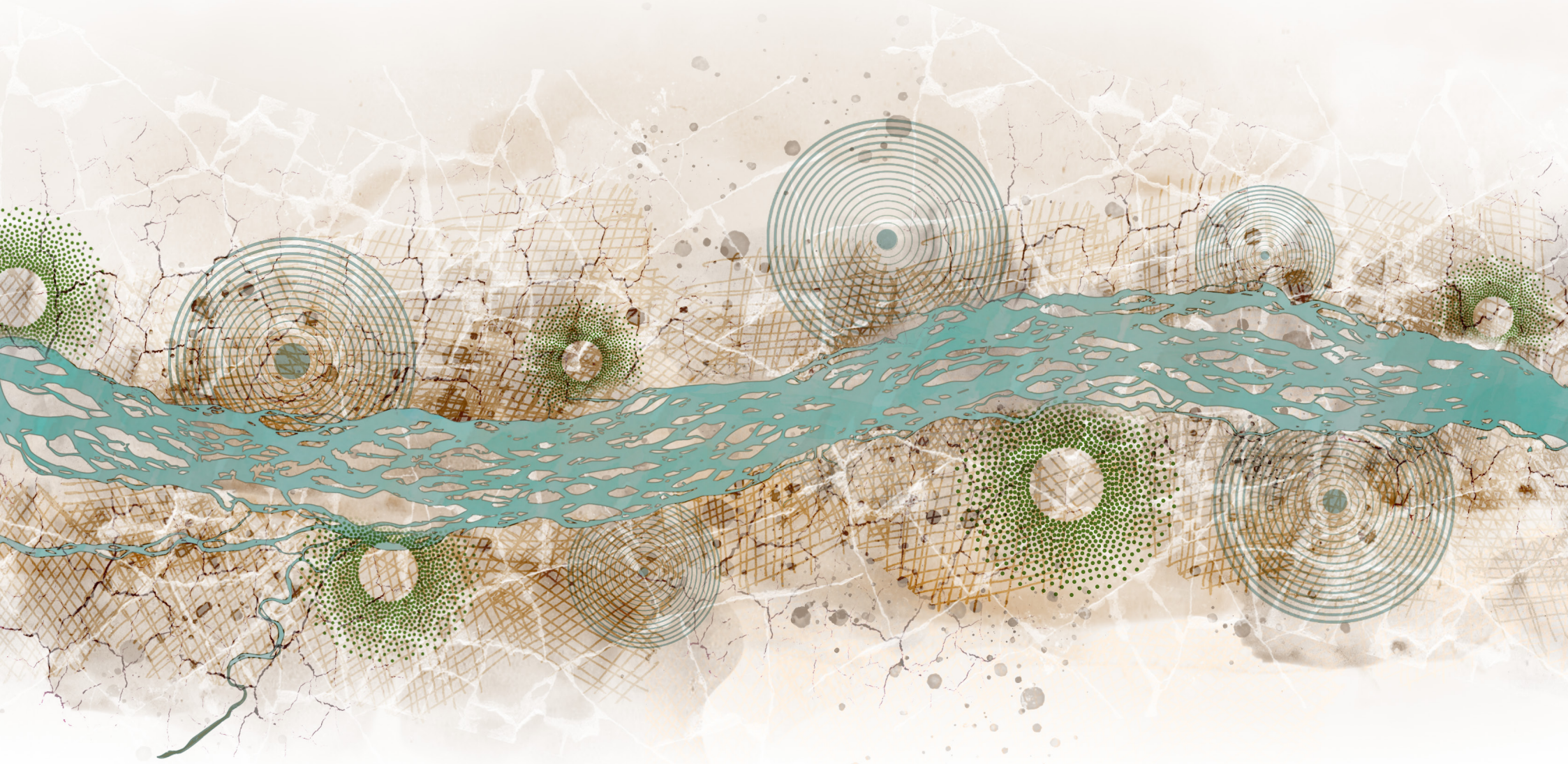
DISCOVERING NATURE'S FLUX

A riparian research and discovery center along the Sabie River



Mohammed .F.A Mukhtar
2014059261

EXAMINERS COMMENTS

DECLARATION

This dissertation is submitted in partial fulfilment of the requirements for the degree M.Arch (Prof) 2021

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

Mohammed Fazlé Ahmed Mukhtar | 2014059261 | mukhtar.mohammed8@gmail.com

Supervisors:

Prof J.D Smit, Mrs P. Smit, Mr H. Raubenheimer and Mr. P. Mabe

Declaration and original authorship

I, Mohammed Fazlé Ahmed Mukhtar am a student registered for the course Master of Architecture (Professional) in the year 2021. I declare the following:

I am aware that plagiarism, (creating the impression that someone else's work is my own by using their work without permission and/or without acknowledging the original source), is wrong. I confirm that the work submitted for assessment for the above course is my own work except where I have stated explicitly otherwise. Every contribution, quote, thought, idea and graphic imagery that is not my own have been acknowledged with a reference and a source.

ACKNOWLEDGEMENTS

I would like to take this opportunity to show my gratitude and thanks to God for granting me this opportunity to have taken this journey in attaining knowledge and developing skills that will benefit me in the future.

I would like to dedicate this dissertation to my parents, Asgher and Muneera for supporting me and paving the road under my feet through my academic journey.
My wife, Aamina, for all the love, support and encouragement that kept me strong.
My loving brothers, Salmaan, Muzzammil and Muddaththir for being my pillars of strength and reminding me to be calm.
My really good friends, Henry Coertz and Muller Ferreira for the amazing company and constant support, motivation and advice.

Prof J.D Smit; Mrs P Smit; Mr H Raubenheimer for their expert advice and guidance through out the year. A special thanks to Mr P. Mabe and J. Olivier for their patience, understanding and perspectives and insight which aided in the realisation of this dissertation.



ABSTRACT

This design dissertation investigates the proposal of a Riparian Research and Discovery Centre on the bank of the Sabie River neighbouring the Kruger National Park. Riparian zones do not function independently from other ecotones and biomes, but they play a complex role in the integration of aquatic and terrestrial ecosystems. The project aims to establish a centre that focuses on riparian observation (long term monitoring) which serves as a base camp for conservationists (researchers and students) to conduct necessary fieldwork for ecological research in the region as well as to educate the commercial and subsistence agricultural communities to encourage healthier forms of interaction with the river and finally to create an awareness of this volatile and fragile biome within the eco-tourism industry. Environmental experiences and the relationship we have with the natural environment can be subjective and a personal question of how we perceive ourselves in relation to it. In order to mediate ventures of discovery, the environment is seen as a locus of meaningful interpretation which evokes an environmental identity where we see ourselves as part of the natural environment. This dissertation aims to interpret this biome conceptually into the proposed design that enhances and aids the experience of the riparian zone on the Sabie River. The proposed design is a result of an ecologically ethical consideration that stems from the establishment of an environmental identity. The building, therefore, responds to the site in a way that evokes a narrative between the user and the surrounding landscape where architecture features as the mediator.

Keywords: Riparian Research – conservation – agricultural communities – eco-tourism – riparian zone – environmental identity – ecological ethics – environmental narrative

PROJECT SUMMARY

Site Description and Location:

The southern bank of the Sabie River bordering the Kruger National Park.

Phabeni Gate, Hazyview, Mbombela District, Mpumalanga, South Africa.

GPS Co-Ordinates: Longitude -25°01'08.3"S

Latitude 31°14'35.5"E

Programme:

A riparian research and discovery centre

Client:

University of Mpumalanga in partnership with SANS Parks.

Fig. 1.1: University of Mpumalanga Logo (University of Mpumalanga, 2021).

Fig. 1.2: SANParks Logo (SANParks, 2015).

Leading research question:

How can mediating ventures of discovery enhance one's felt experience through a riparian biome at the Sabi River?

The main intent of an ecologist is to preserve the ecosystem that involves the interconnections between plants, animals and the environment and the interaction with humans. Ecology aims at saving the environment through scientific analysis of flow charts and data capturing. This thesis aims to investigate the embodied experience of this specific natural landscape and to translate it into a narrative that an architectural intervention may hope to guide the user along with this felt experience of temporalities and natural events. This theme hopes to investigate how people experience natural environments and how these different experiences could be viewed in terms of an embodied and felt experience, that could be applied similarly to architecture. Secondly, research into eco-tourism and how a building can become the tour guide and mediator for the user through this natural landscape. After identifying the embodied felt experience, how can it become part of the narrative the building hopes to convey? By looking into the philosophy of environmental hermeneutics, the building hopes to be set with-in this landscape in such a way that it enables a dialogue to occur between the building, the user and the surrounding natural landscape.

The Proposed Program

The accommodation list consists mainly of an educational centre, which is aimed at three main user groups, that would incorporate learning and teaching facilities. Firstly, the discovery centre is aimed at facilitating conservationists (researchers and students) to provide a base camp for riparian fieldwork as well as other related ecological fieldwork in the surrounding area. The second user group is the local rural community, to educate farm owners on the need for riparian buffer zones to create a longer sustainability that the river offers them, as well as more sustainable commercial and subsistence farming practices. The third user group is the tourism sector, which provides a meeting point for the user and nature to gain a better understanding of the bodily experience and exposure towards this natural landscape.

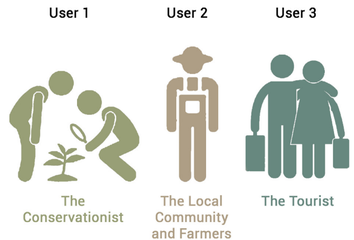


Fig. 1.3: Illustration indicating the selected user groups in the region (Author, 2021).

The Site:

A framework was developed in order to aid the selection of the site, the framework entailed a site that is:

- Close enough to an eco-tourist route in the region;
- Close enough to one of the entrance gates into the Kruger National Park;
- Economically Sustainable, it needed to be close enough to an urban and rural community;
- The site needed some history of contestation;
- The ecological research needed to be specific for that site.

The chosen site, that checked all the boxes, is located on the southern bank of the Sabie River in the Mbombela Municipal District, 14km outside of Hazyview, neighbouring the Phabeni Gate of the Kruger National Park. The Sgula family was granted the land by the King in the village of Makoko in 1970. During the course of the development of the Kruger National Park, the portion of land towards the east was taken by the State when the boarders of the Park was established. This slight verbal exchange of history of the site gave clues to the contestation of the site and added another layer of exploration within this thesis.



Fig. 1.4: Image of the Sabie river and the proposed site (Author, 2021)

TABLE OF CONTENTS

i
Examiners Comments ii
Declaration iv
Acknowledgements v
Abstract vii
Project Summary viii
Table of contents x
Introduction xii
Research methodology xv

Chapter 01

PROJECT AIMS AND CHALLENGES

Project aims and challenges 4
- Typology 4
- Topology 6
- Morphology and Tectonics 8
- Research Question 9
- Summary of project aims

Chapter 02

CONCEPTUAL AND THEORETICAL EXPLORATION & GROUNDING

The Touchstone 12
Theoretical Framework 15
Theoretical approach 16
- From hermeneutics to environmental hermeneutics 17
- Environmental identity 18
- Environmental experiences 19
- Ecological Ethics 21

Theoretical Precedent Studies 22
- Hush – Steve Messam 22
- Allmannajuvet Zinc Mine Museum– Peter Zumthor 24

Formative Conceptual Ideas 26
- 1 Biome-Mimicry 26
- 2 Riparian Promenade 27
- 3 Burrowed 28

Conceptual Framework 29

Chapter 03

SPIRIT OF THE SITE

Introduction and Site Overview 32
Understanding the regional context 34
The Development and Conservation of The KNP 36
The Site Region 38
- The southern hub 38
- The Environment: Terrain Analysis 39
- The Environment: Climatic Conditions 40
- Spatial Development of the region 41

Framework For Site Selection 42
Site Analysis 44
The Sabie River as a Spine 46

Chapter 04

TECTONIC AND DESIGN SYNTHESIS

Technical Investigation 50
- SSLI CAMPUS 50
- WITS Rural 59
- Witklipfontein Eco-Lodge 60
- The Enterprise Centre at The University of East Anglia 62

Design Development 64
- Accommodation List (approx m^2): 65
- Phase 1 - Initial Ideas: 66
- Phase 2: Working back to the formative idea 73
- A turning point towards a realized design: 76

Spatial Development 82
- WELCOMING CENTRE AND CAFE 82
- Interpretation Spaces 87
- Ecological library 93

Chapter 05

FINAL DESIGN RENDERS AND TECHNICAL DRAWINGS

Towards a Final Design 96

Chapter 06

REFLECTION AND REFERENCES

Reflection 134
References 135

INTRODUCTION

With the increasing number of the human population across the world, we find ourselves struggling to find the balance between sharing the limited resources between ourselves and that of the other-than-self; being the natural environment. Thankfully within the South African context, we see the country taking on this challenge early on in our history and the existence of Kruger National Park is a long-lasting demonstration of this conservation effort towards preserving the natural environment. However, the conflict between the conservation of natural resources and the consumption of them is still a pressing matter, especially in the lower region of the Kruger National Park.

Within the world we live in, we are able to recognize two specific environments. There is the methodically organized built environment and the self-adaptive natural environment which is in constant flux. My interest in the topic of this thesis focuses on the latter based on the passion I have for natural environments. This passion and interest led me to one of my favourite destinations for the regional focus for this thesis; The Kruger National Park (herewith referred to as KNP). The KNP is the oldest and largest conservation park in South Africa and forms the focus of this thesis. The surrounding region (the Lowveld) is embedded with a rich source of natural resources which in turn attracts recreational activities and ecological research within and around the KNP.

The KNP since its inception has always struggled in its efforts to conserve nature. The history of the park reveals the struggle of the people, who now live on the periphery, to benefit from natural resources whilst preserving nature for future generations. The tourism industry contributes to a major part of the economic turnover in the region, in light of this, the notion of eco-tourism can be introduced to potentially alter the view people have of this natural environment. Eco-tourism focuses on the awareness created to cater for recreational activities, in a more sustainable fashion, for both the natural environment and the economic benefit for the local inhabitants of the area.

The region's major concern is finding the balance between resource consumption and resource conservation. This conflict of interest is prominent in the southern region of the KNP in the northern parts of the Mpumalanga region. By introducing the proposed project in the selected region, this thesis hopes to alter the perceptions of the community's understanding of conservation from being more than laws and policies and to shift towards a more ethical understanding of seeing oneself as part of the environment that they live in. The need for the shift in the understanding of conservation is that the conservation practices are not just limited to the borders of the park, but applies to the degraded land that the communities have settled in; which is on the periphery of the park.

This dissertation questions how architecture is able to mediate ventures of discovery to enhance one's felt experience and interpretations of a natural landscape, more specifically the riparian zone (meeting point between land and water) at the Sabi River. This thesis proposes an ecological research centre that accommodates 3 main user groups, the conservationists, the communities and the tourists in an exchange of conservation-based information, agricultural practices, skills and resources. The aim of the centre is therefore to create a greater awareness of the fragility of riparian buffer zones, whilst implementing processes within community programs aimed at land rejuvenation and appropriate interactions with the natural environment. Second to this is the awareness of other ecological biomes that exist in the area. In order to reach the level of appropriate interactions with nature, there first needs to be an understanding developed in interpreting nature and experiencing it to further develop these conservative practices. The building hopes to increase the process of these interpretations and experiences between the users and nature.

This thesis does not investigate solutions for ecological rejuvenation or rehabilitation or to establish conservation policies, rather it is aimed at an investigation into how architecture can become the mediator and interface between the users and nature, to become the means to educate and transform the interactions we have with nature by changing the perceptions we have of our natural environments.

In order to mitigate the complexity of the dissertation, the topics of research and discussion are mainly structured around the terms typology, topology, morphology and tectonics. Typology refers to the type of building that is being proposed, who the users are that it will need to accommodate, as well as any quantitative data needed to establish an appropriate program for the proposed design and cognitive interpretation focused to establish the ontological nature of the proposed building. Topology refers to the location of the site and the surrounding context, analysis in terms of quantitative and cognitive data affecting the site for the proposed design on a macro, micro and mezzo level. Morphology is generally described as the form-giving and the methods of form-giving of the building which is established from the apparent influences of the typological and topological challenges and restrictions of the project. Tectonics refers to the physical assembly of the detailed architectural design, as well as the synthesis between the research conducted and the final proposed design.

Structure of this thesis :

Chapter 1: Project challenges and aims
Challenges were established by investigations into typology, topology, morphology and tectonics which established the aims and problem statements.

Chapter 2: Conceptual and theoretical exploration and grounding
This chapter outlines the initial conceptual approach through an abstract idea that encapsulated the intended essence of the project which aided the development of design concepts that were more applicable to the typological and topological response of the design. This chapter also contains the discourse justifying natural environments to be a locus of meaningful interpretation and appropriate precedent and case studies to inform the proposed design.

Chapter 3: Spirit of the site
Being an outsider of the site location, this chapter includes an in-depth analysis of the regional context including a brief history of the KNP, the user groups within this greater context, as well as the framework established for site selection concluding with the quantitative and qualitative interpretations of the chosen site.

Chapter 4: Design and tectonic synthesis
This chapter includes the documentation of early concept models, sketches as well as ideas of the initial design process and synthesis of the research conducted.

Chapter 5: Reflection and evaluation
This chapter concludes the dissertation with a reflection of the design process and major design decisions that were made and evaluates the success or lack thereof with regards to the design.

RESEARCH METHODOLOGY

This dissertation has various exploratory layers of research methods that were used in order to address the main issues of the project, which is aimed at achieving the end goal of a proposed architectural design. The start of the journey is to establish the project complexities by looking into the challenges and aims under the categorisation of typology, topology, morphology and tectonics. The next part was to locate an appropriate site for an ecological research centre, the location of the site, through a framework developed for the selection of the site, led to further specificity to the type of ecological research to be conducted, namely a riparian research centre.

The following methods of research were adopted throughout this dissertation:

A touchstone was designed and built to represent the core essence of the project. This in turn aided the development of various concepts that were explored through sketches, keywords and models that represented the concepts in an abstracted interpretation that was more applicable to the site and program for the proposed design.

A theoretical essay was written that frames the ontological approach of the design and sets the appropriate thought process by conducting a literature review relevant to the dissertation's focus areas.

This led to applicable architectural precedent and case studies that aided the design decisions with regards to the typological, morphological and tectonics of the proposed design.

A thorough site investigation was conducted by analysing data found in the Mbombela District Municipality's site development framework, as well as other sources, to gain a better understanding of the regional context and the spirit of the site region. The analysis then focuses on the actual area on which the proposed design is to be constructed which entails a quantitative investigation (interpretation of the existing site conditions and restrictions) as well as qualitative/cognitive interpretations of the personal experiences of the site.

Interviews with two ecologists in the area were conducted in order to gain a better understanding of the functioning of research centres in the context of the proposed design. These interviews aided the brief development as well as understanding the social dynamics between conservation and the surrounding communities.

CHAPTER

01

PROJECT AIMS AND CHALLENGES



Fig. 1.5: Edited photograph of the railway bridge from the southern bank of the Sabie River (Auhtor, 2021).

PROJECT AIMS AND CHALLENGES

Determining the multiple complexities of this dissertation was an overwhelming task to begin with, due to the number of considerations that needed to be taken into account. In order to simplify this process, in a way that is understandable and that can be easily be translated later into possible design resolutions, this chapter investigates these challenges into the categories of typology, topology, morphology and tectonics.

The typological investigation involved asking the question: “what needs to be designed?” and “who it will be designed for?”. Understanding the typology would address key elements of the functions that need to be considered for the design and the user groups that the design is centred around.

The topological investigation involves looking closer into the site conditions, both quantitative and qualitative aspects of the site. The key question asked was what does an ecological research centre look like within this specific site region? The site holds many challenges for the design but also revealed that the key conceptual and theoretical notions are guided by the location of the proposed design. Identifying the challenges of the site will aid in the appropriate design decisions that need to be made in the ecologically ethical mindset.

Whilst identifying the challenges with regards to the proposed site region and the building type, the next step was to identify the challenges of the form-giving of the design taking the previous considerations into account. In order to achieve this, investigations into a theoretical discussion were done to identify the nature of the mindest that needs to be held when making design decisions. The design concepts aim to link the typological character and the location of the proposed design with the theoretical investigation into realistic architectural approaches.

The structural methods considered during the design process links closely with the morphological challenges identified. The tectonics of the proposed design links closely with the conceptual approach and generates the morphological character of the proposed design. This results in challenges that will be closely investigated along with morphology as well as the logic outlined in the theoretical investigation.

Typology

Typology, as mentioned before, relates to the type of building that is being proposed and for whom it will be designed. The typology of the proposed design integrates a combination of various typical and perceptible architectural typologies, namely conservation, research, visitor, learning and exhibition. These typologies need to be stitched seamlessly into a coherent whole, whilst each of these typologies carrying various archetypal connotations or preconditions of what they typically represent. . However, the word typology is applied similarly in different fields of study and research. The typology of the ecological biome that the project is situated in is categorized as the riparian biome.



Fig. 1.6: Black storks and a crocodile in the Sabie River from the bank on site (Author, 2021).

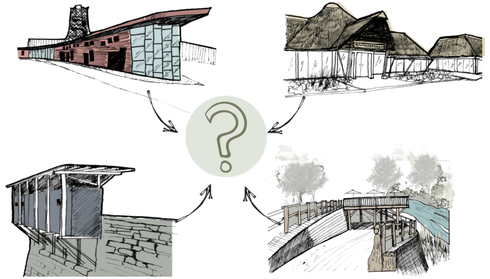


Fig. 1.7: Various architectural typologies (Author, 2021).

A riparian area is defined by Ilhardt, Verry and Palik (2000: 29) as :

> *“Riparian areas are three-dimensional ecotones of interaction that include terrestrial and aquatic ecosystems, that extend down into the groundwater, up above the canopy, outward across the floodplain, upv the near-slopes that drain to the water, laterally into the terrestrial ecosystem, and along the watercourse at a variable width.”*

Clients:

UNIVERSITY OF MPUMALANGA

Fig. 1.8: University of Mpumalanga Logo (University of Mpumalanga, 2021).

South African NATIONAL PARKS

Fig. 1.9: SANParks Logo (SANParks, 2015).

The clients chosen for the proposed design are the Mpumalanga University’s School of Biology and Environmental Sciences (SEBS) in collaboration with South African National Parks (SANPARKS). The SEBS school currently has a postgraduate programme where students are required to conduct fieldwork research in natural environments. The chosen site makes it ideal to conduct research within a conservancy as well as the periphery of the KNP within the communities where large areas of land are currently in a severely degraded state, this will be further discussed in the site investigation of this thesis. The KNP has conducted various ecological as well as socio-conservational research programs within the park as well as on the periphery of the park. During the late 1980s, the Kruger National Park Rivers Research Programme (KNPRP) was envisioned along with the Department of Water Affairs and concluded its river research in April 2000 (Breen, Dent, Jaganyi, Madikizela, Maganbeharie, Ndlovu, O’Keeffe, Rogers, 2000: 6). This program was responsible for managing water quality and the flow of the major rivers entering and flowing through the KNP (Breen et al. 2000: 8). The re-establishment of the KNPRP will aid in further river research that focuses on educating community members on the appropriate interaction with the river in order to preserve the rivers' health and sustain both the people and the natural environment.

Users:

The conservationist.

These users include 2-3 researchers who will be conducting research on the river and surrounding biomes in and around the KNP with the main objective of gathering the necessary data to develop more appropriate forms of river utilisation for the rural communities. Among them will be a group of 10-20 SBES students from the University of Mpumalanga who will visit the site to do fieldwork necessary for their postgraduate research as well as other workshops needed for their studies.

The agricultural community.

The surrounding communities have always come off second with regards to nature conservation, this will be further discussed in chapter 3 of this dissertation. The inclusion of community outreach in the project stems from the theoretical notion that in order to establish a public policy that is socially acceptable, as well as environmentally ethical, the need for understanding the environment is imperative to reach this goal. The conservationists will hope to educate the community with appropriate interactions with the river and the importance of the riparian zones along the rivers.

The Tourists

Eco-tourism aims at creating awareness of the fragility of our natural environments in a sustainable manner that further conserves the natural environment and economically benefits the surrounding community. The idea of attracting nature enthusiasts and those wanting to gain a better understanding of this environmental biome aids in attaining revenue that will contribute to the running costs of the centre.

Practical Design Challenges and Aims:

The major challenge to overcome in this project would be to develop a design methodology that orders the programming of the different functions. This would entail a coherent layout of the various functions with regards to the public spaces for the tourists, semi-private and private spaces for researchers and students as well as semi-public learning spaces for the community. Second to this is the challenge of developing a layout that will aid in the design of a research base camp that highlights an experience that allows for the interpretation of this ecological biome.

Experiential Challenges and aims:

The core concept of the design is the created awareness of this ecological biome, the riparian zone. The main challenge throughout the design process would be to keep the user fully engaged in a narrative with nature throughout the design. The aim is to design spaces that would reflect the ecotones of this biome and create opportunities to contemplate and experience these natural thresholds or defined ecotones between land and water.

Topology

The site is located next to the railway bridge and the border of the KNP on the bank of the Sabie River, within the larger context of the northern region of the Mpumalanga province. The majority of the site is currently utilised for agricultural use, and the riparian buffer has been severely altered for its natural resources (shrubs and reeds are constantly cleared out to carve out river sand from the river bank). The site needs to be an integral part of the investigation, due to the nature of the proposal, the only clue that the proposal has in generating a theoretical and conceptual framework, stems from the site which becomes the overriding determinant of the decisions that had to be made. A whole chapter in this dissertation is dedicated to understanding the history and present situations of the site region and the roles that each identified user plays within this site region. This investigative stance was taken to understand the site as the author is a foreign entity to this region.

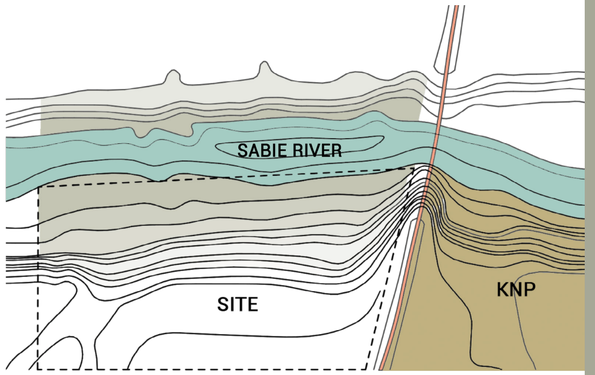


Fig. 1.10: Topographical map of the proposed site (Author, 2021).

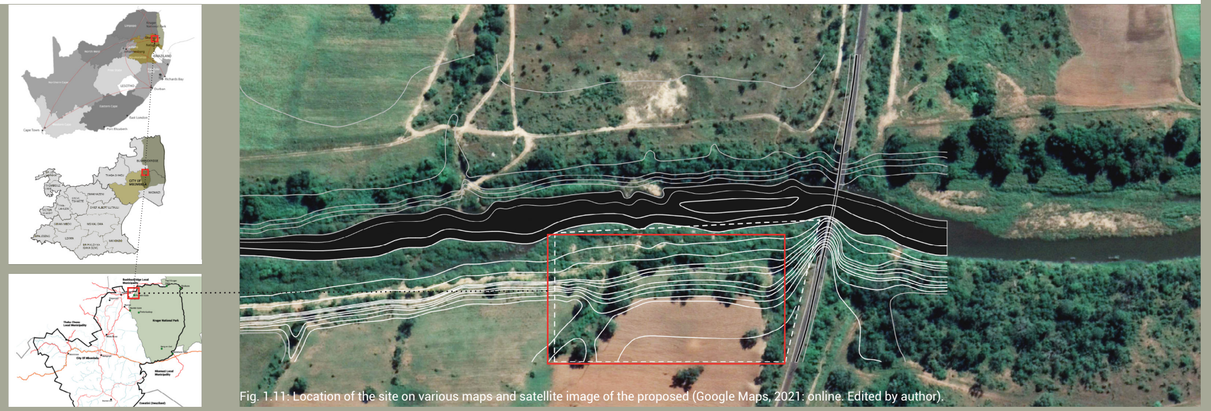


Fig. 1.11: Location of the site on various maps and satellite image of the proposed (Google Maps, 2021: online. Edited by author).

Quantitative Challenges and Aims

The site is located on a steep slope within the riparian zone with a total rise of 11m from the water edge to the ridge of the tree line. The slope provides various possible design resolutions towards the challenges that the site holds, for example, vertical circulation to reach the desired promenade of the design from the entrance of the upper terrace (the ridgeline before the slope). Apart from the topographical challenges of the slope, another added complexity is to preserve as many of the prominent trees within the ecotone as well as leaving room for the addition of new trees in hopes of densifying this ecotone of the riparian zone. Another challenge would be to appropriately respond to the climatic conditions of the area, these climatic conditions will have to be considered with regards to the morphological as well as the tectonic challenges.



Fig. 1.12: Image of site from the southern bank looking towards the upper terrace (Author, 2021).



Fig. 1.13: Image from the southern bank through the reeds looking east towards the railway bridge (Author, 2021).



Fig. 1.14: Image of the site from the railway bridge looking onto the southern bank (Author, 2021).

Experiential Challenges and aims

As mentioned before, the site is located next to the railway bridge, which symbolizes the first interaction that man has with the river on the site. The railway bridge sits perpendicular to the river and contrasts the movement of man over the movement of nature. The challenge of the proposed design within this site would be aimed to establish a reconnection between man and nature, where nature dominates, and man observes and contemplates (interprets) in hopes of establishing an environmental identity (seeing oneself as part of nature). It is in this light that the interaction with the site needs to be subtle, hidden, and places itself second to nature.

Morphology and Tectonics

Morphologically the proposed design would need to establish itself in such a manner that it seems complementary to the natural setting. The other complexities to consider during the morphological development would be to use the future generated concepts that will be inspired by the site to be carried out through the design process. The morphological development, as well as the tectonics of the proposed design, are considered holistically due to the relation they have for the proposed design

Practical Design Challenges and Aims

The morphological development relates directly to the structural make-up of the proposed design. The morphology would be a direct product of the structural systems used that would need to be centred around an ecologically ethical approach towards the sensitivity of the site. The morphology would also be affected by the appropriate response to the climatic conditions as well as the limitations of the natural buildings materials to be considered that will be found in the region. The structural approach of the proposed design would need to relate to the natural elements found on site. These materials will also have certain limitations when considered structurally. Metaphorically the structural system can aid in further communicating the aim of appropriate interactions with nature and the complementary effect that the design may have within this natural setting. This will closely relate to the theoretical and conceptual approach of the design in a holistic view.

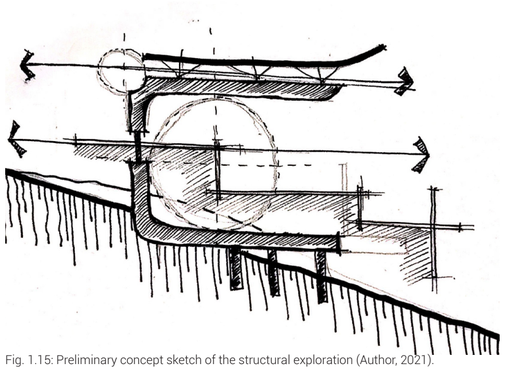


Fig. 1.15: Preliminary concept sketch of the structural exploration (Author, 2021).

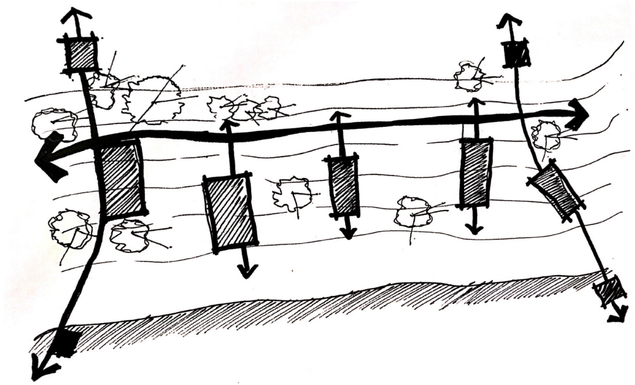


Fig. 1.16: Preliminary sketch of a the layout of the proposed design on site (Author, 2021).



Fig. 1.17: An interpretation of nature being seen as oneself as an embodiment of one's identity (Author, 2021).

Research Question

How can mediating ventures of discovery enhance one's felt experience through a riparian biome at the Sabi River?

Summary of project aims

Typology – Interweave the various typologies of the proposed design and seamlessly distinguish the domains between public and private spaces for the defined user groups, whilst focusing on the major aspect of the experiential journey to create an awareness of this landscape.

Topology – Overcome the site challenges with regards to the topographic qualities of the site, in the quantitative and qualitative aspects of the site for an ecological appropriate design that also responds to the climatic conditions of the region. The main aim is to pick an appropriate level on site that optimises the narrative journey through the site.

Morphology and Tectonics - The morphology aims at coming off second to nature, reducing the human presence on site by taking into consideration the natural materials to blend in with the site and resemble the ecologically ethical consideration in the design.



Fig. 1.18: Panoramic view of the Sabie river into the Kruger National Park (photographed by author).

CHAPTER

02

CONCEPTUAL AND THEORETICAL EXPLORATION & GROUNDING



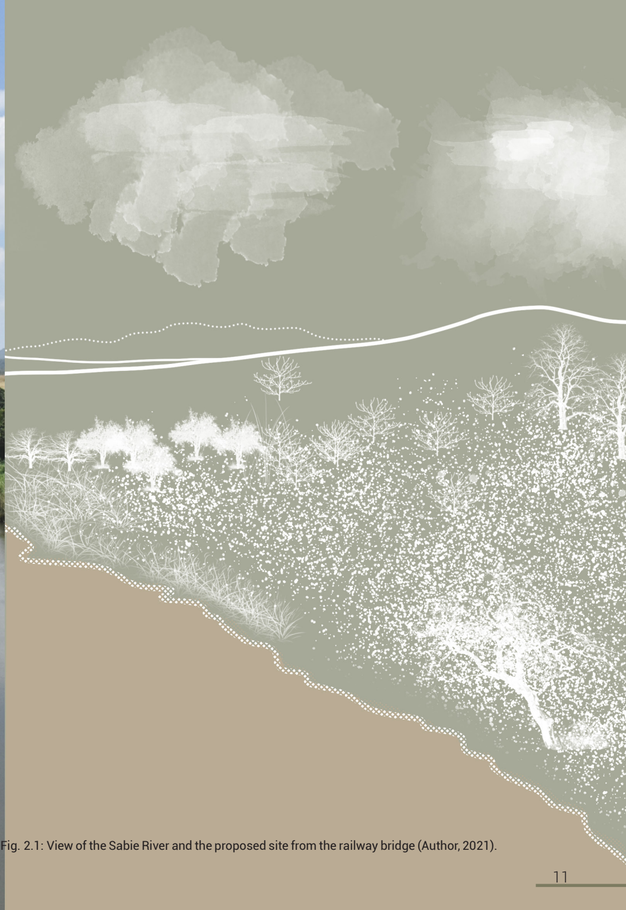


Fig. 2.1: View of the Sabie River and the proposed site from the railway bridge (Author, 2021).

THE TOUCHSTONE

The Riparian Promenade

The Touchstone, which has been envisioned as an abstract form of the project, sets out to explore the essence of the proposed project. It aims to express the intuition, the intention, as well as the theme of the proposal. The touchstone gathers its inspiration from the 'promenade architecturale', an architectural concept developed by Swiss-French architect Le Corbusier. In essence, this concept encapsulates the intentional path designed for a user to experience a specific built environment.

"Buildings also condition our reading of time; like the cinematic or literary arts, they can speed up, slow down, halt and reverse time." (Louw 2016: 17)

Time is an essential element and concept that forms part of the layering of what the promenade attempts to amplify. A felt experience can be made specific to a certain space over a certain period, and altering the experience once time has passed or if one moves along the path into another space. Pallasmaa believes like many others in the academic field that architecture can 'condition' our personal image or experience of time.

The concept that is embodied within the touchstone stems from these principles and ideas set within the promenade architecturale. Movement along a path is used to raise one's consciousness of the connections between living things and their environment, which is achieved over a period of time. The idea is not simply just a path designed within the broad term or domain of nature, but within the riparian biome of the site, along an existing and dominating path, the river. The riparian promenade is the main essence of this project and what it aims to become. **A path to allow the user to experience the space. The space being nature: a non-geometric, non-constricted spatial entity that has its own systems, and connections.**

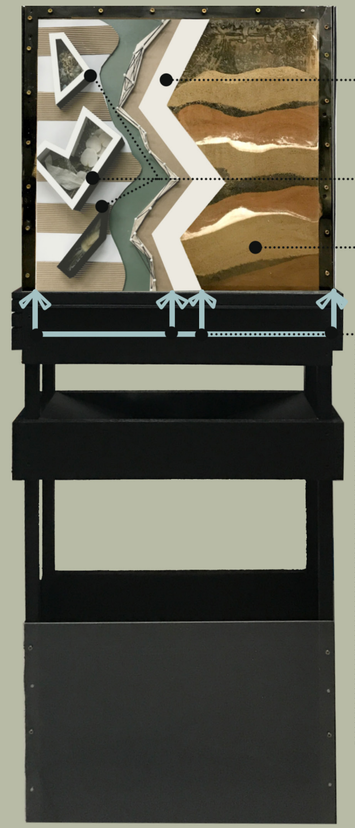
After completing the installation, it occurred to me that architects have the ability to alter the duration of the felt experience of time within a designed built form to express a narrative, a ritual and the likes of the cosmic order. The installation is built in a way where time appears to be controlled at first instance. The absolute time is a domain that remains constant, and as time passes, the felt experience of how long or short it feels can be altered. The promenade is indeed a device that could be used to heighten the sensory experience of a built environment, as well as the natural environment. The definition of the riparian zone was mentioned earlier gives a new perspective into the understanding of this biome. The site is a **three-dimensional ecotone**, and the architectural intervention can serve to add the fourth dimension to connect the tapestry of all the ideas.

