# Edged on the strange and emerged - Nature's Indigenousness

**An eco-regenerative research Centre, Barberton**



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# Examiners comments



Figure 1: Ecognosis between human and nature (Author, 2022)



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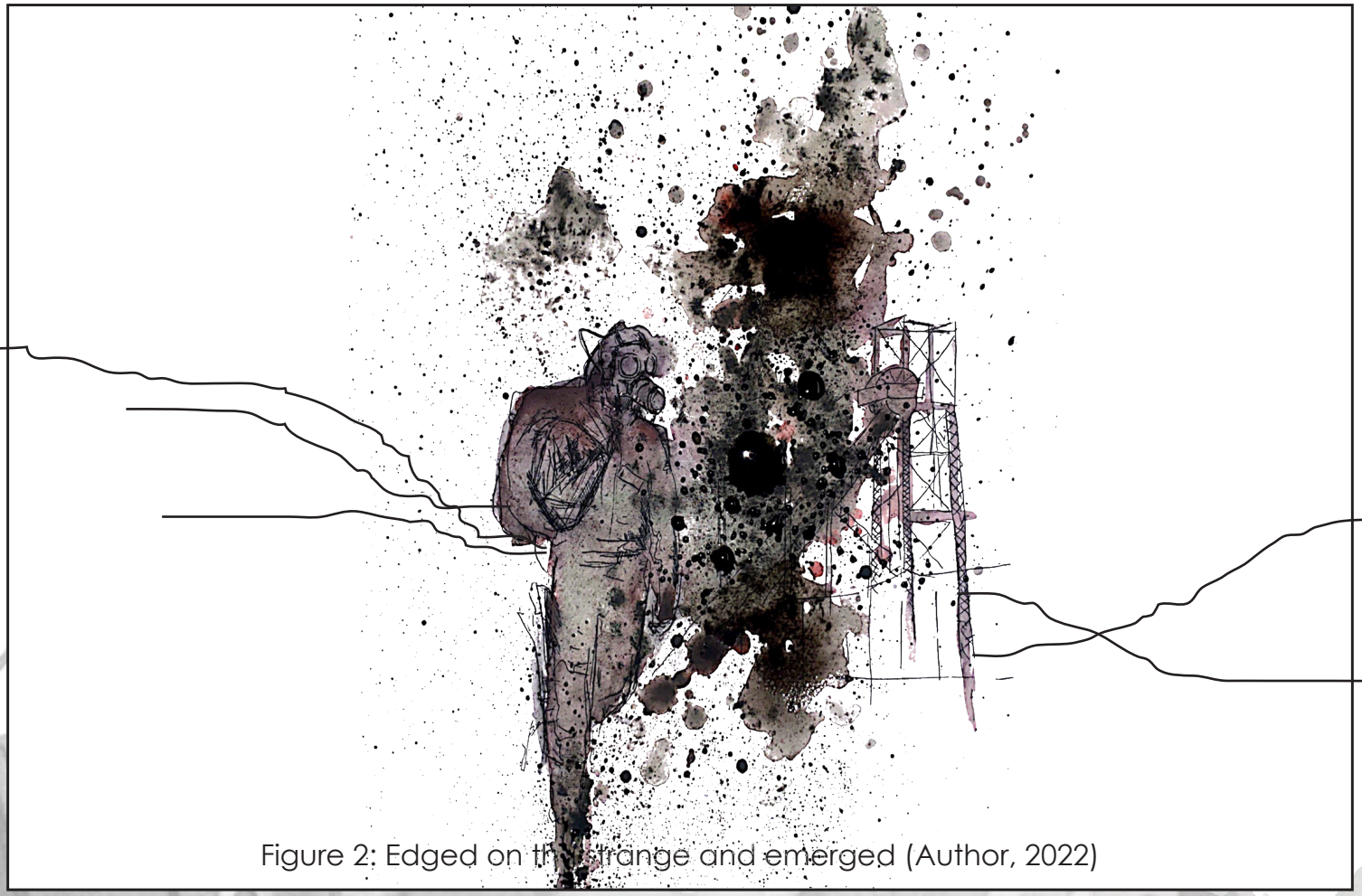


Figure 2: Edged on the strange and emerged (Author, 2022)

Declaration:
This dissertation is submitted in partial fulfillment of the requirements for the degree M.Arch.(Prof). at the University of the Free State. The research in this document is my own work, unless stated otherwise.

# Abstract

This dissertation investigates the architectural design of an Eco-Regenerative Research Centre in Barberton. Two objectives guide the research.

The primary aim of the dissertation project is to accommodate the programmatic needs of the Research Centre. The Research Centre investigates the potential of employing hyper-accumulative plants for landscape rehabilitation after mining. Toxins in the soil are naturally broken down by hyperaccumulative plants, restoring the soil and allowing for landscape regeneration. This process further allows for a more feasible rehabilitation solution through processing these hyperaccumulative plants to extract the metals. This process is known as phytomining.

Apart from functioning as a Research Centre, the Centre also welcomes visiting academics and representatives from the mining industry to observe and learn about the negative impact of mining and the regenerative processes being studied. To this educational purpose, the second aim of the dissertation project is linked: to create a facility that poetically aids in nurturing the experience of being indigenous to nature – not separate from nature. The first aim links to the client's needs, whereas the second aim attempts to link to the client's inherent desire: creating a consciousness of our human indigenousness to nature – put differently: our human embeddedness in the fruits and harm of one natural system. In order to highlight this embeddedness, the design attempts to create awareness of both the harm caused by our anthropocentric condition and the opposite nature-centered condition, where humans are but a participant in the network of nature. Ecognosis is the emerged understanding of the strange and dark motions of our natural world, including our devastation of it (counting the act of mining), which both frightens and enlightens us about our natural kinship with the environment.

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# Introduction

The dissertation investigates the design of an Eco-Regenerative Research Centre in Barberton, while attempting to reach a twofold goal. First, the dissertation project aims to accommodate the programmatic requirements of the research center, which studies natural processes of rehabilitation and regeneration on landscapes devastated by mining.

To this aim, hyperaccumulative plants form the basis, not only of the research center but also of this dissertation's inquiry. Hyperaccumulative plants naturally break down toxins in the soil, rehabilitating the soil and allowing the regeneration of the landscape.

Apart from functioning as a hub for research, the center also invites visiting scholars and representatives from mining houses to observe the regenerative processes explored by the researchers – hoping to create awareness of both the destruction caused by nature and possible solutions addressing these left-behind wastelands.

Here, the notion of our human indigenousness to nature is important. From the preceding, the second aim of the dissertation project is formulated: a design solution, which not only accommodates the practical needs of the client but also assists in cultivating the experience of our indigenousness to nature – the client's desire. On the poetic level, the dissertation endeavors towards a nuanced design, which may allow the occupants and visitors – possibly, spellbound by their emerged anthropogenic state – to experience some cognizance of their inseparableness from nature (figure 3).

To this second aim, the design attempts to continuously move the visitor from its master state, as an hyperobject estranged from and powering over nature, to a mere participant in the master ship of the natural network. Ecognosis defines cognition of the uncanny, sublime, strange, and dark movements within our world and also our destruction within this world (including the act of mining), which both scares us and enlightens our indigenousness to nature.

Reserach question:

How can an architectural intervention assist researchers and visitors to conceive of themselves as the perpetrator and victim of the mining landscape and part of the natural system of things?

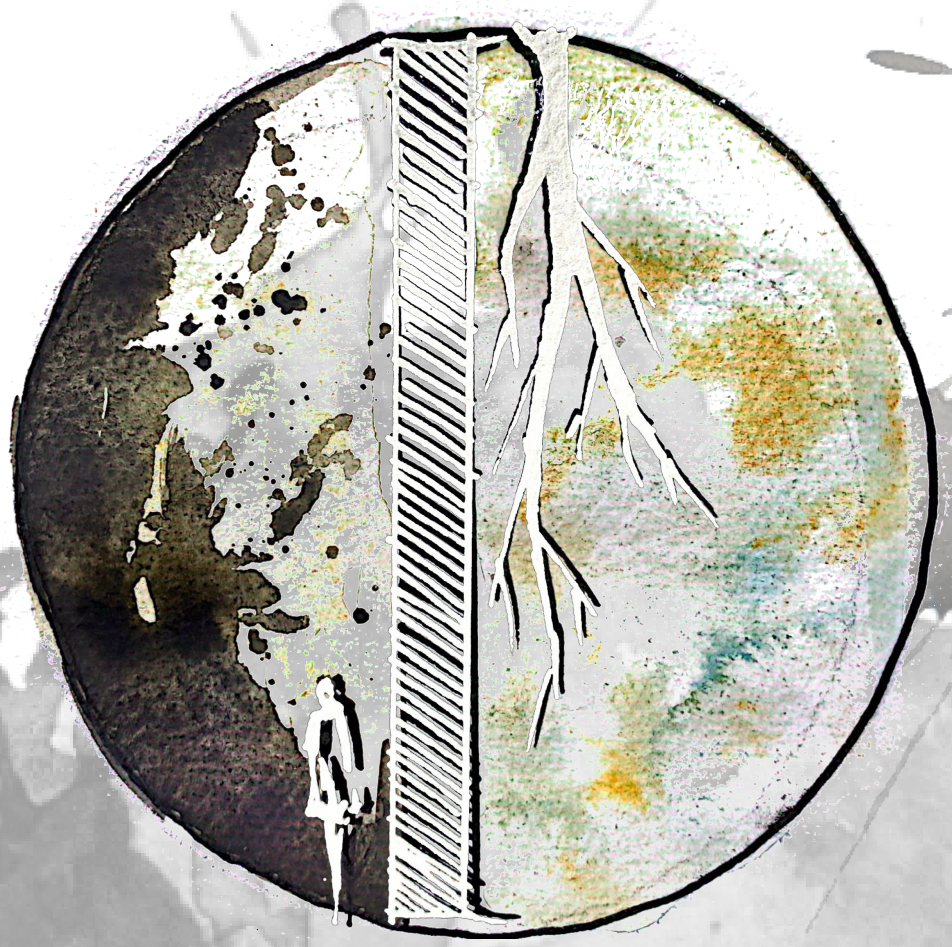


Figure 3: The questionable relationship between humans and the natural system (Author, 2022)

# The dissertation consists of five chapters

**Chapter One** attempts to situate the first aim of this dissertation: determining and satisfying the programmatic needs of the Eco-Regenerative Research Centre. This chapter starts by employing a fictional narrative. By presenting this narrative, the very real potential of an environmental crisis is raised. The necessity of this narrative is based on the findings of the section in chapter two; Danger as a reason to Act and change Actions, to provide an image of the environmental apocalyptic obsolete to create a platform to critically reflect on the future. Utilizing the fictional narrative the dissertation's physical setting is briefly introduced - Chapter Three presents an in-depth analysis of the data and cognitive qualities of the site and broader context.

The context offers several environmental challenges caused by tailings, which are examined to comprehend the potential of various solutions: from current mining rehabilitation to Phytoremediation and Phytomining. As the site of this design dissertation and the impact of mining on its site conditions are related to and representative of a larger impending environmental tragedy, research into natural processes of rehabilitation and regeneration of mining sites is important. The latter study field informs the client's pragmatic needs for research into hyperaccumulative plants and introduces the topic of this dissertation, mine rehabilitation by phytoremediation and phytomining. The chapter concludes with the demarcation of the client's functional program.

Situating the client's greater desire and with it the poetic aim of the project, **Chapter Two** works towards questioning the human condition that is viewed as apart from and in control of nature. To question the human condition cognizance of a nature-centered condition – that is a view of the human as simply a participant in the network of nature – is required. The chapter starts by introducing my first reaction to mining destruction and landscape regeneration, presented as a touchstone, from which three concepts were developed. The concepts introduce the preliminary conceptual ideas, which lead to a literary review and theoretical interpretation of notions related to anthropocentrism and nature-centredness. In an attempt to address the client's larger goal: working with and through nature, this investigation centers on the relationship between humans and nature towards the concept of ecognosis. This chapter further explicates the notion of hyperobjects and reimagines this term, through creative interpretation, within the contexts of mining and mining action. Reflecting on these conceptual and theoretical ideas, the chapter endeavours to identify architectural innovation in terms of dark ecology, concluding with related precedents.

**Chapter Three** analyzes the larger contexts and specific siting of the dissertation project. Site research is both concerned with identifying factual data and subjective and cognitive qualities of the site. In attempting to understand and respond to the site conditions, architectural precedent studies are analyzed. The early steps of the design process are introduced in **Chapter Four** as it moves toward the final design solution. This chapter attempts to prove that the Eco-Regenerative Research Centre responds to the needs and poetic desires of the client, through the combination of research into, reflections on, and creative interpretations of concepts and theories, and design and construction precedents.

# ARCHITECTURAL INTERVENTION

RESEARCH CENTRE:

- RECEPTION
- LABORATORIES
- NURSERIES
- OFFICES
- ARCHIVE/LIBRARY

AUDITORIUM

INDIGENOUS PLEASURE GARDEN

RESEARCH BAR/CAFETERIA:

- KITCHEN
- RESTROOMS
- INDOOR SEATING
- OUTDOOR SEATING
- GREENHOUSE
- BOARDROOM

MINING REHABILITATION :

-PHYTOREMEDIATION
-PHYTOMINING



TOOLS:

- DARK ECOLOGY

- HYPEROBJECTS

- CONSUMER CULTURE

- DANGER AS REASON TO ACT AND CHANGE ACTIONS

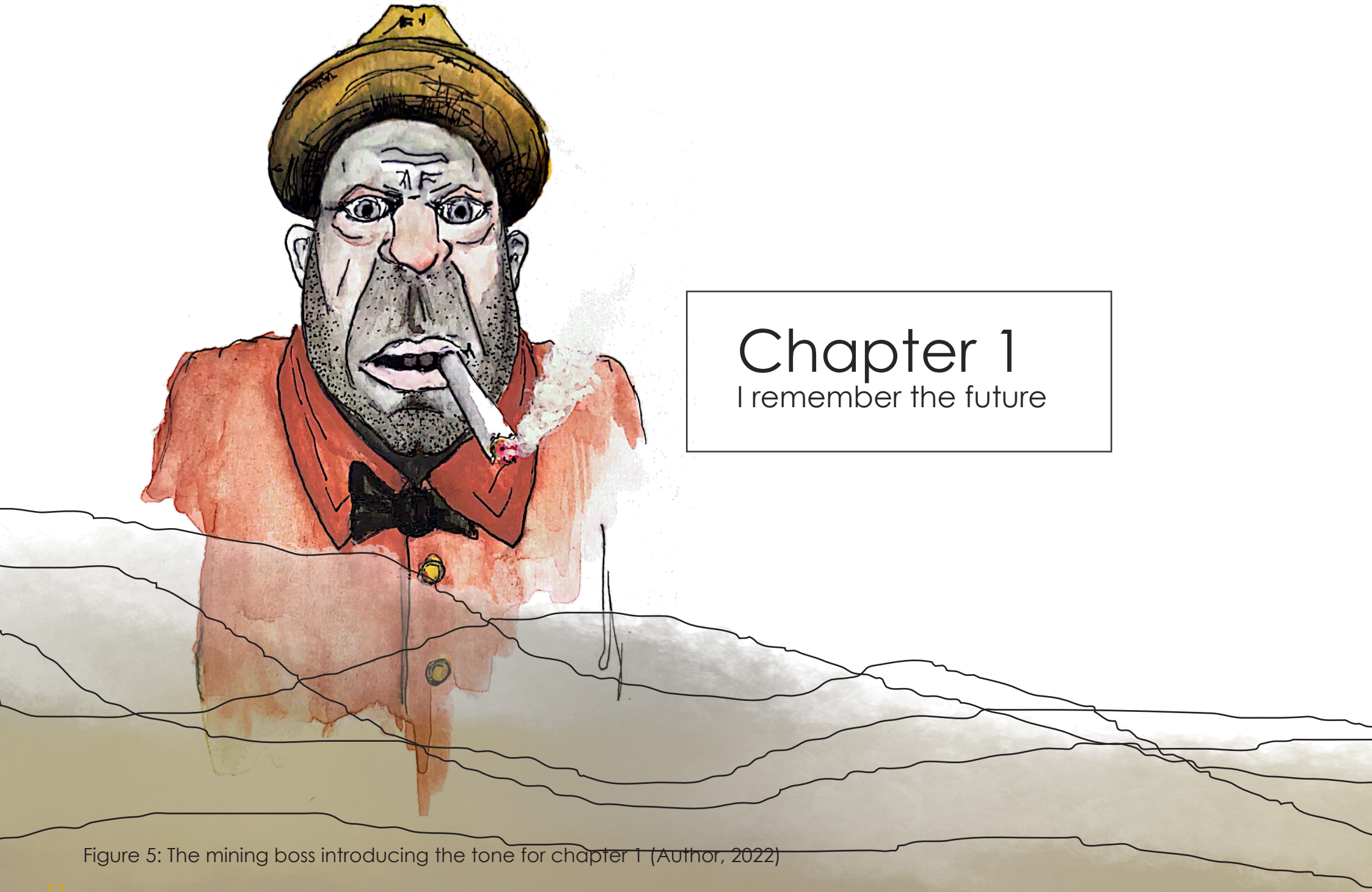
AWARENESS:

- HARM CAUSED BY OUR ANTHROPOCENTRIC CONDITION

- HUMANS ARE BUT A PARTICIPANT IN THE NETWORK OF NATURE

THE EXPERIENCE OF BEING INDEGENOUS TO NATURE WITHIN THE ECOLOGICAL 'MESH'

# THEORETICAL INFLUENCES



# Chapter 1
## I remember the future

Figure 5: The mining boss introducing the tone for chapter 1 (Author, 2022)

The following visual and written narrative is based on my attempt to understand and present the greater greed within-which the current site conditions developed and where it might end without immediate regenerative intervention – it is not too late.

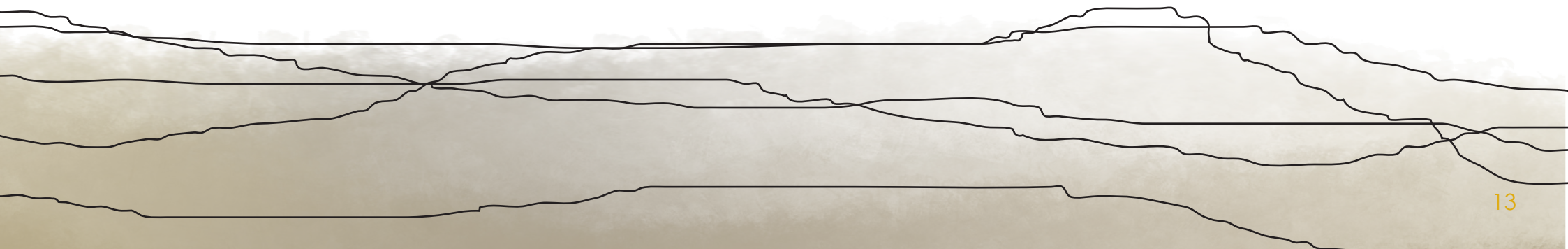




Figure 6: Mining narative 1 (Author, 2022)

I remember the future. Heavy skies filled with metal beasts, all in search for the last. The new kings of the world… Miners.



Figure 7: Mining narative 2 (Author, 2022)

Until one day the boss had to bear heavy news. Earth has been drained to the core.



Figure 8: Mining narative 3 (Author, 2022)

With nothing left, humanity has finally reached an environmental apocalyptic obsolete.

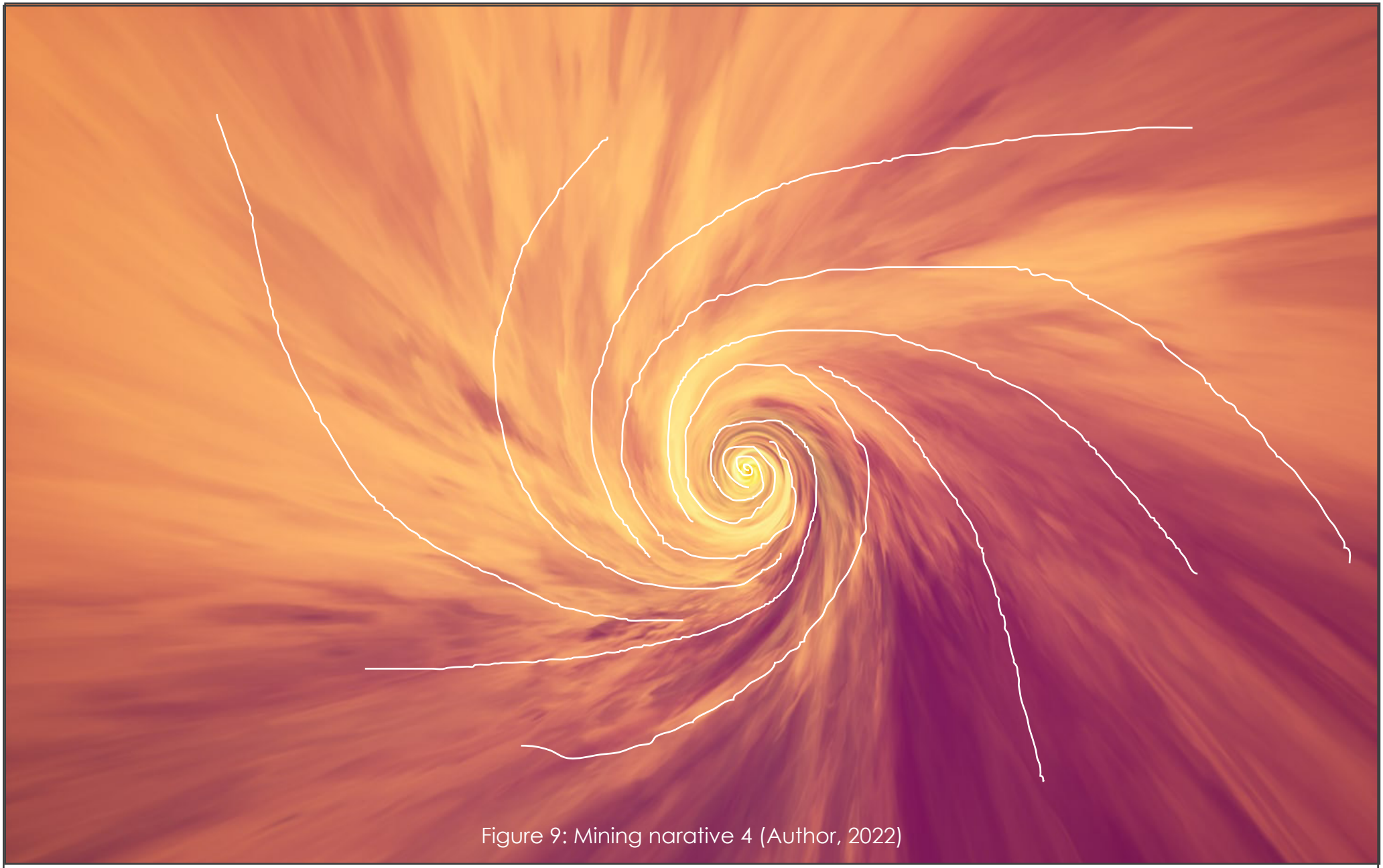


Figure 9: Mining narative 4 (Author, 2022)

With a white flash, everything suddenly changed. He warped through space to a time when humanity still had hope.



Figure 10: Mining narative 5 (Author, 2022)

He found himself back to where everything started. The place where the first gold stock exchange took place in South Africa… Barberton.

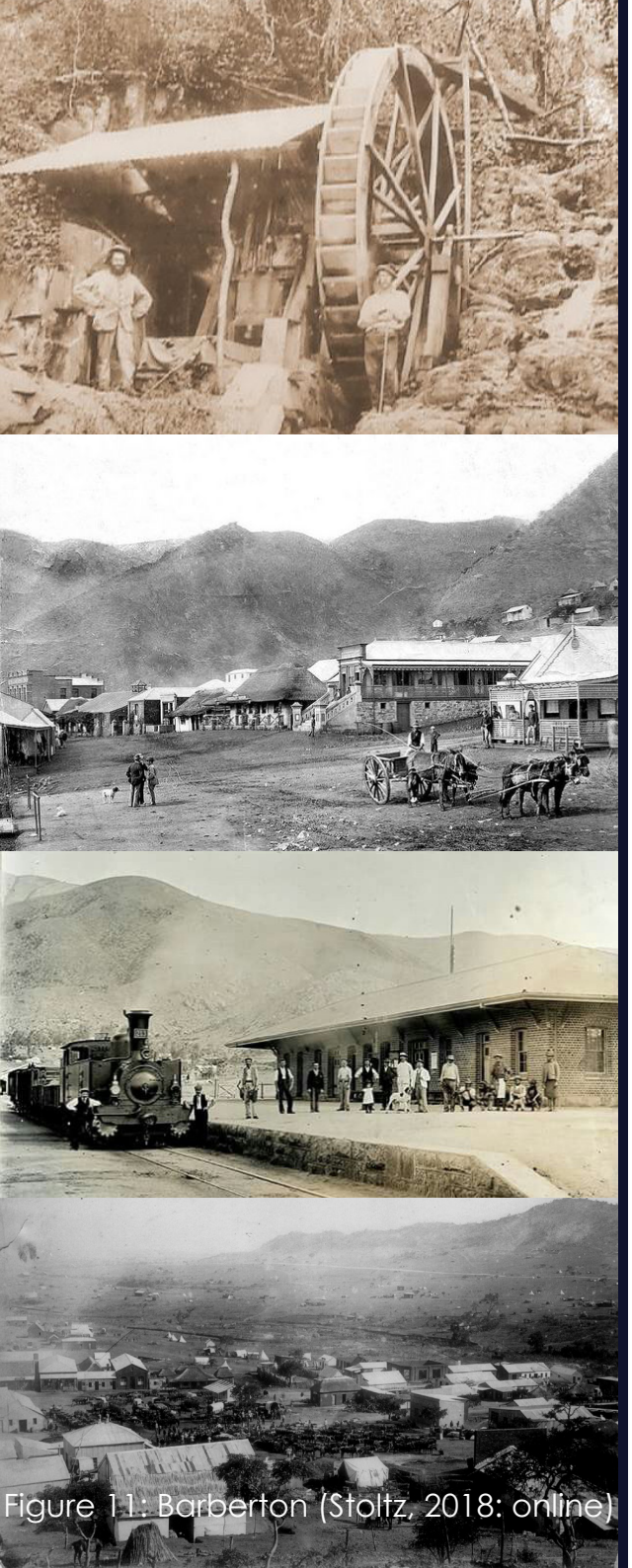


Figure 11: Barberton (Stoltz, 2018: online)

# Barberton: From its ancient origin to a specific tailing site

As a geological mecca, the Barberton area in Mpumalanga lures people from all over the world to probe the earth's beginnings and riches. Within the context of South Africa's gold industry, Barberton is the historical place where the first gold stock exchange was established. The mountains around Barberton are amongst the oldest in the world, dating back 3.5 billion years. The mountains include some of the most ancient, exposed rocks on the planet. These volcanic rocks, which scientists call the Barberton Greenstone Belt, have given direct evidence of the conditions of life on the surface of the very early Earth (South African Tourism, 2022: online). Regarded as one of South Africa's prime historical and geological gems, Barberton needs to be conserved and sustained from the greed for gold, which puts this beautiful area at risk.

The mining industry within Barberton has vastly grown and with the current commercial goals, the natural landscape is barely sustained. Each mine is obligated to provide a rehabilitation plan for the landscape, but it falls onto the DMR to make sure that this rehabilitation plan is met.

Mining rehabilitation becomes very expensive and is not commercially beneficial to these mining companies, which leads to corners being cut and unusable pieces of land that are left behind (Gómez-Arias, 2022). Millions of hectares all over the world are left with waste rock mountains and toxic waste, essentially damaging every beautiful little piece of nature that we have left.

A short drive from the beautiful town of Barberton leads to the well-known Fairview-gold mine. On the edge of this gold mine and the Mountainlands Nature Reserve lies a neglected gold tailing site. With little to no orientation through the forest, the approaching to this site is accompanied by a sense of confusion and being lost.  As the forest starts to clear, the existing pipeline on the site becomes a useful navigational element and accordingly plays a major role in the experience and memory of the site. Finally exiting the thick forestry, I had to stop and collect my thoughts as I was confronted by the devastation of the beautiful nature that had just been embraced. Materials from demolished buildings replaced nature, the earth turned upside down and inside out as far as the eye can see.

This complete devastation of what once was in the same condition as the Mountainlands Nature Reserve embodies the harmful and exploited world left behind by the mining industry in general. The experience, from forest to wasteland, sparked an initial investigation into other ways of thinking. Innovating and imagining not only mining but the rehabilitation of terrains impacted by mining activities.

Tailings are a by-product of mining, which consist of left-over materials resulting from the separation process of metals. This specific tailing site at one of Fairview Mine's gold mining sites comprises a variety of dams used to isolate valuable metals from lower-grade ores. This separation process contaminates the water and leaves very dangerous sources of toxic chemicals (SME, 2021: online). On this tailing site, the abandoned and unmaintained dams have possibly left the soil absorbed with high-risk toxins. Demolished buildings and discarded materials further inhibit the rehabilitation of the site (Figures 13 & 14).



Figure 12: Location of the abandoned tailings (Author, 2022)

The footprint and cast-off mining and building materials (figure 13), provide the opportunity for possible innovation and reuse, also through architecture, which might minimize the carbon footprint of a new building. Mines are supposed to be strictly observed and limited to the amount of land they claim, yet mines often invade the borders of natural pockets, alike the Mountainlands Nature Reserve, while completely obstructing the natural state of its site. It is from my experience and observation at the Fairview site, that I started to investigate phytoremediation – a natural process that assists in the rehabilitation of mined terrains (SME, 2021: online). I expand on phytoremediation processes on page 24.



Figure 13: Abandoned tailings site (Author, 2022)



Figure 14: Photographs of the abandoned tailings site conditions (Author, 2022)

# Client needs: Pan African Resources

Pan African Resources (PAR) – owns Fairview Mine and is one of the few mining companies that are open to positive environmental change. Currently, their environmental focus is only on green energy and tailing retreatment acquisitions.




Figure 15: Pan African Resources logo (Pan African Resources, 2022: Online)

Involved in the mining industry and living near Barberton, an anonymous source informally explained the truth behind the environmental concern of mining operations. In her experience what mining houses present to the community, is very different from what they do environmentally. When it comes to rehabilitation, most mines are guilty of cutting corners. For instance, a green energy approach might have more to do with the commercial feasibility of the mining house's operations, than with deep-seated environmental care. Similarly, a focus on green energy is a baseline essential to operating mines in South Africa, given the country's economic status and difficulties in providing electricity. The same goes for the tailing retreatment acquisitions, the effects of these environmental actions and processes have less to do with real concern for nature – utilizing resources and reducing environmental damage – than pure capitalist incentives. It is therefore necessary to provide a commercially feasible solution for this client when it comes to environmental concerns and rehabilitation. Phytoremediation and phytomining offer such a possible alternative.



Figure 16: Pan African Resources website fotos (Pan African Resources, 2022: Online)

# Phytoremediation and Phytomining:

## Towards possibilities of unaffected environmental care

Heavy metal contamination is mostly caused by the discharge of huge quantities of waste rocks and tailings through mining activities. Environmental decontamination is crucial for socioeconomic and sustainable development since contaminants and leachate from mining regions penetrate the food chain and damage soil, water, flora, and animals. Therefore, it is imperative for mining houses to rehabilitate the landscape with the aim of full natural restoration. The cost of rehabilitating, however, forces mining companies to take shortcuts and discover methods to abandon toxic waste sites and mountains of waste rock. All around South Africa, examples of abandoned mining sites that have been merely fenced off for centuries are to be seen. The major problem is therefore not only the mining activities themselves but the rehabilitation of the landscape. This problem introduced a very exciting opportunity known as phytomining, allowing for a commercially viable rehabilitation method to take place.

More thorough research of the location led to the discovery of one of South Africa's only naturally occurring hyperaccumulator plants. The Berkheya Coddi, an indigenous hyperaccumulator plant from the Asteraceae family, is found on an abandoned tailings site and is protected under the Mountainlands Nature Reserve. Hyperaccumulator plants can accumulate extraordinary amounts of heavy metals by growing on metalliferous soils. These plants can be used for phytoremediation or phytomining (Castaares & Lojka, 2020: online).

Phytoremediation is the process of reducing concentrations or toxic characteristics of a contaminated site by using hyperaccumulating plants (Leung, 2020: online). These plants reclaim the polluted soil and stabilize soil fertility by absorbing heavy metals and contaminants derived from anthropogenic activities such as industrial activities that affect the quality of life for both humans and animals. This method has proven to be a very cost-effective environmental restoration technology (Leung, 2020: online).



Figure 17: Berkheya Coddi in Mountainlands Nature Reserve (South African Tourism, 2022: online).



Figure 18: Berkheya Coddi (Author, 2022)



The hyperaccumulator plant also offers the possibility of a commercial alternative within the mining industry. This plant provides an opportunity for Phytomining. Phytomining is the technique of extracting metals from ores and other solid materials typically using fungi, or plants (phytoextraction also known as biomining). Phytomining can be used as a surface mining method and already has been implemented in certain regions of the world.

Phytomining has several stages:

- Plants take in the minerals through their roots.
- The petals are then burned.
- The ash is added to water, allowing the minerals to dissolve.
- Electrolysis is then used to extract the metal from the mineral.

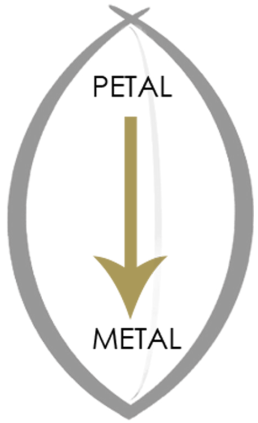



Figure 19: Phytomining process (Author, 2022)

"By virtue of their existence on metalliferous soils, hyperaccumulator plants are actively threatened by mining, and timely identification is necessary to take advantage of their unique properties," said senior author Dr. Antony van der Ent, of The University of Queensland, in Australia. Instead of just demolishing all of the flora and fauna, mines now have the opportunity to make even more money through actually saving and researching plants.



Figure 17: Berkheya Coddi in Mountainlands Nature Reserve (South African Tourism, 2022: online).

For phytomining to become a viable surface mining method of gold for Pan-African resources, research on this specific hyperaccumulator plant known as the Berkhyea Coddii is necessary. The existing research on the Berkheya Coddii is currently focused on Nickel mining. Nickel mining specifically has a very large negative impact on the environment and phytomining could be part of the solution, whilst being used to clean up old, contaminated mining sites (Milne, 2021). The current in-depth research done on the Berkheya coddii confirms that this hyperaccumulator plant can produce annual biomass of 22 t ha−1 and up to 1% (w : w) Ni in the dry above-ground biomass (Robinson,1997).

Further research is necessary to possibly use the Berkheya Coddi plant for gold phytomining (figure 20), leading to an architectural project that accommodates research facilities to provide for this need.

The goal of this project is therefore to research and explore possibilities of an architectural intervention, which provides research in, information, and active experimentation of the use of this plant genus as an ecological way of rehabilitating mines throughout, both on-site and on other mined sites in the country.

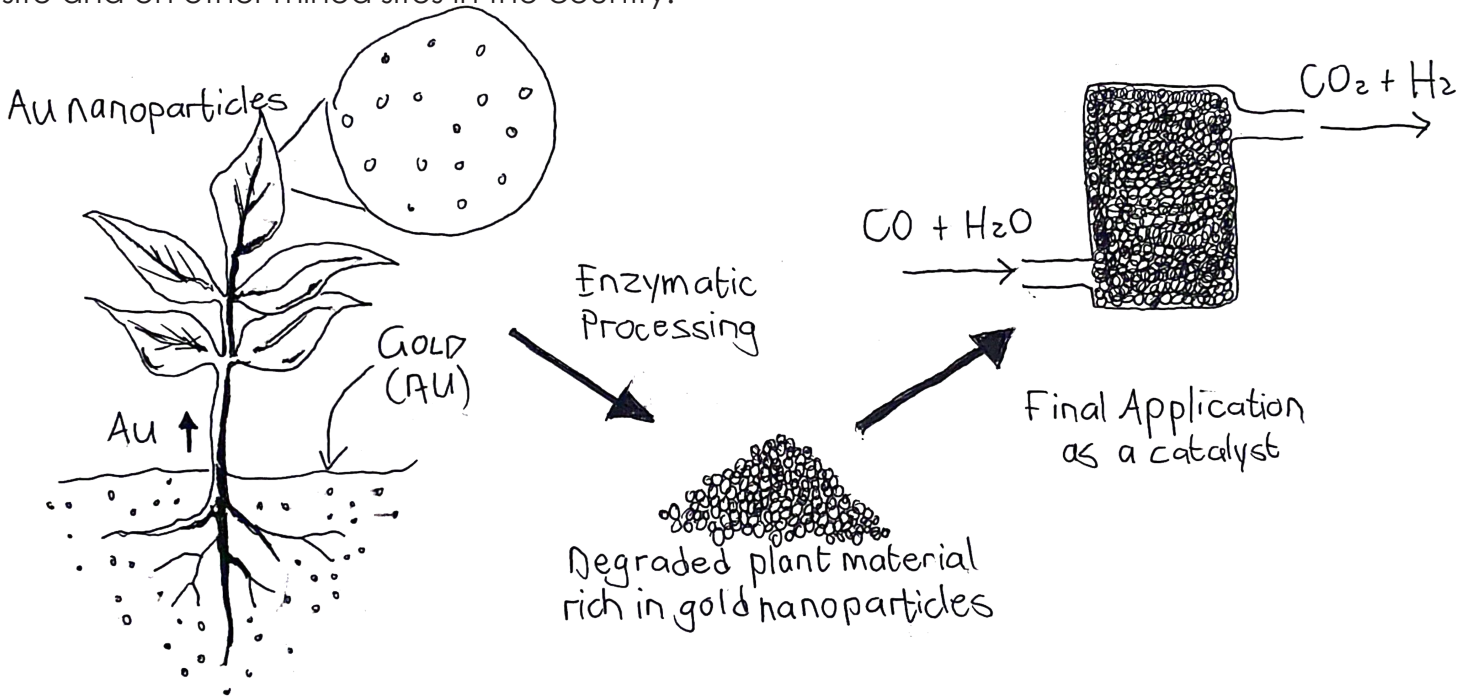



Figure 20: Phytomining process (Author, 2022)

# Understanding current mining rehabilitation

This section is adapted from an in-depth interview that I had with an environmental geologist, Dr. Alba Gómez-Arias (figure 21) from the University of the Freestate. The goal of this interview is to grasp a better understanding of how current mining rehabilitation processes work and what her opinion is regarding phytoremediation and phytomining since there is limited precedent for this process.

As mentioned before, all mines in South Africa are expected to have a full rehabilitation plan to rectify all damages done to the landscape. Some of these plans stretch over 100 years, but it is up to the DMR to make sure that these rehabilitation plans are followed. This is where most mines start to cut corners since it becomes the DMR's responsibility to follow through with the rehabilitation if they neglected to follow up on the mines.



Figure 21: Dr Alba Gómez-Arias (Author, 2022)

With the amount of power and resources that mines all over the country have, it has become the norm to simply scrape everything in a big hole and cover it as if nothing ever happened, leaving the soil contaminated and unfertile. Alba further states that most mines don't even bother to cover their tracks and leave hazardous pieces of the earth for locals to deal with. Mines tend to sell a community with dreams by creating jobs and expanding small towns, but once the resources are depleted, they simply leave thousands of people without an income and useless land. Mines normally don't last more than 20 to 30 years, leaving the community in a very challenging condition.

"The mines always make huge damage to the population. They give you money while it is working, but once they have left, they just leave a lot of unemployed people in a land that is worthless" (Gómez-Arias, 2022).

The traditional rehabilitation method consists of testing for toxins all over the site. Testing the water and soil contamination through collecting monsters and running these tests in the lab. The machinery necessary to run tests would form part of the wet lab as mentioned in the program and would not take that much space as seen in figure 22.



Figure 22: Machinery and tools needed (Author, 2022)

Once these tests are done, one can now appropriately respond with a chemical reaction to balance the contamination. This usually consists of using geotextile to cover the area to make it permeable, then adding some other materials like clay. Then the topsoil layer is added, making it fertile for plants. It is very important to rehabilitate all the affected layers since toxins spread all over the country and world through the water flow (Gómez-Arias, 2022).
What is your experience with phytoremediation?

She explained that in Spain, phytoremediation made its stance years ago already. The examples that she was exposed to are however mostly phytoremediation wetlands to clean contaminated water. Several studies on different plants were made to appropriately place the right vegetation in the right place.



Figure 23: Lab Instrument (Author, 2022)




What happens to the plant once it absorbed all of these toxins?

"That's the thing, we live in a very close-knitted world where everything is in a cycle. Animals will eat these plants and we eat the animals, circulating the toxins. Unless you do very well and dispose of the plants" (Gómez-Arias, 2022).

I then introduced the Berkheya coddi to her and explained the process that I aim to follow in this project. To use the plant as a phytoremediation method and then harvest the plant to extract the heavy metals consumed, allowing for a phytomining process to take place whilst simultaneously providing a commercial rehabilitation method for mining companies. She expressed her general concerns for the plant's ability to survive the toxins, but once I showed the existing lab tests that have been done on the Berkheya coddii on this specific site that I aim to work on, she felt more confident in the success of this project aim.

"It is worth the try. If you do it well and you do the research and you do it properly, it's going to make a huge impact. It's really going to help environmentally speaking" (Gómez-Arias, 2022).

How would you imagine this process function?

"You should have two sections. One is dedicated to the plants where you can do more research on different plants to figure out which one works better for each site. Different mines will have different conditions, some will be more acidic, others alkaline, and some more nickel. So, you take the samples from the soil, put them in a pot, and test the plant's uptake. On the other side, there is one crucial parameter, and it is the soil. You need a section in the building that is a lab dedicated to the soil. There could be a nursery near the lab to test the soil mixtures with different plants to see which one is better" (Gómez-Arias, 2022).

As a researcher, what do you need in this building?

"You need a few instruments and machinery to analyze the toxicity, some hand instruments, and storage space to put the samples and a greenhouse. It is important to control the humidity in the building so that the tests don't get affected" (Gómez-Arias, 2022).

We then took a tour of the labs that she works in, allowing for a better understanding of the necessary scale and equipment needed. This interview confirmed the real possibility of this project being successful and a better understanding of a possible program followed.

