

*Celebrating the natural romantic landscape of the Diepwalle
forest through man's explorative experience*

Declaration & Acknowledgements

Dissertation submitted in partial fulfilment of the requirements of the degree M. Arch. (Prof).
All the work contained in this document is my own, except where otherwise acknowledged.

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The work contained in this dissertation has not been previously submitted to meet the requirements 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 person except where due reference is made.



Diepwalle Forest. Photograph: Doman, J. 2019

Preamble

The focus of the dissertation stems from a personal interest and experience in the mystical Knysna Forest. This curiosity was further strengthened by Dalene Matthee's novel 'Circles in the Forest'. This mystical forest was partially threatened in June 2017, due to the raging Knysna wildfire. The drought South Africa experienced since 2016 strongly contributed to this devastating threat. The wildfire led to the question of man's ethical responsibility toward nature. The notion of providing layers of protection and conservation of the lush indigenous Knysna forest, became the golden thread that informed the aim of this dissertation.

The aim for this dissertation is for man to celebrate and re-connect with nature, rather than being two separate entities. The site for this dissertation proposal is located 22km east from Knysna, within the Diepwalle Forest Nature Reserve. The proposed Forest Exploration Hub offers the visitor a platform to experience and discover nature, through the various functions of the proposed design. The intention of the proposal is not to conserve the forest through the separation of man and nature, but rather to inform and educate the visitors on conservation measures, forest histories, facts and myths. Celebration of the indigenous forest take place through various sensory experiences that enhance man's connection with the forest.

Theoretical notions such as embodiment, narrative and architectural promenade steered the investigation towards creating a place where man and nature can co-exist.

Keywords: ethical responsibility, conservation, celebrate, exploration, experience, connectedness, co-existence.

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Photograph of indigenous trees at Diepwalle Forest. (Author, 2019)

Introduction

Diepwalle Nature Reserve is a forest ecology that is rich in different tree structures, species and in density. A total of 465 plant species have been recorded within this specific forest ecology. The rich plant diversity is a result of the ranging topology, soil types and the microclimate in the Diepwalle area (Geldenhuys 1991).

The Nature Reserve offers various ways to explore the rich environment, for example through the Elephant hiking trails and the Rooted-in-Time self-drive tour. Multiple attraction points connect the various hiking trails, such as the Big Tree, Velbroeksdraai, Old Forester's House, Legends Museum, to name only a few. These attraction points allow visitors to explore the different voices of the forest as it is experienced through myths, legends, the sites and artefacts.

The Root-in-Time drive is currently supported by a relatively primitive infrastructure. Most of the attraction points offer essential elements, such as water-points. Unfortunately, the only proper amenities and information is found at the Diepwalle Forest Station, this is also where the main office and camping site is located. The Root-in-Time drive, which is a self-explorative drive is open for the public to explore on their own. This drive does not provide a guided tour. Thus, the visitors are equipped with only the basic information and guidelines, leaving the experience and the discovery of the forest open to the visitor's own interpretation.

The proposed Forest Exploration Hub aims to offer possibilities of providing a centralised hub where the visitors can find various information on the surrounding context, the forest and the different plant species. The proposed Forest Exploration Hub provides a platform for the visitors to have a sensory exploration where the forest can be experienced in its full glory.

This dissertation investigates man's explorative embodied experience within the indigenous Diepwalle Forest. The golden thread tying the various elements of the dissertation together is the notion of protecting and conserving the natural forest ecology. The design proposal aims to re-connect man and nature by providing a platform for celebrating and exploring the romantic forest topology.

A comprehensive investigation of similar building typologies, romantic landscape architecture and narrative design principles create an informative basis for the design. An in-depth investigation and analysis of the Diepwalle SANPark and the proposed site is practically linked with theoretical principles that formulate a design methodology.

The dissertation document is organised under four main parts. Part 1 and 2 is structured under themes of typology, topology, morphology and the logic of tectonics. Typology is used to investigate and explore the various interventions according to their type and functional character. Topology relates to site-specific influences and unique natural context that informs the proposed design. Morphology refers to the form-giving of the proposed design, as it is informed by typology and topology. Conceptual explorations further aid to generate a meaningful morphological approach. The logic of tectonics is outlined by structural and material systems that are conceptually informed and expressed through construction.

Part 3 of the dissertation describe the synthesis of the design process and how the explorative research and conceptual investigations of Parts 1 and 2 assisted in the development of the design proposal.

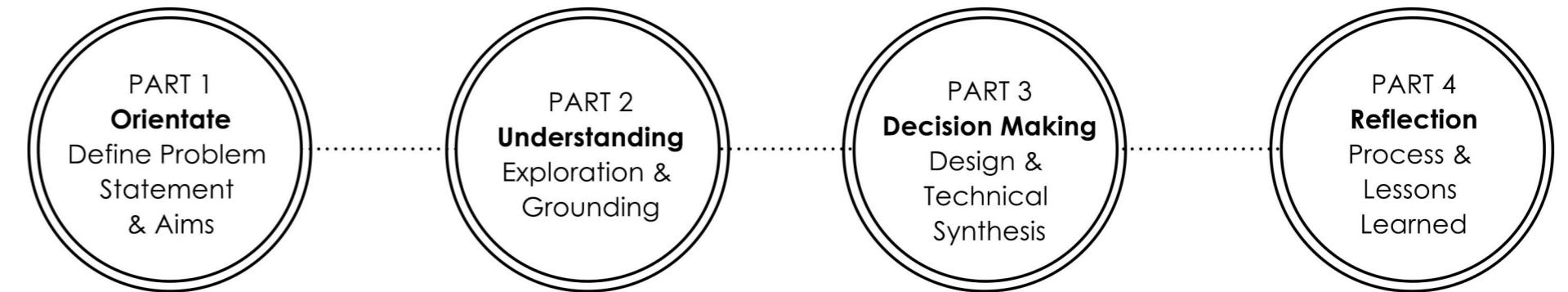
Part 4 concludes the document and reflects on the dissertation's challenges and the initial project aims to evaluate the design and documentation process and achievements.



Image Source: Online

Research Design

The dissertation document is grounded in an explorative research method. To organise the investigation, four main platforms – typology, topology, morphology and tectonics – are examined to formulate a problem statement and project aims for the design proposal. This enables a clear definition of setting out the project parameters and challenges that formulate the design process. These investigations aid to explore what to design (client brief), for whom (user profile) and where the most suitable location would be for the design intervention. In-depth reasoning is used as a tool to inform the form-giving of the design, as well as how the design proposal can be structured logically.

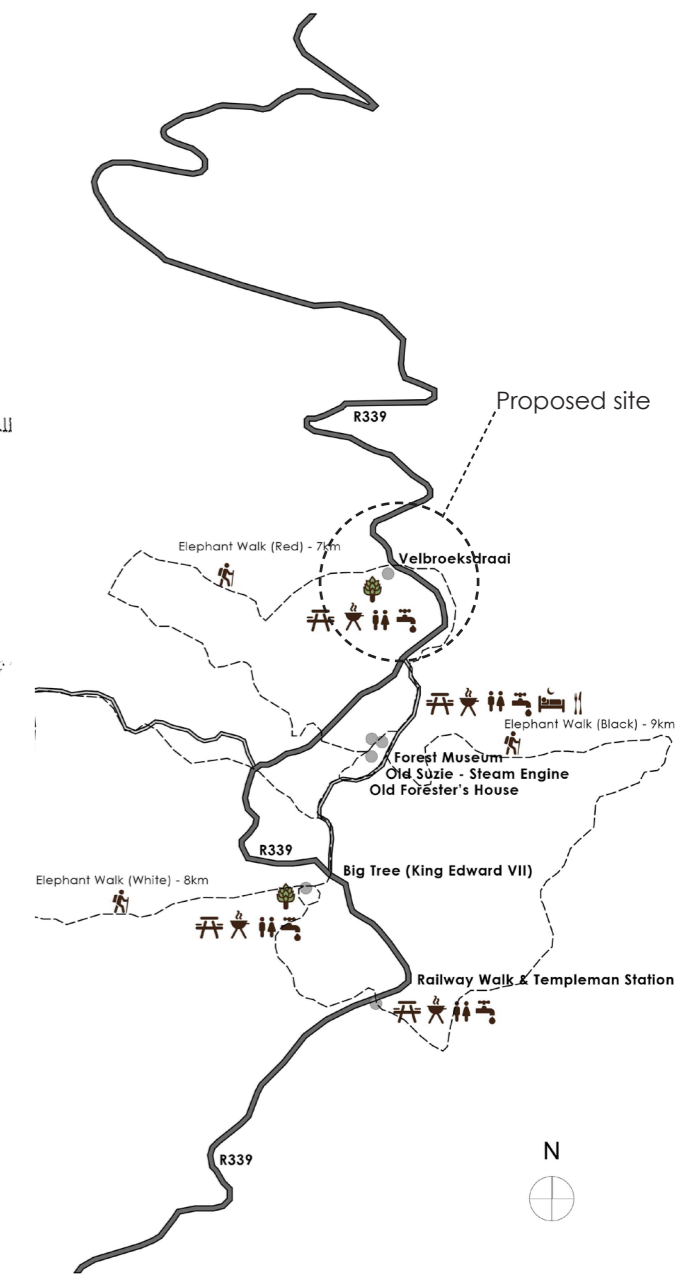
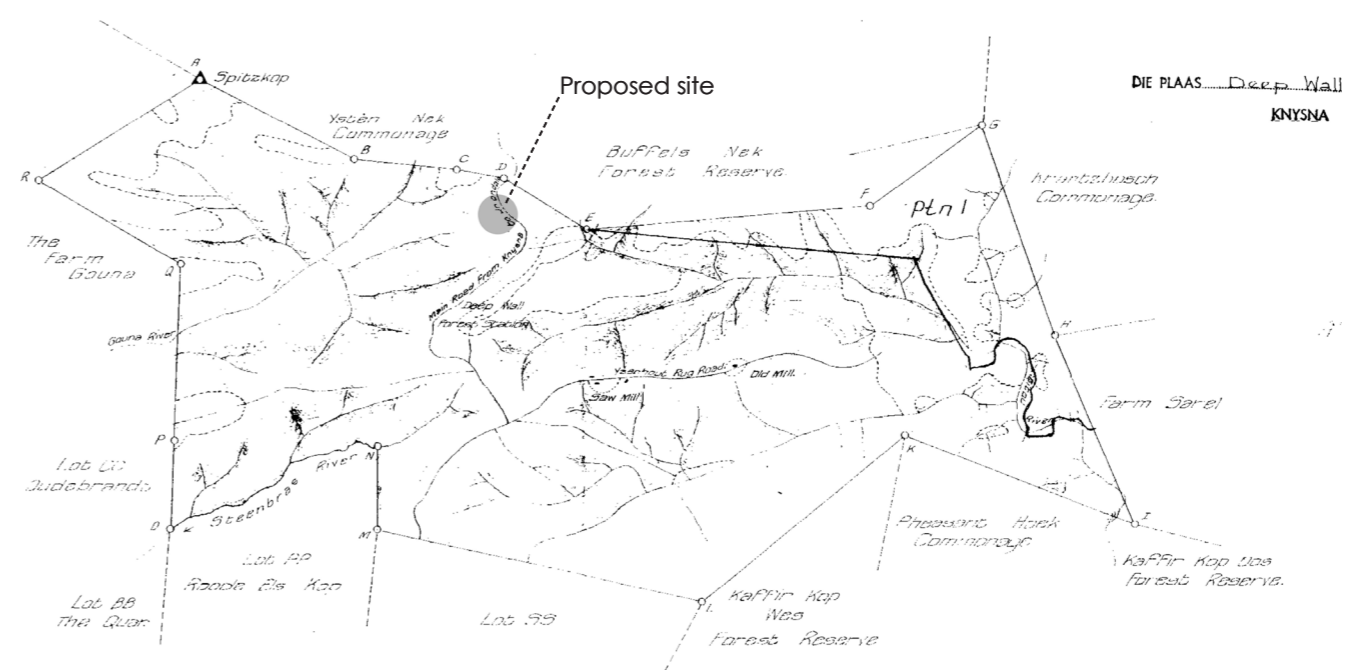




Part 1 - Project Challenges & Aims

Orientation

The purpose of this chapter is to orientate the reader on the themes of typology, topology, morphology and tectonics related to the proposed design intervention. Each theme consist of a problem statement and set of project aims which provides the reader with a comprehensive outline on the research theme. This chapter serves as a framework for the exploration and grounding investigation in Part 2.



Project rational

The investigation started as a reaction towards the destructive Knysna wildfires of 2017. Questions such as whether the indigenous Knysna forest should be protected, preserved, conserved, or celebrated steered the initial decision-making process. All of these questions are based on the notion of protecting natural resources, but the essence of each idea differs.

With preservation, the idea is to keep the natural resource in its current state where the notion of decay or destruction cannot reach the preserved entity. Preservation has a robust set of rules against human influence, whereas preserved areas are usually set aside and human-free (Smith, 2018: Online).

Conservation, on the other hand, is the act of carefully managing and protecting resources so that it might last longer and survive the effect of reckless consumption. According to Austin Smith (2018), conservation is the act of man attempting to create a sustainable relationship between humans and the environment. With the modern conservation movement, the focus is placed on climate change, water issues, and the education of the public on conservation of the natural environment, especially among children and scholars (Cooper, 2006: Online).



“Conservation is a state of harmony between man and land.” (Leopold, 1966: 145)

Typology:

User Profile

The proposed design serves as a gathering space for numerous users visiting the Diepwalle Forest. The user group is not bound to a certain margin, but also invites an array of users to explore the various functions that the proposed design has to offer. The design strives toward creating a hub where people will gather in order to celebrate and explore the mystical Diepwalle Forest.

Visitors: Locals, tourists

Recreation: Hikers, cyclists

Education: Student, scholars, researchers

Naturalists: Birdwatchers, foresters, environmental activists

Basic Accommodation List:

- + Information Centre & Shop
- + Forest Hiking Trails
- + Observation Tower
- + Rooted-In-Time Forest Museum
- + Botanical Research Library
- + Control Room & Observation Centre
- + Forest Experiential Restaurant
- + Forest Infused Gin Tasting Bar
- + Culinary Studio & Workshop
- + Indigenous Forest Nursery



Problem statement

The notion of designing a built form within the natural romantic landscape of the Diepwalle Forest leads to the question of appropriateness within the protected indigenous context. Conservation of the indigenous forest is the driving factor within the design. Alternative methods of conservation is investigated where nature may be celebrated and appreciated, instead of preserving from the rest of mankind.

The typological response to the romantic forest context will require a built form that becomes porous as thresholds between nature and architecture are set in place. Exploring methods of joining and incorporating nature within the built form will allow for a more holistic approach towards the natural environment. Alternative methods of applying conservation through architecture will ensure that the Diepwalle Forest is being protected and maintained, while being explored and appreciated.

Aim

The aim of the proposal is to create a suitable design solution and accommodation list for the client by investigating various visitor gatherings which is driven by narrative and explorative typologies within the natural landscape. Further, the proposed design aims to celebrate the natural romantic forest topology through methods of informing, educating and experiencing the indigenous forest context.

The proposed design intends to question how the exploration and appreciation of a specific place is achieved, while allowing for notions of conservation to be implemented through the design. The typological aim will question whether architecture can set methods of conservation in place for the romantic landscape exploration. Can the type of architectural intervention aid in providing a platform to celebrate, explore and also conserve the indigenous Diepwalle Forest?

Topology:

Problem Statement

The Diepwalle Forest forms part of the larger Knysna-Tsitsikamma Afromontane Forest Complex. It is located more towards the eastern border of the Forest Complex. Diepwalle Nature Reserve is a SANPark that consist of a kind of tall, shady, multi-layered indigenous forest. The Nature Reserve provide various tourist attractions, visitor sites as well as hiking and cycling trails.

Yearly visitors from all over come to experience the Knysna Forest topology in its full glory. The current infrastructure provided for the various tourist attraction sites consist of basic timber and sandstone structures. The experience of the current infrastructure is interpreted as primitive and also environmentally sensitive for it does not overwhelm the natural topology, but rather becomes a part of the forest landscape.

The proposed site, Velbroeksdraai, forms part of the Routed-in-Time Visitor's Drive that connects the various tourist attractions into a collective experience. The site consist of a clearing in the forest with a moderate sloping terrain. The site is a well-known picnic spot which forms part of the Elephant Walk.

Due to the minimal infrastructure available at Velbroeksdraai, the typical time visitors spend are kept to a minimum. Information boards communicate the necessary site histories as well as fauna and flora information, but most of the natural landscape is open for exploration and interpretation.

The Diepwalle Nature Reserve plays an important role in educating the public on the various indigenous tree species found within the Knysna-Tsitsikamma Afromontane Forest Complex. The unique forest character is experienced through the various Elephant Walking trails meandering through the Diepwalle Nature Reserve. Layers of conservation is required to ensure that the Diepwalle Forest continues to reconnect man with his natural environment. Additional mediums of gathering is required to narratively guide the visitor towards educational explorations.

Aim

The design proposal aim to comprehend and engage with the complexities of the Diepwalle Forest ecology. An in-depth topological investigation and analysis of the proposed site within its romantic context is used to inform and formulate an appropriate site specific design resolution. Further, the design proposal intend to include the various human ecological environments present within the forest context. The ecological environmental investigation explore the various human, social, historical and cultural factors that are present within the landscape. These factors is used to assist the design process in formulating an informed outcome on the identities and voices found within the indigenous Diepwalle Forest context.

In addition, the proposal strives toward achieving a sense of conservation through the design. Measures such as passive design principles and greenery filtering the build-form allow the visitor to experience the notion of conservation as an addition type of environmental education.



Tree cluster on site, Velbroeksdraai, Diepwalle. Photograph: Doman, J. 2019

Morphology:

Problem statement

The design methodology and form-giving of a typical visitor centre is meant to encourage exploration of the particular site. The ontological approach of the unique forest context requires narrative explorations in and through the romantic landscape. The proposed intervention will act as a platform for gathering and exploration, while also experiencing a sense of conservation education.

The organic meandering routes and undefined clearing within the forest landscape will inform the morphological approach towards site and the building typology. Conceptual notions that guide the morphological exploration include themes of natural conservation, narrative exploration, embodied experience and promenade architecture.

The well-known forest novels of Dalene Matthee provide additional layers of complex comprehension into the forest exploration and human connection. The visitor's lived experience circling through the forest will provide layering of meaning and connectivity that is uniquely experienced within the forest topology.

Aim

The morphological aim of the design proposal is to encourage education on the environmental conservation of the Diepwalle Forest topology. The proposed built form strives towards celebrating the natural forest landscape through the enhancement of man's explorative connectivity with nature. By providing an exploration platform that is porous towards the natural landscape, connections between nature and architecture is achieved. The design proposal is driven by notions of conservation of the Diepwalle Forest landscape, while simultaneously initiating the education thereof. By providing a meandering promenade that is routed in the narrative exploration of the natural landscape, man's embodied experience promotes connectivity with the forest topology.

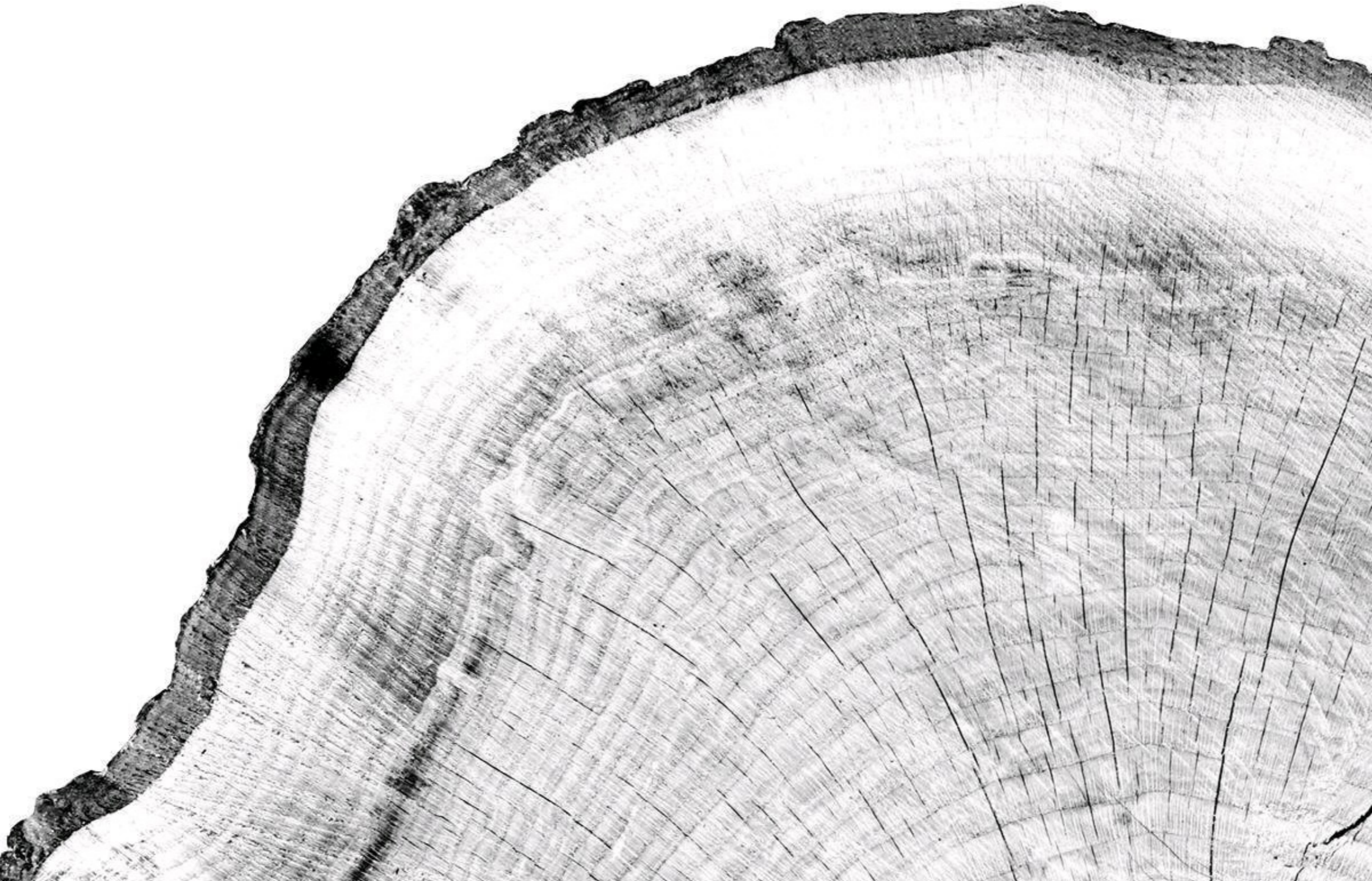
Logic of Tectonics:

Problem statement

Structural philosophy of the proposed design is informed by the forest topology it is situated in. The topology comprise of a romantic landscape where the rhythmic verticality of the tree trunks provide a chaotic order. The construction of a typical gathering structure within the forest context such as Diepwalle require a tectonic material choice and method of construction. The character and natural quality of the forest provide valuable guidelines towards formulating an informative design. The structural systems integrated into the design conceptually express the key notions driving the design proposal.

Aim

The structural decision making that relates to tectonics is mostly derived from the morphological design approach and the various conceptual explorations. The approach to structure is mostly guided through the contextual investigation of appropriateness and availability. The tectonic aim toward design is to formulate a structural built form that is considerate towards the natural landscape, as well as appropriate in the manner in which the tectonic structure is executed. The structural design approach should form part of the natural context and encourage human connectivity within the natural forest topology.



Formulating a Research Question:

How can architecture become a platform of **exploration and celebration** of the Diepwalle Forest?

Additionally, how can the Forest Exploration Hub provide measures of **conservation and the education** thereof?

Overall project goals include:

- Celebrating the romantic forest landscape through passive design principles
- Creating an architectural promenade within the forest landscape where the visitor has an array of explorative options that narrate man through nature
- Providing an informative platform for the uncovering of various notions of protection and conserving the indigenous forest



Part 2 - Exploration & Grounding

Conceptual Development & Underpinning

This chapter aims to investigate various design generators through an explorative research methodology. The initial design considerations and conceptual approaches discussed in Part 1 provided a platform for further exploration. Part 2 consist of an in-depth study into the typology, topology, morphology and tectonics of the proposed idea in order to formulate an appropriate design methodology.



Initial concept sketch. Drawing: Doman, J. 2019

Conceptual Platform:

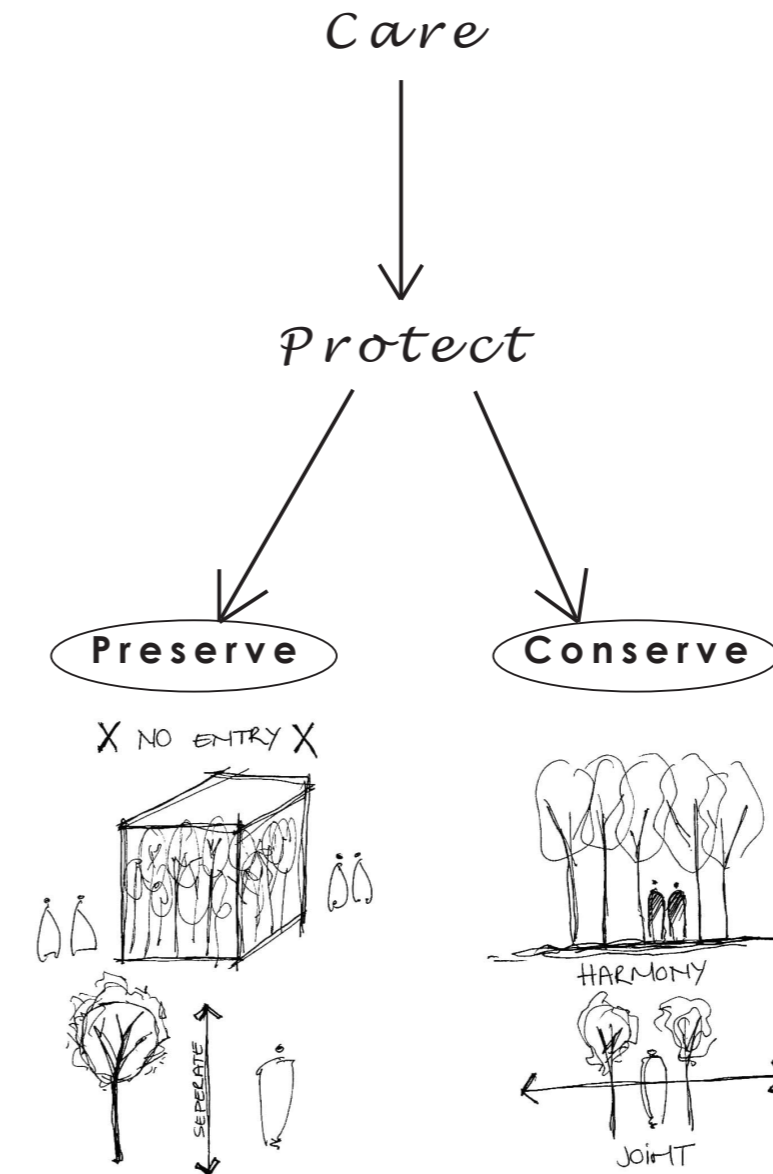
Touch Stone

The conceptual platform for the touch stone developed from the notion of environmental ethics and care for the ecology of the Knysna – Tsitsikamma Afromontane Forest. The wildfire that took place in the Knysna region in 2017 and the increasing draught conditions in South Africa provoked the notion of safeguarding the forest against factors such as climate change. The SANPark organisation aim to conserve the natural Knysna – Tsitsikamma Forest by setting out and identifying the indigenous forest as a nature reserve. This provides the forest ecology with a layer of protection and preservation against measures such as neglect and unauthorised logging.

Through the course of developing a conceptual touch stone, the golden thread (known as the essence of the project) was identified as *protecting and conserving nature*. An ecological intervention within the Diepwalle Forest is a result of providing the forest with a protective layer.