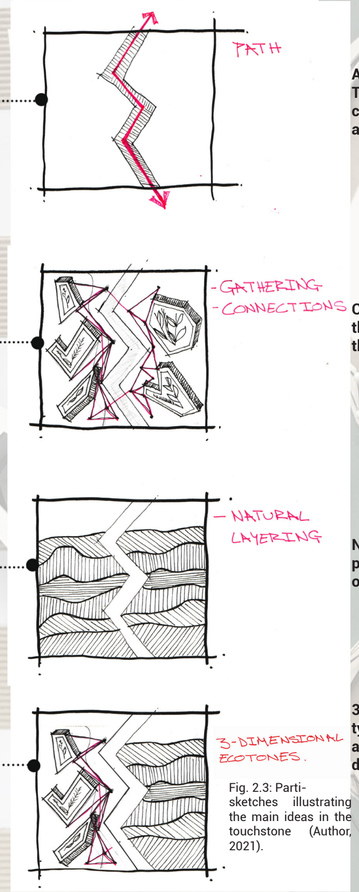
It became evident that an underlying question remained unanswered. How does this inform the architecture that needs to be considered? What was however accomplished was the effect the proposed design hopes to achieve; that **the architecture aims to be a space that allows for the experience of revealing the interconnections between living things and the environment.**



Fig. 2.2: Image of the touchstone illustrating the layering of the sand before the installation (left) and revealing the interpreted nature connections (right) (Author, 2021).

The layering of different types of sand resembles the make-up of the natural environment, and as time passes, the environment reveals the interconnections between various elements hidden within itself. The sand layers then fall, making the user aware of time passing by, like sand in an hourglass, and reconfigures itself to form a new pattern in the container at the bottom. Metaphorically this suggests **the gathering and the processing of the given information from the environment.** The path is highlighted as a constant figure from the beginning to the end of the installation. Along this datum, time passes by it, at one's own experience or perception of time. The datum represents the river, and what the riparian promenade could potentially be conceptually.





A path to allow the user to experience the space. The space being nature: a non-geometric, non-constricted spatial entity that has its own systems, and connections.

Observing the hidden inter-connections between things and the interpretation of the act of gathering this new information.

Natures given layering, and the re-figuring of a new pattern in the chamber below resembles the volatility of the riparian zone.

3-Dimensional ecotone resembled in the 3 layering types of installation, the path, the layering, and the act of gathering as seen as respective, but holistic dimensions.

Fig. 2.3: Parti-sketches illustrating the main ideas in the touchstone (Author, 2021).

THEORETICAL FRAMEWORK

Research Question

How can mediating ventures of discovery enhance one's felt experience through a riparian biome at the Sabi River?

Can an environment be a locus of meaningful interpretation in order to create awareness?

- Hermeneutics to Environmental Hermeneutics
- Eco Tourism and Community Education

What is the aim of this created awareness?

- Environmental Identity
- Observation + ? = Conservation

Does the experience of an environment always lead one on the detour for 'reflective meditation' and understanding?

- Environmental Experiences
- Observation + Participation (Experience) = Conservation

How does this moment of narrative/dialect between the self and other-than-self set off?

- Ecological Ethics
- The Ecologically Ethical Mindset and Spirit to Inform Design Decisions

Fig. 2.4: Theoretical diagram explaining the line of thought and structure of the theoretical lens (Author, 2020).

THEORETICAL APPROACH

After evaluating and reflecting on the initial ideas that generated the touchstone, the concept of the promenade and the relation time has on an experience was not an appropriate mindset to generate a thorough theoretical discussion for a dissertation of this nature. The promenade architecturale was a concept generated in the modernist movement which focused on experiencing the built form, in this case, it can be translated into a concept rather than a starting point for a theoretical discussion for this dissertation.

It was at this point that a reflection on the research question was needed to guide the structuring of the lens through which this project will be analysed, justified and interpreted. This section gave clues to relevant formative ideas that link to themes set out in this theoretical approach and will aid in the design development of the proposed design. These formative ideas will be discussed in the section followed by the theoretical precedent studies of this chapter.

By focusing on the key elements of the research question, the theoretical framework was developed by asking sub-questions that revealed possible points of discussion to build up the theoretical lense. These sub-questions built on each other aids in cohesively linking the themes to each other. Each sub-theme concludes with an interpretation of the theories discussed and possibilities for the approach towards the proposed design.

Environmental hermeneutics as an approach to the interpretation and justification of meaningful experiences within natural environments

The leading inquiry of this dissertation, the investigation into the theory of hermeneutics, is considered to provide justification for the means to place **value on the experiences** that people have within **natural environments**. This theory provides a model to interpret the environment as an identity in relation to individuals who encounter natural landscapes. The investigation also leans towards an appropriate response to some vital aspects identified in the theory in order to reach a strategy to develop formative ideas for the morphological resolution of the proposed design. This theoretical approach will first introduce the theory of hermeneutics following the work of environmental philosophers who have translated this theory into "environmental hermeneutics".

Philosophy pertaining to ecological matters is a relatively new subject in the realm of architectural disciplinary discourse. Ecological philosophy finds its origin with regards to the growing awareness of the consequence of environmental devastation and resource depletion (Utsler, 2009: 173). The detrimental effects of human activity led some philosophers to think about what possible questions could be raised for discussion to bring about some form of change (Utsler, 2009: 173). Ecological philosophy is merely a version of applied philosophical ethics. This subject matter did not, however, remain stagnant in the field of ethics, due to the ontological value that occurs, discussions have branched out into many fields, to name but a few: environmental aesthetics, eco-feminism, environmental theology. David Utsler (2009: 173) suggests that if all these fields have "gone back to the earth itself", and philosophers, even phenomenologists, then why not the possibility of applying hermeneutics as a model for environmental philosophy?



Fig. 2.5: Experimental digital composites titled "We Are Nature VI", expressing the love, passion and interaction with the wonder and beauty of nature (Relander, 2020: online).

From hermeneutics to environmental hermeneutics

The theory of hermeneutics has its origin in the legal and theological methodology which governs the application of the Law and theological texts which was developed by Friedrich Schleiermacher and Wilhem Dilthey into a general theory of human understanding (Drenthen, 2016). Martin Heidegger further developed hermeneutics into a fundamental philosophical approach which was worked through by Hans-Georg Gadamer, Paul Ricoeur and others (Drenthen, 2016). Hermeneutics often places focus on the interpretation of written texts, however, the scope and application of this theory is more general, and can be applied to **"those elements in the world that somehow convey meaning and yet require interpretation"** (Drenthen, 2016: 1). The analogical reasoning placed on the principal is that this form of interpretation is not limited to written texts, but may also be universally applied, such as "[...]works of art, human actions and possibly even environments and landscapes." (Drenthen, 2016: 1), and is a "form of thinking itself" (Clingerman, Utsler, Drenthen and Treanor, 2014: 2). If the above claim that hermeneutics may be universally applied to experiences or actions, which in their entirety is mediated through language, is open for deeper contemplation and interpretation, therefore environmental experiences or narratives also calls for hermeneutics.

The justification for **environmental experience to be a locus of meaningful interpretation** is based on the notion that our experiences of environments are expressed and understood through language as well as the former claim. Language, according to Paul Ricoeur in *Interpretation Theory: Discourse and Surplus of Meaning* (cited in Utsler, 2009: 173), is related to the "ontological condition of being-in-the-world", thus bringing human experience and encounters to language. Therefore, the quest for understanding by interpretation can be viewed as a fundamental characteristic of human existence.

"Environmental hermeneutics allows us to understand the language of the environment but also grants us the opportunity to include the environment as part of our identity" (Author, 2021).

David Utsler first begins to structure environmental hermeneutics by looking at Paul Ricoeur's hermeneutics of the self. Even though this starting point appears anthropocentric, Utsler suggests that the hermeneutic approach by Ricoeur overcomes this binary opposition between anthropocentric and eco-centric (Utsler, 2009: 174). This claim of the first mediation between the two in binary opposition is where the need for hermeneutics comes into effect. It is within the notion that the self, as an "account of personal identity", would not oppose this binary dialect between the anthropocentric to eco-centric, rather it would require creative tension to develop what Utsler refers to as the call for **"environmental identity"** (Utsler, 2009: 174) i.e., where the self is identified or understood in relation to the environment.

Environmental hermeneutics allows for an ontological discussion to be held about the environments which we experience to be spaces that can be interpreted, contemplated and holds value for these experiences to be meaningful. The result of this mindset being developed is that an awareness of the selected site can be viewed through this lens as a **natural environment that is a locus for potential meaningful experiences.** This awareness can be further translated into a typology of the proposed design, where **eco-tourism and community education** as an outreach and conservation effort about the intrinsic value riparian zones hold.

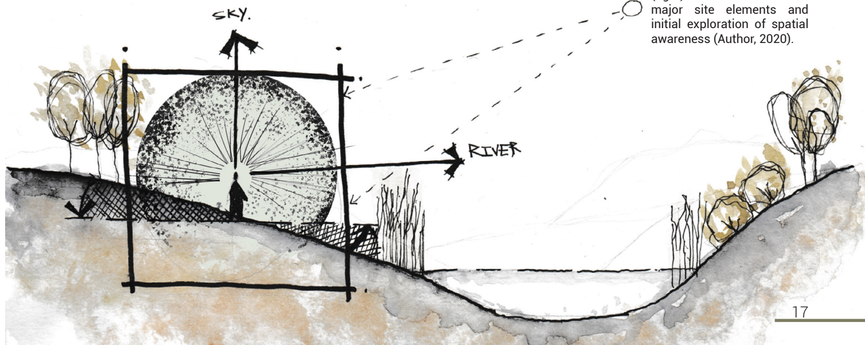


Fig. 2.6: Experiential sketch (right) of the awareness of major site elements and initial exploration of spatial awareness (Author, 2020).

Environmental identity

“There is no world without a self who finds itself in it and acts in it; there is no self without a world that is practicable in some fashion.” (Ricoeur, 1994: 311)

Ricoeur realized the importance of narrative identity after his book Time and Narrative, and the quest of understanding oneself within a narrative identity that followed a question of an ethical aim of being such a self. Narrative identity forms part of our personal identity, in that we tend to understand who we are when we narrate stories about ourselves to others. It is in this light that we carry out “emplotment”, composing narratives around certain past events containing other people (or places and environments) within this narrative, and we identify ourselves along with the other. In his book *Oneself as Another, 1994*, Ricoeur carefully untangles the meaning of Selfhood. Utsler interprets this process of selfhood offered by Ricoeur in this book which outlines three philosophical intentions (Ricoeur, 1994: 1–4), in an attempt to place a link from narrative identity, to environmental identity.

1. “Primacy of reflective meditation” which is the **detour of introspection** against the cogito.
2. The dialect between the Ipse and Idem. Idem referring to the identity of a person which never changes and Ipse referring to selfhood where the personality of one may change over time.
3. Dialect of selfhood with otherness.

Utsler suggests that the first and third intentions brought forward can be applied to establish environmental identity. The first intention takes the notion of a **detour** in the form of **“environmental experience”** (Utsler, 2009: 174). This reflective or introspective detour leads one into understanding oneself. The third intention offers a profound way of considering environmental identity; the dialect between the self and the other-than-self is not viewed in comparison to each other, but that the dialect “selfhood of oneself implies otherness to such an intimate degree that one cannot be thought of without the other” (Ricoeur, 1994: 3). With these two intentions combined this is when we begin to establish an environmental identity.

The environmental identity can be established by composing a series of events (experiences) within the proposed design. These events need to be choreographed according to a specific strategy to target specific felt experiences that can be more meaningful and intentional (that the proposed building responds to the site itself and comes second to the environment). The main aim of the research component of the proposed design focuses on the conservation of the riparian zones along the river, which entails a series of **observations before any ethical action may be executed to result in preservation**. These **points of observation** for the tourist however involves trying to create the opportunity to see the environment as part of the world they live in through the act of participation and experience. In order to choreograph these events of environmental experience, it is important to attempt to understand what these environmental experiences may be.

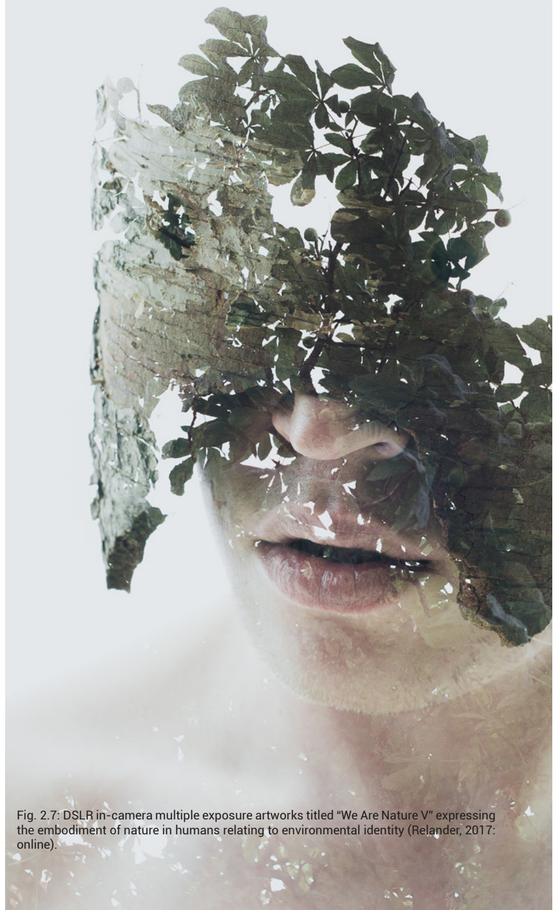


Fig. 2.7: DSLR in-camera multiple exposure artworks titled “We Are Nature V” expressing the embodiment of nature in humans relating to environmental identity (Relander, 2017: online).

Environmental experiences

Does the experience of an environment always lead one on the detour for ‘reflective meditation’ and understanding?

This question opens up a dialogue to the intention of the thesis, serving as a baseline from which to work and hopefully to characterize the dialogue of symbiosis between the proposed design and the natural environment the user will experience.

The human-nature connection that exists is relative to the person who experiences nature and is subject to one's own understanding of the self in relation to nature. People's perception about the acceptability of various kinds of human inter-[action] with-in natural environments (one's own ethic) stem from two basic concepts according to Herbert Schroeder (environmental ecologist and philosopher). He makes the distinction that people either see themselves as “apart from nature” or “part of nature” (Schroeder, 2007: 294). These two concepts provide various possibilities on how one might experience different kinds of places as these experiences are subject to one's current perception of natural environments. Schroeder further explains that these concepts along with the variable of human interaction within these environments add to the various possibilities of experience (Schroeder, 2007: 294). The examples he gives state the following:

> With-in environments that have little to no interaction of human activity with a sense of being separate from nature might experience the space as if he/she is intruding on nature or that he/she feels out of place because of the ‘remoteness’. In contrast to someone who has a sense of being part of nature within this setting might feel a sense of belonging or a sense of peace within this solitude (Schroeder, 2007: 294-295).

> With-in environments where there are a mixture of natural and built elements poses two very interesting approaches to establish a sense of meaning. A sense of being separate from nature might experience the mixture of human and natural elements in stark contrast to each other. The sense of being part of nature might view the two elements (natural and built) as complementary and harmonizing in their composition (Schroeder, 2007: 294-295).

This view illustrated by Schroeder then suggests that our mere encounter with a natural environment is subject to our relation with it. What does this mean in the hermeneutic sense? Moral experiences and meanings of nature come into effect as soon as we start articulating our relationship with the world (Drenthen, 2016: 7). If one views being part of or separate from nature, this does have an effect on the experience one might encounter within these natural settings, but they however can be altered to create a greater awareness of the natural space and its relation to others. It is only at this point that one may hope to gain a better understanding one oneself in relation to nature, if the person is an active participant in the appropriate interpretation to seek that meaning, and in some cases to stumble upon them.



Fig. 2.8: A man in contemplation in the remoteness of nature, the feeling of his experience is subjective to the man's perceptions of his relationship with the natural environment (Manat, 2017: online).

The concluding factor would then be; to acknowledge that there will be a conflict of various interpretations, but neither one can be classified to be the correct one. Consideration of the tapestry of ecological relationships, including the interpretation and participation of human threads, reveals a way in which we can come to think of the environment as another based on intracorporeality (Utsler, 2009: 175). Hermeneutic philosophy would aim to mediate these conflicts of interpretations. It is at this point I suggest the introduction of the mediation to occur; employing human interaction in built form. That architecture can be the mediator between the self in relation to the natural environment to transform the "neutrality of space into a meaningful place" (Drenthen, 2016: 7).

A reflection on environmental philosophy after researching into it exposes that these philosophers reflect on the natural environment, but seems to distance themselves from the experiences of the natural world. This draws a parallel into what Ricoeur notes as the productive form of distantiation in critical hermeneutics (Utsler, 2009: 176). Ricoeur views that this alienating distance from what is being interpreted is not opposing the binary opposite of active participation or appropriation (bearing the meanings of what is being interpreted that plays a role in one's own life, i.e, the narrative environmental identity) (Utsler, 2009: 176) (Drenthen, 2016: 5). For Ricoeur, distantiation is not opposed to the relation of belonging (participatory appropriation) but is part of it (Utsler, 2009: 176).

The act of distantiation does not isolate the person from moving back towards appropriation, these acts are contemporaneous in that the apprehension of meaning and self-understanding are too contemporaneous (Utsler, 2009: 176). The productive form of distantiation is therefore understood to be the dialectical counterpart of "participatory belonging' (inter-active experience) that becomes the mediator oscillating between remoteness and proximity (Shcoreder's concepts of environmental experience) that contributes to a fuller understanding of environmental experiences.

Ecological researchers partake in this act of distantiation and appropriation unknowingly when conducting their research. For the proposed design these principles of actively participating and appropriating become the means towards the notion of environmental identity through the first step of distancing oneself from what is being experienced. These principles would need to feature in the approach of the proposed design in the form of pulling the user in and out of spaces (which harmoniously blends with the environment) and placing them within the biome resulting in an intricate play between proximity and isolatedness where reflective interpretation may occur simultaneously as the theory suggests.

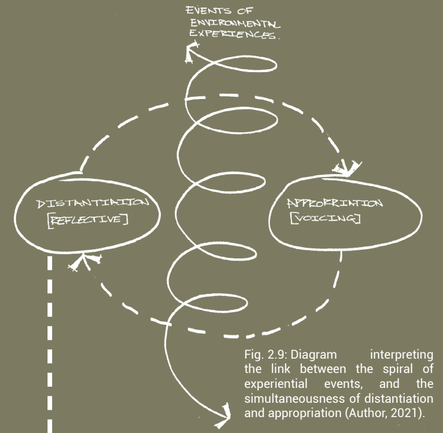


Fig. 2.9: Diagram interpreting the link between the spiral of experiential events, and the simultaneousness of distantiation and appropriation (Author, 2021).

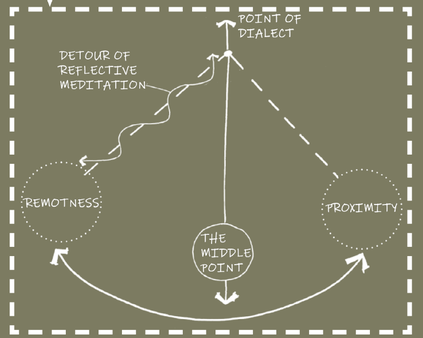


Fig. 2.10: Diagram interpreting the act of distantiation and the link between proximity and remoteness in relation to the type of environmental experiences (Author, 2021).

Ecological Ethics

How does this critical moment of narrative/dialect between the self and other-than-self set off?

To address this question the dissertation looks back at Utsler's model for environmental hermeneutics. It was mentioned at the beginning of this chapter that ecological philosophy was initially just a version of applied philosophical ethics. So far in this section, a mode of thinking has been established, and now a reflection on an appropriate approach arises.

Due to the nature of the proposal in this dissertation, it is necessary to resort to an ecological ethic to establish a logical baseline for any project centred around an ecological matter. Ecological ethics cannot be covered in its entirety within a subsection of a dissertation. **Rather, ecological ethics serves as a baseline logic that guides the thought process, intent and design decisions of the dissertation.**

Utsler suggests going back to Ricoeur's theory of the self. Ricoeur suggests that humans are regarded as agents, who are 'responsible for their actions' (Pellauer & Dauenhauer, 2021). The question then about the appropriate actions of this agent leads into a discussion Ricoeur highlights as the ethical intention or ethical aim that this agent strives towards (Utsler, 2009: 175). Utsler suggests that this is the starting point for mediating the tension between the complex tapestry of "environmental visions and narratives"(Utsler, 2009: 175) as well as experiences. The "ethical intention" Ricoeur refers to is defined as **"aiming at the "good life" with and for others in just institutions"** (Ricoeur, 1994: 172). Utsler includes within this aim **"the symbiotic arrangement between humans and the natural environment"** (Utsler, 2009: 175). This ethical aim acts as a measure to determine moral norms within a society, these then get translated into public policy.

Ecology is defined as the science that studies the interconnections and relationships between living organisms and their environments (Schroeder, 1996). Multiple views dictate the interactions of these parties in question, however, according to some ecologists and ecological philosophers, humans are "[...] not "above" the ecosystem but living members of it" (Utsler, 2009). It is undeniable that humans have a relationship with the external world, be it with rivers., streams, animals or plants. To enable individuals to arrive at this point of understanding themselves as living members of the environment they dwell in. This allows the proposed project to set itself on the ethical intention of allowing individuals to contemplate their own actions with regards to the natural environment, more specifically their interaction with the river.

Many individuals, including the farm owner of the site, use the river as a means for sustaining their agricultural plantations which sit close to the edge of the river. Many other farmers, as well as urban settlements along the river upstream, utilize the river for substance in some way shape or form. The upstream use of the river greatly impacts the sensitive ecology within the protected Kruger National Park. The need for ecological ethics is then clear to establish a public policy to conserve, protect and restore the environment by means of appropriate interaction with the river.

The intent of discussing ecological ethics in the dissertation is not a means to resolve the conservation issue of riparian zones within this region. The discussion serves as a starting point to encourage an awareness of the fragility of nature as well as the appropriate form of interaction with nature. With the intended proposal, the user gains a sense of himself in relation to nature, and the proposal is established on an ethical intent of sustainability of the Sabi River and many others that flow through the region before flowing through the Kruger National Park.

"Humans are deeply connected with nature - if humans identify with nature, then taking care of the natural world will become part of taking care of oneself." (Ball, 2015: online)

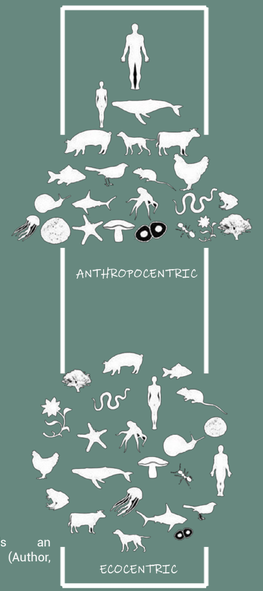


Fig. 2.11: Towards an ecological ethic (Author, 2021).

THEORETICAL PRECEDENT STUDIES

This section will look into two precedent studies that incorporate the major principles outlined in the theoretical discussion. These precedents serve to promote that an appropriate interaction with nature can be sensitive and subtle in its presence yet metaphorically impactful in its meaning to narrate a specific awareness. The lens that was created in the previous section will be used to analyse these precedents that will provide a means of justification towards the theory being applied in the proposed design of this dissertation.

Hush – Steve Messam

Location: Newbiggin-in-Teesdale, County Durham, UK.
Date: July 2019

This temporary art installation located in the remote landscape of the North Pennines Area of County Durham, aims to draw attention to one of the areas most distinctive but overlooked features which seems like a picturesque natural geological formation but is actually a scar left by the old lead miners. These 'hushes' were created by damming up a stream then releasing the water to wash the surface away and expose the desired minerals (Graham, n.d.: online). This process of excavation was known as hushing. Steve Messam attempts to create an awareness of this old mining site by transforming the historical site by interpreting the landscape to alter one's perception of the familiar environment in a re-imagined way.

The dynamic artwork stretched 370m long, 50m wide and 45m at its pinnacle point over the Bales Hush (Messam, 2019). 5km of saffron dyed polypropylene fabric was used for the installation which was suspended by cables and custom fixings to span the fabric and fill the void of this manmade scar (Messam, 2019). The main intention of the installation was to create an awareness of man's past actions to expose an old mining practice of the area which also informs the viewers of the heritage of the town. The scale of the installation along with the brightly coloured fabric allowed viewers to meander up and beside this gorge to contemplate the environment in a new way. The use of fabric meant that even though the hush is a tranquil space, it was temporarily given a voice that was amplified by the sounds of the fabric in the wind.

The Bales Hush is a Site of Special Scientific Interest and environmental sensitivity was one of the objectives of the installation (Messam, 2019). This mindset and attitude governed Steve's intentions from the beginning as well as the design decisions of the installation. The use of polypropylene as a choice of material meant that it was easily recyclable at the end of the installation, the cable and fixings which left no permanent marks on the site will be re-purposed in future projects (Messam, 2019), and the time selected for the installation was also considered due to the nesting seasons of endangered ground-nesting birds.

The lessons learnt from this precedent is that a narrative of man's past actions in the environment can be expressed in an experience that creates an awareness of the current situation of the environment. The second lesson is that the installation also creates this experience with an ecologically ethical mindset and intention from the offset from planning down to execution. This installation provided the viewers with an outdoor experience that contributed to their alternative interpretation of it, hence understanding themselves in relation to the environment (creating an environmental identity through awareness).



Fig. 2.12: Photograph of a hush in the North Pennines Area (Tenenbaum, 2019: online).

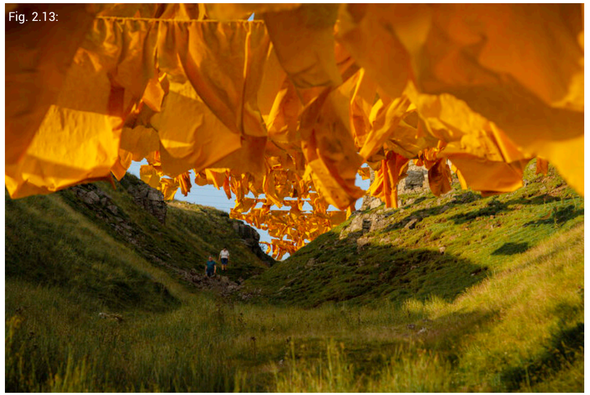


Fig. 2.13:



Fig. 2.14:



Fig. 2.15:



Fig. 2.16:

Fig. 2.14-2.17: Photographs of the Hush installation by Steve Massam (Messam, 2020: online)

Allmannajuvet Zinc Mine Museum– Peter Zumthor

Location: Sauda, Norway
Date: 2016

Peter Zumthor pays meticulous attention to detail, materials and articulation of the experience in his works with the care to place. The Allmannajuvet Zinc Mine Museum encapsulates the character and persona of who Zumthor is, the attention to narrate a story through metaphoric design that exemplifies the voice of this mountainous forest region of Norway, with a subtle and humble approach that is not direct and cliché.

Zumthor's approach to any design in a natural setting is to learn the landscape. Zumthor expresses that this knowledge of the landscape is needed in search of the right balance in the choice of materials, scale, and shapes (Cutieru, 2020: online). This project is located on an old mining site of the late 1800s and the mining culture forms part of the place's identity. Similar to the previous precedent of the Hush mining site, the museum aims to express the hidden struggles man underwent in this natural setting, voicing a narrative within the design. Unlike the previous precedent, man's effect on nature is not what is being emphasised here, but the narrative of a specific experience of the past.

At first glance, the Zinc Museum in its typology appears nothing like one would expect a museum to look. This form-giving is something that was generated through the knowledge of the site and the place, knowledge that Zumthor emphasises as a prerequisite for projects of this nature. Three black, shed-like boxes perched over the site on light wooden frame structures that blend in with the skinny vertical trees in the foreground of the stereotomic mountain. However, in the effort of the structures to meticulously rest lightly on the earth, the black boxes with their intense light-sucking blackness against the snow in winter has a curiously concentrated visual potency, but their scale and shape place them second to that of the might of the mountain in the background (a humble attitude).

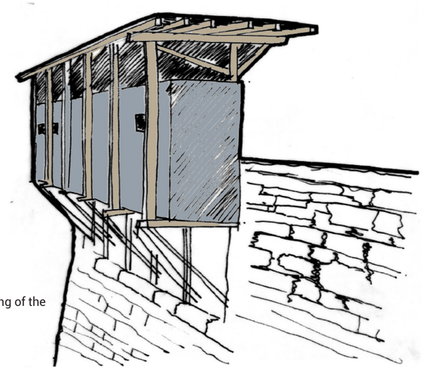


Fig. 2.17: Sketch of the service building of the Zinc Museum (Author, 2021).



Fig. 2.18: Photograph of the exhibition building in its context (Amoretti, 2017: online).



Fig. 2.19: The delicate frame structure touching the topography lightly, suspending the metaphorical dark box (Amoretti, 2017: online).

In the narrative of symbolically connecting zinc back to its origins, Zumthor uses the material in various forms, like the roof and door. These sheets of corrugated zinc used to clad the roof echoes the ethos of the original mine structures and the doors are cladded with heavy zinc panels (Slessor, 2017: online). Handles of untreated forged zinc become the first thing visitors touch, this becomes a reminder of the beauty, utility and origin of this disregarded metal (Slessor, 2017: online).

The structures appear very simple in their makeup, their presence on the site is almost minimal, but the impact in the intent of the meaning and place is voiced through an experience of this narrative journey. This method of approaching architectural design in terms of craftsmanship, materiality and assembly into a composition of humble simplicity is what the proposed design hopes to follow.

The lesson learned in this precedent with the theoretical lens is that the **use of unambiguous typologies** can contribute to the appropriate reaction in a natural setting. Secondly, to match the substance of the landscape and place, **the use of materials, as well as the construction methods used, should relate to the context** to ensure a composition that blends in and becomes easily relatable. Thirdly, on a more tectonic level, prefabrication and details of assembly can be more than just technical in their approach. The **details and joints of materials and nature can potentially embody a sense of care, poetics and can be approached with an ecologically ethical mindset.**



Fig. 2.20: The three black boxes in contrast to the environmental context in the background (Amoretti, 2017: online).



Fig. 2.21: Meticulous positioning of the building orientated to specific views (Amoretti, 2017: online).

FORMATIVE CONCEPTUAL IDEAS

The touchstone opened up a few ideas concerning the approach of the project. Even though the exercise itself portrayed an early concept and did not successfully encapsulate the essence of the project, the ideas that stemmed from the touchstone were formulated based on the clues that were inspired by the site and typology of the proposed project. The design concepts built on these ideas in the touchstone as well as the main themes in the theoretical discourse. The concepts were generated from an abstracted analysis of the main elements of the site plan and interpreted site sections. The concept sketches and models were generated to aid the morphological development of the design and does not interpret the theoretical underpinning of this dissertation, but rather relates main themes to the concepts.

1 Biome-Mimicry
Riparian Thresholds | Eco-Tones |Buffers

This concept deals with the abstract interpretation of the Riparian Zone found on site. It translates the experiences of each zone into a model that separates them in one view, but combines them in their natural order in the other. The conceptual drawings begin with exploring the physical section of this zone into its various ecotones and abstractly translate them into architectural verbs and composition of geometries that could aid the design process. The aim of this concept for the proposed design is to establish a threshold between these zones to aid the user in identifying each of them within the building, and also provide pause spaces for these to be experienced and interpreted.

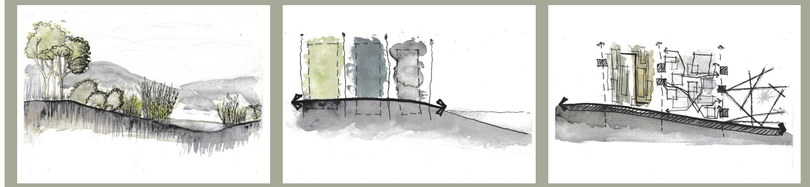


Fig. 2.22: Conceptual site sections responding to the generated formative idea (Author, 2021).



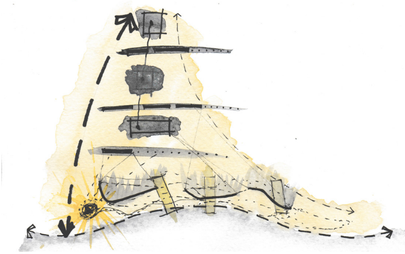
Fig. 2.23: Conceptual model exploration of Biome-Mimicry and conceptual explorations of riparian threshold, eco-tones and buffers (Author, 2021).

2 Riparian Promenade
Temporality | Path | Pivot | Movement

This concept builds on the one instilled within the touchstone mentioned previously in this chapter. The main idea of this concept was to highlight the two binary movements of the railway (North to South) and the river (West-East). The idea of the intervention becoming a means for the user to experience the holistic biome of the riparian is a concept that needed to be followed through within the design. This concept lends itself to the notion that a prominent path parallel to the dominant river axis becomes the main means of movement lateral to the site. The drawings expressed the collision and meeting point between the movement of man and nature. These prominent axes will be utilised in the site planning of the proposed design to choreograph a path with moments of events for the user to be able to interpret the environment in hopes to create an awareness of this biome.



Fig. 2.24: Conceptual model exploration of a Riparian Promenade (Author, 2021).



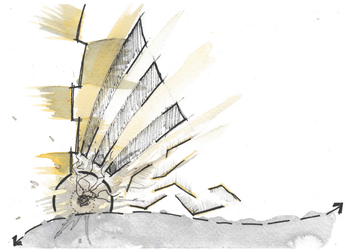




Fig. 2.25: Conceptual exploration sketches of the formative idea (Author, 2021).

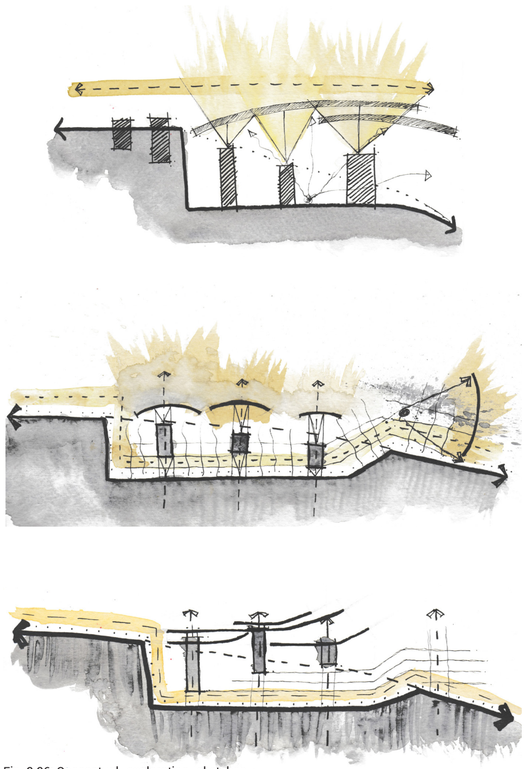


Fig. 2.26: Conceptual exploration sketches of the formative idea (Author, 2021).

3 Burrowed
Concealed | Blend-[In] | Sub-[Merge]

This concept is the main generator for the initial morphological approach of the design. In an attempt to allow the design to hide in the landscape, the initial conceptual sketches explore various ways of addressing the site slope on section. The use of tectonic elements allows for the idea of voids to be filled in that sits above the site line and supports the interpreted canopy of the roof structures of the design. The various slithers of the canopy of different lengths and heights allows for the conceptual play of hierarchy whilst maintaining a continuous language for morphological exploration. The idea of cutting into the slope and pealing the layers of the canopy to create the illusion of the slope lines still being present and allows for the structure to be hidden under the lines of sight from the ridgeline above. This concept also gave clues towards the structural touchstone that addresses the response to the climatic conditions of the region, this will be explained later in this chapter.

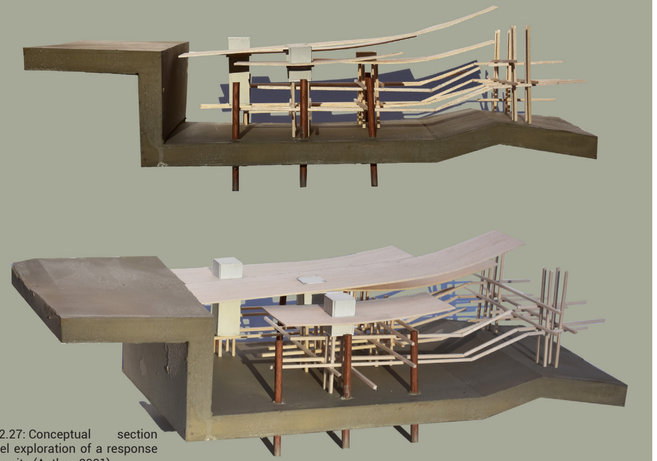


Fig. 2.27: Conceptual section model exploration of a response to the site (Author, 2021).

CONCEPTUAL FRAMEWORK

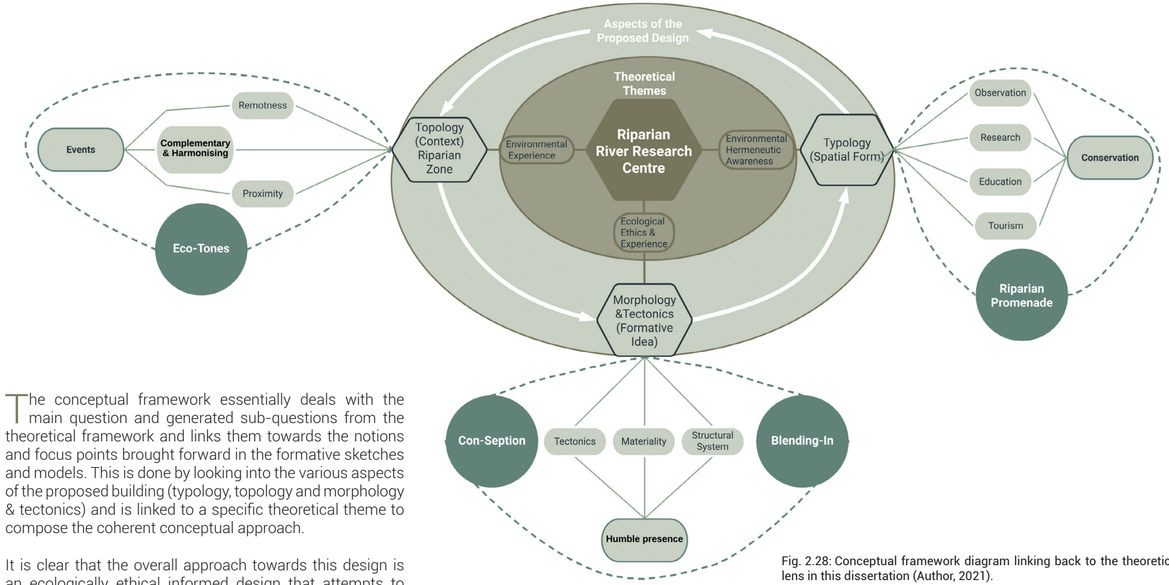


Fig. 2.28: Conceptual framework diagram linking back to the theoretical lens in this dissertation (Author, 2021).