# Program

- Entrance/ Reception
- Research bar / Cafeteria
- Archive / library
- Dry lab (3d printing, robotics)
- Wet lab (chemicals and burning process of plants)
- Waste disposal unit
- Storage Pantry
- Nurseries
- Offices
- Collaboration room / Pavilion
- Restrooms
- Pleasure garden extending the national park
- Loading dock
- Parking



Figure 24: Plan development (Author, 2022)



Work bench space
Wet lab: 24m²



Fume cabinet
Wet lab: 24m²

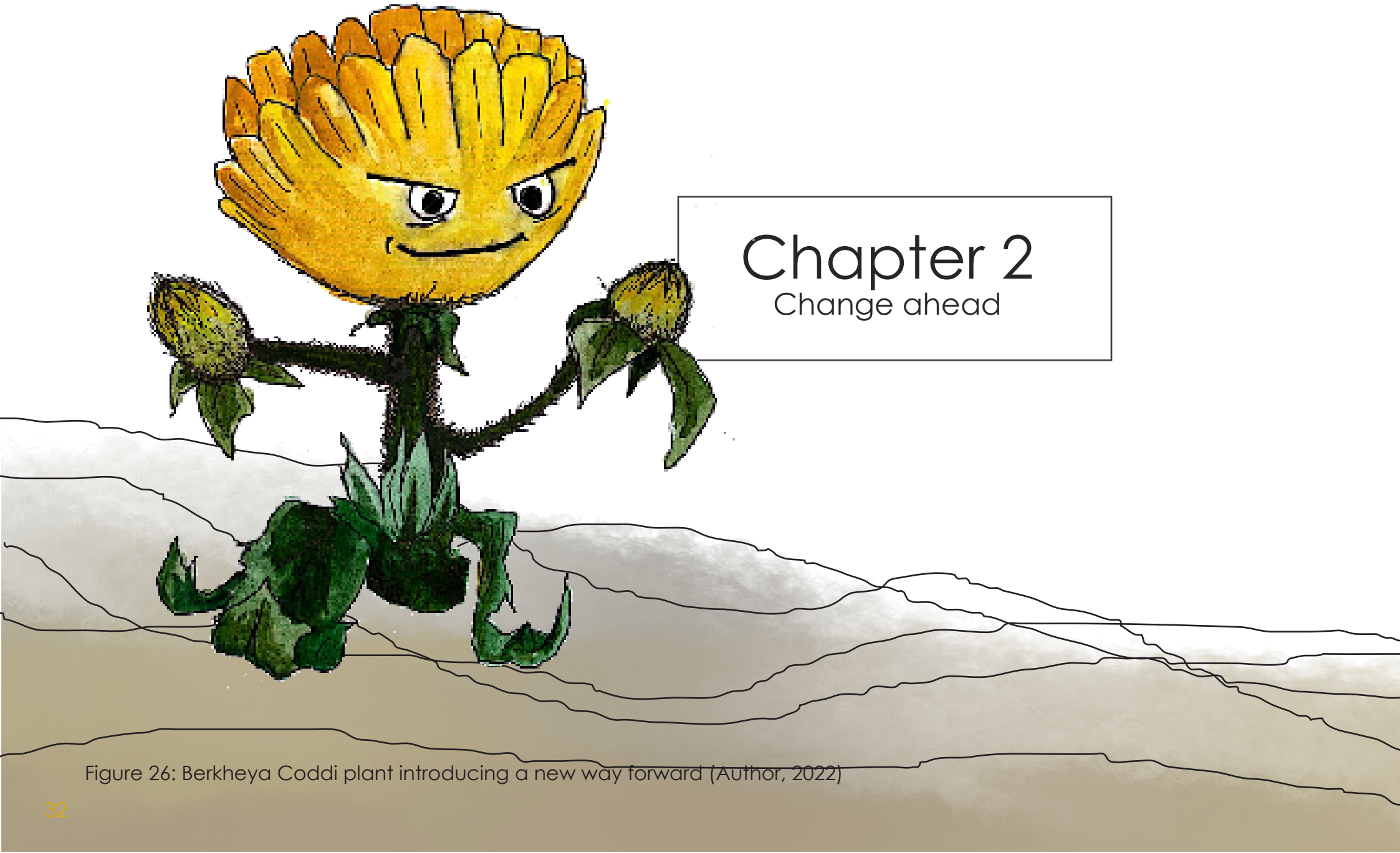


Waste disposal unit
in fume cabinet
8m²



Lab equipment, extraction
and fume cabinet
Dry lab: 26m²

Figure 25: Photographs taken within chemical lab of the Univeristy of the Freestate (Author, 2022)



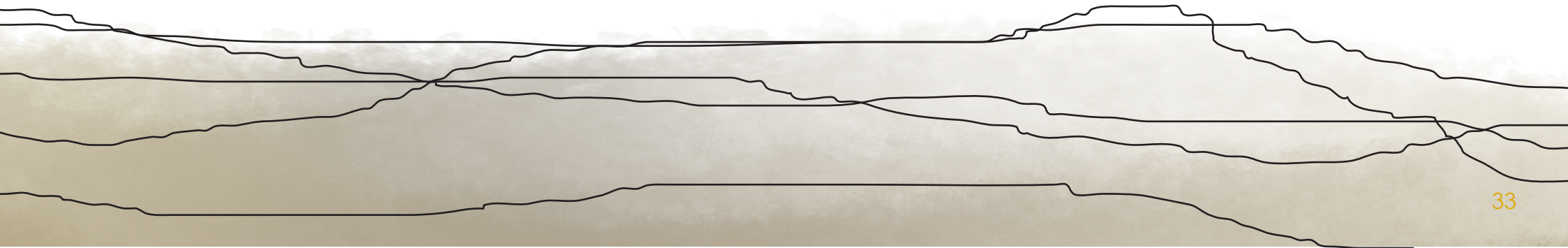
# Chapter 2
## Change ahead

Figure 26: Berkheya Coddi plant introducing a new way forward (Author, 2022)

To challenge the idea that humans are apart from and in charge of nature might constitute the underlying goal of the client. As much as this goal might define the client's deep-rooted desire, it might also define the poetic aim of the dissertation project. It is necessary to question the anthropocentric condition to understand a nature-centered condition: a view of humans as merely participants in nature's network.

The chapter first explains my initial response to the effects of mining and the possibilities within landscape regeneration, which serves as the research touchstone. From the touchstone, three conceptual approaches were identified. A literature review and theoretical interpretation of ideas related to anthropocentrism and nature-centrism follow and synthesize the three concepts.

The literary review is centered on the client's greater objective of working with and through nature. This inquiry focuses on the interaction between people and the natural world to comprehend the idea of ecognosis. The concept of hyperobjects is further explained in this chapter, and it is creatively reinterpreted in relation to mining and mining activity. The chapter attempts to discover architectural innovation in terms of dark ecology by reflecting on these conceptual and theoretical notions, and it concludes with comparable antecedents.



# A first response to the scars on site:
## Touchstone:

The design process strives towards architectural innovation which introduces beings to the hedonistic edge through the fundamental role of dark ecology. This can be achieved through understanding the dystopic narrative of the mining industry and using it to tension the edge as a sensory threshold with aggregation as the architectural product. This symbiosis between structure and environment further motivates a regenerative design with existing materials and structures as footprints.



The touchstone captures this essence by displaying the process of unearthing whilst simultaneously converting this negative process into a regenerative action. The sand slowly fills the scar and produces rich earth for flowers to grow in.



Figure 27: Touchstone (Author, 2022)



Figure 28: Photograph taken of the unearthing process in Fairview mine (Author, 2022)

# Initial thoughts:

## Taking a lead from the Touchstone:




Figure 29: Concepts
(Author, 2022)

# The Hedonistic edge - First concept

In the context of this dissertation, the hedonistic experience represents the self-indulgent human pursuit of pleasure - often at the cost of nature and preempting consumer culture (page 48).

'Hedonism' combined with the word 'edge,' refers to a mental state which questions hedonism and realizes that the unchecked pursuit of egocentric pleasure can cause destruction and harm.
The 'edge' further refers to the location of the site, edging between Mountainlands nature reserve and Fairview mine. The site, similar to the above-mentioned mindset, is located in between the purity of untouched nature and the chaotic destruction of the mine.

Ecognosis is the consciousness of the implicit dystopic narrative, which lies underneath explicit hedonism. It is also the consciousness of the implicit need to change our way of looking at ourselves in relation to the rest of the natural world. Ecognosis is a consciousness in tension, which realizes the mysteries of our embedded relationship with nature, and our responsibility to innovate, check and redress our role within the natural system. Ecognosis means that we attempt to reach the edge of our explicit hedonistic experience at the cost of nature. At the same time, it means that we attempt to find the potential of experiencing hedonism with the natural world by removing the edge we mentally emplaced between humans and nature. Ultimately, the hedonistic edge or ecognosis might promote ecological growth. This concept introduces the theoretical path which led me to dark ecology.

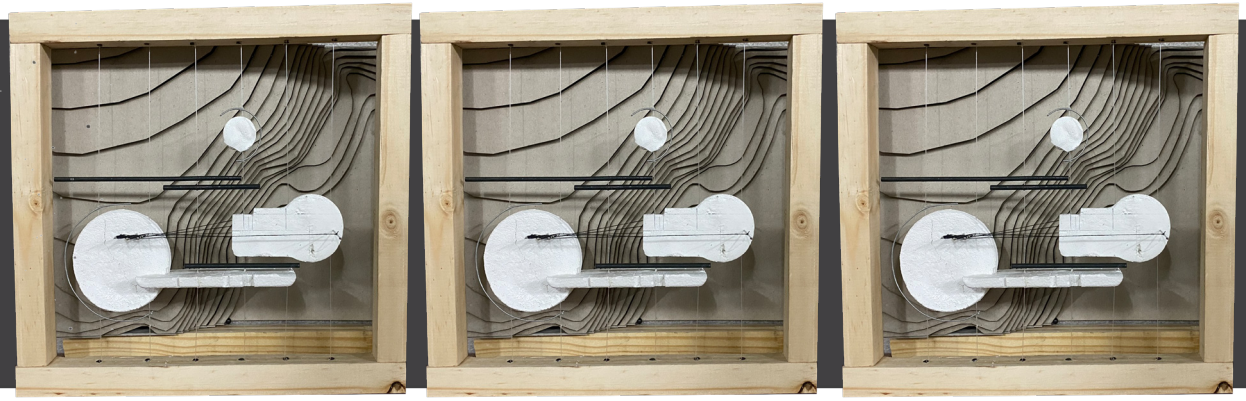


Figure 30: The hedonistic edge (Author, 2022)

# Phyto[reclamation] - Second concept

Phyto[reclamation] relates to the origin of the word Phuein which means ‘come into being’. This theme explores architecture as an intervention by investigating the process and impact of phytomining. This theme shows nature in flux with the landscape and inspires architecture that does the same. This concept influences the design to extend the Mountainlands nature reserve and further reclaim the mines through the building as the catalyst. The architecture further allows a view of the mine and its progress through the use of phytomining.

Nature as an intervention inspires architectural innovation that not only motivates this reclamation process but becomes the natural intervention itself. These notions led to the third concept, building as a vegetation deity.



Figure 31: Phyto[reclamation] concept (Author, 2022)

# Building as vegetation deity - Third concept

Through investigating buildings as vegetation deities, interesting architectural solutions come to light within the regenerative design realm. A building whose disappearance and reappearance, or life, death, and rebirth, embodies the growth cycle of plants.

A deity can be seen as a god or goddess with the ability to regenerate itself. A Deity typically undergoes dismemberment, scattering, and reintegration which can be interpreted through architecture (Academic, 2022: online).

This concept is supported by the scope of dark ecology and the theoretical precedent study, Urban Algae Folly on page 56.





Figure 32: Building as vegetation deity concept (Author, 2022)



Figure 33: Ecognosis between human and nature (Author, 2022)

# From binaries to a ecological "mesh":
## The relationship between humans and nature

The era of heightened ecological consciousness has started, but nature is more alienated from humans than ever before. Despite humankind seeing itself as the global shaper and saving entities of the natural world, the environment has been lost within our human grasp (Morton, 2016: p. 20; 136). Today, humankind faces the harsh reality of an apocalyptic environmental obsolete and it is, therefore, necessary to critically rethink life as we know it, starting with our perception of nature.

What exactly is nature? Immediately a series of living picturesque and harmonious natural elements and inanimate natural landscapes present themselves in the wired system of our minds. This idea of nature as something beautiful or sublime but other than human was relatively recently introduced to Western thought by the Romantics (Nanda, 2019: online). Reacting to a changing world, which was becoming increasingly industrialized and urbanized – essentially undermining nature – a group of artists, architects and writers turned their collective attention to the relationship between the human and the natural: the start of the Romantic era (Morton, 2013: p. 19-21). These Romantic thinkers tried to bridge the imposed Enlightenment binary of subject(human) and object(nature) by perceiving the human as being one with nature. Yet, the critique of the Romantic view is in the verb: perceive.

Although this aesthetic notion visually understood humans as being influenced emotionally by the power of nature, it is still dependent on the separation of the human and nature: on distinguishing the human from the natural. However much the former was emotionally one with the natural system, the human was still not a part of the natural world. Aesthetically and emotionally, the Romantics placed the human back into nature but not within an interdependent, intertwined, and interrelated relationship with the rest of the natural world (Morton, 2016: p. 136). The nostalgia towards nature did not resolve the distance between the human and nature, instead, it reiterated the psychological distance which we emplaced between I/us (the human) and the innocent or powerful them (the natural) (Morton, 2013: p. 19-21).

Psychological distance describes how far away something is from the human self, whether it be in terms of social distance, time, location, or likelihood of occurrence (Newell et Al, 2014: 453). It has particular significance for many environmental issues, especially issues related to the protection of nature against pollution and destruction or combating the causes of climate change.

In the context of this study, the lack of pressure for regenerative and rehabilitative action might stem from the psychological distance between humans and the harm caused by mining on the landscape. The further a person is from, and the less a person conceives of themselves as impacted by environmental destruction, the less they care and the less moral obligation they have towards lessening the harm.

Environmental destruction is often not a primary concern when people seem to see it as a remote phenomenon that is unclear and far removed from their daily lives in terms of time, society, and geography (Newell et Al, 2014: 453). This is especially the case with the scares and damage caused by mining, as these landscapes are fenced off or not within the daily frame of most people's cognizance. However, changing perception might go a far way, but it does not address our inherent categories of the human and the natural.

Together with enlightenment's rationalization of nature, this common-sense distance from nature – unintentionally accentuated by the best of the Romantics – is a source of our anthropocentric (human-centered) thought. Anthropocentric thought may be counter-reactive to our conceived efforts to care for, conserve, rehabilitate and preserve the earth as we still see ourselves as the guardians of nature. We are still placed within, but not inseparable from the elements of the non-human and inanimate. When the conceived dichotomy of nature and humans is questioned and understood as problematic, the harm and destruction of nature are legitimized as destroying us, not it. To address the psychological distance between humans and nature, therefore, calls for a more immediate engagement with nature, beyond aesthetic or perceived closeness with nature (Nanda, 2019: online).

The abandonment of the romantic conception of nature is necessary to approach a working philosophy of ecology. Human activities tend to be perceived and conceived as a version of nature, forgetting that people are completely part of the totality of the natural system – functioning as a single cell within a giant natural organism. Nature is not something that exists outside of people, it is human, or put differently humanity is nature – just another gear within the nature-machine.

Timothy Morton disagrees with the anthropocentric notion, which favors human existence over that of non-human and inanimate objects. As an object-orientated philosopher, Morton explains that we need to break the distinction between humans versus nature and start to conceive and portray everything on earth as entities working together within a whole, an ecological "mesh" (Morton, 2016: p. 40; 94).



Figure 34: Distinctive sides to nature (Author, 2022)

To interpret Morton's metaphor of an ecological "mesh", I revert to another metaphor, like ecological 'mesh', which he employs to define the integrated human-nature system. During an interview with Nicholas Korody (Korody, 2016: online), Morton describes the integrated human-nature system as a gigantic operating system with all kinds of different data inside it, all reacting to each other. Some data components are small and others enormous but all of them form part of the operating system.
By making use of the ecological "mesh", Morton attempts to erase the ambiguity within our system of understanding the world, essentially introducing a new way of thinking about humans and nature, known as dark ecology. This is the paradoxical idea that in order to save the environment, the idea of nature, as a separate category, needs to be abandoned completely: in Morton's words: "If everything is nature, then nothing can be nature – it's a useless concept" (Korody, 2016: online). We are not to save the world outside of ourselves, but ourselves as embedded in the mesh of the natural.

He further states that the ecological devastation that has been reached today should be confronted without viewing it as a version of nature, but as a problem with the unified natural system (Morton, 2016: p. 111). This new fundamental way of thinking about entities captures their animacy and avoids the process of reducing things to dull substances for a human subject. People are then exposed to the other scales of entities and the human-world correlation is not conceived as the dominating entity anymore, but merely beings existing with hyperobjects within the mesh.

Morton's philosophy of Dark Ecology challenges us to admit to our part within this broken system and to not merely feel guilty as the perpetrator who has committed a crime, but to feel the guilt that arises from the realization that we are both perpetrator and victim (Nanda, 2019: online). This realization can according to Morton be seen as "ecognosis" - the moment when humans begin to rethink their position in the Anthropocene and move towards considering themselves a species within the natural world (Nanda, 2019: online).

Now that nature is no longer seen as a useful concept, it is important to dive deep into reality and let tension, fear, and excitement take over to understand the unifying ecological "mesh", and all of its parts.



Figure 35: Timothy Morton (Author, 2022)



# Hyperobjects within the ecological "mesh":
## tearing the web from within

Morton describes hyperobjects as things that are massively distributed on a massive scale in time and space which exceeds human apprehension. (Morton, 2013: p.12-17)
The writer and filmmaker, Gabriel Shalom, defines a Hyperobject as "Something that can be in more than one place at once". Hyperobjects are viscous, nonlocal entities that are vastly distributed in time and space and exhibit their affects and effects interobjectively (Morton, 2013: p.12). They are seen as the cause of the end of the world as we know it and promote deterritorialization such as global warming, Styrofoam, and radioactive plutonium.

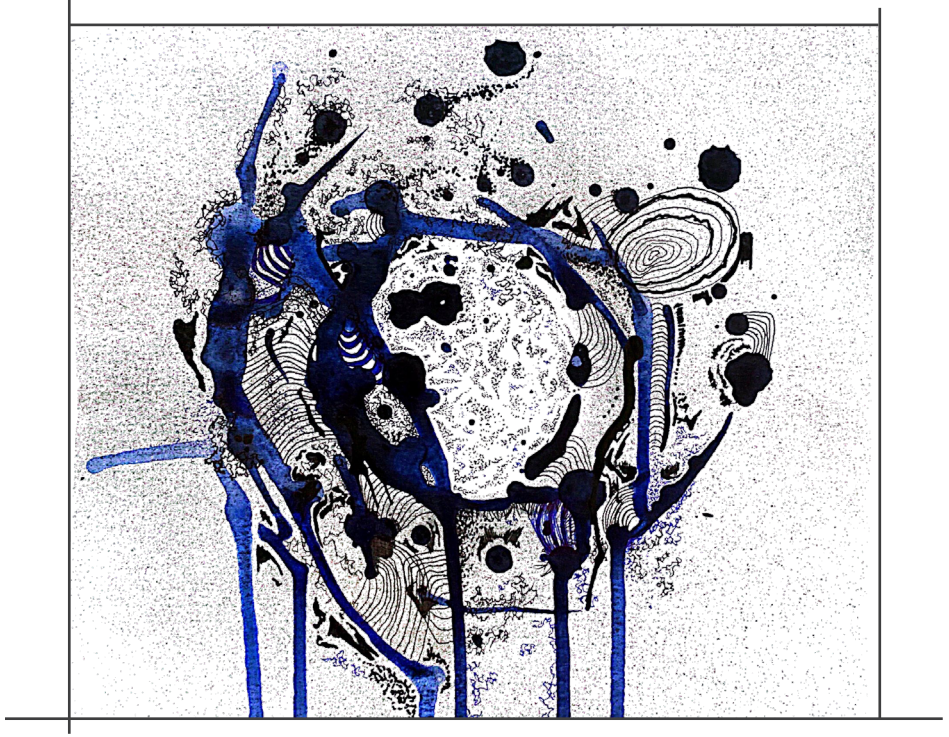


Figure 36: Hyperobject web reflection (Author, 2022)

These are the results of viscous objects that contribute greatly to the gradual decay of the earth, essentially ending life on earth completely. Hyperobjects have the potential to render humans vulnerable, inseparable from the vulnerability of the earth system or ecological "mesh". To make sense of hyperobjects, I view the ecological "mesh", as a web containing growing objects, some remain small some grow enormous, like hyperobjects, as the objects grow or shrink the web adjusts, but it might someday break.



Figure 37: Anthropocene timeline within hyperobjects (Author, 2022)

These hyperobjects break the barrier that we have built between the world, nature, and the environment and show how human events are completely interlinked with these concepts. Hyperobjects question the notions of external and internal, they are massive in scale like global warming, or massive in quantities like minuscule pieces of plastic drifting unseen from our water to the inside of our bodies. Hyperobjects further challenge the idea of the end of the world: not as something that will come someday but framing it as something that has already started. With the ecological "mesh", humankind has, since the start of the Anthropocene, already embarked on the apocalyptic environmental obsolete. In this sense, it is uncanny, because it is not fully translatable or graspable, but through using statistics and data, its presence is undeniable (Morton, 2013: p.12-17).

This realization that humankind is living within hyperobjects and is not in any position of significance above nature, breaks the typical ecological way of thinking about life itself. Morton further states that we merely coexist with all these other life forms within a gigantic entity working as a system, the ecological "mesh (Morton, 2013: p.17). Humankind and other beings are for better or for worse caught up in algorithmic loops within this system, stuck in massive hyperobjects forced upon us. These entities will completely outlive humankind, and merely hosts people. Morton sees ecological awareness as a potential infinity of entities on infinite scales that opens (Nanda, 2019: online). Morton questions the idea that the whole is greater than the sum of its parts by saying that "the whole is always less than the sum of its parts" and calls this logic subsidence (Morton, 2016: p. 27).

This infinite entity within beings is wrapped in other entities. There is therefore no rank of entities, supporting his notion of subsidence since there are more parts than wholes. "Objects are Tardis-like, larger on the inside than on the outside", this quote from Timothy Morton introduces the idea that there are more entities in the world that can dissolve hyperobjects than entities that promote them (Morton, 2016: p. 27).

Each decision that is being made in the world therefore either supports or dissolves hyperobjects. This understanding of hyperobjects and the possible influence people have on hyperobjects, sparked my questioning of the origin of hyperobjects in the first place, initially challenging Morton's view.

Figure 38: Background showing interlinked system within hyperobjects (Author, 2022)

Is human evolution within the Anthropocene epoch not responsible for the creation of the most lethal hyperobjects? Is this unstoppable force of nature, the global shapers known as humankind, the ultimate hyperobject? This reflection on Morton's book introduced the first possible research question:

How can Architectural innovation allow humankind to critically notice itself as the hyperobject by examining the integration of the past, present, and future through mines?

However, this argument is flawed as it again separates humans, even within their role as hyperobjects from the integrated natural system, instead, it is possible to view ourselves as both perpetrators and victims of the mining industry – the true hyperobject of this investigation.

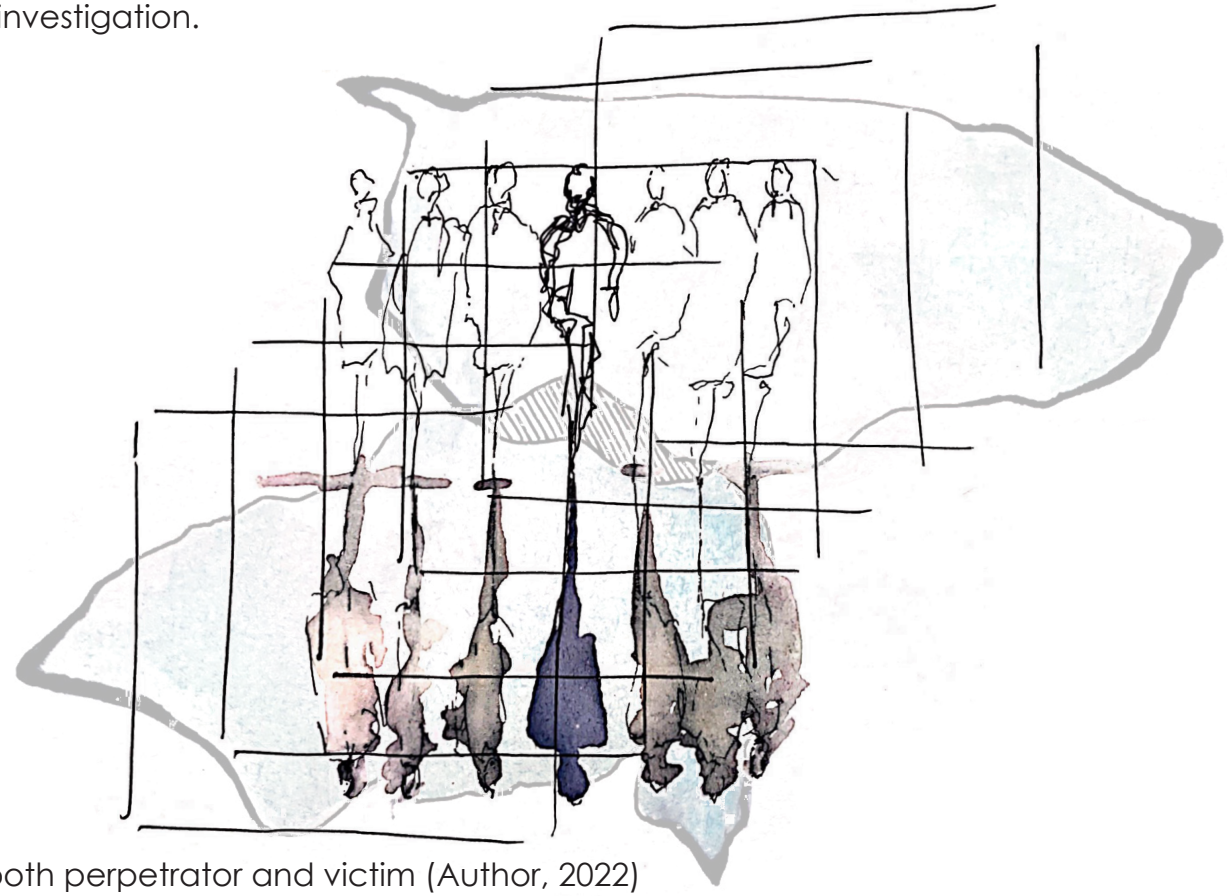


Figure 39: Humans is both perpetrator and victim (Author, 2022)

How then can an architectural intervention assist researchers and visitors to conceive of themselves as the perpetrator and victim of the mining landscape and part of the natural system of things?

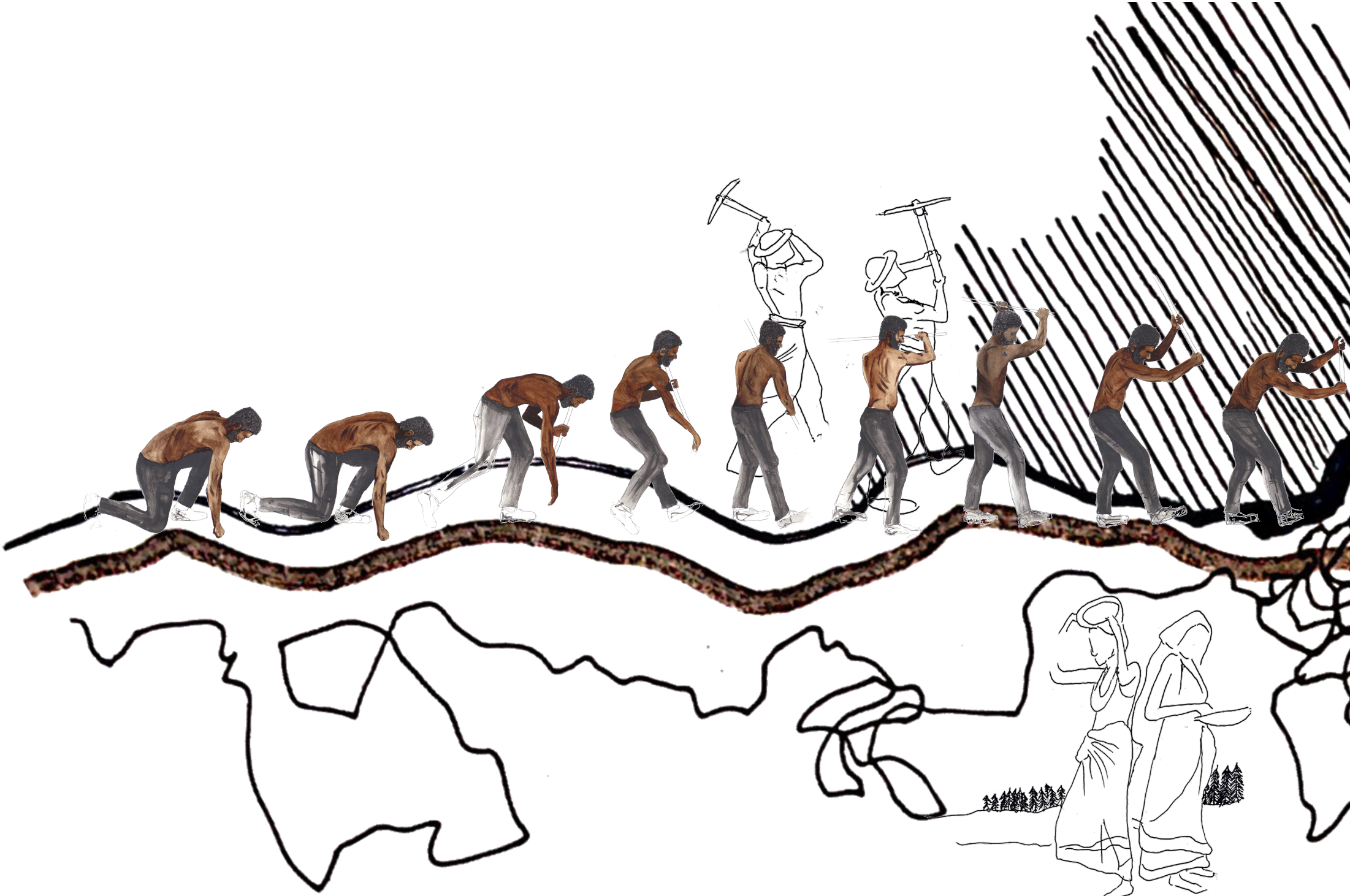
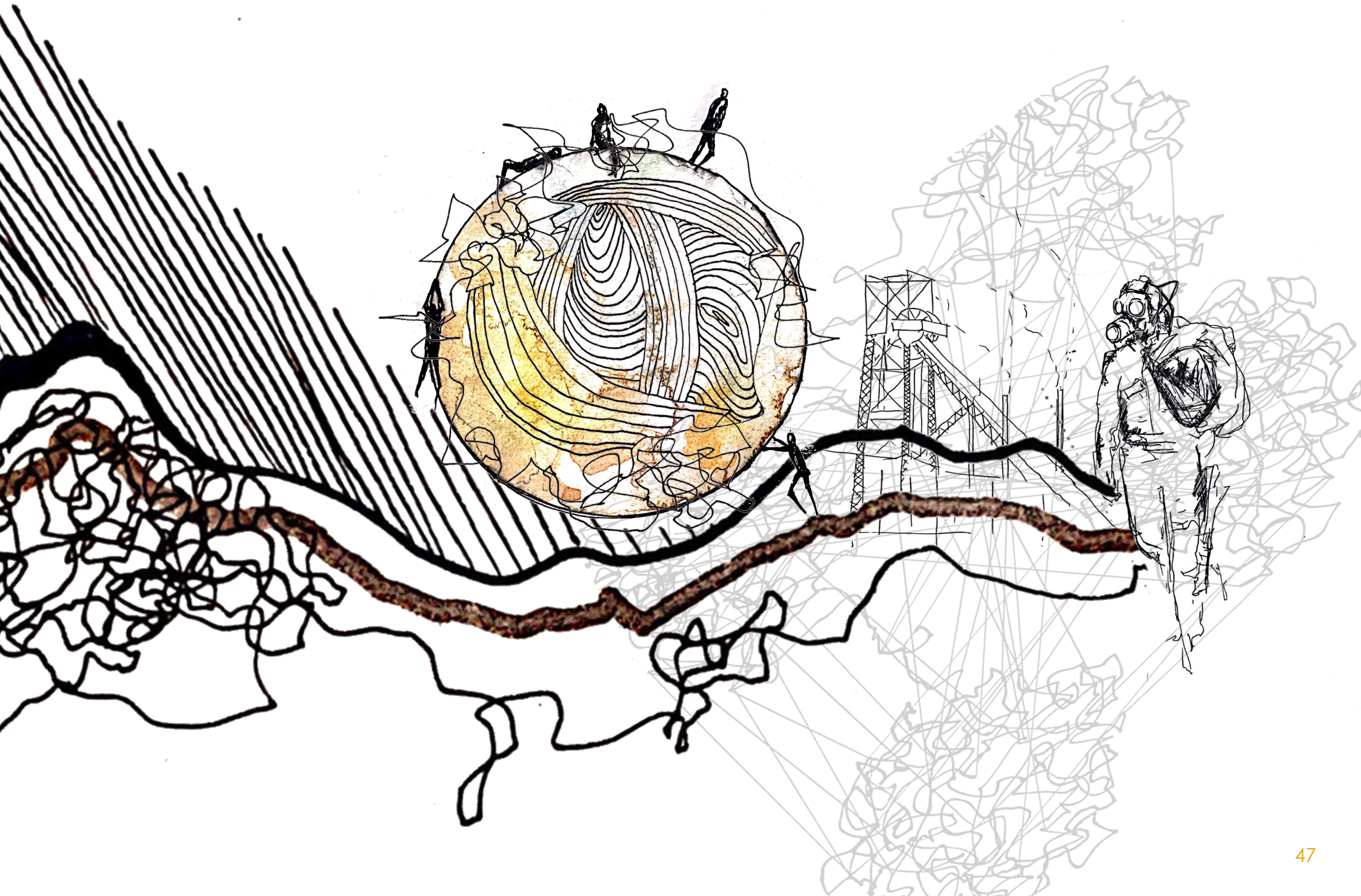


Figure 40:  Timeline: From the Anthropocene to the environmeantal apocolyptic obsolete (Author, 2022)



# Mines as hyperobject:
## From the Holocene to the Anthropocene

To reflect on the history of human beings is to understand the effects and effects of the production system that functions like a machine – Morton might call it: a hyperobject of production – in the Anthropocene (Morton, 2013: p.15-16). For Morton, as there is no distinction between humans and nature, this production machine is not apart from nature, but the way nature functions with hyperobjects in the Anthropocene.

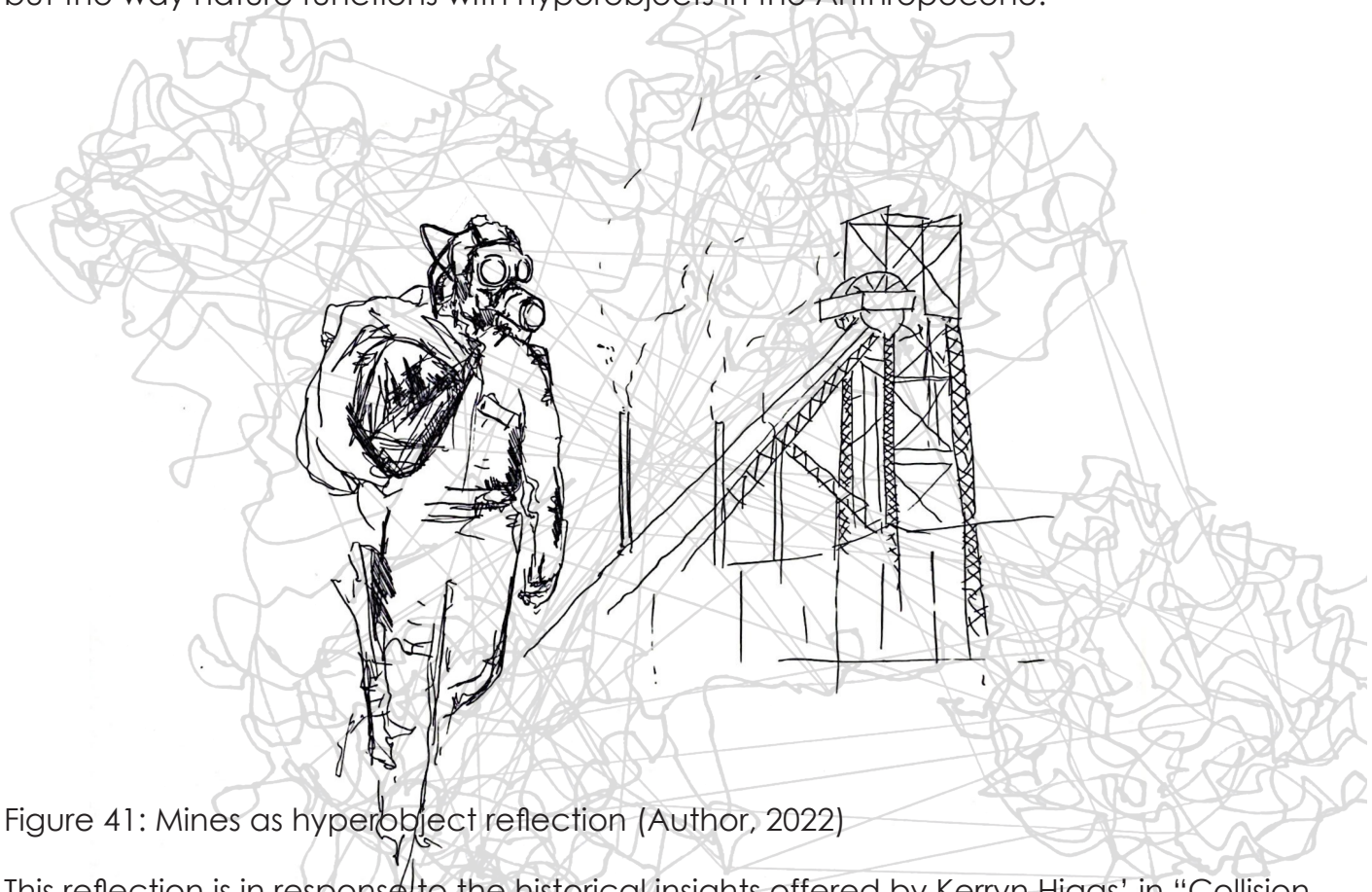


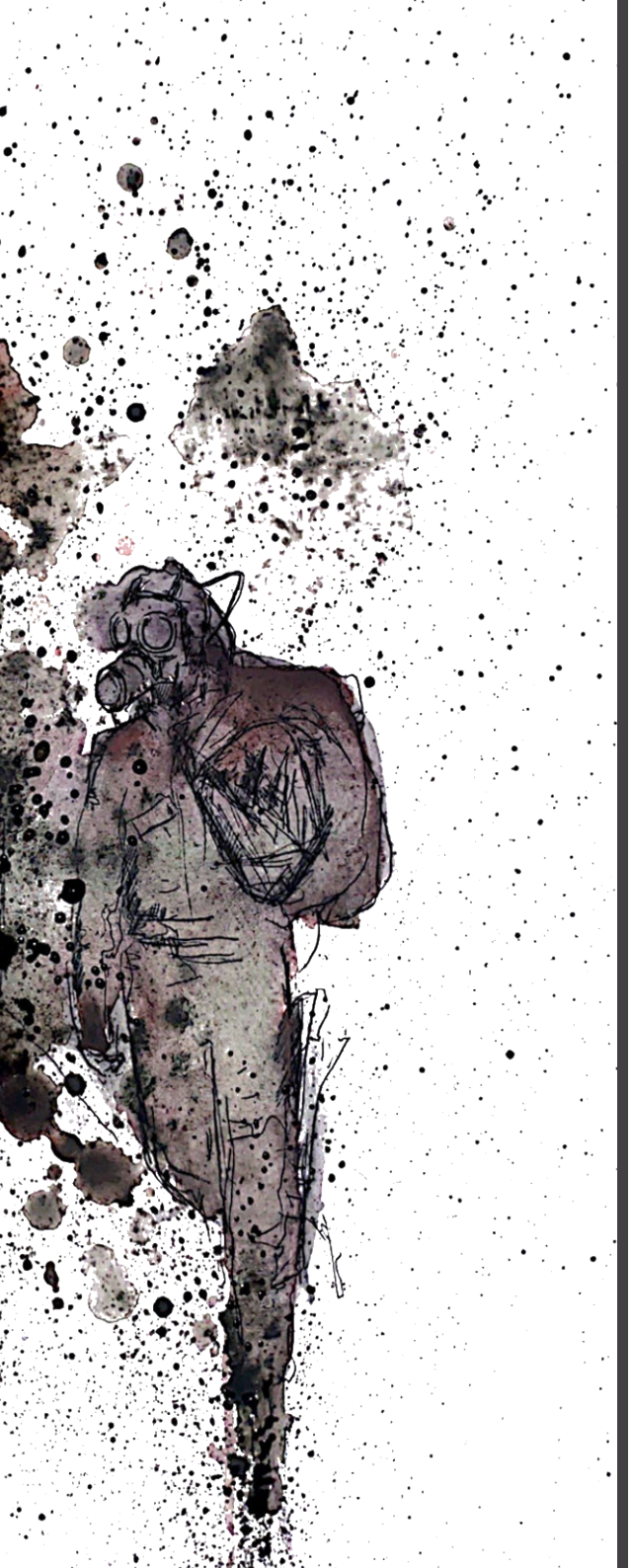
Figure 41: Mines as hyperobject reflection (Author, 2022)

This reflection is in response to the historical insights offered by Kerryn Higgs' in "Collision Course: Endless Growth on Finite Planet" and her take on consumer culture in her article: A Brief History of Consumer Culture (Higgs, 2021: Online). To respond appropriately to the possible future, it is important to understand the past.





Figure 42: Mines as hyperobject reflection 2 (Author, 2022).



To reiterate, hyperobjects can be seen as objects that together contribute to the gradual decay of the environment towards an apocalyptic obsolete natural system. The mining industry is a direct result of humanity's consumption culture and can be regarded as a massive role player within the hyperobject, of global warming. The mining industry is at a point where it is an unstoppable force of destruction, unearthing the world one hole at a time.

Consumer culture dates back to the moment in the Holocene when people stopped living with and from the land to when we realized that we can live beyond the carrying capacity of the environment. Before consumerism started there was no way to store food for long periods of time and therefore, there was no ability to acquire surplus (Higgs, 2021: Online).

This resulted in a very egalitarian social system where women had autonomy, and no real rigid dominance hierarchy among men existed. Only after the invention of agriculture and the domestication of plants and animals, the storage of surplus resources took place, essentially starting the Neolithic revolution. The controlling of the production and distribution of these surplus resources led to a change in human cultural and social organization. People started to create barriers between humans and nature, acting as larger entities (Kerryn, 2014, p. 3-14).

Consumerism completely immersed people and these resources became a way to provide status and dominance. More efficient ways of gathering finally introduced mining. Mines all over the world were initiated to produce cheap energy and precious metals and minerals (Morton, 2016: p. 136).

With abundant energy metals and minerals, people were no longer site-specific species and could live almost anywhere in the world, becoming a functional super organisms. People went from maximizing grain surplus to expanding human territory. People then started to maximize the surplus value to trade with which finally led to money, but what money effectively is, is merely a claim on some energy, metals, or minerals. People are enmeshed in systems of production, systems of manufacture, and systems of use and it is incredibly important to recognize these entities forming part of the system as a whole. Money, trade, and technology are therefore all in service of this superorganism that humankind created (Higgs, 2021: Online). As one of the main sources of carbon dioxide in the system, mines play a significant impact on global warming, which becomes a vital component of the overall structure of this particular hyperobject. The less time there is for people and animals to adapt as these environmental changes occur more quickly. People can protect themselves from the harsh realities of the environment because of this cumulative culture, which plays a crucial role in shaping the environment to their comfort.



Figure 43: The start of the consumer culture (Author, 2022)

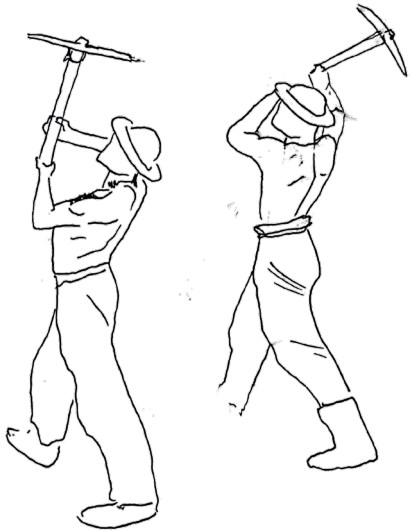


Figure 44: Mining activities (Author, 2022)



Higgs elaborates on humanity's ignorance through a more economic and political lens, but when viewed in context with the spirit of this project, the actual power and position of mines throughout the world becomes more evident. She reflected on the classic 1928 work, Propaganda by Edward Bernays, Sigmund Freud's nephew, and pioneer in public relations:

"The conscious and intelligent manipulation of the organized habits and opinions of the masses is an important element in a democratic society. Those who manipulate this unseen mechanism of society constitute an invisible government which is the true ruling power of our country . . . It is they who pull the wires which control the public mind, who harness old social forces and contrive new ways to bind and guide the world" (Bernays, 1928, p. 37).

Mining entities all over the world are influencing and intelligently manipulating humanity into this ignorant mindset that perpetuates consumer culture. To keep the wheel of capitalism and consumerism turning, we need to think that nature is an infinite resource, removed from our concern, and there for our use. Humankind lives within a mesh of energy-eating interdependence without recognizing the bigger whole, introducing the biggest paradox of our time. This begs the question, is consumer culture combined with the manipulation by a capitalist system, blinding us to the imminent danger of a global environmental meltdown?

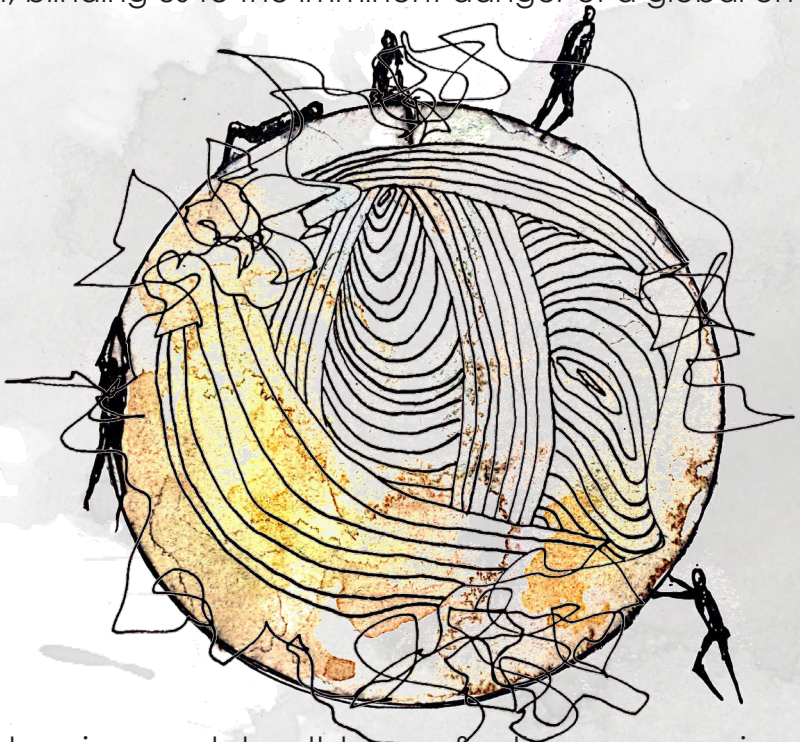


Figure 45: Global environmental meltdown reflection: consumerism (Author, 2022)

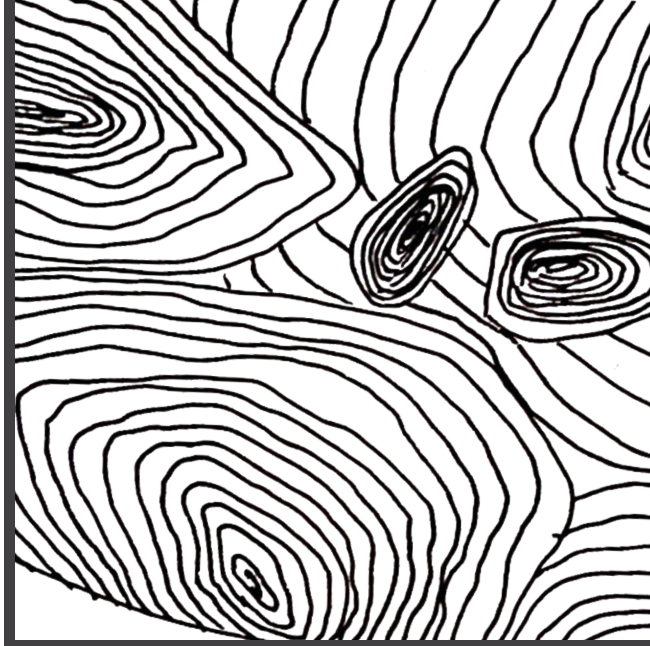
# Danger as reason to Act and change Actions

Bruce Hood, Stephen Lewandowsky, and Renee Lertzman explicate this section's aims to understand the ways humans react to imminent danger and why we do not react to the danger of environmental destruction.

