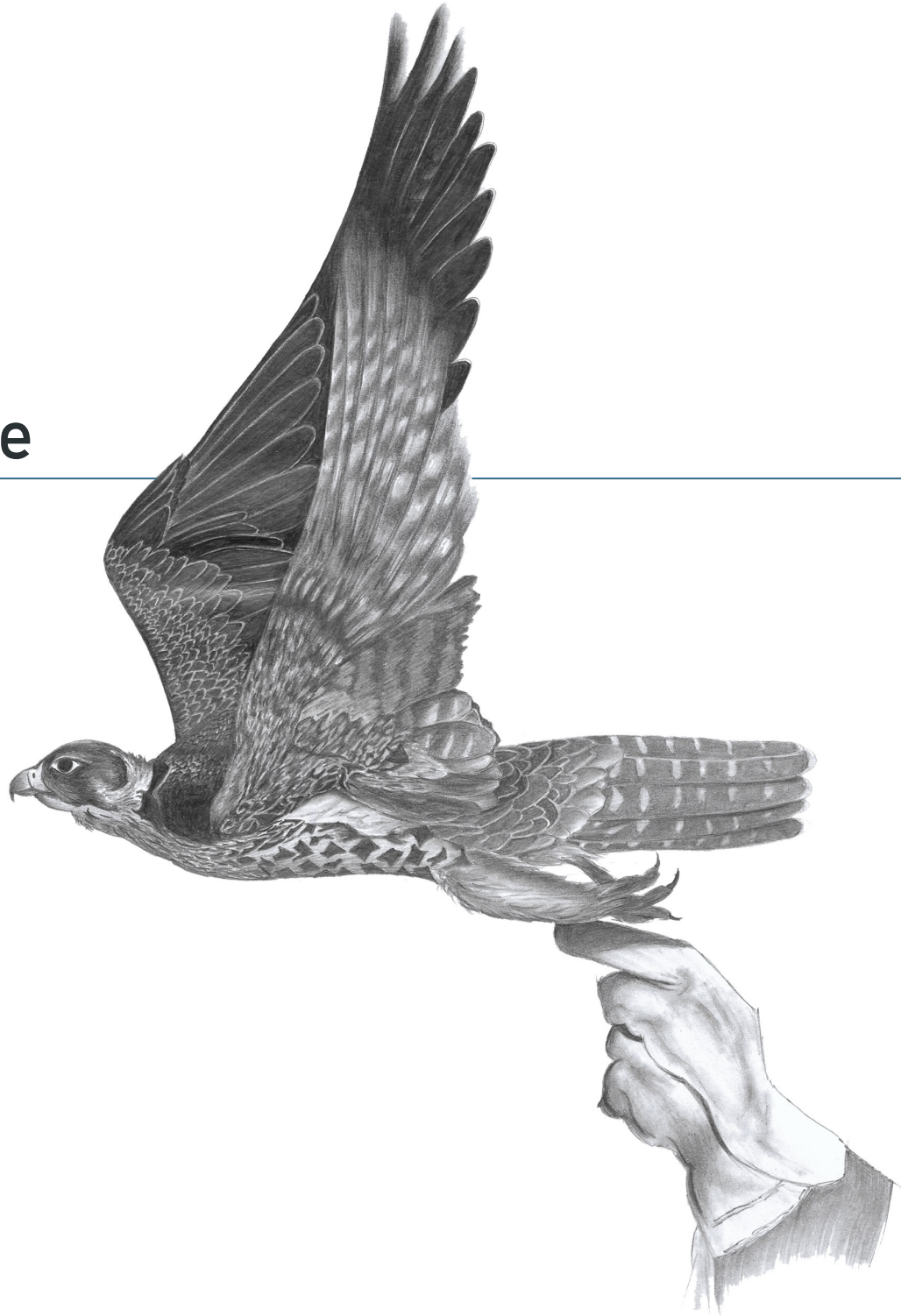
Avian Breeding Centre

Signal Hill, Happy Valley Conservancy, Bloemfontein



Derik van Blerk | 2014073734 | M.Arch (Prof)

Acknowledgements:

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Our Father in heaven who loves us dearly.

My parents, who gave me the opportunity to spend the last five years at this wonderful school of architecture.

Claudia, my biggest supporter, my motivation, my sanity, and my love.

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The rest of my irreplaceable cubicle mates - Franco, Bratwin, Isabelle and Hennie.

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Dawid Hendrik van Blerk | 2014073734 | dhvanblerk@gmail.com | 076 167 8241

Supervisors:

Prof. J. Smit, P. Smit, J.H. Nel

Department of Architecture, Faculty of Natural and Agricultural Sciences University of the Free State.

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This dissertation is submitted in partial fulfilment of the requirements for the degree M. Arch. (Prof).

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Declaration of original authorship:

I, Dawid Hendrik van Blerk, the author of this dissertation, declare that the work contained in this dissertation is my own and has not been previously submitted to meet the requirements for a qualification at this or any other institution of higher education. To the best of my knowledge, this dissertation contains no material previously published or written by any other person except where due reference is made.

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06 December 2019

Preamble

The proposed project is an Avian Breeding Centre that specialises in the successful breeding and rehabilitation of smaller raptors such as falcons, kestrels, hawks, buzzards, and owls. The location for the project is on Signal Hill in the Happy Valley Conservancy, Bloemfontein.

This project was born from three personal regions of care and interest: the primary root that it stems from is a deep love for all wildlife. I grew up in a family of “birders,” so it was inevitable that my love for wild animals in their natural habitat would spread towards these avian predators. Secondly, in my years of studying at the University of the Free State, I have developed an interest and care for the city of Bloemfontein. This influenced my site selection since I wanted to feel like my work is an investment into the place. Lastly is my interest in the relationship that exists between the natural environment and the architectural result of human dwelling. The edge that exists between the urban and the natural is often a liminal space, or the two entities are in tension with one another. The Happy Valley Conservancy embodies this notion as a green pocket of land that is encapsulated by urban and suburban developments.

These personal regions of care form the catalyst for this thesis. The aim of this document is to convey something of this care to the reader so that they too, might experience the essence of the natural site that is embodied within the architecture.



i Introduction

This dissertation uses the development of an Avian Breeding Centre to investigate the edge that exists between man and nature, and how architectural form can be used as the mediator that reconciles man with the natural site. This interaction between nature and built form is something that has been celebrated, ignored, pondered upon, and adapted for hundreds of years. However, in modern South African cities, green spaces and architectural creations are barely mentioned in the same sentence.

This dissertation aims to re-establish this connection between man and nature by investigating the inherent character of Signal Hill. Once this character is established, the architectural resolution aims to capture this as a lived experience on the site.

Throughout this dissertation, various design challenges are identified that relate to the place of the project, the program of the projects, and the form of the building in the landscape. These challenges are addressed through an architectural intervention that is driven by the conceptual underpinning of the project as well as theoretical literature.

The design process and eventual design synthesis aims to embody these conceptual and theoretical underpinnings of the project as a manifestation of the topological, typological, and morphological qualities that are inherent to this specific project.

ii Research methodology

This document is structured in a way that forms a chronological narrative of the development of the design project over the course of the year. Naturally, the research methodology is structured to reflect this narrative. An explorative research methodology was used as a way of investigating a very broad array of possible influences on the project. Once this is finished, the most applicable influences are prioritised and extensively investigated.

From this extensive investigation, challenges are identified that relate to the place of the project, the program of the building, and the architectural resolution of the project. Unfortunately, this methodology does leave the opportunity for possible project influences to slip through the floorboards before being analysed, if the deduction of influences is done improperly or carelessly.

In an attempt to formulate the design methodology so that it is both suitable and unique to this specific project, the following influences were analysed and was used to identify challenges inherent to the project:

An exhaustive case study that is complemented with a personal interview was conducted with a professional person that owns a raptor rehabilitation centre. This interview and case study allowed me to form a deep understanding of the various challenges that raptor rehabilitation faces, while also highlighting the amenities and services that are required for such a development.

A quantitative and qualitative analysis of the context was completed to gain an understanding of the essence and character of the place while highlighting the topological challenges.

The first two steps in the research methodology were combined to generate a conceptual underpinning that serves as a golden thread that binds the project together.

From this conceptual underpinning, applicable theoretical literature was identified and reviewed. This literature underlined various approaches to addressing the natural landscape through architectural intervention.

These approaches were contemplated until an appropriate design resolution that responds to all of the project challenges came into being.

iii Document design

Part 1
Grounding the project

Part 1 of this document aims to formulate the background for the project by explaining the client that will use the project, the practical aims of the development and functioning of the project's program, and the place of the project.

Part 2
The essence of the project

Part 2 of this document forms the conceptual underpinning for this project. Through a physical manifestation of the essence of the project as well as the development of three design concepts a research question is formulated. This research question becomes the lens through which the entire project is viewed.

Part 3
The technical report

Part 3 of this document investigates various technical aspects that influenced the design process and the eventual design synthesis. The aim of this chapter is to integrate these influences with the conceptual and theoretical design of the project to create an amalgamated approach to the design resolution.

Part 4
The design development

Part 4 of this document elucidates the complete development of the design. This process is constantly informed by theoretical underpinnings, case studies, precedent analysis, and the functional requirements for the project.

Part 5
The final design synthesis and technical resolution

Part 5 of this document shows the final design synthesis through a series of sketch plans, photographs, physical models, and digitally edited representations of the architectural resolution.

Part 6
Reflection and references

Part 6 of this document concludes this thesis with a reflecting chapter as well as the reference list. During the reflection, I will aim to critically establish if the project successfully achieved what it set out to accomplish. I will also highlight some areas that I believe could be bettered in terms of this document, as well as the design resolution.

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Part 1

Grounding the project

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1.1 Introduction

Part 1 of this document focuses on setting up the background of the project. This includes the function of the project's program, the client that the proposed development is for, and an in-depth analysis of the place of the project and its surrounding context. This background will form the base of the conceptual development of the project, which in turn serves as the catalyst for the design process. Part 1 of this document is directly supplemented by Part 3 of this document, which investigates various technical aspects that will influence the design resolution. Although these two parts share some information, the majority of these investigations comments one another, especially in terms of the in-depth site analysis in these two parts.

The functions and operations of the project are divided into four parts. Each of these parts is briefly discussed in Chapter 1.2 of this document. The first part explains the aims of the project's program. The second and third parts speak about the rehabilitation process for sick or injured birds and the process of raptor breeding, respectively. The last part briefly discusses the different users of the project and how they will be accommodated.

The next part elaborates on the requirements of the Endangered Wildlife Trust, who is the primary client for the project. Along with this, the requirements of two smaller, secondary clients are also discussed and how these different clients will work together to achieve the project's aims.

Lastly, the place of the project is analysed on three levels: the macro, mezzo, and micro levels. Each of these levels has an influence on the character and experience of the selected site, and this analysis aims to gain a clear understanding of this character.

1.2 The function and operation of the project

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Figure 1.1: A peregrine falcon at the Falcon Ridge Bird of Prey Sanctuary (Van Blerk, S., 2019: photograph)

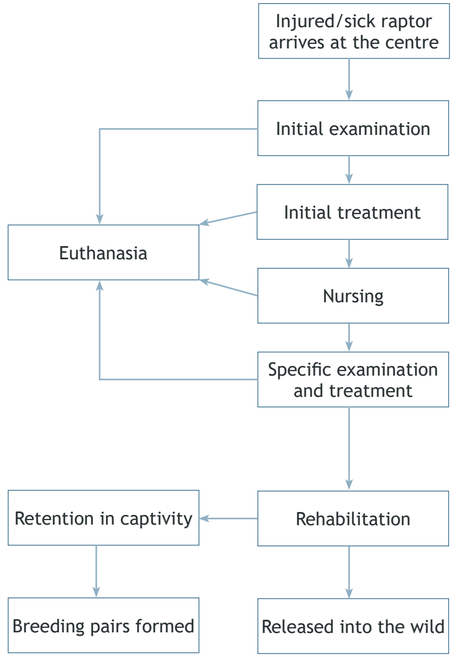
1 - The aim of the project's program

As mentioned earlier, the Avian Breeding Centre specialises in the successful breeding and rehabilitation of smaller avian raptors. This project program is used as the vehicle that facilitates the investigation into the interaction that happens on edge between the natural site and man-made architecture. However, for this investigation to be successful, the program of the development needs to be successful first. In the following section, I will highlight the primary aims of the project as well as challenges that could potentially arise from these aims.

The primary aim of this project is to supplement the dwindling number of wild raptors that live in the vast Free State landscape through a controlled avian breeding process. This decline in raptor numbers are not exclusive to the Free State, but is, unfortunately, a reality all across South Africa (Hoffmann, 2019: personal communication). The natural habitats of wild raptors are incrementally minimised by the development of new infrastructure, urban expansion, farming activities, and mining activities on a daily basis (Smallie, n.d).

All of these are human-based activities that have a negative impact on raptor species across South Africa. Raptors that are successfully bred and raised at the Avian Breeding Centre will be trained to hunt by a team of professional falconers and, upon reaching maturity, be released into the vast Free State landscape, where their movement and breeding patterns can be monitored to enhance and fine-tune future efforts.

The secondary aim of the project is to provide a safe haven for wild raptors that are injured beyond the point of successful rehabilitation and, therefore, cannot be released back into the wild. These raptors will then permanently stay at the Avian Breeding Centre. In most cases, these injured birds can still be used as breeding pairs that rear chicks, creating a connection with the first aim of the project program.



2 - The raptor rehabilitation process

The rehabilitation process that the Avian Breeding Centre will follow is explained in Figure 1.2. This is a linear process that starts when a sick or injured bird arrives at the centre. A qualified veterinarian will do an initial screening and examination of the raptor to determine the extent of the injury or the sickness. When this is established, the raptor is given initial treatment while being nursed by the rehabilitation staff at the centre.

The raptor will constantly be monitored to see if it is displaying signs of healing. If this is not the case, the raptor is re-examined, and more specific treatment (such as surgery or antibiotics) is prescribed. It is important to note that throughout this whole process, the veterinarian can make a judgment call to euthanise the raptor if the veterinarian does not think the raptor has a chance of recovering from its injuries.

If the raptor does show signs of improvement, the rehabilitation process will carry on. The raptor will be cared for until it is strong enough to fly again. Once the raptor can fly again, it will be handed over to a professional falconer, who will let the raptor fly and train to hunt under controlled conditions until it has regained its full hunting fitness. At this point, the raptor is re-released back into the wild.

If the raptor goes through the rehabilitation process but does not regain its ability to fly normally, then the raptor will find sanctuary in the permanent avian enclosures at the centre. If there is another raptor from the same species and opposite sex at the centre, then a breeding pair can be formed. These breeding pairs will raise their chicks in the specialised breeding enclosures at the centre, and when the chicks reach maturity, they will be taught to hunt by the professional falconer before being released into the wild.

3 - The avian breeding process

As mentioned in the previous chapter, the breeding pairs at the centre will mostly be formed by injured raptors that cannot be released back into the wild since they will not be able to hunt for themselves or for their chicks. During mating and breeding season, these breeding pairs will be moved to the specialised breeding enclosures (discussed in Chapter 3.5, Chapter 4.2, and Chapter 4.4 of this document), where they will be able to raise their chicks without human interference.

It is imperative that the chicks do not make any contact with humans during the first 2 – 3 weeks of their life, especially when being fed since this can cause imprinting in the raptors, meaning they will grow up thinking that the human is their parent and that they are in fact human as well (McBey, 2019: personal communication). If this happens, the chance that the raptor has of being released into the wild will disappear, and the raptor will have to stay in captivity for the rest of its life. During these first weeks of the chicks life, the raptors are often fed live prey so that the chicks learn how to kill their prey. Obviously, they will not learn hunting skills here; that becomes the professional falconer's responsibility.

A lot of raptor species, especially falcons, often have a brood of two chicks. As the chicks start to grow, the dominant chick will kill the other one (Hoffmann, 2019: personal communication). In the controlled environment of the Avian Breeding Centre, the second egg can be removed from the nest before it hatches. This second egg will then be held in incubation units where it will hatch artificially. Unfortunately, this chick will then have to be raised by humans, which puts it at the risk of imprinting. It is possible to raise this chick with the help of a dummy, that tricks the raptor into thinking that is its parent. However, this has had varying levels of success (Hoffmann, 2019: personal communication).

4 - The different users of the building

The users in this project are divided into three different categories. The primary user is the raptor. The secondary user is the staff member, and the third user is the public visitor (Figure 1.3). The entire development aims to reflect this hierarchy, with all the design decisions starting off with the needs of the raptor.

Hierarchically the staff members fall just below the raptor. The staff members will work at the Avian Breeding Centre on a day to day basis, which is why their needs are addressed just after the raptor. The public visitor is seen as the user that comes to the centre to draw an experience from the other two users, which is why their needs fall last.



Figure 1.3: The raptor, the staff member, and the public visitor are the three different users of the project.

1.3 The client for the project

The client that I have selected for this project is the Endangered Wildlife Trust (EWT), specifically their Birds of Prey Programme (BoPP). The EWT was funded in 1973 and is a non-profit, non-governmental organization that is dedicated to “conserving threatened species and ecosystems in east and southern Africa to the benefit of all people” (The Endangered Wildlife Trust, 2019: online). The BoPP is one of the largest EWT programmes and focuses on the conservation of diurnal and nocturnal raptors, vultures, and their natural habitats.

In conjunction with the EWT, two satellite clients will also be facilitated in this development. They are a private business called Avian Pest Solutions as well as administration offices for the South African Falconry Association - Free State (SAFA Free State).

Avian Pest Solutions (APS) is a professional problem bird and small animal control business that operates in the Free State, Gauteng, and the Western Cape. They utilise trained raptors to chase problem birds from urban, suburban, and rural areas:

> Raptor based bird control is a natural and sustainable technique that is part of the balance of nature; it is chemical-free, non-polluting, cruelty-free pest bird control without the use of any poisons. This system works because birds are inherently terrified of raptors, and they never grow accustomed to raptors. If birds are stressed, they stop breeding and usually leave the area of their own free will and do not return readily, removing the pest birds (Avian Pest Solutions, 2018: online).

The APS contact person in the Bloemfontein, Tim McPherson, will have an administrative office space in the staff offices for the Avian Breeding Centre. Since he is a professional, qualified falconer, he can help the staff members with raptor training and flying. SAFA Free State will also be accommodated within the staff offices for the Avian Breeding Centre.

ENDANGERED
WILDLIFE TRUST

BIRDS OF PREY
PROGRAM

conservation in action

Figure 1.4: The Endangered Wildlife Trust (The Endangered Wildlife Trust, 2019: online).

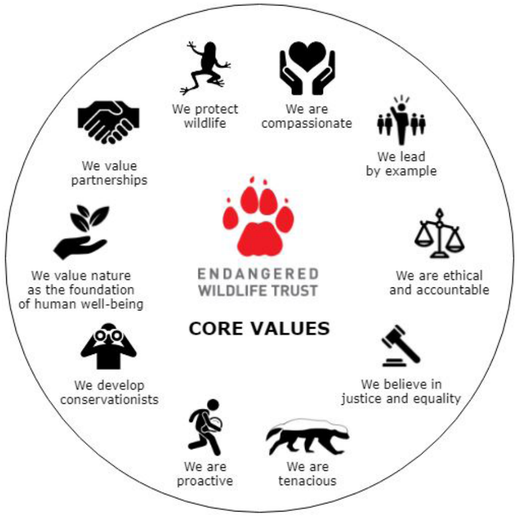


Figure 1.5: The core values of the EWT (The Endangered Wildlife Trust, 2019: online).

APS
THE NATURAL SOLUTION

Figure 1.6: Avian Pest Solutions.

SAFA
SOUTH AFRICAN
FALCONRY ASSOCIATION

Figure 1.7: South African Falconry Association - Free State

1.4 *The place of the project*

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Avian Breeding Centre on Signal Hill, Bloemfontein

Understanding the place of the project is integral to the synthesis of an appropriate architectural response to the site. The aim of this chapter is to investigate the place of the project on three levels: the macro, mezzo, and micro levels. The macro-level analysis focuses on the site in relation to the greater context of Bloemfontein, the landmarks that surround the site, and nodes of public interest around the site. The analysis of The Edge restaurant as a precedent that shares the same context as the selected site also forms a part of this broader investigation.

The mezzo-level analysis introduces the Happy Valley Conservancy on both a physical and experiential level. Functions that immediately surrounds the conservancy, access to the conservancy, existing elements, and the possible connection between the site and the project program form the physical analysis of the conservancy. The initial experience that the visitor has as he/she starts to explore the conservancy is captured as a progressive narrative that explains the experiential aspect of the journey towards the site on Signal Hill.

The micro-level analysis aims to introduce the selected site for the proposed project against the slope of Signal Hill. The influence that the existing elements and structures have on the character of the hill is discussed together with a basic analysis of the potential influence that these elements might have on the design resolution and construction approach.

This investigation is supplemented by the technical report (Part 3 of this document) that investigates specific aspects of the site that could influence the theoretical concepts surrounding the structure and construction methods of the project. All of these investigations are amalgamated and used throughout the design process to inform the conceptual development, the theoretical thought, and the subsequent design development and eventual resolution.



Figure 1.8: South African map highlighting the Free State and Bloemfontein (Property Search South Africa, 2019: online map – edited by Author).



Figure 1.9: Artwork depicting the Free State landscape (Van Heerden, [n.d]).

Bloemfontein is no different, as the town originated in the mid-1800s around the natural flow of a small spruit that runs from east to west between three main topographical elements: Naval Hill and Signal Hill to the north and Fort Hill to the south (Auret, 2016, p. 3). From this central horizontal artery, the town started to spread out into the landscape, filling the spaces between the hills without ever venturing too far up the gradual slopes of the hills.



Figure 1.10: Happy Valley Conservancy within the Bloemfontein context (Property Search South Africa, 2019: online map – edited by Author).



Figure 1.11: Statue of Nelson Mandela on Naval Hill (Botha, T., 2019: photograph).

- The context of Bloemfontein

Today, the two northern hills form natural enclaves that are surrounded by urban and suburban developments. These enclaves have been minimally developed, allowing them to retain their natural essence within the urban macro context. Both of these natural environments are currently accessible to the general public. The most prominent of the two hills, Naval Hill, features the Franklin Game Reserve while the lesser Signal Hill forms a part of the Happy Valley Conservancy.

The Happy Valley Conservancy is situated towards the west of Naval Hill and the north of the Bloemfontein Central Business District. It forms a natural barrier between the dense urban fabric of the CBD and the medium-density of the suburban developments towards the north and northwest of Bloemfontein. Other notable landmarks in the proximity of Signal Hill include the Loch Logan Waterfront shopping centre to the southwest, the University of the Free State to the west, and expansive suburban developments to the north (Figure 1.10).

This mixture of different development types that surround the site result in a wide variety of public spaces and functions that attract visitors and passers-by to the area. This can be beneficial to the project as it will help to create awareness of the proposed development. The most popular public functions that surround the Happy Valley Conservancy are highlighted in Figure 1.12. The court buildings that line the historic institutional axis of President Brand Street is the reason for Bloemfontein's status as South Africa's judicial capital. Second Avenue is lined with frequently visited restaurants, while Naval Hill contains the Naval Hill planetarium, the Franklin Game Reserve, the Edge Restaurant, and the Naval Hill Parkrun.

As you shift your focus more towards the site in specific, it becomes evident that Naval Hill and Signal Hill rise above the urban realm as natural landmarks in the city, surrounded by a network of roads, businesses, residences, and institutions (Figure 1.13). The natural topography around the two hills forms a steady slope down towards the south until it terminates in the flow of the Bloemspruit at the southern edge of the CBD. This slope creates the sense that the hills rise even higher above the built environment than they actually do, while also facilitating the opportunity to appreciate extensive views over the city of Bloemfontein when you find yourself on the summit of one of these hills.

Left
Figure 1.12: Nodes of popular public interest around the site (Property Search South Africa, 2019: online map – edited by Author).



Right
Figure 1.13: Happy Valley Conservancy and Naval Hill as natural landmarks within the city (Property Search South Africa, 2019: online map – edited by Author).



The Edge - Naval Hill

Architects: *Reinier Brönn Architects*
Location: *Bloemfontein, South Africa*
Project year: *2014*
Project type: *Public restaurant*

The Edge restaurant is situated right on the south-western tip of the Naval Hill summit, right next to the landmark statue of Nelson Mandela inside the Franklin Game Reserve. The site of the restaurant opens up immense views that stretch over the city of Bloemfontein before dissipating into the extensive Free State landscape. A part of the view from the restaurant looks directly over Signal Hill, creating an immediate connection between the two elevated sites. As the crow flies, the restaurant is just 820m from the summit of Signal Hill (Figure 1.14).

As a precedent, this building is influential to my design intervention since it engages with a very similar context as well as sharing some of the inherent challenges that are present with regards to the interaction between the building and the landscape. The Edge restaurant makes use of the same views over Bloemfontein as those offered by Signal Hill, albeit they are more extensive due to the higher elevation (Figure 1.15). The design resolution of The Edge also takes on a different approach to the way that it sits inside the landscape than the approach that I used in the design intervention for the Falcon Breeding Centre, although this is primarily due to the client's requirements for the restaurant.

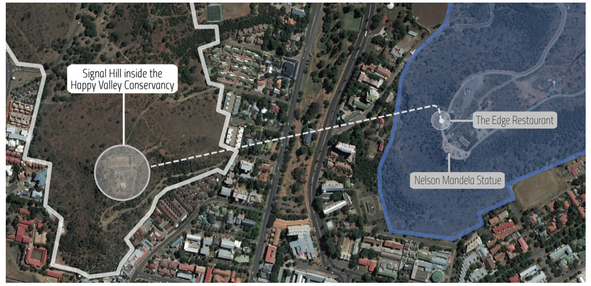

Figure 1.14: The Edge restaurant in relation to Signal Hill (Property Search South Africa, 2019: online map – edited by Author).



Figure 1.15: The view from The Edge restaurant with Signal Hill towards the right, (photograph by Author, 2019).

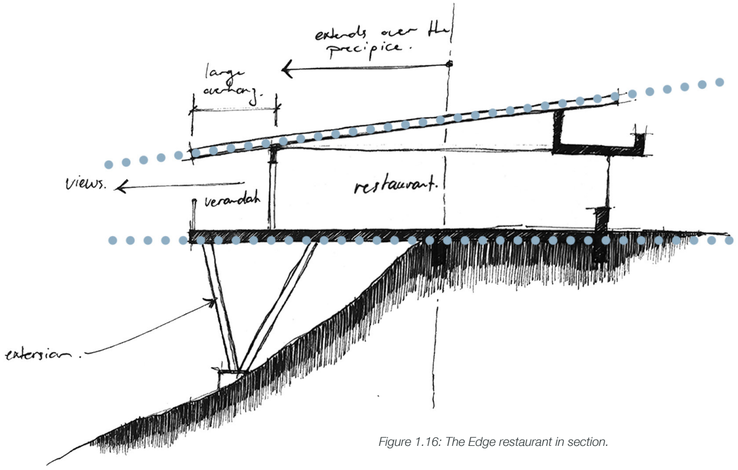

Figure 1.16: The Edge restaurant in section.

Conceptually the design of the restaurant aims to blur the threshold between Naval Hill and the surrounding views by extending the building over the edge of the summit into the landscape (Figure 1.16, Figure 1.17). Upon visiting the restaurant, this concept is carried through over very well on an experiential level. Visitors feel like they are almost 'thrown' over the edge of the hill and into the landscape. Outdoor terraces all around the western edge of the restaurant extend the floor plane even further towards the view, strengthening the concept. The mono-pitched roof is slanted down towards the western side of the building and enjoys a very large overhang on this edge to defend the building against the western sun (Figure 1.16).

The extension of the building over the edge of the hill allowed the architect to utilize the space that is created underneath the building as a private outdoor enclave that still makes full use of the site views (Figure 1.19). This space is pinned in between the dug-out part of the hill and the vertical steel structural supports of the floor plane, creating a cave-like space below the building.



Figure 1.17: The Edge restaurant viewed from the bottom of Naval Hill (Reinier Brönn Architects, 2014: online)



Figure 1.18: The view over Bloemfontein from the deck of The Edge restaurant (Reinier Brönn Architects, 2014: online)

To further the engagement between the building and the views from the site, the architect employed the form-giving of the space to communicate different thresholds. The floor plan of the building takes on a rectangular shape with the services (kitchen and bathrooms) protruding as boxes out of the eastern facade of the building, while the western facade of the building is very linear. The outdoor terrace on the western side of the building becomes the threshold between the building and the view. Here the architect followed a more dynamic form-giving to define the terrace, placing the building into dialogue with the organic order of the natural environment that it reaches out towards (Figure 1.20).

The architect also utilized the natural dolerite rocks that are found on the site as cladding materials to create a visual connection between the building and the site (Figure 1.21).

In the case of The Edge restaurant, the successful execution of the concept as a built form did, unfortunately, have some questionable consequences as well. The extended floor plate with the open space beneath it creates a very dark and pronounced shadow underneath the building. This highlights the building's presence tremendously when viewed from afar (Figure 1.23). Although this is not such a big problem, it does mean that the building does not really blend into the landscape, but instead imposes itself onto the natural environment. Furthermore, the positioning of the building right on the edge of the hill means that the silhouette of the hill is altered by the building. This results in a small alteration in the character of the famous Naval Hill (Figure 1.22).



Figure 1.19: The cave-like space underneath the restaurant (Reinier Brönn Architects, 2014: online)

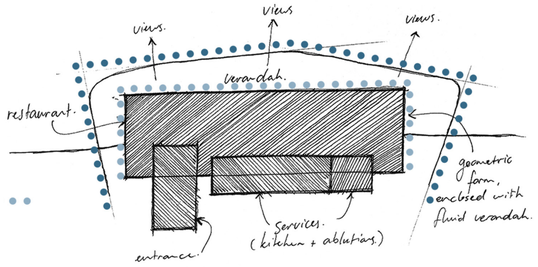

Figure 1.20: The differences in formgiving between thresholds in the building.



Figure 1.21: Dolerite rocks from the site are used as cladding material (Reinier Brönn Architects, 2014: online).

If you look critically at the engagement between the building and the site, one can argue that there are some missed opportunities where the design resolution could be more sensitive towards Naval Hill and the Franklin Game Reserve as a whole. However, the analysis of this building highlighted these possible shortcomings to me and opened up the opportunity to take a different design approach to these same challenges. Therefore, the resulting design intervention on Signal Hill looks to avoid these problems and accommodate the dialogue between the natural landscape and the built environment as a unified whole.



Figure 1.22: The outline of Naval Hill is altered by The Edge restaurant.

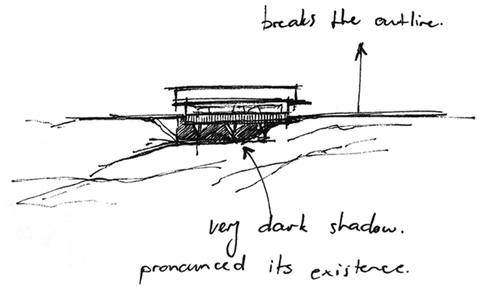

Figure 1.23: The pronounced shadow underneath the building when viewed from afar.

- Immediate surrounding influences

The Happy Valley Conservancy has an area of approximately 424 880 square meters and consists of two small koppies that form a natural valley through the middle of the conservancy. Signal Hill is the larger of the koppies and sits on the southern side of the small valley. The northern hill features two large water reservoirs buried within its summit. A slight ridge is formed between the northern edge of the two koppies along a northwest-southeast axis, creating a small topographical basin in the middle of the conservancy. Brill Street runs through this valley to dissect the conservancy into northern and southern parts (Figure 1.24 - Figure 1.26).



Figure 1.24: The view over the Happy Valley Conservancy from the summit of Signal Hill (photograph by Author, 2019).

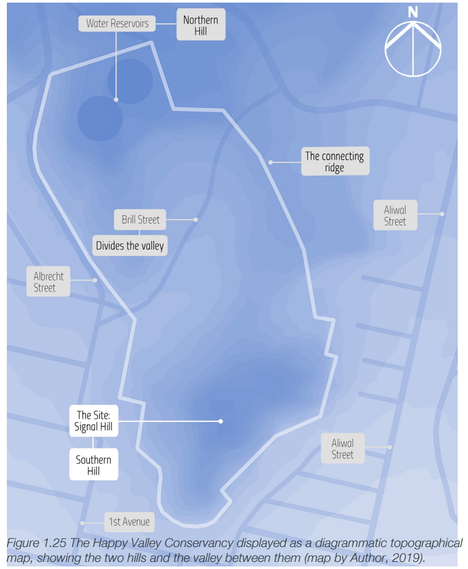

Figure 1.25 The Happy Valley Conservancy displayed as a diagrammatic topographical map, showing the two hills and the valley between them (map by Author, 2019).



Figure 1.26: The Happy Valley Conservancy within its immediate context with Signal Hill highlighted as the project site (Property Search South Africa, 2019: online map – edited by Author).

Access to the conservancy also feeds off to both sides of Brill Street, although only the southern side of the valley has a small dirt track that leads deeper into the site. The conservancy is bordered by a mixed-use commercial zone along its south-eastern edge and mixed-use suburban residential developments from the southwest to the west in the form of the Westdene suburb. Residential developments towards the north are less dense and broken up by more open natural spaces. The Provincial Premier's residence borders the conservancy towards the north, with the Oliewenhuis Art Museum sitting just beyond this residence. C&N Meisieskool Oranje is situated along the north-eastern border of the conservancy (Figure 1.26).

This vast combination of different functions that surround the site will call for a design response that does not impose itself onto or interferes with the current context of the site. This will play a significant role in dictating where on the site the design intervention will fit in most appropriately, as it will have to shy away from the site boundaries in order to respect the context around the site. Aiming to remove the design intervention from the site boundaries will also complement the bird's need to be removed from human interaction during the first couple of months of immaturity to avoid the possibility of imprinting, which will destroy the bird's chances of being released into the wild (see Chapter 1.2 of this document).

- The initial experience of the site

Upon entering the conservancy from Brill Street at the bottom of the valley, you find yourself beneath a canopy of trees that vary significantly in species, including karee, acacia, wild olive, pine, willow, and stinkwood trees (Figure 1.27). This shrouded experience creates a contrast with the vast, blue dome of the Free State sky that we have come to know in Bloemfontein. Through the canopy of trees, you catch glimpses of the sky, and occasionally the two hills that surround you, but you never have a complete view of their full respective inclines (Figure 1.28). These glimpses already create a subconscious vertical connection between the ground and the sky before the visitor starts ascending along the slopes of Signal Hill.

At this stage of the journey through the conservancy, you find yourself completely removed from the bustling city life around Happy Valley. The hills that form the valley surround you on all sides, while the sound of the occasional car driving through Brill Street delivers the only clue that you are actually in the middle of the city of Bloemfontein.

From here, a small dirt road hints for you to explore further into the conservancy, leading you towards Signal Hill. As you move deeper into the conservancy, the density of the trees gradually reduces, and Signal Hill reveals itself to you. The terrain opens up into the veld-grass covered slope of the hill that draws your gaze upwards towards the outline of the Signal Hill against the blue Free State sky (Figure 1.28, Figure 1.29).



Figure 1.27: The trees at the bottom of the valley shrouds your surroundings (photograph by Author, 2019).

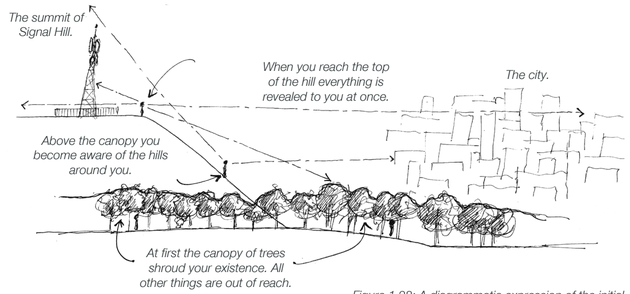

Figure 1.28: A diagrammatic expression of the initial experience of the site.



Figure 1.29: Site sketch of the most prominent view of Signal Hill.

This moment in the journey through the site plays a pivotal role in the experience of the site since this is the first time that the visitor perceives the complete visual character of Signal Hill (Figure 1.29, Figure 1.31). It will also be along this part of the journey that you will catch the first glimpse of the building against the backdrop of the hill. This moment of revelation is something that could be preserved and celebrated in the design resolution as a part of the architectural promenade that leads up to the building. As you move closer to the edge of the canopy of trees, the vertical connection with the glimpses of the sky becomes accentuated. This automatically causes the visitor to gaze up at the sky, connecting earth and sky.

This notion comments on the falcon's breeding process, where the birds are nurtured to maturity inside enclosures where they only have a visual connection with the sky. When the birds do reach maturity and are released into the wild, they can soar through the sky as a lived experience, while the human visitor views the bird soaring through the sky. This completes the vertical connection between the site and the sky, as well as the connection between the intervention's program and the sky.

3 - Signal Hill, Happy Valley Conservancy, Bloemfontein

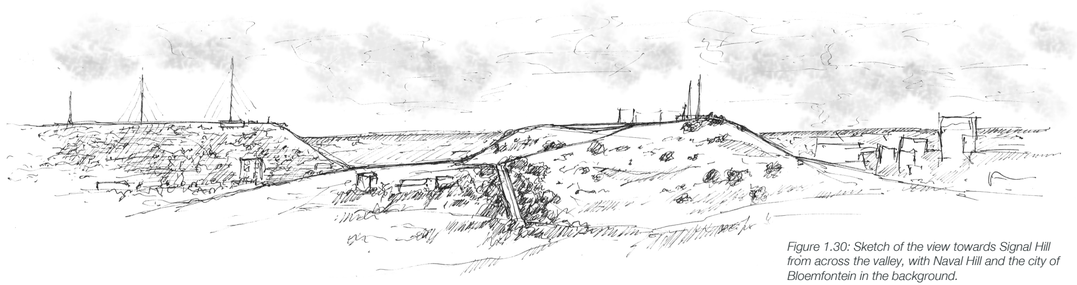

Figure 1.30: Sketch of the view towards Signal Hill from across the valley, with Naval Hill and the city of Bloemfontein in the background.

- The character of Signal Hill

As you start to explore the conservancy, you become aware of various natural and man-made elements and influencing factors that contribute to the overall essence of the site. The enclosed canopy of trees is substituted by the sloping natural topography that is dotted with smaller trees, shrubs, and bushes. Shale dolerite boulders and loose rocks of varying size protrude out above the carpet of veld grass and break the dominant texture of natural growth around the hill (Figure 1.31).

The existing trails and paths that you follow on the site seem to lead in all directions, splitting and turning without warning. However, this apparent random layout of the movement through the site is the result of the primary use of the existing trails on the site. Signal Hill is home to one of Bloemfontein's prime mountain biking circuits, which curves through the valley and around the slopes of the hill. These cycling trails are used on a regular basis, creating clear and worn in tracks through the site. The trails are used by cyclists and hikers alike (Figure 1.32, Figure 1.33).



Figure 1.31: The shale dolerite rocks that are littered around the entire hill have a strong visual presence on the site (photograph by Author, 2019).

The importance of this layer on the site lies in the influence that it will have on future design approaches, as the design intervention will have to respond appropriately to this integral piece of site context. The design intervention will either aim to retain all of these trails without changing their layout, or incorporate alternative routes as a part of the design intervention. Removing the trails from the site is not an option, as they form an intrinsic part of the conservancy's character while generating public interest in the site.

As mentioned earlier, the Happy Valley Conservancy is mostly undeveloped. Apart from the cycling trails, the only other main developments are municipal service-based installations. However, these installations also play a vital role in the essence of the site.



Figure 1.32: The mountain biking trails through the site features a series of manmade jumps and ramps to add to the difficulty of the course (photograph by Author, 2019).



Figure 1.33: The cycling and hiking trails on Signal Hill (Property Search South Africa, 2019: online map – edited by Author).



Figure 1.34: Two of the radio towers on the summit of Signal Hill (Photograph by Author).

The most prominent and influential of these municipal installations are three radio towers that sit within close proximity to one another on the summit of Signal Hill. The radio towers belong to Mangaung's electrical power distributor (Centlec) and are fenced off at the base of each tower with palisades. The towers are between 20-30 meters high, stretching the top of the hill further into the sky. The vertical extension of the towers from the site up has a significant influence on the physical outline of Signal Hill against the horizon, as the summit of the hill becomes an even more pronounced connection between the ground and the sky (Figure 1.34).

The connection between the site and the heavens played a partial role in the decision to work on this specific site. The towers project the human condition of wanting to conquer nature, reaching higher into the sky than the natural topography. This notion is something that is also reflected, maybe even to a greater extent, on the neighbouring Naval Hill. Giant radio masts sit atop this hill, right in the middle of the Frankin Game Reserve. This connotation between man and nature creates the opportunity for the program of the design intervention to comment on this condition.

Figure 1.35 aims to portray my own understanding of the site as a diagram. Elements of the hills are visible through the canopy of trees, reaching through the branches to create a connection with the visitor. From the edge of the treeline, the site starts extending upwards towards its summit with a growing incline. The texture of the hill also changes as the elevation rises, moving from grasslands to a rougher texture of dolerite boulders jutting out from the ground. At the top of the hill the three radio towers reach into the open sky, extending the limits of the site out of our reach. Upon standing at the summit, you have a view of the entire city, however you can't see its silhouette. The elevation change generates a new horizon consisting of vast Free State plains and other small hills.

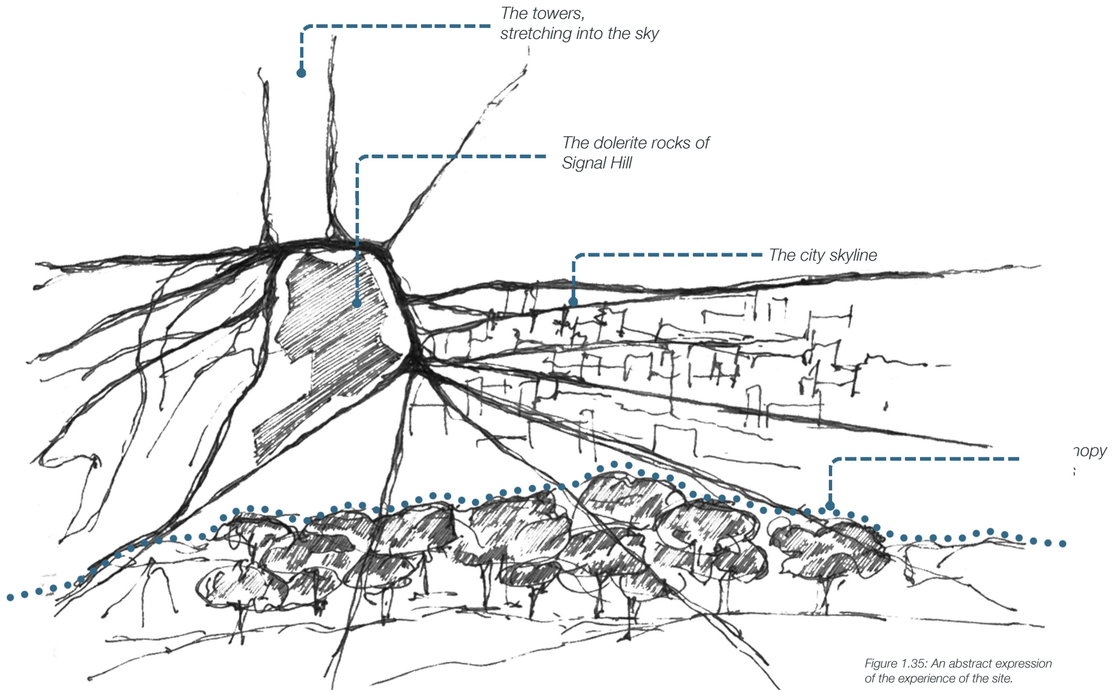

Figure 1.35: An abstract expression of the experience of the site.



Figure 1.36: The significant existing elements on the site that influence the character of Signal Hill (Property Search South Africa, 2019: online map – edited by Author).

Other significant manmade influences to the character of the site include the access road that runs to the radio towers on the summit of the hill, a submerged concrete water reservoir at the foot of the towers on the summit of the hill, and the remaining ruins of a small stone bird-watching hide (Figure 1.36).

As mentioned before, access to the conservancy feeds off of Brill Street. The access road that starts from this point is divided into 4 parts (Figure 1.36). Initially (1), a dirt road forms a part of the informal parking arrangement at the bottom of the valley next to Brill Street. From there (2), a concrete two-track path wide enough for a single vehicle runs from East to West, connecting with another servitude entrance on the eastern side of the site (Figure 1.37). The third part (3) is a single-lane asphalt road that runs along the ridge of the hill towards the summit. This road terminates at the foot of the radio towers (Figure 1.38). From there (4), a dirt road snakes down the steep eastern side of Signal Hill until it connects to another servitude entrance.

Although these roads might seem like insignificant details, they will play a pivotal role in choosing the final positioning on the site for the design intervention. Building entirely new roads onto the site from the same access street to accommodate the design intervention will not be a sensible decision from a sustainability point of view. This will mean that the design must develop at least one aspect of it close to one of these roads so that access to the built project is as easy as possible.



Figure 1.37: Part (2) of the access road (photograph by Author, 2019).



Figure 1.38: Part (3) of the access road (photograph by Author, 2019).



Figure 1.39: The concrete top surface of the water reservoir (photograph by Author, 2019).

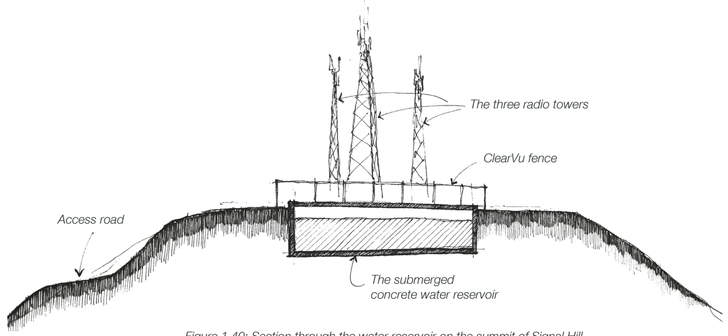

Figure 1.40: Section through the water reservoir on the summit of Signal Hill.

The next influential element on the site is the existing concrete water reservoir at the foot of the radio towers on the peak of Signal Hill. This water reservoir maintains a rather unassuming image on the site. However, on a practical level, it could play a significant role in both the design process as well as construction methods of the project. The reservoir's approximate dimensions are 48m x 22m, with an unknown depth since the reservoir is subterranean. The exposed top surface is a concrete slab, and the entire reservoir is fenced off with ClearVu fencing (Figure 1.39, Figure 1.40).

The location and the materiality of the water reservoir becomes an important aspect to include in the thought process when making design decisions. Since it is built inside the ground right at the top of the summit of Signal Hill, the reservoir could be susceptible to the forces that are present in the construction process, such as vibrations and tremors. Since the eventual project is likely to sit against the side of Signal Hill, a design resolution should be reached where the construction process will not disrupt the ground to the extent that the reservoir receives damage due to these vibrations and tremors in the ground of the hill.

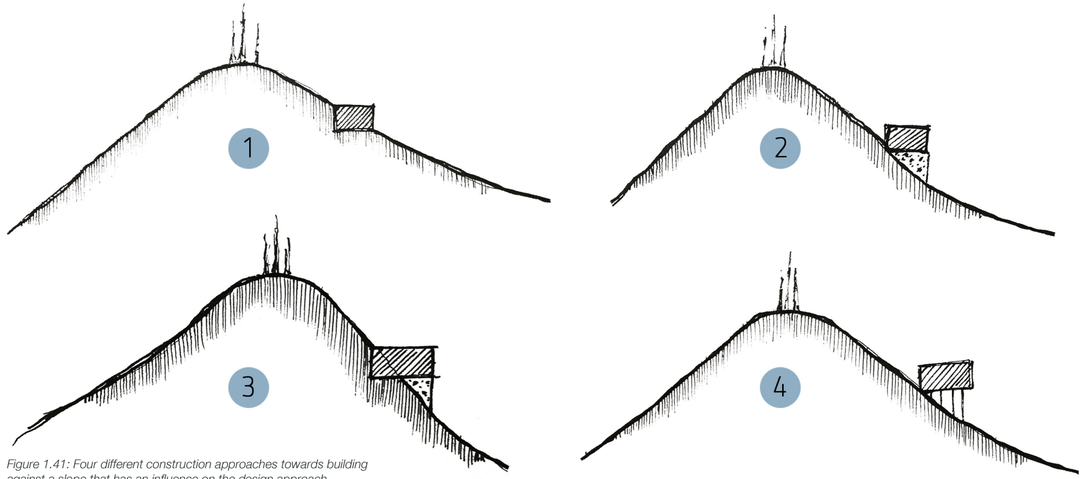

Figure 1.41: Four different construction approaches towards building against a slope that has an influence on the design approach.