The conceptual framework essentially deals with the main question and generated sub-questions from the theoretical framework and links them towards the notions and focus points brought forward in the formative sketches and models. This is done by looking into the various aspects of the proposed building (typology, topology and morphology & tectonics) and is linked to a specific theoretical theme to compose the coherent conceptual approach.

It is clear that the overall approach towards this design is an ecologically ethical informed design that attempts to exceed mere sustainability guidelines and becomes poetic in its composition in a humble manner. Preservation is the ultimate aim, which will be achieved by observation and research-oriented facilities as well as a community educational platform. Tourism forms part of the program in hopes to generate revenue for the centre as well as creating an awareness of this volatile and fragile biome.

CHAPTER

03

SPIRIT OF THE SITE

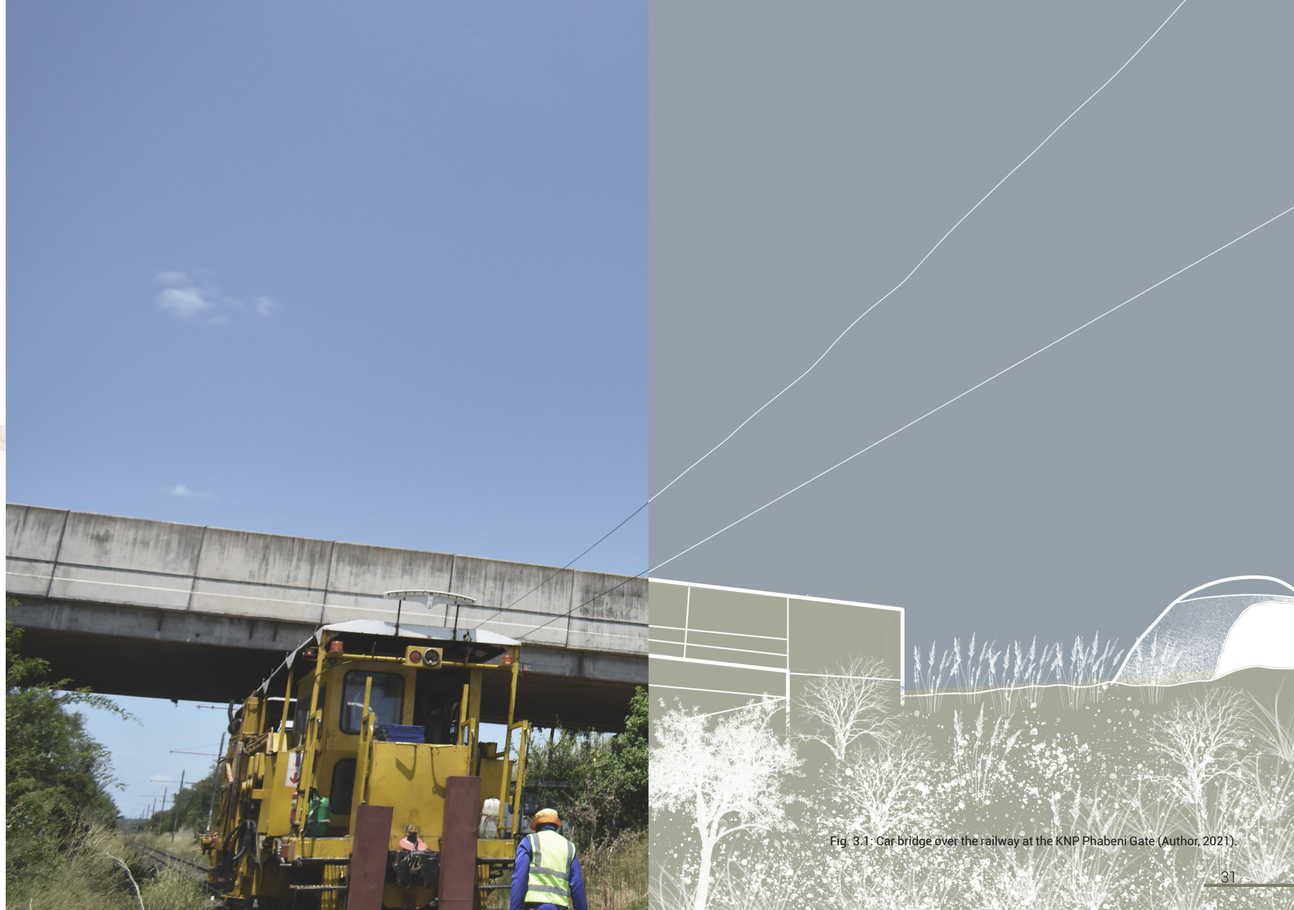


Fig. 3.1: Car bridge over the railway at the KNP Phabeni Gate (Author, 2021).

Introduction and site overview

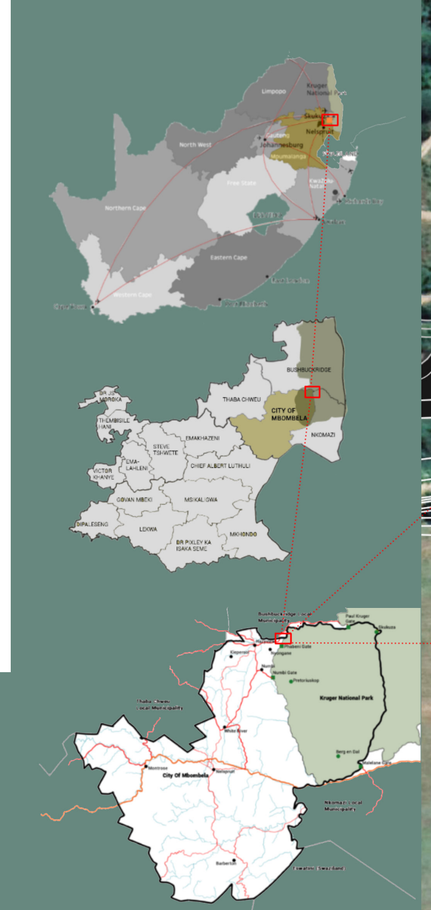
The site was the main driving force behind this dissertation and informed other factors such as the conceptual framework, theoretical underpinning and programme development of the proposed design. In the previous chapter, the theoretical framework developed a mode of thinking towards architecture being able to act as the mediator between the user and nature to aid the dialogue between the self and other-than self, in hopes of reaching introspective action of ethical consequence. The main idea for the dissertation was to create awareness of this sensitive ecotone towards various user groups of the area.

The chosen site is located in the southern region of the Ehlanzeni district of Mpumalanga, on the western boundary of the Kruger National Park on the bank of the Sabie River. The region has a rich natural biodiversity that supports various user groups, industries and amenities. These user groups include conservationists, local communities living along the periphery of the park and tourists.

An investigation into the southern region of the Kruger National Park and its surrounding context was conducted to develop an understanding of the relationship between these user groups and the natural environment. The southern region, more specifically, the upper Mbombela Municipal District, was investigated due to the high population density and activity of the region. The area is a hub of activity from tourist attractions, urban development and agricultural development. The area is also dealing with a lack of infrastructure in the agricultural department for local subsistence farmers as well as devastating land degradation due to this industry (MEGDP, 2011: 30).

The site region also contributes to the user groups that the proposed design aims to attract and accommodate. The site region, neighbouring the Kruger National Park, makes it an ideal location to study the interaction between people and nature on the periphery of the Park, and to set a more appropriate relationship with the environment.

“Mpumalanga has not only been blessed by nature’s bounty, but has also long been a setting in which humans have grappled with the question of their appropriate relationship with nature.” (Delius & Hay, 2009: 19)



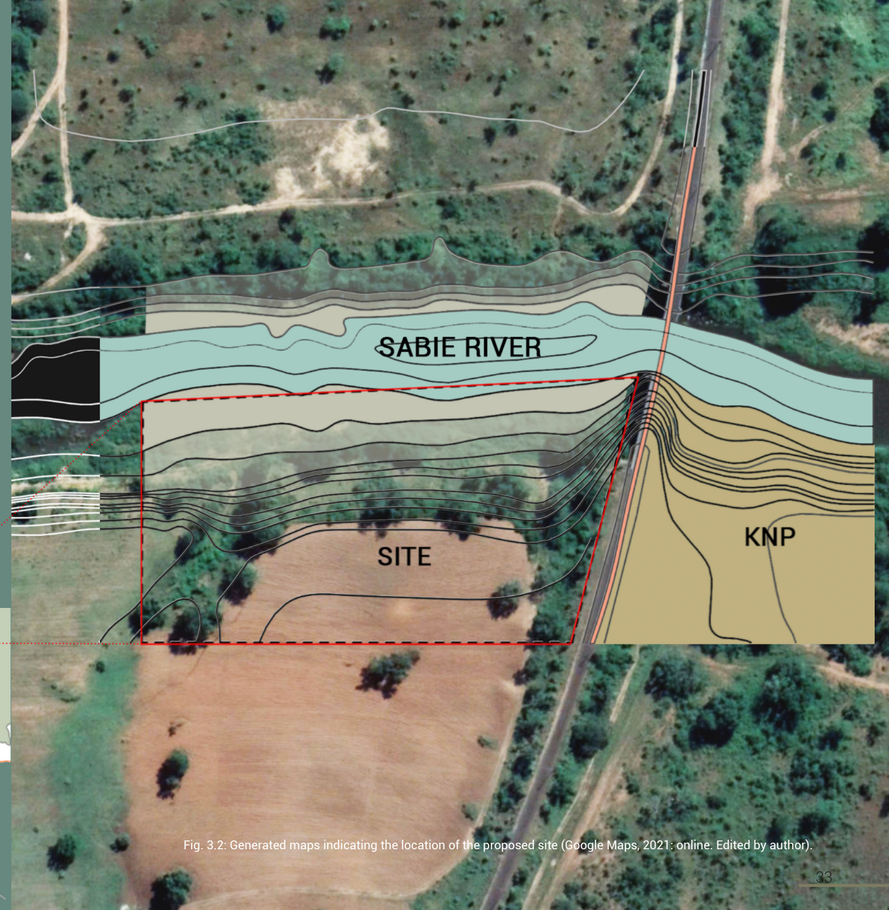


Fig. 3.2: Generated maps indicating the location of the proposed site (Google Maps, 2021: online. Edited by author).

UNDERSTANDING THE REGIONAL CONTEXT

The place of the rising sun (Mpumalanga)

"Mpumalanga is a newly created province, but the region it encompasses has a very rich history" (Delius & Hay, 2009: 11). All this history comes in many forms such as cultural heritage as well as many layers of geological treasures and archaeological findings which shows evidence of the earliest phases of the history of the planet. In many parts province, these histories become the place's identity and form the place's narrative for the people still residing in these areas and for the tourists wanting to enrich their journey's.

The evidence of early human settlement in this region dates back some 1.7 million years. This archaeological mining ground revealed traces of human interaction between the Stone Age San and the Iron Age farming communities (Delius & Hay, 2009: 17). Other early settlers in the region include early tradesmen, European settlers and prospectors. These narratives of history are still present today and have been captured in rock-art paintings in caves, old remnants in ruins of homesteads scattered throughout the landscape of the region. These sites have become heritage sites that bear testament to the interaction and relationship these settlers had with this diverse natural environment.



Fig. 3.3: Map of Mpumalanga with the locations of major towns and places of historical interest (Delius & Hay, 2009: 6).

Economic Revolution

In the 19th Century, the region was filled with excitement, full of danger and possibility. People were attracted to this area at the time for many reasons. A lot of which had to do with making a living as well as political influence. The natural mineral resources (such as gold, iron and platinum ores) embedded in the rich geology played an important role in the more recent history of the region (Delius & Hay, 2009: 27). The land bears scars from the actions of those preceding us today and still guides a lot of the current economic activity in the area presently. Towns such as Pilgrim's Rest and Barberton were established due to the gold rush in that area at the time (Delius & Hay, 2009: 125). Unrivalled amounts of coal formed by vast swamps of rotting forests 200-300 million years ago established towns like Witbank and have made Mpumalanga "the powerhouse of South Africa" (Delius & Hay, 2009: 125).



Fig. 3.4: Stone-walled homesteads in Mpumalanga (Delius & Hay, 2009: 40).

Topography affecting economy

Mpumalanga relies heavily on nature as the main generator for all its income. The province is divided into two sections by the escarpment, namely the Highveld to the west and the Lowveld to the east. The region is mainly within a grassland biome, the escarpment forms a transitional zone between the grassland area and the savanna biome. The Highveld area is most suitable for the mining and manufacturing industries. Whilst the subtropical climate in the Lowveld is most suitable for the agriculture and forestry sector of the province (Mpumalanga.gov, 2020).

Mpumalanga's biggest economic generators are the mining, manufacturing, agriculture and forestry, and the tourism sector. In the southern Highveld region, the geological layering is best suited for mining, the province produces 80% of the country's coal and is responsible for 22% of the overall mining industry in the country (REB Provincial Review, 2016: 1). Large scale manufacturing companies producing chrome alloy and steel are located in the northern region of the Highveld (South Africa-Info, n.d.). The Lowveld with its subtropical climate is a large region for agriculture with many towns yielding a variety of produce that makes up a large percentage of the national agricultural industry.



Fig. 3.5: Maize silo in the Mpumalanga highveld (Delius & Hay, 2009: 12).

Agriculture and nature conservation

Agriculture in Mpumalanga is one of the biggest economic generators in the region, with the land coverage of this industry being the most in comparison to the other industries in the area. A total of almost 70% of the land coverage is used for agriculture, of which almost 15% of this total is used for natural grazing land which produces beef, poultry, mutton, dairy and wool (MEGA, 2020: online). The agricultural produce can be categorized into two main groups:

1. Summer Cereal and Legumes
   Most of this crop is mainly cultivated in the Highveld region and consists of soya beans, maize, potatoes, canola and sunflower (MEGA, 2020: online).
2. Tropical, Subtropical and Citrus Fruit, Nuts, and Sugar Cane.

Most of this produce is farmed in the Lowveld region due to the subtropical climate (MEGA, 2020: online).
The Mbombela district of Mpumalanga produces a third of South Africa's citrus fruit for exporting and is responsible for most of the subtropical fruit produce including mangoes, avocadoes, bananas, litchis and nuts (Mpumalanga.gov, 2020: online). The transport networks in the province serve to distribute this agricultural bounty out of the province into the rest of the country as well as to the docks for export. The two major road networks are the Maputo Development Corridor (MDC) which acts as a trade route from Gauteng to the port in Maputo, and the coal haulage routes (MEGDP, 2011: 32).

These same networks that supply the food production industry allow tourists to travel and journey through this beautiful landscape. These routes connected old mining towns in the past and now serves as key routes for the tourism industry. The Panorama Route is the second most toured route in the tourism industry. It starts in Lydenburg to Sabie then to Graskop where you can venture up the R532 towards the provincial border of Limpopo with multiple natural sightings on route or the R533 towards Pilgrim's Rest which is another heritage site in the region. The two largest land coverage per industry is the agricultural sector (almost 68%) and nature reserves and protected areas (19%) (MEGDP, 2011: 16).

These industries cannot be viewed independently because they share the same natural structures of the landscape which is the common denominator in question.

There is a dire need for both the tourism and the agricultural industries to come to a symbiotic relationship to ensure that sustainable farming practices are being implemented to protect the biodiversity that attracts visitors to the region. Finding the correct balance is a tricky matter, because the people in the region have always struggled to come to terms with the appropriate relationship they need to cultivate with this natural landscape.

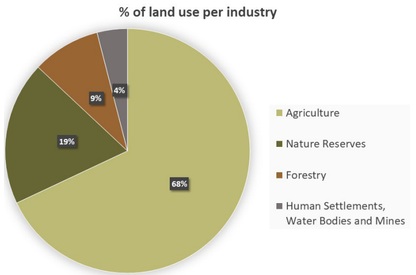


Fig. 3.6: Percentage of land-use per industry based on information obtained from MEGDP (2011: 16) (Graphic by author, 2021).

THE DEVELOPMENT AND CONSERVATION OF THE KNP

Brief History

The Lowveld during the mid 19th century attracted many people to the region for many different reasons. Some political, others adventurous driven to seek income in unconquered land. The region was teeming with wildlife and attracted hundreds of hunters, Africans and Boers, as a means for economic survival. Sport hunters travelled to the region to claim their trophies for themselves which added towards their narrative documentation of their great expedition to the wild bush of Africa (Delius & Hay, 2009: 125). This led to a lot of the wildlife being destroyed at a very rapid rate. This attracted one keen conservationist in the area, Richard Kelsey Loveday, to take some form of action to restore wildlife in the area.

The pressure from Loveday on the president at the time (Paul Kruger) led to the proclamation of the Gouvernement Wildtuin (Government Game Reserve) on March 26 1898 (Delius & Hay, 2009: 127). After the Anglo Boer War, the reserve was known as the Sabie Game Reserve and was under the authority of Major James Stevenson-Hamilton. When the warden took over in 1902 there was not much game in the reserve, there were no black rhino, elephants, elands or hartebeest (Delius & Hay, 2009: p.130). In 1903 the Shingwedzi Game reserve was proclaimed and was also under the authority of James Stevenson-Hamilton (Joubert, 2007: 2). After numerous expansions of the Sabi and the Shingwedzi game reserves, James wanted to establish a national park for visitors to experience the sightings of wild animals in their natural habitat (Delius & Hay, 2009: 133). In 1926 the National Parks act was instated and the Reserve was renamed the Kruger National Park.

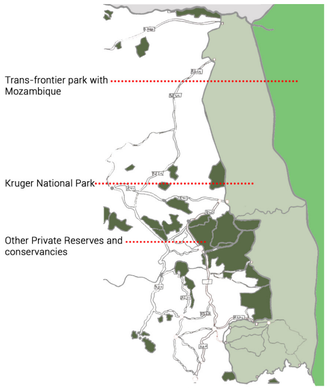


Fig. 3.7: Conservancies in the region (Author, 2021).

A contested landscape

The expansion of the park from its inception up until the last decade has not come without any cost. During the late 19th century when the Sabie and Shingwedzi Game Reserves were proclaimed, many African locals in the area were ordered to leave. Numerous farms were also purchased by the government to extend the area of the park. The establishment of the park's borders was done by what was called "The Red Line". This was a north to south barrier created by existing farm fences along the western boundary of the KNP (Joubert, 2007: 146).



Fig. 3.8: Development of the KNP from 1898-2011 (Meskell, 2012: 79).

"Mpumalanga has not only been blessed by nature's bounty, but has also long been a setting in which humans have grappled with the question of their appropriate relationship with nature." (Delius & Hay, 2009: 19)

Why the need for national parks?

In the proposal for the commission of inquiry set forth to have the act legislated, there were many reasons for the establishment of a national park. The government stated that the purpose of the national park would be to protect wildlife and their natural habitat, generate public revenue from tourism (the informal establishment of the tourism sector), establish the most ideal place to study ecology in its entirety (zoology, botany and other life sciences) and add cultural value to the country (Delius & Hay, 2009: 133). In this way, specific user groups could be identified in the operation and income generators of the park, these include rangers, tour guides, researchers and tourists. However, for as long as there has been the need to conserve nature, there have always been challenges posed by others that threaten the conservancy through the exploitation of natural resources.

Ecological threats

An interview was conducted with ecologist Professor Wayne Twine of the WITS Rural Facility in an attempt to broaden the understanding of the ecological threats in the area. He stated that poaching, inappropriate farming practices, as well as river exploitation are among the biggest ecological threats. Activities such as wood harvesting, improper subsistence farming as well as overgrazing of livestock are starting to negatively affect the edge condition of the KNP and is becoming more apparent in the ecology of the region. Twine also stated that the ecological state of the rivers is being affected by improper use by farm owners along the rivers, which affects the silt content, river flow and many other factors of the river and alters the sensitive ecosystems that depend on these veins of life both in and out of the conservancy of the KNP (Twine, 2021: interview).







Fig. 3.9: Photographs of a few wildlife on the Sabie River who are dependent on river ecosystems (Author, 2021).

THE SITE REGION

The southern hub

Conservation in this region has not directly alleviated some of the socio-economic problems that the region faces. Although, this can not be said only in a negative light. Some game reserves in the area have attempted to reach out to the the surrounding communities in an attempt to strive towards inclusiveness in conservation. This is known as 'community conservation', these areas are protected in such a manner that benefits the local community (Delius & Hay, 2009: 140). By including the community in decision making about the use of natural resources and the management of it, this enables a more appropriate form of interaction with nature.

With the influx of tourists coming to the province, especially to the KNP a lot of the infrastructure in the province had to be developed. The southern region of the KNP experienced massive developments with regards to infrastructure and rest camps to accommodate the influx of tourists. The map (Fig. 3.11) indicates the development of the Park's roads that were constructed to accommodate the influx of tourists, as well as increasing sighting opportunities of wildlife across this vast conservancy.

Ath the same time, the northern region of the province also developed rapidly and small towns, like Hazyview, became urbanized to accommodate the influx of residents and tourists. The population density map (Fig. 3.10) indicates that the concentration of people is located within the southern region of the KNP close to the recently developed areas. The influx of people, tourists and locals led to a lot of new road development networks to accommodate the users in the area. The Maputo Development Corridor (MDC) (Fig. 3.12) was one of such developments in the province. As mentioned previously in this chapter, the MDC served as the main trade route from Gauteng, through Nelspruit, to reach the ports of Maputo. This is also the main route used by local and international tourists wanting to experience this natural landscape.

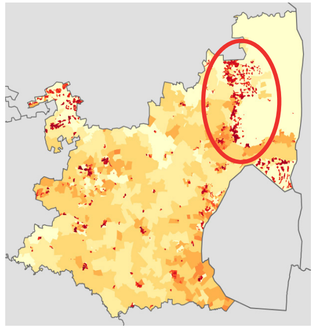


Fig. 3.10: Population density map of Mpumalanga (Creative Commons, 2010: online).

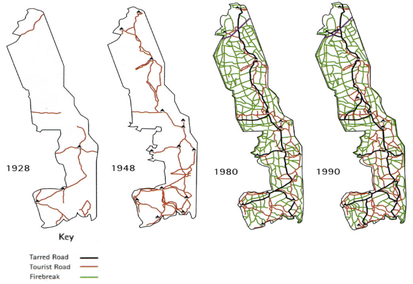


Fig. 3.11: Maps illustrating the development of road infrastructure in the KNP from 1928-1990 (Joubert, 2007: 109: edited by author).



Fig. 3.12: Map illustrating the main roads, and the MDC Route through the region (Author, 2021).

The Environment: Terrain Analysis

The Mpumalanga region falls mainly under the Grassland Biome next to the Savanna Biome, as seen on the map (Fig. 3.14). This biome covers almost a third of South Africa, making it the largest biome in the country. Due to the central location of this biome, it neighbours others including the Savanna, Thicket, Nama Karoo and the Forest biome (Matsika, 2007: 22). Due to its proximity to other biomes, there are diverse species of animals and plants found within it. The grassland biome is also one of the most conducive areas for agriculture due to its soil, hydrology and climatic properties (Matsika, 2007: 22).

Within Mpumalanga 3 biomes exist which consists of 68 vegetation types. According to the Mpumalanga Economic Growth & Development Path (2011), the 3 biomes occurring in the province contains 68 vegetation types. Of these vegetation types, 9 are forest types, 31 are savanna types and 28 are grassland types. These vegetation types give a clear indication of the animals, birds and insects that are associated with them. An assessment of the status of the ecosystems in the province led by the Mpumalanga Tourism and Parks Agency in partnership with SANBI revealed that close to 9% of the land surface area is categorized as critically endangered (MEGDP, 2011: 30). The most threatened ecosystem in the province occurs within the grassland biome. 37.8% of the land area has undergone transformation due to mining and agricultural activities (MEGDP, 2011: 30).

The term grassland is misleading, as it suggests that the land cover is only that of grass/veld. However, there is a variety of plant species that attracts a diverse range of animals and insects. The map (Fig. 3.13) shows the extent of the diverse plant groups in the southern region of the Kruger National Park. These include savanna bush, thickets, open tree savanna, dense tree savanna and dense mountainous bushveld.

Visiting the Park as well as other nature reserves it was observed that the biodiversity and ecosystems are a very intricate and interrelated system. The habitats of the Park could be broadly categorized into 4 major categories: Grass, Tree, Soil and River ecosystems. Even though these systems can be seen or studied in isolation, they form part of a larger holistic system.

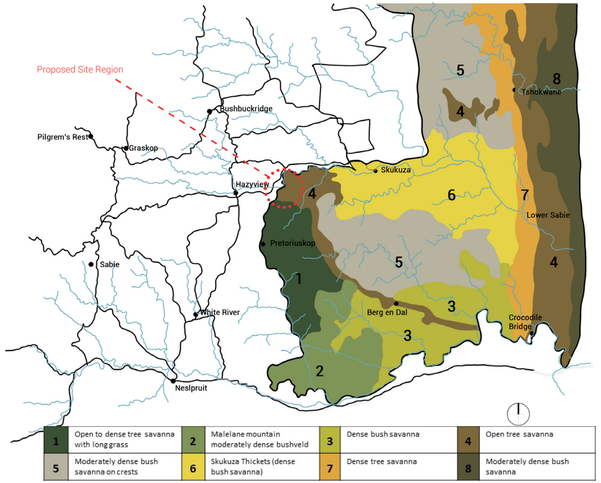


Fig. 3.13: Map of the region illustrating the known vegetation types based on info obtained from (Frandsen, 2019) Drawn by (Author, 2021).

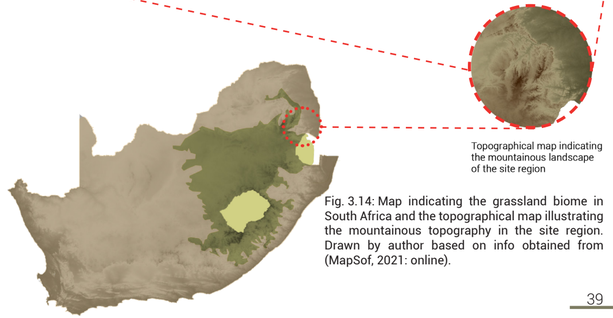


Fig. 3.14: Map indicating the grassland biome in South Africa and the topographical map illustrating the mountainous topography in the site region. Drawn by author based on info obtained from (MapSof, 2021: online).

The Environment: Climatic Conditions

In order to address the necessary passive design strategies for the proposed design, the dissertation needs to evaluate these climate conditions. The main factors influencing the climate of any region are altitude (height above sea level) and the location (positing in relation to the ocean, and the equator) (southafrica.co.za, 2021: online). As mentioned previously, Mpumalanga can be split into two major regions, the Highveld and the Lowveld. The site region is located in the Lowveld, which is at a lower altitude in close proximity to the sea on the east. This results in moderate temperatures due to lower air pressure, which allows for more moisture to be stored in the air. The result of this humidity places the region in a sub-tropical climate.

Temperature

The average temperature in the area is relatively moderate. The graph illustrates the average high and low temperatures of each month. In the summer months, the average high temperature is 28 degrees Celcius and a low temperature of 17 degrees Celcius. The winter months are when the region experiences its dry season, and during this time the average temperature is between a high of 23 degrees Celcius and a low of 10 degrees Celcius. This dry winter with a relatively moderate temperature causes the region to suffer from mild-servere drought and negatively impacts the agricultural industry as well as the natural landscape in the area. Tight water restrictions are a result of this and need to be considered within the proposed design with water reticulation systems.

Rainfall

The graph illustrates that the region experiences the most rainfall during the summer months (October-April), with an average of 20 rainfall days per month during this period. Along with this rainfall, comes serious issues of floods within and the surroundings of the Park. This should be duly noted along the regions of the Sabie River, and the floodplain lines should be drawn and acknowledged in order to design within safe proximity to the river. This mass volume of rainfall during the summer can also be an opportunity to capture and use this water during the dry winter months.

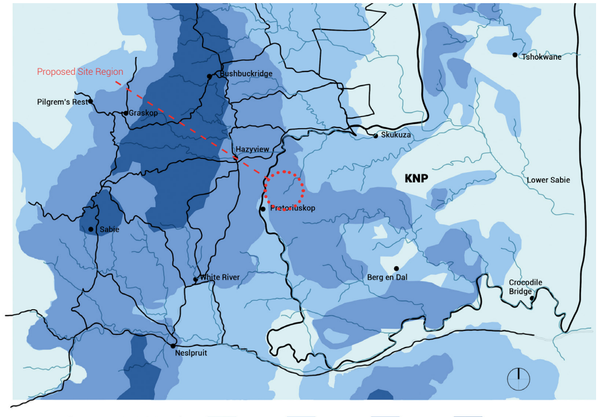


Fig. 3.15: Map indicating the maximum rainfall in the southern region of the KNP. (Frandsen, 2019) (Drawn by author, 2021).

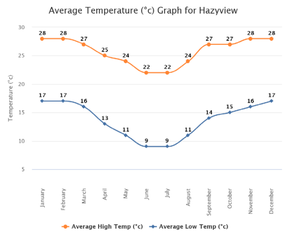


Fig. 3.16: Monthly average temperature graph (WorldWeatherOnline, 2021: online).

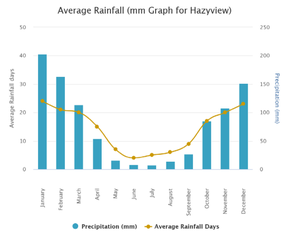


Fig. 3.17: Monthly participation and rainfall graph (WorldWeatherOnline, 2021: online).

Spatial Development of the region

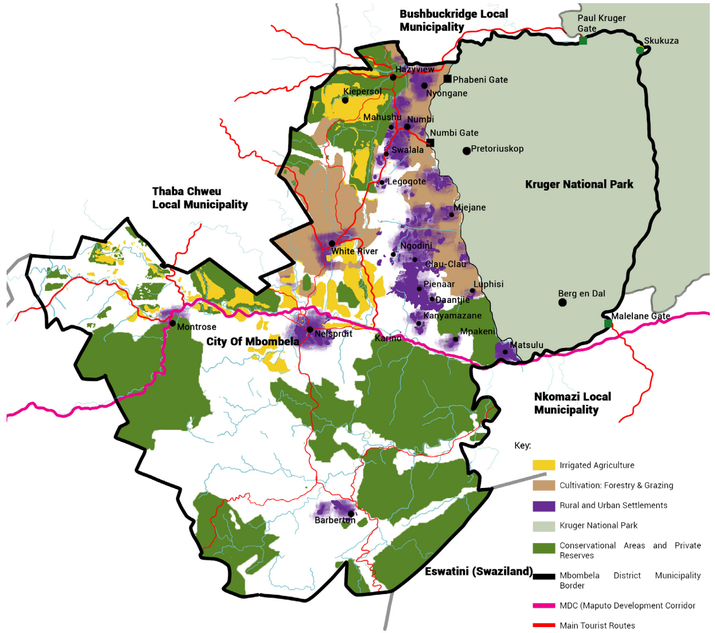
Protected Areas

In light of the history of conservation in the area, more specifically that of the Kruger National Park (KNP), it was mentioned earlier that there are other forms of conservancies found in the area. These protected areas in the form of private game reserves with lodges and tourist facilities also strive towards the main mission of the KNP. These private and state-owned land facilitates the protection of biodiversity and practices sustainable use of the natural wildlife.

Community Settlements

From the outset of conservation initiatives in the region, local communities have come off second best. During the establishment of the Park's borders during its early stages, local inhabitants were forcibly removed for the sake of conserving the natural resources of the area. Since 1994 SANParks has adjusted its policies in accordance with international best practices to give recognition to communities along the periphery of The Kruger National Park (Delius & Hay, 2009: 138–139). These practices involve locals communities in decision making with regards to nature conservation, tourism and resource consumption. This was done in an attempt to change the conception that the majority of the community members had; that conservation and protected areas were only for the whites, and in recent times it has shifted to a conception that it is only a luxury for the wealthy.

Establishing an integrated structure between man and nature



The map above indicates the relation between the urban and rural edge lines and that of the conservation and protected areas as well the vast land use for agriculture and cultivated land. According to the Spatial Development Framework of the Mbombela Municipality (2018: 131), the first step towards an integrated structure can be done through mapping and emphasizing the protection of biodiversity areas, river corridors, ridges and mountainous areas and natural heritage sites. As part of this framework, the municipality established this urban and rural edge to limit the sprawl of these areas in an attempt to place major priority on the Critical Biodiversity Areas (CBA's) and the Environmental Support Areas (ESA's) as these areas are viewed as the region's asset (Mbombela Municipality, 2018: 131).

Fig. 3.18: Map illustrating various land-use industries in relation to conservation areas in the region. Drawn by author based on information obtained from Mbombela Municipality (2018: 73–82: online).

FRAMEWORK FOR SITE SELECTION

In the process of locating the most appropriate site for the proposed project, the site needed to be located in an area that would benefit the three main user groups identified for the use of the proposed design. A framework was considered during the course of exploring the region during site selection:

1) The site needed to be close to the KNP in order for students and researchers to conduct fieldwork studies in close proximity to the centre. This also aids in the theoretical aim of establishing an environmental identity in which the individual sees themselves in relation to nature;
2) The site needed to be close enough to one of the tourist routes for easier access into the centre by tourists;
3) The site needed to be located close to the main urban and rural communities to be economically sustainable for community outreach programmes with agricultural farmers;
4) The site needed to generate a specific ecological research field to be focused on.

The selected site that met the above criteria finds itself neighbouring the railway bridge which borders the KNP on the bank of the Sabie River close to the Phabeni Gate of the KNP. As mentioned previously, the site played an important generator throughout this dissertation, it developed the overall topic, theoretical theme, as well as the specific ecological research field to be focused on by the researchers to educate the community and the tourists.

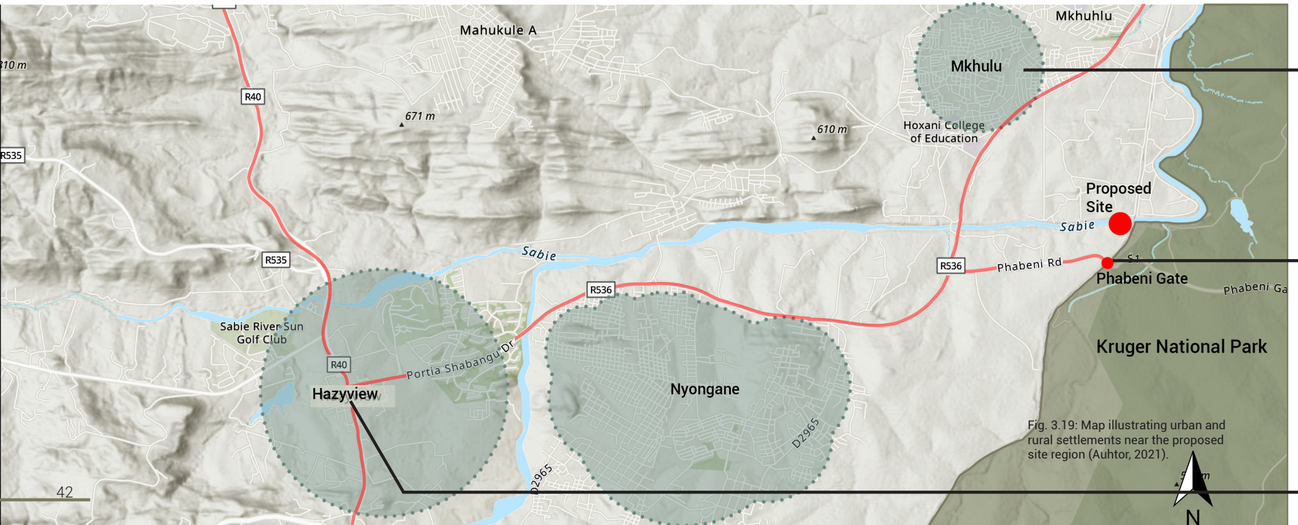


Fig. 3.19: Map illustrating urban and rural settlements near the proposed site region (Auhtor, 2021).

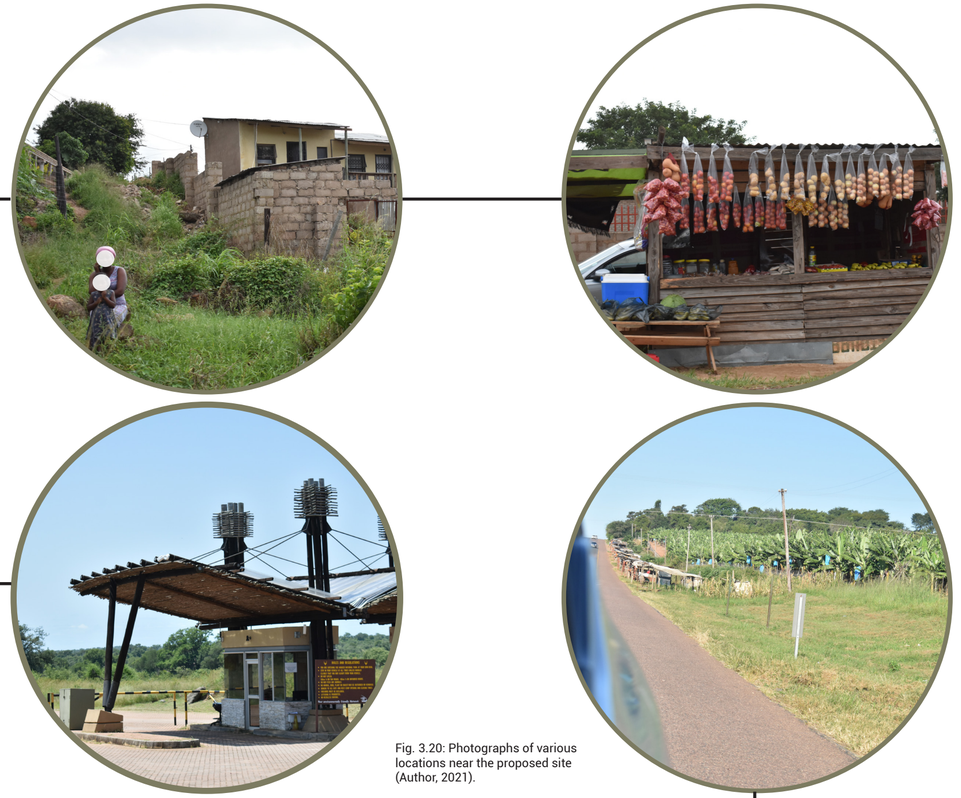


Fig. 3.20: Photographs of various locations near the proposed site (Author, 2021).

SITE ANALYSIS

Accessibility

The Phabeni Gate is a popular entrance gate for tourists travelling from Hazyview and is the closest entry point for local and international tourists coming from Gauteng. Phabeni Road sits just off the main tourist route (the R536) and north of this road just before the Phabeni Gate lies a gravel road that is the only access road towards the proposed site.