According to Dr. Bruce Hood, professor of developmental psychology and author of 'The self-illusion, it is fundamentally important to understand the history of humankind to appropriately respond to the future. Contemporary society still portrays truths of our ancestry. People are still wired the same and strive towards the reward of "the hunt". People work hard intending to consume some of these modern-day objects and are still triggered by known dangers of our ancestors such as predators, sicknesses, and lethal weapons. The human perceptual system is seen as something that is not attuned to massive changes that are happening on the planet, nor are they attuned to the very fine-grained details of those changes. The alarm system in the human brain is however very attuned to the amygdala, which performs a primary role in the processing of memory, decision-making, and emotional responses, relating to primal dangers and emotional trigger words (Hood, 2012: online).

Australian psychologist, Dr. Stephen Lewandowsky further supports this view in his paper "Recursive fury: Conspiracist ideation in the blogosphere in response to research on conspiracist ideation". He explains how the primal gut reaction and people's response to instant danger in comparison to a slow and ponderous response towards complex issues in the world, differs. Contemporary society with all its evolutionary impulses however struggles to comprehend unknown dangers of the future, causing the majority of humankind to be completely ignorant of this dark ecological route that has been embarked on, inevitably leading to apocalyptic environmentalism obsolete (Lewandowsky, 2013: online).

Dr. Renee Lertzman, climate psychologist and environmental strategist, and author of the book "Environmental Melancholia: Facing the Unbearable", is completely committed to the idea that a better understanding of oneself becomes the key to unlocking actions necessary to save the world from an environmental apocalyptic obsolete. The presence of uncertainty, a sense of precarity, and a feeling of vulnerability and confusion allow people to be most susceptible to adhering to a message that meets those anxieties and uncertainties with confidence (Lertzman, 2019: online). Once these feelings are channeled to stay in touch with the unbearable reality of hyperobjects, people tend to act accordingly to prohibit this daunting dystopic future.



The presence of uncertainty, a sense of precarity and a feeling of vulnerability and confusion allows people to be most susceptible to adhering to a message that meets those anxieties and uncertainties with confidence (Lertzman, 2019: online).





Figure 46: Freedom Park (ARCHTIZER, 2011)

In the case study, Isivivane, Freedom Park: A critical analysis of the relationship between commemoration, meaning, and landscape design in post-apartheid South Africa, a better understanding of a meaningful design is grasped. The perception and experience of the landscape influences create a platform for people to identify with the place. The design focus on one aspect being a place for 'cleansing and healing', which allows for a better understanding and connection between visitors and the design (Young, 2019: p. 20).

Freedom Park is an indigenous and local example of an uncanny experience that connects people to a crucial message portrayed through architectural innovation. This way of thinking provides a platform for architectural innovation to essentially portray this brutal and crucial message of the reality of hyperobjects to people that interact with the building. Architecture and design cannot prevent an apocalyptic environmental obsolete, but they can create a platform for critically rethinking our actions.

South African architect Mpethi Marojele (MMA Studio), explained during the Sophia Grey lecture of 2022, how he as an architect functions and designs. With the birth of consciousness and the understanding of origins, his practice is based on the need to understand the relationship between cause and effect. He designs on the basis that architecture is a direct result of people seeking refuge, shelter, prospect, and freedom. In the design of Freedom Park, He described how he envisioned the architecture as one with nature by allowing nature to permeate throughout the design. This supports my project's initial concept of phyto[reclamation], essentially allowing wild nature to permeate and become the ornamentation of the building.



Figure 47: Moments between human and nature (ARCHTIZER, 2011, Adapted by Author, 2022)

It is therefore important to design moments where nature's role and fragility can be questioned to create a platform where the relationship between humans and nature can be connected to the unbearable reality of hyperobjects, becoming one with ecognosis.

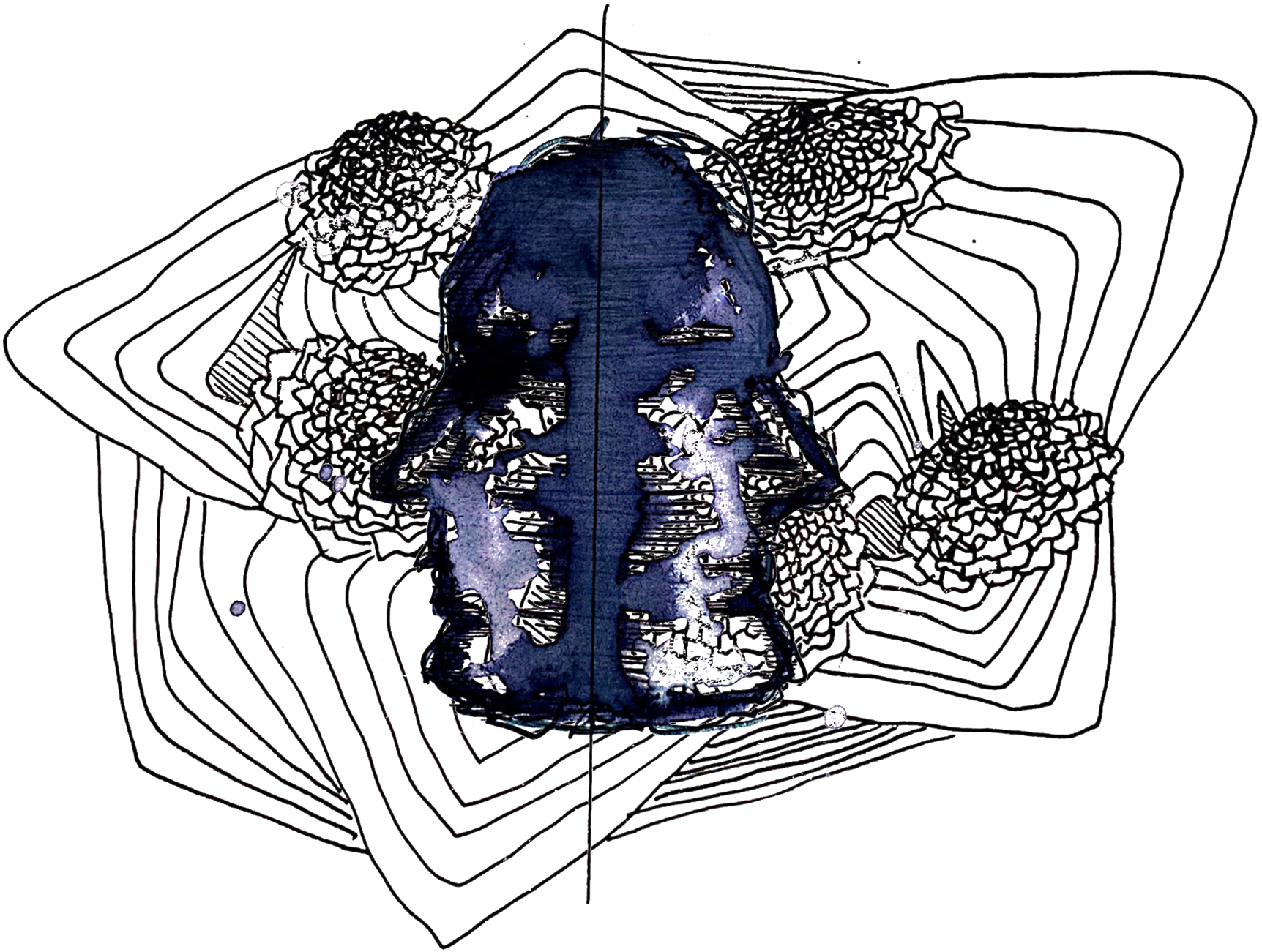


Figure 48: Relationships that matter: Ecognosis reflection (Author, 2022)

Architecture might be defined in many ways, but when stripped to its roots, it functionally acts to protect humans from natural and human danger. Today, architecture needs to protect the ecological "mesh" from an apocalyptic environmental obsolete. It cannot displace its function as protection but can change the way it meaningfully relates to nature, or poetically acts as an object in the ecological "mesh".

By understanding what makes humans respond to danger and nature, it might be possible to understand how architecture can present danger and nature to invoke a fear of natural destruction and a positive and meaningful concern for the environment.

On the one hand, it seems from the preceding that the architecture needs to invite the haunted and uncanny into the design, to remove the distance between the far-off danger, to make the human feel vulnerable and confused(Korody, 2016: online). On the other hand, it seems that architecture needs to invite the natural into the design, as to resolve the distance between human and nature and connects to the ecological mesh.

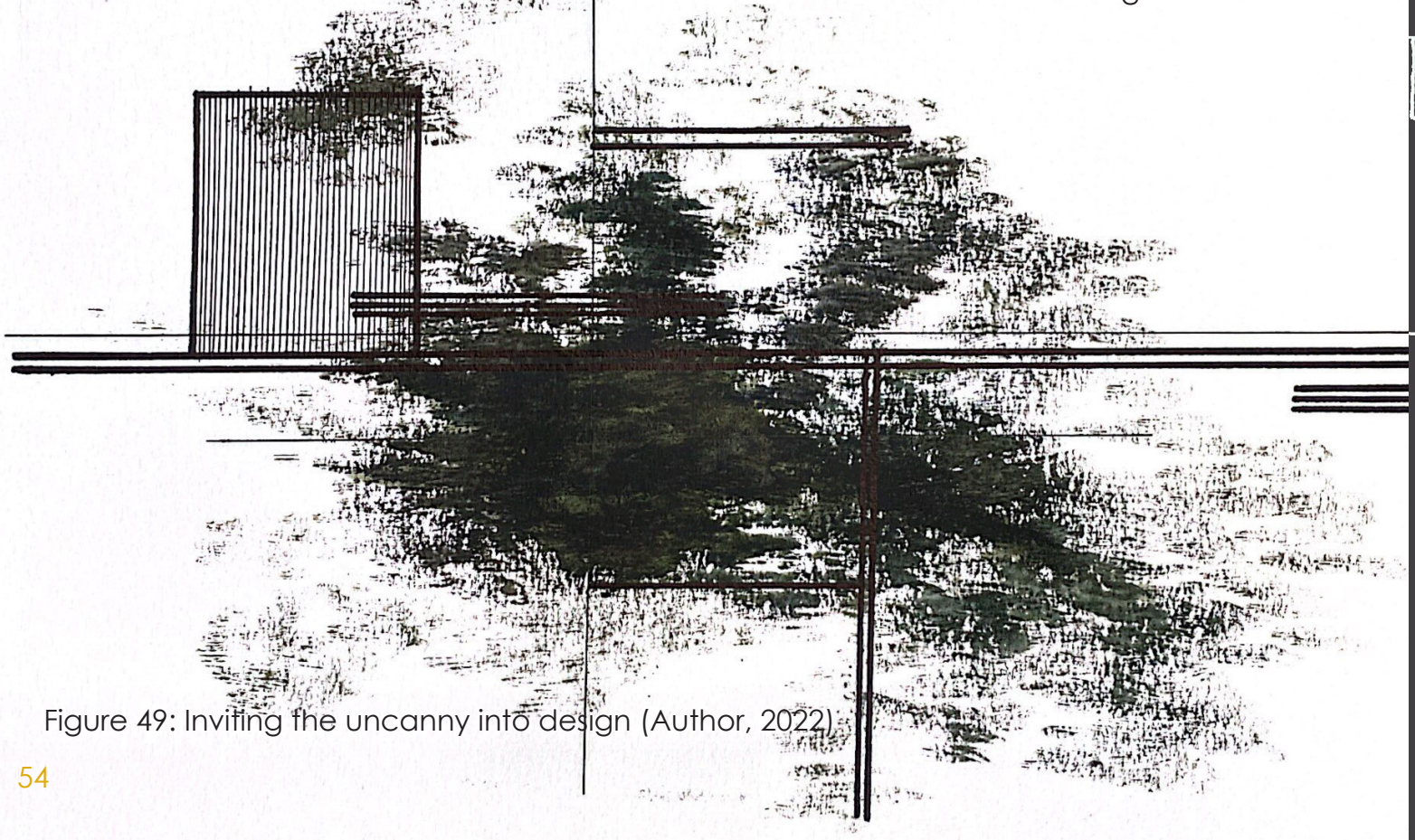


Figure 49: Inviting the uncanny into design (Author, 2022)

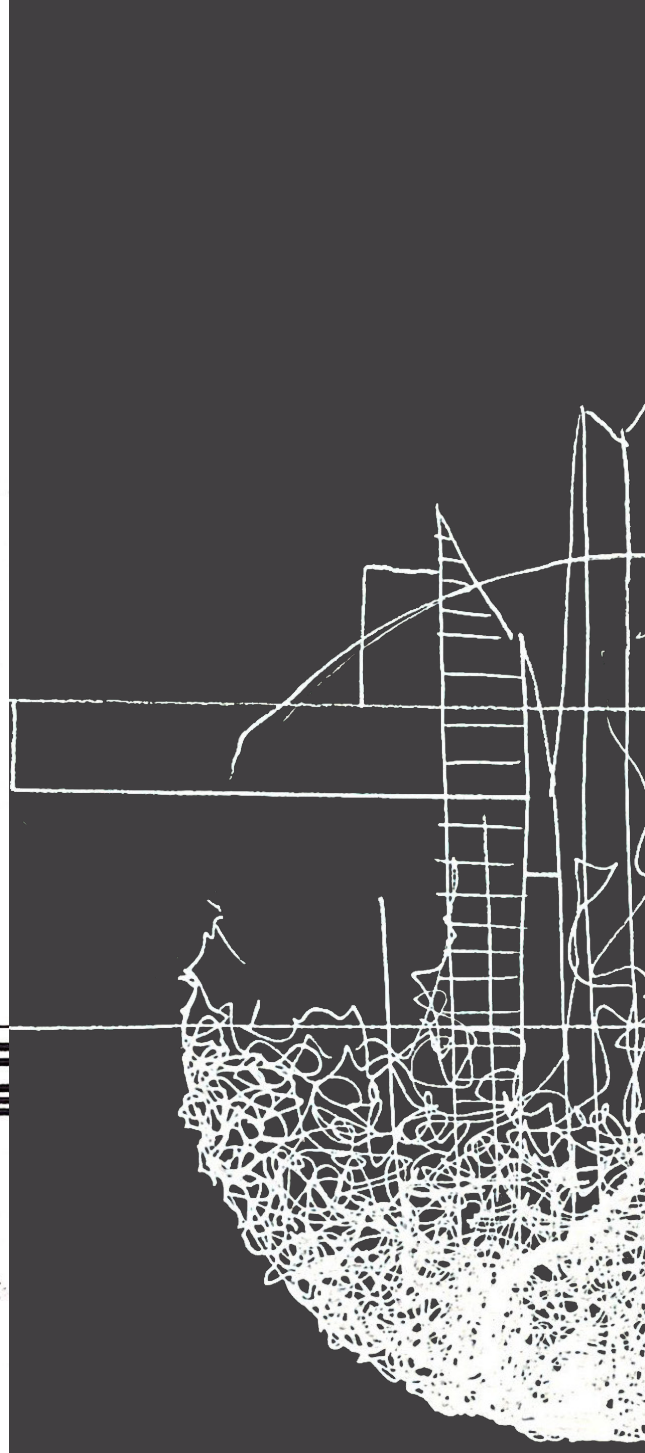
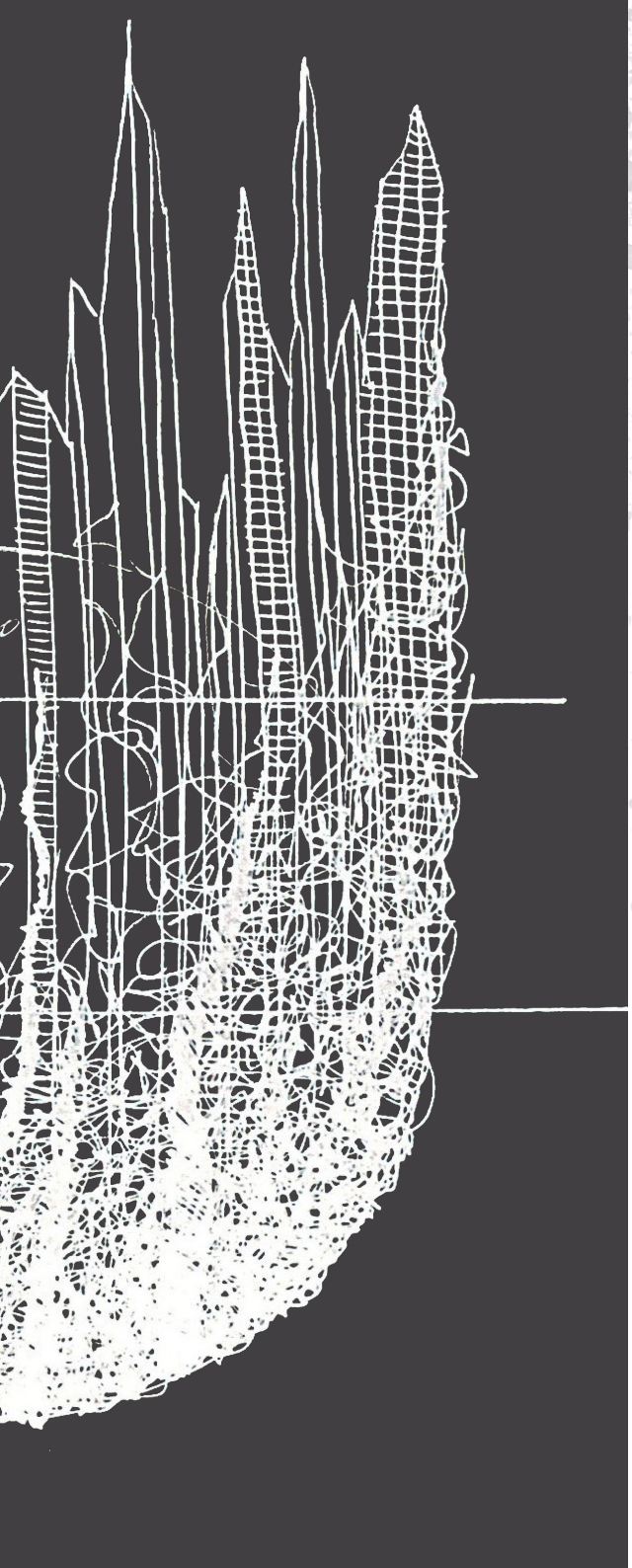


Figure 50: Architecture growing through Dark Ecology (Author, 2022)



# Dark Ecology as the foundation for meaning in architectural design

The architectural relevance of Dark Ecology is discussed in reference to Martin Heidegger, Le Corbusier, Norberg Schulz, and architect Christopher Alexander. The future of appropriate architectural innovation through the lens of Dark Ecology is further discussed and supported through precedent studies.

German philosopher, Martin Heidegger, alludes to the fact that buildings can clarify things in an environment leading to moments of Aletheia, where the work reveals certain aspects of the landscape to the viewer. This feeling of Aletheia should be encouraged within architecture through a rationally comprehendible design (Heidegger, 1981).

This combination becomes a fundamental way of design since it inspires an enhanced experience of interaction between humans and building, or in this case the danger inherent to mining and the potential of rehabilitation – put differently greeting awareness of the uncanniness and homeliness of the ecological "mesh" (figure 50). This might assist people to critically rethink themselves as the cause and victim of the hyperobject of mining.

Architecture may present itself as an object that is aware of the danger and cares for nature. Not only care for their surroundings, but for democracy, aesthetics, culture, tradition, and history. "You touch my heart… I perceive your intentions". These famous words of Swiss-French architect, Le Corbusier, show that architecture has immense power to alter the worlds of the many people who spend their lives in the building over its life span (Le Corbusier. 1923). The understanding of people and their situatedness can be the focus of a design process, but also the insight into what is truly necessary for this specific time and place.

The Urban Algae Folly, Expo Milano 2015 Future Food District (figure 51), shows a very direct interpretation of design interlinked with dark ecology, successfully raising awareness by creating a platform where this uncanniness can portray the necessary message.

This project introduced a new and unique vision of the future of bio-digital architecture, which was directly influenced by Timothy Morton's first notions of 'dark ecology'.

This structure is the world's first living edible architecture and successfully captured the audience's attention, essentially allowing for critical reflection to take place. This is essentially the same goal that this dissertation has, whilst simultaneously presenting a possible solution toward a better future.

This project integrates agriculture and bio-digital systems within an architectural prototype to challenge the traditional conception of building. This project attempts to completely integrate nature and building by using microalgae organisms as the building blocks whilst allowing it to grow (IAAC, 2020: Online). The public played a vital role in the evolvement of methods called "collective urban cultivation" which resulted in an inherently responsive and adaptive system that cultivated 35g of Chlorella a day, which absorbed 1.5kg of carbon dioxide and produced 750g of oxygen daily (IAAC, 2020: Online). This realization that building and humanity cannot and should not be distinguished from nature, resulted in architectural innovation that meets Earth's goals as a whole.

Identifying some entities such as innovation, research, and education within the reality of hyperobjects that become essential role players that could dissolve the prominence of global warming and have a positive-earth scale impact. Material, technology, and environment has been unified and reflects Morton's notion that humans should not strive to derive from the nonhuman anymore and seek more symbiotic relationships and interactions. This dissertation is further inspired to incorporate these essential role-playing entities mentioned, into the program of the building, leading to a research and learning center.

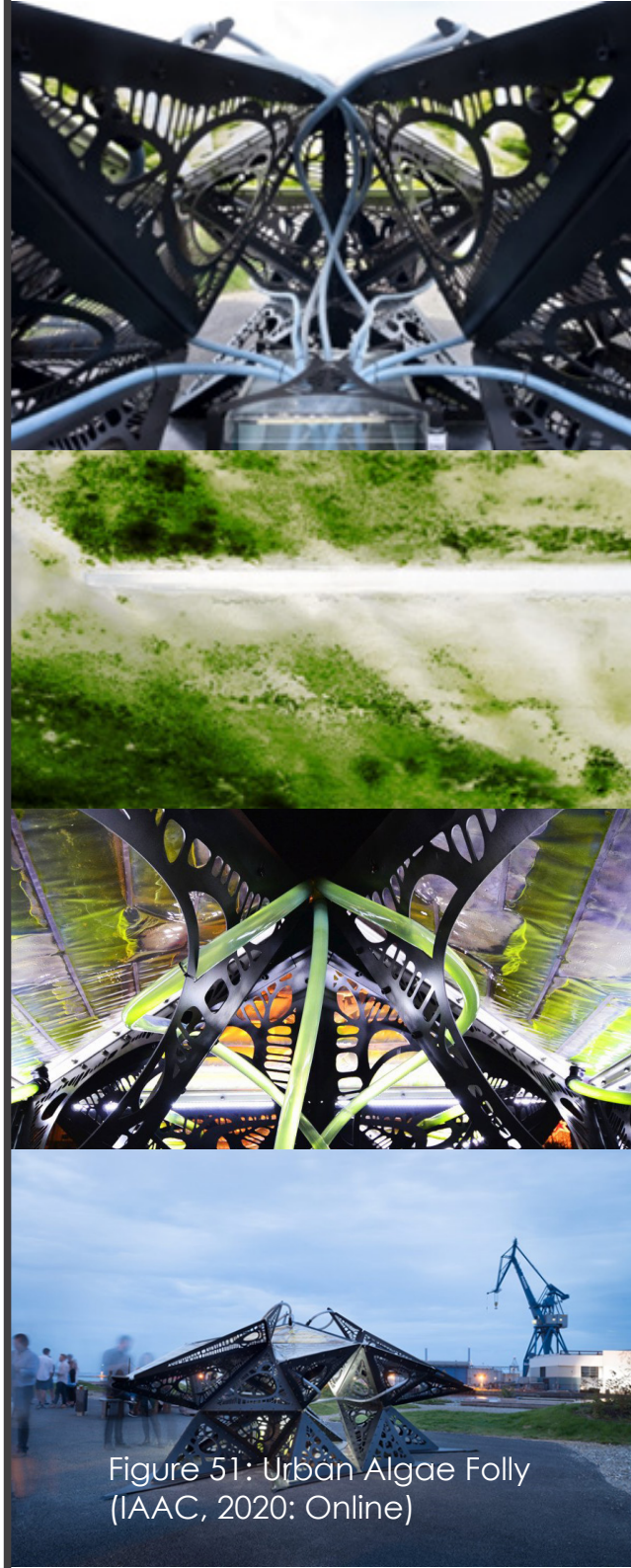


Figure 51: Urban Algae Folly (IAAC, 2020: Online)

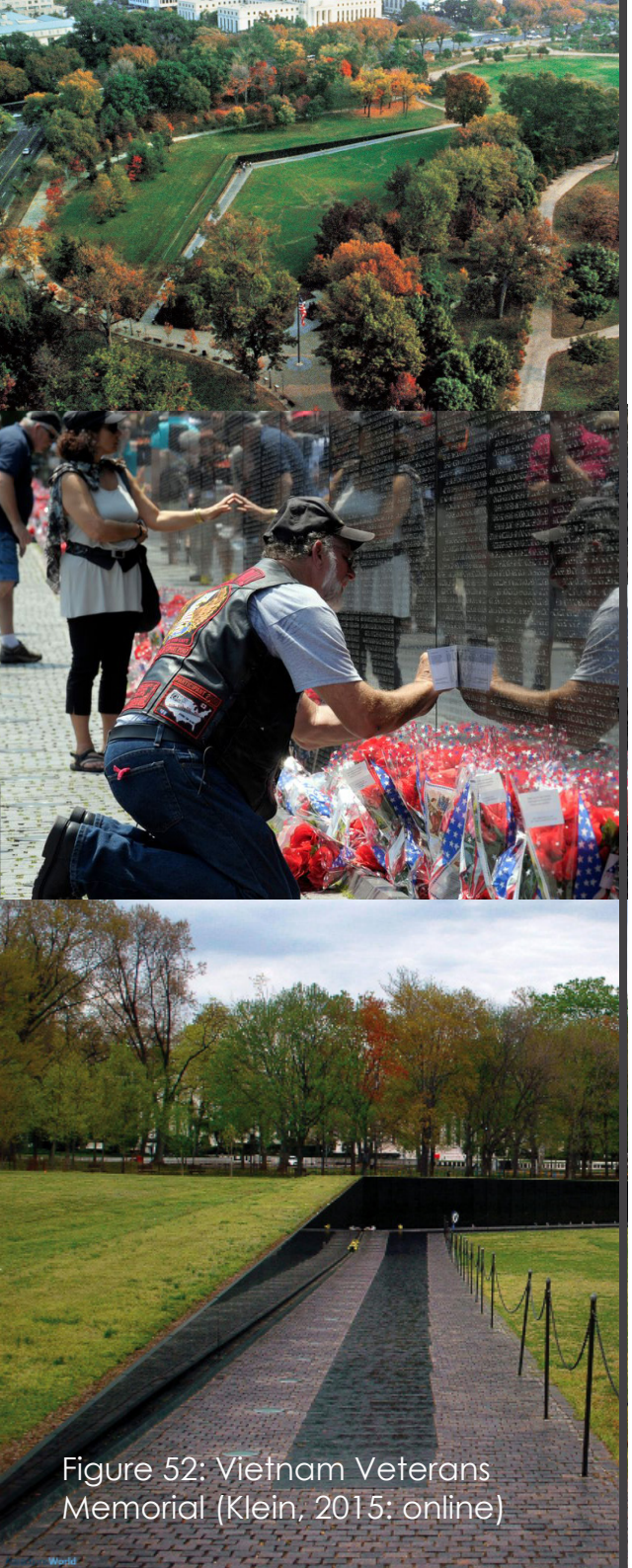


Figure 52: Vietnam Veterans Memorial (Klein, 2015: online)

To know what is needed architecturally, the understanding of time is essential. Every act of becoming, becomes an existential act where the perimeters of our existence are being challenged, but more acutely, a search for affirmation. Norwegian architect, Norberg Schulz, mentions that a work of architecture is creatively answering the voice by making a corresponding image that will reveal the place in a significant way and contribute to the destiny of the place.

The Vietnam Veterans Memorial of Maya Lin is a perfect example of a design that understands the necessity of a specific time by answering the voice of place. The uncanniness of this design successfully translates into an emotional experience where people can critically reflect on the significance of the Vietnamese war and its effects. In Lin's words: "I imagined taking a knife and cutting into the earth, opening it up, an initial violence and pain that in time would heal" (Klein, 2015: online).



Figure 53: Design concept of the Vietnam Veterans Memorial (Klein, 2015: online)

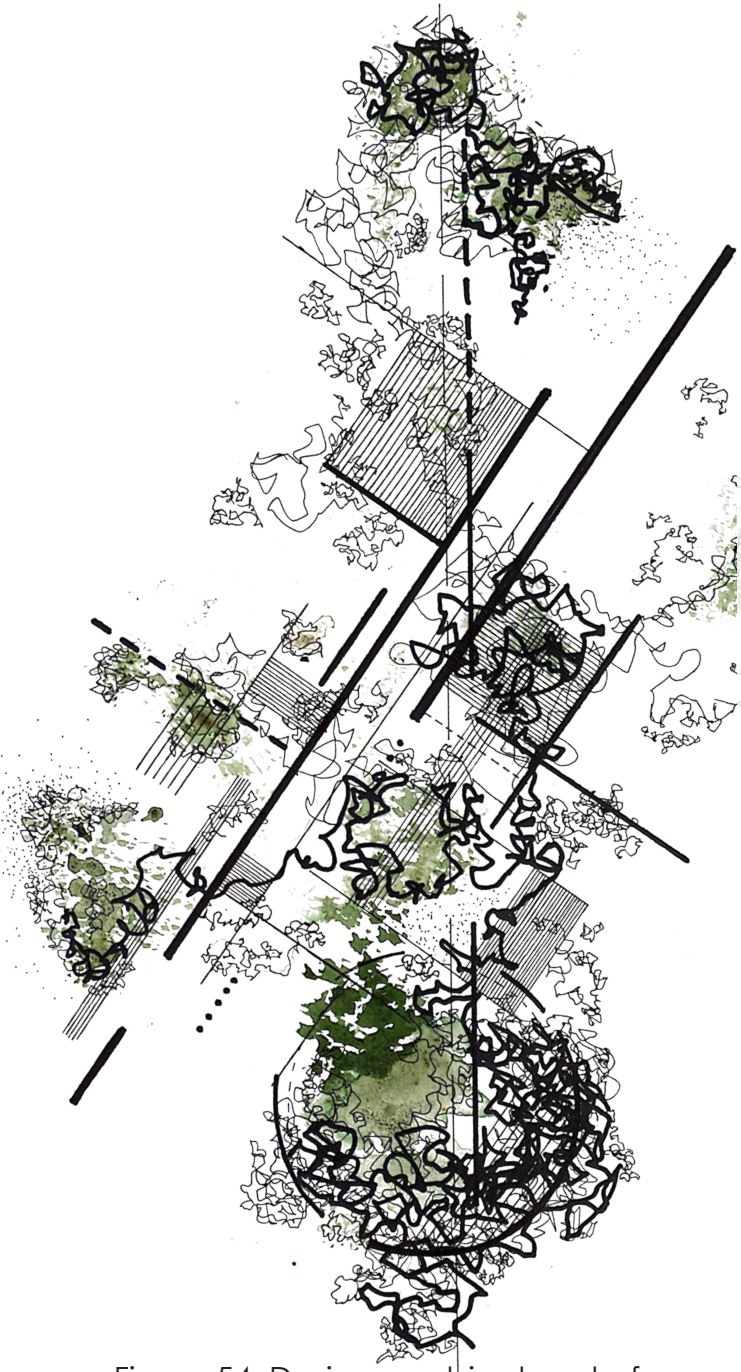


Figure 54: Design as object part of the ecological 'mesh'(Author, 2022)

Guided by architect and design theorist Christopher Alexander, I came to the understanding that it is not a sense of timelessness that sustains a work but rather the morality embedded in the work through the connection to and clarification of the specific genius loci. "An architect's power also comes from his capacity to observe the relationships which matter — the ones which are deep, profound, the ones which do the work" (Alexander, 1979: 218). These connections completely correspond with Timothy Morton's idea of a system of entities forming part of a bigger whole, and as architects, it is crucial to understand this world of entities and systems to appropriately design a building that is relevant to the time and place.

People's cultural development is constantly influenced, those buildings that surround us stimulate (or not) our imagination and define our artistic sensibilities. This influence originates in whatever - intentionally or unconsciously - inspires those involved in its creation; it is embodied in the fabric and forms of the buildings.

"Buildings are haunted, not just by their past, but also by their future" (Korody, 2016: online).

During an interview between Morton and Korody, Morton describes his idea of an ecological architectural practice as a design that implies a spectral, un-pin-downable future happening at all kinds of overlapping temporal scales. A design that comprises not only the function of the building for that specific time but the future. Buildings outlive generations to come, and should be in motion with nature, keeping in mind the inner fragility of things (Korody, 2016: online).

To mold ideas into design, one must know where to look for these 'relationships which really matter' and begin to connect with them, clarifying what was once just known to the architect, to those who begin to interact and be affected by the other natural and build objects in the web of objects. This design, therefore, has to respond meaningfully to the realities that people are facing today, and more importantly the realities that people will be facing in the future since we are already in motion of molding this apocalyptic obsolete today.

Buildings have effects and affect us, the same as nature has effects and affects us. When we realize that all the objects in the ecological 'mesh' have effects and affect each other, the ideas that we have wrestled with and molded into built form become our world (figure 54).

# Conclusion

This chapter inspires architectural innovation that is relevant to the Zeitgeist of the time and ecological future. This concerns politics, democracy, genius loci, and our society's challenges. Through understanding the haunted reality of hyperobjects and the crucial impact humanity has on them, it became clear that the design had to aim for some cognizance that molds human indigenousness to nature. Throughout the investigation of this chapter, it became clear that an emerged anthropogenic state could be reached through designing spaces where the presence of nature becomes uncertain, vulnerable, and confusing in order to allow people to be most susceptible to adhering to this message.

The design therefore not only becomes a possible solution for the mining rehabilitation process through phytoremediation and phytomining, but a vessel to a message that questions the anthropocentric condition to provide a better understanding of a nature-centered condition. This understanding becomes a crucial part of the design and aims to both scare and enlighten us about our indigenousness to nature to care for the future of humanity.

The following chapter investigates the site in depth and introduces a local precedent study, Witklipfotnein Eco Lodge in South Africa, as a perfect example of the combination of material, technology, and environment that portrays an architectural approach in ecognosis with an ecological future.

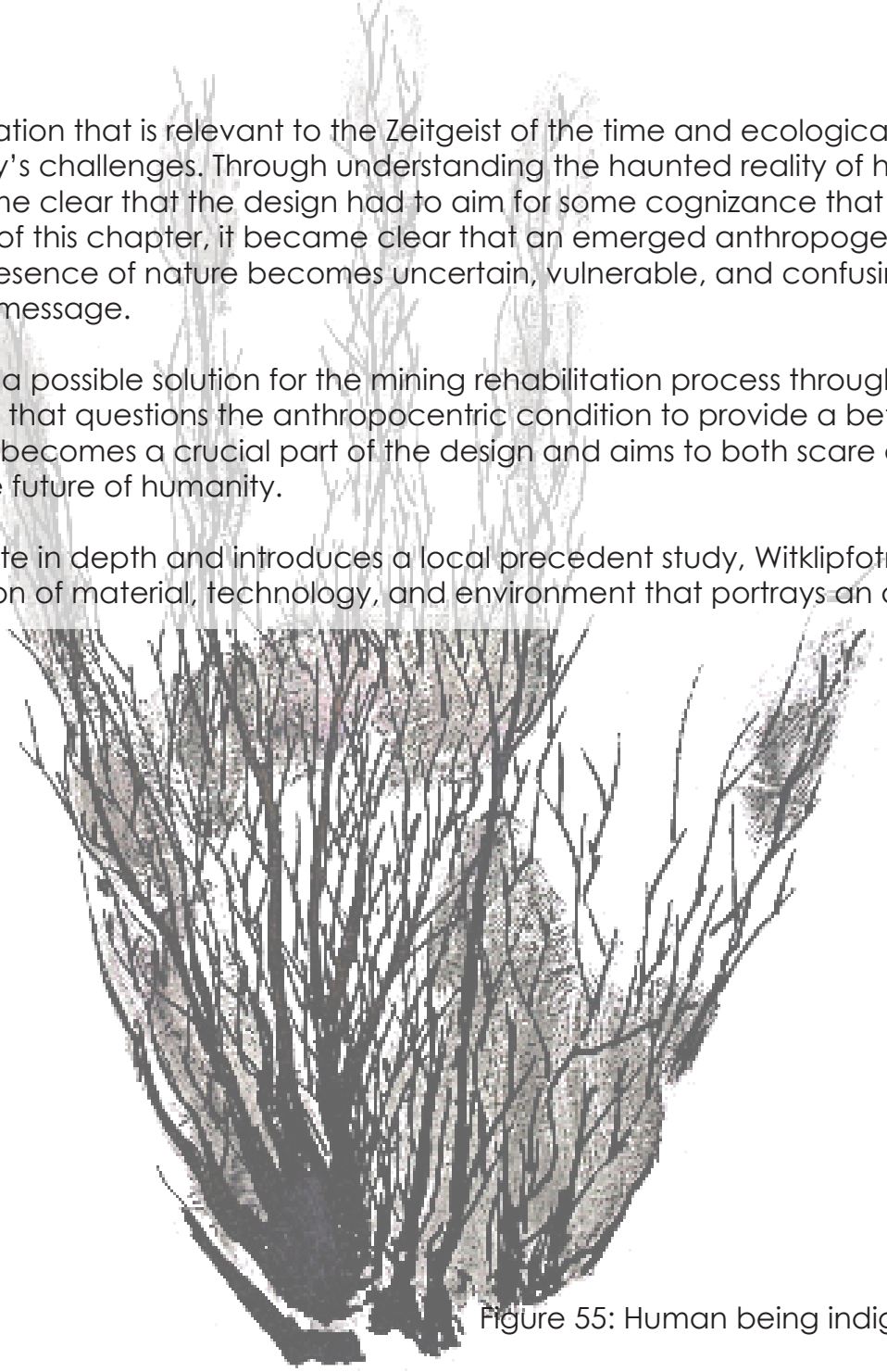
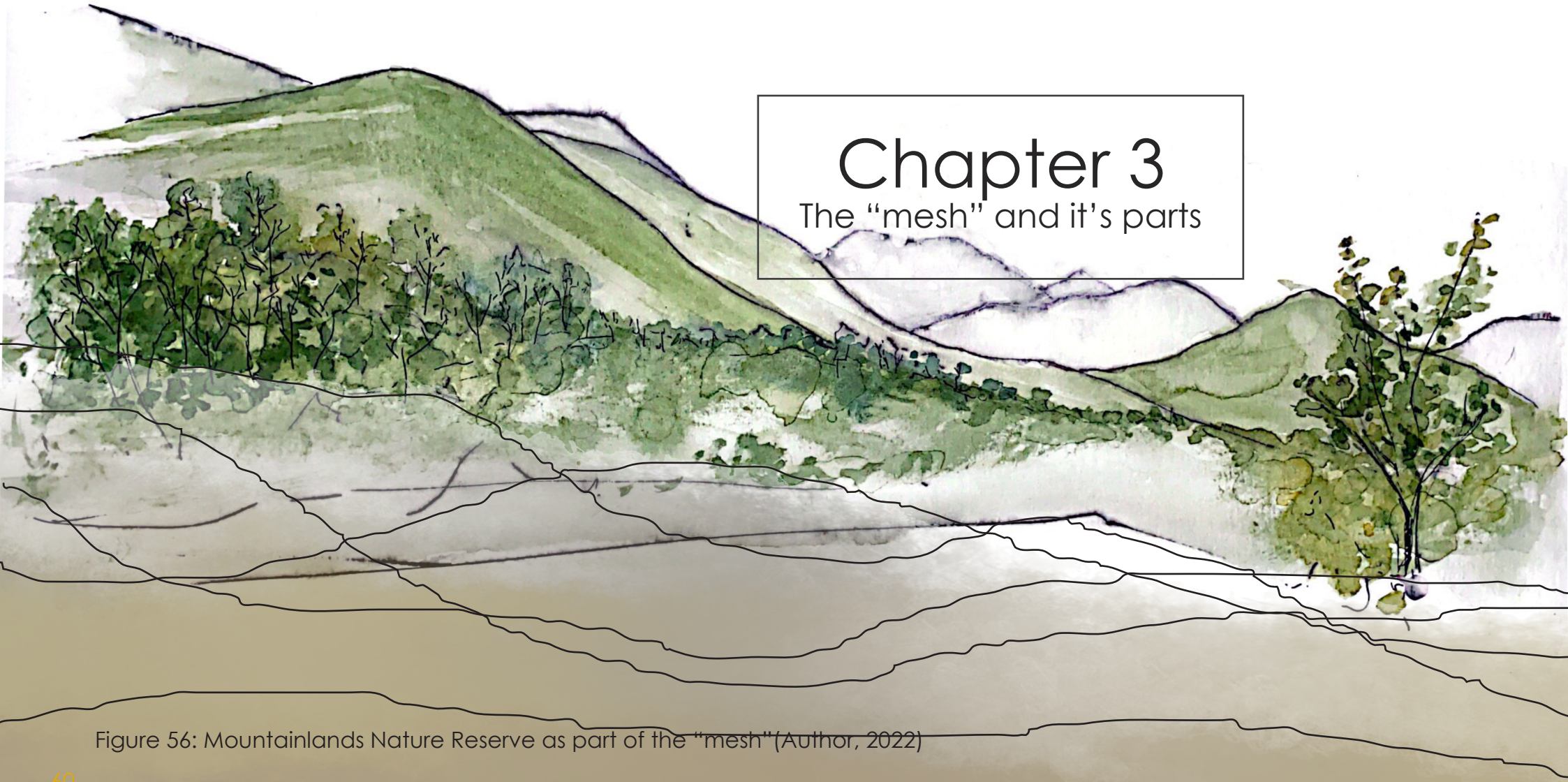


Figure 55: Human being indigenous to nature (Author, 2022)



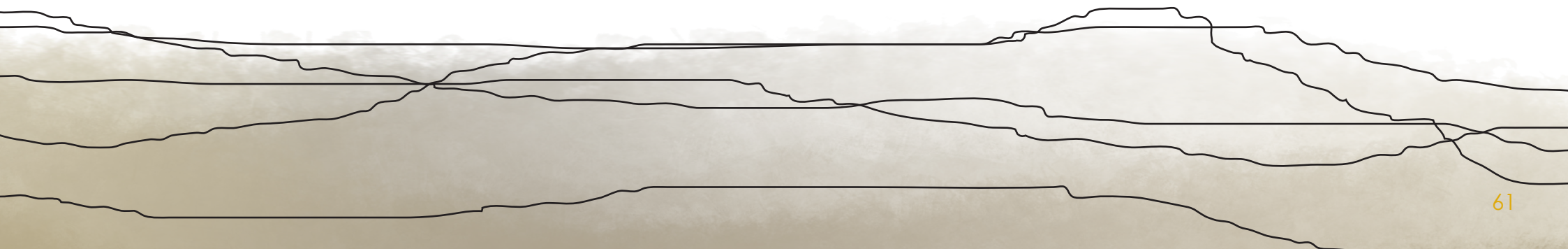
# Chapter 3

## The “mesh” and it’s parts

Figure 56: Mountainlands Nature Reserve as part of the “mesh”(Author, 2022)

Chapter Three analyzes the larger contexts and specific siting of the dissertation project. Site research is both concerned with identifying factual data and subjective and cognitive qualities of the site. The site investigation further introduces new design opportunities and inspirations.

Attempting to understand and respond to the site conditions, architectural precedent studies such as Witklipfotnein Eco Lodge in South Africa and the Redesign of the Roman Quarry, Austria, are analyzed.



# Site and Context Analysis

## 1. Macro Site Analysis:

This section refers to the relationship and influences the broader context of Mpumalanga and Barberton on the project. This the province is known for mining activities all over since it is filled with South Africa's richest resources. Barberton is well known as the location where the first gold stock exchange took place in South Africa, and lures people from all over the world as a geological mecca, to probe the earth's beginnings and riches.