Highlighted above are four popular design approaches when working against the side of a steep slope (Figure 1.41). The first approach cuts a part of the slope away and then fills it again with the building. The next approach is to create an artificial plinth for the building to sit on that extends out from the natural slope of the site.

These two options can also be combined into one approach by cutting a little bit and of the land away and then building a small plinth. The last option is to lift the building above the slope through the use of stilts. All four of these approaches will be considered as viable options for the development of the design synthesis.

Concluding thoughts

This in-depth analysis of the place of the project forms an integral part of the base that the design process responds to. Each of the three levels in this analysis contributes towards reaching a collective understanding of the conscious and subconscious forces that are embodied within the location of the project. This understanding allows both the conceptual development as well as the design development to respond appropriately to the character of the selected site. As mentioned earlier, this analysis of the place of the project is investigated in even more detail in the Technical Report (Part 3) of this document.

The macro-analysis highlighted the project location within the broader context of Bloemfontein in the Free State. This was useful in terms of identifying functions that surround the site. These functions are then related to the selected site through the possible influence that they could have in terms of drawing public visitors to the development, movement around the site, and the types of views you can expect around the selected site. One of these functions, The Edge Restaurant, is analysed as an architectural precedent that responds to and draws inspiration from the same context as the proposed development.

The mezzo-analysis introduces the Happy Valley Conservancy as a pocket of natural green space within the urban framework of Bloemfontein. The experience that the visitor has when arriving in the conservancy and starts exploring the site is the most prolific aspect of this analysis since this site experience later develops into one of the conceptual catalysts for the design development.

The micro-analysis aimed to show the influences on the character of Signal Hill. These include the existing natural elements on the site as well as the few existing man-made elements on the site. This analysis is continued in Chapter 3.2 of this document, where the site-specific topography, the geology of the site, and the relevant cadastral data is analysed.

Part 2

The essence of the project

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2.1 *The essence of the project - a touchstone for the Falcon Breeding Centre*

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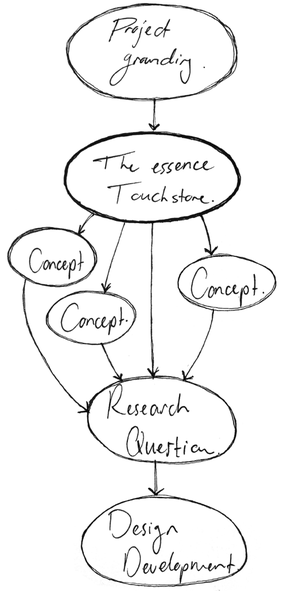
Signal Hill (photograph by Author, 2019).

This chapter aims to explain the essence of the project as a physical manifestation (referred to as the “touchstone”) that addresses the problem statement. The problem statement is informed by both historical and basic theoretical influences that relate to the relationship between the city and the natural landscape. Some of these theoretical influences are carried through into the design process, which is discussed in more detail in Part 4 of this document.

This forms the background for the conceptual development of the touchstone. Within this development, it is important to keep in mind that the touchstone aims to address the problem statement and not merely highlight the problem. This allows the touchstone to embrace a dynamic aspect that signifies the shift in the status quo that the project aims to achieve. The play in the contrasting materialities of the touchstone is carried through into the conceptual development of the project (see Part 4 of this document) and eventually into the final design synthesis (see Part 5 of this document).

Lastly, the final synthesis of the touchstone is explained along with photographs and sketches of the final resolution in its various states of symbolism. This manifestation is used as the catalyst that informs the next chapter in Part 2 that elucidates the conceptual development of the project.



Keywords

built environment
natural ecosystems
imbalance
scale

The development of the touchstone for this thesis is based on the rapid growth of the modern ***built environment*** and how this is busy marginalizing ***natural ecosystems***, creating a significant ***imbalance*** between the built environment and nature. Although this inclination is most evident in our modern cities, one can trace the roots of this trend throughout history. Vitruvius’ ancient rules for Roman architecture “followed rational dictates that set buildings apart from nature” (Ingersoll, 2012, p. 575). The fixation on architectural style and composition carried on throughout the Renaissance period, ultimately creating a Western architecture that is theoretically alienated from nature (Ingersoll, 2012, p. 575).

A more recent influence on this attitude is the First Industrial Revolution. The immense strength of automating the production process that was birthed with the First Industrial Revolution towards the end of the 18th century allowed cities the ability to develop at an unprecedented rate (Flashes Magazine, 2017, pp. 54-56). This capability to expand our cities created another catalyst for mankind’s domineering attitude over the natural landscape, an attitude which has since been growing exponentially across the entire globe.

One can draw correlations between this stance and the Apollonian world view, where the earth is viewed as a sphere that is separated from human existence. This signified view of the earth as a whole creates the opportunity for humanity to name it, study it, draw it, and place it in relation to other celestial bodies. Visualizing the sphere of the earth in space depicts the earth as an entity that is conquerable by all those that observe it, which is what mankind subsequently set out to do (Figure 2.1). As mankind’s influence spread around the globe, a circulating exchange network developed across the surface of the earth, known as globalization. (Cosgrove, 2003, pp. x-xii; 2-7).

Unfortunately, this process of globalization tends to focus more on the virtual surface networks that make up our economic, geopolitical, technological, and cultural landscapes (Cosgrove, 2003, p. 3) while neglecting humanity’s most primal environment: the natural landscape. As our modern city networks keep on expanding, the natural spaces and the ecosystems that used to flourish around cities are generally either pushed further away to the periphery of our spheres of influence or internalized into small green pockets within the urban framework. In the city of Bloemfontein, the latter is clearly prevalent. Small green pockets of land are wedged in between urban and residential zones throughout the city. (Figure 2.2).

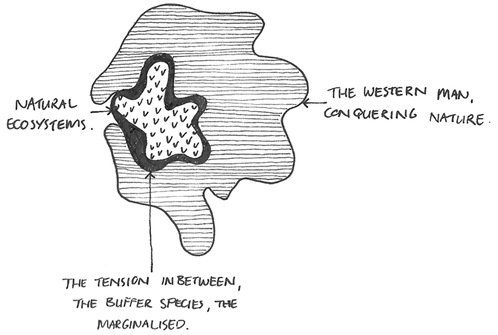


Figure 2.1: A depiction of the conquering nature that man has over natural ecosystems.

2 - Conceptual development of the touchstone

The touchstone is a manifestation of this imbalance that exists within our modern urban environments. Conceptually it is crucial that the touchstone doesn't merely expose an existing problem, but instead adapts towards a solution for the given situation. To address this dynamic aspect of the touchstone a simple balance ***scale*** structure is used to portray the effect that the Apollonian world view of the western man has on the natural ecosystems that used to exist around cities. The scale becomes unbalanced by the materiality, size, and weight of the built environment, which is contrasted with the more lightweight depictions of a natural ecosystem (Figure 2.3).



Figure 2.2: The green spaces in Bloemfontein that are surrounded by urban and residential zones (Online, 2019 - edited by Author).

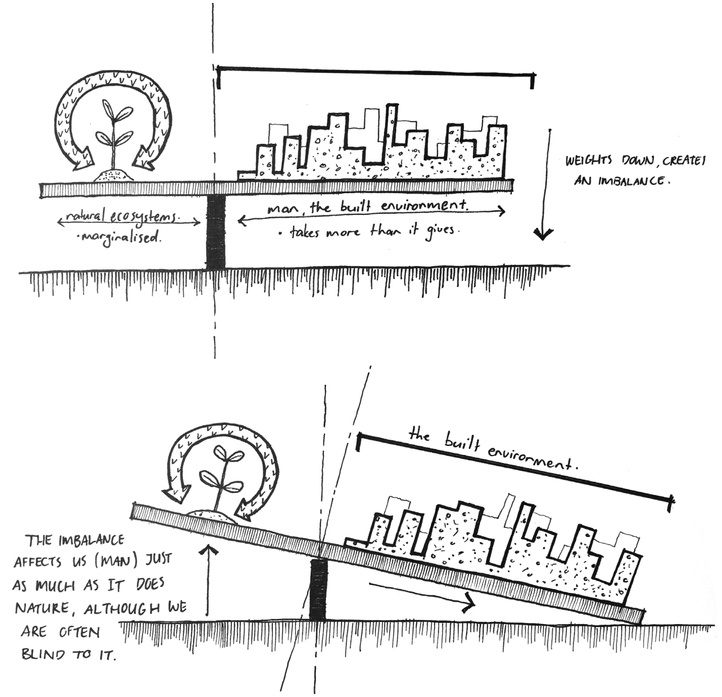


Figure 2.3: The conceptual development of the scale structure that forms the touchstone.

3 - Synthesis of the touchstone

As a built object that captures the essence of the thesis, the touchstone starts to embody some preliminary guiding elements that could inform the design process at a later stage like materiality and possible conceptual form-giving.

The balance scale is constructed from a thin concrete beam that pivots around an off-centre pointer axis. This pivot point is made from a tectonic timber frame that is mounted to the base of the structure, while strings are used to connect the different frame members to one another. The one side of the concrete beam has a more prominent horizontal protrusion from the pivot point than the other side, which obviously weighs it down more. At this end of the beam is a separate, moveable concrete weighing piece (Figure 2.4). This signifies the built environment and the domination that man has developed over nature and the skewed ratio between the urban mesh and green space that exists within Bloemfontein. At the shorter end of the balancing beam, the green pockets of Bloemfontein are depicted through natural elements such as rocks, plants, and timber construction (Figure 2.4).

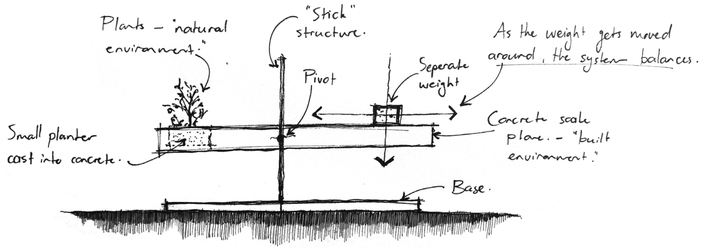


Figure 2.4: The initial development of the structure for the touchstone.



Figure 2.5: The "verdrukking" of the natural elements (photograph by Author, 2019).



Figure 2.6: The final touchstone in its unbalanced state (photograph by Author, 2019).

Naturally, the whole system is in an unbalanced state since the more significant protrusion is heavier and has a greater cantilever than on the opposite side (Figure 2.5). At this point, the plants and rocks in the system are being pressed in between each other and the concrete beam. This shows how our cities often exploit and, for lack of a better word, verdruk the natural landscape (Figure 2.6).

However, by moving the piece of concrete closer to the pivot point – and in doing so closer to a sustainable compromise with the natural environment – one can balance the whole system and release the tension between the natural elements and the built environment (Figure 2.7, 2.8). This creates a harmony between the harshness of the built environment and the natural landscape (Figure 2.9).



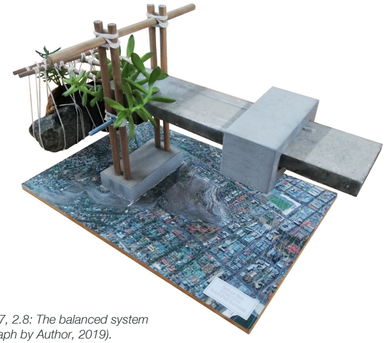


Figure 2.7, 2.8: The balanced system (photograph by Author, 2019).

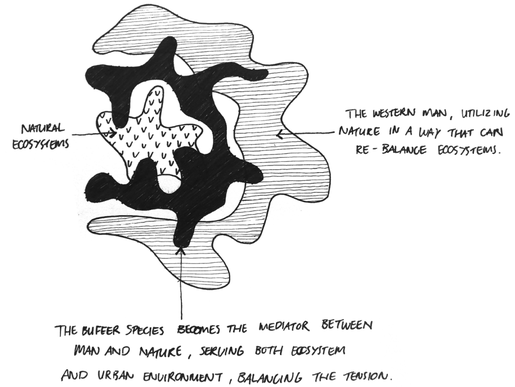


Figure 2.9: The harmony that the balance between man and nature brings.

Concluding thoughts

As a touchstone, I believe that this structure successfully captures the essence of the thesis. The simplicity of the structure and the representations of the different components create a clear understanding of the lens through which the project as a whole is viewed. This lens carries an influence throughout the design process and is used along with the conceptual development as a method of aligning decisions with the underlying thought processes for the entire project.

2.2 *Connecting ideas with physical space through conceptual development*

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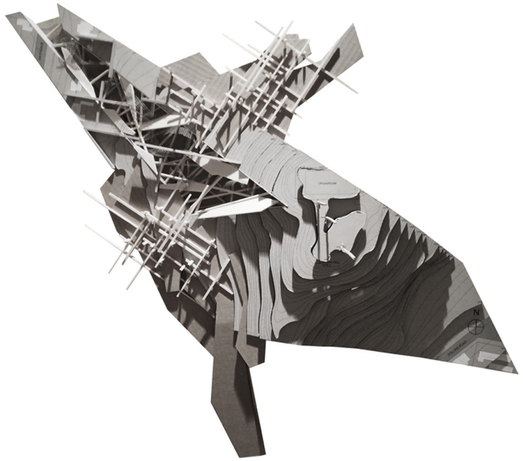
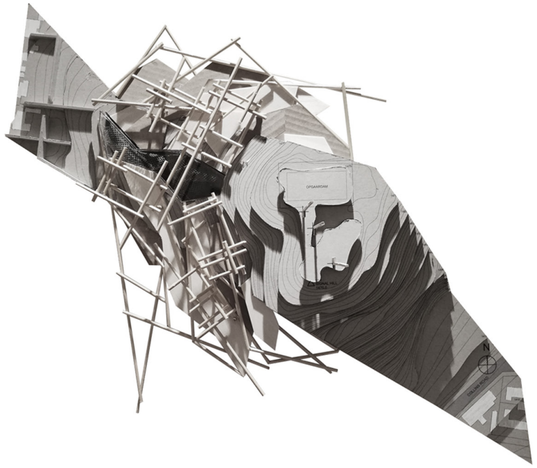




This chapter aims to connect the abstract thoughts that guided the development of the touchstone with the physical space that defines the selected site as well as the requirements that the client has. This is achieved through the development of three architectural concepts that are placed on the site, containing hints of the project program, orientation, materiality, and structural typology. Similar to the touchstone, each of the concepts is inherently connected to the natural environment, in this case, Signal Hill. These connections between site and concept are abstracted by a set of keywords that describe the nature of that concept.

These conceptual elements are used to guide the design process as it moves forward, informing theoretical approaches, technical resolutions, structural investigations, and the morphological development of the project. It is also from these concepts and the touchstone that the research question for this thesis is born. The research question captures the aim of the project and will eventually be used to measure the success of the project.

touchstone → *site + client* = *concept*

The conceptual development of the project is born by combining the abstract thought of the touchstone and the physical reality of the client and the site. This basic formula is used to generate three different concepts, each grounded in the physical space that surrounds the selected site. After developing the thoughts behind the touchstone, I found this connection with the physical site to be critical towards the success of the concepts since the touchstone already started investigating mankind's interaction between the city and the natural landscape. Therefore, all three of the concepts are site-driven concepts.

Since the inspiration that is found in the site is similar for all three concepts, their physical manifestations all have a similar result as well. The three concepts are expressed as physical models that use sections of the existing site topography as a base. The selection of these sections formed the first exercise in orientating the project on the site. This resulted in a roughly similar section of the site being used across all three concepts (Figure 2.10).

The materiality of the three models also relates to one another, while alluding to possible design influences. The tectonic stick-like structures that are prevalent in all three models aim to capture the lightweight nature of the typical avian enclosure, whilst also expressing the conceptual thoughts behind each specific model (Figure 2.11).

This expression of an avian enclosure is strengthened by the presence of a thin, grey mesh in each of the models, which points at the traditional method of covering these enclosures, which is through the use of a thin, permeable mesh or netting. Although the mesh is applied in a different way in each model that relates to that specific concept, the notion behind it remains roughly the same. This combination of materiality and symbolism binds the three concepts with a golden thread, allowing the different concepts to read as one.

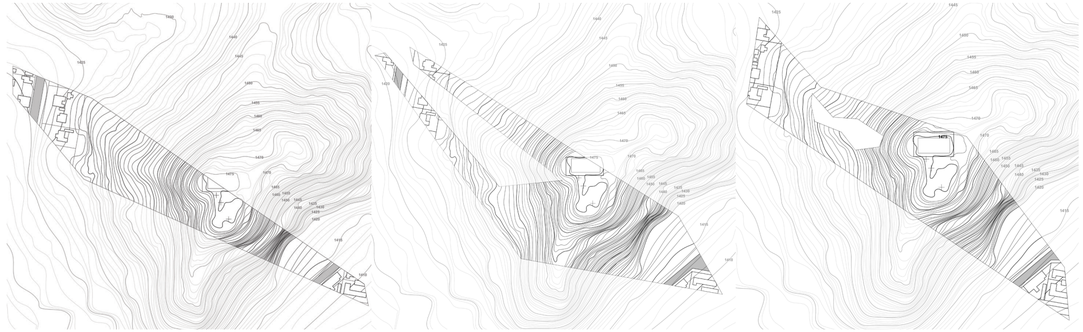


Figure 2.10: The three sections of the site that are used for the concept models.



Figure 2.11: The prevalent tectonic stick-like structures (photograph by Author, 2019).

Keywords

caged
influence
butterfly effect
inside - outside
here - there



Figure 2.12: A physical manifestation of "the confined expanse" (photograph by Author, 2019).

This concept is based on a play in the contrast that exists between an enclosure and the vast expanse of the Free State landscape. On a broad level, the project aims to breed falcons inside this green pocket of land that is gridlocked within the city of Bloemfontein, while facilitating a dialogue between the human dweller and the natural landscape. This concept can be related to the butterfly effect. In chaos theory, this metaphor suggests that "a butterfly's gently flapping wings in Mongolia could, in unpredictable ways, influence weather conditions in Boston" (Grover, et al., 1997, p. 268). Similarly, the process of avian breeding happens inside breeding enclosures, which temporarily inhibit the free flight of the falcon. However, upon reaching maturity, the falcon is released into the wild where it will aid in upholding the integrity of wild raptors across the Free State. A small change in the city of Bloemfontein could have broad influences over the landscape of the entire province. Naturally, this concept takes on a more organic approach that opposes the strict grid pattern that makes up most of the city of Bloemfontein.

The model for this concept is portrayed as a thin sliver of the selected site on Signal Hill as a means of showing the nature of the site within the context of the city (Figure 2.12). The green pocket of the Happy Valley Conservancy is partial, excluded, and almost disengaged from the urban fabric. It does not form a whole. Furthermore, this also speaks of the containment of an enclosure, where you cannot move past the confines of its edges.

On this sliver of the site, a rough representation of the avian enclosures are built as mesh-covered frame structures. However, these frames are only covered on the top; the sides are left open. This relates back to the practical aspect of the project, where the raptor will start their lives inside an enclosure before being let free to live in the wild. From within these “open-closed enclosures,” the design reaches out past the confines of the site and the enclosures (Figure 2.13).

The protrusions are visual representations of the effect that this project could have on both the local context of Signal Hill as well as the broader Free State landscape.Furthermore, the development of this concept starts alluding to the organization, orientation, and materiality of the final design on the side of Signal Hill since this is the first actual design response on the site.

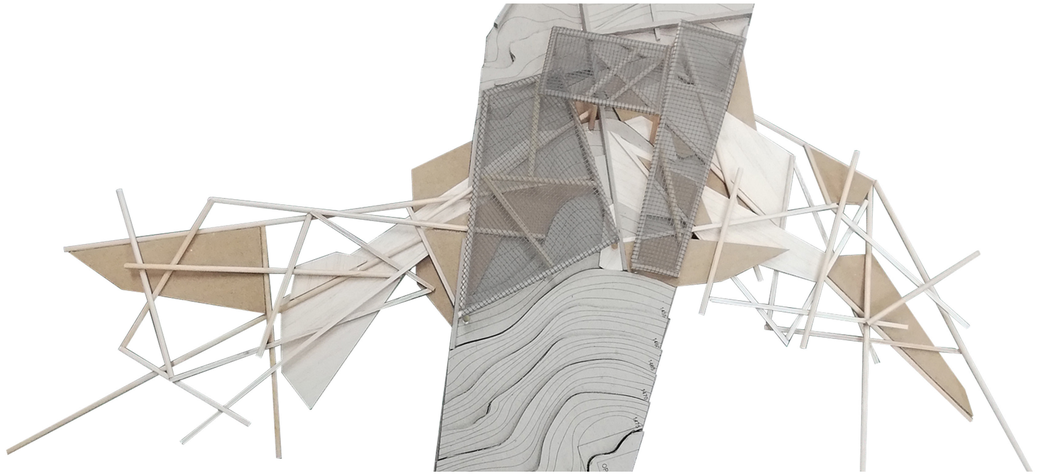


Figure 2.13: Reaching out past the confines of the enclosures (photograph by Author, 2019).

Keywords

cracks
broken
growth
roots
holding together

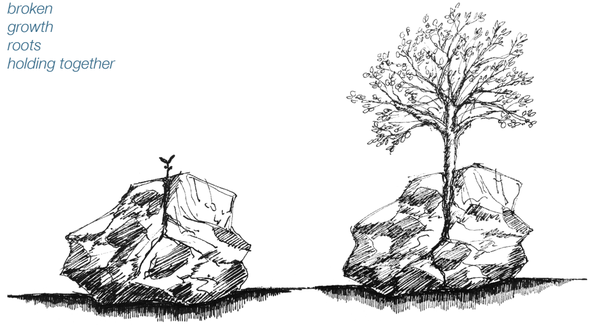


Figure 2.14: The growth of a plant in a crack in a boulder that leads to mechanical weathering of the rock.

This concept draws from the process of a large rock that gets mechanically weathered over time by a seed that starts to grow inside a crevice in the rock. As the seed turns into a plant, the roots keep on growing, forcing their way deeper into the crevice. This makes the crack bigger and bigger over time. If the plant has a strong enough root system, the crevice will carry on opening until the rock is eventually split into two parts (Figure 2.14).

However, since the roots forced their way through the rock before it split open, they often become the bonding mechanism that carries on holding the rock together. The entanglement between root and rock creates a whole. If you remove the plant from the rock, it will fall apart and you will be left with two loose parts of a broken boulder.

I used this process as a lens through which I viewed the landscape and the selected site. The rock becomes the metaphor for the predominantly natural, clean, and unused site against the slopes of Signal Hill. The design of the avian breeding centre in this clean landscape becomes the tree that starts to grow inside the green pocket of the conservancy. Initially, the site is cracked open through the intervention, but as the building starts to take shape, it becomes buried within the hill as an extension of the landscape instead of an imposition on the landscape. As the functional aspect of the project starts to develop, this extension of the landscape actually becomes the incubator that adds meaning to the site.

Conceptually this metaphor carries a lot of weight since it has the potential to guide a lot of future design decisions. The lightweight protrusion of the tree that is anchored within the heavy base of the rock opens up plenty of opportunities with regards to the organization of the design, technical resolutions, and the dialogue between the morphology and the tectonics of the design (Figure 2.15, 2.16).

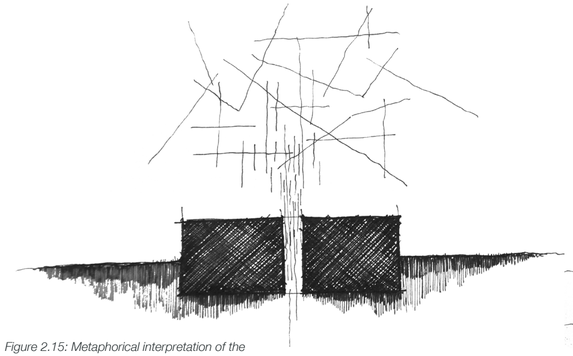


Figure 2.15: Metaphorical interpretation of the tectonic tree that grows from the anchored base of the rock.

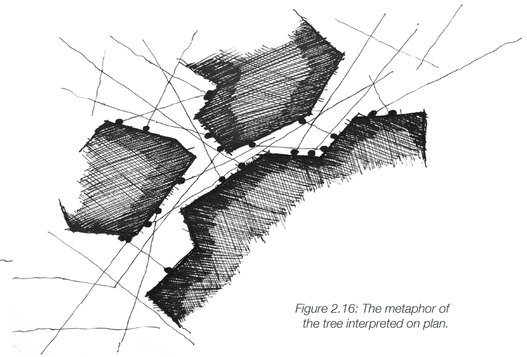


Figure 2.16: The metaphor of the tree interpreted on plan.

The model for this concept is portrayed as a piece of the site that is physically cracked open at one end. Inside the crack, tectonic stick structures form a web that holds the crack and the site together (Figure 2.17). Woven into the maze of this web is a mesh material that refers to the breeding enclosures, which will form a large part of the functional aspect of the project (Figure 2.18). The subterranean position of this woven mesh points towards the possibility of burying parts of the project inside the hillside.

From this crack, the intervention extends out past the confines of the site into the surrounding landscape. This part of the concept took on a more geometric, linear approach in terms of its organization (Figure 2.18). The pattern that this creates is offset from the urban grid that surrounds the site.

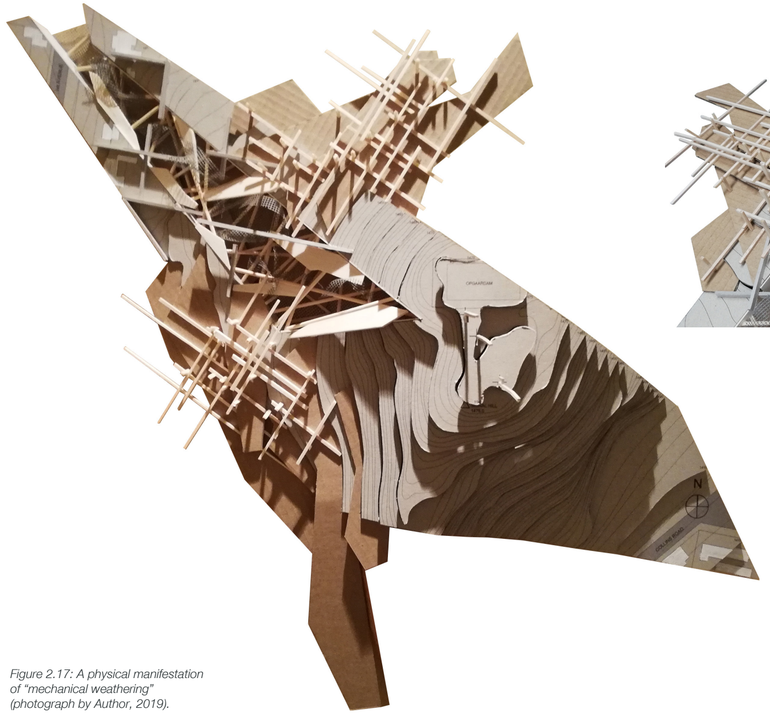


Figure 2.17: A physical manifestation of "mechanical weathering" (photograph by Author, 2019).

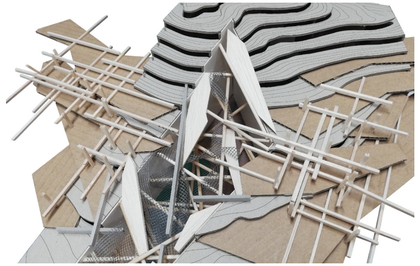


Figure 2.18: The crack in the site and the grid that spreads from it (photograph by Author, 2019).

Keywords

artificial
enclosed
mediator
buried
transparent

The last concept is inspired by the process of artificially incubating eggs to hatch them. Mankind has developed ways to mimic the natural way in which parent birds get their eggs to hatch successfully. However, if this artificial process is carried out correctly and successfully, then the hatching of the chicks are still a natural result. Although this concept has an obvious and clear connection to the program of the project, there are underlying notions that can be used to gain a deeper understanding of the site.

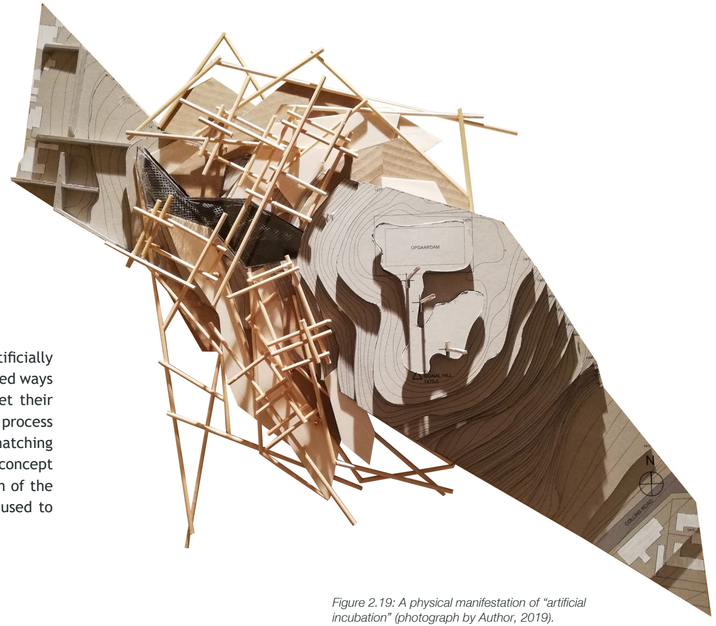


Figure 2.19: A physical manifestation of "artificial incubation" (photograph by Author, 2019).

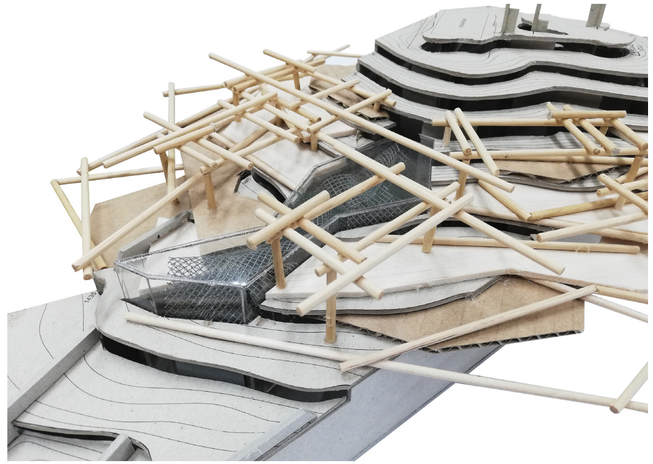


Figure 2.20: The transparent box filled with folded mesh (photograph by Author, 2019).

As mentioned earlier in this document, the Happy Valley Conservancy forms one of many enclosed, natural pockets that are distributed throughout Bloemfontein (see Chapter 2.1 of this document). By applying this concept of artificial incubation to this enclosed site, one can start arguing that the site, together with the program of the project, becomes the incubator that breeds a new approach and attitude towards the natural landscape as a whole. This relates directly to the thoughts behind the touchstone for this thesis discussed in Chapter 2.1, as well as the previous concept of *mechanical weathering*.

The model for this concept features a similar timber frame structure as in the first two concept models (Figure 2.19). However, this model aims to combine the organic approach of the first concept with the geometric approach of the second concept as a mediator between the natural and the artificial processes of incubation.

Buried inside the contours of the model underneath the frame structure is a transparent box (Figure 2.20). Firstly, this transparent box becomes the symbol of incubation, containing something within itself. Secondly, it speaks of the way that the project buries itself inside the slope of the hill, merging itself with the landscape. Lastly, the transparency of the box allows you to see the folded mesh of the enclosures inside it, referring to the transparency of the project and the engagement between the birds, the public, the staff, the site.

5 - The lens of the project - the research question

How can avian breeding influence the meaning of natural place-making on Signal Hill, Bloemfontein?

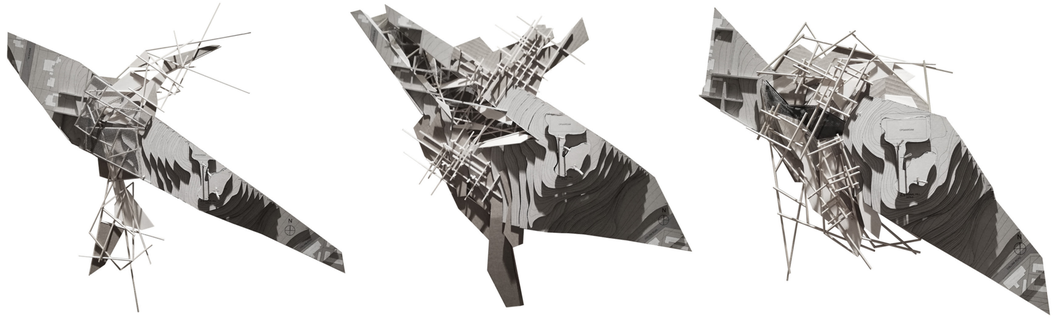
Through this expression of the essence of the project and the conceptual development, the research question for the project is formulated. This research question becomes the lens through which the project is viewed. Together with the three concepts, it is also used to guide the thesis in terms of theoretical investigations and the topological, typological, and morphological development of the design process (see Part 4 of this document). According to this, all the design decisions are required to contribute to the meaningful relationship between the landscape and the building. The program of the project becomes the platform that facilitates this dialogue between man and nature.

The success of the eventual design resolution will also be measured against this statement. The utilization of a clean, natural site can be risky and, if managed incorrectly, be to the detriment of such a site. In Chapter 6.1 of this document, I will critically reflect on this notion to establish if the design resolution successfully achieved this or not.

Concluding thoughts

When looking at all three concepts together in retrospect, one starts to pick up on various underlying themes that are prevalent throughout all of them. The thread that binds them all together is contrast. All three concepts play with different contrasting elements that are juxtaposed against each other: the confined vs. the expanse, the mechanical vs. the organic, the artificial vs. the natural.

This thread, combined with the materiality of the models, allowed me to tie various aspects of all three concepts together into one amalgamated approach as the design process develops. This conceptual approach is then interwoven with theoretical thought to lead the design development and technical resolution forward.



Part 3

The technical report

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Signal Hill (photograph by Author, 2019)

3.1 Introduction

This part of the document investigates some of the influences that will have an effect on the technical design and resolution of the project. The aim of this chapter is to integrate these influences with the conceptual and theoretical design of the project to create an amalgamated approach to the design resolution. A brief project description is followed by five chapters that divide these influences into the following categories: site location, sustainable design, materiality, service requirements, and structural investigations. In order to clearly explain the technical aspects of the project, some of the content in this part of the document might be repeated in other parts of the document.

- Project description

  As discussed in Part 2 of this document, the aim of this project is to investigate the relationship between the modern city and the natural environments that are enclosed within this urban realm. The program that facilitates this dialogue between man and nature is an avian breeding centre and sanctuary for falcons and smaller birds of prey. The site for the proposed development is on the northern slope of Signal Hill inside the Happy Valley Conservancy, Bloemfontein (Figure 3.2, Figure 3.3).

  The breeding program in this development will supplement the number of small raptors that live in the vast Free State landscape since farming developments often marginalize these buffer species. The project will also serve as a sanctuary and rehabilitation centre for injured, sick, or imprinted raptors that cannot survive in the wild.

As mentioned earlier, this part of the document focuses on five different aspects of the technical resolution of the project. The first chapter investigates the site location in terms of the surrounding context, the municipal development framework for the selected site and the relevant cadastral information, the topography of the site, and lastly, the basic geotechnical composition of the site.

The second chapter identifies areas where the project has the opportunity to lower its carbon footprint by utilizing sustainable design principles. These areas include building orientation, natural light, natural ventilation, rainwater collection, and managing stormwater on the site.

The third chapter aims to analyse possible material choices that are inspired by both the landscape and the program of the project. The next chapter focuses on the special service requirements for the different users of the project. These users are divided between the raptor, the staff member, and the public visitor. Lastly, initial structural typologies for the design project are explored and discussed.

3.2 Site information

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2 - Development rights *81*
3 - Cadastral information *83*
4 - Topographical analysis *84*
5 - Geotechnical analysis *91*

As mentioned in Chapter 1.4 of this document, the selected site for this project is on Signal Hill, which is inside the Happy Valley Conservancy in Bloemfontein, Free State, South Africa (Figure 3.2). The Happy Valley Conservancy forms a freely accessible natural pocket within the urban framework of central Bloemfontein. The conservancy has an area of approximately 424 880 square meters and consists of two small *koppies* that form a natural valley through the middle of the conservancy.

Signal Hill, on the southern side of the small valley, is the larger of the two *koppies* and Brill Street runs through this valley to further dissect the conservancy into its two parts (Figure 3.3). Access to the conservancy also feeds off from Brill Street. The conservancy is bordered with mixed-use industrial zones along the south-eastern edge and mixed-use residential zones from the southwest to the west (Westdene). The northern residential developments are less dense and broken up by more open natural spaces. C&N Meisieskool Oranje forms the North-eastern border with the conservancy.

The proposed site for the project is the north-western slope of Signal Hill (Figure 3.4). This side of the hill not only has the best orientation but also has the most gradual slope of all the sides, making navigation through the site easier.



Figure 3.1: South African map highlighting the Free State and Bloemfontein (Property Search South Africa, 2019: online map – edited by Author).



Figure 3.2: Happy Valley Conservancy within the Bloemfontein context (Property Search South Africa, 2019: online map – edited by Author).



Figure 3.3: The Happy Valley Conservancy within its immediate context with Signal Hill highlighted as the project site (Property Search South Africa, 2019: online map – edited by Author).



Figure 3.4: The selected position of the development marked in white (photograph by Author, 2019).

2 - Development rights

The most recent zoning record that relates to the planned use of the Happy Valley Conservancy is the Mangaung Metro Micro Framework Map compiled on 05 December 2016. In this document, the Happy Valley Conservancy, along with other green spaces such as the Franklin Game Reserve on Naval Hill and the Sewe Damme Conservancy, is zoned as part of the MOSS (Metropolitan Open Space System) (Figure 3.5). The complete Mangaung Metro Micro Framework Map is attached at the end of this chapter as Annexure A.

The MOSS framework is defined as followed by the local municipality:

> The Metropolitan Open Space System (MOSS) is a rationalised network of open spaces aimed at complementing the built fabric by providing the urban environment with natural open space for recreation and general amenity, protecting biodiversity in urban areas and providing animal and plants species with habitats and protecting heritage or cultural sites where possible within the system (Mangaung Local Municipality, 29: 2005).

The MOSS framework aims to include major physiographic features like river systems, dams, and hills that make up the natural topography of the area. The aim is to link this natural open space system with public open spaces that are developed in urban areas to create a free flow between the density of the urban environment and the open natural environment (Mangaung Local Municipality, 188: 2018).

In Chapter 7 of the Provincial Gazette of 03 February 2017, it is stipulated that the development of such open spaces for parks and other uses are subject to Municipal approval, and an application for such a development might require another application which provides alternative open space within the vicinity of the proposal:

> 89. LAND FOR PARKS, OPEN SPACES, AND OTHER USES:
> (1) When the Municipality approves a development application which provides for the use of land for residential purposes, the applicant may be required to provide land for parks or public open spaces.
> (2) The extent of land required for parks or public open spaces is determined by the Municipality in accordance with a policy approved by the Municipality.
> (3) The land required for parks or public open spaces must be provided within the land area of the development application or may, with the consent of the Municipality, be provided elsewhere within the municipal area, as contemplated in section 50(2) of the Spatial Planning and Land Use Management Act.
> (4) When a development application is approved without the required provision of land for parks or open spaces within the land area of the development, the applicant may be required to pay money to the Municipality in lieu of the provision of land (Provincial Gazette, 38: 2017).

Since the MOSS zoning is only open for development pending Municipal approval, there are currently no regulations regarding permissible floor area ratios, building heights, site coverage, parking requirements, etc. All of these rights and regulations will be taken into account by the municipality and stipulated upon approval of the development.

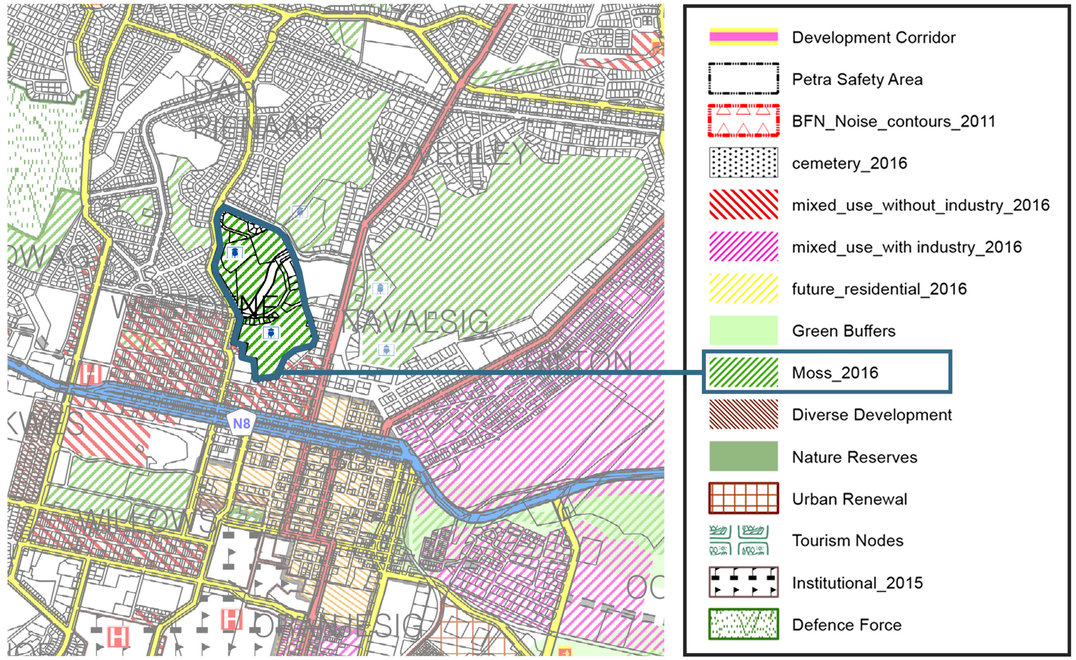


Figure 3.5: A detailed representation of the MMM Micro Framework Map of 2016 for the Happy Valley Conservancy (MMM, 2016: online map - edited by author).

3 - Cadastral information

The site plans (Annexure C – 1:1000; Annexure D – 1:500) were generated through the analysis and amalgamation of the SG-diagram of the site, which was obtained from the Chief Surveyor-General website (Chief Surveyor-General of South Africa, 2019: online) (Annexure B) and various other topographical information sources as well as personal research.

It is important to note that there are some discrepancies between the layout of some roads and erfs on the SG-diagram and their physical location where they were built. This is with specific reference to the planned location of Brill Street and the erfs that run alongside this street. The site plan also features two site section lines (Site section A-A and Site section B-B).

Some other important things to take note of with relation to the site plans:

- Contour intervals at 5m indicate a rise of approximately 45m from the foot of the hill to the summit.
- There are no servitudes indicated on the SG-diagram on this site.
- Since the site is relatively undeveloped, there are no municipal stormwater or sewerage connections on site.
- The 1:1000 site plan displays the entire farm portion that Signal Hill sits on, while the 1:500 site plan displays the portion of the site that I am using for this design dissertation.
- There are currently no building lines on the site, and a building line of minimum 4m from the nearest boundary edge is assumed.
- All the boundary angles of the site are measured as an “inside angle,” regardless if it is an acute, obtuse or reflex angle. The table with the site particulars (boundary peg co-ordinates, boundary angles, boundary lengths) is attached as Annexure E.

As mentioned in Chapter 1.4 of this document, the topography of the Happy Valley Conservancy is defined by two small koppies that form the small valley in between them. The lowest point in the valley is situated at +-1430m, which is still well above the average height above sea level for Bloemfontein at 1395m (Dateandtime.info, 2019: online). The highest point in the conservancy is the summit of the southern koppie, Signal Hill, at 1475m above sea level. In Figure 3.6, the topography of the entire conservancy is depicted as a colour intensity map that clearly shows the koppies, the valley, the conservancy boundary, and the proposed area for development as well as the location of site sections A-A and B-B.

These site sections are displayed in Figures 3.8 and 3.9, respectively. Section A-A cuts through the proposed area of development on Signal Hill, giving a clear understanding of the intensity of the gradient for that part of Signal Hill. The gradients from these sections were also reduced to line drawings that allowed me to measure the gradients as a positive degree from a 180 degrees horizontal line (Figures 3.10, 3.11).

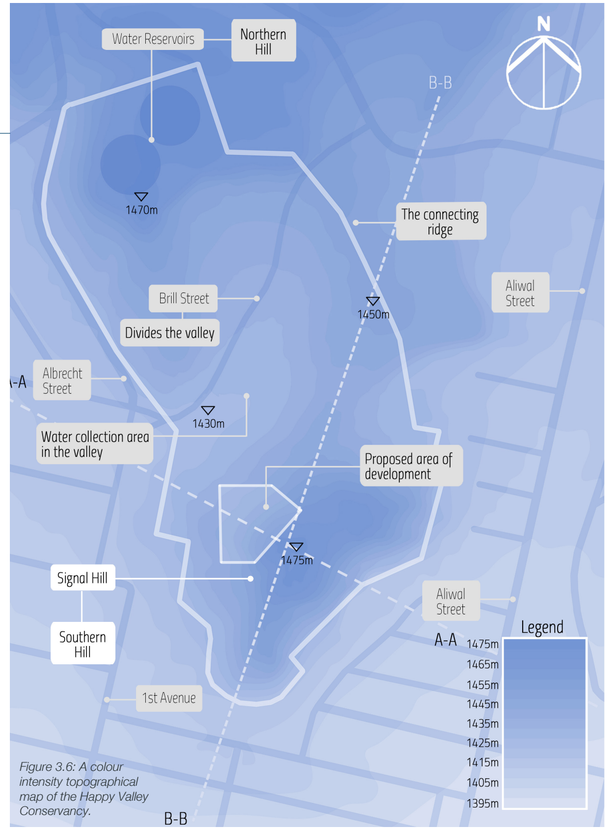


Figure 3.6: A colour intensity topographical map of the Happy Valley Conservancy.



Figure 3.7: Vegetation distribution map of the Happy Valley Conservancy.

Figure 3.7 shows a vegetation distribution map as an overlay over the colour intensity map. This map clearly shows the influence that water runoff and collection has on the conservancy (indicated by arrows). As can be expected, the valley is the area with the densest vegetation since this is the water collection area for most of the conservancy. The vegetation in this area comprises of various shrubs, trees, and veld grass. It is also interesting to note that the north-western face of Signal Hill is mostly devoid of vegetation other than grass with only a few shrubs appearing here, while on the southern side of the hill, the opposite is visible.

