

In the heart of the Kalahari Manganese field, where the ancient rhythms of the  
Khoi /San once harmonized seamlessly with nature, this project presents

# ECHOES OF WHISPERING FOOTPRINTS

REDEFINING SPACE THROUGH TRANSITIONING FROM LINEAR CONSTRUCTS TO CIRCULAR SYSTEMS IN  
ARCHITECTURAL DESIGN

## HOTAZEL CULTURAL INCUBATOR SPACE & INNOVATION HUB

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**i. ABSTRACT**

Hotazel is a small, arid, and remote town located in the Northern Cape province of South Africa, known for its rich manganese reserves and predominantly mining based economy. This project anticipates challenges of the depletion of these reserves leading to the closure of mines in the region. The inevitable impacts result in economic challenges for the local population. By introducing a new industry, this initiative seeks to provide opportunities for the town's youth and beyond, fostering economic and social development. 'Echoes of whispering footprints,' is a project proposal of a 'Cultural Incubator space and innovation hub' in Hotazel, aiming to bridge the gap between the existing industries and the local community. The project is rooted in the concept of circularity, not only in its architectural typology but also in its approach to community engagement and environmental upkeep. It draws inspiration from the historical context of the Kalahari, where the Khoi San people lived in harmony with nature, respecting the land and its natural processes. This harmonious relationship is mirrored in this project's design philosophy, which aligns with the principles of Glenn Murcutt's "touch the earth lightly."

This principle emphasizes minimal environmental impact and encourages an architectural design that is sensitive to the natural environment. Through the creation of a Cultural Incubator and innovation hub, the project aims to equip the community with circular practices, enabling the town of Hotazel to become self-sustaining and environmentally conscious. The design and programming of the space will not only support the local economy by diversifying the town's industrial base but also foster a culture of innovation. By embracing circularity, the project aspires to create a model of development that is non-harmful to the environment, promoting a future where the community thrives in harmony with its natural surroundings. Diversifying the local economy and equipping the community with skills in circular practices, this intervention aims to mitigate the impact of mine closures. In this way, the project not only addresses the immediate needs of the community but also prepares Hotazel for a circular future beyond mining.

**ii. DEDICATION**

To my family, whose encouragement and prayers have provided strength when I needed it most, thank you for being my pillars of strength and cheerleaders, guiding me toward my dreams.

To my parents, whose unwavering love, guidance and sacrifices have shaped me into the person I am today. Your belief in my potential has been a constant source of motivation throughout this journey. I will forever be grateful for your guidance. This achievement is as much yours as it is mine.

**Last but not least, to God Almighty, I would not be here if it weren't for Your grace and mercy from inception to this point. Thank You for ordering my steps and blessing me every step of the way.**

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## 1 Placement & Perspective

### 1.1. Introduction

In response to the anticipated mine closures and economic downturn and transition predicted to face Hotazel, this design approach of a Cultural Incubator Space and Innovation hub envisions a future beyond the town's mining operations, expected to cease within the next century. This model aims to reduce architectural and environmental material waste and promote circularity by integrating structures that give back to the mother nature.

A context sensitive approach guided the identification of informants, translating them into design intentions and strategies. The design evolved through thoughtful programming, interactions, and a heritage-sensitive approach tailored to Hotazel. Each phase of spatial development was continuously evaluated for its economic viability and cultural relevance to the town.

### 1.2. Hotazel

Hotazel is a mining town situated in the Joe Morolong local municipality, part of the John Taolo Gaetswe District Municipality in the Northern Cape of South Africa. Nestled deep within the Kalahari Desert, the name "Kalahari" originates from the Khoisan term 'Kgalagadi,' which translates to "the waterless place." The town is both remote and arid, positioned approximately 48 kilometers northwest of Kuruman. Kuruman is the nearest town for residents to access essential goods, with Kathu being the next closest option. Both Kathu and Kuruman are situated along major routes such as the N14, serving as key transit points for many travelers. **Error! Not a valid bookmark self-reference.** and Figure 2 portray the context of the town of Hotazel which is a rural mining town transitioning to a small urban town.



Figure 1 Left : Mine dumps in Hotazel, Right :Flora and fauna of the town,(Source: Author,2024)



Figure 2 Left:Functional railway track with cargo in transit, Right : Virgin land within the town centre,(Source: Author,2024)

### 1.2.1. Significance of Hotazel

Being located in the Gamagara mining belt, a region with extensive deposits of iron ore and manganese, which contribute to 80% of the world's manganese, makes the town a vital hub for the mining industry in South Africa. The Gamagara mining belt *Figure 3* not only contributes to the local economy through employment opportunities and infrastructure development but also plays a crucial role in the broader national economy by supporting industries related to mineral extraction and processing.

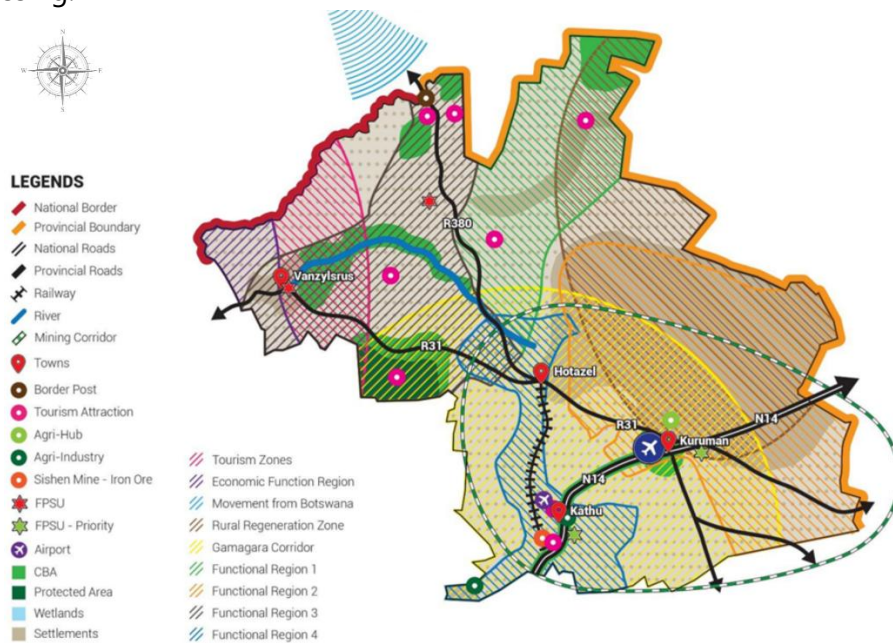


Figure 3 Gamagara Mining Corridor, (Source:Final SDF,2012)

### 1.3. Problem Statement

The Gamagara Municipality comprises of three economic sectors: primary, secondary, and tertiary, (SDF, 2012). The main economic sectors

within these are mining, agriculture and community services, (Basson, 2018), with mining making up the bulk of the services. As mining operations continue to grow in the region, the population in and around Hotazel is anticipated to grow as well, driving a demand for the expansion of other community services to accommodate this growth. This growth highlights the need for a cultural incubator space and innovation hub to foster sustainable community development, create alternative economic opportunities, and preserve local heritage as the region transitions over time.

### 1.4. Context & Site Selection

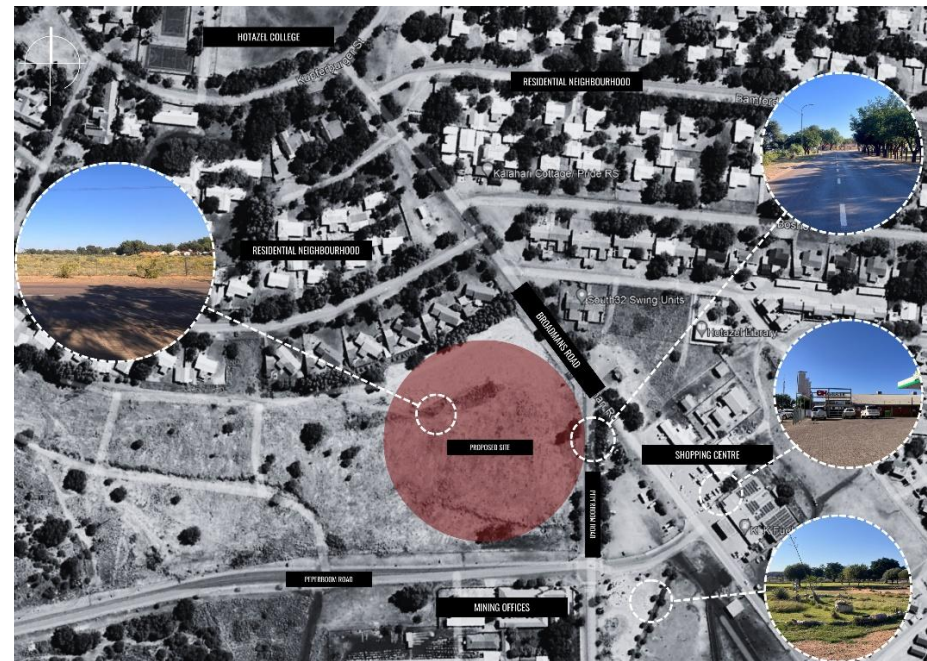


Figure 4 Immediate context of the selected site, (Source:Google Maps,2024)

Echoes of Whispering footprints: Hotazel Cultural Incubator Space & Innovation Hub

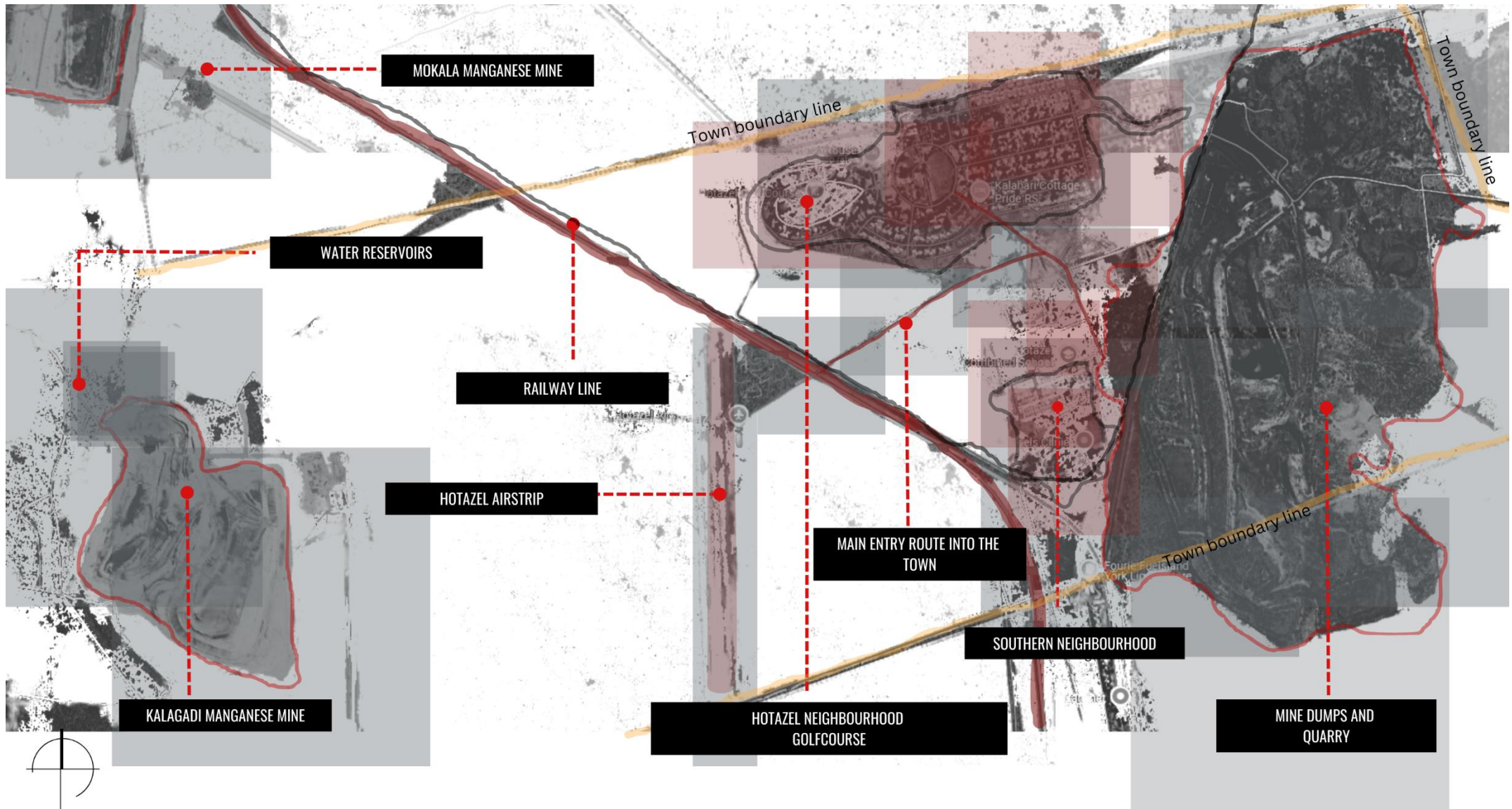


Figure 5 Aerial view of Hotazel town context(Source: Author)

## Echoes of Whispering footprints: Hotazel Cultural Incubator Space & Innovation Hub

The town currently provides only two schools, *Figure 6*, both of which offer education from elementary to matric levels, with no facilities for post-secondary or tertiary education. This absence of higher education opportunities creates a significant gap in youth engagement after high school, leaving young residents with limited options: either to relocate for further education outside the town or to enter the local mining workforce.