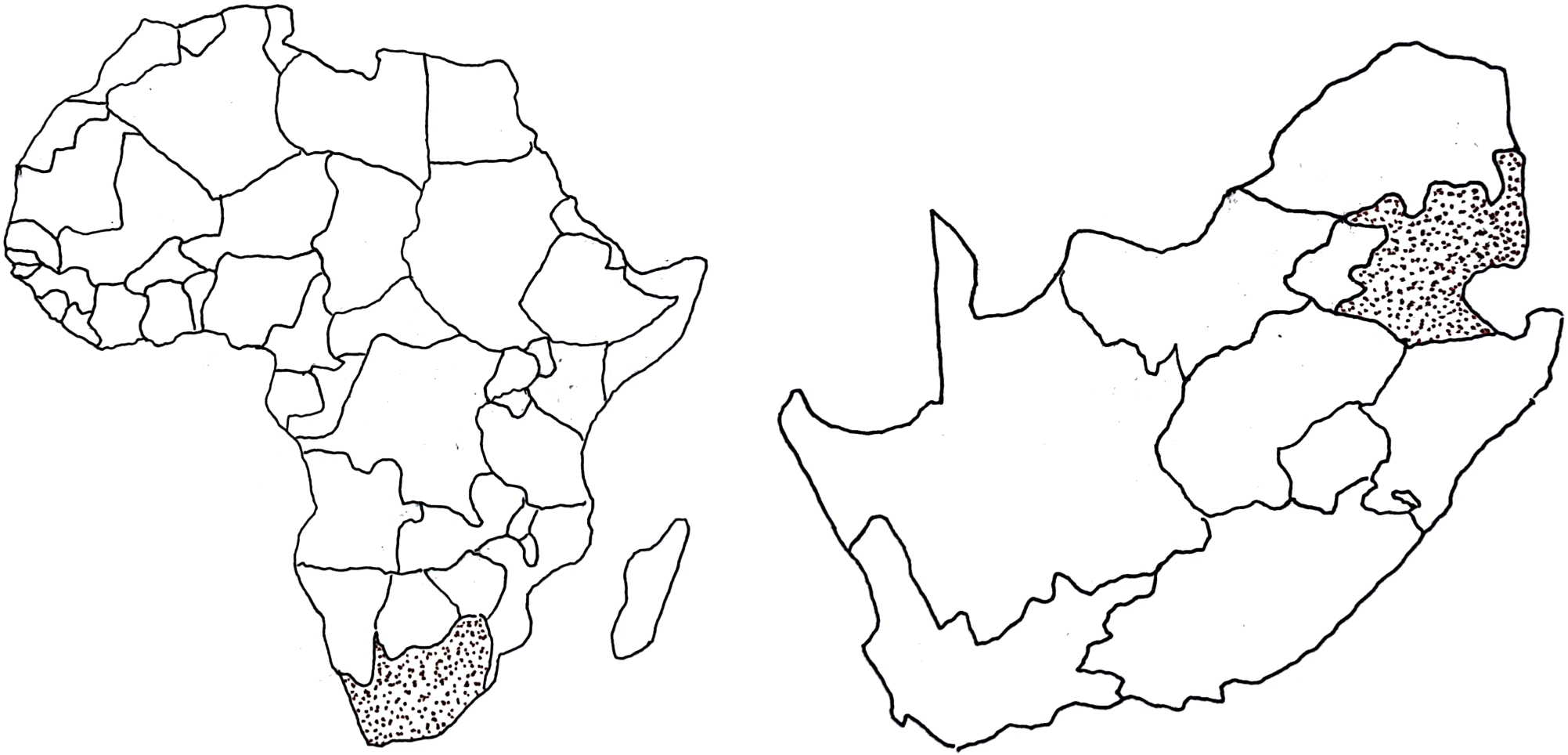


Figure 57: Locality plan of South Africa to Mpumalanga (Author: 2022)

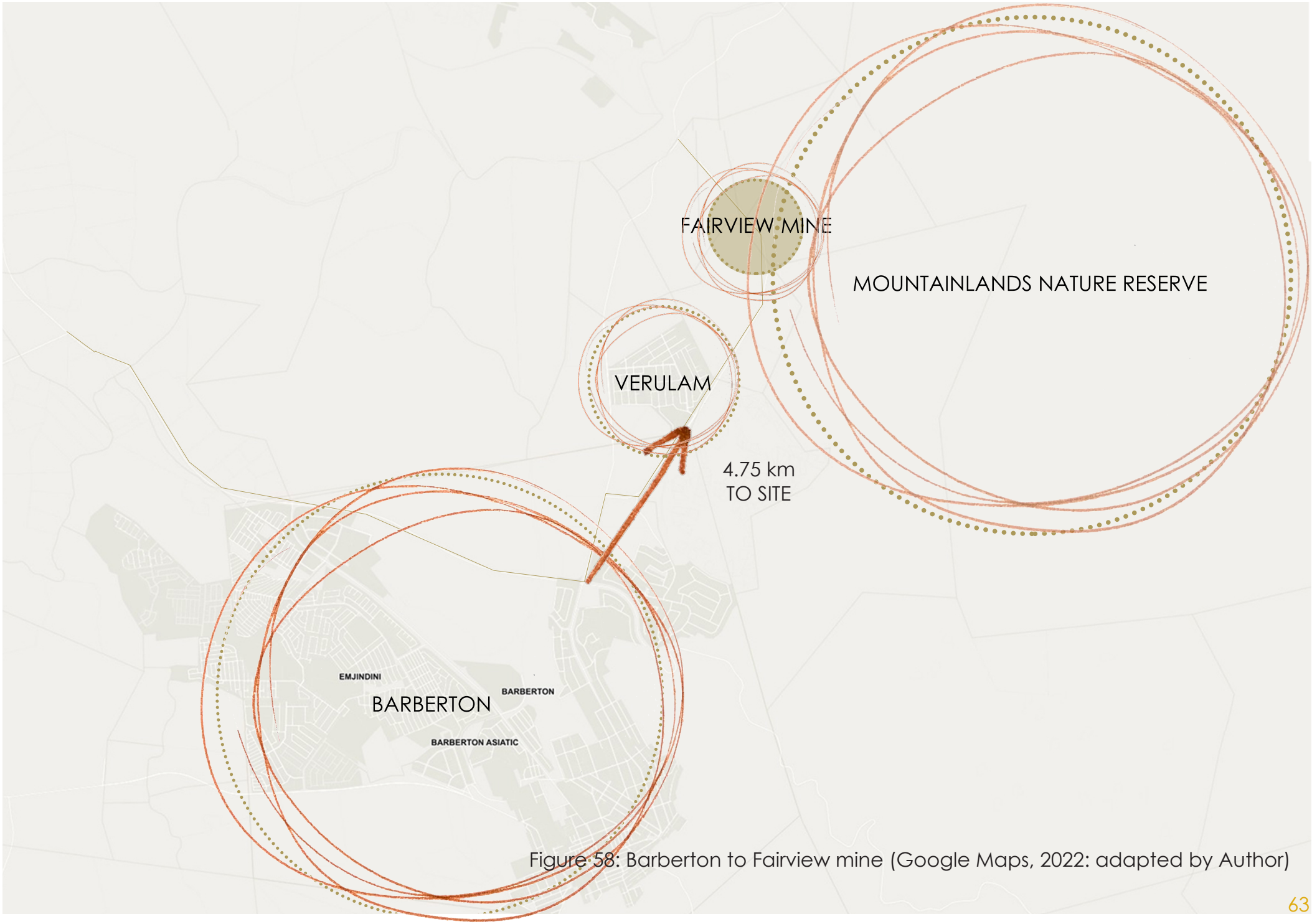



Figure 58: Barberton to Fairview mine (Google Maps, 2022: adapted by Author)

# 2. Mezzo Site Analysis:

Fairview mine focus on both surface mining and underground mining. Being an active mine, a lot of challenges regarding site visits and information presented themselves. The mine functions with processing plants, offices, TSF's, Loading docks, tailings, and some abandoned tailing sites as seen in figure 59.

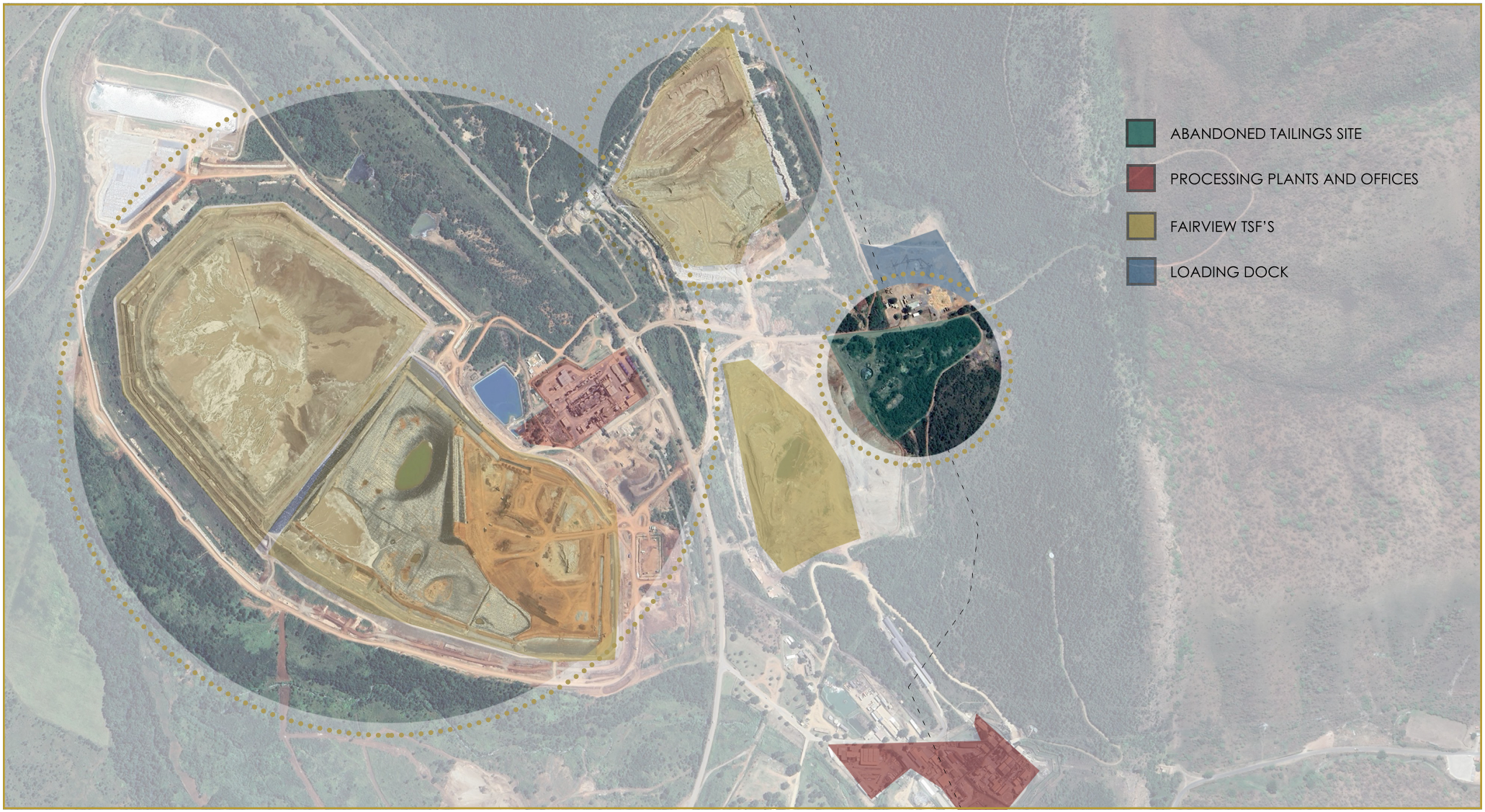



Figure 59: Fairview mine (Google Maps, 2022: adapted by Author)



Figure 60: Abstract site exploration(Author, 2022)

The abandoned tailings site is surrounded by all the previously-mentioned mining activities, but more importantly the Mountainlands Nature reserve. The mine has infiltrated the nature reserve's borders and left the old tailings site in a very distraught condition. The Mountainlands Nature reserve is however known for its beautiful scenic routes and untouched nature.



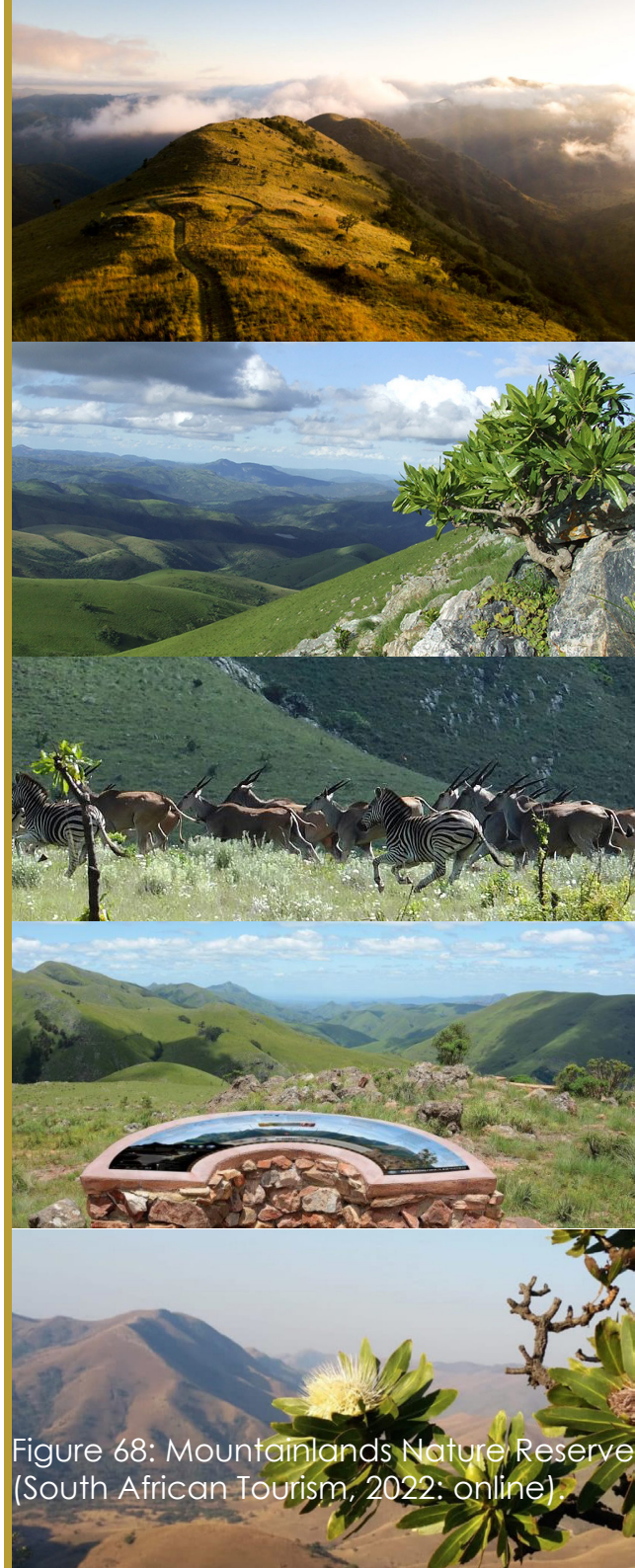


Figure 68: Mountainlands Nature Reserve (South African Tourism, 2022: online).





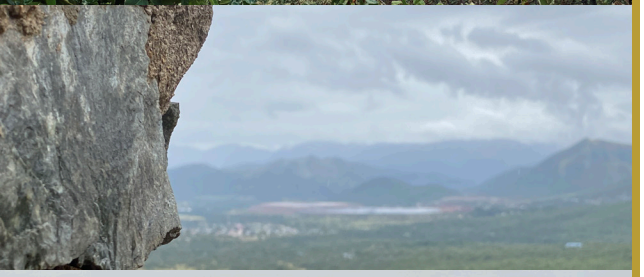





Figure 69: Barberton (Author, 2022)

Warm and temperate summers with an average temperature of 20.8°C are followed by a cold and wet winter with an average temperature being 12.3 °C. The average rainfall of Barberton is 785mm per year. The Köppen-Geiger climate classification is Cwb. January is the month with the highest relative humidity (75.74 %) and August is the month with the lowest relative humidity (51.94%).

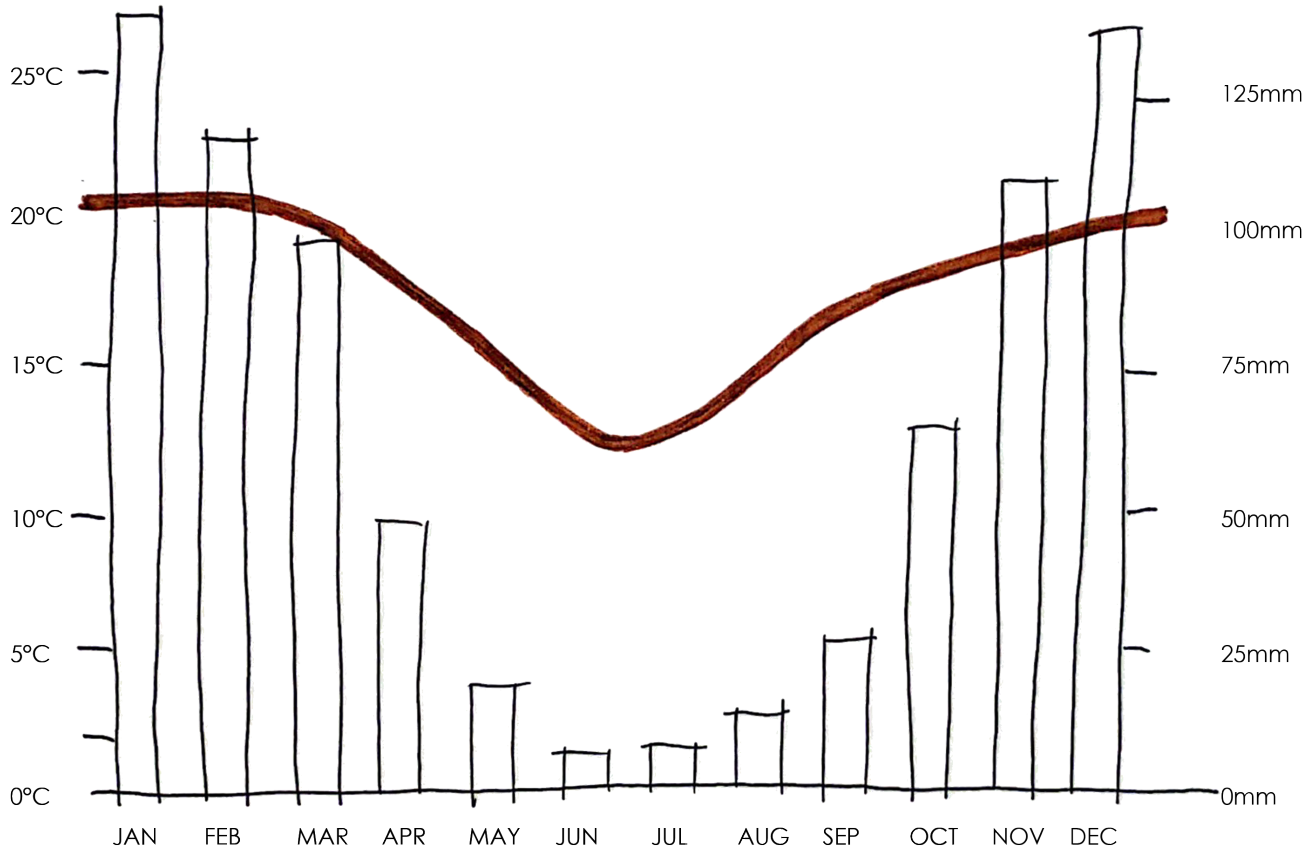



Figure 70: Weather by month for Barberton (Climate-data, 2022: Online)

These statistics (figure 70) clearly show that the climate is very humid throughout the year and is one of the biggest challenges regarding the labs and compressed earth construction.
The abandoned tailings site is surrounded by all the previously-mentioned mining activities, but more importantly the Mountainlands Nature reserve. The mine has infiltrated the nature reserve's borders and left the old tailings site in a very distraught condition. The Mountainlands Nature reserve is however known for its beautiful scenic routes and untouched nature.

# 3. Micro Site Analysis:



Figure 71: Site location (Google Maps, 2022: adapted by Author)



Figure 72: The site (Author, 2022).







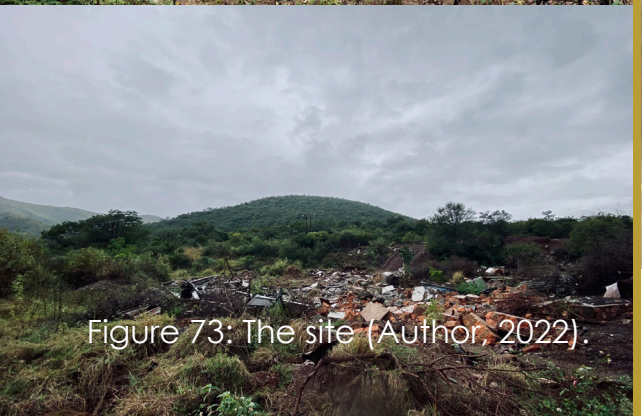


Figure 73: The site (Author, 2022).

The site is stretched from east to west (figure 74), allowing for northern and southern facades to be designed. The Mountainlands nature reserve on the east will start each day with a beautiful sunrise over the historical mountains and untouched nature. With the sun following the path as seen in figure 74, people will get to see the sunset over the devastating mine west of the site. As time goes on, this dystopic quarry will be filled with beautiful yellow Berkheya Coddi flowers, portraying a sunset with new hope. This sunrise and sunset becomes a very important role player when designing with the intention of creating memorable experiences that affect and motivate people.



Figure 74: Site influnces (Google maps, adapted by Author, 2022)



Figure 75: Site plan with influences (Author, 2022)

The Mountainlands nature reserve provides a fair slope into the abandoned Tailings site, leading to a drastic drop into the quarry of Fairview mine. This slope provides the opportunity for a water collection system that can be used for plantations, nurseries, and greenhouses.

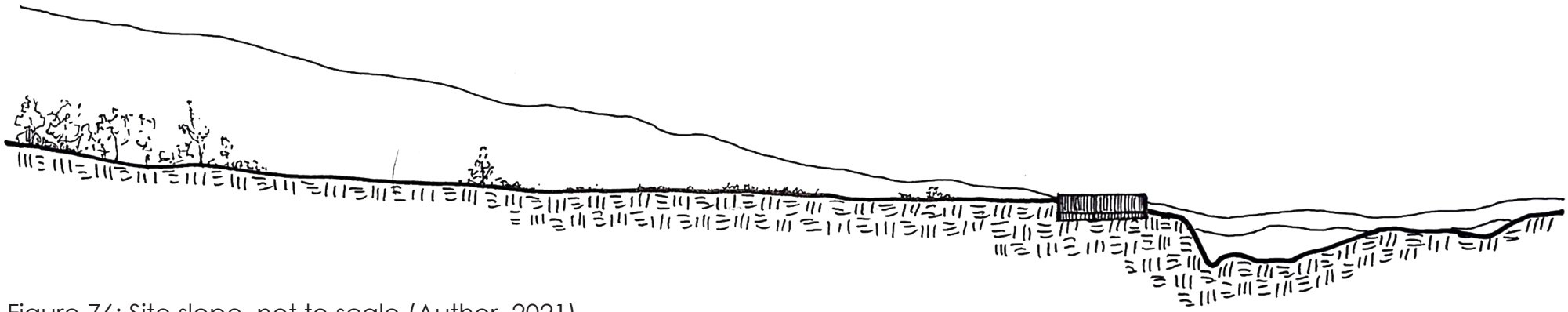


Figure 76: Site slope, not to scale (Author, 2021)

The Barberton Greenstone Belt consists of three major rock units: The Fig Tree, Onverwacht group, and Moodies Group. The sedimentary soil conditions of Barberton are very rich in metals and have a very limited flora that can survive these conditions, known as endemics. This high concentration of heavy metals is generally toxic to most vegetation, but at least 30 endemics have been found in these unfavorable sedimentary soil conditions (Barberton Tourism: Online).



Figure 77: Site geology (Author, 2022)

The abandoned tailings site has been left in a devastating condition. With demolished building materials and other hazardous objects covering the site, the flora has been completely neglected. Nature is however slowly but surely reclaiming the site and growing over leftover building materials. Most of the biodiversity and vegetation on the site comes from the Mountainlands nature reserve.

The Mountainlands nature reserve is known as a botanical wonderland with emerald green grass and yellow Berkheyas that grows along many roads. Beautiful orange-red squiggles of Bauhinia galpinii can be found in forestry and one of the most iconic flowers, the Barberton daisy can be found all over. From the world's tallest tree aloe (Aloe barberae) to the world's smallest aloe (Aloe albida) can all be found in this South African Eden (Barberton Tourism: Online).



Figure 78: Site Flora (Author, 2022)



Figure 79: Photographs of flora on Tailings site (Author,

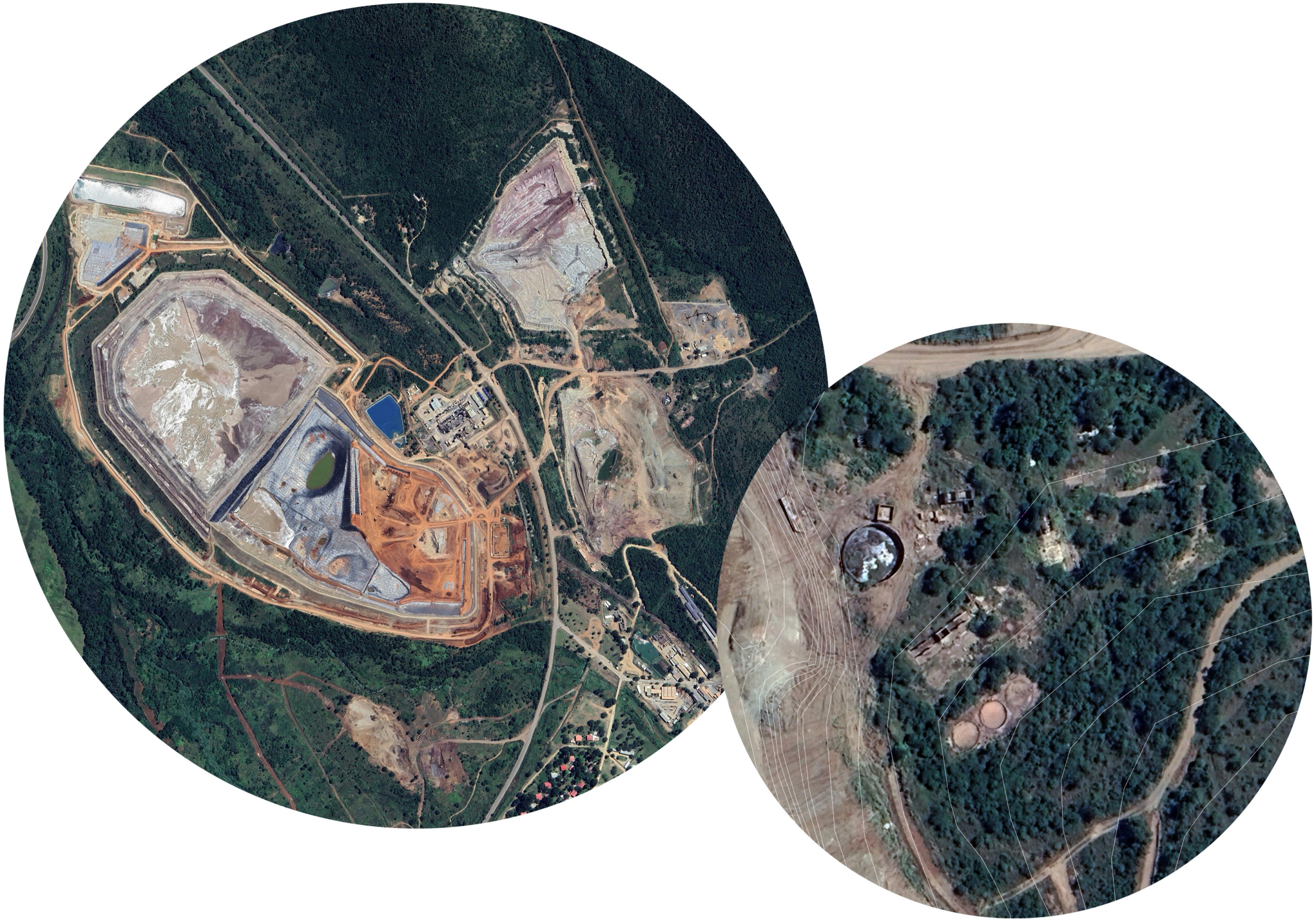


Figure 80: Fairview mine to abandoned tailings site (Google maps, adapted by Author, 2022)

# Witklipfontein Eco Lodge

## GLH Architects, Vredefort, South Africa



Architect: GHL Architects

Location:  Witklipfontein Farm, Vredefort dome

Built: 2015 - 2018

Area: 400 m²

Client: Xavier Huyberechts

Figure 81: Witklipfontein Eco Lodge (Huyberechts, 2018: online)

This precedent study supports a vision of architecture in symbiosis with nature (figure 82). Architectural innovation allows buildings and nature to be seen as one entity. This supports the notions of dark ecology, seeing all entities within this bigger whole as one functional system. This design allows the structure to disappear within the surrounding landscape with a combination of a modern minimalistic design and traditional vernacular building techniques. The building aims to provide overnight guests with an experience of being in full harmony with fauna, flora, and nature. This eco-lodge further present guests with fun activities such as treasure hunts, game drives, mountain biking, and guided hiking trails (figure 82).









Figure 82: Witklipfontein Eco Lodge (Huyberechts, 2018: online)



Figure 83: Witklipfontein Eco Lodge (Huyberechts, 2018: online)







Figure 84: Witklipfontein Eco Lodge (Huyberechts, 2018: online).

Building Techniques:

One of the most apparent building techniques is as previously mentioned, the beautiful traditional vernacular design, essentially allowing the building to read as one with nature. The construction of this building barely uses cement and consist of a regenerative approach, essentially minimizing its carbon dioxide emissions. Some of the traditional vernacular building techniques consist of rammed earth walls as seen in figure 85 below.

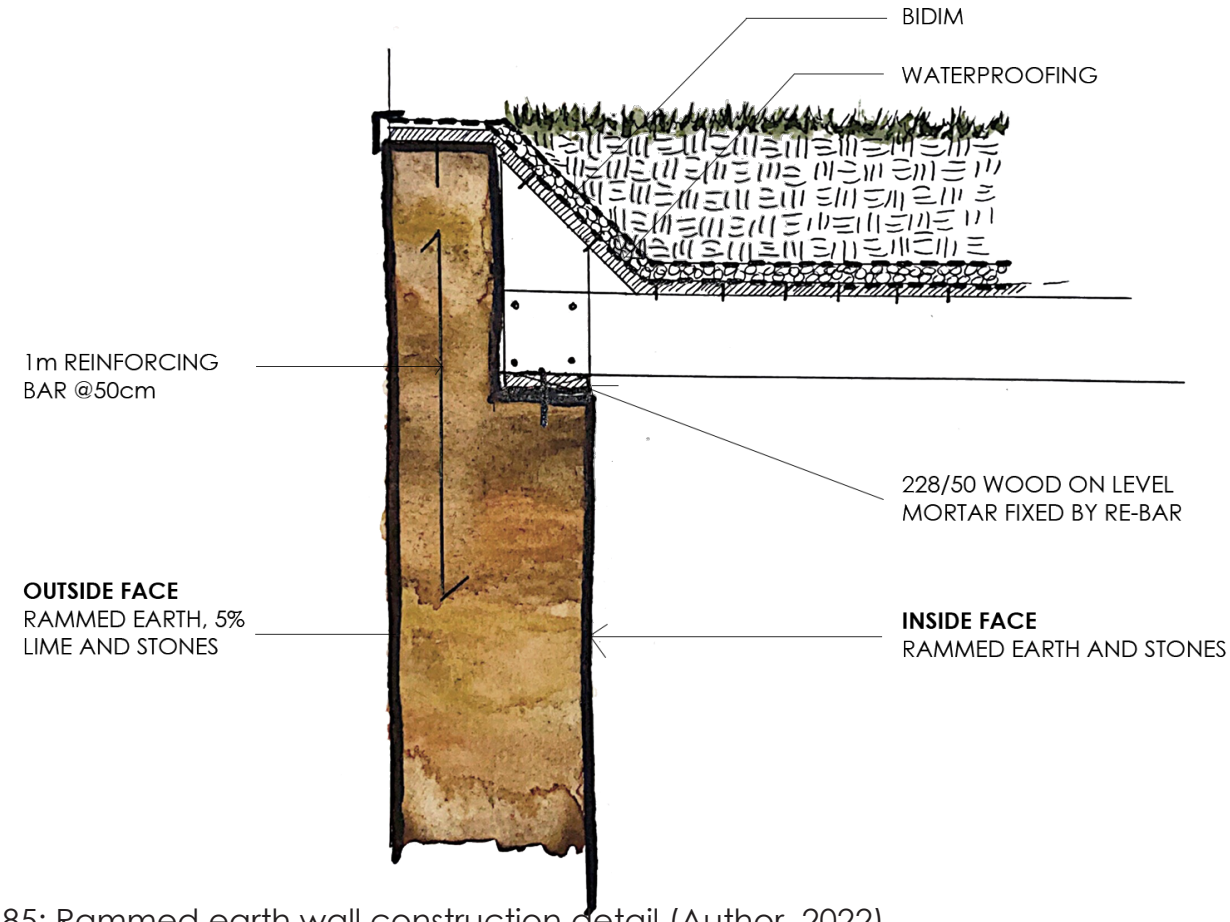



Figure 85: Rammed earth wall construction detail (Author, 2022).

Rammed earth construction is an ancient technique where damp earth (made up of sand, clay, gravel, and possibly stabilizer), is a compressed layer for layer, creating a wall structure (Cao, 2020: Online). The incorporation of on-site materials makes this construction method very appealing and relevant to the design goals of this dissertation.

This building method further supports one of the leading themes of this dissertation, which is to innovatively find the underlying opportunities within the process and product of unearthing and therefore directly connects the touchstone with the construction of this thesis. This method further allows for adaptive reuse to take place of the existing waste rock on the site.



Figure 86: Witklipfontein Eco Lodge perspective (Author, 2022).

The structural method used was perhaps the largest contribution to the building's success and merit, not only because it meant that the architects were employing local techniques in an immensely creative manner, but also because it led to a harmonious relationship between humans and nature (figure 86).

The green roof becomes one of the most important features within this design, since it does not draw attention to the structure itself, but rather celebrates the indigenous natural elements whilst sitting harmoniously within the landscape. Figure 87 below shows a construction detail of the indigenous green roof.

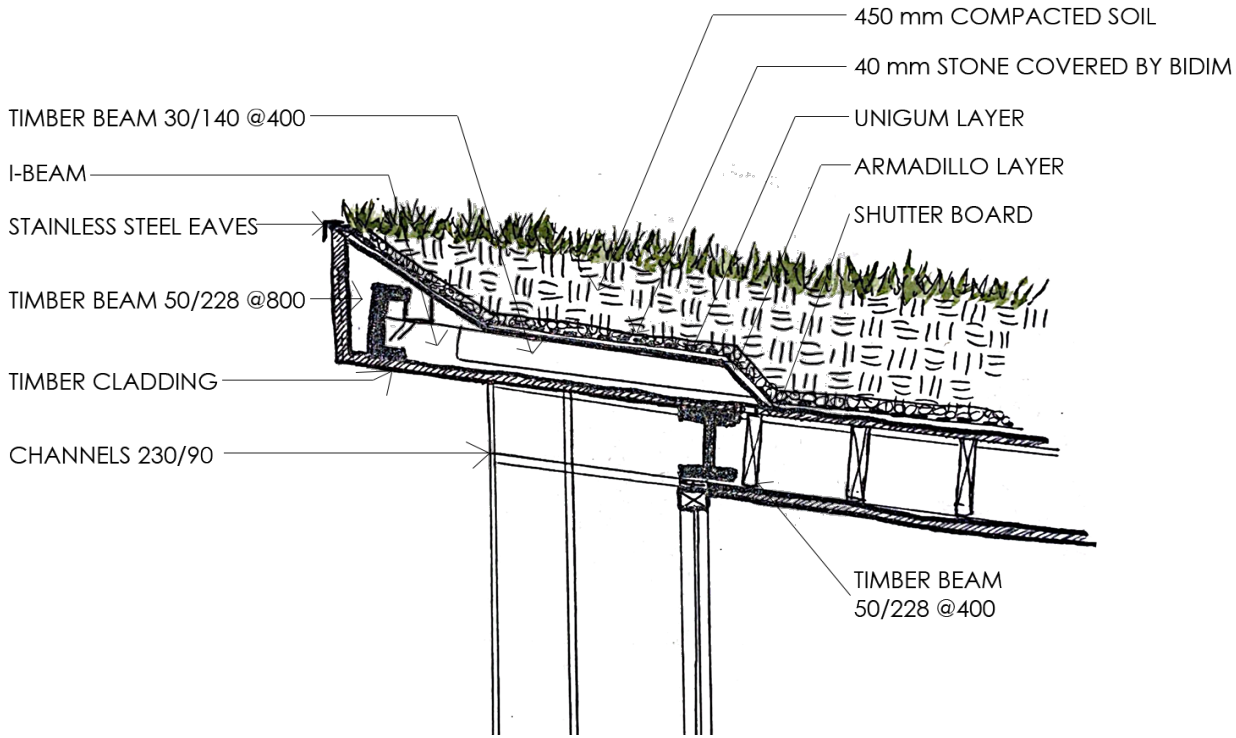



Figure 87: Green roof construction detail (Author, 2022).



Figure 88: Witklipfontein Eco Lodge (Huyberechts, 2018: online)

The structural elements of this building are redefining the relationship between the natural world and the built environment in a way that is beneficial to both. The mass of the building is comprised of a continuous skin, composed of local rammed earth construction, and compiled rock walls. These walls play a massive role in assisting in natural circulation through the building as discussed at a later stage, and the construction of the stone walls is detailed as seen in figure 89 below.

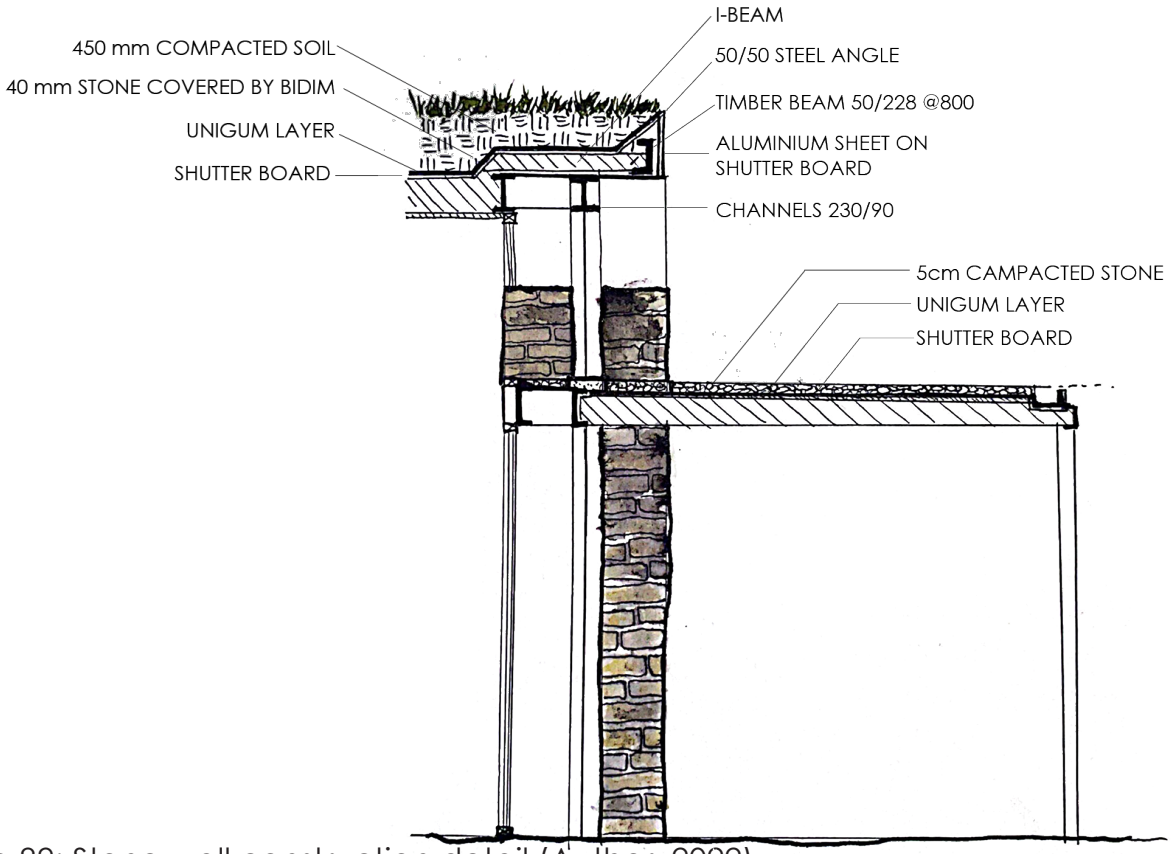



Figure 89: Stone wall construction detail (Author, 2022).

Circulation techniques: Horizontal movement throughout the building is addressed by gradually revealing new spaces while concealing others. The slightly angled lines of the structure's movement paths and walls create a natural line for users to follow, with as few harsh corners as possible, creating a strong feeling of the natural flow in the design. This supports the design concept of building as a vegetation deity, putting nature in flux through architectural innovation as seen in figure 89. One of the biggest influences that this precedent study has on this thesis is the role the building plays in harmony with nature as an entity, essentially working together within the system, similar to the notions of dark ecology.

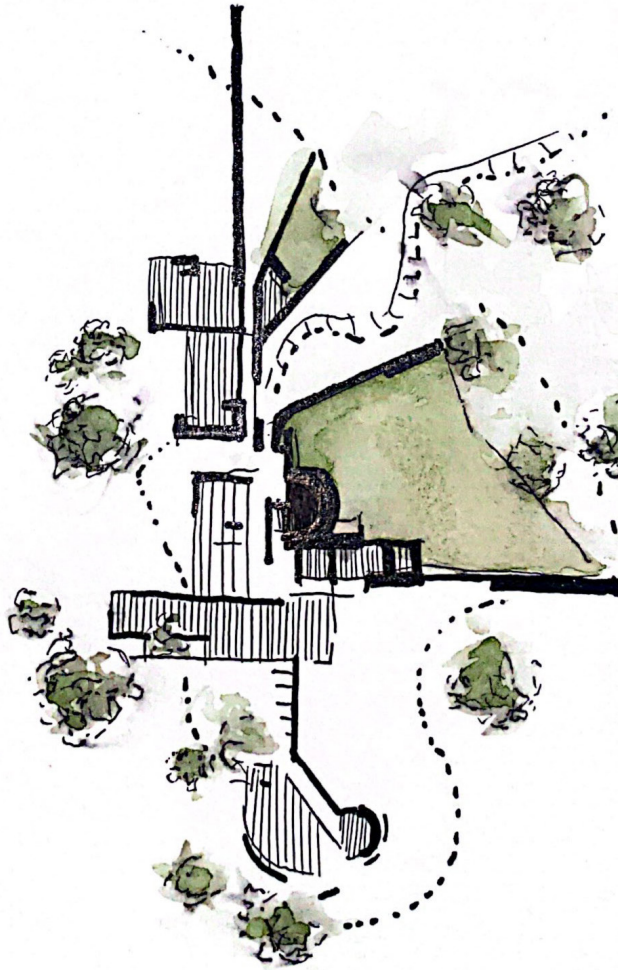


Figure 90: Nature in flux with the circulation (Author, 2022).

Application to design:

The first phase of the design development of this thesis consists of identifying existing footprints of the abandoned tailings site that might affect the form and function of the building. Initially, I aimed to use this existing footprint to minimize the additional carbon footprint of the design, leading to a very fragmented approach as seen in figure 91. Parts of this design approach clearly show the Witklipfontein Eco Lodge's influences on plan and perspectives. Some other influences that the Qitklipfontein Eco Lodge had on my design approach are:

- The use of vernacular materials.

- Using a green roof with the aim of extending the natural landscape.

- Questioning the obvious natural boundaries between building and nature.

- Humanity being indigenous to nature.

- Construction methods incorporating stone walls.

