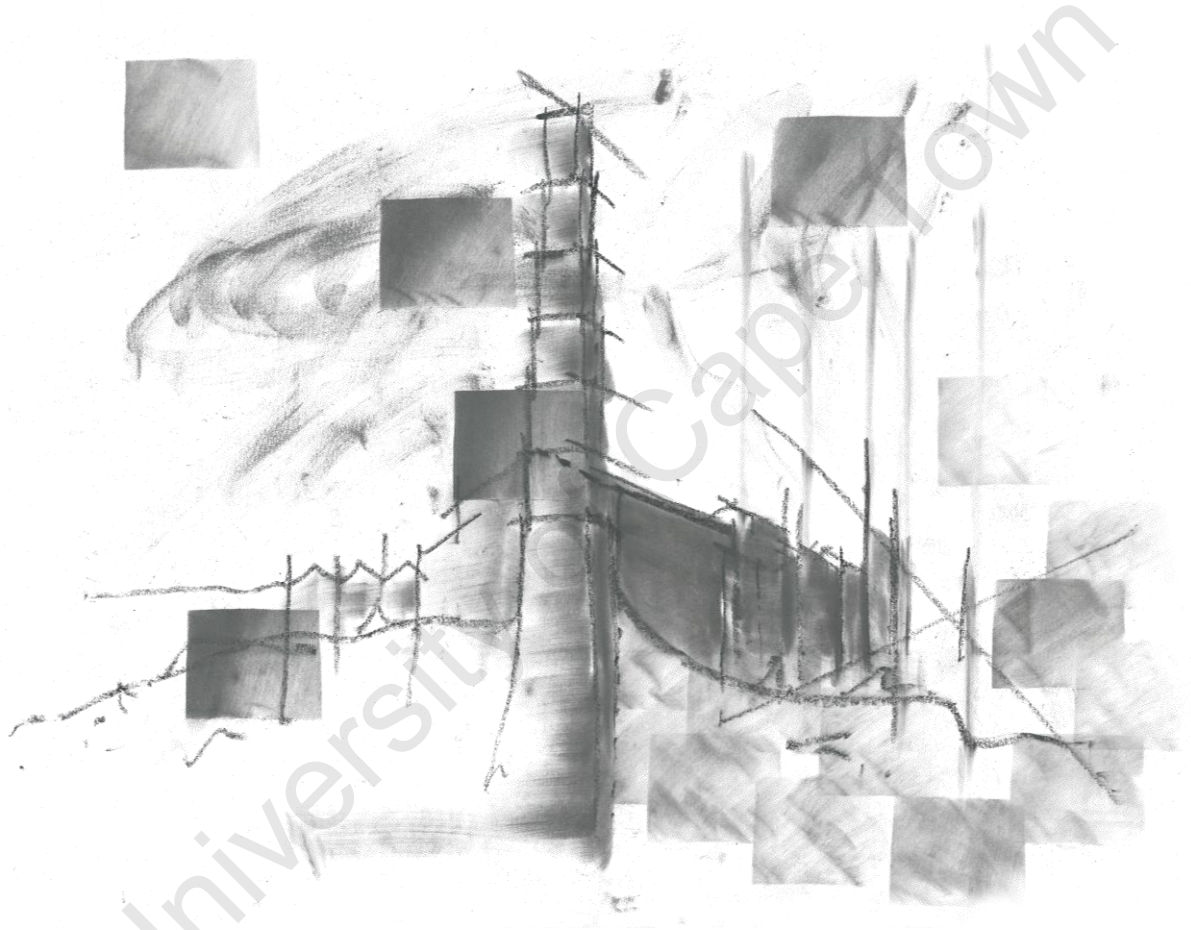
Re - Fuse

Place | Material | Nature



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Master of Architecture (Professional)
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University of Cape Town – School of Architecture, Planning and Geomatics.
Design Dissertation
Supervisor: Stella Popanicolaou
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STUDENT NAME: WARREN HOFFMAN.
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Figure 1: View of the site and part of its context (Author, 2023).

Abstract

The project ‘Re-Fuse’ is about the transformation of a site where the landscape through its recent history is a visual and physical spectacle of the environmental damage humankind has caused in the search of virgin materials (Mining) and burying of used materials (Landfill). Through analysis of the site and its context, I identify a position and a response on the potential utilization of architecture as a tool to aid in a positive social and environmental impact on the community and society at large.

By understanding place, engaging with the local materials, and the existential soils of the site, past and present in order to reform a connection to a landscape disconnected from nature. But importantly, remembering its industrial and extractive past that led to its current state, including the influence society had on its morphology, through the use of existing and new infrastructure, with the intention of encouraging social engagement with the land and materials, promoting scientific research and the awareness of the impacts of waste including its potential as a valuable material resource.

Thus, leading to the primary focus of waste management, with the reuse of an existing abandoned industrial warehouse, refurbished through the utilization of existing and implementation of new spatial interventions to form a material recovery centre that’s sole focus is to limit landfill use through valuing waste as a raw material via the creation of new products, increasing a materials lifespan through reuse, upcycling or downcycling, with the intention to keep the materials within our production systems, limiting the use of new mined resources.

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Figure 2: Initial site impressions: Landscape transformation and site materials (Author, 2023).

Figure 3: Material Transformation – Structure & Decomposition, Connection & Separation, Splitting & Merging. (Archi-Maki I) – Dialogue with place (Author, 2023).

Introduction

"*We are in constant dialogue and interaction with the environment, to the degree that it is impossible to detach the image of the self from its spatial and situational context. 'I am the space where I am', as the poet Noel Arnaud put it*" (Pallasmaa, 2011:125).

My interest revolves around a site and its context, an essential aspect that I have utilized as key to establishing an enquiry and form a response.

The linear process theory is key in understanding and categorizing the current and past uses of the site and context identified, with the circular process theory identified as a response.

These theories discussed by Katie Treggiden speak primarily about our engagement in the making of materials and their lifecycle, which includes the environmental impact.

My intent from the analysis to follow is to highlight humankinds' material impacts on the environment, why we need to re-address the way we work, find solutions to limit and reuse our waste, and establish a holistic engagement with our neglected and fixed audience 'the environment' which acts on us and our built fabric.

What can I do in aiding a positive message and change to the public on the awareness of waste, its impacts, and the importance to change our management systems by seeing value in waste and the landscape, whether that be in the making of architecture, its material use or programmatic function.

Linear & Circular Process

The linear process is a model of consumption and production that encompasses the analogies of ‘Take’, ‘Make’ and ‘Waste’, whereby the materials we extract to make things inevitably end up as waste (Treggiden, 2020:18). Waste is material considered of no value. Thus, indicating that the through the linear process materials lose value through their use.

These processes produce environmental impacts that are threatening the ecological systems of the planet. To alleviate this our reliance on the extraction of virgin materials from the earth needs to be limited. Thus, principles of a circular approach with a design philosophy of the cyclical use of materials needs to be considered in all stages of the ‘Take’, ‘Make’ and ‘Waste’ process, essentially removing waste and pollution through all the stages of the production process (Figure 16).

Essentially the principal is to think about waste differently. Instead of burying or incinerating the material, it rather goes through a stage of material transformation. The transformation can happen in multiple ways, it can be ‘Reused’, ‘Refabricated’, ‘Recycled’ or ‘Returned’ to the earth as some form of compost (ecological benefit) (Treggiden, 2020:21). We need to understand the value of materials and there properties so that we may fully engage with them throughout their lifecycle and process of various transformations and uses, eliminating the possibility of the material from ending up as waste, buried or incinerated.

Additionally, and most importantly we need to consider the environmental impact of materials (Figure 17). Primary bulk materials used globally are steel, cement, plastics, paper and paperboard (Van Wyk et al, 2012:677). Materials such as steel, cement and plastics not only utilize large amounts of energy in there making but have been modified through various treatment processes that are not only harmful to the environment but create materials where the potential of breaking the material down into its various constituent parts to be recycled or reused becomes an energy intensive process that potentially surpasses the impacts of the materials first use, rendering it unsustainable for manufacturers to consider as a resource for new material manufacturing. This is where design becomes important, not all materials can be recycled and utilized again as it was originally intended prior to recycling, for example recycled steel requires the addition of virgin materials (extracted from the mining process) for the material to be utilized as it was originally designed prior to the recycling process.

In the future our choice of materials and there making process needs to be selected and modified for use with the intention of reuse without reliance on new virgin materials and without the need of high energy intensive processes to break the material down for new use as a raw material.

With modified materials we seemingly cut of the origins of a material with no way of return.

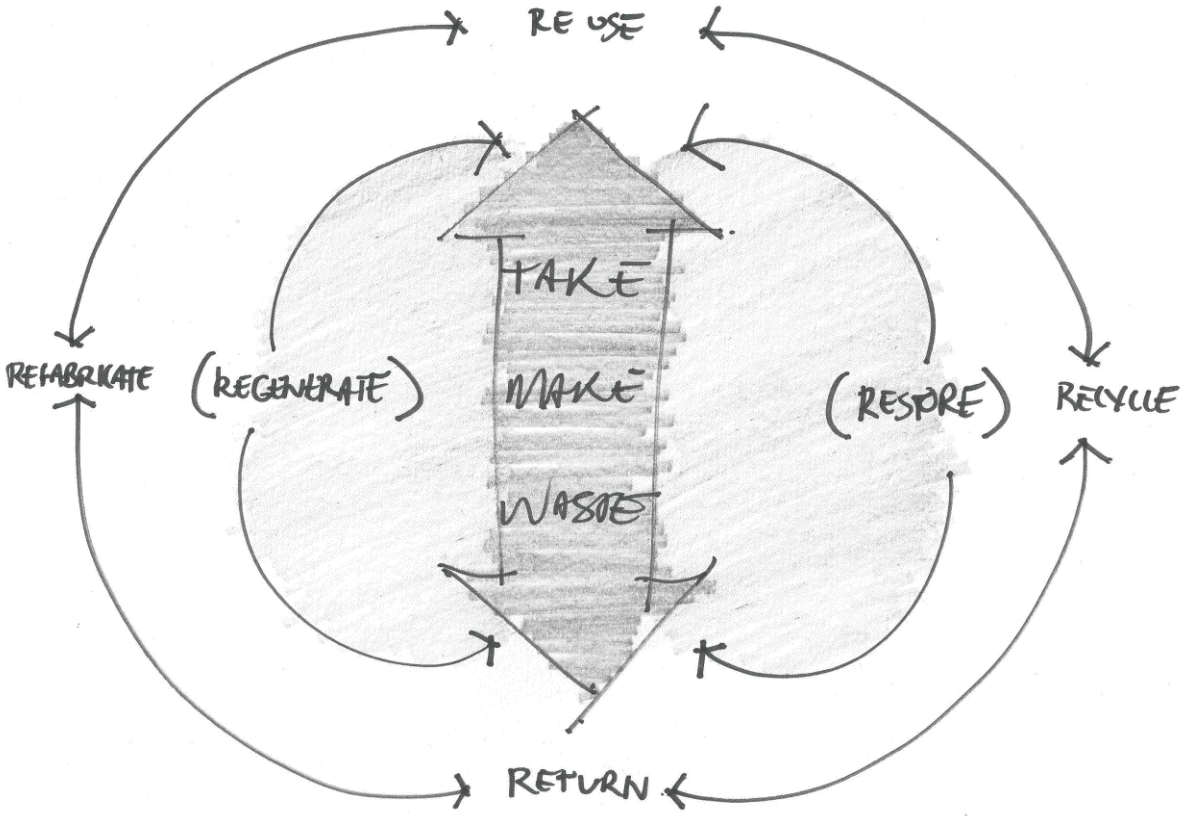


Figure 4: A circular look at our linear processes (Author, 2023).

Figure 5: Productive Landscapes of Agricultural (Foreground – Mellish Farm) and Open Cast Mining Infrastructure (Background – Afrisam Quarry) which form part of the context (Author, 2023).

Place

Context

The chosen site is located in the Northern Suburbs of Cape Town in an area called Vissershok, derived from the name of a local farmstead established in 1683 during the period of Dutch rule as a VOC cattle outpost (Breytenbach, 2017:2). (Figure 6)

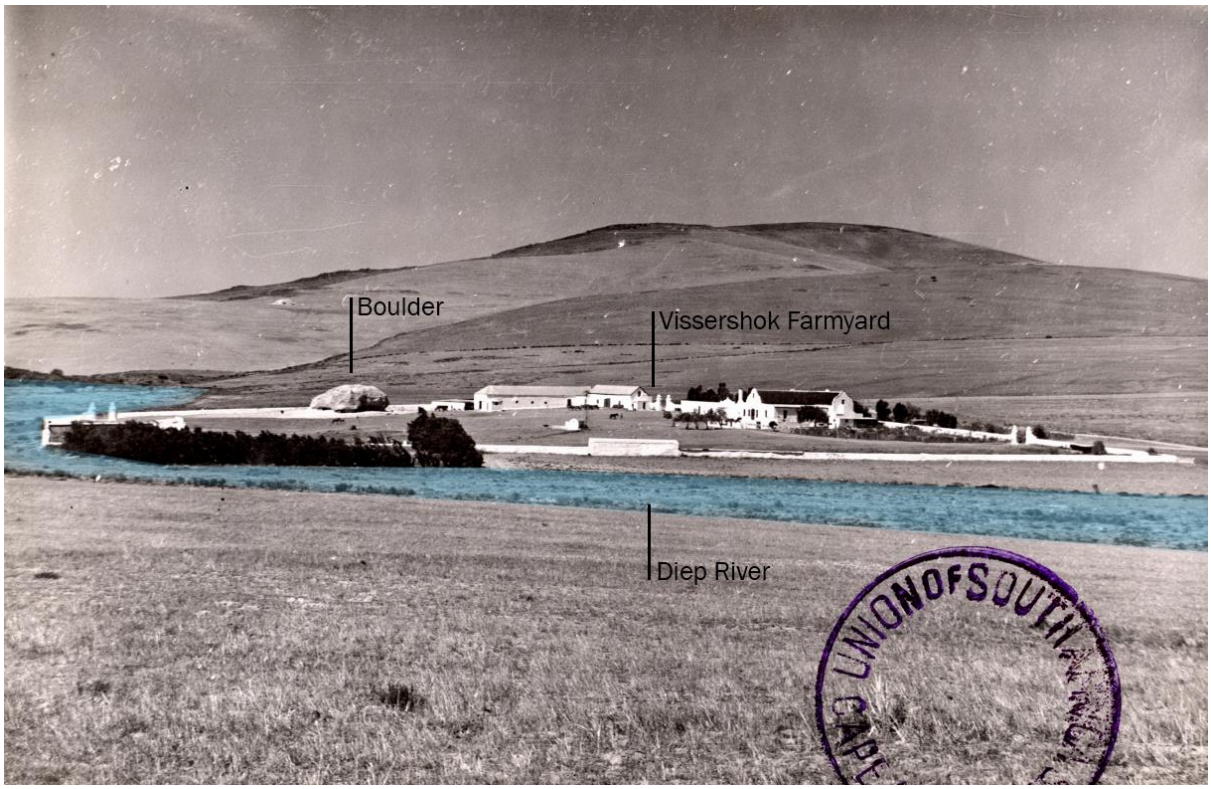


Figure 6: 20th Century photo of the Vissershok Farmstead showing the cultivated fields and a large boulder (A sign of the material available in the context and now actively quarried) (Breytenbach, 2017).

The context forms part of a rural area of productive landscapes on the urban edge of the Blaauwberg district of Cape Town. The productive landscapes range from agricultural (Farming) too industrial use (Open cast mining and Landfill).

The agricultural lands remain as one of the largest and oldest of the land uses in the area, and still actively producing, with many of the farmlands listed by the city to be of historical significance. The agricultural practices are monocultural, consisting largely of the growing of wheat and canola which are switched between the growing seasons.

