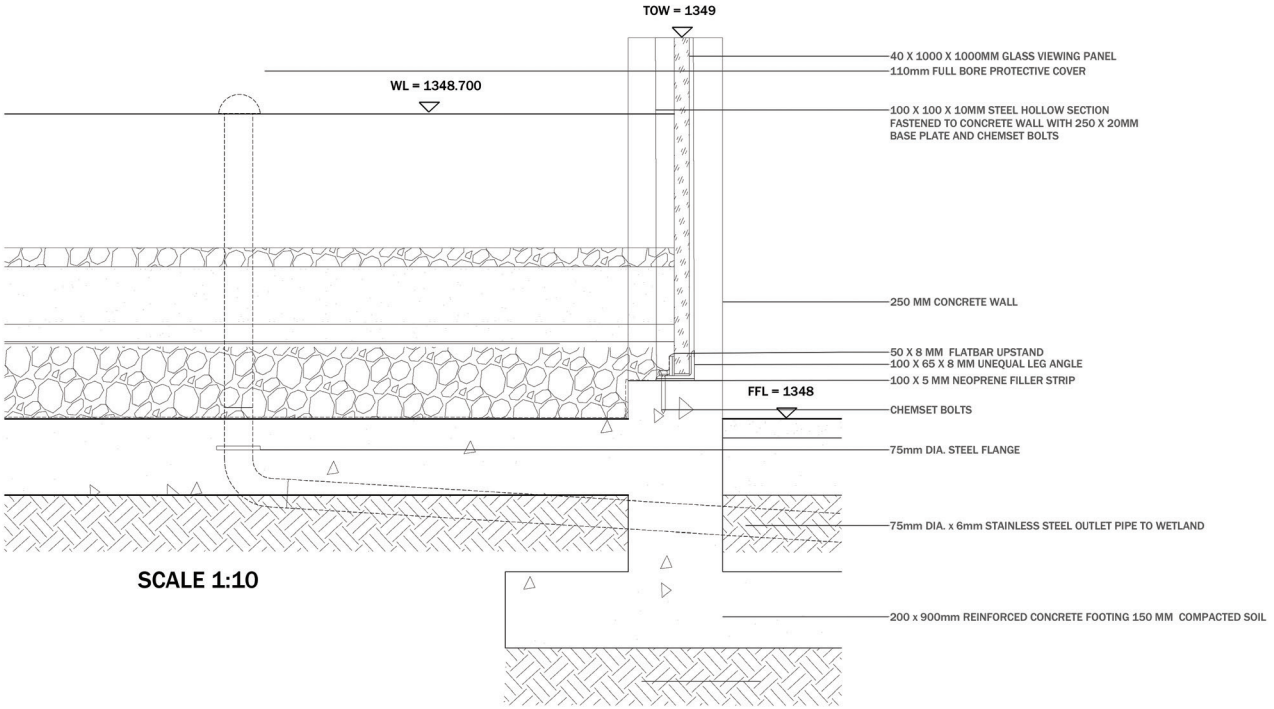


Fig 9.4: Wetland (Author 2015)

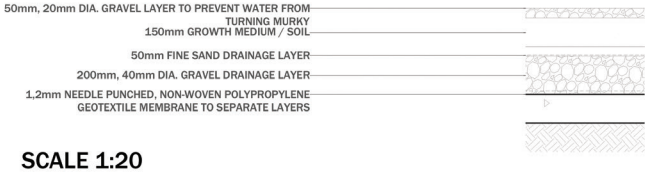
© University of Pretoria



SCALE 1:100



SCALE 1:10

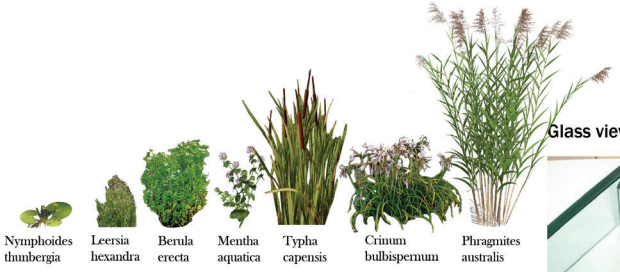


SCALE 1:20



EASTERN HIGHVELD WETLAND PLANT MIX

* Berula erecta
* Leersia hexandra
* Mentha aquatica
* Phragmites australis
* Typha capensis
* Crinum bulbispermum
* Nymphoides thunbergia