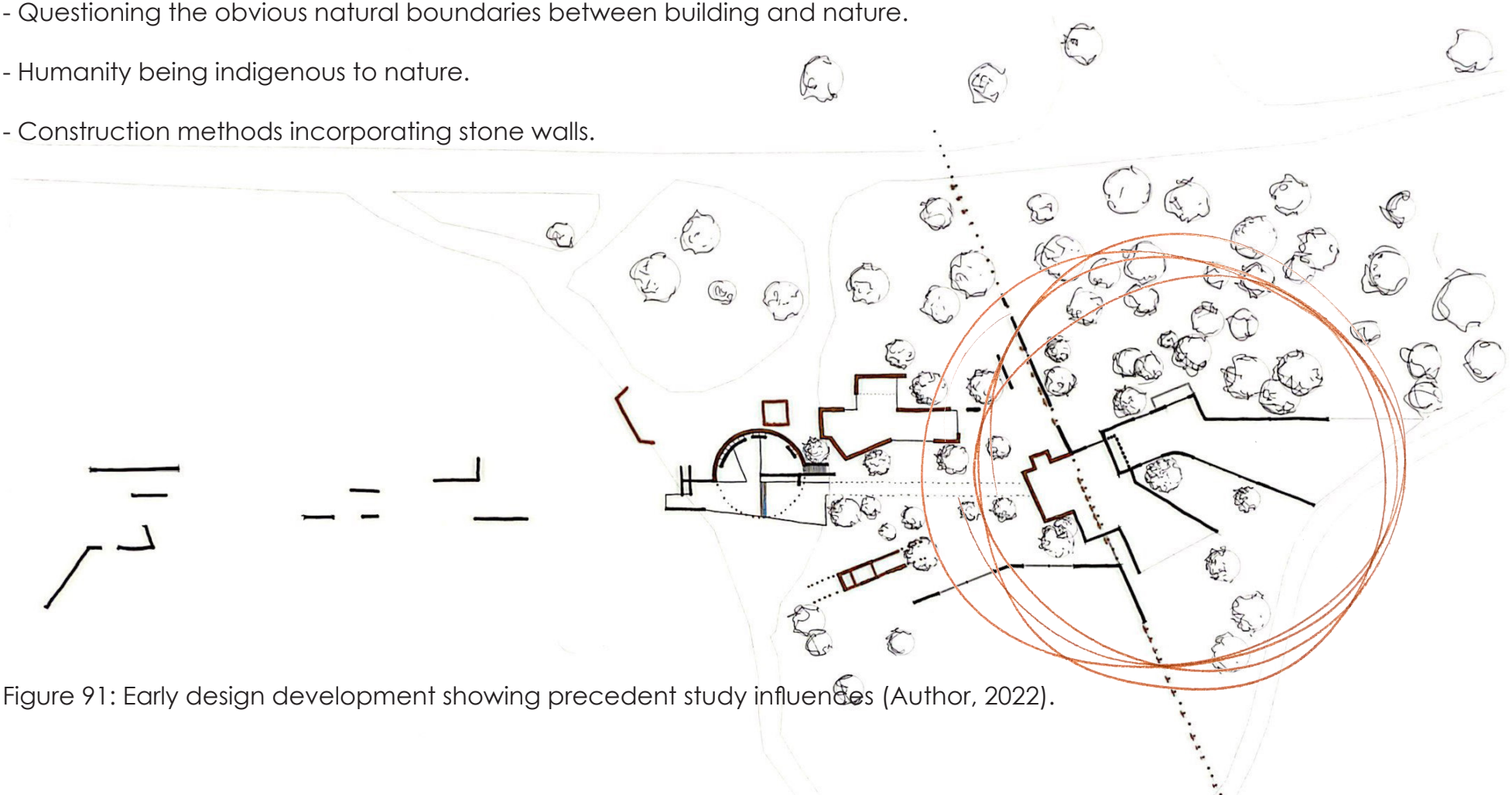


Figure 91: Early design development showing precedent study influences (Author, 2022).

# Redesign of the Roman Quarry, Austria

This precedent is a good example of an architectural response to a post-mined landscape. The use of material, predominantly the use of Corten steel creates an experiential walkway. Seamlessly resting and reacting to the slope of the site is the main takeaway. The choice of material remains true to the industrial heritage of the site. Nothing is imposed yet the narrative builds up to a pinnacle at its end. The stage where the opera will be performed. Creating a sense of arrival to reflect upon the journey. This method of using structures to connect with people and portray a specific emotion plays a very big role in the design approach of this dissertation.

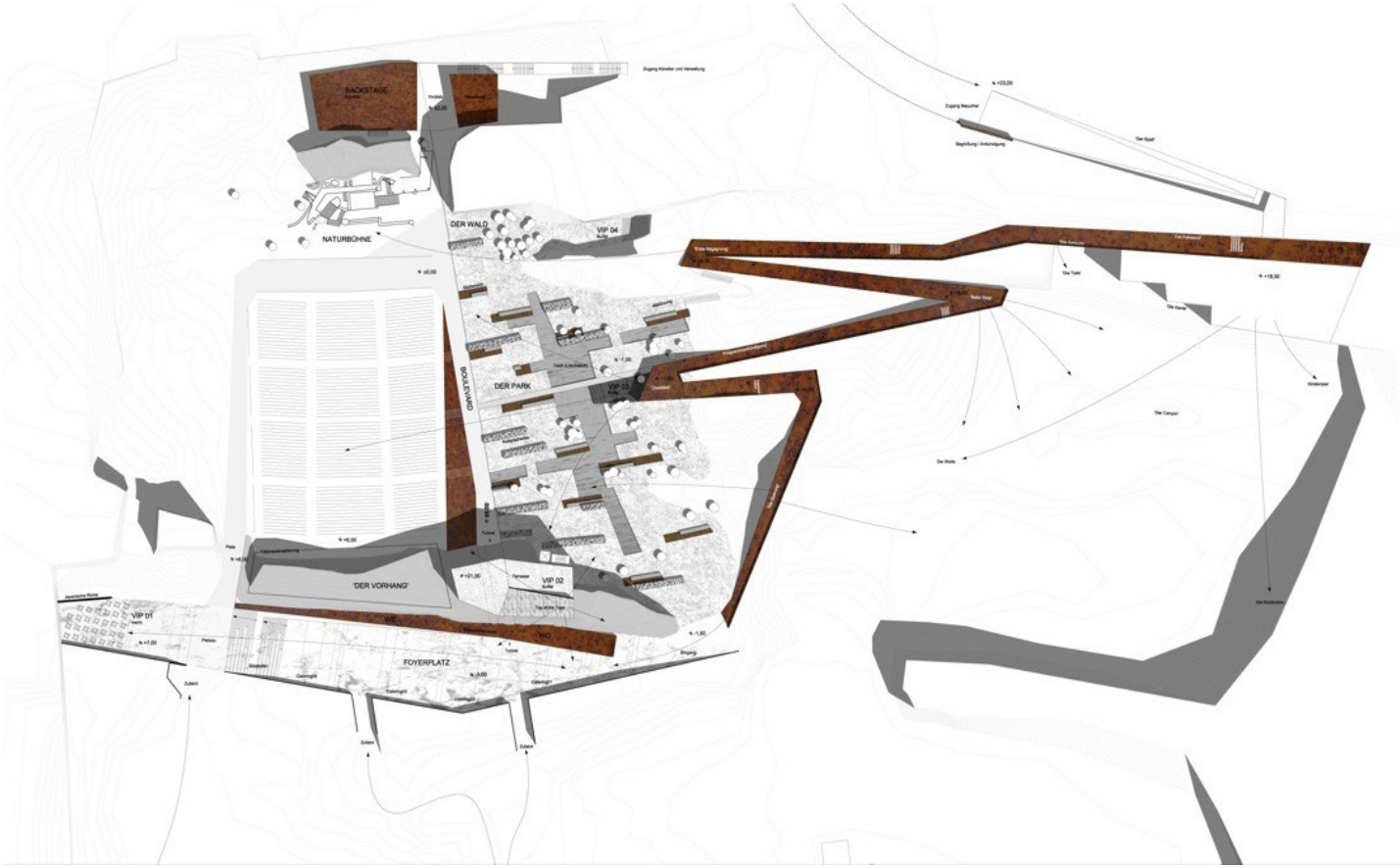



Figure 92: Redesign of the Roman Quarry (Hurnaus, 2008: online)









# Chapter 4
## Design development

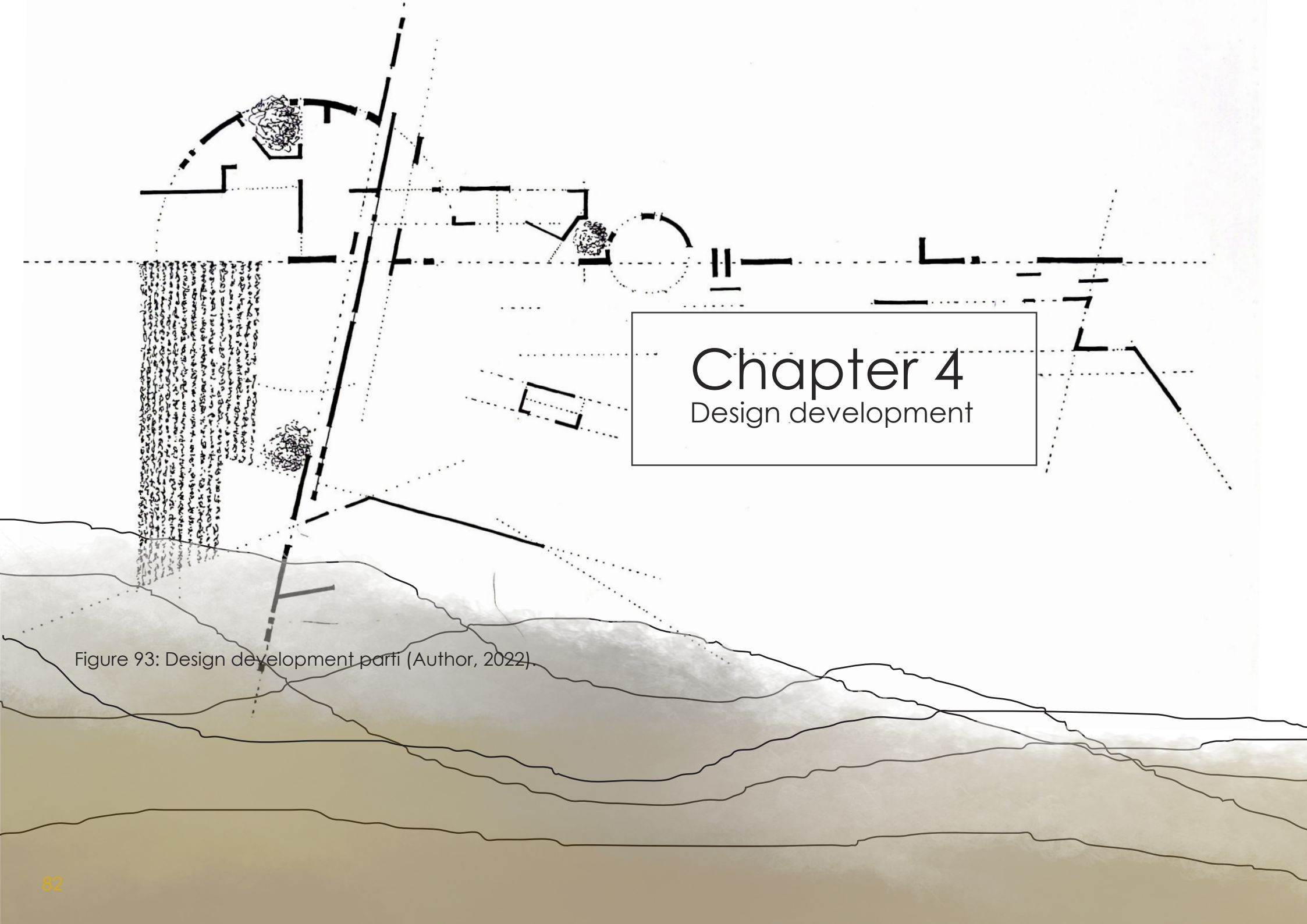


Figure 93: Design development parti (Author, 2022).

The early steps of the design process are introduced in Chapter Four as it moves toward the final design solution. This chapter attempts to prove that the Eco-Regenerative Research Centre responds to the needs and poetic desires of the client, through the combination of research into, reflections on, and creative interpretations of concepts and theories, and design and construction precedents.

# Design Development

The Hedonistic Edge concept played a very big role within the early development stages and developed into the first design parti.

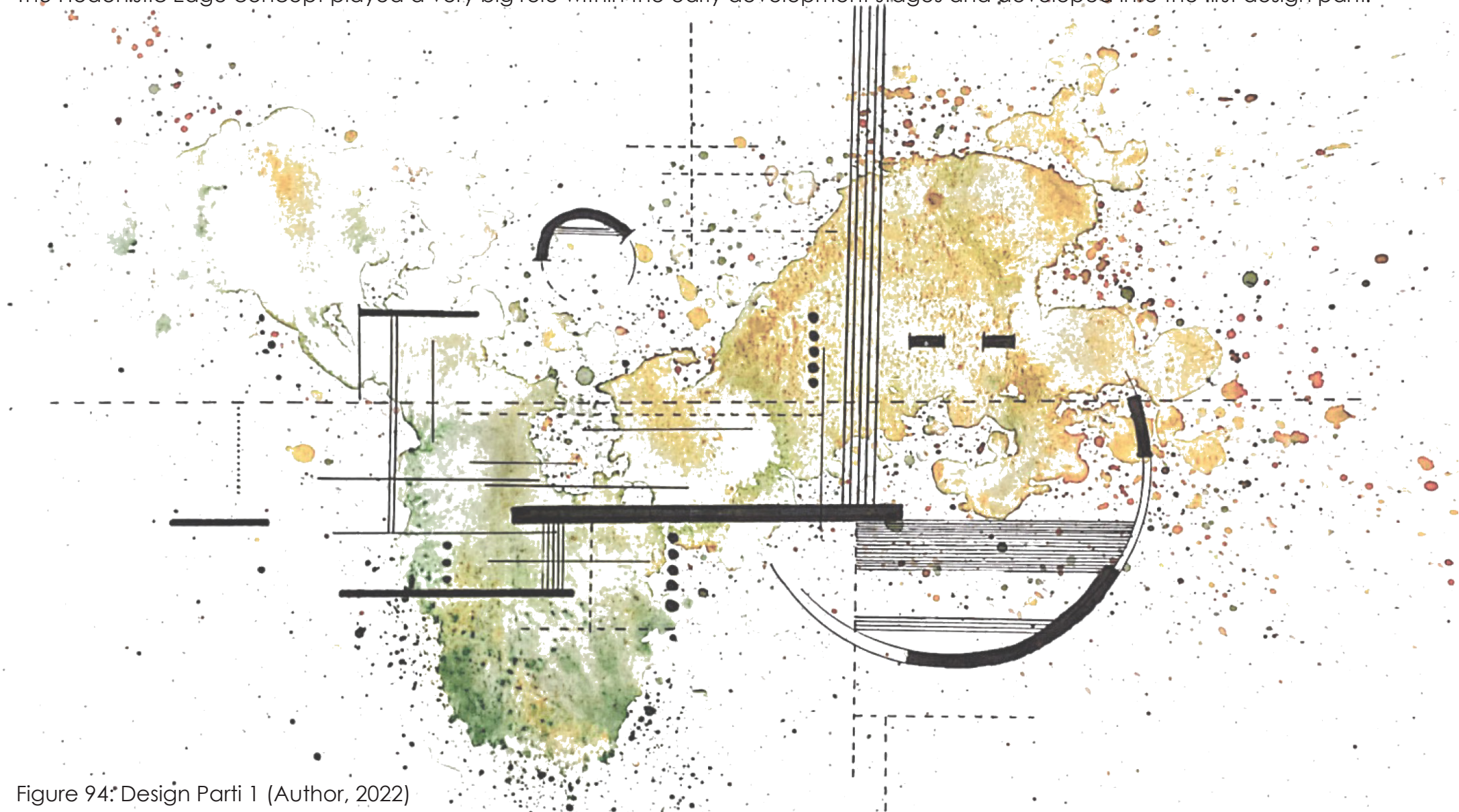


Figure 94: Design Parti 1 (Author, 2022)

Through keeping certain existing footprints consistent throughout the design development, one part of the building aims to celebrate the history of the site whilst the other part becomes one with the Mountainlands nature reserve. This design approach allows for a natural flow of natural reclamation to take place and motivates this process throughout the architecture. The first phase of the design development consists of identifying existing footprints of the abandoned tailings site that might affect the form and function of the building. Initially, I aimed to use this existing footprint to minimize the additional carbon footprint of the design, leading to a very fragmented approach as seen in figure 96. When a site visit was conducted, I had a chance to experiment with materials on site that were influenced by the certain approach of the Hedonistic Edge concept as seen in figure 95.



Figure 95: Site explorofations (Author,



Figure 96: Design Parti 2 (Author, 2022)

This design parti (figure 97) incorporates the lessons learned from previous explorations through keeping the existing footprint fixed in place, mimicking this footprint within the new additions, clearly showing possible points of entry, and creating opportunities for nature to permeate throughout the design. These explorations provide multiple opportunities within fragmented pockets where human can become indigenous to nature.

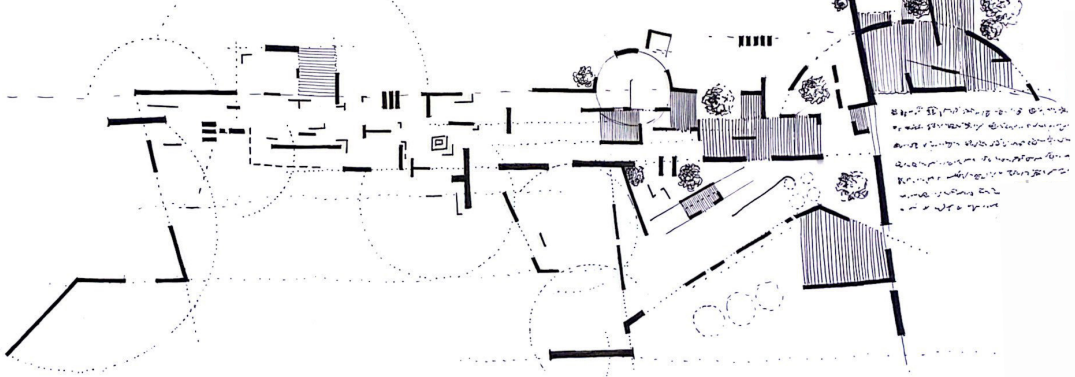


Figure 97: Design Parti 3 (Author, 2022)

This parti (figure 98) can be seen as the heart of the design and became the reference point for decisions made throughout the architectural interpretation.

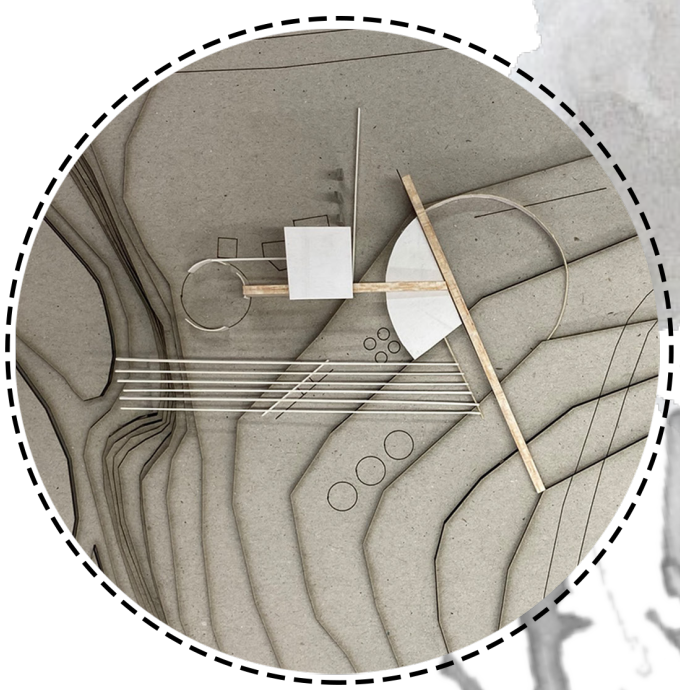


Figure 98: Design Parti 4 (Author, 2022)

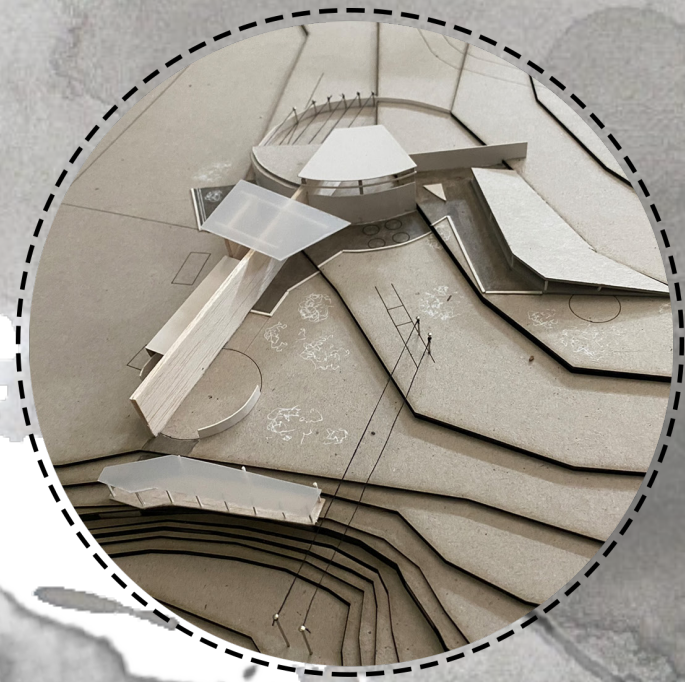
Model 1



Model 1



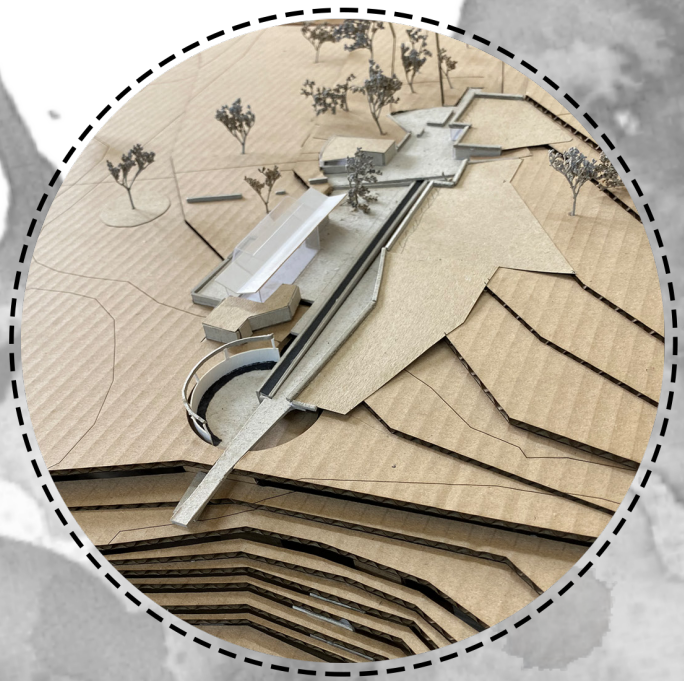
Model 2



Model 2



Model 3



Model 3

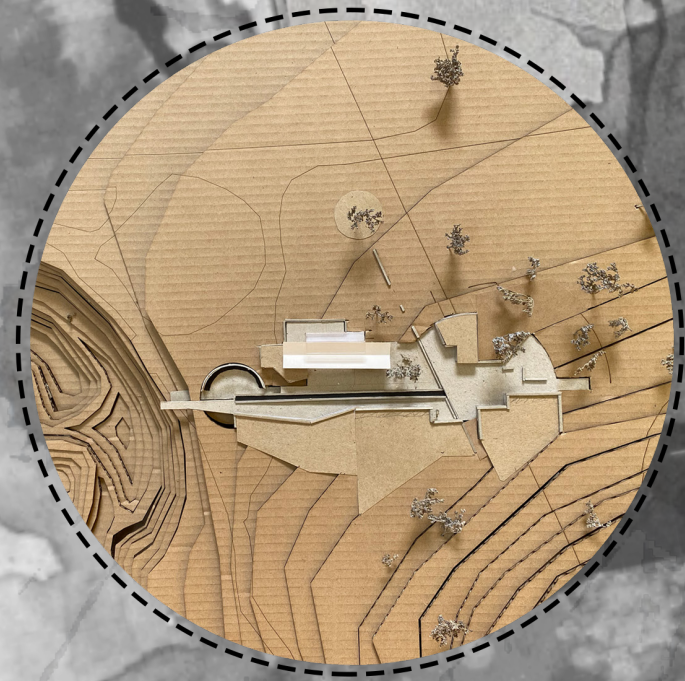


Figure 99: Model process based on previous parti's (Author, 2022)

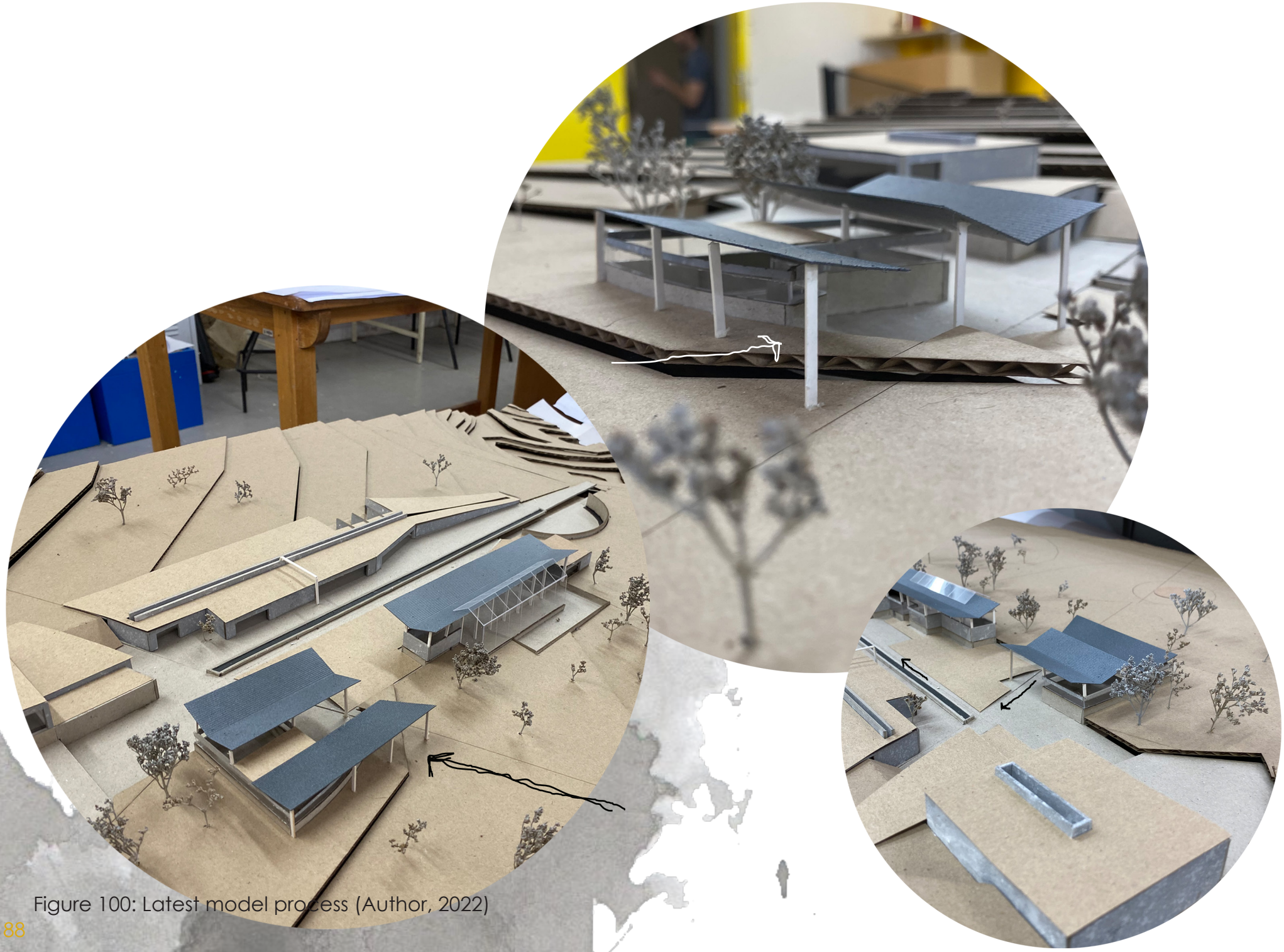


Figure 100: Latest model process (Author, 2022)





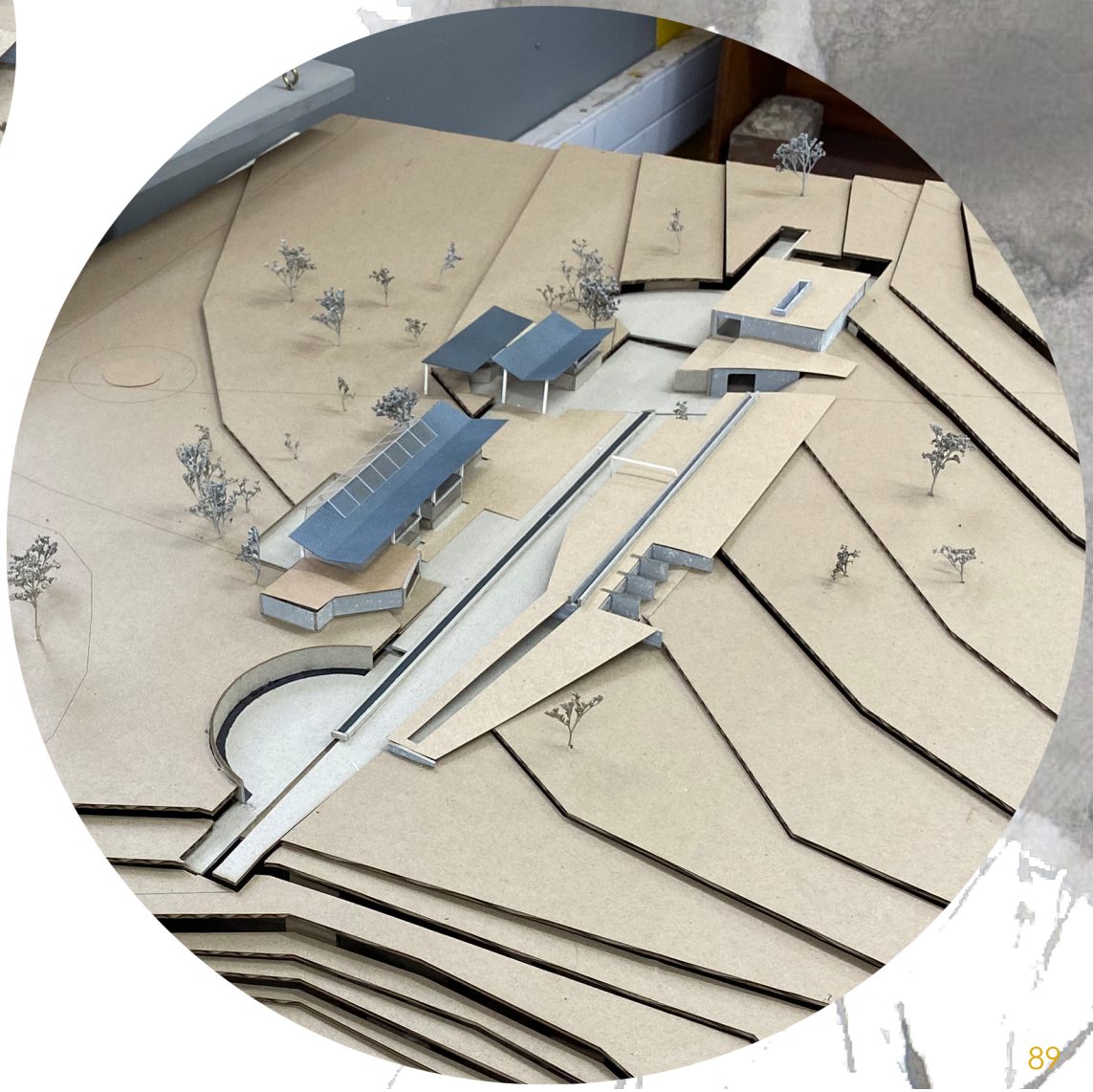
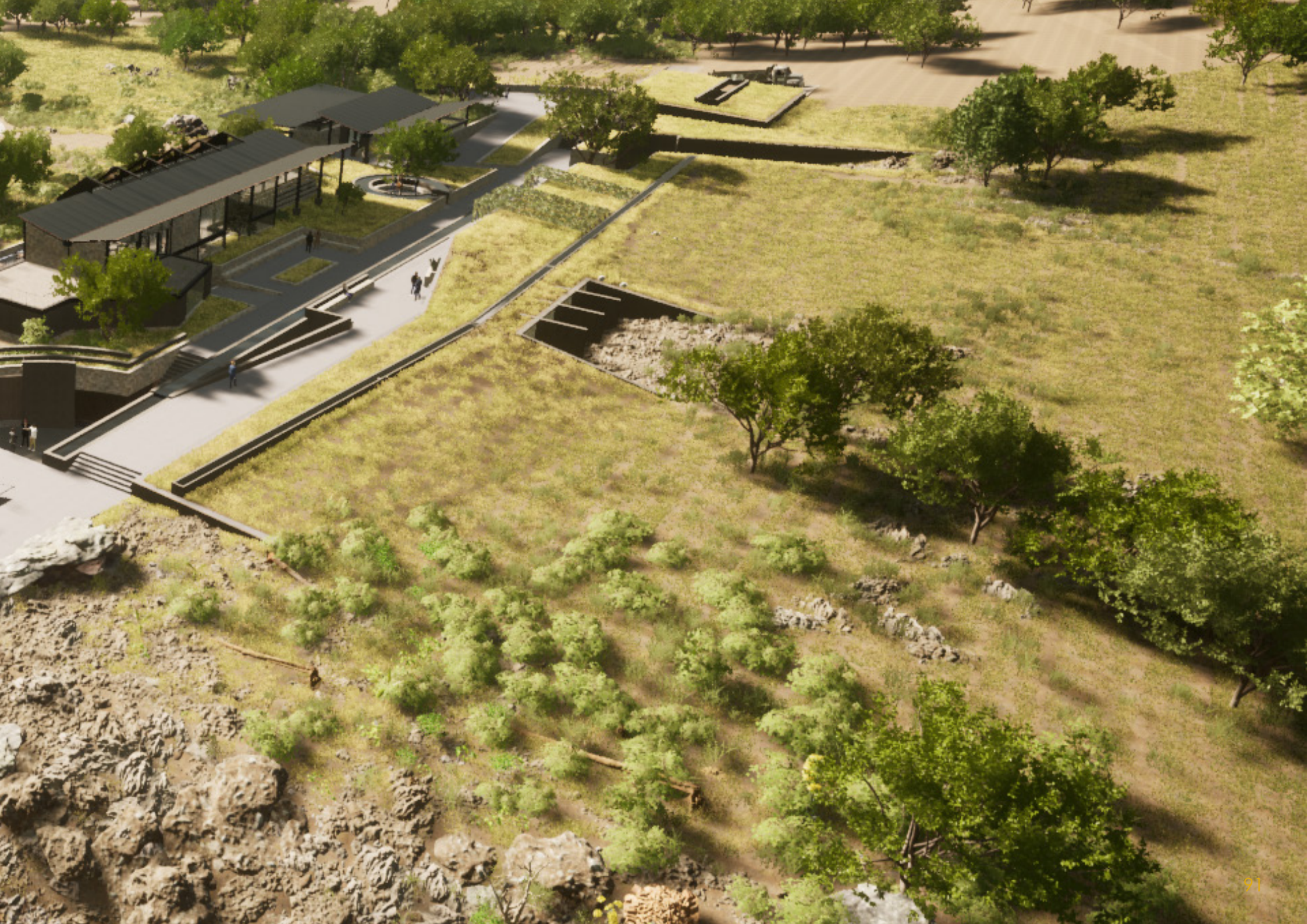




Figure 101: Perspective(Author, 2022)



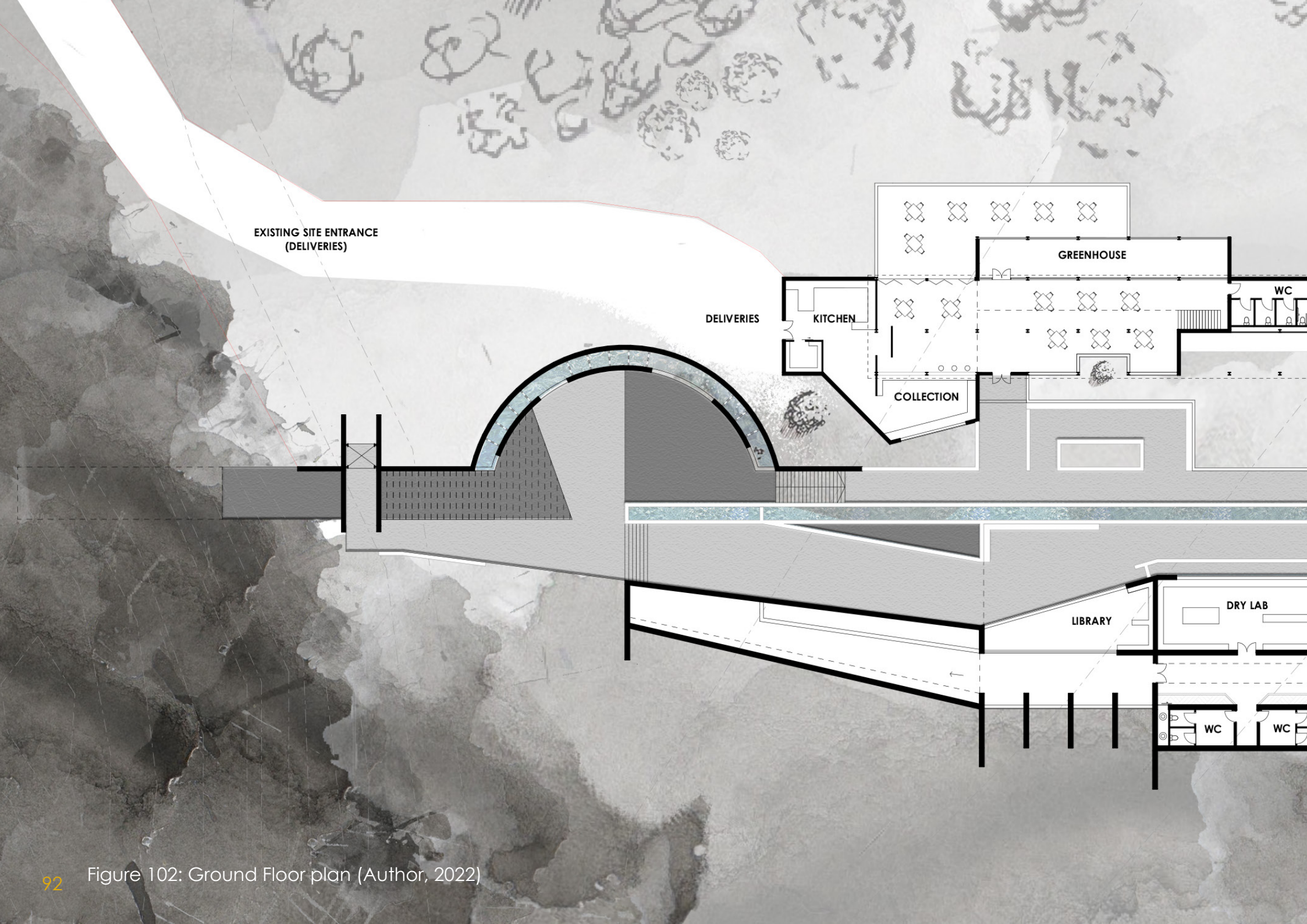



Figure 102: Ground Floor plan (Author, 2022)

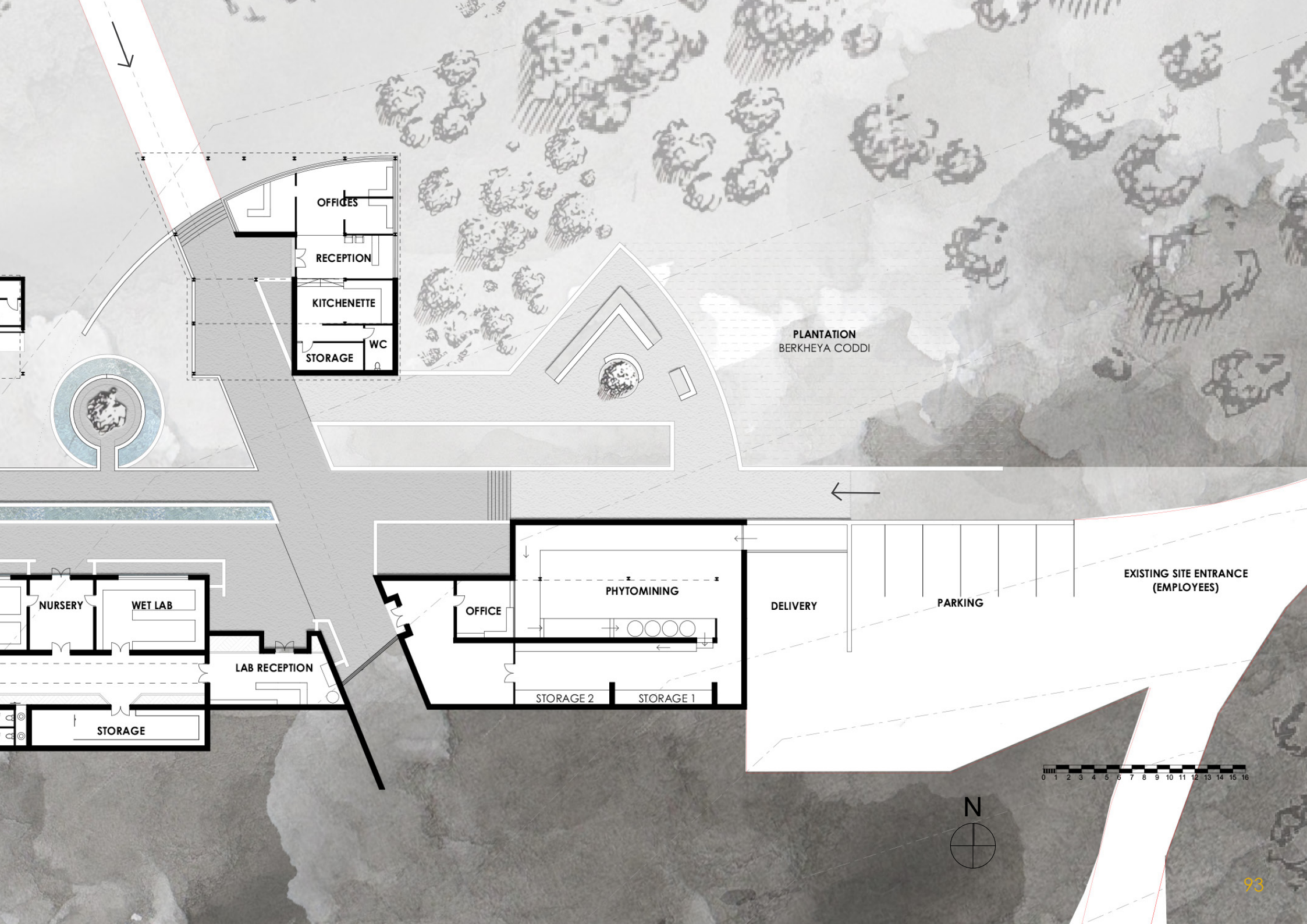

OFFICES
RECEPTION
KITCHENETTE
STORAGE
WC
PLANTATION
BERKHEYA CODDI
NURSERY
WET LAB
LAB RECEPTION
STORAGE
OFFICE
PHYTOMINING
STORAGE 2
STORAGE 1
DELIVERY
PARKING
EXISTING SITE ENTRANCE
(EMPLOYEES)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
N



Figure 103: Roof plan rendering. Not to scale (Author, 2022)

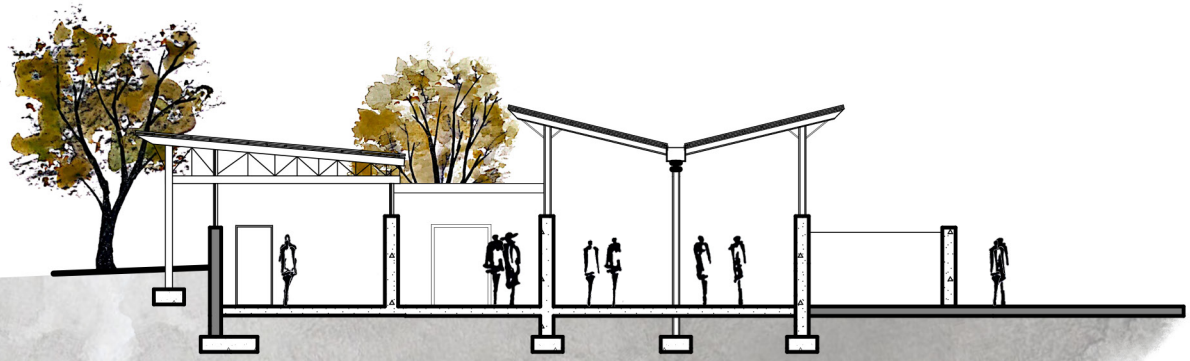


Figure 104: Section AA (Author, 2022)



Figure 105: Perspective showing roof structures (Author, 2022)

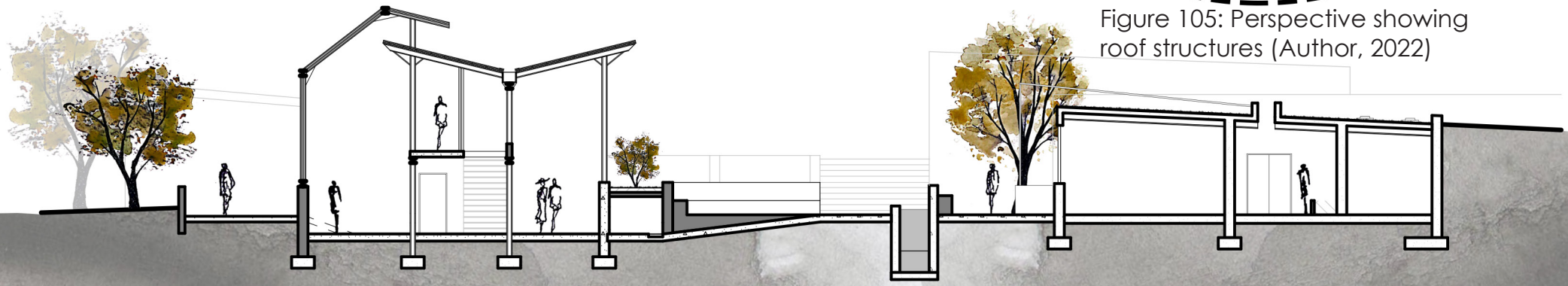
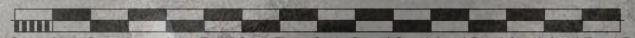


Figure 106: Section BB (Author, 2022)



The entrance experience aims to provide the first attempt towards making people feel indigenous to nature through allowing them to sink within the natural landscape (figure 106). By placing nature above the visitors, the roles between humans and nature invert, allowing nature to become the superior entity. Once the visitor has moved down the entrance stairs, they are provided with an opportunity to rest or wait (figure 109).