The open cast mining practices in the area, of which there are a few, are littered along the Durbanville/Tygerberg hills. These mining practices are all dedicated to the quarrying of Malmesbury Shale (Hornfels) which are found in the region and used primarily in the construction industry.

Landscapes of conservation also exist in the context predominantly towards the coastline, forming part of the Blaauwberg Nature Reserve.

Further History of the context are highlighted in the timeline (Figure 7).

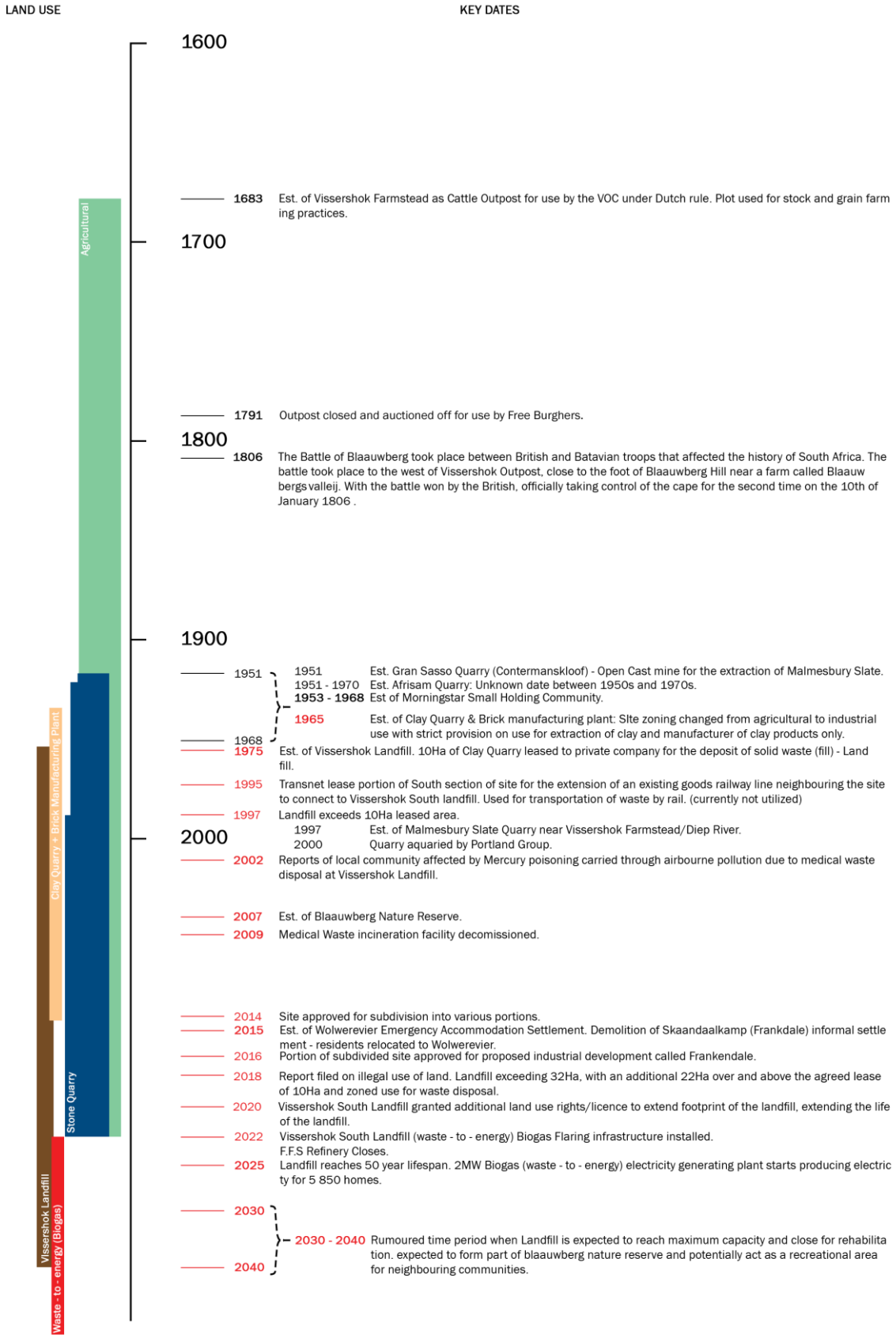


Figure 7: *Contextual History Timeline (Site = Red) – (Author, 2023) based on* (Ajam, 2003; Breytenbach, 2016, 2017; Chambers, 2016; Department of Environmental Affairs and Development Planning, 2017; Hauwa, 2022; Hendriks, 2021; Smit, 2018; Sokanyile, 2015; Vissershok WMF, 2022).

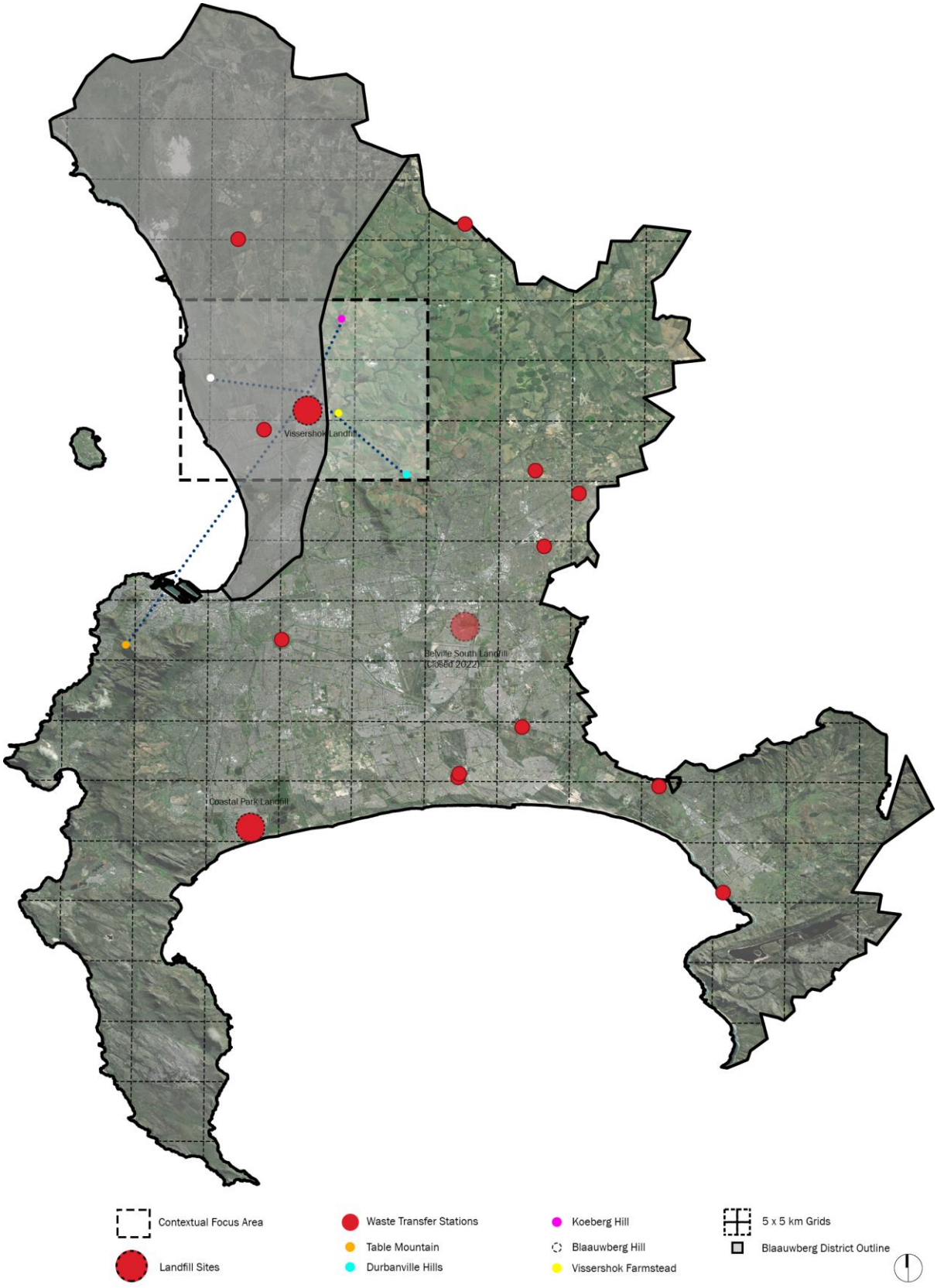


Figure 8: Metropolitan Context Map highlighting focus area, district, landfill, and transfer stations (Author, 2023).

Figure 9: View on site of the northern part of the private landfill. Also shown is the expanse of alien plant species on-site and presence of clay in the soils (orange texture seen on the ground) (Author, 2023).

Site

The focus though shifts away from the farmstead to a site a few hundred meters away along Frankdale road, positioned amongst the actively used Vissershok Landfills. The site being a 1960's brownfield site with a history relating to the extraction (Quarrying) of raw material (Clay) that aided in the production of kiln fired clay bricks that took place within the built infrastructure that remains. Now discontinued, the quarry portion of the site has been subdivided for use as a Private Landfill, established in 1975 where hazardous and municipal waste is buried (Figure 9).

The landfill serves as a reminder of the issues of waste management, its effects on the environment and as a storage vessel of societies material and dietary habits stored in cells and covered over, allowed to decompose over time, potentially creating new transformed materials, resulting from the various materials, there properties and potential chemical constituents merging together.

However, one element that has remained important from its past use is the importance of clay, previously extracted to make a material (bricks), now used to cover over and seal materials that generate the landfill.

Although the landfill takes up a large portion of the site, the majority of the site is undeveloped and left to accumulate dumped waste and continued growth of alien plant vegetation which has significantly damaged a landscape containing lowland fynbos, considered of critical importance to the biodiversity of the region.

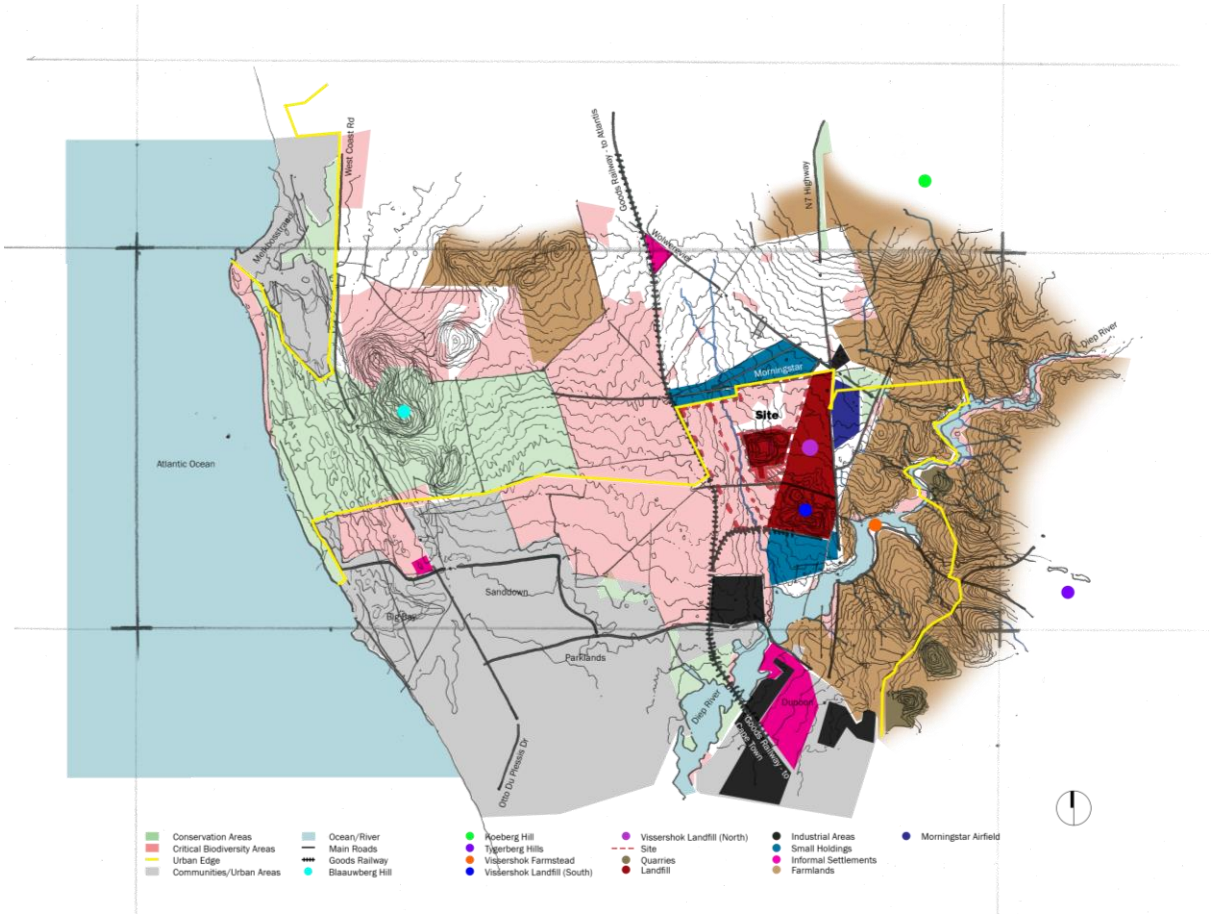


Figure 10: Site, context and its various land uses (Author, 2023).

Figure 11: Site Plan (Author, 2023).

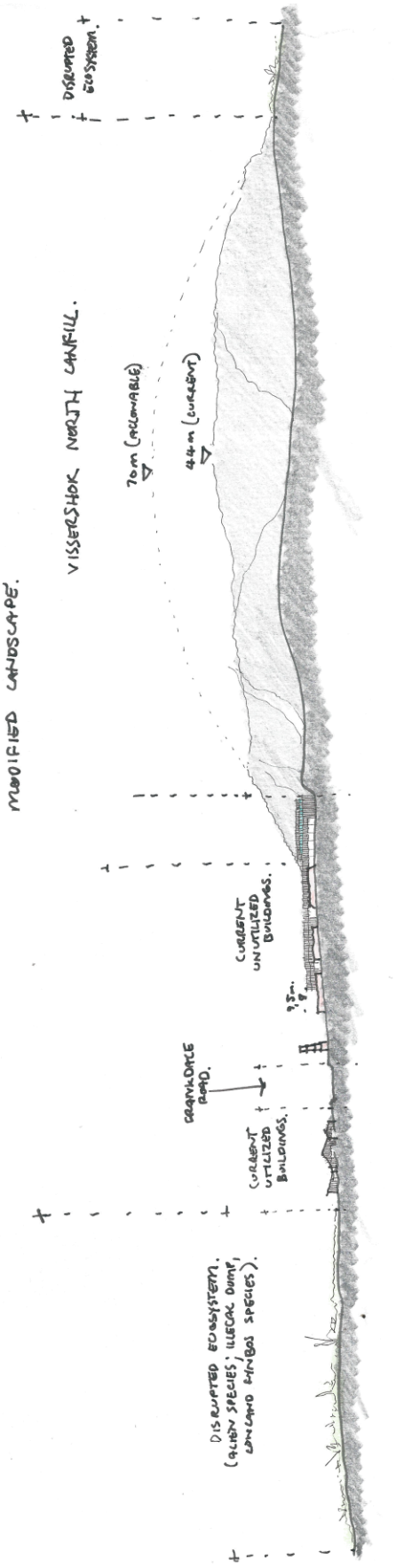


Figure 12: Section through the site's topography (Author, 2023).

Community

In order to understand the neighbouring communities better I interviewed residents from Wolwerevier, Skaandaalcamp and Morningstar in relation to the site.

The purpose of this exercise also aided in understanding the needs of the community and the potential programmatic use of the chosen site to aid in addressing these needs.

Wolwerevier (Respondent Name: Brenda)

A community populated with South Africans of Afrikaans or Xhosa speaking with a large portion of foreigners who rent houses in the community.