Kuithe, S. n.d. Caged: Ribcage and Flowers Oil Painting. Redbubble Art Print. Online. Available at: <https://www.redbubble.com/people/sckuithe/works>

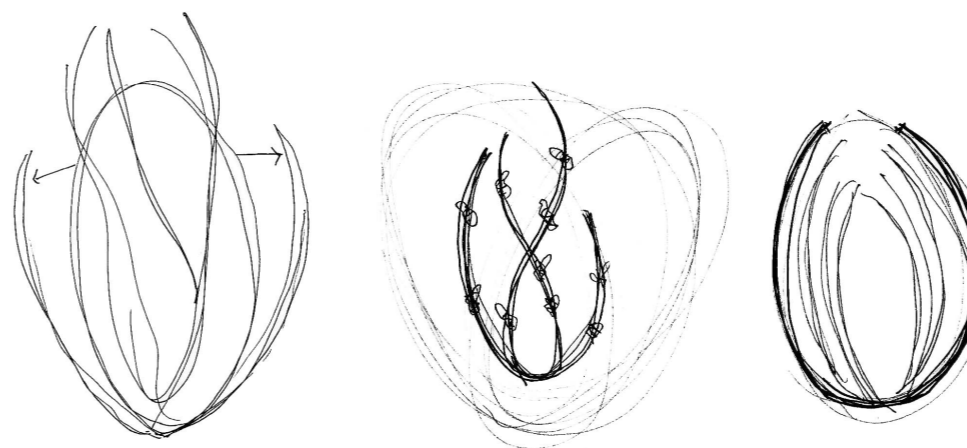
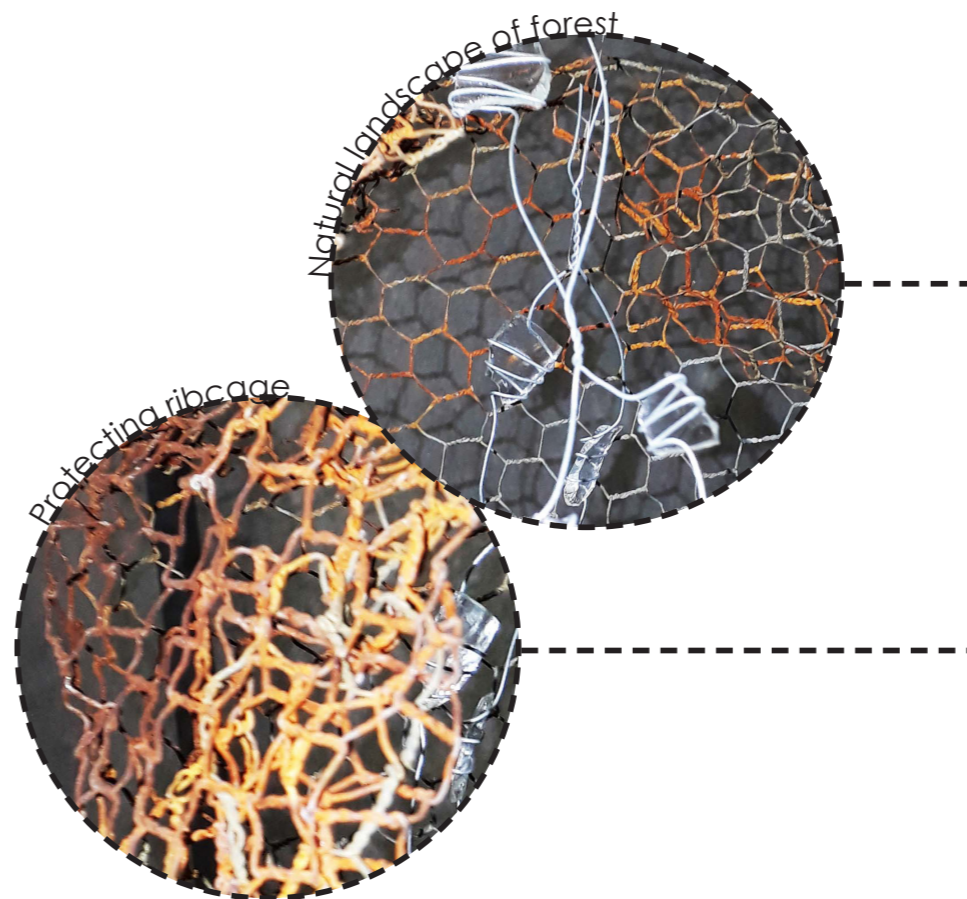


Identifying the difference between *protection, preservation & conservation:*

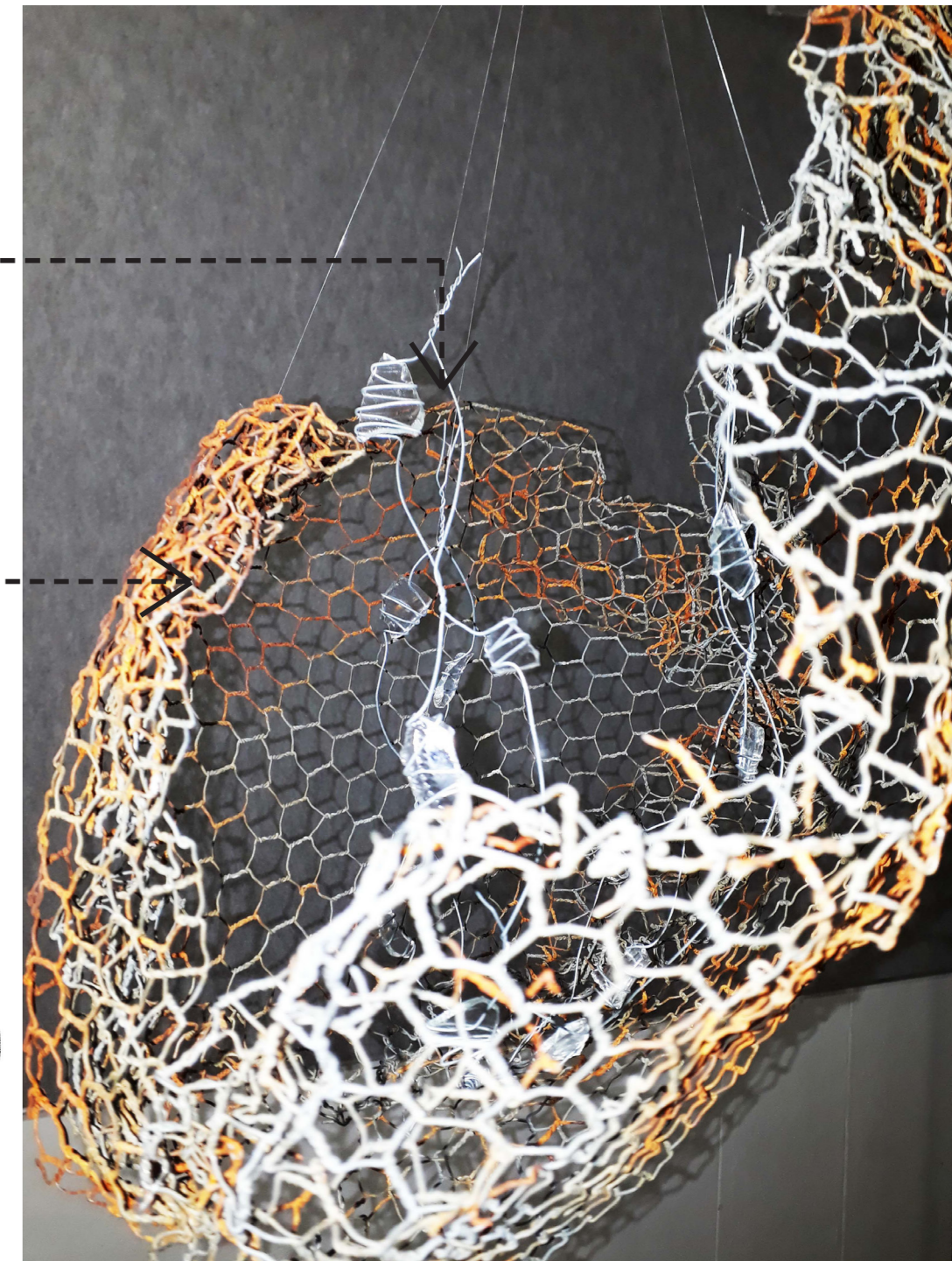
In order to protect something, various measures can be set in place to ensure the abundance of the particular item. When something is preserved it is kept in its current state where the notion of decay or destruction cannot reach the preserved entity. On the other hand, conservation is the act of carefully managing and protecting resources so that it might last longer and survive the effect of reckless consumption. Both preservation and conservation are measures of protection. The important difference between these two measures is that the one excludes human interaction, whereas the other one allows for human interaction in a respectful manner.

Touch Stone

The touch stone depicts the concept of protecting and preserving life. It consists of a shell-like rusted chicken mesh cover that wraps around delicate pieces of glass that is weaved together with thin galvanised wires. The touch stone is a rough assemblage of discarded objects that is joined together with care. The outer rusted layer portrays a ribcage that shields and protects the gentle woven glass configuration. The glass configuration is a depiction of nature and the Knysna – Tsitsikamma Forest. In order to ensure the exploration and appreciation of the natural forest landscape of Diepwalle, a measure of protection should be initiated.



Touch stone process with golden thread being the notion of protection.
cover - shell - ribcage





Design Concepts

From touch stone to conceptual site reactions

The touch stone is an evaluation of the driving factor that informs and outlines the design proposal. The three design concepts are spatial reactions to the site through personal experience and analysis. A conceptual outline is formed by the touch stone and is used as a guide to understanding and interpreting the three design concepts.

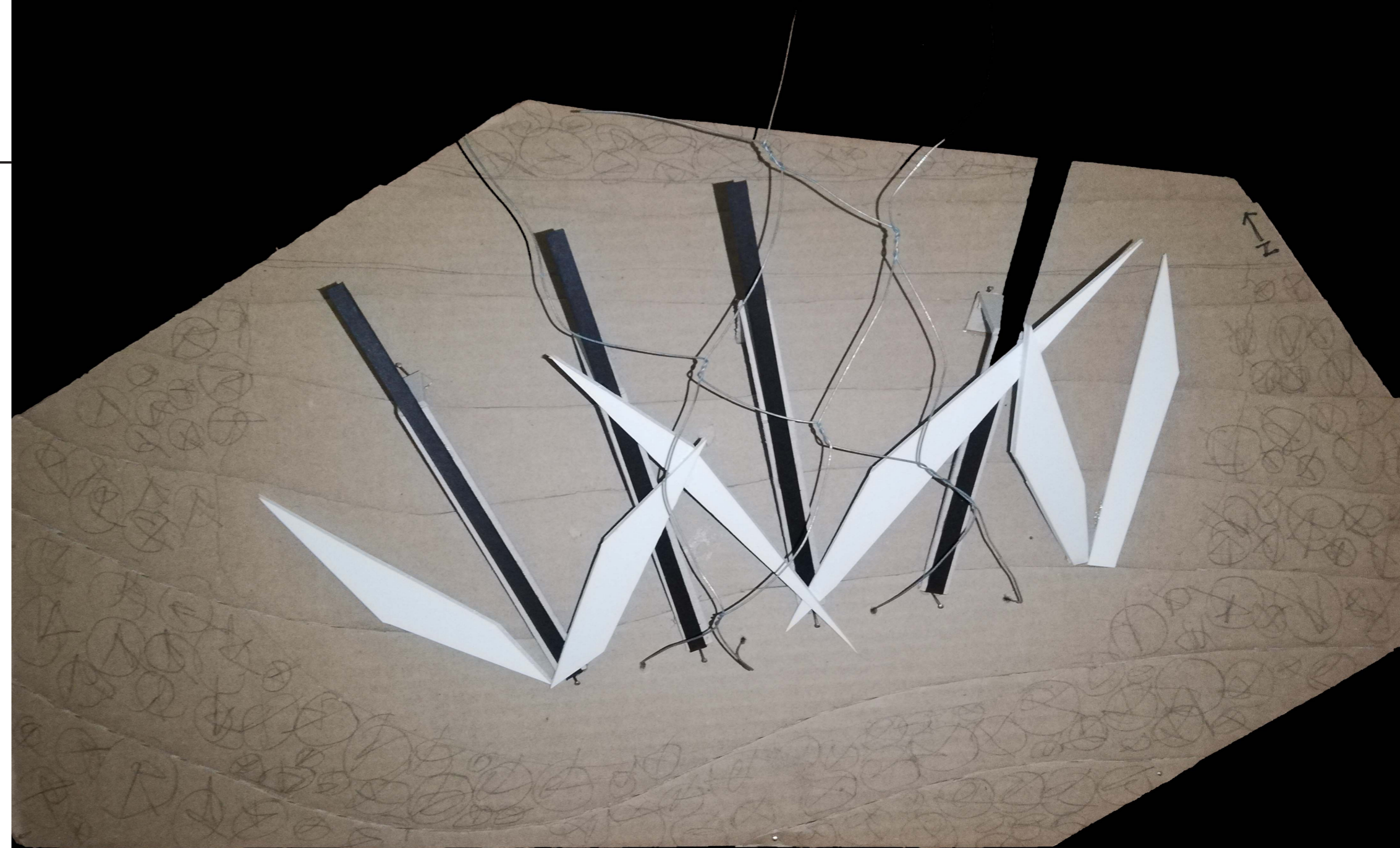


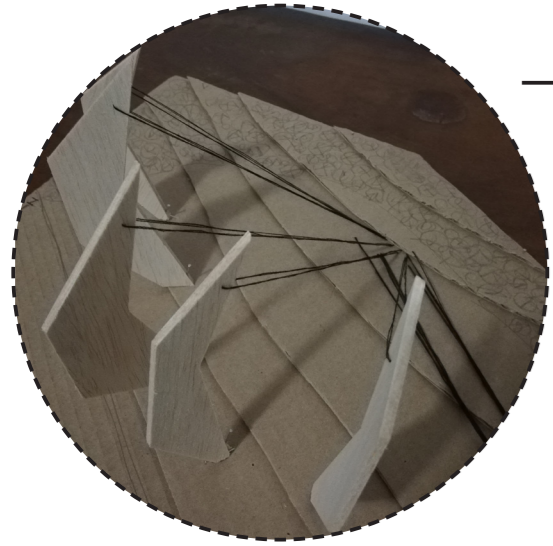
Concept 1: Protrusion

Protrusion is the act of extending past the periphery of an element. The concept of protrusion stem from analysing the site as a clearing in the forest that seems to unfold suddenly as one move through the forest. The vast openness of the site protrudes the verticality of the organically rhythmic forest order. The noting of protrusion can be used as a design tool to inform the approach and reaction to site. The romantic landscape expects a design resolution that will protrude the forest floor as it is lifted from the ground and touches the earth lightly. The idea of growing out of the earth like a tree and reaching up towards light is also defined by the conceptual approach of protrusion.



Emerging out of the site and reaching out towards the sun - site slope strongly influence the act of protruding out of forest.

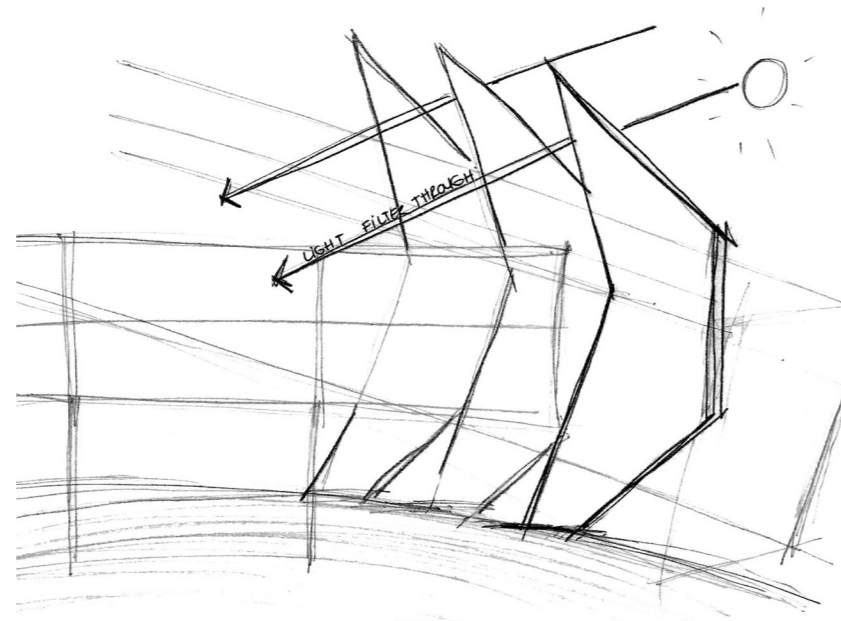
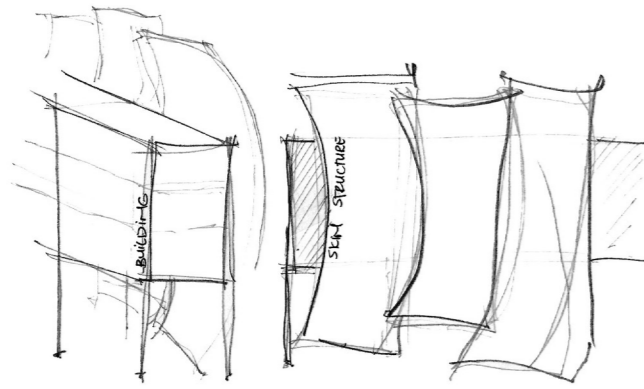
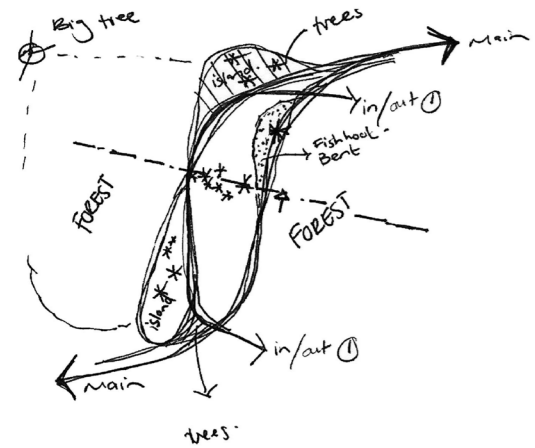




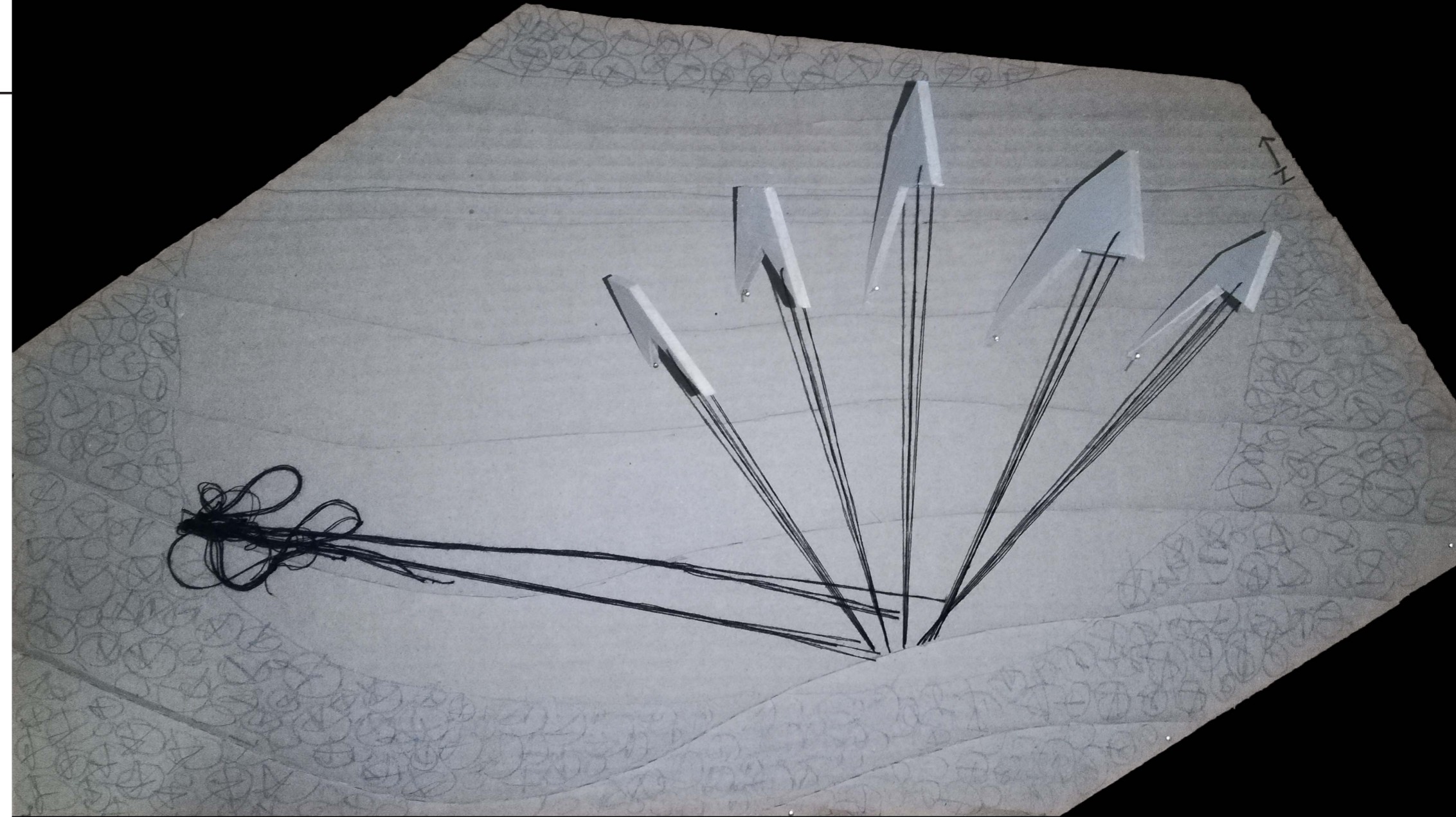
Concept 2: Tension

Tension refers to the act of opposing elements working against each other without reaching a harmonious balance. On site tension is experienced between the dense forest and the vast openness of the proposed site. Tall indigenous trees reach high towards the sky while the scale of the visitor disconnects man from nature. The cluster of forest trees are experienced as out of reach and enormously out of scale in relation to the visitor. The visitor does not influence the totality of the forest experience, but is still powerful enough to inflict destruction onto the indigenous forest landscape.

Tension towards a design proposal comes into play when considering the appropriateness of the design resolution. The proposal should form an intimate connection between nature and architecture in order for man to explore and experience both without notions of tension being present.



Timber fins create a ribcage, half is shown and other half suggested through shadows. Indication of protection & coverage.

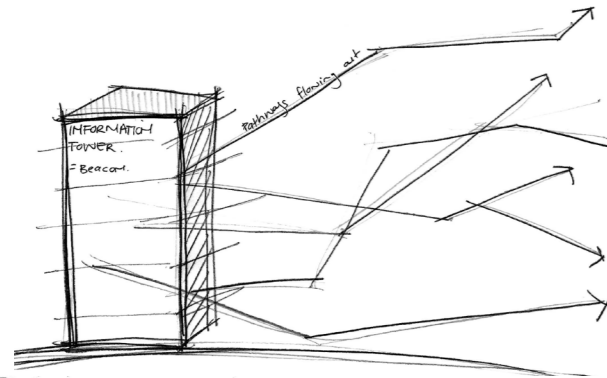
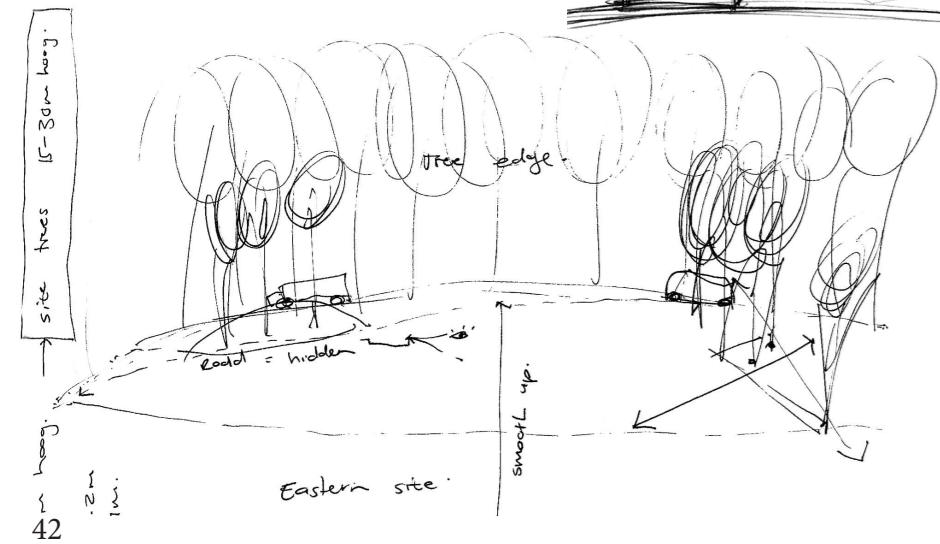




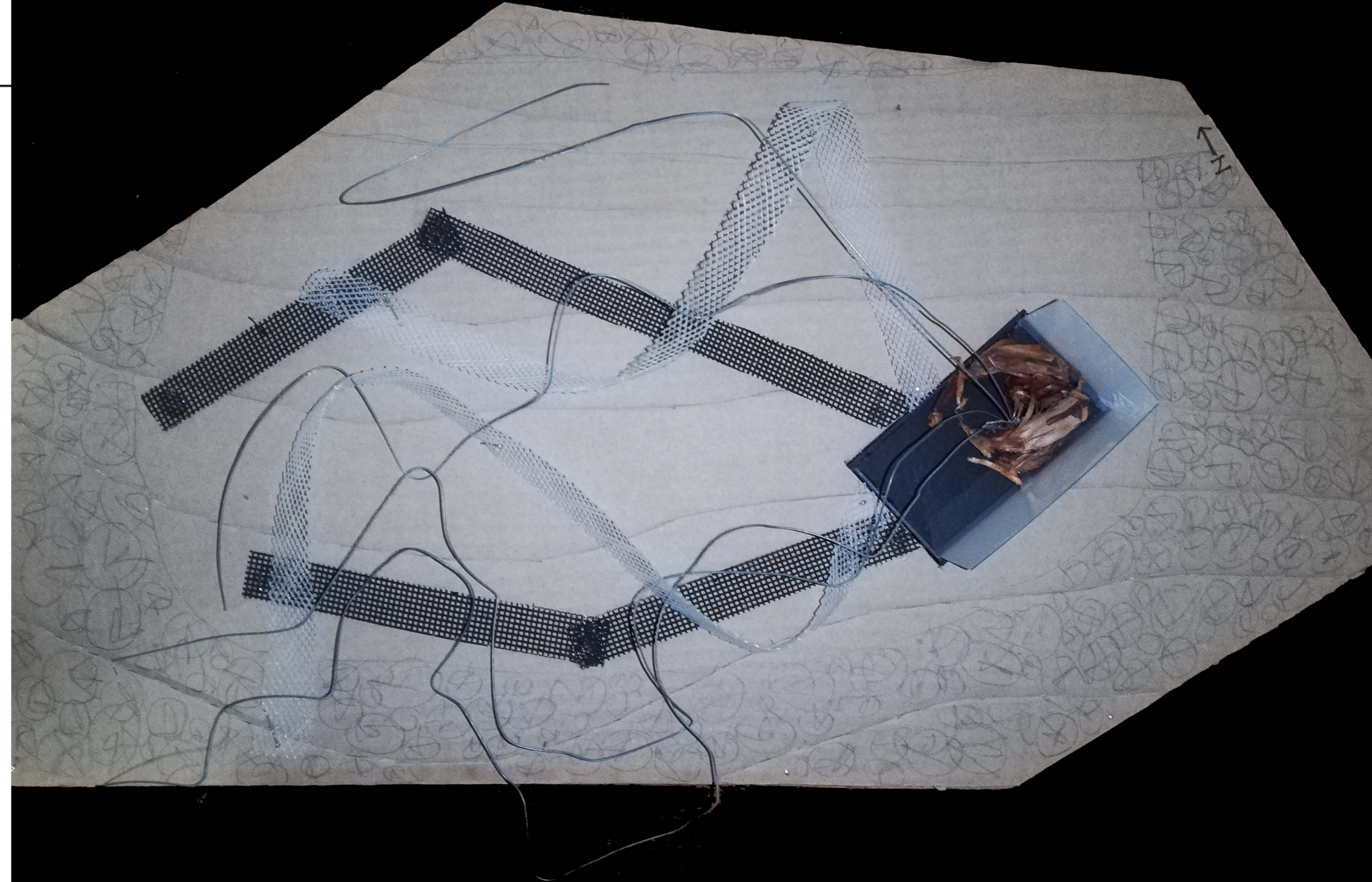
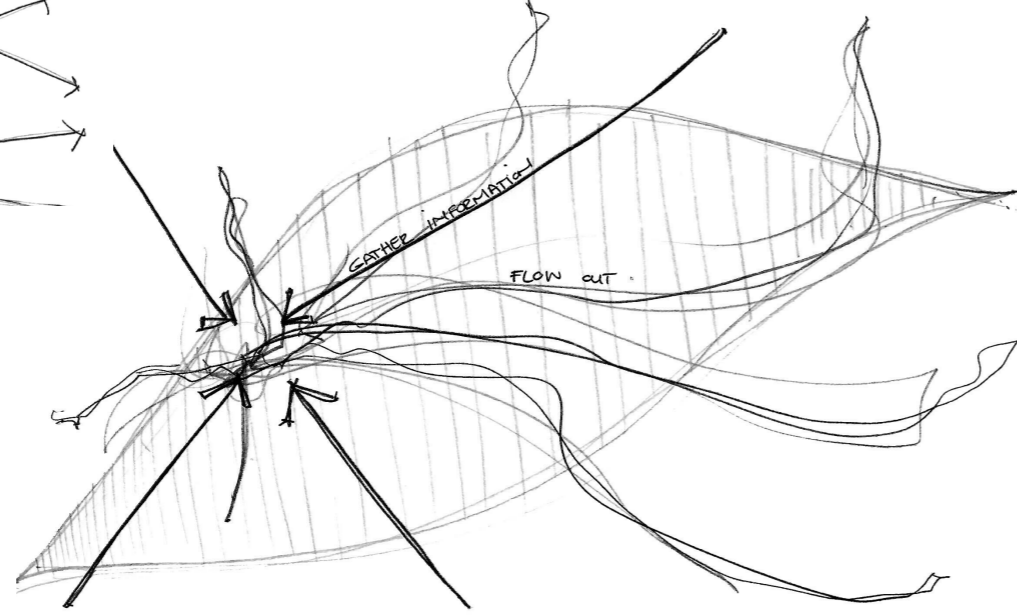
Concept 3: Assemblage

Assemblage is the gathering and joining together various elements to form an intertwined entity. The gathering of various elements create the opportunity for exploration and discovery to take place. The design concept initiate that the proposal consist of various parts flow together to achieve a central gathering of lived experiences. Rhizomatic notions of multiplicities within the Diepwalle Forest allow for a harmonious accumulation of discoveries and explorations. The concept further strive towards creating an assemblage that connects man with nature and formulate a seamless relationship between nature and the build form.