SCALE 1:50

Glass viewing panels



Stainless steel frame

* Durable and weather resistant

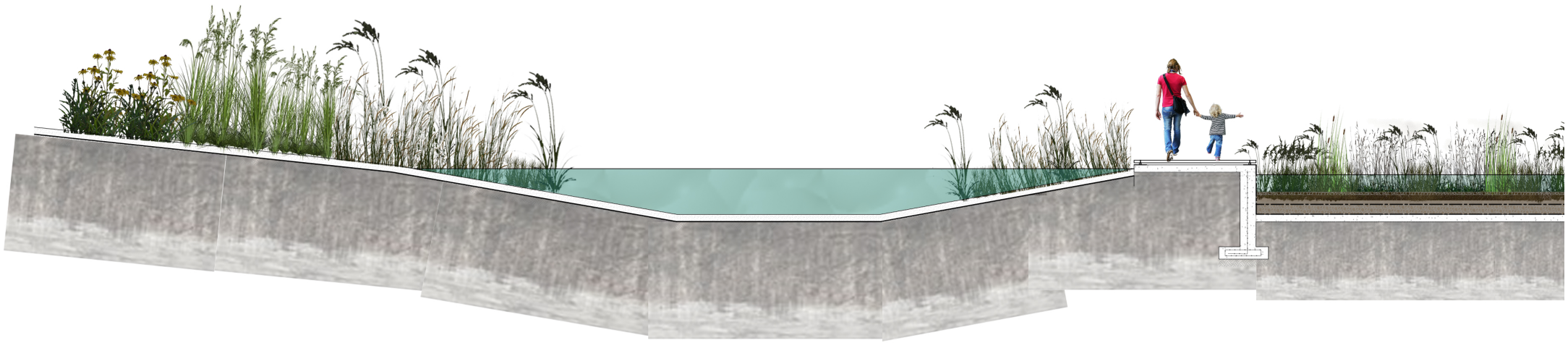


StaLok Paving

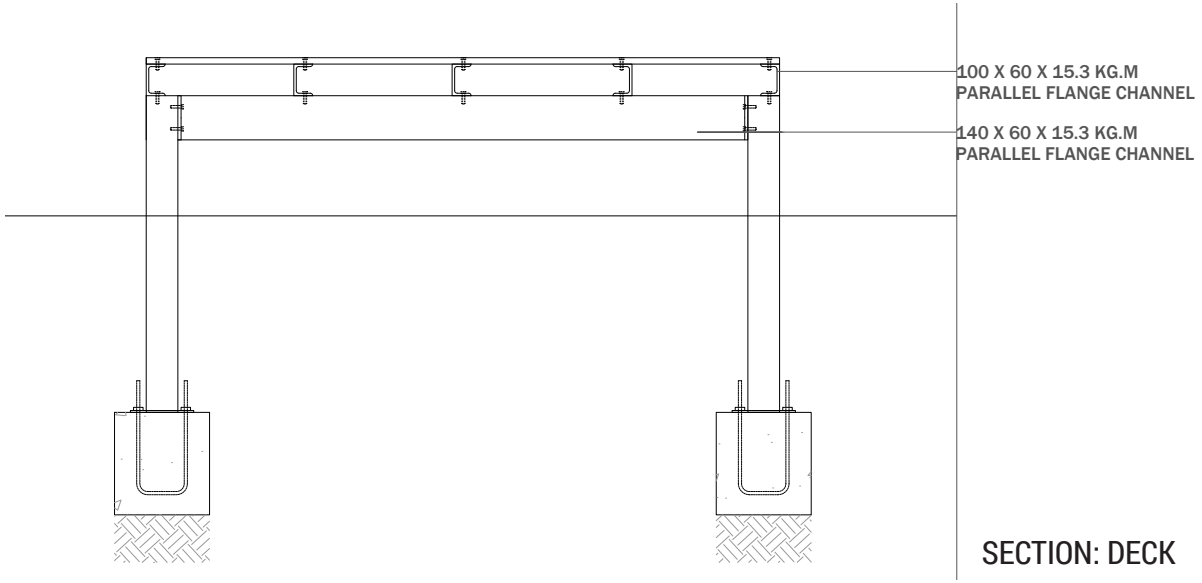
* Innovative StaLok Waterless technology transforms natural decomposed granite and crushed stone into a unique natural paving material.
* Polymer technology gives increased strength, resulting in increased traffic resistance, but also maintains flexibility.
* Resist weathering from water.
* Simply needs compaction.