The settlement is meant to be a temporary housing facility setup by the City of Cape Town.

What percentage (estimated) of the residents at Wolwerevier are unemployed?

An estimated 90% of the community are unemployed and depend on SASSA Grants as income and support.

Are there any jobs available to do within the community?

The odd jobs available largely ranged between washing clothes and babysitting children whose parents are out working during the day.

What do you feel is the major contributor to unemployment in the area?

Lack of opportunities in the area, accessibility in terms of traveling costs to and from the area to areas of potential employment. Lack training and skills development programmes available in the community.

Is there a community centre at Wolwerevier?

Yes, the ECD community centre was built in 2019 for use by the Wolwerevier community but largely can only be utilized by those who can afford to pay for its use, thereby questioning its definition as a community centre if only available to select few residents who can afford to pay to utilize it. The Wolwerevier church located near the landfill on Frankdale road is utilized for the community and caters for 100-150 personal, with suggestions to increase the church size or find land to rent and build a community hall and cater for educational programmes. However, this has not come to fruition yet.

Is there a park or sports field/facilities available for use by the community?

There is no sports facility or field setup for use by the city. There is a park facility available to use by the community, however a park facility with soft landscaping would be ideal as a few kids have injured themselves falling of the equipment onto hard landscaped ground.

What does the community do with its waste?

There are no bin/skip drop off facilities at Wolwerevier. Waste is placed in refuse bags and ends up been placed at the entry to the settlement for the city to collect on bin collection days.

Some of the dwellings are modified more than others, why is that?

Permanent residents are more inclined to do visually appealing upgrades/extensions to their homes than residents who rent.

Roughly what are the various skillsets of residents at Wolwerevier?

Builders, Farm labourers, carpenters, retail and fast food workers, teachers, nurses and accountants to name a few.

What has been a negative, moving from the neighbouring Wolwerevier Farm dwellings to Wolwerevier Settlement?

Greenery? No green spaces, congestion and zinc dwellings are not well insulated, either too hot or too cold.

Skaandaalcamp (Respondent Name: Brenda)

Name of a settlement neighbouring Vissershok Landfill where housing was removed or demolished, and residents were moved to Wolwerevier.

How long were you a resident of Skaandaalcamp community?

All my life, I was born there.

When was Skaandaalcamp settlement established?

1984/85 as a Coloured & Xhosa community.

Since moving to Wolwerevier, what aspects of Skaandaalcamp do you have fond memories of compared to Wolwerevier?

What I miss most is the freedom that one felt at Skaandaalcamp in terms of having no set property boundary limits set by the city, allowing gardens and homes to be larger, creating breathable indoors spaces more private than the confined ones where families have to fit into a one bedroom, impacting one's mental health and claustrophobia.

What materials were used and where were the materials sourced from in the making of one's house at Skaandaalcamp?

The majority of materials used were found objects of Zinc or Timber Board sourced from the landfill or bought new.

How many residents moved from Skaandaalcamp to Wolwerevier?

An estimated +- 500 to 600 residents moved from skaandaalcamp to wolwerevier in 2015. Only documented residents received houses.

What employment opportunities were available for residents at Skaandaalcamp?

Skills and employment opportunities at the time were that of recyclers (Waste Pickers), Residents also created their own gardens for the planting and growing of food and were employed within the local farmlands during harvest season. These opportunities were not only profitable for the residents in terms of income and food for their families but also allowed the opportunity for families to send their children to tertiary education institutes for further studies and skills development for their children. These opportunities were lost when the residents moved to Wolwerevier. The landfill closed its access to the community and the promised accessibility to jobs by the city didn't materialize.

What has been a positive, moving from Skaandaalcamp to Wolwerevier?

Better service provisions.

Morningstar (Respondent Name: Joy)

A small holding community neighbouring the chosen site at Vissershok.

How long have you been a resident of the Morningstar community? Is there any specific reason for choosing to live in a small holding community rather than in townhouses?

I have been a resident of the Morningstar community since the 1980's. I grew up living on a small holding, farming areas and in a built-up suburb and I prefer the option of living closer to nature and the outdoors that smallholdings offer. My love for horses and animals meant that naturally I would need to live in a community of larger properties that would allow me to facilitate my desire to live closer to these animals.

What's the major change you have noticed in the community from the first year you were a resident till currently, in terms of growth and has this affected the use of the properties in a positive or negative way?

The community has grown as council allowed properties to be subdivided into one-hectare plots, housing density increased as a result with most properties having more than one house on the property. A main house and additional cottages which are then rented out. Most properties in the area are used for equestrian activities with the stabling of their own horses or as a livery business for stabling of other people's horses. Overall properties have become denser and more developed, which could be a positive and a negative.

Since you have been a resident at Morningstar has the neighbouring landfill caused any health-related issues within the community other than the reported articles on mercury poisoning?

Since I have been living in Morningstar, smells, dust and respiratory issues are often a regular occurrence, dependant and effected by the wind.

The Morningstar community is largely made up of small holdings, where does the community have gatherings and what is largely the use of the properties in the area?

There is a Private Hall that is utilized by the community at Zonnekus Holiday Resort when needed. Most properties have small businesses on them that the property owners run. These businesses vary. However, equestrian activities are the most predominant use of the properties in the area.

Are there any public or private recreational facilities in the area?

The properties in the are large enough for owners to have their own private spaces to enjoy without the need of public recreational facilities. There are privately owned businesses on a few of the properties in the area that is available for the public to use at a cost.

What employment opportunities are there in the community?

Employment opportunities are largely related to equestrian activities, gardening and general household jobs.

Are you actively involved with the community in anyway, if so how, if not why? Are there opportunities for residents to get involved with the community?

No. I am generally a busy person and don't necessarily make myself available for community engagement unless necessary, but this is generally out of choice as I am comfortable been a private person. However, all residents in the community are generally well informed on meets and activities in the area, but I tend to limit my engagement.

Name one positive and one negative about the community?

A definite positive is community support in the area, everyone helps each other when needed or asked. A negative aspect would be services in terms of telecommunication which is quite weak and interrupted as well as maintenance of roads is poor. Transport is also a major issue, taxis are expensive as community is away from the built-up suburbs, most residents must own a car to get to work.

What do you feel is necessary for the community to improve and become more attractive for residents to want to reside in Morningstar?

It's difficult to say, really depends on what one is looking for, to live away from the suburbs, closer to nature. If services to the area are improved one could have connectivity like the suburbs with the freedom of privacy and potential connection to nature that comes with larger plots.

What do you do with your waste? Are there any recycling facilities in the area or pick-up options?

Currently there is a municipal collection service that collects bins on Tuesdays in the area. The community use to have a recycling drop off facility outside Zonnekus Holiday Resort, but this facility was removed after residents were placing non-recyclable waste in the facilities provided. The closest drop off facility for recycling is at the neighbouring landfill.

Reflection

- Importance of community togetherness and participation.
- Allow community to play a part in the process of making via material sourcing etc.
- Value of the landscape for production and conservation of local biodiversity in the area, including its role in the community as a contributor to a healthier environment.
- Issue of waste management and the city. Only two landfills in the city remain, Coastal Park and Vissershok.
- Potential role of programme and site to facilitate employment and reintroduce the value of waste in a positive aspect.
- Why the city should invest in the community and increase the value of waste management. Residents of the city pay for waste removal, the city then buries it. If they use waste as a resource they could make more money, be more sustainable and conservative, by reducing mining practices in search of raw materials and biodiversity destruction as a result of land-use.

Figure 13: Existing, abandoned Clay Manufacturing Plant – Largest structure on site (Primary Building Focus) (Author, 2023).

Existing Infrastructure

Here I will speak about my engagement with the site based on my site notes and also included some existing sketches, drawings of the existing infrastructure to get a sense of materiality and scale.

The existing structures on site are of industrial origins, designed using steel portal frame structural typologies with brick infill walls, concrete floors, steel framed cottage paned windows and corrugated profiled asbestos & polycarbonate sheeting with steel roof vents. The forms generated contain double or mono pitched roofs all at varying scales. For the purpose of this dissertation, my main building focus is that of the largest existing building, with the remaining buildings forming part of the overall masterplan design.

The largest building takes the form of a cross in plan, formerly used as the principal building for the manufacture of kiln fired clay bricks, made from the clay derived on site. The kiln still exists on site and visible on approach to the site along Frankdale Road from the N7 Highway turnoff.

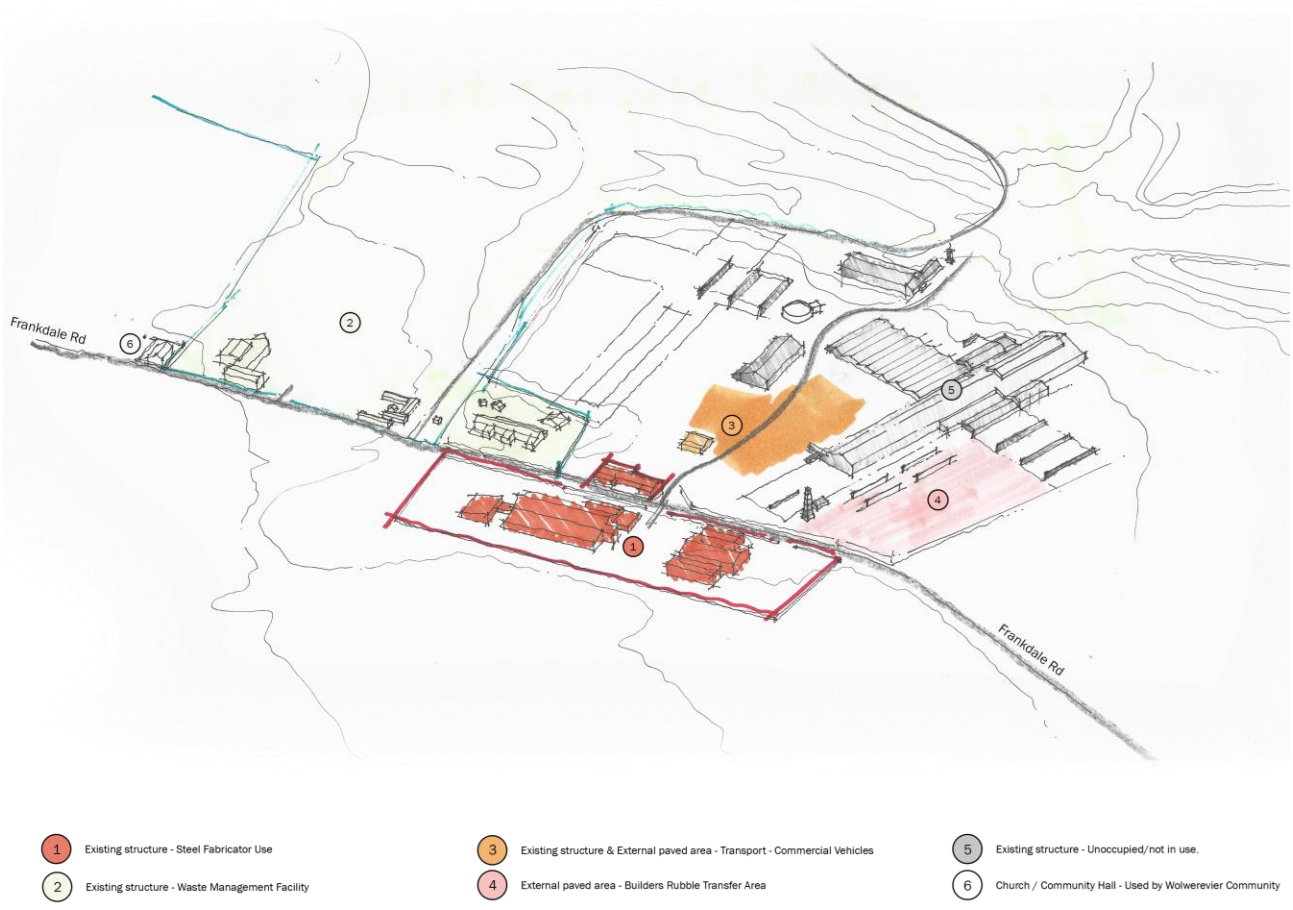


Figure 14: Axo-Sketch of existing structures on-site and their use (Author, 2023).

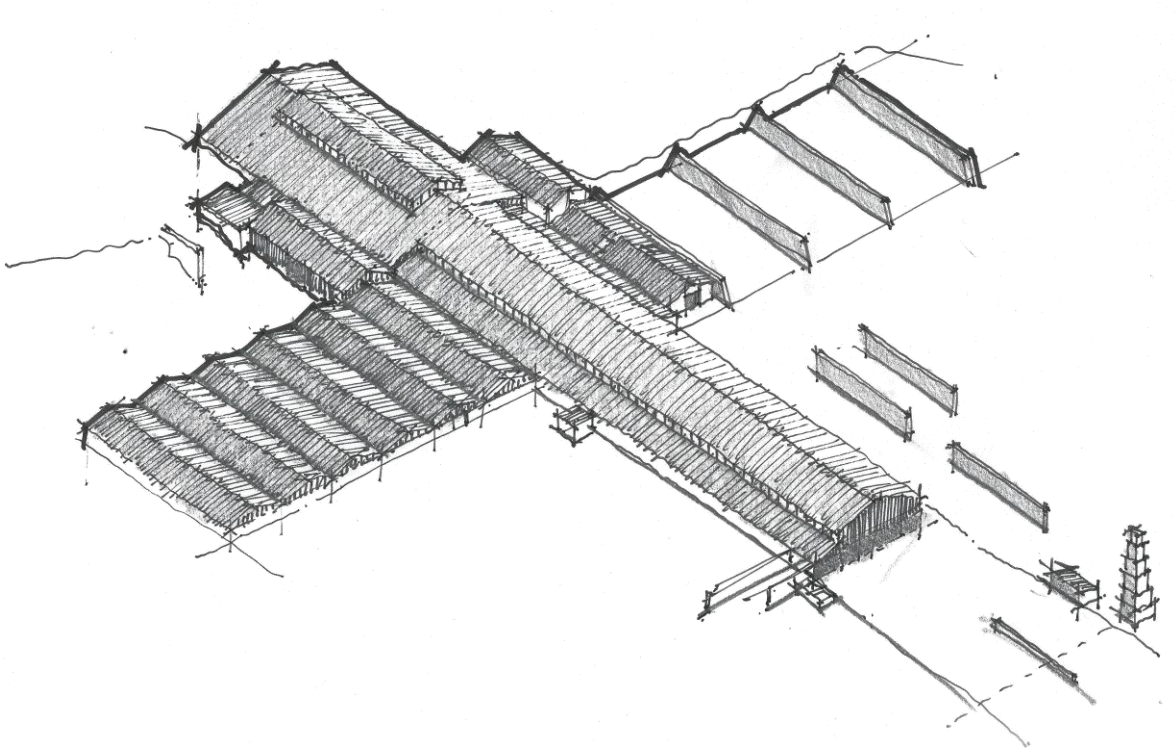


Figure 15: Axo-Sketch of the largest existing building on site and primary focus for design development (Author, 2023).