Discover and uncover

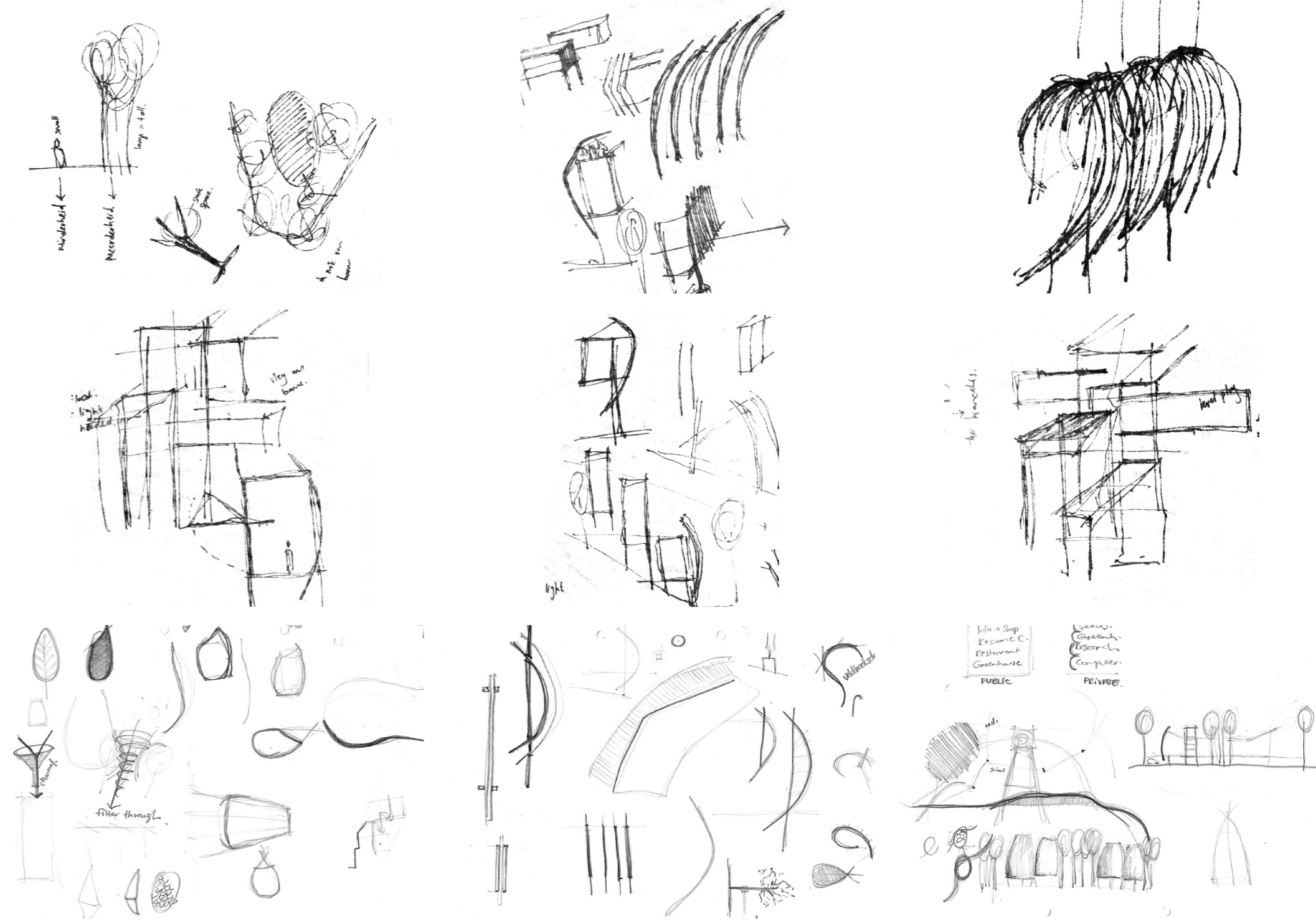
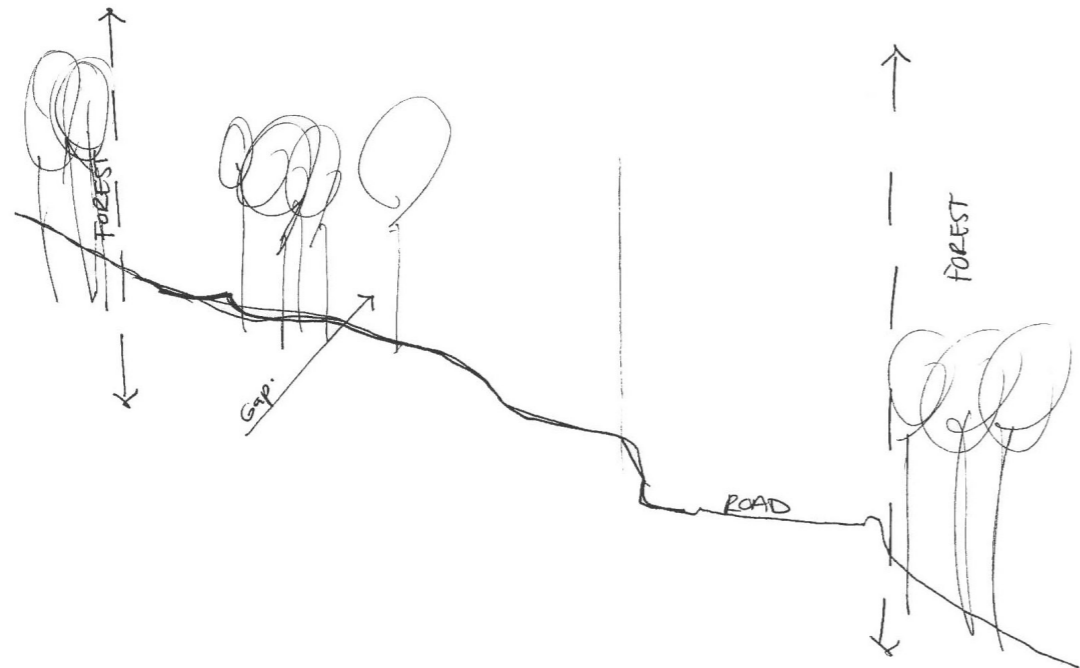


through exploration



Conceptual Process

The conceptual process is primarily driven by the notion of protection which evolved into the idea of conservation. The conceptual development reacts to the site and is influenced by the qualities of the site. The drawings are done to explore various possibilities of how the proposed design responds to the qualities of the site and to envision design proposal possibilities.



Typology:

The client



Knysna Municipality

MISSION STATEMENT

"Inclusive...Innovative...Inspired!!"

MAIN OBJECTIVES

- + Conserving natural resources
- + Quality municipal services
- + Development of people

REQUIREMENTS FOR ACCOMMODATION LIST

- + Recreational activities within the indigenous forest landscape
- + Providing measures of conservation education to the public and tourists



South African National Parks

South African National Parks

MISSION STATEMENT

"National Parks will be the pride and joy of all South Africans."

MAIN OBJECTIVES

- + Acquire and manage national parks of indigenous wildlife, landscapes and vegetation

REQUIREMENTS FOR ACCOMMODATION LIST

- + Proper facilities to provide tourists with information
- + Indigenous plant nursery
- + Control centre from where observations can be made

User Profile

The proposed design serves as a gathering space for numerous users visiting the Diepwalle Forest. The user group is not bound to a certain margin, but also invites an array of users to explore the various functions that the proposed design has to offer. The design strives toward creating a hub where people will gather in order to celebrate and explore the mystical Diepwalle Forest.

- Visitors:** Locals, tourists
- Recreation:** Hikers, cyclists
- Education:** Student, scholars, researchers
- Naturalists:** Birdwatchers, foresters, environmental activists

Information Centre & Shop	
Space description	Area (m ²)
Information Desk & Pay Point	38
Informative Exhibition Boxes	25
Shop Area	75
Services:	
Main Office 1	19
Safe	5
Office 2	20
Store Room 1	13
Store Room 2	5
Female WC 1	11
Disable WC 1	4
Male WC 1	10
Total	225

Observation Tower	
Space description	Area (m ²)
Seedbank	100
Rooted-In-Time Forest Museum	72
Botanical Research Library	72
Control Room & Observation Centre	72
Multi-Functional Seminar & Function Space	72
Observation Tower Lookout Point	72
Total	460

Indigenous Forest Nursery	
Space description	Area (m ²)
Indigenous Plants for Retail	327
Nursery Pay Point	24
Vermiculture	48
Services:	
Nursery Storage	40
Staff Room 2	9
Nursery Refuse Collection Point	7
Store Room 3	5
Female WC 2	11
Disable WC 2	4
Male WC 2	10
Total	485

Forest Experiential Restaurant	
Space description	Area (m ²)
Restaurant Reception & Pay Point	12
Indoor Seating	260
Outdoor Seating	
Planter Boxes	
Forest Infused Gin Tasting Bar	170
Culinary Studio & Workshop	130
Services:	
Restaurant Kitchen	112
Wash-Up Area	10
Chief Chef Office & Control	10
Check Point	
Dry Storage	8
Utility Storage	6
Staff Room 1	15
Cold Room	8
Total	741



PRECEDENT STUDY | 01

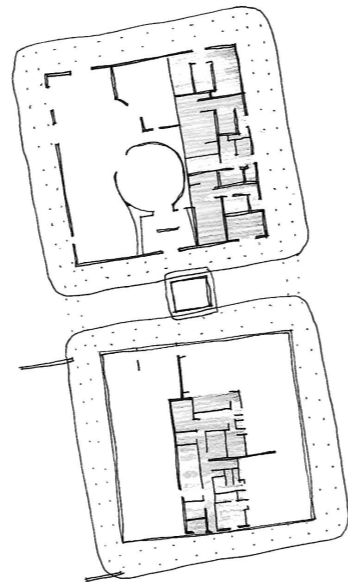
Similar function

STONEHENGE VISITOR CENTRE
 Stonehenge, Amesbury, UK
 Denton Corker Marshall Architects
 2013

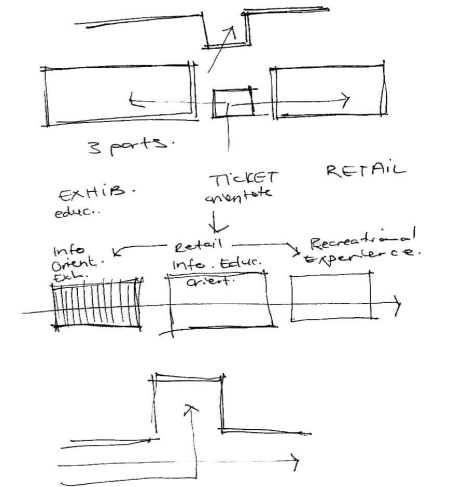
The Visitor's Centre is designed to touch the earth lightly, leaving a minimal permanent scar to the World Heritage site. The design comprises of simple enclosures that is linked together with a perforated, undulating canopy. A series of columns holds the roof structure up, while resting on a limestone platform. Materials that are local and renewable has been used as far as possible to ensure a sustainable design.

The design consist of three pods of different functions and materials. The museum function is the largest and clad in chestnut timber. The second largest pod houses the retail and educational facilities and is clad in glass. A zinc cladded ticket pod fills the gap between the two large pods and act as an orientation point for the visitor.

Roof as binding element



According to Denton Corker Marshall Architects (2013) "The design of the centre is based on the idea that it is a prelude to the Stones, and its architectural form and character should in no way diminish their visual impact, sense of timeless strength and powerful sculptural composition. Where the Stones are exposed, massive and purposefully positioned, the centre is sheltered, lightweight and informal. And where the Stones seem embedded into the earth, the centre rests on its surface."



STONEHENGE VISITOR CENTRE:
 TYPOLOGY:
 visitors centre



Denton Corker Marshall. Stonehenge Visitor's Centre. Amesbury, UK. Photographs: Peter Cook. 2013

- Lessons learned:**
- + Roof as binding element to join pods together
 - + Functional organisation and placement of services
 - + Minimal impact on site



ENSITU Architects. Panarama Rainforest Discovery Centre. Cocle, Panama. Photographs: Patrick Dillion. 2012

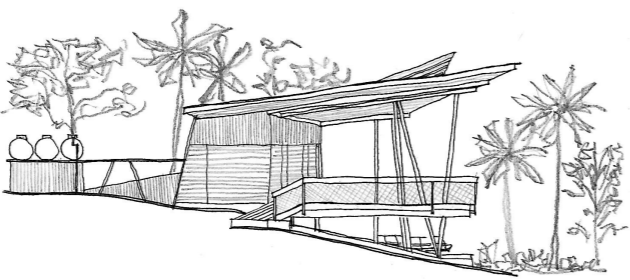
PRECEDENT STUDY | 02

Similar context

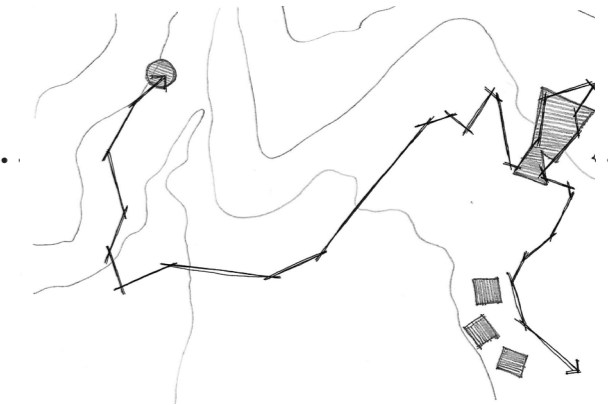
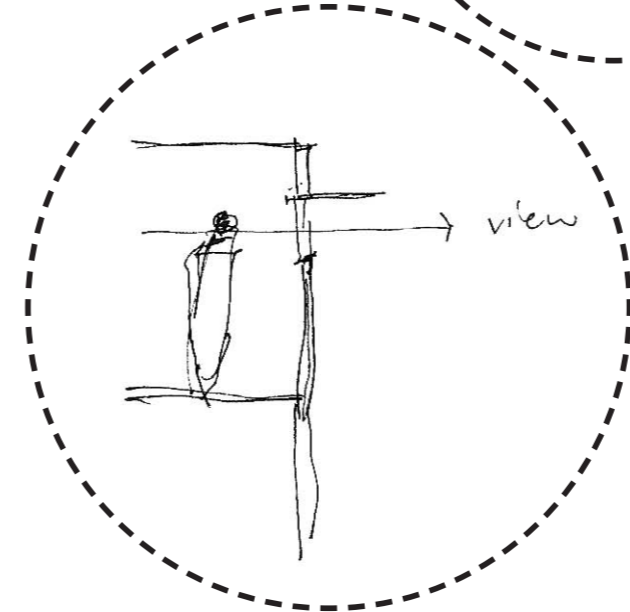
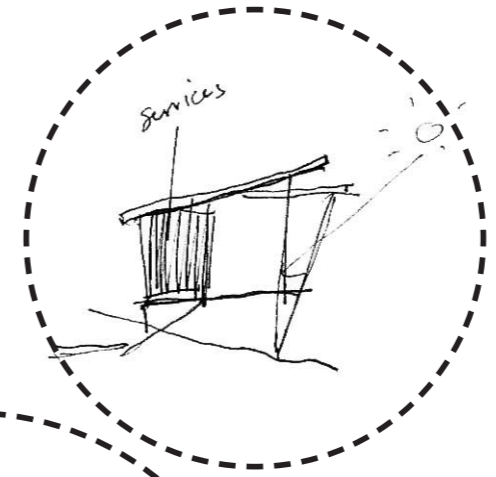
PANAMA RAINFOREST DISCOVERY CENTRE

Cocle, Panama
ENSITU Architects
2008

The Panama Rainforest Discovery Centre is focussed towards protecting and preserving the habitats of native bird species. The centre is designed to be "off the grid" in order to have minimal impact on the site. Sustainable principles used throughout the design are photovoltaic panels to generate energy, recycled materials, rainwater catchment and the use of natural ventilation. The design consist of meandering pathways that leads the visitor from the Visitor's Centre towards the Observation Tower.



- Lessons learned:**
- + Narrating visitor through site
 - + Designing built form to fold around natural context
 - + Off-grid design
 - + Using nature to guide layout



Narrative quality



ENSITU Architects. Panarama Rainforest Discovery Centre. Cocle, Panama. Photographs: Patrick Dillion. 2012

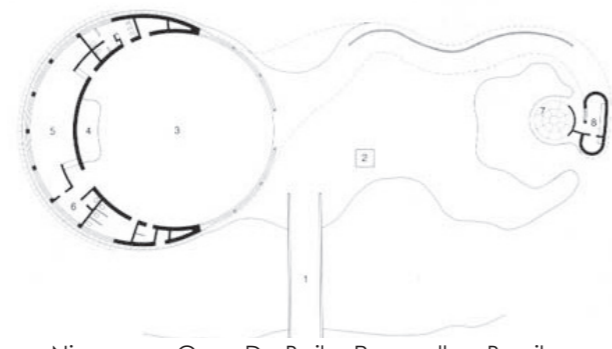
Image source: Online

PRECEDENT STUDY | 03

Formgiving

CASA DO BAILE
Pampulha, Brazil
Oscar Niemeyer
1940

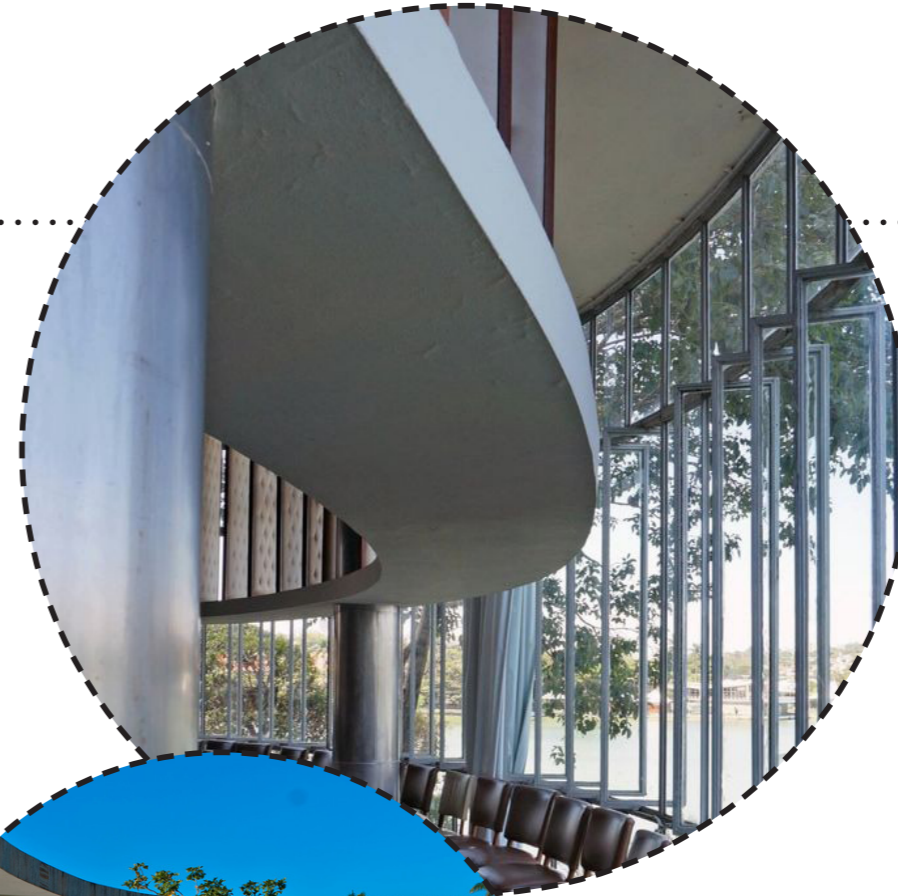
Casa do Baile in Pampulha is a building that is in touch with nature as it reacts and echo's the winding outline of the lake. The serpentine concrete slab acts as a frame that encloses the landscape. This metaphor becomes a way in with the landscape can be read and reimagined. The building is simple but spatially complex as it allows for multiple sensorial experiences.



Oscar Niemeyer. Casa Do Baile. Pampulha, Brazil.
Photographs: Andrew Higgott. 2016

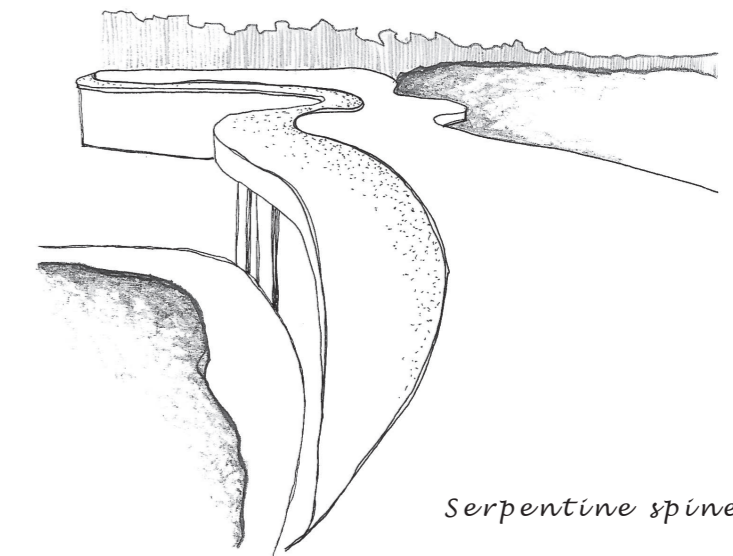


Oscar Niemeyer. Casa Do Baile. Pampulha, Brazil.
Photographs: Andrew Higgott. 2016



Lessons learned:

- + Architectural promenade
- + Curved pathway meandering along natural features
- + Embodiment through experience of form-giving

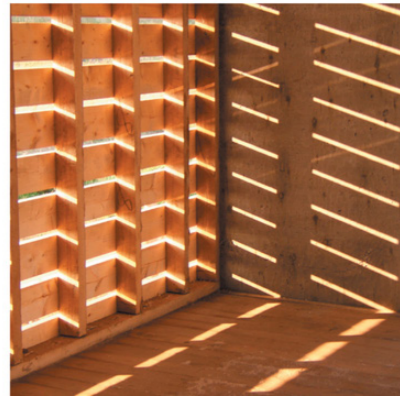


Serpentine spine



Oscar Niemeyer. Casa Do Baile. Pampulha, Brazil.
Photographs: Andrew Higgott. 2016

Nature inspire formgiving



Mackay Sweetapple Architects, Ghost Lab 5, Kingsberg, Nova Scotia. Photographs: John Thomson, 2008

PRECEDENT STUDY | 04

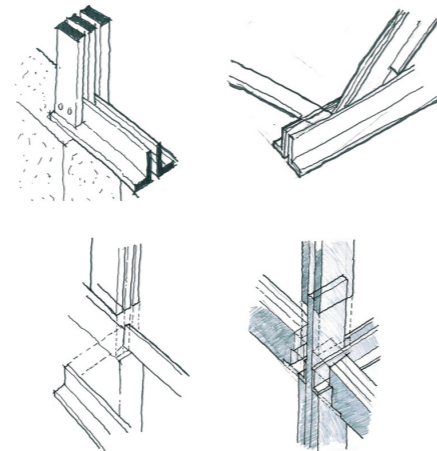
Timber construction

GHOST LAB 5

Mackay-Lyons Sweetapple Architects
Kingsberg, Nova Scotia
2008

The timber structure was designed and erected in two weeks by 19 students and under the leadership of Mackay-Lyons and Mac Lean (2008: Online). The process started out with conceptual development and then evolved into uncovering the way in which the timber joints will work. The quasi-permanent structure stands alone in the field like a ghost in the landscape. It could be argued that the structure functions to serve the landscape maker, as it echoes the outline of its surroundings.

Steel and timber connections



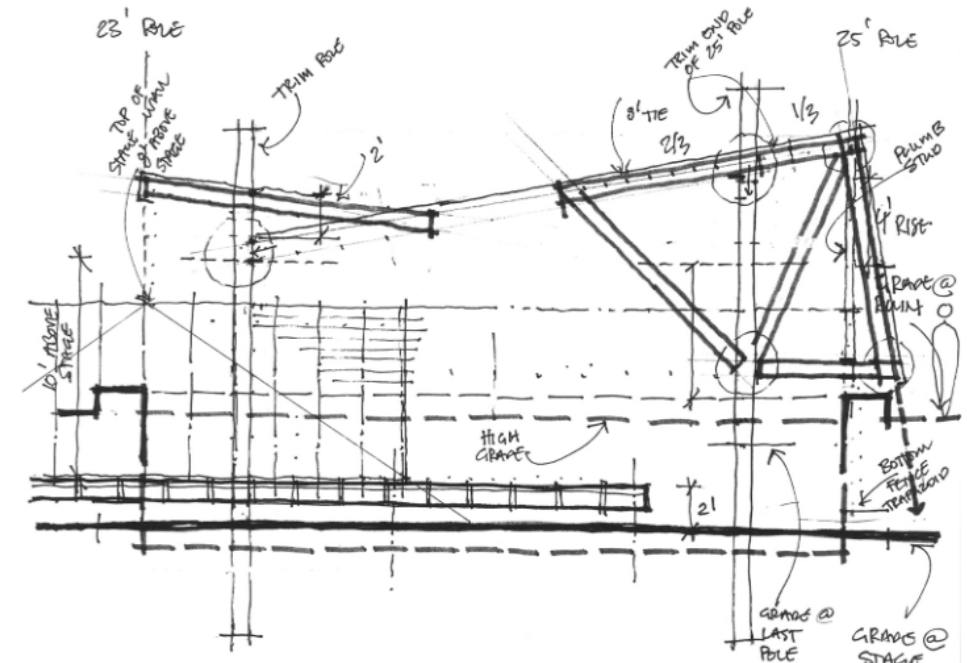
Mackay Sweetapple Architects, 2008. Ghost Lab 5: Structure details. Online. Available at: mhsarchitects.ca/ghost5.html

Mackay Sweetapple Architects, 2008. Ghost Lab 5: Structure details. Online. Available at: mhsarchitects.ca/ghost5.html



Lessons learned:

- + Timber exploration
- + Material use and combination
- + Timber as a natural material that fades into landscape



Mackay Sweetapple Architects, 2008. Ghost Lab 5: Structure details. Online. Available at: mhsarchitects.ca/ghost5.html

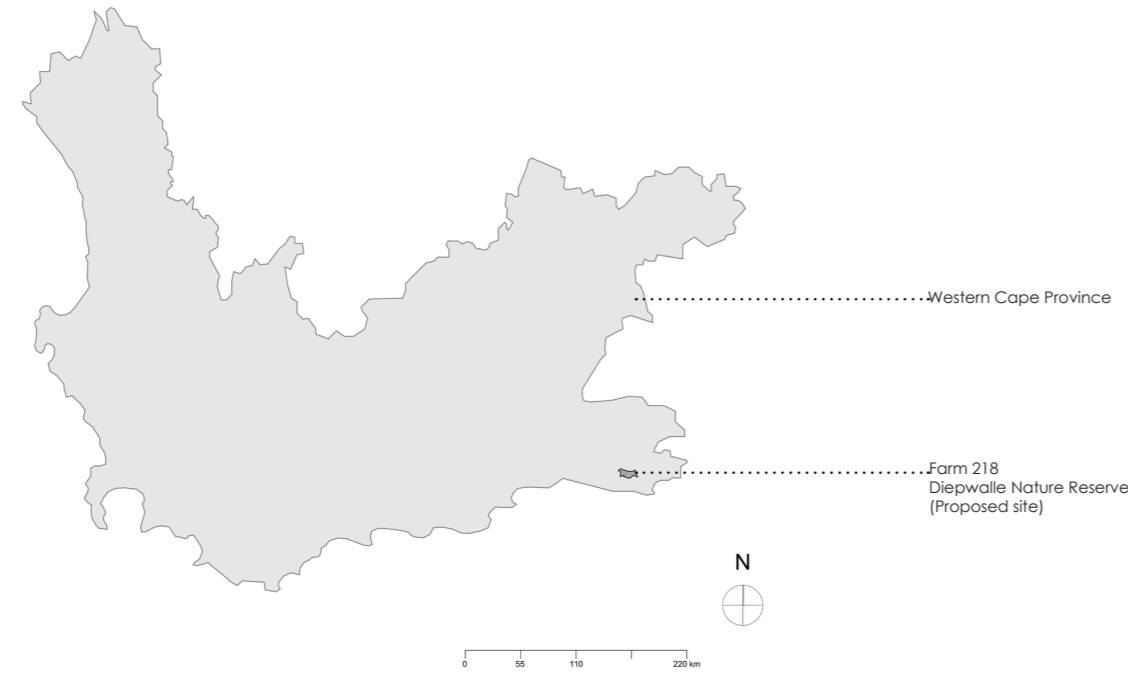


Topology

Site Analysis

This section of part 2 focusses on the broader Western Cape context, as well as the indigenous Diepwalle forest environment that influences the character of the site. The investigation aims to identify physical influences on the site, as well as the various voices that effect the site character.

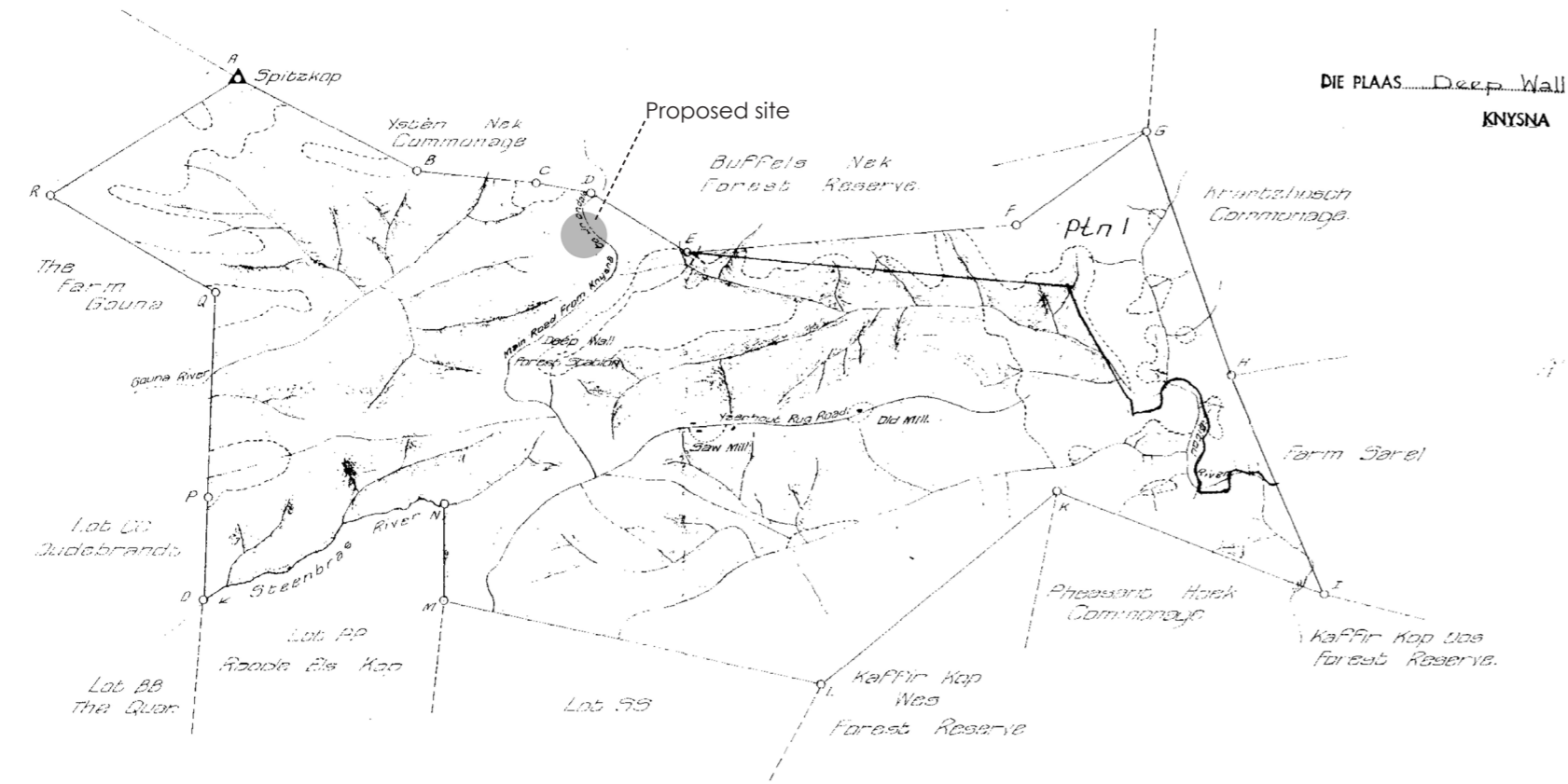
The design proposal is situated within the Diepwalle Forest, approximately 22km outside of Knysna on the Prins Alfred Pass (R339) in the Western Cape. The macro context consists of a foothill topography that forms the transition zone between the Outeniqua mountain range and the Indian Ocean. The oceanic climate offers an ideal environment for a diverse ecology of plant growth and birdlife. The scenic quality of the Western Cape ensures a unique tourist experience where man is able to reconnect and appreciate nature.