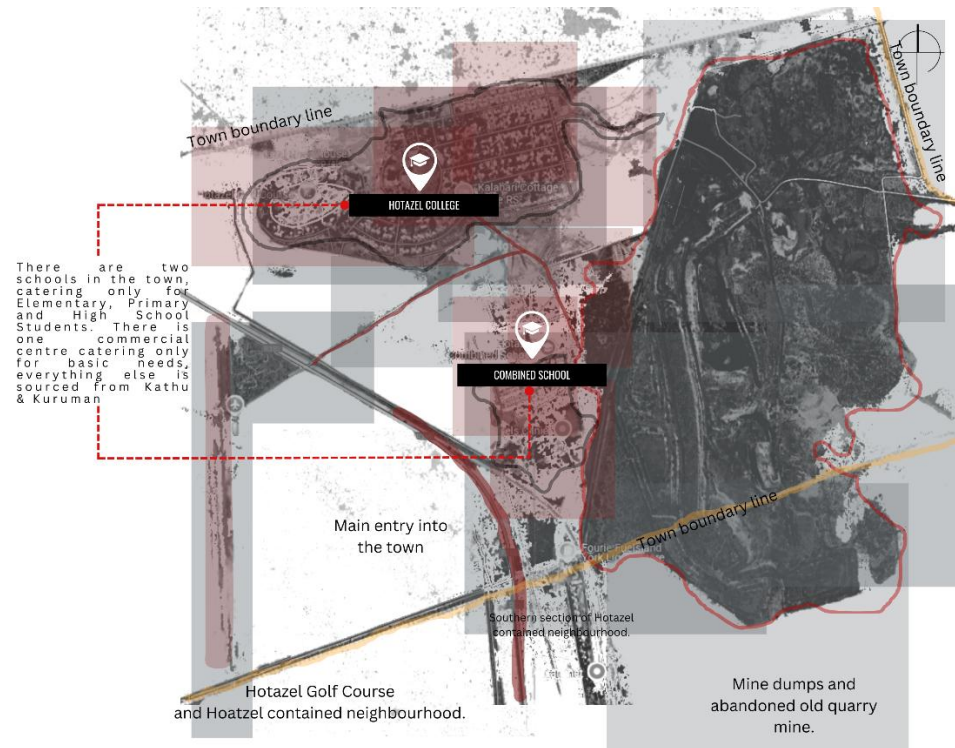


Figure 6 Location of the two schools in the town, (Source: Author, 2024)

The selected site for the Hub was influenced by the town's compact layout and convenient accessibility from multiple directions illustrated

in *Figure 5*, where the active community zones are highlighted in red and mine dumps in grey, showing Hotazel's contained structure, where residential neighborhoods, offices, and community services are centralized, while the mining zones are dispersed beyond the town's core. *Figure 7* illustrates the town's zoning layout, highlighting the concentration and clustering of activities within its core areas and the selected site.

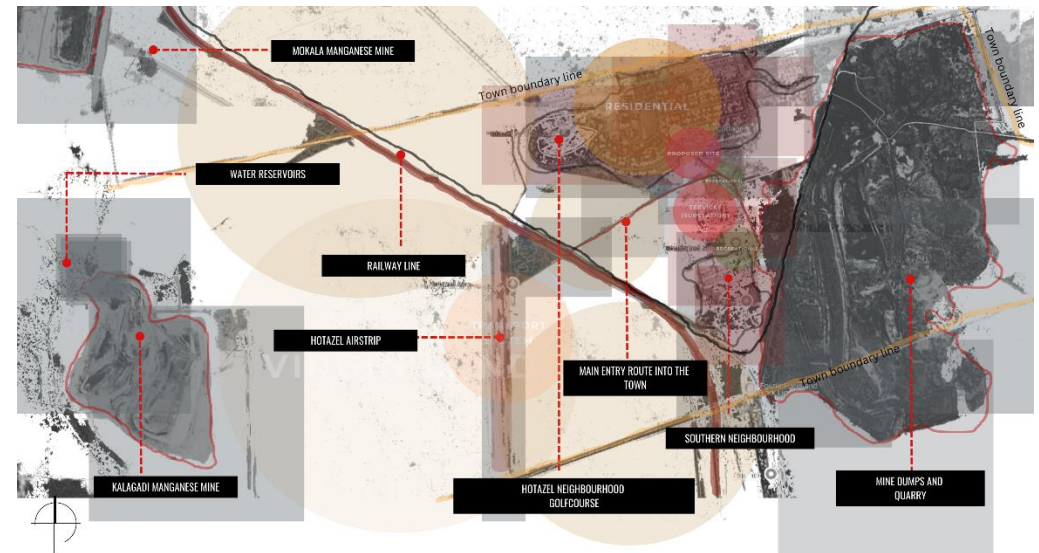


Figure 7 Zoning of the town of Hotazel. (Source : Author, 2024)

Hotazel's compact and resource-centered layout, with its clustering of residential, community, and industrial zones, reflects both the potential and challenges facing the town. The proposed Hub, thoughtfully positioned within the town's accessible core, aims to address these gaps by creating a vibrant space for cultural educational, and economic activities.

## 2. Design Research

### 2.1. Programme Development

**Echoes of whispering footprints** : A Cultural Incubator Space and Innovation Hub.

*“Back to earth, redefining space through transitioning from linear constructs to circular systems in architectural design.”*

This project draws inspiration from the early settlers of the Kalahari, the Khoi San, who once inhabited the area where Hotazel is now located. The design concepts are influenced by the ancient rhythms of Khoi San life, which embraced a deep harmony with nature. Their lifestyle exemplified a non-intrusive relationship with the environment, living as one with the land rather than imposing upon it.

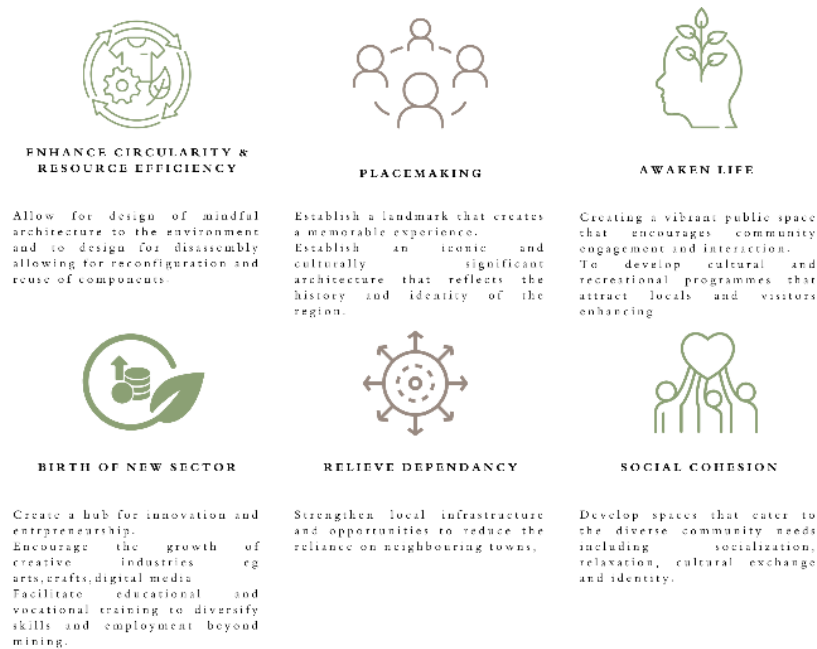


Figure 8 Project Intentions for the Hub,(Source:Author:2024)

The project intentions *Figure 8*, are to follow through the principles of the Khoi San while addressing context specific need of Hotazel.

### 2.2. User Profiles

The population of Hotazel comprises of diverse social classes and user groups, spanning both rural and urban backgrounds. This diversity stems from the mining industry, which attracts various professionals, as well as skilled and unskilled workers. Some of these individuals commute, while others settle in the area, either with their families or independently.

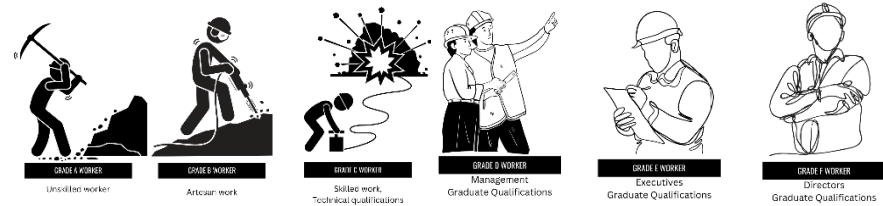


Figure 9 Type of skills available for Hotazel,(Source: Industry Consultant:2024)

### 2.3. Legacy Intergration

Integrating the principles of family values, harmony with nature, and preservation of family structures, the cultural incubator space attracts people to the town by meeting both social and economic needs. It challenges the notion that there is nothing to do in the desert, much like the Khoi San, who sustained their families and found water in seemingly barren landscapes. This intervention weaves together history, modernity, and future aspirations while balancing social, economic, industrial, and environmental elements. *Figure 10* is a timeline of the activities and transformations that the land of the Kalahari went through to present day and how these influenced how the town has been shaped.

## Echoes of Whispering footprints: Hotazel Cultural Incubator Space & Innovation Hub

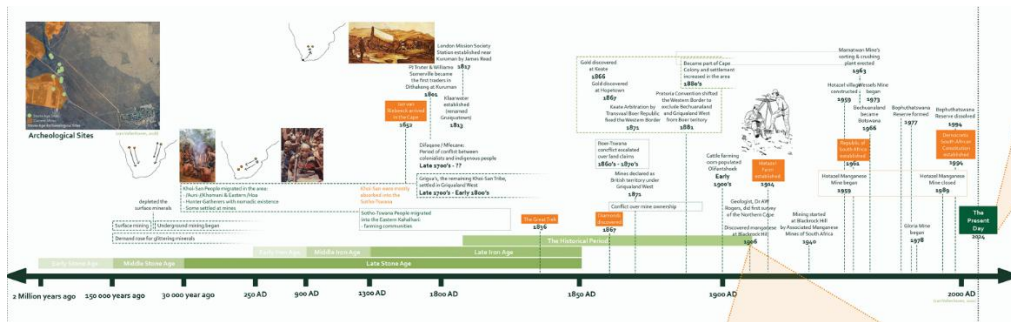


Figure 10 Timeline of mining development in the Hotazel,(Source: Groupwork extract:2024)

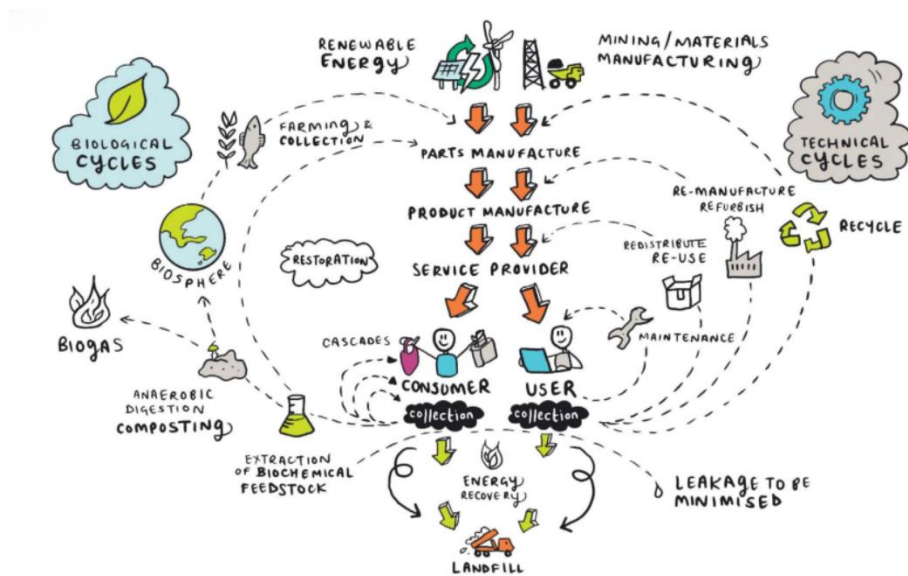


Figure 11 Circularity intergrated into the mining industry and its supporting industries (Source:Coreo,2018)

## 2.4. Climatic Data

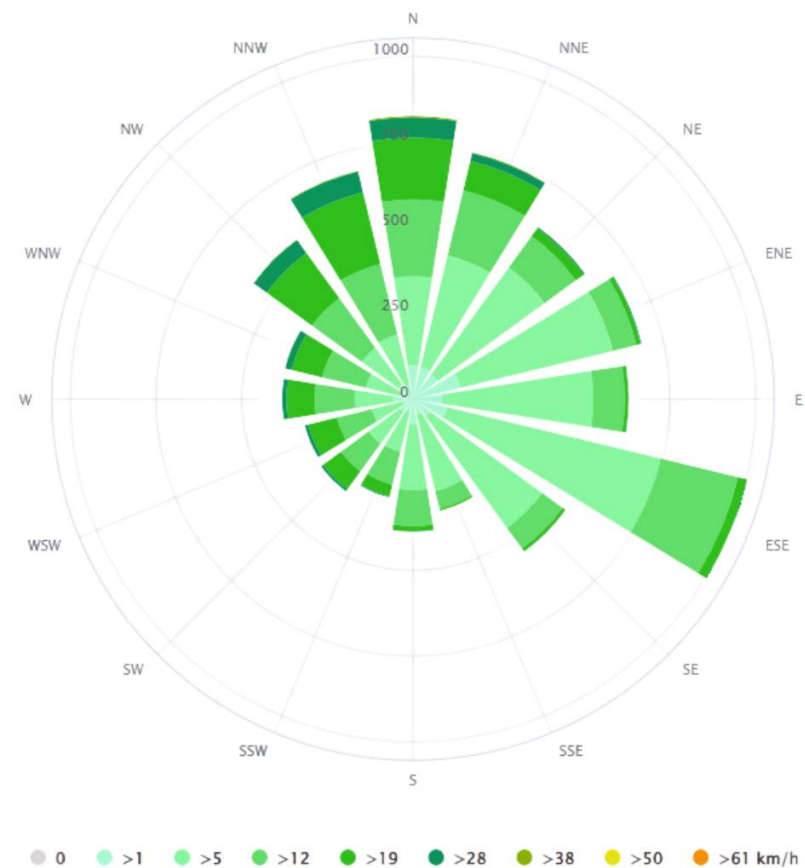
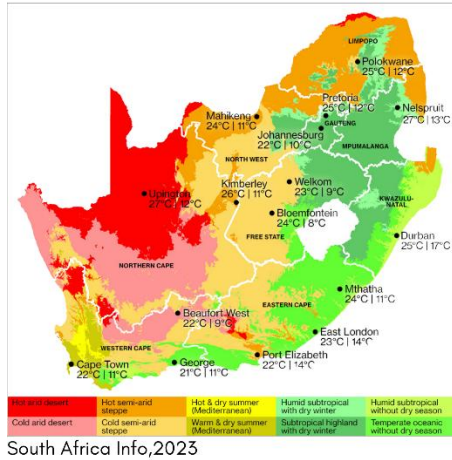


Figure 12 Left : Hotazel wind rose,(Source : Meteoblue,2024)

In an environment like that of Hotazel which is classified as hot arid desert region, according to the Koppen Geiger climate classification, Figure 13, it is important to take note the prevailing wind direction to be able to maximise on wind to cool the indoor spaces.

**KOPPEN GEIGER CLIMATE CLASSIFICATION**



The updated SANS 204-2 standard identifies six primary climatic zones in South Africa. It aims to establish the maximum energy demand and consumption limits for the design of buildings in South Africa's climate, incorporating these guidelines into the National Building Standards.