Land Use

The site, as well as the neighbouring context, is mainly used for agricultural purposes, this is especially evident towards the edge of the Sabie River before the borders of the KNP. The site is primarily used for seasonal agricultural crops (banans, avocadoes, potatoes, chillies, etc...) with grazing lands located further south of the farm owner's crops. The selected portion of the site for the proposed design finds itself within the riparian zone close to the riverbank.

Current Infrastructure

The farm currently has a smallholding where the farm owner, Mike Sgula, resides with 3 of his brothers. They have access to water from two water points that were installed after the government bought a portion of the family's land on the east as part of the compensation. The railway bridge that crosses the Sabie River is the borderline between the farm and the KNP conservancy.

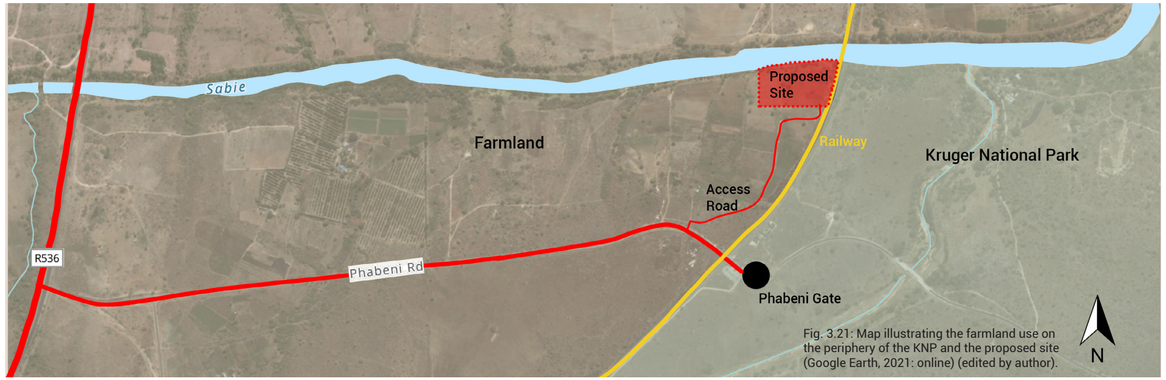


Fig. 3.21: Map illustrating the farmland use on the periphery of the KNP and the proposed site (Google Earth, 2021: online) (edited by author).

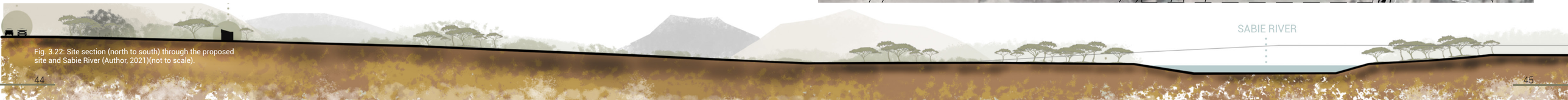


Fig. 3.22: Site section (north to south) through the proposed site and Sabie River (Author, 2021)(not to scale).

Topography

From the edge of the Phabeni road, the farm's topography gradually slopes towards the lowest point being the river. The topography of the farm is relatively flat until the ridgeline where tall Amarula and Thorn-Bush trees signify the threshold of the start of the riparian edge before the grassland terrace. The proposed site drastically slopes towards the river edge from the ridgeline, this is due to the current soil erosion (as an effect of the health of the riparian zone) as well as external human-altering factors of the terrain (excavating river sand for sale purposes).

Flood Line

The rivers in the region are prone to unexpected floods during the summer rainfall season. The flood line needs to be acknowledged in order to design the proposed building in safe proximity to the river.

Prominent Trees

Riparian zones are resilient in their nature due to the rapid growth rates they undergo from one flood season to the next. The sites' riparian zone can be categorized as mainly a shrubby reed scrub and reed scrub type (characterized by species such as Trema Orientalis, Flueggea Virosa, Gymnosporia spp, Combretum spp., Ficus spp. and Phragmites mauritianus) (Ayres, 2012: 51). The prominent trees identified was the Amarula and Thorn-Bush trees south of the proposed site on the ridgeline with more species of trees that make up this visual threshold on site. These existing trees play an integral part in this biome and should be noted in the design process to not only preserve but also integrate them as part of the narrative experience of the site.

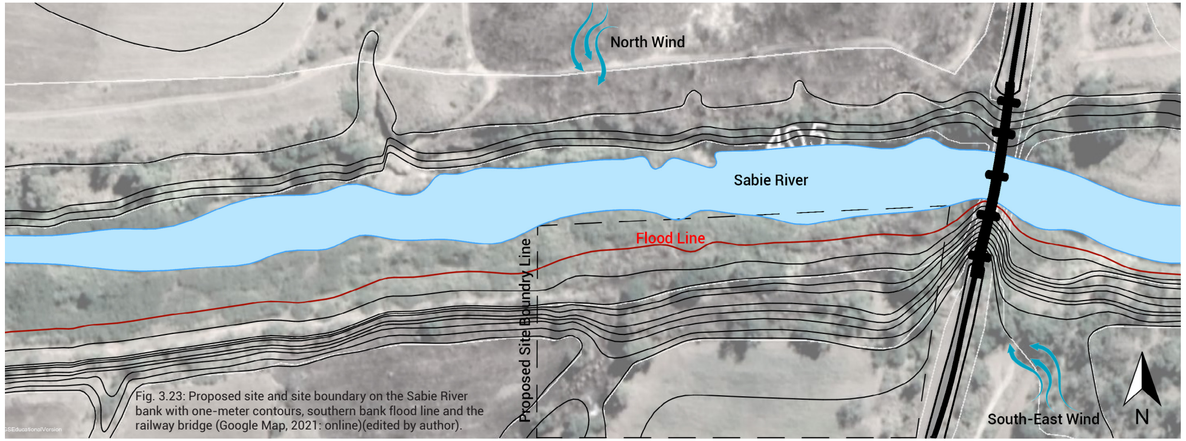


Fig. 3.23: Proposed site and site boundary on the Sabie River bank with one-meter contours, southern bank flood line and the railway bridge (Google Map, 2021: online)(edited by author).

THE SABIE RIVER AS A SPINE

The Sabie River is 230 km in length and is one of the major tributaries of the Inkomati River System that discharges into the Indian Ocean in Mozambique (IUCN, n.d.: 1: online). The river passes through various topographical changes and land-use areas before reaching the Conservancy of the KNP and four other private game reserves. This river system in its entirety is an important asset to both the society and regional economy (Barnard, Morgenthal, Stolz and Venter, 2021: 2) which is very dependent on agriculture and tourism as economic generators of the region. According to Ayres (2012: 15), (Barnard et al., 2021: 2), Sudlow (2008: 6) and Thirion and Jafta (2019: 54), anthropogenic disturbances such as manmade structures (dams and weirs), commercial forestry plantations, commercial and rural agricultural lands, as well as the urbanisation of the rural settlements, has an increasing impact on the overall health of the river ecosystem. Not only does this river serve as an economic spine to the region, but the river was also classified as the most diverse in its biodiversity. The current state of the river differs from one section of it to the other, but was noted is that the middle catchment area (the site region for this dissertation) is directly impacted by overgrazing and improper subsistence farming practices (Sudlow, 2008: 6–7).

How does the focus on riparian zones aid in sustaining the river's health?

Riparian zones do not function independently from other ecotones and biomes, but they play a complex role in the integration of aquatic and terrestrial ecosystems. They essentially become a threshold between land and water. Riparian zones act as a corridor for animal movement, slows down water flow (which replenishes the groundwater with nutrients), and encourages sediment deposition (which aids in providing the soil with nutrients) (Ayres, 2012: 17).

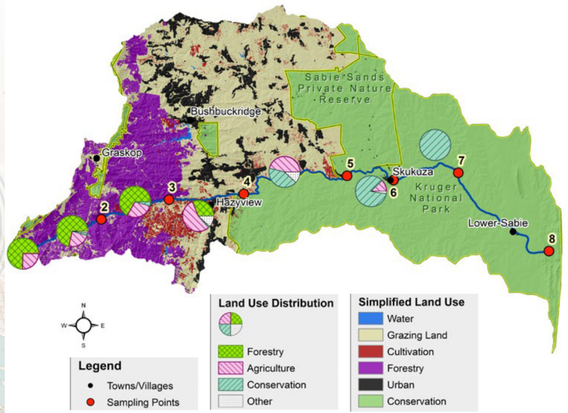


Fig. 3.24: Land use distribution and human activities along the Sabie River (Barnard et al., 2021: 5).

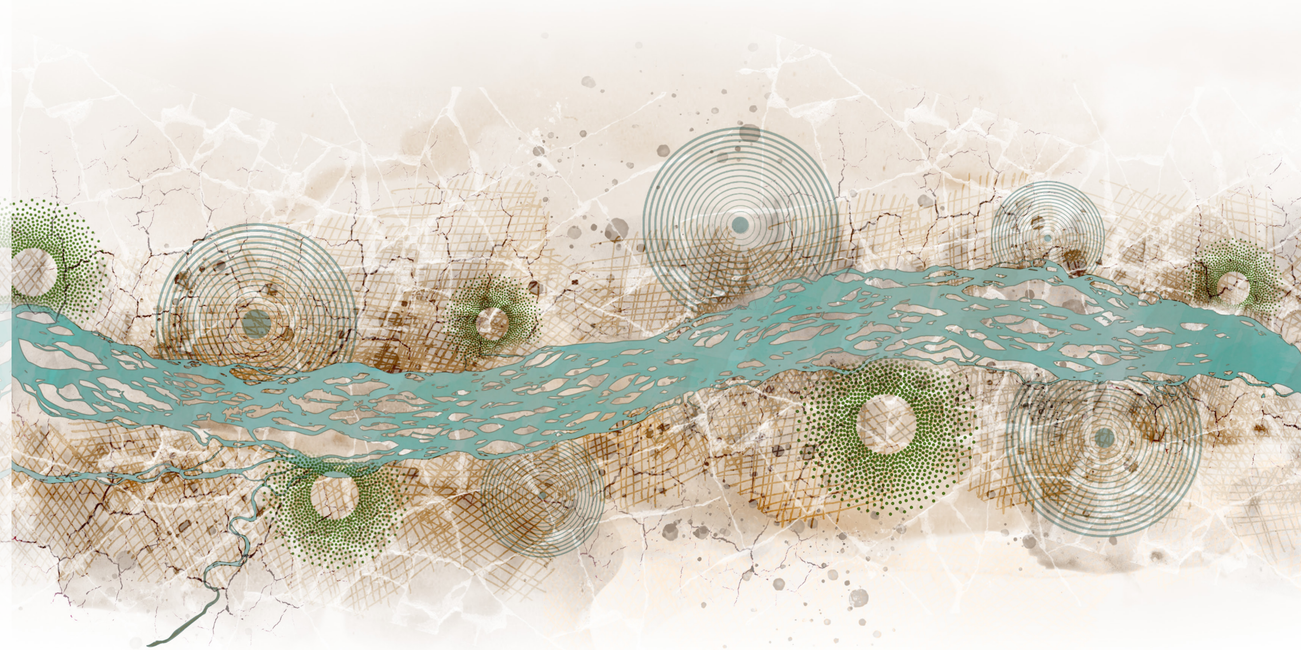


Fig. 3.25: Illustration image of the Sabie River as a spine of activity through the region, both human and natural activities in symbiosis (Author, 2021).

CHAPTER

04

TECTONIC AND DESIGN SYNTHESIS



Fig. 4.1: Render of the intial obersvation tower design overlooking the research centre (Auhtor, 2021).

TECHNICAL INVESTIGATION

Visited Case Study:
SSLI CAMPUS - Nicholas Whitcutt & Kevin Mitchell

Location: Skukuza Rest Camp, Kruger National Park, South Africa.
Date: 2017

The visit to the SSLI Campus was very beneficial in an attempt to understand the construction techniques and strategies needed to respond to the harsh climatic conditions of the region. The campus is also constructed on permaculture principles as well as an attempt towards a zero-carbon construction method, which lines up with an ecological ethical mindset set out in the theoretical discussion of this dissertation.

Environment and micro-climate

The Skukuza Science Leadership Initiative (SSLI) campus is located opposite the Wildlife Veterinary Services building on the outskirts of the Skukuza Village in the Kruger National Park (KNP). The campus is tucked away from the public eye on a private reserve staff road just off the main public road into the Skukuza rest camp. The campus is ideally located for ecological and environmental studies due to the 20 000km2 Kruger National Park which has diverse vegetation types, landscapes and terrains, including various geological characteristics, ecological gradients (fire regime, rainfall, nutrients and soil) and intact fauna and flora communities. The location of the campus also led to trying to incorporate a sense of nature into the design, this was achieved by designing the overall development scattered across the site, and allowing for views into the bushveld of the KNP and designed courtyards.

The climatic zone of the region falls under the category Cwb, the climate is generally hot and humid with a rainy summer season and a dry winter season. The climatic conditions played a major factor in the design decisions of the SSLI campus, the architects took into consideration passive design strategies to overcome the use of external climate control systems to create thermally comfortable spaces in the extreme climate. StepSA (Spatial and Temporal Evidence for Planning in South Africa) has generated a map of the climatic condition based on data collected over the year to generate an accurate category of climatic zones across the country. StepSA has also generated a passive design strategy consideration table based on these climatic zones as an appropriate response to the climate. The guidelines for the types of passive design strategies to be considered for the specific site region are passive solar heating, thermal mass, and natural ventilation. These principles will be a focus of analysis in the Science Center building later on in this investigation.

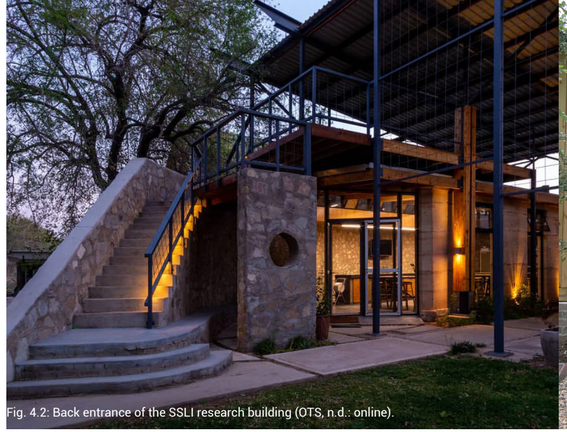


Fig. 4.2: Back entrance of the SSLI research building (OTS, n.d.: online).



Fig. 4.4: A residential unit on the SSLI Campus in line with the scheme's conceptual approach illustrating sustainable and permaculture principles (Photograph by author, 2021).

Climatic characteristics				Passive design strategy					
Description	Köppen-Geiger class.	Area in km²	Percent (%)	Passive solar-heating	Thermal mass	Exposed mass and night purge ventilation	Natural ventilation	Direct evaporative cooling	Indirect evaporative cooling
Equatorial climates (0.2%)	Aw	2296	0.20	▪			▪		
Arid climates (70.89%)	Bsh	192 269	16.59	▪	▪	▪	▪	▪	▪
	Bsk	275 927	23.81	▪	▪	▪	▪	▪	▪
	Bwh	188 784	16.29	▪	▪	▪	▪	▪	▪
	Bwk	164 629	14.20	▪	▪	▪	▪	▪	▪
Warm temperate climates (28.91%)	Cfa	42 918	3.70	▪			▪		
	Cfb	93 405	8.06	▪	▪		▪		▪
	Cfc	84	0.01	▪	▪		▪		
	Csa	5 120	0.44	▪	▪		▪		
	Csb	18 395	1.59	▪	▪		▪		
	Cwa	31 162	2.69	▪	▪	▪	▪		
	Cwb	140 405	12.11	▪	▪		▪		
	Cwc	3 564	0.31	▪	▪		▪		
	Total	1 158 958	100.00						

Fig. 4.3: Climatic charismatics and appropriate passive design strategies to be implemented (StepSA, 2021: online).



User Behaviour and Space Requirement

The establishment of the SSLI campus focused on a core conceptual program that yields three key products which target three main user groups (Kruger, 2021: interview).

Long-Term Research
The holistic approach to scientific and educational activities in the field that results in data collection, which contributes to the much-needed research for the Kruger National Park. The research obtained in the SSLI gets submitted and registered with the SANParks Scientific Services (NsansiTrust, 2016: online).

Education
The education of individuals ranges from high school, university as well as those already in the workforce. The main ethos of the education offered is understanding why sustainability is critical in the 21st century and our human connection to and reliance on functional ecosystems. Most courses offered focuses on the personal skills necessary to succeed in the workplace within the environmental sector (NsansiTrust, 2016: online).

Social Justice (community outreach)
Cultural and intellectual exchange is key. This is an important factor within the SSL campus. An interview with Laurence Kruger, who runs the campus, has emphasised the transfer of knowledge with the community members surrounding the KNP to aid them in their interaction with the ecosystems that surrounds them as well as contributing to the development of their personal skills to earn a living. During the construction of the campus, half of the construction team included staff members who work at the SSLI, these staff members through the construction process developed their own skills in the construction industry and are now able to take on private construction work as contractors in and outside of the KNP (Kruger, 2021: interview).

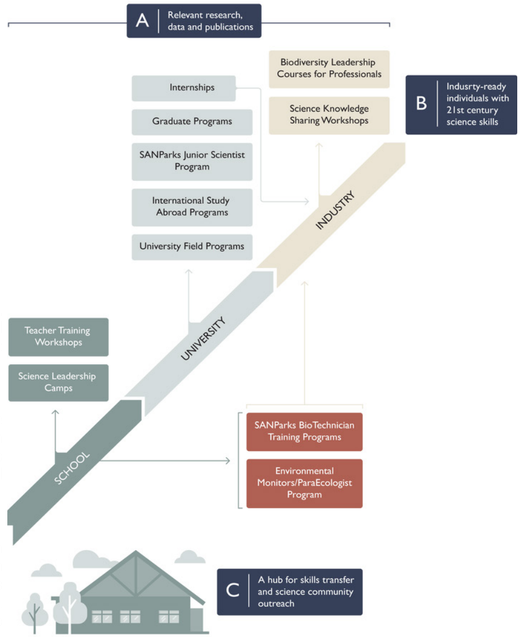


Fig. 4.5: Conceptual framework of the functioning of the SSLI Campus (NsansiTrust, 2016: online).

Space Requirements:

SANPark, the Organisation for Tropical Studies (OTS) and Nsasani Trust are the main partners that developed the SSLI campus. The client's brief entailed a campus that could accommodate the three main user groups mentioned previously within a building that is constructed on permaculture principles and sustainability, in order to deepen the awareness and our response to the environment.
The campus design was based on three phases, phase one was the cafeteria space and renovations of existing buildings which was the admin office, and the student dormitories. The second phase was the research centre. Phase 3 entailed constructing self-catering living units which also encapsulated the ethos of permaculture and sustainable construction practices.

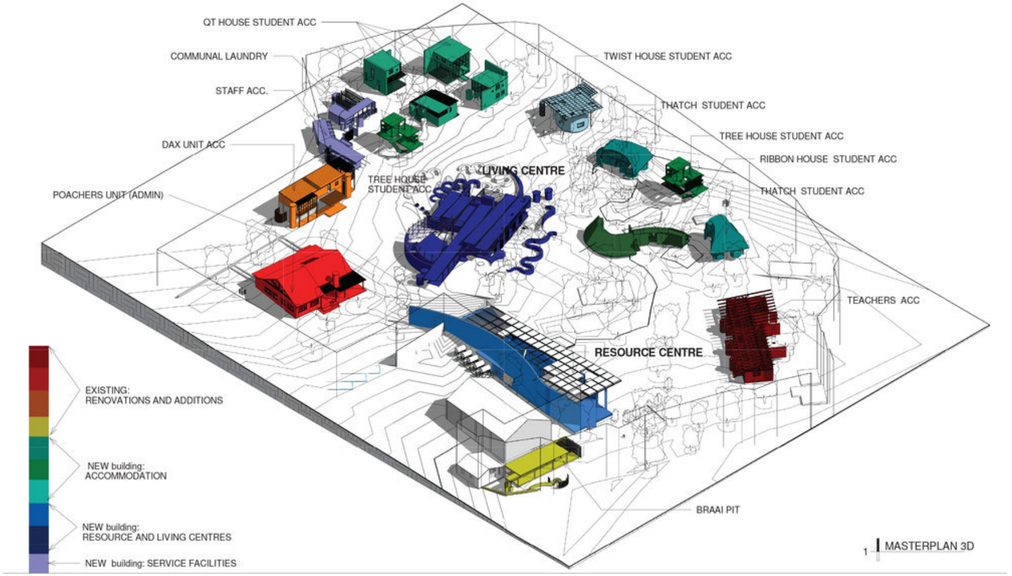


Fig. 4.6: Masterplan of the various developments proposed on the site of the SSLI Campus (NsansiTrust, 2016: online).



Fig. 4.7: Using existing trees to layout organic circulation routes (Photograph by author, 2021).



Fig. 4.8: Yoga-Deck built over leftover construction rubble (Photograph by author, 2021).

Site Planning

The campus is designed with minimal urban principles that guide the user through the site. The scattered functions across the site provoke the feeling and sense of still being out in the wilderness of the KNP. Even though an electric fence surrounds the site, there is still a feeling of being exposed to nature. Crushed stone pathways are organically laid out connecting the various spaces. Large bush courtyards obstruct the view from one end of the site to the other, which does contribute to the disorientating aspect of wondering through the site for the first time. The site does become easier to navigate through due to its organic layout of the various functions. The site had an old helicopter landing pad where the science centre currently sits (Kruger, 2021: Interview).

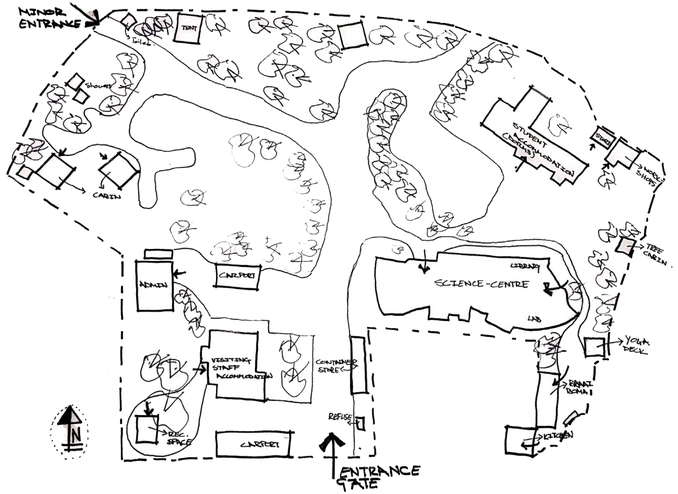


Fig. 4.9: Map of the SSLI Campus and its various functions (not to scale) (Drawn by auhtor, 2021).

SLLI – Research Building

The research centre is the building that will be the main focus for this investigation among the new structures that were built on the site. The research centre was designed to accommodate between 40-50 students and researchers. A lecture theatre able to seat 50 students is the first space you encounter entering the science building. The centre has a library with a collection of over 400 ecological books making it one of the largest literary collections in the ecological field in the region. The library also has study areas for students designed by asking students what they consider to be a conducive study environment (Kruger, 2021: online). The library space is laid out with tables made from recycled timber that is positioned in front of windows looking out into the internal courtyard. A laboratory, that acts as a wet and dry lab, is laid out with communal workstations to encourage group learning amongst the students. The toilets and storage spaces are placed central to the main public spaces for easy access.

Circulation

The research centre has two main entrances into a courtyard where each primary space spills out into. The courtyard is an essential element as it acts as the main circulation route through the centre, creating the experience of still being surrounded by nature with landscaping placed alongside the circulation path.

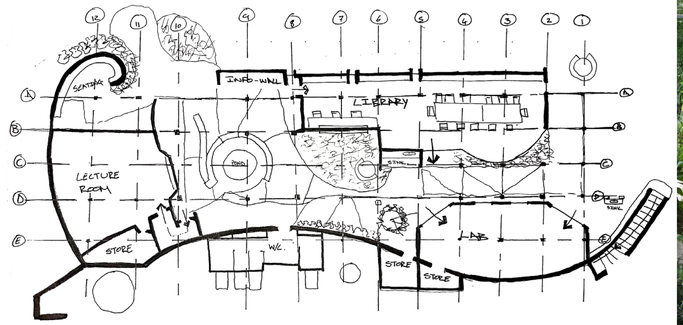


Fig. 4.10: Floor plan of the research building (spaces planned around a central courtyard) (Drawn by auhtor, 2021).



Fig. 4.11: View from the internal courtyard facing east towards the exit (Photograph by auhtor, 2021).

Utility and Space Enhancement

In order to create the experience of feeling like you are still in the conservancy of the KNP, the architects utilize panels of glazing, clerestories and methods of allowing various types of light into the spaces. This makes the user always aware of the external environment. The architects used a roof canopy structure over all of the spaces including the courtyard. The canopy has cut-outs to allow sunlight into the courtyard and specific panels of roof sheeting were substituted with clear polycarbonate roof sheeting with timber slats below to allow filtered light into the courtyard. The canopy can metaphorically be associated with the effect of sitting under a tree



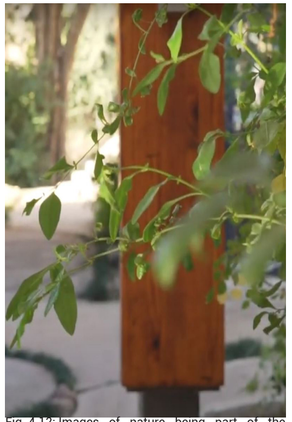


Fig. 4.12: Images of nature being part of the buildings composition and spatial enhancement (Photograph by author, 2021).

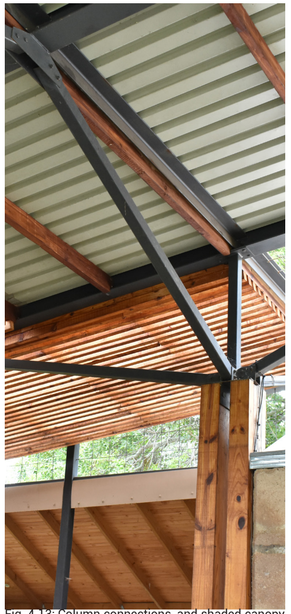


Fig. 4.13: Column connections, and shaded canopy roof with filtered light mimicking a tree (Photograph by author, 2021).



Fig. 4.14: Interior image of the library space with northern light entering through the clerestory (Photograph by author, 2021).



Fig. 4.15: Image of the central courtyard space (Photograph by author, 2021).

Response to climate as a design generator

The architects used passive design strategies to overcome the challenging climatic conditions of the area by adopting thermal mass, cross ventilation as well as a double roof system as a response to these challenges.

Thermal Mass
The architects decided to construct thick external walls built out of re-purposed stone and rubble as well as lime-stabilized rammed earth walls in the library space. The high thermal reduces the time for heat/cold from penetrating the walls, allowing for the internal temperature of the building to remain comparatively stable. This means that the internal spaces are warmer in winter and cooler in summer in comparison to the outside temperature.

Cross Ventilation and Shading
The various spaces are relatively long and narrow and are orientated with the longer façades facing north and south. This orientation allowed the architects to design clerestories in the spaces to allow northern and southern light into the spaces. The region has predominant north and south-east winds, which allows the building to open itself up to allow for these winds to pass through the space from the windows through the clerestory. This was achieved by designing a Trombe wall in the library space to maximise on these predominant winds.

The steel roof canopy is also not merely there for aesthetic or experience qualities, it serves as a shading device over the roofs of the mains spaces and the courtyard. By shading the roofs below, the internal temperature underneath this canopy during the summer months is dropped by 10 degrees Celcius in relation to the external temperature in an unshaded area.

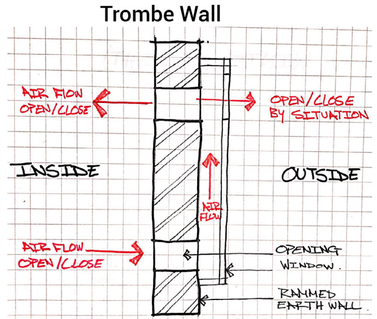


Fig. 4.16: Sketch illustrating the function of a Trombe wall (sketched by author, 2021).

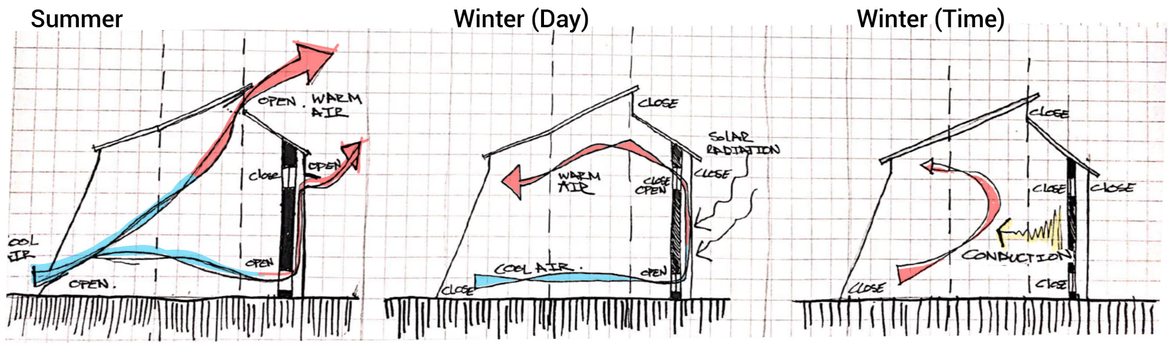


Fig. 4.17: Sectional sketches illustrating the cross-ventilation strategy with the Trombe wall and clerestory of the library space (sketched by auhtor, 2021).

Choice of Materials

The choice of materials was dictated two primary concerns, sustainability and climate response. Local building materials were outsourced to reduce the carbon footprint of the projects construction process.

Floors:
In an attempt to reduce the amount of cement used throughout the project, the flooring system considered was a rammed earth slab topped with a concrete mixture stabilized with lime and finished with an epoxy sealer. This allowed the building to have a firm stable floor, however, the floor started cracking due to the amount of foot traffic in these spaces.

Walls:
The 'giraffe wall' (the curved exterior wall on the southern side) and some of the other walls were constructed out of repurposed rubble from the demolition of the helicopter pad and a dam wall in the KNP.

The rammed earth walls were stabilized with lime as an alternative to cement contributing towards the 'zero carbon' mindset. The wall was built from soil found on site from excavations and outsourced from the Skukuza borrow pit (readily available nearby). If the building was to be demolished the soil could be returned to the earth resulting in a 'zero footprint'.

The mud-brick wall in the lecture room was made out of mud bricks moulded on-site with insitu soil sourced from the site. This meant that bricks did not need to be transported and the thickness of the wall can contribute to a high thermal mass. This also meant that labour was created locally.

Roofs:
Laminated timber beams were used which resulted in a slimmer roof structure which meant easy and minimal transport.
The steel elements place a contrast between natural and processed material and become an accent feature complementing this contrast. The roof canopy is a composite structure between wood and steel, where the steel components become the major structural elements resulting in longer spans which meant fewer structural columns.

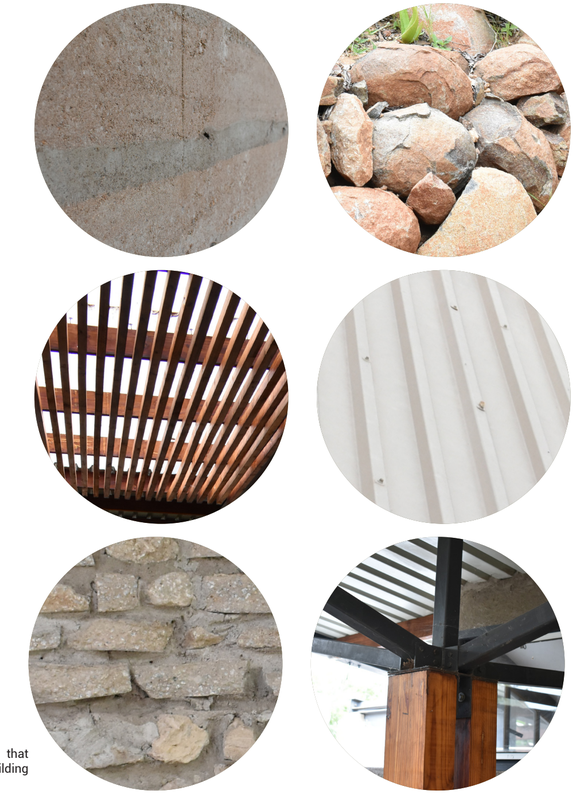


Fig. 4.18: Various materials that are found in the research building (Photographs by author, 2021).

Sustainability

Rainwater catchment tanks are used throughout the site to water the courtyards and landscaping. The research centre has 4 rainwater tanks that become an aesthetic feature in the courtyard space. These rainwater tanks are also connected to feed hand washbasins and the toilets in the centre.

As mentioned before, the building focused on low-carbon construction methods. This meant outsourcing materials that were close to the site as well as recycling materials on-site without removing the excess rubble and waste to landfill sites.

A solar panel farm is located just outside of the site that generates the electricity for the campus. This solar farm also contributes to the power grid of the Skukuza rest camp.

The SSLI campus aided in understanding the functioning of an ecological research centre that aims towards similar user groups of this dissertation. By following a gut feel approach as opposed to the painstaking guidelines of green star ratings and sustainablility guidelines, trusting one's own instinct to produce a building with the least environmental impact, is the true essence of ecological ethics that can resonate from an established environmental identity.

Lessons Learnt:

- Typological functioning of research-orientated facilities in a wilderness site.
- Appropriate passive design strategies as a response to the climate of the region; thermal mass, cross ventilation and double roofs.
- Executing the ecologically ethical mindest by repurposing excavated soil, and nearby rubble.
- Using local building materials contributes to the sense of place and becomes relatable within the region.



Fig. 4.19: Southern glazing with views to the courtyard in the library space (Photograph by author, 2021).



Fig. 4.20: Tree inspired roof canopy shading the courtyard and the buildings underneath (Photograph by author, 2021).

Visited Case Study:
WITS Rural - Katherine Mareé Otten

Location – Mpumalanga, South Africa.
Date - 2016

This research facility serves as a base camp for ecological researchers across South Africa and abroad. This was an expansion project of an existing research facility designed by Katherine Otten. Located on the provincial border of Mpumalanga and Limpopo, is it in close proximity to private game reserves and is just off the main road or the Orpen Gate of the KNP. Its location makes it ideal for students and researchers to conduct fieldwork studies in the conservancy as well as projects and research relating to the rural community in the area.

The location in an environmentally protected context became a key driving factor influencing the conceptual approach to the design (Otten, 2016: online). The environmentally conscious mindset is present in this design is worthy to take note of. The expansion of the facility meant the refurbishment of existing buildings and where new structures were added was done in a way where it does not expand too far out into the bush-veld.

The facility has accommodation units that are open for use to the public, a wet and dry laboratory, conference facilities, a restaurant, computer labs, offices and a recreational pool area. The buildings are individual units that are linked by covered walkways. These individual buildings were micro-orientated around protected trees and only a total of two trees had to be removed. The shifting geometry of the buildings allows for the opportunities for courtyards and gathering spaces to be designed to fill in the gaps between the buildings. This extends the environment into the scheme and creates visual vistas into the thicket. The covered walkways acknowledge the landscape and make the user aware of the topography by rising, falling and tucking itself under the extensive tree cover. The walkways in some places are cut and stepped back where a tree has become an obstacle, in approaching the design in this manner the trees become integrated within the design and doesn't appear to be an obstacle on the path.

The project also took into consideration the sustainability factors relating to the choice of locally available material, passive climate control with cross ventilation and efficient orientation, rainwater collection and an on-site waste purification plant that irrigates the courtyards.

Lessons Learn:

- Community outreach and research into rural policy structures are needed in the region.
- The conceptual approach of fragmenting the buildings into the site encourages further user integration and awareness of the surrounding environment with the implementation of walkways.
- Designing the buildings around protected trees instead of removing them, as well as incorporating the landscape into the design as a response to the conceptual approach.
- Scale, texture, and colour aids in the buildings receding into the landscape resulting in a humble quiet approach to the morphological design.



Fig. 4.21: Walkways are designed to respect the existing trees by steeping to and away from them without needed to remove them (Photograph by author, 2021).



Fig. 4.22: Thresholds highlighted between hard and soft surfaces and walkways that opens up towards the landscape at the end (Photograph by author, 2021).



Fig. 4.23: [illegible] through to the thicket, blurring the [illegible] between interior and the external environment (Photography by [illegible]

Precedent Study:
Witklipfontein Eco-Lodge – GLH Architects

Location – Vredefort, South Africa.
Date - 2018

This residential building does not serve relevance towards the typology of the proposed design in this dissertation, however, this precedent becomes relevant when analysing the morphology of this eco-lodge. The concept 'Burrowed', that featured in the formative idea development earlier in this dissertation, relates to the conceptual approach of "blending in" evident in this precedent.
Located in the Free State on a private game reserve, the building seamlessly blends and disappears into the surrounding landscape. This concept of blending in and being concealed within the veld is the main driving factor for the design decisions(Huyberechts, 2018: online). The site slope seems to be slightly lifted for the building to be tucked in underneath it. This was achieved by using a planted roof that blurs the lines between where the building ends and nature begins.

The panoramic views achieved by large open-able glazing infill panels blurs the boundary between inside and outside. This blurred threshold enables the environment to form part of the interior spaces and elevated the bush living experience (Huyberechts, 2018: online). The site is the main concept generator once again in a project of this nature. Due to the remoteness and environmental seclusion, passive design strategies were considered in the floor, walls and roof due to the climatic conditions of the region. Thermal mass was the response to the daily 20-degree Celcius variance that is experienced in the region. Thick stone walls, rammed earth walls, as well as a planted roof, become the choice of materials to slow down the thermal transition of the exterior temperature into the interior spaces (Huyberechts, 2018: online).



Fig. 4.24: Ariel view of the house blending into the landscape (Huyberechts, 2020: online).



Fig. 4.25: Panel glazing allows the building to open itself allowing the surrounding landscape into the space (Huyberechts, 2020: online).

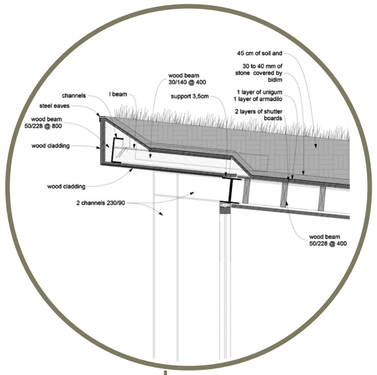


Fig. 4.26: Detail of planted timber plywood roof structure (Huyberechts, 2020: online).