Site section A-A

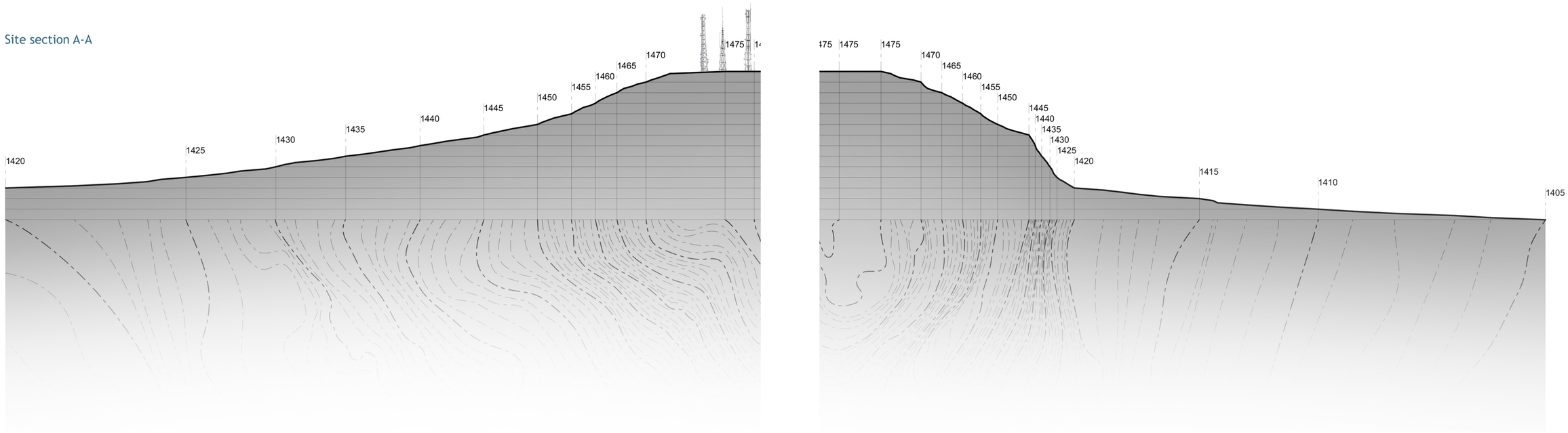
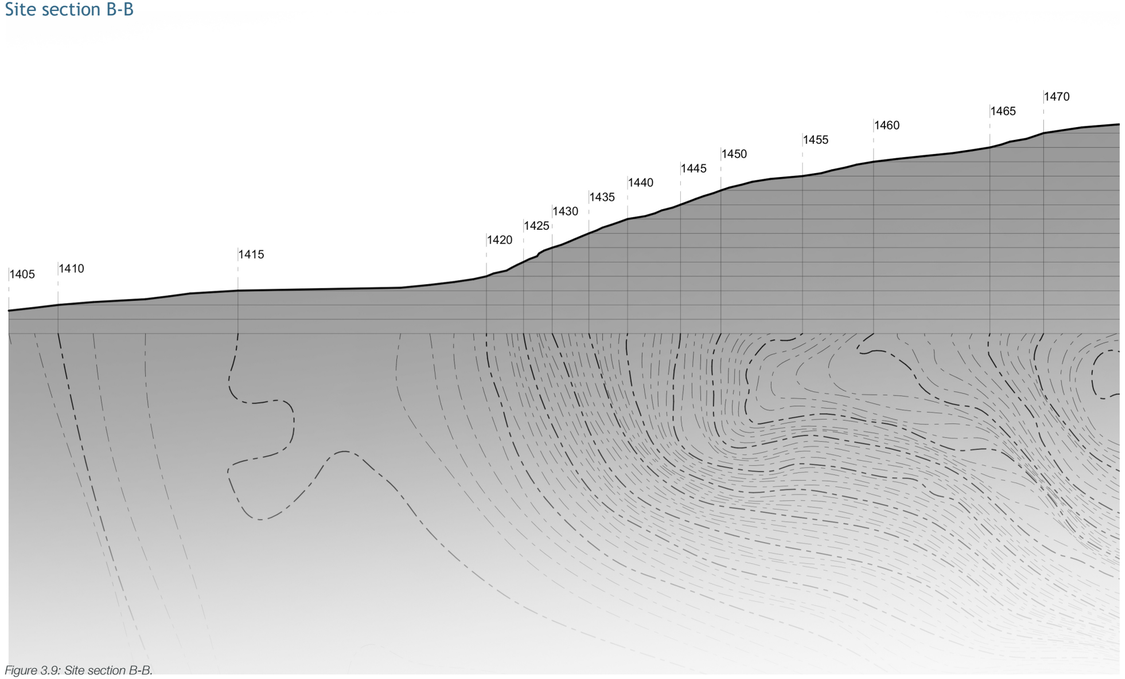


Figure 3.8: Site section A-A.

Site section B-B



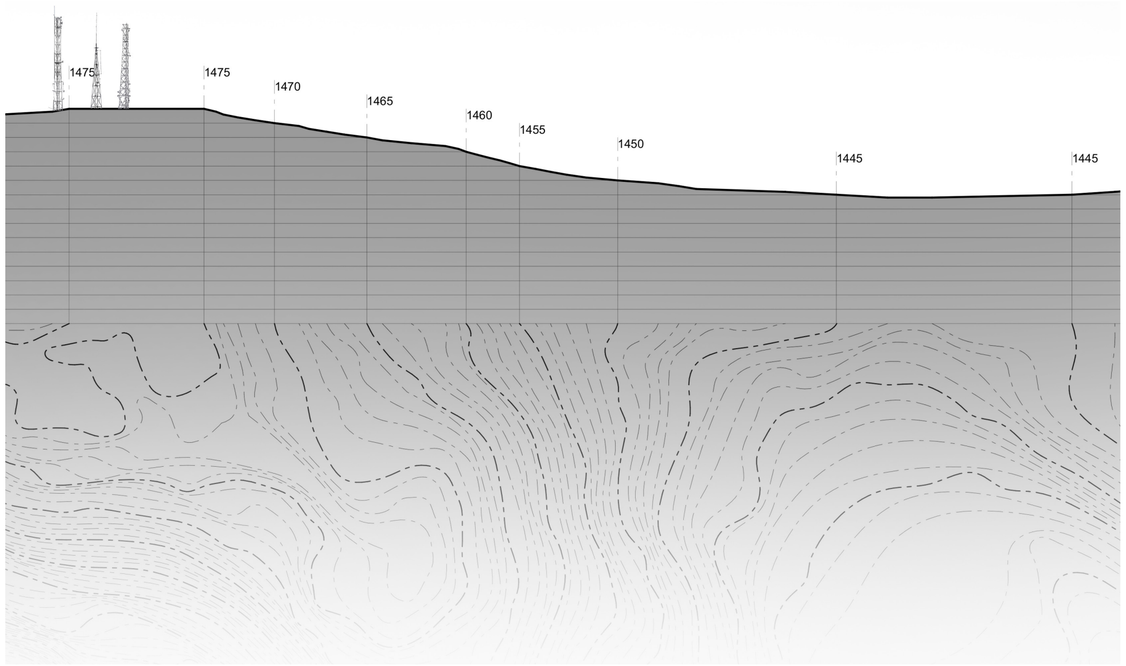


Figure 3.9: Site section B-B.

Site section A-A

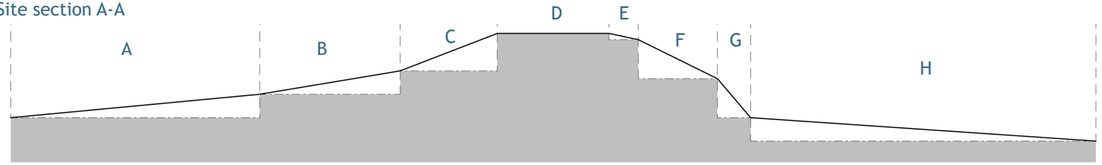


Figure 3.10: Site section A-A.

Site section B-B

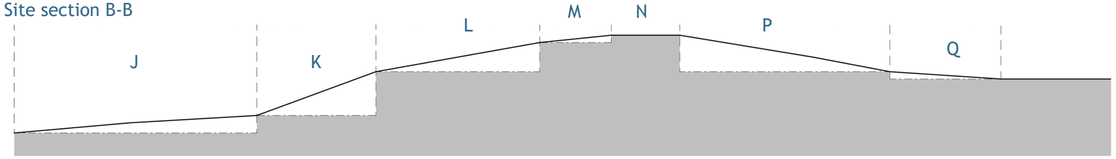


Figure 3.11: Site section B-B.

A-A		B-B	
#	DEGREES	#	DEGREES
A	5.3	J	4.1
B	4.1	K	20.1
C	15.7	L	10.1

D	0.0	M	5.8
E	12.0	N	0.0
F	26.2	P	9.3
G	49.5	Q	3.8
H	3.7		



Figure 3.12: The loose shale dolerite rocks that are scattered all around Signal Hill, with Naval Hill in the background (photograph by Author, 2019).

This section of the technical site investigation forms a basic geotechnical analysis that identifies the type of rock and its distribution on the site. This information could influence structural decisions throughout the design process since the geotechnical properties of the site might have an influence on the foundation design of the project. Furthermore, the possibility of using the rock that is available on site to build stone walls or gabion structures will also be explored through this analysis.

The entire Happy Valley Conservancy is littered with loose, angular rocks and stones that vary greatly in size, from large boulders to smaller pebbles. These rocks all form a part of the Karoo sequence of sedimentary rock, specifically dolerite shale rock (Van Blerk, 2019: personal communication). Due to the layered composition of these rocks, they are not extremely strong and often tend to split open. The loose rocks that are scattered throughout the site have a big impact on the visual character of Signal Hill and how one perceives the hill since they protrude out above the carpet of veld grass all around the hill (Figure 3.12, Figure 3.13).

The remains of a small stone structure that was built from the stone on the site are still visible on the site. It is believed that this used to be a small bird hide situated along one of the hiking paths (Figure 3.14). These stones on the site also offer the potential to be utilised in the design process at a later stage through gabion construction for retaining walls or even low, non-loadbearing landscape walls.



Figure 3.13: Larger shale dolerite boulders on the site (photograph by Author, 2019).



Figure 3.14: The remains of a small bird hide that was built on the site (photograph by Author, 2019).



Figure 3.15: Some of the smaller rocks embedded in the ground form a part of the ground surface texture on the site (photograph by Author, 2019).



Top right, bottom right
Figure 3.16: The size of the smaller rocks on site that could be used in gabion construction (photograph by Author, 2019).

The rockiness of the site means that the substrate underneath the layer of topsoil is most probably also shale dolerite rock. It is difficult to determine how thick this layer of topsoil is before you reach the rocky substrate, but it is safe to assume that it is not extremely deep since the site is on this rocky hill. This will influence foundation construction and eliminates a lot of foundation possibilities. This is especially applicable in cases where a column and beam structural system is used since you would normally opt for deeper pad foundations or piled foundations, which could prove difficult if the plan is to not blow up most of the hill with dynamite prior to construction.

However, if the eventual design resolution does not exceed double-storey height but still requires a column and beam structure, it is possible to combine a shallow, continuous strip foundation with broad pad foundations that supports both the walls and the columns (Laubscher, 2013, pp. 194-195) (Figure 3.17). This is ideal since strip foundations can be stepped to follow the slope of the hill (Figure 3.18). These foundations can be placed directly onto the rock substrate if necessary.

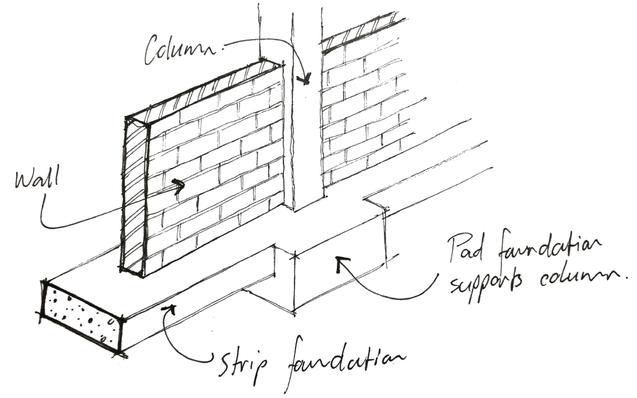


Figure 3.17: The combination of a shallow strip foundation and a pad foundation.

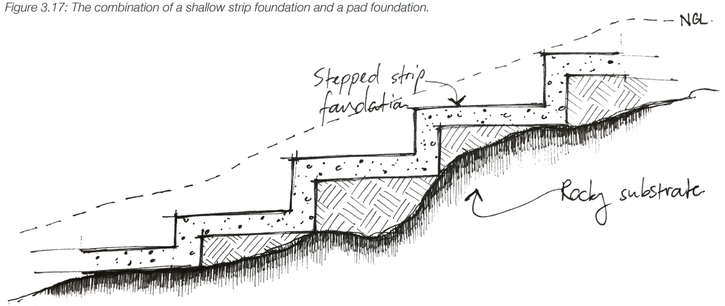


Figure 3.18: The strip foundation stepping down to follow the slope of the hill.

3.3 Sustainable design framework

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- Utilizing natural ventilation *96*

- Natural light *96*

- Mitigating heat islands *97*

2 - The influence of the climate of the region ***99***

- Rainwater collection *99*

- Stormwater runoff on the site *99*

The location of the site against the north-western slope of Signal Hill offers various opportunities to incorporate sustainable principles into the design resolution:

- Orientation

  The orientation of the site allows the building to follow the same north-western orientation, which will allow the building to utilize a lot of natural sunlight. However, the warm western summer sun in Bloemfontein could prove problematic during the summer seasons since this will overheat the building.

  Solar protection on a building scale can form a passive shading device against the outside skin of the building on the exposed facades. These passive shading devices are not only functional but can become design elements that contribute to the character of the building (Figure 3.19). Furthermore, large roof overhangs can be utilized to protect the interior from the high solstice of the summer sun, while allowing the lower solstice winter sun to penetrate the building and warm the interior spaces (Conradie, 2018, pp. 63-64).

- Utilizing natural ventilation

  The passive shading devices that prevent direct sunlight from entering the building can also be utilized to maintain natural ventilation through the building. If these shading devices allow the flow of air through them, then permeable facades can be incorporated into the design resolution (Figure 3.20). The prevailing western wind direction in Bloemfontein, combined with the orientation of the site, will strengthen this notion as the breeze will naturally flow through the building (Figure 3.21).

- Natural light

  As mentioned, the orientation of the site allows for the optimal utilization of natural lighting inside the building. Since the program of the building is mainly focused on daytime activities, the use of natural light inside the building can minimise the need for electrical lighting inside the building. Barret argues that the advent of fluorescent lighting in the 1930s removed the need for architects to consider the way that daylight enters the building. This gave rise to the creation of deep floor plans that rely purely on artificial lighting (Barret, 2009, p. 7).

  If the efficient use of natural light becomes an important design element, then this notion will have to be addressed in the design resolution. The use of narrow floor plans that allow light to enter from both sides could achieve this (Figure 3.22). Furthermore, skylights can also be utilized to flood deeper interior spaces or internal circulation routes with natural light (Figure 3.23, Figure 3.24).

- Mitigating heat islands

  The location of the development inside the natural environment of the Happy Valley Conservancy challenges the design resolution to minimise the building's contribution to urban heat islands that influence the local micro-climate. Levermore et al. define urban heat island intensity as "the difference in temperature between an urban site and a rural site" (Levermore, et al., 2017, p. 360). This difference in temperature is most often caused by the absorption of the sun's radiation in the overwhelming presence of concrete and brick surfaces in urban environments.

  A study into the effect that green spaces have on urban heat islands was completed in Mumbai in 2018. In this study, it was found that green roofs in urban environments create a significant drop in temperature within that micro-climate (Dwivedi & Mohan, 2018). This strategy of utilizing planted roofs for the building could also be applied to the design intervention on Signal Hill. Furthermore, the use of paved surfaces could also be kept to a minimum by replacing these surfaces with natural alternatives to aid this strategy.

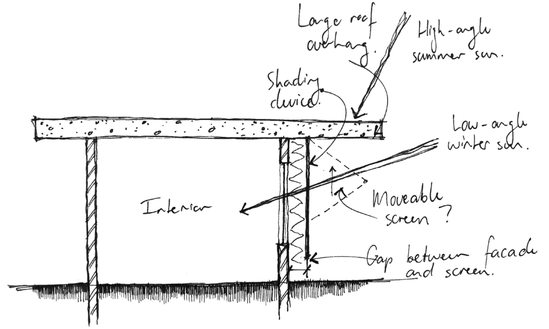

Figure 3.19: The use of shading devices on exposed western facades as well as large roof overhangs.

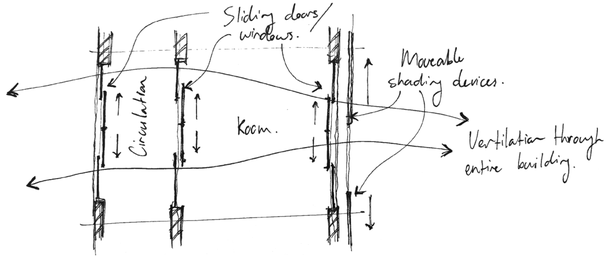

Figure 3.20: Utilizing natural ventilation through the building.

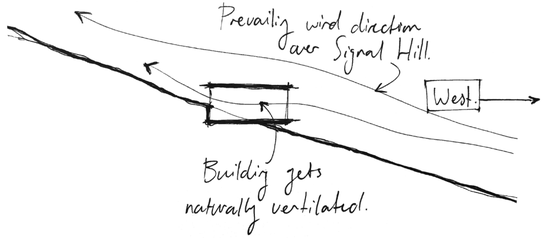

Figure 3.21: The prevailing wind direction on the site can aid in building ventilation.

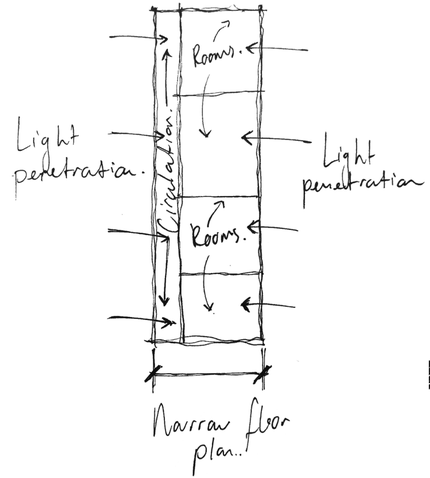

Figure 3.22: A narrow building footprint allows natural light to flood in from both sides of the building.

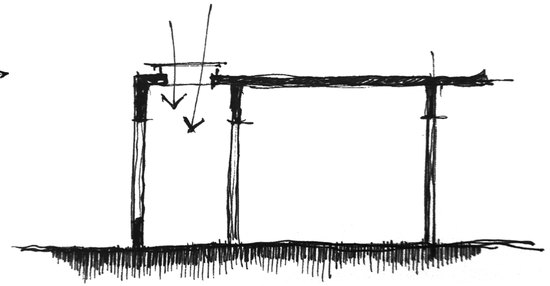

Figure 3.23: The use of skylights to light up circulation routes.

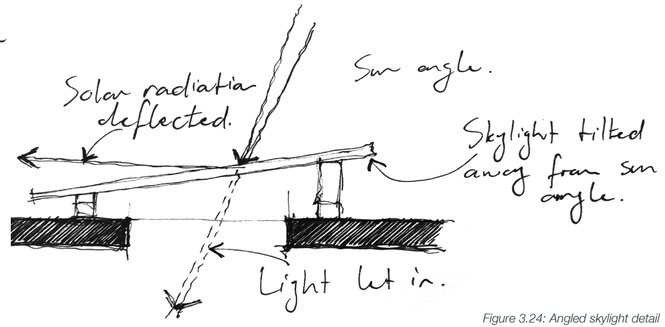

Figure 3.24: Angled skylight detail

- Rainwater collection

The climate of Bloemfontein is generally known to be dry with hot summers and relatively cold winters. The average rainfall for Bloemfontein is only 550mm, most of which falls during the summer months of November to March (Figure 3.25) (Climate-Data.org, 2019: online) (Hensley, et al., 2006, p. 12). This drier climate challenges design resolutions to incorporate efficient rainwater collection systems as well as water management systems that capitalize on the little rainfall that is available throughout the year. Since the program of the proposed design project is not heavily pedestrian in terms of daily water usage, there is an opportunity for the proposed building to be almost completely removed from the municipal water supply.

- Stormwater runoff on the site

The location of the proposed development on Signal Hill has the potential to influence the stormwater runoff on the site in both a positive way and a negative way. As discussed in Figure 3.7 of this document, the main water catchment area for water runoff in the conservancy is in the valley on the northern side of Signal Hill. From here some of the water seeps into the ground, and some of it flows into the municipal stormwater system in Brill Street. As expected, very little water is absorbed on the proposed area of the development since it is located against the slope of Signal Hill. This is demonstrated in the distribution of vegetation on the site (see Figure 3.7).

If the proposed development responds positively to this observation, the distribution of vegetation on the site could be altered by introducing more indigenous plant growth in the proposed area of development. This could be achieved by designing planted terraces that act as catchment areas, the use of green roofs that absorb water instead of removing water, and channelling natural stormwater runoff into gardens or water collection tanks.

However, the development also runs the risk of negatively impacting the current system. For example, the extensive use of exterior paved surfaces will increase the amount of water that flows down Signal Hill as well as the speed with which it flows. This will allow even less stormwater to seep into the ground, which will be detrimental to the existing vegetation on the site. Both of these outcomes are factors that will have to be addressed through the design resolution to have a positive influence on both the existing conditions on the selected site as well as the micro-climate of the surrounding area.

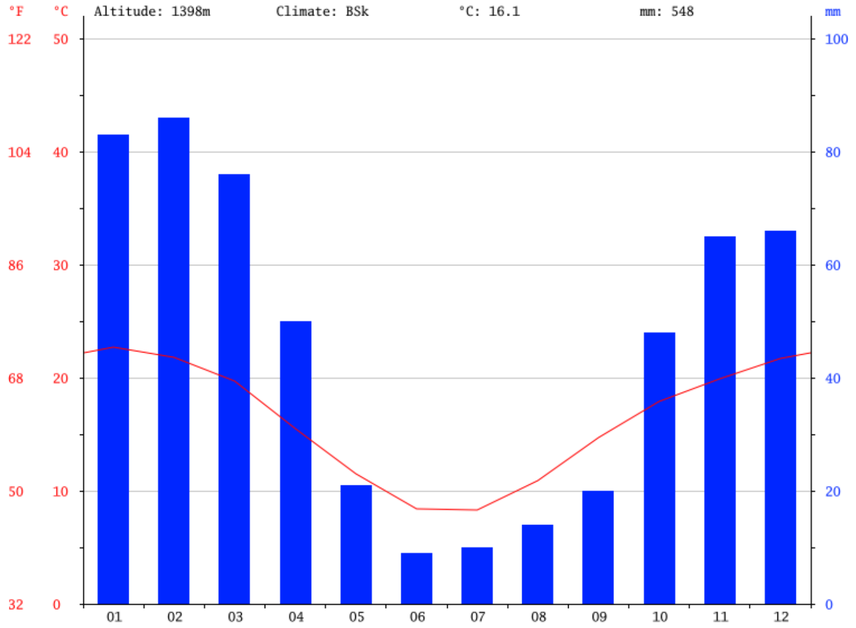

Figure 3.25: The average monthly rainfall for Bloemfontein (Climate-Data.org, 2019: online).

3.4 Materiality of the project

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- *'Wattle and reed' panels* *106*
- *Construction materials* *108*

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- *Mesh and netting* *108*

The nature of this project calls for a design resolution that blurs the line between building and landscape. The success of the project will lie in the way that the building is sensitively placed inside the landscape. This notion is supported by the program of the project, the selected site, and the development of the concepts. Reaching a design resolution that will successfully embody the essence of the surrounding natural landscape will require a building that embraces the textures and materials of this landscape. These natural materials will be used in combination with project-specific materials that are dictated by the program of the project, as well as its users.

1 – Materials inspired by the landscape

- Stone

  The most obvious material that could be utilized in the design resolution, which is already found in the surrounding landscape, is the dolerite shale rocks that are strewn across the site. Unfortunately, the layered composition of these loose rocks is not very strong, so these rocks are not ideal for use in structural or loadbearing applications. However, as mentioned in Chapter 3.2 of this document, these rocks can still be utilized as cladding elements, gabion structures, or in non-loadbearing landscape walls. The characteristics of these rocks can also be used to guide the texture selection of other natural cladding materials.



Figure 3.26: The character of the dolerite rocks found on the site (photograph by Author, 2019).



Figure 3.27: The rocks have been used to build a small bird hide on the site (photograph by Author, 2019).

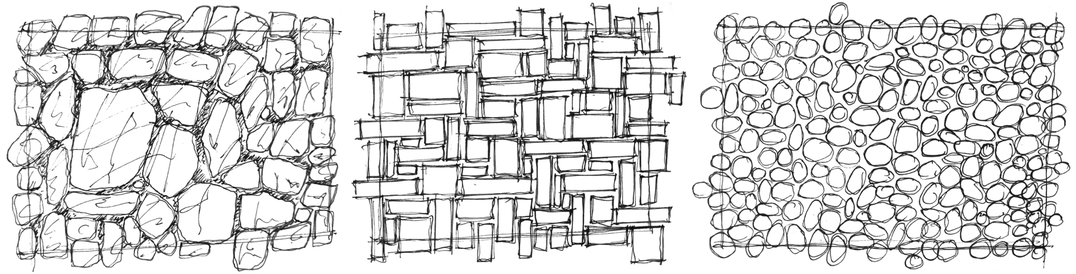

Figure 3.28: Three different explorations of basic rock textures and shapes for cladding purposes.



Figure 3.29: Examples of dolerite gabion structures.

- Veld grass

Together with the dolerite rocks that are prevalent in the Happy Valley Conservancy, the veld grass that covers the surface of Signal Hill also plays a big role in establishing the character of the selected site (Figure 3.31, Figure 3.32). This character can be carried through to the building through the use of planted roofs that carry the veld grass from the landscape into the design resolution. If successfully achieved, this will blend the edge between the building and the landscape on elevation, perspective, and roof plan (Figure 3.30).

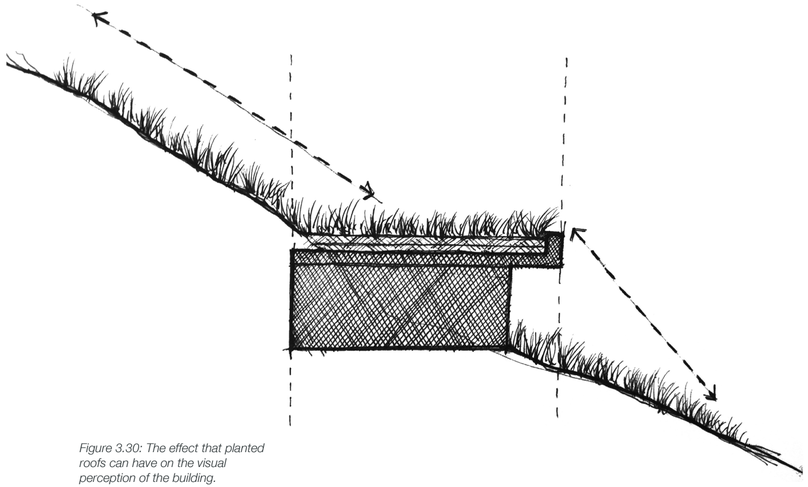

Figure 3.30: The effect that planted roofs can have on the visual perception of the building.



Left
Figure 3.31: The difference in character and colour of the grass on Signal Hill before heavy summer rains - 02 February 2019 (photograph by Author, 2019).
Right
Figure 3.32: The difference in character and colour of the grass on Signal Hill before after summer rains - 15 March 2019 (photograph by Author, 2019).

- ‘Wattle and reed’ panels

This material as a cladding and shading option is conceptually driven. The notion that the building becomes a manifestation of a thin plant that grows from a crack in a heavy rock is embodied in the use of this tectonic screen that extends from the anchored base of the building. These panels also break the direct and often harsh Free State sunlight into softer, filtered light. One can also experiment with the design, alignment, and composition of these panels to create a diverse selection of visual textures (Figure 33 - Figure 35).

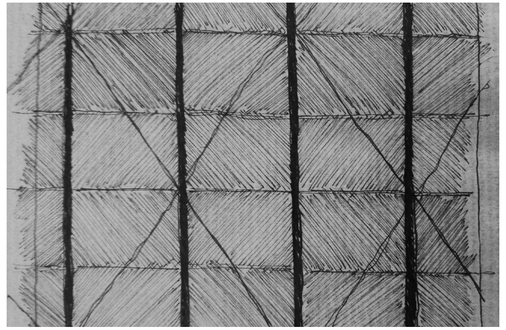

Figure 3.33: A diagrammatic example of a weaving pattern for a shaded verandah that is made from wattle sticks that are mounted onto a steel frame structure.



Figure 3.34: Examples of different wattle and ‘reed panels’ using different weave patterns, colours, and wattle types.

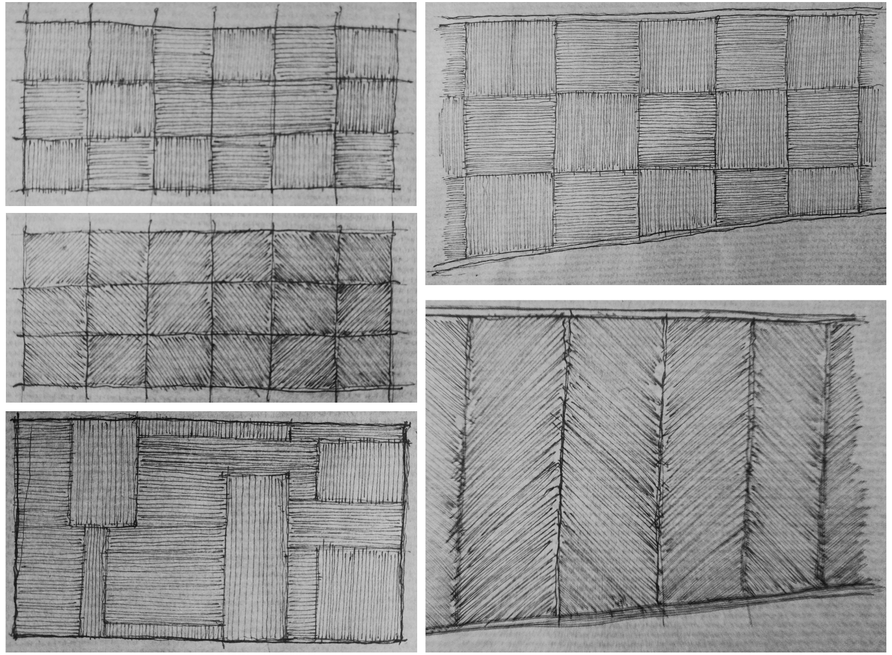

Figure 3.35: A diagrammatic exploration of different possible patterns for ‘wattle and reed’ cladding and shading screens.

- Construction materials

As discussed in Chapter 3.2 of this document, the geological composition of the selected site will influence the design of the selected structure (investigated in Chapter 3.6 of this document) as well as the construction materials that are eventually used for the building. The shallow layer of topsoil on top of the rocky substrate guides the design resolution towards materials that can utilize shallow foundations, such as traditional loadbearing masonry construction and concrete construction.

This also suits the program of the project, since it is unlikely that the building will utilize more than one storey. The use of these construction materials will inadvertently also influence the material palette of the project as a whole, and it will be important to maintain a balance between the use of these manmade materials and the natural materials mentioned in this chapter.

2 - Materials that are driven by the program of the project

- Mesh and netting

The most prevalent texture that is required by the program of the building is the mesh and netting that covers the avian enclosures. This material also becomes an extension of the conceptual dialogue between tectonic and stereotomic elements mentioned in the previous paragraph.

A rigid mesh is usually used as the first layer of cover in the enclosures since it is generally stronger than netting. The holes in the mesh are smaller (approximately 10mm in diameter) so that the raptor's talons cannot get caught in the mesh. It is also preferable to use a darker coloured mesh such as black or grey since this does not break the visitor's vision as much as a lighter colour would when looking into an enclosure (Hoffmann, 2019: personal communication).

The netting for the enclosures is used as a looser second layer of covering that acts as a fail-safe if the first layer of mesh accidentally gets broken and the raptor escapes. This layer can either be placed close to the mesh with a small gap in between them (50mm) or further away with a large gap of up to 500mm. The netting can have larger holes (approximately 50mm squares) than the mesh but should also be a darker colour (Hoffmann, 2019: personal communication). In some cases, the raptor in the enclosure is known to break the mesh covering with its beak and talons. If this is the case, up to three layers of covering are used.

Left
Figure 3.36: This steel mesh enclosures at the African Bird of Prey Sanctuary is not ideal since it only has one layer of cover and the holes in the mesh are slightly too big (Hoffmann, 2019: personal communication) (photograph by Author, 2019).

Right
Figure 3.37: An example of a triple-layered enclosure at the Falcon Ridge Bird of Prey Sanctuary. This specific enclosure is for a very large and rather aggressive raptor (photograph by Author, 2019).





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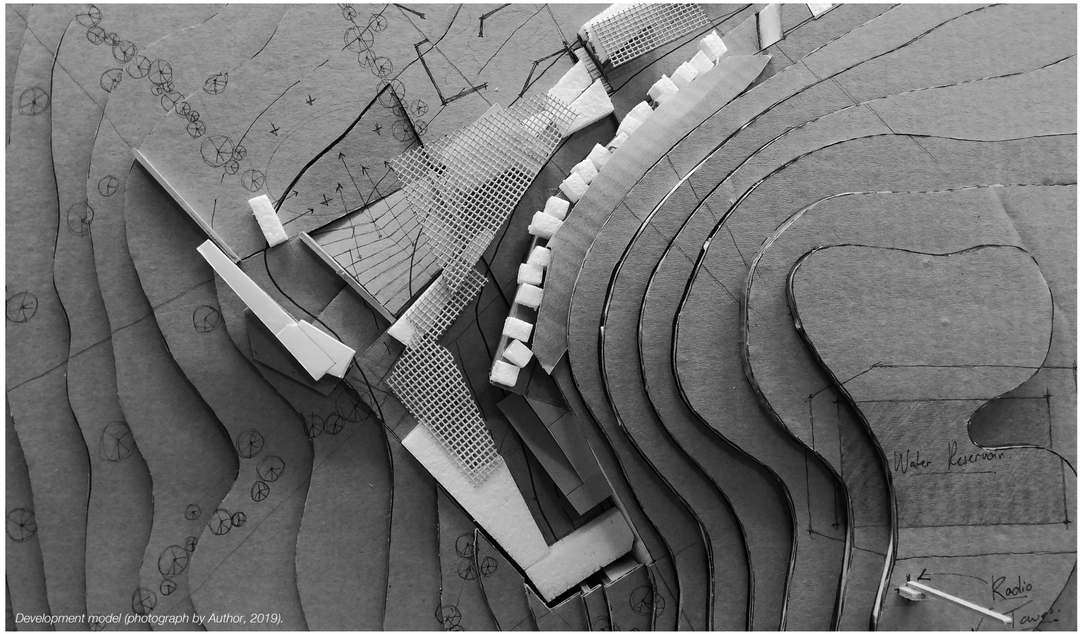
- Accessibility



Development model (photograph by Author, 2019).

The investigation into the requirements of special services for this project is an interesting one since the first user in the project is the raptor. After that is the staff member, and then the public visitor, which means that the service requirements for the project will be focused mainly on the raptor as opposed to the normal requirements for humans.

In this section of the document, I will highlight some of the most important aspects relating to the services surrounding avian breeding and avian enclosures that need to be addressed in terms of the safety, wellbeing, and comfort of the raptor. For this to be able to happen, you need to form a deep understanding of the everyday requirements that a raptor has. A personal interview with Shannon Hoffmann, director of the African Bird of Prey Sanctuary in Pietermaritzburg, helped me to form this understanding. I will also take a brief look at some of the service requirements that will affect the two other users in the project – the staff member and the public visitor.

1 - The enclosure

As discussed in Chapter 4.2 of this document, the avian enclosure becomes the micro-habitat in which the raptor has to thrive. For this to happen, the following requirements must be adhered to:

- The enclosure must be big enough; the width of the enclosure must be able to accommodate three wingspans of the bird that is kept inside the enclosure (Figure 3.38).
- The enclosure must be protected from the elements while still letting natural light in; at least a third of the enclosure must be completely covered with a solid material that can keep water out of that third of the enclosure (Figure 3.39).
- The enclosure must have a solid base wall of at least 1m high to keep rodents out (Figure 3.39).
- The enclosure must have enough space for the raptor to perch on; one perch per raptor in the enclosure is usually sufficient (Figure 3.39).
- The enclosure must be completely enclosed with a strong, permeable covering like steel mesh or strong netting. It is preferable that two layers of covering are used in case the first layer fails in adverse weather conditions or if the raptor manages to break through the covering (Figure 3.40).
- The enclosure must be easily accessible for the feeding and cleaning staff; however, there must always be two doors that control the access into the enclosure so that the raptor cannot fly out while the door is open (Figure 3.41).
- The enclosure must have a safe space for the raptor to rest in; special enclosed timber boxes are made specifically for this purpose (Hoffmann, 2019: personal communication) (Figure

2 – Breeding enclosures

The requirements for breeding enclosures are the same as with normal enclosures, except for certain additional specifications:

- The enclosure must have enough breeding space for the breeding pair; breeding boxes that are similar to the special enclosed timber boxes that raptors rest in are used for the breeding process. They are simply bigger in size to accommodate two raptors with their chicks inside, and often have a small heating element attached to them in areas with colder seasonal climates (such as Bloemfontein). Such a heating element can be connected to a small solar-powered cell that stores the energy required to heat the nesting box.
- The enclosure must not encourage any human interaction; this is to avoid the process of imprinting of young birds (up to one month old) where human interaction with the raptor chick leads the raptor to believe that it is a human. Breeding enclosures are usually set aside in a private part of the development, or the sides of the enclosure are made from a non-permeable material to avoid too much visual contact with humans (Figure 3.43).
- The enclosure should have some form of digital surveillance available inside the enclosure to monitor the health and growth of the raptor chicks.

3 – The organization of the development

In terms of the overall development of the project, there are some important aspects that need to be incorporated with regards to food delivery and distribution for the raptors, and cleaning services for the enclosures.

- Food usually gets delivered to the sanctuary twice a week; the food storage unit should, therefore, be easily accessible on the site for the delivery vehicle (a small truck or refrigerated van).
- The food storage and preparation unit should ideally be centrally located within the development to make food distribution to all the enclosures easier (Figure 3.44).
- Most of the raptors are fed chicken chicks with some preferring a red meat diet; therefore, the food storage and preparation unit requires a cold room for the storage of this food.
- The design of such a unit should allow the installation of the necessary cooling equipment required for a cold room.

- The enclosures are to be cleaned every second day; this involves raking the floor area of the enclosure to get rid of any animal bones, bird droppings, and any other loose debris. The resting boxes are also to be cleaned, and fresh drinking and bathing water must be supplied.
- The bones, droppings, and debris that is raked up then get collected in a bucket and removed from the enclosure.
- Once removed from the enclosure, it gets loaded into a wheelbarrow and taken to a dedicated refuse area at the sanctuary.

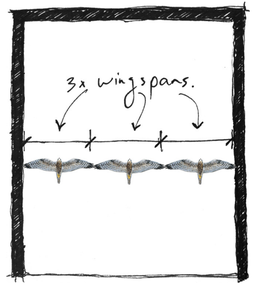


Figure 3.38: The minimum size of an enclosure with relation to the raptor inside the enclosure's wingspan.

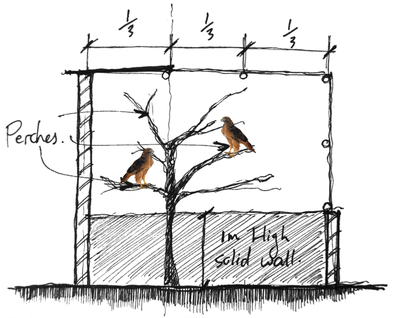


Figure 3.39: Avian enclosure requirements on section.

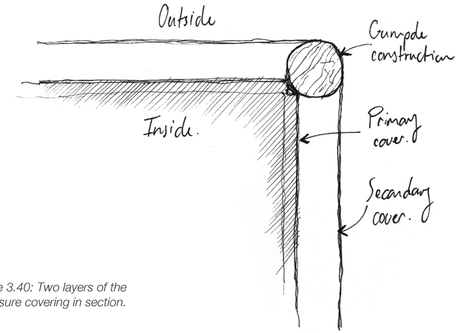


Figure 3.40: Two layers of the enclosure covering in section.

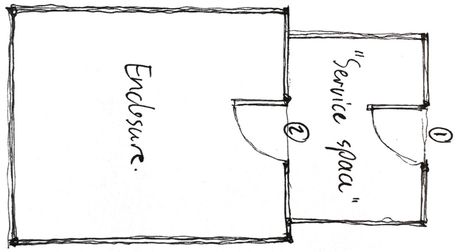
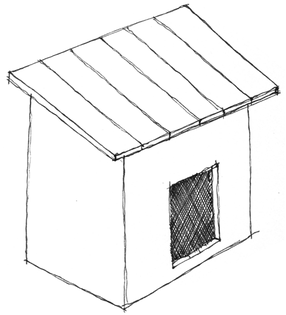


Figure 3.41: Enclosures are required to have two separate access doors.



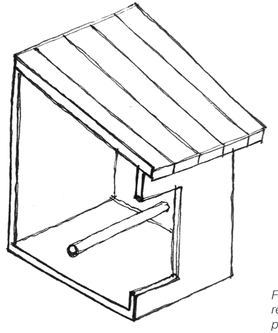


Figure 3.42: A timber typical resting box for a raptor in perspective and section.

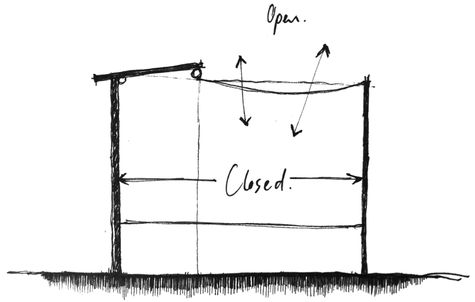


Figure 3.43: A basic design of the enclosed breeding enclosure.

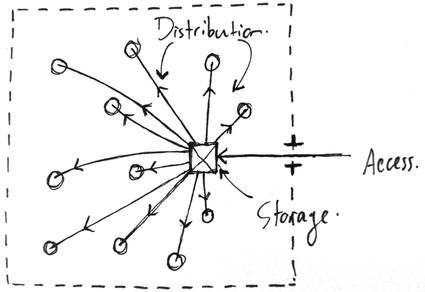


Figure 3.44: A basic diagram of the food storage unit in relation to the rest of the development.

- Santation

The existing conditions on the selected site make the provision of sanitation services rather difficult. Since the selected site is mostly undeveloped, there is currently no connection to the municipal sewerage removal system. Creating such a connection might prove to be extremely difficult and expensive.

Therefore, alternative options for sewerage disposal will have to be considered and investigated. A septic tank system might be the obvious solution to this problem. However, the rocky nature of the ground and the relatively steep slope of the site means that the installation of a standard septic tank system might not be possible, as explained in the following paragraph:

> A septic system works when liquid wastes are separated from solid wastes in the tank, and the liquid wastes are disposed of in the septic drain field. This cannot happen if the area around the septic drain field is rocky. If the bedrock is thick and the topsoil is too thin to handle the waste, then a septic system installed in the area will just lead to surface runoff or pooling of liquid wastes (Misionrahma, 2018: online).

The most likely alternative system that can work on a rocky site with shallow bedrock is a septic mound system (Figure 3.45) (The United States Environmental Protection Agency, 2018: online). This system works in a similar fashion to a standard septic tank system, except that an artificial wastewater absorption trench system is created on top of the existing ground level, hence the word “mound.”

> The constructed sand mound contains a drain field trench. Effluent from the septic tank flows to a pump chamber where it is pumped to the mound in prescribed doses. Treatment of the effluent occurs as it discharges to the trench and filters through the sand, and then disperses into the native soil (The United States Environmental Protection Agency, 2018: online).

Unfortunately, this system is almost three times more expensive than a standard septic tank system and require more regular inspections and maintenance.

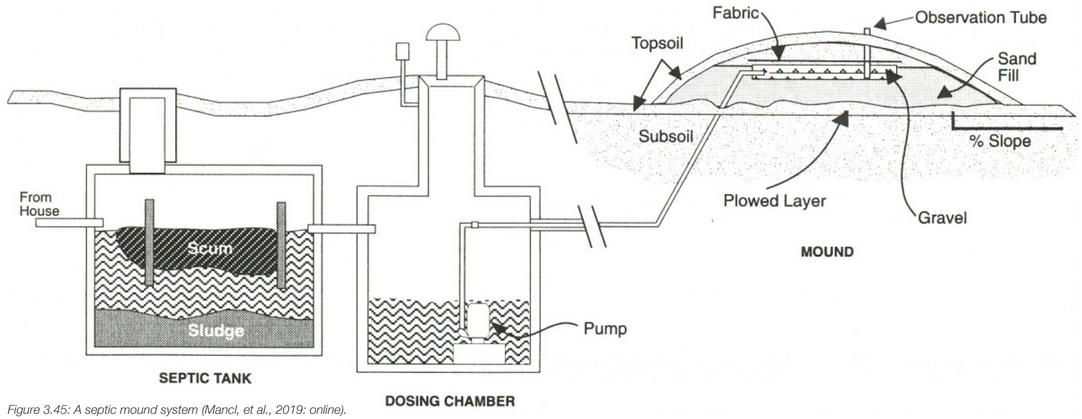


Figure 3.45: A septic mound system (Mancl, et al., 2019: online).

- **Accessibility**

Accessibility in the proposed development can be divided between the other two users: the staff member and the public visitor. Unfortunately, all staff members are required to be fully-abled to work at a centre like this since almost all of the work is physical like cleaning enclosures, taking the raptors out to fly, feeding the raptors, etc. Since this development is run by a non-profit organization, most of the administrative work is done by the same staff members that do the physical work at the centre.

This means that the areas in the development where only staff members are concerned will not necessarily be fully accessible to wheelchair users or other physically disabled users.

However, in this development, the public visitor will be fully accommodated in terms of accessibility needs. The low-storey nature of the development makes this easier since no vertical circulation lifts are going to be used. Ramps and walkways will be used to navigate through the public part of the development, and obviously, an accessible bathroom unit will also be available.

3.6 *Structural investigation*

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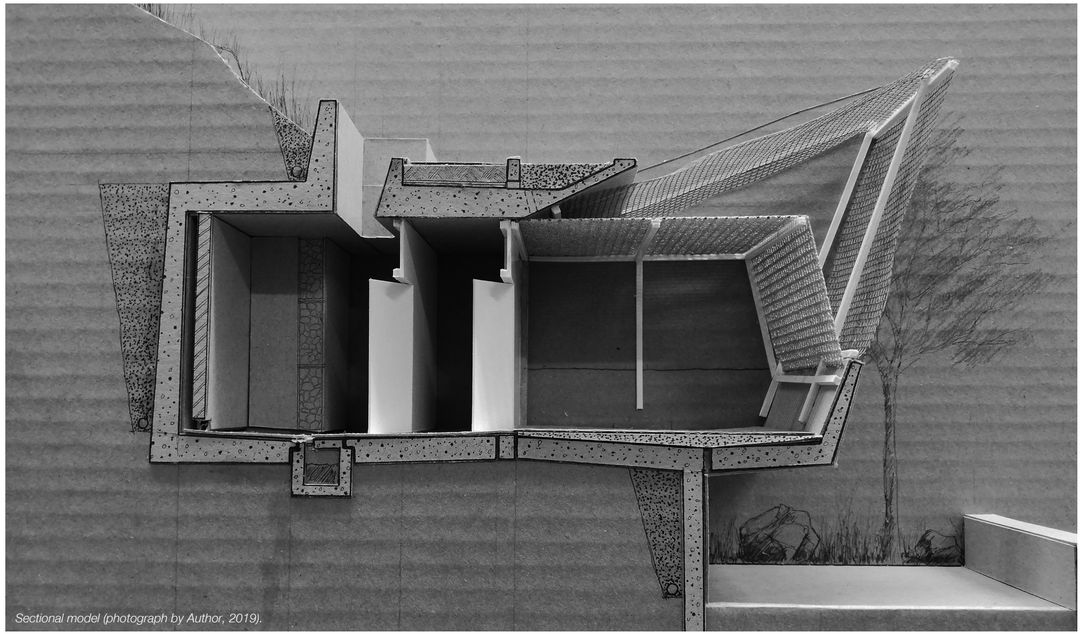
2 - Moving forward *122*



Sectional model (photograph by Author, 2019).