Description	Köppen-Geiger Classification	Area in km <sup>2</sup>	Percent (%)	Passive Solar Heating	Thermal Mass	Exposed Mass and Night purge Ventilation	Natural Ventilation	Direct Evaporative Cooling	Indirect Evaporative Cooling
Equatorial climates (0.2%)	Aw	2296.00	0.20	■					
Arid climates (70.89%)	Bsh	192269.00	16.59	■					
	Bsk	275927.00	23.81	■	■				
	Bwh	188784.00	16.29	■	■	■			
	Bwk	164629.00	14.20	■	■	■			
Warm temperate climates (28.91%)	Cfa	42918.00	3.70	■	■				
	Cfb	93405.00	8.06	■	■				■
	Cfc	84.00	0.01	■	■				
	Cca	5120.00	0.44	■	■				
	Ccb	18395.00	1.59	■	■				
	Cwa	31162.00	2.69	■	■				
	Cwb	140405.00	12.11	■	■				
Csa	2564.00	0.22	■	■					
<b>Total</b>		<b>1158958.00</b>	<b>100.00</b>						

Current distribution of Köppen climate categories in South Africa, along with proposed passive design strategies, (Source: Conradi,2012)

South Africa Info,2023

Figure 13 Köppen Geiger Classification for South Africa,(South Africa Info,2023).

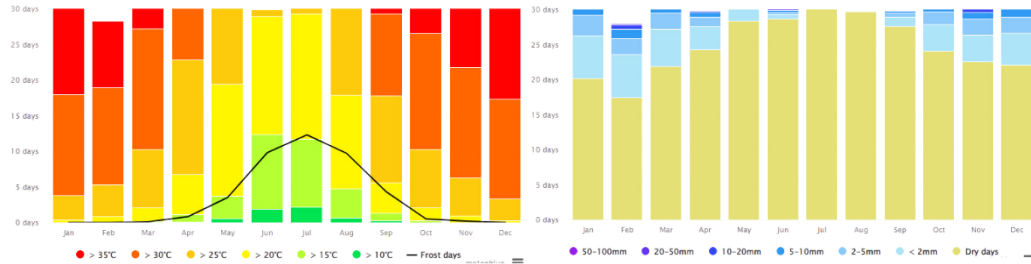


Figure 14 Left :Temperature levels in Hotazel ,Right:Precipitation levels in Hotazel,(Source:Meteorule:2024).

These climate classifications guided the overall design and material selection to create an architecture that functions effectively within its context. They also influenced the choice of design precedents, favoring examples suited to desert-like environments. Desert climates require careful selection of materials due to their sensitivity to extreme temperatures and arid conditions.

The design of the hub is to incorporate materials with high thermal mass. Rammed earth is an eco-friendly and non-toxic alternative to traditional construction materials. It has proven advantageous in hot climates, making it a notable option for enhancing resilience against climate change, (ASHRAE, 2018). Materials such as gabion stone walls and rammed earth have a high thermal mass.



Rammed Earth



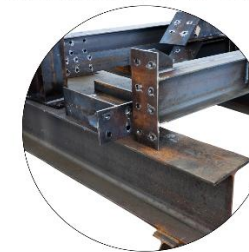
Gabion Stone Wall



Timber



Cow dung flooring



Repurposed Steel



Low-E glass

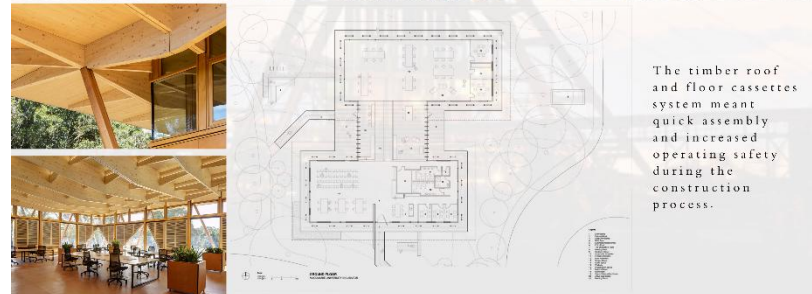
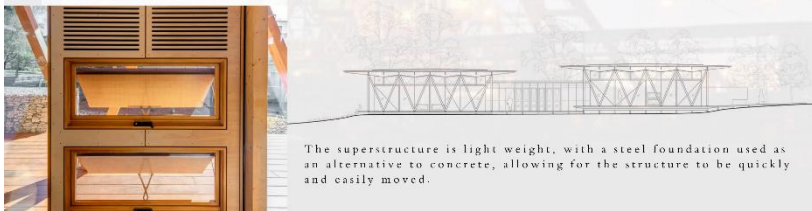
Figure 15 Material palette for the design of the hub,(Source: Author,2024)

High-density building materials, including rammed earth, brick, adobe, and stone, possess considerable thermal mass, which significantly helps in stabilizing temperature fluctuations within a building (or room), (Popovic, et al., 2017).

## Echoes of Whispering footprints: Hotazel Cultural Incubator Space & Innovation Hub

### 2.5. Design Precedents

#### i. Macquarie University Incubator, Australia



#### CONSTRUCTION METHODOLOGY

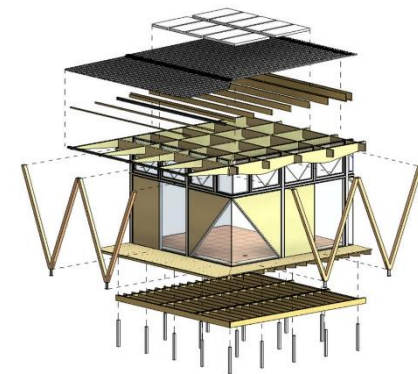
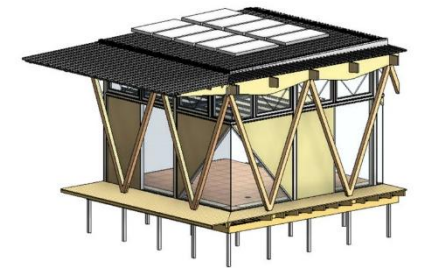
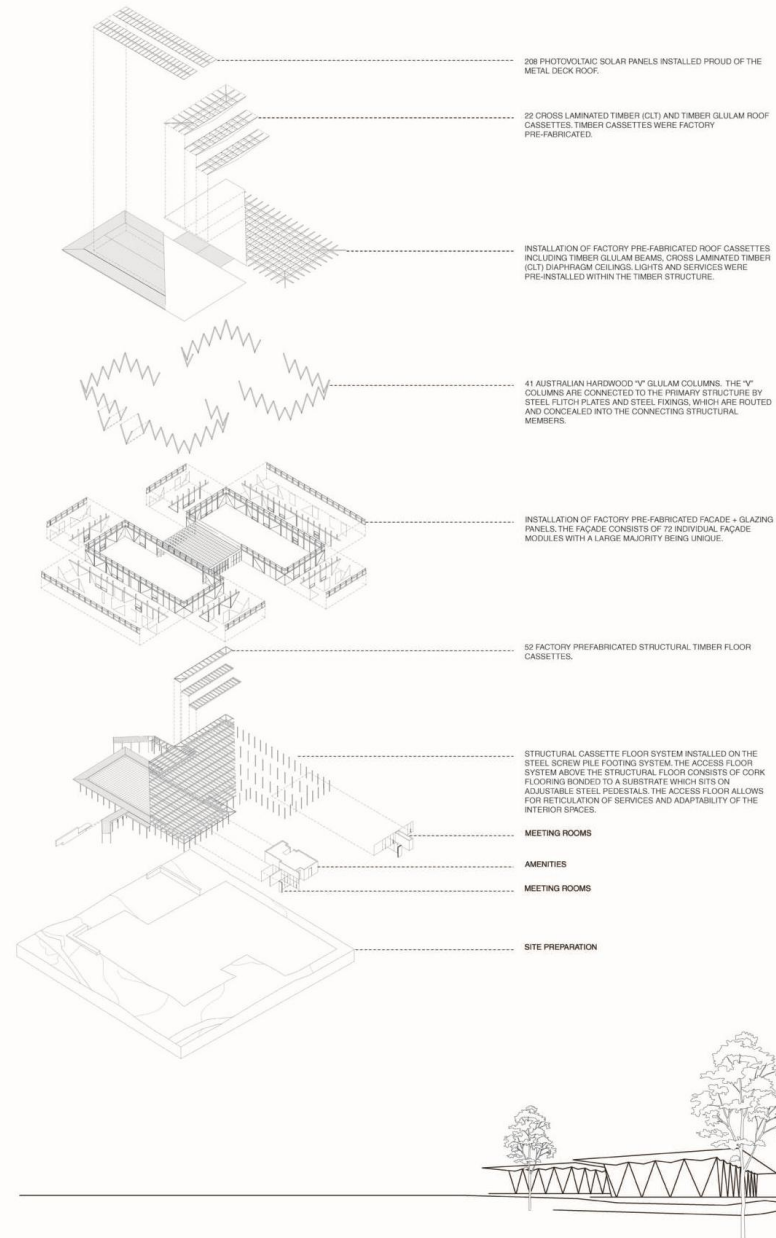


Figure 16 The Macquarie University which uses the principles of circularity, disassemblability, (Source: Arup: 2024)

**BOTSWANA INNOVATION HUB** *Incubator Space & Innovation Hub*

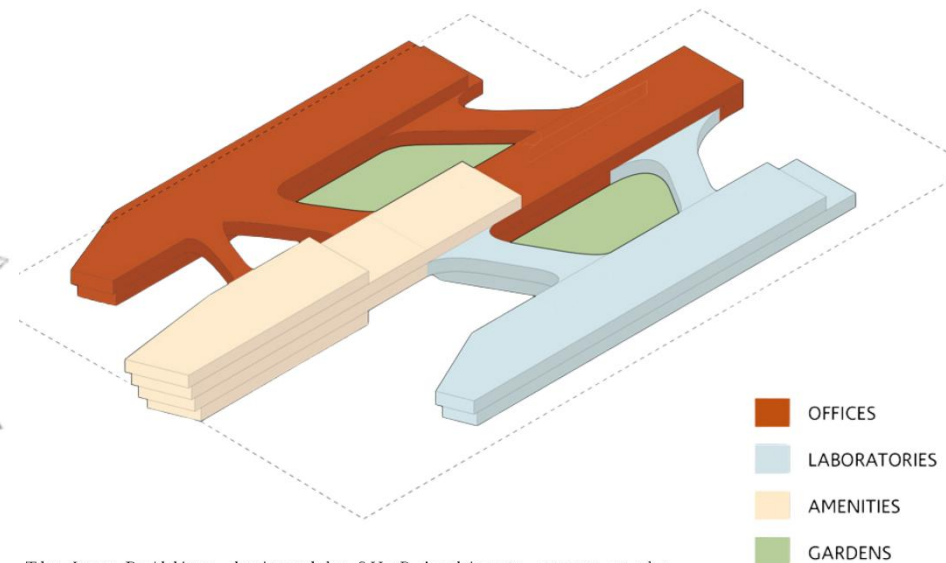
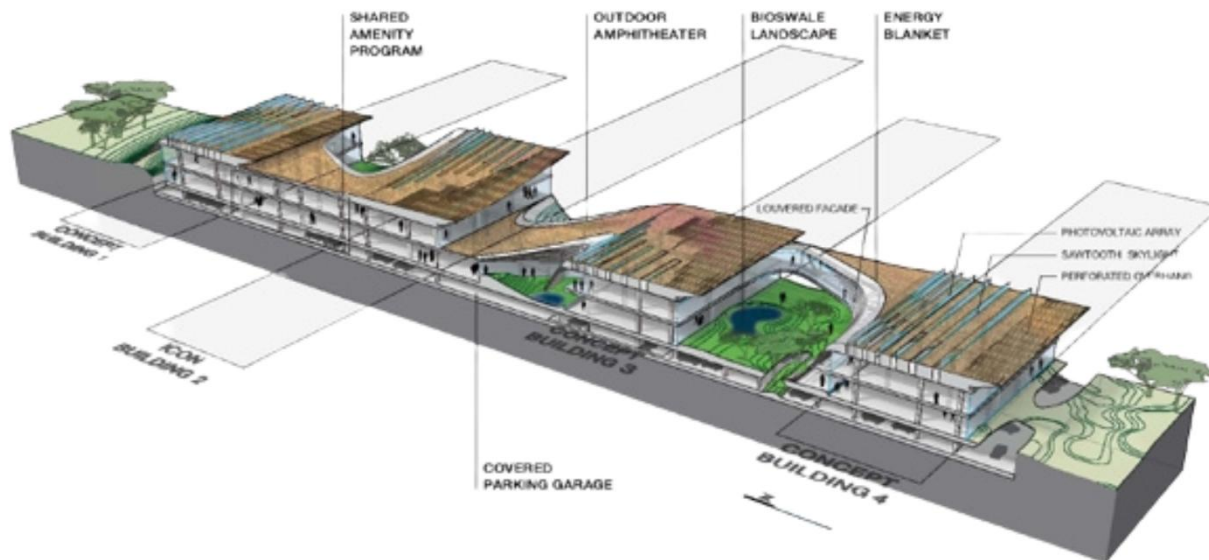


The Botswana Innovation Hub represents a significant government investment aimed at diversifying the economy, which currently relies heavily on diamond extraction, by shifting towards high-end IT. This initiative is crucial as agriculture is not viable for sustaining the economy, with 70% of the land covered by the **Kalahari Desert**.

The ambitious building, designed in a dynamic, futuristic architectural style that harmonizes with the environment, is set to attract international organizations as the country's first LEED-certified structure, located on the outskirts of Gaborone.



The building is an 'energy blanket': an extensive green roof for the innovation hub featuring large overhangs that provide passive shading for the building's interior.

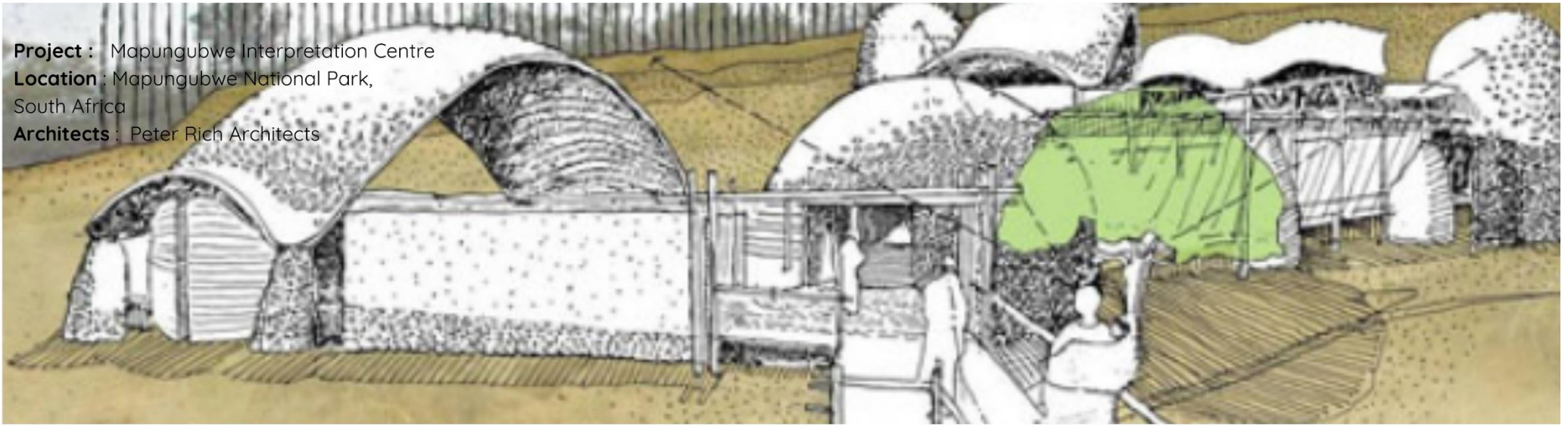


The Icon Building, designed by SHoP Architects, serves as the centerpiece of the Botswana Innovation Hub Science and Technology Park in Gaborone.