Macro site map of Western Cape & Diepwalle Nature Reserve location

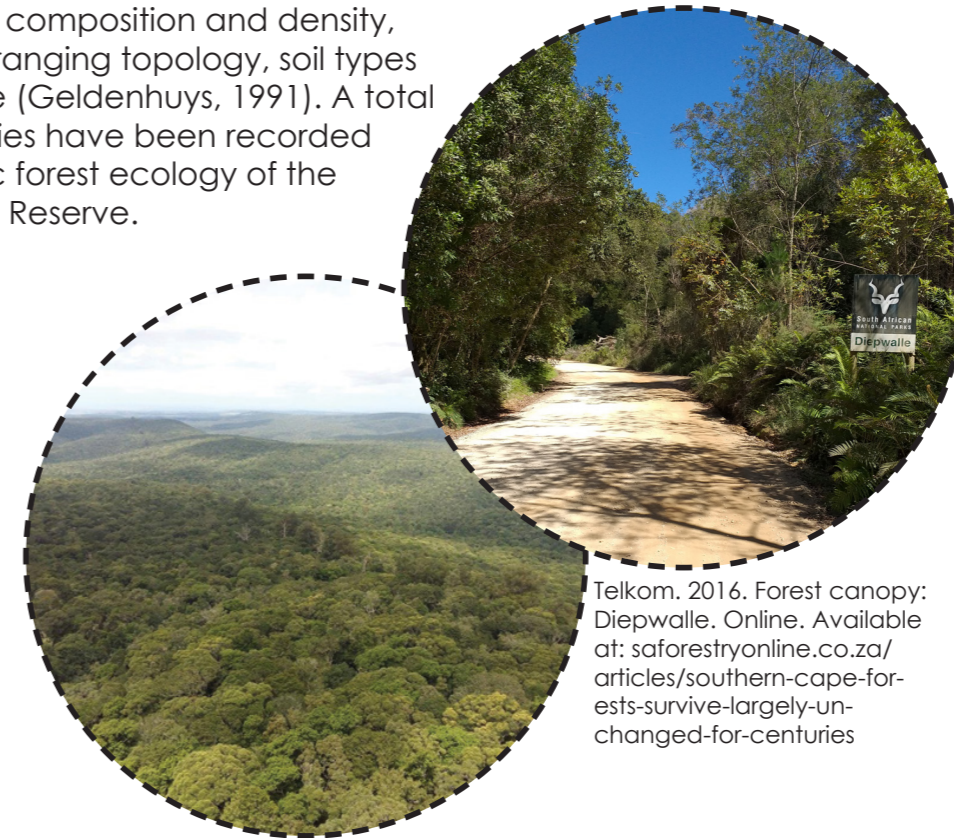


The map depicts a portion of the Western Cape with various nature reserves.



Surveyor General Diagram of Farm 218, Diepwalle Nature Reserve. The proposed site is situated towards the northern border of the farm portion. Cape Farm Mapper. 2019. SG Diagram: Farm 218. Online. Available at: <<https://gis.elsenburg.com/apps/cfm/>>.

The project is situated within the Diepwalle Nature Reserve (Farm 218) which consist of Southern Cape Afrotemperate Forest vegetation. The forest ecology is rich in tree structure, species composition and density, as a result of the ranging topology, soil types and microclimate (Geldenhuys, 1991). A total of 465 plant species have been recorded within the specific forest ecology of the Diepwalle Nature Reserve.



Telkom. 2016. Forest canopy: Diepwalle. Online. Available at: safeforestryonline.co.za/articles/southern-cape-forests-survive-largely-un-changed-for-centuries

Diepwalle Nature Reserve offers a self-explorative Rooted-in-Time drive that has multiple stop points which celebrates the various historical aspects of the Diepwalle Forest. These attraction points allow visitors to explore the different mystical voices of the forest as it is experienced through myths, legends, sites and artefacts.



Routed-in-Time self explorative drive, Diepwalle Nature Reserve.

Routed-in-Time Drive

The strip images shows the various attraction points on the Routed-in-Time self exploration drive.





Velbroeksdraai
Picnic spot
Diepwalle Nature Reserve

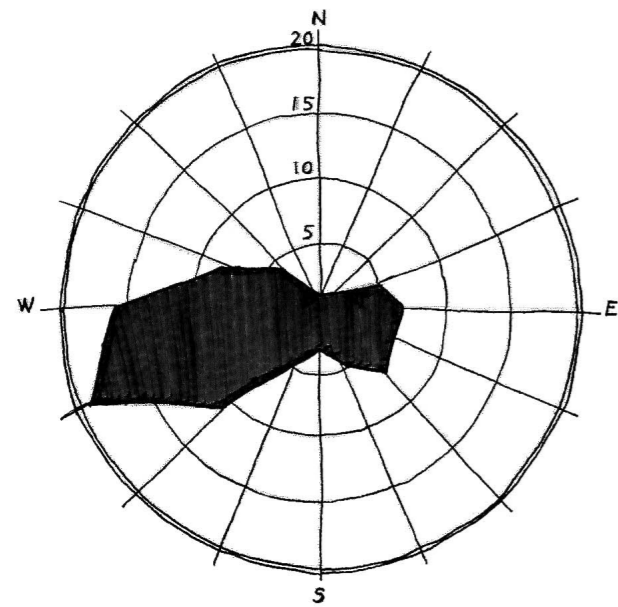
Originally known as Veldhoekdraai, this was once a notorious spot for drivers. The very narrow road with a sharp bend reminded one of a fish hook. To get anything but the smallest vehicle past the corner, you were forced to edge your way round it through a series of forwards-and-backwards manoeuvres.

The picnic spot offers a perfect pause space to cool down and freshen up. This stop also offers a short circular trail (± 1km) with the opportunity to view a few forest giants in their prime.

Climate

The Western Cape consists of an array of climatic classifications. Diepwalle Forest falls under the Oceanic Climate classification (Climate Data.Org, 2019: Online), where the minimum and maximum temperatures doesn't fluctuate much. The average temperature of Diepwalle range from 9 to 22 degrees in winter and 18 to 28 degrees in summer. The Western Cape region receives winter rainfall of up to 74mm in August (Elsenburg, 2019: Online). The overall sun angle range from 41 degrees in winter to 88 degrees in summer. The prevailing wind direction, as experienced in the Diepwalle Forest, range from west to southwest.

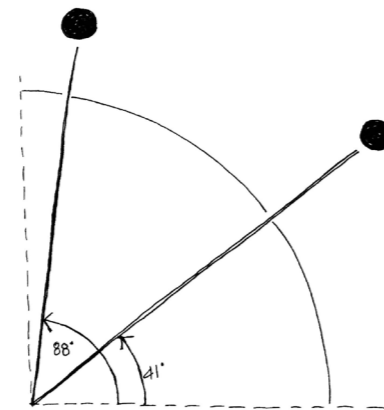
Wind direction distribution in %



Prevailing wind direction of Diepwalle - ranging west to south-west.

Sun Study

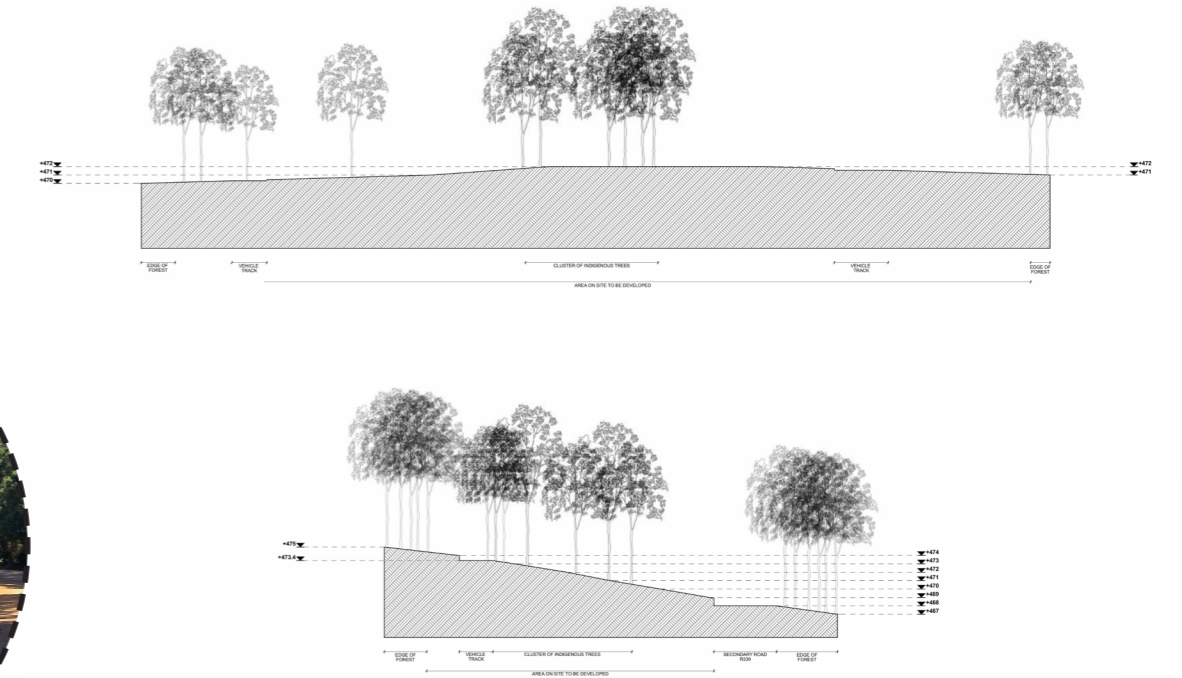
Sunlight is a vital element in the forest topology for it allows photosynthesis to take place. The filtered light quality is a unique characteristic of the forest topology and aid in enhancing the place-specific experience.



Solar geometric study of sun at Diepwalle Nature Reserve

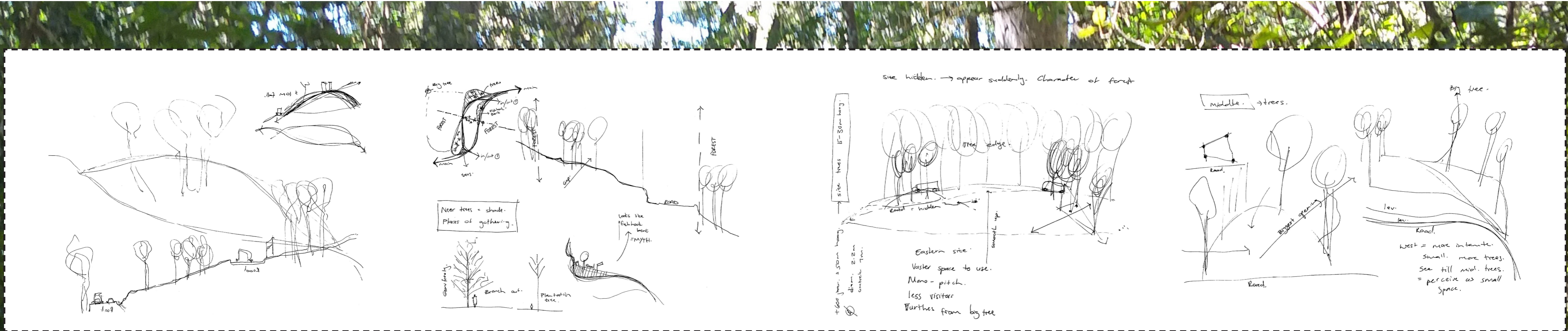
Topography

The macro context consists of a foothill topography which forms the transition zone between the mountain range and coastal areas with an altitude of between 350m and 550m (Scriba, 1984). Rainwater flows towards the valleys of the foothills and drains into various streams and rivers. On the meso scale, the rainwater flows towards the Bietou River, a few kilometres north from the site. On the micro-scale the site is situated on a relatively steep slope of approximately 7 degrees falling towards the north, providing various drainage possibilities to the proposed development.



Sections taken through the proposed site, Velbroeksdraai, Diepwalle nature Reserve. Site slopes with 7 degrees.

Ontological approach to site

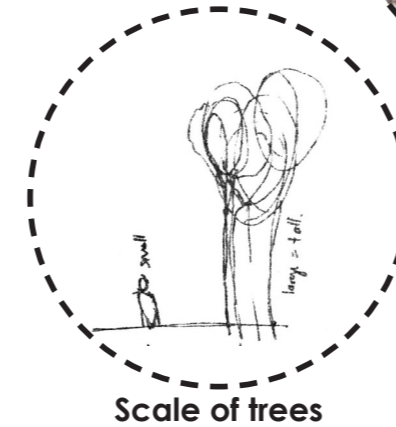
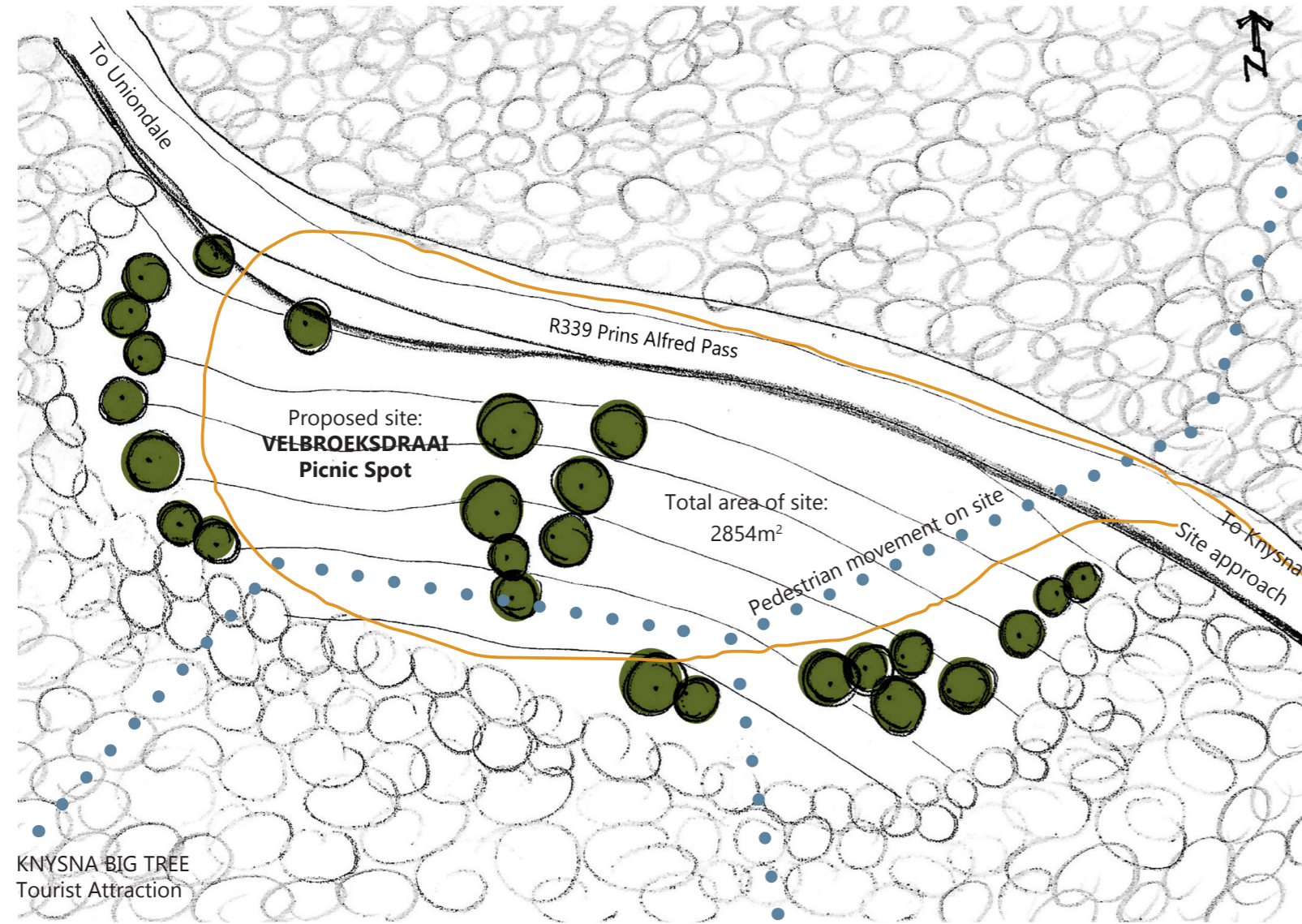


The drawings are initial site sketches that was made upon visiting the site in March 2019. They are quick drawings to mark out existing site features and site experiences.

The proposed site consist of 2854m² of clearing within the Diepwalle Forest that can be utilised for the design proposal.

The site is experienced to be more semi-public than completely public for it is hidden within the Diepwalle Forest. There are two short distant trails that loop from the site and into the forest, resulting in pedestrian movement across the site.

The site slopes with 7 degrees towards the northern part of the site. This allows for the site to be more public towards the north, and more private towards the southern part where the forest edge provides a threshold before entering the cluster of indigenous trees.



Scale of trees



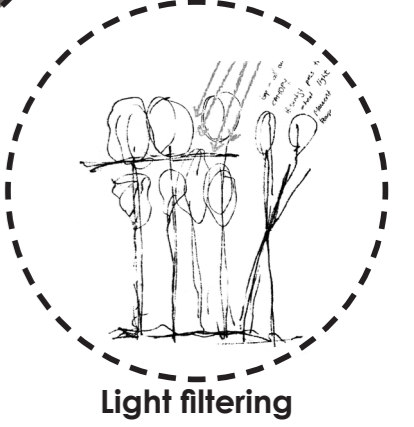
NATURAL FEATURES
The site and surrounding area consist of sandstone rock formation.



LIGHT QUALITY
Light quality plays an important role within the romantic forest landscape. Light filters through the tree canopy in a playful manner.

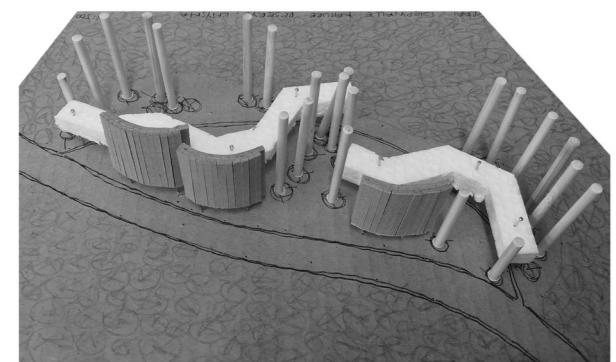
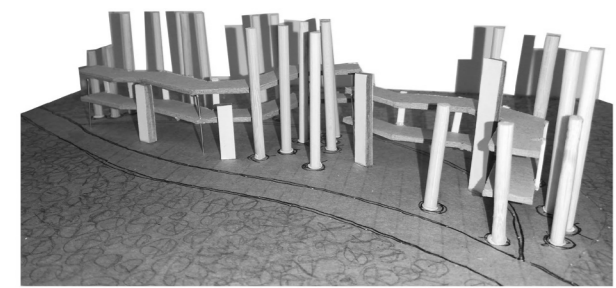
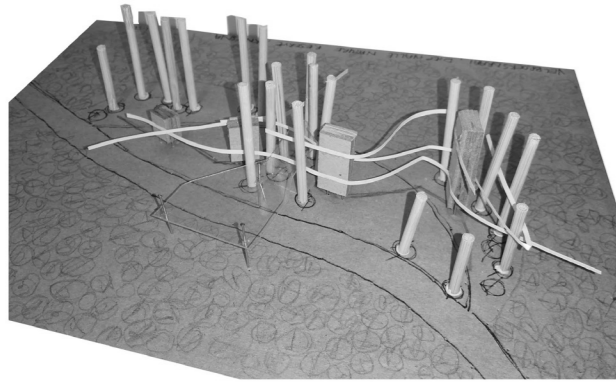


NOISE
Trucks from nearby Timber Plantations pass by the site. The noise from these trucks disrupt the tranquility of the site.



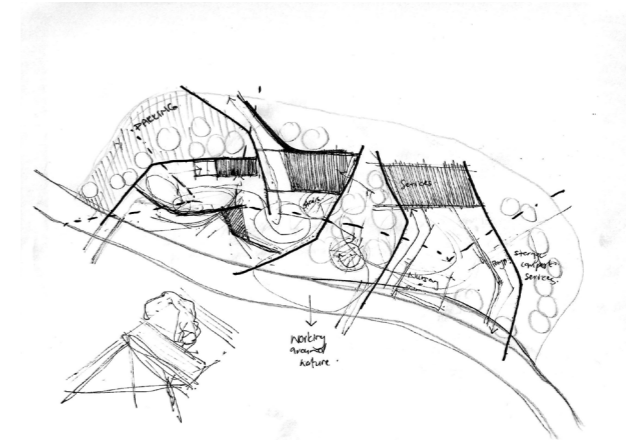
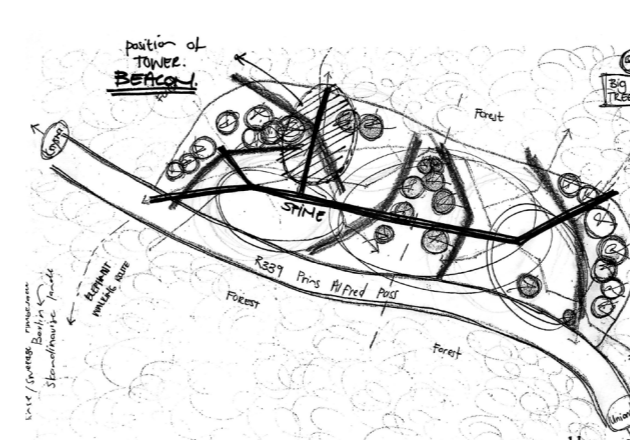
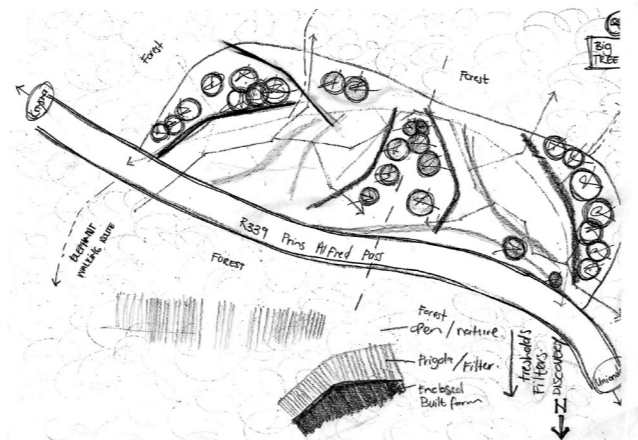
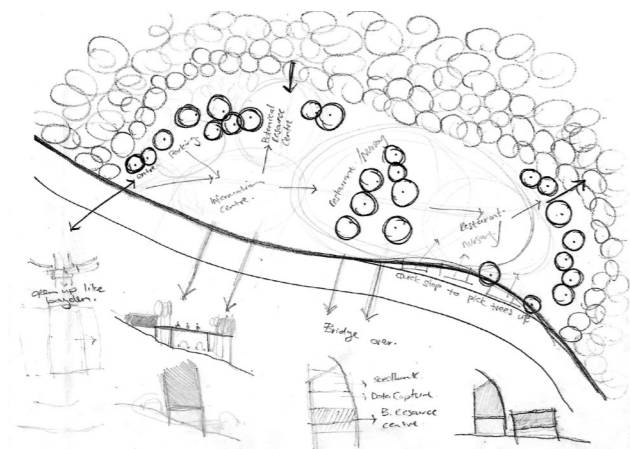
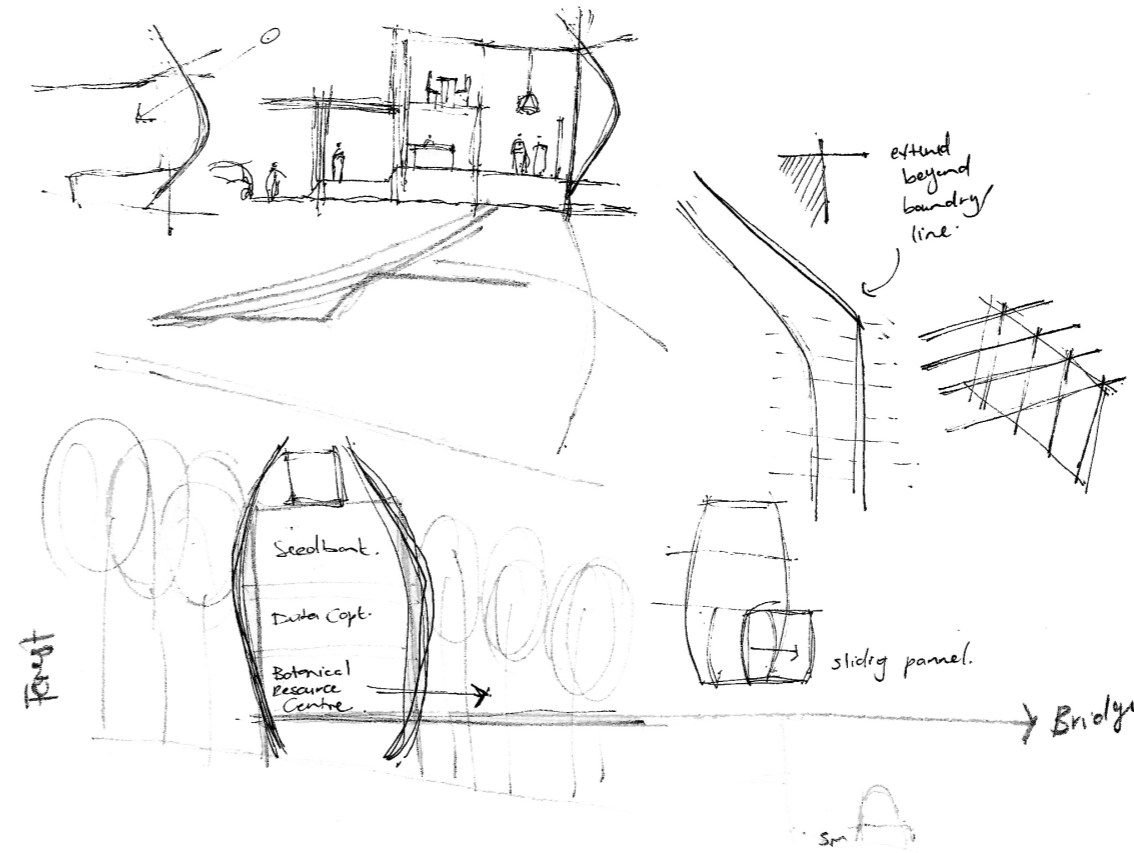
Light filtering

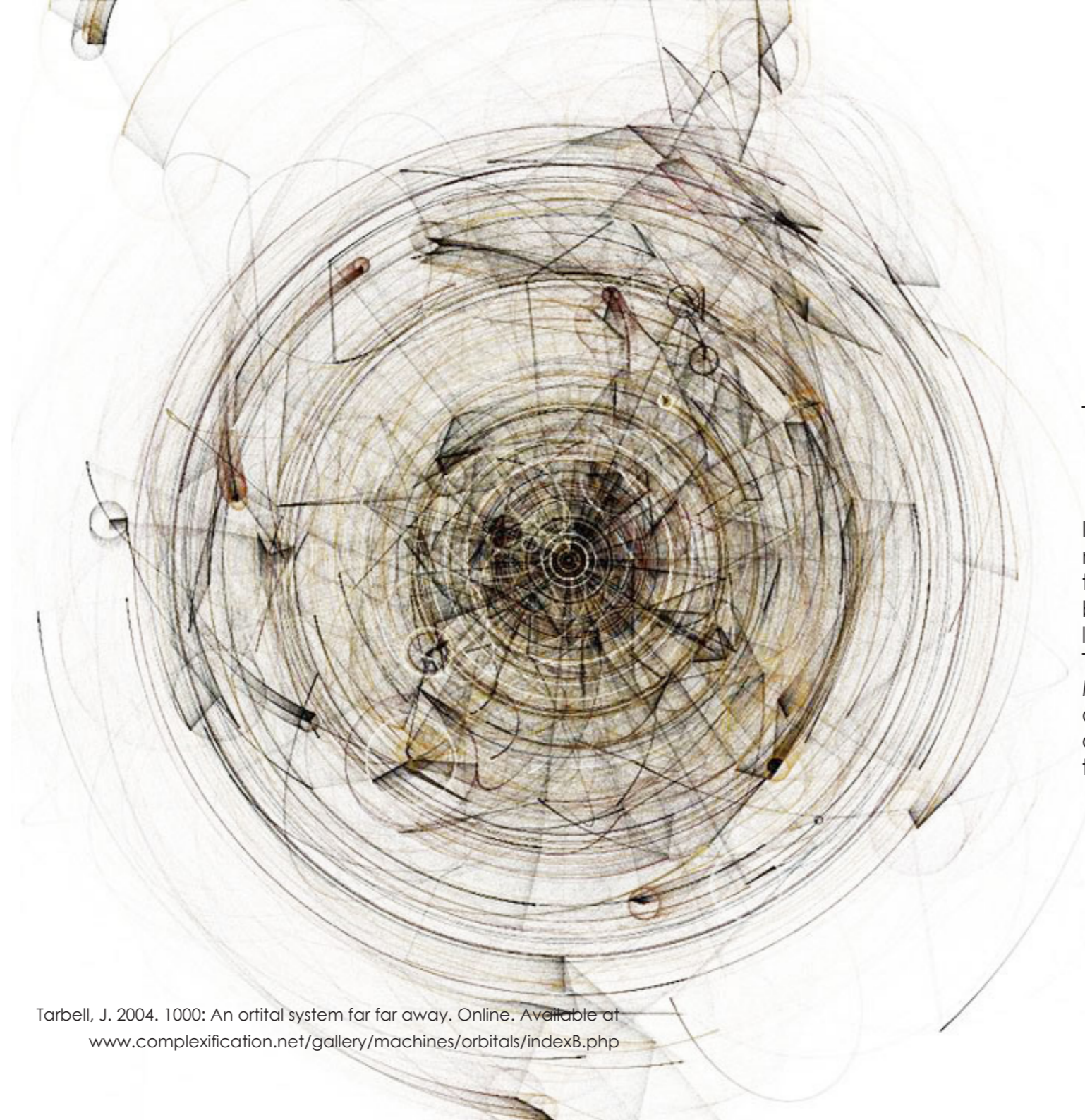
Velbroeksdraai Diepwalle Forest.
Photograph: Doman, J. 2019



CONCEPTUAL APPROACH TO SITE

The sense of discovery was one of the driving factors behind developing a design proposal. The conceptual aim is to allow visitors to meander through the site as they explore and learn more about nature. The introduction of beacons within the landscape provides order within the chaotic density of the forest. A protective layer or shell provides a buffer against direct northern sunlight. Thresholds provide an interactive engagement between man and nature. The visitor filters through the site in a similar manner that natural light filters through the forest, continuously re-instating the notion of discovery.





