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Urban Healing through Symbiosis

Addressing the state of urban wellbeing in Pretoria by rehabilitating critical public green space in Nieuw Muckleneuk and introducing a centre for complementary therapy to promote collaborative, deep-rooted healing for all

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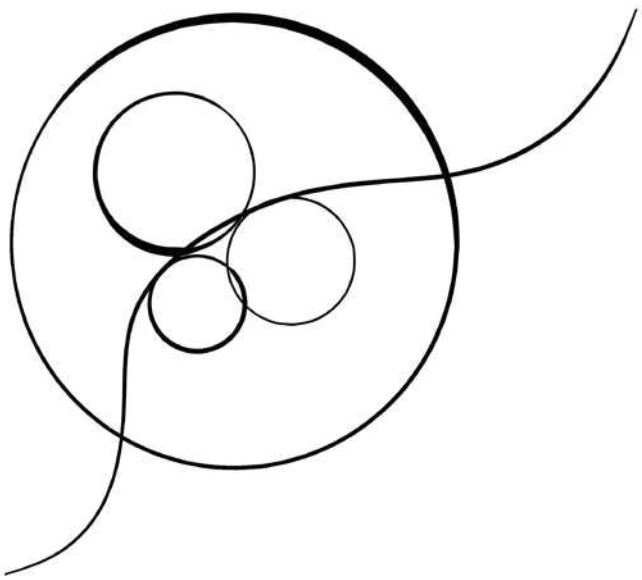

A b s t r a c t

The City of Tshwane municipality's population will almost double from 3.5 million to 5.8 million by 2050 (Green Book, 2023). Pretoria, as a city within this municipality, is set to experience urban growth pressure. With this expansion comes several critical issues hindering the city's ability to adapt and develop, such as: access to adequate resources and services, the reduced quality of life of its residents and associated potential mental health issues, as well as the loss of critical biodiversity.

The intervention addresses the pressing need for improved access to mental healthcare resources in a city where a notable portion of the population suffers from mental health issues. Thus, it proposes a facility that provides complementary therapy interventions in combination with conventional therapy, and presents how access to public green space can play a vital role in healing. In an effort to improve Pretoria's environmental vulnerability, this renewed purpose aims to preserve and regenerate green sites across the city as it continues to densify. Salutogenic and biophilic design strategies are used to provide a comprehensive solution using natural systems to address human wellbeing and the state of nature in the city.

The design resolution, located in Nieuw Muckleneuk, is a series of spaces bridging the Walkerspruit river and nesting into the ground at either end, anchoring and reconnecting each side of Trim Park into a newly activated urban green site. It illustrates how innovative building technologies (IBTs) can reduce a project's carbon footprint and energy demands. Moreover, contextually-specific passive design principles and the curated introduction of indigenous plant species at a site level, exemplify how architecture is enriched when the context and site are allowed to shape the buildings. This presents a new typology in which architecture serves as a facilitator between critical urban stakeholders to ensure symbiotic collaborations that produce environmentally-responsible building practices and an improved sense of urban wellbeing for the city, its residents and nature.

Keywords: Salutogenesis, biophilia, passive design, integrative, mental health, innovative building technologies, environmental sustainability, urban wellbeing, symbiotic relationships.

Project Parti Diagram (Author, 2023)

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DEFINITIONS

Symbiosis

A relationship between different entities or groups that is based on a mutually beneficial interaction (Brusowankin, 2022).

Alternative and complementary therapy practices

Complementary and alternative medicine (CAM) are a range of healthcare methods not currently recognized as part of conventional medical practices (National Centre for Complementary and Integrative Health). When CAM therapies are used in place of conventional treatment, it is considered 'alternative' therapy whereas if methods are used alongside typical treatments, it is considered 'complementary' and thus 'integrative' medicine (NCCIH,n.d).

Integrative health

Aims to enhance the treatment process by coordinating both conventional and complementary practices. It promotes multimodal practices (NCCIH, n.d) of various technique combinations that best address the specific needs of the user and their individualised treatment plan. It is an evidence-based approach to treatment that addresses the physical, emotional, mental and spiritual needs of the patient to optimise the healing experience (Cleveland Clinic, 2022).

Psychological and physical approaches

In an effort to achieve a holistic healing plan, physicians and therapists engaging in integrative health practices can make use of a variety of activities to activate all spheres of wellbeing - emotional, physical, social and mental.

A few complementary activities are as follows:
Tai chi, yoga, acupuncture, massage therapy, art therapy, music therapy, dance, hypnotherapy, pilates, animal-assisted activities, and support groups.

These can be used in conjunction with conventional forms of therapy such as:
Psychotherapy medication, talk therapy, social-worker case management, and hospitalisation.

LIST OF FIGURES

Photo taken on site (Author, 2023)

Contextual Background

Urbanisation

As Pretoria experiences more urbanisation, open green spaces have diminished, leaving only small pockets of disjointed public green spaces between densifying urban areas (Figure 3). There is a large proportion of land that has lost the majority, if not all, natural features leaving the remaining green spaces' biodiversity even more critical. Actions must be taken to re-introduce lost biodiversity and reconnect green spaces across the urban scale as stipulated in the city's Environmental Management Framework (EMF) strategies (City of Tshwane, 2016).

Critical Public Green Space

The City of Tshwane is rated 6th out of the 9 municipalities within Gauteng in terms of environmental vulnerability (The Greenbook, CSIR 2023). This rating suggests a strong discourse regarding decisions about environmental resources preservation and extended urban growth through land-use reallocation. While the city needs additional space to accommodate more people and associated services, the urban fabric also benefits greatly from public green space and therefore it cannot simply be removed or neglected.

Climate Change & Building Technology

Along with the extensive urbanisation comes the issue of climate change and the role of the built environment in reducing the carbon footprint of human settlement development. As of 2014, the Intergovernmental Panel on Climate Change (IPCC) reported that the building industry accounts for approximately 32% of the final energy usage and 18% of the total carbon emissions across global human activities (IPCC, 2014).

There is the potential for architects to promote more eco-conscious structural and material solutions that lessen the impact of construction and long-term building operations on the environment. Alternative or innovative building technologies (IBTs) are non-conventional materials and methods that could reduce the embodied energy, operational energy and/or carbon footprint of a development. It is therefore the intention of this project to investigate an instance where IBTs can be used in place of traditional building techniques such as clay masonry and concrete construction to produce an architecture that speaks to a carbon-conscious design approach.

Proposed Programme

Mental Health & Urban Wellbeing

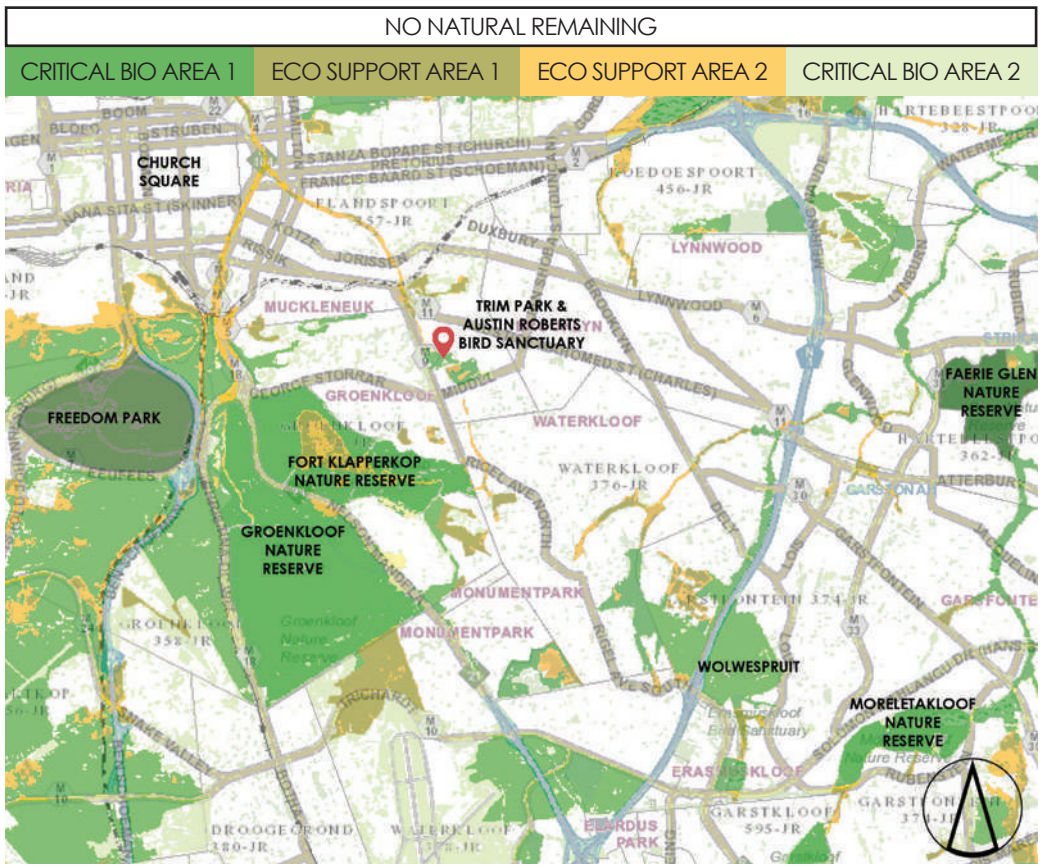
Concurrently, the country's healthcare industry is experiencing immense financial pressure and limited access to mental health resources. Presently, 1 in 6 people suffer from a form of anxiety, depression and/or substance abuse (SADAG, 2010). This statistic coupled with less than 4% of the national budget allocated to mental healthcare services has resulted in a diminished sense of human wellbeing.

Due to the critical state of mental wellbeing in urban areas, such as the City of Tshwane, the design intends to alleviate current and future pressure on healthcare institutions as the city continues to grow by introducing a facility that provides a wider range of less conventional, complementary forms of mental healthcare interventions. This approach seeks to address day-to-day stressors experienced by vulnerable individuals by affording them a variety of more informal, relaxed techniques of responding to times of crisis or excess pressure.