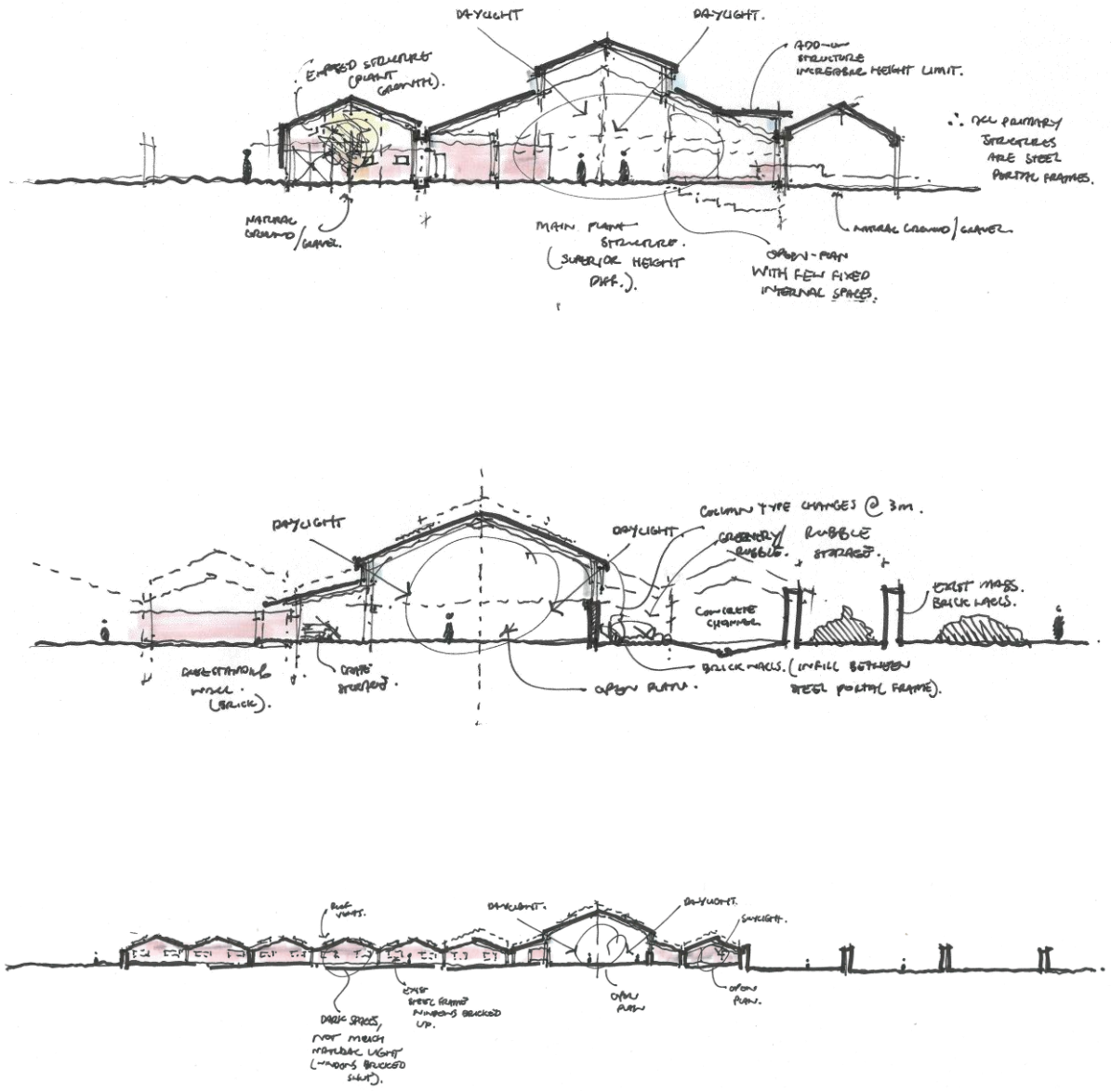


Figure 16: Sectional studies of largest existing building on site (Author, 2023).

Figure 17: Image showing the largest open plan section of the existing building (Author, 2023).

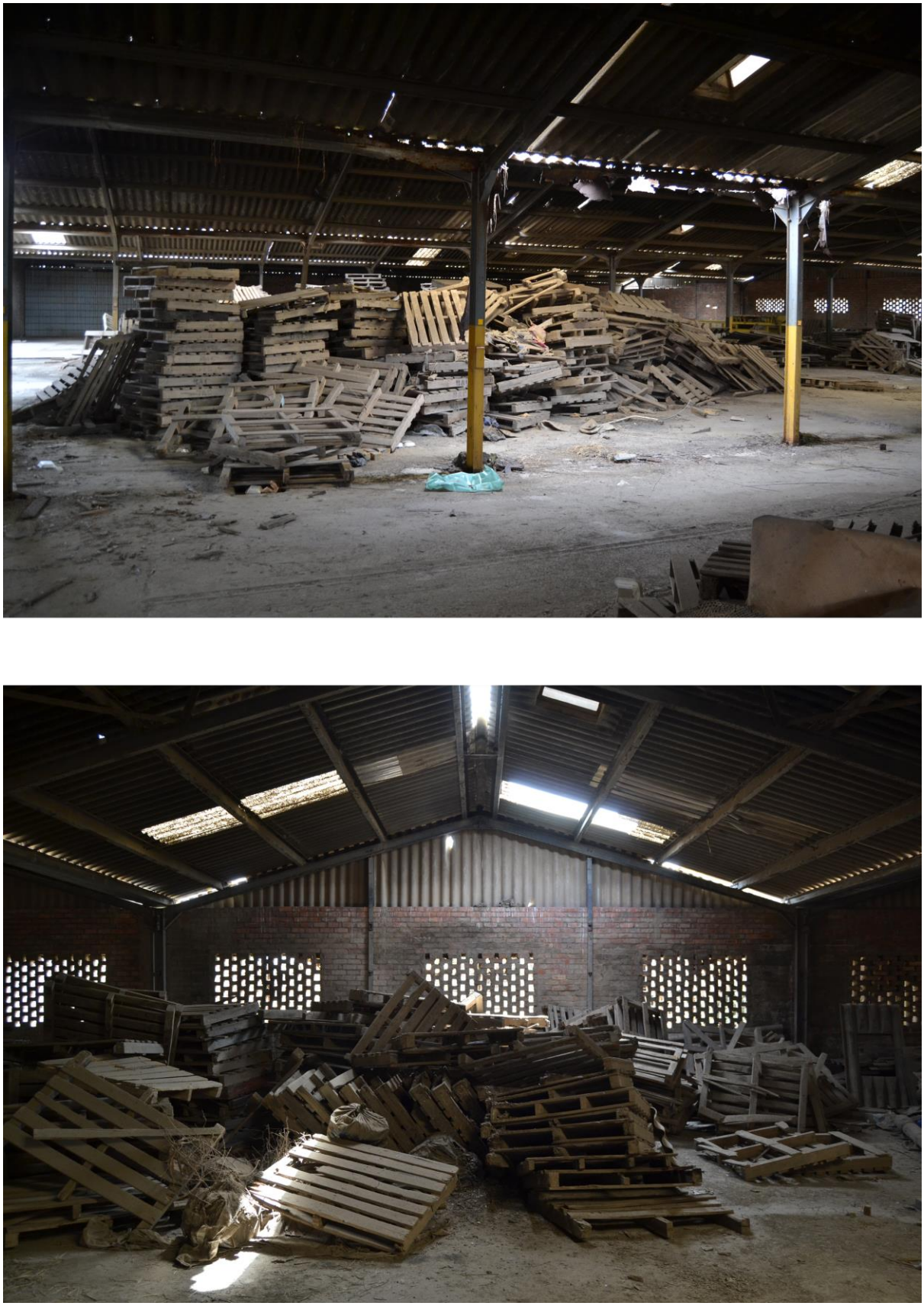


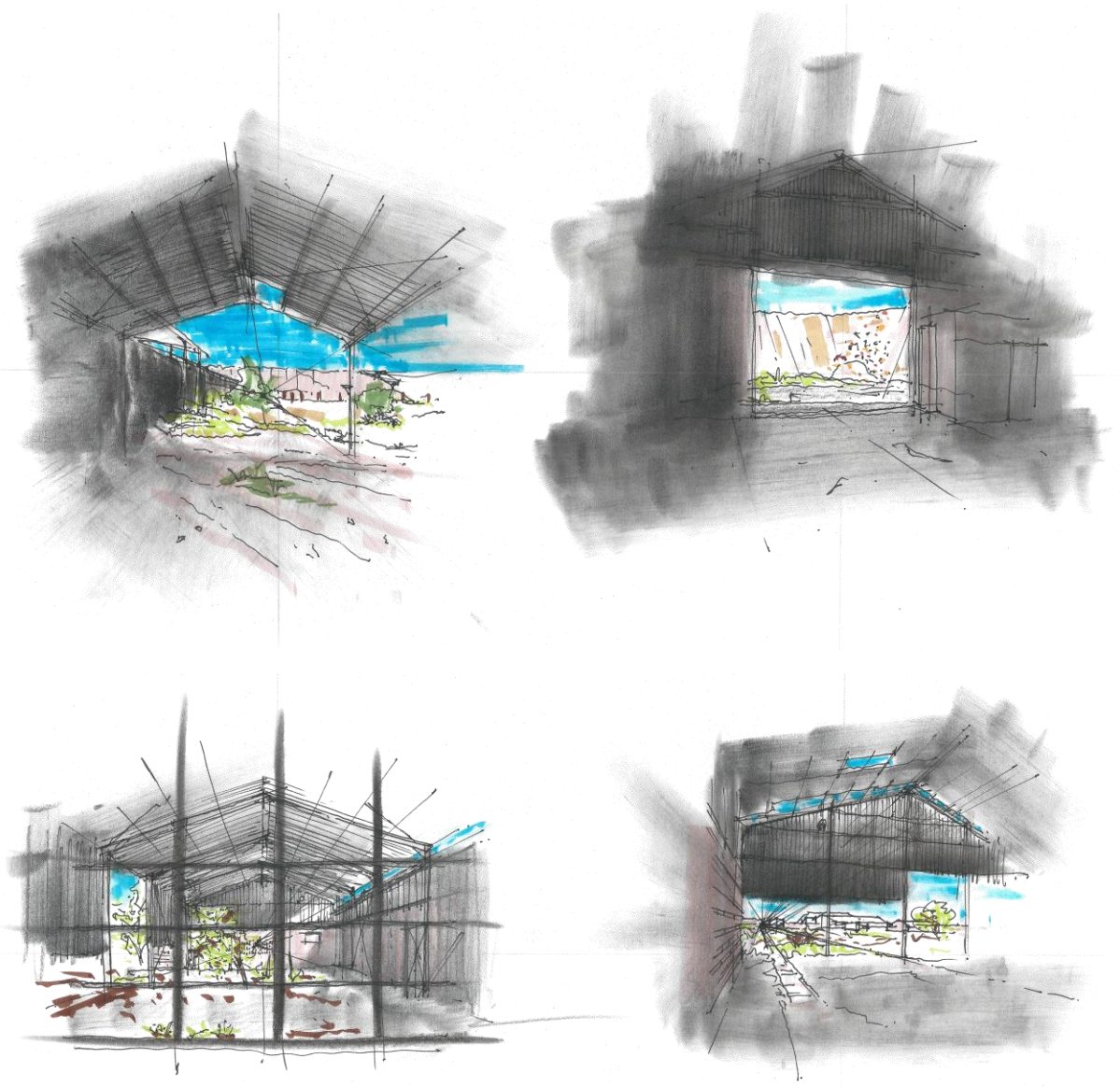
Figure 18: Interior images of buildings west wing with its collection of timber pallets (Author, 2023).

Figure 19: Northern section of the building showing materials and infrastructure from its past use as a clay manufacturing plant (Author, 2023).

Figure 20: External views of the Northeastern section of the existing building (Author, 2023).

Figure 21: Image showing the state of the existing buildings South façade infrastructure (Top) and one of the current uses of the external spaces available on site for the use as building rubble sorting facility (Bottom) (Author, 2023).

Figure 22: Image showing external area of western and southern façade of the existing building (Author, 2023).



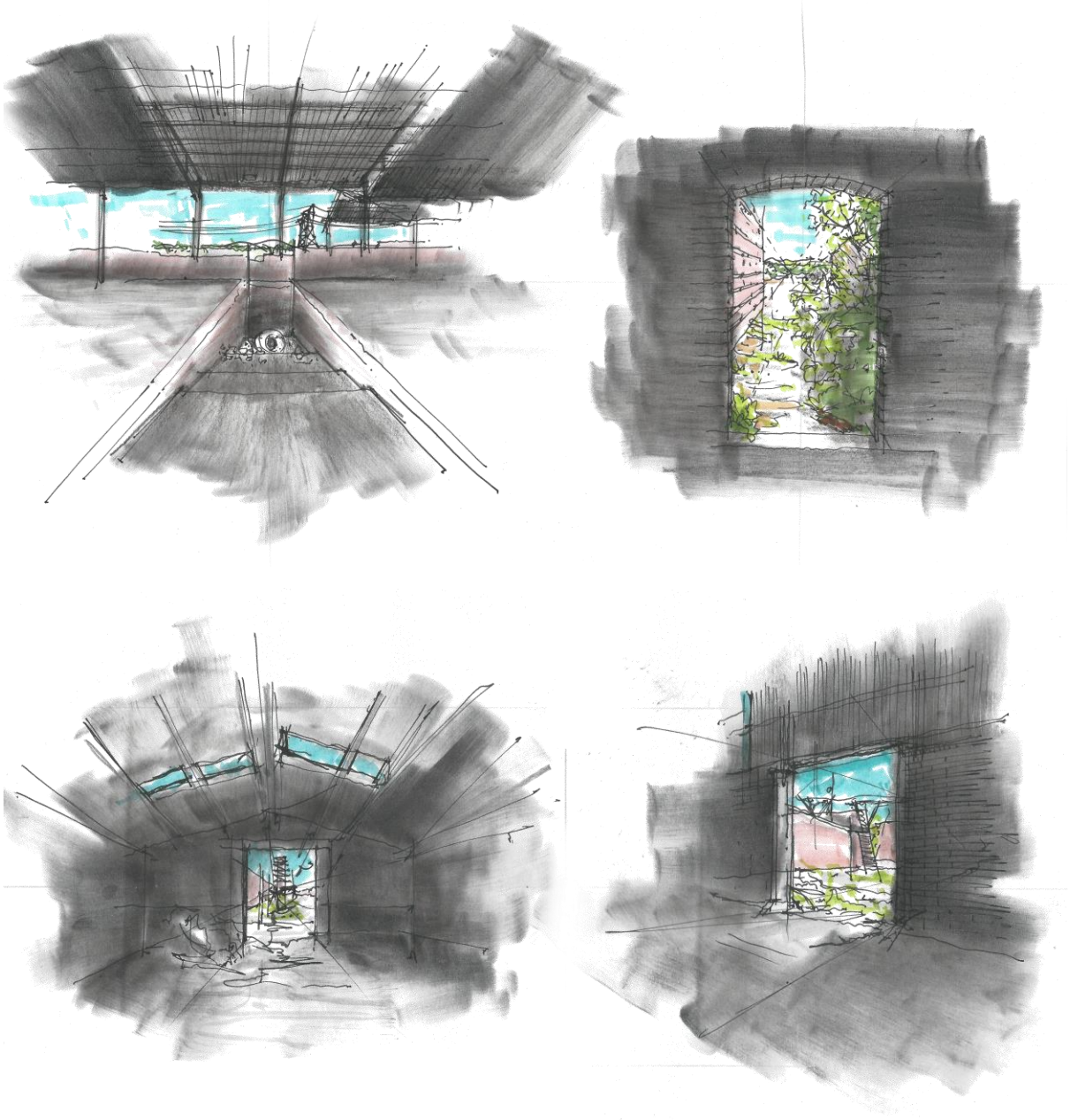
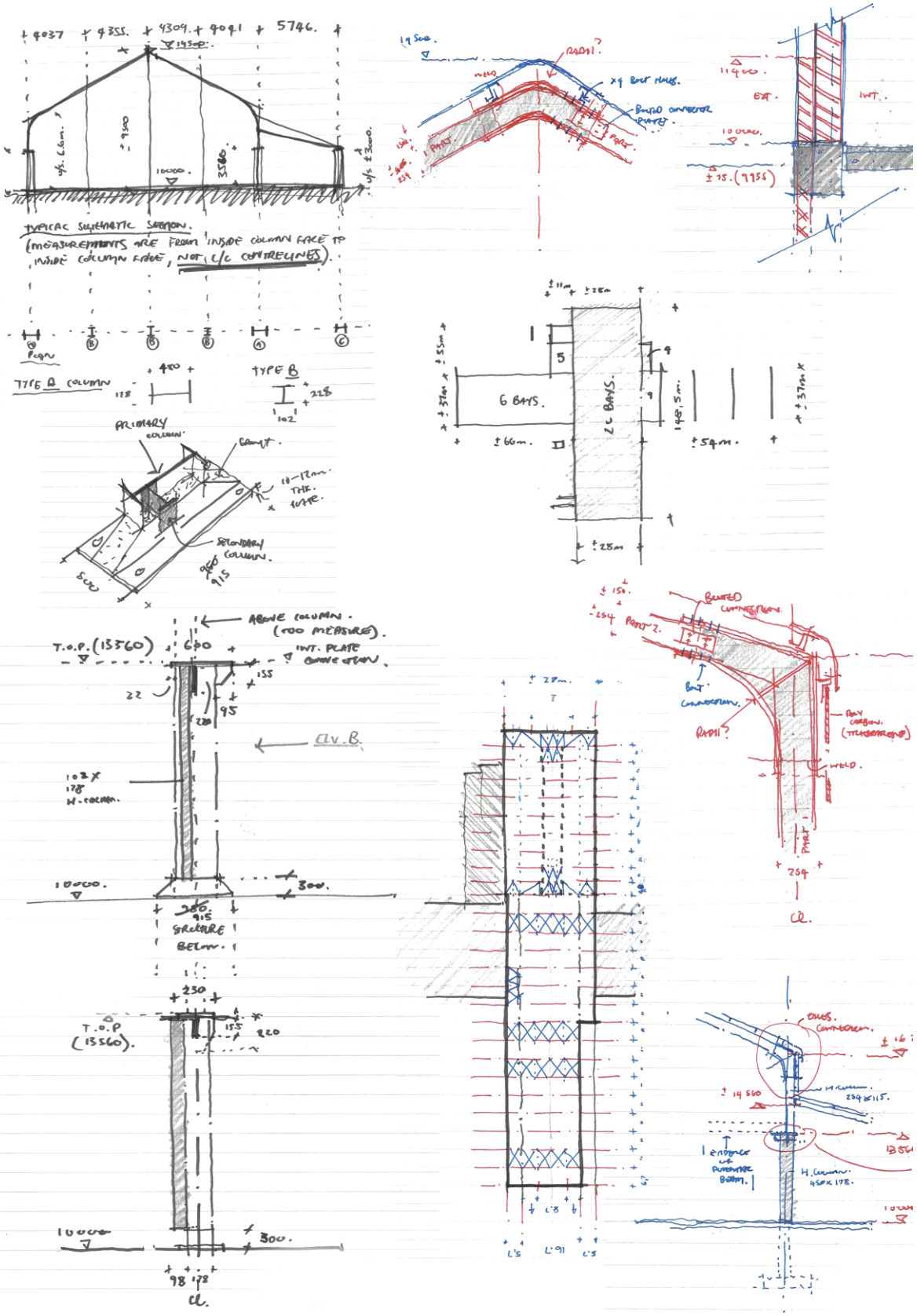