Morphology

Theoretical Exploration

In order to formulate an informed morphological design proposal, various theoretical notions are investigated and analysed to ensure a meaningful experience of place. The theoretical approach of environmental ethics provide a starting point to the relationship between man and nature. Man's embodied experience is analysed within the forest landscape and related to similar connections made within the proposed build form. The narrative quality of the Knysna – Tsitsikamma Forest as portrayed through Dalene Matthee's novels, is used as a design tool to guide the visitor's exploration through the design proposal. The narrative notion is further investigated through the idea of an architectural promenade that acts as an explorative axis that guides the visitor through the proposed design and into the forest.

Environmental ethics:

Towards conserving the forest ecology

Environmental ethics is perceived as the study of values, concerns and consequences related to human connections with the natural environment (Attfield, 2012). It is further expressed that environmental ethics relate to people's behavioral interest towards the future generation of the natural environment. The act of evaluating human relationship within nature, provide an outline to link these two entities. In the article "Architecture of the Forest" (2008: 102), Louekari elucidates the notion where every human being is inherently connected to the natural environment they inhabit. Our perception and sensory response towards the natural environment indicate our ability to connect and impose measures of care onto the specific inhabited landscape.

In the article "The ethics of Foucault and Ricoeur: an underrepresented discussion in nursing" (2006: 225), Flaming draws a comparison between the theoretical approach of the 'self' and the 'other'. It states that ethical behavior forms over time, as it is continuously in tune with the 'other' whom the actions and behaviors of the 'self' influence. Through the notion of ethical behavior, it is understood that the 'self' requires the 'other' as an essential element for exercising care and ethical living.

The concept of caring for oneself and projecting the same care outwards, can be applied to the idea of behaving ethically towards the natural landscape. Environmental ethics, therefore, originate from the measure of care exercised by the 'self'. By applying these concepts to the design proposal, it is evident that by perceiving and analysing environmental ethics through lived experiences, the visitor ('self') will reflect these ethical notions onto the indigenous forest context ('other'). Therefore the design proposal should become the vessel through which conservation is experienced and perceived, to extent and project the same conservation onto the natural environment.

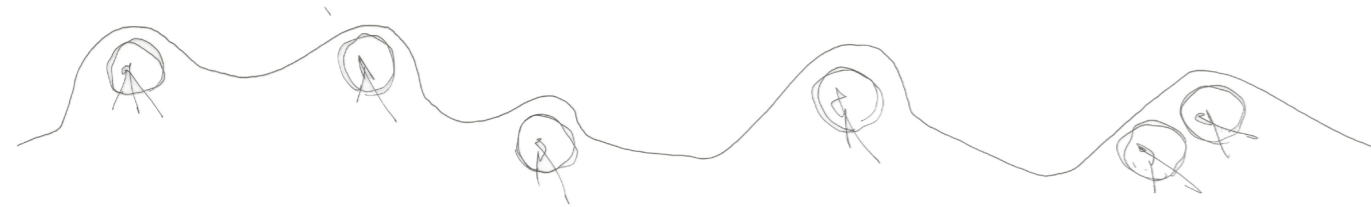
Man & Nature:

Celebration of Co-existence

“Environmental ethical thinking can only make sense if, and only if, human beings relate with nature by recognising how interrelated they are, and how they could further such relationship. Otherwise, an attempt to disconnect human beings from their interconnectedness with nature is not sustainable and reasonable.”
(Chemhuru, 2017: 21)

Through the interconnectivity between human beings and the natural environment, it is possible to protect the well-being of both entities. Behrens (2011: 54) argues that everything in nature is interdependent and that the well-being and future existence of human beings rely on the health of the natural context. Callicott (1995) elucidates that the inherent value of nature does not derive from nature but through the value ascribed to nature by human beings. The interdependence between man and nature allows for these two entities to co-exist through notions of applying care.

Human beings are in all aspects a part of nature (Hattingh, 1999: 69) and can and should, therefore, not be disconnected. As previously stated, our senses are an extension of the human body that allows man to connect with nature. Through introducing nature into the built form, an intertwined connection can be created that will aid in supporting the idea of celebrating nature and the forest topology. The design proposal should aim to flow and twist around the given natural topology in a manner of seamlessly joining man with nature.

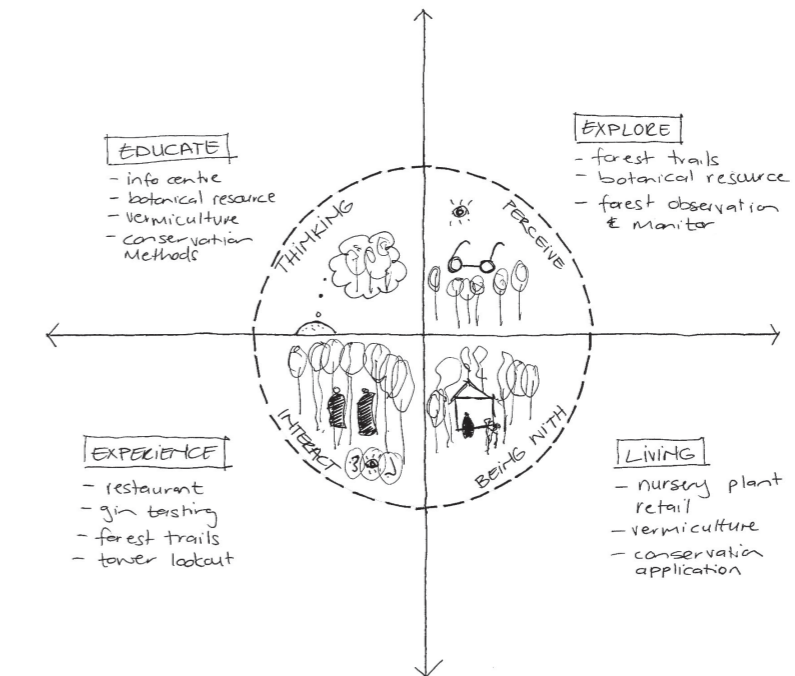


Embodiment:

Man's bodily experience within nature

The human body is inherently connected with its natural environment. Notions of embodied cognition theory express that humans creatively combine physical experience with the natural environment (Russell, 2013: 476).

There are four types of connectivity through which humans relate to the natural environment; knowing and thinking, perceiving, interacting and being-with (Russell, 2013: 477). These four elements can be applied to the justification of the design proposal. Conservation education, passive and green design strategies, explorative forest trails and merchandised indigenous plant species are practical measures that can be applied and incorporated within the design.



Four types of connectivity according to Russell (2013: 477), and related back to elements in the design.

Narrative:

Attaching meaning to place and the forest ecology

According to Richard Kearney (2002:129), “every human existence is a life in search of a narrative”. The notion of searching for a narrative can further be explained as the search for meaning and identity. In Dalene Matthee's novel 'Circles in the Forest' (1984), the path through which the main character is led acts as a measure to which meaning and identity are gradually uncovered. Narrative leads man through the context of time to uncover self-identity and through this process also formulate the value of other identities (Rasmussen 1995: 165). Through designing an explorative platform, human beings are able to uncover and attach meaning to their lived environment.

The concept of mimesis relate to the act of re-imagining and re-interpreting certain fixed ideas in order to formulate new layers of understanding (Kearney 2002:12). This statement can be related back to the narrative aspect within the design proposal, where pathways are incorporated as tools for inviting exploration and formulation of identities and meanings. Mimesis is not the act of coping with reality but re-interpreting and applying it. The design proposal aims to incorporate measures of conservation to initiate conversations and new interpretations of applying environmental ethics. The design proposal strives to become the narrator of environmental ethics. By providing possibilities of uncovering the notion of conservation through the design, the visitor may experience meaning and re-attach identity to place.

“Stories make possible the ethical sharing of a common world with others in that they are invariably a mode of discourse.” - (Kearney 2002: 150)



Architectural Promenade:

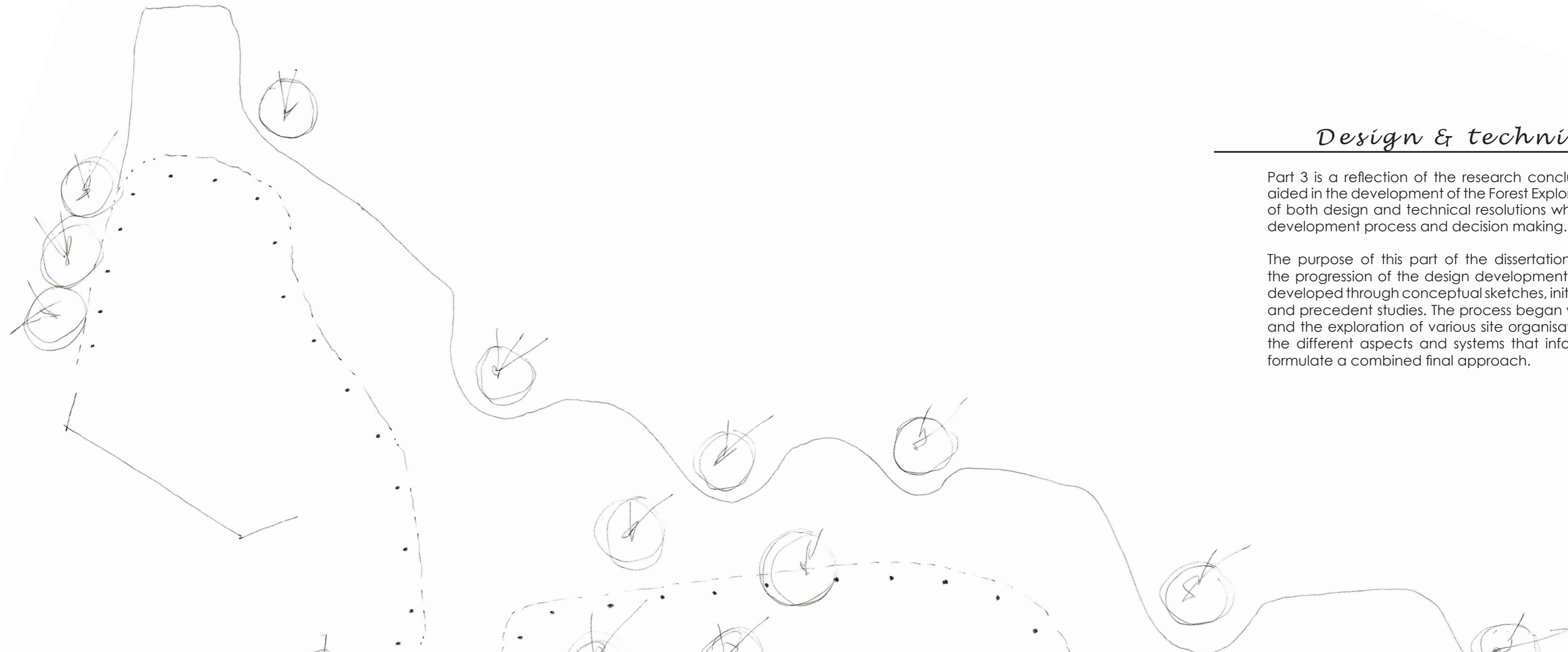
Exploring nature through the built form

An architectural promenade can be described as a pathway through which the visitor of a building, walks or meanders to explore and appreciate the various elements of the built form. The architectural promenade act as a narrative device that generates a storyline through different visual connections (Samuel, 2010: 67). In 'Architecture of Paris: An Architectural Guide' (2004: 247), Ayers elucidates Le Corbusier's theory that it is through walking and roaming about in a space that man appreciates the character identified with the specific space.

With the notion of implementing an architectural promenade within the design proposal, it is important to understand the essential characteristics of this specific notion. An architectural promenade is an axis that is strategically laid out to ensure an optimal bodily experience in and around the built form. Various visual links aid to ensure that the architectural promenade is supported as a series of revelations, rather than a linear route. The eye plays a vital role in guiding the visitor through the design and arousing a sense of curiosity and discovery.

The architectural promenade, as an axis, ensures that man and nature are organised in a harmonious way. By analysing the pathways within Oscar Niemeyer's Pampulha Complex, it is clear that he has a certain destination in mind for the axis, but still makes provision for multiple meandering routes. This notion creates a definite hierarchy in the importance of the spatial connections, while also providing for the design concept of exploration and celebration to be achieved.





Orientation:

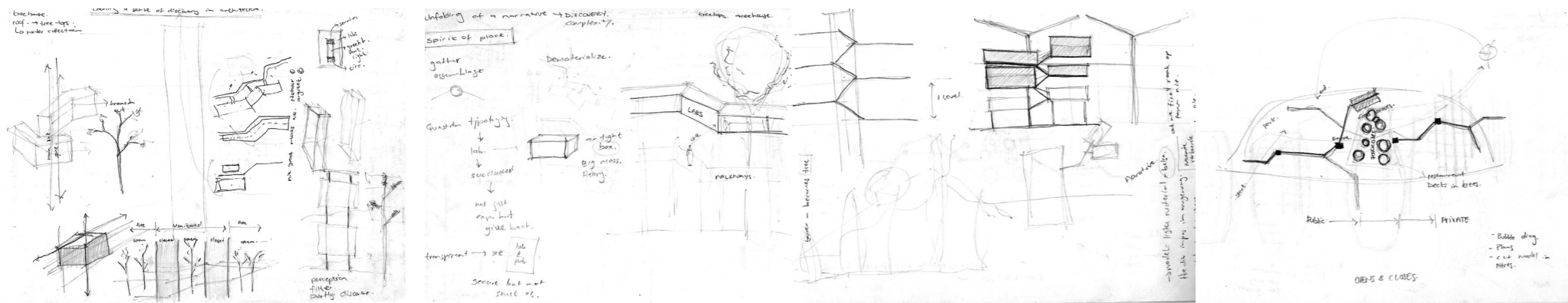
Design & technical synthesis

Part 3 is a reflection of the research concluded in Part 1 and 2, which aided in the development of the Forest Exploration Hub. Part 3 is a synthesis of both design and technical resolutions which is presented through the development process and decision making.

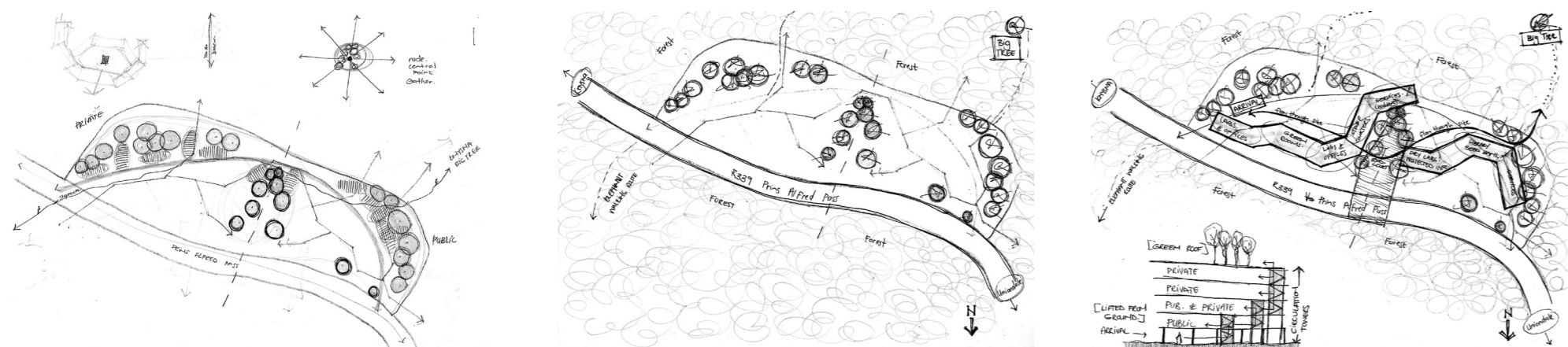
The purpose of this part of the dissertation is to explain to the reader the progression of the design development process. The design process developed through conceptual sketches, initial ordering of the site, models and precedent studies. The process began with ontological site sketches and the exploration of various site organisation methods. Part 3 explains the different aspects and systems that informed the design process to formulate a combined final approach.

Conceptual sketches and initial site ordering

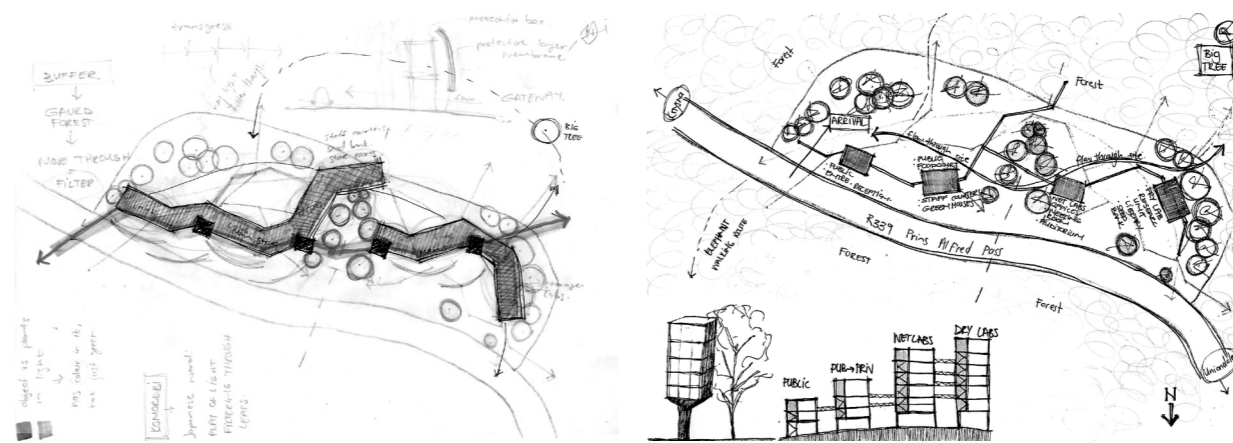
The design process started with various site ordering explorations. Initially, the notion of meandering through the site, in an ordered but explorative manner was explored. After that, the idea of beacons that sits lightly within the landscape was explored as vertical ordering methods. The structure of trees with its branching quality was investigated and analysed in terms of functional placing.



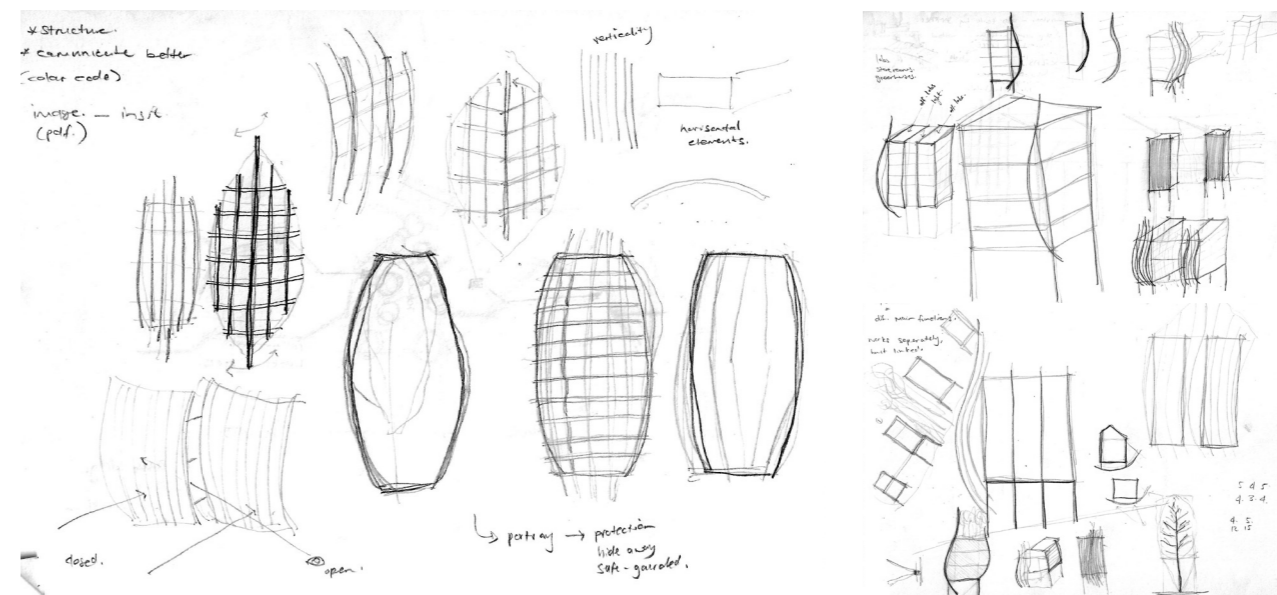
Tree structure influence the branching out and organising of various functions



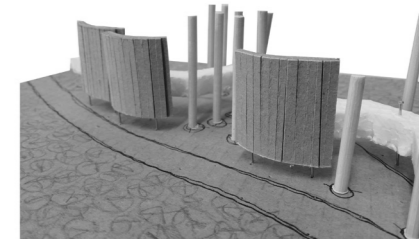
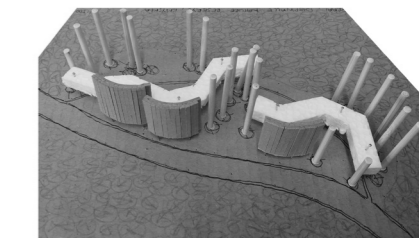
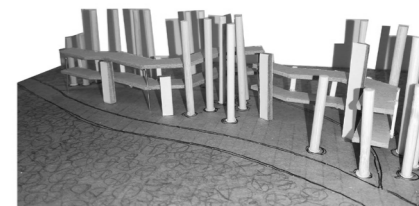
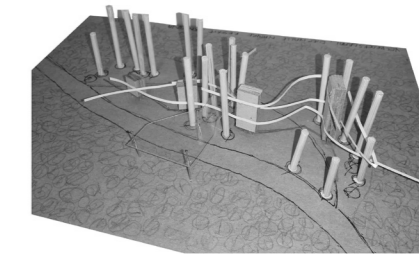
Organising site and exploring the placement of functions. Aim to create architectural possibilities that follows the natural landscape of the site.



Organising site by the use of vertical beacons within the landscape which allows meandering to take place through the various functions of the towers.

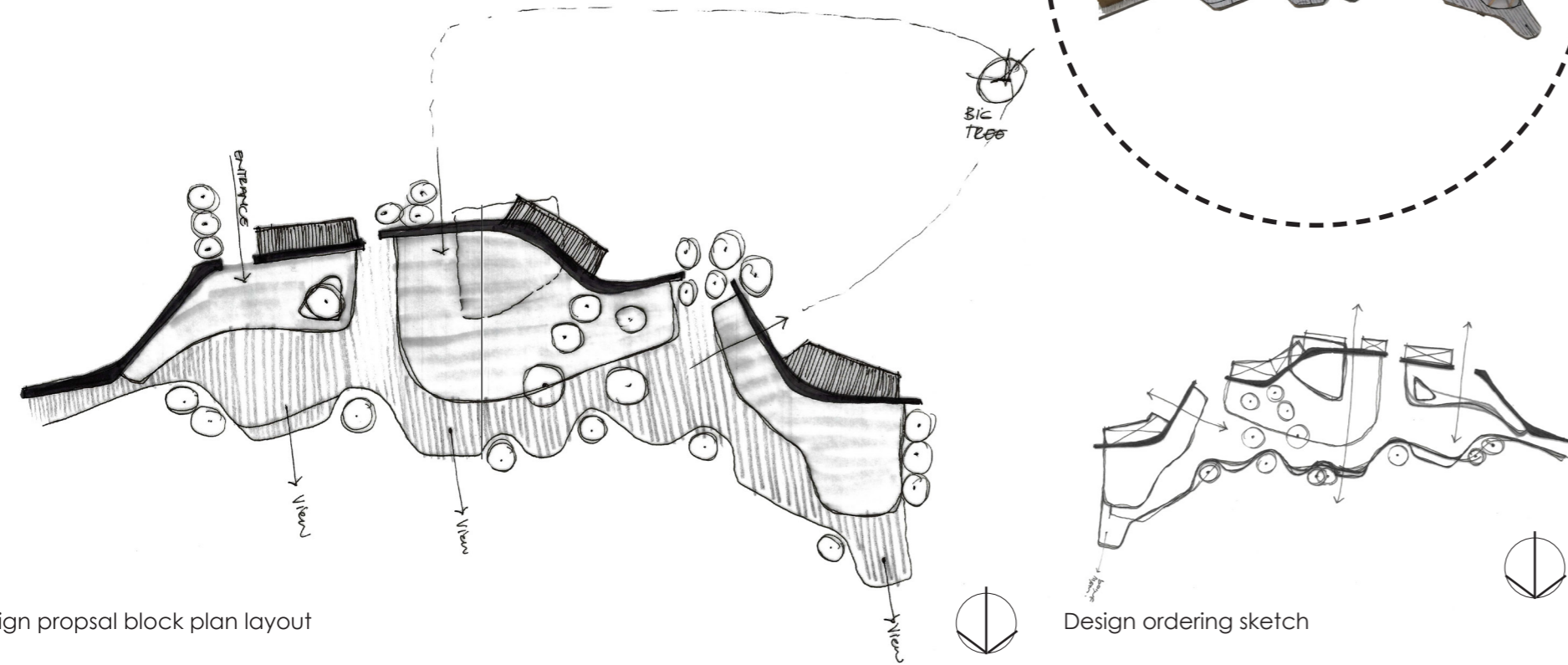


Designing of shell-like structures to reflect conservations and protection of the forests



First Design Proposal:

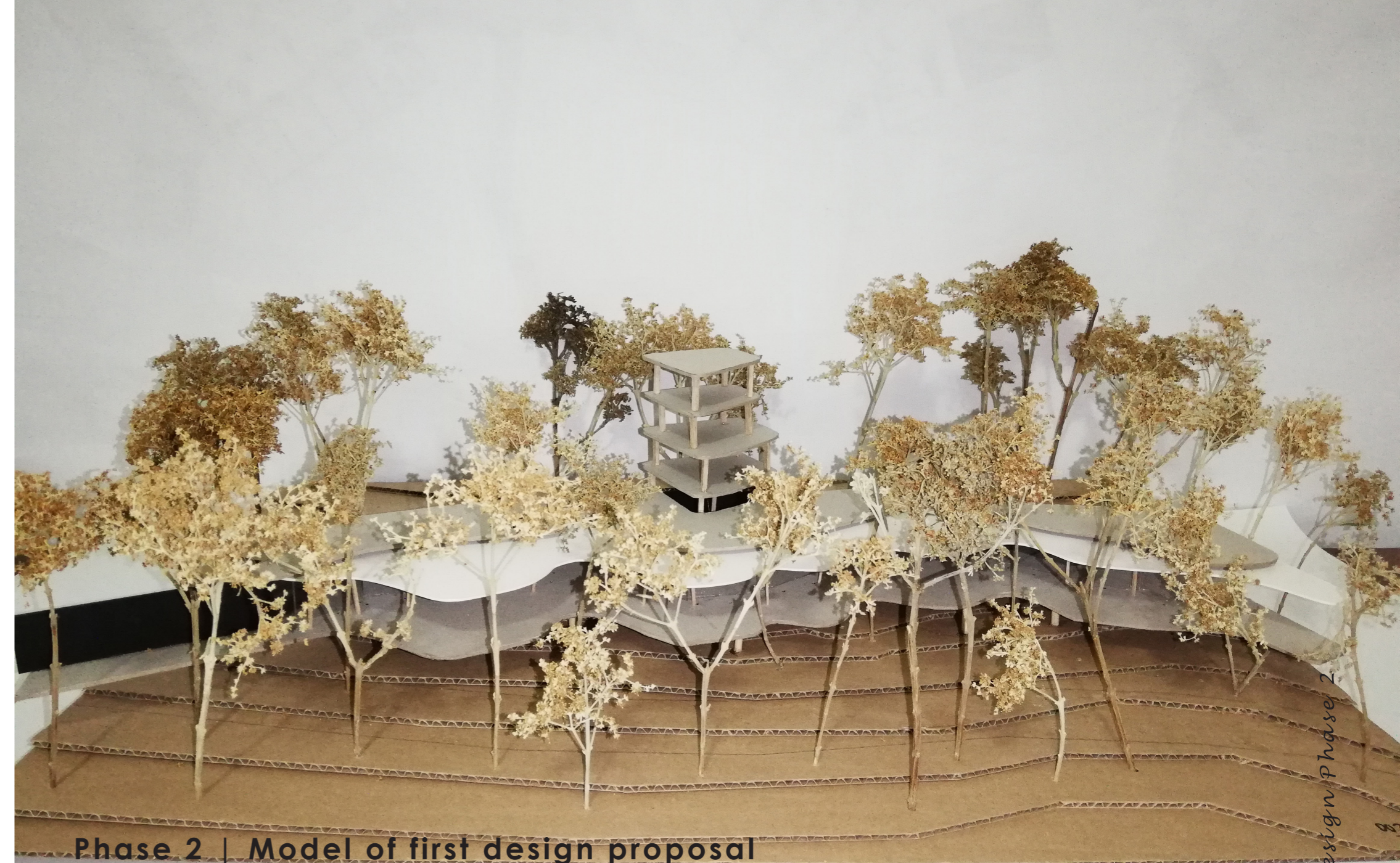
After exploring various conceptual approaches to the site, a design proposal that is more organic and free-flowing in form led the development process. A sandstone wall is used to form a datum which binds the various functions together. The datum wall separates the served and service spaces. The tower in the middle creates a hierarchal point that orientates the visitor. Columns follow the vertical quality of the forest topology.