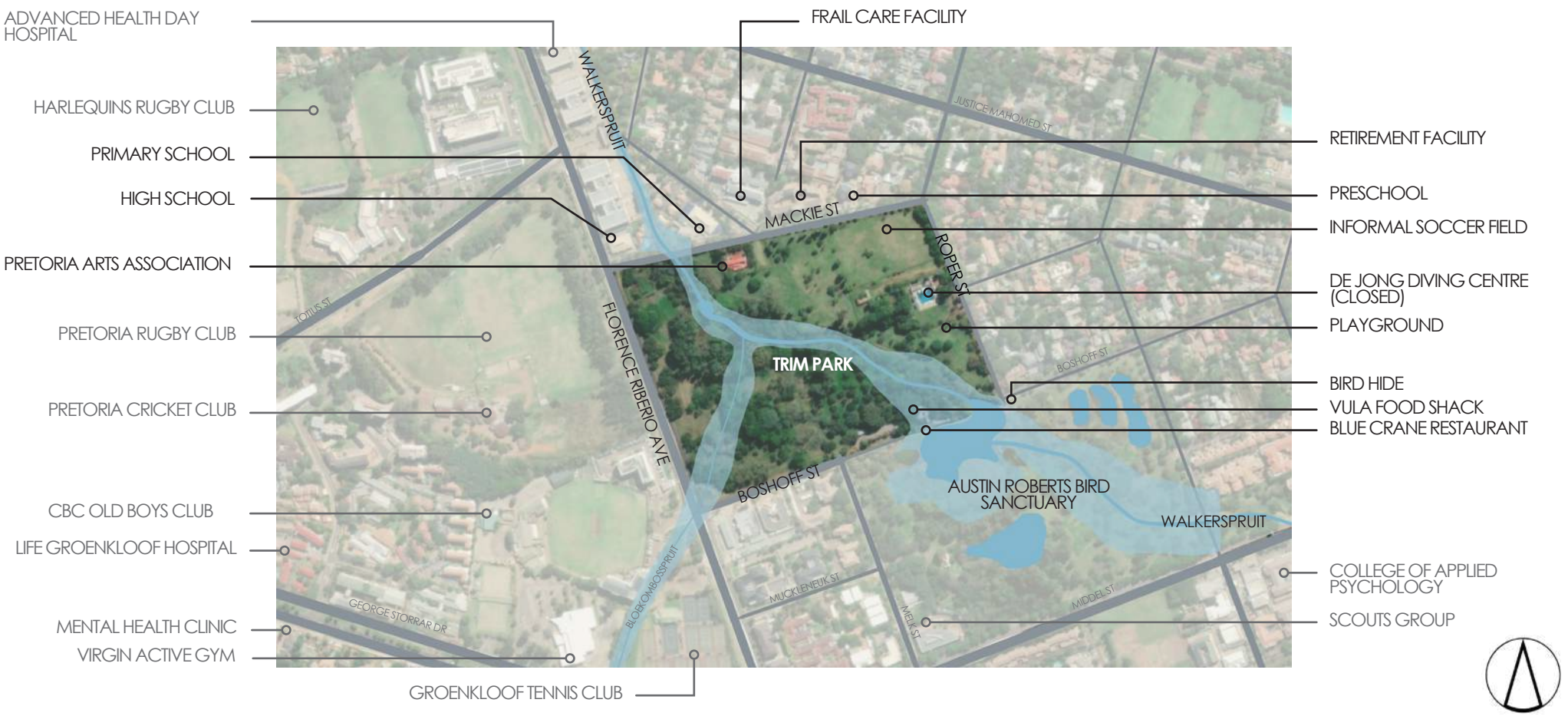
At the same time, the design intervention aims to break the stigma related to mental illness and wellbeing by inviting numerous types of users and groups to participate in research, engage with professionals and embrace a healthier form of city living by partaking in outdoor activities.

A summary of the proposed programming follows:

- *A mind and body centre* - A venue that accommodates group pilates, yoga and meditation sessions as well as host functions and lectures related to the general public and students in regards to mental health and wellbeing.
- *An art centre* - An exhibition space, private consultation rooms as well as open plan studios to accommodate instructed art and music (instrumental) workshops.
- *A resource centre* - A publically accessible library, consultation rooms and study space to house research programmes and information related to mental wellbeing.
- *A variety of outdoor spaces* ranging in publicness, integrated into the landscape for outdoor activities such as animal assisted therapy, sports, bird watching, meditation and group therapy.



Biodiversity Analysis of Pretoria (TMSDF 2021)



Existing context: programmes & users (Author, 2023)

Site Selection & Context

Rationale

Contested space requires a balanced approach, one that benefits both the growth of the city but also supports a strong focus towards a high quality of life for all that inhabit it - human, nature and animals alike. It is for this reason that the site selection criteria aimed to identify a green site within a densifying region that was at risk of being lost to settlement development if not effectively integrated with the urban fabric.

The selected location of the project was determined by several factors and mapping exercises (Figure 3). Based on the various scales (Macro - at regional level, meso - at neighbourhood level and micro - at site level) of mapping conducted on the existing urban fabric, the site identified was a public green site south east of Pretoria CBD: Trim Park, Nieuw Muckleneuk, Pretoria (Figure 2).

Trim Park, Nieuw Muckleneuk, Pretoria

Based in an urban region just outside City of Tshwane's central business district, the project seeks to address the contextual and site-specific needs of the location as well as ensure its own, and similar sites, longevity as the city continues to grow (Figure 2).

In relation to Figure 6, the following features are present near to and on site:

- Walkerspruit river that divides the site in two
- Pretoria Arts Association Gallery
- De Jong Diving Centre
- An informal soccer field
- A playground

A portion of the park which is only accessible from the Austin Roberts' Bird Sanctuary, a protected green site built on an old clay quarry, on the adjacent property.

All current programmes are seen as physically, socially, mentally and/or emotionally beneficial to a space of passive healing yet all function in isolation of one another, with little-to-no interaction between them. By reconnecting these segregated programmes throughout Trim Park and introducing complementary programmes, a new life can be brought to the public green space and reinstate its importance at an urban scale.

The site was chosen based on its proximity to a wide range of user groups vulnerable to high stress situations and potential mental health conditions such as students, young adults, the elderly and health professionals.

South-west section of Trim Park shows a prominence of nature (Author, 2023)

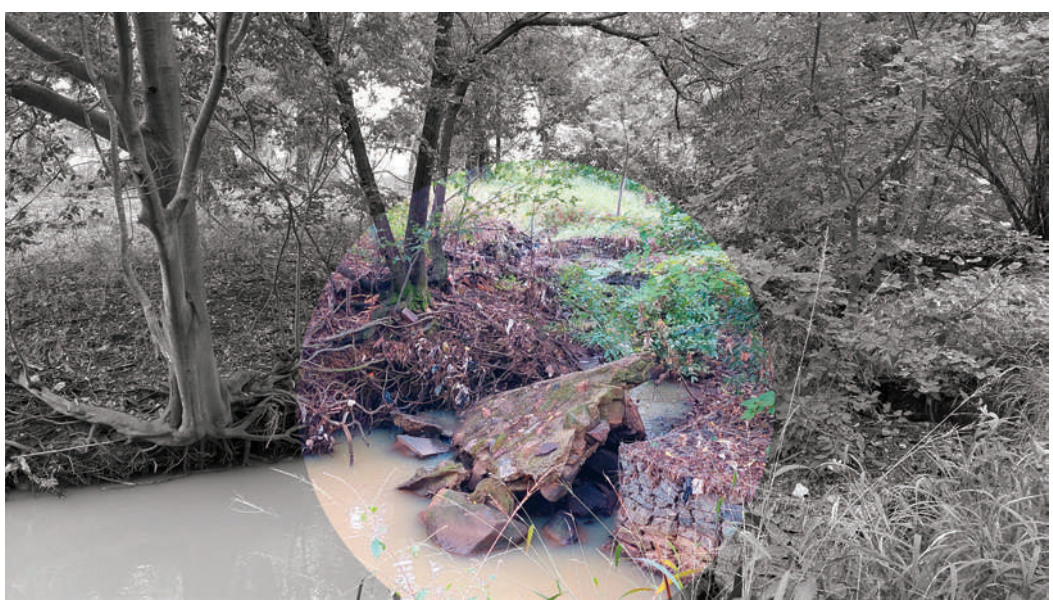
North-east section of Trim Park shows a strong presence of human intervention (Author, 2023)

Another important factor became its general accessibility. The park is located along one major city route (Florence Ribeiro Avenue) with several public bus stops and adequate pedestrian access points across the site. However, currently on site not all circulation routes are adequately maintained or accessible, with a fence running along the north-eastern side of the Walkerspruit river dividing the site in two. It is intended to optimise these routes and improve upon existing infrastructure where possible.

The environmental systems present on site are in poor condition (Figures 9-11). The existing outdoor lighting network, public seating, and walkways are in disrepair and many of the river's flood control measures (layered gabion wall systems) have failed. Many of the trees and plant species across the site are diseased, dying and/or invasive species which negatively impact on water resources. Because of these conditions, methods of rehabilitation without diminishing the genus loci are critical to the design intervention and make this site a strong candidate to illustrate how a sensitive, well-considered intervention can promote the upkeep of public green space.

Dilapidated park bridges (Author, 2023)

Damaged outdoor lighting network (Author, 2023)



Crumbling river infrastructure (Author, 2023)

Project Summary

The intended design aims to project the architectural idea of sustainability by fulfilling the needs of the end-user, the site and the context; and carefully balancing the use of available resources with the future in mind whilst rejuvenating and preserving critical green spaces, and thus a comprehensive sense of urban wellbeing in the city through re-integration with nature and salutogenic design principles.

Project Outcomes

The following five points are the intended outcomes from this design intervention:

- The rehabilitation & revitalisation of the existing site as a critical public green space in the city as it continues to densify.
- Provide an enriched healing experience to users based on the principles of the Sense of Coherence by Aaron Antonovsky.
- Integration of IBTs, passive design strategies and energy-efficient buildings that promote architectural practice that is environmentally sustainable and responsible.
- Reduce the pressure on existing mental healthcare services by providing a diverse range of opportunities for complementary treatment options that function alongside conventional interventions.
- Promote a healthier lifestyle for urban dwellers by reconnecting users back to nature and their community.

Site Selection Criteria

To summarise, the final site selection was informed by:

- Proximity to a variety of potential user groups.
- An underutilised public green space with critical environmental characteristics in need of rehabilitation.
- Ease of access or the potential for improved accessibility into and across the site.
- Has existing programmes that the intervention can tie into and extend upon.

Design & Technological Investigation

With reference to Figure X, key technical, spatial theory and design informants were founded upon the intended outcomes of the project brief.

Building for Inherent Sustainability
Passive design principles integrated into construction practices and operational strategies promote long-term ecological sustainability. Optimal use of these principles is directly linked to the particular site and climatic conditions.

Therefore, a thorough understanding of the location and distinguished qualities of the locus is paramount to selecting the appropriate passive strategies during the project's uptake, operation and demolition.

The identified site, Trim Park, is located in the CWB[1] climatic region of Pretoria. This means the area experiences a temperate climate with hot, wet summers and dry, cold winters. In response to this, the following passive design principles are applicable to the design intervention:

- Passive solar applications (natural daylighting and heating)
- High insulation systems (ie. thermal massing)
- Maximise north-facing facades
- Adjustable shading systems
- Cross ventilation techniques (natural cooling)
- Double glazed windows

Figure 5 represents a map of areas containing critical biodiversity versus areas that have little-to-no nature remaining. In response to the ongoing loss of critical biodiversity and hydrology systems across urbanising areas in the City of Tshwane, this design intervention aims to illustrate the role architecture can play in preserving critical green space and infrastructure alongside city growth.

As the site is located within the Marikana Thornveld[2] region, an endangered vegetation system, adequate steps are taken to generate a comprehensive landscape development plan aimed at preserving indigenous plant and animal species, whilst removing diseased and alien species that threaten the hydrology and biodiversity of the site.

An ecologically sensitive approach that respects the existing natural fabric whilst ensuring the site's longevity is therefore encouraged. However, it is worth noting that any kind of man-made intervention (i.e the period of construction) will to some extent disrupt the natural systems present, it is the intention that this temporary state will be out-weighed by its long-term integration as a form of ecological-support and success in maintaining public green spaces' importance in the urban fabric now and in future.