The structural investigation for this project was a continuous process that evolved with the design development, as discussed in Chapter 4.4 of this document. As a result of this, the structural philosophy for this project shifted from an initial approach that was based purely on my perception of ‘sustainable design’ towards an approach that was guided by the conceptual development of the whole project, as discussed in Chapter 2.2 of this document. This integration between the structural philosophy and the conceptual development of the design ensures that the entire design resolution is bound together with a golden thread.

1 – The initial structural approach

As mentioned, the first response in terms of the project’s structural resolution was driven by my own perception of ‘sustainable design.’ The aim of this approach was to allow the building and the site to exist as separate from one another. This meant that the design resolution was not allowed to scar the site in any way to maintain the essence of the site. The resulting structure had to lift the building above the ground, touching the site in as few places as possible (Figure 3.46, Figure 3.48; 3.49). The use of gum-pole construction was selected instead of steel construction since this material reflects more natural properties than steel. Figure 3.47 shows very basic initial diagrams that led my thoughts into this structural resolution.

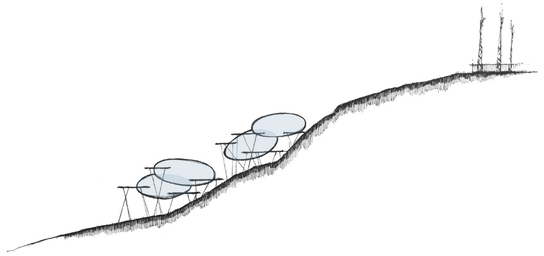


Figure 3.46: A diagrammatic sketch of the building above the site.

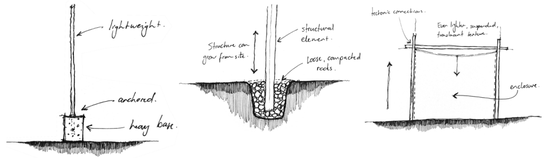


Figure 3.47: Initial explorations into gum-pole construction.

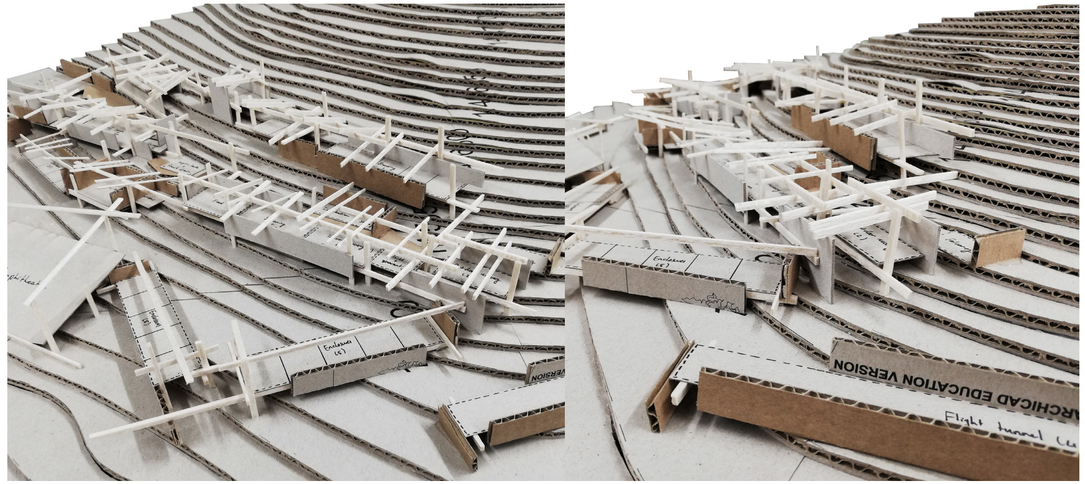


Figure 3.48, Figure 3.49: The initial concept model that followed the ‘sustainable design’ approach (photograph by Author, 2019).

2 – Moving forward

This initial structural philosophy and design approach changed after the first external review in April, as discussed in Chapter 4.4 of this document. Upon reflection, I realized that the direction that the design resolution was moving towards was removed from the conceptual underpinning of the project. Therefore, the decision was made to rethink the way that the building interacts with the site by re-aligning the approach with the concepts developed in Chapter 2.2 of this document. Inevitably, this decision had a massive impact on the structural development of the project as well.

Moving forward, the concept of viewing the site as a cracked rock that gets split open by a plant growing from this crack inspired both the design and structural development. This concept called for a design resolution that has a heavy, anchored base that is buried inside the landscape. From this base, lighter elements start protruding outwards as extensions of the landscape. This concept is particularly evident in the development of the structure for the breeding enclosures in the project (Figure 50, Figure 51).

This concept drove the structural design towards a concrete system where the foundation, floor slab, retaining wall, and roof overhang are integrated into one element that serves as the heavy base that is buried inside the landscape. Steel members that support the mesh covering for the enclosures are fixed to this base, forming the lightweight extension of the landscape (Figure 50, Figure 51).

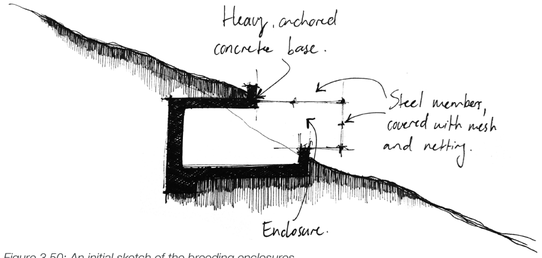


Figure 3.50: An initial sketch of the breeding enclosures.

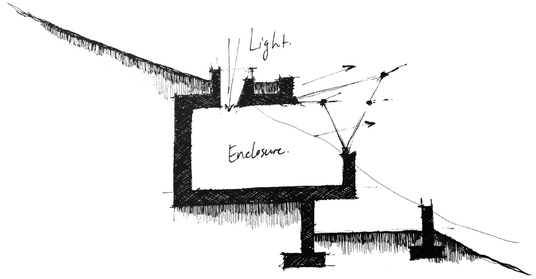


Figure 3.51: A developed sketch of the breeding enclosures.

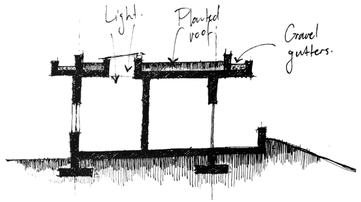


Figure 3.52: The frame structure with planted roofs.

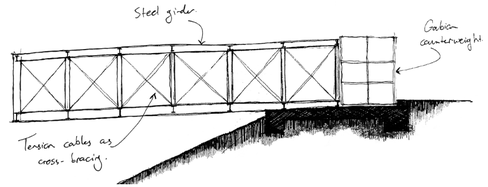


Figure 3.53: The basic idea behind the flying tunnel.

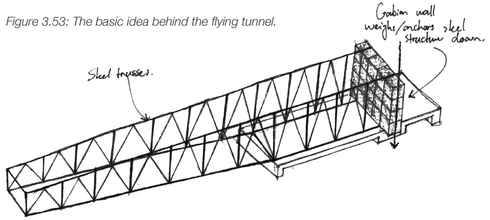


Figure 3.54: Initial axonometric view of the structure for the flying tunnel.

This structural approach guided the development of some of the other functions in the proposed project as well. Since almost all of these functions are single-story buildings with planted roofs, a similar structural system could be developed and applied throughout these functions. These structures use a simple column and beam system with infill masonry cavity walls. The foundations for these columns are a hybrid between a pad foundation and a strip foundation, as mentioned earlier in this chapter. The roof developed into a single concrete planted system with large overhangs and several openings that serve as skylights (Figure 52).

The final structural development that took place was that of the flying tunnel (see Chapter 4.4 of this document). The nature of this element within the design project called for a different structural system to the rest of the project to accommodate its functionality. Aesthetically and hierarchically, this element became something that is celebrated within the broader scheme, embodying the relationship between man and raptor as well as man and landscape.

The flying tunnel is anchored to the site at the one end, while the other end cantilevers over the downward slope of Signal Hill. The structure consists of two deep steel girder trusses that form the walls of the tunnel. These girders are braced with horizontal steel members. Furthermore, tension cables are used as cross-bracing within the girder truss to stiffen the entire system. The entire tunnel is bolted onto a concrete slab and anchored at the back end with gabion boxes that serve as a counterweight (Figure 53, Figure 54). The entire tunnel is then clad with wattle and reed panels.

3.7 Concluding thoughts

In summary, this part of the document highlights certain project challenges in various areas of the overall development of the avian breeding centre. Analysing these challenges allowed me to develop appropriate solutions in response to these challenges that align the technical resolution of the project with the conceptual framework established in Part 2 of this document.

Since these resolutions are driven by the conceptual underpinning of the project, a lot of these resolutions could be used throughout the rest of the design process as a base from where decisions are made in terms of the topology, typology, and morphology of the project. In retrospect, there are still a lot of areas that could be identified and investigated further from a technical point of view to generate a more holistic design resolution, especially with relation to the structural investigation and the sustainable design framework. Although these chapters create a sound basis for further development, there are still a lot of unexplored options and opportunities that could add layers of complexity to the final design resolution.

This part of the document also sets up the backdrop for Part 4 of this document where relevant case studies are discussed, the accommodation list for the project is established, and the theoretically-driven design development is explained.

3.8 Annexures

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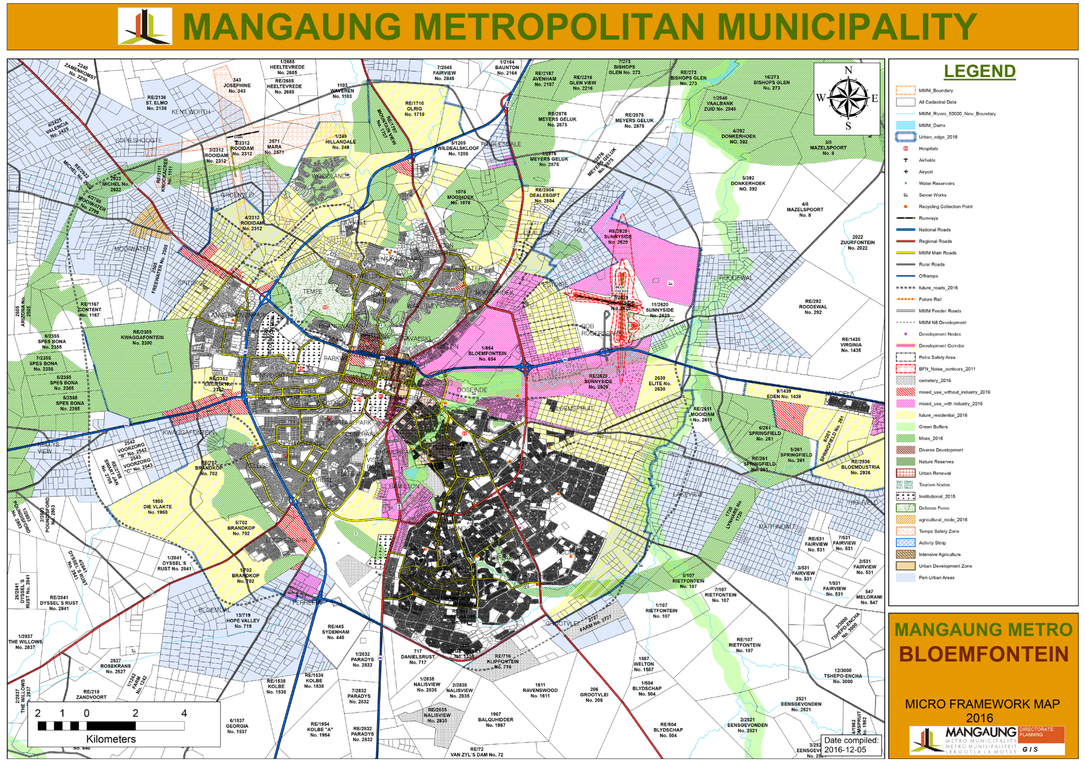
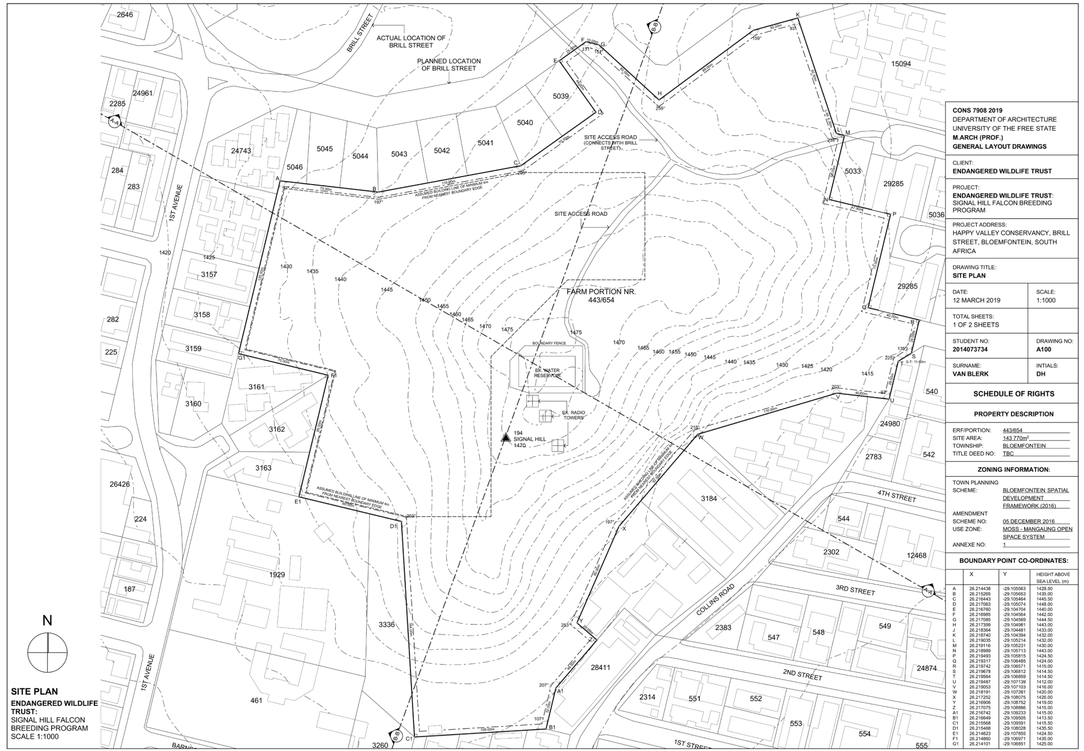


2 - Annexure B - Chief Surveyor-General SG Diagram of the proposed site





SITE PLAN
ENDANGERED WILDLIFE TRUST:
SIGNAL HILL FALCON BREEDING PROGRAM
SCALE 1:1000

CONS 7908 2019
DEPARTMENT OF ARCHITECTURE
UNIVERSITY OF THE FREE STATE
M.ARCH (PROF.)
GENERAL LAYOUT DRAWINGS

CLIENT:
ENDANGERED WILDLIFE TRUST

PROJECT:
ENDANGERED WILDLIFE TRUST:
SIGNAL HILL FALCON BREEDING PROGRAM

PROJECT ADDRESS:
HAPPY VALLEY CONSERVANCY, BRILL STREET, BLOEMFONTEIN, SOUTH AFRICA

DRAWING TITLE:
SITE PLAN

DATE:	SCALE:
12 MARCH 2019	1:1000
TOTAL SHEETS: 1 OF 2 SHEETS	
STUDENT NO: **2014073734**	DRAWING NO: **A100**
SURNAME: **VAN BLERK**	INITIALS: **DH**

SCHEDULE OF RIGHTS

PROPERTY DESCRIPTION

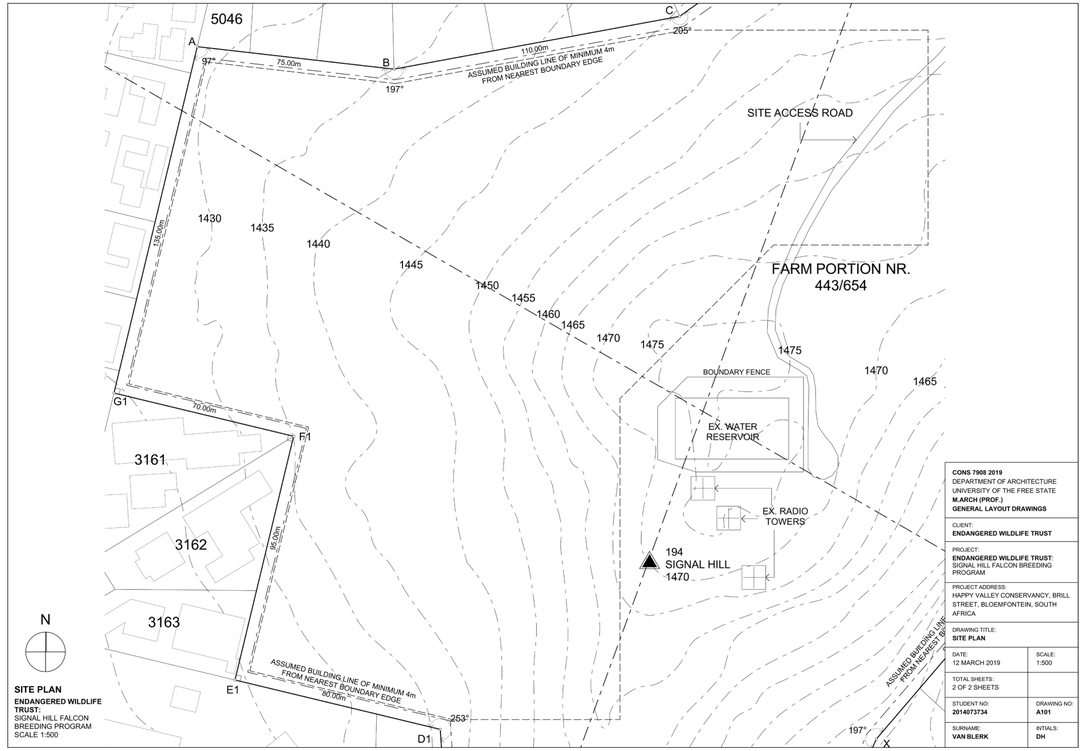
ERF/PORTION:	443/654
SITE AREA:	143.772m²
TOWNSHIP:	BLOEMFONTEIN
TITLE DEED NO:	TBC

ZONING INFORMATION:

TOWN PLANNING SCHEME:	BLOEMFONTEIN SPATIAL DEVELOPMENT FRAMEWORK (2016)
AMENDMENT SCHEME NO:	05 DECEMBER 2016
USE ZONE:	MOSS - MANGAUNG OPEN SPACE SYSTEM
ANNEXE NO:	1

BOUNDARY POINT CO-ORDINATES:

	X	Y	HEIGHT ABOVE SEA LEVEL (m)
A	26.214438	-29.105983	1428.80
B	26.215285	-29.105653	1439.00
C	26.216443	-29.105464	1440.00
D	26.216760	-29.105734	1440.00
E	26.216760	-29.106734	1440.00
F	26.216985	-29.104564	1442.00
G	26.217586	-29.104585	1444.50
H	26.217399	-29.104981	1443.00
J	26.217740	-29.104981	1442.00
K	26.218740	-29.104364	1432.00
L	26.219035	-29.105214	1432.00
M	26.219035	-29.105214	1432.00
N	26.219988	-29.105713	1430.00
P	26.219493	-29.105815	1434.50
Q	26.219317	-29.106455	1434.50
R	26.219317	-29.106455	1434.50
S	26.219876	-29.106572	1414.50
T	26.219564	-29.106950	1414.50
U	26.219497	-29.107139	1412.00
V	26.219497	-29.107139	1412.00
W	26.219191	-29.107291	1420.00
X	26.217252	-29.108075	1426.00
Y	26.217252	-29.108075	1426.00
Z	26.217075	-29.108268	1416.00
A1	26.216742	-29.108233	1416.00
B1	26.216649	-29.108505	1413.50
C1	26.215568	-29.108591	1415.50
D1	26.214623	-29.107055	1424.50
E1	26.214623	-29.107055	1424.50
F1	26.214860	-29.106971	1426.00
G1	26.214101	-29.106851	1425.00



SITE PLAN
ENDANGERED WILDLIFE TRUST:
SIGNAL HILL FALCON BREEDING PROGRAM
SCALE 1:500

CONS 7908 2019
DEPARTMENT OF ARCHITECTURE
UNIVERSITY OF THE FREE STATE
M.ARCH (PROF.)
GENERAL LAYOUT DRAWINGS

CLIENT:
ENDANGERED WILDLIFE TRUST

PROJECT:
ENDANGERED WILDLIFE TRUST:
SIGNAL HILL FALCON BREEDING PROGRAM

PROJECT ADDRESS:
HAPPY VALLEY CONSERVANCY, BRILL STREET, BLOEMFONTEIN, SOUTH AFRICA

DRAWING TITLE:
SITE PLAN

DATE:	SCALE:
12 MARCH 2019	1:500
TOTAL SHEETS: 2 OF 2 SHEETS	
STUDENT NO: **2014073734**	DRAWING NO: **A101**
SURNAME: **VAN BLERK**	INITIALS: **DH**

ERF/PORTION NR.	TOWNSHIP	SITE AREA
443/654	BLOEMFONTEIN	143 770m^2

SURVEYOR PEG ID	CO-ORDINATES		BOUNDARY ANGLES (degrees)	HEIGHT ABOVE SEA LEVEL (m)	BOUNDARY LENGTHS (m)	
	X	*Y*				
A	26.214438	-29.105563	97	1428.50	A-B	75
B	26.215265	-29.105653	197	1435.00	B-C	110
C	26.216443	-29.105464	205	1445.50	C-D	70
D	26.217063	-29.105074	90	1448.00	D-E	48
E	26.216760	-29.104704	90	1440.00	E-F	25
F	26.216985	-29.104564	131	1442.00	F-G	10
G	26.217085	-29.104569	151	1444.50	G-H	62
H	26.217399	-29.104981	259	1443.00	H-J	89
J	26.218364	-29.104481	159	1433.00	J-K	35
K	26.218740	-29.104394	93	1432.00	K-L	92.5
L	26.219035	-29.105214	238	1432.00	L-M	6.3
M	26.219116	-29.105231	90	1430.00	M-N	50
N	26.218989	-29.105713	90	1443.00	N-P	47.9
P	26.219493	-29.105815	90	1424.50	P-Q	73
Q	26.219317	-29.106485	90	1424.00	Q-R	40
R	26.219742	-29.106571	90	1415.00	R-S	26
S	26.219678	-29.106812	135	1414.50	S-T	11.6
T	26.219564	-29.106859	225	1414.50	T-U	29.5
U	26.219487	-29.107139	97	1412.00	U-V	40
V	26.219053	-29.107103	203	1416.00	V-W	110
W	26.218191	-29.107281	213	1420.00	W-X	92
X	26.217252	-29.108075	197	1426.00	X-Y	80
Y	26.216906	-29.108752	253	1419.00	Y-Z	20
Z	26.217075	-29.108886	90	1415.00	Z-A1	48
A1	26.216742	-29.109233	207	1415.00	A1-B1	32
B1	26.216649	-29.109505	107	1413.50	B1-C1	100
C1	26.215568	-29.109591	90	1415.50	C1-D1	164
D1	26.215468	-29.108028	253	1435.50	D1-E1	80
E1	26.214623	-29.107855	90	1424.50	E1-F1	95
F1	26.214860	-29.106971	90	1435.00	F1-G1	70
G1	26.214101	-29.106851	90	1425.00	G1-A	135

Part 4

The design development

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A fish eagle lands on a perch during a flying show at the Falcon Ridge Bird of Prey Sanctuary (Van Blerk, S., 2019: photograph)

4.1 Introduction

Part 4 of this document aims to explain the final influences and challenges that guided the development of the design before the final design synthesis. These design influences are divided into three sections. The first section forms an in-depth analysis of three case studies that I visited to gain a deeper understanding of the way that raptor rehabilitation centres work, the requirements that these raptors have to thrive in captivity, and the functional elements that are part such a development. During these visits, I conducted personal interviews with the owners and some of the staff members that work at these raptor centres.

I used the knowledge that I gained from the analysis of these case studies to compile a comprehensive accommodation list for the Avian Breeding Centre. This accommodation list contains all of the functional requirements for this development across all three users: the raptor, the staff member, and the public visitor. After the accommodation list was finalised, the process of developing the design started.

The third section starts the chronological narrative of how the design developed throughout the year. This narrative is continuously informed by various sources of theoretical literature. These sources include Tadao Ando's writings about architecture in the landscape, Bruno Latours' "matters of concern," and Richard Ingersoll's environmental paradox. These theoretical sources are used as a tool to address and overcome the design challenges that are inherent to the selected site, the program of the building, and the conceptual underpinning of the project.

This concurrent discussion between the narrative of the design and the theoretical concepts allowed me to continuously relate the one to the other, forming a holistic representation of the design process. This concurrent discussion starts with the initial, rather unsuccessful, design response and how this unsuccessful response actually helped to guide me towards a more appropriate response. From here the process basically started over with the extensive development of parti plan diagrams, which eventually developed into a full, diagrammatic plan.

After the planning exercise of the development was completed, I started to develop a morphological approach to the architecture in the landscape. This morphological development was primarily guided by the conceptual underpinning and the program of the project. This morphological development carried on through various different functions within the design development, before culminating in the final development model that was built. This model forms the introduction into the next part of this document, which is the final design synthesis.

4.2 Influential case studies

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- Food storage and preperation *139*

- Clusters of enclosures *139*

- The flying shows *140*

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2 - Falcon Ridge Bird of Prey Sanctuary, Champagne Valley, South Africa ***144***

- Case study information *144*

- The organization of the sanctuary *145*

- Rehabilitation through sustainable use *146*

- The flying show *147*

3 - Montecasino Bird Gardens, Johannesburg, South Africa ***150***

- Case study information *150*

The African Bird of Prey Sanctuary is situated 20km outside Pietermaritzburg in the Kwazulu-Natal province, South Africa. The sanctuary offers a safe haven for around 180 different birds of prey including eagles, vultures, falcons, and owls. The raptors in the sanctuary are either captive-bred or 'non-releasable rehabilitation' birds, meaning they would not survive in the wild. These raptors form the largest part of the public interface of the sanctuary since they can be viewed in their micro-environment enclosures. Some of these raptors are trained by a qualified falconer and then used as practical educational tools during daily flying shows at the sanctuary (African Raptor Centre, 2018: online).

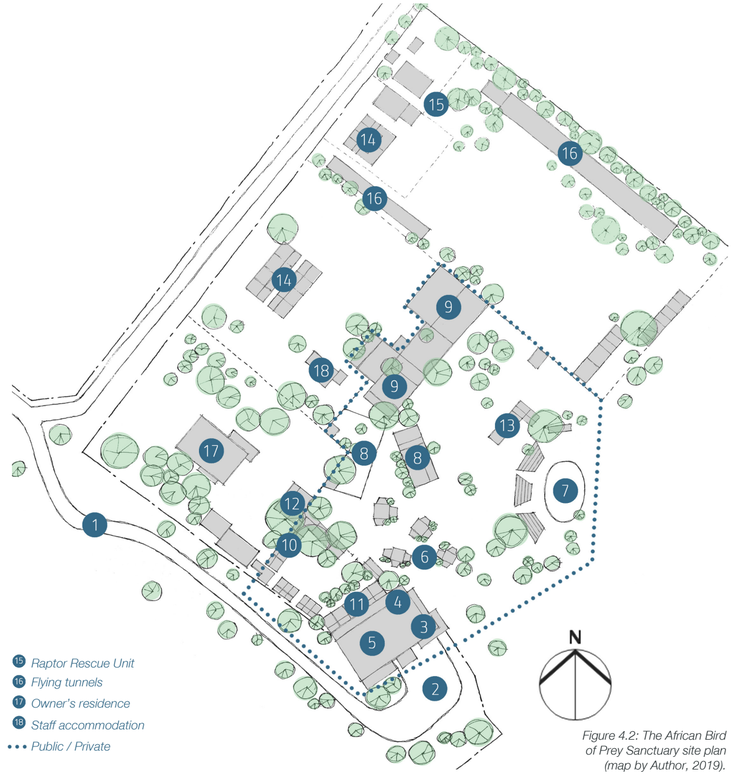
The sanctuary also has a Raptor Rescue Unit which focuses on the successful rehabilitation and release of injured, sick or orphaned raptors. This unit is run by two consulting veterinarians and is fully equipped to facilitate the specific needs of aerial predators. The sanctuary also runs the successful "Bred 4 the Wild" Bearded Vulture Breeding Programme (Figure 4.1) which aims to supplement the dwindling numbers of this vulture species in the wild. This combination of functions generates a working formula for the conservation of indigenous raptor species in South Africa (African Raptor Centre, 2018: online).

Case study information

Location: *Pietermaritzburg, South Africa*
Project type: *Bird of prey rehabilitation centre and sanctuary*
Project year: *2006*



Figure 4.1: The Bearded Vulture enclosures at the African Bird of Prey Sanctuary (photograph by Author, 2019).



Legend

1. *Entrance*
2. *Parking*
3. *Reception*
4. *Cafe*
5. *Indoor flying arena*
6. *Honeycomb enclosures*
7. *Flying show performances*
8. *Other enclosures*
9. *Vulture enclosures*
10. *Owl enclosures*
11. *Big eagle enclosures*
12. *Food storage & preperation rooms*
13. *Weighing & sound room*
14. *Breeding enclosures*
15. *Raptor Rescue Unit*
16. *Flying tunnels*
17. *Owner's residence*
18. *Staff accommodation*

• • • Public / Private

Figure 4.2: The African Bird of Prey Sanctuary site plan (map by Author, 2019).

The African Bird of Prey Sanctuary was built in 2006 on a piece of farmland that was donated to the organization by the previous owner of the farm. The property had a lot of existing structures on it, so the owners took it upon themselves to utilize as much of these structures as possible as a cost-cutting measure. The entire Raptor Rescue Unit is situated inside the farm's old staff accommodation quarters that were renovated to suit its new function, while many of the enclosures are farm buildings that have been opened up and adjusted to suit the needs of the raptors that now live inside them. Although this strategy did save a lot of money, it does mean that a lot of the enclosures and other functional elements are not as efficiently laid out as the owners would like them to be (Hoffmann, 2019: personal communication).

As a case study, this sanctuary was tremendously influential in terms of generating a suitable accommodation list and program for the Falcon Breeding Centre on Signal Hill. Interviews with the owners and staff members at the sanctuary created an in-depth understanding of the requirements that these aerial predators have to thrive in captivity, the raptor breeding process, the requirements for the enclosures, the challenges the sanctuary faces, etc. Some of these requirements have a direct influence on the organization of the overall sanctuary, while others play a role in the morphology of the enclosures and the public spaces.

In terms of the general layout and design of such an avian raptor centre, six of the most important aspects to address are highlighted and discussed in this chapter. This analysis is then applied to the design of the Falcon Breeding Centre to inform the functional requirements of such a development.

- **Separation of users**

The three users of the sanctuary, the raptor, the staff members and the public visitor have to function in harmony with one another, with the pivotal aspect being the health, comfort, and safety of the raptors at the sanctuary. The staff and public come second and third to the raptors. The staff members should have relatively easy access to all the enclosures. Since different species of raptors have different requirements in terms of everyday care, it makes sense to group similar species together in the broad layout of the sanctuary. The public visitor has to be controlled in this type of environment. You can allow them to roam freely within the allocated area of display enclosures, but access control to non-public parts of the sanctuary (Figure 4.2) is imperative as it could put the raptor's safety in danger (Hoffmann, 2019: personal communication).

In the case of my design resolution on Signal Hill, this separation of users opens an opportunity to utilize the natural slope of the hill to create terraces that dictate this separation. The higher terraces have the potential to become private spaces that discourage public access, while the more accessible lower levels are where the public visitors are accommodated (Figure 4.3).

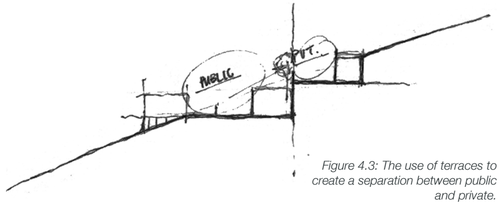


Figure 4.3: The use of terraces to create a separation between public and private.

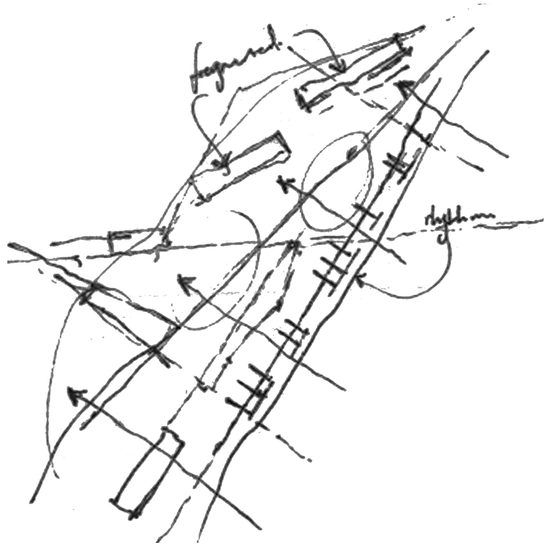


Figure 4.4: The breeding enclosures form a rhytmical spine for the intervention.

- **Food storage and preparation**

The storage facility for the raptor's food should ideally be centrally located within the broader layout of the sanctuary to make the distribution of food during feeding times as easy as possible. At the African Bird of Prey Sanctuary, an old farm workshop that is located in the middle of the property was converted to accommodate the cold storage, dry storage, and a food preparation area. If possible, this area should also be accessible to small delivery trucks, since food is delivered roughly four times a week. Unfortunately, this is not the case at the sanctuary, and food has to be transported from the parking area to the food storage facility by staff members (Figure 4.2) (Hoffmann, 2019: personal communication).

- **Clusters of enclosures**

Clustering enclosures together in groups of 3-5 enclosures allow you to quarantine specific clusters at the potential outbreak of disease. This is a very basic yet successful strategy to avoid the mass-outbreak of disease (see nr.6 in Figure 4.2) (Hoffmann, 2019: personal communication).

Interpreting this notion as an ordering principle allows you to take a linear element that is made up of a number of repeating iterations of the same typological element (such as the enclosures) and use it to create a broken rhythmical order in the design. Figure 4.4 is an explorative diagram that forms an initial investigation into this rhythmical organization for the design of the Falcon Breeding Centre. An ordered backbone is applied to the shape of the contours of Signal Hill with the rest of the intervention emanating from this spine.

- **Flying shows**

The daily flying shows at the African Bird of Prey Sanctuary is the biggest magnet for public participation in the organization. These shows take place in a small outdoor amphitheatre-like space (see nr.7 in Figure 4.2). The “performance” area is a flat grass-covered area that is decorated with small shrubs, rock formations, and a couple of perches that are spread out in the surrounding landscape (Figure 4.5).

During these flying shows, the falconer displays some of the aerial skills of a selection of trained raptors through the use of lures and bait placed around the performance area. All the raptors that are used in these shows are non-releasable birds that would not survive alone in the wild.



Figure 4.5: The falconer with her raptor during a flying show (photograph by Author, 2019).

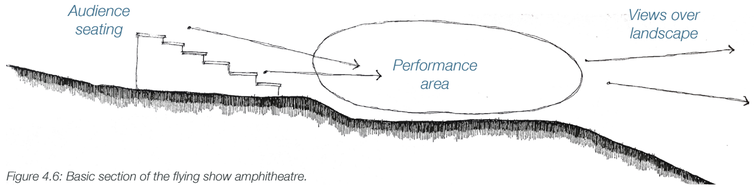


Figure 4.6: Basic section of the flying show amphitheatre.

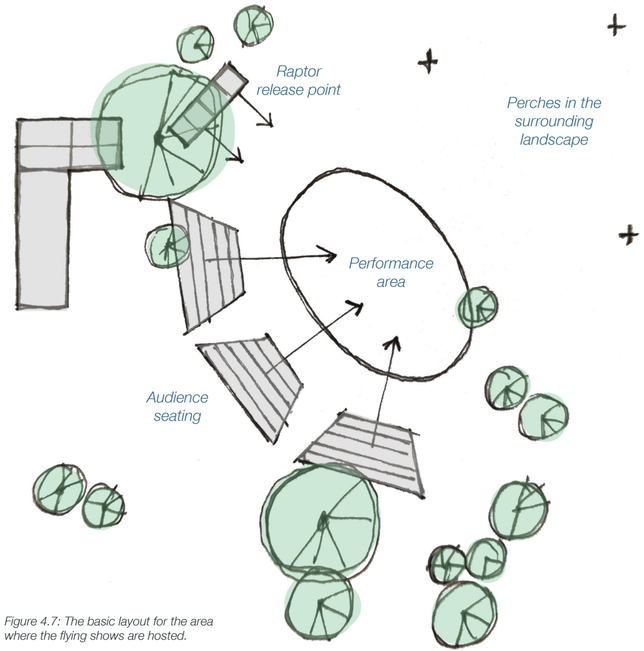


Figure 4.7: The basic layout for the area where the flying shows are hosted.

During the show, there is a lot of interaction between the falconer (the host of the show) and the audience. The falconer encourages the participation of the audience by asking them questions and inviting volunteers to help her. This requires the audience to sit relatively close to the performance area. At this sanctuary, the audience seating is arranged like an amphitheatre and consists of simple brick supports that are spanned with timber planks to form seating arrangements (Figure 4.6, 4.7).

The falconer has two assistants that are tasked with prepping the raptors for release at the right moment during the show. The birds are kept in specialized cages that can easily open to release the bird. These cages are placed next to the performance area so that the raptor has a clear view of the falconer upon release (Figure 4.7).

- **Enclosure layout and design**

The most important aspect of a raptor sanctuary like this is the enclosures. The general layout of the enclosures have already been discussed, but there are many more specifications and requirements that make these enclosures fit for raptor living. The co-owner of the African Bird of Prey Sanctuary, Shannon Hoffmann, believes that the most important thing to remember is that you are essentially creating a small microhabitat for each specific bird. This means that the bird must find it safe, comfortable and relatable. Some of the imperative requirements when designing enclosures are listed below:

- Every enclosure must have two access doors so that one door can always be kept closed (Figure 4.8).
- Every enclosure must have at least a third of the roof area covered.
- Every enclosure must have sufficient protection from the elements.
- Enclosures must be cleaned regularly, so a loose, flat ground-covering like a layer of coarse sand works well.
- Enclosures must have a solid base of approximately 1m above the ground to minimise rodent infestations.
- Every bird in the enclosure must always have at least one perch available to sit on.
- The enclosures should not be too big since raptors can accelerate at tremendous speeds. A large enclosure means they can accidentally fly into the mesh covering and injure themselves.
- Enclosures should be wider than two wingspans of the raptor species that inhabit that enclosure.
- Enclosures should have solid divisions between adjacent enclosures (Hoffmann, 2019: personal communication).

Some of the enclosures at the African Bird of Prey Sanctuary is arranged in a “honeycomb” formation (see nr.6 in Figure 4.2). This allows three enclosures to share a single, central service access point while facing in three different directions. Greenery is used between the open spaces next to the enclosure to create privacy for the inhabitants. The three enclosures are also able to share a single solid roof covering element (Hoffmann, 2019: personal communication).

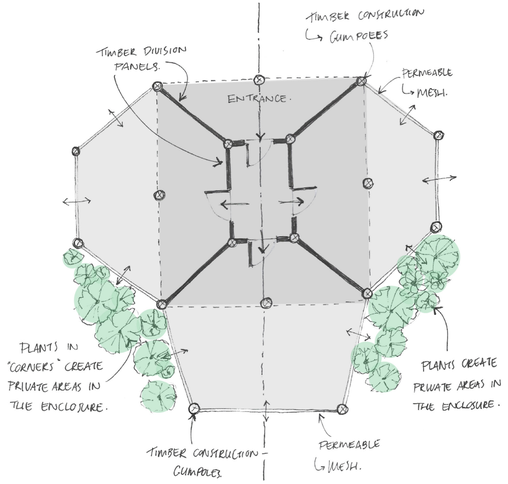


Figure 4.8: The layout of the “honeycomb” enclosure cluster.

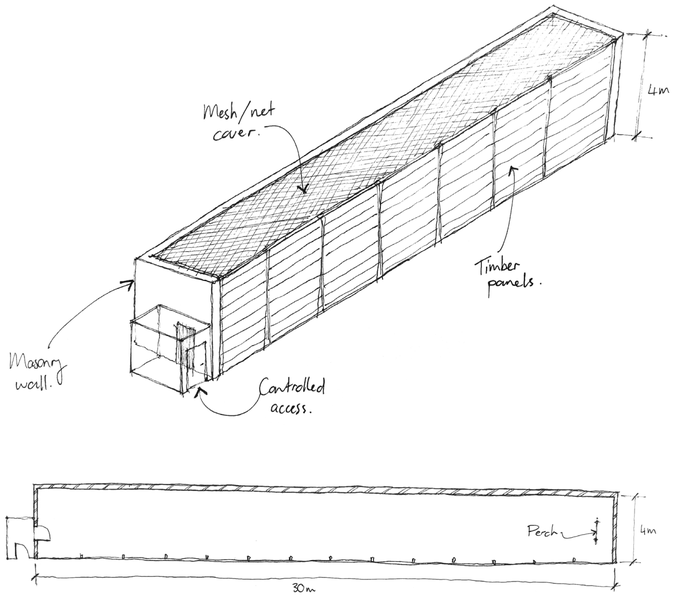


Figure 4.9: Sketches of the smaller flying tunnel at the African Bird of Prey Sanctuary.

- **The flying tunnel**

The flying tunnels at the African Bird of Prey Sanctuary are used to test the flying fitness of rehabilitated raptors prior to release into the wild (see nr.16 in Figure 4.2). These tunnels offer a controlled environment for these flying tests where constant observation of the raptor is possible. This sanctuary utilizes two flying tunnels. The larger one has dimensions of 65m x 5m and facilitates flying tests for large eagles and vultures. The smaller flying tunnel has dimensions of 30m x 4m and is used for smaller raptors like falcons and owls. Both tunnels have a height of approximately 4m (Figure 4.9). In the design of the Avian Breeding Centre, a flying tunnel similar to the smaller one will be utilized since the project deals primarily with smaller raptors like falcons.

These tunnels are rectangular structures that are closed off on all four sides. Only the top of the enclosure is open, although it is still covered with the same mesh/netting that is used for the raptor enclosures (Figure 4.9). This creates a connection between the raptor and the sky, which encourages the raptor to make the flight through the tunnel. Before the test commences, the falconer will place a piece of meat on a perch at the far end of the tunnel. This will lure the raptor to fly through the tunnel while the falconer can observe the flight.

2 - Falcon Ridge Bird of Prey Sanctuary

Case study information

Location: *Champagne Valley, KZN, South Africa*
Project type: *Bird of prey rehabilitation centre and sanctuary*

The Falcon Ridge Bird of Prey Sanctuary is situated in the picturesque Champagne Valley in the Kwazulu-Natal province, South Africa. This avian raptor sanctuary is relatively small compared to the aforementioned African Raptor Centre. The sanctuary's primary goal is to facilitate the successful rehabilitation process of avian predators that are injured, sick, or abandoned as chicks. If the predators successfully complete this rehabilitation process, they are released back into the wild. If not, the birds are given a permanent new home at the sanctuary where they receive lifelong care (McBey, 2019: personal communication).

The sanctuary utilizes the rich tourism industry in the Champagne Valley area to generate public interest and awareness in the conservation and protection of avian predators. This is achieved primarily through the extremely educational and informative raptor flying shows that are held daily at the sanctuary. During these shows, the visitor gets to experience the full hunting and intellectual potential of these avian predators. The income that the tourism industry generates, along with donations, are the sanctuary's primary sources of funding (McBey, 2019: personal communication).

As mentioned earlier, the Falcon Ridge Bird of Prey Sanctuary is ideally situated on one of the mountain ridges that make up the beautiful Champagne Valley. The sanctuary enjoys tremendous views over this valley towards the north (Figure B). The entire sanctuary is organized around this northern view (Figure A), ensuring that both the raptors who live at the sanctuary as well as the public visitor constantly enjoy these breathtaking views. As a case study, the first-hand experience at this raptor sanctuary helped me tremendously in furthering my understanding of the processes behind successful raptor rehabilitation, breeding, and training. I also analyzed this sanctuary to identify possible shortcomings and conflictions that can arise between the raptor who lives in the enclosures and the experience of the public visitor.



Figure 4.10: The view over the valley from the sanctuary (photograph by Author, 2019).



Figure 4.11: The Falcon Ridge Bird of Prey Sanctuary site plan (map by Author, 2019).

Legend

1. *Entrance*
2. *Parking*
3. *Paying point*
4. *Public walkway*
5. *Enclosures*
6. *Site storage*
7. *Lapa with rest seating*
8. *Tuck shop*
9. *Show seating*
10. *Performance space*
11. *Perch locations*
12. *Water feature*
13. *Berm*
14. *Owner's residence*
15. *Forest*
16. *Main road*
17. *Adjacent property*

••• *Public / Private*

- **The organization of the sanctuary**

The sanctuary is developed on a farm portion that borders the R600 road. Between the road and the sanctuary, there is a strip of dense pine forest that creates a privacy buffer between the sanctuary and the road. Access to the sanctuary feeds directly off this road. Upon arrival at the sanctuary, the visitor that arrives by vehicle parks in a very informal parking area underneath the dense canopy of trees inside the strip of forest (see nr.2 in Figure 4.11). Although family vehicles don't have a problem navigating through this area, the nature of the parking arrangement will make it difficult for large vehicles like buses to manoeuvre through it.

From the parking area, a footpath leads up the slope of the hill. Unfortunately, the sanctuary does not have an official entry point with a reception and information centre. Instead, they utilize a single, open manned paying point at the end of the parking lot that acts as the entrance and the access control into the centre (see nr.3 in Figure 4.11). This is inconvenient since the visitor doesn't experience a sense of arrival where they can pay and find information about the sanctuary. During harsh weather conditions, this will also not be functional.

From the paying point, the footpath leads the visitor into the sanctuary, where you catch glimpses of the enclosures that house some of the raptors.

Most of the enclosures at the sanctuary are positioned along a straight artery that is created by the footpath (see nr.4, 5 in Figure 4.11). Following this artery, you arrive at the area where the flying shows are hosted (see nr.9, 10 in Figure 4.11). This space is situated on an elevated grass-covered plateau that extends from the slope of the hill. The seating arrangement is made up of loose plastic garden chairs that are packed in a semi-circle shape. Once these are occupied, visitors simply sit on the extra lawn space that surrounds the performance area (Figure 4.11). The performance area is surrounded by a small tuck shop that sells refreshments and merchandise, an open thatched lapa with a coffee bar, landscaping gardens, and water features (Figure 4.11).

- **Rehabilitation through sustainable use**

The rehabilitation process at the Falcon Ridge Bird of Prey Centre is integrated with the public experience at the centre. Raptors that have been rehabilitated through surgery or treatment of disease are not fit enough be released directly back into the wild. In order to regain their flying and hunting fitness, these rehabilitated raptors are trained to hunt by a qualified falconer. Once a relationship has been established between the raptor and the falconer, the raptor gets incorporated into the public flying show. This gives the raptor the opportunity to simulate hunting conditions on a daily basis without straining itself. The raptor will then be a part of the daily flying show until the falconer is happy with the fitness levels of the raptor, after which the bird is transported to and released into a suitable habitat.



Figure 4.12: The seating area during a flying show (photograph by Author).



Figure 4.13, Figure 4.14: A Verreaux's eagle and a Peregrine falcon are tethered to their perches during the flying show (photographs by Author, 2019).