The building also employs an ecological mindset by using natural materials during the construction process with minimalist modern composite structural elements. This was a re-interpreted approach to vernacular building techniques. The building was constructed with almost no cement, and the use of a shutter system, heavy load-bearing earth and stone walls supports the heavily planted roof above (Huyberechts, 2018: online). The entertainment centre is constructed using sandbag construction technique finished with straw and soil plaster with a Swedish paint soil pigment. The combination of natural elements into the building brings nature further into the space, and blends into the environment due to the natural colour hues of the materials used.

Lessons Learnt:

- Re-interpretation of vernacular construction methods
- Hiding the building by burrowing in part of the building into the site
- Raw use of natural materials contributes towards a warm natural feeling and blends the structure in the environment due to the natural hues of the materials considered.
- The structural system for the planted roof (shutter board system) without the use of concrete.
- Reading the site for clues towards conceptual approach and morphological exploration.



Fig. 4.27: Natural materials used to blend the building into the landscape (Huyberechts, 2020: online).

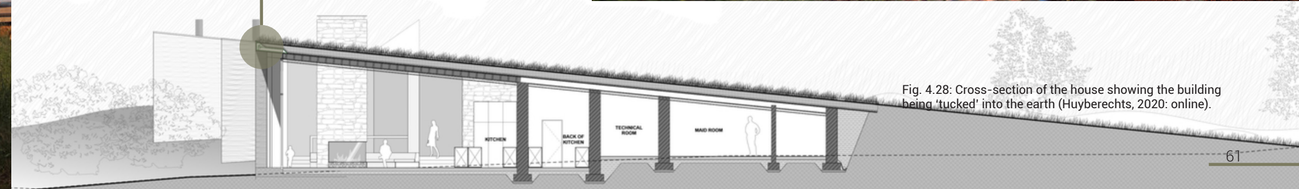


Fig. 4.28: Cross-section of the house showing the building being 'tucked' into the earth (Huyberechts, 2020: online).

Material Precedent Study: Thatch Wall Cladding System
The Enterprise Centre at The University of East Anglia – Architype

Location – Norwich, United Kingdom
Date - 2015

This university office building was dubbed as UK's greenest building and was designed to attain a Passivhaus standard and a BREEAM outstanding rating (Architype, 2015: online). The building features spaces that support business support workshops, networking activities, research development activity spaces for new graduate startup companies (Architype, 2015: online).

The building attains this low-carbon construction by adapting construction techniques and outsourcing locally sourced materials which lower the overall carbon output of the design. The design implements a plethora of innovative and alternative bio-based materials such as straw, reed, reclaimed oak, recycled rubber and flint (Passivehaus Trust, n.d.: online). The relevance of this study is a material analysis of a thatch cladding system that was designed for the building.

Described as the rival of traditional craft for modern construction (The Construction Index, 2014: online). The architects designed a system to allow for the traditional building vernacular to be installed in a modern manner. The method can be explained in simple terms as a typical timber sandwich stud wall construction method with exterior and interior cladding panels with a water vapour layer and insulation in between. The exterior panel is a timber cassette made out of plywood with timber battens fixed to the back of the cassette. The cassette is built off-site and filled with thatch using steel wire that's tied into the backboard to fix the bundles of thatch to the cassette. These cassettes then get transported to the site and installed onto timber frame substructure and the thatch is then trimmed after the cassettes have been installed to achieve a consistent visual appeal of one long panel of thatch.



Fig. 4.29: Thatch, timber and glass composition of the façade design (Passivehaus Trust, n.d.: online).

The consideration of the use of this material in the proposed design as a cladding system is due to the fact that parts of the design will be constructed with a timber structural frame that will be lifted off the ground. In the lessons noted in the previous precedents, thermal mass is an important passive design strategy especially in the region of the proposed design. To achieve the required thermal mass for the buildings that are lifted off the ground, thick rammed-earth, masonry or stone walls was not an option to consider. In order to contribute to the feeling of the building blending in with the landscape, natural materials such as thatch can be used as an alternative cladding for a wall system.

Thermal mass is measured in terms of an R-value that gives a reading of thermal resistance. A high R-value means that the material performs better as a thermal insulator. According to TASA's Guide to Thatch in South Africa (TASA, 2016: 91: online), a table was generated calculating the minimum thickness of thatch needed to produce the minimum required R-value based on the climatic zone of a specific project. This information gathered was targeted for the main purpose of thatch being used as a roofing material, however, the R-value obtained from this data based on the thickness of the thatch serves as an indication of the R-value that will contribute to the thermal mass of the exterior wall system. This research will be used later in the technical report of the final design resolution and the application of this material as a wall cladding system.

DESCRIPTION	Climatic Zone 1	Climatic Zone 2	Climatic Zone 3	Climatic Zone 4	Climatic Zone 5	Climatic Zone 6
Minimum required R-Value (m2.K/W)	3.7	3.2	2.7	3.7	2.7	3.5
Minimum required thickness for thatched roofs (mm)	207	179	151	207	151	196
Direction of heat flow	up	up	up & down	up	down	up

$$D(m) = R(m2.K/W) \times k(W/(m.K)$$

Fig. 4.30: R-value and thatch thickness (TASA, 2016: 91: online).

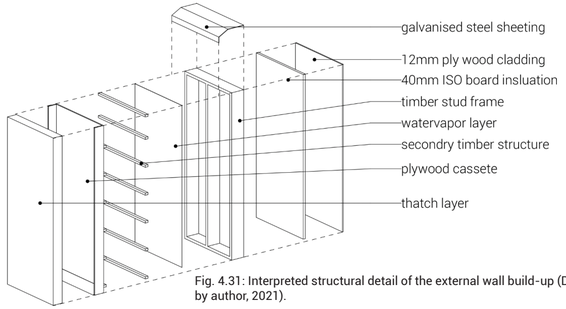


Fig. 4.31: Interpreted structural detail of the external wall build-up (Drawn by author, 2021).



Fig. 4.32: Image of the thatch cassette being installed onto the timber substructure (Sara, 2017: online).

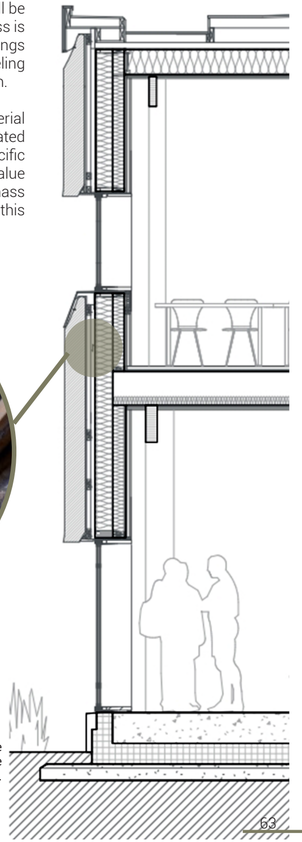


Fig. 4.33: Detailed section of the Enterprise Building illustrating the external wall system (Smith, 2015: online).

DESIGN DEVELOPMENT

The design process that has been presented in this dissertation follows a linear process of various stages of the development of the proposed design to eliminate any confusion, and to best illustrate the thought process that was followed. In reality, the design process happened alongside the development of the theoretical and formative ideas discussed in Chapter 2, as well as technical issues that started to arise with a few of the phases in the design process.

The design process starts with an initial mind map of the programme of the design, as well as plan-focused layout drawings to grasp the scale of the various spaces in relation to each other and the site. the first phase attempts to first interpret the formative ideas towards an architectural exploration of layout and massing models on site.

The second phase started to incorporate the theory as well as stepping ahead with the formative ideas in mind. Sectional explorations were done during this phase that becomes pertinent to the experiential aspect in the design.

The third phase was a tricky reflection phase of an attempt to work back towards earlier ideas that possessed a closer resolution towards the conceptual approach of the design. In an attempt to work back to the more promising conceptual interpretations, the design process resorts to more planning and layout explorations. With the aid of architectural programming software, the final layout in this phase was translated into a morphological exploration to start materialising the layouts into 3-dimensional space.

The tectonic exploration and considerations are what gave the design a complete turning point. By considering technical resolutions, the design starts to develop into its final resolution after realising that the building's morphology, is a direct result of the tectonic make-up of the design, as noted in Chapter 1 of this dissertation. The structural approach results in major design decisions that were considered and this linked the technical and construction resolution to the design process and simultaneously worked towards a final resolution.

The final resolution will be presented by means of a spatial development section where the various spaces of the proposed design will be presented with technical sketch plans, sections, and 3-dimensional computer generated renders. This section serves as a technical report for this dissertation.

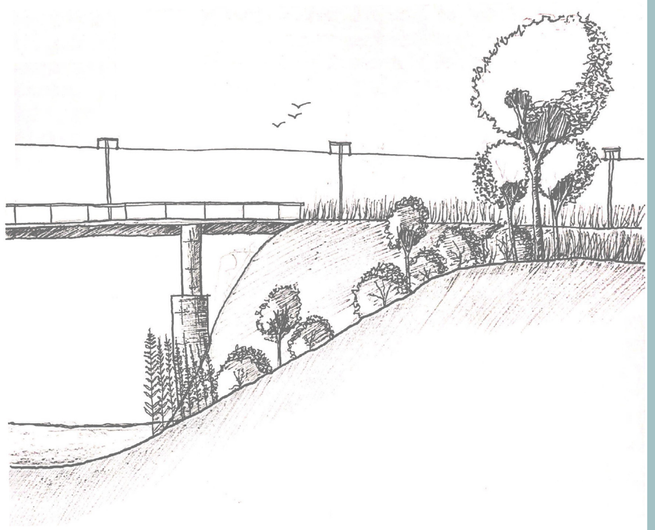


Fig. 4.34: Site section sketch (not to scale) (drawn by author, 2021).

Accommodation List (approx m²):

Riparian Research and Discovery Centre

Visitor
781,5 m²

- Reception – 46,41m²
- Storage – 6,89 m²
- Café – 186,38 m²
- Kitchen – 46,25 m²
- Refuse Keep – 25,57 m²
- Balcony Terrace - 126 m²
- Unisex Toilets – 60,3 m²
- Garden Storage – 11,5 m²
- Janitors Storage – 11,5 m²
- Café Office – 19,3 m²
- Staff Break Room – 29 m²
- Outdoor Staff Seating Area – 28,4 m²
- Eco-Tone Interpretation Spaces – (70+67+47)= 184 m²

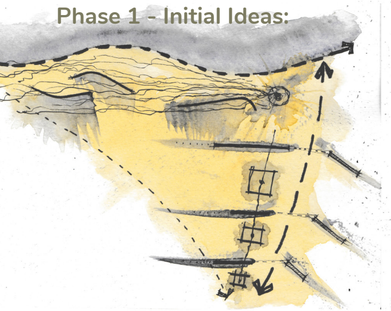
Education
282,65 m²

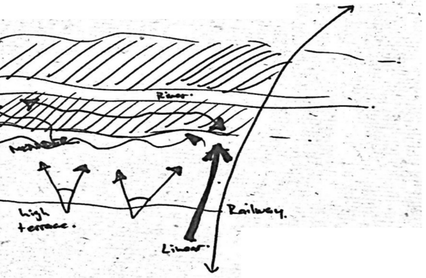
- Library – 46,2 m²
- Lecture/Multi-Purpose Room – 80,6 m²
- Storage – 12,25 m²
- Unisex Toilet – 62 m²
- Outdoor Lecture/Gathering Space – 81,6 m²

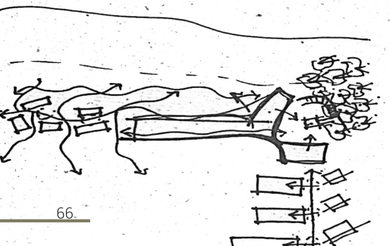
Research
250 m²

- Discussion Rooms – 46,4 m²
- Office Space – 23 x 2 = 46 m²
- Kitchenette and lounge – 50,4 m²
- Wet Lab – 47 m²
- Dry Lab – 47 m²
- Lab Storage – 12 m²

Phase 1 - Initial Ideas:







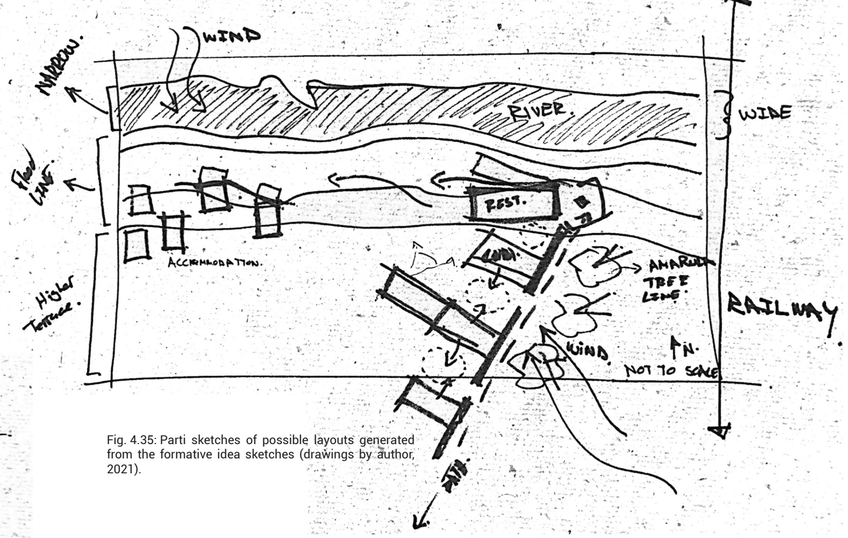


Fig. 4.35: Parti sketches of possible layouts generated from the formative idea sketches (drawings by author, 2021).

Focusing on the dynamics of the site in terms of movement between man (the railway) and nature (the river) the initial idea was to interpret these clues into a layout. This was done by interpreting the conceptual idea of the riparian promenade, mentioned in Chapter 2, by placing functions in hierarchy of the public to private spaces mimicking the movements found on site.

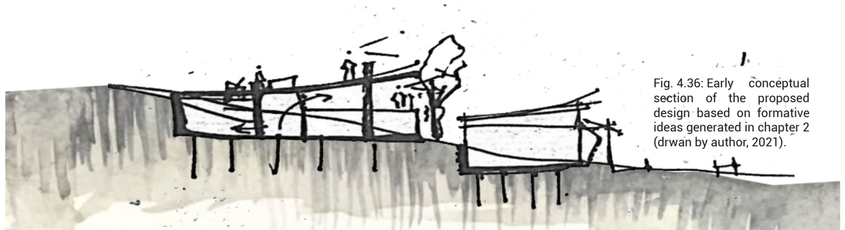


Fig. 4.36: Early conceptual section of the proposed design based on formative ideas generated in chapter 2 (drwan by author, 2021).

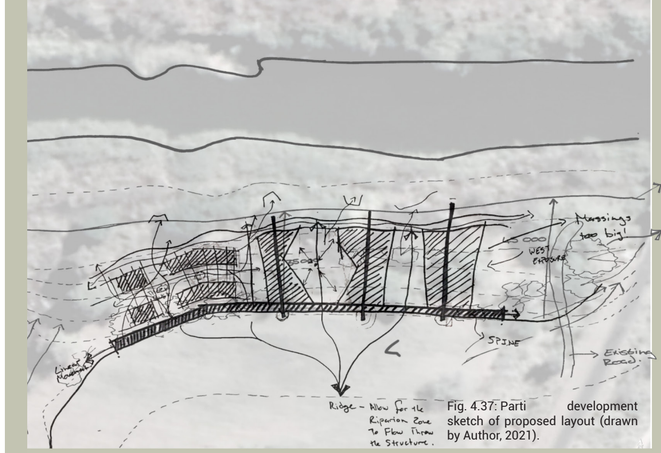


Fig. 4.37: Parti development sketch of proposed layout (drawn by Author, 2021).

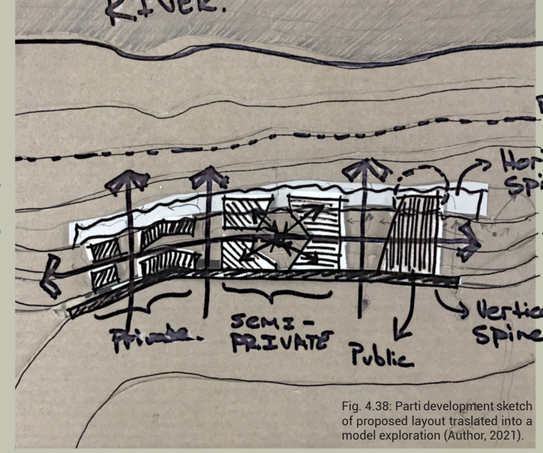


Fig. 4.38: Parti development sketch of proposed layout traslated into a model exploration (Author, 2021).

The next approach was to read the river as a spine and using the topography of the site (the ridgeline) to place this circulation space (the spine) along the ridgeline and latch the spaces onto it). The sectional sketch on the left was the first attempt at incorporating the burrowed-in concept to hide the building from the lines of sight from the edge of the ridge.

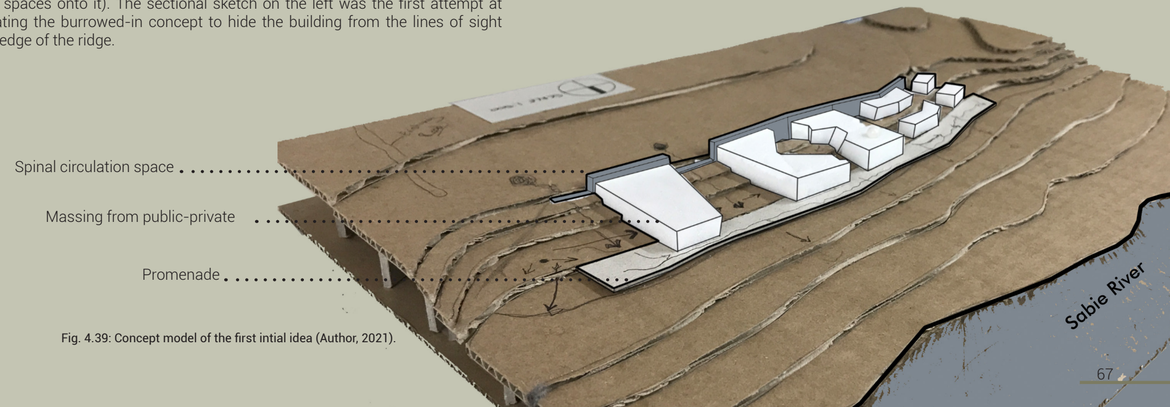


Fig. 4.39: Concept model of the first intial idea (Author, 2021).

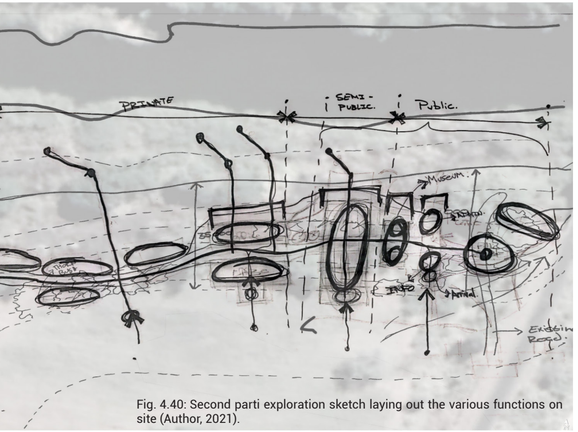


Fig. 4.40: Second parti exploration sketch laying out the various functions on site (Author, 2021).

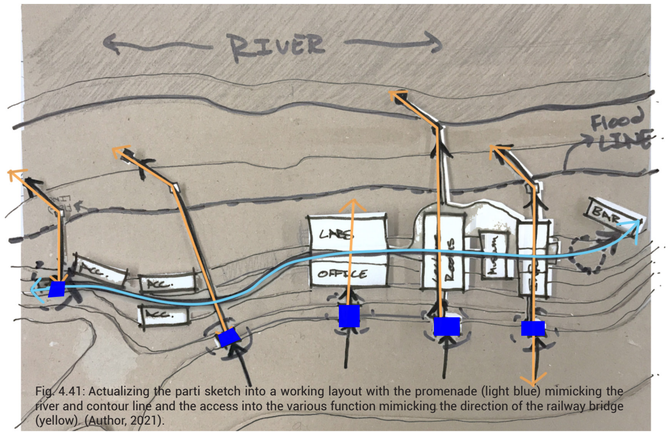


Fig. 4.41: Actualizing the parti sketch into a working layout with the promenade (light blue) mimicking the river and contour line and the access into the various function mimicking the direction of the railway bridge (yellow). (Author, 2021).

The second attempt of translating the idea of the concepts stemmed from trying to incorporate the massings within the middle of the riparian eco-tone and the promenade passing through the massings and the landscape, mimicking the river as a corridor. In section the idea of responding to the proposed design as a 3-dimensional ecotone, vertical towers are placed on the ridgeline onto paths that bisect the promenade leaping towards the river relating the movement of man (the railway) once again.



Fig. 4.42: Sectional exploration of the tower elements connecting the promenade to the upper terrace ridgeline (Author, 2021).

The functions in this layout are placed along this promenade from the public (right) to private (left). The middle point of the layout is where the research being done meets the community and the tourist by means of a museum and lecture rooms. The layout at this point became loosely spread out within the riparian zone still hidden from lines of sight from the ridgeline. The vertical towers are meant to be light and tectonic to blend in with the tree line (the first eco-tone in the riparian zone), and also serves as observation points for ecologists and tourists. The walkways that stretch toward the river mimic man's original movement found on site, but respects the river by not intruding too far in

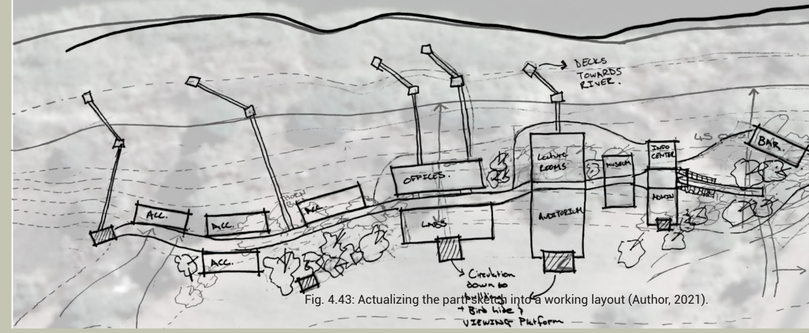


Fig. 4.43: Actualizing the parti sketch into a working layout (Author, 2021).

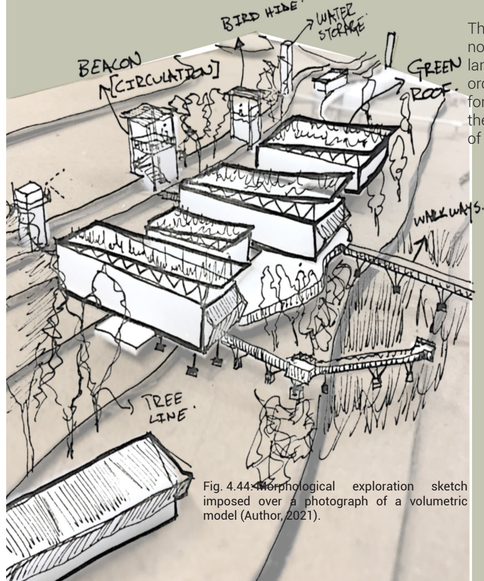


Fig. 4.44: Morphological exploration sketch imposed over a photograph of a volumetric model (Author, 2021).

The scale of the buildings in relation to the context was governed by the notion of not allowing the buildings to become too dominant over the natural landscape and staying hidden on the slope under the ridgeline, secondly, in order to work towards a narrative journey, the Normande allows for the opportunity to fragment various functions along with the site and allowing for a series of events in the form of spatial experiences to be developed.

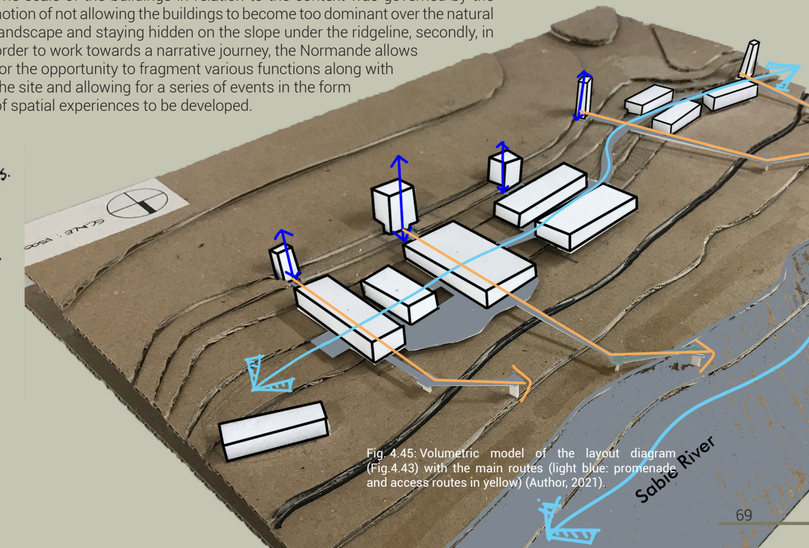


Fig. 4.45: Volumetric model of the layout diagram (Fig.4.43) with the main routes (light blue: promenade and access routes in yellow) (Author, 2021).

The second phase of the initial ideas attempted to interpret the themes set out in the theoretical discussion in Chapter 2. The layout retains the idea of the spinal promenade in the previous explorations and the functions of the design start to become more realistic in their scale in terms of their spatial requirements. The tower elements have been reduced to two, which become the main entry points down to the promenade from the ridgeline. The interpretation of the balance between man and nature was seen as the functions responding differently to the landscape to emphasise the various levels to which the design may respond to nature. The more orientated the functions are towards ecology the more sensitive the spaces need to be towards nature. For example the addition of a courtyard in the research component of the design versus the admin building. The use of various paths was added to inform the narrative experience through the site.

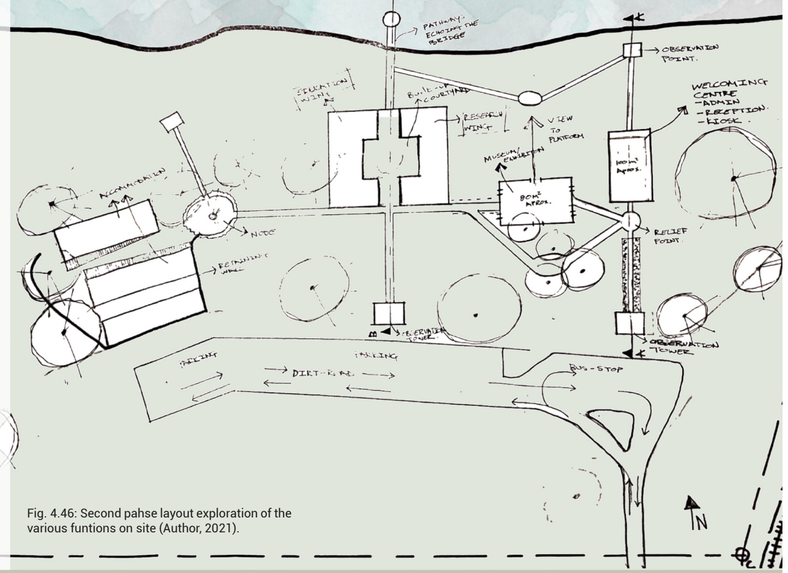
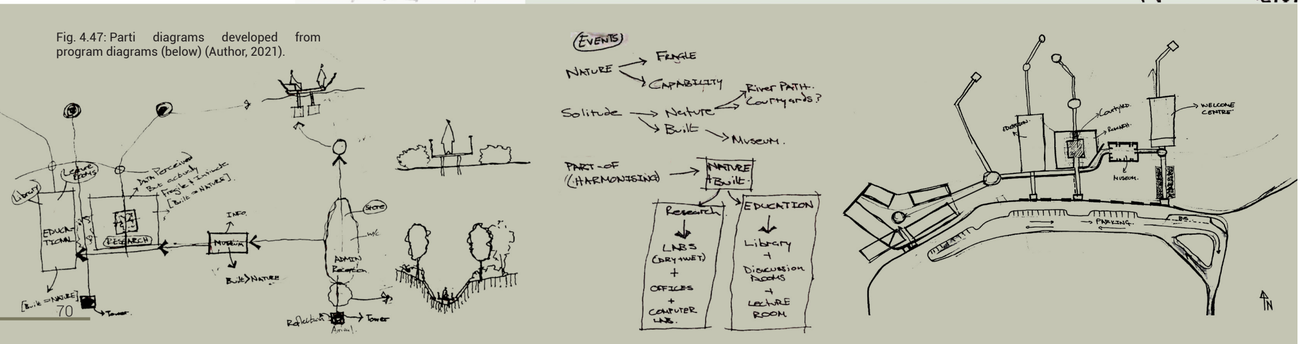
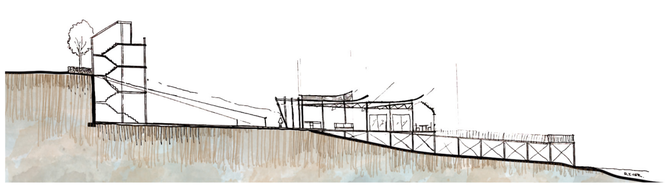


Fig. 4.46: Second pahse layout exploration of the various funtions on site (Author, 2021).

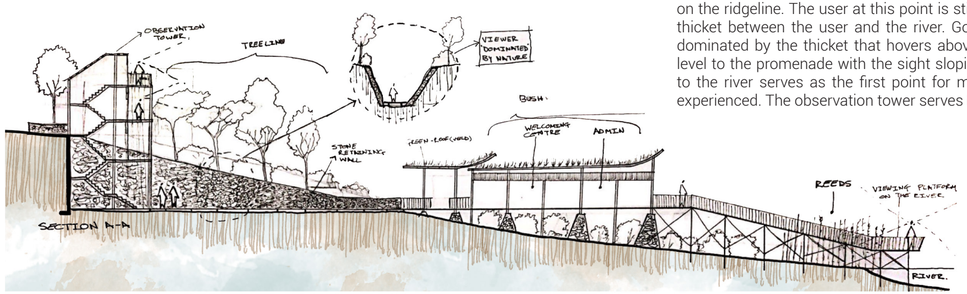
Fig. 4.47: Parti diagrams developed from program diagrams (below) (Author, 2021).





The attempt of interpreting the theoretical themes was also considered in the sectional development of the design. The observation towers, as well as the viewing platforms on the river's edge, become moments of distantiation (isolation) where the user contemplated the experience between these two points resembling the appropriation (proximity) of the user within the biome. The roofs structures were interpreted from the burrowed-in concept mentioned in Chapter 2.

The visitor's tower (Section A-A): the visitor approaches the entrance towards a tectonic structure that blends in with the verticality of the prominent trees on the ridgeline. The user at this point is still unaware of the river due to the thicket between the user and the river. Going down the tower, the user is dominated by the thicket that hovers above by placing the user on a path level to the promenade with the sight sloping alongside. the walkway down to the river serves as the first point for meditative reflection of what was experienced. The observation tower serves the same purpose for the visitor.



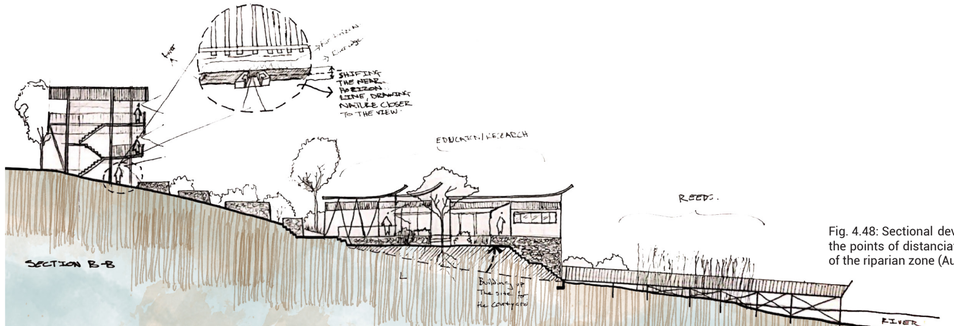


Fig. 4.48: Sectional development drawings articulating the points of distanciation through the various biomes of the riparian zone (Author, 2021).

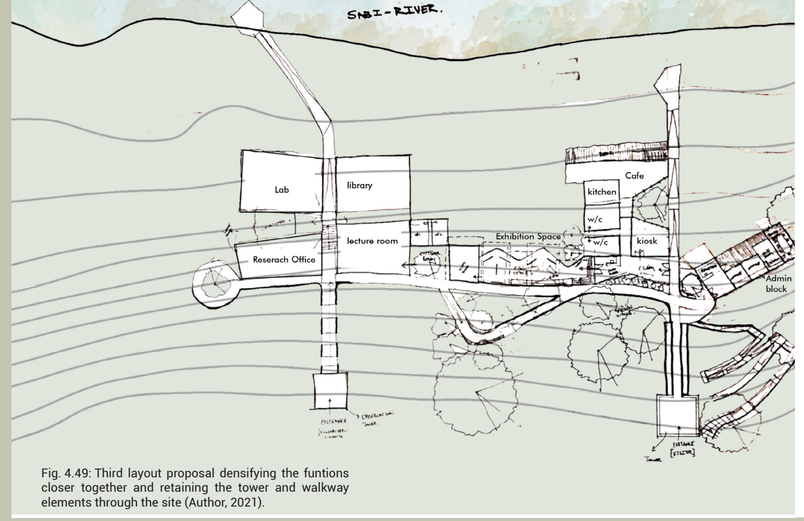


Fig. 4.49: Third layout proposal densifying the funtions closer together and retaining the tower and walkway elements through the site (Author, 2021).

Reflecting on this design phase, the layouts appeared too forced within the landscape. The buildings appear too symmetrical in some cases, which is a potent design tool but becomes a stark contrast in the natural setting, which is not the aim of the design. The interpretation of the theory at this stage led the process towards design errors that contradicted the initial conceptual exploration in the previous phase.

A point of reflection needed to be made in order to develop the design along with the main concept generator instead of depending on the theory to generate the design. The theoretical approach of an environmental narrative to contemplate on needed to be choreographed by events, and allowing the buildings to be oriented around existing trees instead of forcing them along a promenade due to the scale and function.

Main concept generator to be reconsidered in the next phase:

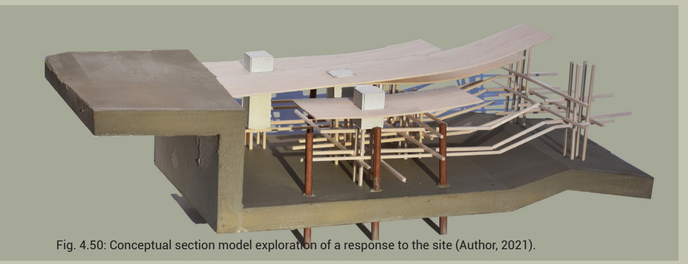


Fig. 4.50: Conceptual section model exploration of a response to the site (Author, 2021).

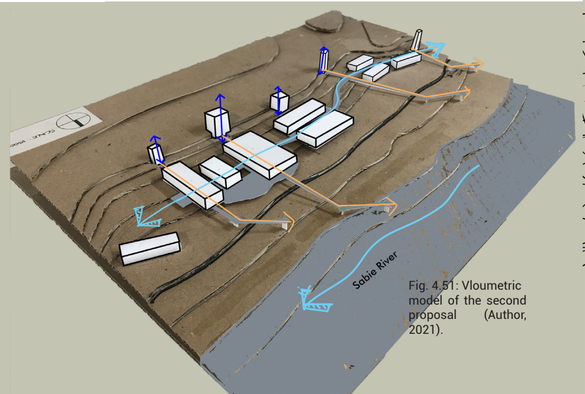


Fig. 4.51: Vloumetric model of the second proposal (Author, 2021).

Phase 2: Working back to the formative idea

As mentioned before, the design process simultaneously manifested along with the developments of the theoretical thought and interpretations of the formative design concepts throughout the course of the year. At this point of the design, a lot needed to be taken into consideration in order to fully start materialising the design into built form. Firstly, considering the actual spatial requirements of the various functions as well as the various spatial designation of public and private spaces needed to be considered. Secondly, this was the first time actual consideration of structural elements were considered as well materials for the morphology of the design. The main concept generator becomes the main aim to translate in this next phase of the design.

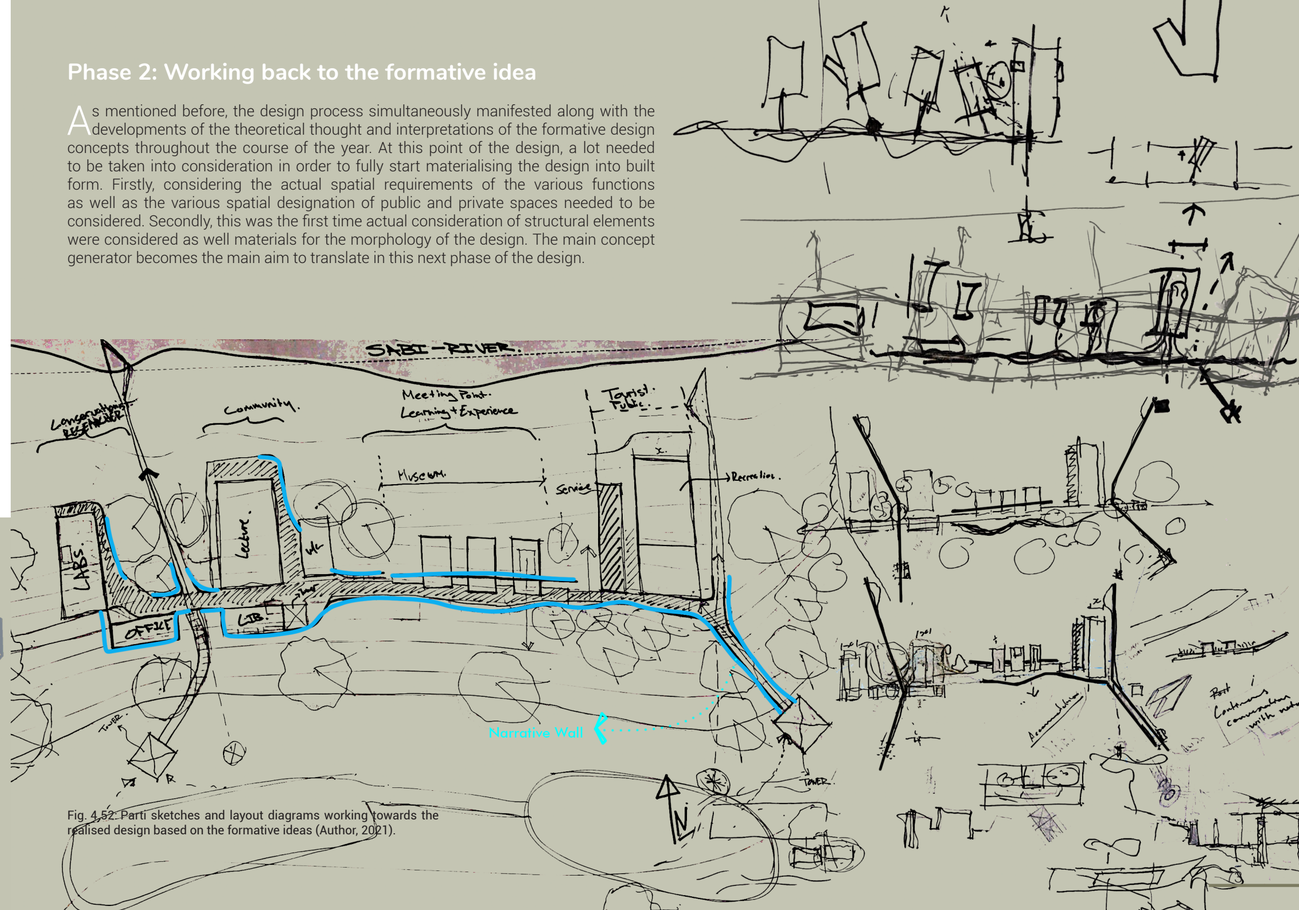


Fig. 4.52: Parti sketches and layout diagrams working towards the realised design based on the formative ideas (Author, 2021).