Technical Innovations
Because the built environment has a large role to play in reducing carbon emissions, innovative technologies and methods of construction seek to identify a new, inherently sustainable architectural language that prioritises a balance between the needs of the project and the environment in which the project is situated.

Lowering the embodied and operational energy consumption in building design in response to the effects of climate change and urbanisation on sustainable resource management is a critical responsibility of the architect.

IBT's and critical response to regional conditions become core components of sustainable architectural practice. Less invasive construction methods and greener building solutions are explored in this project and outcomes are compared to that of conventional practices in an effort to highlight the potential savings that technical innovations can have in the building industry. It is also critical that any material removed be recycled back into the site and reduce the negative impact construction might have on the natural fabric.

Therefore, the technical resolution of this design project provides an example of how material and structure selection, spatial planning and approach to integrated site management can greatly contribute to reducing the impact of human activities on the environment.

Architecture that Heals
Alongside the intervention's ecological sensitivity, the resulting architecture seeks to optimise instinctive healing experiences for a variety of users and stakeholders. This is accomplished through various scales in the design:

- A considered curation of public, semi-public and private spaces.
- Sensitive and sustainable building material and technical system selection.
- Both tangible and intangible connections to nature through the various senses.
- A symbiotic healing process of the surrounding environment through methods of ecological system rehabilitation and site revitalisation.

Several of these points speak towards the idea of Salutogenesis and psychologically-supportive design described by Antonovsky and architect Alan Dilani, all of which have the purpose of responding to and improving upon the state of mental health and wellbeing of people living in the city.

All of these larger issues and characteristics can be combined to formulate a design intervention that seeks to address the relationship between problems and challenges faced across similar South African urban contexts.

Biophilic Design

Biophilia - A hypothetical human tendency to interact or be closely associated with other forms of life in nature: a desire or tendency to commune with nature (Merriam Webster). This concept further informs the idea of biophilic design - an approach that fosters beneficial contact between people, buildings and nature (Kellert, 2009). By "bringing the outdoors in" through biophilia, biophilic design has the potential to aid in passive healing as well as produce architecture that is eco-conscious, thus reducing the impact of a building on the environment (Stouhi, 2023).

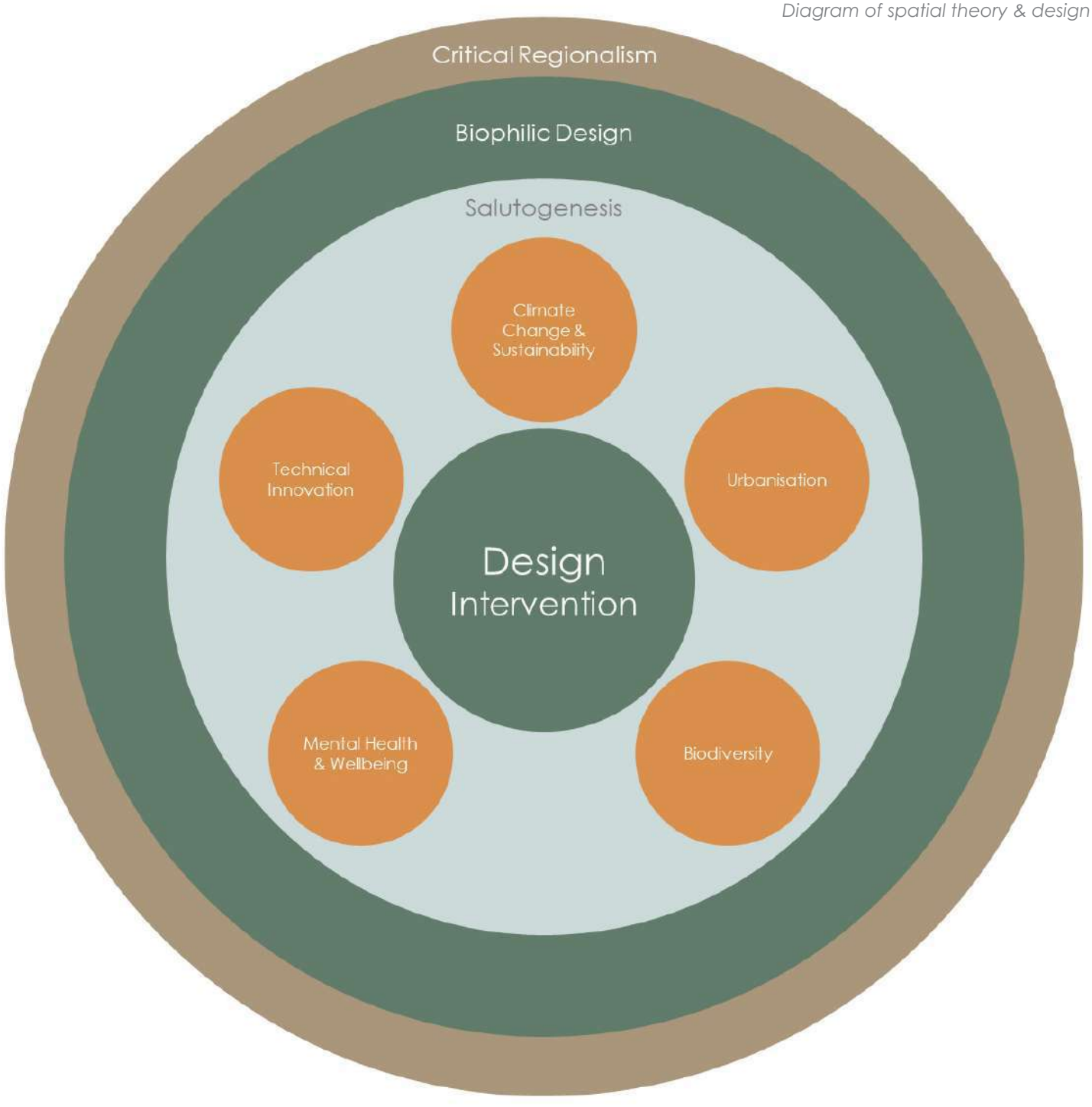
1 CWB - The Koppen-Geiger climate classification symbol for temperate (c), dry winter (w), warm summer (b) (Peel, 2007).
2 Marikana Thornveld region - An endangered vegetation group made up of open Acacia karoo woodland-type species, shrubs and various grass species (Mucina & Rutherford, 2006).

Salutogenesis

An approach to human health that examines the factors contributing to the promotion and maintenance of physical and mental well-being rather than the cause of disease, with particular emphasis on the coping mechanisms of individuals which help preserve health despite stressful conditions (Merriam Webster, 2023). Aaron Antonovsky, a sociologist, studied the impact of stress on an individual's health and observed how stress and the day-to-day lifestyle coping mechanisms alter a person's sense of wellbeing. It was this study that prompted the idea of Salutogenesis - 'salus' meaning health and 'genesis' meaning the origin. Antonovsky later developed the scale mode he called: A Sense of Coherence.

From this scale, one can gain insight into how certain individuals are able to cope with stress and maintain their health. Within this model, there are three components - comprehensibility, manageability and meaningfulness. In the context of spatial design, each term can be defined as follows (Gattupalli, 2022): Comprehensibility -The extent to which a person can make sense and understand their surroundings. Spatial legibility can be enhanced through intuitive wayfinding methods, views to nature, demarcation of colour and datums. Manageability - The users' sense of control in a space. By providing access to more options, users are able to choose and adjust their environment to best suit their needs, giving them an improved sense of independence. Meaningfulness - A person's sense of motivation and emotional worth attached to the healing process. The incorporation of creative, engaging spatial experiences has the potential to greatly improve a person's sense of optimism and can, at times, speed up their recovery.

Diagram of spatial theory & design informants (Author, 2023)

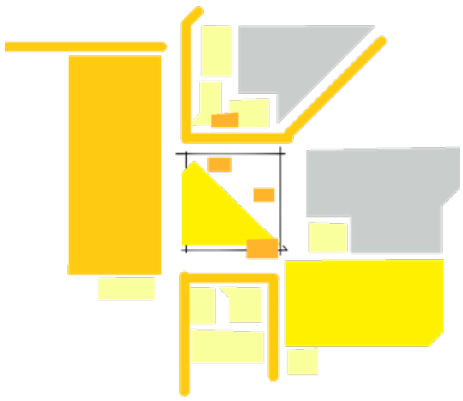


Critical Regionalism

Architecture that consciously supplants the international style of Modern Architecture by responding in a place-specific way to the context of the immediate physical and cultural context of the project to produce a project that has a sense of place and meaning (Frampton, 1998; Tzonis & Lefaivre, 1996). In doing so, the resulting architecture is more environmentally sustainable as it responds to the regional climatic conditions, locally available technology, skill and materials as well as follows a rational, optimised layout based on the spatial requirements of the desired programmes.

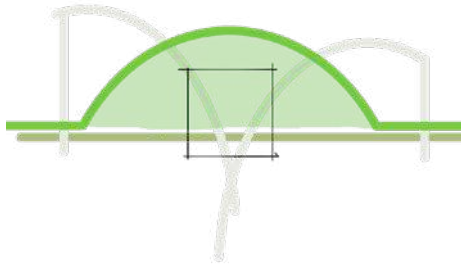
U r b a n V i s i o n

This project aims to examine how an interdisciplinary approach, combining a sustainable regional design approach, psychology, and user-centred informants can facilitate the development of a new typology for mental wellbeing in the city, providing better access to healthcare and healing for both people and green spaces. The specifics of this instance may serve as an opportunity to develop a network of such a typology spanning throughout the urban fabric of Pretoria, reconnecting vital public green spaces through reprogramming and rehabilitation of environmental infrastructure.