© University of Pretoria

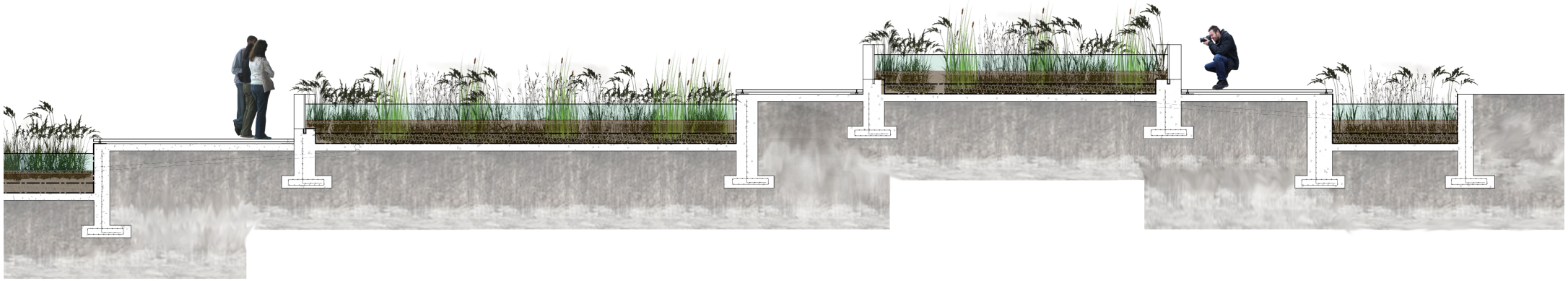


SECTION: WETLAND



SECTION: DECK

© University of Pretoria



Conclusion:

This chapter demonstrates the technification of the ecological stage. Through the technification it becomes clear how the design allows the audience to experience nature more intensely and boldly in the sense that the concealed becomes revealed. Materiality is an important aspect within the technification, as it defines the habitats for plant growth as well as encourage exploration from the audience. The details also clearly shows how the garden is designed with change and that it will transform into an end product that can not be predicted. Only time will tell.

© University of Pretoria

© University of Pretoria

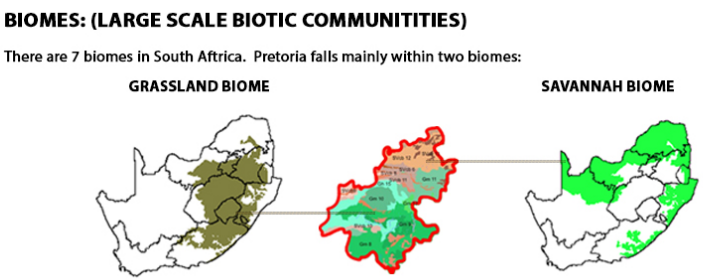
Chapter 10

Planting Strategy

A regional landscape spectacle.

© University of Pretoria

Planting strategy:



Rietvleiriver Highveld Grassland

Ecosystem delineated by the Rietvleiriver and associated tributaries and wetlands.









Magaliesberg Pretoria Mountain Bushveld

Ecosystem delineated by the Magaliesberg ridge system and associated koppies.









The Pretoria NBG is situated in the Gauteng province. Within this province we find the rare occurance of having two biomes, both very rich in biodiversity: the Grassland biome as well as the Savannah biome. Because of this occurance, there are a few ecosystems that are very fragile and specific to a certain environment. Their sensitivity causes some of these ecosystems to become critically endangered due to urban development or any other disturbance of their natural habitat. In these ecosystems there are also critically endangered species that needs to be conserved in order for them to still be growing naturally.

The main goal with this design of a theme garden within the botanical garden is to create a regional landscape theme garden that mostly focuses on the didactic as well as ecological aspect of the garden, as was proved lacking from the site analysis in chapter 5. The ecological aproach will focus on recreating these habitats for the conservation of the endangered plant species, and the didactic aspect will come in with the design of these habitats in a way that draw people's attention to a part of the plant that usually goes unnoticed or reveal something that is normally hidden from the naked eye. The aim is also to a awaken an interest in endemic planting, rekindle one's appreciation there off by highlighting the biodiversity and uniqueness and using a person's emotional conection to his regional landscape to do so.