Figure 23: Interior sketches of the existing primary building on site (Author, 2023).


TYPICAL SCHEMATIC SECTION.
(MEASUREMENTS ARE FROM INSIDE COLUMN FACE TO INSIDE COLUMN FACE, NOT C/C CENTRELINES).
TYPE A COLUMN
TYPE B
PRIMARY COLUMN.
SECONDARY COLUMN.
ABOVE COLUMN. (TOO MEASURE).
INT. PLATE CONNECTION.
T.O.P. (13560)
102 X 178 H. COLUMN.
10000.
300.
SECTION BELOW.
6 BAYS.
22 BAYS.
BOLTED CONNECTION.
BUTT CONNECTION.
WELD.
INT.
EXT.
H. COLUMN. 450 X 178.

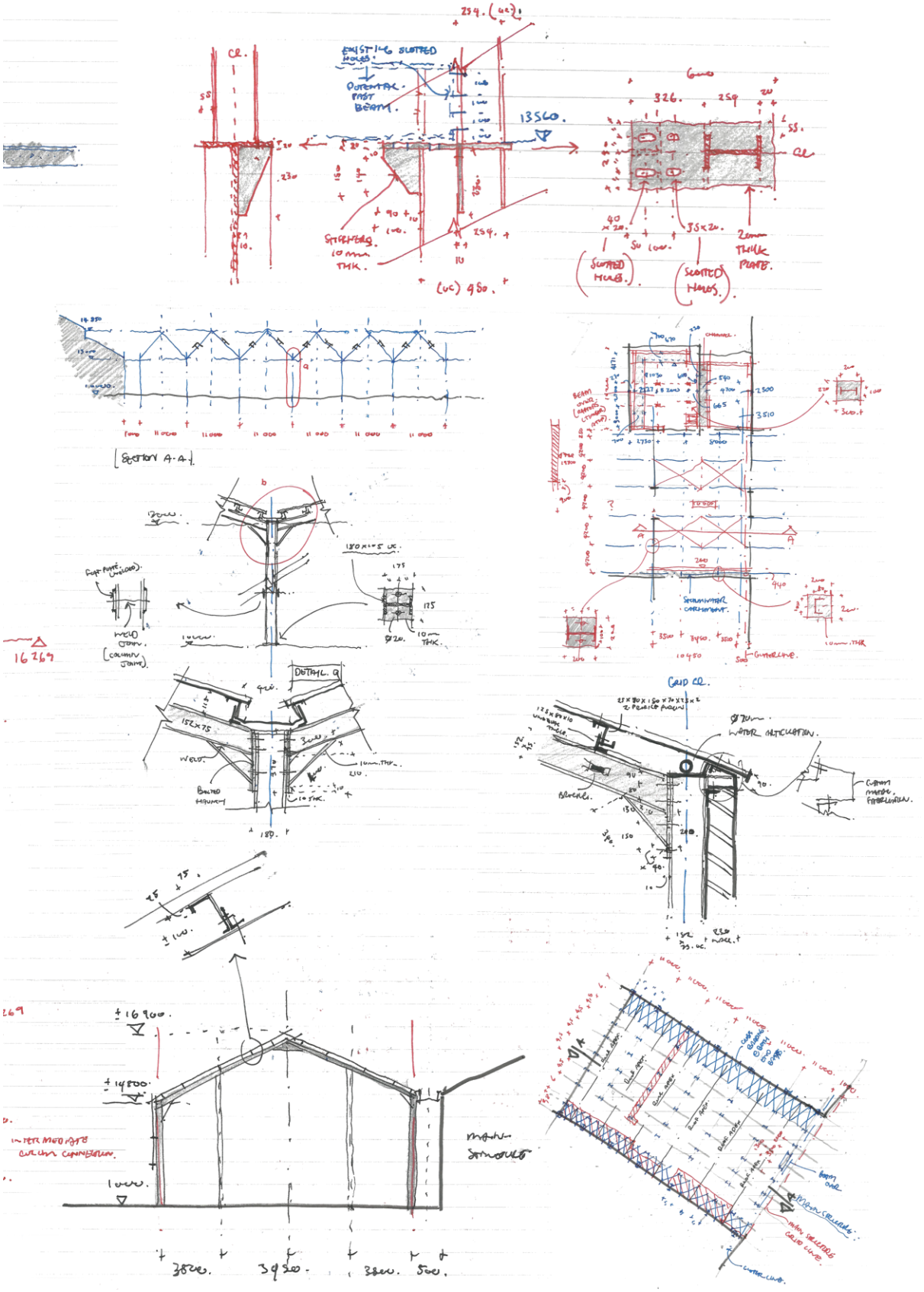


Figure 24: Survey sketches of existing structure of primary building focus (Author,2023).

Approach

When walking through the abandoned structures on-site, one notices how the environment has acted on the building, the presence of decay, dust and growth which has crept into various spaces throughout the structures as an inevitable that the environment will eventually take back the space occupied by the structure, this process of environmental systems trying to merge with man-made structure is present and an aspect I would like to retain or enhance within a new design intervention. Considering the scale of the site, existing structures, and their internal qualities in addition to my reflection on the community and site/landscape, retaining the existing structures is essential not only to extend the use of these structures but to retain the industrial qualities of the site as a reminder of the productive landscape that exists and the scale of the past clay brick manufacturing operations. But, more importantly the 'reuse' and 'adaptation, of the existing structures to new programmatic use without the need for demolition, conserving the enormous amount of embodied energy that was required to make them, reducing the negative impact the built environment has on the environment.

Intervention Strategies

By taking into consideration the qualities offered by the existing buildings in terms of structure, materiality, scale, spatial flexibility, height, and light qualities with the intention that they aid in its potential for new programmatic use, an adaptive reuse strategy was looked at with a specific focus on Lillian Wong's 'Actions as Interventions' approach. These approaches are 'Passive', 'Performative' or 'Referential'.

Actions	Description	Intervention
Passive	• Transformation with minimal alterations to the existing structure.	• Interior Retrofit. • Minimal structural intervention leaving 'DNA' of the host intact. • Temporary user experience, space potentially reinvented based on use during host buildings life cycle. • Host identity suppressed.
Performative	• Host goes through transformation from incomplete to whole.	• Host participates. • Acknowledges hosts through integration of its defining principles.
Referential	• Host 'rejuvenated' through design strategies and actions that are 'co-dependent' on the hosts past.	• Respects confinement of host site and its 'DNA'.

Each one of the three actions acknowledges the existing structure in some way or form. My intention is to engage with the existing structure, acknowledge its qualities and characteristics by actively integrating the existing elements within the new use. To implement this intention the use of ‘Performative’ and ‘Referential’ actions will be incorporated as a design intervention strategy due to their active engagement with the host structure.

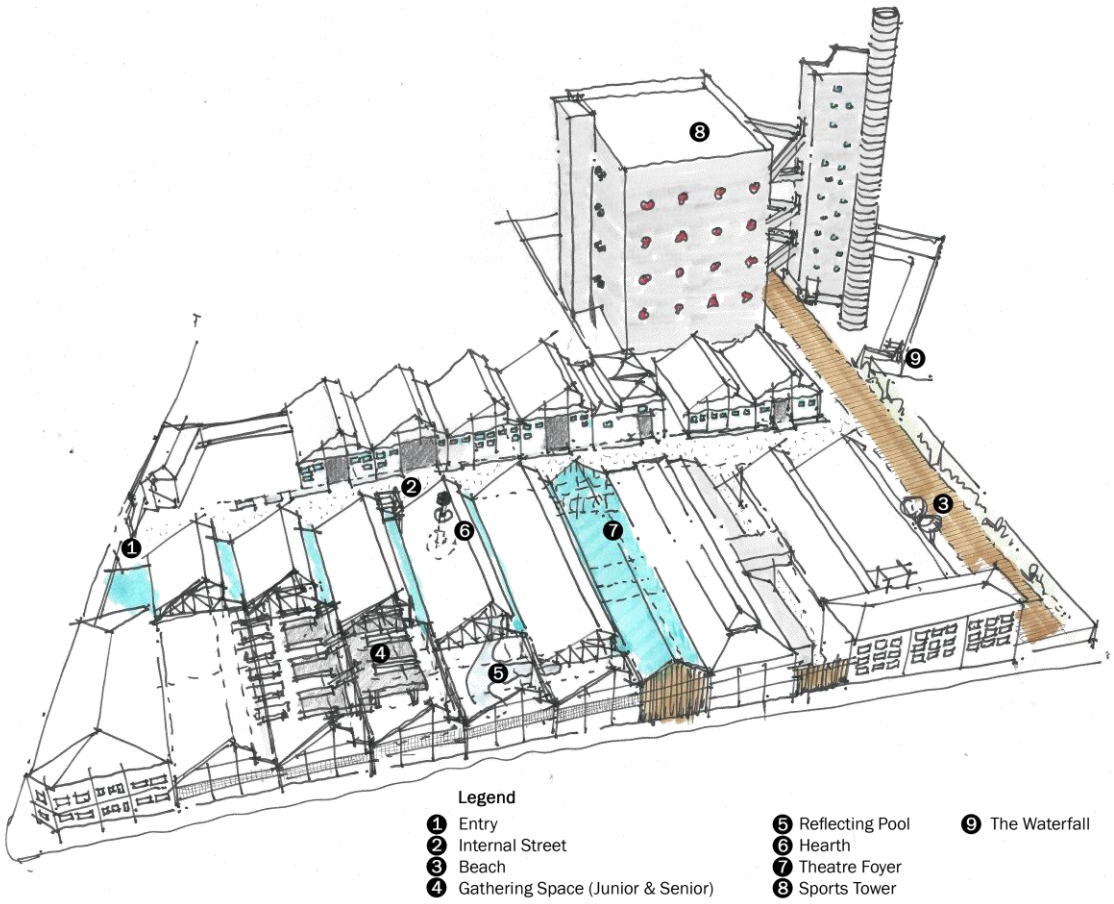


Figure 25: The SESC Pompéia site and its built fabric (Author, 2023) adapted from (Lima et al, 2013).

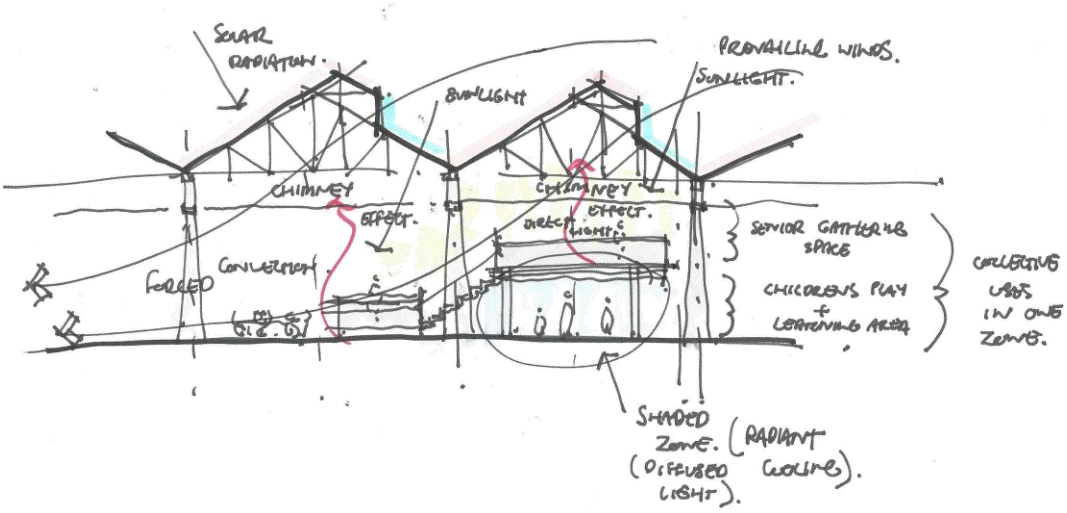


Figure 26: Gathering space thermodynamic application at SESC Pompéia (Author, 2023) adapted from (Benedito, 2021).

Precedence

SESC Pompéia cultural and leisure centre – São Paulo, Brazil (1977-1986)– Lina Bo Bardi

To understand how architects have successfully reused, enhanced, and valued the qualities of an existing structure and their site I looked at the SESC Pompéia Centre designed by Lina Bo Bardi.

The SESC Pompéia is an adaptive reuse project that successfully rejuvenates a site from industrial use to social importance as a cultural centre for the surrounding community.

Lina Bo Bardi sort value in the existing infrastructure in terms of the material, structural innovation of the concrete system and by observing the informal use of the spaces by the community prior to establishing a new programme (Condello et al, 2016). As a result, a social programme for use by the community was thought to be ideal.