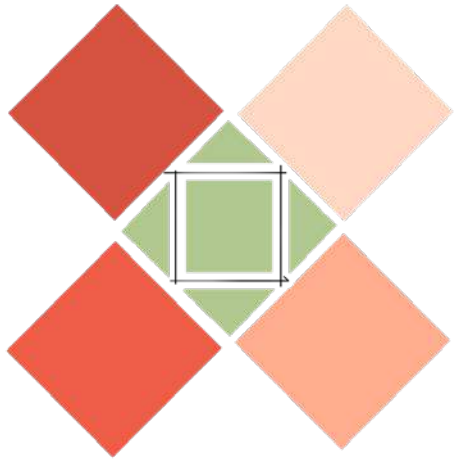


Human Activity - Private vs Public

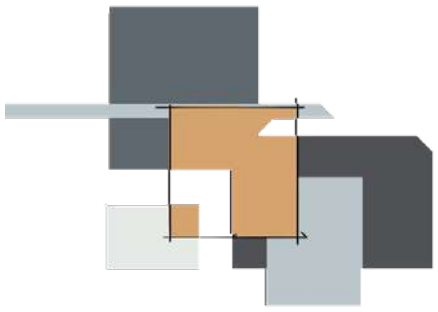
Public Open Space



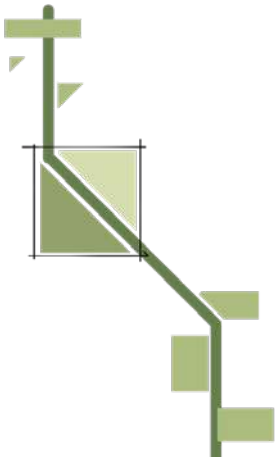
Extension of Green Space



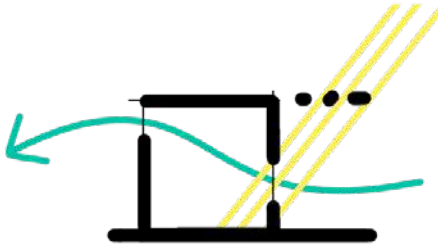
Tectonics - Respect the Existing



Interconnectedness

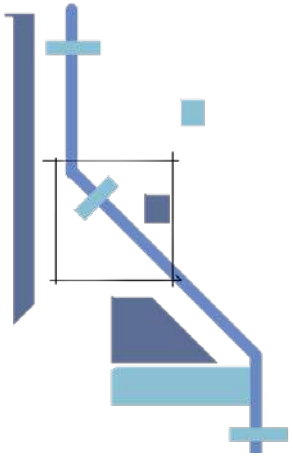


Scale, Barrier & Connectivity

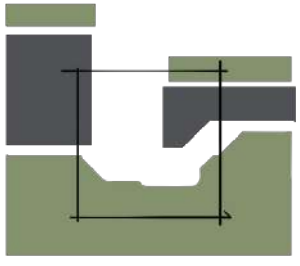


Passive Design Principles

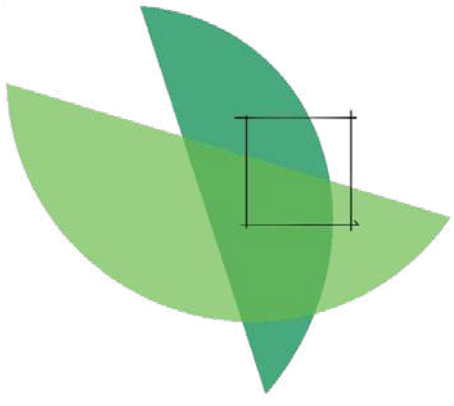
Regenerative Socio-economic Networks



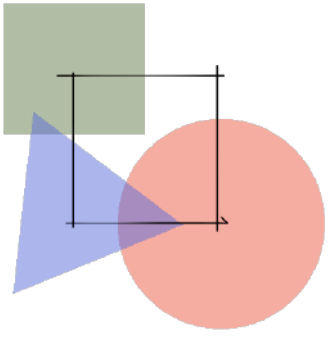
Rehabilitate Natural Water Systems



Sensitive Biodiversity Intervention



Symbiotic Healing



Multi-species Users

Key mechanisms of the urban vision (Author, 2023)

Urban Vision: Reconnecting public green space along river networks - introducing urban wellness infrastructure (Author, 2023)

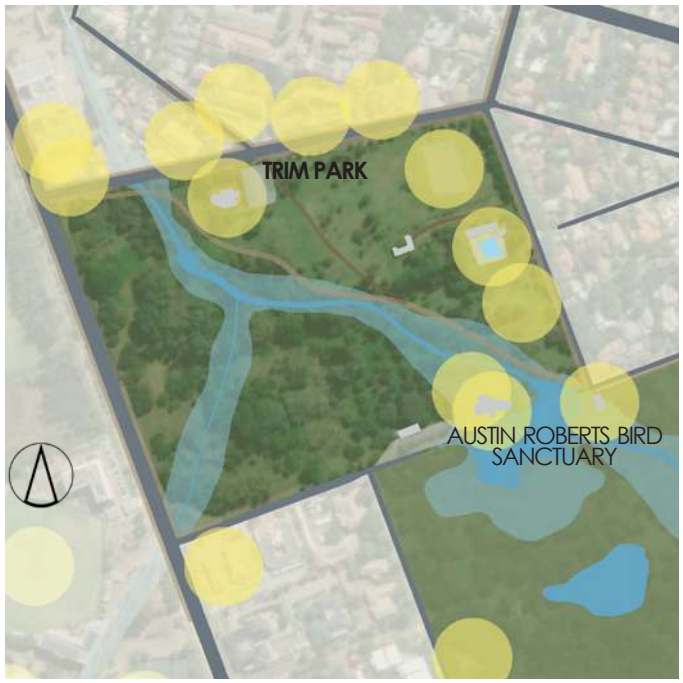
Site Masterplan

At a master plan scale, it is not the intention of this project to develop and reprogramme the entire area into human activity but to rather reconnect the two halves of the park, restore critical ecological infrastructure and improve the connection between city dwellers and the natural environment - to facilitate a well-rounded healing experience and sense of wellbeing across the context by making the site more physically accessible, safer and advantageous to a wider range of users. The introduction of several new programmes to the site seeks to uplift the interaction of existing and potential new users, namely:

- A centre for several complementary healing activities
- A new dog-friendly Parkrun circuit (5.1km) along the reinstated jogging paths across the site
- Several exhibition spaces (internal and external) for the art gallery and musicians
- Additional parking along the main side of access - Mackie street
- Formalising the existing soccer field into two seven-aside soccer fields
- Physical therapy centre (physiotherapy and biokinetics) and sports pavilion on Roper street
- A series of pop-up market spaces near the Blue Crane restaurant and parking
- Reintroducing of a variety of Indigenous plant species planted across the landscape to attract additional native animal species back to the site

Trim Park: Current conditions (Author, 2023)

Existing Circulation & Access

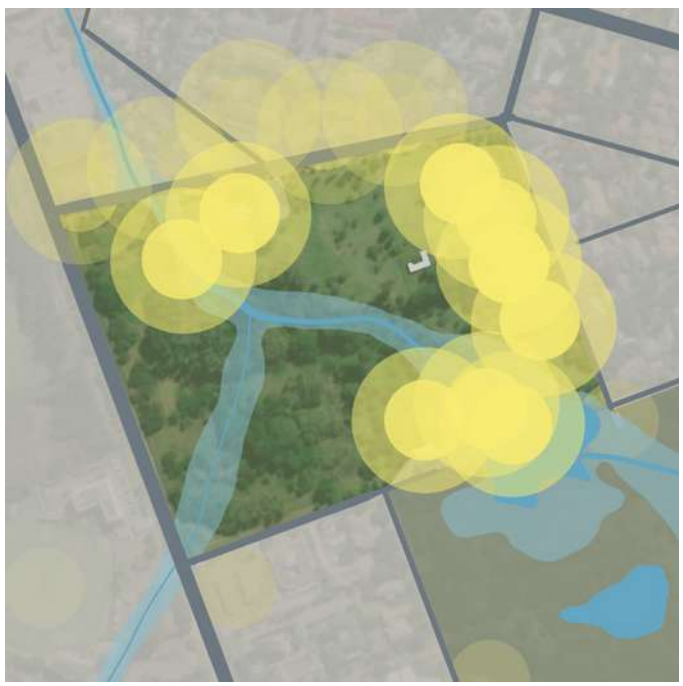


Existing Activities

Existing Vegetation & Environmental Elements

Trim Park: An urban wellness campus - proposed improvements (Author, 2023)

Proposed Circulation & Access



Proposed Activities

Proposed Vegetation & Environmental Elements

The intention of this project is to focus on the complementary therapy centre component of this larger plan.

new formal pedestrian entrance & path

additional parking & solar panel canopies

seven-aside soccer fields & stands

physical rehabilitation centre

reintroduction of jogging route along existing streetlight network

pop-up market stall spaces for community market days

improved access and infrastructure to De Jong Diving Centre and playground

Trim Park site masterplan: An urban wellness campus (Author, 2023)

Design Iteration Process

At each milestone of this project, iterations were evaluated against the core design principles identified by the theory, to name a few:

- Environmental sustainable use of materials and spatial organisation
- Accessibility and response to the principles of a Sense of Coherence
- Optimised and inherent healing experiences that engage all the senses
- Connectedness to nature and the larger site and context

Milestone 1: Architecture as a healing space
A clear understanding of what contributed to a healing environment was critical to grounding the project. Several precedents were investigated - both of conventional, institutional healthcare centres as well as alternative centres for healing. It was decided that a hybrid solution of both typologies would be further explored and developed.

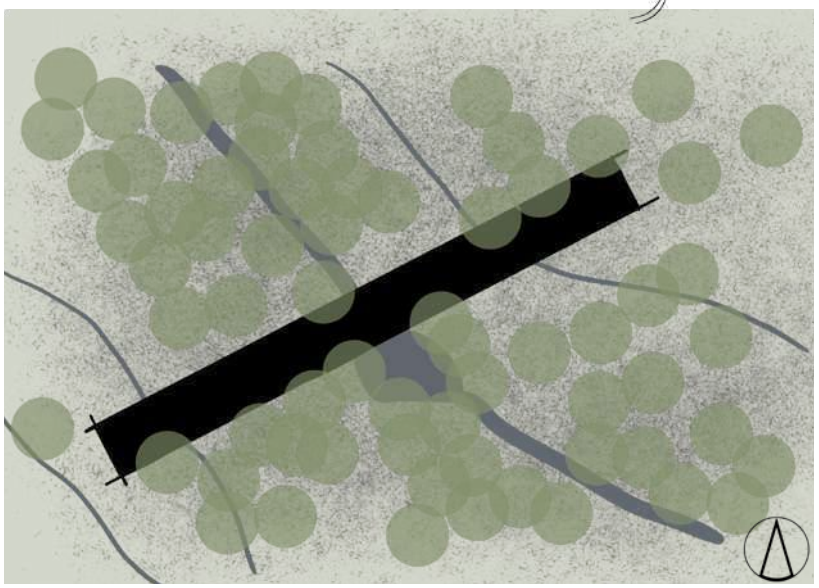
Milestone 2: Architecture as a bridging device
The idea of a physical space that connected each side of the site over the river was strong and accessible. However, the architecture became a superficial object in the landscape, void of any deep-seated engagements with nature and too closely resembled the sterile, corridor typology of most institutional healthcare centres.

Milestone 3: Architecture as landscape
Breaking up the building into programmes spread across the river and site spoke to an organic spatial solution embedded in the landscape. However, navigation between spaces became disjointed and inaccessible which contradicted the characteristics of salutogenic design - innate healing spaces that are legible, well connected and lend themselves to an intuitive journey.