Design proposal block plan layout

Design ordering sketch

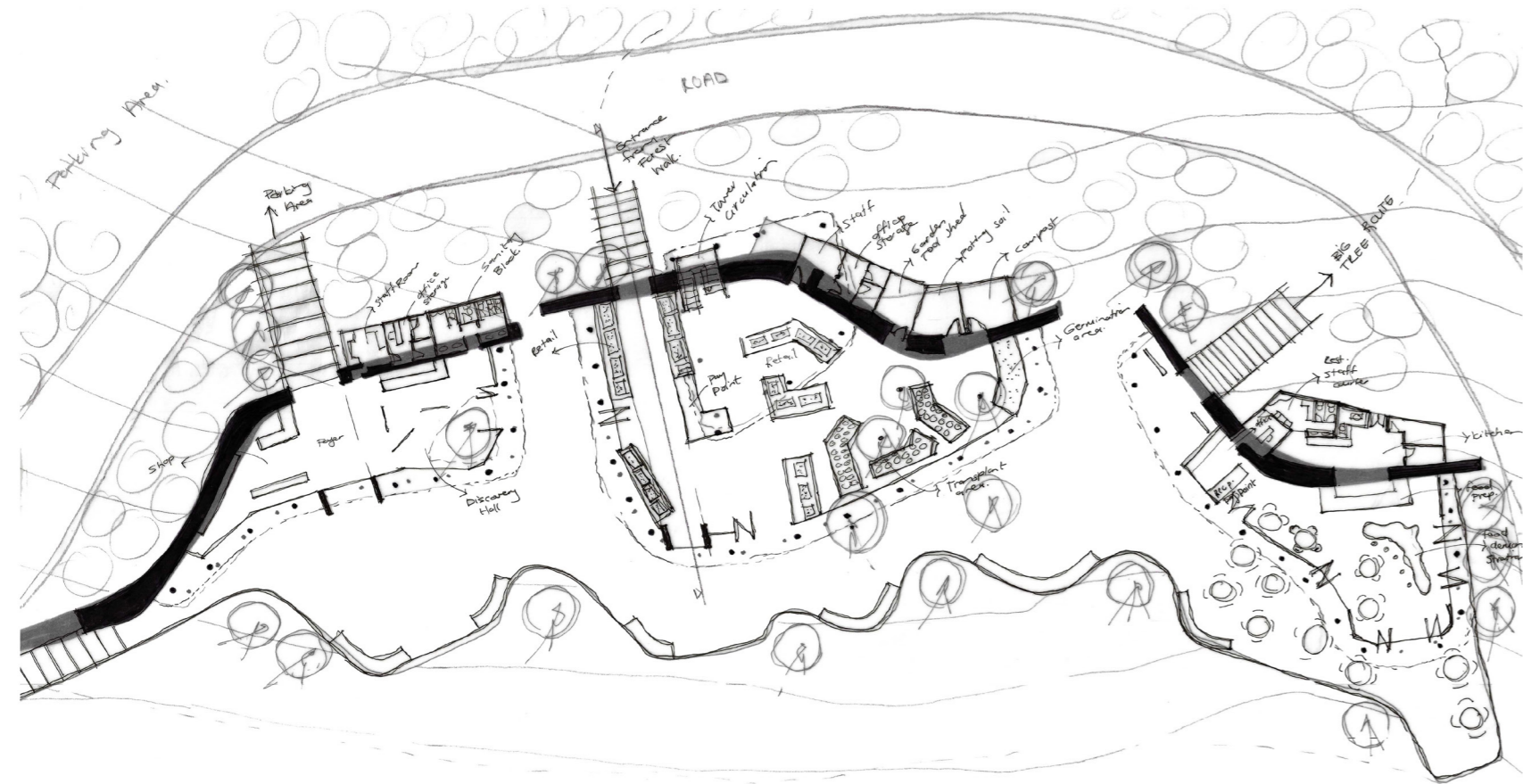
Concept model of design proposal



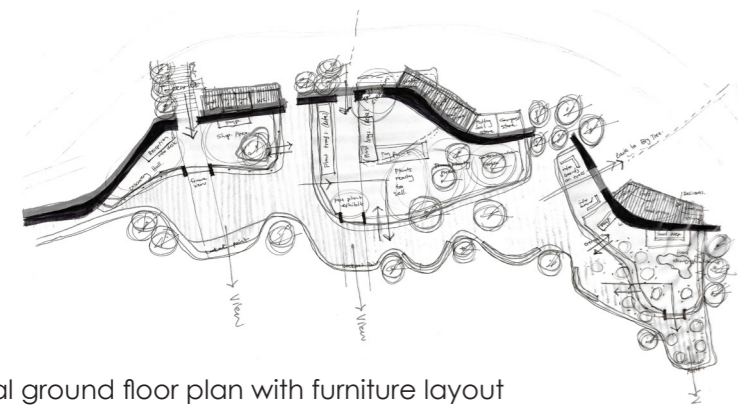
Phase 2 | Model of first design proposal

1:200

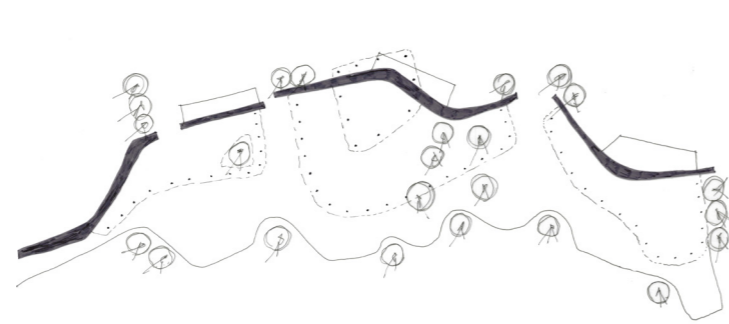
Design Phase 2



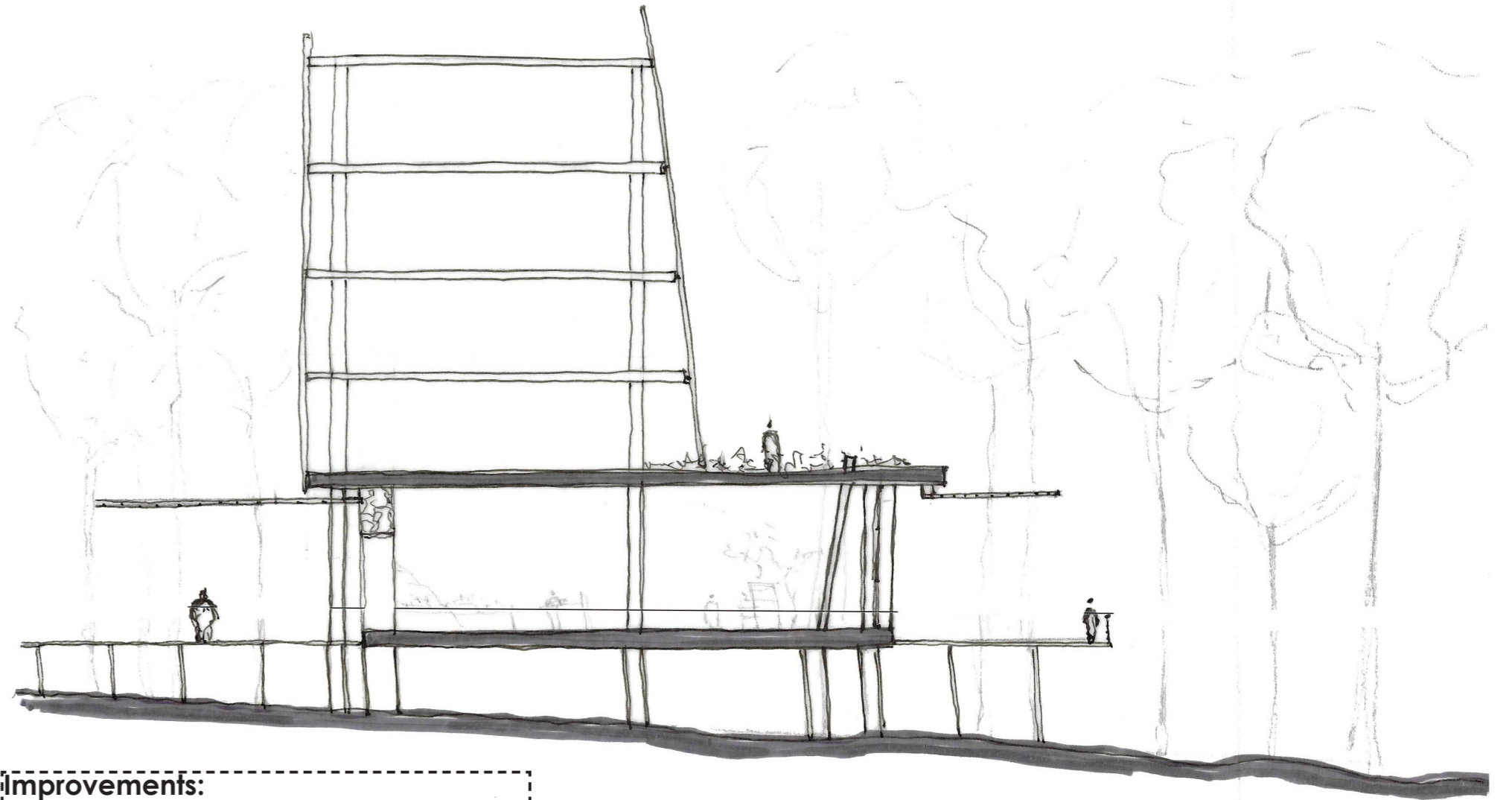
Ground floor plan with furniture layout



Initial ground floor plan with furniture layout



Initial structural indication



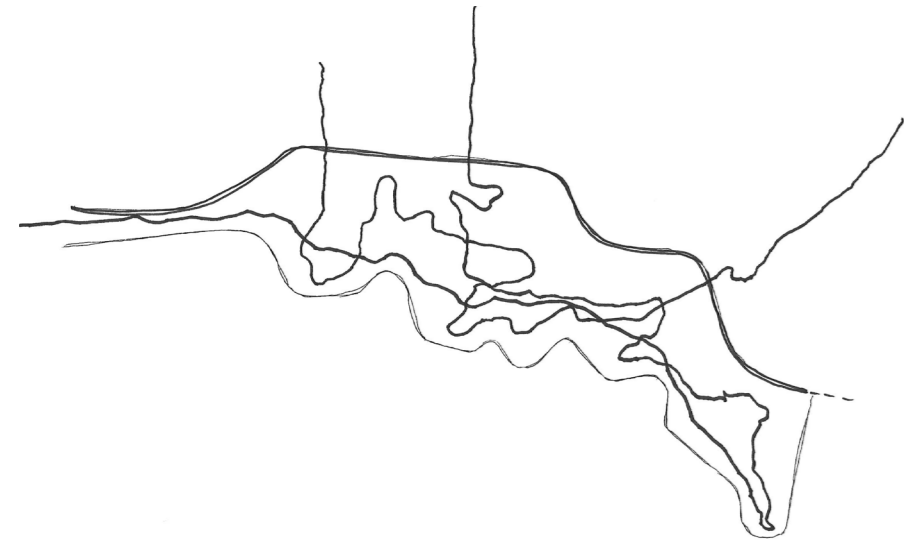
Improvements:

- + Move road towards the southern side of the building
- + Make roof canopy more proious for light to filter through

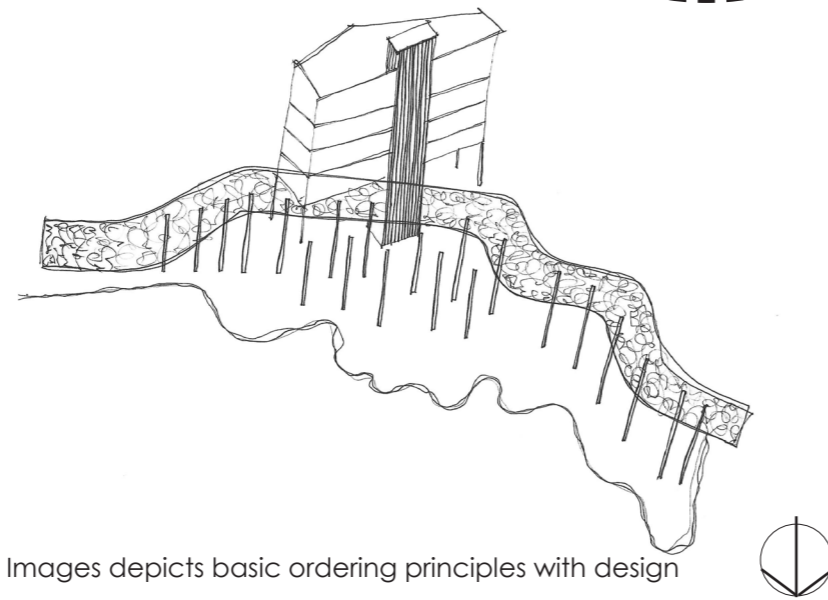
Section B - B
Nursery & Tower

Second Design Proposal:

The second design proposal was completed for the June external examination. The aim was to present a design that moves towards a final design proposal. The internal space layouts are more accurately designed in the second proposal, compared to the previous proposal. The tower was enlarged to ensure adequate space for functions. With the second proposal, most of the focus was towards finalising the planning and spacial layout. In the third design phase, the focus shifted towards structure and materiality.



Meandering pathways within the design



Images depicts basic ordering principles with design



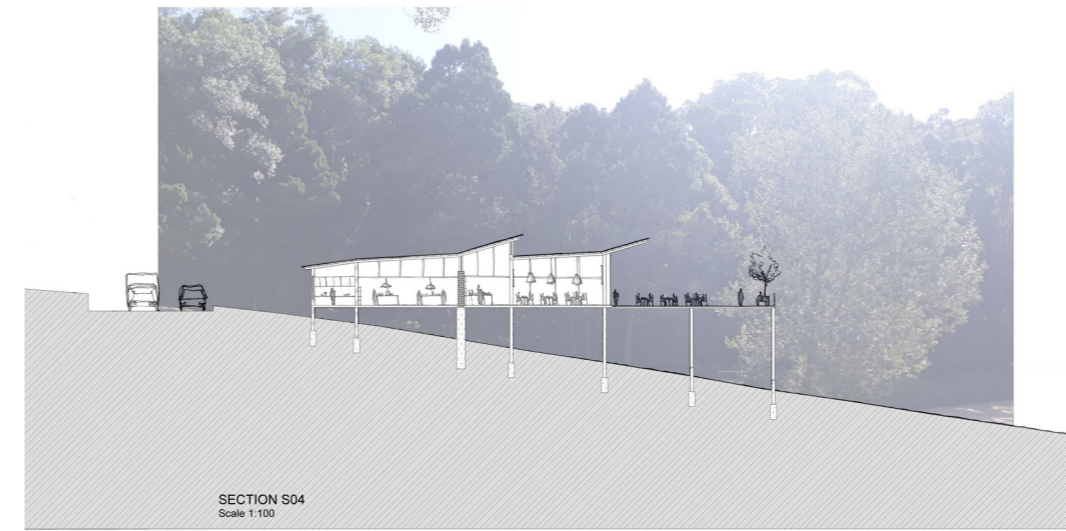
Phase 3 | Model of second design proposal

1:200

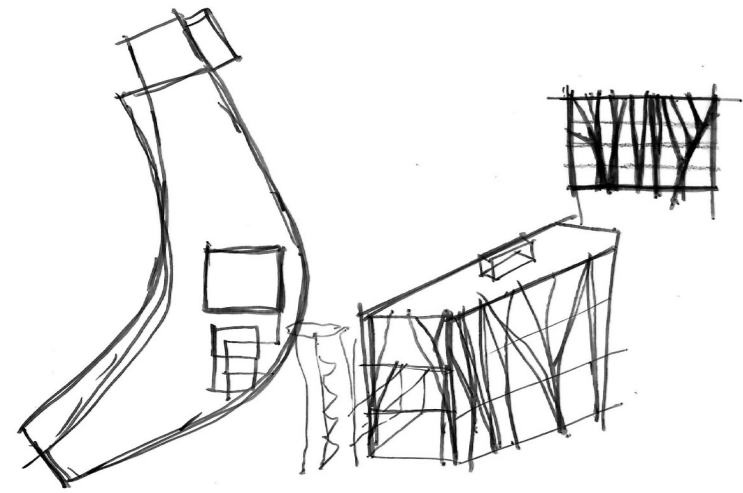
Design Phase 3



GROUND FLOOR PLAN
Scale 1:200
Velbroeksdraai, Diepwalle



- Improvements:**
- + Tower more organic & less commercial
 - + More nursery towards west and restaurant towards the middle
 - + Move entrance
 - + Less parking
 - + Step design to follow natural site slope



Structural Investigation Process

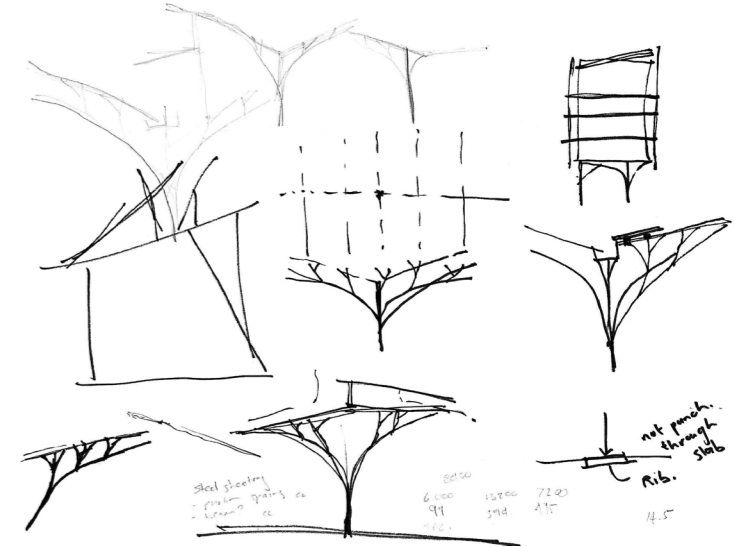
The structural investigating explored various typologies in order to find the most suitable structural design for the proposed Forest Exploration Hub within the indigenous Diepwalle forest. Initially, methods on how structures can imitate nature or how structures are inspired by nature were investigated.

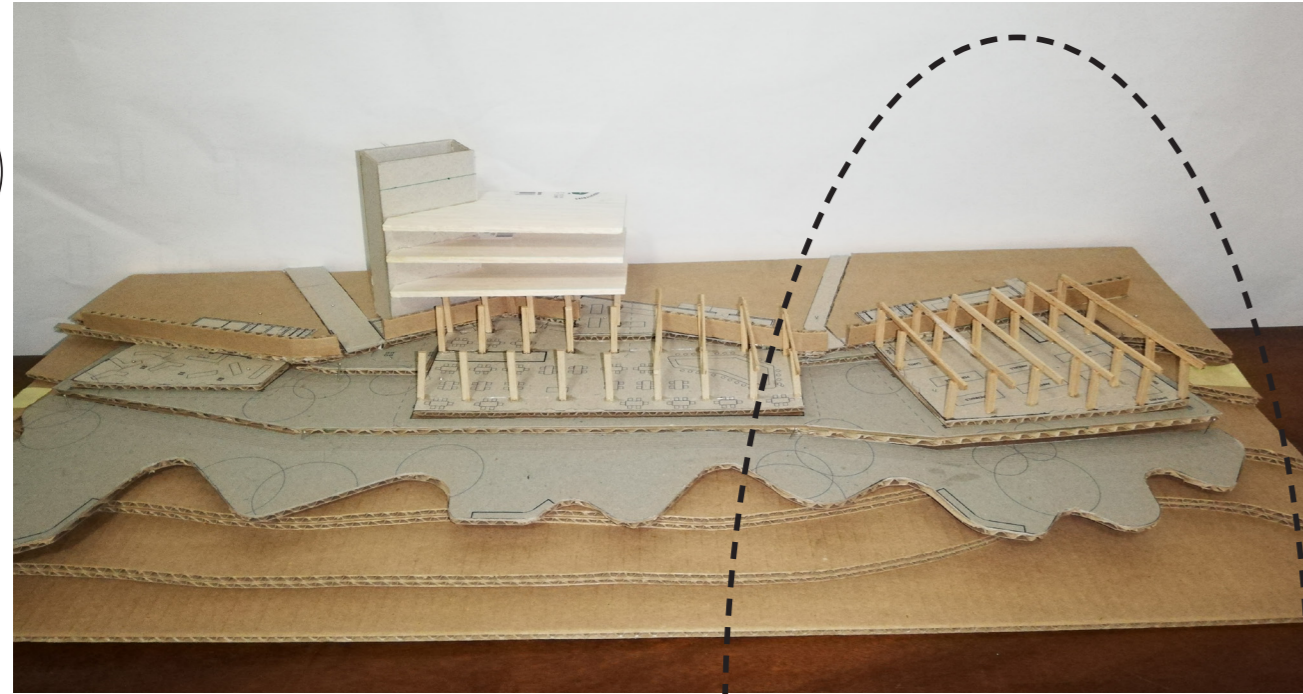
The first structural system considered for the tower consisted of structural concrete skins which formed a tree branch pattern on the facade. These skins formed the structural members supporting the various floor levels. This structural proposal appeared as stereotomic mass and the material used gave a robust harsh finish. Thus, this structural proposal is not suitable for this proposed design as the structure is not sensitive towards the forest landscape.

Thereafter the investigation led to the use of a column and beam structure with cladding panels, to achieve the same aesthetic quality. Gothic ribbed vaults were then considered to achieve a tree branch effect, with the columns and beams merging into one element. This system was integrated with the use of upside-down timber trusses to create a branching structure for the rest of the single storey facilities.

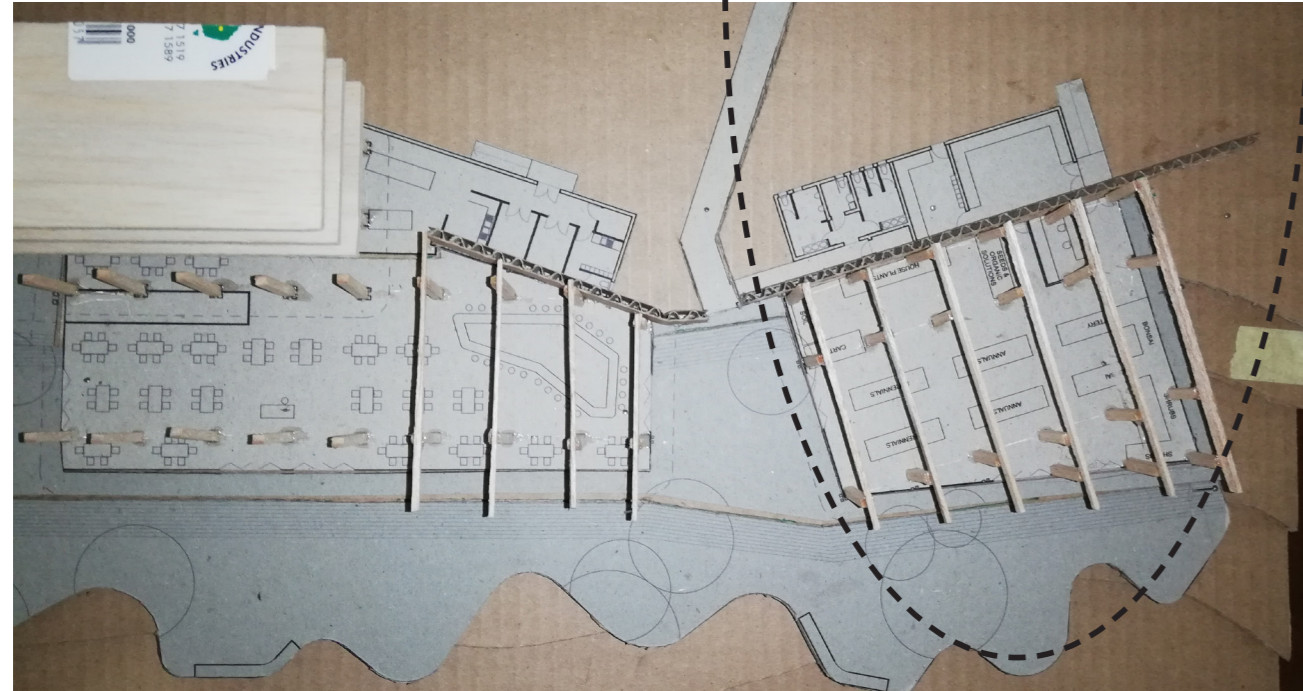
All these structural considerations posed the question as to whether the structural typologies are suitable imitations of nature and if imitating nature is at all necessary?

The structural response is a simple tectonic structural system, which is the most suitable for the forest typology. The columns consist of a four timber column cluster which supports the mono-pitch laminated timber beam. The various timber connections are secured with steel plates and bolted screws.





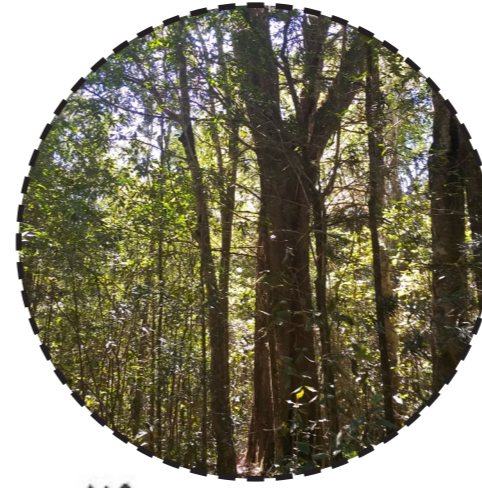
Simplistic mono-pitch tectonic laminated timber structure



Timber connections with steel plate and bolted screws.



Skin section taken through a part of the building to show column cluster with beams spanning in both directions.



The structural typology was inspired by the tree assemblage of the forest. A timber column cluster consisting of four columns imitate the forest tree structure.

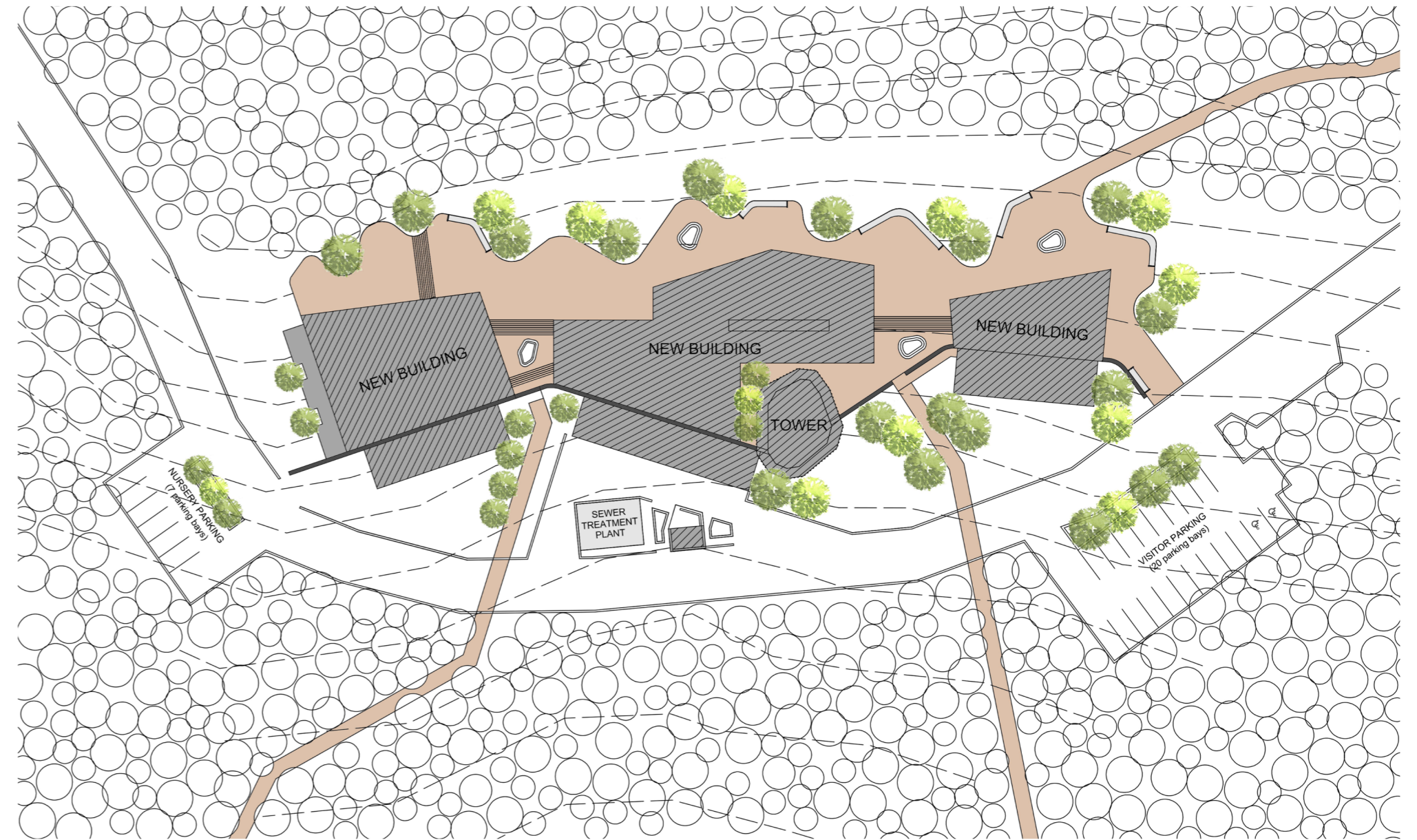
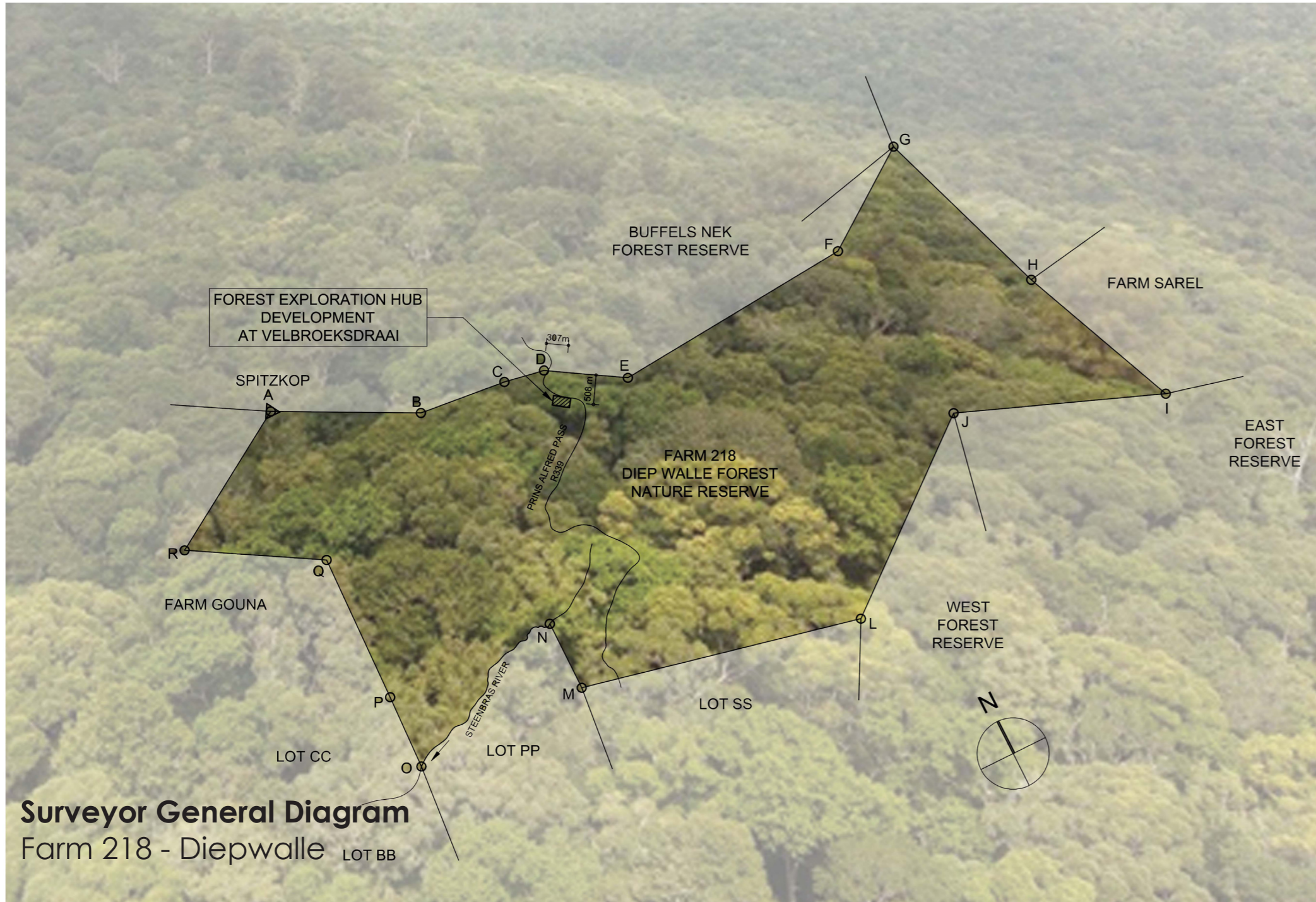


Nursery perspective to show structure



Northern Perspective

Towards a Final Design:
Forest Exploration Hub

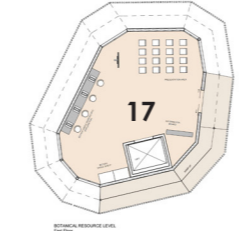
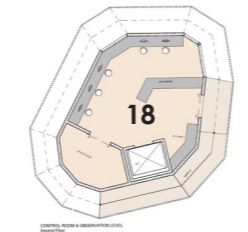
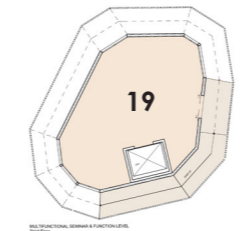
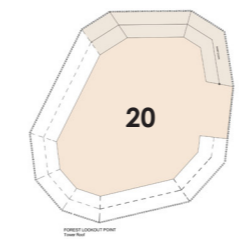




- 1. Information Centre & Shop
- 2. Main Office 1 & 2
- 3. Store Room 1
- 4. WC Block 1
- 5. Rooted-In-Time Forest Museum
- 6. Forest Experiential Restaurant
- 7. Forest Infused Gin Tasting Bar
- 8. Culinary Studio & Workshop
- 9. Restaurant Kitchen
- 10. Indigenous Forest Nursery
- 11. Vermiculture
- 12. Nursery Storage
- 13. WC Block 2
- 14. Sewer Treatment Plant
- 15. Refuse Removal Point
- 16. Forest Trail

- Forest Observation Tower**
- 17. Botanical Resource Level
- 18. Control Room & Observation Level
- 19. Multi-functional Level
- 20. Forest Lookout Point

Groundfloor Plan
Not to scale



Tower Floor Plans
Not to scale

Forest Exploration Hub

Celebrating the natural romantic landscape of the Diepwalle forest through man's explorative experience.