- **The flying show**

The flying show is hosted by Greg and Alison McBey, co-owners of the Falcon Ridge Bird of Prey Sanctuary, and two assistant bird handlers. They are both experienced falconers with expert knowledge of the nature and capabilities of these avian predators. During the flying shows, there are four or five temporary perches set up throughout the immediate surroundings (see nr.11 in Figure 4.11). The birds that are part of the flying team for that day are tethered to these perches while they wait for their part in the show (Figure 4.13, 4.14).

The locations of these perches around the audience create a truly immersive and unexpected viewing experience as these birds are released from different places all around the audience. Upon release, the birds do very low swoops over the audience members to get to the falconer in charge of the show. The "performance space" where the falconer handles the raptors and hosts the show from has a single sawn down tree stump which serves as a perch for the raptor during the show. The only other physical element that is a part of the flying show is a small man-made pond which is used to show off the hunting skills of the fish eagle (Figure 4.16).



Figure 4.15: Greg McBey swings a lure through the air for a peregrine falcon to catch (Van Blerk, S., 2019: photograph).



Figure 4.16: A fish eagle grabs a piece of lure bait from the pond during a flying show (Van Blerk, S., 2019: photograph).

Case study information

Location: *Johannesburg, South Africa*
Project type: *Bird and reptile sanctuary*

The Montecasino Bird Gardens caters to a completely different experience than that of the African Bird of Prey Sanctuary and the Falcon Ridge Bird of Prey Sanctuary. At Montecasino, the focus is shifted from the birds to the visitor – the experience is similar to that of a zoo. These gardens also offer the visitor more than just birds to view with arachnidial enclosures, lizard and snake enclosures, and even a few monkey enclosures. The gardens also feature big a walk-in aviary with over 60 different species of birds inside (see nr.6 in Figure 4.18).

However, the reason for choosing this case study is the purpose-built amphitheatre, where they host their flying shows (see nr.4 in Figure 4.18). The flying shows at Montecasino features a wide variety of bird species, including owls, falcons, buzzards, hawks, and a few water birds. The amphitheatre that is built for these shows is partially covered by shaded netting that is spanned over steel supports. The seating area is made from concrete steps with composite decking defining the seats. The amphitheatre can easily seat approximately 150 people (Figure 4.17, Figure 4.19).

The “performance space” where the falconer hosts the shows is designed and decorated to suit the needs of the performance. Perches are placed all around the performance area and the amphitheatre, allowing the birds to make swooping passes over the audience. The birds are released into the show from behind the eclectic facade of the “back-of-stage” functions (Figure 4.20).



Figure 4.17: The purpose-built arena for flying shows (photograph by Author, 2017).



Figure 4.18: The Montecasino Bird Gardens site plan.

Public / Private

1. *Entrance*
2. *Reptile enclosures*
3. *Various outdoor enclosures*
4. *Outdoor amphitheatre*
5. *Monkey enclosures*
6. *Walk-through aviary*
7. *Big bird enclosures*
8. *Breeding/rehabilitation enclosures (private)*
9. *Falconry training grounds*
10. *Highway*

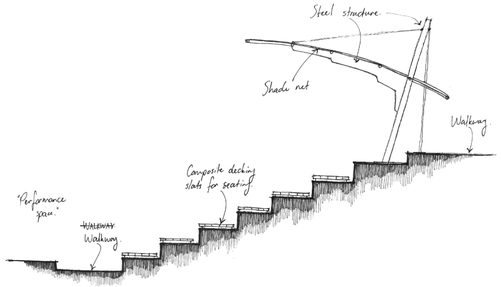


Figure 4.19: Section through the amphitheatre.



Figure 4.20: The performance area (photograph by Author, 2017).

User: the raptor

Facility	Service	Amount	Size (area in m^2)
• Breeding enclosures	• Enclosures	20 @ 12m^2	240
	• Cleaning storage		10
		3 x 6m^2	18
• Permanent enclosures	• Enclosures	26 @ 20m^2	520
	• Cleaning storage	6 x 6m^2	36
		3 x 10m^2	30
• Rehabilitation clinic	• Screening & sterilisation room		16
	• X-ray room		8
	• Pharmacy & lab tests		15
	• Equipment sterilisation		6
	• Surgery room		20
	• Medical waste disposal		10
	• ICU rooms	4 x 4m^2	16
	• Incubation room		9
	• Chemical lock	2 x 6m^2	12
	• Observation & IT room		8
	• Laundry room		9
	• Linen storage		6
	• General storage		5
	• Cleaning storage		5
	• Clinic staff WC		4
	• Generator room		10
	• Circulation		54
• Food storage & preparation	• Food delivery, preperation, cleaning, equipment storage		24
	• Cold storage		5
	• Dry storage		3
	• Cleaning storage		2
• Falconry	• Flight tunnel		160
	• Bird release	4 x 40m	8
	• Observation room		9
	• Falconry equipment & cleaning storage		12
		TOTAL [m^2]	**1326**

User: the staff member

Facility	Service	Amount	Size (area in m^2)
• Administration & offices	• Director's office	2	18
	• Veterinarian office		10
	• Rehabilitation staff & office administrator		20
	• Avian Pest Solutions, SAFA office		15
	• Archive room		8
	• Cleaning storage		1
	• Boardroom		20
	• Kitchenette		7
	• Staff bathrooms	2 x 3m^2	6
	• Receptionist		5
	• Waiting area		8
	• Circulation		30
• Staff lounge & services	• Lounge		20
	• Kitchen		16
	• Storage		5
	• Female bathroom		9
	• Male bathroom		9
	• Locker & changing rooms	2 x 12m^2	24
	• Laundry room		12
	• Laundry storage		3
	• Cleaning storage		5
	• Circulation		27
• Staff quarters	• Overnight rooms	3 x 9m^2	27
	• En suite bathrooms	3 x 6m^2	18
	• General storage		1.5
	• Cleaning storage		1.5
	• Circulation		13
• Parking	• Staff parking	10 x cars	260
		TOTAL [m^2]	**599**

User: the public visitor

Facility	*Service*	*Amount*	*Size (area in m²)*
• Reception	• Receptionist, curio shop, information centre		46
	• Storage		8
• Ablutions	• Accessible toilet		4
	• Female toilets		15
	• Male toilets		15
• Flying shows	• Amphitheatre		216
	• Falconry equipment storage		18
		TOTAL [m²]	**322**

General

Facility	*Service*	*Amount*	*Size (area in m²)*
• Site functions	• Site workshop		63
	• Generator room		8
	• Battery room		2
	• Pump room		6
• Rainwater collection	• Water tanks	2 x 25m²	50
• Undercover vehicle storage	• Covered parking for specialised bakkies	2 x 21m²	43
• Sanitation	• Septic mound system		200
		TOTAL [m²]	**372**

GRAND TOTAL	**2619m²**



A Wahlberg's Eagle lands on Alison McBey's glove during the flying show (Van Blerk, S., 2019: photograph).

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In the opening sentence of the introduction to the book *Theorizing a new agenda for architecture: an anthology of architectural theory 1965-1995*, Kate Nesbitt states that architectural theory "is a discourse that describes the practice and production of architecture and identifies challenges to it" (Nesbitt, 1996, p. 16). As a definition, this statement reduces the often mystifying topic of theoretical discourse to its bare essence: theory as a design tool that guides one in the making of architecture, while at the same time highlighting possible obstacles that need to be overcome (Figure 4.21). These obstacles can have a myriad of origins, ranging from past and present social issues to ecological and environmental sensitivity. Arguably, these complications can be labelled as pragmatic: they are the results of logic and action, they have a history, they can be measured and rationalised.

Tadao Ando, however, adds to Nesbitt's statement by specifying another significant step to architectural creation that involves "contemplating the origins and essence of a project's functional requirements and the subsequent determination of its essential issues" (Ando, 1996, p. 459). Ando goes on to explain that the complexity that this step adds allows the architecture to embody the true character of its origin (Figure 4.22).

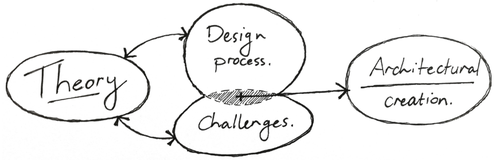


Figure 4.21: Nesbitt's depiction of theory as a design tool.

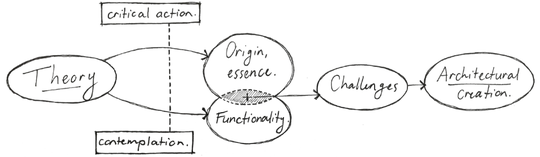


Figure 4.22: Ando's depiction of architectural creation.

The aim of this chapter is to combine these two definitions, expressing the progression of the design of this thesis as a holistic, chronological, and personal narrative. This narrative started to develop in Part 2 of this document, where the essence of the project and the site-driven conceptual development served as a catalyst for the development of the research question. This research question informed most of the theoretical thoughts that guide and challenge the design process. These briefly include Bruno Latour's "matters of concern," Tadao Ando's interpretations of the natural site, Richard Ingersoll's architectural paradox, and Glenn Murcutt's thoughts on sustainability.

As the progression of the design develops, inherent challenges are continuously identified and measured against the aforementioned aspects as well as the theoretical discourse of the narrative. In some cases, the design process deviated from these challenges to such an extent that critical reflection and realignment with the concept of the project was necessary.

1 – Orientating the proposed development

As mentioned earlier in Part 2 of this document, the ties that were created between the site and the concepts formed the first exercise in orientation on the site. The concepts were all grounded on the northern slope of Signal Hill, as this location is central in relation to the larger conservancy. This location respects the notion that the birds need to be removed from human interaction during the first couple of months of immaturity to avoid the possibility of imprinting. It also opens the opportunity for the eventual building to utilise the ideal solar orientation on the site. The slope on this side of the hill is also the less steep than the other sides, which will ease the workability on the site. This approach to the orientation on the site did not change as the design started to grow from concept to the first built response (Figure 4.23).

Initially, the move forward from the conceptual stage to a built response proved to be difficult for me. This was due to my own uncertainty and indecision about what the design could be and what type of design response would be suitable for this specific site. I eventually grabbed onto what I thought was the most important part of this design project: maintaining the natural site exactly as it is. At first, I thought that this could be achieved by keeping the project from touching the site at all. This approach was birthed from my own - slightly misguided - interpretation of the Australian architect Glenn Murcutt's famous term "touch this earth lightly" and the implications that I thought this would have on the sustainability of the project.



Figure 4.23: The selected position of the development on the northern slope of Signal Hill (photograph by Author, 2019).

In my mind, "touching the earth lightly" simply meant lifting the building from the ground on stilts, maintaining the existing landscape underneath the building. My entire approach to the project started to revolve around the idea that in order to be sustainable, I must try to preserve the landscape as it is, and that anything that touches the landscape will leave a degenerating scar. To avoid this scarring, you would obviously require a lightweight stick-like structure that can be lifted above the slope of the site, which would, in turn, create a direct visual link with the morphology and materiality of my three concept models. This convinced me that I was on the right path.

2 – The initial design response

This thought process generated the first design response on the site. This response was completed around the first External Design Review in the middle of April 2019. The design consisted of tectonic timber members that raise the suspended floor plates above the slope of the hill (Figure 2.24). The only influencing factors in terms of the planning for this response were the basic shape of the contours and the linear division between public and private space (Figure 4.25).

The design is ordered in a way that hugs the side of the hill, following the bend of the contours. Since I was trying to avoid contact with the site, I was hesitant to suggest altering the natural topography of the site. From this natural bend in the topography, a linear division was created to establish public (accessible by visitors) and private (accessible by staff members) spaces.

The private functions are placed on the higher terrace of the scheme, with the public spaces making up the lower part. As the scheme moves lower down the hill towards the public spaces, the layout also starts to break away from the linearity of the private spaces, allowing for dynamic public movement patterns to take shape (Figure 4.26). Although there was some form of functionality incorporated into the program at this stage, it wasn't at all developed enough to bear any hierarchical weight within the broader scheme.

As mentioned earlier, the morphology of this response resulted from the visual connection that was established between the concept models and the structure through the use of timber frames. In conjunction with the frame structures, thoughts about rainwater harvesting on the site led to the use of repetitive mono-pitched roofs that are all orientated to allow the most northern light into the building (Figure 4.27, Figure 4.28).

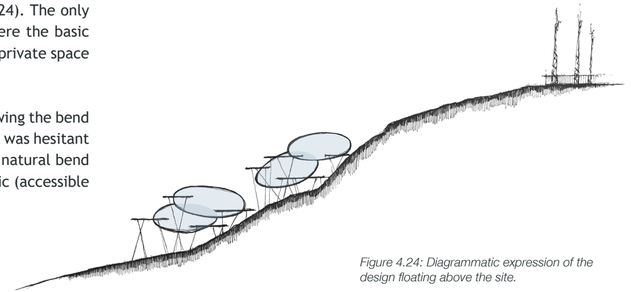


Figure 4.24: Diagrammatic expression of the design floating above the site.

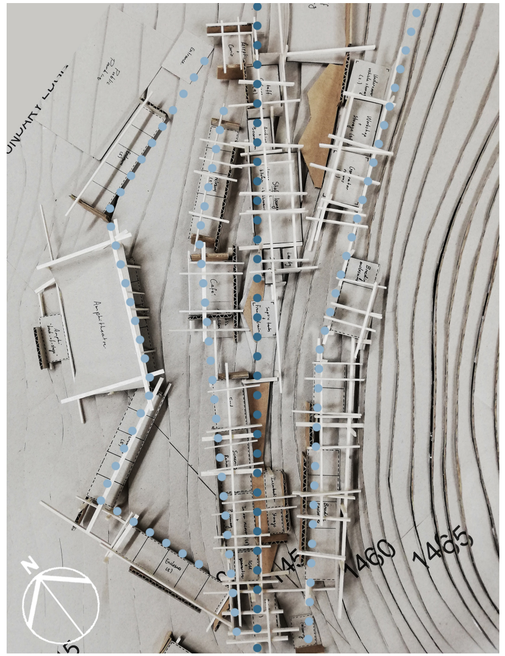


Figure 4.25: The layout of the initial design, showing the linear division between public and private space (photograph by Author, 2019).

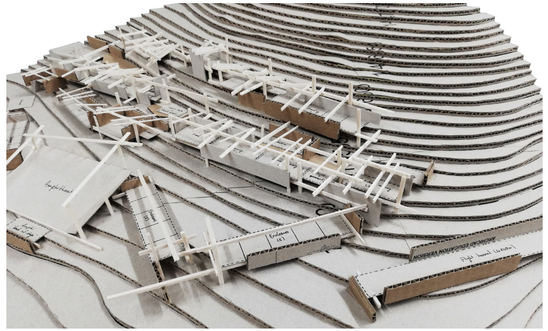


Figure 4.26: The division between linear space and dynamic space (photograph by Author, 2019).

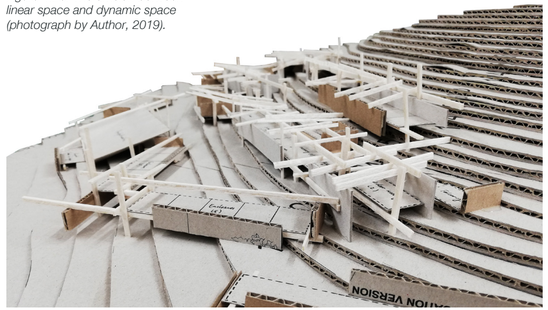


Figure 4.27: The mono-pitched roofs as a result of rainwater harvesting possibilities (photograph by Author, 2019).



Figure 4.28: The morphology of the design response that speaks of the concept models (photograph by Author, 2019).

Although this is a theoretically fair and viable approach towards reaching an architectural solution, the execution was lacking depth and appropriateness in this case. At this point, the project sacrificed its rooted connection to the site that was present in the development of the concept models for a factual checklist of 'sustainable' items which was simply accepted as ideal and true for every given situation.

In the article *Why Has Critique Run out of Steam? From Matters of Fact to Matters of Concern*, Bruno Latour states that although these "matters of fact" (like pragmatic checklists) are not invalid entities, they do not define reality and our lived experience by themselves. Instead, they are only partial renderings of our complete experienced reality (Latour, 2004, p. 232). He goes on to explain that one of the problems with modern society is that we have submitted to accepting and using these "matters of fact" as the dictator of our realities. This submission has diminished our ability to be critical of these "matters of fact" without completely abandoning them (Latour, 2004, p. 231).

When viewing this notion from a post-rational, architectural point of view, one can argue that this is the exact position that the design intervention found itself in at this stage. The proposed building focused solely on a single possible facet of the development as a whole, without engaging with the complete experienced reality of the natural landscape. The belief that this is the architectural creation that captures the essence of both the site and the project's functionality resulted in the substitution of the reality of the site, the functionality program, and the inherent connection between the concept and technical resolution for the face value of 'sustainable principles.'

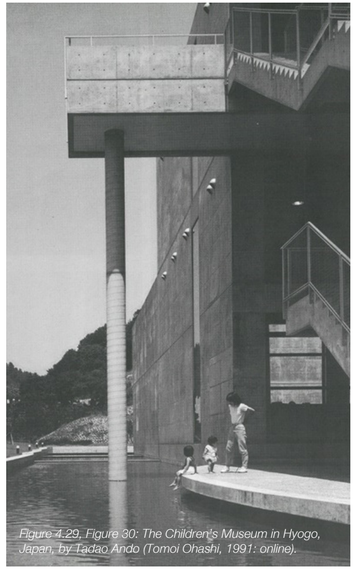
However, Latour also proposes a more realistic mentality when shaping our lived experiences, which substitutes the dictating attitude of "matters of fact" with "matters of concern." The purpose of this switch would be to turn away from the rigid pragmatism of "matters of fact," towards an attitude of identifying that which is of concern to our lived realities and then protecting and caring for these matters (Latour, 2004, p. 232).

I attempted to move on from the disillusionment of the initial design response by reflecting on the matters of concern that surround the project. The primary area of concern is the natural site and the relationship that the project has with it, which was successfully captured in the development of the concept models. However, something of that essence got lost in the first design response, despite clear visual links to some of the concept models.

Because the initial design response was so hesitant to change the landscape, and instead chose to rather float above the site, it actually ended up imposing itself onto the site and ignoring the architectural resolution that the site is revealing within itself. In the essay *Towards new horizons in architecture*, Tadao Ando says that architects should accept that the presence of any architectural form – regardless of its character or intentions – will always create a new landscape. However, if this presence of architecture transforms a place with a new sense of intensity, then the "discovery of a new relationship with nature is possible" (Ando, 1996, p. 461).

He carries on to say that architecture should only be composed after uncovering and understanding the "essential logic inherent in a place" (Ando, 1996, p. 461). This includes the site's physical characteristics, its cultural influences, its climate, the movement patterns across the site, noticeable environmental features, and the surrounding city structure. In doing this, you are able to capture both the origin and essence of the project as well as "the architecture which the site itself is seeking" (Ando, 1996, p. 461). This notion relates directly to the development of the concept of *Mechanical Weathering* that was discussed in Chapter 2.2 of this document. Here the site was viewed as something that got split open by the architectural intervention, but instead of degenerating the essence of the site, the building actually adds meaning to the natural environment.

To uncover the inherent logic that is already a part of Signal Hill, I re-investigated the lived experience that the visitor has as one moves through the site as another "matter of concern." This allowed me to pinpoint the essence of the site, which in turn guided the resolution of the next design response towards the architectural resolution which the site is seeking. This response aimed to capture and protect the essence of the existing site within the architecture as a lived experience.



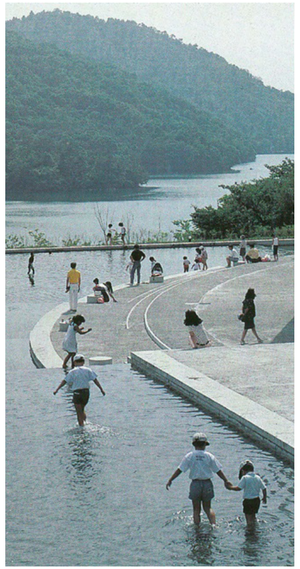


Figure 4.29, Figure 30: The Children's Museum in Hyogo, Japan, by Tadao Ando (Tomoi Ohashi, 1991: online).

As discussed in Chapter 1.4 of this document, the experience of moving through and exploring the site becomes pivotal in understanding and capturing the character of the Happy Valley Conservancy and Signal Hill. I believe it is also on this explorative journey that the visitor comes across the essence of the site.

This journey starts in the basin at the bottom of the valley on the northern side of Signal Hill, where the canopy of trees encapsulates you. The trees are penetrated by filtered light that passes through from above, while glimpses of the sky can be caught from below. This vertical connection almost makes you feel like you are walking through a crevice in the landscape where the earth is torn into two (Figure 4.31). You do not know what is up ahead; you cannot yet see the hill that is in front of you, and you are not aware of the city around you, only the sky above you.

As you move deeper into the site, the canopy gives way and you are confronted with the slope of Signal Hill. Nothing but the selected site is revealed to you. You cannot see past the outline of the hill towards the city yet; you only gaze upwards towards the meeting point between the silhouette of the landscape and the sky. This confrontation makes you notice all the things that give the selected site its character: the dolerite rocks that are strewn between the yellowed veld grass, the darker shrubs that dot the slope, and the three radio towers on the hill's summit.



Figure 4.31: The thought of moving through a tear in the landscape.

Footpaths lead you up against the incline of the hill. This elevation change slowly reveals more of the surroundings to you. However, these surroundings are all still part of the natural landscape. The city is still hidden from view behind the hill. Looking back to where the journey started, you have a view over the canopy of trees and the rest of the conservancy. The tree-rich suburb of Westdene is partially visible but hardly recognisable from this point of view.

It is only upon reaching the summit of Signal Hill that the city towards the south reveals itself to you in a sudden moment of realisation (Figure 3.32). This creates a connection between the natural landscape and the urban environment; however, the entire experience of the promenade still protects the integrity of the natural site while allowing the visitor to form a connection with the character of the site.



Figure 4.32: On the summit of Signal Hill, the city is revealed.

Influential precedent where the architectural promenade is integral to the success of the design

Freedom Park

Architects:	*GAPP, Mashabane Rose Architects, MMA*
Location:	*Salvokop, Pretoria, South Africa*
Project type:	*Monument, memorial, museum*
Project year:	*2008*

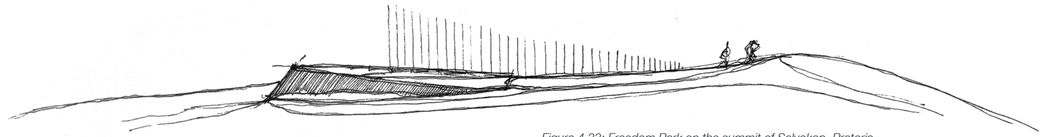


Figure 4.33: Freedom Park on the summit of Salvokop, Pretoria.

Freedom Park is analysed as a precedent that utilises an extensive journey through the site as an 'architectural promenade' that connects the visitor with the inherent qualities of the natural landscape in which the monument and museum is built. Freedom Park is a contemporary freedom monument and museum that symbolises and commemorates South Africa's commitment to democracy. The project site is the prominent Salvokop Hill in Pretoria (Figure 4.33), right across from the historical Voortrekker monument.

The extensive intervention was completed in three intermittent phases: a Garden of Remembrance, a Place of Remembrance, and a Pan-African museum and archive. Each of these phases forms a delicate dialogue between the "African-inspired architecture and the landscape" (Young, 2009, p. 98). The architectural intervention also responds to the site's ecological value through the reintroduction of indigenous plant species, sparking an extensive site rehabilitation process (Young, 2009, p. 98).

The different phases of the project are situated in various positions around the hill. The progressive, ritualistic journey through the landscape that connects these different phases creates a narrative that allows the visitor to reflect on the shared history that the memorial encompasses (Figure 4.34).

The second phase: The 'Place of Remembrance' or *sikhumbuto* is situated at the very top of the hill and is arguably the most prolific space in terms of the ritualistic journey as the narrative and the landscape culminate on the summit of Salvokop. *Sikhumbuto* responds with sensitivity to its location at the summit of the hill by burying itself inside the hill, leaving only a very subtle alteration to the silhouette of the hill behind (Figure 4.35). The predominant use of natural textures and materials aids in the generation of a dialogue between landscape and building (Figure 4.36).

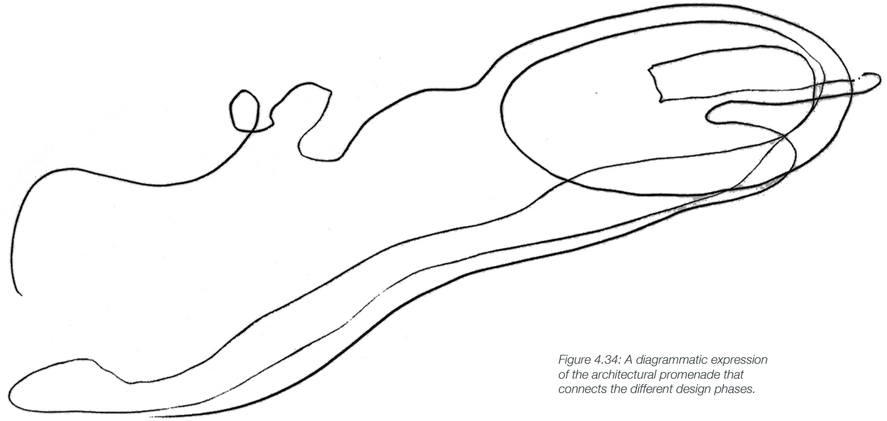


Figure 4.34: A diagrammatic expression of the architectural promenade that connects the different design phases.

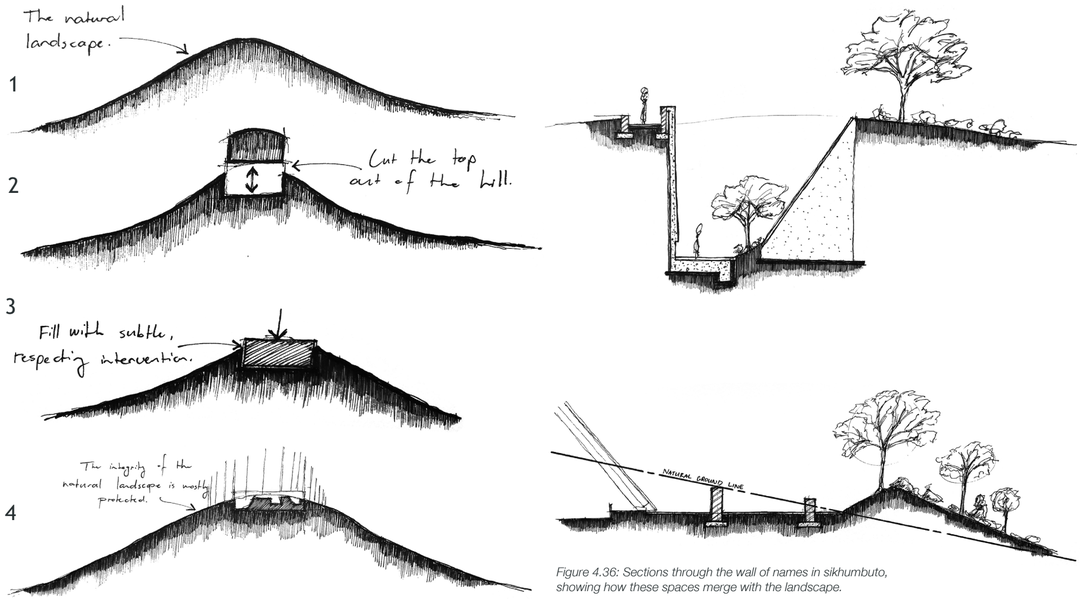


Figure 4.35: Sikhumbuto becomes a subtle replacement for the natural summit of Salvokop.

Figure 4.36: Sections through the wall of names in sikhumbuto, showing how these spaces merge with the landscape.

Apart from the vertical connection with the sky that the tall steel posts around *sikhumbuto* create (Figure 4.33, Figure 4.35), there is also an inherent closeness to the earth present in these spaces. A section through the 'Wall of Names' reveals spaces that are sunken below the natural ground line. The slope of the hill is used to create a visual barrier from the outside world, immersing the visitor into the landscape (Figure 4.37).

As an influential precedent, this notion of visual barriers is something that can be incorporated into the design of the Avian Breeding Centre as a measure of reflecting the essence of the site. As a design element, this will allow the development to remain sheltered from the urban surroundings while focusing on the connection between the natural site and the building.



Figure 4.37: The culmination of the ritualistic journey at the summit of Salvokop (Mashabane Rose Associates Architects, 2008: online).

Extending Tadao Ando's view of the natural landscape and how architectural creation will always create a new landscape is the American author Richard Ingersoll. In his chapter *The Ecology Question and Architecture* in *The SAGE Handbook of Architectural Theory*, Ingersoll argues that all acts of architecture will inherently oppose ecology since "every act of building betrays the environment, as it requires the displacement of 'natural' relationships" (Ingersoll, 2012, p. 574).

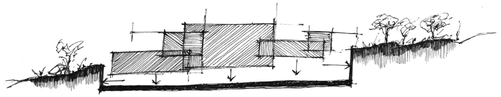


Figure 4.38: Any act of architecture will always displace 'natural relationships.'

Similarly to Ando, Ingersoll accepts the paradox that this creates, but instead of abandoning this "matter of fact," he critically works towards identifying a possible harmony between the building and nature. Ingersoll does this by elucidating the approaches followed by a few historically famous architects, such as Frank Lloyd Wright, Le Corbusier, and Paolo Soleri (Ingersoll, 2012, pp. 576-578) before speaking of the influence that the advent of land architecture had on the relationship between building and ecology (Ingersoll, 2012, pp. 580-584). In this chapter, I will briefly elaborate on some of these topics and their relation to this thesis as catalysts for future design decisions.

This environmental paradox has led many designers that involve ecology in their approach to architecture to conceptually mimic nature in their designs (Ingersoll, 2012, p. 574) in an attempt to mitigate the struggle that exists between architecture and natural phenomena (Ingersoll, 2012, p. 574).

The Italian architect Paolo Soleri aimed to combine architecture and ecology in what he called 'arcology.' He developed this notion as an improvement on Le Corbusier's later works that floated above the ground with vertical density. Soleri saw the city as a single "beehive-like organism" that distributed resources equally while conserving land usage (Ingersoll, 2012, pp. 577-578). This notion eventually rose to the modern idea of biomimicry in architecture. Frank Lloyd Wright, on the other hand, designed buildings that became a part of the landscape. The low-lying, subtle architecture that resulted from this approach followed the shape of the contours on the natural site, blending the building into its surroundings. This approach created an unprecedented connection between the building and the natural site.

Following in Wright's footsteps of building into the landscape is Mexican architect Emilio Ambazs. He popularised the idea of land architecture in the early 1980s. According to Ingersoll, land architecture aims to integrate the architecture into landforms or to evoke new landforms:

> Land architecture, either through digging into or rising out of the land, keeps a building from being seen on its own. It opens the possibility of reconciliation of the artificial environment of architecture with that of nature (Ingersoll, 2012, p. 583).

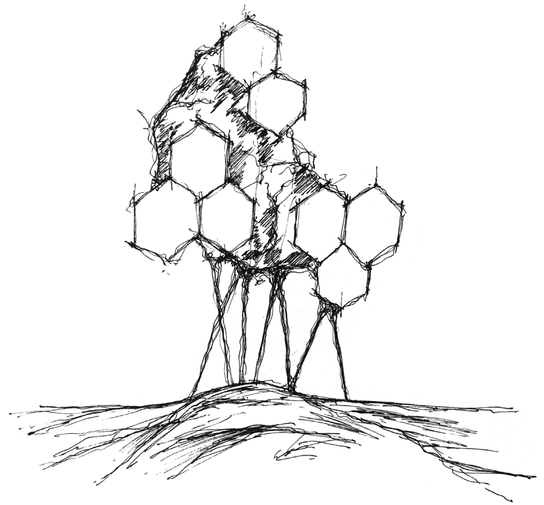


Figure 4.39: An abstraction of Soleri's 'vertical city.'

In retrospect, Ingersoll's definition of land architecture creates an accurate summary of the other architect's attempts at dealing with the environmental paradox that architecture creates. Both Le Corbusier and Soleri's elevated, vertically dense architectures were aimed at minimising the amount of land that is used by the building. The planted roofs in Le Corbusier's later works placed the building in between two 'layers of nature.' Wright's designs in the landscape draw the natural site into the architecture, blurring the line between building and nature.

Lastly, the notion that the building cannot be perceived on its own, but that the landscape becomes an inherent part of the character of the architecture (and vice versa) reflects Ando's view of the inevitable new landscape that architecture creates. The discovery of this new relationship between building and nature allows for reconciliation between the two opposing entities.

Ingersoll's writings, as well as Ando's view of the landscape, proved to be pivotal in the continuation of the design development. My view on the natural landscape and the architecture's interaction with it changed significantly. Accepting the environmental paradox that architecture creates as a "matter of concern" re-aligned my thoughts with the conceptual underpinning of the project identified in Chapter 2.2 of this document. The continuation of the design response also drew inspiration from Ingersoll's definition of land architecture and how this approach could birth a new landscape that has an intense connection with the building.

This chapter aims to interpret the writings of Ando and Ingersoll in the continuation of the design development after the initial response. These influences are elucidated through the chronological presentation of development sketches and concept models. Furthermore, various applicable precedent studies are analysed and used to supplement the theoretical notions behind the design decisions.

As mentioned before, the approach towards the natural landscape was re-thought and re-aligned with the conceptual underpinning of the project. This process started through an extensive sketching exercise that generated a series of parti plan diagrams. These diagrams started as visual abstractions of the essence of the site and the inherent experience that is captured within the natural site (Figure 4.40). The diagrams continued to develop into basic ordering diagrams that started to give me clues about the organisation of functions and movement patterns through the site.

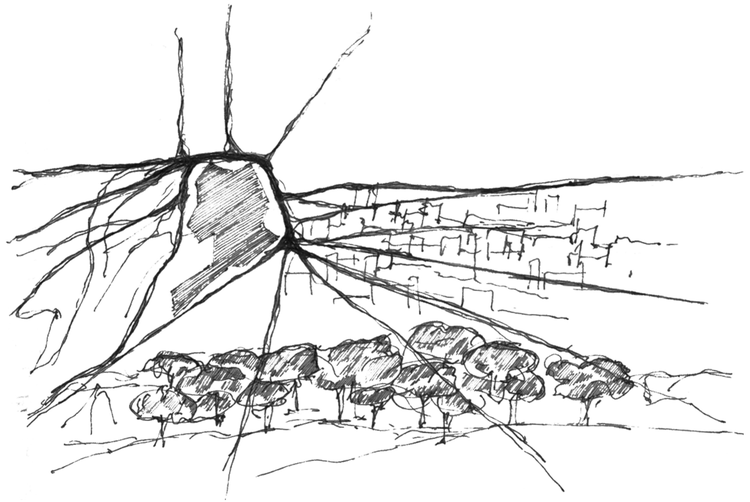


Figure 4.40: Abstracted diagram that portrays something of the essence of the site.

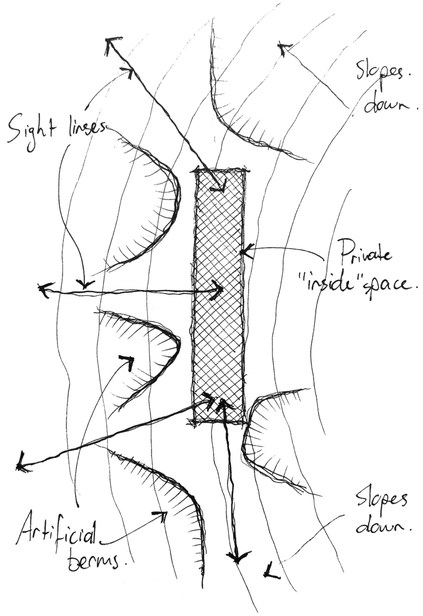


Figure 4.41: A post-rational explanation of the landscape manipulation in the parti diagrams.

The first set of parti diagrams were drawn rather spontaneously. They all started with a basic representation of the contours that make up Signal Hill, after which loose shapes were sketched over the site. The first few parti sketches did not really have any order or rhythm to them; they were simply created on impulse and feeling.

The one thing I did try to incorporate into all of the sketches was the idea of creating artificial berms towards the western side of the development that lifts the landscape higher than the level of the building. This allows the landscape to wrap around the building, submerging certain parts or certain functions of the development inside the landscape (Figure 4.41, Figure 4.42) while also serving as a thermal mass barrier (Ingersoll, 2012, p. 583). Most of these berms are placed on the 'outside' edge of the development, creating a private 'inside' for the development. These berms can then be manipulated to create visual sightlines from inside this private space, out over the landscape (Figure 4.43). This submersion into the landscape reflects something of the model built for the concept of Mechanical Weathering, where the architecture grows out from an arterial split in the landscape (see Chapter 2.2 of this document).

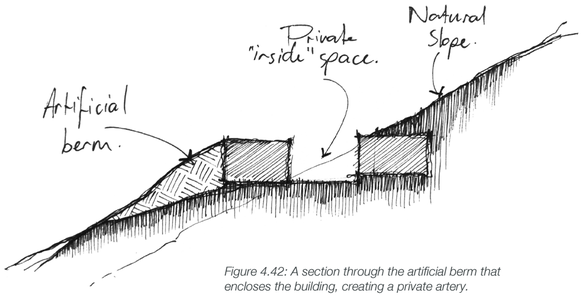


Figure 4.42: A section through the artificial berm that encloses the building, creating a private artery.

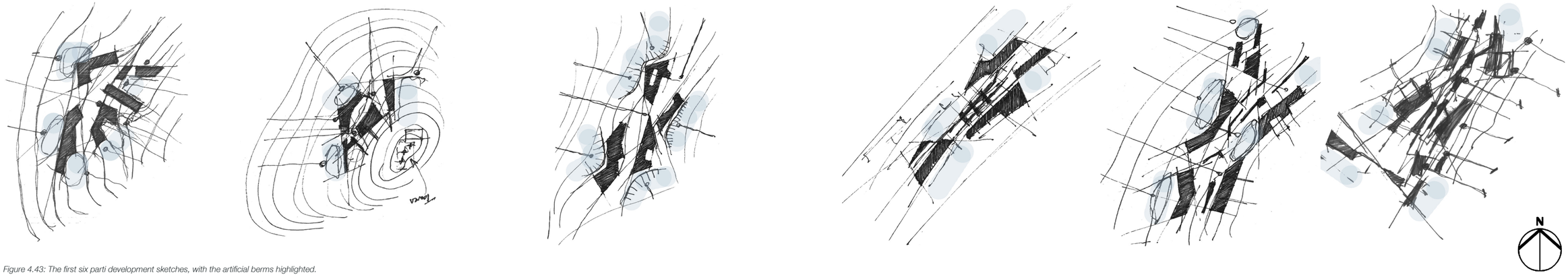


Figure 4.43: The first six parti development sketches, with the artificial berms highlighted.

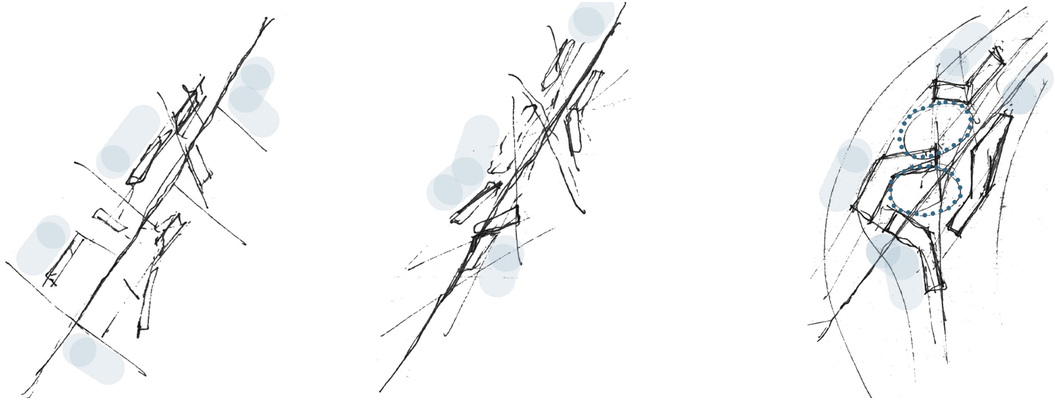


Figure 4.44: The next three parti sketches are ordered by a strong arterial axis. Fragmented functions feed off of this axis.

The next set of parti sketches started to develop a stronger feel for organisation as a development. I introduced a stronger artery that runs parallel to the contours in the middle of the development, with functions organized around this axis. I started to use fewer, more fragmented functional spaces that sit at different angles compared to the arterial axis line. Several different compositions were investigated. Within this central artery, courtyard spaces started to develop (Figure 4.44).

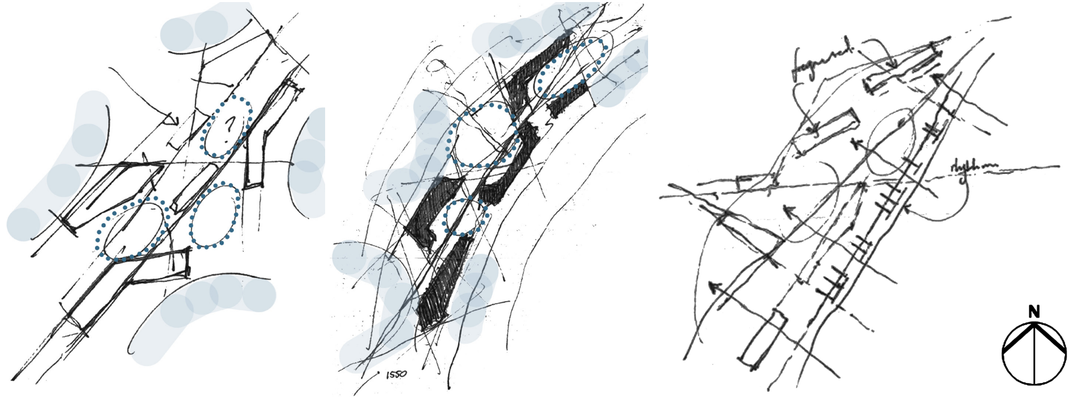


Figure 4.45: The next three parti sketches started to develop the courtyard spaces while drawing a rhythm from the landscape.

The last set of parti sketches started to develop the courtyard spaces that are formed in-between the functional shapes as pause spaces within the development. The fragmented, angled functions started to form a rhythm that juxtaposes the linear central artery. The last parti diagram in this set proved to be pivotal in the layout of the rest of the design resolution. A rigid rhythm that sits inside the slope of the hill was created as a contrast to the fragmented, arbitrary form-giving that sits directly on the opposite side of the artery. This creates the notion that the design almost 'fans out' from this rhythmic position in the landscape (Figure 4.45).

This speaks of the model built for the concept of *The Confined Expanse*, where the design spreads out over the landscape from an anchored position on the site (see Chapter 2.2 of this document). This rhythm that is created from within the landscape is investigated further in the precedent of the Rural House, which is built in La Garrotxa, Spain, by the 2017 Pritzker Prize winners RCR Arquitectes. This precedent also guided me in the development of land architecture in section, since this building is partially buried inside the crest of a hill.

Influential precedent that creates a rhythm in the landscape

Rural House

Architects: *RCR Arquitectes*
Location: *La Garrotxa, Spain*
Project year: *2007*
Project type: *Residential*

The Rural House is built on a farm portion in the La Garrotxa region of Spain and enjoys natural views all around it. The house is located on a linear ridge where one field steps down to another. The design aims to sit quietly within the landscape while framing as much of the outside views as possible. Working on such a delicate position in the landscape poses a number of challenges.

The primary challenge when working within such a pristine landscape is not to design a building that imposes itself on the landscape, but rather something that carefully places itself within the landscape. The architects addressed this by using the ridge as the spine around which the building is ordered and then burying the primary circulation corridor inside this ridge (Figure 4.47 - Figure 4.52). Access into the building is also gained from this subterranean level, so the visitor moves down into the landscape before experiencing the architecture and the views that are captured from inside the building (Figure 4.51).

The living spaces feed off of this subterranean circulation corridor towards the most prominent southern view. These living spaces are encapsulated in rectangular, Corten steel-clad boxes that rhythmically protrude from the ridge in the landscape (Figure 4.47, Figure 4.53). The harsh materiality of the building was inspired by the client's brief, with the resulting product strengthening the connection to the ruggedness of the landscape.

Another challenge arises in the utilization of the natural views and their respective connections between the public spaces and the private living spaces, as well as the contrast between inside and outside in these spaces. As mentioned, the private living spaces are placed on the southern side of the subterranean circulation corridor, with the living space projecting itself into the landscape (Figure 4.48).



Figure 4.46: The Rural House viewed from the bottom field (Archdaily, 2017: online).

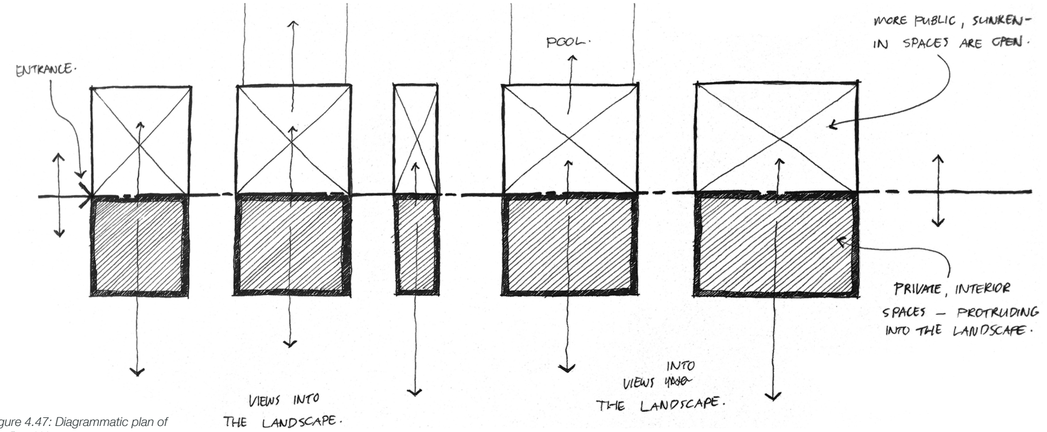


Figure 4.47: Diagrammatic plan of the Rural House.

On the other side of the circulation corridor, you find more public outside spaces like the swimming pool and outside terraces, yet these are all submerged within the landscape (Figure 4.48). The only connection that you have with the nature that surrounds you when inside these spaces is a vertical connection with the sky.

This contrast in spaces relates to my project in the sense that the birds, the primary user, becomes the primary dictator of building orientation and the utilization of views, while the public visitor is the one that experiences the site as a journey that is cut into the landscape.

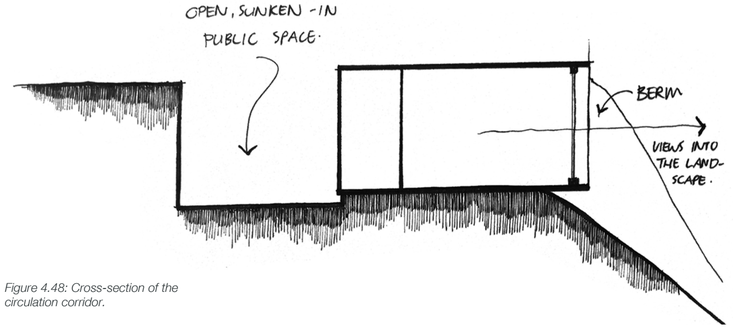


Figure 4.48: Cross-section of the circulation corridor.

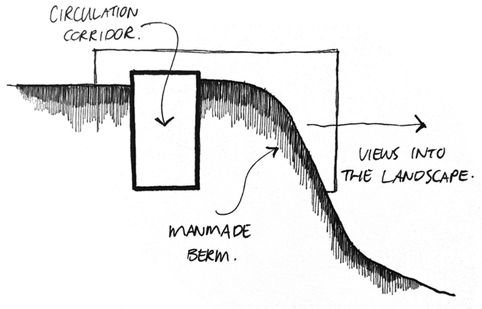


Figure 4.49: Cross-section of the living and outside spaces.