Through tearing the building apart (figure 110), nature tumbles down through this scar. This tear becomes a vocal point for the people that enter the site and immediately sets the destructive tone of the design thesis. Through displacing nature and creating dramatic moments where nature is being questioned such as this tear (figure 110), the presence of uncertainty, a sense of precarity, and a feeling of vulnerability and confusion present themselves to the visitor. As Dr. Lertzman explained on page 51, these feelings allow people to be most susceptible to adhering to a message that meets those anxieties and uncertainties with confidence (Lertzman, 2019: online). It is, therefore, crucial to create these moments throughout the design to not only remind people of the devastation and reality of the environmental apocalyptic obsolete but inspire them towards a better future through providing some solutions such as phytomining and phytoremediation.

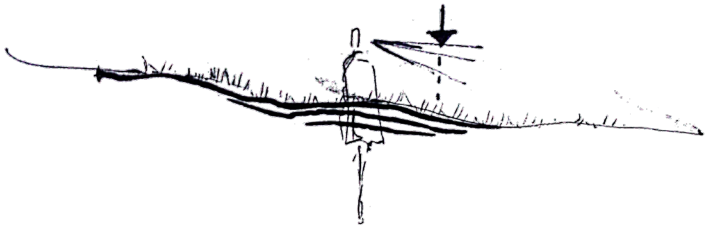


Figure 106: Visitor merge within landscape (Author, 2022)

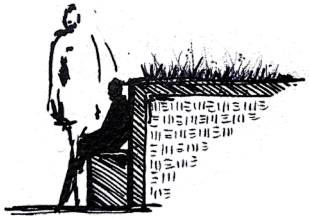


Figure 107: Seating within landscape (Author, 2022)



Figure 108: Entrance (Author,



Figure 109: Placing nature above the visitor (Author, 2022)



Figure 110: Nature pouring through the scar (Author, 2022)



Figure 111: Entrance building(Author, 2022)

Figure 113 is a pocket within the axis that allows people to sit within the landscape. This experience provides another opportunity where the landscape envelopes humanity, essentially becoming a humbling experience where nature shows its superiority. The surrounding water and filtered light create a peaceful environment where self-reflection can take place.

The plan connects the dystopic narrative of the quarry (west) and the Mountainlands nature reserve (east) through the axis that stretches through the middle of the design. With the sun rising above the forestry, a hopeful future is represented, and with the sun setting over the quarry, the past motivates people towards better solutions.

Through blurring obvious boundaries that act as categories of human versus nature, interiority and exteriority are being questioned. In certain instances, the design, therefore, aims to create a symbiosis between natural elements and people through the use of exterior seating and allowing nature to permeate through and over the architecture (figure 116).

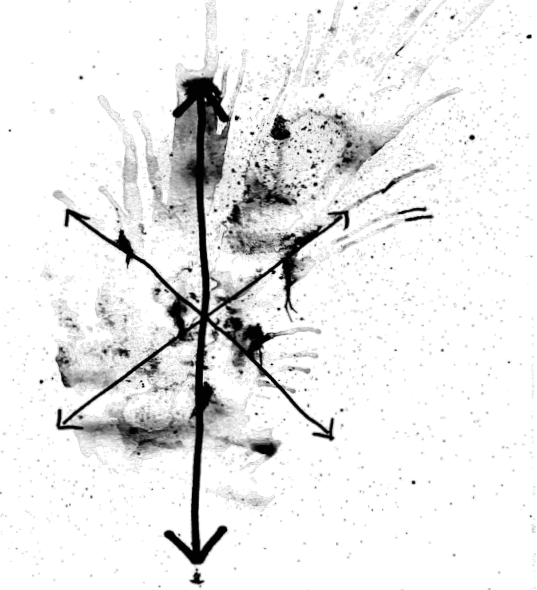


Figure 112: Axis connecting naratives (Author,



Figure 113: Seating within elements of nature (Author, 2022)



Figure 114: Axis through design (Author, 2022)



Figure 115: Blurring boundaries through designed seating (Author, 2022)



Figure 116: Axis connecting east to west through architectural innovation (Author, 2022)

The aim of the research bar/cafeteria is to provide a space for visitors and employees to enjoy a meal whilst being able to do more research. The research bar/cafeteria frames nature as the uncanny through displacing the landscaping within a glass box (figure x). This greenhouse provides an opportunity for regulated tests to be done on hyperaccumulative plants in an enclosed environment. The greenhouse further becomes a display of nature's fragility to visitors, further adding to the uncanny experience between human and nature.

The vertical garden that is designed within the façade of the architecture becomes another example of typical boundaries that is being blurred and questioned. The stepped façade allows for vegetation to grow within the architecture and becomes another opportunity for certain plants to be grown with no direct sunlight. The building therefore provides opportunities throughout the design for different types of plants to be grown and nursed through creating a different variety of light quality throughout the design. The use of vertical gardens and green roofs not only minimizes the carbon footprint of the building but helps to regulate the temperature within the building itself.

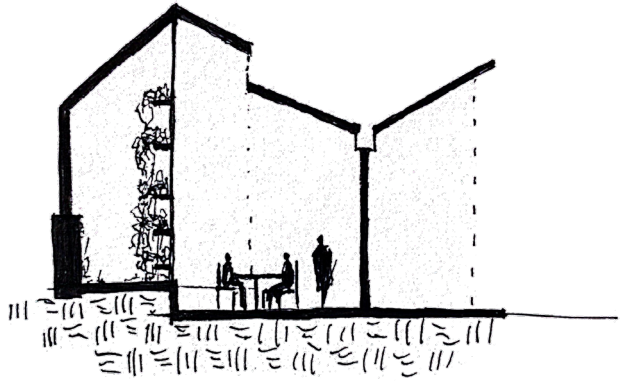


Figure 117: Reseach bar/cafeteria (Author, 2022)

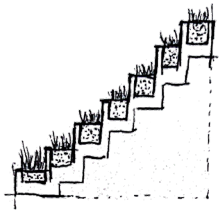


Figure 118: Stepped vertical garden (Author, 2022)



Figure 119: Vertical garden within architectural boundaries (Author, 2022)



Figure 120: Greenhouse and exterior seating (Author, 2022)



Figure 121: Research bar/cafeteria (Author, 2022)



Figure 122: Research bar/cafeteria interior (Author, 2022)

The laboratories and phytoming factory form part of the private section of the design. It is very important to have regulated temperatures and humidity throughout these parts, but also to communicate people's indigenousness to nature throughout the building. This is done through wrapping exterior sections of the laboratories in vegetation as seen in figure 124. These wraps further provide filtered light, complimenting the climate. It is very important for workers to be reminded of their cause by creating a positive environment where the growth of life is represented through plants. The corridor is framed with nature and natural southern light falls through the light gap within the green roof (figure 125).

The awareness of the descent within the earth is predominately clear through replicating a mine tunnel. This corridor and auditorium represent the historical aspects of the site. It is important to be reminded of history in order to focus on the future. The auditorium space echoes with falling water, creating an uncanny experience by framing the sky. The water poetically provides an opportunity for reflection to take place while the natural landscape is out of sight. Moving through the auditorium, the Fairview mine quarry is framed. Looking over the quarry, the pure devastation of nature presents itself. A glimpse of the environmental apocalyptic obsolete (figure 127). Is this humanity's future?

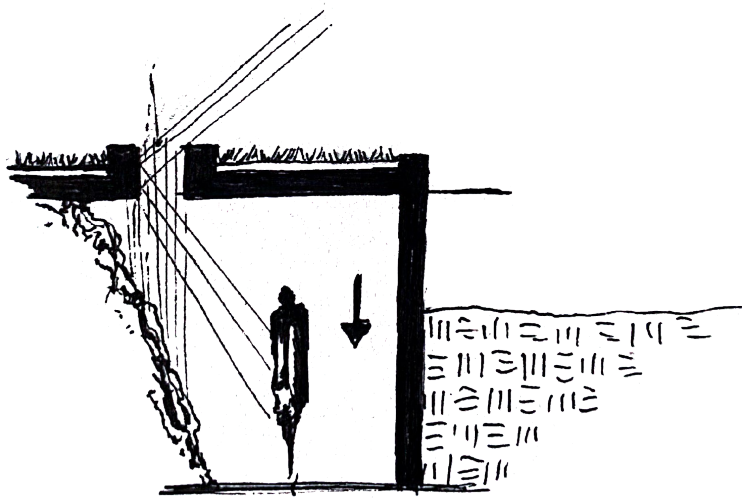


Figure 123: Descent into landscape refering to mining tunnels (Author, 2022)



Figure 124: Lab interior (Author, 2022)



Figure 125: Green roof light gap (Author, 2022)



Figure 126: Auditorium (Author, 2022)



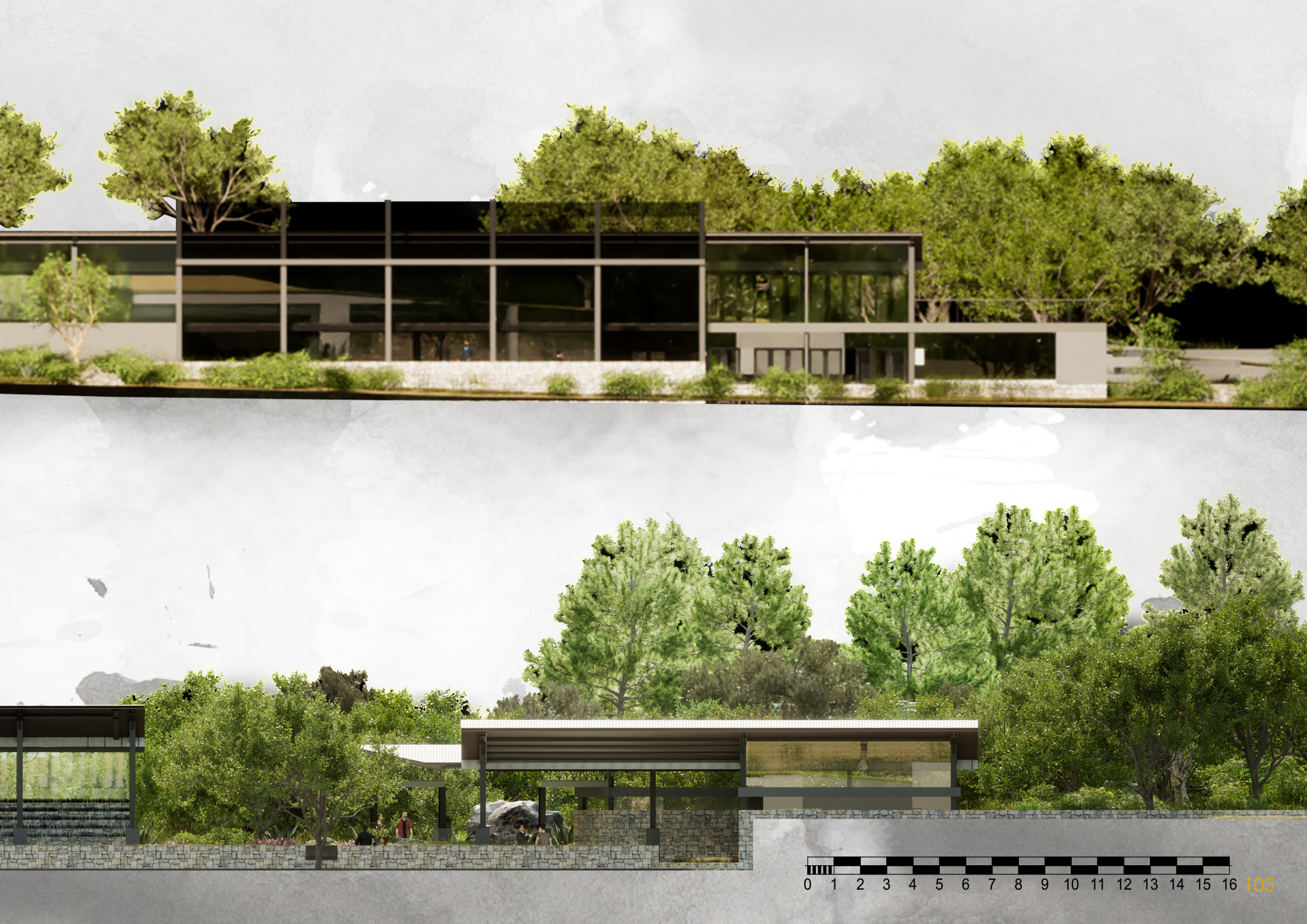
Figure 127: Unified perspective(Author, 2022)

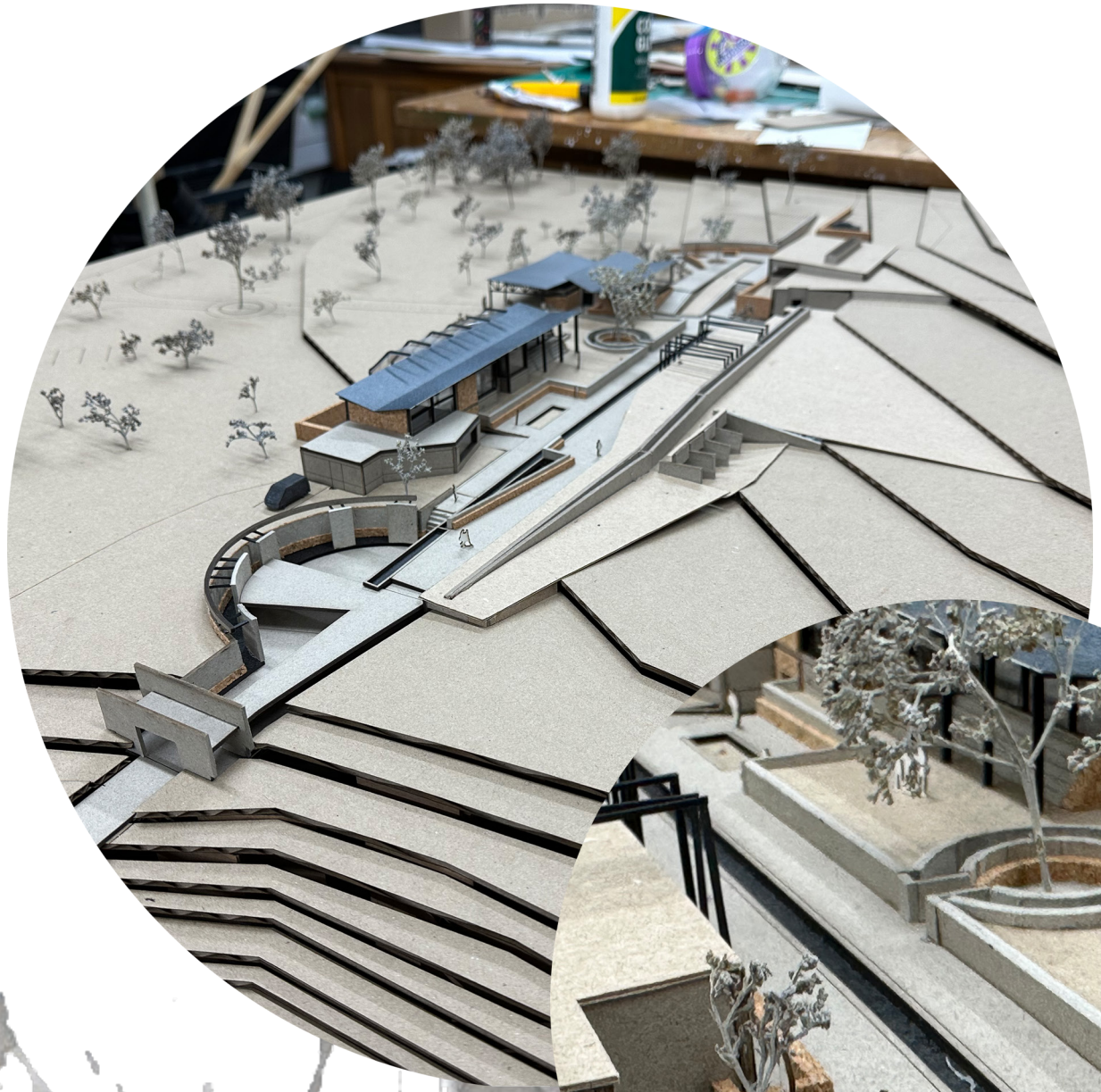


Figure 128: North Elevation (Author, 2022)

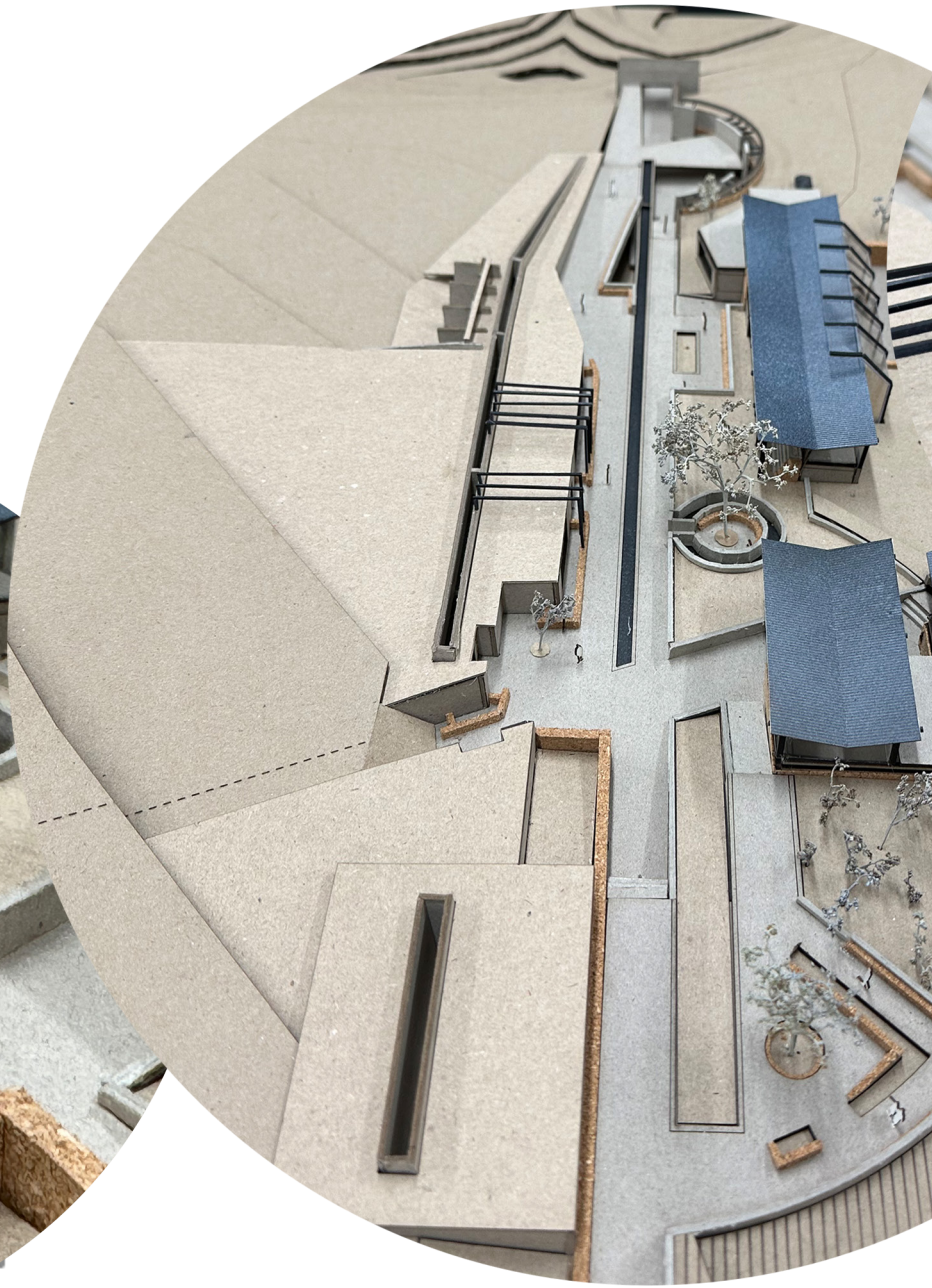


Figure 129: South Elevation (Author, 2022)

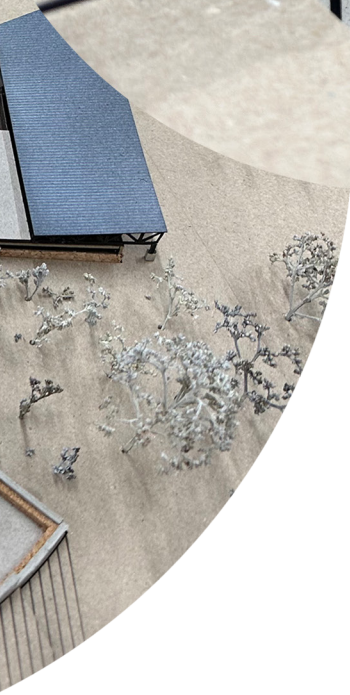

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

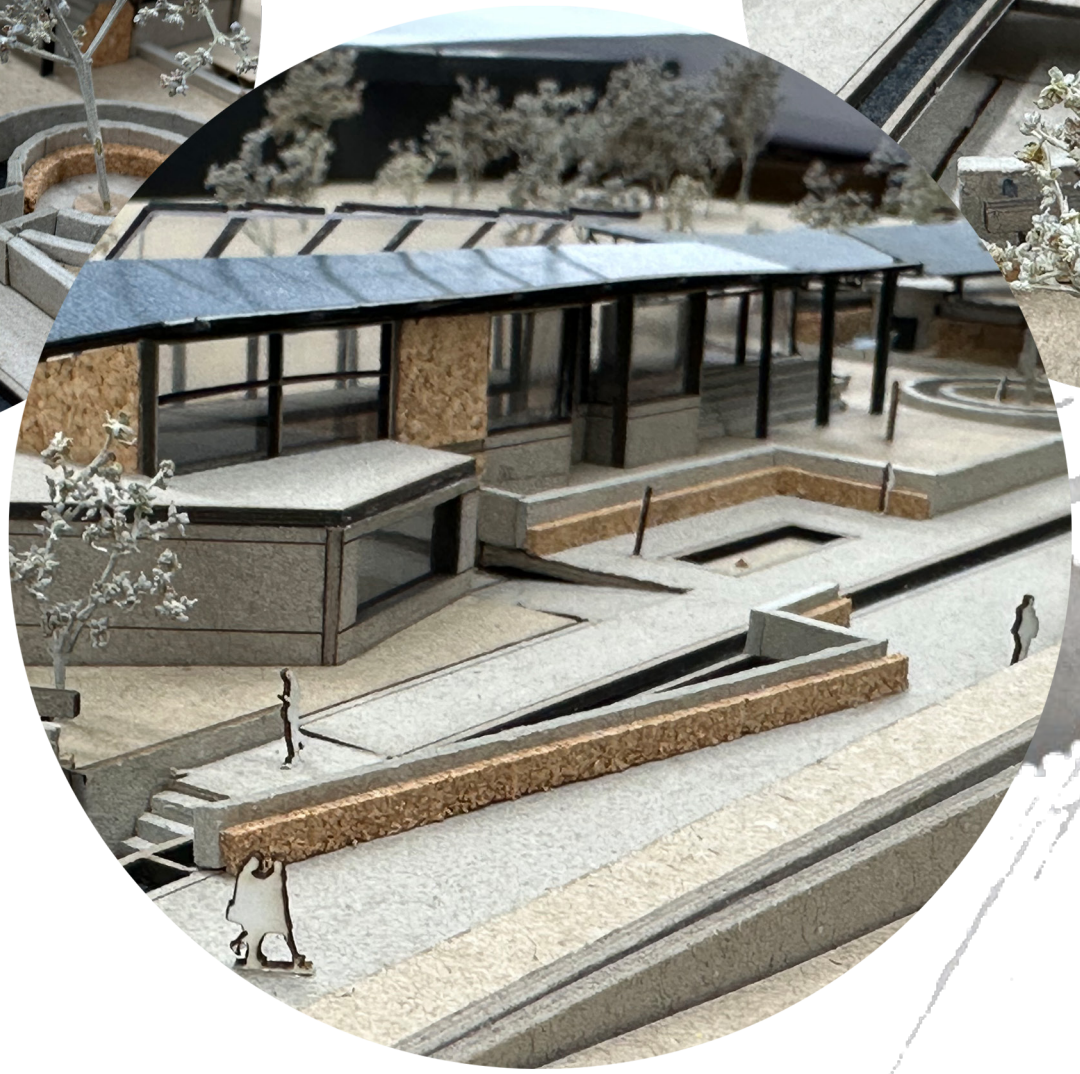




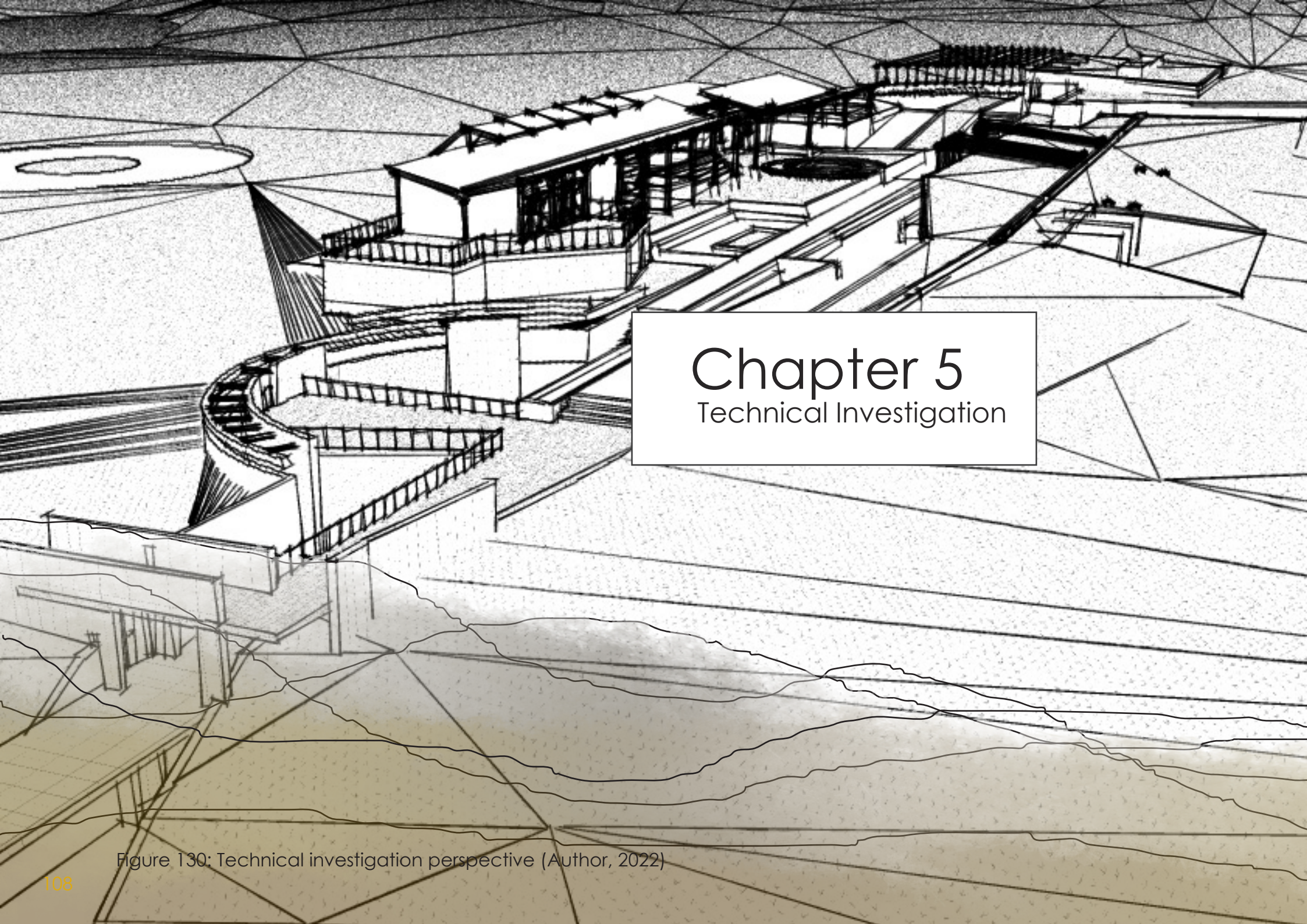












# Chapter 5
## Technical Investigation

Figure 130: Technical investigation perspective (Author, 2022)

All the previous chapter's interpretations, explorations, and development are compiled within this investigation in order to formulate a design that combines the theory, development, function, and structure. The site environment, entrances and parking, site planning, circulation, structure and materiality, and functional aspects of the phytomining factory are explored in order to portray the symbiotic relationship between the different parts of this designed system to rehabilitate mined sites and create a platform where people can become indigenous to nature.

# The site and environment

The Fairview mine operation has been functioning for over 100 years and is seen as a flagship mine since it's a long-life, high-grade operation. This mine produces over 80,000oz of gold per year and has an estimated life of 20 years left (Pan African Resources, 2022: online). It is therefore crucial to have a functioning rehabilitation plan in place since parts of this mine have already been abandoned such as the tailing site chosen for this thesis. The Eco-regenerative Research Centre, therefore, aims to rehabilitate these parts of the mine that has reached the end of their term whilst simultaneously providing an additional income through the use of phytomining. These mines are focused on mining high-grade ores, leaving ideal conditions for hyperaccumulative plants to flourish and rehabilitate the landscape.

The surrounding environment of the site consists of mining transportation trucks and machinery that move from one mining site to the next. The Eco-regenerative Research Centre further overlooks this chaotic environment whilst being comforted with the luscious surroundings of the Mountainlands nature reserve. By extending the nature reserve throughout the design, this building becomes an important mechanism that allows nature not only to permeate through this specific site but all destructive mining activities in the future. With thousands of mining sites all over Mpumalanga and South Africa, this building aims to become a more permanent structure to cater to mining sites all over the country as the vegetation deity mothership.

# Site Parking and entrances

The visitor parking is located at the northern entrance as a newly proposed route (marked as number 1). This parking is scattered underneath existing trees (marked as number 2) and integrated into the natural landscape. Through placing the parking within natural elements, the visitors are introduced to the first clues towards creating awareness of their indigenousness towards nature. The pedestrian entrance route is marked with rocks found on site that follow the existing footprint of the abandoned tailings. The existing footprint and composition are further embraced by placing a circular island within the entrance route to orientate people (marked as number 3)

The employee entrance follows the existing route on-site and becomes a secure entrance with a gate (marked as number 4). With 6 allocated parking spots (marked as number 5), the employees of the laboratory and phytomining factory have a short scenic walk toward their workplace. The other staff that works within the northern buildings such as the research bar/cafeteria and reception/ office can make use of the visitor parking spots. A delivery bay is located (marked as number 6) next to the staff entrance that is allocated for company trucks to offload the hyperaccumulative plants. These plants will then be placed on top of the conveyer belt that moves into the phytomining factory, enabling a smooth process. This process is inspired by my family's small beetroot factory on a farm in Hoopstad since a similar process is followed for the collection and sortation. This process will be discussed in more depth on page 113.

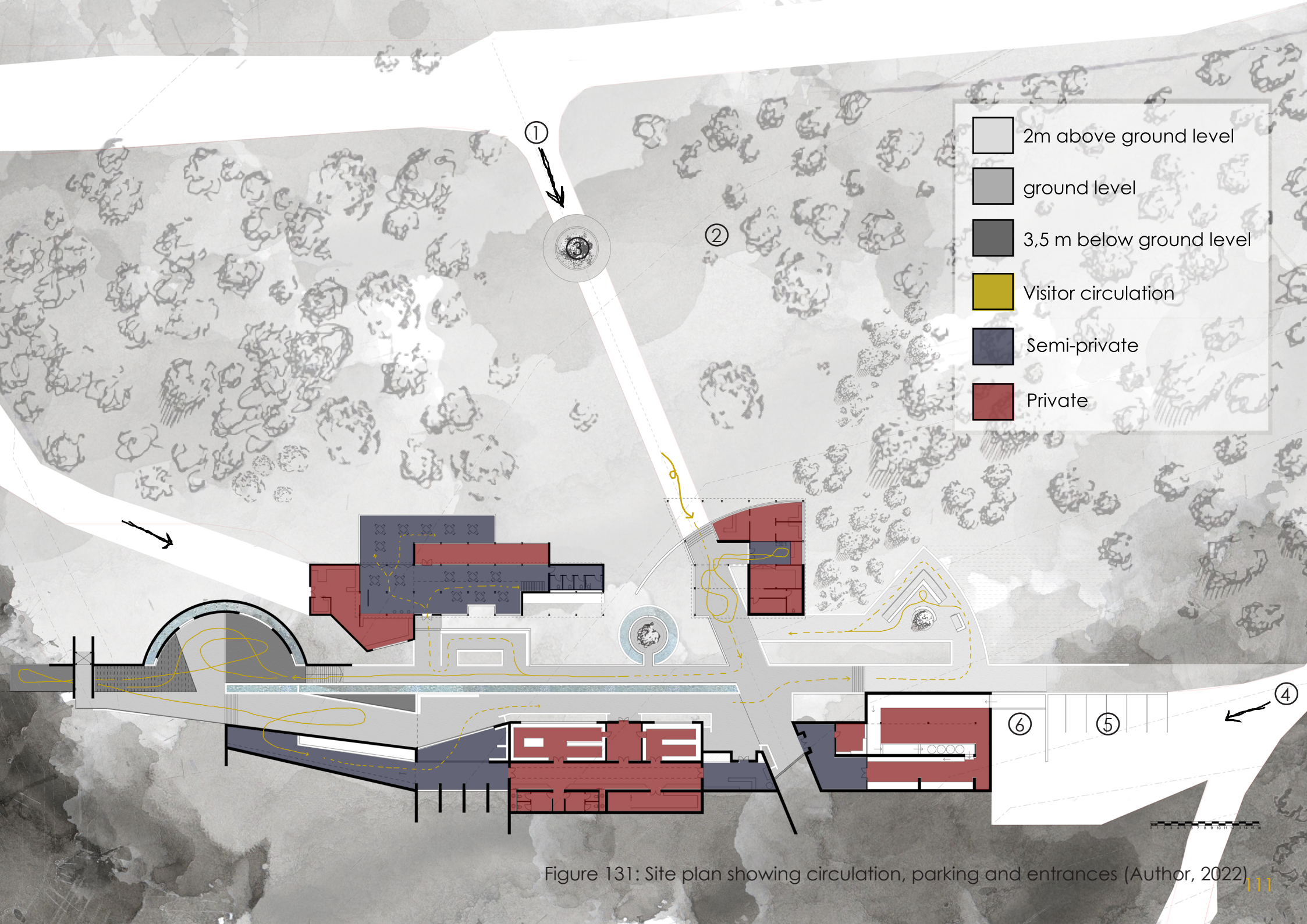



Figure 131: Site plan showing circulation, parking and entrances (Author, 2022)

# The site planning

Site planning and landscaping form a very fundamental part of this dissertation since it becomes part of the architectural language that portrays an important message as discussed throughout the theoretical discourse. This message aims to directly address each individual that walks on the site and uses indigenous plants and vegetation to connect people to nature. Through displacing nature in a way that makes people feel uncomfortable or allows people to question this displacement, the awareness of the relationship between human and nature are triggered. The different elevated levels of landscaping further contribute to these notions, placing the visitor in a position where nature becomes superior to humanity in certain instances.

The landscaping further allows for the Mountainlands nature reserve to be extended throughout the design, becoming a pleasure garden for people to visit and learn about indigenous plant species and their capabilities by placing information boards all over the site.

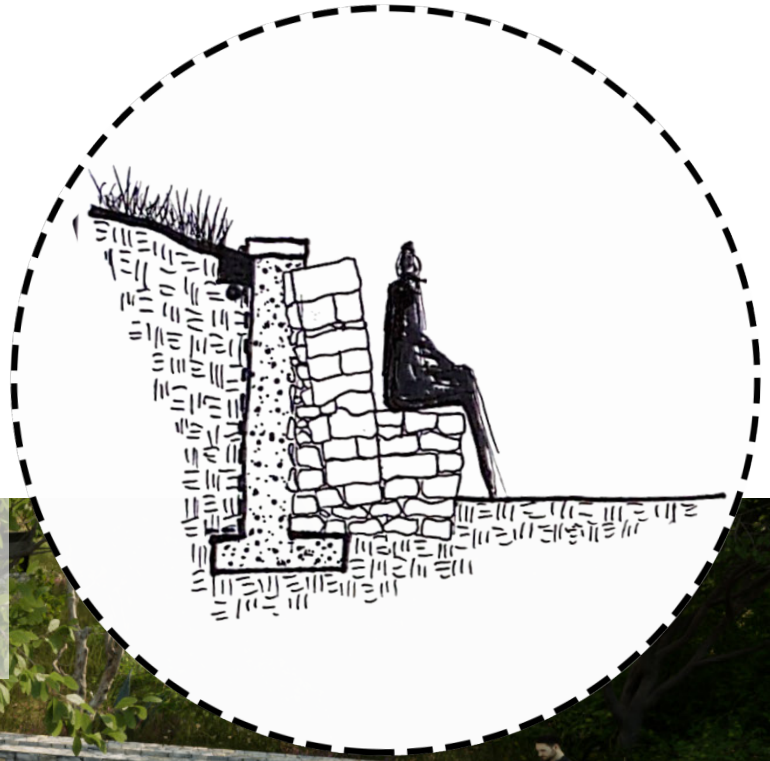


Figure 132: Materiality of pleasure garden seating (Author, 2022)

Figure 133: Pleasure garden (Author, 2022)

The storm-water control further contributes to the poetic notions and goals of the design since it becomes a major feature within the axis of the plan. With the design being carved into the landscape, the stormwater flows into the axis through following drainage paths as seen in figure 131. The designed landscaping redirects all stormwater towards the axis. This water axis follows the decline in the landscape towards the original tailing dam. Once the water reaches the dam, it filtrates through a system and becomes a water feature in the form of a waterfall. The water is stored within the dam whilst enhancing the poetic experience between humans and nature.

This water can be used for controlled irrigation of the greenhouse, landscaping, and plantations of hyperaccumulative plants as seen on page 112. A stormwater catchment area (figure 134) is placed at the foot of the tear between the southern buildings, the entrance stairs, the pleasure garden ramp, the research bar/cafeteria entrance ramp, and the auditorium stairs.

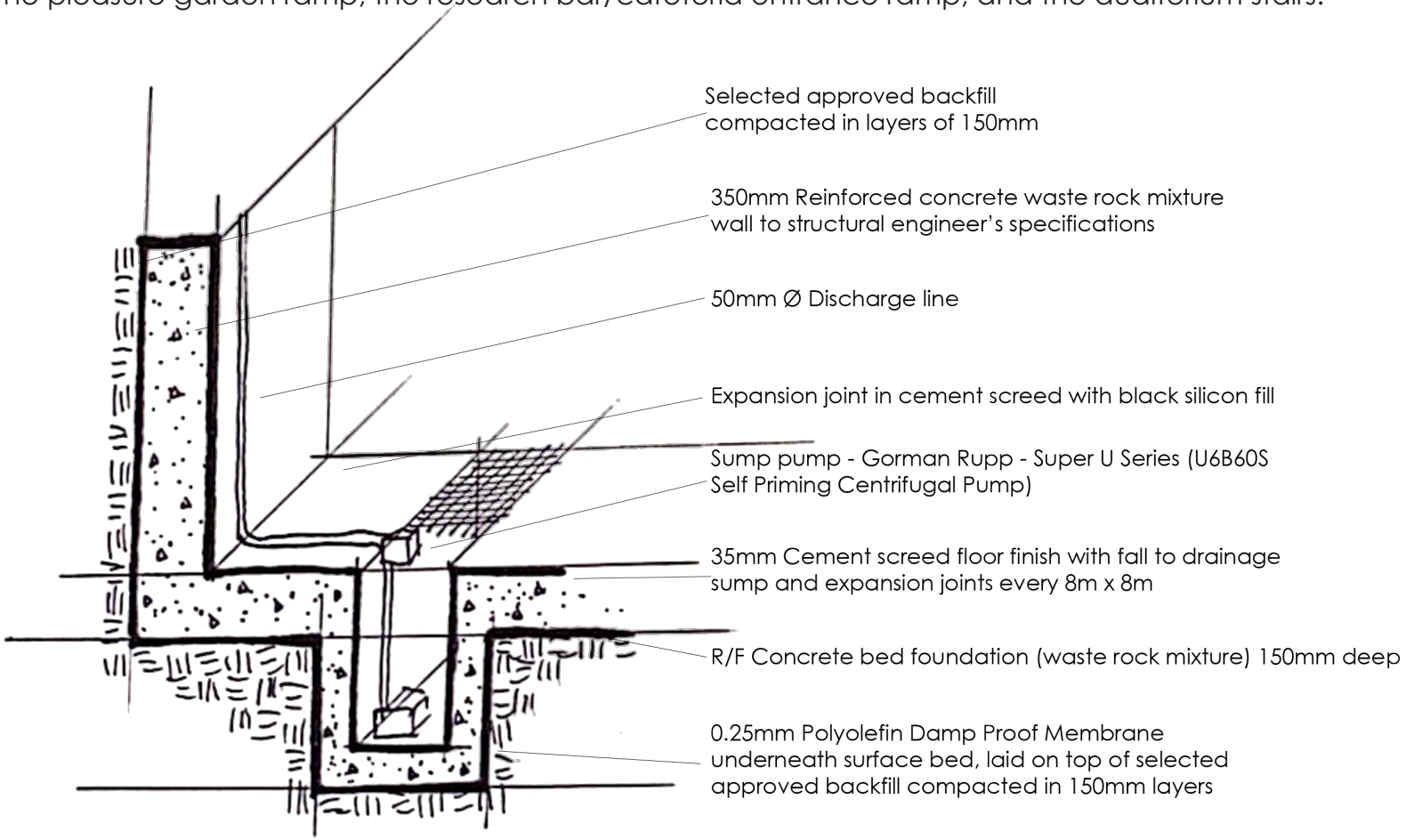



Figure 134: Stormwater catchment area (Author, 2022)

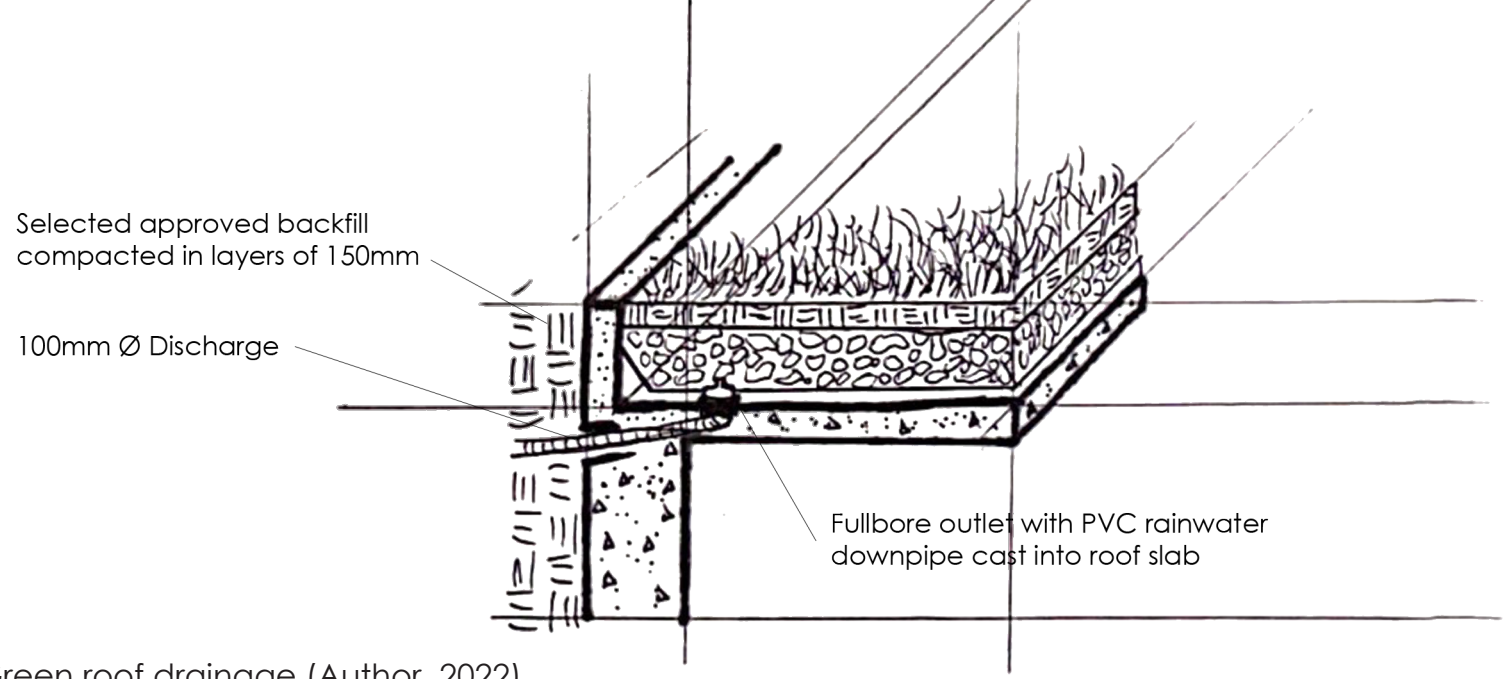



Figure 135: Green roof drainage (Author, 2022)



Figure 136: Hyperaccumulative plantation irregation (Author, 2022)

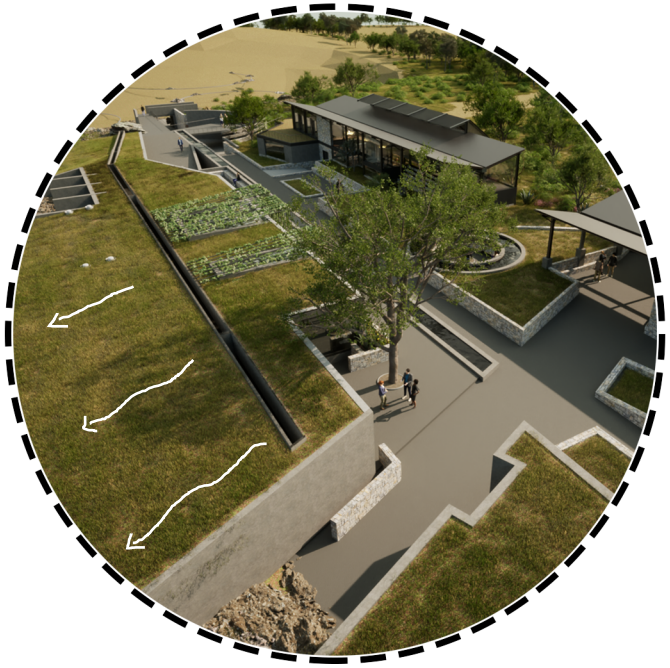


Figure 137: Green roof drainage (Author, 2022)



Figure 138: Stormwater flowing into axis (Author, 2022)

# Phytomining factory

With very limited information on precedents regarding phytomining factories, I had to take initiative and incorporate my own opinion and experience to formulate a practical and functional system. This system is based on my family's beetroot factory on a farm in Hoopstad. Similar to the beetroot factory, a conveyer belt transports the plants from the exterior drop-off area to the factory. This conveyer belt transfers the hyperaccumulative plants to a drying station where the plants are dehydrated to prepare for the furnace. Workers will then make use of a trolley to place the plants inside the furnace, initiating the burning process. This burning process takes a few seconds, turning the plants into ash. The ashes are then moved to the electrolysis process. Once the extraction of the metals is done through the electrolysis process, the metals are weighed, packed, and stored. More lab tests are done on certain samples of the metals to formulate a more productive system.