The aim for this dissertation is for man to celebrate and re-connect with nature, rather than being two separate entities. The site for this dissertation proposal is located 22km east from Knysna, within the Diepwalle Forest Nature Reserve.

The proposed Forest Exploration Hub offers the visitor a platform to experience and discover nature, through the various functions of the proposed design. The intension of the proposal is not to conserve the forest through the separation of man and nature, but rather to inform and educate the visitors on conservation measures, forest histories, facts and myths. Celebration of the indigenous forest takes place through various sensory experiences that enhance man's connection with the forest.



Groundfloor Plan

Not to scale

PRINS ALFRED PASS R339

- 1. **Information Centre & Shop**
- 2. Main Office 1 & 2
- 3. Store Room 1
- 4. WC Block 1
- 5. **Rooted-In-Time Forest Museum**
- 6. **Forest Experiential Restaurant**
- 7. Forest Infused Gin Tasting Bar
- 8. Culinary Studio & Workshop
- 9. Restaurant Kitchen
- 10. **Indigenous Forest Nursery**
- 11. Vermiculture
- 12. Nursery Storage
- 13. WC Block 2
- 14. Sewer Treatment Plant
- 15. Refuse Removal Point
- 16. Forest Trail



INFORMATION CENTRE & SHOP
SECTION D - D
Scale 1: 50

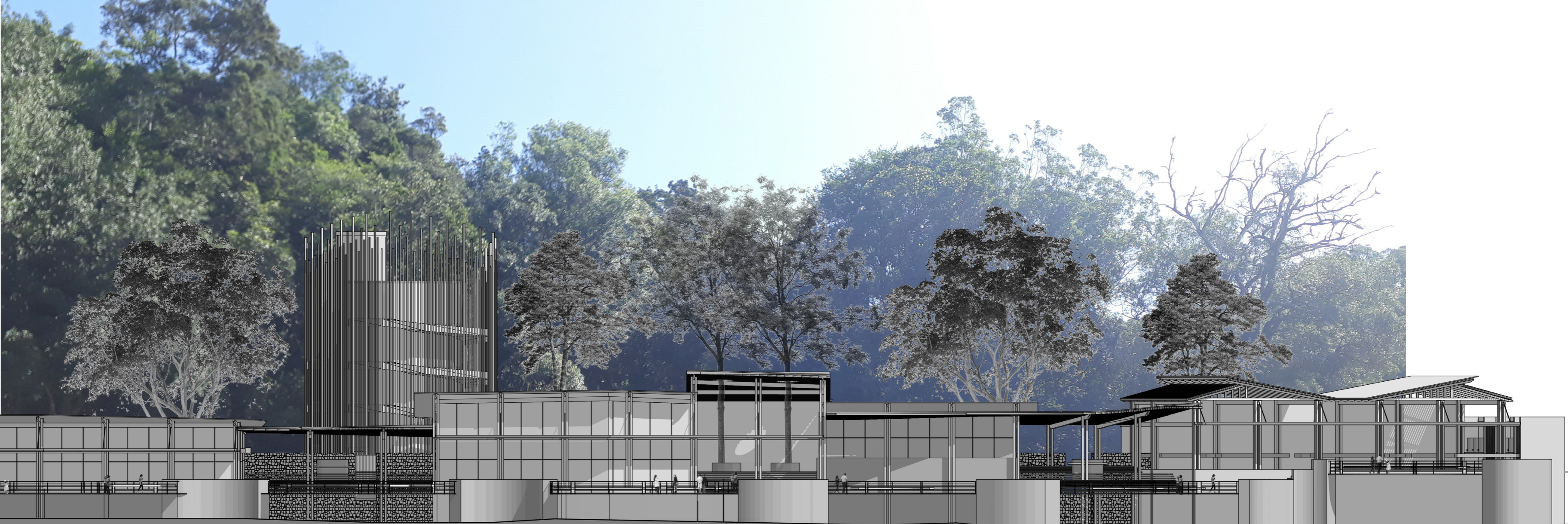




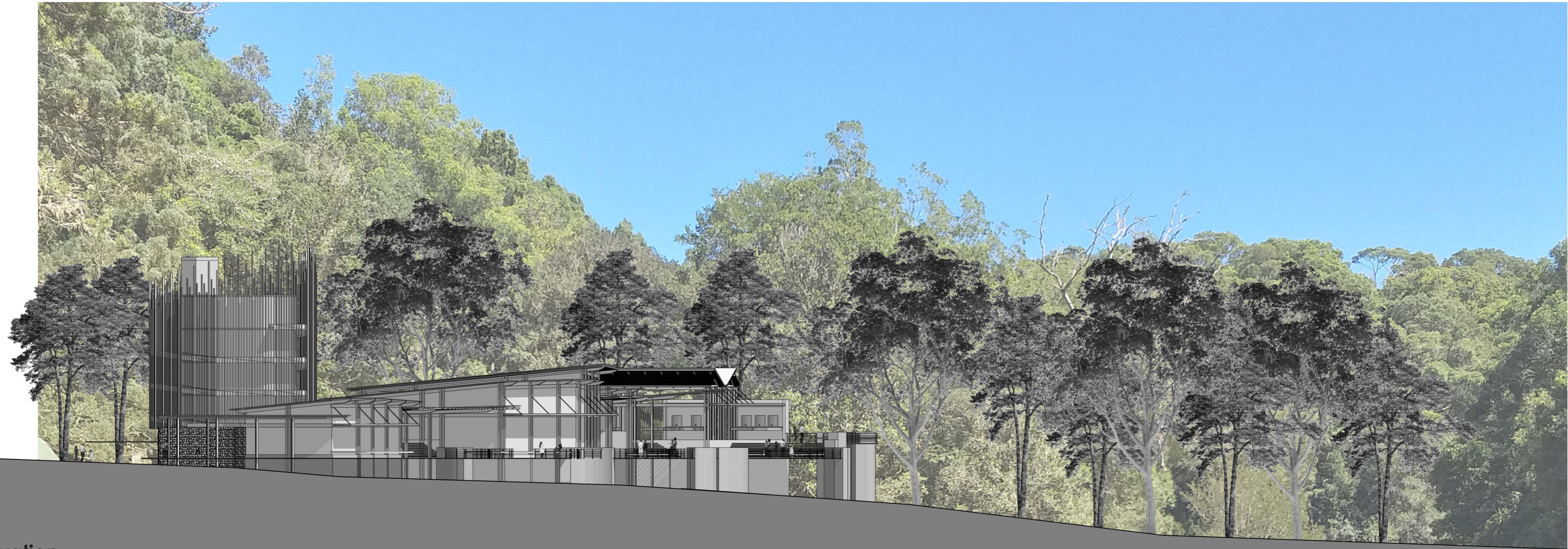
**INDIGENOUS FOREST NURSERY
SECTION A - A**

Scale 1: 50





North Elevation



East Elevation



Parking Lot

Prins Alfred Pass R339

Bus Parking

Service Courter

Forest Walk

Observation Tower

Prins Alfred Pass R339

Entrance

Forest Walk

Nursery Parking Lot

Information Centre & Shop

Forest Experiential Restaurant

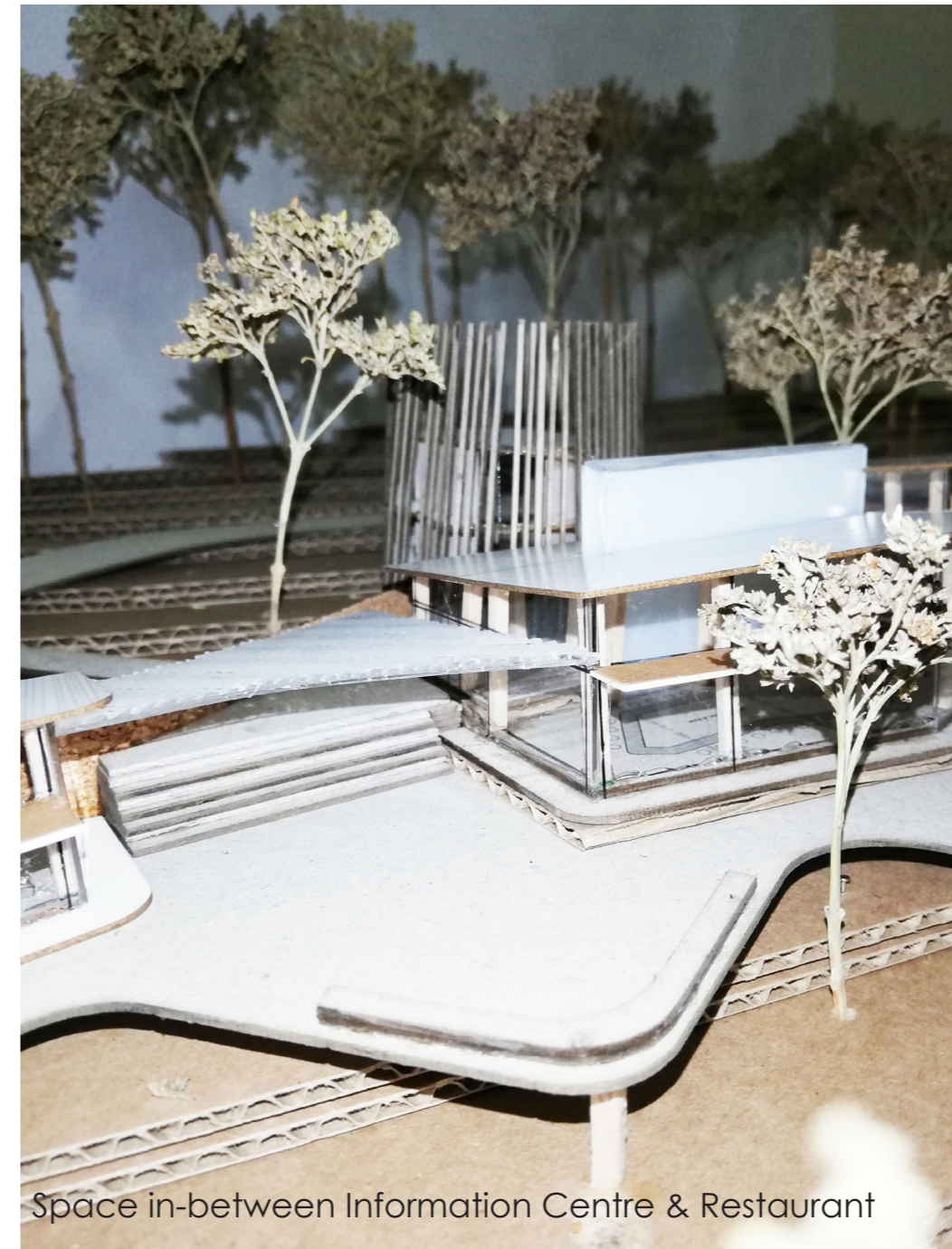
Indigenous Forest Nursery

Deck

Seating

Deck

Forest Walk



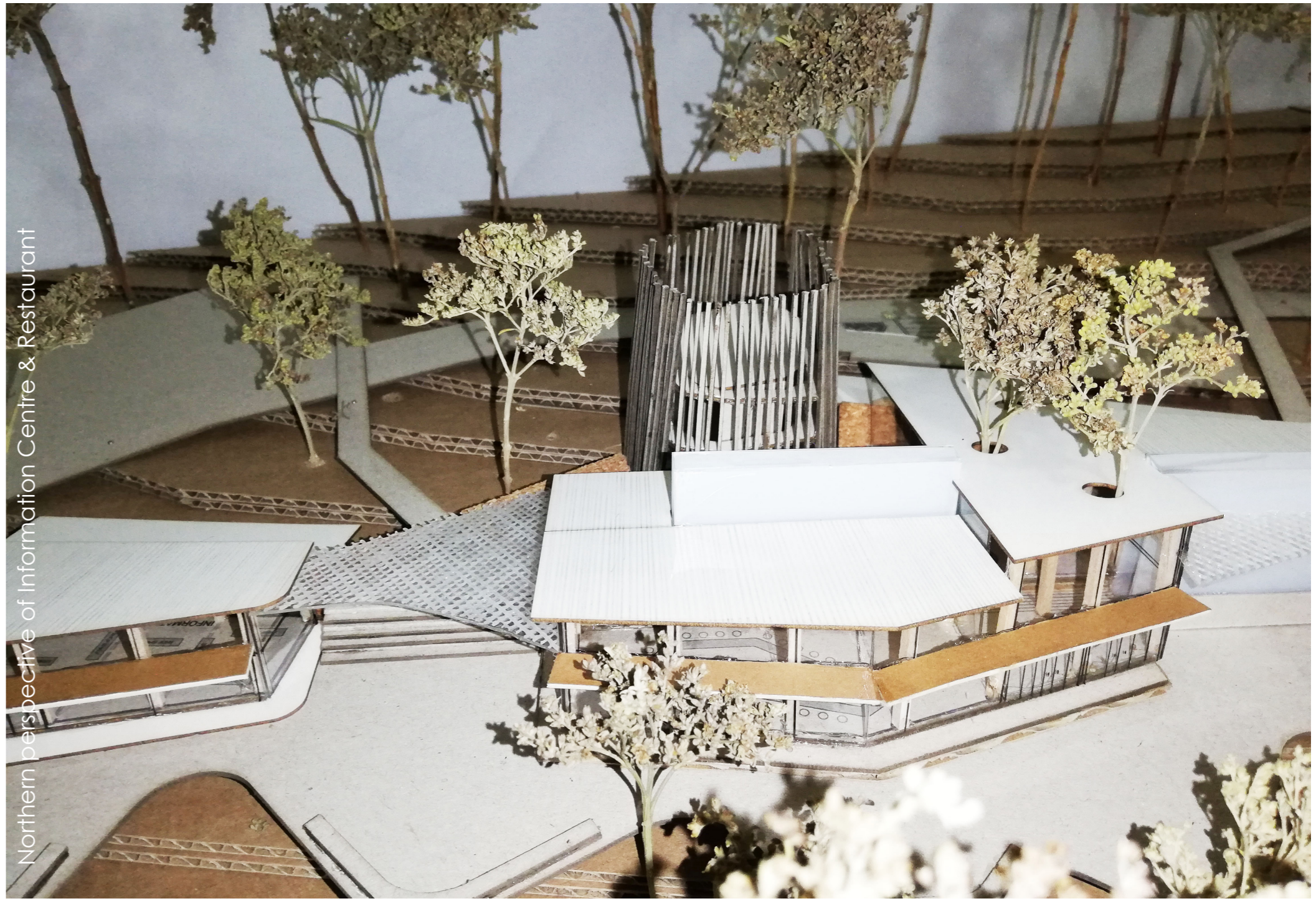
Space in-between Information Centre & Restaurant



Eastern perspective

Northern perspective of Restaurant & Observation Tower





Northern perspective of Information Centre & Restaurant



Northern West perspective



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Introduction

The dissertation is a proposed Forest Exploration Hub within the Diepwalle Forest Nature Reserve which is located 22km east from Knysna in the Western Cape. The project was initially driven by the idea of providing layers of protection and conservation to the indigenous Knysna forest, after the raging wildfires of 2017. The Forest Exploration Hub aims to provide an integrated platform where visitors can celebrate and re-connect with nature, rather than being two separate entities. The proposal will inform and educate the visitors on conservation measures, forest histories, facts and myths. The celebration of the indigenous forest is further strengthened by various sensory experiences that enhance man's connection with the forest. Theoretical principles such as embodiment, narrative and architectural promenade steer the investigation towards creating a place where man and nature can co-exist.

This chapter on technical design development is used to elaborate on the macro, meso and micro site-specific qualities, as explored through the site analysis. The various sustainability measures that were investigated and implemented in the design to reduce the buildings carbon footprint is listed and explained in-depth. The material choice and the reasons for the selection, whether conceptual or physical, is expressed to give an overview of the material used within the design. Lastly, the various structural typologies that were studied are described, concluding with the chosen structural typology which were implemented in the design.

The site analysis investigates the location of the site, with the relevant cadastral data. The analysis further identifies sun angles, climate, topography, vegetation and soil and rock types that are found on the site.



Fig 1: Location map of Western Cape & Diepwalle Nature Reserve

1.1 Location

The site is situated within the Diepwalle Forest Nature Reserve, approximately 22km outside of Knysna on the Prins Alfred Pass (R339) in the Western Cape. The macro site information is set out on drawing A001, together with the Surveyor-General diagram of Farm 218 and the Block Plan of Velbroeksdraai where the proposed Forest Exploration Hub is located.

The site is located in a natural clearing within the indigenous Diepwalle Forest and forms part of the various tourist attraction points along the “Rooted-in-Time” forest drive, as depicted in Figure 2. The clearing is ideal for the proposed development because minimal harm is done to the indigenous forest in terms of construction or the provision of access roads.

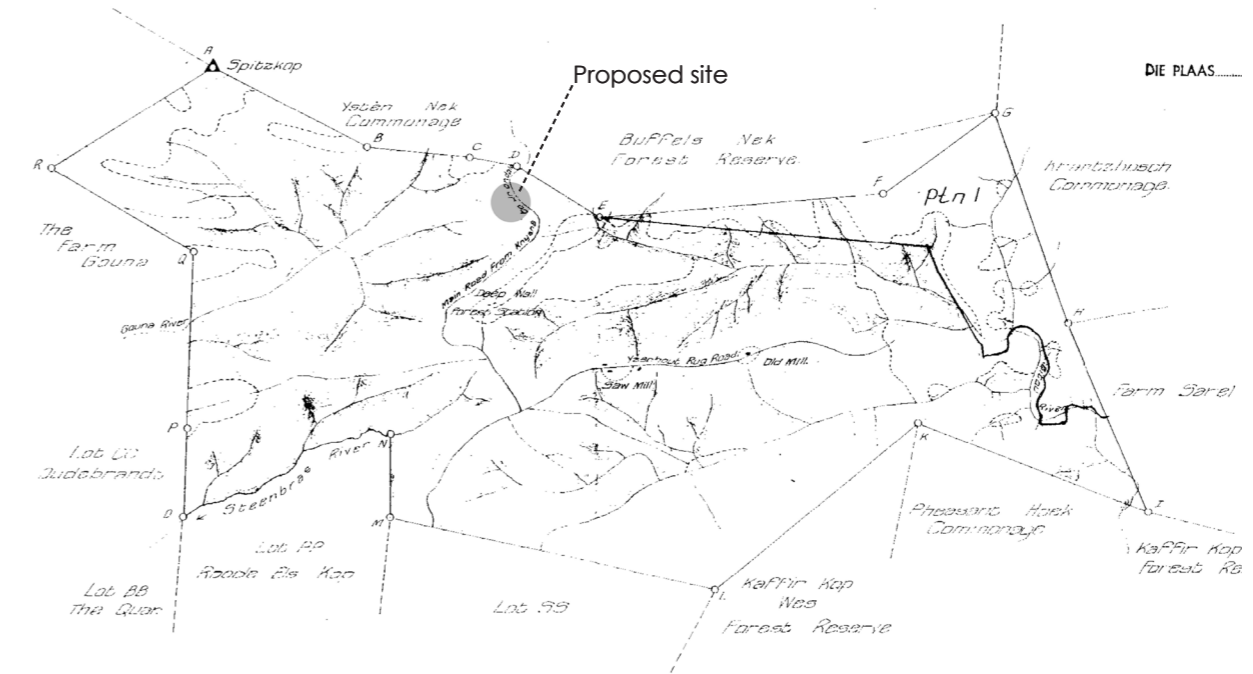


Fig 2: Surveyor Diagram of Farm 218, Diepwalle Nature Reserve. The proposed site is located along the Prins Alfred Pass (R339). (Cape Farm Mapper, 2019: Online)



Fig 3: Routed-in-Time self explorative drive, Diepwalle Nature Reserve. (SANParks, 2019: Online)

1.2 Climate

The Western Cape consists of an array of climatic classifications. Diepwalle Forest falls under the Oceanic Climate classification (Climate Data.Org, 2019: Online), where the minimum and maximum temperatures doesn't fluctuate much. The average temperatures of Diepwalle range from 9 to 22 degrees in winter and 18 to 28 degrees in summer. The Western Cape region receives a maximum rainfall of up to 74mm in August (Elsenburg, 2019: Online). The overall sun angles, as depicted in Figure 5, range from 41 degrees in winter to 88 degrees in summer. Figure 4 express the prevailing wind direction, as experienced in the Diepwalle Forest, which mostly range from west to southwest.

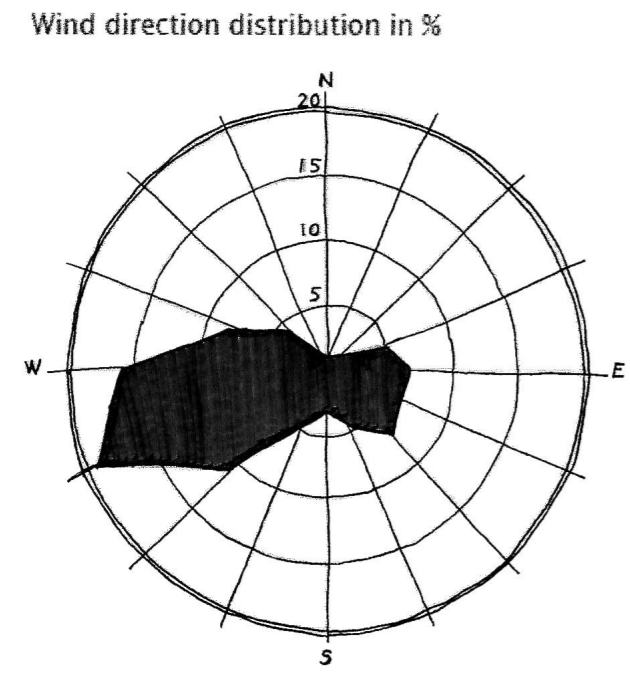


Fig 4: Prevailing wind direction of Diepwalle - ranging west to south-west.

1.3 Sun Study

Sunlight is a vital element in the forest topology for it allows photosynthesis to take place. The filtered light quality is a unique characteristic of the forest topology and aids in enhancing the place-specific experience.

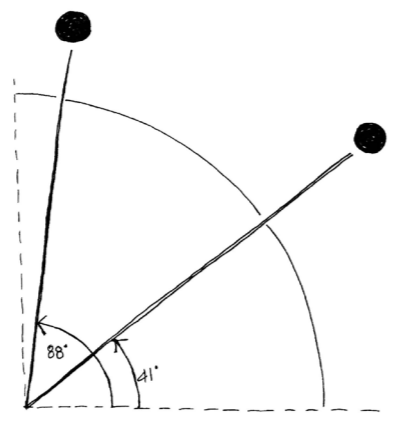


Fig 5: Solar geometric study of sun at Diepwalle Nature Reserve

1.4 Topography

The macro context consists of a foothill topography which forms the transition zone between the mountain range and coastal areas with an altitude of between 350m and 550m (Scriba, 1984). Rainwater flows towards the valleys of the foothills and drains into various streams and rivers. On the meso scale, the rainwater flows towards the Bietou River, a few kilometres north from the site. On the micro-scale the site is situated on a relatively steep slope of approximately 7 degrees falling towards the north, providing various drainage possibilities for the proposed development. The topographical information related to the micro context is set out on drawing A002, where the contour lines on the Site Plan represent a one meter difference in height.



Fig 6: Eastern entrance to site. (Author)

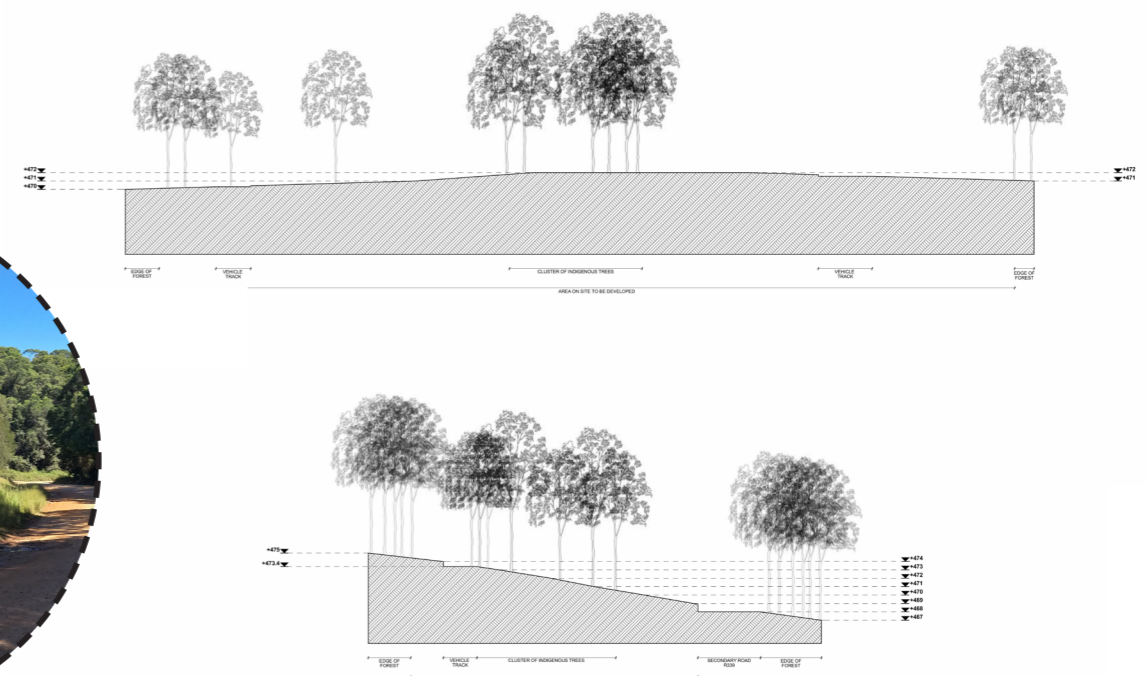


Fig 7: Sections taken through the proposed site, Velbroeksdraai, Diepwalle nature Reserve.

1.5 Vegetation

On a macro scale, the vegetation type is known as the Southern Cape Afrotemperate Forest. The biome is rich in tree structure, species composition and density, as a result of the wide ranging topology, soil types and microclimate (Geldenhuis, 1991). A total of 465 plant species have been recorded within the specific forest ecology. Von Breitenbach (1974: 328) ascribe the occurrence of various species to the different climatic forest types which each consists of unique ecological complexities.

On the micro scale, the site for the proposed Forest Exploration Hub is a natural clearing within the forest which is covered with grass, aiding in protecting the site from ground erosion. The tall indigenous trees surrounding the site provides a natural and dense wind barrier which benefit the design and structure of the proposed building.

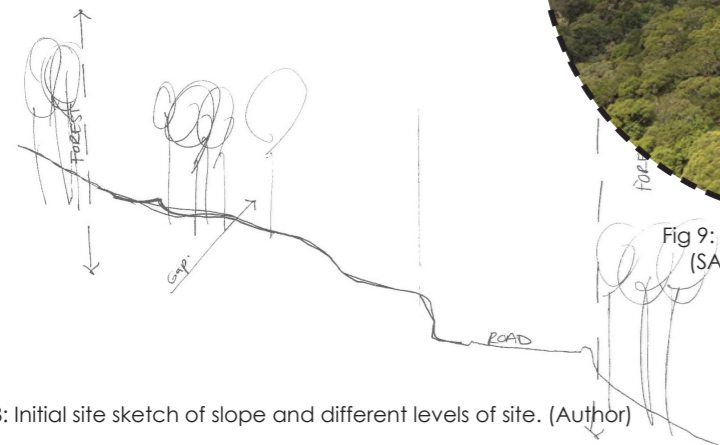


Fig 8: Initial site sketch of slope and different levels of site. (Author)



Fig 9: Diepwalle forest canopy. (SA Forestry, 2016: Online)

Fig 10: Photograph of typical road through the Diepwalle Nature Reserve. (Author)

1.6 Soil

The soil type at foothill areas such as Diepwalle, typically display gravels and sands that are classified as ancient alluvial fans. Cape Farm Mapper (2019: Online) state that the soil found in the region is classified as Podzolic Soil and consists of a sandy texture with less than 15 percent clay content. Soil found within the indigenous forest is prone to be thicker and more humus-rich. According to Grindley (1985), leached soils accumulate organic matter on the surface, but is nutritionally deficient.