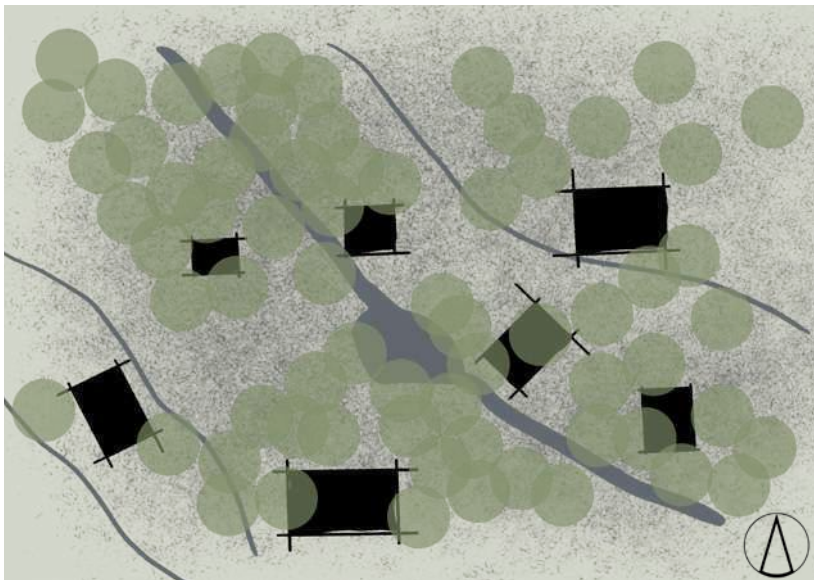
Milestone 4: Architecture as an extension of natural systems
By combining the findings of previous milestones and with further responses to specific climatic characteristics, a comprehensive solution was refined. The result is an architectural intervention that stitches the site back together whilst respectfully engaging with the existing natural systems. The building therefore becomes an extension of the existing environment.

Design Resolution
(Figure 22) The specific placement of the intervention is around an area of the site where the existing gabion wall system along the river has failed. This has resulted in a split in the river around the walls and has led to large amounts of erosion on either side of the river banks. The design re-introduces additional flood control measures whilst also acting as a bridge, connecting each side of the site over the Walkerspruit river.

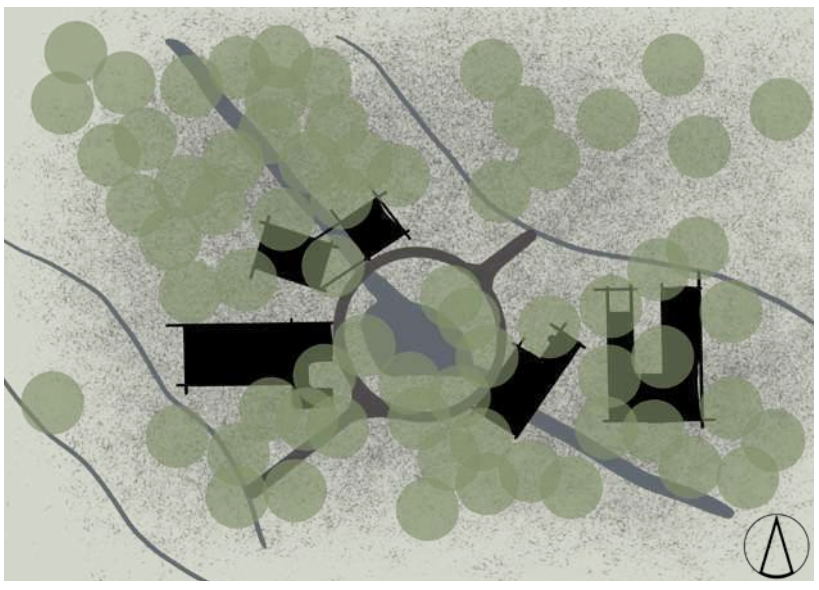
(Figure 21) A series of programmed spaces ranging in publicness positioned across the river and landscape, positioned and shaped by the existing trees and river floodline. The centre ties into the existing Pretoria Arts Association which acts as a formal welcoming arrival to the site from the parking. Upon exiting the gallery, the user is able to choose from several routes - some that extend into the larger site, and one that passes over the river, giving access to the dense forested areas of Trim Park. Along this route, users come upon the three main buildings - an art centre, resource



Architecture as a bridging device (Author, 2023)



Architecture as landscape (Author, 2023)



Architecture as an extension of natural systems (Author, 2023)

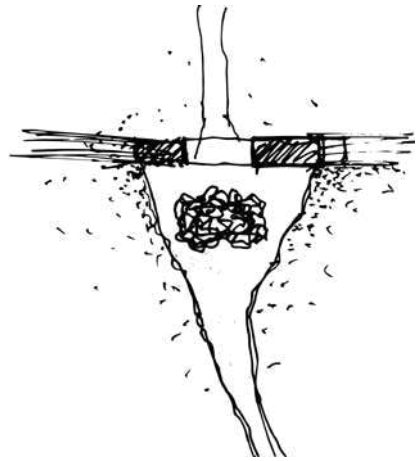
centre and mind & body centre arranged around a new retention pond where the river once split into two around the river structures.

Upon entering each building, there is a transition from public activities to smaller, intimate spaces and semi-private outdoor break-away spaces which have visual connections tied to the extended landscape. This addresses the need for both collaborative group activities, as well as private moments of contemplation and therapy.

From either side of the river, the building is nested into the ground - a stereotomic intervention made up of Hydraform compressed dry-stack interlocking soil blocks made from material on site. As the building extends towards the river, it lifts up on micropiles over the floodlines into a light tectonic structure composed of lightweight steel framing and composite walling panels.

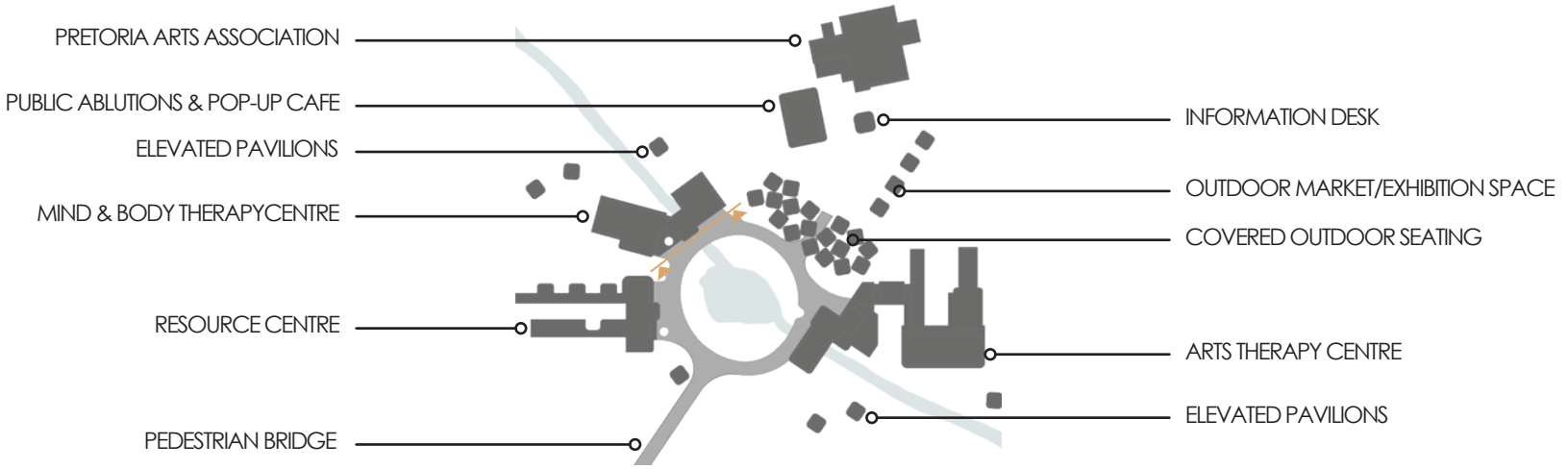
The roofs are activated by a number of accessible ramped walkways and levels of an extensive green roof system of several indigenous plant species and outdoor spaces for activities and elevated views to the larger landscape. This in turn camouflages the built elements, drawing them back into the natural landscape and allows nature to cover and overtake the structure as time progresses.

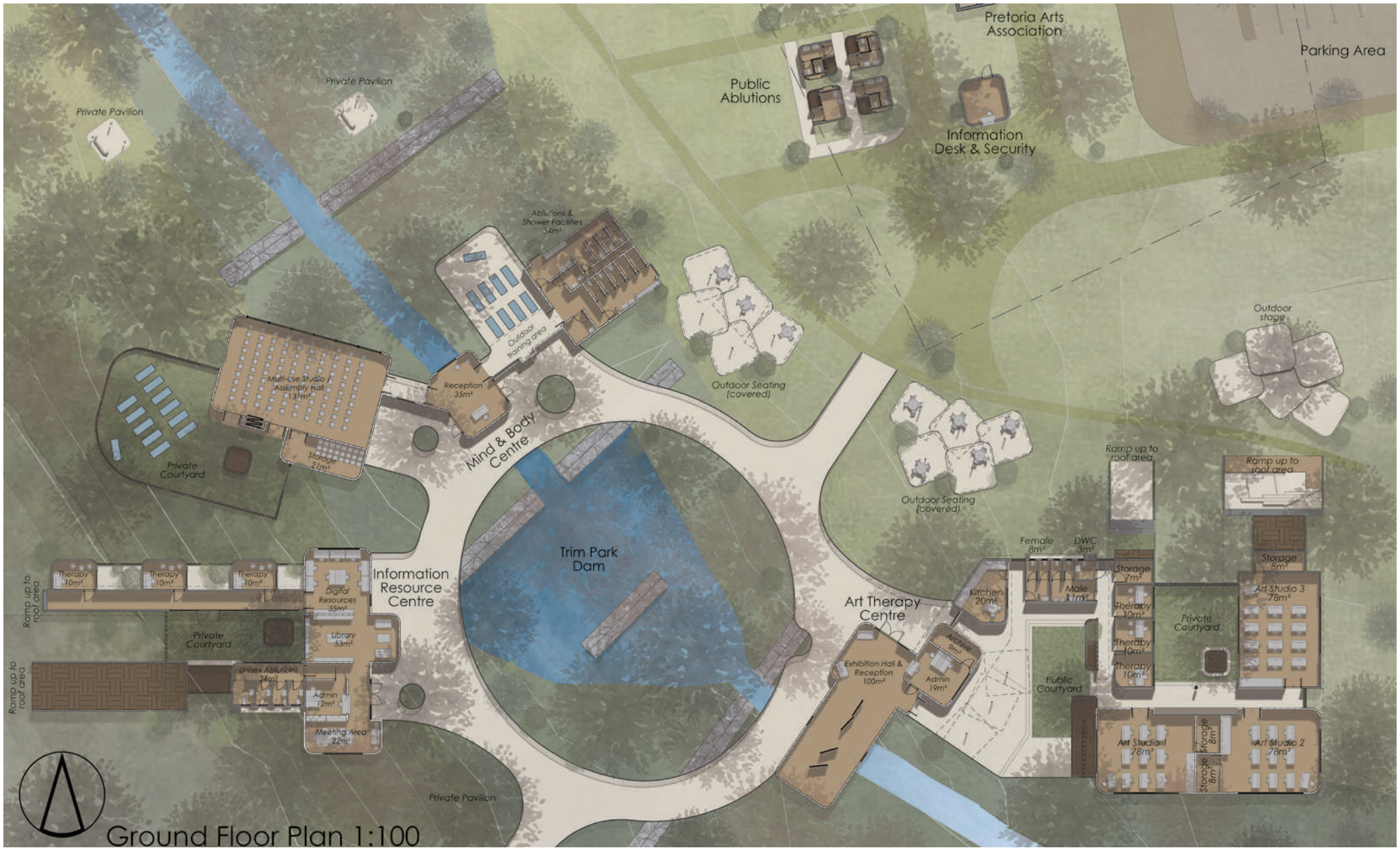
Gabion system failure over time & new infrastructure (Author, 2023)