This facility, utilizing cutting-edge green technologies, will support various initiatives in technology incubation, education, and scientific research. It will offer advanced telecommunications infrastructure with high-capacity international connectivity, reliable power, and professional business services.

Figure 17 Botswana Innovation Hub which is located in the Kalahari, in Botswana, (Source: Archidatum, 2024)

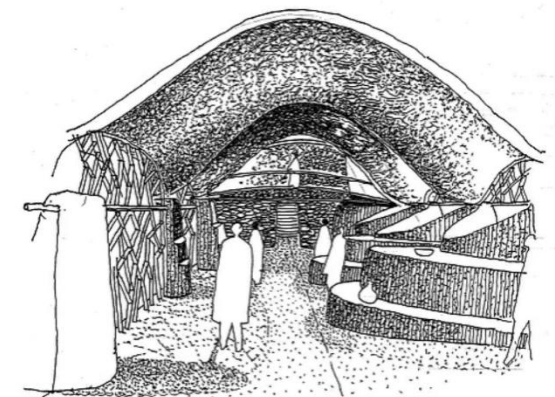
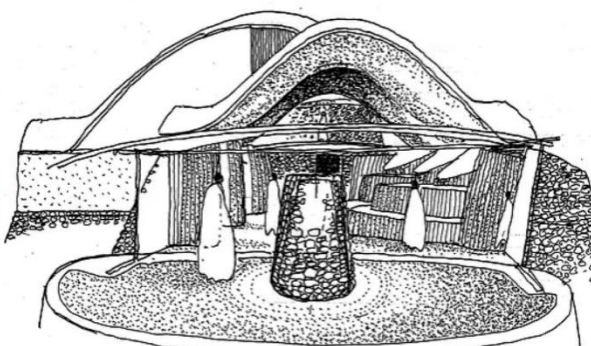
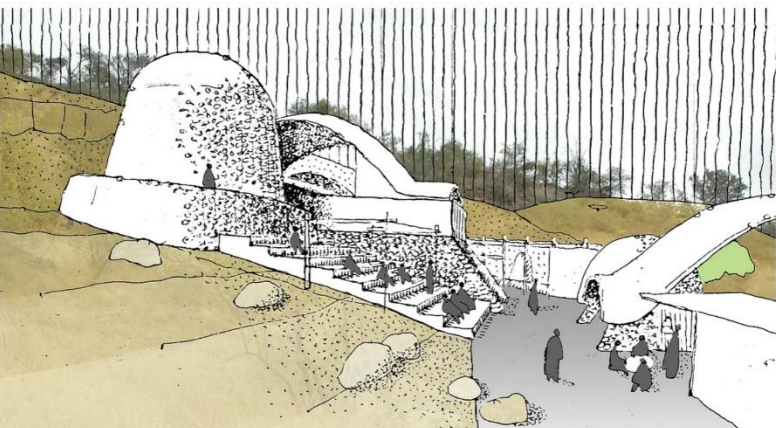
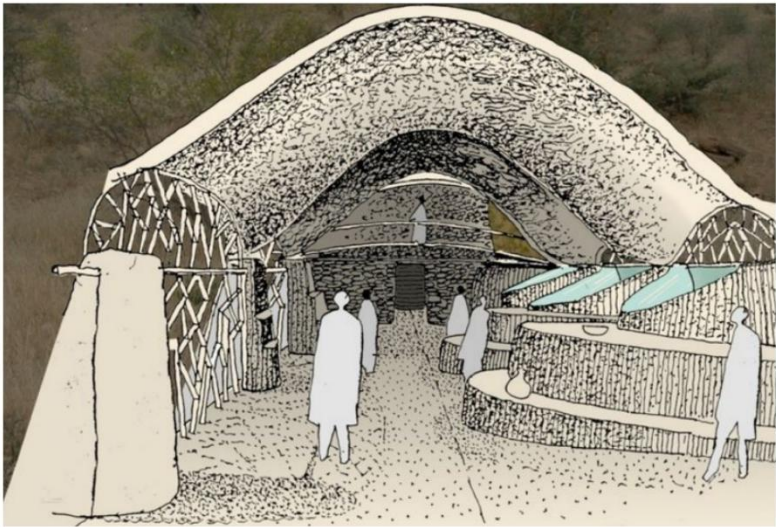
**Project :** Mapungubwe Interpretation Centre  
**Location :** Mapungubwe National Park,  
South Africa  
**Architects :** Peter Rich Architects



HOW CAN A PEOPLE WHO WERE ONCE THE EPITOME OF CULTURAL SOPHISTICATION AND SOCIAL DOMINANCE MODERNIZE THEIR LIFESTYLE WHILE PRESERVING A DEEP, INTRINSIC CONNECTION TO THEIR ROOTS?



This is a region nearly disconnected from the rest of South Africa, so abundant in natural beauty and diverse species that it appears as though it has remained untouched for the past thousand years.



### **3. Synthesis**

#### **3.1. Urban Framework**

##### **Intergrating present strategies with future perspectives.**

##### **3.1.1. Current Situation**

The town of Hotazel was established in 1959 at the center of this corridor to provide support for mine workers. Although the mine ceased operations in 1989, the town continues to serve the 11 remaining mines in the region.

The mining industry in Hotazel operates within a rigid hierarchical structure, ranging from unskilled A-grade laborers to F-grade executives at the board level. This stratification has significantly influenced the town's social and spatial dynamics, leading to a pronounced class divide, which will be explored in subsequent sections.

Similar to mining regions worldwide, Hotazel grapples with the challenges posed by a predominantly migratory workforce. Many employees commute daily or weekly from nearby towns or distant cities, resulting in unsustainable patterns of workplace fatigue, high transportation costs, and elevated carbon emissions. Furthermore, the Mining Charter advocates reducing migrant labor due to its adverse social consequences.

A pressing issue in Hotazel is the housing shortage, which impacts 4,581 employees and their families. Addressing this requires local development; however, the town relies heavily on distant neighboring towns for resources. This dependency exacerbates costs and emissions, creating a cycle of importing materials, local consumption, and waste disposal elsewhere—an inherently unsustainable model.

Beyond mining, animal agriculture is the region's secondary economic activity. Programmes for animal and veld management aim to support this sector, but limited skills training and the land's low carrying

capacity have hindered progress. Nonetheless, the potential use of underground water from disused mines offers a promising, sustainable alternative for agricultural development.

##### **3.1.2. The Question**

The critical question facing Hotazel is how the town will evolve to address the housing needs of mining employees and their families.

Mining, by nature, follows a linear lifecycle—mines are established, operated, depleted, and eventually closed. Mining towns often mirror this trajectory, confronting two potential outcomes: either diversifying their economy to sustain themselves beyond mining or succumbing to isolation and limited opportunities, ultimately becoming ghost towns. The future of Hotazel hinges on which of these paths it chooses to pursue.

Three key factors will shape Hotazel's trajectory:

1. **The Temporality of Mining:** The mines along the Gamagara Corridor are anticipated to close within the next century. While new mining activities may emerge further along the corridor, the increasing distances pose significant challenges to Hotazel's viability as a mining town.
2. **Geographic Isolation:** Situated along the R380, Hotazel remains isolated from major transportation routes, with minimal economic activity beyond mining. Historical precedents, such as Pomona, Eureka City, Elizabeth Bay, and Leydsdorp, demonstrate that isolated mining towns often face abandonment after mine closures, perpetuating an unsustainable linear lifecycle.
3. **Potential for Secondary Industry:** The region's cattle and sheep farming sector offers an avenue for economic diversification. Although currently underdeveloped, strategic urban planning and investment could help

expand this industry, providing Hotazel with a foundation for sustainability beyond mining. The goal is to transition from mining dependency to becoming an agricultural service center, while developing housing infrastructure sustainably to meet current mining demands. Hotazel will experience rapid growth over the next 80 years, followed by a decline in mining, population, and housing, with agriculture sustaining the community thereafter.

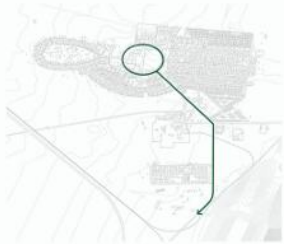
### **3.1.3. Solution and Future Making**

Five core developmental principles have been established to guide Hotazel's future:

1. **Containment:** This principle emphasizes limiting urban sprawl by prioritizing infill development while adopting a "leave no trace" philosophy to preserve the natural environment.
2. **Water:** Aims to transform low-lying areas into water collection zones, repurposing them as community activators and functional spaces.
3. **Reinforcing the Secondary Industry:** Focuses on integrating the surrounding agricultural sector into the town's infrastructure to promote growth, collaboration, and diversification.
4. **Reinforcing the High Street:** Plans to enhance the central high street as a vibrant communal hub, fostering retail and recreational opportunities for residents and visitors.
5. **Promoting Class Integration:** Seeks to bridge existing social divides by creating inclusive activities and spaces that encourage interaction and cohesion across different societal groups.

In contrast, deconstruction principles were developed to guide Hotazel's decline after its 100 year lifespan, focusing on preserving water and agricultural infrastructure. The following section covers the deconstruction principles, timeline predictions and explorations with which Hotazel can take.

# Echoes of Whispering footprints: Hotazel Cultural Incubator Space & Innovation Hub



## Spatial Axis

The town is based spatially around a dominant axis formed by the central ring-road and strong north-south road.



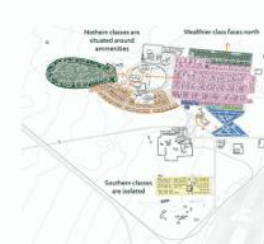
## Anchor Points

The Hotazel Club and the retail area act as anchor points for gathering and socialising within the town.



## Architectural Identity

Hotazel finds its identity in single story, low-density buildings of various styles.



## Class Segregation

The building typologies and locations have created a segregation between the community based on mine class rankings.



## Education Separation

The separation of basic education to the north and south creates a divide between children of higher and lower income classes.



## Youth Focus

The street infrastructure is designed for children to safely move around town giving them greater access and freedom.



## Disconnected Mining Services

Mining, the centre of the town's existence, remains isolated from the town through barriers & fences.



## Development Restrictions

The town is enclosed by barriers on all sides. The R380 road creates a boundary to the west & the Hotazel Mine site and mine dump restrict development to the east. The train line forms a boundary to the south.



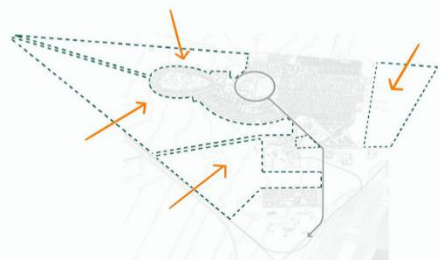
## Green Fabric

The cyclical nature of the environment and human activity have resulted in scarring in the landscape.



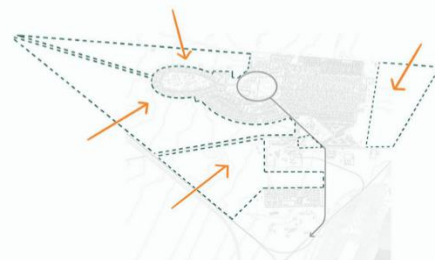
## Water Sourcing

The gentle gradient of the town creates limited opportunities for water storage therefore the town turned to isolated water infrastructure, limiting the potential for collection.



## Reinforce the Secondary Industry

Bring the agricultural industry from the surroundings into the town to promote its development & collaboration.

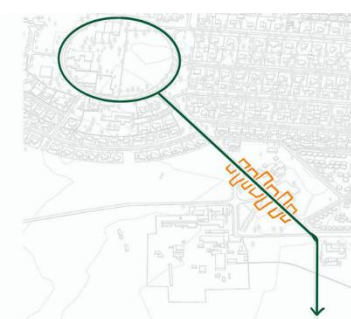


The agricultural infrastructure remains to support the continuing industry.



## Promote Class Integration

Develop activities to promote integration across the segregation divides.



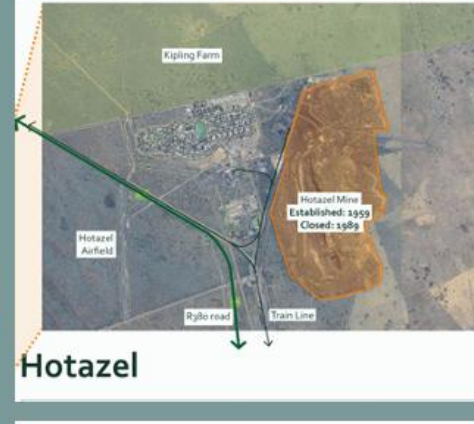
## Reinforce the High Street

Develop retail & recreation around the central high street to promote it as the communal hub.



## Water

Utilise low points for water collection & use this as activity generators within the community.