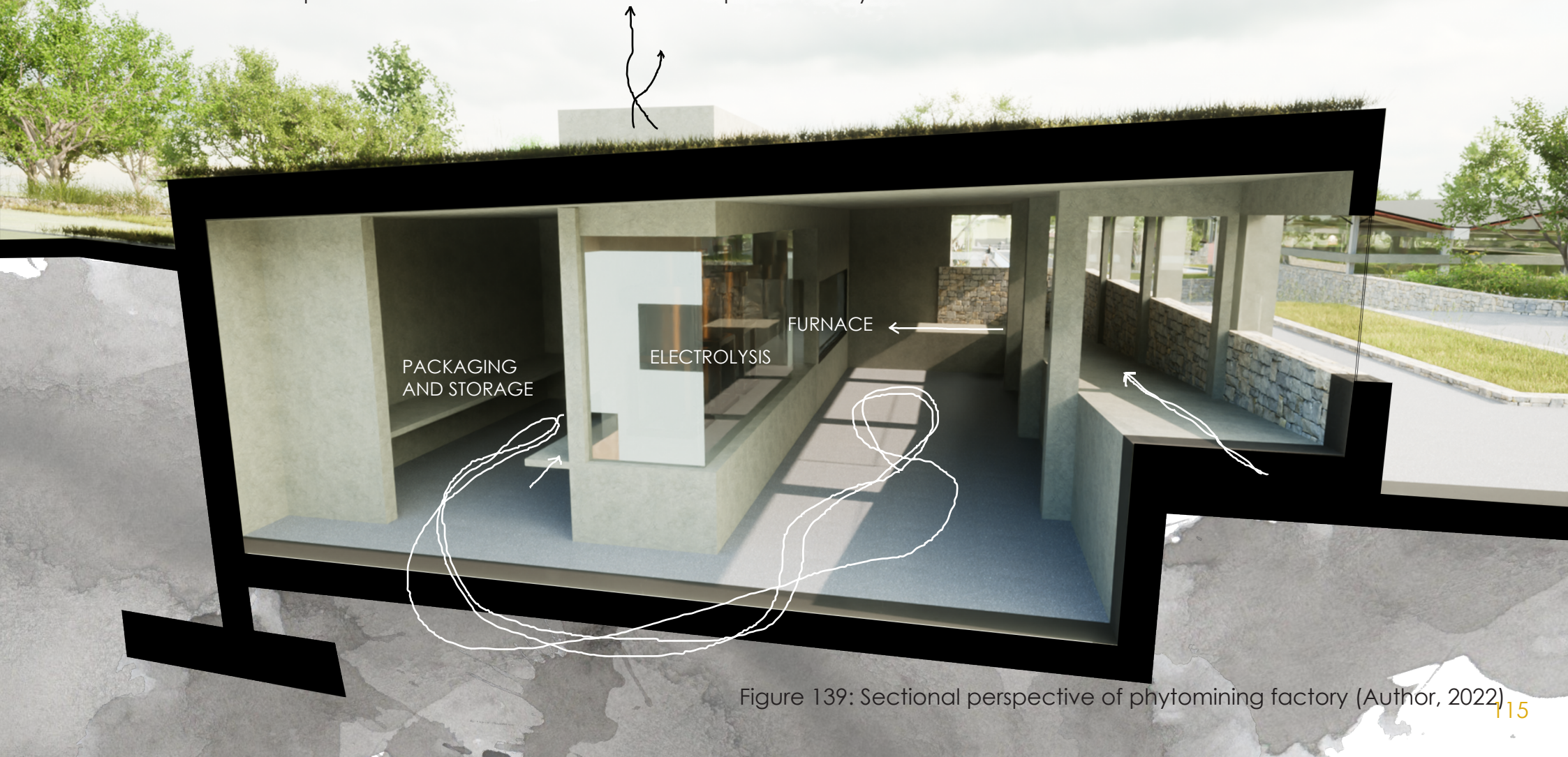



Figure 139: Sectional perspective of phytomining factory (Author, 2022)

# Vertical and Horizontal circulation

The circulation through the design takes the visitor through certain experiences, narratives, and moments via vertical and horizontal movement. These different spaces all form part of the integral 'mesh' and function together to portray the overall message to the visitor. It is, therefore, necessary to not only experience the beauty of the indigenous pleasure garden, but the devastation of the mined quarry to fully grasp the depths of this dissertation.

The vertical and horizontal circulation of this design consists mostly of a variety of levels used on the ground level to capture different experiences between humans and nature.

The entrance of the building steps the ground floor into the landscape, creating clear and defined routes to be followed. It further includes an experience where nature feels foreign and uncanny through carving the ground floor into the natural landscape, essentially placing nature above people. Within cities and buildings all over the world, people got used to living in conditions where they can overlook nature without ever exposing themselves to the elements. This design, therefore, inverts these conditions where nature becomes the spectator and people the spectated through the use of vertical circulation.

The visitors are then greeted with a map of the building, showing the prescribed route to be embarked on. With designed seating in front of the reception, groups of scholars can comfortably wait for their superior to conduct a quick meeting within the reception. The visitors can then follow the route towards the axis with the tear in the southern building as the focal point, starting the poetic journey towards nature's indigenousness.

Making their way toward the research bar/cafeteria, a circular pocket greets them with a harmonious experience between man and nature as seen in the circular seating in figure 142, where nature embraces people with filtered light, stimulating sounds of water whilst being seated within the landscape.



Figure 140: Entrance steps (Author, 2022)

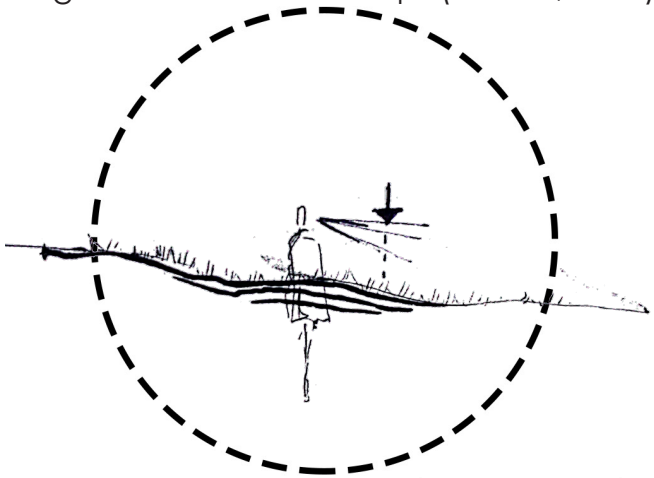


Figure 141: Nature levels (Author, 2022)

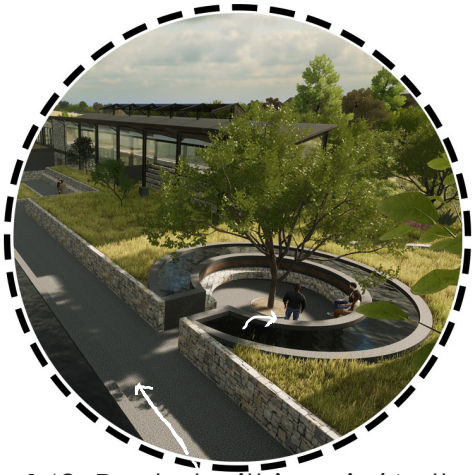


Figure 142: Pocket within axis (Author, 2022)

Entering the research bar/cafeteria, the boxed nature (greenhouse) becomes the focal point. This design creates an uncanny experience where nature's fragility is framed within human intervention.

The research bar/cafeteria (figure 143) consists of two floor levels. The ground floor level consists of a kitchen, cooling unit, waitron station, collection bar, double volume indoor seating, outdoor seating, greenhouse, and ablutions. Following the stairs up to the second floor, people are greeted with a Wi-Fi lounge. This lounge is connected to a corridor that overlooks the ground floor seating area and greenhouse, leading to an open-plan office space and board room. This office space and boardroom can be used as a multifunctional room and can be extended to the rooftop terrace by opening the folding doors.




Figure 143: Sectional perspective of research bar/cafeteria (Author, 2022)

The corridor then meets the library on ground level, and the building can then be exited. With strict laboratory regulations in place, visitors can make their way past the laboratories and spectate these activities from the outside. These activities introduce the start of the possible solutions to the problem statement that was introduced at the lookout point. By following the axis towards the east, the Mountainlands nature reserve is framed and represents a hopeful future. The phytomining factory will then present itself as another possible solution that can be spectated from the outside. The journey then ends with the beautiful pleasure garden that aims to create an experience where humans become indigenous to nature. This pleasure garden creates pockets of space where people can be in full harmony with natural elements and hopefully realize that to take care of nature is to take care of oneself.

Following the axis towards the auditorium, visitors further emerge within the landscape by stepping down the stairs. A waterfall creates an eerie experience with the sky being framed through the architectural intervention. This part of the design reflects the history of the mining site and deliberately places the visitor in a dramatic state where the uncanny overpowers all. With nature out of site, an underground corridor frames the devastation of the mined quarry and leads to a lookout point. This lookout introduces the problem statement of this project without any words necessary, allowing people to become aware of the mining hyperobject and to be most susceptible to listening to possible solutions that will be introduced next.

The southern part of the auditorium becomes a place where large meetings can be held, and special events can take place. The auditorium then leads towards an underground ramp that inclines to the ground level. The mining tunnels are portrayed by exposing the earth within this corridor, further emphasizing the descent of the landscape. The architecture follows the contours of the landscape and steps the design in three parts to accommodate the natural fall (figure 131, page 109). The southern laboratory building sinks within the natural landscape and meets the contours through the pitch of the green roof.

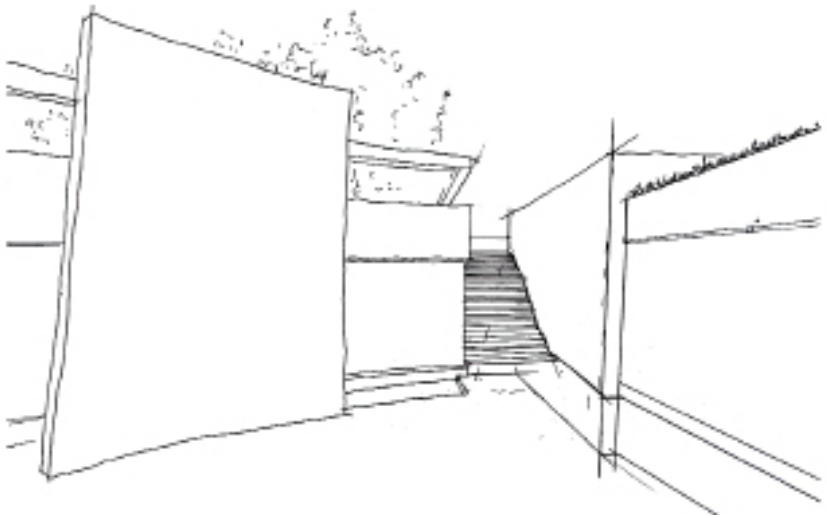


Figure 144: Stairs leading into auditorium (Author, 2022)

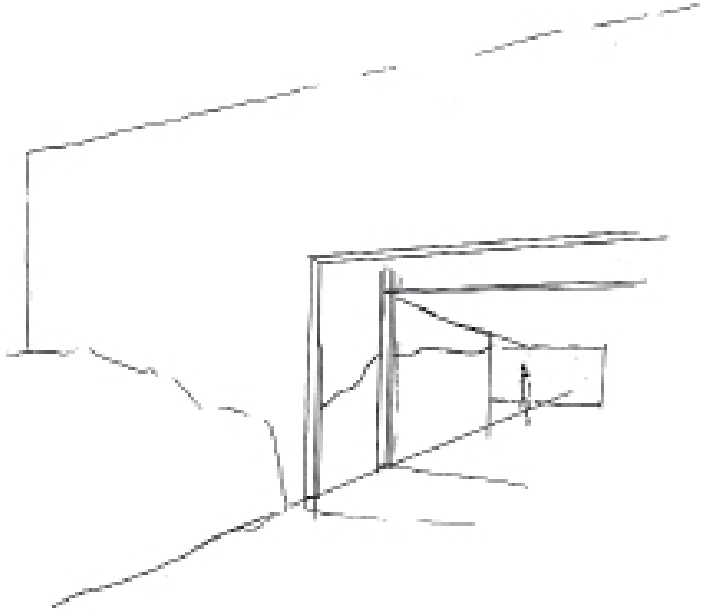


Figure 145: Underground corridor fariming the quarry (Author, 2022)

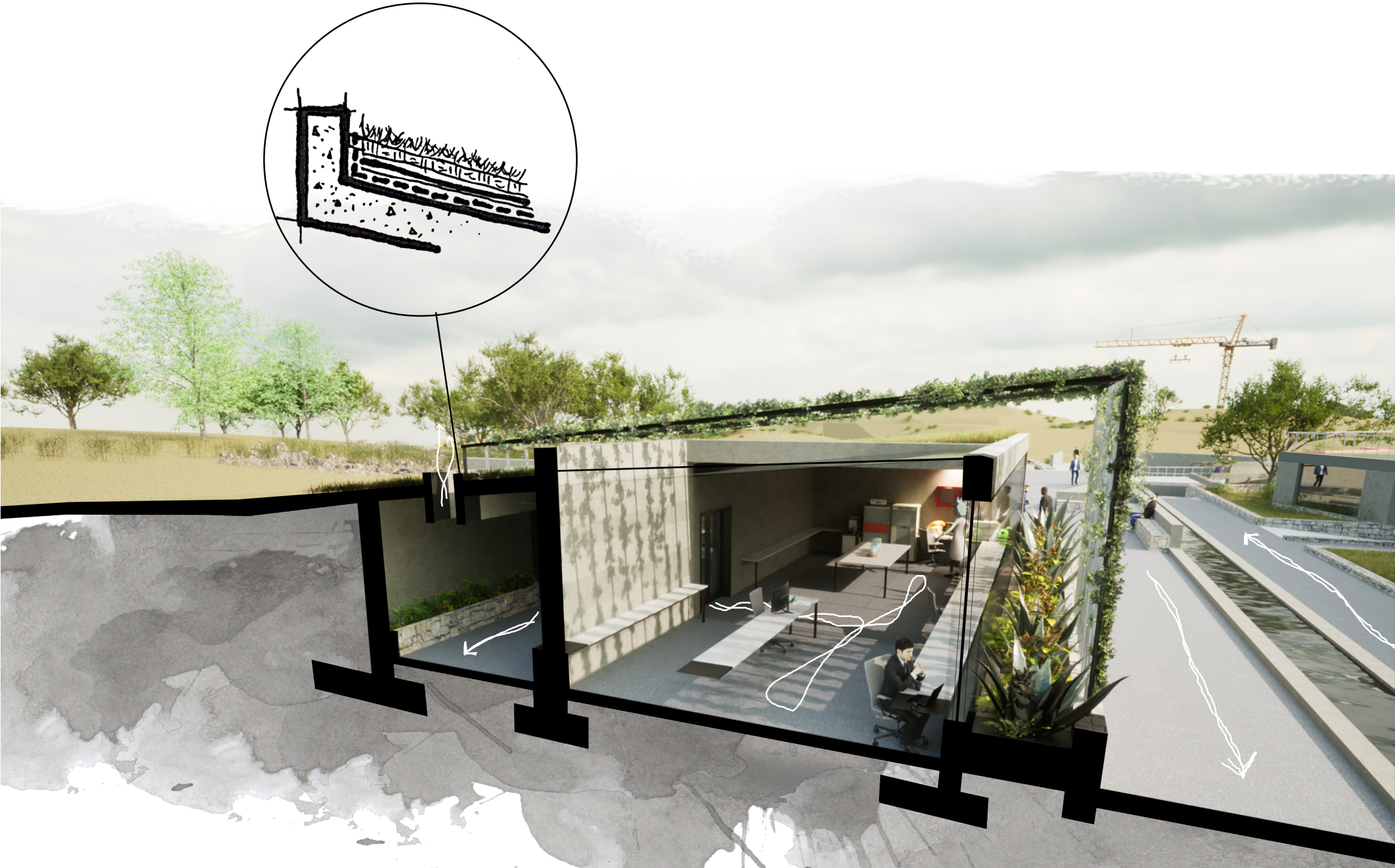


Figure 146: Sectional perspective of laboratory (Author, 2022)

# Structure and materiality

Waste rock can be seen as a by-product of mining and consist of excavated broken rock that is silt to boulder size particles (James & Aubertin, 2013: online). These excavations can in many cases fill up mountains of waste rock, and in the case of Fairview mine, that is the reality as seen in figure 147.

These waste rock mountains can be repurposed in the following ways (Lottermoser, 2011: online):

1. Resource of minerals and metals

2. Backfill for open voids

3. Landscaping material

4. Substrate for revegetation at mine sites

5. Aggregate in embankment, road, pavement, foundation and building construction

6. Asphalt component

7. Feedstock for cement and concrete



With the abandoned tailings site being demolished and excavated, it is very important to create a stable soil condition to prevent surface subsidence. This can be done by backfilling the site with a waste rock cement mixture known as a cemented rock-tailing filling. This mixture uses tailings and waste rock as aggregate, cement, and water according to a certain proportion to prepare a filling slurry (Zhao, 2020: online).

This mixture can be adjusted to be used for foundations, in-situ walls, and green roof structures.

Figure 147: Waste rock mountains surrounding the site (Author, 2022)

The structure of the design is further influenced by the typical steel framed structure used throughout mining construction and poetically displays these materials intending to create moments throughout the design where the architecture supports the dystopic narrative to convey the necessary message (research question). The design, therefore, uses structural elements and materiality to create moments where people either feel connected or disconnected from nature, supporting the poetic narrative of the theoretical aspects of this dissertation. The use of glass allows people to spectate activities throughout the design, essentially enabling them to reflect on the journey they have embarked on.

Through using natural rock and stones found on site within walls and seating, the existing language of Mpumalanga is met within the design. This materiality component is also inspired by the precedent study, Witklipfontein Eco Lodge.
The green roof structure aims to minimize the carbon footprint of the laboratories and factory, whilst simultaneously providing a regulated environment with appropriate humidity and temperatures. Similar to the Witklipfontein Eco Lodge, the green roof (figure 148) enables the design to become one with the landscape, allowing for a natural extension within the design.

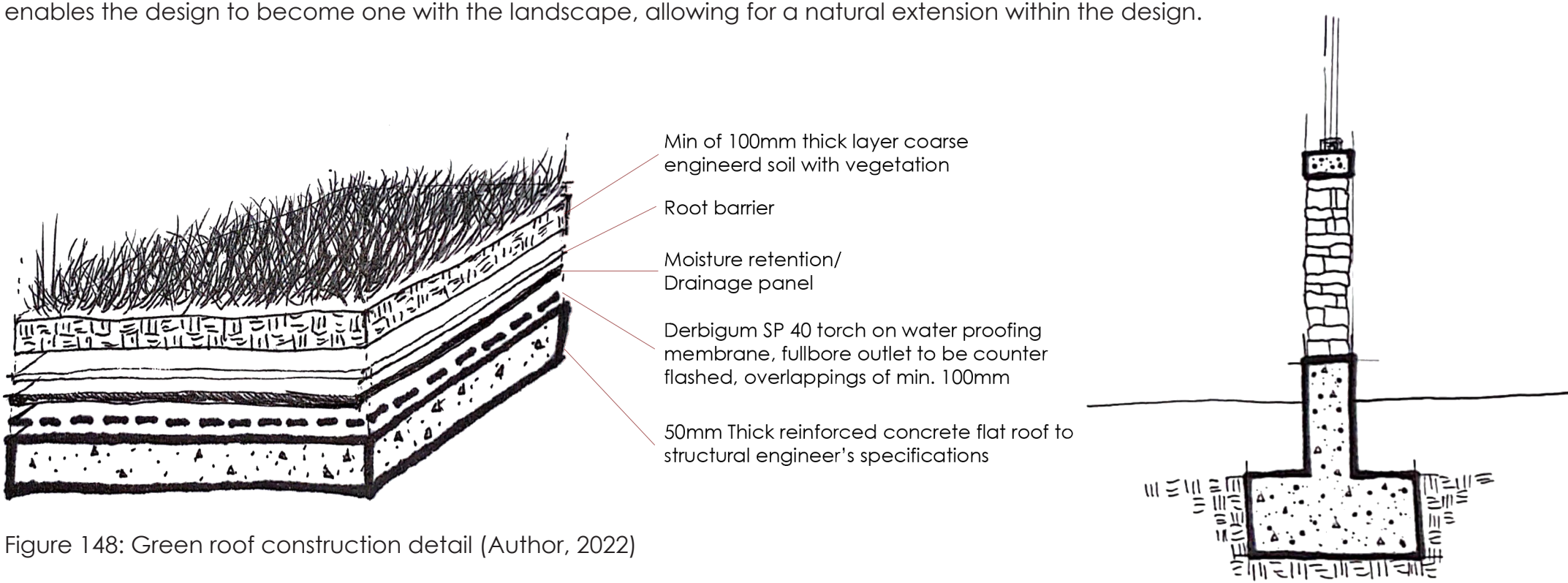



Figure 148: Green roof construction detail (Author, 2022)

The use of rammed earth within the library corridor and auditorium walls creates an awareness of being underground. The corten steel used within the auditorium refers to the historical components of the site and allows for a natural decay over time that supports the dystopic narrative of an environmental apocalyptic obsolete.

# Appendix A
## Construction Documentation

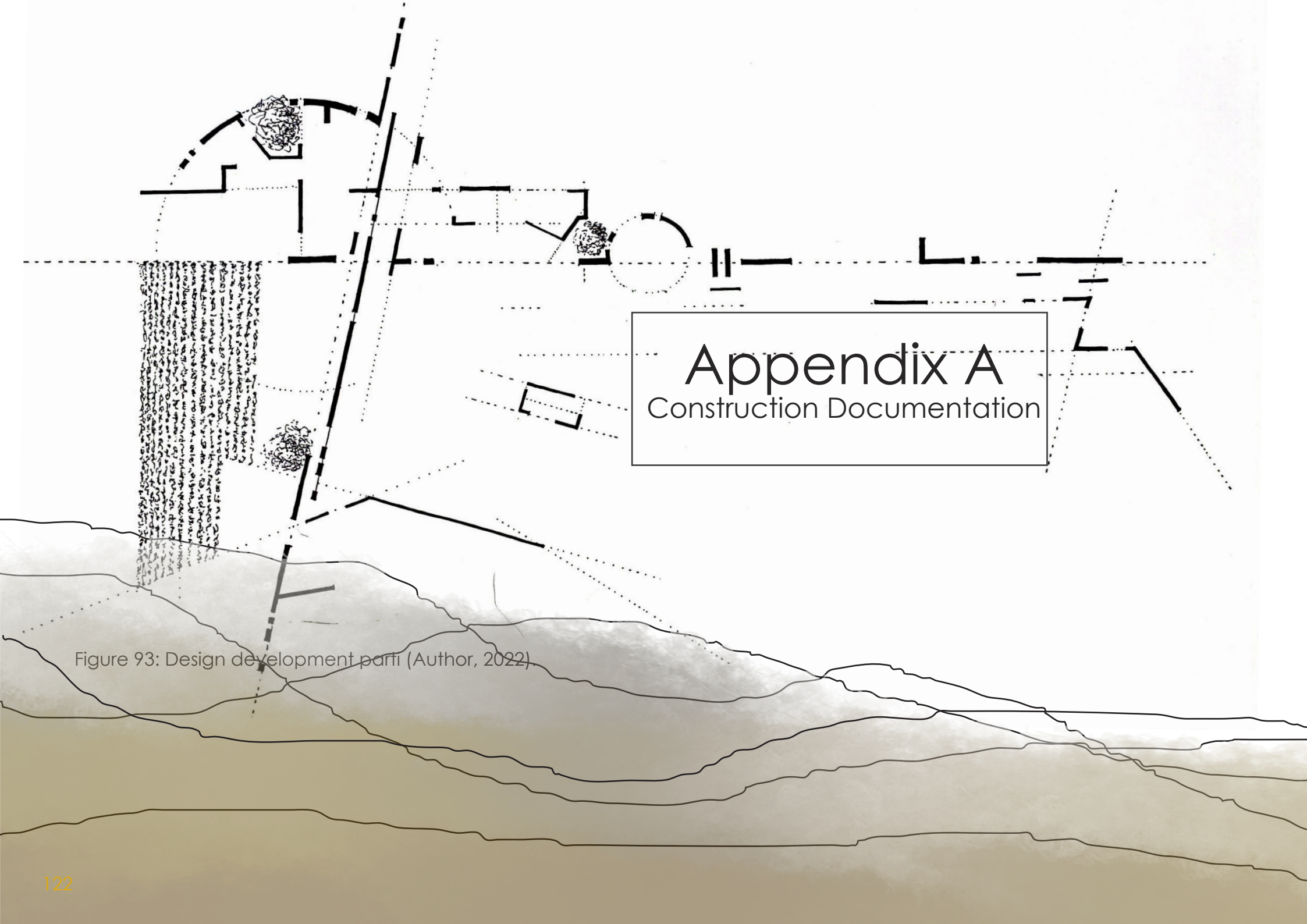
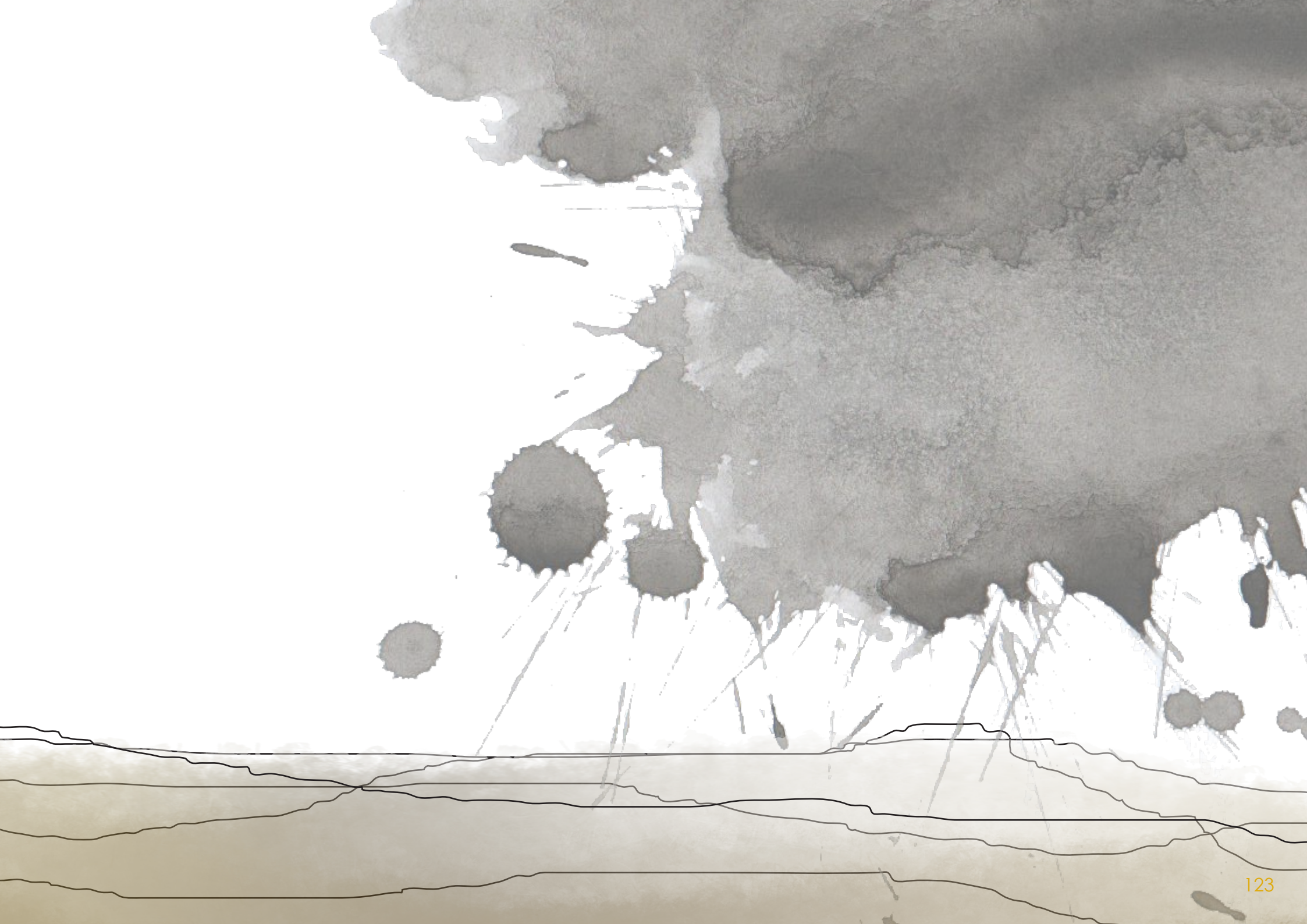
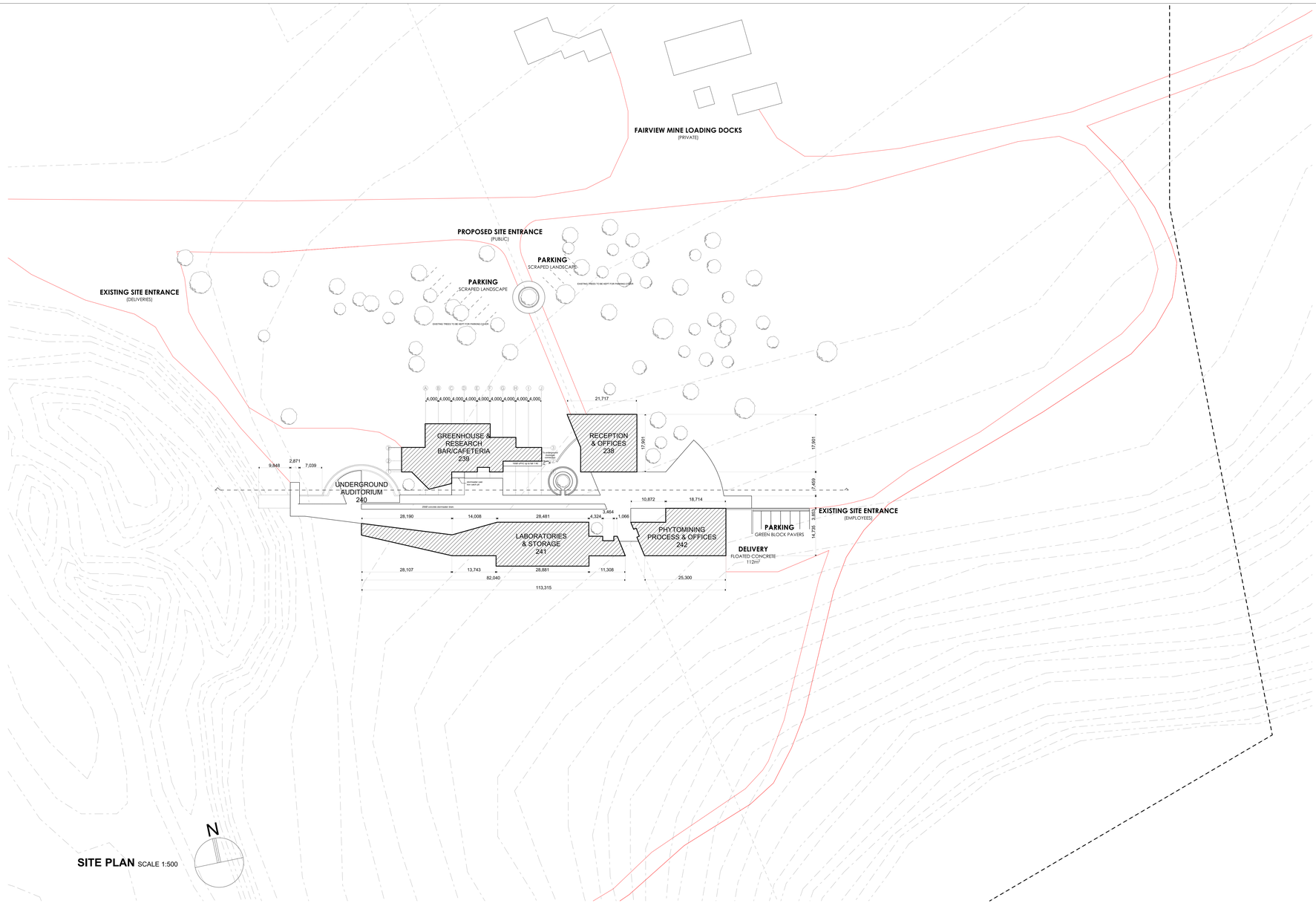
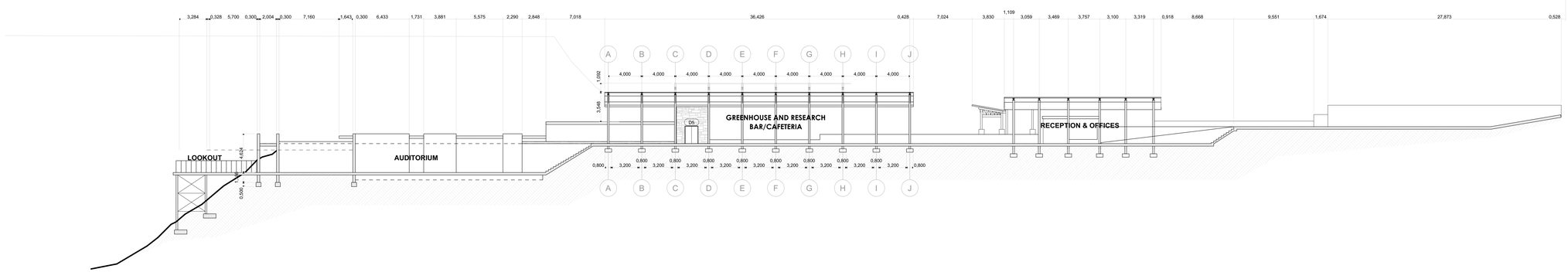


Figure 93: Design development parti (Author, 2022).






**SITE PLAN** SCALE 1:500




**SECTION THROUGH SITE** SCALE 1:200



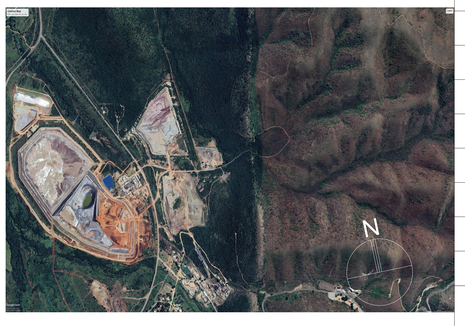
**ROOF PLAN RENDERING OF DEVELOPMENT** NOT TO SCALE



**AERIAL OVERVIEW OF DEVELOPMENT** NORTH EAST DIRECTION



**AERIAL PHOTO OF SITE** EXISTING CONDITIONS




**AERIAL PHOTO OF FAIRVIEW MINE** EXISTING CONDITIONS

ARCHICAD EDUCATION VERSION

NOTES:

N

DRAWING TITLE:
**SITE PLAN**

| DRAWING NAME: | SCALE: |
|---|---|
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| A0 02: SITE PLAN | 1:500 |
| A1 01: SECTIONS | 1:100 & 1:50 |
| A1 02: ELEVATIONS | 1:100 |
| A1 03: AUDITORIUM SECTION | 1:50 |
| A2 01: UNDERGROUND AUDITORIUM | 1:200 |
| A2 02: GREENHOUSE DETAILS | 1:50 & 1:20 |
| A2 03: LABORATORY DETAILS | 1:50 & 1:20 |
| A2 04: EXPLOSIVE VIEW | 1:2000 |

**CONS 7908**
DEPARTMENT OF ARCHITECTURE
UNIVERSITY OF THE FREE STATE

DOCUMENTATION:
**M.ARCH (PROF)**
**DISSERTATION**

PROJECT TITLE:
**AN ECO-REGENERATIVE RESEARCH CENTRE**
FAIRVIEW MINE, ABANDONED TAILINGS
BARBERTON, MPUMALANGA, 1200

CLIENT:
**PAN AFRICAN RESOURCES**

PAN AFRICAN
RESOURCES

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|---|---|
| 14 NOV 2022 | 1:200 & 1:1000 |
| STUDENT NO: 2015006477 | DRAWING NO: A0 01 / 2 / P |
| SURNAME: GROENEWALD | NAME: CHRISTIE-ANN |

ARCHICAD EDUCATION VERSION

NOTES:



**EXISTING SITE INFLUENCES** SCALE 1:1000

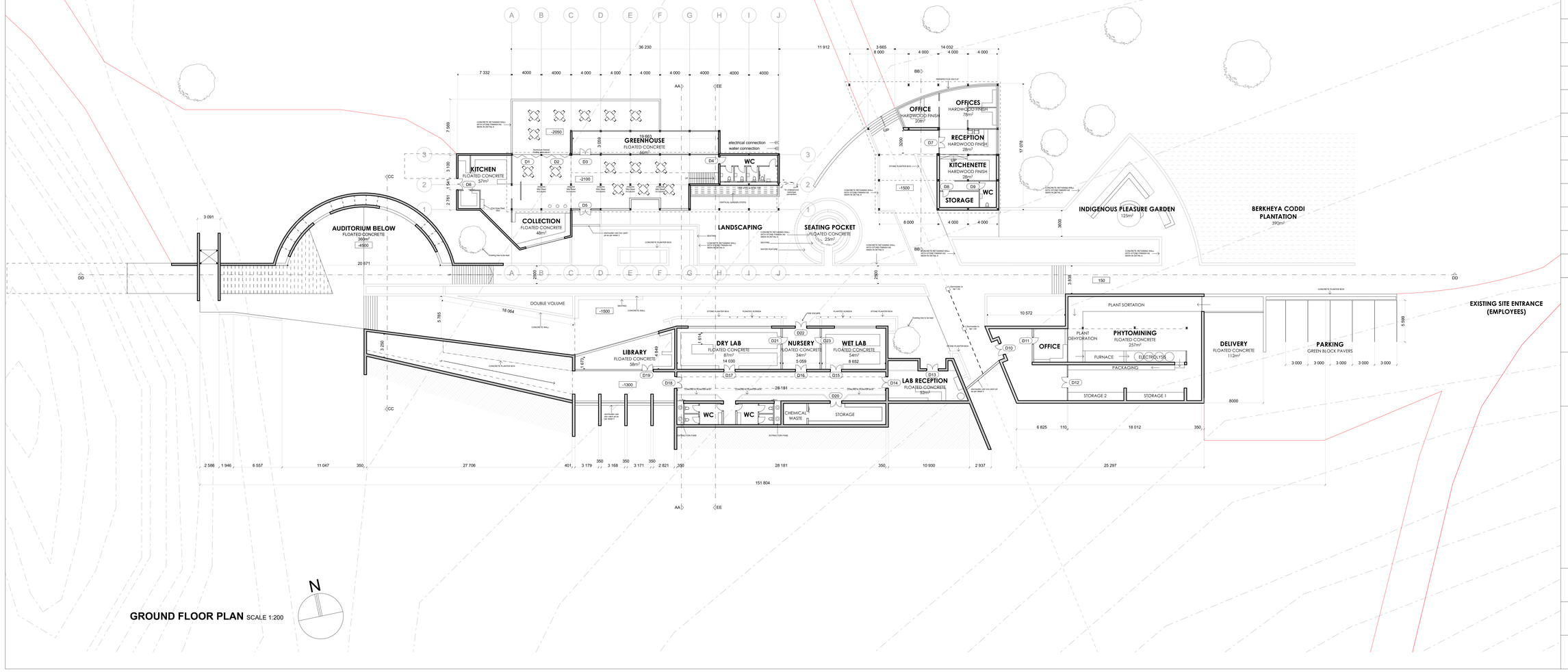
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PARKING
SCRAPED LANDSCAPE

EXISTING TREES TO BE KEPT FOR PARKING COVER

PARKING
SCRAPED LANDSCAPE

EXISTING TREES TO BE KEPT FOR PARKING COVER




**GROUND FLOOR PLAN** SCALE 1:200

N

N

DRAWING TITLE:
**GROUND FLOOR PLAN**

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| A0 02: SITE PLAN | 1:500 |
| A1 01: SECTIONS | 1:100 & 1:50 |
| A1 02: ELEVATIONS | 1:100 |
| A1 03: AUDITORIUM SECTION | 1:50 |
| A2 01: UNDERGROUND AUDITORIUM | 1:200 |
| A2 02: GREENHOUSE DETAILS | 1:50 & 1:20 |
| A2 03: LABORATORY DETAILS | 1:50 & 1:20 |
| A2 04: EXPLOSIVE VIEW | 1:2000 |

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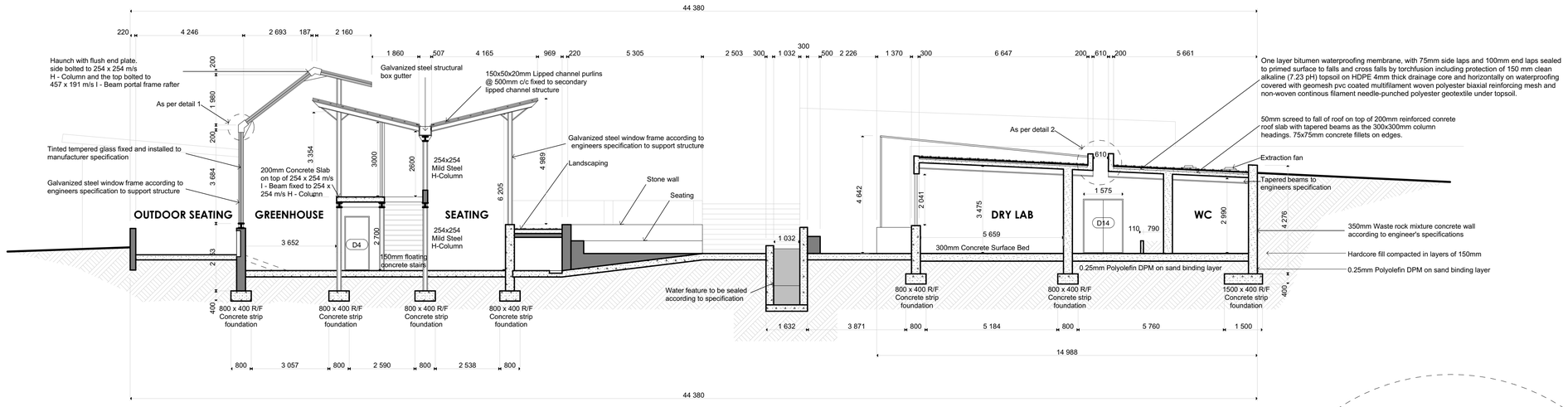
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BARBERTON, MPUMALANGA, 1200