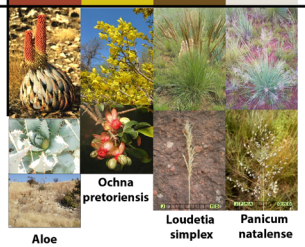
© University of Pretoria

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

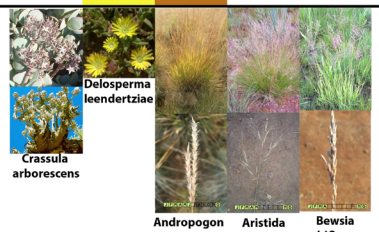
Magaliesberg Pretoria Mountain Bushveld

FOLIAGE [DEC NOV OCT SEP AUG JUL JUN MAY APR MAR FEB JAN] FLOWERING

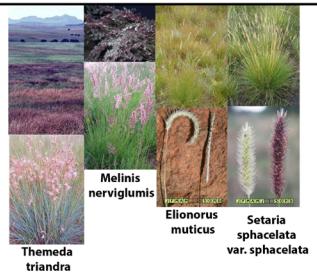
SUCCESSION	PIONEER
	CLIMAX
SIZE	MATT
	SMALL
	MEDIUM
	TALL
	VERY TALL
WATER	DRY
	WET
HABITAT	NORTH
	SOUTH
	PLAINS
	ROCKY
LIGHT	SEMI-SHADE
	SUN
	SHADE
MOTION	CONTINUES
	MOMENTARY
SPACE	Individual
	Clustered
DISTANCE	BACKGROUND
	FOREGROUND
SHAPE	CURVED
	SHARP
TEXTURE	ROUGH/COARSE
	SMOOTH/FINE
COLOUR	COOL
	WARM



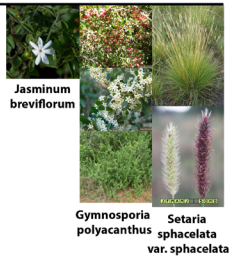
Gold reef mountain bushveld



Rand Highveld Grassland



Marikana thornveld



Moot Plains Bushveld

© University of Pretoria

Planting strategy:

Gold reef mountain bushveld

The vegetation occurs on rocky hills and ridges often west-east trending with more dense woody vegetation often on the south-facing slopes associated with distinct floristic differences. Tree cover elsewhere is variable. Tree and shrub layers are often continuous. Grasses are dominant on the lower layers. Some areas have dense stands of alien plants. There are two endemic plant species, including one Aloe species, which occur in this area.

This area consists predominantly of quartzites, conglomerates and some shale horizons of the Magaliesberg, Daspoort and Silverton Formations (Vaalian Pretoria Group) and the Hospital Hill, Turffontein and Government Subgroups (Randian Witwatersrand Supergroup). Soils are shallow, gravel lithosols of the Mispah and Glenrosa forms

Slope stabilising plants

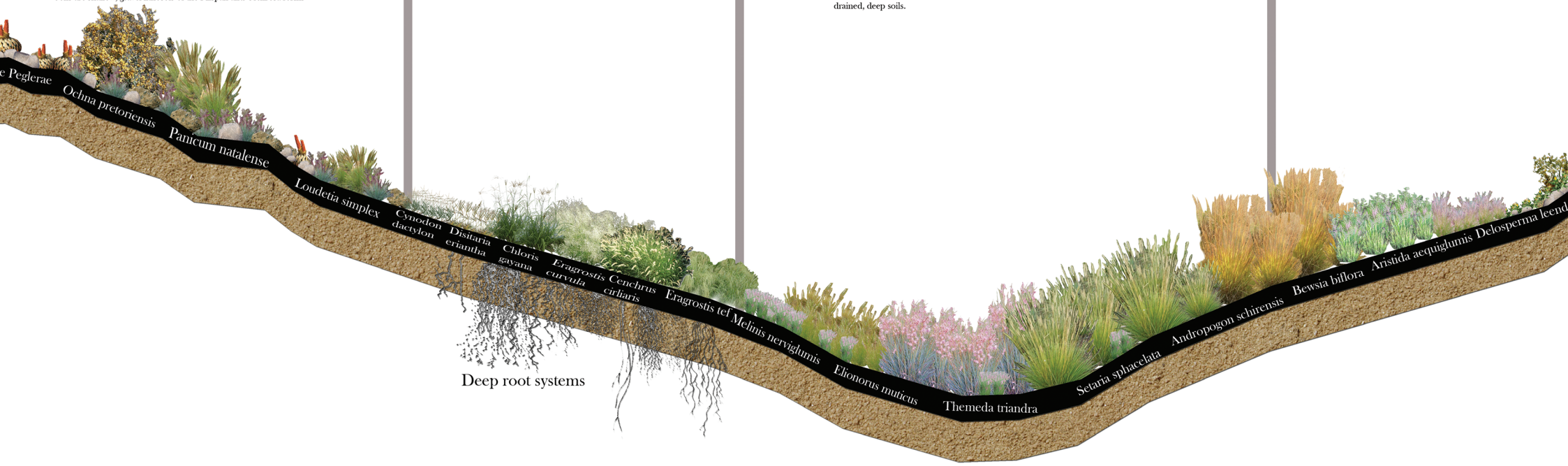
Marikana thornveld

An open Acacia karroo woodland, occurring in valleys and slightly undulating plains, and some lowland hills. Shrubs are more dense along drainage lines, and rocky outcrops or in other places protected from fire. Considerably impacted, with 48% transformed, mainly cultivated and urban or built up areas. Near Pretoria, industrial development is a greater threat of land transformation. Alien invasive plants occur localised in high densities, especially along the drainage lines.