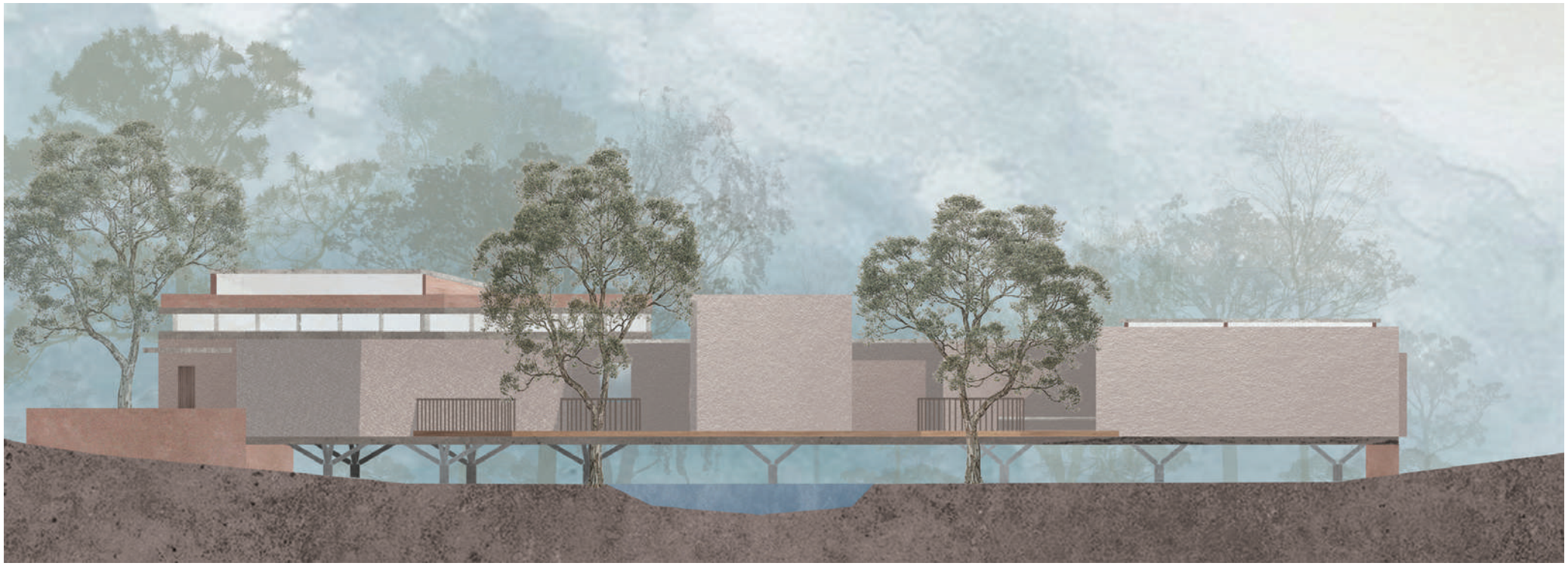
The journey: programmes & scale of publicness (Author, 2023)

Material palette inspired by nature (Various, 2023)





Ground Floor Plan (Author, 2023)



South elevation of Mind & Body Centre (Author, 2023)

From the elevated walkway and bridge over the river, each centre is accessible through a reception area. The programming then breaks off into areas for more public use and zones reserved for more private interventions.

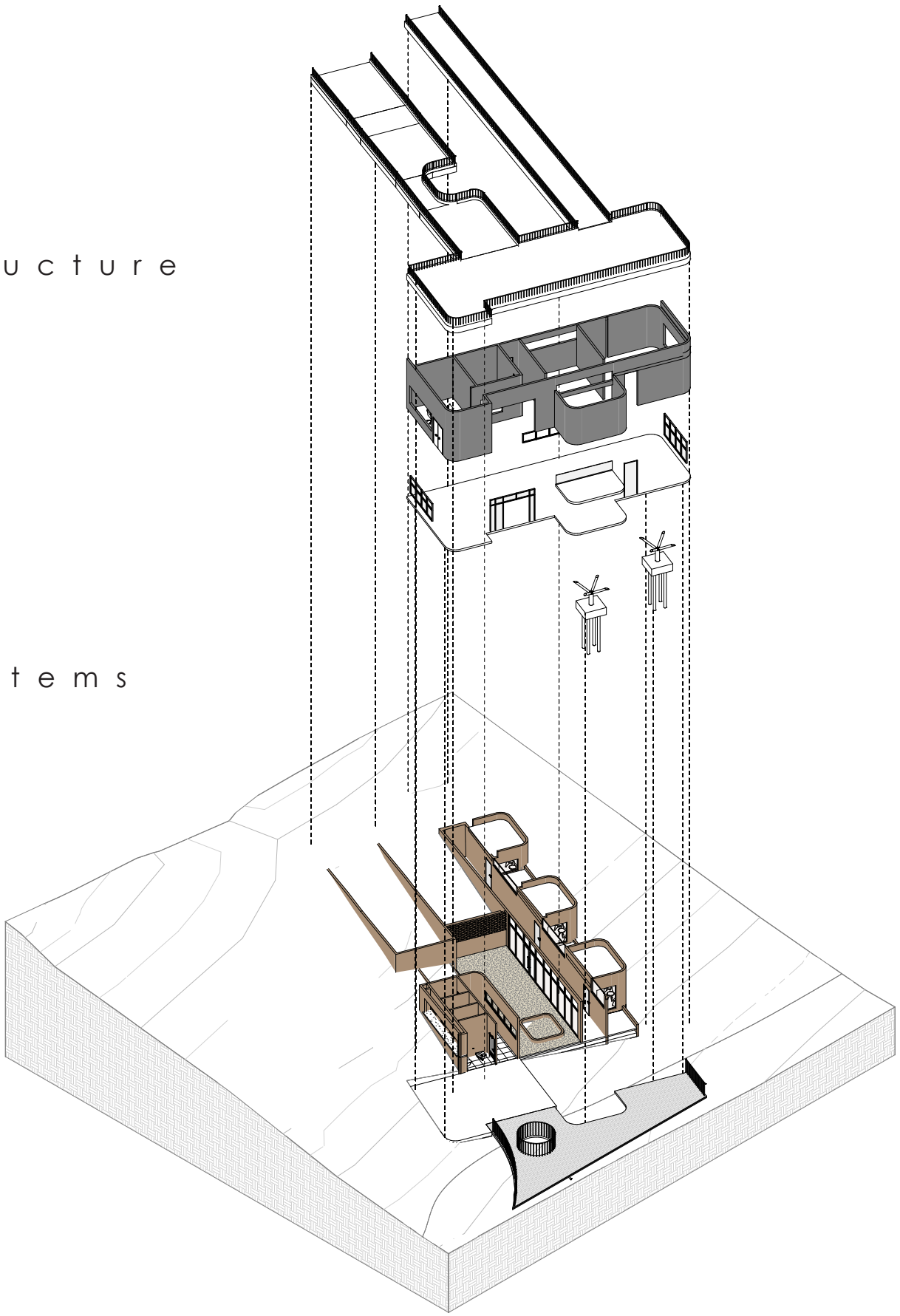
The buildings are composed around natural features, integrating them into the design. Staggering spaces along walkways optimises on audible and visual connections to the landscape.

The treehouse-like structures spread throughout the site are multi-functional platforms for private use such as bird watching, meditation, art and picnics.

A human-scale approach ensures the design is welcoming and easily accessible to the users at ground level. This along with the elevated green corridors above the buildings ensure the architecture ties back into the site.

The intention is for the building to symbiotically become part of the natural systems as it improves the site's longevity in the urban fabric.

Perspective render of the resource centre (Author, 2023)



Building Structure (Author, 2023)

Structure & Building Systems

STRUCTURE

Each building is essentially composed of two tectonics - one heavy stereotomic system anchored to the site on each side of the river and the other, a non-intrusive lightweight composite system lifted over the river and zones of high sensitivity such as the floodlines. The building's materiality and system responds to the positioning of these zones and natural features accordingly, thus each centre's technical resolution is particular to its location.

In both instances, following the conditions of Noncrete's restorative initiative, the concrete required in floor and roof slabs will contain biomass fibres taken from the removal of diseased and invasive tree species present on site that hinder water sources and the propagation of indigenous plants.

Within the stereotomic structure, a Hydraform machine will compress soil from site excavations and produce dry-stack interlocking blocks to assemble walls.

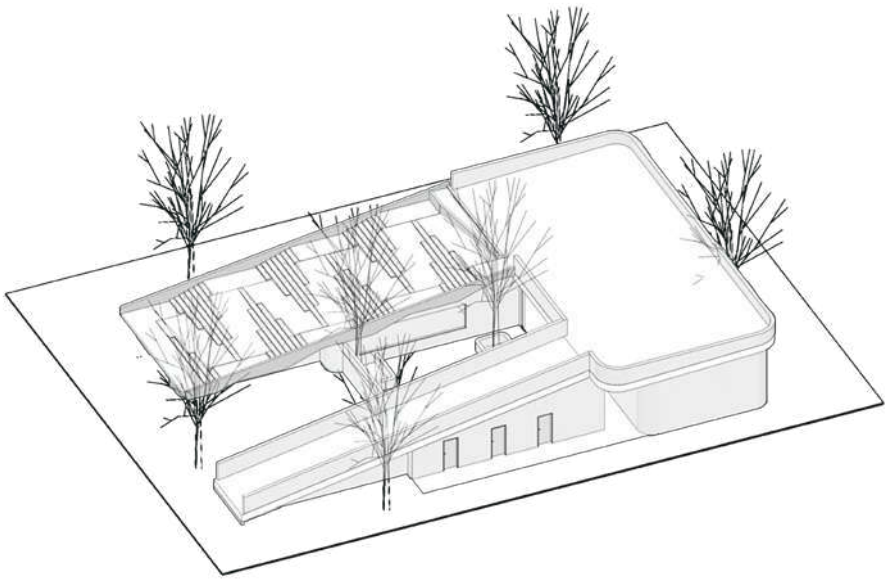
The lightweight structure comprises a light steel frame and an insulated composite walling system on a steel framing structure set on micropile foundations to limit the intrusion on the ground and subsoil conditions on site.

The main roof system is made up of a permanent steel shuttering layer, a reinforced concrete (Noncrete) slab and suitable soil layer for planting grasses and small plants across the roof areas.