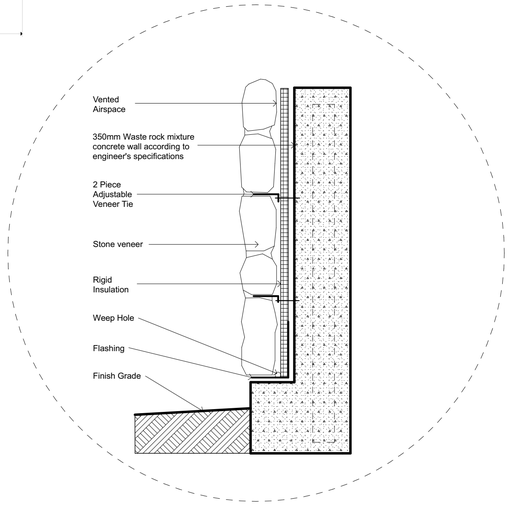
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**PAN AFRICAN RESOURCES**

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RESOURCES

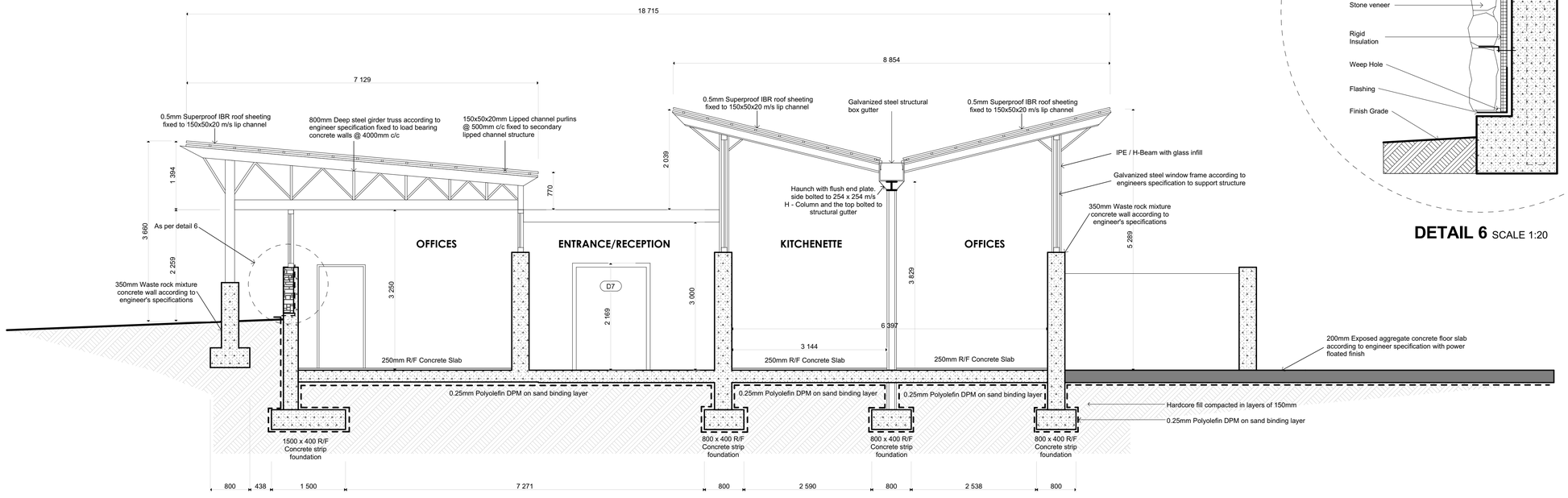
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| SURNAME: GROENEWALD | NAME: CHRISTIE-ANN |




## SECTION AA SCALE 1:100




## DETAIL 6 SCALE 1:20




## SECTION BB SCALE 1:50

NOTES:

ARCHICAD EDUCATION VERSION

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| A1 02: ELEVATIONS | 1:100 |
| A1 03: AUDITORIUM SECTION | 1:50 |
| A2 01: UNDERGROUND AUDITORIUM | 1:200 |
| A2 02: GREENHOUSE DETAILS | 1:50 & 1:20 |
| A2 03: LABORATORY DETAILS | 1:50 & 1:20 |
| A2 04: EXPLOSIVE VIEW | 1:2000 |


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UNIVERSITY OF THE FREE STATE

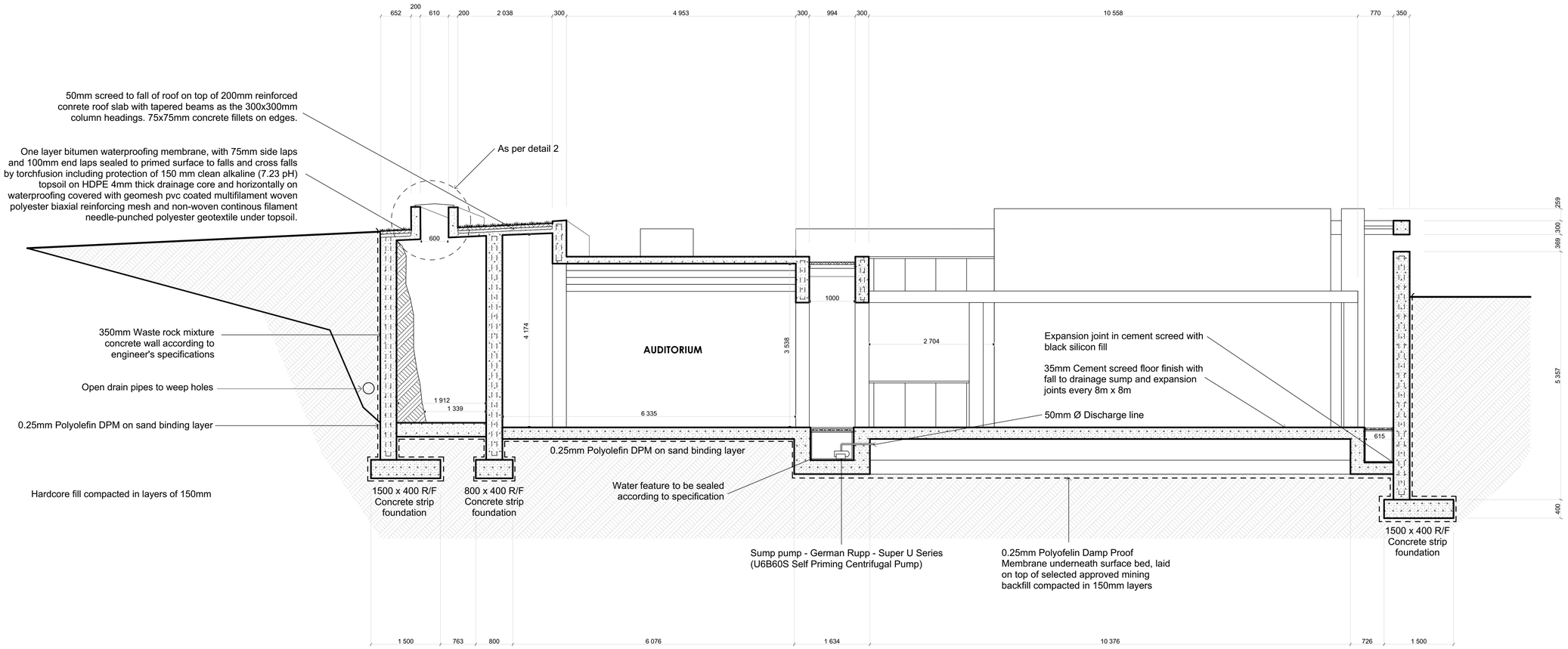

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BARBERTON, MPUMALANGA, 1200

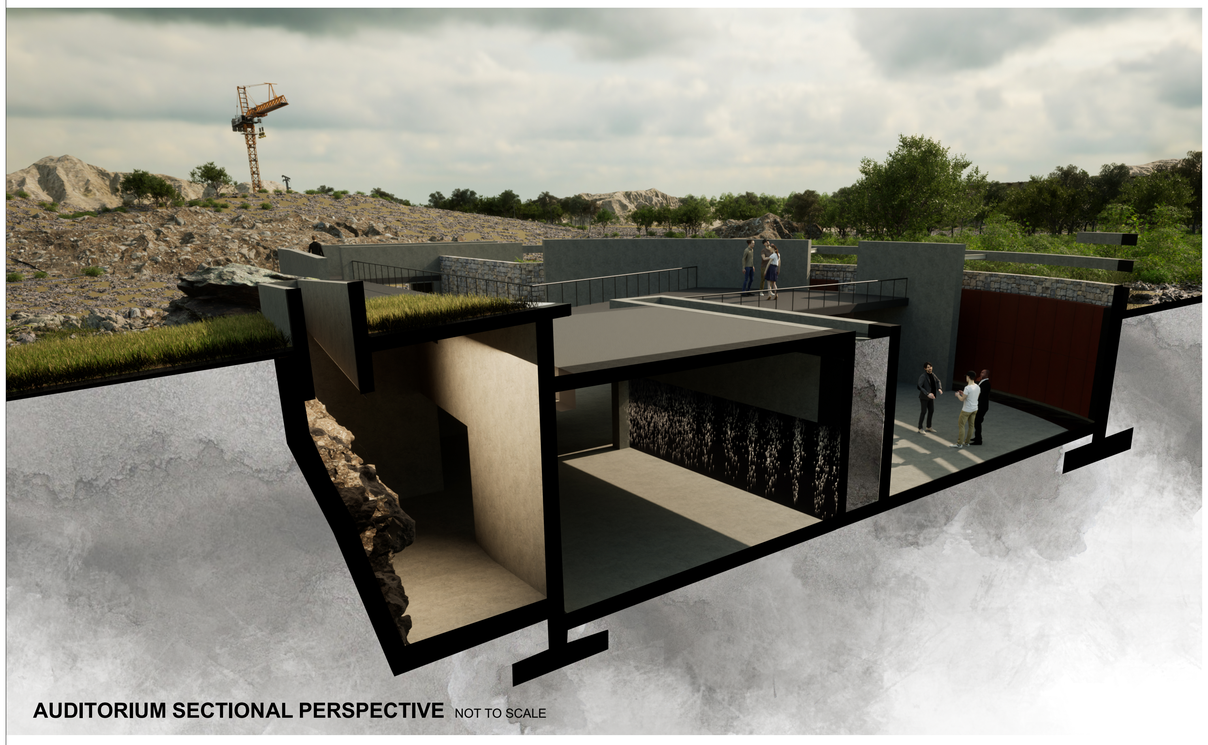
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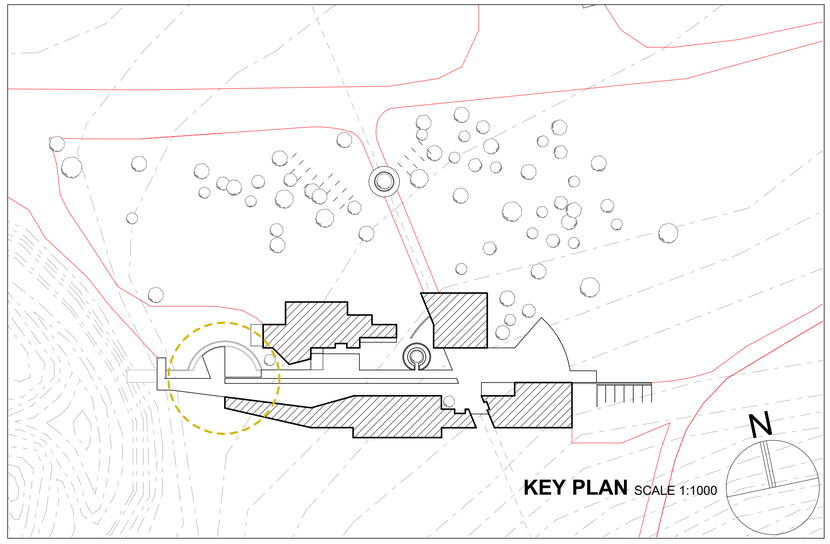
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| SURNAME: GROENEWALD | NAME: CHRISTIE-ANN |




**SECTION CC** SCALE 1:50



**AUDITORIUM SECTIONAL PERSPECTIVE** NOT TO SCALE




**KEY PLAN** SCALE 1:1000

NOTES:

ARCHICAD EDUCATION VERSION

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| A1 02: ELEVATIONS | 1:100 |
| A1 03: AUDITORIUM SECTION | 1:50 |
| A2 01: UNDERGROUND AUDITORIUM | 1:200 |
| A2 02: GREENHOUSE DETAILS | 1:50 & 1:20 |
| A2 03: LABORATORY DETAILS | 1:50 & 1:20 |
| A2 04: EXPLOSIVE VIEW | 1:2000 |

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DEPARTMENT OF ARCHITECTURE
UNIVERSITY OF THE FREE STATE

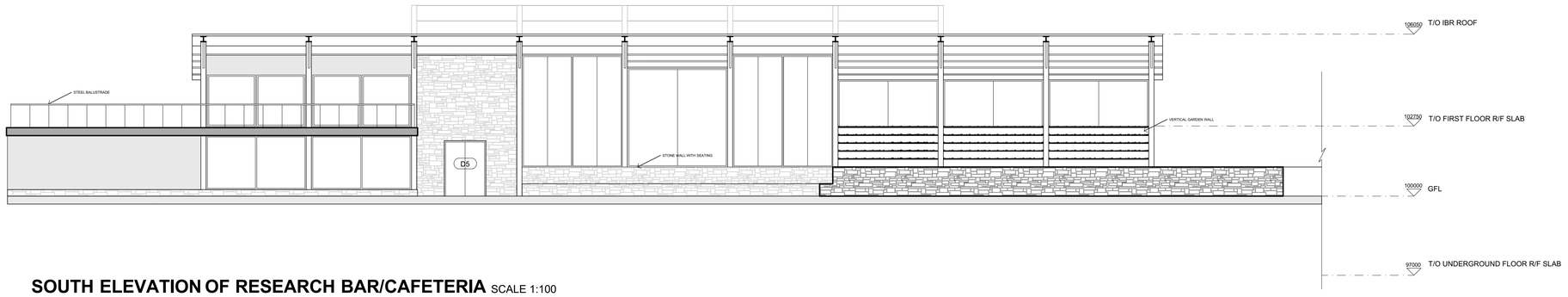
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**DISSERTATION**

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BARBERTON, MPUMALANGA, 1200

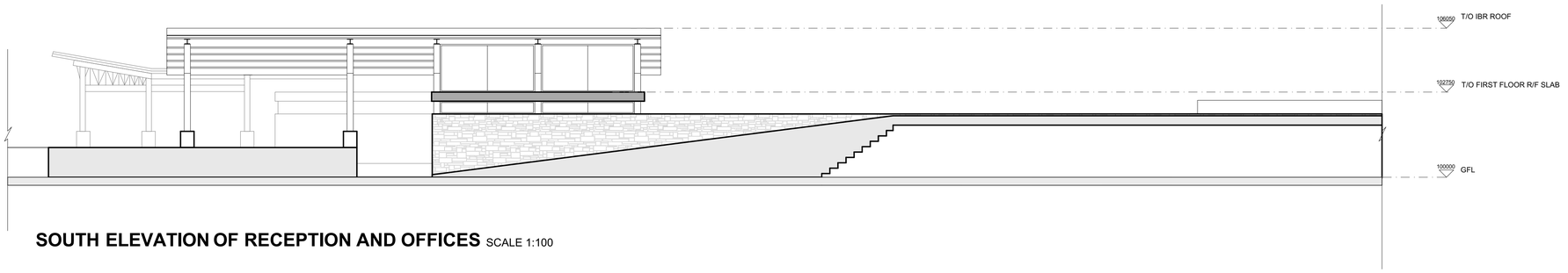
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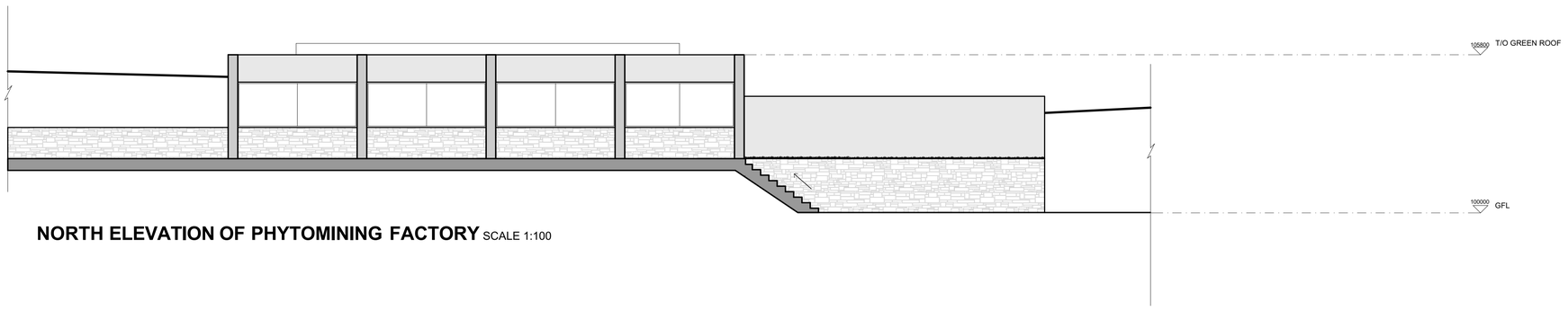
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| SURNAME: GROENEWALD | NAME: CHRISTIE-ANN |



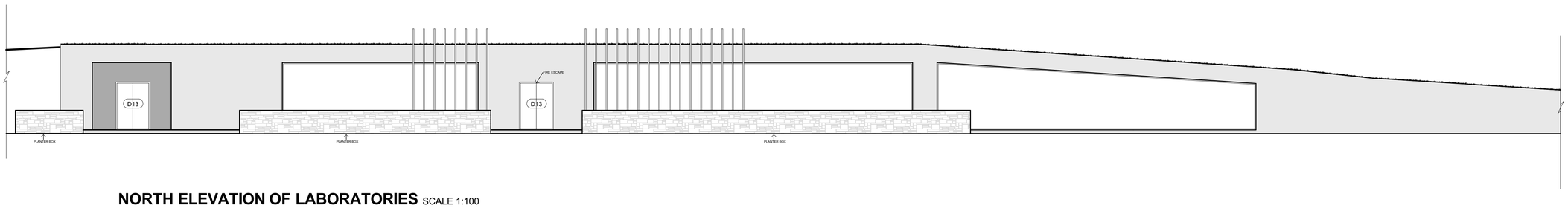

**SOUTH ELEVATION OF RESEARCH BAR/CAFETERIA** SCALE 1:100




**SOUTH ELEVATION OF RECEPTION AND OFFICES** SCALE 1:100




**NORTH ELEVATION OF PHYTOMINING FACTORY** SCALE 1:100




**NORTH ELEVATION OF LABORATORIES** SCALE 1:100

NOTES:

ARCHICAD EDUCATION VERSION

DRAWING TITLE:
**ELEVATIONS**

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| A1 02: ELEVATIONS | 1:100 |
| A1 03: AUDITORIUM SECTION | 1:50 |
| A2 01: UNDERGROUND AUDITORIUM | 1:200 |
| A2 02: GREENHOUSE DETAILS | 1:50 & 1:20 |
| A2 03: LABORATORY DETAILS | 1:50 & 1:20 |
| A2 04: EXPLOSIVE VIEW | 1:2000 |

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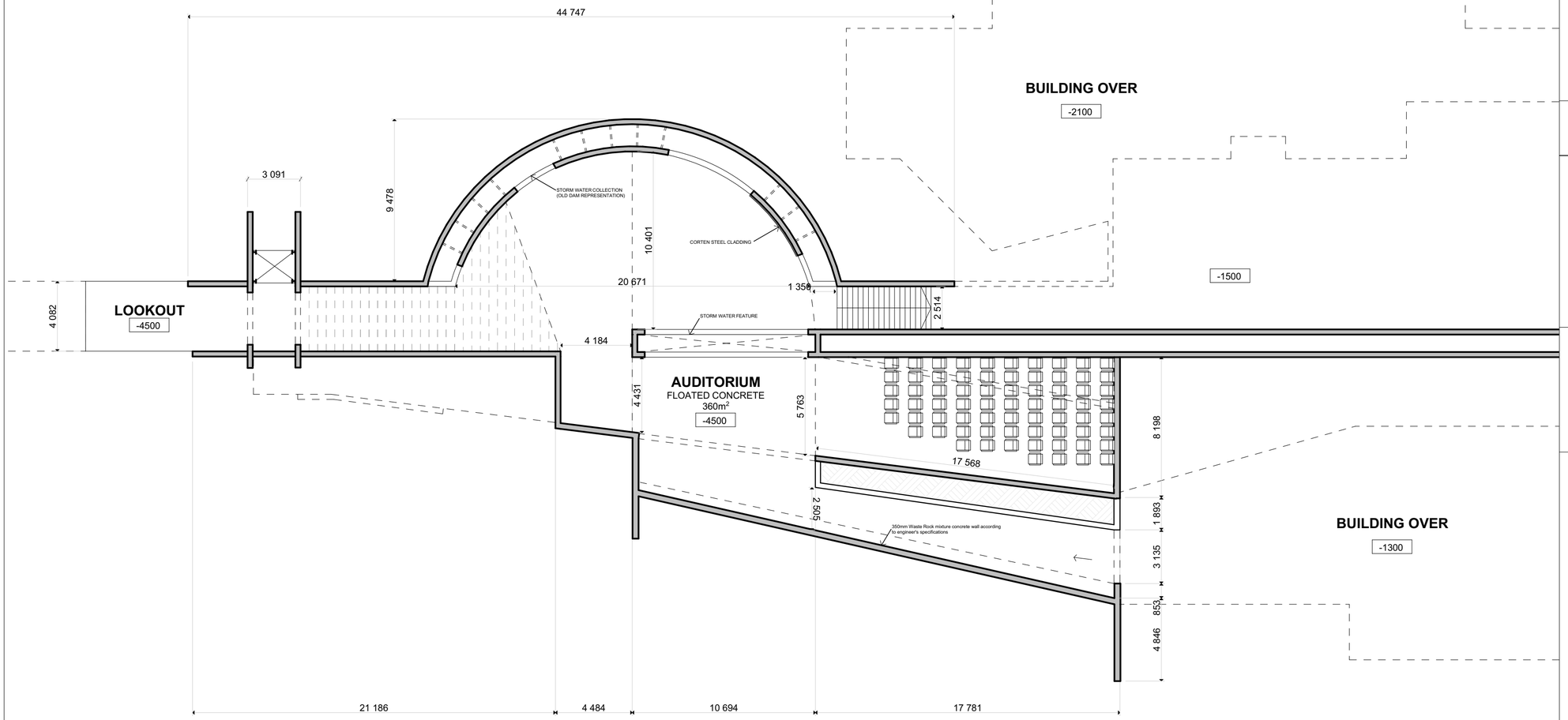
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PROJECT TITLE:
**AN ECO-REGENERATIVE RESEARCH CENTRE**
FAIRVIEW MINE, ABANDONED TAILINGS
BARBERTON, MPUMALANGA, 1200

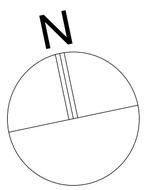
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**PAN AFRICAN RESOURCES**

PAN AFRICAN
RESOURCES

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| STUDENT NO: 2015006477 | DRAWING NO: A1 02 / 3 / P |
| SURNAME: GROENEWALD | NAME: CHRISTIE-ANN |

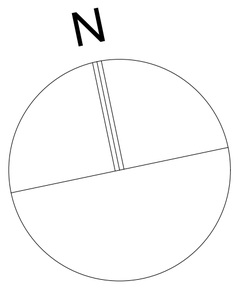



## UNDERGROUND AUDITORIUM FLOOR PLAN SCALE 1:200




NOTES:

ARCHICAD EDUCATION VERSION




DRAWING TITLE:
**UNDERGROUND AUDITORIUM**

**CONS 7908**
DEPARTMENT OF ARCHITECTURE
UNIVERSITY OF THE FREE STATE

DOCUMENTATION:
**M.ARCH (PROF)**
**DISSERTATION**

PROJECT TITLE:
**AN ECO-REGENERATIVE RESEARCH CENTRE**
FAIRVIEW MINE, ABANDONED TAILINGS
BARBERTON, MPUMALANGA, 1200

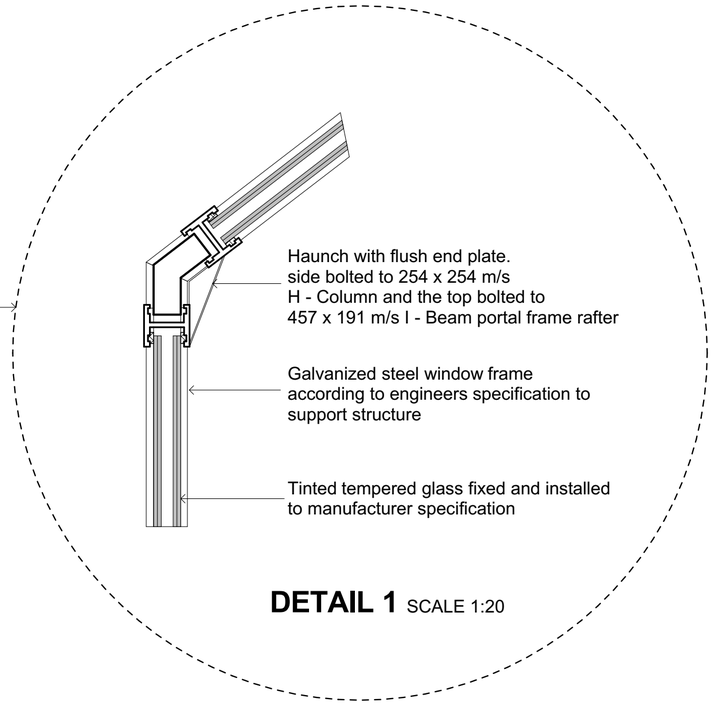
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PAN AFRICAN
RESOURCES

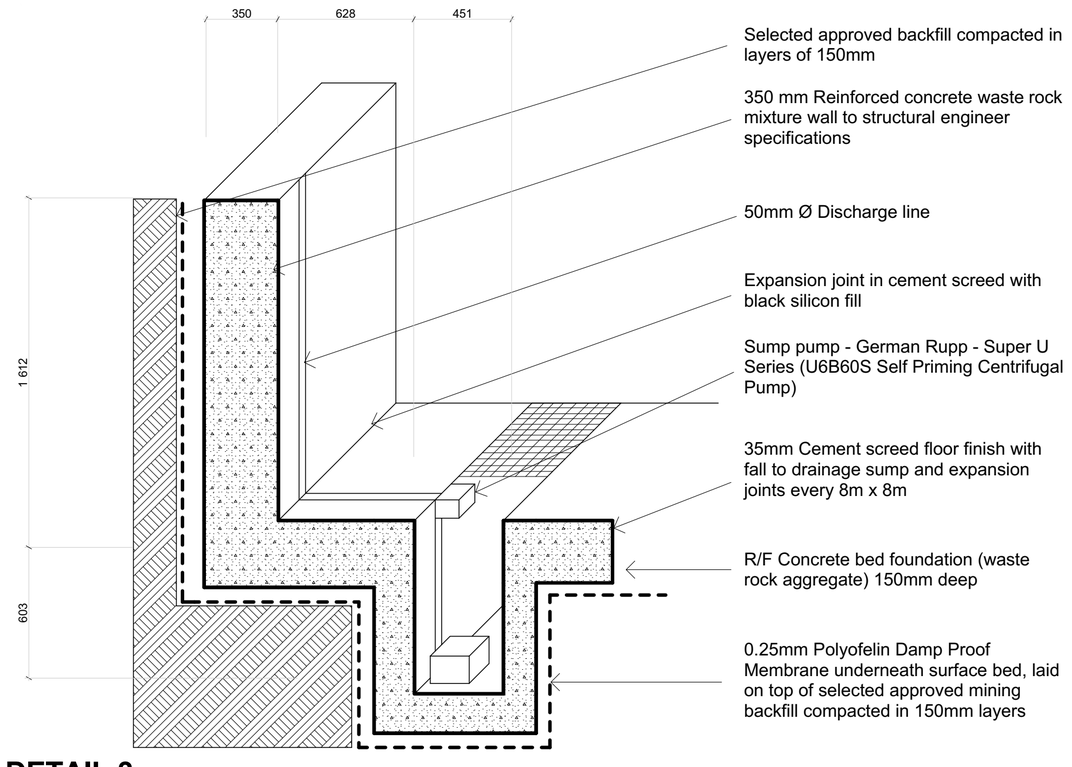
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| SURNAME: GROENEWALD | NAME: CHRISTIE-ANN |



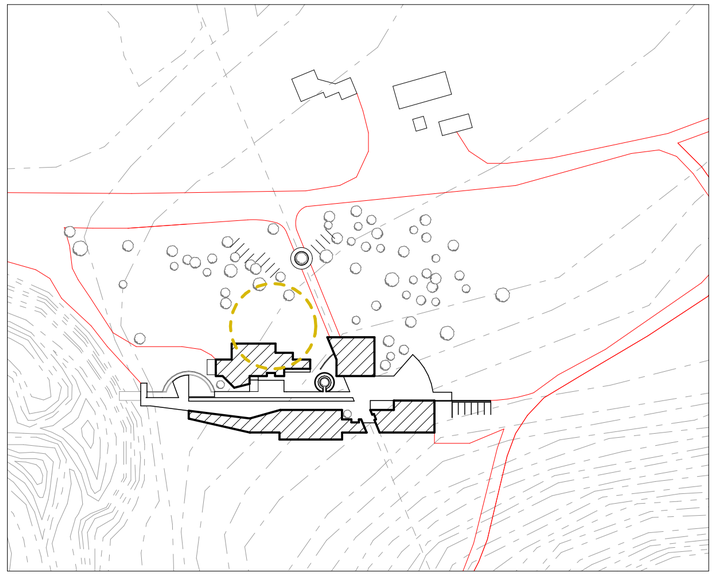
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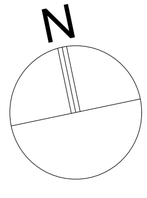



**DETAIL 1** SCALE 1:20




**DETAIL 3** SCALE 1:20






**KEY PLAN** SCALE 1:2000

NOTES:

ARCHICAD EDUCATION VERSION

DRAWING TITLE:
**GREENHOUSE DETAILS**

**CONS 7908**
DEPARTMENT OF ARCHITECTURE
UNIVERSITY OF THE FREE STATE

DOCUMENTATION:
**M.ARCH (PROF)**
**DISSERTATION**

PROJECT TITLE:
**AN ECO-REGENERATIVE RESEARCH CENTRE**
FAIRVIEW MINE, ABANDONED TAILINGS
BARBERTON, MPUMALANGA, 1200

CLIENT:
**PAN AFRICAN RESOURCES**

PAN AFRICAN RESOURCES

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| STUDENT NO: 2015006477 | DRAWING NO: A2 02 / 4 / P |
| SURNAME: GROENEWALD | NAME: CHRISTIE-ANN |

Haunch with flush end plate. Side bolted to 254 x 254 m/s H - Column and the top bolted to 457 x 191 m/s I - Beam portal frame rafter

Galvanized steel window frame according to engineers specification to support structure

0.5mm Superproof IBR roof sheeting fixed to 150x50x20 m/s lip channel

150x50x20mm Lipped channel purlins @ 500mm c/c fixed to secondary lipped channel structure

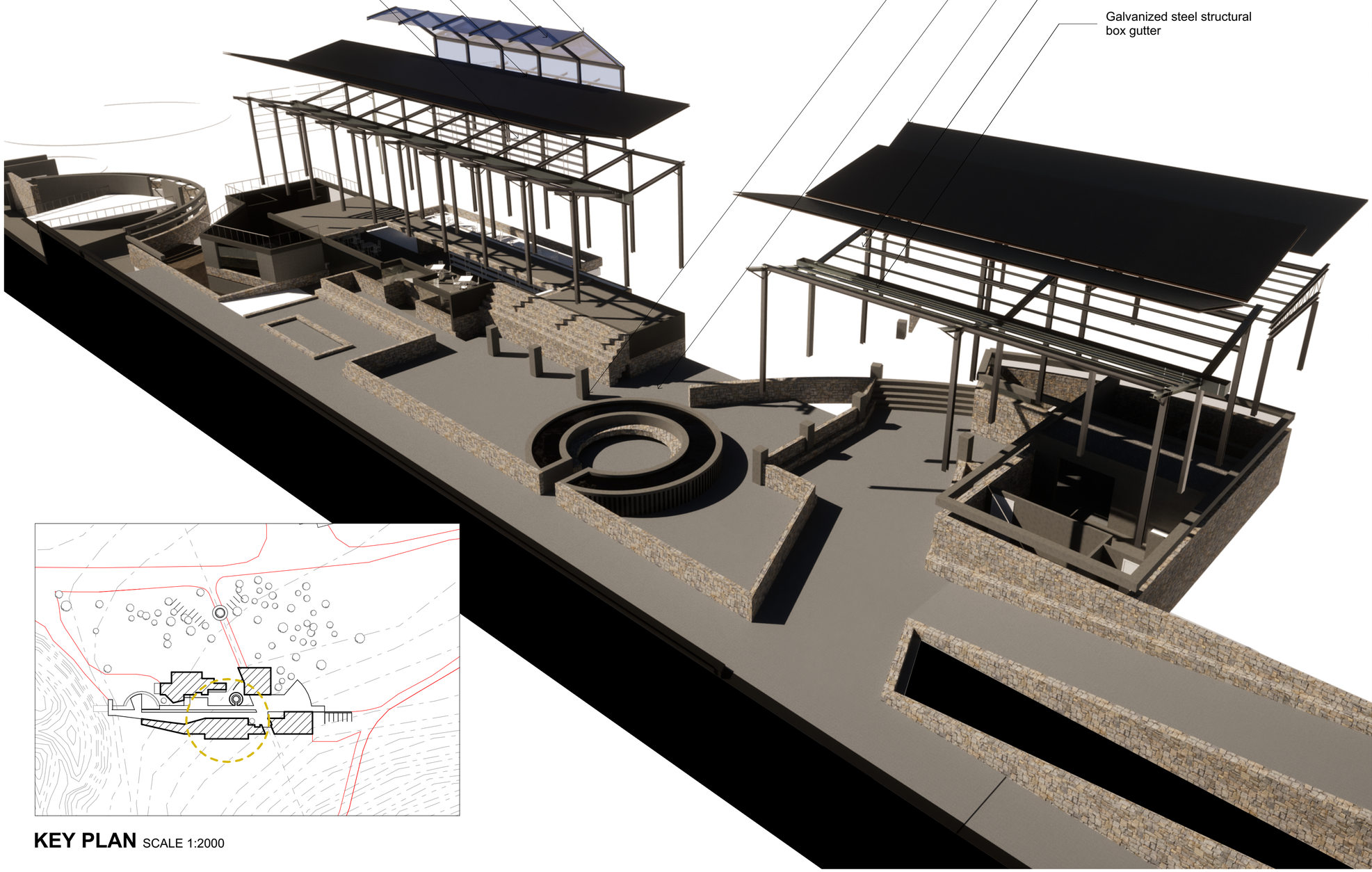
35mm Cement screed floor finish with fall to drainage sump and expansion joints every 8m x 8m

350mm Waste rock mixture concrete foundation wall according to engineer's specifications

0.5mm Superproof IBR roof sheeting fixed to 150x50x20 m/s lip channel

150x50x20mm Lipped channel purlins @ 500mm c/c fixed to secondary lipped channel structure

Galvanized steel structural box gutter





**KEY PLAN** SCALE 1:2000

NOTES:

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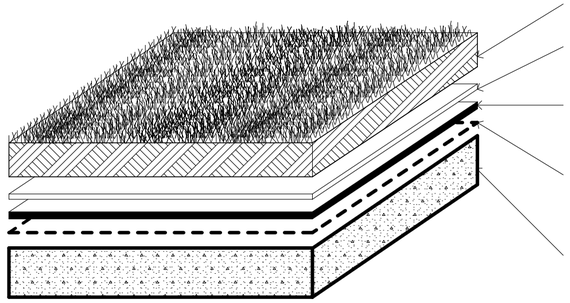
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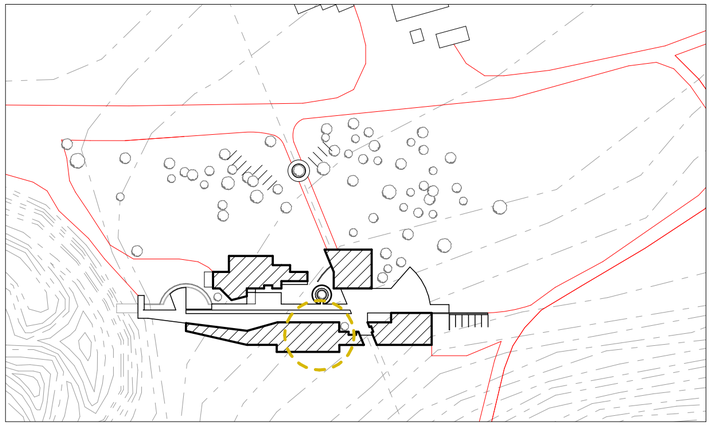
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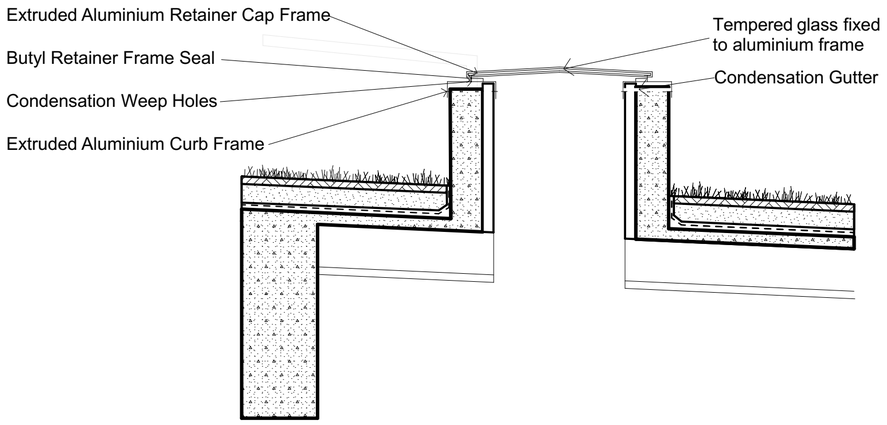
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| SURNAME: GROENEWALD | NAME: CHRISTIE-ANN |



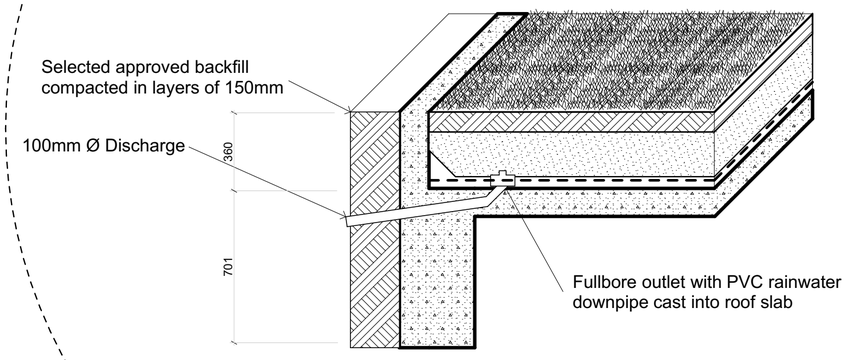

**DETAIL 5** SCALE 1:20



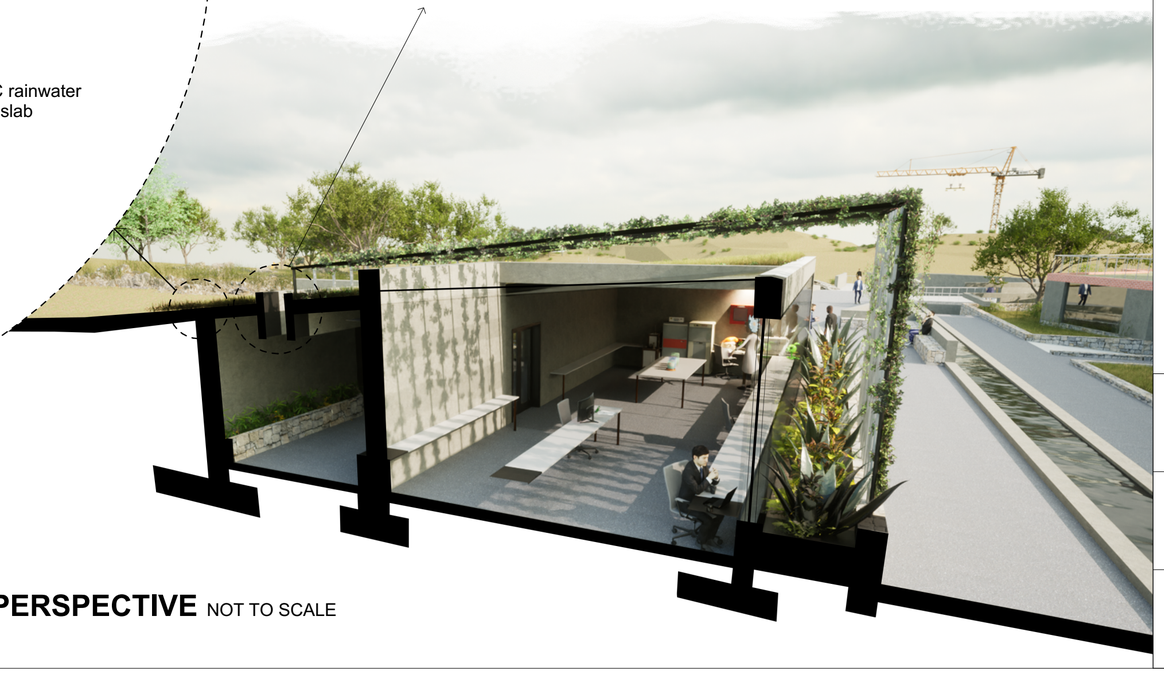
**KEY PLAN** SCALE 1:2000




**DETAIL 2 (artistic skylight domes)** SCALE 1:20




**DETAIL 4** SCALE 1:20



**SECTIONAL PERSPECTIVE** NOT TO SCALE

NOTES:

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Edged on the strange and emerged - Nature's Indigenousness

An eco-regenerative research centre, Barberton

Christie-Ann Groenewald

Examiners comments

Figure 1: Ecognosis between human and nature (Author, 2022)

Examiners comments

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

Christie-Ann Groenewald | 2015006477 | christieanngroenewald@gmail.com

Date of submission: 14 November 2022

Figure 2: Edged on the strange and emerged (Author, 2022)

Declaration: 1 This dissertation is submitted in partial fulfillment of the requirements for the degree

M.Arch.(Prof). at the University of the Free State. The research in this document is my own

work, unless stated otherwise.

Abstract

A special thanks to my supervisors for their guidance
and advice throughout the process.

Supervisors:

J. I. Olivier
Prof. J. Smit
P. Smit
H. Raubenheimer

# Edged on the strange and emerged - Nature's Indigenousness
# **An eco-regenerative research Centre, Barberton**

This dissertation investigates the architectural design of an Eco-Regenerative Research Centre in Barberton. Two objectives guide the research.

The primary aim of the dissertation project is to accommodate the programmatic needs of the Research Centre. The Research Centre investigates the potential of employing hyperaccumulative plants for landscape rehabilitation after mining. Toxins in the soil are naturally broken down by hyperaccumulative plants, restoring the soil and allowing for landscape regeneration. This process further allows for a more feasible rehabilitation solution through processing these hyperaccumulative plants in order to extract the metals. This process is known as phytomining.

Apart from functioning as a Research Centre, the Centre also welcomes visiting academics and representatives from the mining industry to observe and learn about the negative impact of mining and the regenerative processes being studied. To this educational purpose, the second aim of the dissertation project is linked: to create a facility that poetically aids in nurturing the experience of being indigenous to nature – not separate from nature. The first aim links to the clients' needs, whereas the second aim attempts to link to the client's inherent desire: creating a consciousness of our human indigenousness to nature – put differently: our human embeddedness in the fruits and harm of one natural system. In order to highlight this embeddedness, the design attempts to create awareness of both the harm caused by our anthropocentric condition and the opposite nature-centred condition, where humans are but a participant in the network of nature.



Architectural master thesis of Christie-Ann Groenewald, born in 1997.