Most of the area is underlain by the mafic intrusive rock of the Rustenburg layered suite of the Bushveld Igneous Complex. Rocks include gabbro, norite, pyroxenite and anorthosite. The shales and quartzites of the Pretoria group also contribute. The soils mainly consist of vertic melanic clay with some dystrophic or mesotrophic plinthic catenas and some freely drained, deep soils.

Rand Hig

The vegetation type occurs on a highly variable landscape with
plains and a series of ridges slightly elevated over undulating su
vegetation is species-rich, wiry, sour grassland alternating with lo
on rocky outcrops and steeper slopes. There is a high diversity
and ridges carry sparse (savannoid) woodlands accompanied by
shrubs. Poorly conserved, only small patches protected. Almost
transformed mostly by cultivation, plantations, urbanisation or
are thirteen endemic species growing in this area.



© University of Pretoria

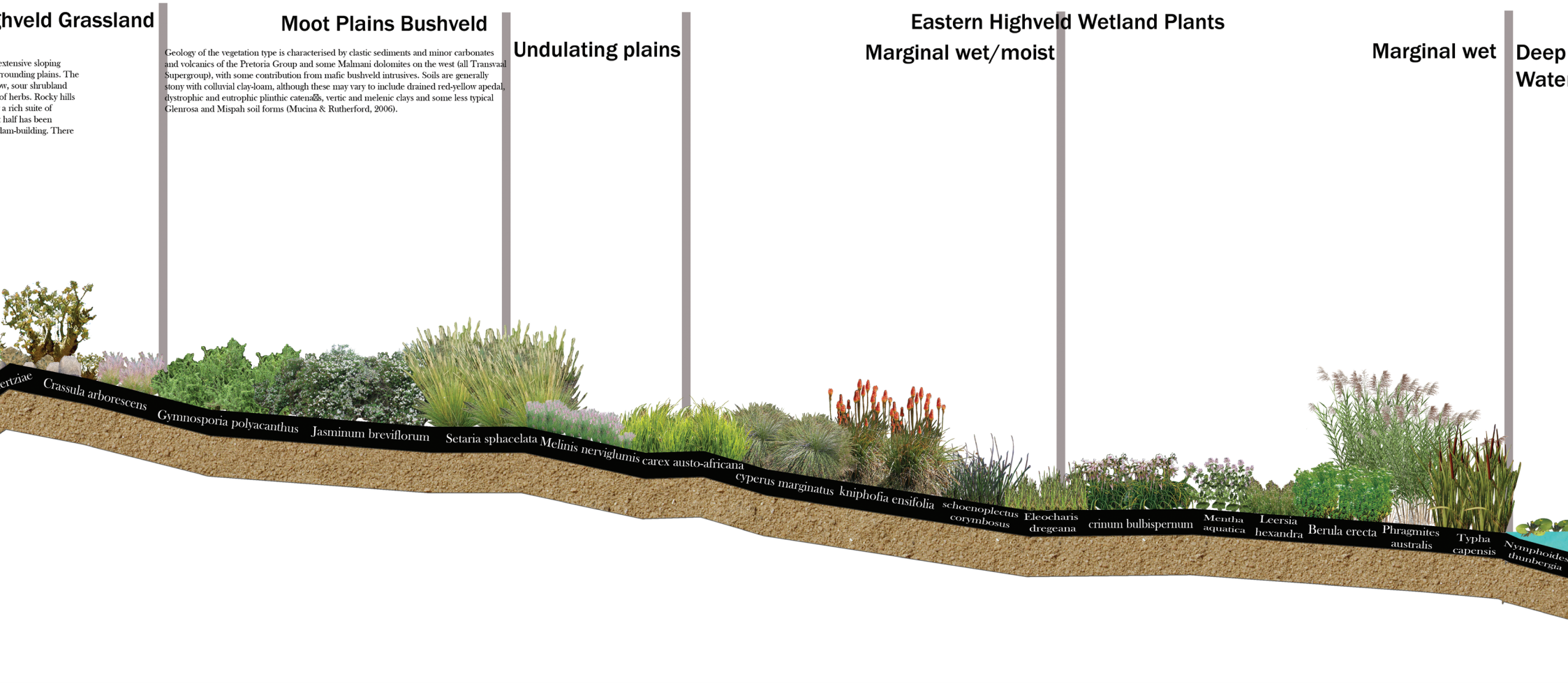


Fig. 10.1: Planting strategy (Author 2015)