Additionally, when analysing the site, Lina Bo Bardi noted that the existing buildings were well orientated to capitalize on the use of São Paulo's climatic conditions, and it is believed that this design decision by the previous architects assisted with the thermodynamics of the internal spaces of the factories and the workers who occupied them. This decision suited Lina Bo Bardi's design philosophy and aided in the existing qualities of the factory spaces. With the removal of a few walls, Lina Bo Bardi "constructed spatial situations for life to occur" (Benedito, 2021:212), by creating a series of internal 'bio-climatic environments', which enhanced the atmosphere of these spaces through utilizing the natural environment to aid in human comfort, limiting the need for mechanical systems. This is a testament to Lina Bo Bardi's strength in analysis, by discovering the qualities of the site and its 'luxuriance' and enhancing them further through actions and interventions.

Figure 27: Existing Kiln – A reminder of its past use (Author, 2023).

Reflection

By retaining the existing structures, I am not only acknowledging its value, but preserving the identity of its past use and participation in resource extraction that existed on site, which although may be seen in a negative light, is a part of the context's history of productivity.

By demolishing the existing structure, I am trying to erase its past and in so doing potentially allowing the rubble to form part of the landfill, unilaterally extending the sites role in damaging the environment. Thus, seeing the existing in a positive manner for potential new use is essential to limit environmental damage, retaining a building's embodied energy as long as possible, and in so doing conserving the planets resources.

The existing structure offers spatial qualities of vast open plans that are an asset in its potential for reuse and due to its scale, potential for various programmatic uses.

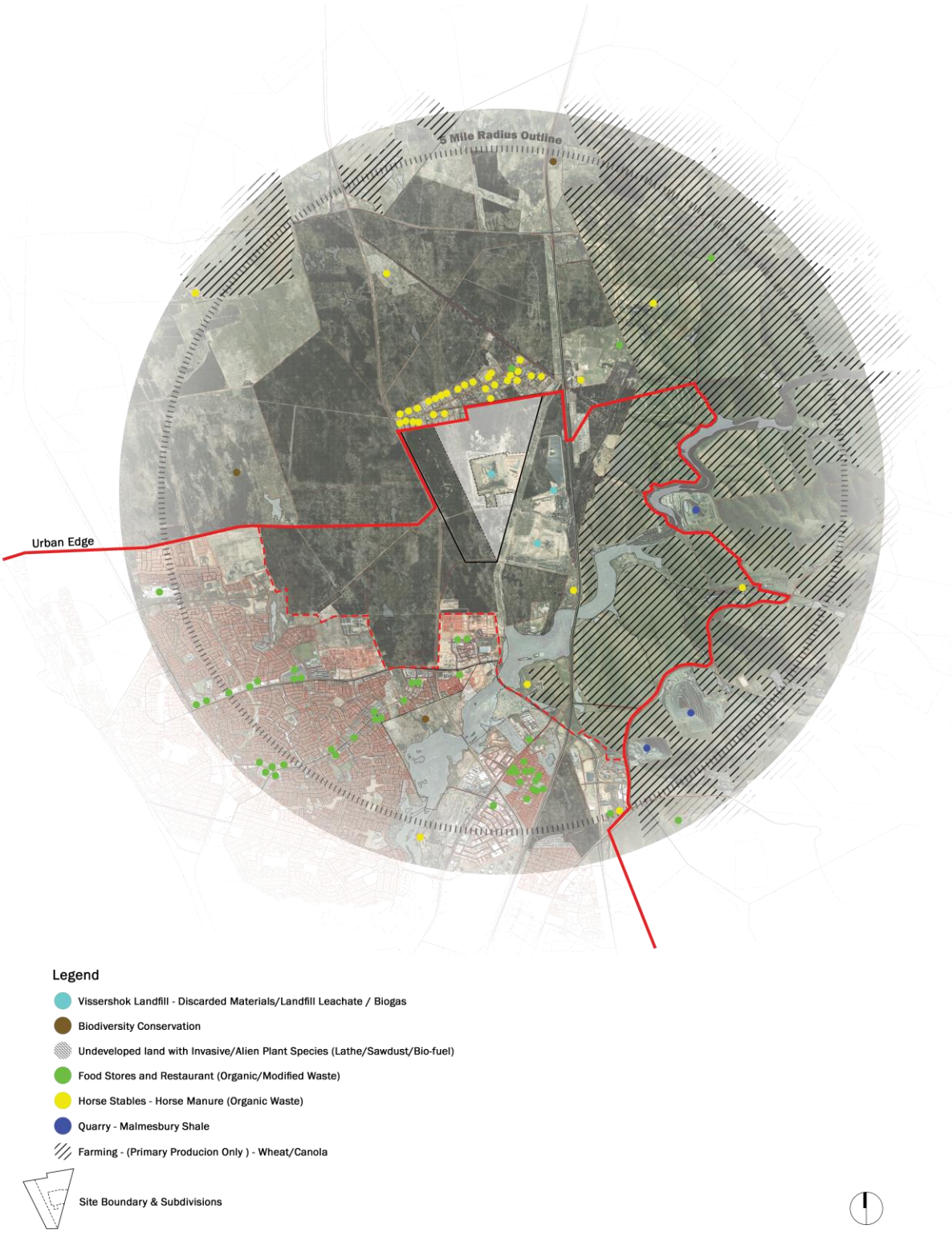


Figure 28: Locally Available Materials - The 5 Mile Radius material sourcing method (Author, 2023).

Material

Sourcing

Material selection in my opinion is probably one of the most important decisions an architect needs to make when it comes to design as it impacts ecological, thermal, spatial, and technological decisions. Material selection should not only be based on its aesthetic appeal. The process of architecture from design to construction to reuse must pay careful attention to material use and sourcing. An architectural design from a practical point of view cannot be conceptually drawn up with the purpose of being realized without a clear intention from the architect of what materials they intend to use for the making of the built structure. As long as we continue to source and utilize materials that are major contributors to environmental damage and are highly processed, limiting their reuse or recyclability, the likelihood of these material impacts continuing remains high.

The site and context have a history of materiality and production, my intention is to bring forward these 'local' materials in the architectural design, highlighting the connection to place (DeSilvey, 2017:12). To assist in the extent of local material use within the vicinity of the site I will be utilizing architect Laurie Baker's 5-mile radius method (Figure 28).

Use

Extracted

Stone, a non-renewable resource, is considered a highly functional material due to its compressive strength, resistance in fire protection, water exposure, mechanical erosion, and weathering. Stone can be used in many building applications such as foundations (above or below ground), lintels and various wall applications (Dall, 2022:80). The potential of stone to be utilized as a reusable building material is "viable when the stone is minimally cut and used in large, regular volumes, with minimal invasive fixings", including how the stone was quarried and how it is used as a building material to allow for easy removal without damage, maintaining its validity of use (Dall, 2022:85).

Clay forms part of the origins of the brick walls of the existing structures and use of the site as a clay quarry and ROK brick manufacturing plant. To retain a relationship with the soils of the site, the use of clay is fundamental. However, since the site has gone through a process of extraction of clay, ideally my intention would be to allow the clay used in new construction to be allowed to return to the site when the structure has reached its lifespan. To do this clay would need to be minimally processed, air dried and not fired for it to not only return to the earth, but if carefully handled can also to be utilized in new construction as a regenerative resource (Dall, 2022:28). This further offers the opportunity for the architecture to be created to carry an identity rooted to place through a process of material conservation (DeSilvey, 2017:12).

The Wohnhaus Flury building in Deitingen, Switzerland by Spaceshop Architects is an example of the use of unprocessed materials that can potentially return to the earth or be reused again as a regenerative material in another project after their current use. The monolithic cob walls are made from locally sourced materials of clay and straw mixed together, finished by cutting the excess cob from the walls generating a rammed earth appearance.

Figure 29: Wohnhaus Flury – View of one of the internal cob walls (Lewis et al., 2022).

To engage further with the clay soils of the site I experimented with adobe brick making as a result of identifying the remainder of materials need to make the bricks were available within a 5-Mile Radius of the site.

Figure 30: Initial Experiment using cardboard moulds. Straw, Clay and Cement (Left), Clay and Straw (Middle) and Clay and Cement (Right) (Author, 2023).

Using the Brick making method outlined by Johan van Lengen in his book ‘The Barefoot Architect’ I created the following adobe brick.

Figure 31: Documenting the Adobe Brick Making process using Clay, Straw, Sand and Horse manure (Author, 2023).

Harvested

The farming practices in the area are predominantly monocultural in that they produce wheat or canola and rotate between the two. Wheat once harvested and kernels removed from the stalk creates a by-product known as straw and is not nutritious as feed for animals and thus is either used in animal stalls as bedding or ploughed back into the farmlands to enrich the soil. Alternatively, once baled they are also utilized in the building industry for strawbale construction. As a potential regenerative material, strawbales can also return to the earth if used in conjunction with natural plasters, binders and paints that are biodegradable. Strawbales are essentially large bricks and many of the various types of brick courses can be translated into strawbale construction. Technological advancement has also allowed straw to be compressed into panels or extruded cables that offer alternative options that the conventional strawbale doesn't (Hebel et al., 2014). Advancement and exploration of alternative construction methods using straw will increase the application of the use of straw in the industry further. However, some architects are utilizing strawbales in innovative ways such as Atelier Werner Schmidt in the design of the Gartist GmbH House in Zurich, Switzerland where strawbales are utilized in the floor walls and corbelled roof.

Figure 32: Strawbale corbelled roof structure of Gartist GmbH house (Lewis et al., 2022).

Reuse

Our society is energy demanding and the built environment plays a large role in energy usage and carbon emissions, which in turn contributes to climate change. This includes the whole lifecycle of materials from extraction, distribution, production, consumption, and waste generated from all these processes which in many cases are very energy demanding. There is a push from global sustainability agendas for industry to source materials that are local and less damaging to the environment through its lifespan including the possibility of upcycling and reusing the building material (Van Wyk et al, 2012:671), preventing the demolished building products from entering landfills and contributing to the generation of greenhouse gases, considered a more damaging air pollutant than carbon dioxide for the environment. Should buildings have an end-of-life or rather a transition of use? This is a relevant question when we consider that most buildings when demolished their materiality ends up buried in a landfill whilst new virgin materials are used to construct a new building. The construction industry is one of the major contributors to landfill growth and at Vissershok Landfill it is the second largest contributor to landfill waste, the first being general municipal household waste.

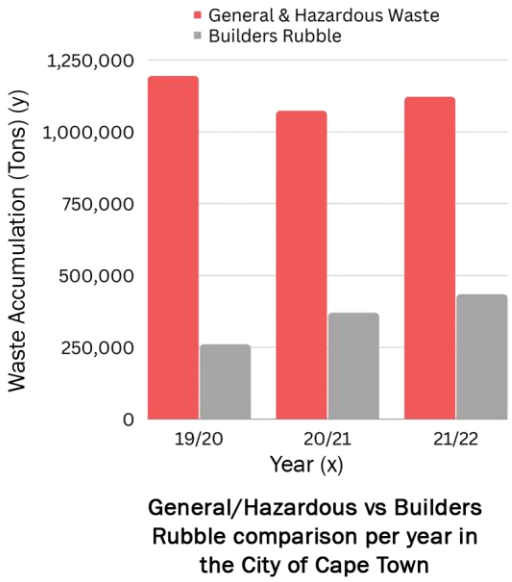


Figure 33: Landfill stats (Author 2023) based on data collect from City of Cape Town's open data portal (Anon, 2020).

With current bulk material resources becoming limited in the near future, sourcing alternative materials are a necessity. Marshall et al have researched the possibility of looking into utilizing buildings assigned for demolition, with a particular focus on limiting concrete waste at landfills and extending the life of concrete material through displacement from the existing building and assigned new use within a new building (Marshall et al, 2020:9).

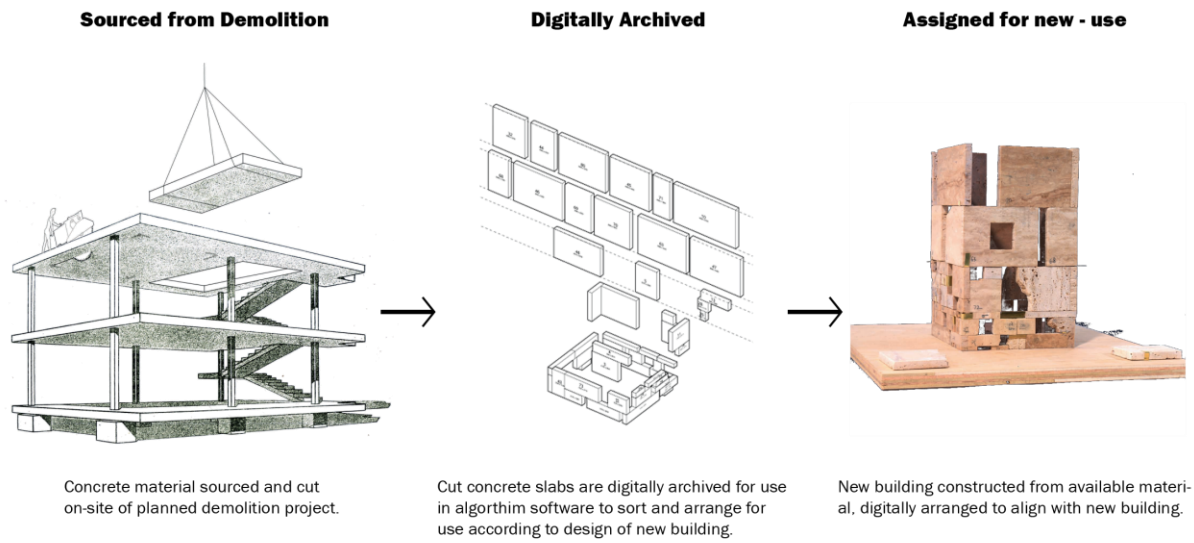


Figure 34: Daniel Marshalls 'Holding Patterns' – A process of extending the life of concrete from buildings assigned for demolition (Marshall et al., 2020).

Waste

Waste is generally categorized as modified, organic (natural) or inorganic (man-made) matter which largely decomposes to either form compost (natural) or toxic leachate (man-made). Both cases of decomposition release C02 into the atmosphere with the former potentially releasing other harmful gases due to the toxicity which takes place inside landfills containing buried mixed matter decomposing at various rates over time. This toxic leachate, a by-product of landfill production requires further treatment and if not managed properly has the potential to leach into the ground water causing further environmental damage.

Waste will always exist. But how we treat waste has constantly been an issue together with our choice in the use of non-recyclable materials. By valuing waste and seeing it as a raw material we can potentially release pressures on our raw material extraction processes and the burying of materials in the ground. Granted not all waste can be reused or recycled. Hebel et al states that reduction in the use of non-recyclable materials is a must, but until such time as regulation allows, what do we do with non- recyclable materials? Hebel *et al* has derived a waste classification system based on modification processes of waste material which ranges from Densified, Reconfigured, Transformed, Designed and Cultivated. These classification processes may offer solutions to extend the life cycle of so-called waste materials or for the storage of non-recyclable materials through modification and new use until such time that these materials may be recycled, if at all. However, this process requires a strict sorting of materials by type to prevent contamination by dissimilar materials, which would hamper the potential of the modified material to be re-modified or recycled in the next life-cycle stage (Hebel et al, 2014:35).

The architectural firm Rural Studio actively works on projects that utilize salvaged materials and materials considered as waste. In the exhibition design for the XXI Triennale International Exhibition, Milan 2016 with the theme '21st Century Design After Design – Architecture as Art' the firm designed a temporary space for 'meeting and debate' utilizing recyclable densified waste bales stacked on top of one another forming racked seating which faces onto a central void. The waste bales after the exhibition return to their lifecycle of being recycled for new use, leaving no waste behind and in so doing questions the actions designers make to conserve our material resources and extend their lifecycles, highlighting societies wastefulness and unsustainability.