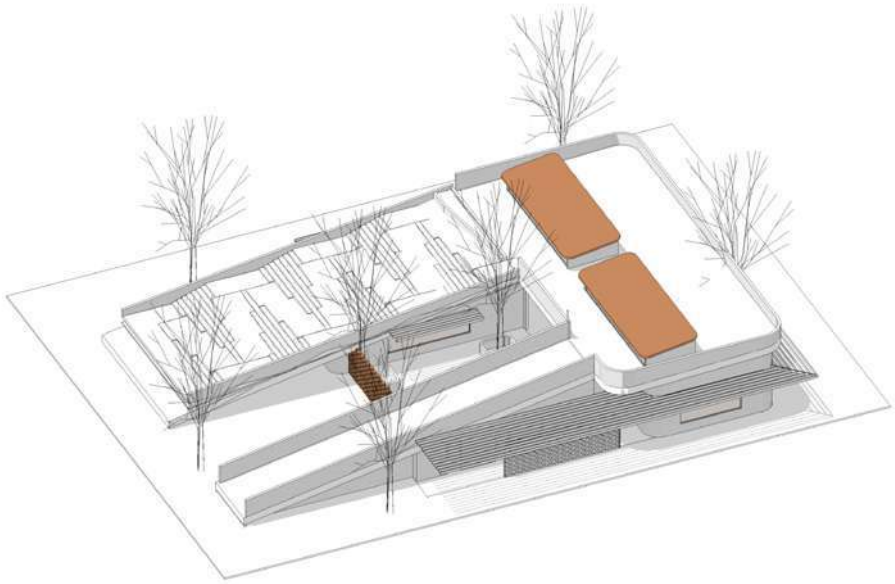
In alignment with the project outcomes, the material and structural systems selected aim to reduce the carbon footprint of the design whilst also limiting the need for external materials to be brought to site by making use of and reintegrating existing materials back into the site.

BUILDING SYSTEMS

The following diagrams in Figure 28 explain the integrated building systems implemented throughout the buildings and site to further reduce the project's carbon footprint and need for artificial forms of thermal comfort control during its occupation.

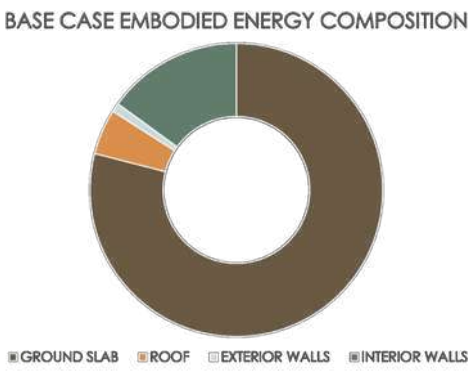


'Base case' version 5 of art centre design - control for testing

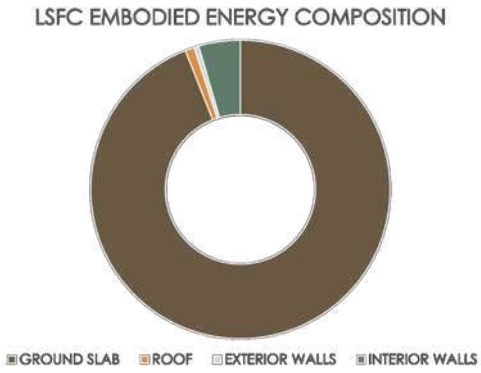


'Improved case' version 6 of art centre design - result from testing

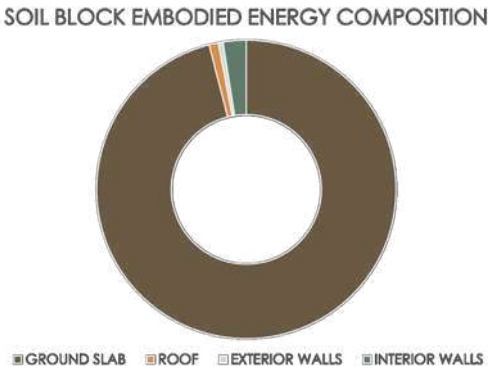
EMBODIED ENERGY - IBT SYSTEMS



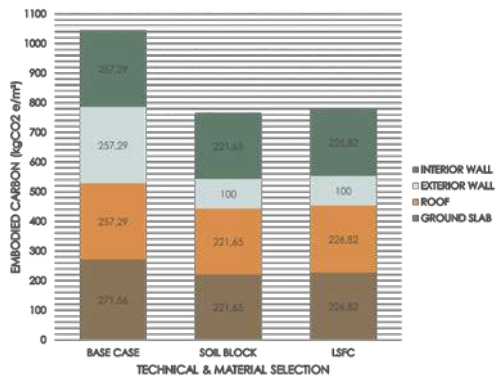
'Base case' version 5 of art centre design - control for testing
Materials: conventional concrete slab & roof, and clay masonry walls



Version 6 of art centre design
Materials: biomass composite concrete slab (noncrete) & roof, and light steel frame panel walling system

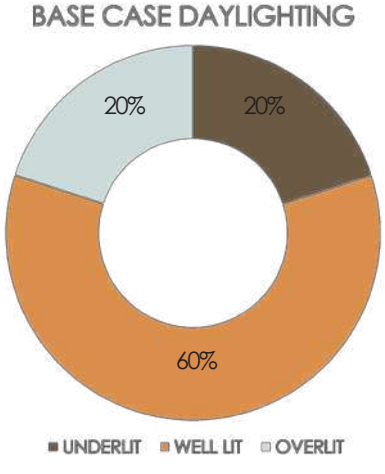


Version 6 of art centre design
Materials: biomass composite concrete slab (noncrete) & roof, and in-situ cast soil blocks (dry stack interlocking system from Hydraform)

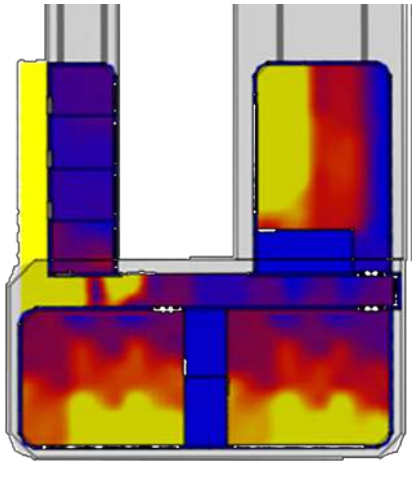


Graph of comparative embodied energy savings from material combinations and selections.
Large savings with IBT systems & non-conventional salb

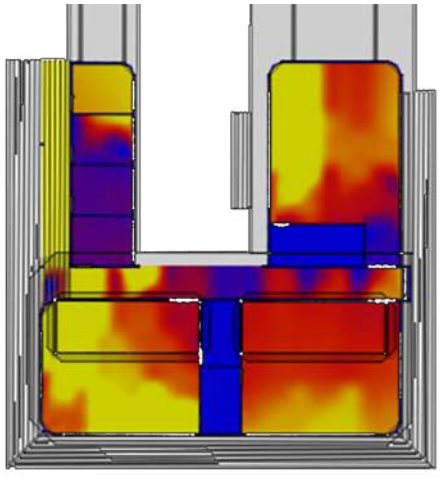
DAYLIGHTING AND TEMPERATURE CONTROL SYSTEMS



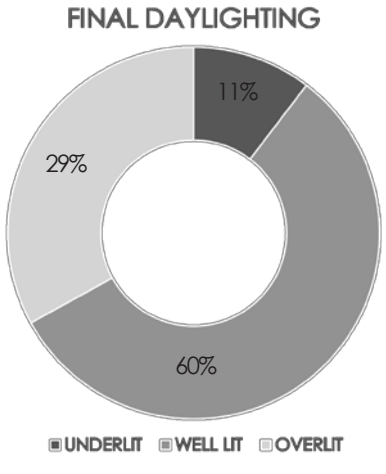
'Base case' version 5 of art centre design - control for testing



SEFAIRA DAYLIGHT MODEL:
'Base case' version 5 of art centre design - control for testing



SEFAIRA DAYLIGHT MODEL:
Version 6 of art centre design - inclusion of shading devices, extended overhangs and additional openings



Version 6 of art centre design - improved daylight spread throughout internal spaces

Integrated building systems (Author, 2023)

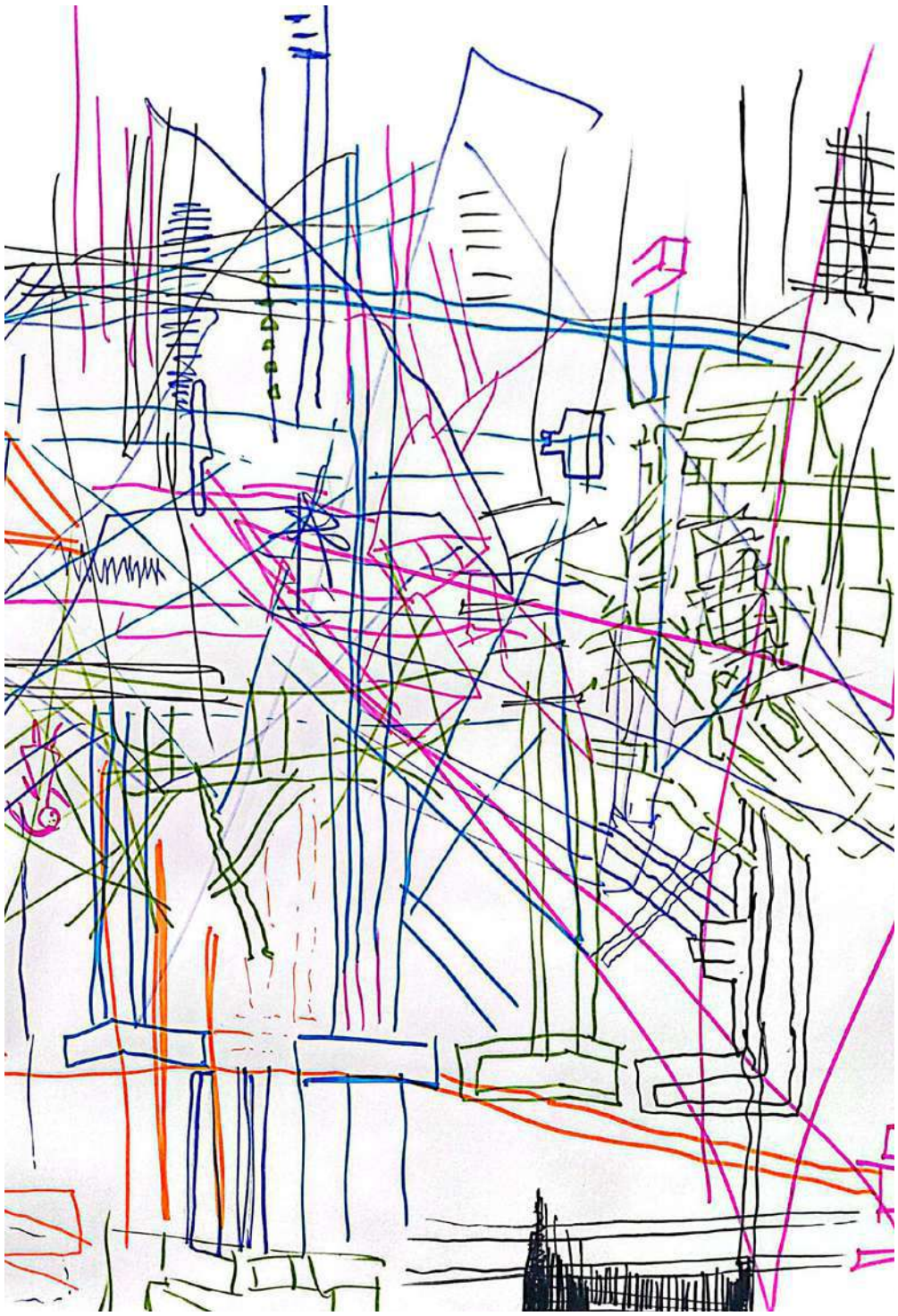
Spatial Principles

Technology

Programme & User

Site & Context

Photographs of each side of the installation's design informants



A scan of the user experience resulting from interactions with the installation

Critical Reflection 1: Mini-project

The following is an excerpt from the original exhibition:

Balanced Interconnections:
In a time where data has become one of the most critical commodities across various industries, sufficient access to information and holistic understanding to project parameters serve as defining guides when generating sustainable design solutions. Design is a fine balance in contradictions (Frampton, 1983). The act of investigation is to explore, uncover and understand the complex interconnectedness of information in every project. Each scenario holds a unique set of informants, and it is the role of the designer to achieve a resolved solution whilst meeting the needs and constraints of both the user/s and the site.