© University of Pretoria

CONSERVATION APPROACH

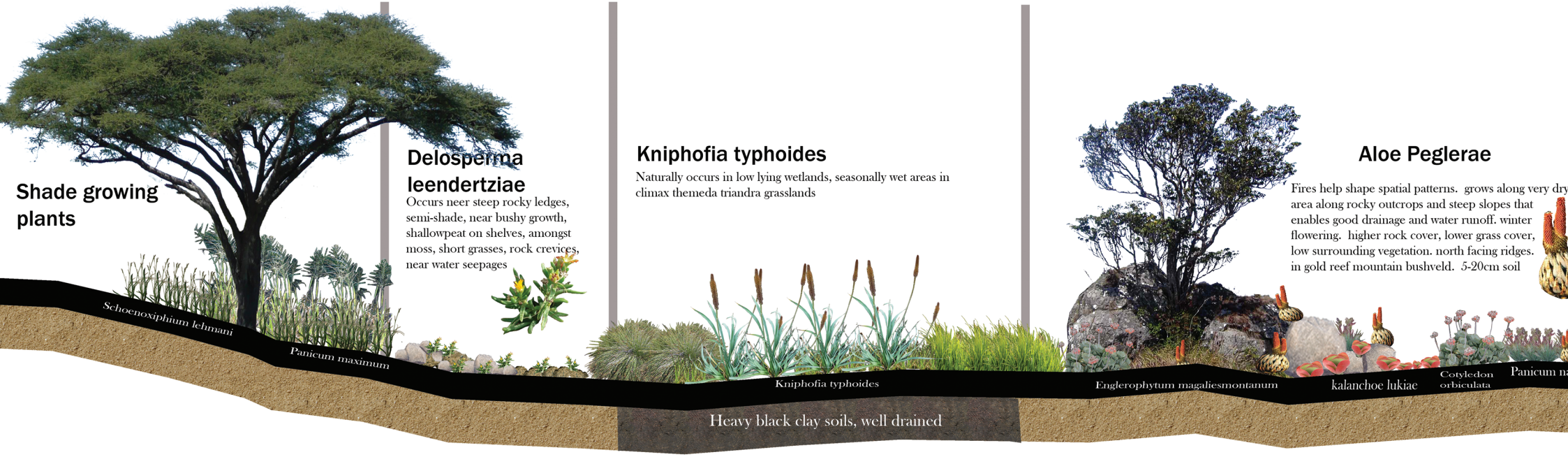
RED OR ORANGE LISTED PLANTS:

Magaliesberg Pretoria mountain bushveld

Aloe peglerae and Delosperma leendertziae

Rietvleiriver highveld wetlands

Melolobium subspicatum, Habenaria mossii, Habenaria bicolor, Kniphofia typhoides



© University of Pretoria

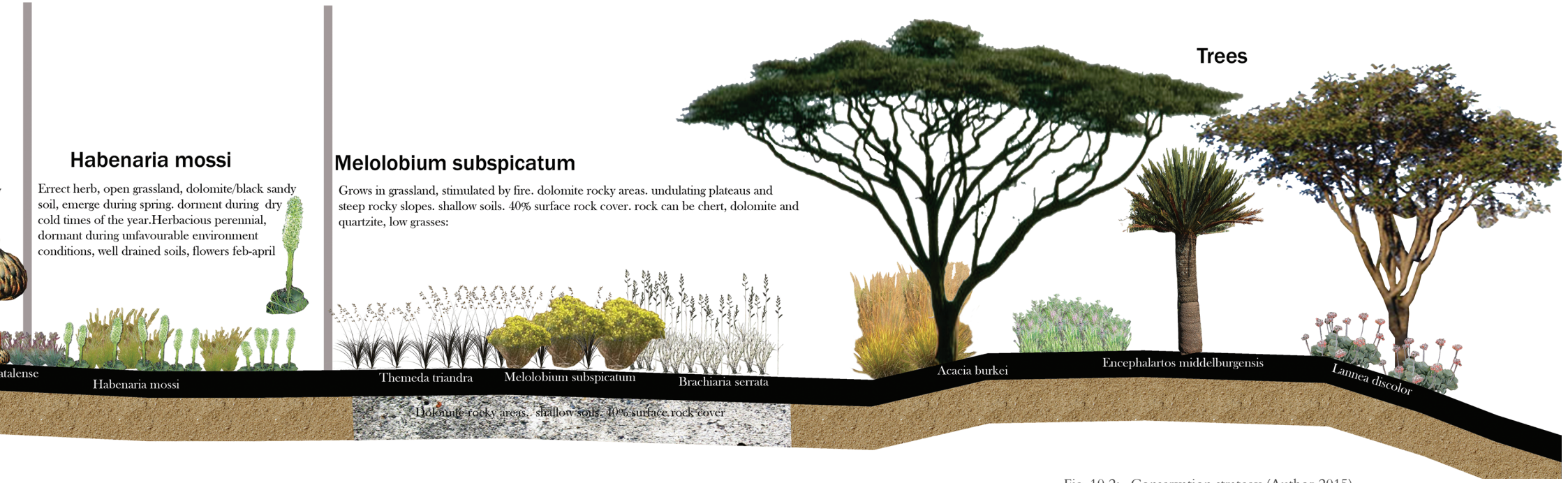


Fig. 10.2: Conservation strategy (Author 2015)

© University of Pretoria

Design experiment



Experimenting with the effects of water on exposed soil. This experiment was done with the design in mind that where the dam wall overflows, it can be left to carve away soil, showing the forces of nature that influences the landscape forms.



Fig. 10.3: Design experiment (Author 2015)

© University of Pretoria

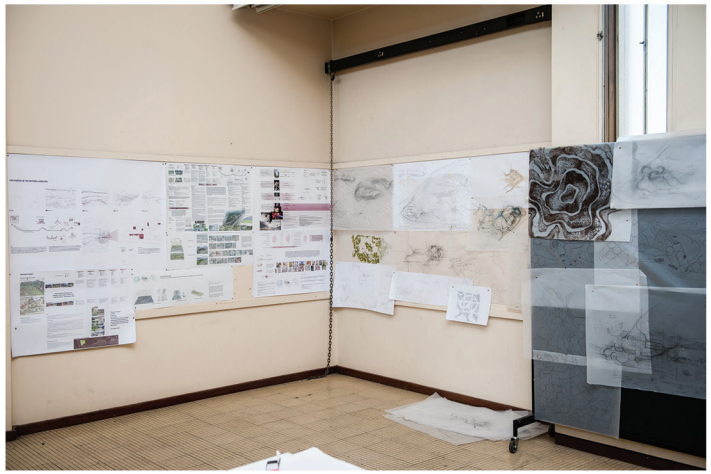
Contour models



Fig. 10.4: Contour models (Author 2015)

© University of Pretoria








© University of Pretoria

Fig. 10.5: Exhibition (Franklin 2015)

Reference list:

Aixart, M. 2015. Conservation of the Mediterranean flora. Museuciencies.cat, viewed 26 October 2015,<http://museuciencies.cat/en/area-cientifica/linies-de-recerca/conservacio-de-la-flora-mediterrania/>.

Ballantyne, R., Packer, J. and Hughes, K. 2008. Environmental awareness, interests and motives of botanic gardens visitors: Implications for interpretive practice. Tourism Management, 29(3), pp. 439-444.

BGCI, 2000. The Gran Canaria Declaration: calling for a Global Program for Plant Conservation. 1st ed. [ebook] Richmond: BGCI, p.1, viewed 25 June 2015. <http://www.cbd.int/doc/meetings/cop/cop-05/information/cop-05-inf-32-en.pdf>.

Boukema Vélez, E. and McIntyre, P. 2002. Louis G. Le Roy: Nature culture fusion. Rotterdam: NAi.

Clark, PG 2011, Synthesis of interlocked molecules by olefin metathesis, doctoral thesis, California Institute of Technology, California, viewed 31 January 2012, <http://thesis.library.caltech.edu/5981/1/Paul_Clark_PhD_Thesis__8-10-2010.pdf>.

Clement, G. n.d. The Garden in Motion. [online] Gillesclement.com, viewed 5 October 20015, <http://www.gillesclement.com/cat-mouvement-tit-Le-Jardin-en-Mouvement>.

Comte. N. 2004. Europe, 1450 to 1789. Encyclopedia of the Early Modern World. 2: 94-108. New York: Charles Scribner's Sons.

Dodd, J. and Jones, C. 2010. Redefining the role of botanic gardens - towards a new social purpose. 1st ed. [ebook] Richmond: Botanic Gardens Conservation International (BGCI), p.56, viewed 25 July 2015, <http://www.bgci.org/public-engagement/socinc/?sec=education&id=socinc>.

Dyer, R. 1960. The Opening of the Pretoria National Botanic Garden. Bothalia, [online] 7(2), pp.391-401, viewed 2 October 2015, <http://www.abcjournal.org/index.php/ABC/article/view/1666/1631>.