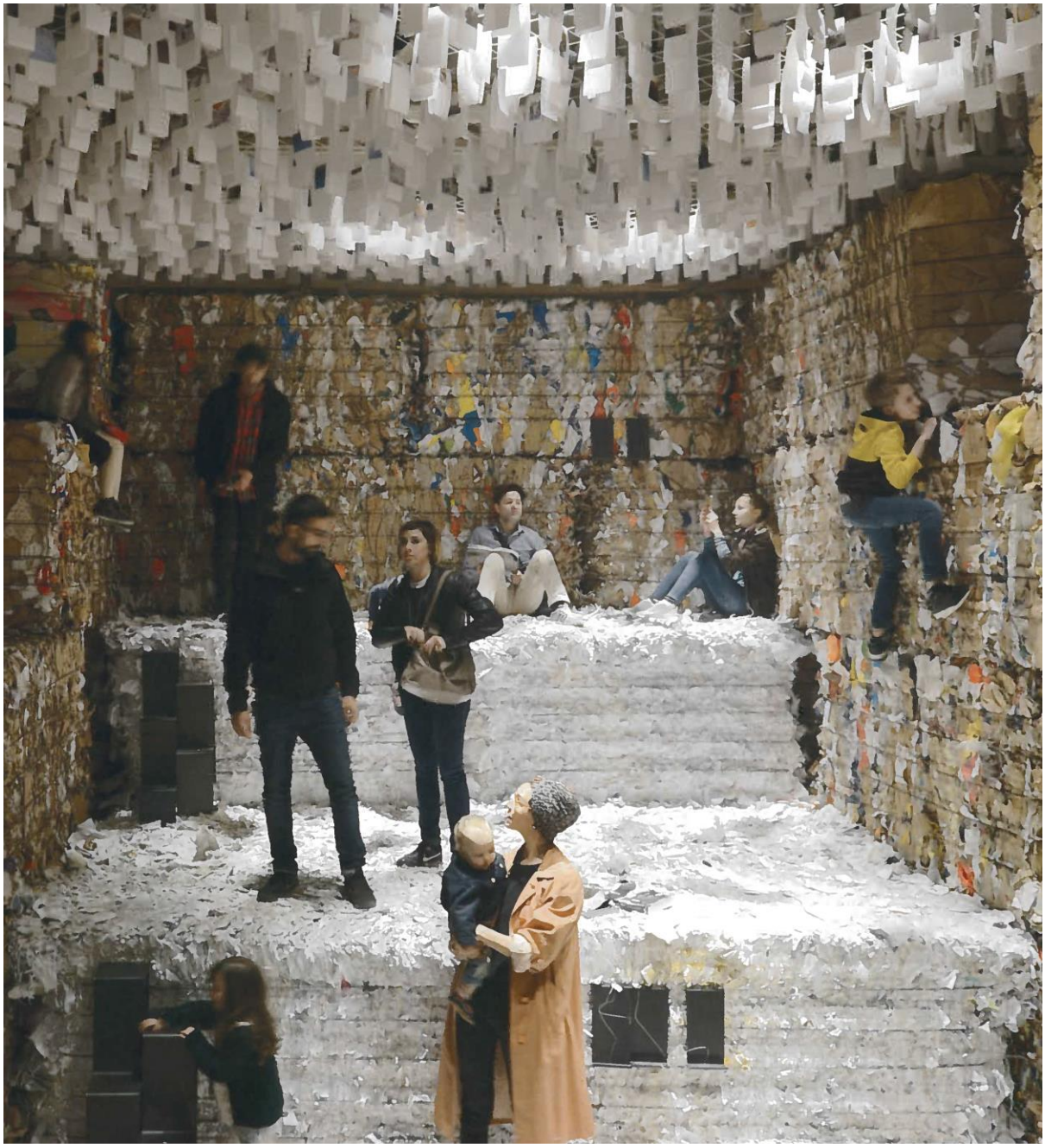


Figure 35: Rural Studio's Exhibition for the XXI Triennale International Exhibition, Milan 2016 (Nicolin, 2016).

Making Process

The process of making requires energy, the amount of energy is determined by the treatment and stages that a material or materials go through to make up the complete product. In a world where rising temperatures need to be kept to a minimum to continue creating a habitable planet, refining a materials manufacturing process can go a long way in reducing the release of carbon dioxide into the atmosphere. An increase in carbon dioxide aids in the increase in temperature changes related to the effects of climate change, keeping carbon from being released will help in reducing temperatures. The making of materials through a linear process leads to the generation of waste which further aids in environmental damage (Treggiden, 2020:19).

Materials such as cement, concrete, steel, aluminium are a few of the major contributors to carbon emissions from the built environment globally. This largely has to do with their process of production, the chemical processes involved, and the energy required in there making (Dall, 2022:81), (Lewis et al, 2022:7). To understand the environmental impacts of a materials production process further, sourcing a material based on its embodied carbon can help identify materials that have a higher and lower carbon footprint. Embodied carbon is the amount of carbon released in terms of the energy used in the making of a material from 'extraction to disposal' (Dall, 2022:115). With the need to reduce our carbon footprint by 45% globally by 2030 and to zero net by 2050 it is essential that architects actively design and consider utilizing materials with a low embodied carbon in order to help meeting these carbon targets (Lewis et al, 2022:7). (See Figure below)

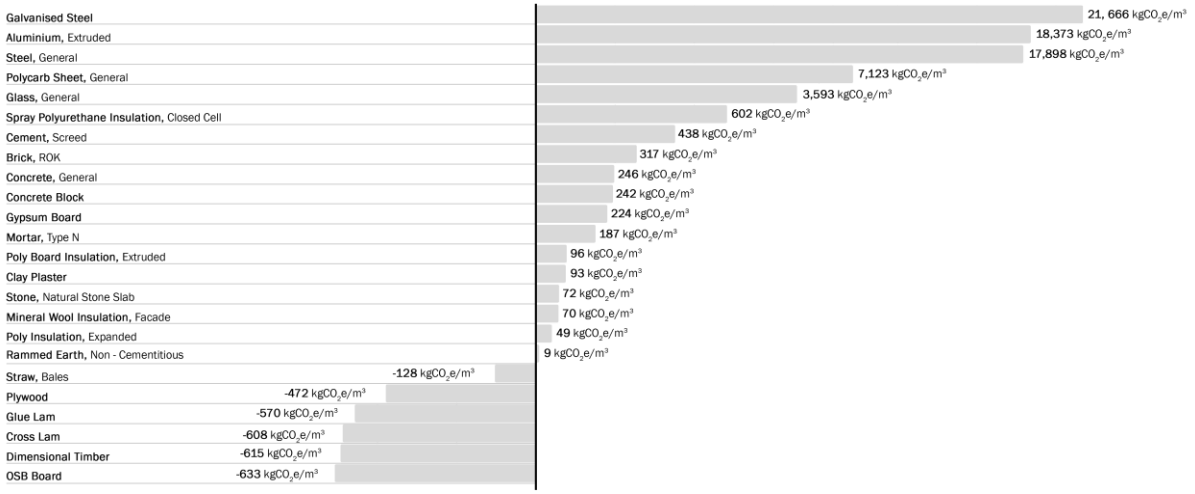


Figure 36: Embodied Carbon Table of a few common building materials (Author, 2023) based on data obtained from (Lewis et al, 2022:337).

Based on the table above, most of the materials that have zero to negative embodied carbon are considered to be in the category of bio-based materials, in that they are sourced from cyclical processes that are regenerative. However, for bio-based materials to be effective in its contribution towards lower carbon footprints stewardship of the land where the raw material is grown must also be looked at in terms of the farming practices and their impact on the ecosystem. Essentially, we need to work holistically with nature, understand its biodiversity and their systems so that we may work alongside them (Dall, 2022:99). Buildings that utilize bio-based materials essentially become carbon storage devices which we occupy, since these materials capture and store carbon naturally prior to their modification as a building material (Lewis et al, 2022:7). One way to reduce the energy demand in the making of materials is to reduce its energy demanding process in the production of the material, its embodied energy and specifying materials with a low carbon impact. Materials

that are bio-based have further potential in waste production after their lifespan and in most case can decompose back into the earth or be preserved through a process of care and maintenance to extend its lifespan further.

Figure 37: Site landscape (Author, 2023).

Landscape

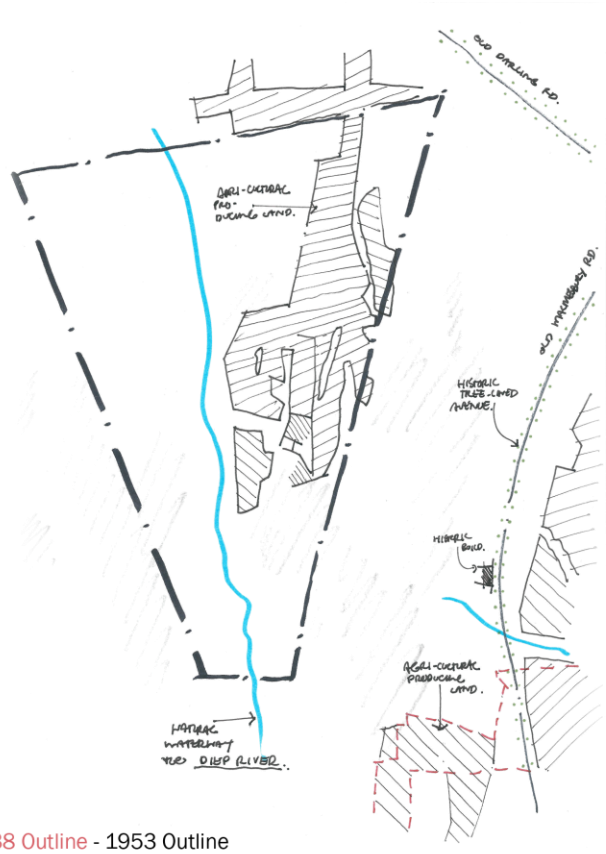
The site and context largely consist of productive landscapes containing multiple uses ranging from a nature reserve, farming, mining and landfill (burial of waste) with the latter two particularly having a profound impact on the landscape and health of the neighbouring communities.

These impacts relating to the community, land and our connection to them are intended to be highlighted through the rehabilitation of the site's infrastructure and landscape for new use through programmatic implementations that are beneficial for the community, landscape and the city from a health, productivity and educational point of view.

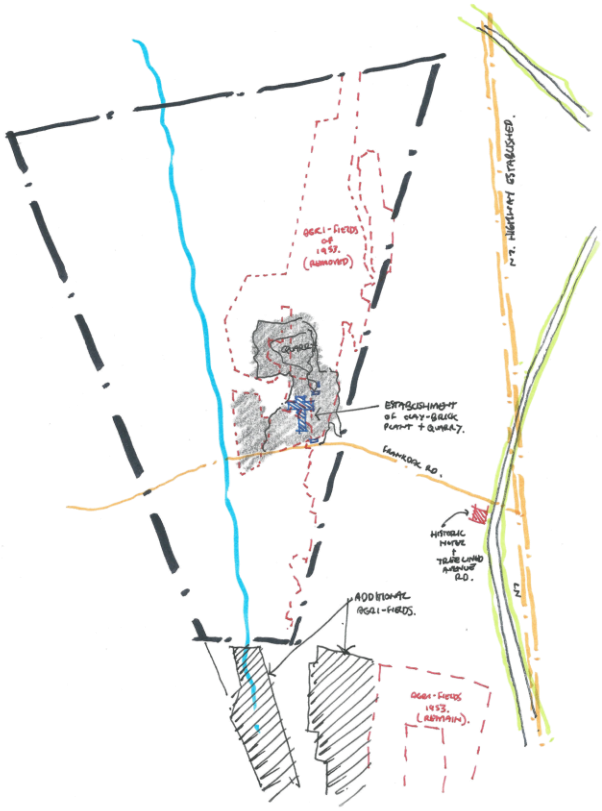
Morphology

To understand how the landscape has changed during its different uses from agricultural, mining and then to landfill over the past 90 years, a study based on aerial photographs of the site was drawn up to highlight the various impacts the changes in land use caused.

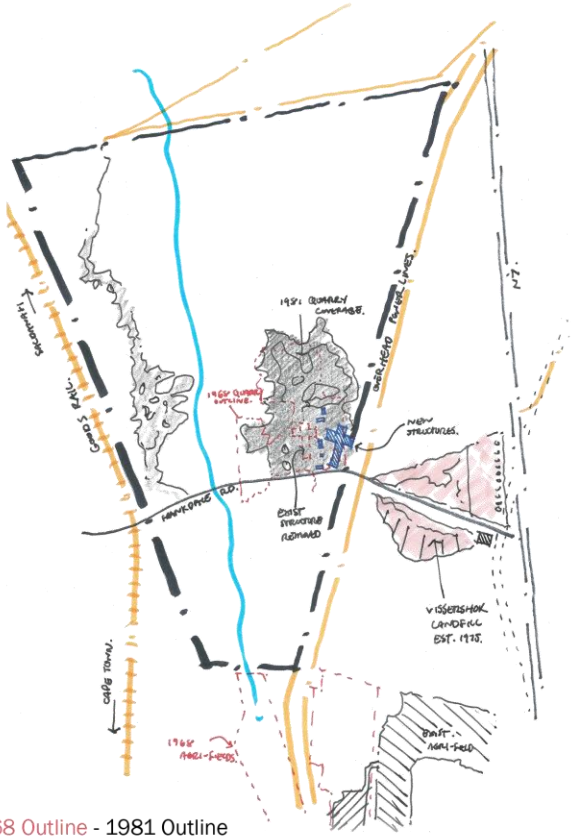
The purpose of this exercise is to understand the extent of the alteration to the landscape and length of time the landscape has been impacted by productive uses, which has contributed to the health of the natural biodiversity of the site.