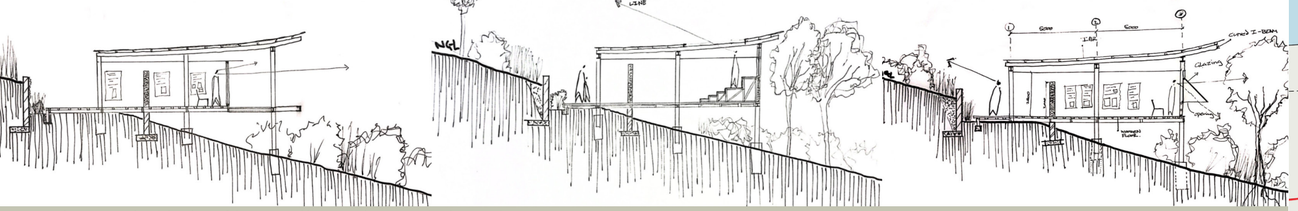


Fig. 4.53: Sectional drawings of the proposed interpretation spaces (Author, 2021).

The layout rethinks the use of various buildings fragmented across the site with the promenade as the spine leading movement into and along the spaces. The buildings are interpreted as slithers relating to the main concept generator. The roof exploration over the main spaces is inspired by the lessons learnt in the precedent study mentioned earlier in this chapter. The exhibition/museum space that featured in the previous phase now becomes translated into interpretation spaces, each one specifically designed to interpret a specific eco-tone in the riparian zone. The tower elements and the walkways are places in between the existing trees found on site.

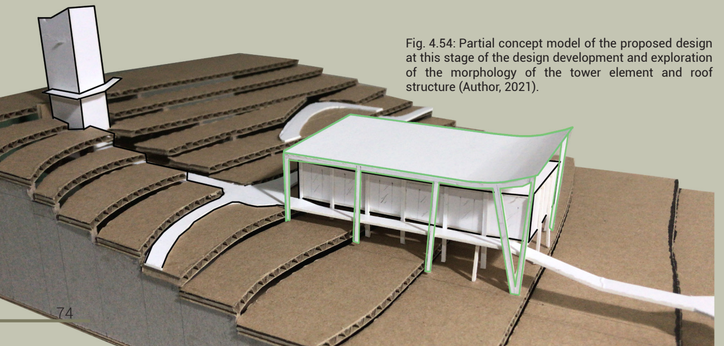


Fig. 4.54: Partial concept model of the proposed design at this stage of the design development and exploration of the morphology of the tower element and roof structure (Author, 2021).

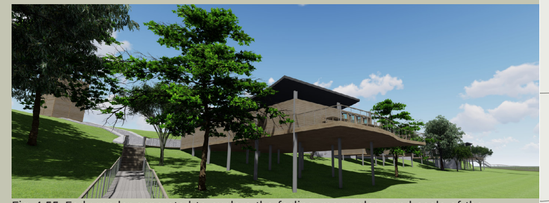


Fig. 4.55: Early render generated to explore the feeling, morpgology and scale of the main building on site (Author, 2021).



Fig. 4.56: Early generated render of the promenade with a view of the interion spaces and narrative wall on the right (Author, 2021).

Fig. 4.57: Early generated render of the promenade with a view of the library space looking down towards the reseach labs (Author, 2021).



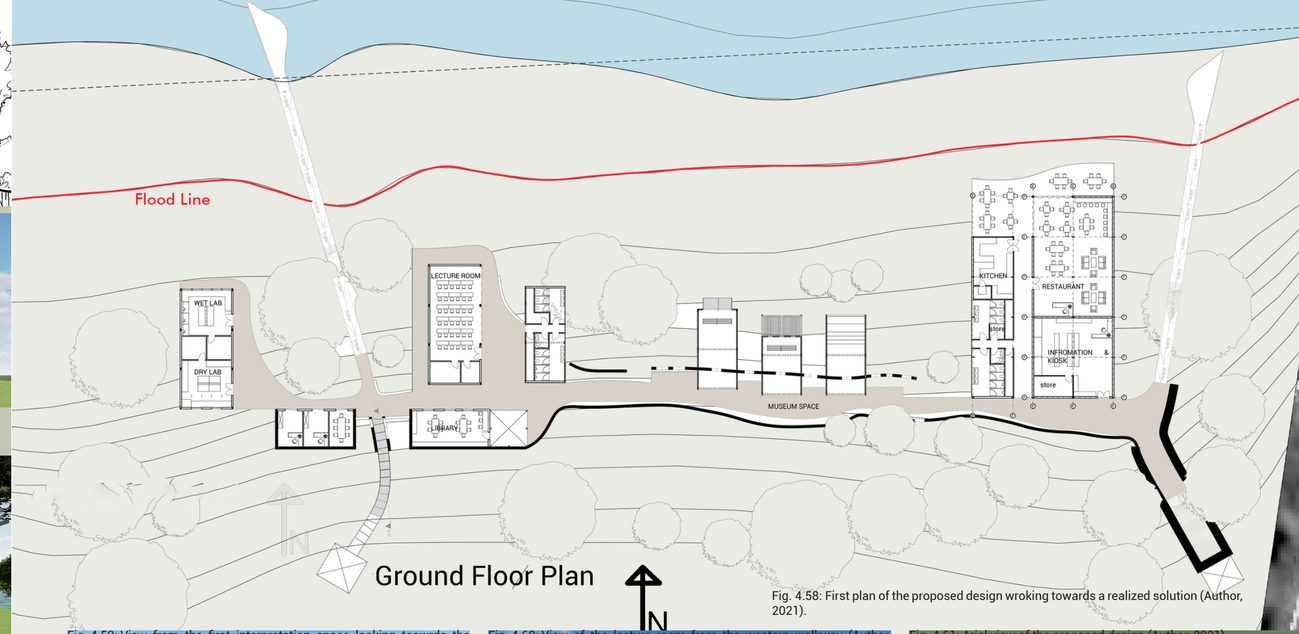


Fig. 4.58: First plan of the proposed design wroking towards a realized solution (Author, 2021).

Fig. 4.59: View from the first interpretation space looking toawrds the ridgeline (Author, 2021).

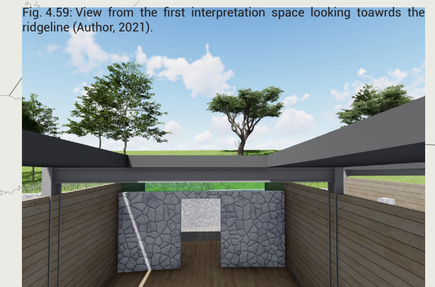


Fig. 4.60: View of the lecture room from the western walkway (Author, 2021).



Fig. 4.61: Arial view of the proposed design (Author, 2021).



A turning point towards a realized design:

Reflecting on the previous phase:

- The layout of the spaces was getting closer towards the formative conceptual idea of the riparian promenade
- The layout was still restricting views and narrative experiences between the viewer and the river.
- Although an attempt was made in creating long slithers towards the river (working back to the concept generator), this resulted in long eastern and western facades. This would require extra passive design resolutions for thermal comfort.
- The morphological exploration and material use still seemed too solid and out of context given the region in which the site is located.
- The promenade is starting to develop with events of interpretation, which can further be developed.

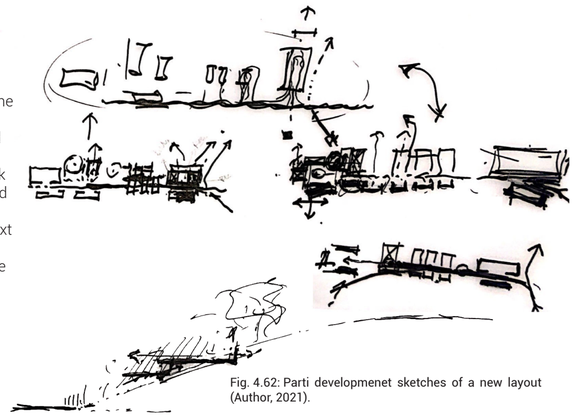


Fig. 4.62: Parti developmenet sketches of a new layout (Author, 2021).

A turning point was made during the final resolution phase when the tectonics of the design became a major point of concern. This is where the reality of the decisions being made has an effect on the environment. A reconsideration of materials informs the morphology and the feeling of the design. By selecting natural materials the building blends into the landscape. The constraints of the materials chosen dictate the scale of the buildings due to spans, connections, and the implementation of the passive design strategies (thermal mass, ventilation). The use of steel was disregarded and substituted with timber as a more ecological decision. Reclaimed stone from nearby quarries make up the thick narrative wall, and the dialogue between the service and served spaces makes the user aware of their position on-site. Re-orientating the buildings facing north and south, opening up towards the view of the river, and allowing for predominant winds to flow through the interior space.

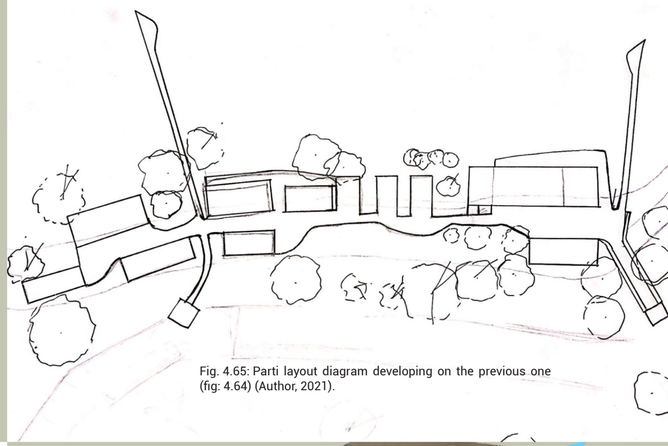


Fig. 4.65: Parti layout diagram developing on the previous one (fig: 4.64) (Author, 2021).

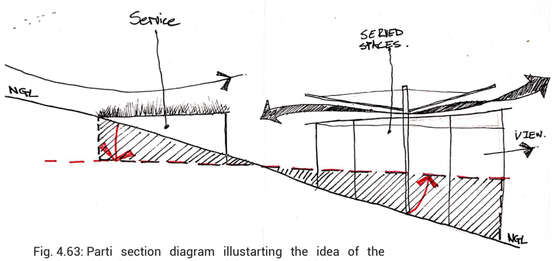


Fig. 4.63: Parti section diagram illustarting the idea of the southern side of the promenade and the northern side in contrast towards the morphological approach, and as a result, a structural contrast towards each other (Author, 2021).

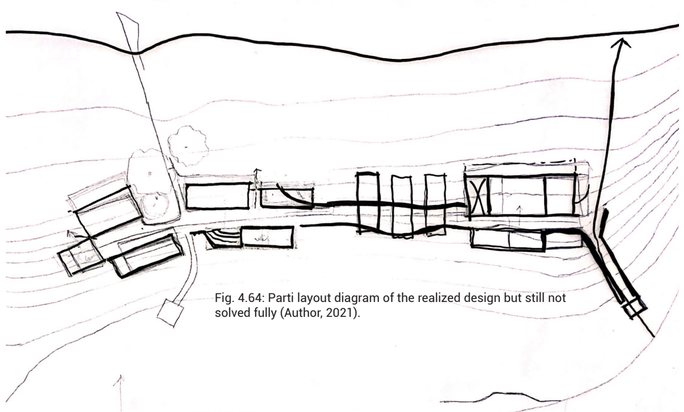


Fig. 4.64: Parti layout diagram of the realized design but still not solved fully (Author, 2021).

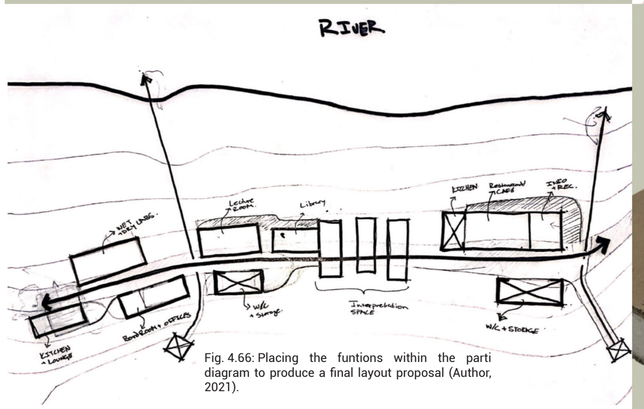


Fig. 4.66: Placing the funtions within the parti diagram to produce a final layout proposal (Author, 2021).

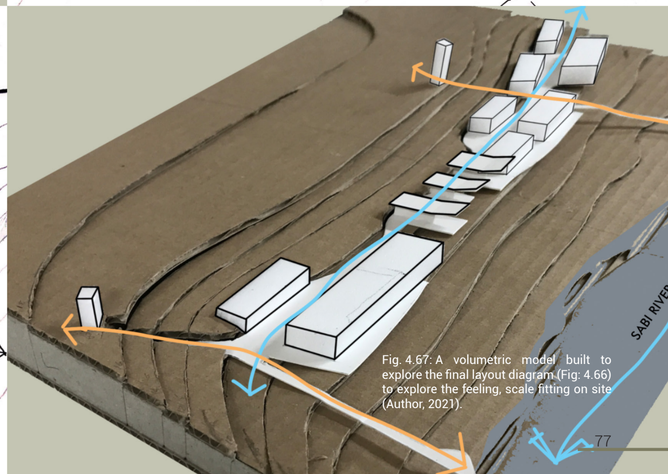


Fig. 4.67: A volumetric model built to explore the final layout diagram (Fig: 4.66) to explore the feeling, scale fitting on site (Author, 2021).

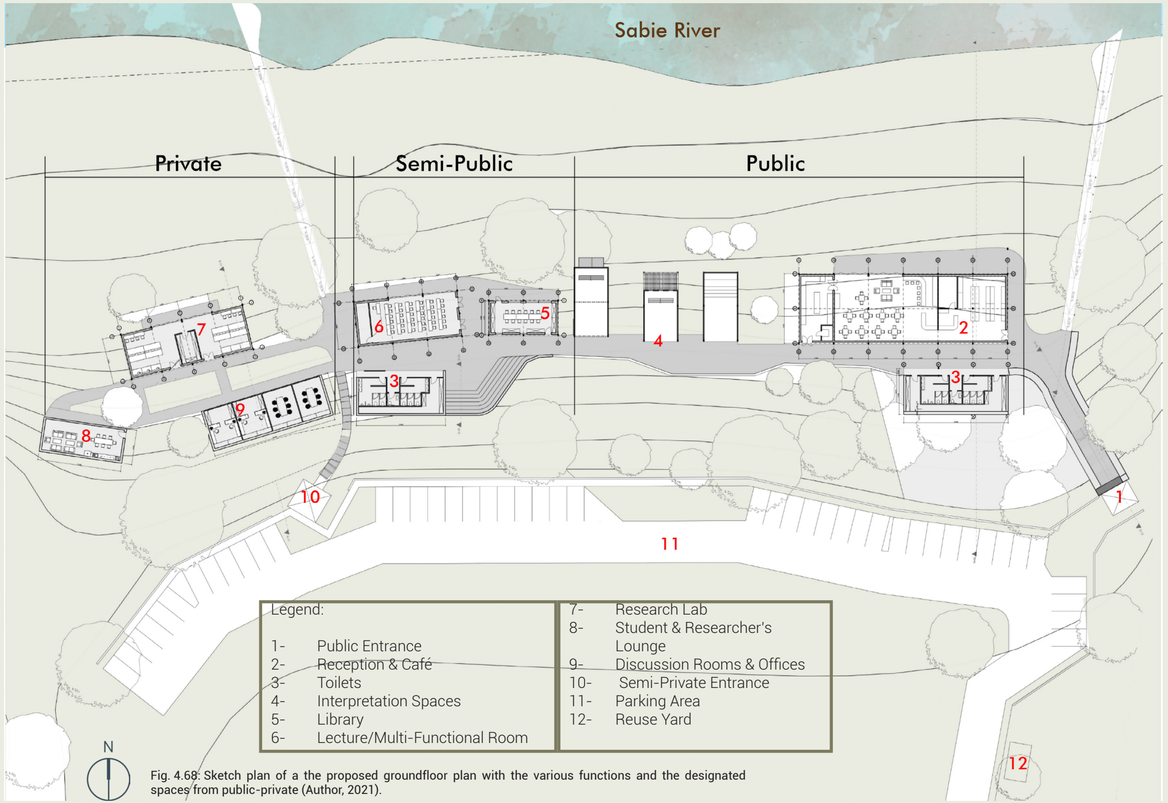


Fig. 4.68: Sketch plan of a the proposed groundfloor plan with the various functions and the designated spaces from public-private (Author, 2021).

The structural development during this phase aided a lot of the design decisions going forward. The focus of the design at this stage was to try and resolve the plan layout according to the necessary spatial requirements for the various spaces. The sections through the reception and ablutions indicate the overall conceptual approach of the design that was resolved in a technical manner. The stereotomic structural system with instu-soil collected from site excavations is used as a backfill to the service buildings on the south of the promenade. This allowed the buildings to be burrowed into the landscape, pealing the landscape and tucking the building underneath. The north-south slither roofs that developed in the earlier stages are re-interpreted into a passive design solution by creating a double roof shading the structure underneath and allows for cross ventilation. This also entailed the structural resolution of timber as the chosen material for the structural system.

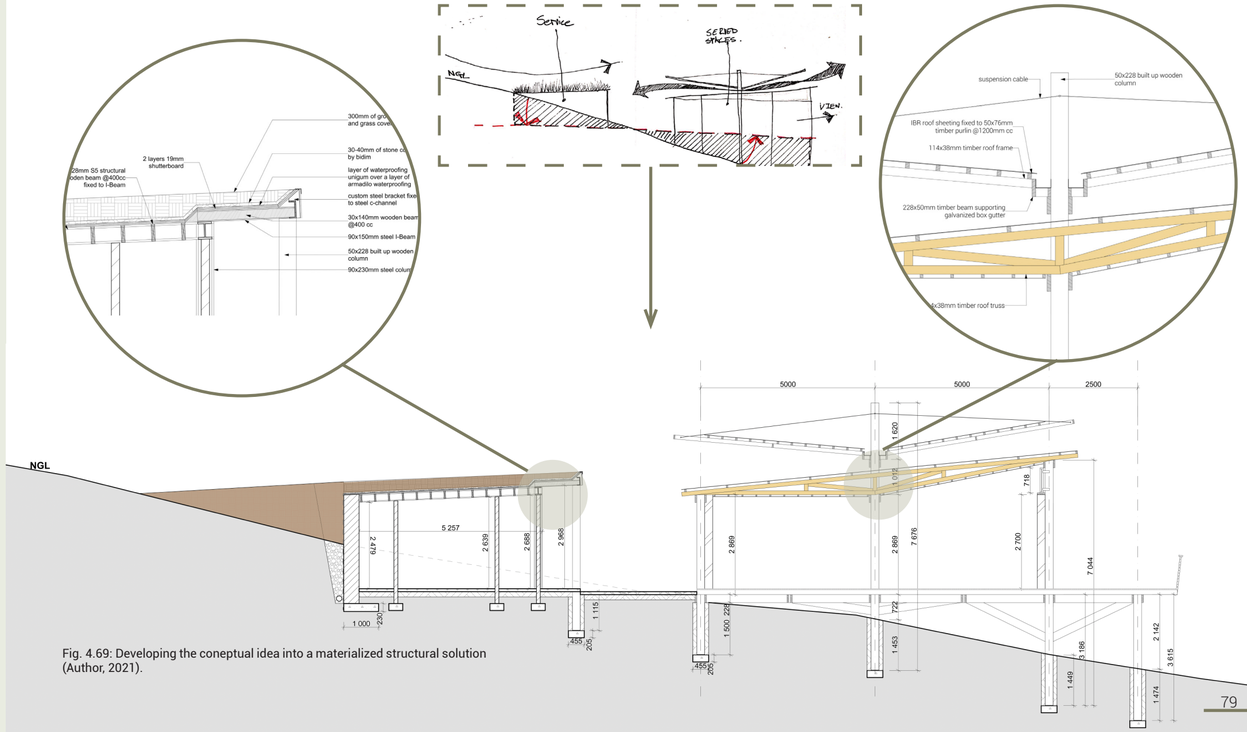


Fig. 4.69: Developing the coneptual idea into a materialized structural solution (Author, 2021).

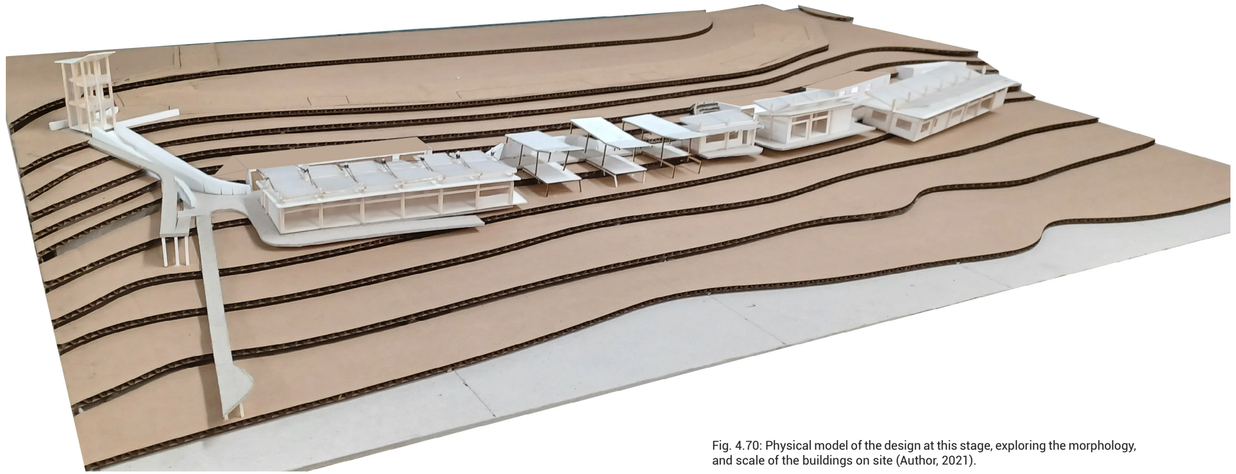


Fig. 4.70: Physical model of the design at this stage, exploring the morphology, and scale of the buildings on site (Author, 2021).

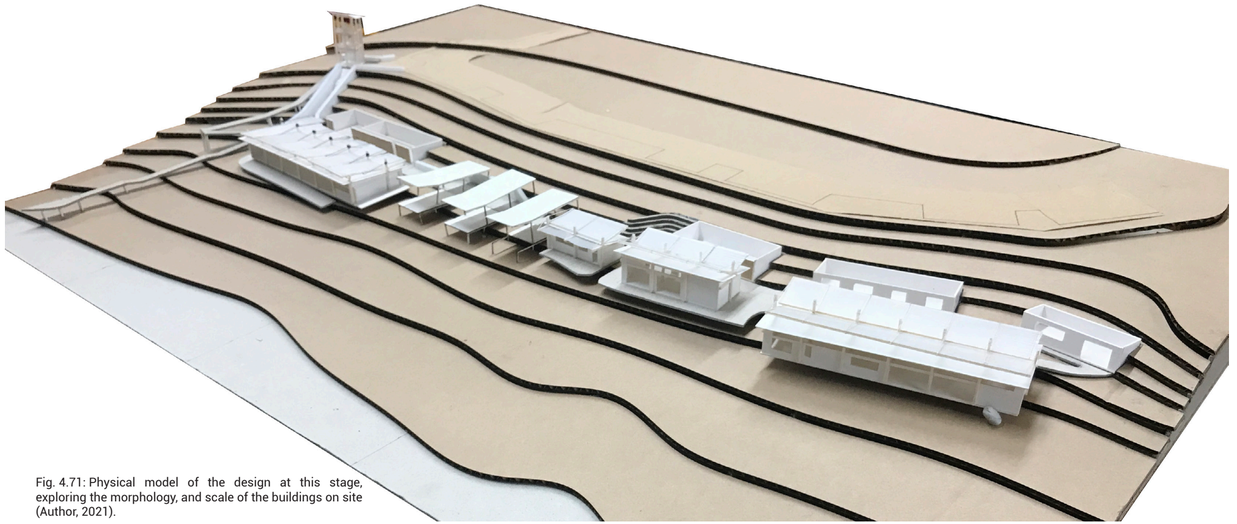
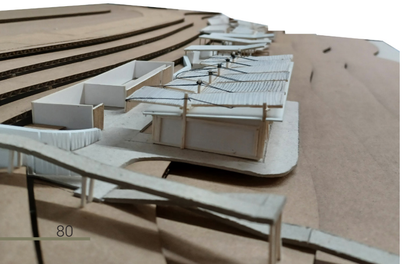
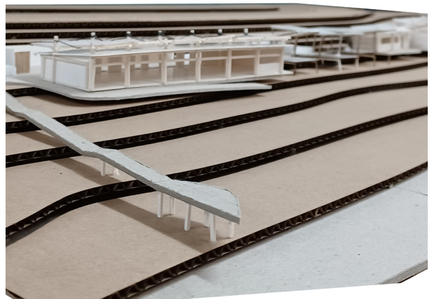
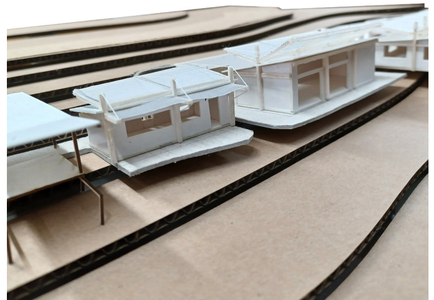


Fig. 4.71: Physical model of the design at this stage, exploring the morphology, and scale of the buildings on site (Author, 2021).

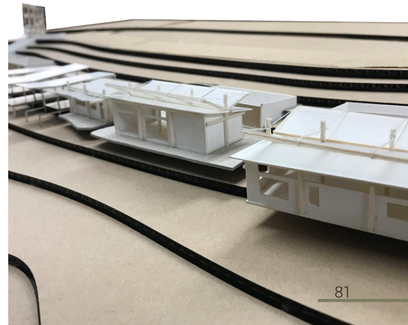












SPATIAL DEVELOPMENT

WELCOMING CENTRE AND CAFE

The visitor will begin their narrative journey through the first tower that is positioned in-between the most prominent trees on-site (two big amarula trees and clusters of acacia and thorn-bush). Exiting the tower into a staircase down towards the promenade, the user is guided by the stone gabion wall towards the reception and café. Services are located across the entrance. The reception and café are interlinked by a corridor with the northern and southern façades being as permeable as possible with stacking doors and glazing. The service building on the southern side of the promenade houses the public toilets, storage areas, staff break-room as well an office for the café.

The section was further developed from the previous phase by rearranging the structural columns of the welcome centre and lining up the shaded roof acknowledging the pitch of the green roof on the opposite side of the promenade. the shaded roof extends itself over the entrance space to emphasise the entrance into the building. This also aids in working back to the formative idea model of the roof slithers mentioned earlier in this dissertation.

Legend:

1- Public Entrance
2- Welcome centre & Café
3- Toilets
4- Interpretation Spaces
5- Library
6- Lecture/Multi-Functional Room
7- Research Lab
8- Student & Researcher's Lounge
9- Discussion Rooms & Offices
10- Semi-Private Entrance
11- Parking Area
12- Reuse Yard

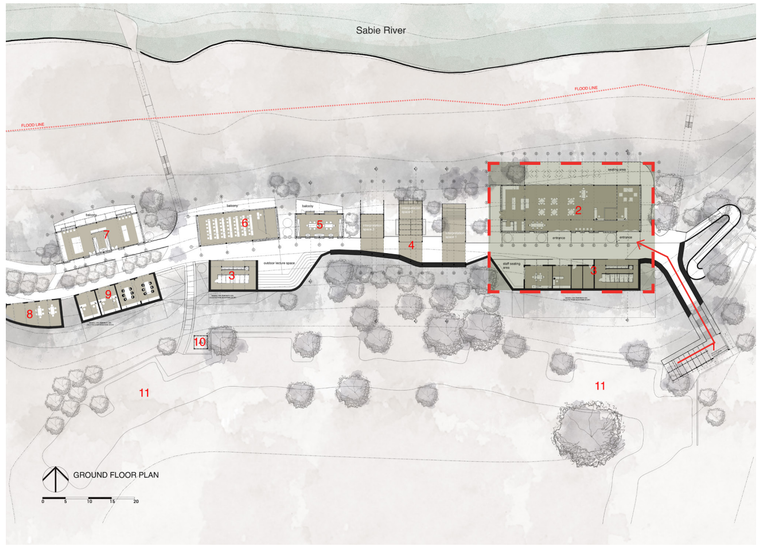


Fig. 4.72: Groundlfoor plan with the welcome centre and cafe highlighted in green (Author, 2021).

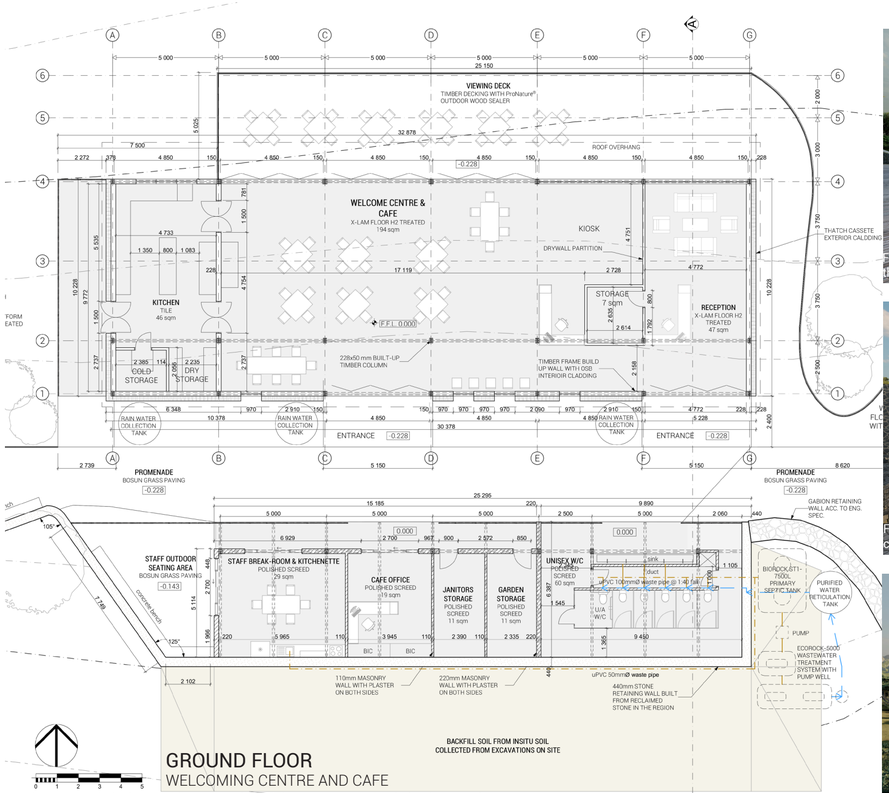


Fig. 4.73: Technical ground floor plan of the welcome centre and cafe (Author, 2021).



Fig. 4.74: View of the welcome centre and cafe from the eastern walkway towards the river (Author, 2021).



Fig. 4.75: Southern view of the welcome centre and cafe (Author, 2021).



Fig. 4.76: View of the welcome centre and cafe from the observation tower (Author, 2021).

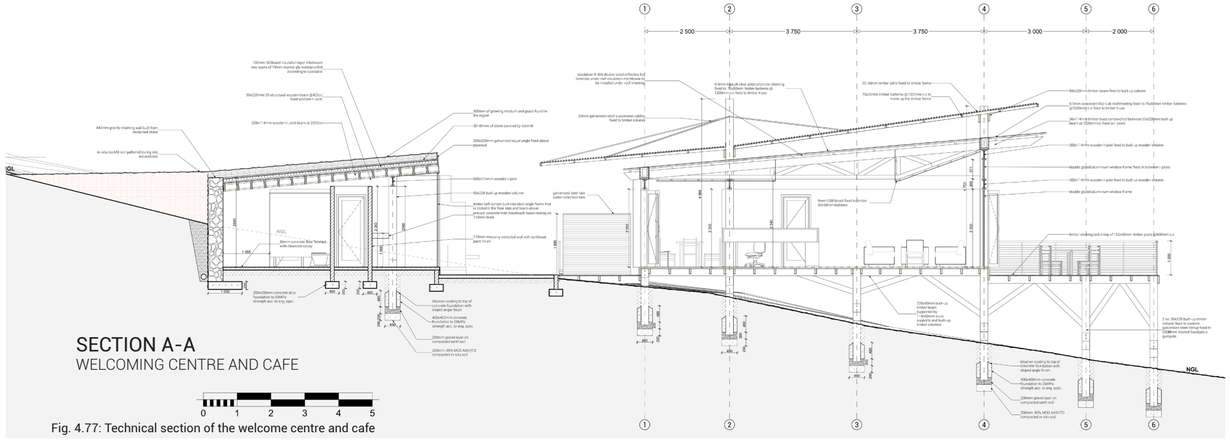


Fig. 4.77: Technical section of the welcome centre and cafe

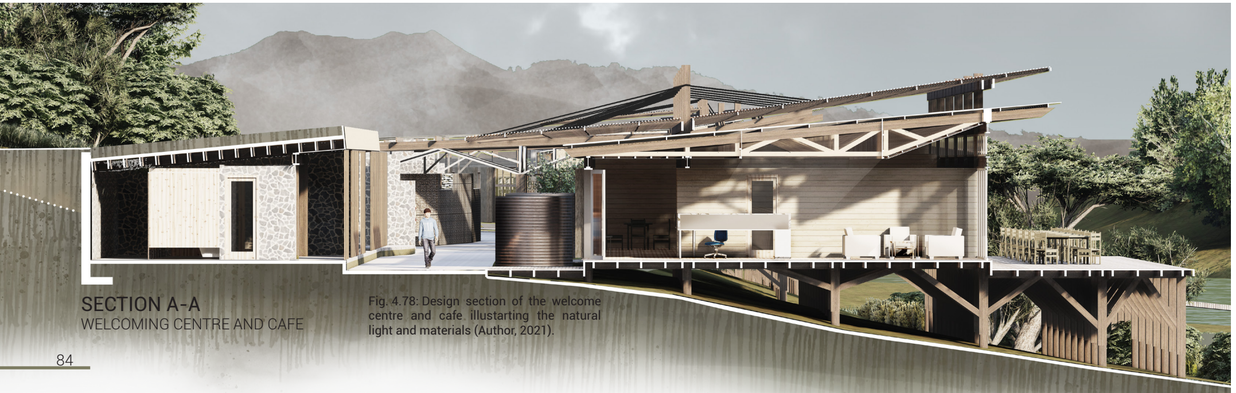
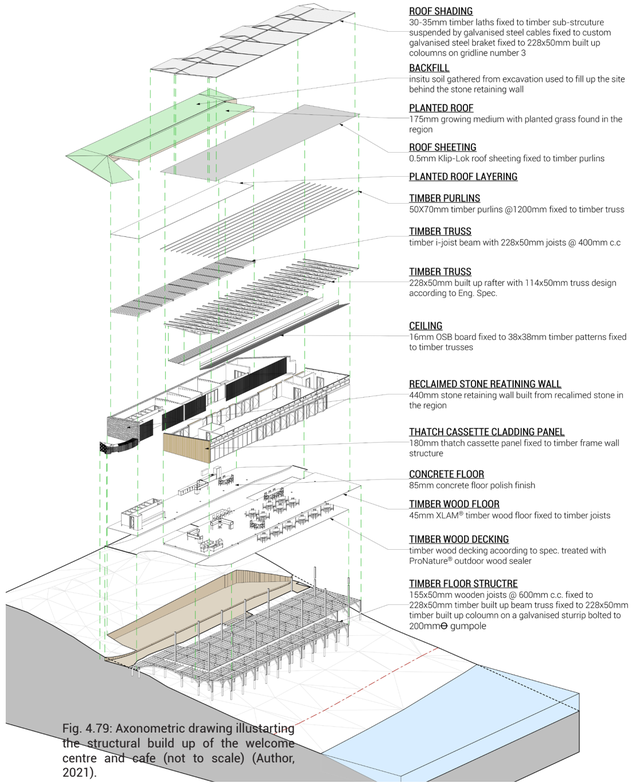


Fig. 4.78: Design section of the welcome centre and cafe illustarting the natural light and materials (Author, 2021).



ROOF SHADING
30-35mm timber laths fixed to timber sub-strcuture suspended by galvanised steel cables fixed to custom galvanised steel braket fixed to 228x50mm built up colourns on gridline number 3

BACKFILL
insitu soil gathered from excavation used to fill up the site behind the stone retaining wall

PLANTED ROOF
175mm growing medium with planted grass found in the region

ROOF SHEETING
0.5mm Klip-Lok roof sheeting fixed to timber purlins

PLANTED ROOF LAYERING

TIMBER PURLINS
50X70mm timber purlins @1200mm fixed to timber truss

TIMBER TRUSS
timber i-joist beam with 228x50mm joists @ 400mm c.c

TIMBER TRUSS
228x50mm built up rafter with 114x50mm truss design according to Eng. Spec.