Technology
User & Program
Site & Context
Spatial Principles

The installation served as an interactive spatial experience of how universal information can be deciphered through the individualised lens of the designer (the object itself) and end-user (the projected interpretation). Like every design, the outcome is subject to the information gathered, the interpretation of that information by the designer's unique perspective and the experience of the client or user.

Another critical outcome of this experience was the highlighted role of the architect as a facilitator between the project's brief and the end-users. It is the responsibility of the designer to consolidate vast amounts of information about the project into a holistic solution that addresses the needs of four critical elements: the client and/or user, the site, the available resources and technologies as well as the fundamental design principles.

Between facilitators, no two design solutions will ever be the same. This characteristic speaks to the multiplicity of design - there are several manners in which to solve the same design problem, each with its own strengths and weaknesses. The success of a design can therefore be measured by how well it balances the needs of all four sides to the particular scenario.

Observations and comments with regards to each facet of the design are discussed as follows.

Design

Over the course of each iteration, the design underwent different spatial configurations, each providing a potential piece to addressing the project outcomes and design strategies. However, it was ultimately a combination of each key milestone that provided a comprehensive design resolution.

Reintroducing a new system of gabion walls at critical points along the Walkerspruit river protects the banks from erosion and provides an opportunity to clean the stretch of river in Trim Park. This in turn ensures adequate flood-control measures are taken and affords better access to clean, fresh water to the animal inhabitants.

While acting as a bridging device over the Walkerspruit river, to reconnect each side of the park, the building's shape and placement carefully responds to the existing zones of sensitivity. Where the footprint would have impeded on the 50-year floodline, it elevates above the ground, ensuring not to impose on the flow of the river. Outside this region, the building nests into the ground and provides users with varying degrees of experiences with the site itself.

It became a balance of functional spatial design that responded to the position of existing natural features with appropriate passive design and climatic strategies such as orientation and facade treatment. The result relies heavily on the surrounding trees for shading and cross ventilation of cooled air from the river.

Ramping the buildings up, as extensions of the ground mimicking hills, provides users with a new perspective to the park. Visitors have access to elevated views of the river, trees and wider park for a variety of activities such as bird-watching, picnics, animal therapy sessions and meditation to name a few.

Technological Resolution

By incorporating new technologies such as IBTs and micro-piling systems, the design's ability to adequately address the need for environmentally sustainable building solutions whilst limiting the intrusion on site was greatly improved.

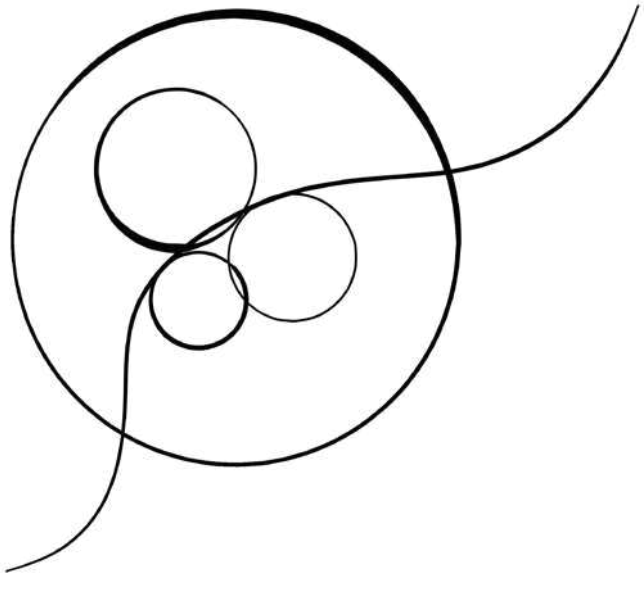
In place of conventional dense concrete slabs and framing structures as well as masonry infill systems like much of the architecture commonly produced in Pretoria, the intervention was more equipped to feed back into the site rather than rely heavily on imported material. In the instance where the structure embedded into the ground, large embodied energy and costs were saved by using in situ soil to produce the Hydraform dry stack interlocking soil blocks used in all walling and retaining wall systems.

Where the structure was required to be lighter and span further distances, a light steel framing and panel system produced by Lightsteel was implemented. Fibre-cement panels on top of rigid insulation infill provided a lightweight solution over the river and sensitive areas.

In response to the climatic requirements, thermal massing became a critical strategy to regulate thermal conditions inside the building. Along with the walling systems, the introduction of extensive green roof systems provided functionality to the roof planes and space for cultivated, indigenous landscaping which, from a design perspective, blurred the lines between what was building and what was nature.

Structural spans and material sizing also played a critical role in reducing the need for heavy equipment and machinery on site during construction. By reducing the spans between load-bearing structures it ensured that sizing was limited to that which a group of labourers could carry safely across site and negated the need for lifting equipment.

Section through elevated exhibition hall (Author, 2023)



Symbiotic community

Conclusion

The resulting user experience provided by the design is one driven by the individual's choice. It promotes independence and empowers the user throughout their healing journey. A combination of public, semi-public and private spaces spread throughout different areas of the site creates a comprehensive complementary healing centre integrated into the landscape, with several outdoor breakaway spaces, courtyards, gardens and views out to the larger context.

With the culmination of different types of complementary therapy, a wider range of users are welcomed to the site, primarily as a form of alternative mental healthcare intervention but secondly, as several opportunities to engage with the existing community in and around Trim Park as well as its inherent natural beauty.

The technical resolution of this design project provides an example of how material and structure selection, spatial planning and approach to integrated site management can greatly contribute to reducing the impact of human activities on the environment.

As an architectural intervention unified with the landscape, many challenges arose due to the vast array of information and informants required to produce a holistic design solution. A design venture such as this cannot be produced in isolation and thus requires a multi-disciplinary approach. Although this project serves as a paper-architecture precedent, in reality a team of environmental professionals, urban designers, engineers and psychology specialists would be required to gain further insight.

This project is an example of how the architect can facilitate harmonious collaboration between the four pillars - design principles, context, user and technology. What results is a cohesive symbiosis of systems, which work together to ensure the best mutually beneficial outcome for all - A resilient public green site in the city of Pretoria that radiates positive healing experiences to people, nature and the urban fabric.

"The more you know, the more you have to design with" - Nico Botes

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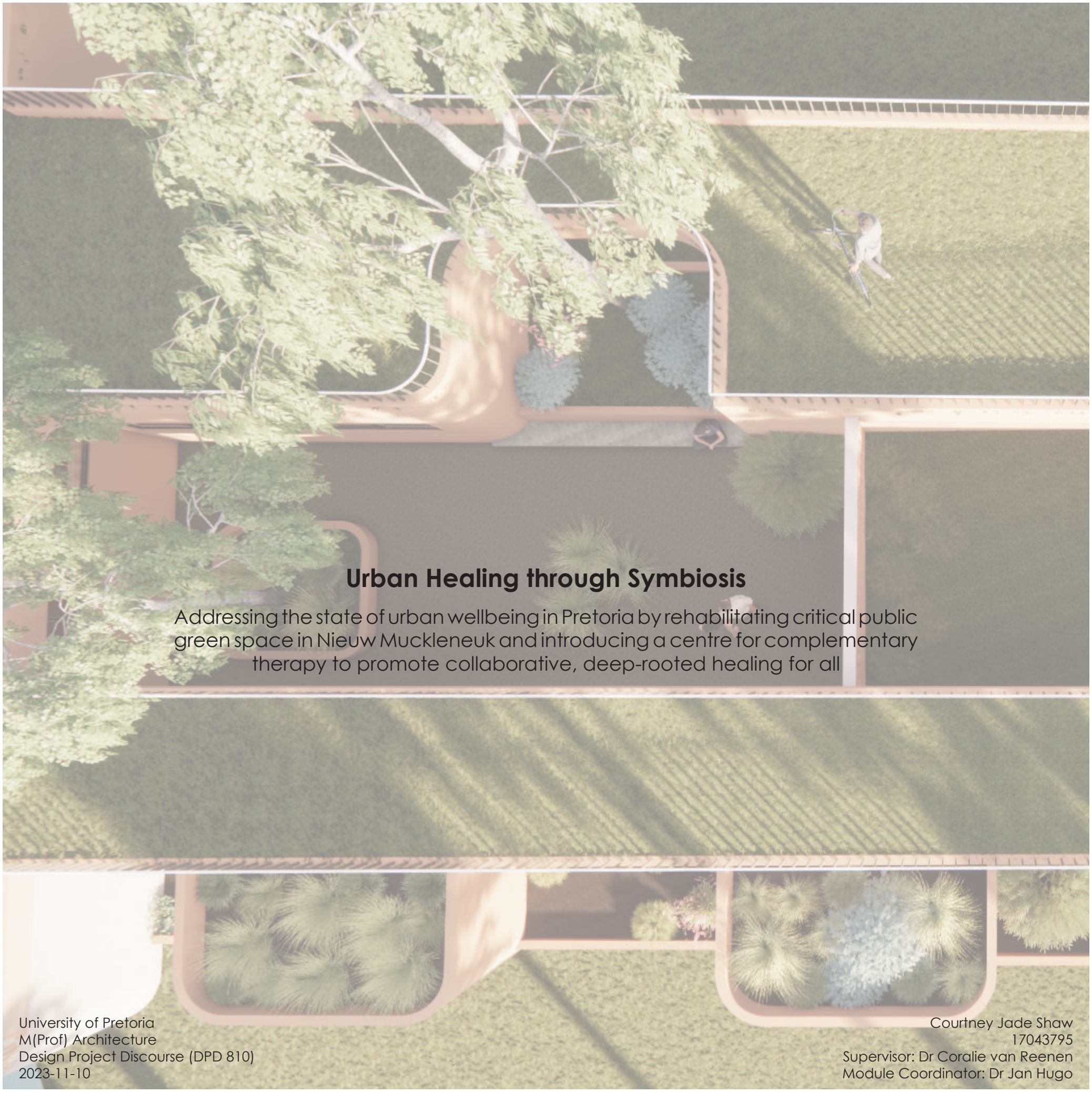

Urban Healing through Symbiosis

Addressing the state of urban wellbeing in Pretoria by rehabilitating critical public green space in Nieuw Muckleneuk and introducing a centre for complementary therapy to promote collaborative, deep-rooted healing for all

University of Pretoria
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