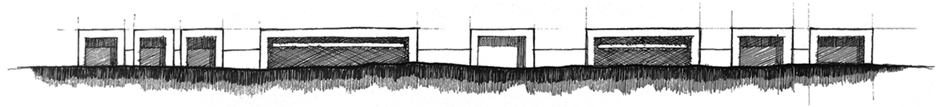


Figure 4.50: The hardly visible northern elevation of the Rural House.

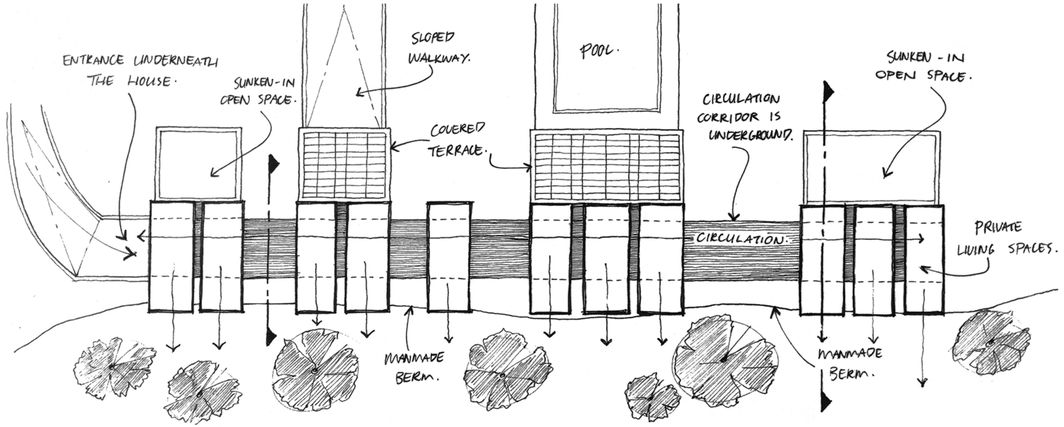


Figure 4.51: The plan of the Rural House.

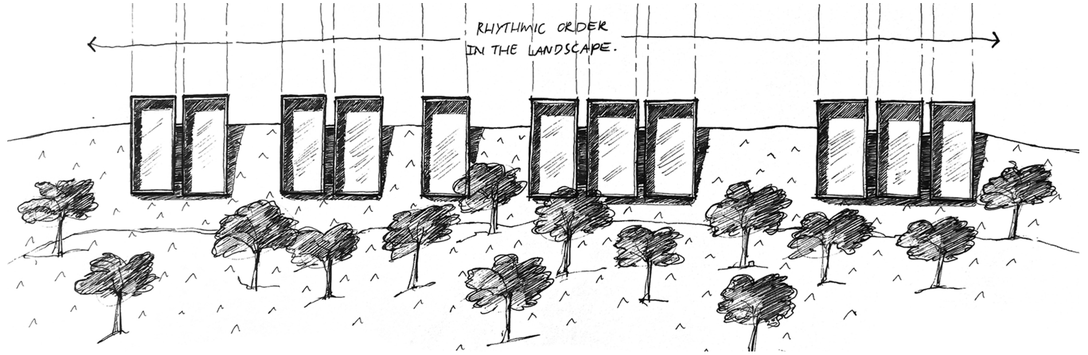


Figure 4.52: The most prominent southern elevation of the Rural House.

This unique way of engaging with the landscape embodies Ingersoll's environmental paradox perfectly. The very act of trying to create a dwelling space that is placed inside the natural environment with views extending over the landscape actually displaces the natural relationships that existed prior to the building's existence. However, the resulting architectural creation ends up meeting nature halfway as a lived experience within the building.

As mentioned earlier, the analysis of the Rural House helped me in investigating the connection between the submerged building and the natural site in section. The dialogue between open and enclosed space, vertical and horizontal views, and inside and outside creates the distinction between public and private spaces. These elements constantly remind the visitor where they are in relation to the nature that surrounds them while moving through the building.

I used these principles to start exploring ways in which changes in elevation, as well as different views from within the development, can start guiding the placement of functions and dictating the use of space inside the development. The starting point for this exploration was the central artery that was identified in Figure 4.44 and the functions that will define this axis.

Figure 4.53 and Figure 4.54 looks at the way in which a private function can be placed inside the slope of the hill and then using the natural gradient to lower the artery that runs along the edge of the private function. The avian enclosures where the raptors live are a good example of such a private function. The private function will then look over the artery, which will most likely be used as a movement space. Other functions can then be placed inside the artificial berm to define the artery and focus it inward, while the private function can enjoy views over these other functions and into the landscape.

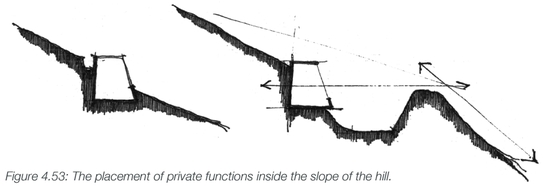


Figure 4.53: The placement of private functions inside the slope of the hill.

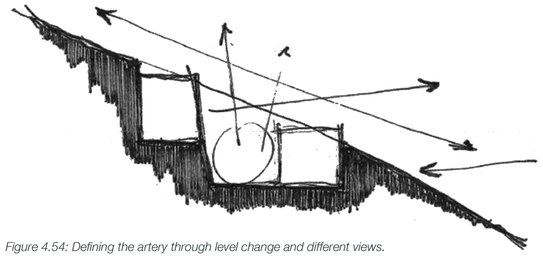


Figure 4.54: Defining the artery through level change and different views.

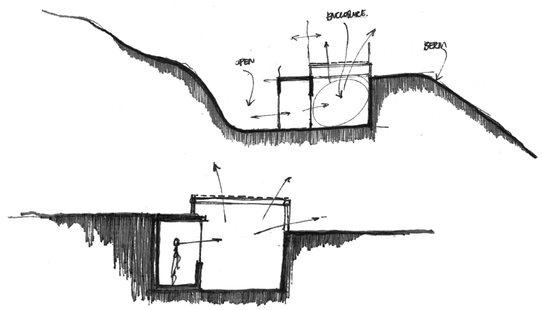


Figure 4.55: The possibility of enclosures that are buried in the landscape.

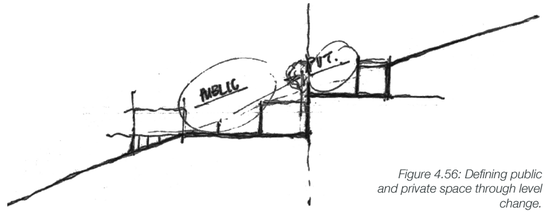


Figure 4.56: Defining public and private space through level change.

Figure 4.55 briefly looks at the possibility of burying some of the private enclosures inside the landscape or enclosing it with an artificial berm. The first diagram places the enclosure inside the artificial berm, forcing it to open up towards the artery. The next diagram completely submerges the enclosure and the walkway that gains access to the enclosure inside the landscape. Although these approaches were considered, they proved to be slightly illogical since the raptor doesn't really have any view out of the enclosure in either of them. This does not reflect the raptor's best interests.

Figure 4.56 explores the option of splitting the central artery through its length into two different terraces with differing heights. The notion behind this split is to create a division between public and private space within the development. The private functions will be placed on the higher terrace, allowing these functions to look out over the rest of the development and into the landscape. The public functions will have a visual connection to the upper terrace, but the public visitor will not be able to go to that terrace.

This idea proved to be a successful way of dealing with both the slope of the site as well as the division between public and private space. This difference in level height was carried on throughout the design development and into the final design resolution.

7 – Moving from parti towards functionality

Splitting the central artery into two terraces that step down with the slope of the landscape to dictate private and public spaces allowed me to start defining functions within the development. The private upper terrace was would primarily be focused on the falcon breeding enclosures as this space fits the functional requirements of these enclosures perfectly, as discussed in Chapter 3.5 and Chapter 4.1.1 of this document. The repetitive nature of these enclosures is used to generate the rhythmical spine that emanates from the landscape. This spine turned into the backbone of the entire development.

The parti diagrams that were discussed earlier in the document were developed into scale 1:500 ordering diagrams. These sketches formed the first exercise in generating building scale on the site. In Figure 4.57, the rhythmical spine of the breeding enclosures forms a straight line that follows the contour of the hill. From this linear spine, the arterial terraces form the mediator between the rhythmical axis and the other fragmented functions and courtyards.

In Figure 4.58, the linear spine was adapted to follow the contour line. This made the spine more dynamic as it twists with the contour of the hill. In this diagram, the central artery is seen as a green belt that runs parallel to the spine. The rest of the functions and courtyards are still undefined at this point.

The next three iterations in the planning exercise evidently show that I struggled to establish a functional composition for the fragmented functions that juxtapose the rhythmic spine of the breeding enclosures. I got stuck in various attempts to create a coherent and logical layout that still reflected the dynamism that was captured in the parti sketches. From Figure 4.59 to Figure 4.61, I attempted to create geometric shapes that read as one element while still remaining fractured into the different functions.

These attempts were not very successful, and the resulting forms seemed to be sporadically placed with awkward connections between them. Due to this arbitrary composition, I also struggled to identify the locations of different functions within the larger development. In each diagram, the functions moved around with unguided uncertainty.

To move past this uncertainty, I had to understand how to use another guiding element that feeds off of the rhythmic spine. This complementary guiding element can then be used to compose the other functions in the development around. This investigation led me to analyse the Byrne Residence by Will Bruder. The prominent use of guiding lines to define and organise spaces within this house, both on plan and section, helped me to overcome the uncertainty present in the current diagrammatic plan.

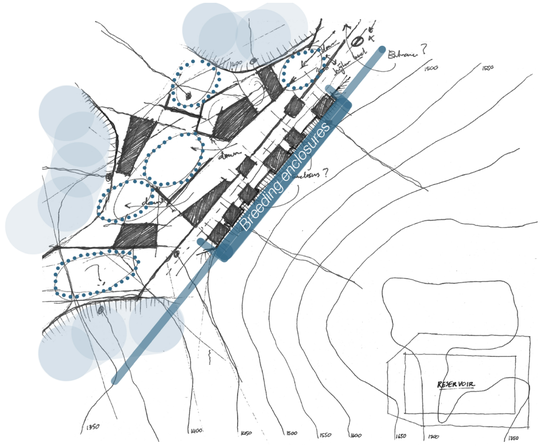


Figure 4.57: The breeding enclosures create the rhythmical spine.



Figure 4.58: The spine of the development twisted with the contour of the hill.

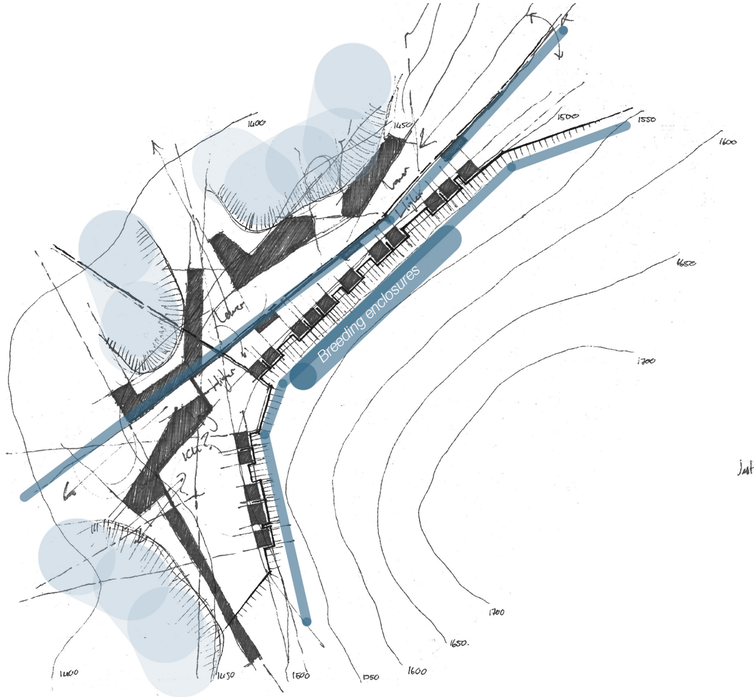


Figure 4.59: Iteration 1.

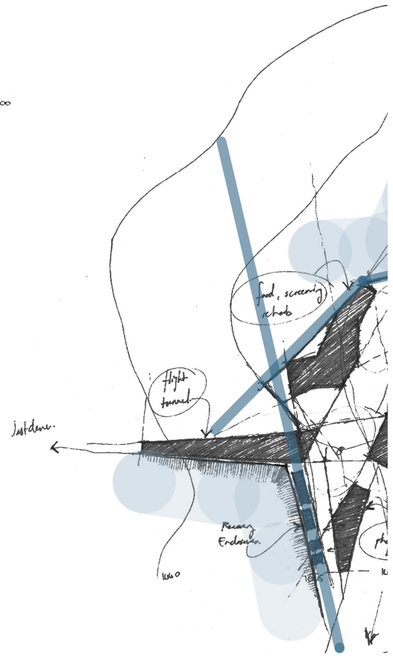


Figure 4.60: Iteration 2.

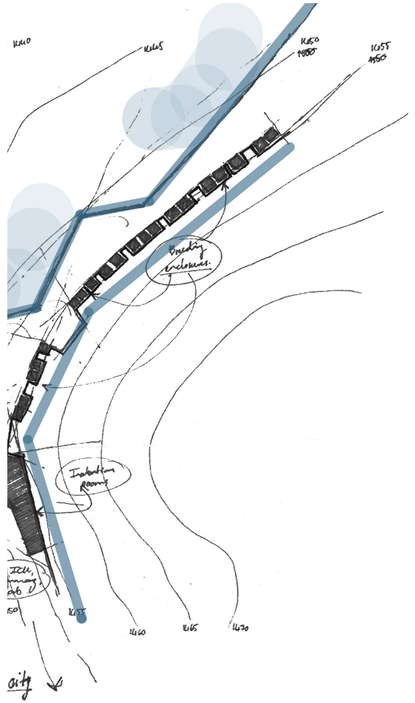
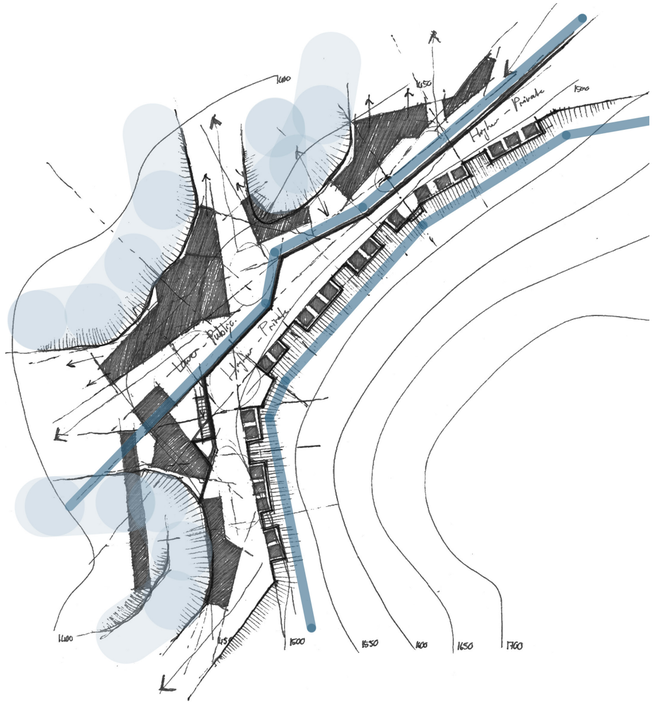


Figure 4.61: Iteration 3.



Byrne Residence

Architects: *Will Bruder Architects*
Location: *Scottsdale, Arizona, USA*
Project year: *1998*
Project type: *Residential*



Figure 4.62: The Byrne Residence within the cosmic landscape (Will Bruder Architects, 2019: online).

The Byrne Residence was conceptually visualized as a canyon residence in the desert, where the spaces are defined by the canyon's walls. The architect used strong, angular ordering lines to orientate the design inside the landscape, with the functional spaces of the house forming between the intersections of these lines (Figure 4.63).



Figure 4.63: Diagrammatic plan of the Byrne Residence.

This approach allowed the architects to have the threshold between interior space and outdoor space blurred because both types of space are defined by the same ordering lines. This approach is worked remarkably well inside the cosmic landscape, where the traditional approach is to only live inwards into courtyards and interior spaces (Figure 4.62).

This ordering notion is carried through into the building's section as well. The typical vertical roof supports are combined with tilted stone walls, adding to the conceptual approach of a canyon house. These walls are intersected with the floor and roof planes, which create similar ordering lines to those on the plan (Figure 4.64, Figure 4.65).

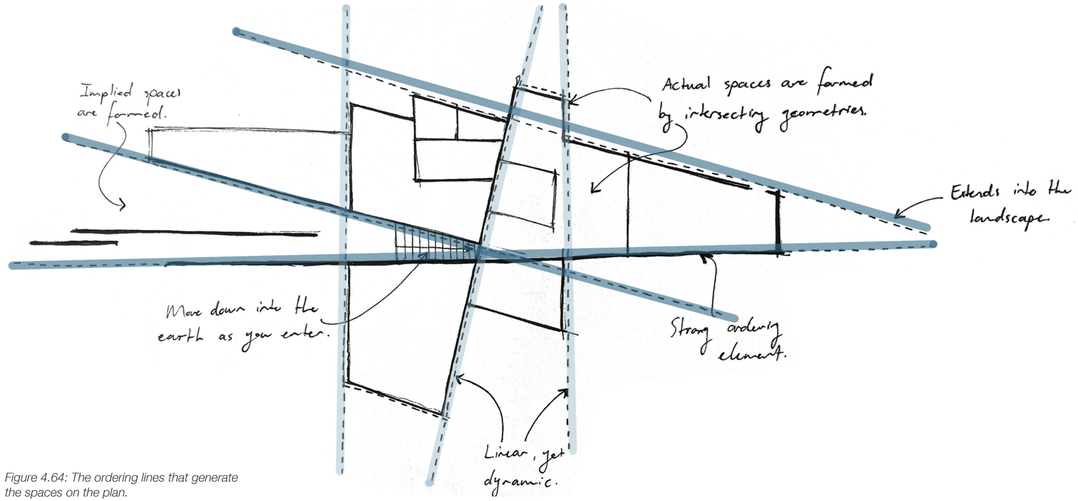


Figure 4.64: The ordering lines that generate the spaces on the plan.

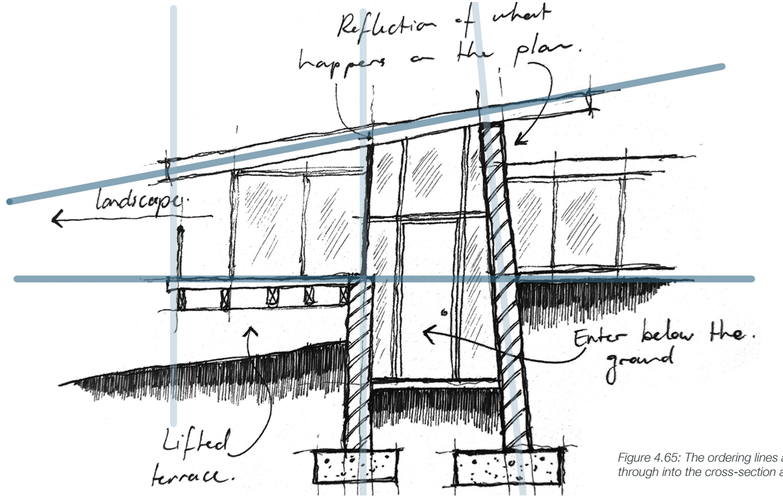


Figure 4.65: The ordering lines are carried through into the cross-section as well..

Will Bruder's composition of ordering lines is based on the simple notion of intersecting geometries. Where two perpendicular lines meet, a new space is defined. Where two lines meet at an odd angle, a different type of space is created. In the Byrne Residence, Bruder created different spaces that are inherently connected to one another because they were generated from the same ordering line.

I adopted this approach towards organisation into the design of the Avian Breeding Centre so that I could visually link different functions together, without putting them underneath the same roof. This eventually led to the creation of harmony and unity within the design development.

To achieve this harmony, I started with the same line that curls around the contour of Signal Hill that was developed from the parti sketches. Another line that is perpendicular to a segment of the spine offsets the spine and creates an axis in the development.

Lastly, lines perpendicular to the linear axis were drawn. These lines are intermitted with an extension of the spine, creating a series of rhythms that run through the development and into the landscape. These regulating lines remained the organizing tool for the plan throughout the rest of the design development (Figure 4.66).

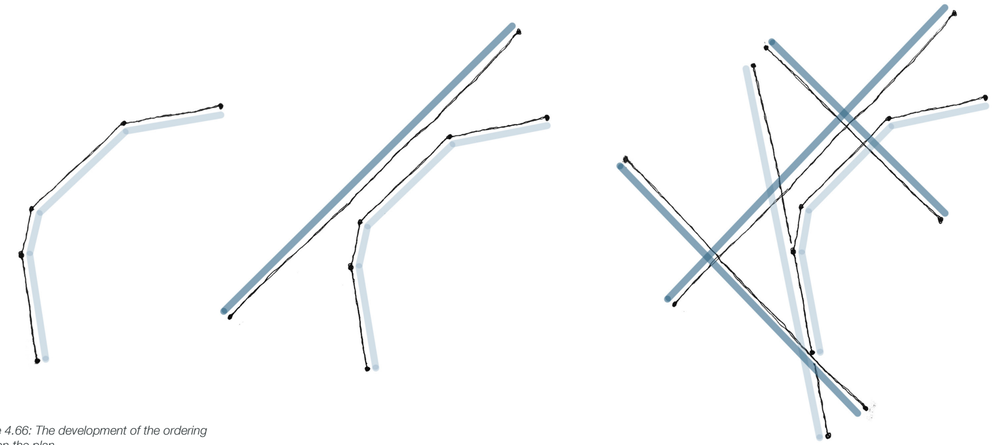


Figure 4.66: The development of the ordering lines on the plan.

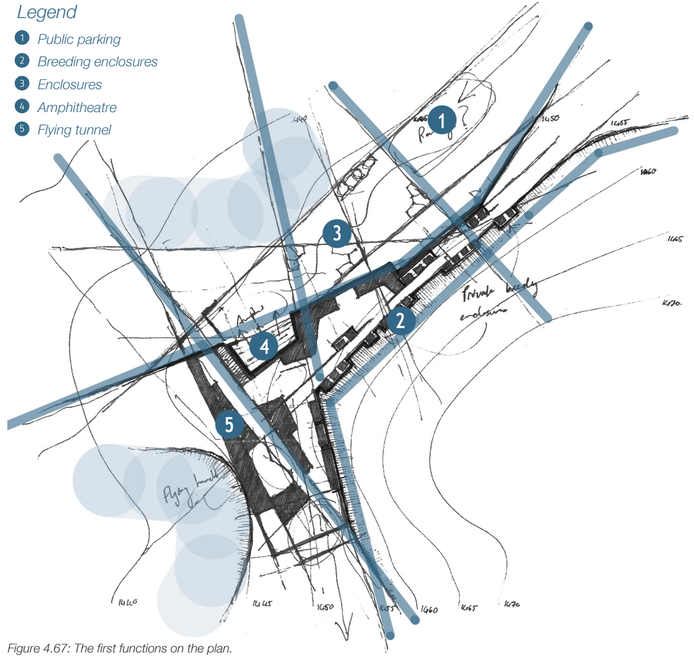


Figure 4.67: The first functions on the plan.

Figure 4.67 is the first diagram where the location of some functions are established within the regulating lines. The public parking space (1) is at the northern end of the development since this edge is the closest to the existing access road on the site. This eventually moved closer to this access road to incorporate a meandering footpath towards the Avian Breeding Centre.

The breeding enclosures (2) still generate the rhythmical spine. The enclosures that the public can visit (3) are placed on the lowest level of the site towards the north, close to the public parking space. These enclosures are divided into pods with a meandering footpath woven in-between the enclosures. The central artery that is formed between (2) and (3) becomes a terrace that facilitates movement between the various private functions.

The seating amphitheatre (4) where the flying shows take place is wedged in-between two of the regulating lines. This space opens with views into the landscape, while perches are placed in this landscape for use during the flying show. The flying tunnel (5) is placed on the southwestern edge of the development as a linear terminating element.

This diagrammatic plan (Figure 4.67) was developed further into Figure 4.68. This plan is divided into two terraces (defined by the blue line) that step down with the landscape. The lower terrace contains all the functions relating to the public visitor, while the top terrace contains all the private avian and staff-related functions. In Figure 4.68, the regulating lines that extend past the confines of the selected site are strengthened are embodied through the use of trees that defines these lines on an experiential level.

The public parking area was removed from the immediate development to a location next to the access road of the site. The public approach is defined through a meandering footpath (1) that runs next to an artificial berm and terminates in the reception, curio shop, and restrooms. From here, it weaves through the clusters of avian enclosures (3).

The staff offices (8) and the food delivery unit (9) is centrally located on the upper terrace, allowing for easy access to the different parts of the development. The food delivery unit is also located closest to the existing service road that connects with the central artery of the proposed development (10). The last function that is added in Figure 4.68 is the rehabilitation clinic (7) that hosts a small surgery facility, an X-ray room, ICU rooms, a pharmacy, and an incubation room.

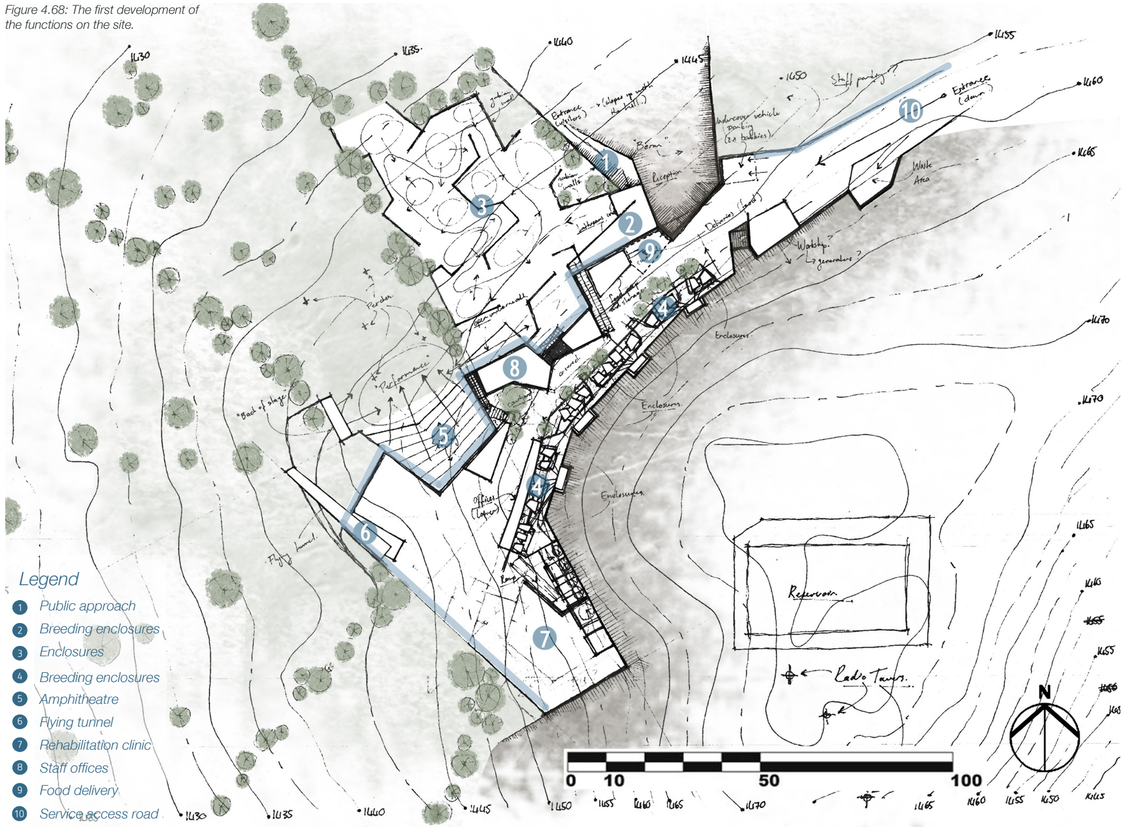
The next phase of the design process focused on the massing of the different functions on the site. Two consecutive development models at scale 1:500 were built based on the plan in Figure 4.68. These models were completed around the second External Design Review in the middle of June 2019 (Figure 4.69 - Figure 4.76). Although these models are not too dissimilar, they were both very successful in pinpointing the exact positions, lengths, and distribution of the regulating lines on the site. Through these models, the character of the breeding enclosures that are buried in the slope of Signal Hill also became clear.

Between the two models I looked at different opportunities to connect the loose buildings of different functions with a permeable overhead screen that defines walkways and courtyards throughout the upper terrace. The most drastic development between the two models lies in the flying tunnel. In the first iteration, the tunnel is a linear element that is partially buried in an artificial berm on the southwestern edge of the development (Figure 4.71).

However, in the second iteration, the morphology takes on quite the opposite direction. This came about discussions about the elements that could be celebrated within the design. The breeding enclosures already form a rhythm in the landscape through their prominent position against the slope of the hill, so it made sense to connect this celebration to another element that relates directly to the primary user: the raptor.

In the second iteration, the flying tunnel is still a linear element; however the whole tunnel protrudes from the landscape through a giant cantilever. This development came about after the following comment by Jan-Hendrik Nel, so credit where it is due: “Why can’t we make the entire flying tunnel fly?” This started an entirely new investigation into the concept, morphology, and construction of this element. The 40m long element became anchored in the landscape at one end, while the other end flies over the landscape as a seemingly endless extension of the landscape.

Figure 4.68: The first development of the functions on the site.



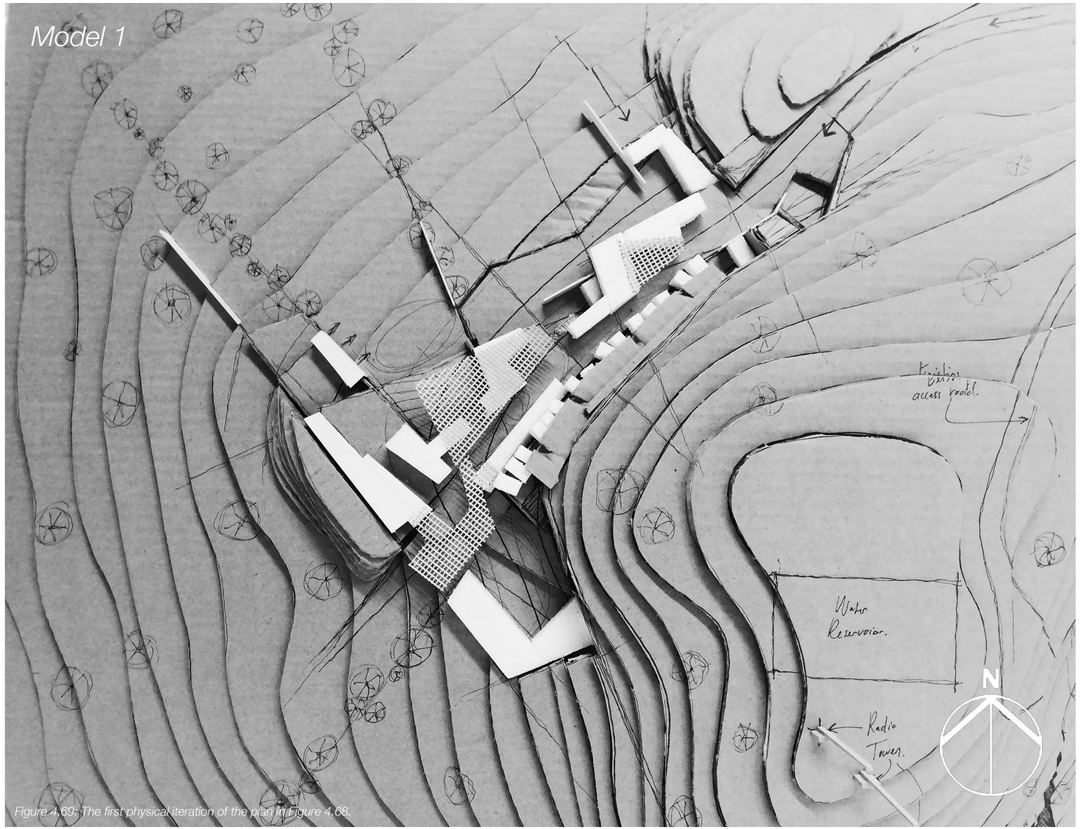
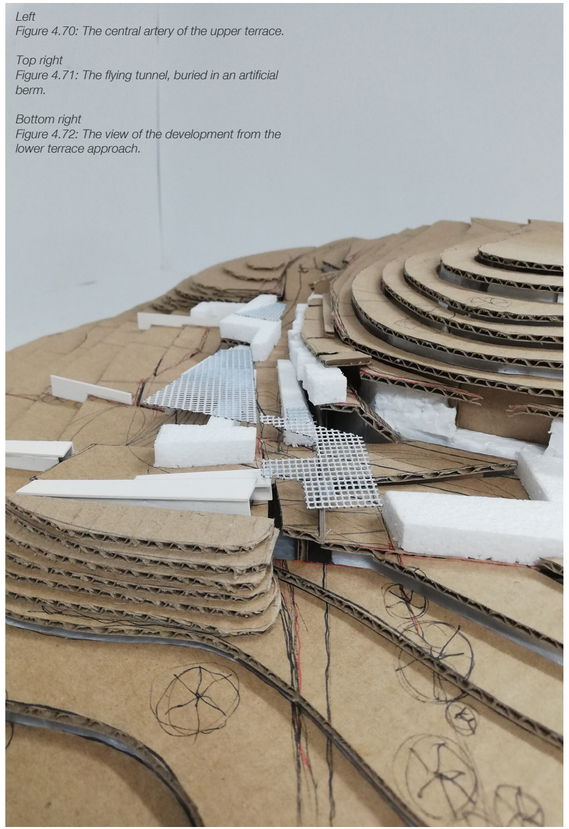


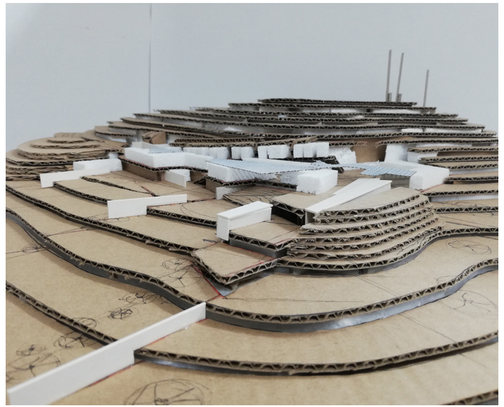
Figure 4.69: The first physical iteration of the plan in Figure 4.68.

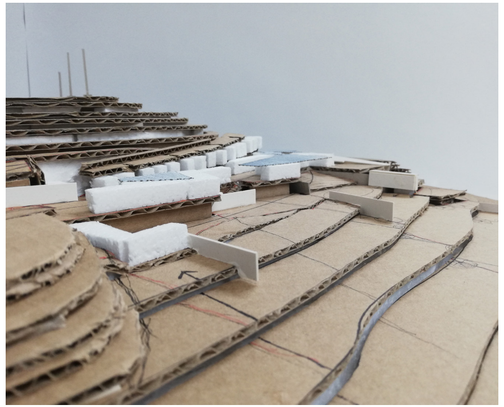
Left
Figure 4.70: The central artery of the upper terrace.

Top right
Figure 4.71: The flying tunnel, buried in an artificial berm.

Bottom right
Figure 4.72: The view of the development from the lower terrace approach.







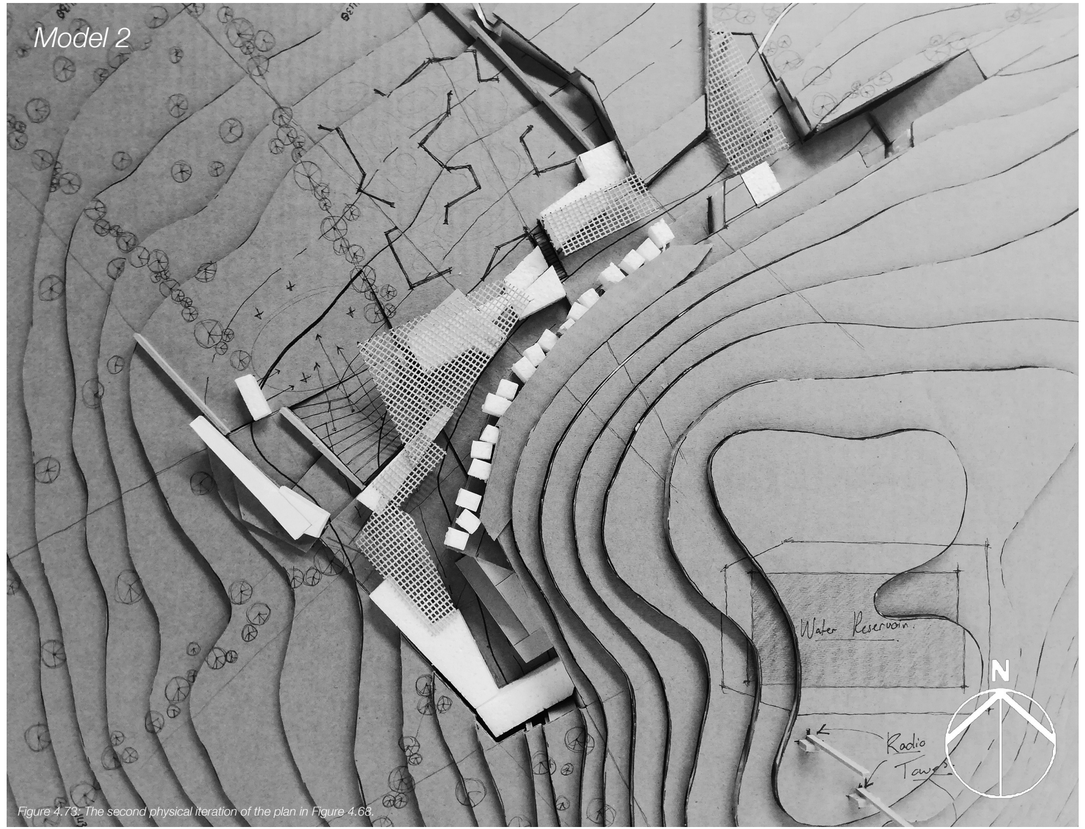
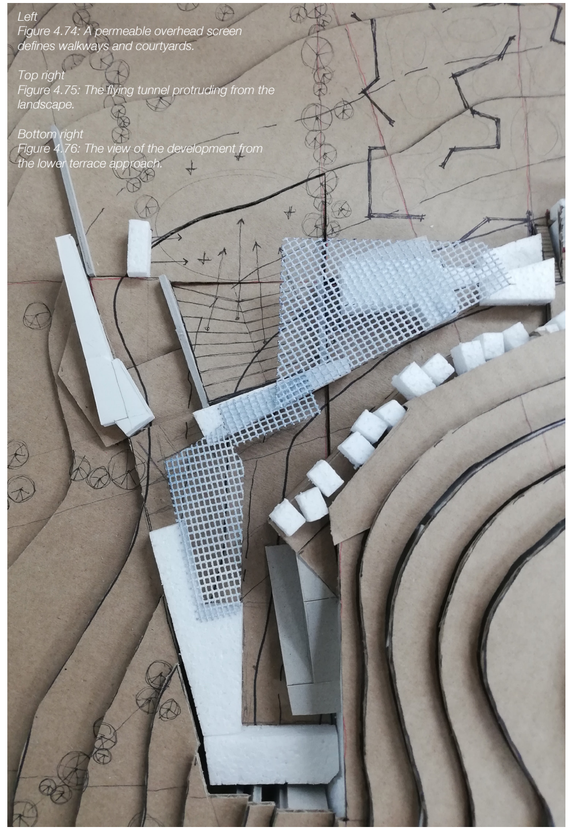


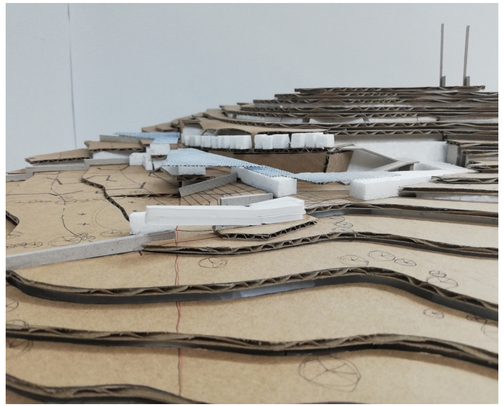
Figure 4.73: The second physical iteration of the plan in Figure 4.63.

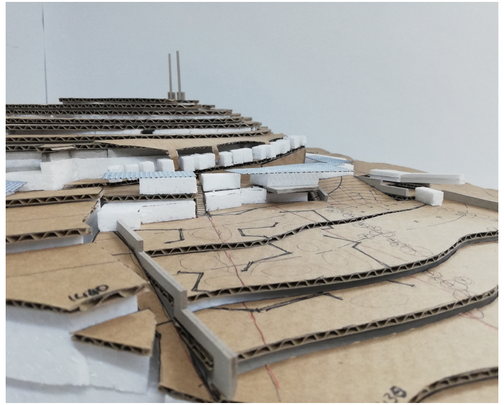
Left
Figure 4.74: A permeable overhead screen defines walkways and courtyards.

Top right
Figure 4.75: The flying tunnel protruding from the landscape.

Bottom right
Figure 4.76: The view of the development from the lower terrace approach.







8 - Facilitating the connection between nature and building through built form

The interface between the building and the natural site is integral to the way that the building is viewed in the landscape. Reflecting on Ingersoll's definition of land architecture (Ingersoll, 2012, p. 583), one can argue that this connection point between man and nature will dictate if the building will be seen on its own, or if it will be seen as a part of the slope of the hill.

The breeding enclosure

Since the inception of the avian breeding enclosure's location as the spine of the development, it was evident that these enclosures will form a subtle part of the slope of Signal Hill. The aim of these enclosures is to firstly embody all the functional requirements for these breeding enclosures, as set out in Chapter 3.5 and Chapter 4.2 of this document.

Once this is achieved, the enclosures aim to reflect the concepts of *The Confined Expanse* and *Mechanical Weathering* (Chapter 2.2) as a lived experience. Lastly, the breeding enclosures aim to mediate a dialogue between man and nature, both as a reflection of the program of the project, and as the meeting point between architecture and the natural landscape. This section of this chapter forms a visual narrative of the development of the breeding enclosure (Figure 4.77 – Figure 4.86). This narrative consists mainly of sectional development since this is the best way to communicate the structure, the way it is anchored in the earth, and the connection with the sky.

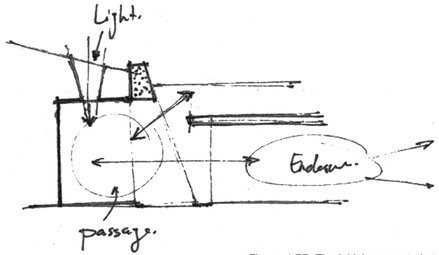


Figure 4.77: The initial concept sketch for the breeding enclosures.

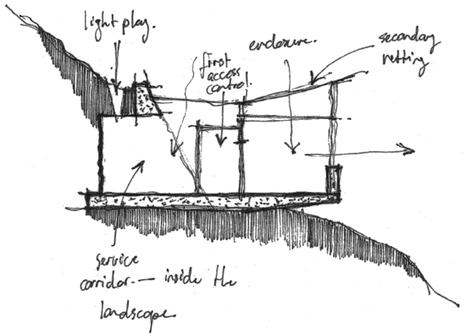


Figure 4.78: The first morphological response.

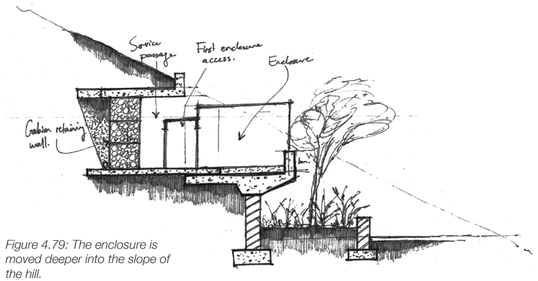


Figure 4.79: The enclosure is moved deeper into the slope of the hill.

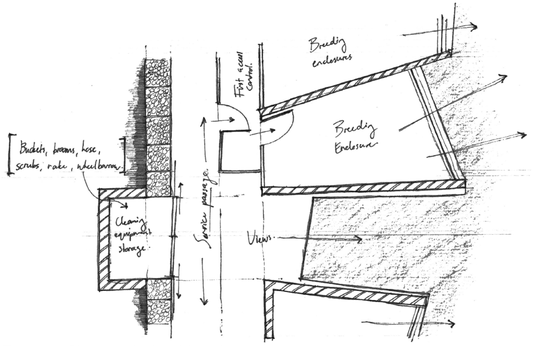


Figure 4.80: Diagrammatic plan of the various elements around the enclosure.

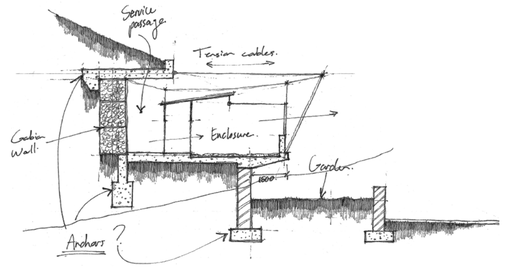


Figure 4.81: The secondary covering is added as an element that embodies the tectonic extension of the landscape.



Figure 4.82: Sectional model of this development phase.

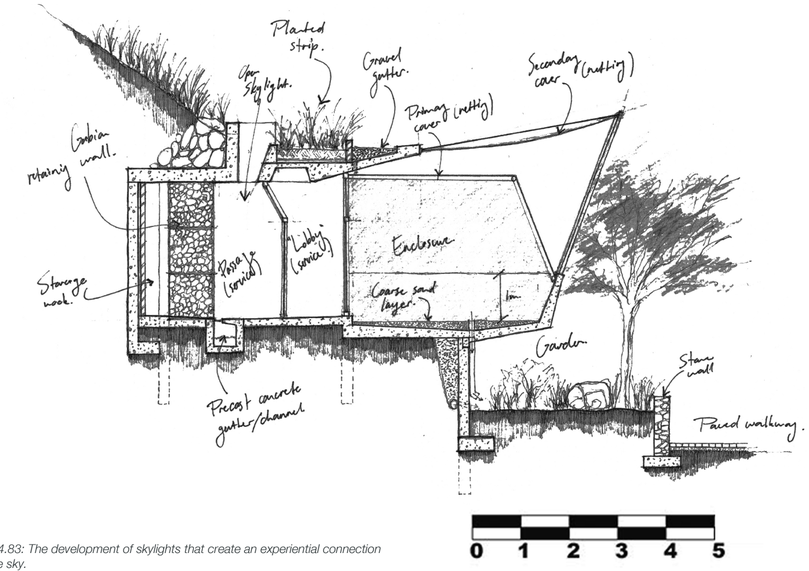


Figure 4.83: The development of skylights that create an experiential connection with the sky.