CEILING
16mm OSB board fixed to 38x38mm timber patterns fixed to timber trusses

RECLAIMED STONE REATINING WALL
440mm stone retaining wall built from recalimed stone in the region

THATCH CASSETTE CLADDING PANEL
180mm thatch cassette panel fixed to timber frame wall structure

CONCRETE FLOOR
85mm concrete floor polish finish

TIMBER WOOD FLOOR
45mm XLAM® timber wood floor fixed to timber joists

TIMBER WOOD DECKING
timber wood decking acoording to spec. treated with ProNature® outdoor wood sealer

TIMBER FLOOR STRUCTRE
155x50mm wooden joists @ 600mm c.c. fixed to 228x50mm timber built up beam truss fixed to 228x50mm timber built up colournn on a galvanised sturrip bolted to 200mmϴ gumpole

Fig. 4.79: Axonometric drawing illustarting the structural build up of the welcome centre and cafe (not to scale) (Author, 2021).



Fig. 4.80: Interioir render of the welcome centre and cafe illustrating the natural light filtered in through the shaded roof strucutre (Author, 2021).

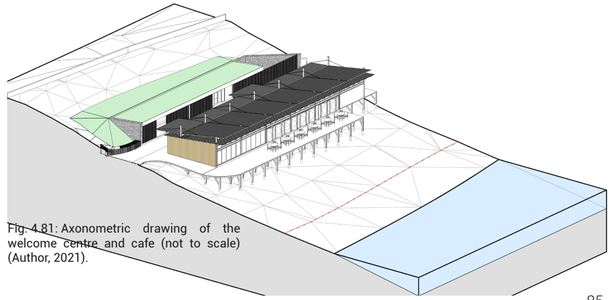


Fig. 4.81: Axonometric drawing of the welcome centre and cafe (not to scale) (Author, 2021).

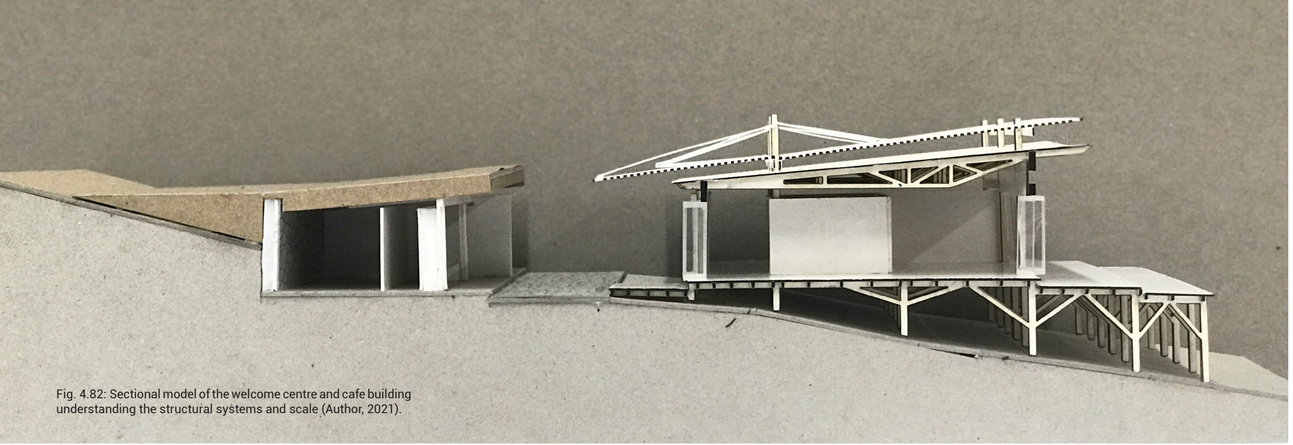


Fig. 4.82: Sectional model of the welcome centre and cafe building understanding the structural systems and scale (Author, 2021).

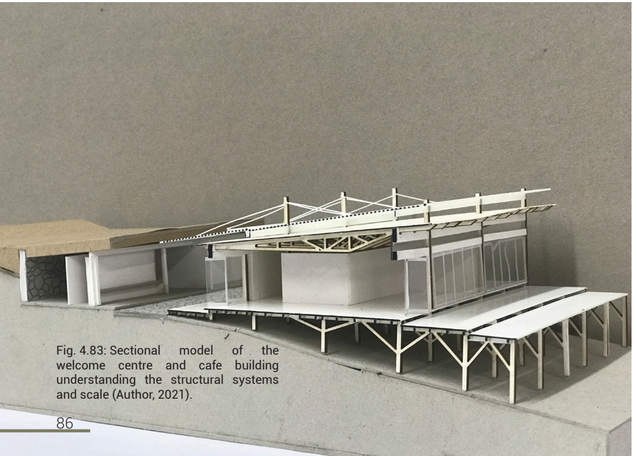


Fig. 4.83: Sectional model of the welcome centre and cafe building understanding the structural systems and scale (Author, 2021).

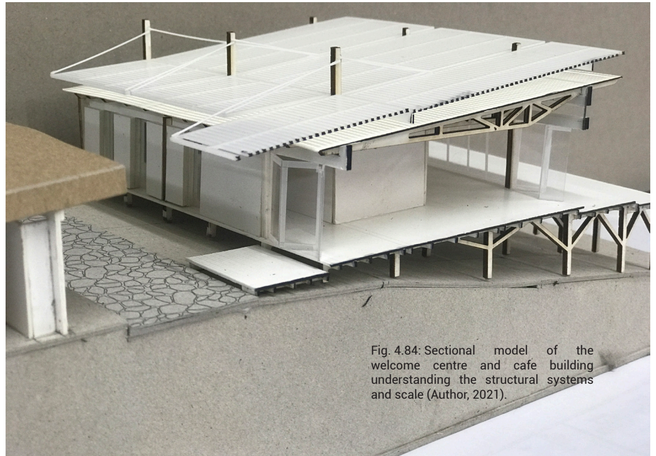


Fig. 4.84: Sectional model of the welcome centre and cafe building understanding the structural systems and scale (Author, 2021).

INTERPRETATION SPACES

The museum space that was incorporated in the previous design phase was substituted by interpretation spaces that would allow the user to be in dialogue with the environment in order to evoke an understanding of the environment through an experience. This would in turn spark an environmental identity of the visitors by pulling them in and out of these spaces (specific proximity and remoteness). These choreographed moments/events are designed to place focus on specific ecotones of the riparian zone, i.e; the tree line, the thicket and the reeds.

Legend:

1- Public Entrance
2- Reception & Café
3- Toilets
4- Interpretation Spaces
5- Library
6- Lecture/Multi-Functional Room
7- Research Lab
8- Student & Researcher's Lounge
9- Discussion Rooms & Offices
10- Semi-Private Entrance
11- Parking Area
12- Reuse Yard

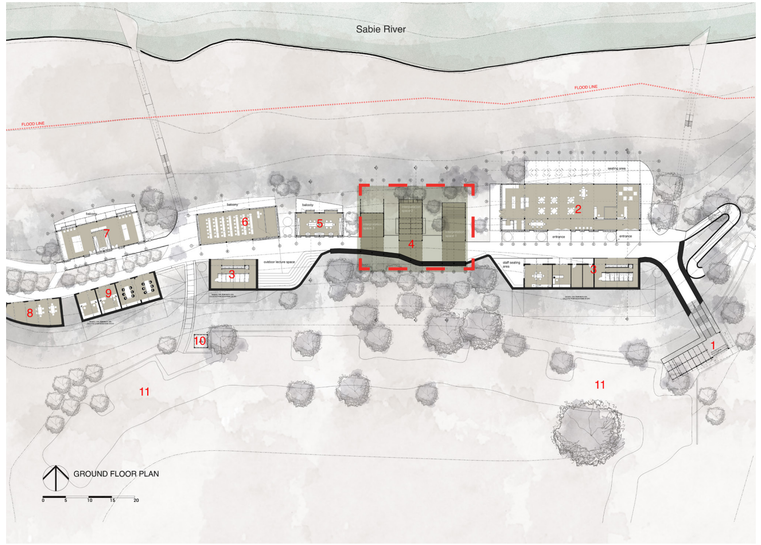
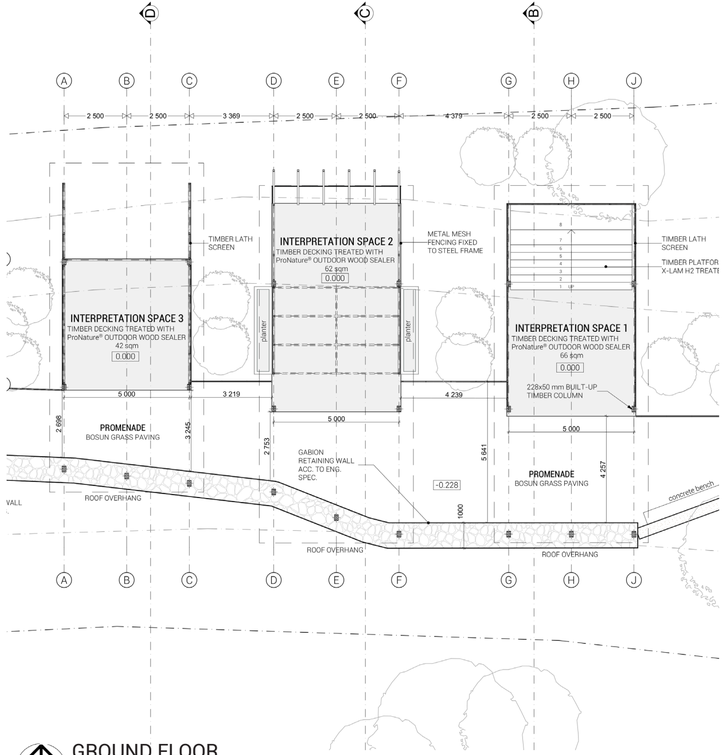


Fig. 4.85: Groundlfoor plan with the interpretation spaces highlighted in green (Author, 2021).



GROUND FLOOR
INTERPRETATION SPACES

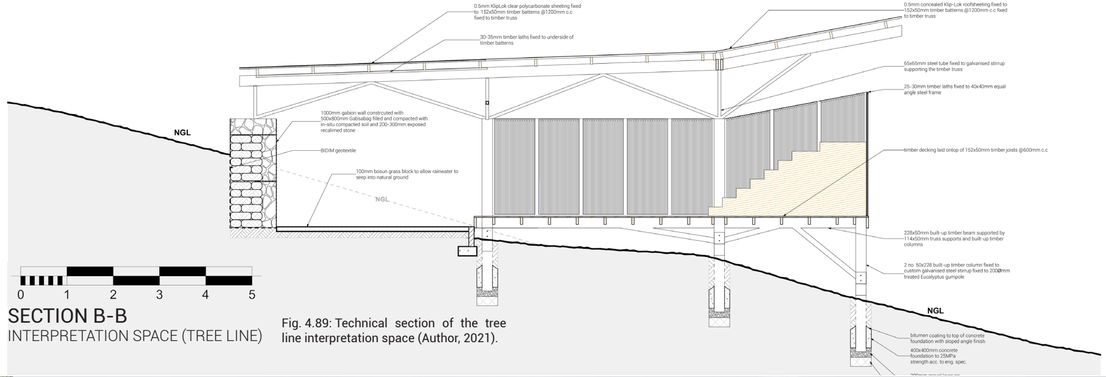
Fig. 4.86: Technical ground floor plan of the interpretation spaces (Author, 2021).



Fig. 4.87: North-Western view of the interpretation spaces (Author, 2021).



Fig. 4.88: North-Eastern view of the interpretation spaces (Author, 2021).

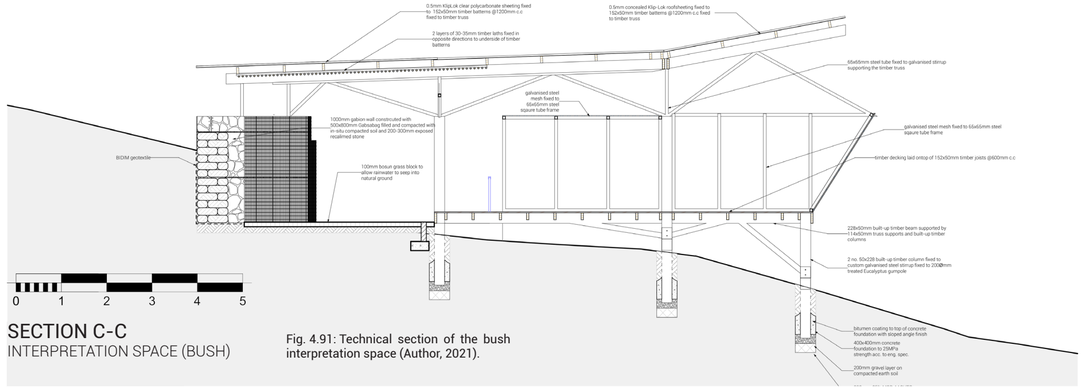


SECTION B-B
INTERPRETATION SPACE (TREE LINE)

Fig. 4.89: Technical section of the tree line interpretation space (Author, 2021).

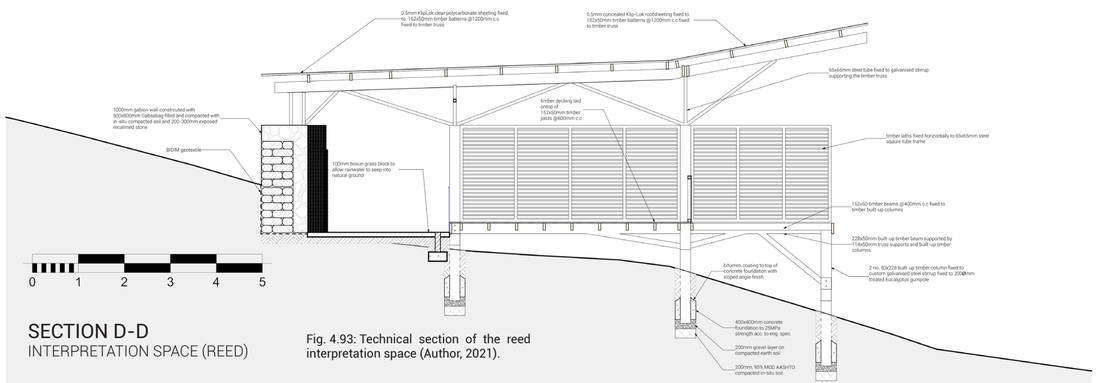


Fig. 4.90: Design section of the tree line interpretation space illustarting the natural light and materials (Author, 2021).



SECTION C-C
INTERPRETATION SPACE (BUSH)

Fig. 4.91: Technical section of the bush interpretation space (Author, 2021).



SECTION D-D
INTERPRETATION SPACE (REED)

Fig. 4.93: Technical section of the reed interpretation space (Author, 2021).



Fig. 4.92: Design section of the bush interpretation space illustarting the natural light and materials (Author, 2021).



Fig. 4.94: Design section of the reed interpretation space illustarting the natural light and materials (Author, 2021).

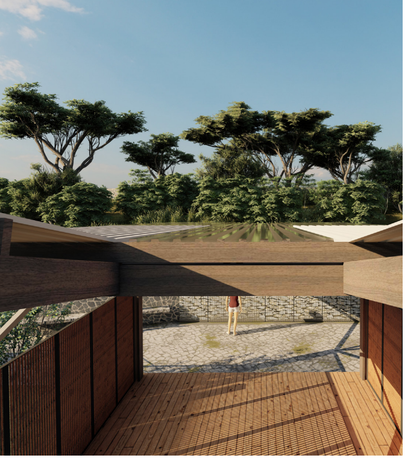


Fig. 4.95: Perspective view of the tree line view from the tree line interpretation space (Author, 2021).

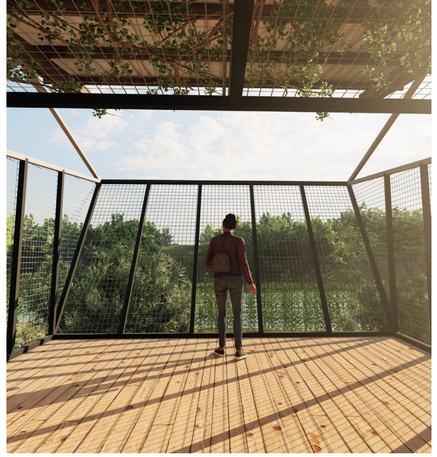


Fig. 4.96: Perspective view looking towards the river in the bush interpretation space (Author, 2021).



Fig. 4.97: Perspective view looking towards the river in the reed interpretation space (Author, 2021).

The tree line

This space focuses on the tree line toward the south of the site that defines the ridge and the start of the riparian zone. This is done by cutting a hole in the roof with the addition of a timber platform underneath that allows the viewer to have a direct line of sight towards the tree line. The roof structure also mimics the branches of a tree and has a timber lath screen underneath clear polycarbonate sheeting that allows in filtered light. creating the feeling of sitting under a tree.

The thicket/bush

The second space focuses on the thicket by tilting a metal mesh towards the thicket to direct the line of sight and focus point. The experience is also heightened to make the user aware of the thicket by using the square mesh as a surface for vines to grow on. This creates a thicket of its own which the user may pass through. The roof also lets in another type of filtered light by adding two layers of timber laths in opposite directions creating a more concentrated light to be filtered into the space.

The reed & river

The third space is positioned to focus on the clearing towards the ridgeline. the line of sight is guided by horizontal elements that extend beyond the space in front of the viewer. The timber lath panels on the side of the structure are also placed horizontally instead of vertically to direct the line of sight.

ECOLOGICAL LIBRARY

The development of this space stemmed from the question what would a library or learning space look like in the wilderness? What feeling would best be created in this space? This sparked the idea of redesigning the layout from the previous stage from a conventional layout, to one that conforms to the structural timber panel like system. The façades were approached in a manner that related to the structural composition of the building by approaching the façade with panels creating a rhythm of solids and voids. The reading and working spaces have been built into the wall facing the river towards the northern façade with a shading screen incorporated into the roof shading structure. Thatch cladding panels are still utilized to create a coherent language with the rest of the structures. The use of timber and thatch creates a warm feeling both internally and externally which blends itself into the landscape during the dry winter and creates a subtle contrast during the lush green summer.

Legend:

1- Public Entrance
2- Reception & Café
3- Toilets
4- Interpretation Spaces
5- Library
6- Lecture/Multi-Functional Room
7- Research Lab
8- Student & Researcher's Lounge
9- Discussion Rooms & Offices
10- Semi-Private Entrance
11- Parking Area
12- Reuse Yard

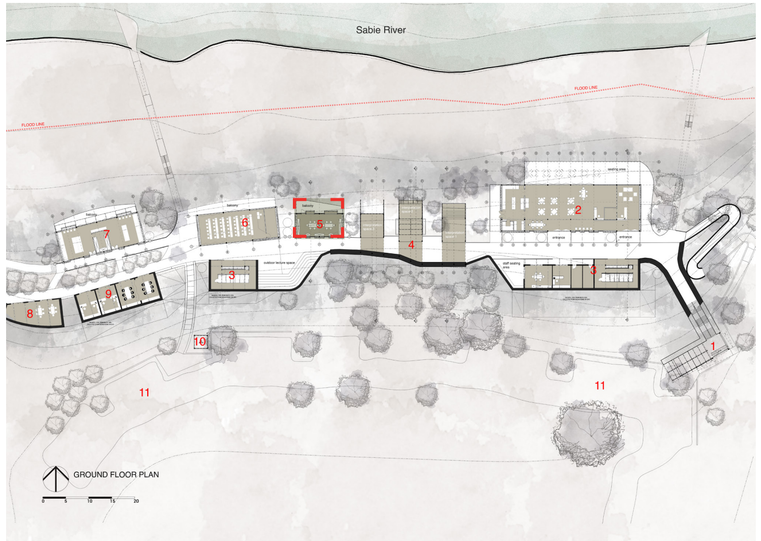
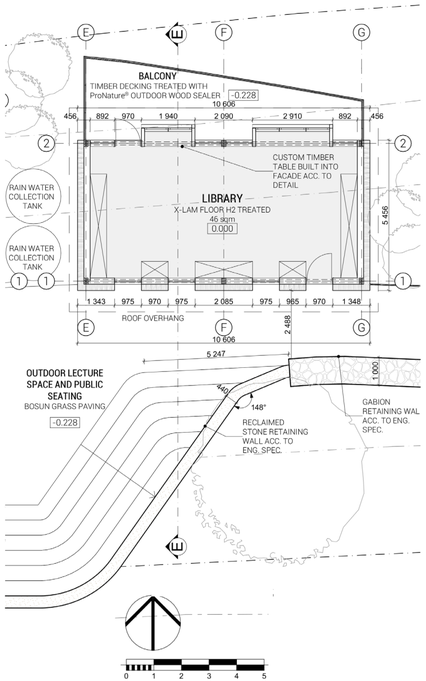


Fig. 4.98: Groundlfoor plan with the library space highlighted in green (Author, 2021).



GROUND FLOOR
LIBRARY SPACE

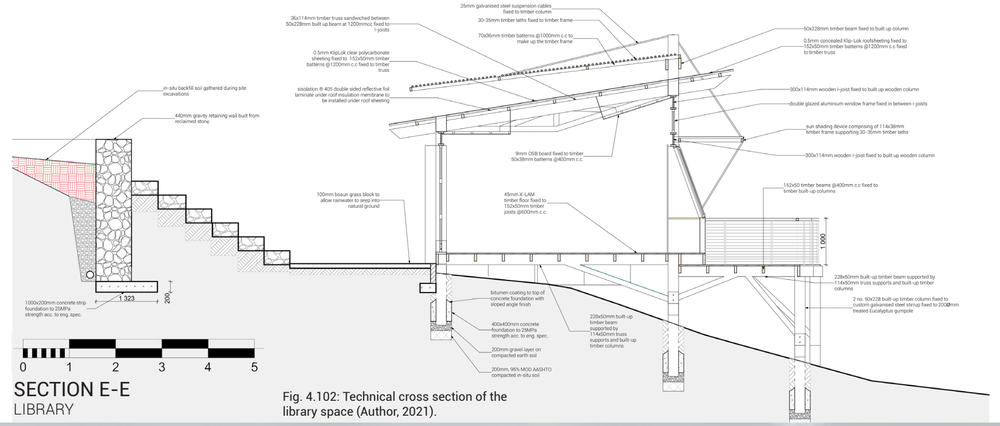
Fig. 4.99: Technical ground floor plan of the library space (Author, 2021).



Fig. 4.100: North-western view of the library space (Author, 2021).



Fig. 4.101: Interior view of the library space (Author, 2021).



SECTION E-E
LIBRARY

Fig. 4.102: Technical cross section of the library space (Author, 2021).



Fig. 4.103: Design section of the library space illustarting the natural light and materials (Author, 2021).

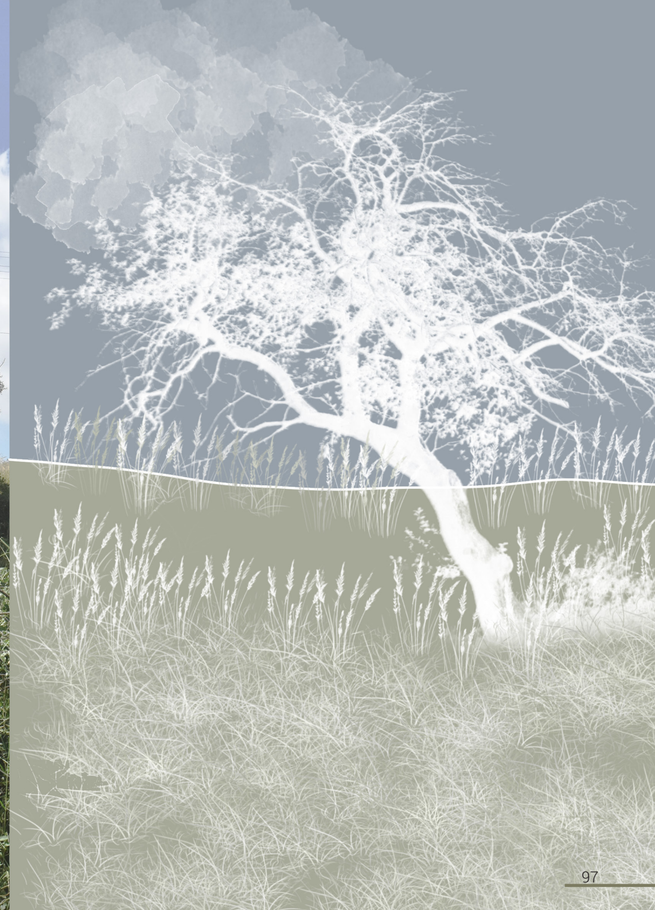
CHAPTER

05

FINAL DESIGN RENDERS AND TECHNICAL DRAWINGS

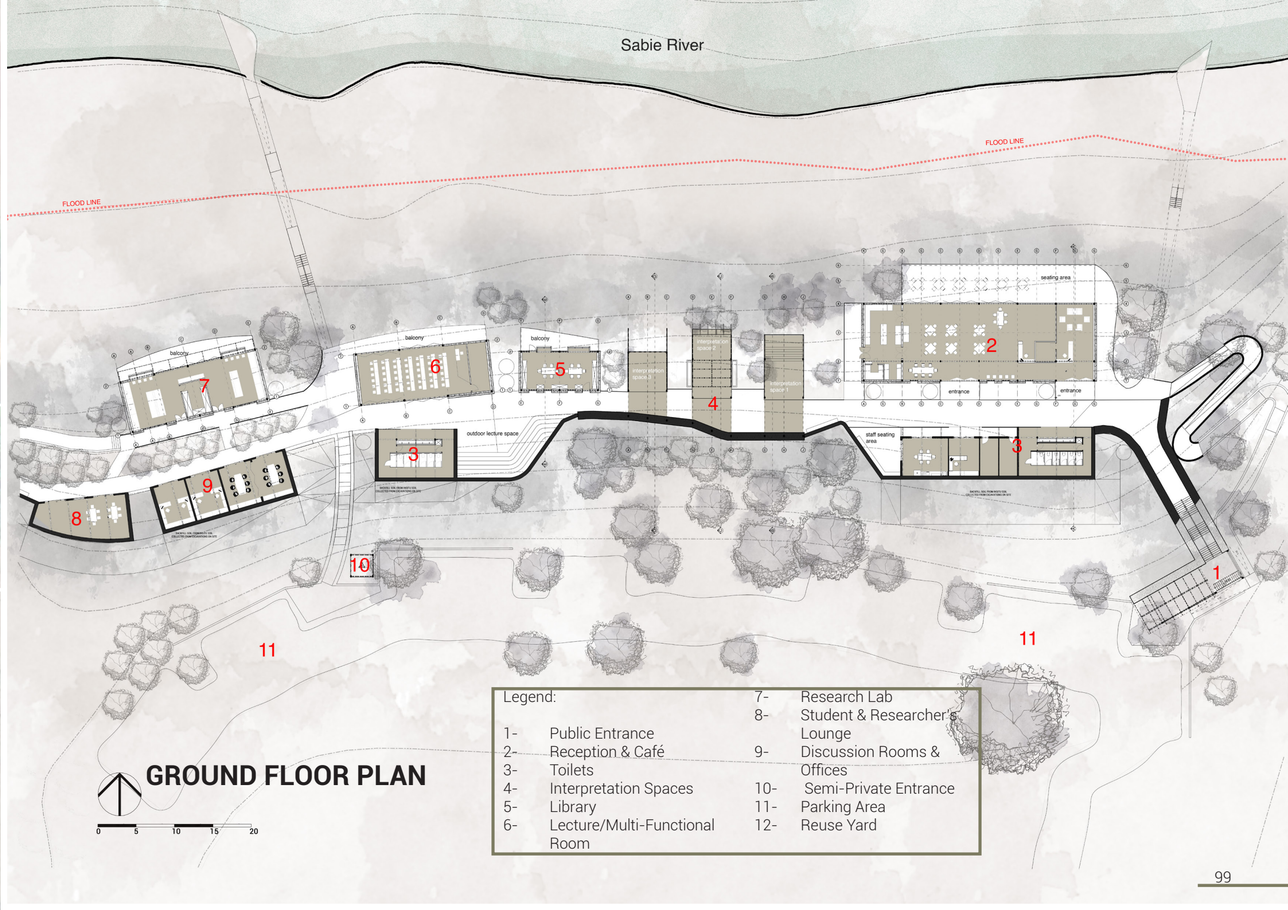


Fig. 5.1: Image of the riparian zone on the proposed site looking up towards the ridgeline (Author, 2021).





SITE PLAN



GROUND FLOOR PLAN

Legend:

1- Public Entrance
2- Reception & Café
3- Toilets
4- Interpretation Spaces
5- Library
6- Lecture/Multi-Functional Room
7- Research Lab
8- Student & Researcher's Lounge
9- Discussion Rooms & Offices
10- Semi-Private Entrance
11- Parking Area
12- Reuse Yard



Fig. 5.2: View of the welcome centre and cafe from the observation tower (Author, 2021).



Fig. 5.3: View of the research centre from the railway bridge (Auhtor, 2021).



Fig. 5.4: Southern view of the welcome centre and cafe (Author, 2021).



Fig. 5.5: View of the welcome centre and cafe from the eastern walkway towards the river (Author, 2021).



Fig. 5.6: View of the railway from the cafe viewing deck (Auhtor, 2021).

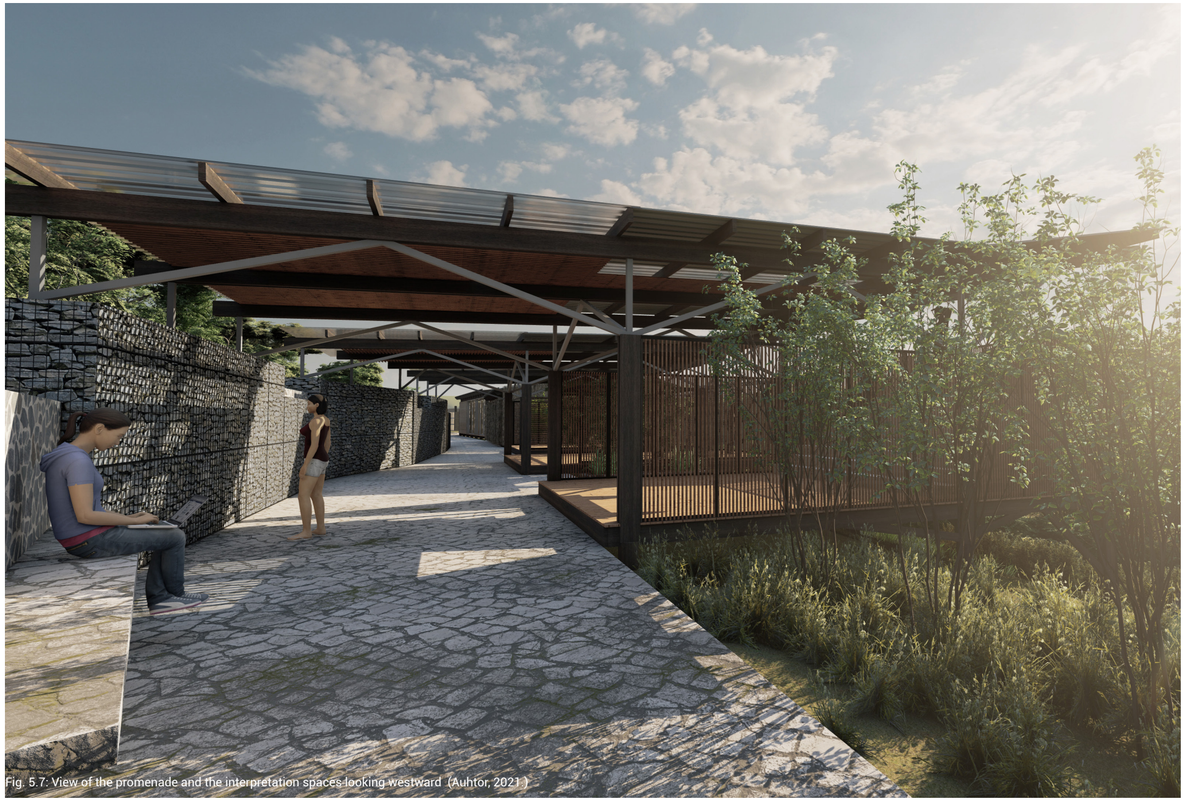


Fig. 5.7: View of the promenade and the interpretation spaces looking westward (Auhtor, 2021).



Fig. 5.8: The bush interpretation space (Auhtor, 2021).



Fig. 5.9: View of the promenade looking eastward toward the cafe from the interpretaion space (Auhtor, 2021).



Fig. 5.10: North-western view of the library space (Author, 2021).v



Fig. 5.11: Interior view of the library space (Author, 2021).



Fig. 5.12: North-Eastern view of the interpretation spaces (Author, 2021).



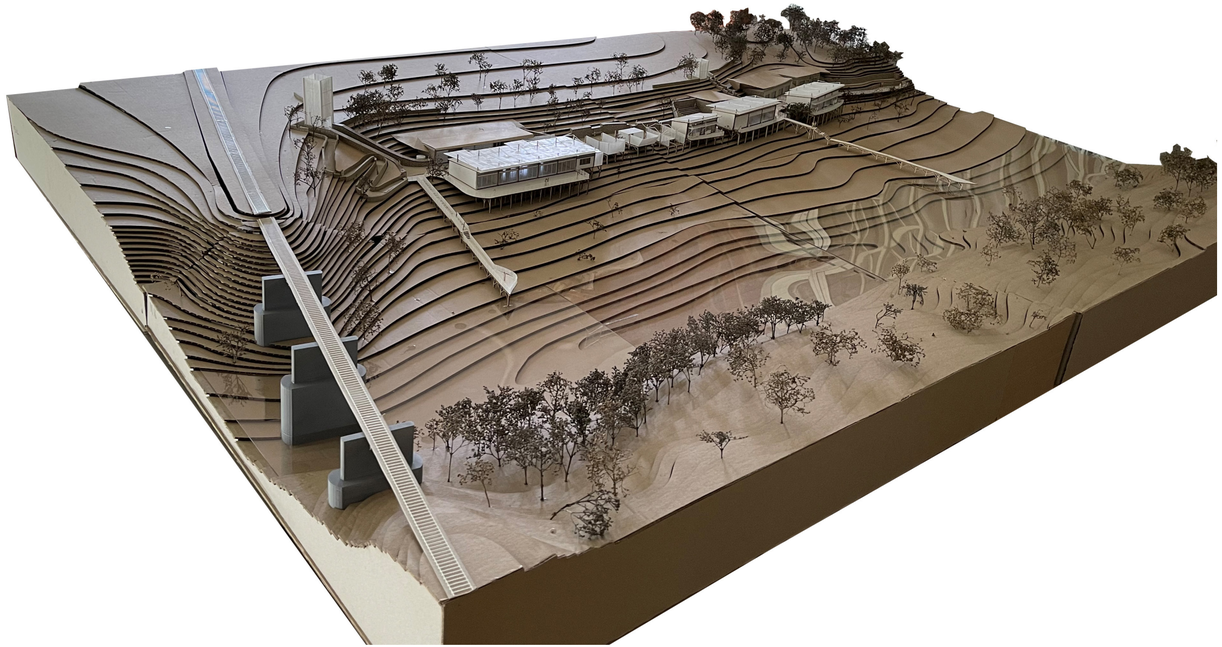
Fig. 5.13: North-Western view of the interpretation spaces (Author, 2021).

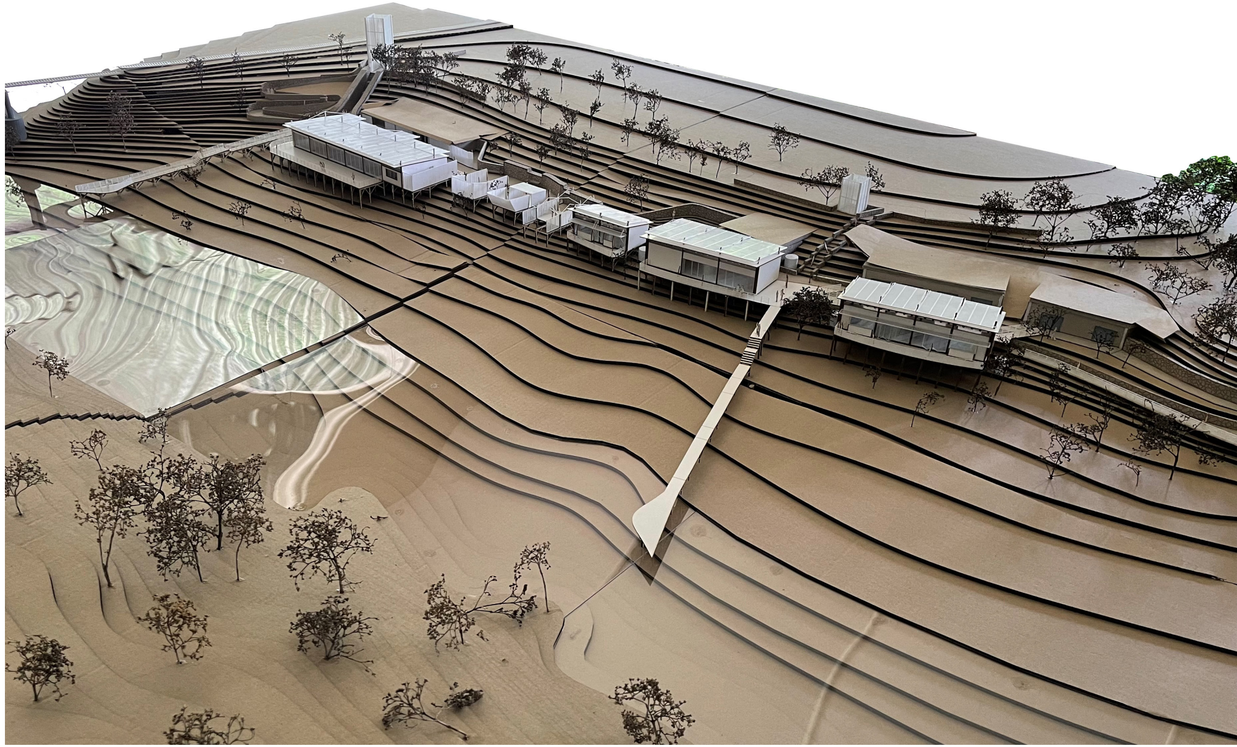


Fig. 5.14: Perspective view looking towards the river in the bush interpretation space (Author, 2021).