**Introduction to Hotazel**

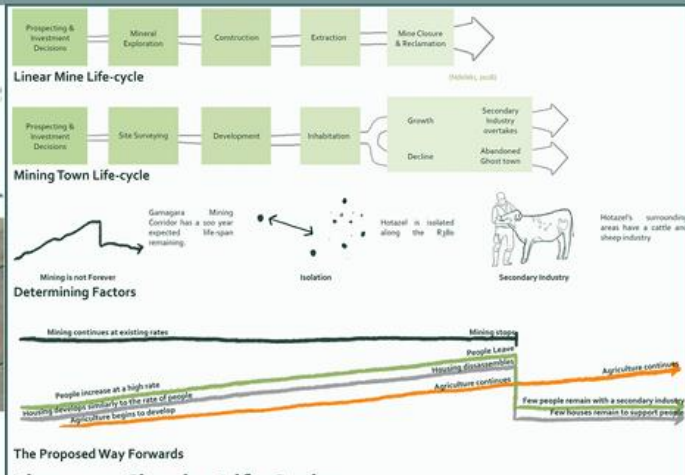
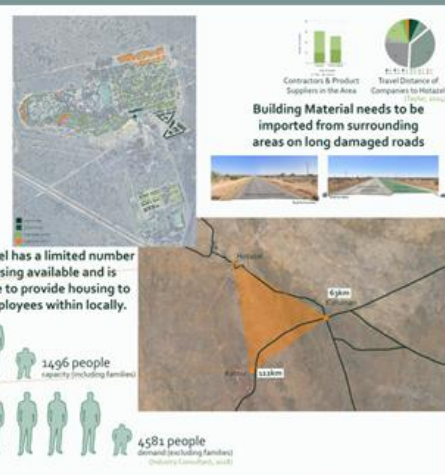
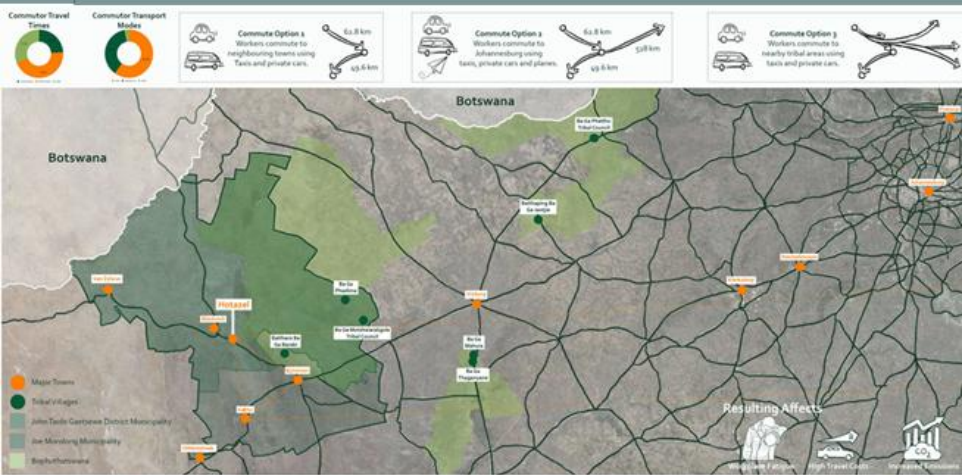
Established in 1959, Hotazel initially supported mine workers. Though the mine closed in 1989, the town now serves 11 other mines in the corridor.

**Social and Spatial Dynamics**

The mines' strict class hierarchy, from unskilled A-grade workers to F-grade executives, has shaped Hotazel's social and spatial landscape, creating a visible class divide.

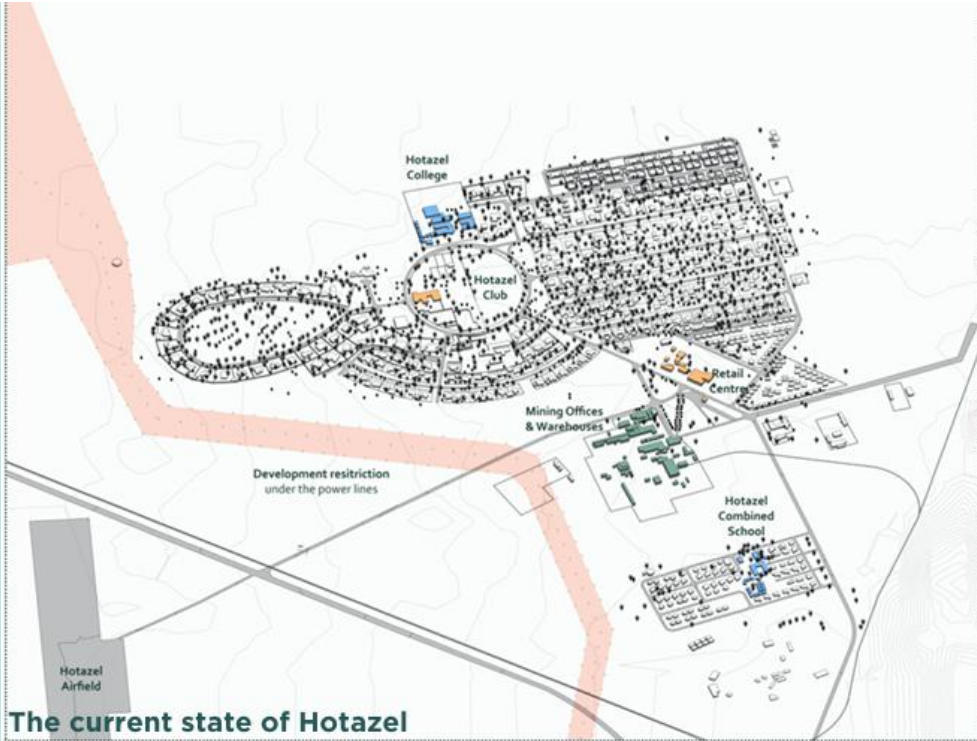
**Workforce Challenges**

Hotazel faces issues with its migratory workforce, including workplace fatigue, high travel costs, and environmental impacts. The Mining Charter advocates reducing migrant labor due to its social consequences.



# Echoes of Whispering footprints: Hotazel Cultural Incubator Space & Innovation Hub

Envisioning



The current state of Hotazel

## The question & intervention

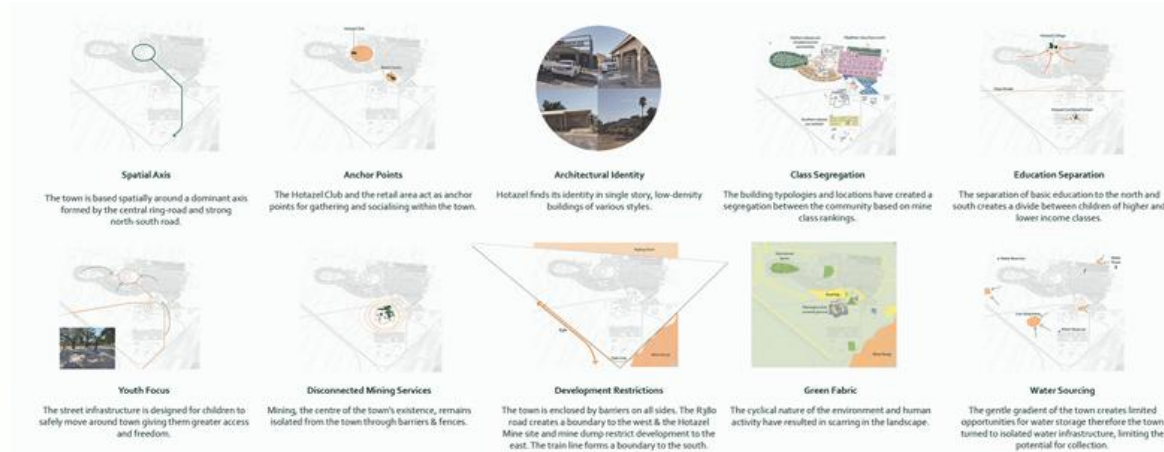
The key question is how Hotazel will expand to meet the housing needs of mining employees and their families:

Mining towns like Hotazel face two potential outcomes: diversification for post-mining sustainability or abandonment due to isolation and limited opportunities.

- 1. Mining's Limited Lifespan-** The Gamagara Corridor mines are expected to close within 100 years. Even if new mines emerge, their distances will challenge Hotazel's role as a mining hub.
- 2. Geographic Isolation -** Hotazel's remote location along the R380, with minimal traffic and industry, mirrors the fate of ghost towns like Pomona and Leydsdorp, highlighting the risks of an unsustainable, linear life cycle.
- 3. Potential in Secondary Industry -** The region's cattle and sheep farming offers opportunities for growth. With strategic urban planning, agriculture could become a foundation for Hotazel's post-mining economy.

### Key Spatial Characteristics

1. Town Layout: Centered on a north-south axis with a central ring road.
2. Gathering Points: Anchored by the Hotazel Club and the retail center.
3. Architecture: Defined by single-storey, low-density structures in diverse styles.



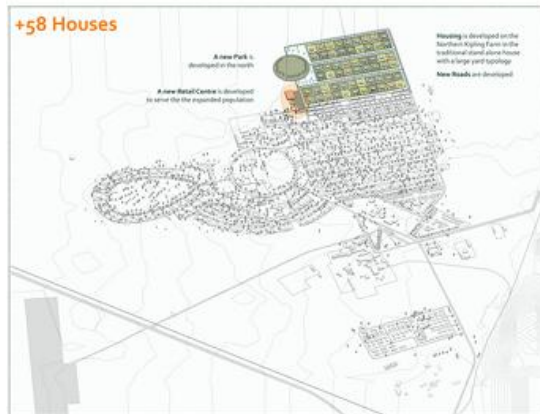
## The Spatial Form of Hotazel

Development strategies

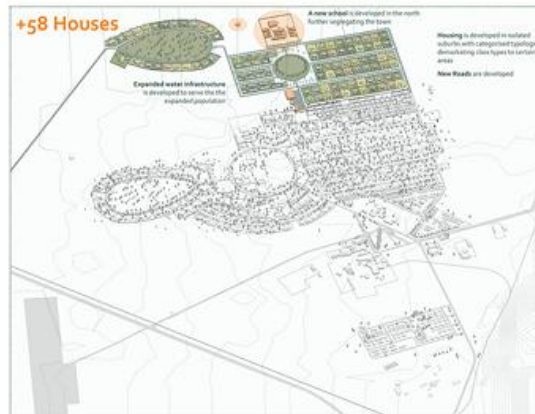


Developing      Declining

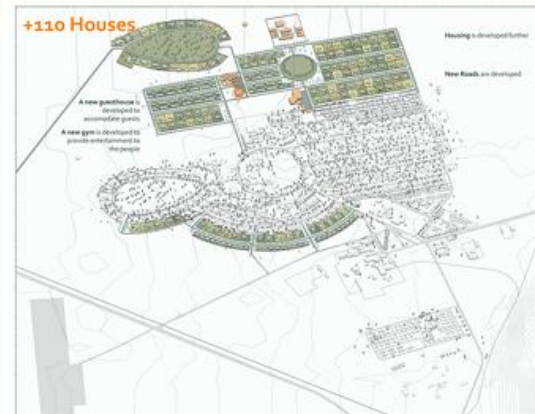
## The undefined future



2024



2044



2064



2084

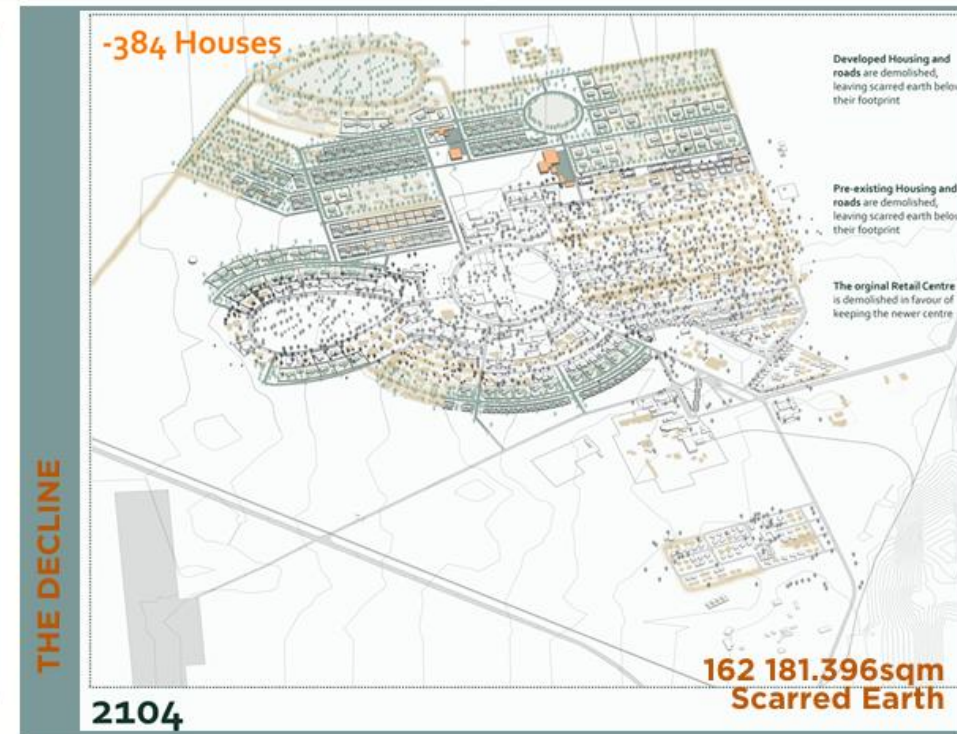
### Urban Framework Planning: Routes of Decline

When planning Hotazel's urban framework, two potential paths of decline were identified: **the undefined future** and **the defined future**. This section examines the implications of an undefined future over a 100-year timeline, exploring its effects on the town's development and sustainability. The proposal route takes on **A Comparative Approach**.

The map on the left for year 2104 show possible effects of an undefined future.

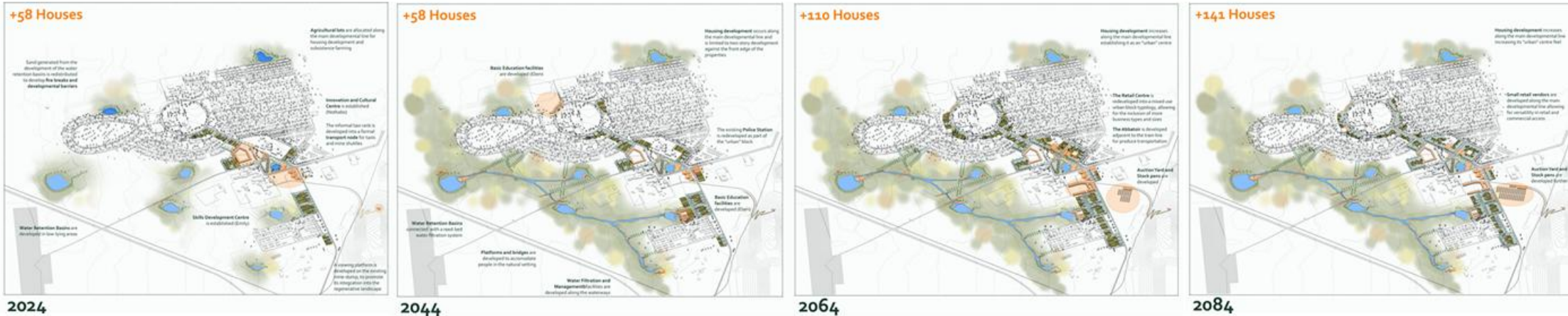
To guide Hotazel's growth, five foundational principles were established:

- 1. Urban Containment:** Prioritize compact growth by focusing on redevelopment within existing boundaries, ensuring minimal environmental impact through a sustainable "leave no trace" approach.
- 2. Water Utilization:** Transform low-lying areas into functional spaces for water harvesting, creating opportunities for these areas to serve as community gathering points.
- 3. Agricultural Integration:** Strengthen connections between the town and its surrounding agricultural lands by enhancing infrastructure, fostering economic collaboration, and supporting industry growth.
- 4. Central High Street Development:** Elevate the central high street into a vibrant focal point, combining retail spaces and recreational facilities to establish a sense of community.
- 5. Social Cohesion:** Address the town's socioeconomic disparities by creating inclusive activities and shared spaces that promote interaction across different social groups.