Surface inspections and visual analysis of shallow cuttings made near the existing gravel road gives a preliminary indication of good foundation conditions. The use of standard strip- and pad foundations should provide adequate sub-structure for the proposed Forest Exploration Hub. Shallow excavations is done by hand and deeper excavations is executed by making use of light excavating equipment. This is ideal for it has a low impact on the natural forest environment.

1.7 Rock types

The main rock type found in the Diepwalle Forest area is Quartzitic Sandstone, which forms part of the Table Mountain Group (Council for Geoscience, 2008: Map). The abundant resource of Quartzitic Sandstone is used to construct retaining- and feature walls.



Fig 11: Photograph of rock types at Velbroeksdraai, Diepwalle Nature Reserve. (Author)

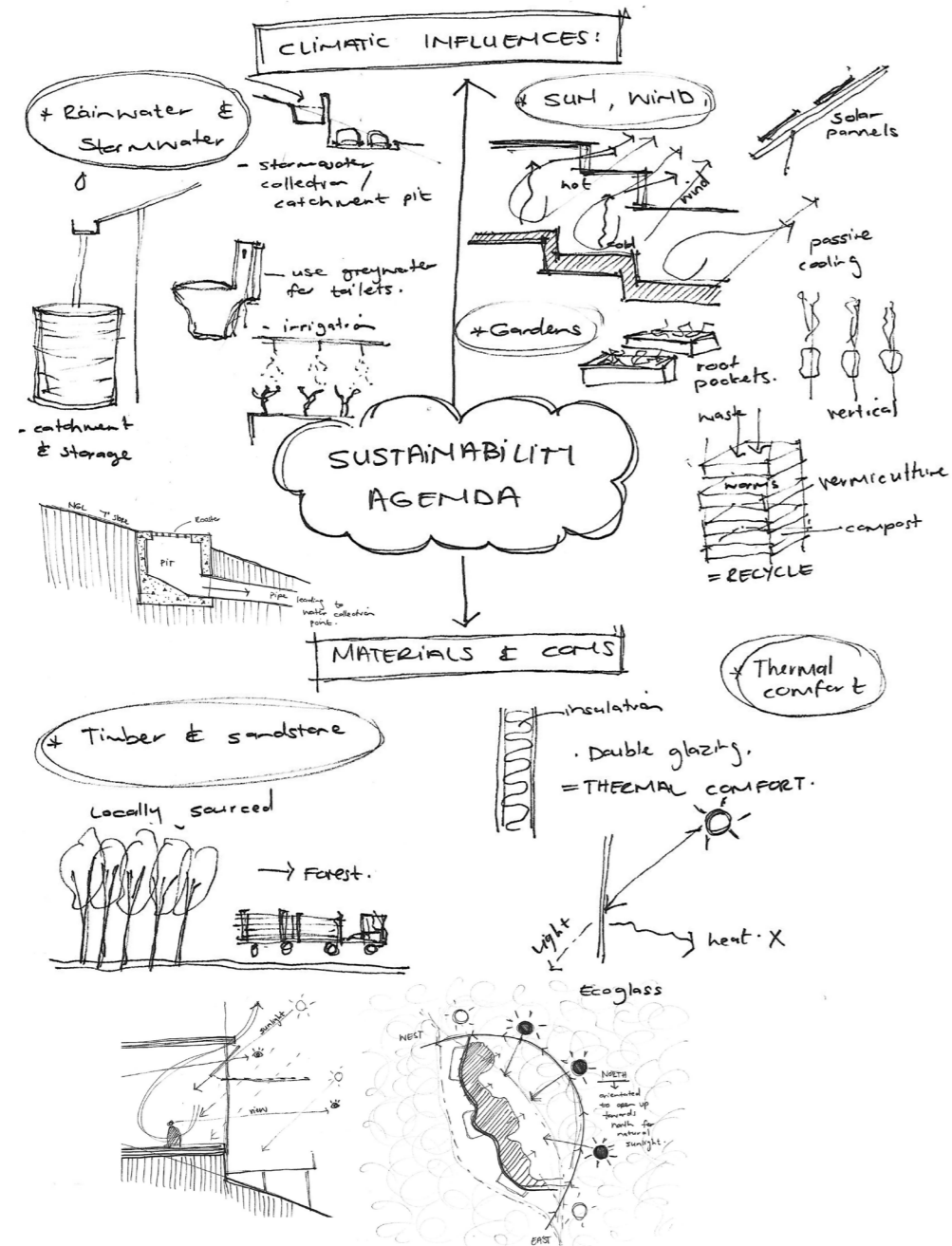


Fig 12: Sustainability agenda for the proposed design. (Author)

2.1 Sustainability

In this section, the various measures which ensure a sustainable outcome are listed. These measures aim to safeguard the indigenous Diepwalle forest ecology by ensuring that the Forest Exploration Hub has a minimal carbon footprint that might impact the protected forest landscape. All the sustainability aspects incorporated in the design is done according to SANS 10400-XA: 2011

The following design innovations were investigated and implemented within the design:

- Applying passive design strategies such as cross-ventilation and double volume spaces, roof insulation, Low-E double glazing, shading devices, and optimisation of natural sunlight
- Garden roofs and various planter boxes ensure that the building becomes part of the natural landscape
- Recycling organic waste from the restaurant by means of vermiculture to produce compost tea for indigenous nursery plants
- Site slope and building roof area allow for collection and harvest of rainwater for irrigation purposes.
- Recycled grey-water to flush toilets.
- Optimising natural sunlight through the use of photovoltaic panels on building roofs to generating green energy.
- Use of natural and locally sourced material such as timber from nearby saw mills and sandstone.
- Incorporate self-sort facilities for recycling of all other refuse materials off site.

2.2 Passive Design Strategies

Double volumes are used on all ground floor areas. This provides thermal comfort during summer months, due to the upward movement of warm air and the downward movement of cold air. Figure 4 depicts the prevailing wind direction (Windfinder.com, 2019) in the Knysna area to be west and south-west. With the incorporation of operable top windows on the northern and southern facade, cross-ventilation is achieved as hot air is pulled out of the building interior. (The windows are perpendicular to the predominant wind direction, this will create a venturi effect creating a negative pressure in the areas of the windows.) With the incorporation of cross-ventilation and double volume spaces, internal thermal comfort for occupants is reached without the use of mechanical cooling.

LambdaBoard roof insulation is used along with Saligna timber ceiling slats to guarantee the reduction of heat transfer through the roof. The R-value of LambdaBoard is the highest per 25mm, therefore this insulation type ensures that the U-value is met with a minimum thickness (LambdaBoard, 2019: Online). The BrownBuilt roof sheeting consists of a light colour to ensure reduced solar absorption (SANS 204, 2011: 58).

For sustainable glazing options, X2 Ultra Low-E (Low emissivity) double glazing is used to keep the building interior cool in summer and warm in winter. Low-E double glazing permits natural light transmission of up to 70% and has a low U-value of 2.7 (PG Smart Glass, 2018: Online).

Most of the northern facade consists of glazing with shading devices, in order to ensure optimal views of the indigenous forest surrounding the site. Shading devices such as perforated steel canopies are incorporated in the design to ensure natural light to reflect into the building interior, without the direct filtering thereof. The various canopy shading devices are designed in accordance with the sun angles in figure 5, as observed through a solar geometry study. This ensures plentiful sunlight to filter and heat up the building during winter months, as opposed to the minimal thermal effect in summer. Pergola's with multi-wall translucent sheeting is used in-between the information centre and the restaurant, as well as between the restaurant and the nursery. These shading devices are used to provide external spaces with protection against rain while allowing natural light to enter.

Sufficient indirect sunlight floods the building interior to minimize the use of task lighting during daytime. The service area of each facility is placed at the southern side of the building and is covered with green roofs. Additionally, to natural light, these functions is provided with low energy task lighting.

2.3 Green Roofs, Gardening and Vermiculture

The incorporation of greenery such as planter boxes and green roofs form part of the basic biophilic design principles that are used to bring the occupants and visitors closer to nature (Kellert: Online). The design services such as the information centre offices, restaurant kitchen and nursery storage consist of green roofs that allow the building to partially fade into the natural landscape. Internal and external planter boxes contain indigenous fern species that aid in purifying and enhancing the air quality and aid in the Biophilic quality of the design. The organic waste from the restaurant is disposed separately and placed in vermiculture drums to produce compost tea for indigenous nursery plants (Sinha et al., 2017, p.364).

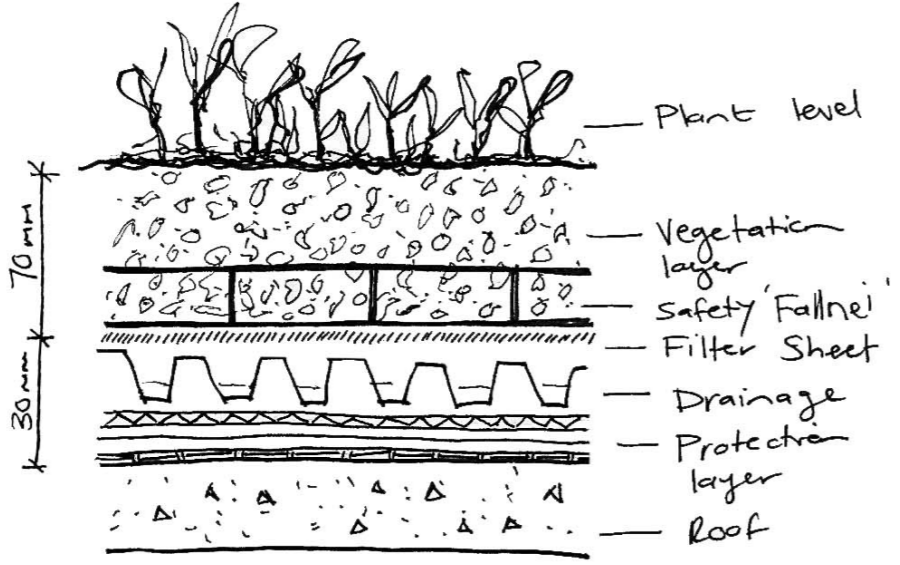


Fig 13: Drawing of the various layers of a typical green roof, as implemented on the design's service facility roofs. (Author)

2.4 Rainwater Harvesting

The Forest Exploration Hub does not make use of municipal water supply, but of various natural resources to supply the proposed building with water. Rainwater is collected from the various roof areas and stored in water tanks on the southern side of the building. The amount of water tank storage is calculated as 1mm on 1m² = 1liter of water (Austin, 2000: 12). The Forest Exploration Hub has a total roof area of 1535m² from where water will be collected, therefore 1mm rain will result in 1535 liters of water collected. The Western Cape region receives most of its rain in August (Elsenburg, 2019: Online), resulting in a maximum rainfall of 74mm.

Thus 74mm x 1535 liter x 0.8 efficiency factor = 90872 liter (90.8kl)
18 x 5kl water tanks is provided to store rainwater.

2.5 Water demand

The water demand for each function is calculated differently. The restaurant, for example, has a much higher water demand due to the preparation of food and required hygiene level. The restaurant will have 72 seats. According to table 9 of Guidelines for Human Settlement Planning and Design (2000: 12), the water demand for restaurants is between 65 to 90l per seat per day. The restaurant has a low service intensity, therefore calculations are based on the lowest value resulting in a water demand of 4.68kl per day (65l/seat/day x 72 seats/ 1000 = 4.68kl). The demand for the rest of the facilities is calculated as 400l per 100 square meters of the floor area. By combining the total floor area of the other functions, a total floor area of 1077 square meter is calculated. This results in a daily demand of 4.3kl ((1077 area/100) x 400l/day) /1000 = 4.3kl). The total daily peak water demand is estimated at 9kl per day. It must be noted that the peak water demand will only be required when the facility is fully occupied.

2.6 Water supply proposal

Considering the previous rainwater harvesting calculations, the harvest of the most rainfall in August (the wettest month) will only provide water for ten days of the above high peak water demand. Rainwater harvesting will not fully sustain the water demand of the design, therefore an alternative water source must be supplied. An interview with Mr. Claas Havenga (2019), Diepwalle Forest Station Manager, informed possible water supply to the site by pumping and filtering water from the nearby Bitou River. (During an interview with Mr. Claas Havenga, Diepwalle Forest Station Manager, stated that water supply to the site will be possible through pumping, filtering and treating water from the nearby Bitou River). A borehole will also be supplied on site to provide an additional water resource.

2.7 Green Energy

Ample sunlight floods the site due to the natural forest clearing that forms the site with trees on the site periphery. Solar geometry study, depicted in figure 5, shows that the sun angles ensure sufficient sunlight to fall onto the various roof areas of the proposed Forest Exploration Hub. According to Cowan (1992), the solar radiation received in the Western Cape (measured in Wh per square metre per day) is 7 956Wh during the best radiation month and 2 390Wh during the worst.

A fair amount of the proposed developed area is covered with a five-degree mono-pitched BrownBuilt roof that opens up towards the north. Photovoltaic panels are positioned on the roofs of the Information Centre, Restaurant and Nursery. The photovoltaic panels do not compromise the overall aesthetic quality of the design and are hardly visible from the Forest Observation Tower. The solar energy that the photovoltaic panels generate substitute the municipal supply. On cloudy days where the sunharvest is low, the local municipal supply will be used. High energy consuming equipment for hot water and cooking will be LP gas based.

2.8 Locally Sourced Material for Low Embodied Energy

The region is rich in sandstone deposits, therefore sandstone is a locally available material that is used in the construction of the "datum" wall which separates served spaces from service spaces. The primary structure of the Forest Exploration Hub consists of locally sourced timber. Structural timber consists of laminated timber square columns and laminated timber rectangular beams. The use of locally sourced material ensures that the building becomes a part of its environment.

The Forest Exploration Hub is constructed out of materials that are locally sourced materials, durable and consist of a translucent quality. The material choice is made according to conceptual influences and physical properties. Development of technical details was used to investigate the method of construction with these various materials.

3.1 Locally Sourced

Locally sourced sandstone is incorporated into the design as a stereotomic wall that forms a “datum” wall connecting and joining the various functions of the Forest Exploration Hub.

Timber is an abundant resource within the region due to the various timber plantation. Saligna Laminated timber beams and columns is used within the design for the primary structure. Laminated timber provides a better durability and fire resistance, in comparison to normal timber. It is also more aesthetically pleasing and has a warmth (and human connection) to it that cannot be achieved with any other material.

3.2 Weathering materials

Steel items are used for specific finishes and to construct the shading canopies on the northern façade of the building. To achieve a weathering surface appearance, coats of Fire Earth Liquid Rust paint is applied to the steel surface. This paint has a more desirable quality since the decorative rusted coating appearance is almost immediately achieved, as the oxidation, rusting process, begin to show effect in a half an hour and will continue thereafter on exposure to the element. These steel items rusted appearance adds to the aesthetics of the proposed Forest Exploration Hub fading into the landscape.

3.3 Translucent

With the translucent materials, natural sunlight is optimised to flood the interior and exterior spaces. The filtered natural light of the forest topology inspired the incorporation of natural sunlight whether direct, indirect or filtered. X2 Low-E Glazing is used to transmit natural light, but not heat. This material choice is part of the sustainability agenda where it strives to increase thermal comfort for the occupants of the building. Opaque multiwall translucent sheeting provides external covered areas between buildings and also protection against rain while it allows for natural light to filter through the spaces.

3.4 Floor covering

Laminated timber floors with a crudo rustic finish are used on the internal floors. This floor covering gives a rich warmth to the various interior spaces in the proposed building and enhances the natural appearance of the external deck area.

3.5 Roof covering

The main mono-pitched roof is the largest uniform finish area with a long roof span and low pitch. These factors led to the choice of an interlocking roof covering system. Most of these roof systems have a prominent visible protrusion detail and profile which tends to draw more attention to the roof. To achieve the architectural aesthetic appearance of the building becoming part of the landscape, the BrownBuilt profile was selected for the proposed building.

3.6 Other materials considered

Concrete and structural steels were investigated and considered as alternative structural materials. Both these materials are suitable and economical products in the construction industry, but these materials do not achieve the required natural design aesthetics of a building in a forest environment. Structural steel used to construct a shell structure gives an industrial feeling to a building, while concrete tends to appear cold and lifeless. Thus locally sourced timber was chosen as the primary construction material for its warm and natural qualities.



Fig 14: Material palette for design proposal consist of saligna laminated timber, sandstone, weathering materials, laminated timber floor covering, multi-wall translucent sheeting and BrownBuilt roof sheeting.

All the services of the Forest Exploration Hub is designed in accordance with the necessary health and safety requirements of Occupational Health and Safety Act 85 of 1993.

4.1 Site access and vertical circulation:

The Forest Exploration Hub is accessed via the Prins Alfred Pass, positioned south towards the backside of the building. Two parking lots with 26 parking's branch off from the road, two of which is disabled parking. Additional bicycle and bus parking is provided for visitors. Space is allocated for informal parking in cases of an event at the Forest Exploration Hub. At the nursery parking lot, space is allocated for deliveries.

The forest exploration tower consists of four floors that lead up to the tower roof lookout point. A ramp circle around the 133 square meter tower at a 1:10 incline suitable for pedestrians. The tower includes an internal elevator that provide access for disabled visitors to the various floors. A fire escape staircase is attached to the southern side of the tower providing an emergency escape route.

4.2 Storm water drainage:

The sloped site provides the ideal environment for natural drainage options for the disposal of storm water on the site. The existing road infrastructure acts as a cut off drain for the water accumulated higher up in the adjacent forest. The rainwater harvested from the roofs decreases the quantity of storm water to be managed on the site. Areas on the site with the possibility of erosion are protected with stone pitching or other reinforced linings that allow grass to grow. The accumulated water is channelled towards the closest natural waterways.

4.3 Service Block for refuse removal:

A service block is provided behind the restaurant kitchen service area on the southern side of the site. The service block is positioned to ensure easy access to refuse removal trucks and also forms a private delivery area for the restaurant. The prevailing wind direction is west south-west, therefore all unwanted odours from services is blown away from the building itself. The service block consists of refuse storage for removal and the storage of organic waste (to be used at nursery vermiculture bins).

4.4 Sewer Treatment:

A septic tank is provided for the sewer collection of the WC blocks by means of 110mm diameter pipes. A Lilliput SBC6000 sewer treatment plant is used to treat sewage from the septic tank (LilliPutSA, 2017: Online). The sewage within the septic tank is constantly pumped into the bio-reactor. The sewage then goes through a purification and disinfection process; after which it is used for irrigation. This process treats sewage on site and also provides the opportunity to recycle wastewater. Not all the purified wastewater is used for irrigation, but the rest is released into the Bitou River via a storm water system.

4.5 Special services:

The restaurant service area consists of a cold room where perishable foods is stored and kept cold. The cooling room temperature is controlled by good insulation of the floor, wall and roof area, as well as through the use of a refrigeration system to mechanically cool the air (PostHarvest, 2014: online). The compressor of the refrigeration system is positioned on one of the external walls of the cool room. A drain is provided within the floor of the cooling room for sanitation purposes in order to wash and clean cool room easily.

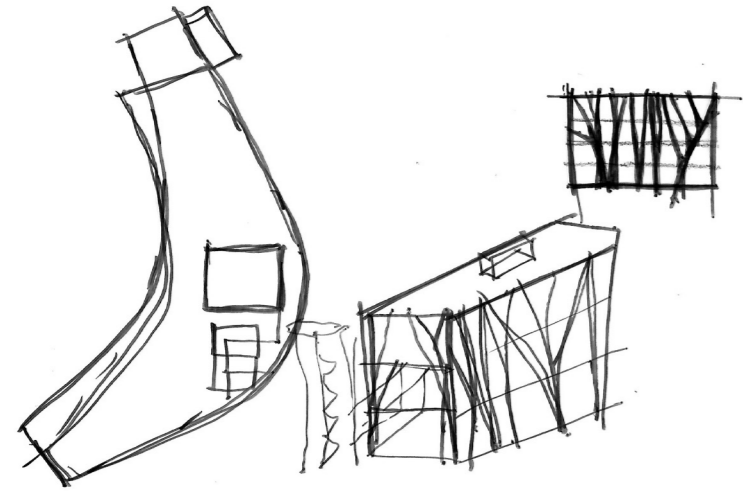


Fig 15: Initial structural system that was investigated, based on the Omotesando building's structure.

5.1 Structural Investigation Process

The structural investigation explored various typologies in order to find the most suitable structural design for the proposed Forest Exploration Hub within the indigenous Diepwalle forest. Initially, methods on how structures can imitate nature or how structures are inspired by nature were investigated.

The first structural system was based on the diagrid exoskeleton structure of the Omotesando building that was designed by Toyo Ito & Associates.

The structural exploration of the "tower" consist of structural concrete columns which formed a tree branch pattern on the facade, as depicted in figure 15. The aesthetic quality of the structural proposal appeared as a stereotomic mass with a robust harsh finish. Therefore the structural proposal was deemed not suitable.

The investigation developed into making use of a column and beam structure with a cladding panel to achieve the same aesthetic quality. Gothic ribbed vaults were then considered to achieve a tree branch effect, with the columns and beams merging into one element. This system was integrated with the use of inverted timber trusses, as shown in figure 16, to create a branching structure for the rest of the single storey facilities.

All these structural considerations posed the question as to whether the structural typologies are suitable imitations of nature and if imitating nature is at all necessary?

The structural response is a simplistic tectonic structural system, which is the most suitable for the forest typology. The columns consist of a four timber column cluster supporting the mono-pitch laminated timber beam. The various timber connections are secured with steel plates and bolted screws.

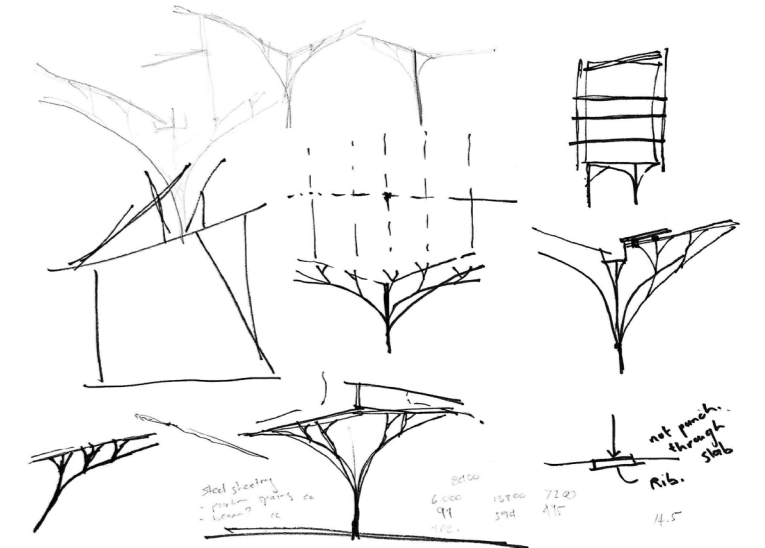
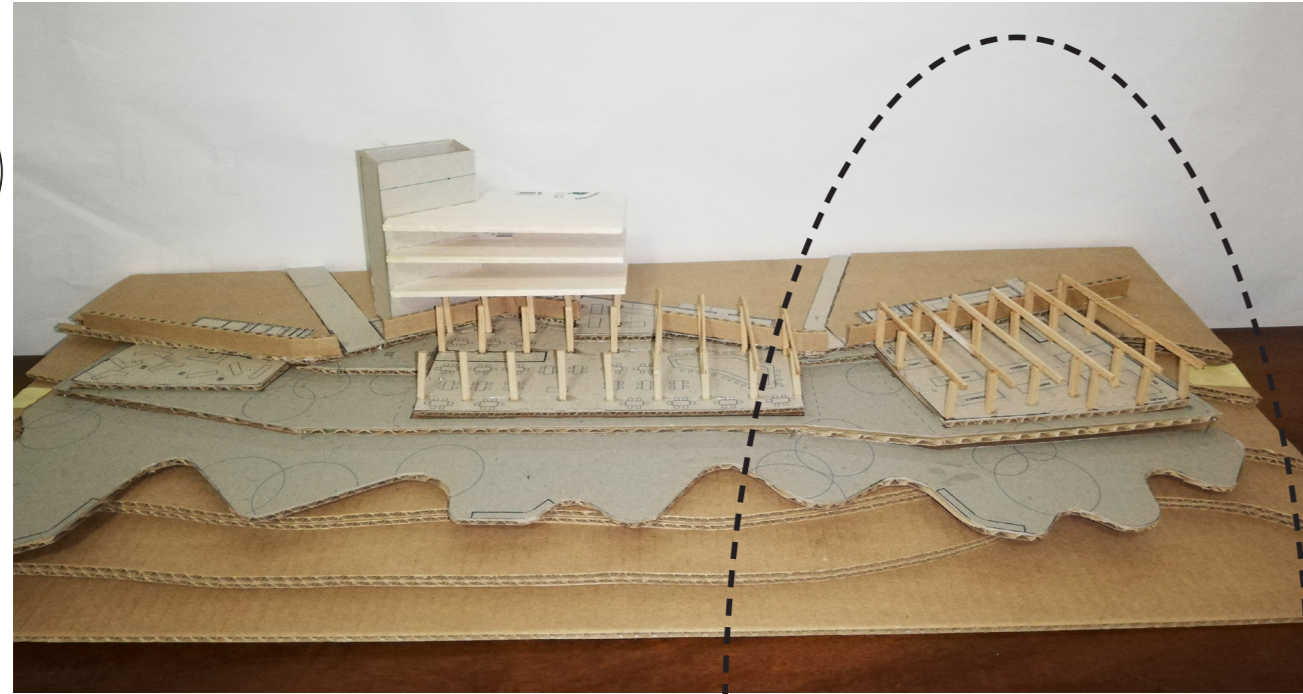


Fig 16: Investigating inverted timber trusses.





Simplistic mono-pitch tectonic laminated timber structure

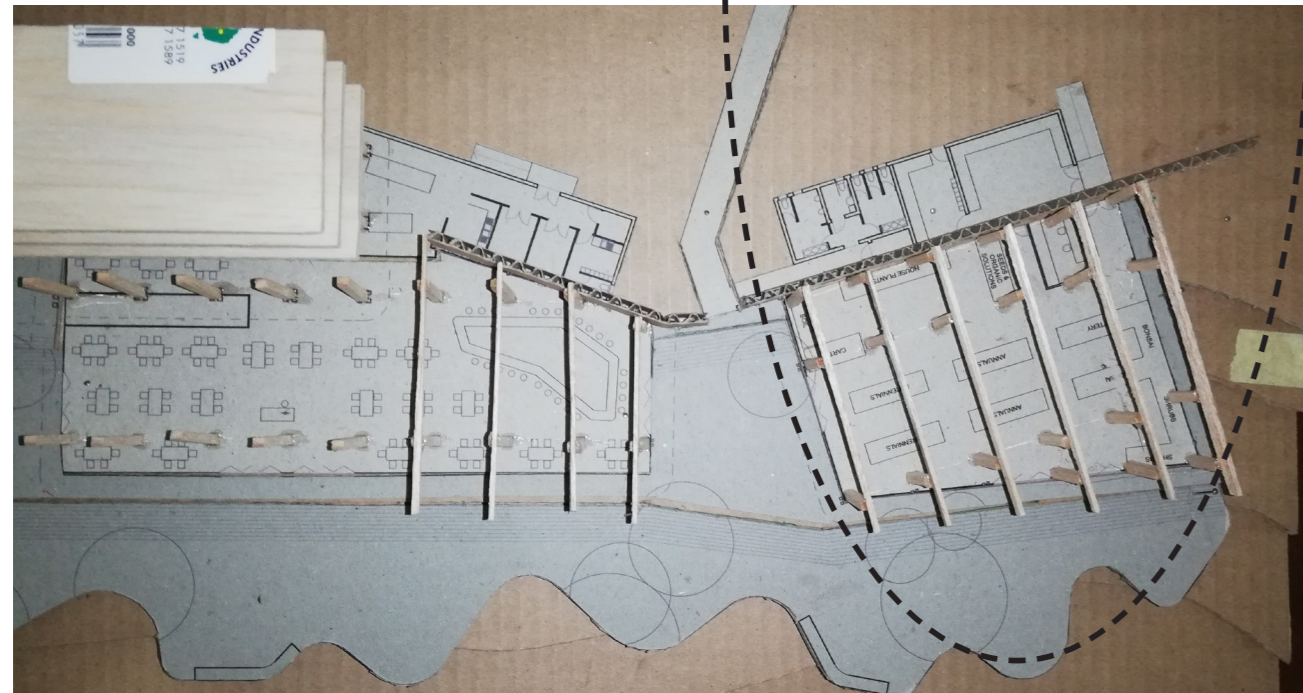


Fig 17: Timber connections with steel plate and bolted screws.



Fig 18: Skin section taken through a part of the building to show column cluster with beams spanning in both directions.



The structural typology was inspired by the tree assemblage of the forest. A timber column cluster consisting of four columns imitate the forest tree structure.



Nursery perspective to show structure

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Part 4 - Reflection

Reflection

This dissertation stemmed from a personal interest in the mystical Knysna forest character, as expressed in Dalene Matthee's novel "Circles in a Forest".

When designing within the urban environment, a specific set of rules and limitations guides the design of the project. Personally, I feel more comfortable designing, within the urban topology, since my personality prefers guidelines. For my dissertation, I decided to work within a landscape topology, instead of an urban environment. Within the natural landscape, there are fewer limitations and more freedom to explore architectural possibilities.

Through the course of this dissertation, I learned a lot about designing within a romantic landscape topology, since most of the previous projects I worked on during my studies was within a complex landscape. The process of creating a design that follows nature was at first, a challenge since there is so much freedom to work with. By looking at various precedent studies and analysing an array of theoretical approaches, the design process became easier. With the dissertation, I learned a lot through trial and error, but I am thankful for the process because it taught me valuable lessons in terms of design. The Forest Exploration Hub is an architectural celebration of the picturesque Knysna forest and specifically Diepwalle Nature Reserve. The narrative and explorative character of the forest topology is a mystical aspect that I am thankful to have experienced through the course of this year.

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