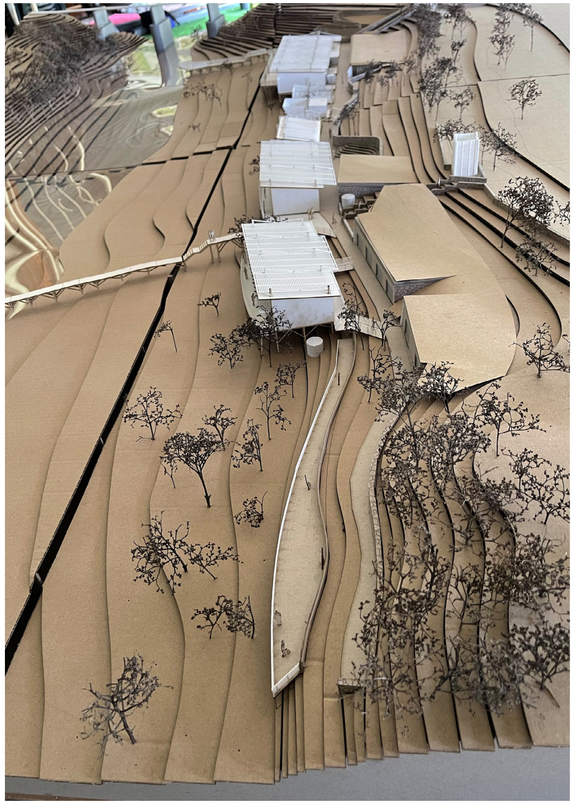


Fig. 5.15: Perspective view looking towards the river in the reed interpretation space (Author, 2021).



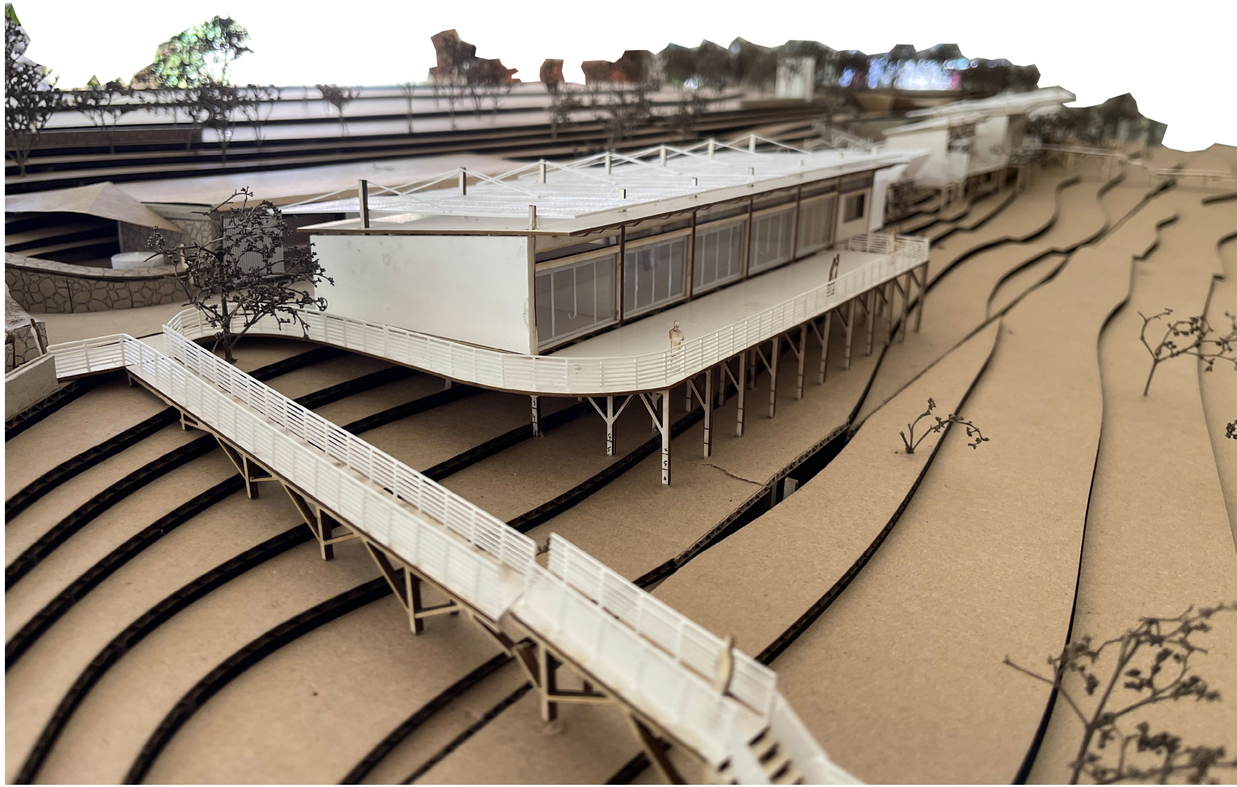


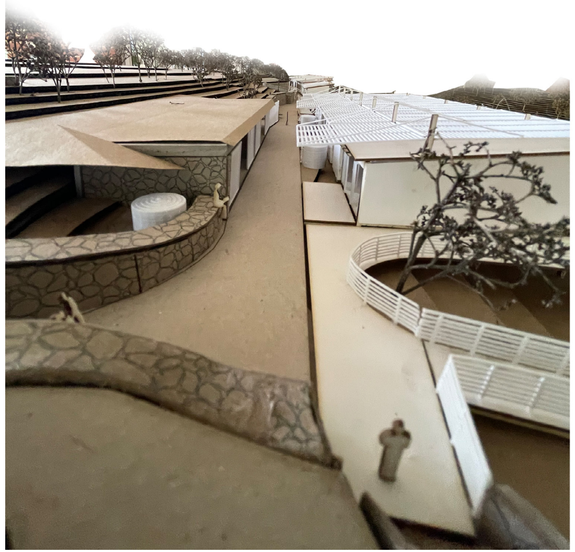




















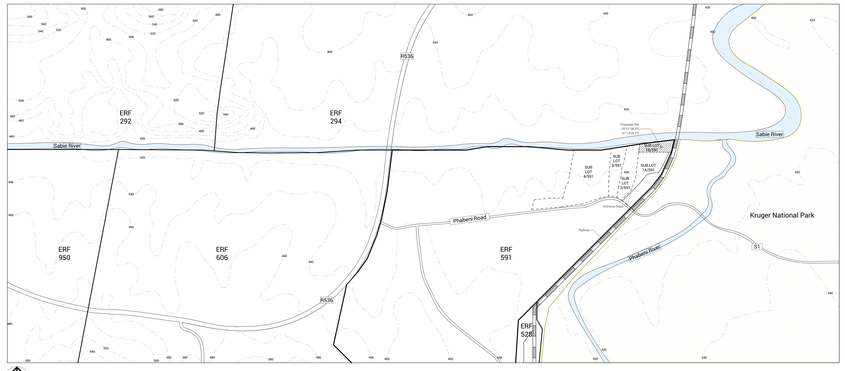




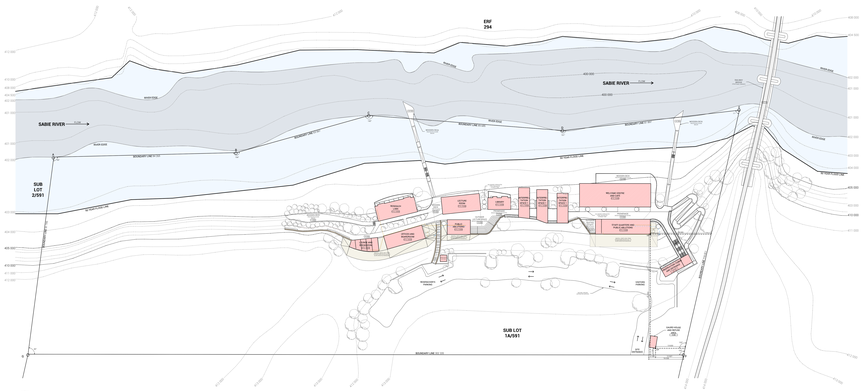








LOCALITY PLAN
SCALE 1:10 000 @ A0



SITE PLAN
SCALE 1:500 @ A0

General Notes **ARCHICAD EDUCATION VERSION**

DRAWING NOTES IN THE SPECIFICATIONS READ AND PERFECTURAL ELEMENTS NOT SHOWN ON ARCHITECTURAL DRAWINGS

All details shown on the drawings are only a guideline and the Contractor is to work out all details shown on the drawings in conjunction with the Architectural Drawings and Specifications.

The Architect accepts no responsibility for any discrepancies in the drawings.

Contractor to check all dimensions on site before commencing with any work.

Contractor to check the levels on site before commencing with any work.

Figured dimensions are to be taken in preference to scaled dimensions.

Contractor to verify all dimensions on site and report any discrepancies in writing to the Architect before proceeding with the work.

Contractor to be responsible for all setting out dimensions on site and shall agree same with Architect before proceeding with the work.

NOTE: Specifications, as contained in general preliminary notes only, have been copied in part from standard specifications and may contain clauses not applicable to this contract. Refer to Architect's specifications for correct and complete information.

Revisions

Rev.	Description	Date

Drawing Notes:

Drawing No:

UNIVERSITY OF THE FREE STATE
DEPARTMENT OF ARCHITECTURE
UNIVERSITEIT VAN DIE VRYSTAAT
DEPARTEMENT ARGITEKTUUR
UFS·UV
BOTHO UNIVERSITY
BOTSWANA
Department of Architecture, Architecture Building
Dean Street, 205 Nelson Mandela Avenue, Park Area, Bo 00a0124 Botho Main

DISCOVERING NATURE'S FLUX
RIPARIAN RESEARCH AND DISCOVERY CENTRE
PROPOSED NEW DEVELOPMENT at Phabeni Road,
Mkumbella,Mpumalanga, 1242, South Africa

LOCALITY PLAN + SITE PLAN

Building Number

Ref. Number	2021	Drawn By	Mohammed Mukhtar
Scale (when printed on A1)	1:500 / NOTE TO DRAWING 1:10,0	Studio Number	2014E69(26)
Date	2021/12/01	Checked By	
UFS Drawing Number	WORKING DRAWINGS A100.0	Rev. Number	

General Notes **ARCHICAD EDUCATION VERSION**

DRAWING NOTES IN THE SPECIFICATIONS READ AND PERFECTURAL ELEMENTS NOT SHOWN ON ARCHITECTURAL DRAWINGS

All details shown on the drawings are only a guideline and the Contractor is to work out all details shown on the drawings in conjunction with the Architectural Drawings and Specifications.

The Architect accepts no responsibility for any discrepancies in the drawings.

Contractor to check all dimensions on site before commencing with any work.

Contractor to check the levels on site before commencing with any work.

Figured dimensions are to be taken in preference to scaled dimensions.

Contractor to verify all dimensions on site and report any discrepancies in writing to the Architect before proceeding with the work.

Contractor to be responsible for all setting out dimensions on site and shall agree same with Architect before proceeding with the work.

NOTE: Specifications, as contained in general preliminary notes only, have been copied in part from standard specifications and may contain clauses not applicable to this contract. Refer to Architect's specifications for correct and complete information.

Revisions

Rev.	Description	Date

Drawing Notes:

Drawing No:

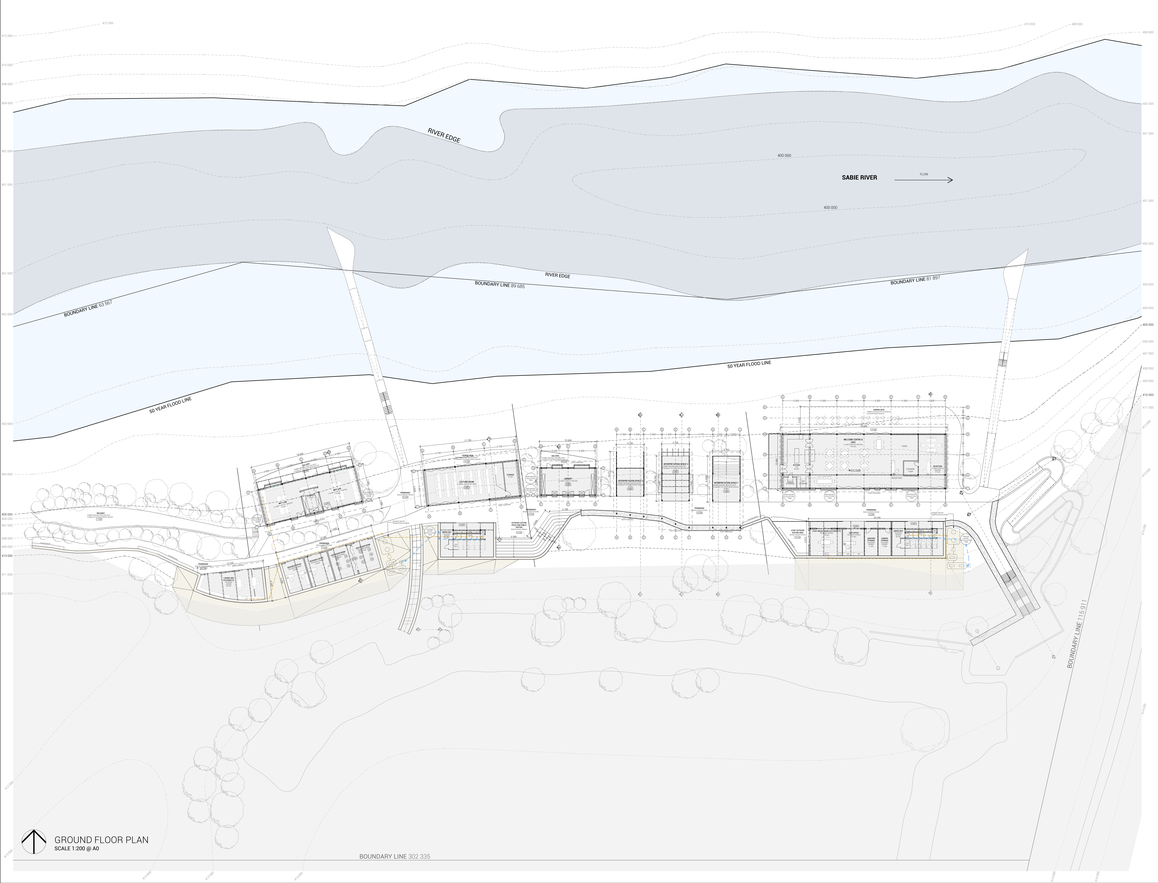
UNIVERSITY OF THE FREE STATE
DEPARTMENT OF ARCHITECTURE
UNIVERSITEIT VAN DIE VRYSTAAT
DEPARTEMENT ARGITEKTUUR
UFS·UV
BOTHO UNIVERSITY
BOTSWANA
Department of Architecture, Architecture Building
Dean Street, 205 Nelson Mandela Avenue, Park Area, Bo 00a0124 Botho Main

DISCOVERING NATURE'S FLUX
RIPARIAN RESEARCH AND DISCOVERY CENTRE
PROPOSED NEW DEVELOPMENT at Phabeni Road,
Mkumbella,Mpumalanga, 1242, South Africa

GROUND FLOOR PLAN

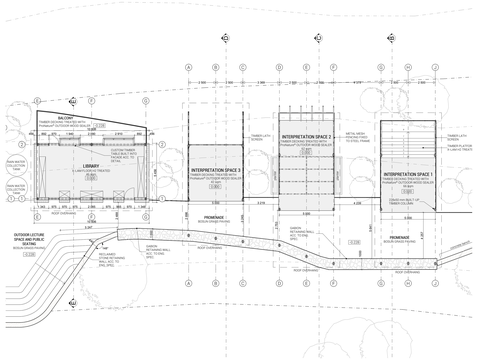
Building Number

Ref. Number	2021	Drawn By	Mohammed Mukhtar
Scale (when printed on A1)	1:200 / NOTE TO DRAWING 1:10,0	Studio Number	2014E69(26)
Date	2021/12/01	Checked By	
UFS Drawing Number	WORKING DRAWINGS A100.1	Rev. Number	

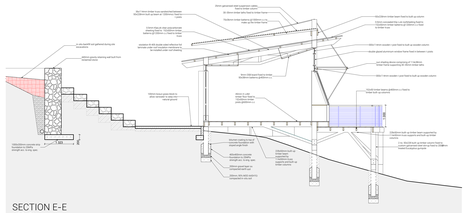


GROUND FLOOR PLAN
SCALE 1:200 @ A0

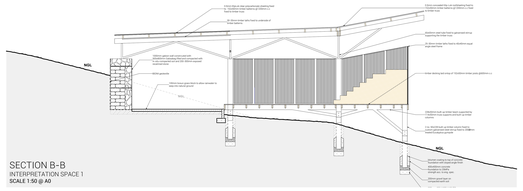

RIVER EDGE
SABIE RIVER
FLOW
400 000
SABIE RIVER
FLOW
400 000
BOUNDARY LINE ST 007
BOUNDARY LINE 007-005
RIVER EDGE
BOUNDARY LINE ST 007
50 YEAR FLOOD LINE
50 YEAR FLOOD LINE
WELCOME CENTRE & CAFE
KITCHEN
STAFF OUTDOOR EATING AREA
STAFF BREAK ROOM & KITCHENETTE
CAFE OFFICE
JANITORS STORAGE
GARDEN STORAGE
VERGED WC
RECEPTION
PROMENADE
ENTRANCE
ENTRANCE
PROMENADE
VIEWING DECK
TIMBER PARAPET WALL WITH SLATTED INFILL
TIMBER PARAPET WALL WITH SLATTED INFILL
TIMBER PARAPET WALL WITH SLATTED INFILL
CONCRETE RETAINING WALL WITH TILING
CONCRETE RETAINING WALL WITH TILING
BACKFILL SOIL FROM INSITU SOIL COLLECTED FROM EXCAVATIONS ON SITE
BOUNDARY LINE 302 335
BOUNDARY LINE 302 331
WORKER'S CHANGE
WORKER'S TOILETS
WORKER'S TOILETS
WORKER'S CHANGE
LOWER ENTRANCE
LOWER ENTRANCE
LOWER EXPERIENCE
LOWER EXPERIENCE
WORKER'S CHANGE
WORKER'S TOILETS
WORKER'S TOILETS
WORKER'S CHANGE
WELCOME CENTRE & CAFE
STAFF SLEEPING / TRAYS
STAFF SLEEPING / TRAYS
WORKSHOP
WORKSHOP
WORKSHOP



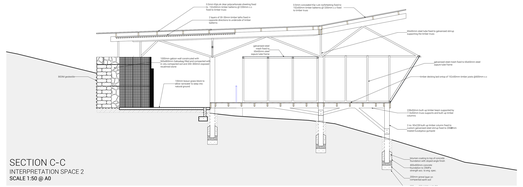
INTERPRETATION SPACES
GROUND FLOOR PLAN
SCALE 1:100 @ A0



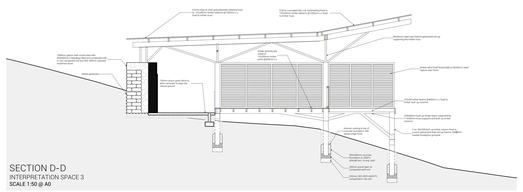
SECTION E-E
LIBRARY
SCALE 1:50 @ A0



SECTION B-B
INTERPRETATION SPACE 1
SCALE 1:50 @ A0



SECTION C-C
INTERPRETATION SPACE 2
SCALE 1:50 @ A0



SECTION D-D
INTERPRETATION SPACE 3
SCALE 1:50 @ A0

General Notes **ARCHICAD EDUCATION VERSION**

DRAWING NOTES IN THE ARCHITECT'S DRAWING ARE FROM PICTURE CLEARLY NOT TO BE SCALED FOR DIMENSIONS

All dimensions shown on the drawings are in millimetres unless otherwise stated. All dimensions should be checked on site before the commencement of any work or the preparation of shop drawings. Any discrepancies must be brought to the notice of the Architect. The Contractor is responsible for the correct setting out of the building in line with particular reference to boundaries and datum lines.

Figured dimensions are to be taken in preference to scaled dimensions.

The Contractor is responsible for the correct setting out of the building in line with particular reference to boundaries and datum lines.

Figured dimensions are to be taken in preference to scaled dimensions.

All dimensions are in millimetres unless otherwise stated.

All dimensions are to be checked on site before the commencement of any work or the preparation of shop drawings. Any discrepancies must be brought to the notice of the Architect.

NOTE: Specifications are based on general performance criteria only. Any proprietary names mentioned are for the purpose of establishing a standard of quality and performance required only.

Revisions

Rev	Description	Date

Drawing Notes:

Drawing Key

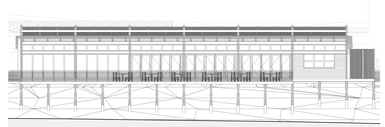
UNIVERSITY OF FREE STATE
UNIVERSITEIT VAN DIE VRYSTAAT
YUNIBESITHI YA FREISTATA
UFS-UV
NATURAL AND AGRICULTURAL SCIENCES
MANAGEMENT, LAW, THEOLOGY & ECONOMIC SCIENCES
Department of Architecture, Architecture Building
Case: Green, 205 Nelson Mandela Avenue, Park West, BLOEMFONTEIN 9301

DISCOVERING NATURE'S FLUX
RIPARIAN RESEARCH AND DISCOVERY CENTRE
PROPOSED NEW DEVELOPMENT at Phaboni Road, Mbombela, Mpumalanga, 1240, South Africa

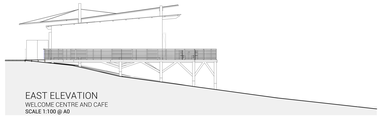
Drawing Title
INTERPRETATION SPACES + LIBRARY
GROUND FLOOR PLAN & SECTIONS

Drawing Number

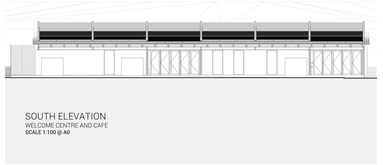
Ref. Number	2021	Drawn By	Mohammed Mukhtar
Title	1:50/PAPER TO DRAWING SCALE	Student Number	2014035251
Date	2021/12/01	Checked By	
UFS Drawing Number	WORKING DRAWINGS A4E2	Rev. Number	



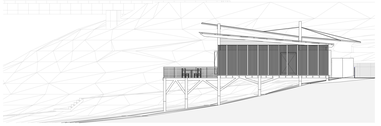
NORTH ELEVATION
WELCOME CENTRE AND CAFE
SCALE 1:100 @ A0



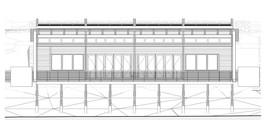
EAST ELEVATION
WELCOME CENTRE AND CAFE
SCALE 1:100 @ A0



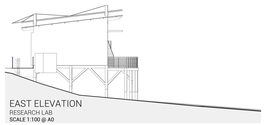
SOUTH ELEVATION
WELCOME CENTRE AND CAFE
SCALE 1:100 @ A0



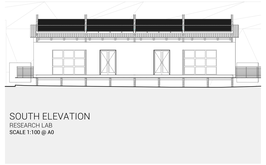
WEST ELEVATION
WELCOME CENTRE AND CAFE
SCALE 1:100 @ A0



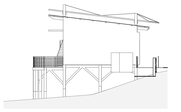
NORTH ELEVATION
RESEARCH LAB
SCALE 1:100 @ A0



EAST ELEVATION
RESEARCH LAB
SCALE 1:100 @ A0



SOUTH ELEVATION
RESEARCH LAB
SCALE 1:100 @ A0



WEST ELEVATION
RESEARCH LAB
SCALE 1:100 @ A0

General Notes **ARCHICAD EDUCATION VERSION**

DRAWING NOTES IN THE ARCHITECT'S DRAWING ARE FROM PICTURE CLEARLY NOT TO BE SCALED FOR DIMENSIONS

All dimensions shown on the drawings are in millimetres unless otherwise stated. All dimensions should be checked on site before the commencement of any work or the preparation of shop drawings. Any discrepancies must be brought to the notice of the Architect. The Contractor is responsible for the correct setting out of the building in line with particular reference to boundaries and datum lines.

Figured dimensions are to be taken in preference to scaled dimensions.

The Contractor is responsible for the correct setting out of the building in line with particular reference to boundaries and datum lines.

Figured dimensions are to be taken in preference to scaled dimensions.

All dimensions are in millimetres unless otherwise stated.

All dimensions are to be checked on site before the commencement of any work or the preparation of shop drawings. Any discrepancies must be brought to the notice of the Architect.

NOTE: Specifications are based on general performance criteria only. Any proprietary names mentioned are for the purpose of establishing a standard of quality and performance required only.

Revisions

Rev	Description	Date

Drawing Notes:

Drawing Key

UNIVERSITY OF FREE STATE
UNIVERSITEIT VAN DIE VRYSTAAT
YUNIBESITHI YA FREISTATA
UFS-UV
NATURAL AND AGRICULTURAL SCIENCES
MANAGEMENT, LAW, THEOLOGY & ECONOMIC SCIENCES
Department of Architecture, Architecture Building
Case: Green, 205 Nelson Mandela Avenue, Park West, BLOEMFONTEIN 9301

DISCOVERING NATURE'S FLUX
RIPARIAN RESEARCH AND DISCOVERY CENTRE
PROPOSED NEW DEVELOPMENT at Phaboni Road, Mbombela, Mpumalanga, 1240, South Africa

Drawing Title
ELEVATIONS

Drawing Number

Ref. Number	2021	Drawn By	Mohammed Mukhtar
Title	1:50/PAPER TO DRAWING SCALE	Student Number	2014035251
Date	2021/12/01	Checked By	
UFS Drawing Number	WORKING DRAWINGS A3E1.1	Rev. Number	

CHAPTER

06

REFLECTION AND REFERENCES

REFLECTION

Reflecting on the success of the project is a subjective process, and in a biased opinion, I think I have managed to successfully approach the design with an ecologically ethical mindset that focused on expressing the unsung voice of the riparian zone within the design. the design developed substantially in terms of materiality and tectonics. The realisation of the morphology directly relating to the tectonic make-up of the buildings become a very important focal point in addressing the design according to the formative ideas. However, due to my personality, I do tend to focus on a lot of the negatives in order to define points for improvement. The design proved to be more complex than I originally anticipated. The technical resolution of the design still needs to be addressed in terms of sustainability and material specifications to a large extent. The current design is still unresolved in terms of the overall scheme and the most challenging part of this design was generating a layout of the various buildings on the site in a manner that was not too imposing on the natural landscape. I think there is still room for further improvement in this regard. The tower elements that were always referred to needs urgent attention as I feel that they may play an important role in the identity of this research centre, approaching them as beacons of environmental knowledge relating to the notion of space for reflective meditation.

This year was a roller coaster of trials and challenges, both mentally and physically. The architectural knowledge gained throughout the year will not be something I will take for granted. The theoretical discourse of the dissertation provided me with insight into the way we can perceive the world in a different light, that it's not too late to consider the environment and what it has to offer if we can approach our actions with it more ethically. The mindset that was generated theoretically through this project is something I think will serve as a base for me going forward into my career.

WORKS CITED SECTION

Amoretti, A. 2017. The Noble Simplicity of Peter Zumthor's Allmannajuvet Zinc Mine Museum. Available: https://www.archdaily.com/803691/the-noble-simplicity-of-peter-zumthors-allmannajuvet-zinc-mine-museum [2021, October 04].

Architype. 2015. Architype / The Enterprise Centre / The UK's Leading Passivhaus, Sustainable Architects. Available from: https://architype.co.uk/project/the-enterprise-centre-uea/ [Accessed 7 October 2021].

Ayres, P. 2012. *Continuous riparian vegetation change following a large, infrequent flood along the Sabie River, Kruger National Park*. B.Sc. Honours in Environmental Sciences at the North-West University. North-West University. Available from: http://dspace.nwu.ac.za/bitstream/handle/10394/8643/Ayres_P.pdf?isAllowed=y&sequence=1 [Accessed 6 October 2021].

Ball, V. 2015. Available from: https://slideplayer.com/slide/5738602/ [Accessed 1 October 2021].

Barnard, S, Morgenthal, TL, Stolz, M & Venter, A. 2021. Impact of land-use and flow conditions on the phytoplankton of the Sabie River, South Africa. *Bothalia - African Biodiversity & Conservation*. 51(1):1–18. doi.org/10.38201/btha.abc.v51.i1.6.

Breen, C, Dent, M, Jaganyi, J, Madikizela, B, Maganbeharie, J, Ndlovu, A, O'Keeffe, J, Rogers, K, et al. 2000. *The Kruger National Park Rivers Research Programme: final report : incorporating the contract report and the review report. Pretoria: Water Research Commission*. Available from: http://www.wrc.org.za/wp-content/uploads/mdocs/TT130-00.pdf [Accessed 27 August 2021].

Clingerman, F, Utsler, D, Drenthen, M & Treanor, B Eds. 2014. *Interpreting nature: the emerging field of environmental hermeneutics*. 1. ed ed. (Groundworks: ecological issues in philosophy and theology). New York, NY: Fordham Univ. Press.

Creative Commons. 2010. English: Population density map of Mpumalanga province of South Africa, from the 2001 Census, at the "Subplace" level. Available: https://commons.wikimedia.org/wiki/File:Mpumalanga_2001_population_density_map.svg [2021, October 09].

Cutieru, A. 2020. Architecture and Nature: A Framework for Building in Landscapes. Available from: https://www.archdaily.com/950043/architecture-and-nature-a-framework-for-building-in-landscapes [Accessed 4 October 2021].

Delius, P & Hay, M. 2009. *MPUMALANGA an illustrated history*. Saxonwold, Johannesburg, South Africa: The Highveld Press. Available from: http://www.mpumalanga.gov.za/mpumalangabook/pdf.html [Accessed 22 July 2021].

Drenthen, M. 2016. *Environmental Hermeneutics and the Meaning of Nature*. V. 1. S.M. Gardiner & A. Thompson, Eds. Oxford University Press. doi.org/10.1093/oxfordhb/9780199941339.013.15.

Frandsen, R. 2019. *Kruger National Park Map*. Somerset West: Honeyguide Publications cc.

Graham, I. n.d. Hush. The Landreader Project. Available from: http://www.thelandreader.com/glossary/hush [Accessed 2 October 2021].

Huyberechts, D. 2020. Witklipfontein Eco Lodge / GLH Architects. Available: https://www.archdaily.com/935202/witklipfontein-eco-lodge-glh-architects [2021, October 09].

Huyberechts, X. 2018. Witklipfontein Eco Lodge / GLH Architects. Available from: https://www.archdaily.com/935202/witklipfontein-eco-lodge-glh-architects [Accessed 7 October 2021].

Ilhardt, B, Verry, E & Palik, B. 2000. *Defining Riparian Areas*. The University of New Hampshire. Available from: https://extension.unh.edu/sites/default/files/migrated_unmanaged_files/Resource006641_Rep9557.pdf [Accessed 17 September 2021].

IUCN, (International Union for Conservation of Nature). n.d. Available from: https://www.iucn.org/sites/dev/files/import/downloads/sabie.pdf [Accessed 6 October 2021].

Joubert, S. 2007. *The Kruger National Park: A History*. V. 1. Johannesburg: Hugh Branching (Pty) Ltd.

Kruger, L. 2021. (Ecological Researcher and Facility Manager of the SSLI Campus). Personal interview about the structural and design approach SSLI campus and the need for centres like this in the region). Mpumalanga, 25th February.

Louw, M. 2016. *The architectural promenade and the perception of time*. 32(2):12–33. Available from: https://www.researchgate.net/publication/342657325 [Accessed 24 September 2021].

Manat, S. 2017. Photo of a Man Sitting Under the Tree · Free Stock Photo. Available: https://www.pexels.com/search/man%20and%20nature/ [2021, October 04].

MapSof. 2021. South Africa Topo Island - MapSof.net. Available: https://www.mapsof.net/south-africa/south-africa-topo-island [2021, July 27].

Matsika, R. 2011. *The conservation status of temperate grasslands in southern Africa*. Grassroots. 11:17–23.

Mbombela Municipality. 2018. Available from: https://www.mbombela.gov.za/2018.html [Accessed 5 October 2021].

MEGA. 2020. AGRICULTURE. Available from: http://www.mega.gov.za/mega-key-sectors/agriculture-2/ [Accessed 23 July 2021].

MEGDP. 2011. Available from: http://www.dedtmpumalanga.gov.za/sites/default/files/documents/MEGDPv4.pdf [Accessed 23 July 2021].

Meskell, L. 2012. *The nature of heritage : the new South Africa*. First ed. West Sussex, UK: John Wiley & Sons, Inc.

Messam, S. 2019. Hush. Available from: https://www.stevemessam.co.uk/hush [Accessed 2 October 2021].

Mpumalanga.gov. 2020. About Mpumalanga Province. Available from: http://www.mpumalanga.gov.za/about/province.htm [Accessed 23 July 2021].

NsansiTrust. 2016. The SSLI Concept. Available from: http://www.nsasani.co.za/the-ssli-concept [Accessed 31 May 2021].

Otten, K. 2016. WITS Rural Facility. Available from: https://www.kateottenarchitects.com/projects/wits_rural_facility.html [Accessed 7 October 2021].

OTS, (Organization for Tropical Studies). n.d. Skukuza Research Station - Organization for Tropical Studies. Available: https://tropicalstudies.org/portfolio/skukuza-research-station/ [2021, October 09].

Passivehaus Trust. n.d. Passivehaus Trust - The UK Passive House Orginisation. Available from: https://www.passivhaustrust.org.uk/projects/detail/?cId=87 [Accessed 7 October 2021].

Pellauer, D & Dauenhauer, B. 2021. *The Stanford Encyclopedia of Philosophy*. Spring 2021 ed. E. Zalta, Ed. Metaphysics Research Lab, Stanford University. Available from: https://plato.stanford.edu/archives/spr2021/entries/ricoeur/ [Accessed 25 May 2021].

REB Provincial Review. 2016. Available from: https://www.tips.org.za/images/The_REB_Provincial_Review_2016_Mpumalanga.pdf [Accessed 23 July 2021].

Relander, C. 2017. We Are Nature - 2017. Available: https://www.christofferrelander.com/we-are-nature-v [2021, October 03].

Relander, C. 2020. We Are Nature - 2020. Available: https://www.christofferrelander.com/we-are-nature-vi [2021, October 03].

Ricoeur, P. 1994. *Oneself as Another*. Translated by Kathleen Blamey. Chicago: The University of Chicago Press.

SANParks. 2015. Available: https://www.sanparks.org/docs/groups_tenders/2015/conti-suits/sanparks-green-logo.pdf [2021, September 16].

Sara, M. 2017. Unique thatch cladding system and natural materials for an inspiring low-carbon Enterprise Centre. Available: https://passivestrategiesforsustainablebuildings.wordpress.com/2017/01/02/unique-thatch-cladding-system-and-natural-materials-for-an-inspiring-low-carbon-enterprise-centre/ [2021, October 09].

Schroeder, HW. 1996. Ecology of the Heart: Understanding How People Experience Natural Environments. In: A. W. Ewert (ed.). *Natural Resource Management: the Human Dimension*. Boulder, CO: Westview Press. pp. 13-27. Available from: https://www.fs.usda.gov/treesearch/pubs/13263 [Accessed 19 April 2021].

Schroeder, HW. 2007. Place experience, gestalt, and the human–nature relationship. *Journal of Environmental Psychology*. 27(4):293–309. doi.org/10.1016/j.jenvp.2007.07.001.

Slessor, C. 2017. Allmannajuvet Zinc Mine Museum in Norway by Peter Zumthor: 'The progeny of an artist-architect'. Available from: https://www.architectural-review.com/buildings/allmannajuvet-zinc-mine-museum-in-norway-by-peter-zumthor-the-progeny-of-an-artist-architect [Accessed 4 October 2021].

Smith, A. 2015. Case study - The Enterprise Centre - *CIBSE Journal*. (2015):4. Available: http://portfolio.cpl.co.uk/CIBSE/201509/uea-passivhaus/ [2021, October 09].
South Africa-Info. n.d. Mpumalanga Information Directory. Available from: https://www.south-africa-info.co.za/country/province/6/mpumalanga [Accessed 23 July 2021].

southafrica.co.za. 2021. Factors Influencing Temperature. Available from: https://southafrica.co.za/factors-influencing-temperature.html [Accessed 25 July 2021].

StepSA. 2021. stepSA - Spatial Temporal Evidence for Planning in South Africa. Available: http://stepsa.org/climate_koppen_geiger.html [2021, October 09].

Sudlow, BE. 2008. *Birds as bio-indicators of the ecological integrity of the Sabie River, Mpumalanga*. Thesis. University of Johannesburg. Available from: https://ujcontent.uj.ac.za/vital/%20access/manager/Repository/uj:12387?view=null&f0=sm_subject%3A"Birds+ecology"&sort=sort_ss_title+asc [Accessed 6 October 2021].

TASA, TA of SA. 2016. Available from: http://www.sa-thatchers.co.za/wp-content/uploads/2016/04/GUIDE-TO-THATCH-CONSTRUCTION-IN-SOUTH-AFRICA1.pdf [Accessed 7 October 2021].

Tenenbaum, P. 2019. Exploring Steve Messam's Hush. Available: https://www.fashionvoyeur.co.uk/2019/08/05/steve-messams-hush/ [2021, October 03].

The Construction Index. 2014. Thatchers make comeback to provide new take on modern methods of construction. Available from: https://www.theconstructionindex.co.uk/news/view/thatchers-make-comeback-to-provide-new-take-on-modern-methods-of-construction [Accessed 7 October 2021].

Thirion, C & Jafta, N. 2019. Available from: https://www.dws.gov.za/iwqs/rhp/state_of_rivers/annual/State_of_Water_2017_2018_hydro_year_updated_FINAL_2019_10_11_web.pdf [Accessed 6 October 2021].

Twine, W. 2021. (Ecological Researcher and Facility Manager of the WITS rural Facility). Personal interview about the WITS rural facility and the effects of the rural settlements on conservation in the area). Mpumalanga, 24th February.

University of Mpumalanga. 2021. Available: https://www.ump.ac.za/ [2021, September 16].

WorldWeatherOnline. 2021. Hazyview Monthly Climate Averages. Available: https://www.worldweatheronline.com/hazyview-weather/mpumalanga/za.aspx [2021, October 09].

turnitin

Similarity

3%

Digital Receipt

This receipt acknowledges that Turnitin received your paper. Below you will find the receipt information regarding your submission.

The first page of your submissions is displayed below.

Submission author:	Mohammed Mukhtar
Assignment title:	Final Document Submission
Submission title:	plagiarism test
File name:	M_Mukhtar_Prelim_Submission_compressed.pdf
File size:	19.7M
Page count:	130
Word count:	27,073
Character count:	143,759
Submission date:	14-Oct-2021 06:44AM (UTC+0200)
Submission ID:	1673496181



Copyright 2021 Turnitin. All rights reserved.