2104

## The designed future



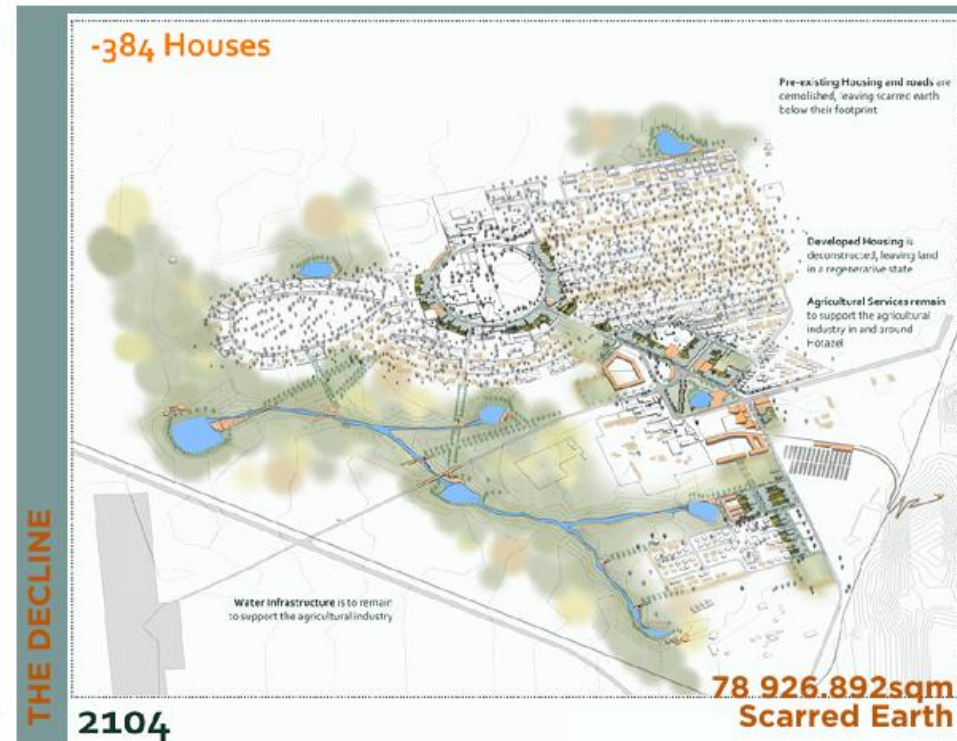
While both progress at the same pace, their outcomes are distinct:

### The Undefined Future (previous page)

- 1.2024 : Expands north, utilizing Kipling Farm for suburban housing, roads, and retail.
- 2.2044 : Stretches further north, creating disconnected suburbs and requiring new water infrastructure and schools.
- 3.2064 : Adds housing, a guesthouse, and a gym.
- 4.2084 : Peaks with sprawling housing and roads.
- 5.2104 : Leaves over 162,000 m<sup>2</sup> of scarred land as traditional housing is demolished, damaging the environment.

### The Designed Future

- 1.2024 : Establishes a vibrant town centre with a transit hub, innovation centre, and agricultural lots supporting housing and subsistence farming. Sustainability measures, such as water retention ponds and revegetated slag heaps, reshape the environment.
- 2.2044 : Remains centralized, expanding agricultural lots, housing, and education facilities. Integrated water systems and park spaces promote community cohesion and support animal grazing.
- 3.2064 : Reinforces the town's core, transforming the retail centre into mixed-use spaces. Secondary industries, like an abattoir and auction yard, support economic growth and community events.
- 4.2084 : Features compact housing, dispersed retail, and spaces fostering community and commerce.
- 5.2104 : Minimizes damage with sustainable deconstruction, preserving water and agricultural infrastructure. Less than 79,000 m<sup>2</sup> of land is scarred, leaving a legacy of resilience and hope for those who remain.



# CULTURAL INCUBATOR SPACE & INNOVATION HUB

At the foundation of all the chaos lies the question,  
**3.3. Design Rationale**  
**WHAT IS THE SOLUTION?**



What other employment opportunities are there?



Children are catered for, where is the youth?

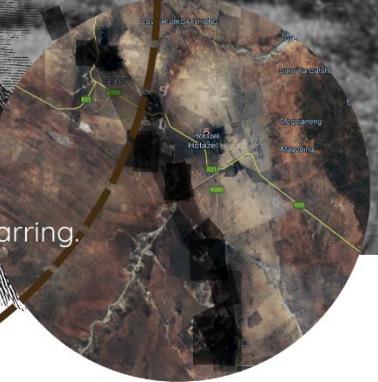


What is the town's Architectural identity?



Is there social cohesion in the town?

How does architecture leave a good trace?



Mines leave environmental scarring.

The Architectural and Spatial structure of Hotazel reflects its industrial roots, but this focus on mining limits the town's potential for growth, diversity, and community-building. The spatial isolation, environmental impact, and absence of family-centred amenities create challenges for establishing a balanced, sustainable living environment in Hotazel.

These Architectural and Spatial challenges result in a community environment that feels more like a temporary, functional settlement than a sustainable, integrated town. This limited spatial development often fails to support a well-rounded lifestyle, making it challenging to foster a sense of belonging and long-term community investment.



Namibia Kolmanskop, Ghost Town

## Family Dynamics



**Spouses and Children:** The roles of the spouse and children remain undefined. What do the wives and children do in a town primarily centred on mining?

**Fragmentation of Families:** This lack of opportunity can lead to family units being dismantled, with some members staying behind while the employed family member works in isolation.

## Economic Impact



**Employment Opportunities:** The mine provides jobs across various skill levels, supporting employment for:

- **Skilled Labour:** Positions in engineering, geology, and management attract educated and specialized workers from bigger cities and across the country.
- **Semi-Skilled Labour:** Opportunities exist for operators, technicians, and other roles that require some technical training or experience.
- **Unskilled Labour:** The mining industry also provides positions for unskilled labour, offering basic employment to those without specialized training.

## Youth Disengagements

The youth, without adequate opportunities, face idleness, leading to social challenges and a lack of engagement.

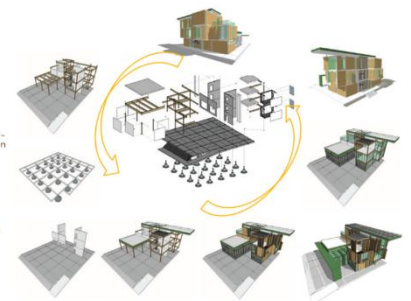


# CIRCULARITY

**DISSERTATION: From Linear to Circular: Advancing Resource Efficiency in the Residential Built Environment in Remote and Arid Regions. The Case of the town of Hotazel.**



## DESIGN FOR DISSASSEMBLY



3.4. Concept

REINFORCE THE FAMILY UNIT

INNOVATION

ONE WITH NATURE

PLACEMAKING

YOUTH ENGAGEMENT

ARTWORK AND CRAFTS

DESIGN FOR DISASSEMBLY

CRAFTWORKS AND ARTISAN WORK



3.5. Iterations and options

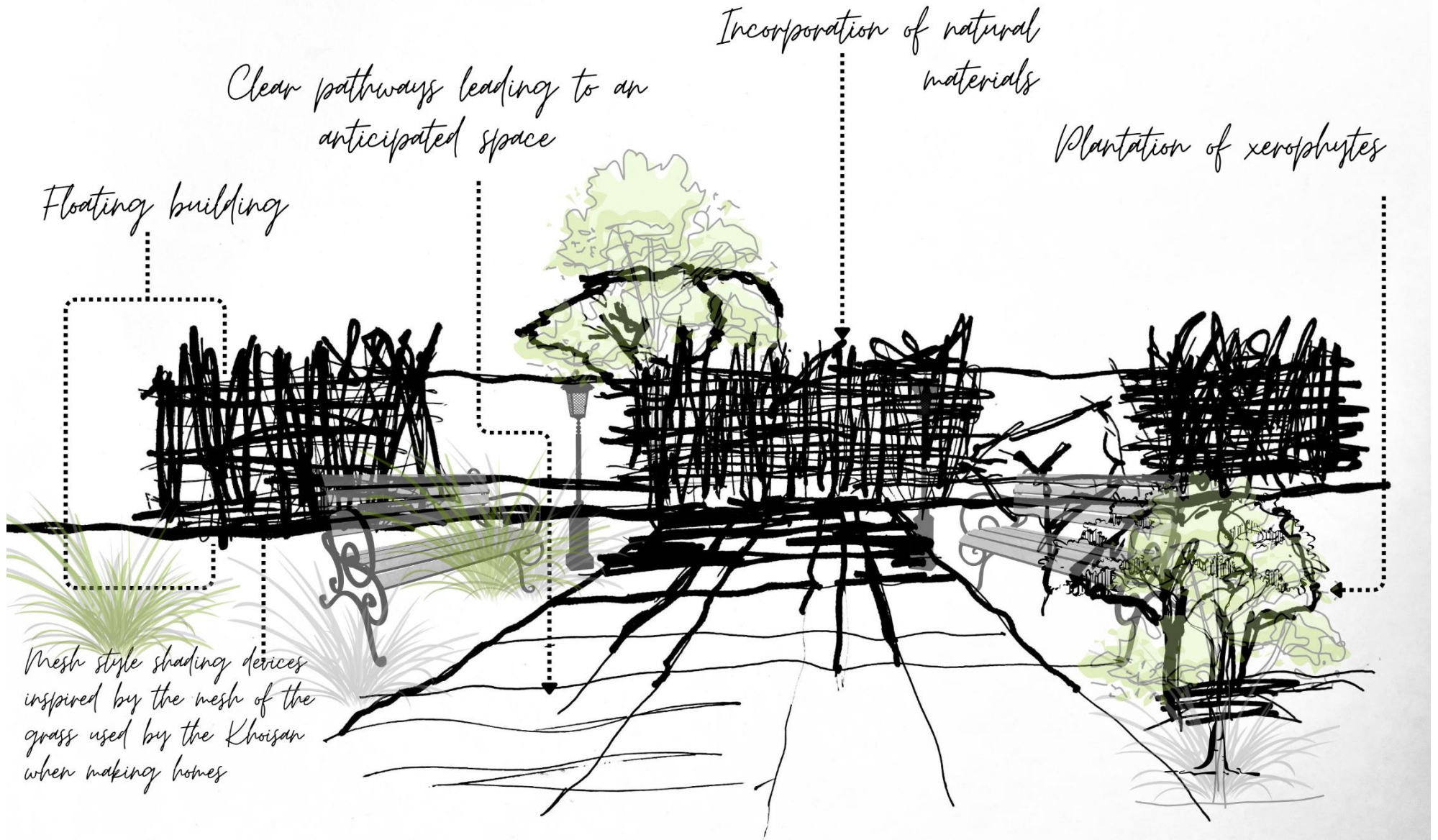
*Visually attractive facades  
murals done by the locals*

*Timber slits as shading devices  
to echo the history of place*

*Visually attractive facades*



Echoes of Whispering footprints: Hotazel Cultural Incubator Space & Innovation Hub



Integration of green spaces  
and pockets into the building

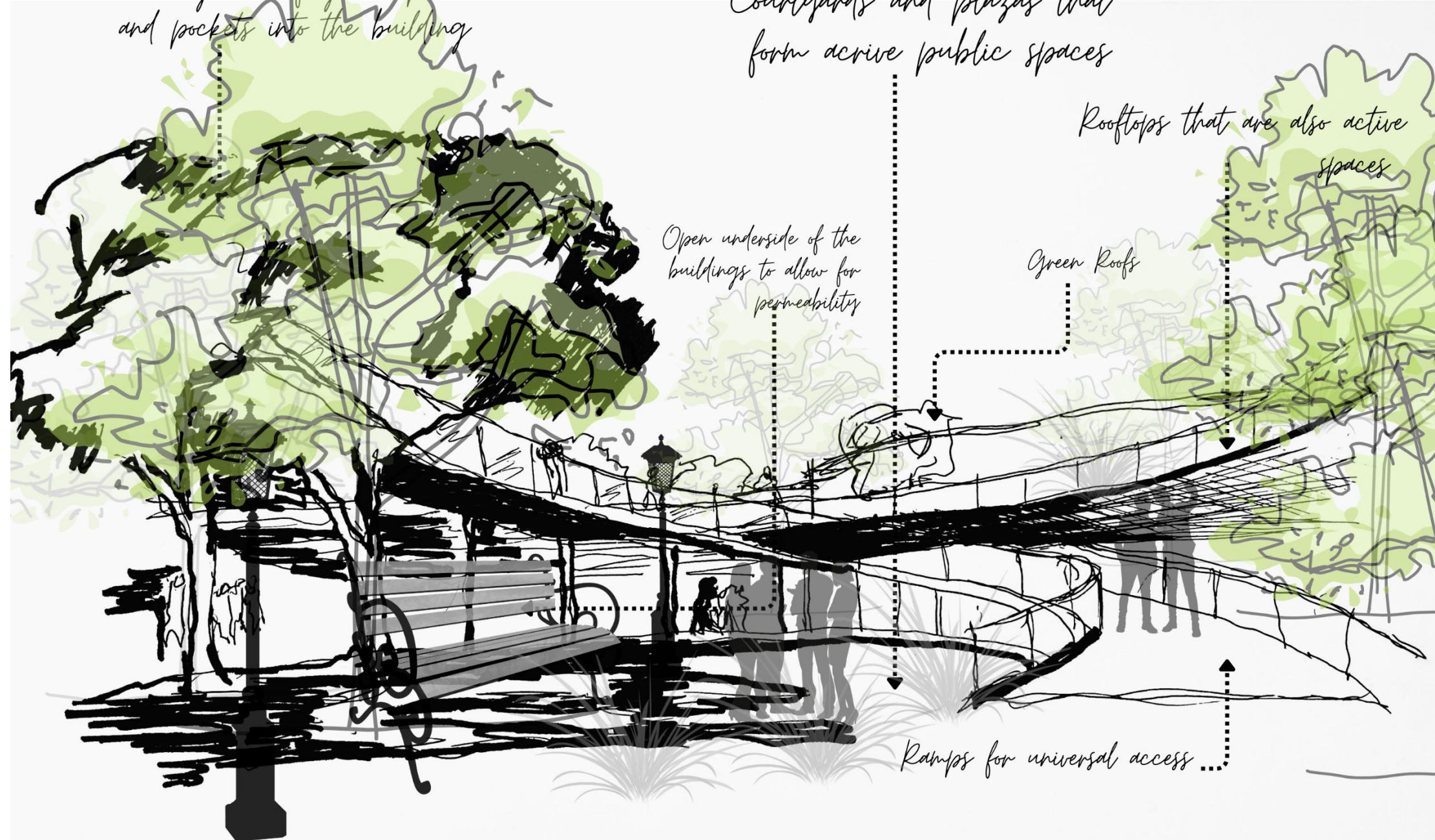
Courtyards and plazas that  
form active public spaces

Rooftops that are also active  
spaces

Open underside of the  
buildings to allow for  
permeability

Green Roofs

Ramps for universal access



### **3.6. Design Overview**

The design of the Cultural Incubator Space and Innovation Hub is a direct outcome of the background research and urban framework established in this thesis. The overarching goal was to create a permeable site with buildings that are accessible from any point, ensuring seamless connectivity. Universal access was prioritized, with ramps and pathways designed to accommodate the needs of physically impaired individuals, reinforcing inclusivity as a core principle.