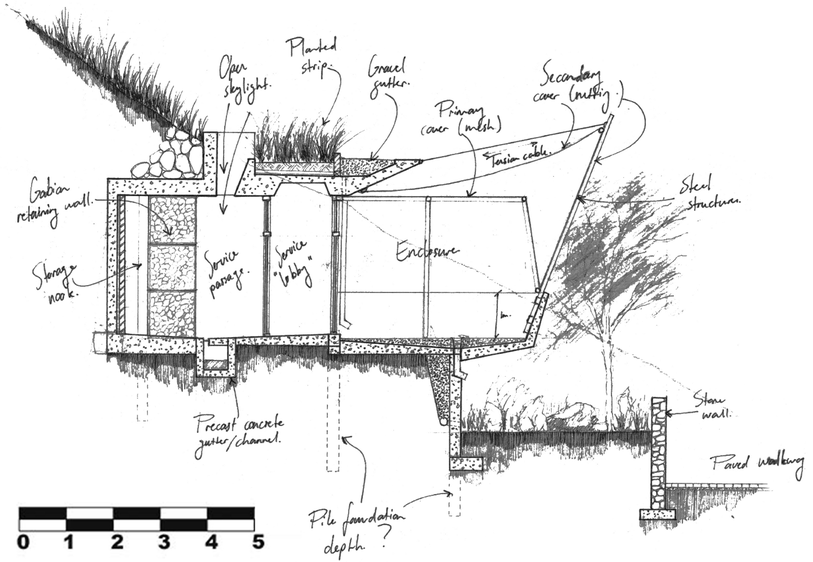


Figure 4.84: The final resolution of the breeding enclosure.

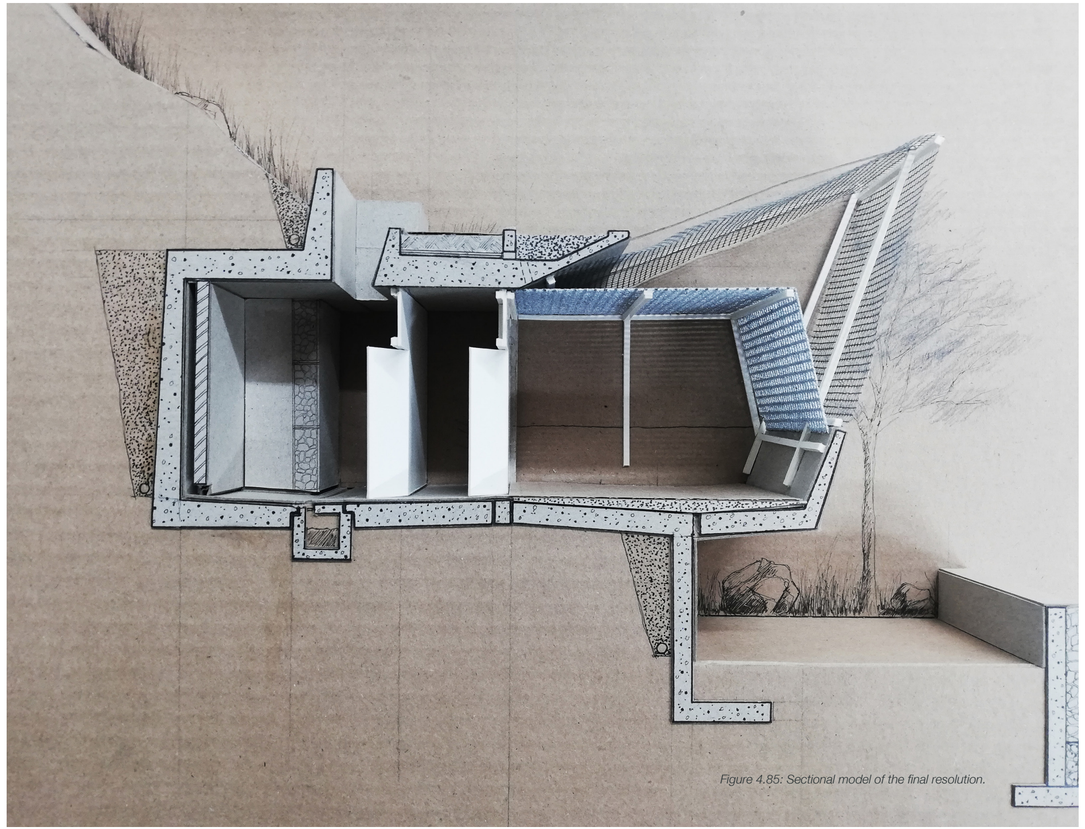


Figure 4.85: Sectional model of the final resolution.

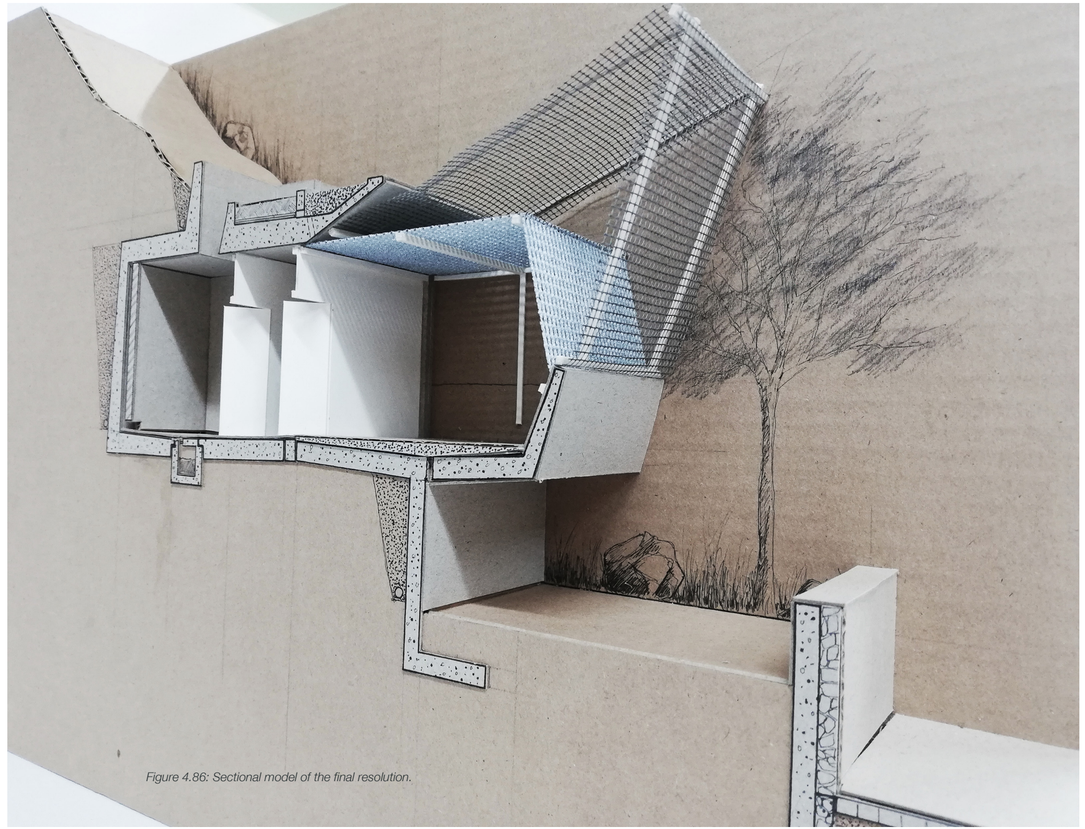


Figure 4.86: Sectional model of the final resolution.

The flying tunnel

As mentioned earlier, the flying tunnel was identified as an element in the design that could be architecturally celebrated together with the breeding enclosures. This celebration was developed into an embodiment of the conceptual underpinning that contrasts the heavy, anchored landscape with lightweight, tectonic elements that protrude from the landscape. The following section of this chapter forms a visual narrative of the development of the development of the flying tunnel (Figure 4.87 - Figure 4.95). This narrative also consists mainly of sectional development.

In the initial section diagram through the flying tunnel (Figure 4.87), the cantilever is still supported by a vertical strut. This support was not only visually unappealing but also seemed to contrast the notion of the tunnel as an extension of the landscape.

I eventually decided to do away with the tension cables that tie the tunnel back into the landscape as well, since this was not really a practical approach and it also did not have the visual effect that I was working towards.

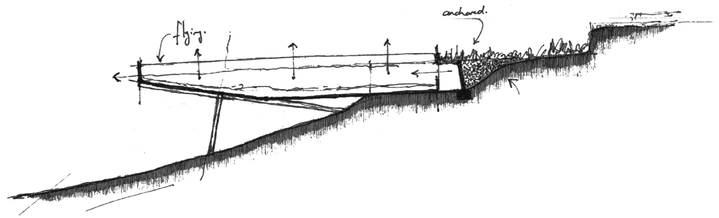


Figure 4.87: The first sectional diagram of the flying tunnel.

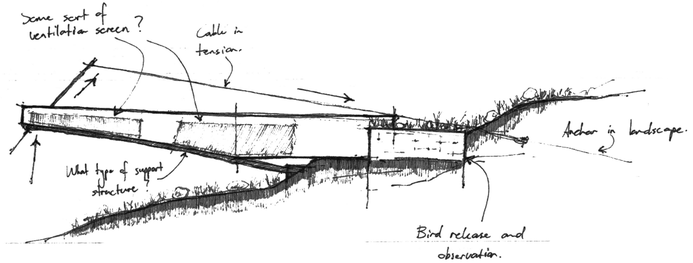


Figure 4.88: The notion of tying the tunnel back towards the landscape with tension cables was explored in this diagram.

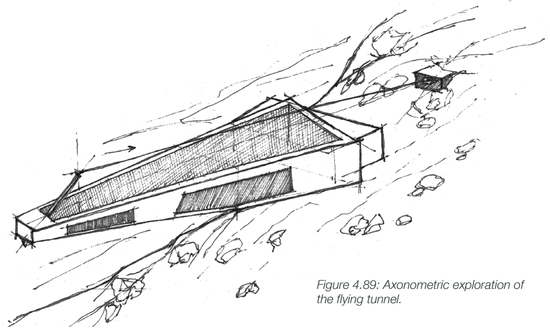


Figure 4.89: Axonometric exploration of the flying tunnel.

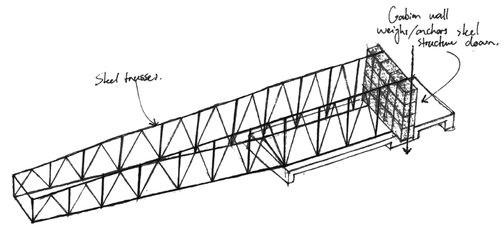


Figure 8.90: Axonometric exploration of the structure for the flying tunnel (see Chapter 3.6 of this document).

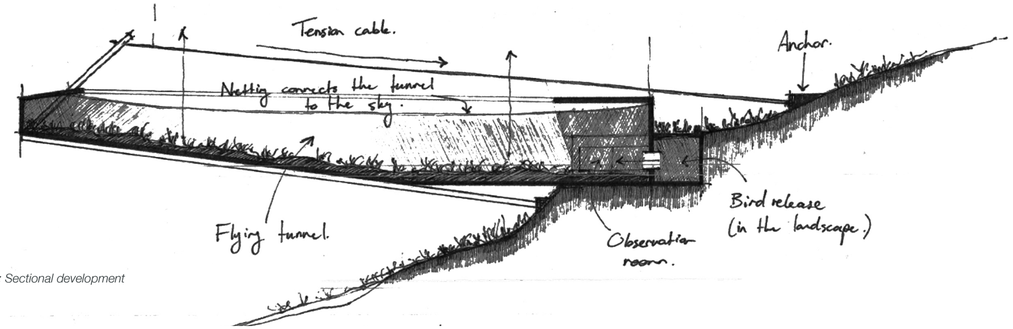


Figure 4.91: Sectional development

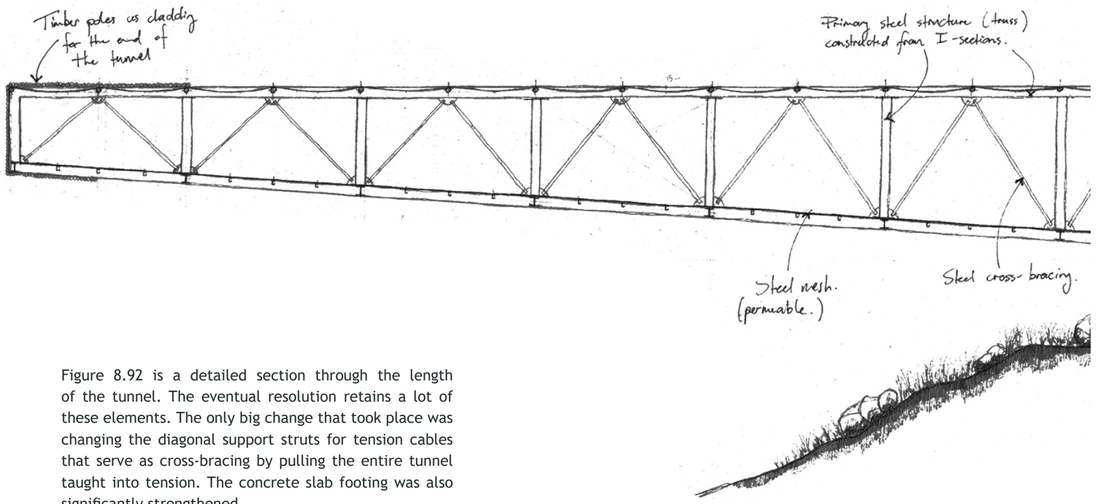


Figure 8.92 is a detailed section through the length of the tunnel. The eventual resolution retains a lot of these elements. The only big change that took place was changing the diagonal support struts for tension cables that serve as cross-bracing by pulling the entire tunnel taught into tension. The concrete slab footing was also significantly strengthened.

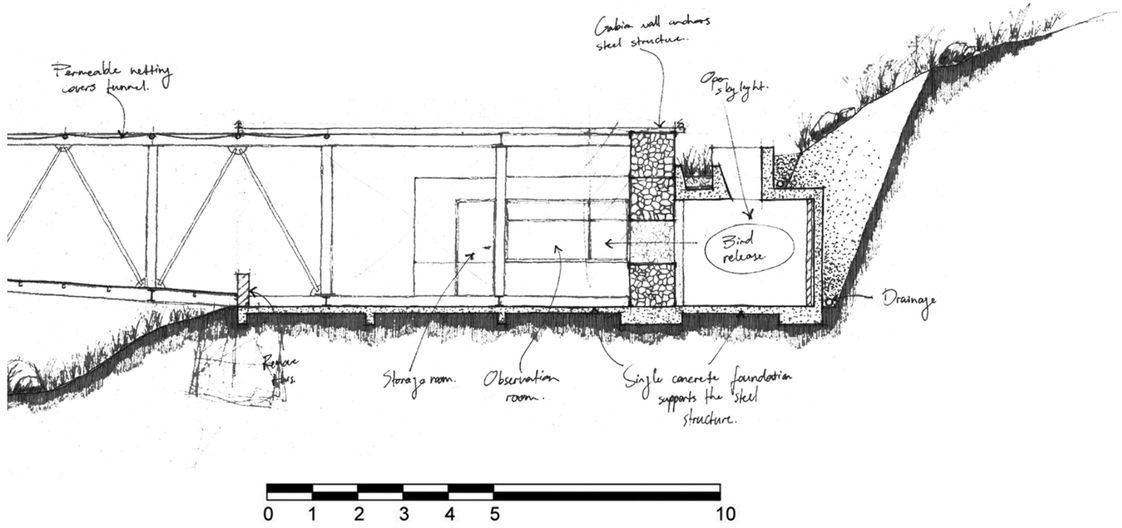


Figure 4.92: A detailed section of the flying tunnel.



Figure 4.93: The first sectional diagram of the flying tunnel.

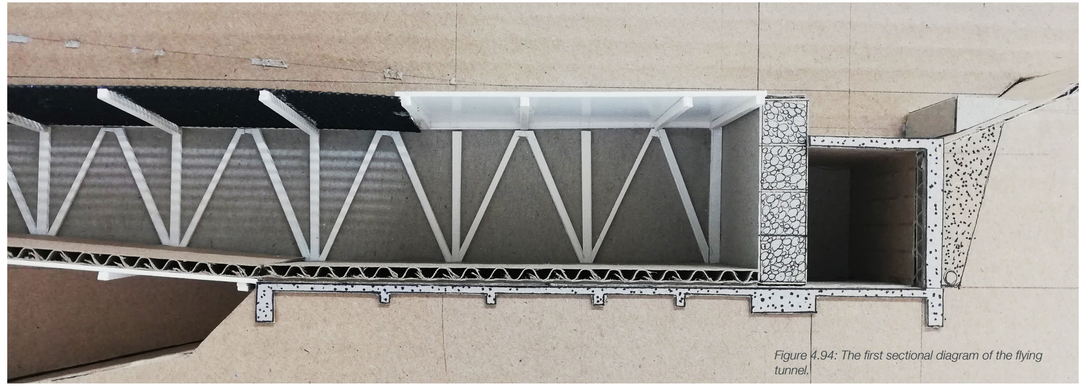


Figure 4.94: The first sectional diagram of the flying tunnel.



Figure 4.95: The first sectional diagram of the flying tunnel.

The breeding enclosure typology

The typology for the breeding enclosures that were developed earlier in this chapter was revisited in the development of the other site functions such as the staff offices, the rehabilitation clinic, and the food storage unit (Figure 4.96 – Figure 4.100). The planted roof system with the large overhangs, skylights, and gravel gutters was re-appropriated and used as a continuous binding element throughout the development. The “protruding box” that the breeding enclosures embodies was redesigned into covered balconies that have ‘wattle and reed’ panels that serve as a shading device (Figure 4.100).

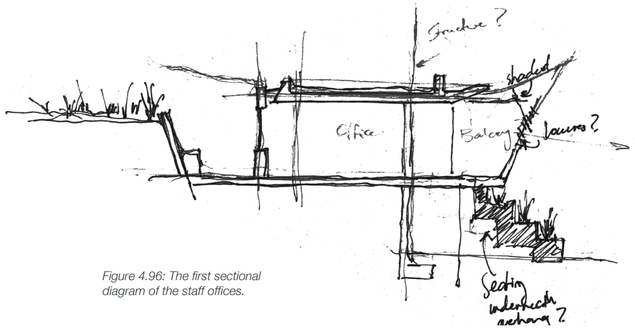


Figure 4.96: The first sectional diagram of the staff offices.

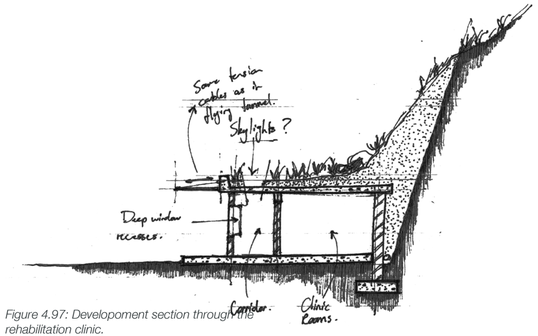


Figure 4.97: Developoment section through the rehabilitation clinic.



Figure 4.98: The re-appropriation of the breeding enclosures into the staff ofices.

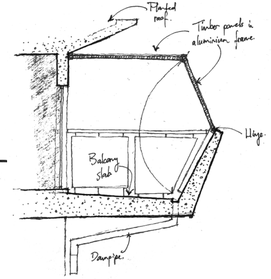


Figure 4.99: The covered balcony.

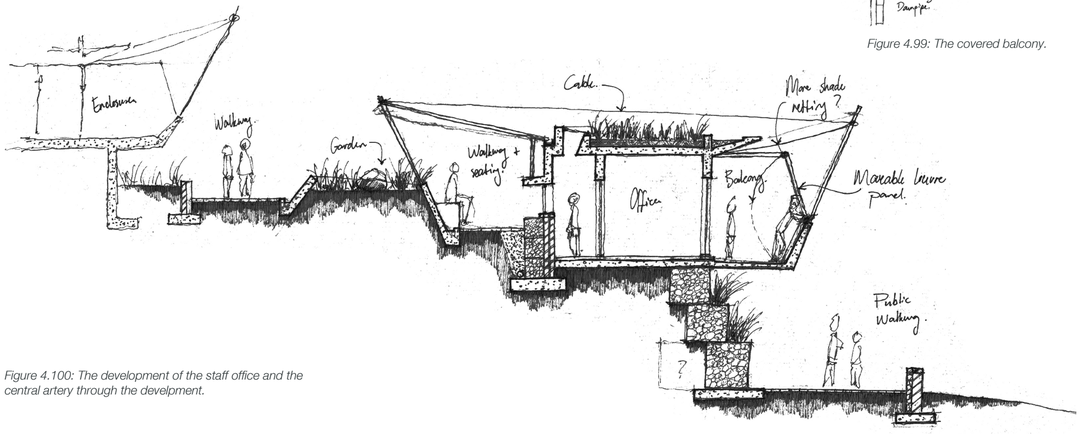


Figure 4.100: The development of the staff office and the central artery through the develpment.



Floor plan - 1st Iteration



Floor plan - 2nd Iteration



Floor plan - 3rd Iteration

The final development model photos

The final development model embodies a lot of elements that are carried through into the final model. At this stage, the planning of the project was mostly complete, and the morphology of all the different buildings on the site have been established. The rhythmical spine from the breeding enclosures still emanates through the design and landscape, with the central artery suggesting movement through the site. The public approach forms a meandering path up the hill.

However, there is one major development in this model. The flying tunnel was spontaneously and rather instinctively moved towards a new location next to and above the public approach. The primary reason for doing this was to celebrate the public entrance through the giant cantilever of the flying tunnel. The public visitor will now walk underneath this cantilever when they approach the building.

Another reason was for logistical purposes. The tunnel's previous location on the western edge of the development was slightly removed from the rest of the functions and not easily accessible, while the new location is relatively central to the other functions.

The final element that still required some development after this model was built was the public viewing enclosures on the lower terrace of the development. These enclosures break the regulating lines through poor placement and awkward connections with one another.



Figure 4.101: The composition of the different buildings in the model (photograph by Author, 2019).

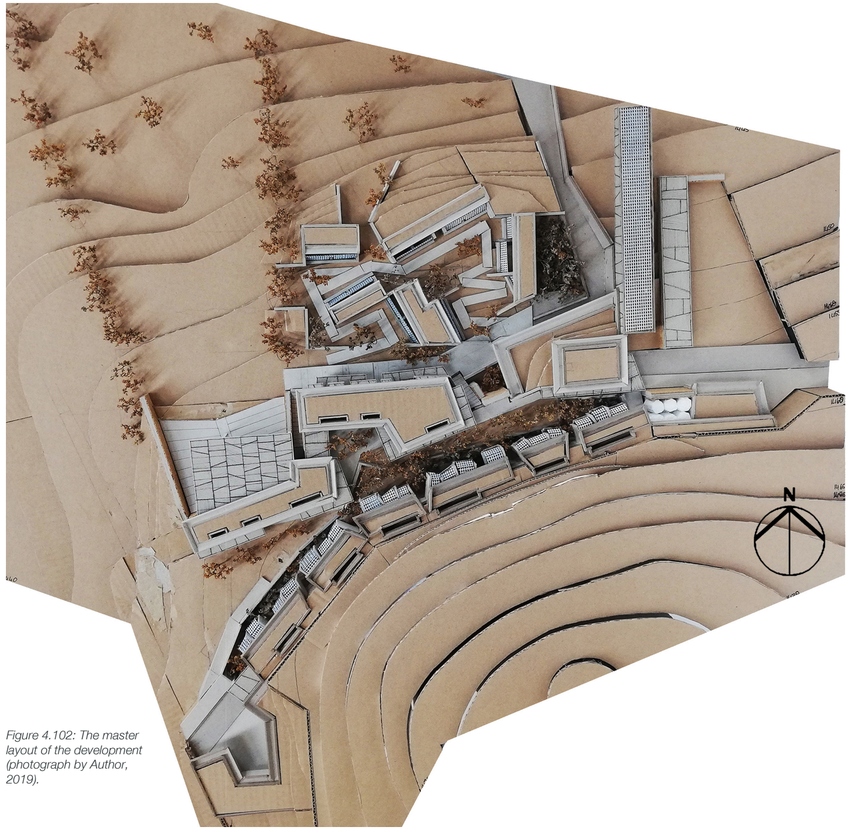


Figure 4.102: The master layout of the development (photograph by Author, 2019).

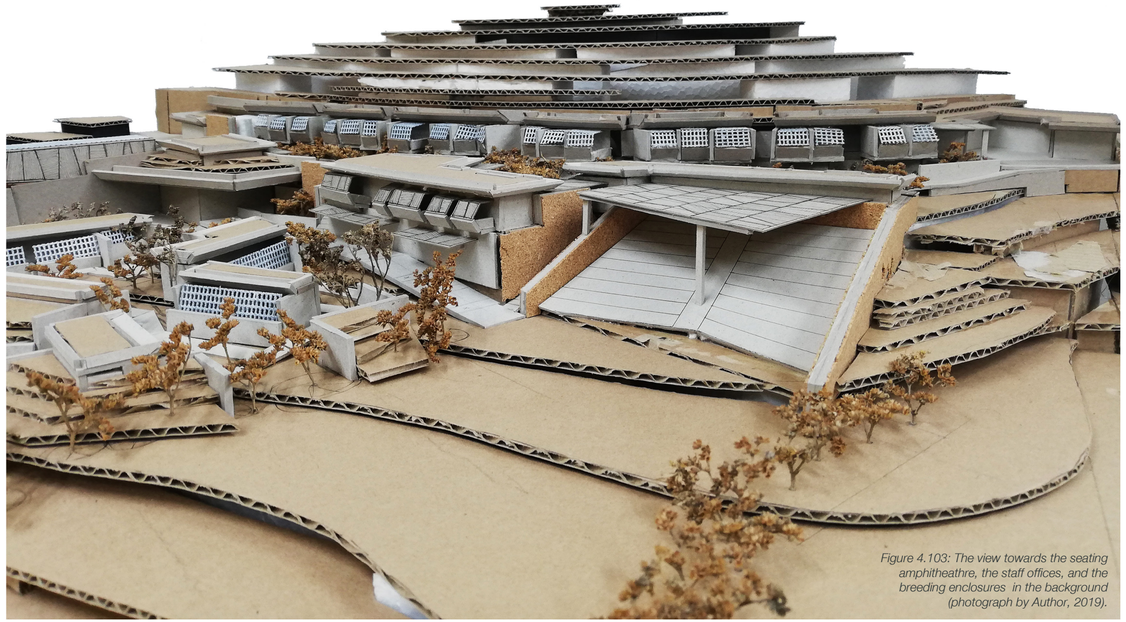


Figure 4.103: The view towards the seating amphitheathre, the staff offices, and the breeding enclosures in the background (photograph by Author, 2019).

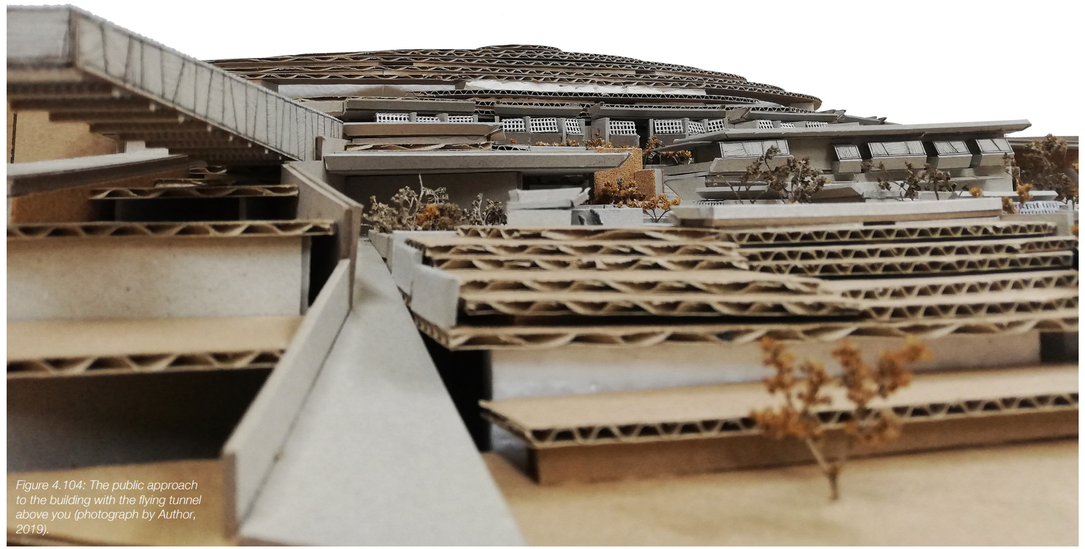


Figure 4.104: The public approach to the building with the flying tunnel above you (photograph by Author, 2019).

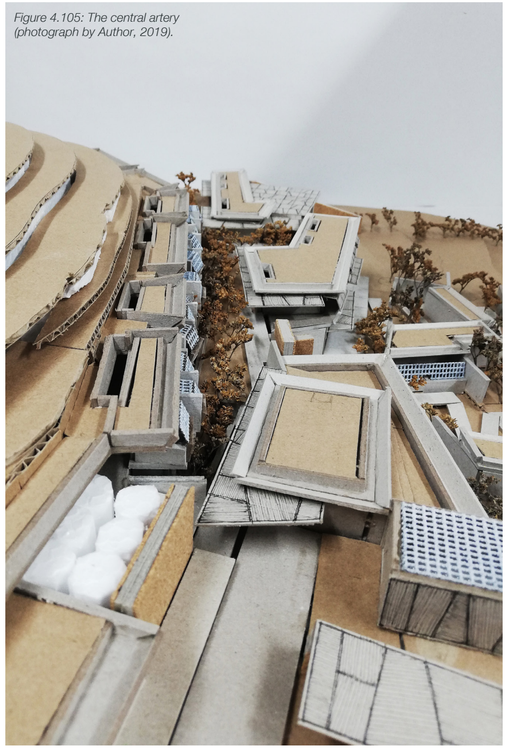


Figure 4.105: The central artery (photograph by Author, 2019).

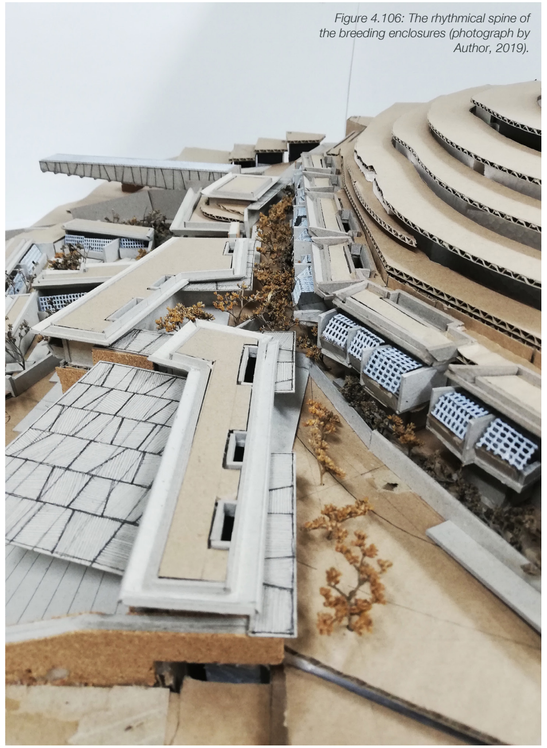


Figure 4.106: The rhythmical spine of the breeding enclosures (photograph by Author, 2019).

Part 5

The final design synthesis and technical resolution

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5.1 The final design synthesis

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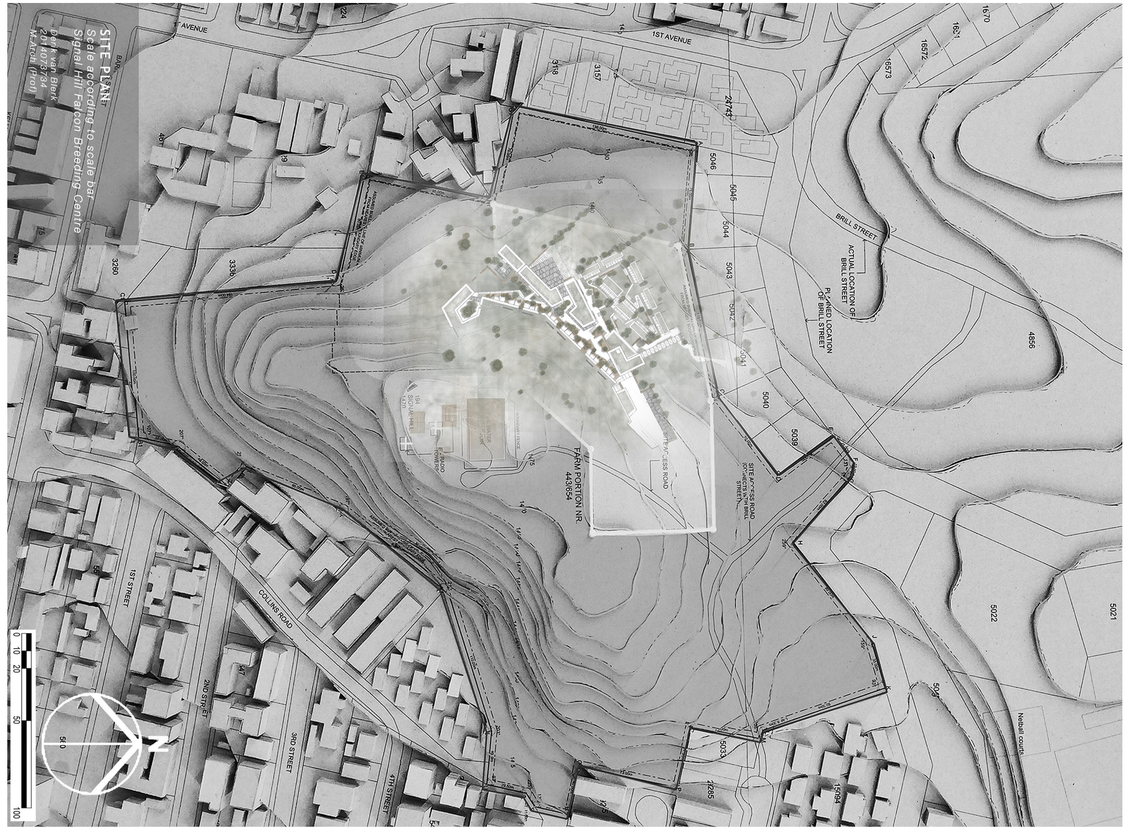



UPPER TERRACE PLAN
Scale 1:200
Signal Hill Falcon Breeding Centre
Derik van Blerk
2014073734
M.Arch (Prof)
N
0 5 10 20 50
LEGEND
1 - Raptor breeding enclosures (20)
2 - Enclosure cleaning equipment storage
3 - Surgery unit
4 - Dispensary and X-ray room
5 - Site workshop and generator rooms
6 - ICU and raptor incubation rooms
7 - Central observation and IT room
8 - Clinic laundry room
9 - Courtyard
10 - Staff and service access road
11 - Staff parking
12 - Site workshop
13 - Generator and pump rooms
14 - Water collection and storage


Exisiting ClearVu fence
Exisiting water reservoir
Three exisiting radio towers
ROOF PLAN
Scale 1:200
Signal Hill Falcon Breeding Centre
Derik van Blerk
2014073734
M.Arch (Prof)
N
0 5 10 20 50
LEGEND
1 - Raptor breeding enclosures (20)
2 - Rehabilitation clinic and ICU enclosure unit
3 - Staff and service access road
4 - Staff parking
5 - Site workshop and generator rooms
6 - Food delivery, preparation and storage
7 - Flying tunnel observation room
8 - Flying tunnel
9 - Reception and boardroom
10 - Staff offices
11 - Staff lounge and kitchen
12 - Staff locker and change rooms
13 - Staff overnight rooms (3)
14 - Private staff courtyard
15 - Public entrance approach
16 - Public reception, information center, and curio shop
17 - Permanent raptor enclosures (20)
18 - Covered seating for flying show
19 - Performance space for flying show

LOWER TERRACE PLAN

Scale 1:200

Signal Hill Falcon Breeding Centre

Derik van Blerk
2014073734
M.Arch (Prof)

0 5 10 20 50

LEGEND

1 - Reception, curio and tuck shop
2 - Accessible WC
3 - Accessible WC
4 - Public male WC
5 - Public male WC
6 - Permanent raptor enclosure (20)
7 - Permanent raptor enclosure (20)
8 - Main walkway
9 - Grass rest space
10 - Seating space

MAIN TERRACE PLAN

Scale 1:200

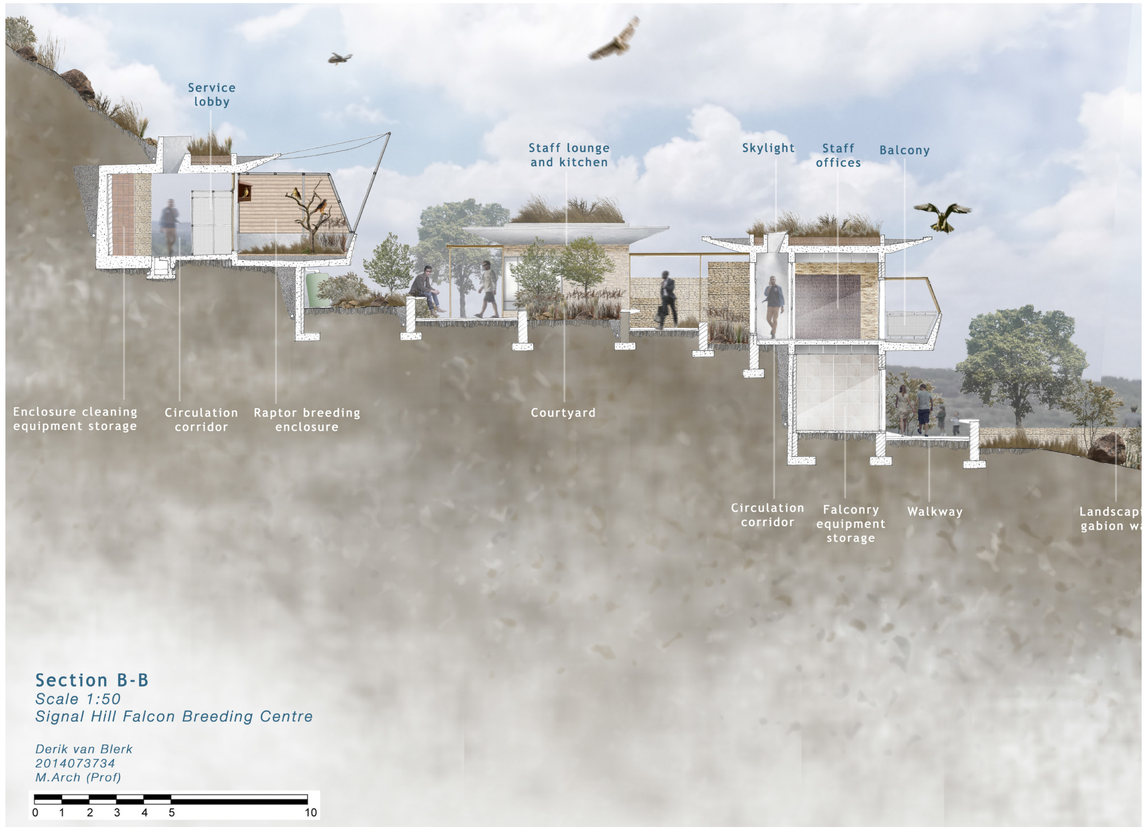
Signal Hill Falcon Breeding Centre

Derik van Blerk
2014073734
M.Arch (Prof)

0 5 10 20 50

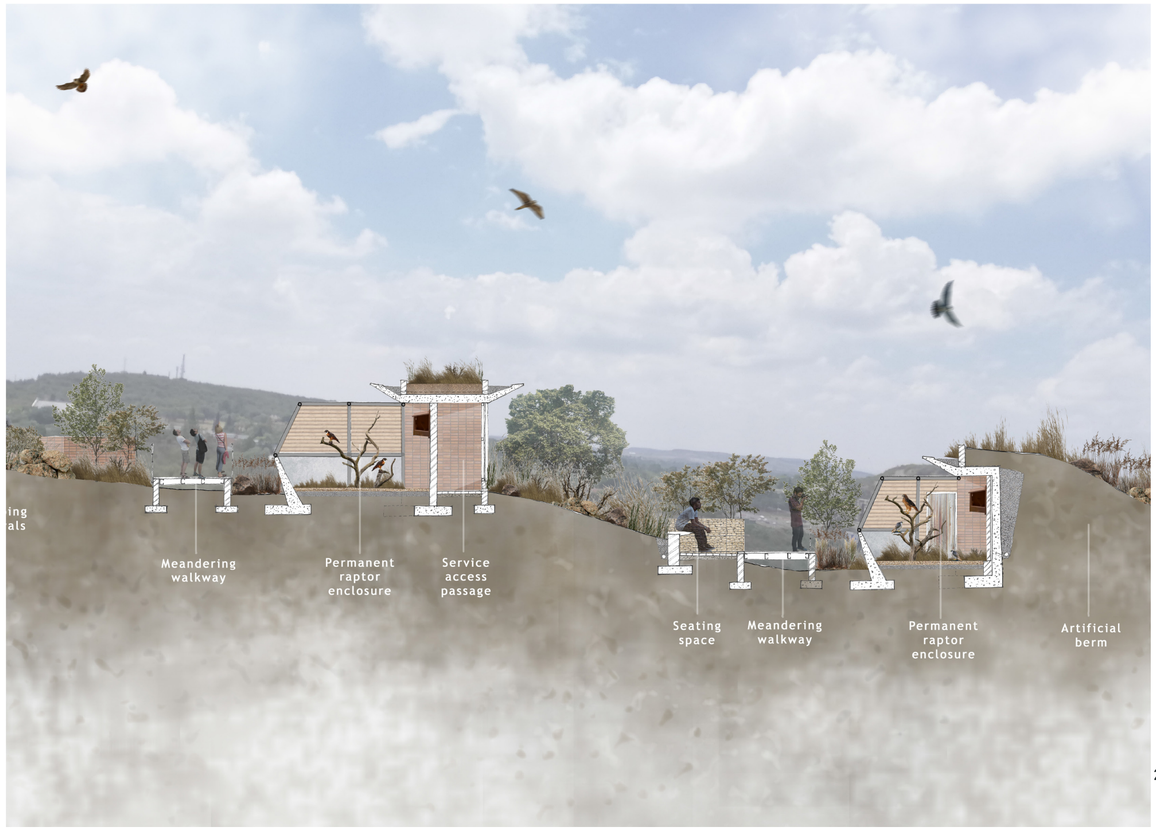
LEGEND

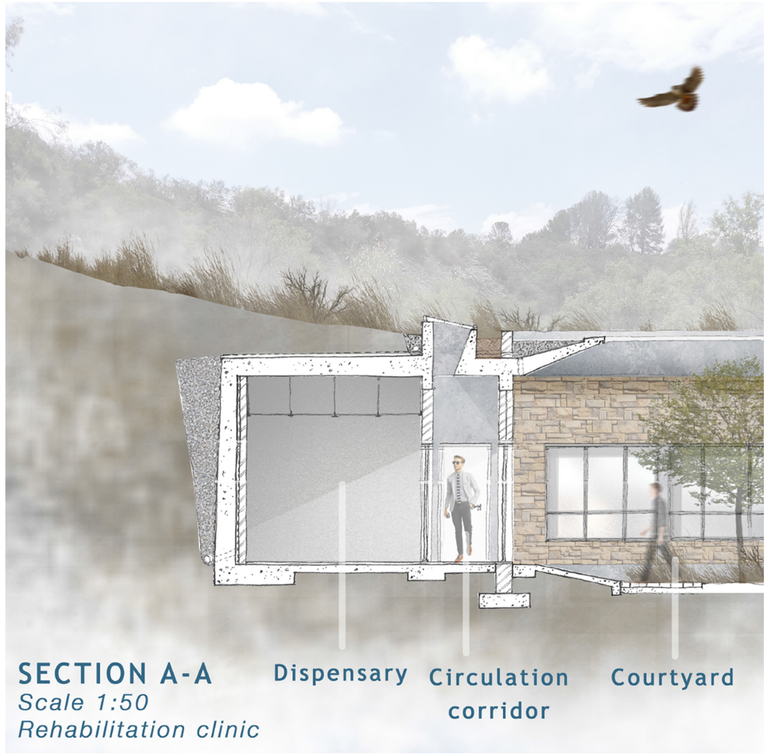
1 - Flying tunnel
2 - Flying tunnel
3 - Raptor rehab room
4 - Raptor food preparation
5 - Food preparation
6 - Kitchenette
Dry storage
8 - Administration block entrance
9 - Reception and waiting area
10 - Kitchenette
11 - Kitchenette
12 - Staff offices with balconies
13 - Staff lounge
14 - Staff kitchen
15 - Female staff changing room
16 - Male staff changing room
17 - Laundry room
18 - Staff ensuite room (3)
19 - Bathroom (1)
20 - Private staff corridor
21 - Private staff corridor
22 - Performance space for flying show
23 - Seating spaces



Section B-B
Scale 1:50
Signal Hill Falcon Breeding Centre

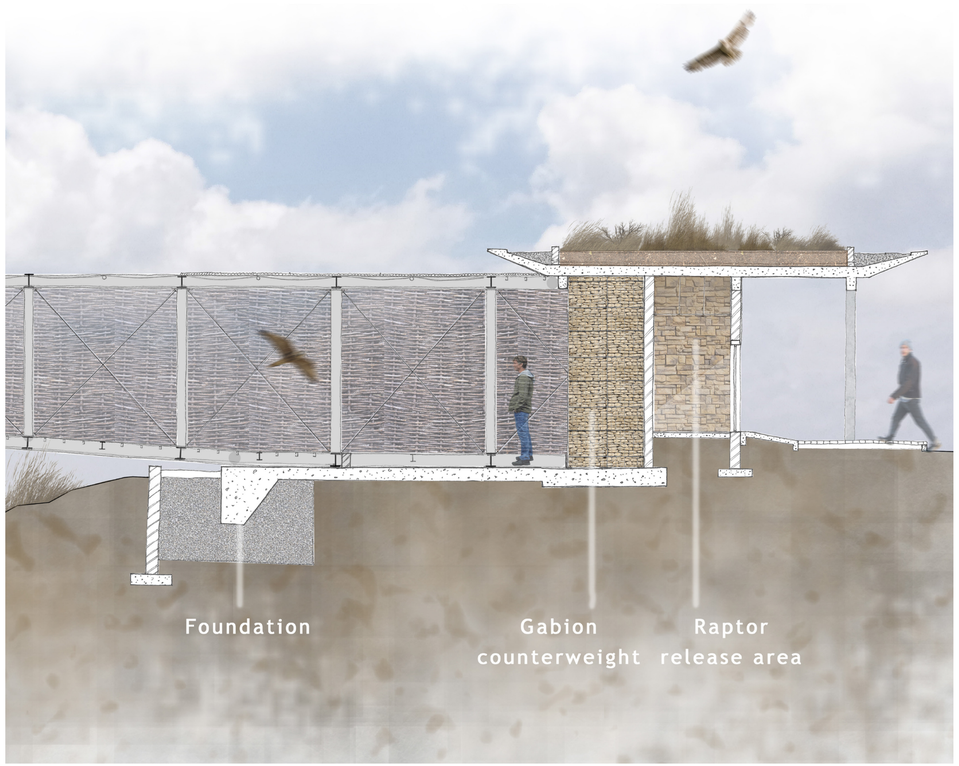
Derik van Blerk
2014073734
M.Arch (Prof)