Ford, J. 2011. Landscape Architecture Course on 'The Bodied Environment' Links Movement and Space. UVA Today, viewed 3 March 2015, <http://news.virginia.edu/content/landscape-architecture-course-bodied-environment-links-movement-and-space>.

Grosz, E. 1999. Introduction. Becomings: explorations in time, memory and futures. London: Cornell University Pres.

Heykoop, L. 2015. Temporality in Designed Landscapes: the theory and its practice in works of some major landscape designers 1945-2005. Ph.D. University of Sheffield.

Jellicoe, G and Jellicoe, S. 2006, The landscape of man, Thames & Hudson Ltd, London.

Johnson, B. 2007. Botanic Gardens: A Living History. London: Black Dog Publishing Ltd., p.64.

Knox, C. 1993. Bridging the divide: the Pretoria National Botanical Garden. Veld & Flora, [online] (79), pp.11-13, viewed 3 October 2015, <http://0-reference.sabinet.co.za.innopac.up.ac.za/document/EJC112710>.

Kurtaslan, B.O. and Brzuszek, R. 2013. Crosby Arboretum (Picayune, Mississippi): A Natural World for All, Advances in Landscape Architecture. <http://www.intechopen.com/books/advances-in-landscape-architecture/crosby-arboretum-picayune-mississippi-a-natural-world-for-all>.

Laurson, J. 2012. The Dances, Joys, Pleasures. Listen.

McHarg, I. 1995. Design with Nature, John Wiley & Sons Inc., United States.

McMillan, J., Cassidy, F., Hayakawa, S. and Marckwardt, A. 1965. Funk & Wagnalls Standard Dictionary of the English Language, International ed. New York: Collier's.

Meyer, E. 2008. Sustaining beauty. The performance of appearance. Journal of landscape architecture.

Mielcarek, L. 2000. Factors associated with the development and implementation of master plans for botanical gardens, master thesis, University of Arizona, Arizona, viewed 15 June 2015, http://arizona.openrepository.com/arizona/bitstream/10150/278728/1/azu_td_1399733_sip1_m.pdf in the Landscape. In P. Walker (ed.) Minimalist Gardens. (Cambridge, MA: Spacemaker Press).

Modernist Dance of 20th and 21st Century. n.d. *Wikispace*, <https://danceguadagno.wikispaces.com/Dance+Styles+and+Genres>.

Naranjo, M. 2013. Contemporary Dance History. [online] Contemporary-dance.org, viewed 25 August 2015, <http://www.contemporary-dance.org/contemporary-dance-history.html>.

Raxworthy, J. 2003. Landscape symphonies: gardening as a source of landscape architectural practice, engaged with change. In: 20th Annual Conference of SAHANZ. Sydney: Society of Architectural Historians, Australia and New Zealand, pp.259-262.

Raxworthy, J. 2006. Landscape: Product/Production – Transgressing edges and doing time evolving new urban contexts. In: IV European Landscape Biennial 2006. Barcelona: COAC, pp. 282-293.

Rocca, A. 2008. The Nomadic Garden, the Permanent Traveller. Planetary Gardens: the landscape architecture of Gilles Clement. Berlin, Birkhauser.

Rogers, E.B. 2007. The history of the Botanic Garden, in NK Monem (ed.), Botanic Gardens: A Living History, Black Dog Publishing ltd., London.

Sanders, D. 2007. Making Public the Private Life of Plants: The contribution of informal learning environments. International Journal of Science Education, 29(10), pp.1209-1228.

Simonds, J. 1983. Landscape architecture. New York: McGraw-Hill.

Smith, G.F., Steyn, E.M.A. & Botha, D.J. 1999. Gardens of the North: our inland National Botanical Gardens. Veld & Flora 85,4: 158-162.

© University of Pretoria

Turner, T. 2014. A Landscape Manifesto, by Diana Balmori. [online] Garden Design and Landscape Architecture, viewed 13 October 2015, <http://www.gardenvisit.com/blog/2014/02/21/a-landscape-manifesto-by-diana-balmori/>.

Walker, P. 1997. Classicism, Modernism, and Minimalism.

Whiston Spirn, A. 1998. The language of landscape.

Willis, C.K. 2003. In support of South Africa's National Botanical Gardens. In: Botanical Society of South Africa: 90th Anniversary, pp. 15-19. Botanical Society of South Africa, Claremont.

Willis, C.K. 2005. National Botanical Gardens: embassies of South Africa's biodiversity and culture. BG journal 2,2: 9-12.

Willis, C.K. 2006. SANBI: Institutional response to implementing the International Agenda. BG journal 3,1: 11-13.

© University of Pretoria