The orientation of the blocks is heavily influenced by the north alignment, a strategic decision to harness and maximize the beneficial effects of natural weather elements. This intentional placement optimizes passive design strategies, enhancing thermal comfort and energy efficiency. Each block incorporates courtyards, which act as hubs and outdoor meeting spaces, fostering collaboration, interaction, and a sense of community.

To enhance permeability, the existing road cutting through the site and the adjacent taxi rank has been transformed into a pedestrian-friendly "people street." This reimagined thoroughfare ensures smooth transitions between the taxi rank and the site, inviting movement and interaction.

The building blocks have been deliberately positioned to allow for future expansion and growth, ensuring adaptability over time. This flexibility reflects a forward-thinking approach, ensuring the design can evolve alongside the changing needs of the community and its users.

The following section delves into the design exploration process and the resulting architectural solution developed as part of the thesis.

Echoes of Whispering footprints: Hotazel Cultural Incubator Space & Innovation Hub



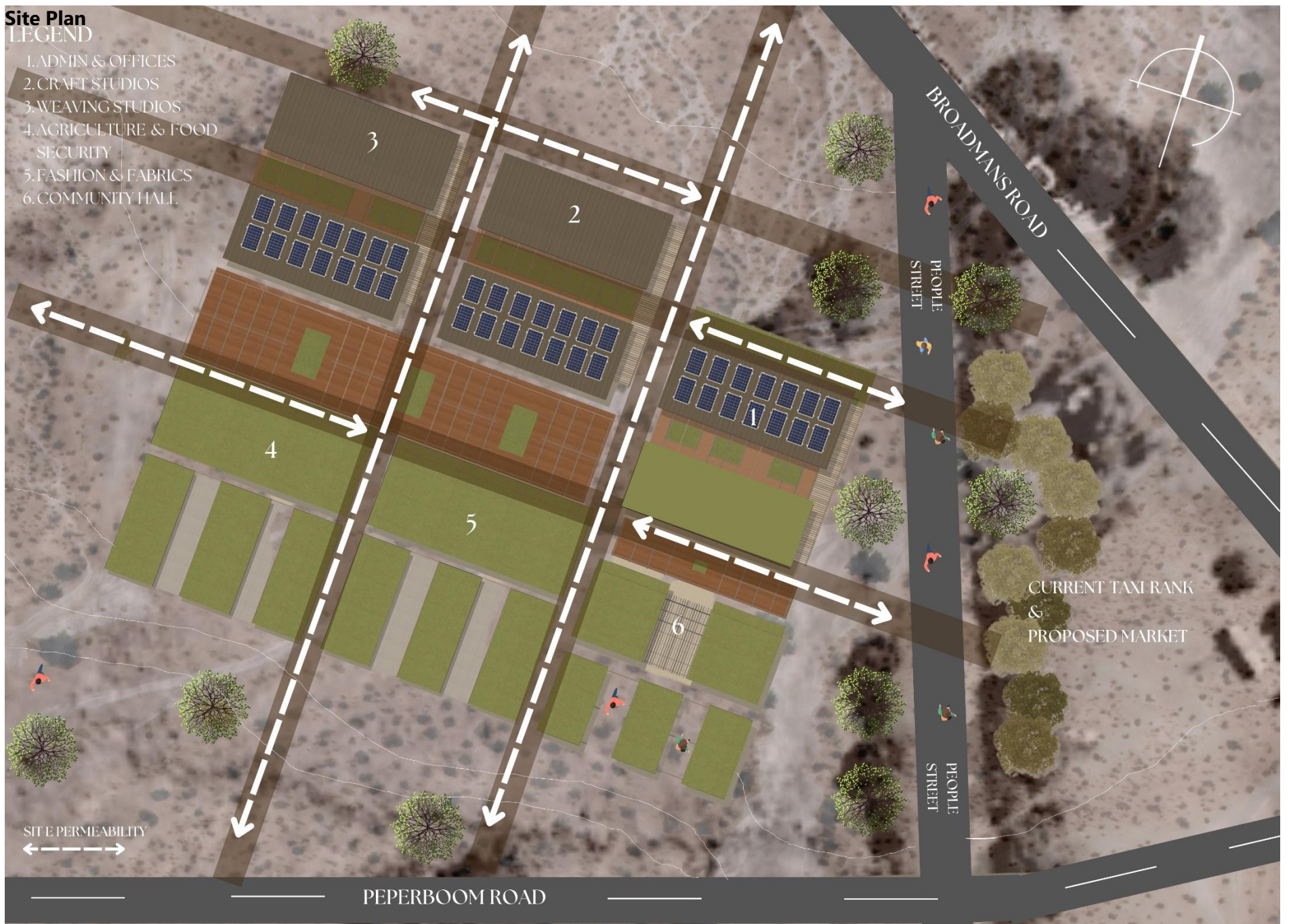
**LEGEND**

1. Admin offices
2. Leather shoe making workshop
3. Sewing workshop
4. Pottery Workshop
5. Arts and craft studios
6. Tech hub
7. People street
8. Taxi rank

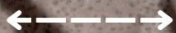
Echoes of Whispering footprints: Hotazel Cultural Incubator Space & Innovation Hub

3.7. Site Plan  
LEGEND

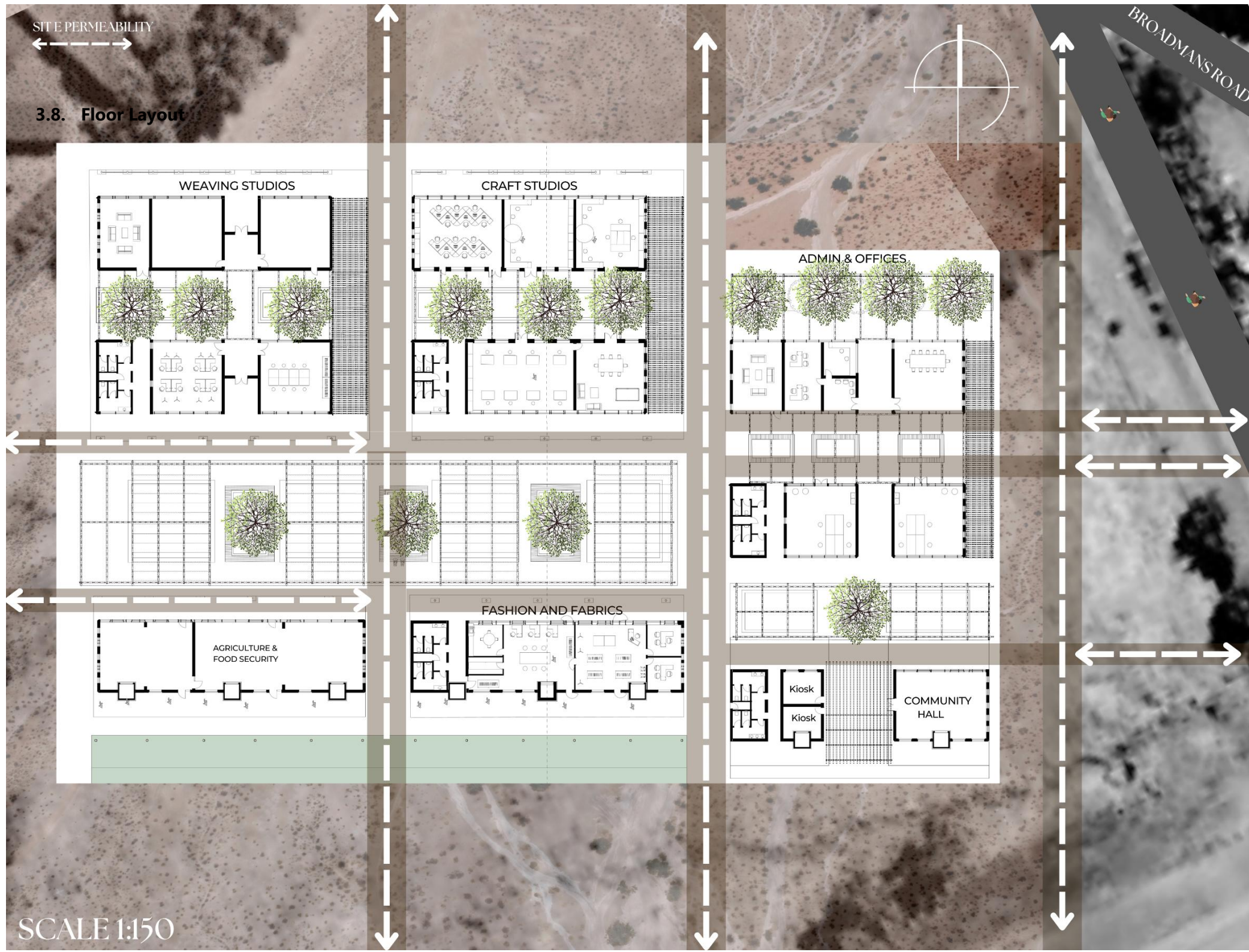
- 1. ADMIN & OFFICES
- 2. CRAFT STUDIOS
- 3. WEAVING STUDIOS
- 4. AGRICULTURE & FOOD SECURITY
- 5. FASHION & FABRICS
- 6. COMMUNITY HALL



SITE PERMEABILITY



### 3.8. Floor Layout



SCALE 1:150

### **3.9. Building Technology**

#### **Building technology & Installation instructions**

##### **Rammed Earth**

Rammed earth is a construction technique that uses natural, compacted soil to create solid, load-bearing walls and structures.

The material used in this construction will be acquired from the site from which the building will be situated. All materials in this construction will be locally sourced due to the town being remote and within a rural context where the sourcing of building material options is scarce.

##### **Wall installation specifications:**

In this project, the walls that use rammed earth are load bearing and non-load bearing walls. The following are the thicknesses for the load bearing walls:

- Load Bearing walls
- Minimum thickness - 300mm
- In this project, a thickness of 450mm should be used. This is to ensure that no reinforcement steel bars are used in the construction
- Maximum Control joint span – 4500mm
- Non-loadbearing walls
- Minimum thickness - 200mm
- The maximum span between control or articulation joints is 4500 mm.
- All corners should be chamfered at 45 degrees / 50mm.

All rammed earth walls, both load bearing and non-load bearing to include waterproofing additive, mixed during the mixing process.

To prevent rising damp into the walls, a 100 mm exposed edge of the earthen floor slab should be maintained above the final paving level.

##### **Material and composition requirements**

The rammed earth mix should have the following composition:

- Sand and Gravel: 45%–80% by mass
- Silt Content: 15% by mass
- Clay Content: 20% by mass
- Organic Matter: 2% by mass
- Aggregate Size: 5 mm

##### **Preconstruction testing**

1. The contractor must test materials approval at least one month prior to the start of work, including:
  - Strength under unconfined compression
  - Water content
  - In-situ Bulk density
2. Spray erosion resistance and abrasion resistance.

##### **Construction Technique**

- Before placement of soil, all surfaces and formwork must be free of debris and excess water.

Formwork should be sealed using materials that prevent misalignment and leakage of the mix, ensuring a smooth and uniform surface finish.

The materials to be used should be:

- Rubber gaskets – these should be applied to formwork joints, creating a tight seal and ensuring proper alignment. The joints should be sealed to prevent moisture ingress. Earthen materials should be used as fillers where necessary.

-The control tolerances should be limited to +/- 10mm in terms of wall position, wall height and wall thickness.

### **Formwork**

Formwork should be constructed according to the specified dimensions of the design.

### **Compaction**

The minimum dry density that should be achieved is at least 95% of the heavy compaction test maximum.

The earth is added in increments, compacted and levelled before the addition of subsequent layers.

If and when work is interrupted between layers, the surface should be scarified and moistened by sprinkling water on the surface to ensure proper bonding.

After compaction, the wall must be protected from uneven drying and excessive exposure to weather conditions. This can be achieved by using waterproof sheeting behind the walls, ensuring it is kept clear of the surfaces to allow for proper air circulation. The sheeting should prevent uneven drying due to sun exposure or shade. All walls should be uniformly covered with the impermeable sheeting to maintain consistent conditions.