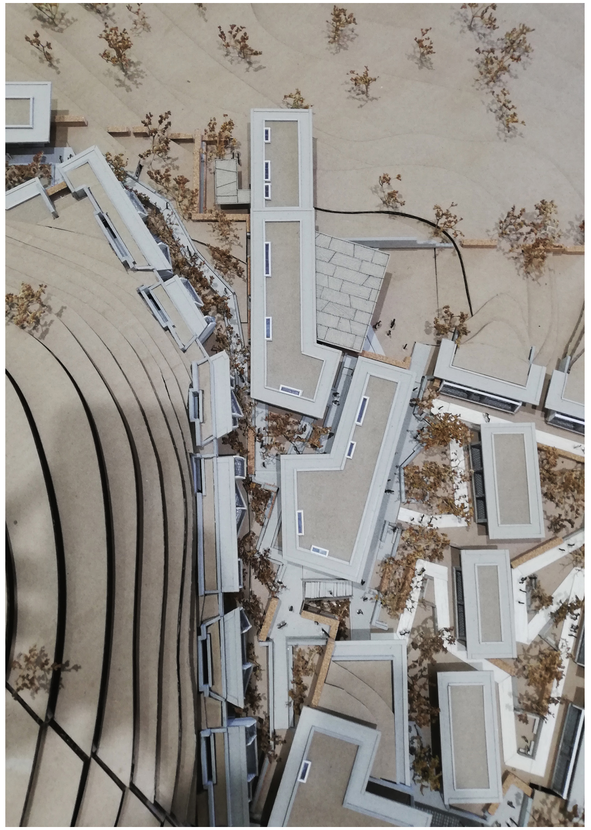

SECTION A-A
Scale 1:50
Rehabilitation clinic
Dispensary
Circulation corridor
Courtyard
0 1 2 3 4 5 10


SECTION D-D
Scale 1:50
Staff overnight quarters
Private courtyard
Circulation corridor
Living unit
Balcony
0 1 2 3 4 5 10


Flying tunnel
SECTION C-C
Scale 1:50
Flying tunnel
0 1 2 3 4 5 10

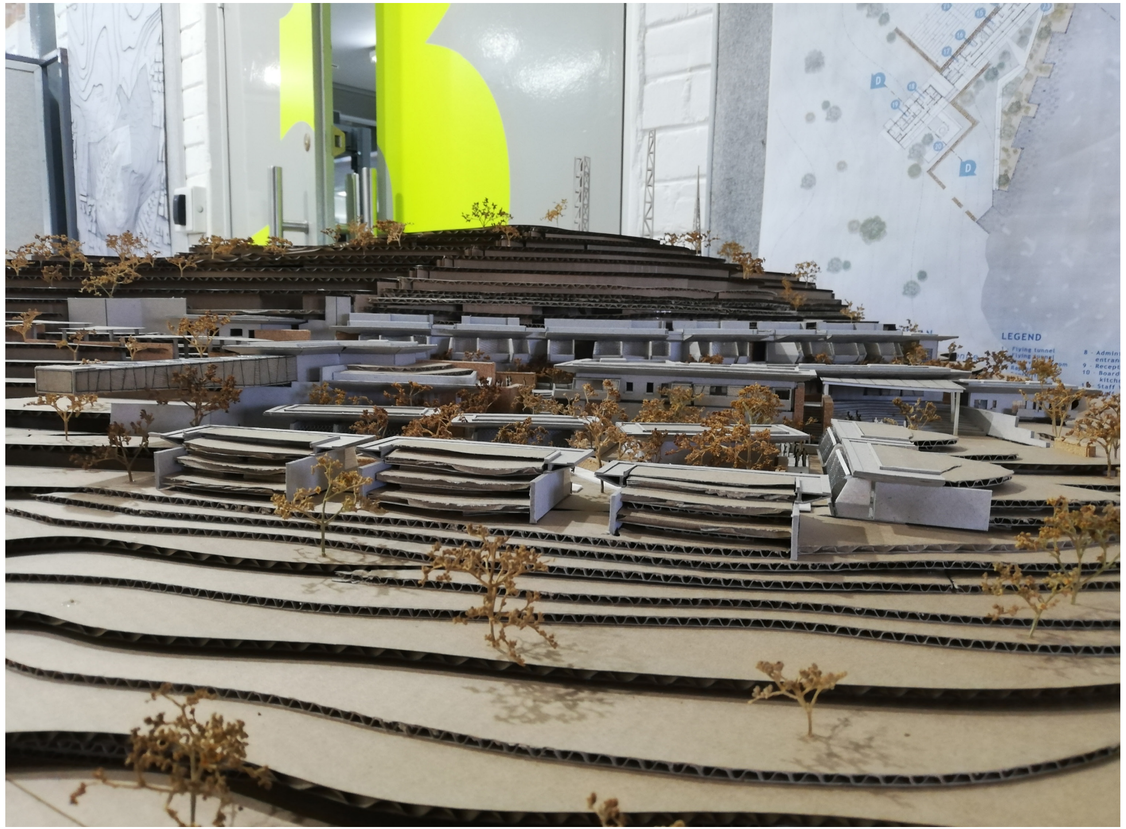

Foundation
Gabion counterweight
Raptor release area

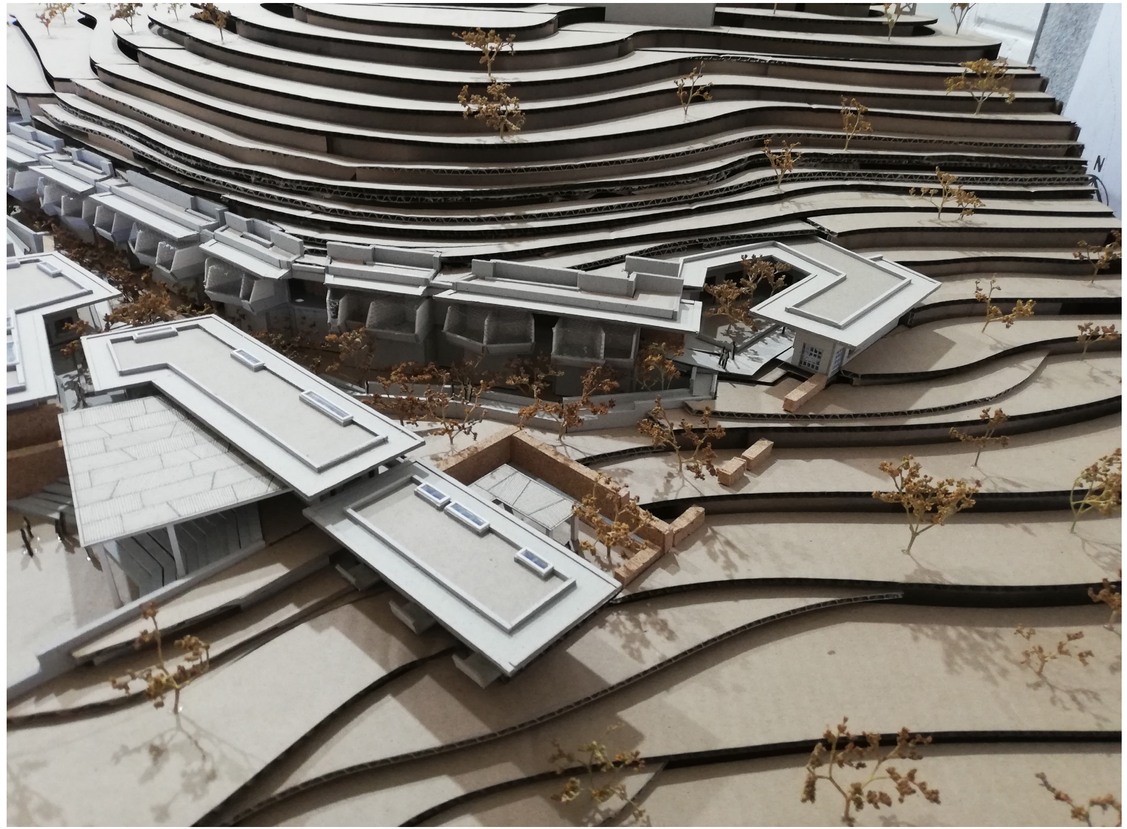




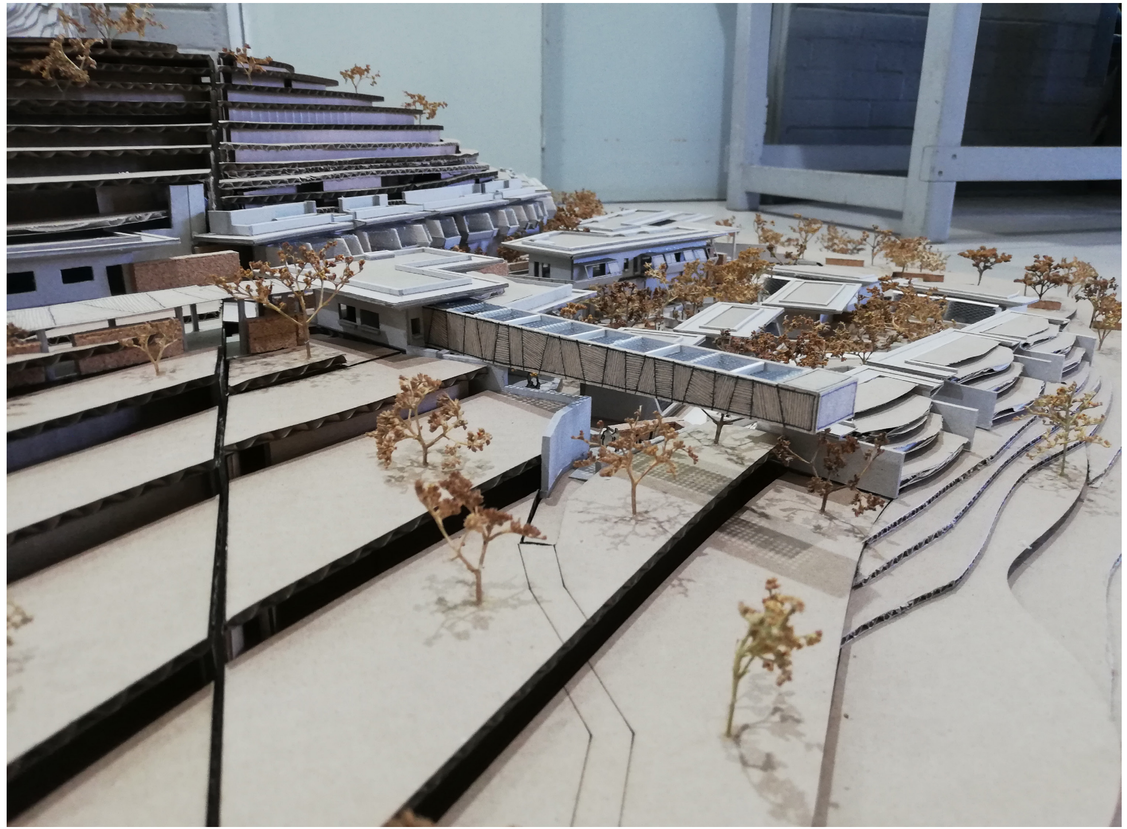


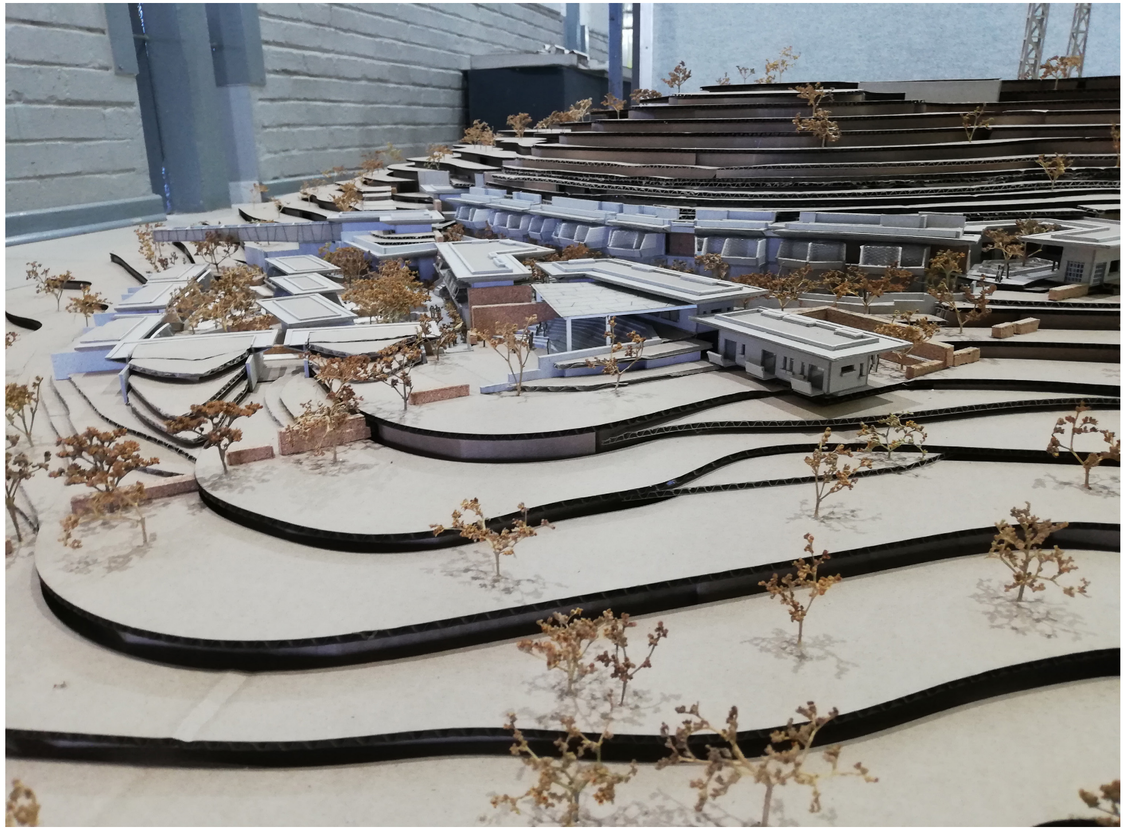



LEGEND













Avian Breeding Centre on Signal Hill, Bloemfontein

5.2 Technical resolution

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6 - Lower terrace plan	*260*
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8 - Section B-B	*263*
9 - Details	*264*

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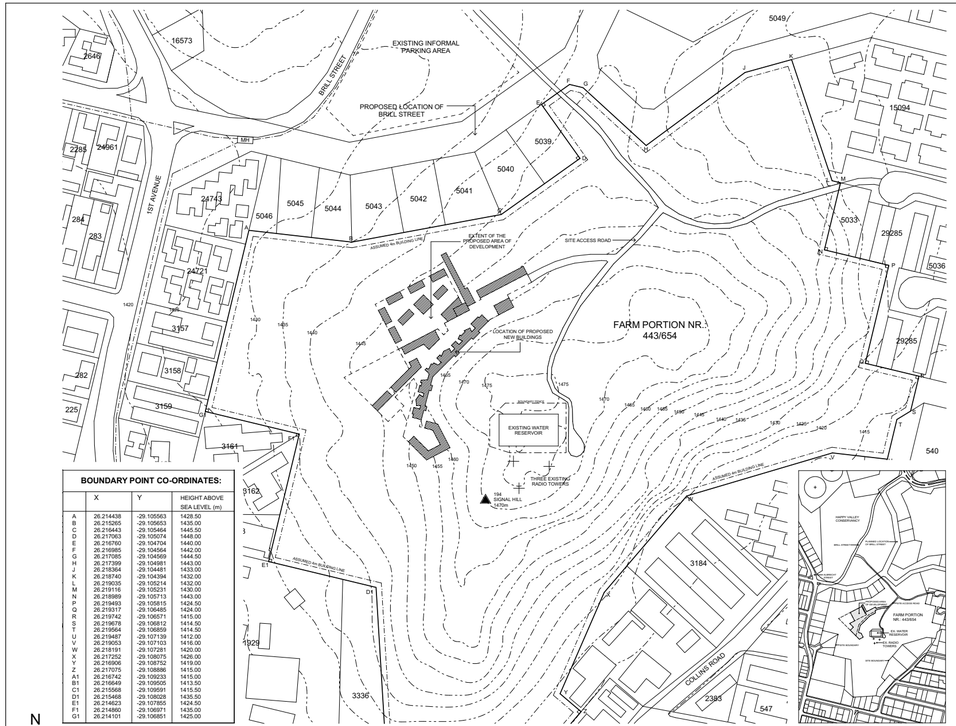

HAPPY VALLEY CONSERVANCY - BROADER LOCALITY PLAN

BOUNDARY POINT CO-ORDINATES:

	X	Y	HEIGHT ABOVE SEA LEVEL (m)
A	26.214438	-29.105563	1438.50
B	26.215265	-29.105653	1435.00
C	26.216443	-29.105464	1445.50
D	26.217063	-29.105074	1448.00
E	26.216760	-29.104704	1440.00
F	26.216985	-29.104564	1442.00
G	26.217085	-29.104569	1444.50
H	26.217399	-29.104981	1443.00
J	26.218364	-29.104481	1433.00
K	26.218740	-29.104394	1432.00
L	26.219035	-29.105214	1432.00
M	26.219116	-29.105231	1430.00
N	26.218969	-29.105713	1443.00
P	26.219497	-29.105815	1424.50
Q	26.219742	-29.106515	1424.50
R	26.219747	-29.106637	1415.00
S	26.219678	-29.106812	1414.50
T	26.219564	-29.106859	1414.50
U	26.219487	-29.107139	1412.00
V	26.219053	-29.107103	1416.00
W	26.218191	-29.107281	1420.00
X	26.217252	-29.108075	1426.00
Y	26.216906	-29.108752	1419.00
Z	26.217075	-29.108886	1415.00
A1	26.216742	-29.109233	1415.00
B1	26.216649	-29.109505	1413.50
C1	26.215568	-29.109591	1415.50
D1	26.215468	-29.108028	1435.50
E1	26.214623	-29.107855	1424.50
F1	26.214860	-29.106971	1435.00
G1	26.214101	-29.106851	1425.00

N

LOCATION PLAN
ENDANGERED WILDLIFE TRUST
AVIAN RAPTOR BREEDING AND REHABILITATION CENTRE
SCALE 1:1000

SCHEDULE OF RIGHTS

PROPERTY DESCRIPTION

PARENT FARM PARCEL NO:	464		
FARM PORTION NO:	443/654	TITLE DEED NO:	
TOWNSHIP:	Bloemfontein	SITE AREA:	143 170m²

ZONING INFORMATION

TOWN PLANNING SCHEME:	Mangaung Metro Mnic Development Framework
DATE:	05 December 2016
ZONE USE:	Mangaung Open Space System (MOSS)
AMENDMENT SCHEME NO:	
ANNEX NO:	

DEVELOPMENT CONTROL MEASURES

PERMISSABLE	CONTROL	ACTUAL
	BUILDING HEIGHT	2 Storeys
	FLOOR AREA RATIO	
	FLOOR AREA	2620m²
n/a	DWELLINGS DENSITY	n/a
n/a	NO. OF DWELLINGS ON ERF	n/a

REVISIONS

REVISION NO:	DATE:	DESCRIPTION:	DRAWN BY:

GENERAL COMMENTS

Location plan compiled using relevant cadastral information, the Mangaung Metro Municipality Developmental Framework of 2016, and personal research.
There are currently no existing municipal sewerage and electrical service connections on the site.
There is no existing stormwater system installed on the site.
There is no building line specified on the site, so a 4m building line from the site boundary is assumed for this project.

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YUNIVESITHI YA FREISTATA

CONS 7908 2019
DEPARTMENT OF ARCHITECTURE
UNIVERSITY OF THE FREE STATE
M.ARCH (PROF.)
GENERAL LAYOUT DRAWINGS

CLIENT:
ENDANGERED WILDLIFE TRUST

PROJECT:
AVIAN RAPTOR BREEDING AND REHABILITATION CENTRE

PROJECT ADDRESS:
HAPPY VALLEY CONSERVANCY, BRILL STREET, BLOEMFONTEIN, SOUTH AFRICA

ERF:
FARM PORTION NUMBER: 443/654

DRAWING TITLE:
LOCATION PLAN

DATE:	SCALE:
29 OCTOBER 2019	1:1000
STUDENT NO: 2014073734	**DRAWING NO:** A101
SURNAME: VAN BLERK	**INITIALS:** DH

ARCHICAD EDUCATION VERSION



N

BLOCK PLAN
ENDANGERED WILDLIFE TRUST
AVIAN RAPTOR BREEDING AND REHABILITATION CENTRE
SCALE 1:500

GENERAL COMMENTS

There is no building line specified on the site, so a 4m building line from the site boundary is assumed for this project.
The locations of existing structures are outlined.
The locations of the proposed new developments are hatched.
All site boundary dimensions are measured in meters between boundary pegs.
Service access is gained from the existing service road on the site.
Public access is gained from the informal parking area next to Brill Street (see Drawing A101).

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CONS 7908 2019
DEPARTMENT OF ARCHITECTURE
UNIVERSITY OF THE FREE STATE
M.ARCH (PROF.)
GENERAL LAYOUT DRAWINGS

CLIENT:
ENDANGERED WILDLIFE TRUST

PROJECT:
AVIAN RAPTOR BREEDING AND REHABILITATION CENTRE

PROJECT ADDRESS:
HAPPY VALLEY CONSERVANCY, BRILL STREET, BLOEMFONTEIN, SOUTH AFRICA

ERF:
FARM PORTION NUMBER: 443/654

DRAWING TITLE:
BLOCK PLAN

DATE:	SCALE:
29 OCTOBER 2019	1:500
STUDENT NO: 2014073734	**DRAWING NO:** A102
SURNAME: VAN BLERK	**INITIALS:** DH

ARCHICAD EDUCATION VERSION



FOR CONTINUATION OF DRAWING A104 (ROOF PLAN), SEE DRAWING A104 PART 2.

N

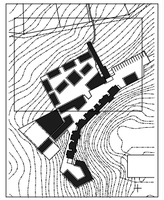
ROOF PLAN

ENDANGERED WILDLIFE TRUST

AVIAN RAPTOR BREEDING AND REHABILITATION CENTRE

SCALE 1:200

LOCATION KEY



GENERAL COMMENTS

ALL PLANTED ROOF SUBSTRATES AND SCREEDS TO SLOPE IN THE INDICATED DIRECTION.

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YUNIVESITHI YA FREISTATA

UFS UV

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DEPARTMENT OF ARCHITECTURE
UNIVERSITY OF THE FREE STATE
M.ARCH (PROF.)
GENERAL LAYOUT DRAWINGS

CLIENT:
ENDANGERED WILDLIFE TRUST

PROJECT:
AVIAN RAPTOR BREEDING AND REHABILITATION CENTRE

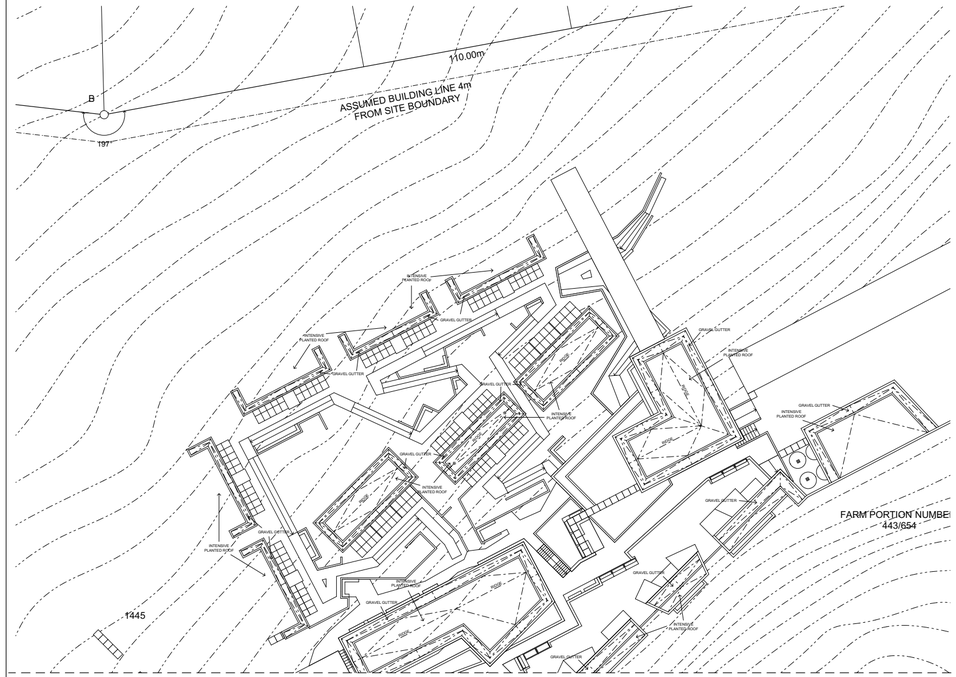
PROJECT ADDRESS:
HAPPY VALLEY CONSERVANCY, BRILL STREET, BLOEMFONTEIN, SOUTH AFRICA

ERF:
FARM PORTION NUMBER: 443/654

DRAWING TITLE:
ROOF PLAN (PART 1 OF 2)

DATE:	SCALE:
29 OCTOBER 2019	1:200
STUDENT NO:	**DRAWING NO:**
2014073734	A104 (1)
SURNAME:	**INTIALS:**
VAN BLERK	DH

ARCHICAD EDUCATION VERSION



FOR CONTINUATION OF DRAWING A104 (ROOF PLAN), SEE DRAWING A104 PART 2.

N

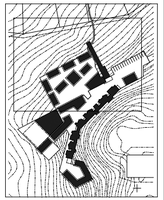
ROOF PLAN

ENDANGERED WILDLIFE TRUST

AVIAN RAPTOR BREEDING AND REHABILITATION CENTRE

SCALE 1:200

LOCATION KEY



GENERAL COMMENTS

ALL PLANTED ROOF SUBSTRATES AND SCREEDS TO SLOPE IN THE INDICATED DIRECTION.

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GENERAL LAYOUT DRAWINGS

CLIENT:
ENDANGERED WILDLIFE TRUST

PROJECT:
AVIAN RAPTOR BREEDING AND REHABILITATION CENTRE

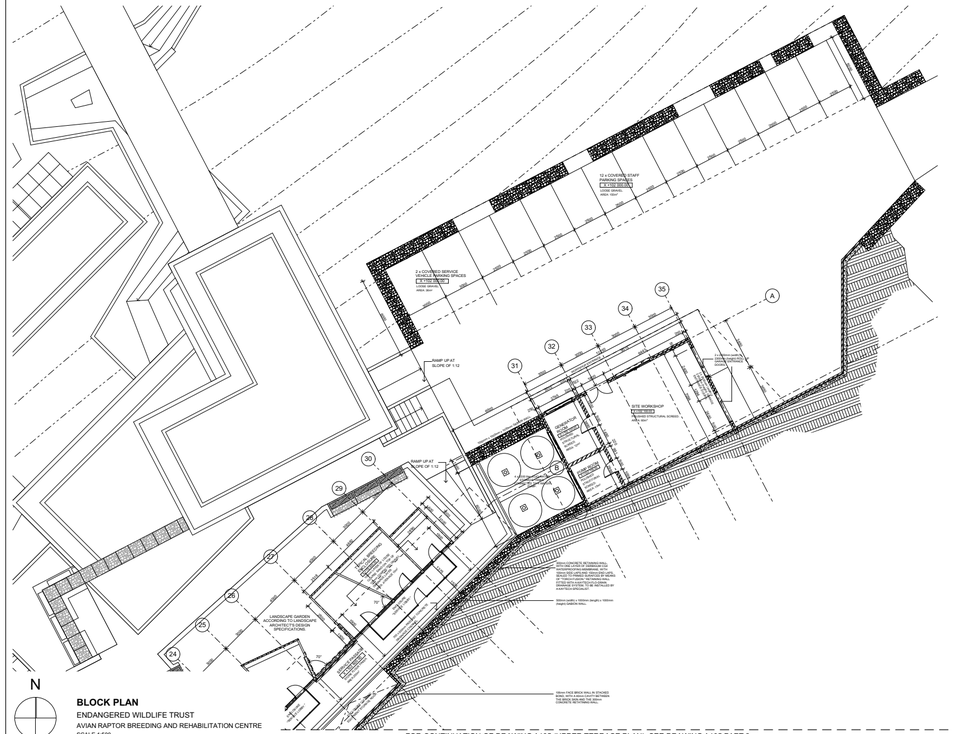
PROJECT ADDRESS:
HAPPY VALLEY CONSERVANCY, BRILL STREET, BLOEMFONTEIN, SOUTH AFRICA

ERF:
FARM PORTION NUMBER: 443/654

DRAWING TITLE:
ROOF PLAN (PART 1 OF 2)

DATE:	SCALE:
29 OCTOBER 2019	1:200
STUDENT NO:	**DRAWING NO:**
2014073734	A104 (1)
SURNAME:	**INTIALS:**
VAN BLERK	DH

ARCHICAD EDUCATION VERSION

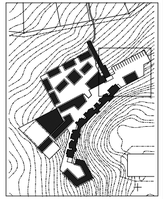


N

BLOCK PLAN
ENDANGERED WILDLIFE TRUST
AVIAN RAPTOR BREEDING AND REHABILITATION CENTRE
SCALE 1:500

FOR CONTINUATION OF DRAWING A105 (UPPER TERRACE PLAN), SEE DRAWING A105 PART 2.

LOCATION KEY



GENERAL COMMENTS

DIFFERENT STRUCTURAL GRIDS ARE DISTINGUISHED BY AN ALPHABETICAL PREFIX.
A TYPICAL FLOOR PLAN FOR THE REPETITIVE BREEDING ENCLOSURES IS SHOWN ON THIS PLAN.
ALL FLOOR LEVEL HEIGHTS ARE MEASURED FROM THE DATUM LEVEL OF +100.000 (SEE DRAWING A301)

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CLIENT:
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PROJECT:
AVIAN RAPTOR BREEDING AND REHABILITATION CENTRE

PROJECT ADDRESS:
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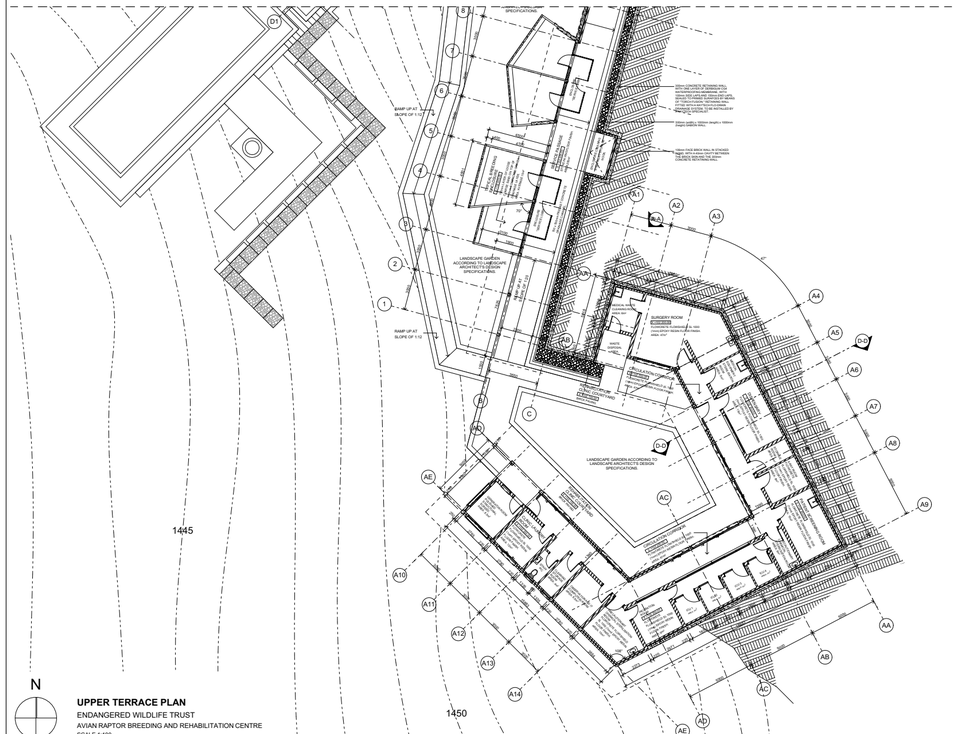
ERF:
FARM PORTION NUMBER: 443/654

DRAWING TITLE:
UPPER TERRACE PLAN (PART 1 OF 2)

DATE:	SCALE:
29 OCTOBER 2019	1:100
STUDENT NO:	**DRAWING NO:**
2014073734	A105 (1)
SURNAME:	**INITIALS:**
VAN BLERK	DH

ARCHICAD EDUCATION VERSION

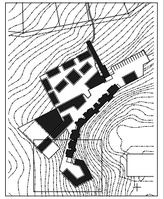
FOR CONTINUATION OF DRAWING A105 (UPPER TERRACE PLAN), SEE DRAWING A105 PART 1.



N

UPPER TERRACE PLAN
ENDANGERED WILDLIFE TRUST
AVIAN RAPTOR BREEDING AND REHABILITATION CENTRE
SCALE 1:100

LOCATION KEY



GENERAL COMMENTS

DIFFERENT STRUCTURAL GRIDS ARE DISTINGUISHED BY AN ALPHABETICAL PREFIX.
A TYPICAL FLOOR PLAN FOR THE REPETITIVE BREEDING ENCLOSURES IS SHOWN ON THIS PLAN.
ALL FLOOR LEVEL HEIGHTS ARE MEASURED FROM THE DATUM LEVEL OF +100.000 (SEE DRAWING A301)

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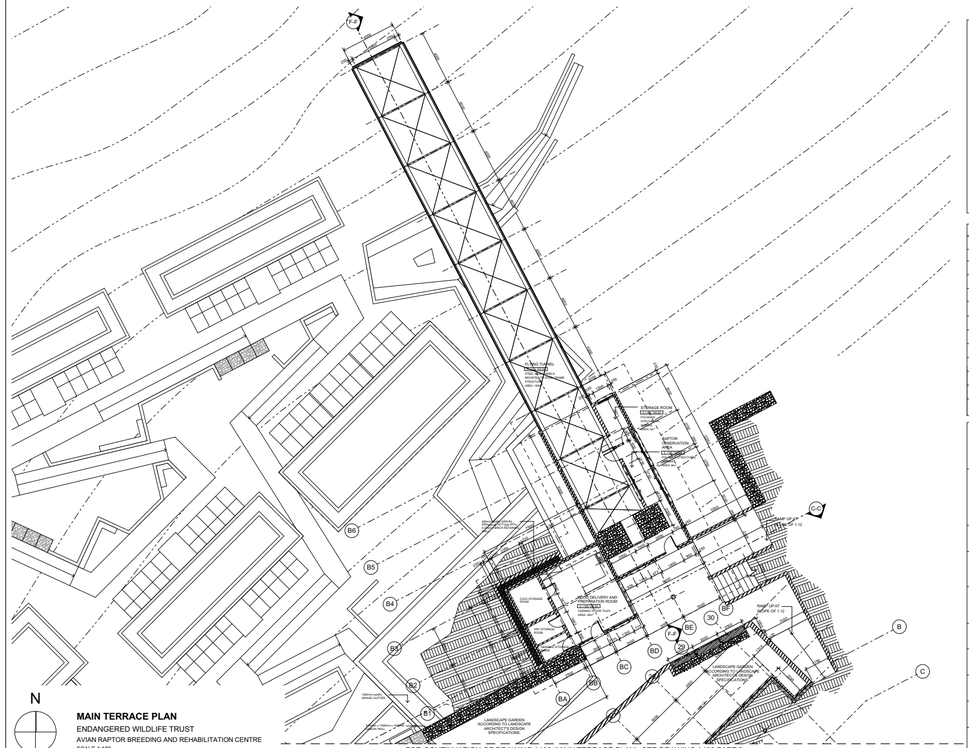
ERF:
FARM PORTION NUMBER: 443/654

DRAWING TITLE:
UPPER TERRACE PLAN (PART 2 OF 2)

DATE:	SCALE:
29 OCTOBER 2019	1:100
STUDENT NO:	**DRAWING NO:**
2014073734	A105 (2)
SURNAME:	**INITIALS:**
VAN BLERK	DH

ARCHICAD EDUCATION VERSION



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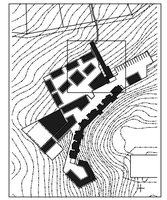

GENERAL COMMENTS

DIFFERENT STRUCTURAL GRIDS ARE DISTINGUISHED BY AN ALPHANUMERICAL PREFIX.

ALL FLOOR LEVEL HEIGHTS ARE MEASURED FROM THE DATUM LEVEL OF +100 (SEE DRAWING A201)

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CLIENT:
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PROJECT:
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HAPPY VALLEY CONSERVANCY, BRILL STREET, BLOEMFONTEIN, SOUTH AFRICA

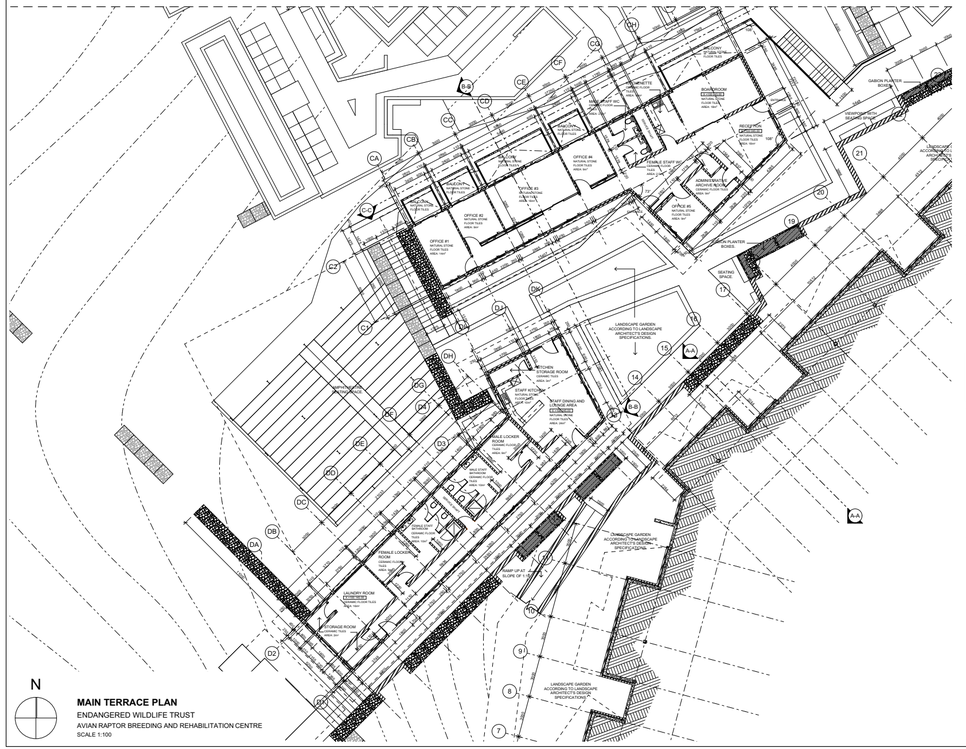
ERF:
FARM PORTION NUMBER: 443/654

DRAWING TITLE:
MAIN TERRACE PLAN (PART 1 OF 2)

DATE:	SCALE:
29 OCTOBER 2019	1:100
STUDENT NO:	**DRAWING NO:**
2014073734	A106 (1)
SURNAME:	**INITIALS:**
VAN BLERK	DH

ARCHICAD EDUCATION VERSION

FOR CONTINUATION OF DRAWING A106 (MAIN TERRACE PLAN), SEE DRAWING A106 PART 1.



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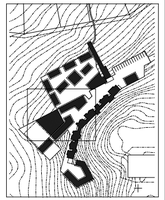

GENERAL COMMENTS

DIFFERENT STRUCTURAL GRIDS ARE DISTINGUISHED BY AN ALPHANUMERICAL PREFIX.

ALL FLOOR LEVEL HEIGHTS ARE MEASURED FROM THE DATUM LEVEL OF +100 (SEE DRAWING A201)

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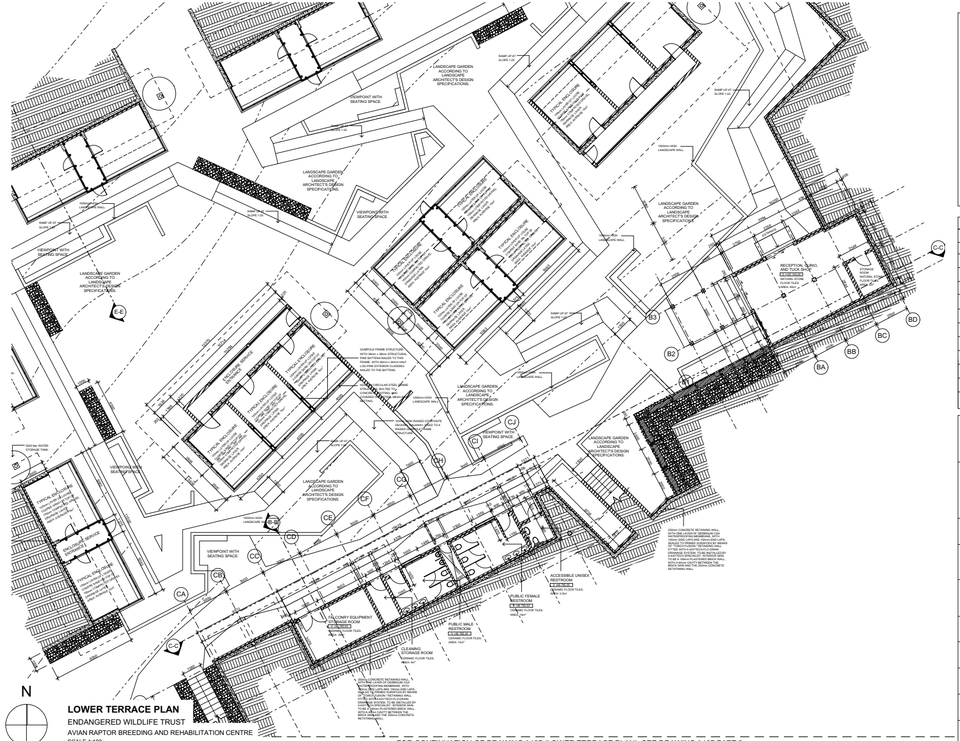
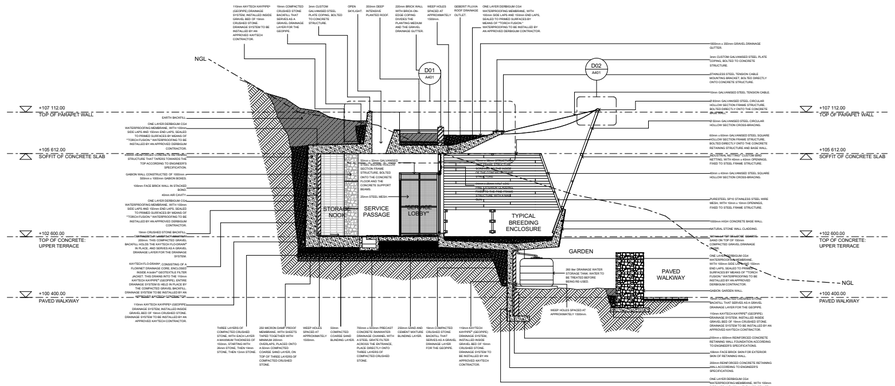
ERF:
FARM PORTION NUMBER: 443/654

DRAWING TITLE:
MAIN TERRACE PLAN (PART 2 OF 2)

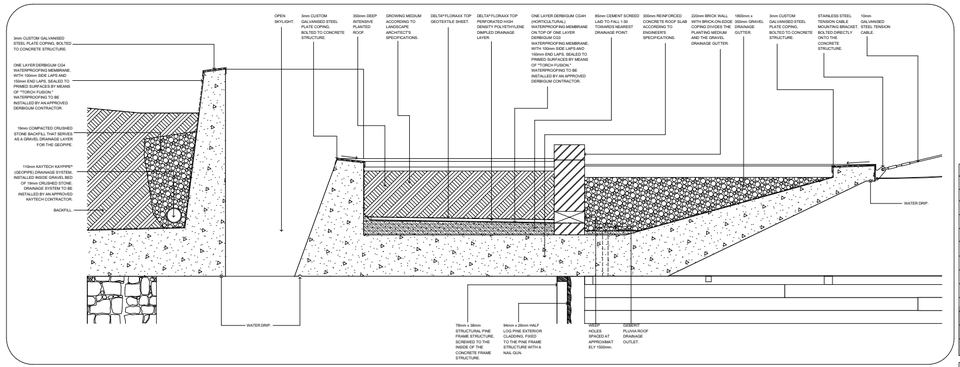
DATE:	SCALE:
29 OCTOBER 2019	1:100
STUDENT NO:	**DRAWING NO:**
2014073734	A106 (2)
SURNAME:	**INITIALS:**
VAN BLERK	DH


LANDSCAPE GARDEN ACCORDING TO LANDSCAPE ARCHITECT'S DESIGN SPECIFICATIONS.
VIEWPOINT WITH SEATING SPACE
VIEWPOINT WITH SEATING SPACE
LANDSCAPE GARDEN ACCORDING TO LANDSCAPE ARCHITECT'S DESIGN SPECIFICATIONS.

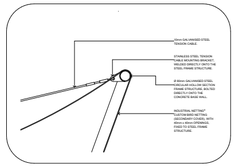


SECTION A-A
ENDANGERED WILDLIFE TRUST
AVIAN RAPTOR BREEDING AND REHABILITATION CENTRE
SCALE 1:50

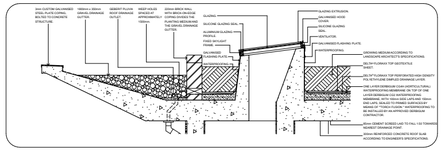
GENERAL COMMENTS



DETAIL 01
ENDANGERED WILDLIFE TRUST
AVIAN RAPTOR BREEDING AND REHABILITATION CENTRE
SCALE 1:10



DETAIL 02
ENDANGERED WILDLIFE TRUST
AVIAN RAPTOR BREEDING AND REHABILITATION CENTRE
SCALE 1:10



DETAIL 03
ENDANGERED WILDLIFE TRUST
AVIAN RAPTOR BREEDING AND REHABILITATION CENTRE
SCALE 1:20

GENERAL COMMENTS

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GENERAL LAYOUT DRAWINGS

CLIENT:
ENDANGERED WILDLIFE TRUST

PROJECT:
AVIAN RAPTOR BREEDING AND REHABILITATION CENTRE

PROJECT ADDRESS:
HAPPY VALLEY CONSERVANCY, BRILL STREET, BLOEMFONTEIN, SOUTH AFRICA

ERF:
FARM PORTION NUMBER: 443/654

DRAWING TITLE:
DETAIL DRAWINGS

DATE:	**SCALE:**
29 OCTOBER 2019	AS INDICATED
STUDENT NO:	**DRAWING NO:**
2014073734	A401
SURNAME:	**INITIALS:**
VAN BLERK	DH

Part 6

Reflection and references

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Chapter 6.2	-	*Turnitin similarity report*	*269*
Chapter 6.3	-	*List of references*	*270*

6.1 Reflecting on the project

If I look back at this year and all pure cardboard-and-paper-and-pixels content that I have produced, then I have to tell myself that this year was a success. In some way or another, whether I did this project well or not, I did something that seemed like an impossible task 10 months ago.

If I do have to look critically at this thesis and the architectural form that I have developed over the course of this year, then I would say there are aspects of the project that can be celebrated, and some that can be questioned and reviewed. If you look back at the project's research question that was formulated in Part 2 of this document, then I would say the project was successful. I do believe that the building embodies the essence of the relationship between man and the Happy Valley Conservancy within itself.

However, in retrospect, I would have to consider the size of the development on Signal Hill in my argument. There is a very valid argument that lies in the comparison between the site prior to the development and after the development. Since this whole thesis was focused on uncovering the essence of the site and embodying it within the architecture, I do have to ask myself "How much of that essence did you uncover? And how much of it is left?"

Obviously, at the inception of this project I was unaware of the potential size of the development, and once the project caught some steam, I simply did not look back and reconsider my approach to the project. However, with that being said, you will always be able to identify certain areas where architectural creation missed an opportunity or could be more sensitive to that which is already there. Retrospection is much easier than living in the moment.

6.2 Turnitin similarity report

Turnitin Originality Report

Processed on: 06-Oct-2019 18:40 SAST
ID: 1185708748
Word Count: 29806
Submitted: 2

M.Arch (Prof) By Dawid Van Blerk

Similarity Index	Similarity by Source	
4%	Internet Sources:	2%
	Publications:	0%
	Student Papers:	3%

6.3 List of references

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