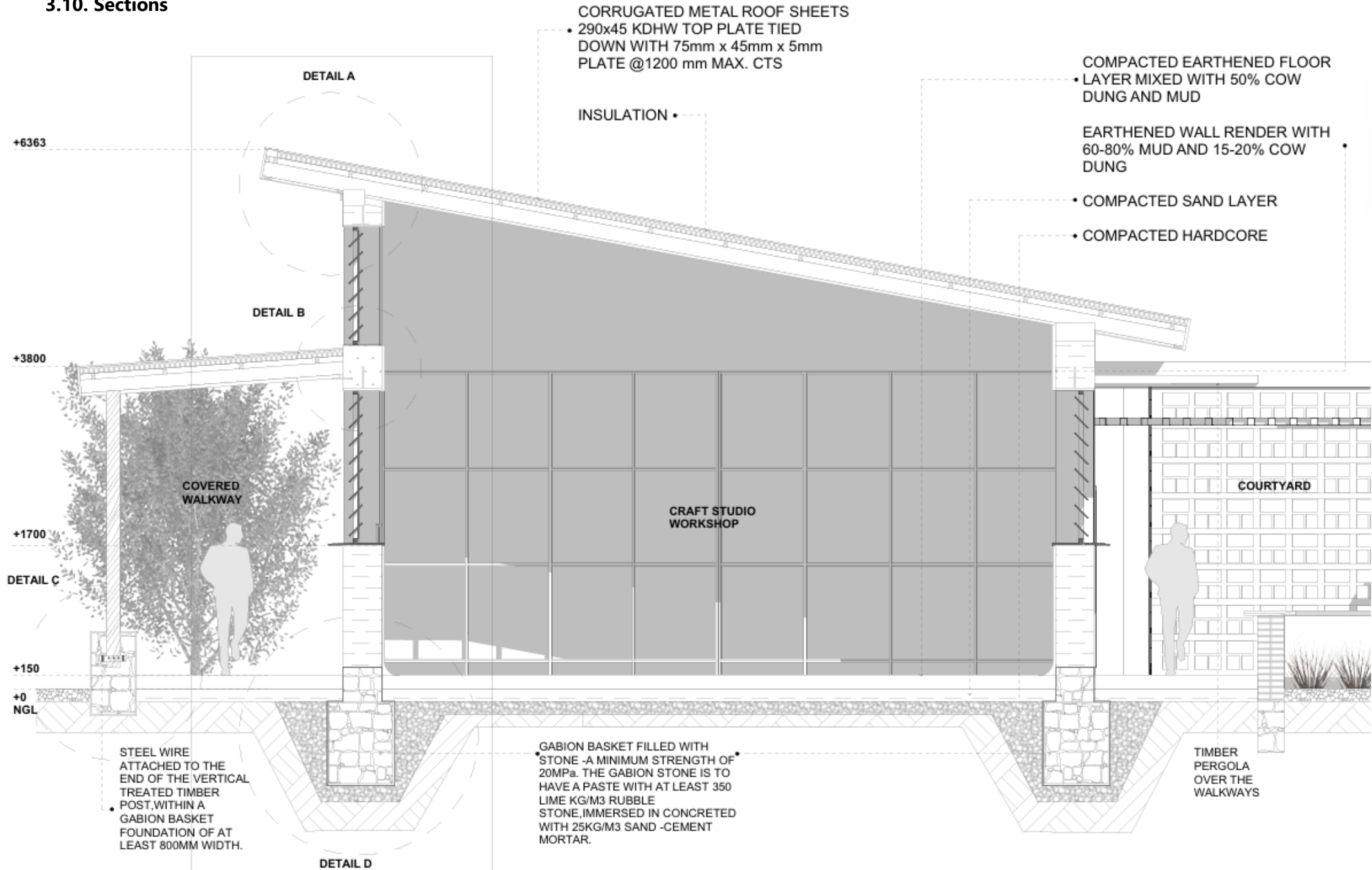
Limewash, clay-based plaster, and - or water-resistant sealants should be used to protect walls from rain, wind, and UV exposure.

### **Joints**

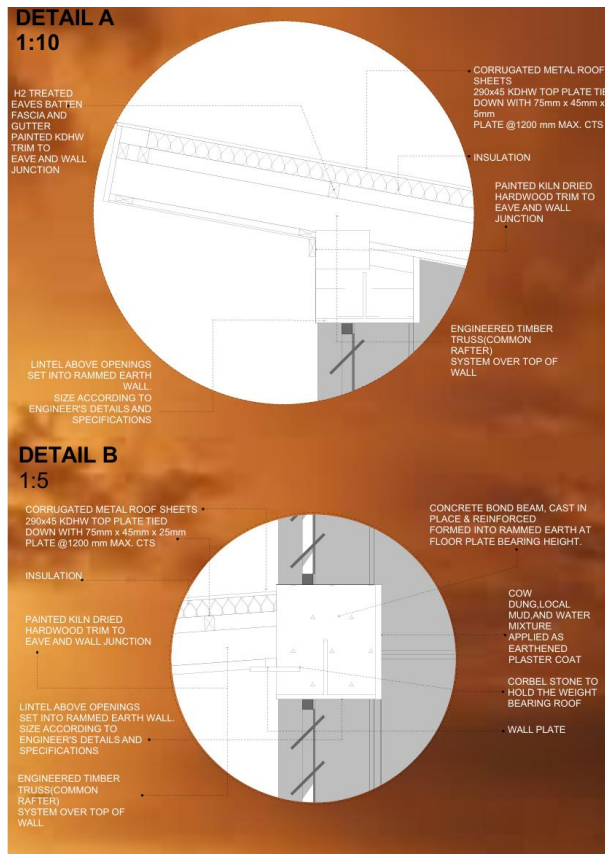
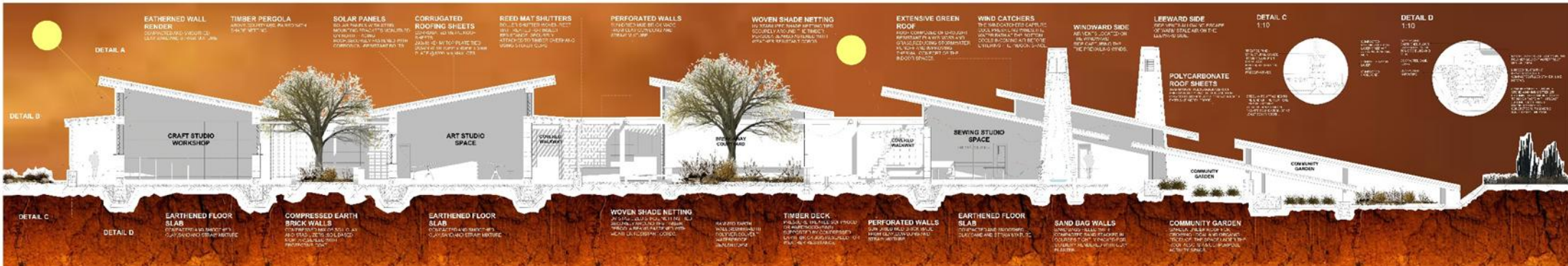
### **Post construction procedures**

Inspection for compliance should occur in regularly for the first 3 months of the construction completion. The inspection for drying and protective coatings.

### 3.10. Sections



## Echoes of Whispering footprints: Hotazel Cultural Incubator Space & Innovation Hub



### Breeze Walls

Clay brick breeze walls, crafted from locally abundant cow dung, as a key architectural feature. These walls serve multiple purposes, providing natural ventilation and shading while maintaining privacy within the building spaces. Their porous structure allows air to flow freely, enhancing thermal comfort.

### Courtyards

The series of courtyards strategically incorporated into the design facilitates effective cross-ventilation throughout the building spaces. These open areas not only enhance airflow but also create pockets of shade and natural light, fostering a comfortable and inviting environment. The courtyards function as integral components of the passive design strategy, mitigating the harsh climate while promoting a sense of openness and connectivity within the site.

### Wind Catchers

The tall wind catchers are a distinctive feature designed to harness the southeastern prevailing winds. These structures channel the air downward into the towers, where it is cooled through a thin film of water before being directed into the building spaces. This passive cooling mechanism enhances indoor comfort by reducing reliance

on mechanical systems.

### Rainwater Harvesting

The roofs are also designed to facilitate rainwater harvesting, directing water to a central collection point. This captured rainwater is then stored and used for irrigation, ensuring efficient water management and reducing dependency on external water sources.

### Sloped Green Roof

The sloped green roof serves a dual purpose by providing thermal comfort for the buildings located on that end of the site. This feature reduces heat gain during the day and helps regulate indoor temperatures, ensuring energy efficiency and occupant comfort. Additionally, the green roof contributes to the aesthetic and environmental goals of the design by blending seamlessly with the natural surroundings.

*Echoes of Whispering footprints: Hotazel Cultural Incubator Space & Innovation Hub*

**3.11. Elevations & Perspectives**

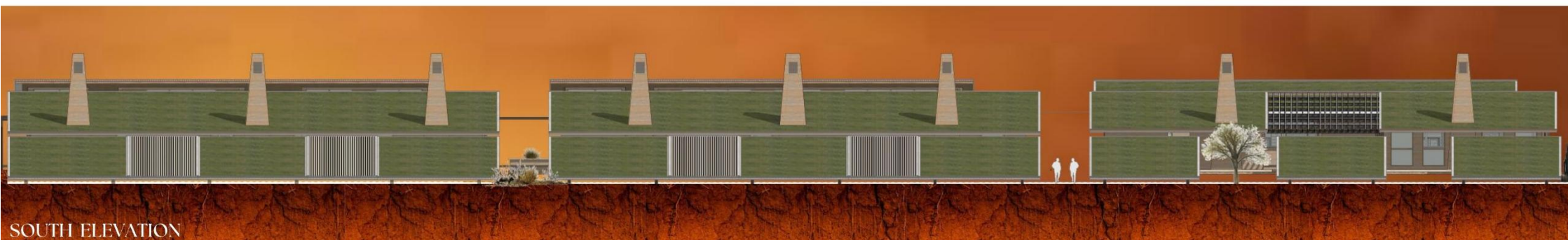


NORTH ELEVATION



RAISED GROUND CARPET

THE GREEN ROOF DESIGN INTEGRATES SEAMLESSLY WITH THE SURROUNDING ENVIRONMENT, ACTING AS AN EXTENSION OF THE LANDSCAPE FUNCTIONING AS A "RAISED GROUND CARPET," THE GREEN ROOF MINIMIZES VISUAL DISRUPTION TO THE NATURAL TERRAIN WHILE PROVIDING INSULATION AND REDUCING URBAN HEAT ISLAND EFFECTS.



SOUTH ELEVATION



NORTH ELEVATION

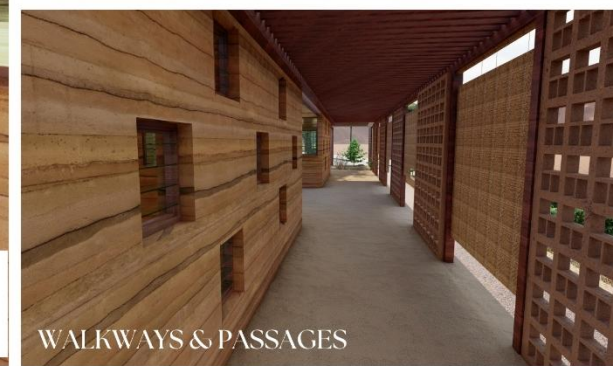


BREAK OUT COURTYARDS

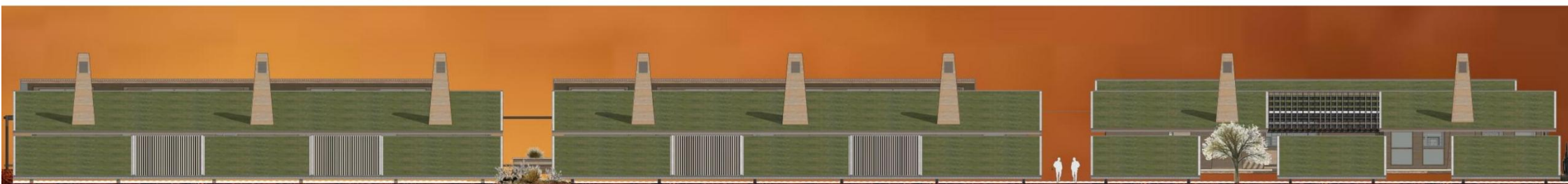
A SEQUENCE OF INTERCONNECTED COURTYARDS, STRATEGICALLY PLACED TO OPTIMIZE THE MICROCLIMATE OF THE BUILDINGS.



ADMIN FORECOURT



WALKWAYS & PASSAGES



SOUTH ELEVATION



EAST ELEVATION



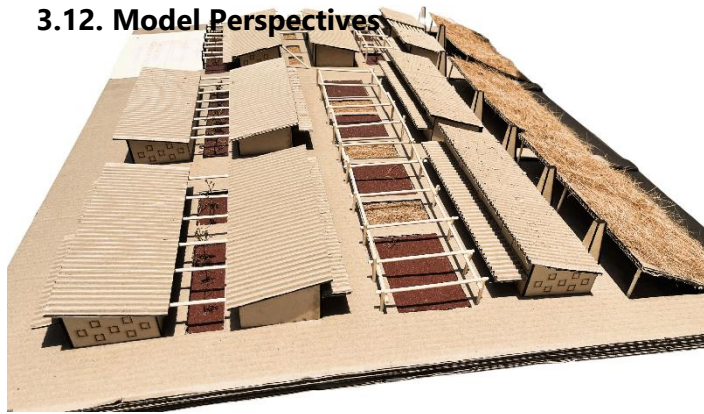
PERFORATED WALLS & ROLLER SHUTTER MATS

REED MATS, SERVE AS A MULTIFUNCTIONAL ELEMENT FOR ENVIRONMENTAL CONTROL. ENHANCING THE BUILDING'S PASSIVE COOLING STRATEGY WHILE ADDRESSING ISSUES OF AIR QUALITY AND SUNLIGHT REGULATION. THE MATS ACT AS NATURAL BARRIERS, PREVENTING DUST FROM ENTERING WHILE FILTERING EXCESS SUNLIGHT TO REDUCE HEAT GAIN. THEY ENABLE WINDOWS TO STAY OPEN, ALLOWING COOL AIR TO FLOW FREELY FOR NATURAL VENTILATION.



WEST ELEVATION

**3.12. Model Perspectives**



## **4. Reflection**

Circularity in the built environment, particularly within the South African context, remains an emerging concept that is yet to gain widespread recognition. However, its importance cannot be overstated, as it offers sustainable solutions to pressing environmental challenges. This study explored the prevalent linear practices within the built environment, drawing parallels to the town of Hotazel. The research highlighted how these practices contribute to inefficiencies and environmental degradation, reflecting the urgent need for a shift toward circular principles.

This study was grounded in the principle of meeting present needs while thoughtfully considering the impact on future generations and the healing of the earth. The inspiration for the project stemmed from an exploration of how the Khoisan people historically lived in the Kalahari, offering a profound example of harmony with nature. This perspective guided the project's amalgamation, influencing both its conceptual framework and execution. Every design choice and material selection was made with sustainability in mind, envisioning how the built environment might evolve in 100 years when the mines inevitably close. Beyond sustainability, the project also addressed the immediate social need for a facility that supports the children of mine workers, with a particular focus on empowering the youth.

The choice of rammed earth as the primary construction material symbolized a return to natural roots while simultaneously empowering the local community through its accessibility and low environmental impact. While the rectangular form of the blocks may initially appear simplistic or monotonous, it offers unparalleled versatility, creating adaptable spaces that can serve various functions over time. This modular approach also allows the design to be replicated and applied to other sites with ease.

Passive design strategies, including stack ventilation, wind chimneys, and courtyards, were incorporated to optimize performance in the town's

hot climate. The design leveraged the natural elements of the site, aligning with the north orientation to capture the southeastern prevailing winds and maximize exposure to northern sunlight for enhanced solar heat gain. These considerations ensure that the building responds effectively to its environment, promoting sustainability and comfort.

## **5. Conclusion**

The Echoes of Whispering Footprints project reinforces the notion that thoughtful, adaptive, and sustainable design is not only achievable but essential in addressing the complex challenges of our time. It stands as a meaningful contribution to the discourse on circularity in the built environment, offering both a functional solution for the present and a legacy of innovation for the future. It brings to light the critical need for further studies on circularity and its relevance within the African context, as well as its implications on a global scale. As the built environment continues to evolve, understanding how circular principles can be effectively adapted to local cultures, climates, and economies will be essential. By expanding research and fostering innovation in this field, we can unlock new pathways to sustainability that address not only environmental challenges but also social and economic inequities.

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