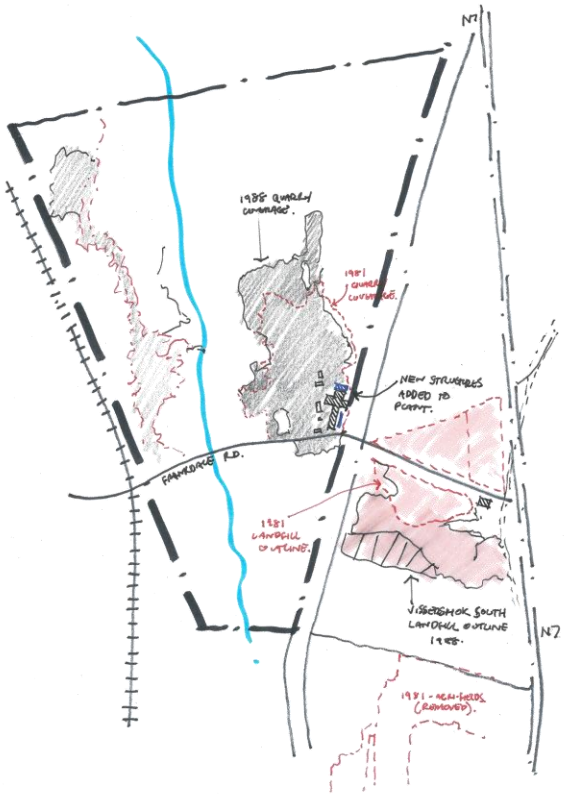
1938 Outline - 1953 Outline



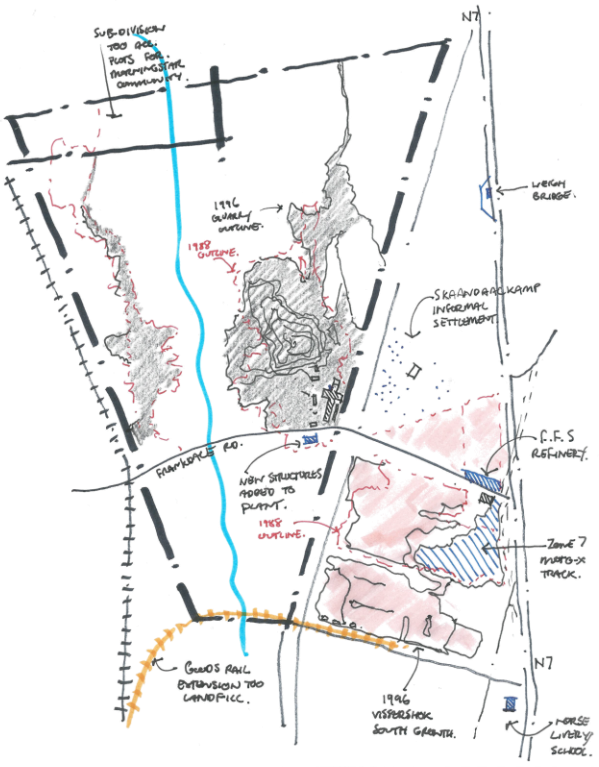
1953 Outline - 1968 Outline



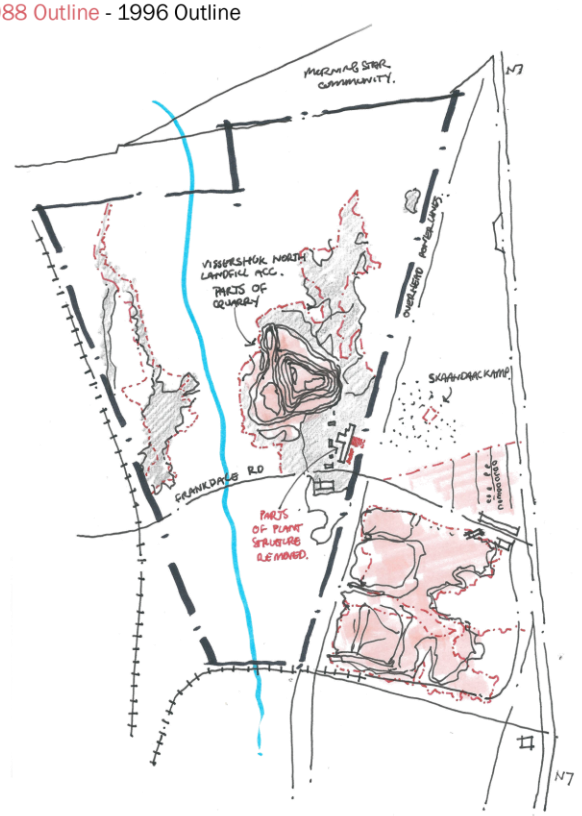
1968 Outline - 1981 Outline



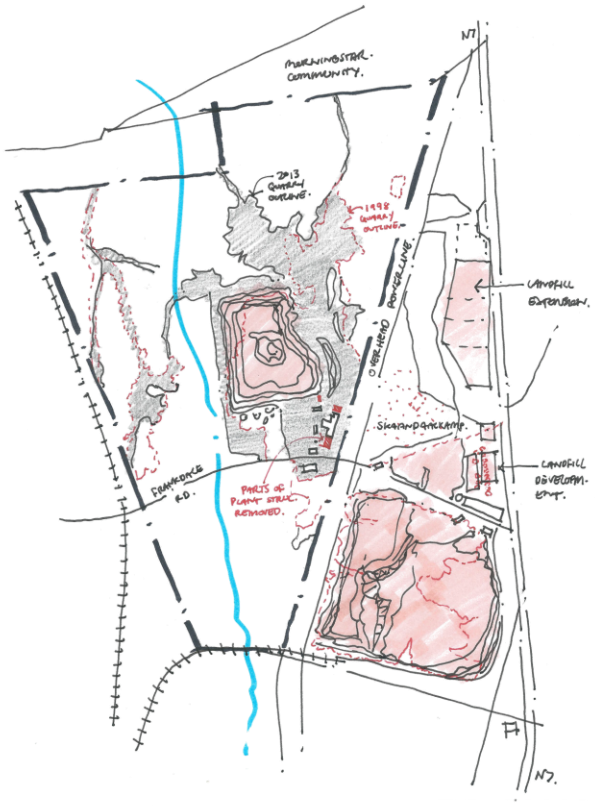
1981 Outline - 1988 Outline



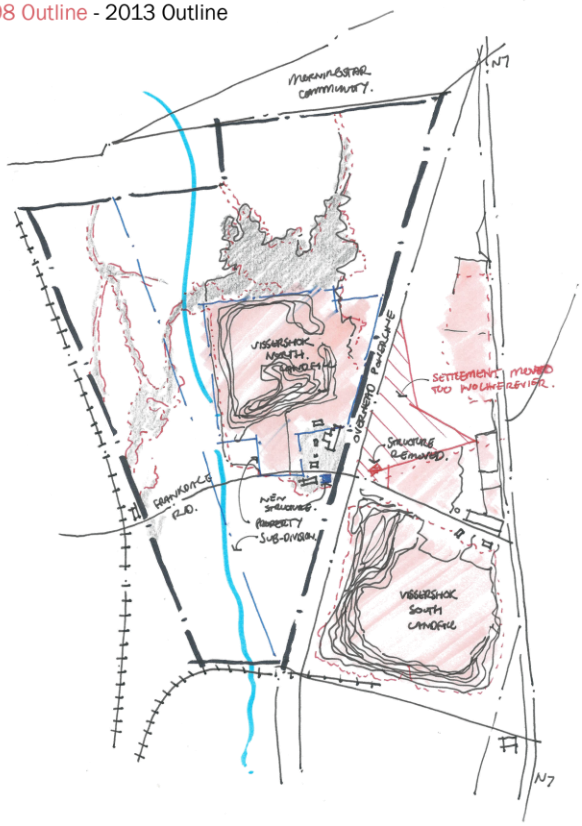
1988 Outline - 1996 Outline



1996 Outline - 1998 Outline



1998 Outline - 2013 Outline



2013 Outline - 2016 Outline

Figure 38: Landscape Morphologies from 1930's to current (Author, 2023).

Biodiversity

Ecologically the context has been transformed largely by the linear processes of 'Take', 'Make' and 'Waste' which has contributed significantly towards biodiversity loss. There are parts of the site and its neighbouring context to the west, which form part of the historic cape floristic region, considered of high ecological value and universal significance (Jennings et al, 2010:6). The region contains lowland fynbos species of the cape flats sand fynbos type with Swartland shale renosterveld and Cape Flats dune Strandveld located further to the west of the site at Blaauwberg Hill nature reserve.

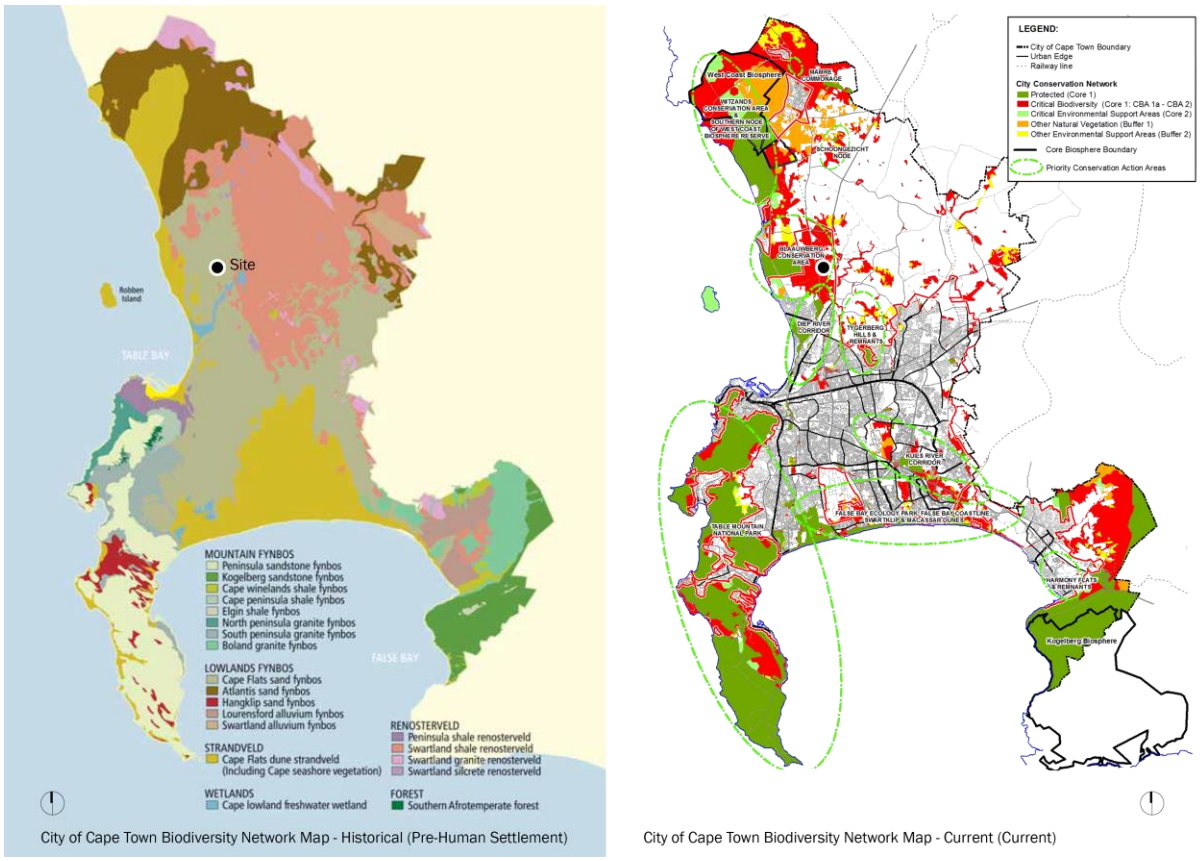


Figure 39: Impacts on Biodiversity – Historically and currently (Jennings et al., 2010).

Notwithstanding, the sites ecology has been significantly impacted by land-use, illegal dumping of waste and lack of stewardship of the land, identified by the uncontrolled growth of alien plant species which has contributed to a reduction of lowland fynbos species population (Mucina et al, 2006:140)

With the species being listed as critically endangered and the site located in an area considered to have the most extensive availability of the species type available in the region, the potential biodiversity loss and species extinction may be significant (Blaauwberg Spatial Development Framework, 2022:30)

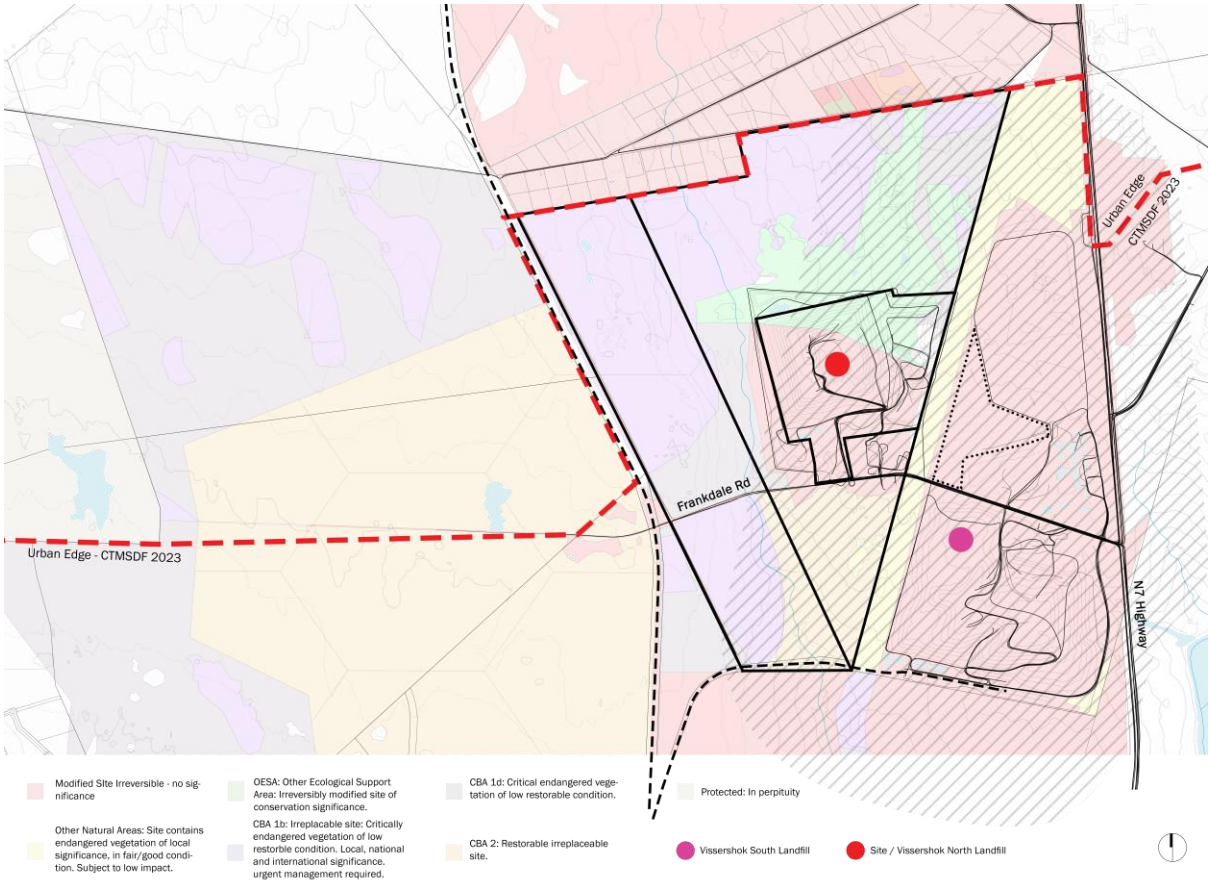


Figure 40: Critical Biodiversity Areas within the site and neighbouring boundaries (Author, 2023).

Although the site has gone through various transformations throughout its history, the presence of dumped matter and unutilized building stock when undisturbed over time, has allowed soils to gather on their surfaces. When the process of decay started to act on them, a process of reconciliation seems to have taken over in the form of a novel ecosystem, whereby vegetation has found a means of resilience and adaptation amongst a landscape of waste and ecological disturbance (Refer to Figure 41).

Ecologist may find it worthwhile to study the processes of novel ecosystems, especially in an environment that has gone through many changes and poses many hazards. With the lowland fynbos species potentially been heavily impacted by climate change (Mucina et al, 2006:136), resilient species that can adapt to changing conditions or assist with the protection of the fynbos species may need to be considered. With the potential of landfill remediation, cultivating the remaining fynbos species and novel eco-systems with the rejuvenated landscape maybe pivotal in sustaining the species and researching further the resilience of species that have remained. Whether we like it or not architecture will impact the ground and affect/damage the immediate environment at the very least. With land use becoming a primary issue in the destruction of biodiversity, we must consider a designs impact on the earth especially as the natural environment is critical for humans to have a future on this planet.

Figure 41: Growth amongst disturbance (Author, 2023).

Repair

Ecologically Vissershok landfill has disrupted the land which includes its vegetation, air, and groundwater. However, it cannot be solely blamed as parts of the ecological damage is inherent from past industrial and agricultural practices prior to becoming a landfill. All three processes of agricultural, quarrying and landfill involve the process of altering the earth, some more impactful than others. The issue with the process of earth moving is that it disrupts naturally formed ecological systems. So why do we disrupt the land? Douglas spencer believes that the potential fixed capital of raw material that is contained in the earth and our desires of commodities allows for this process to continue until resources are dried up and scarce (Spencer, 2012:84). From an ecological point of view, according to David Chambers there has been mention of the potential rehabilitation of Vissershok South Landfill (City owned) once it closes to form part of the Blaauwberg Nature Reserve and act as a recreational area for neighbouring communities (Chambers, 2016).

The potential new use of a landfill after it has been decommissioned creates an intriguing prospect and an interesting proposition for the existing infrastructure of the site and its potential new use. But how do you rehabilitate a landfill? Depending on the current and planned use of the landfill a process of remediation is necessary to determine whether the site is safe for public use (Grudziecki et al, 2016:47). The potential challenges of remediating a landfill site are highlighted below (Figure 42).

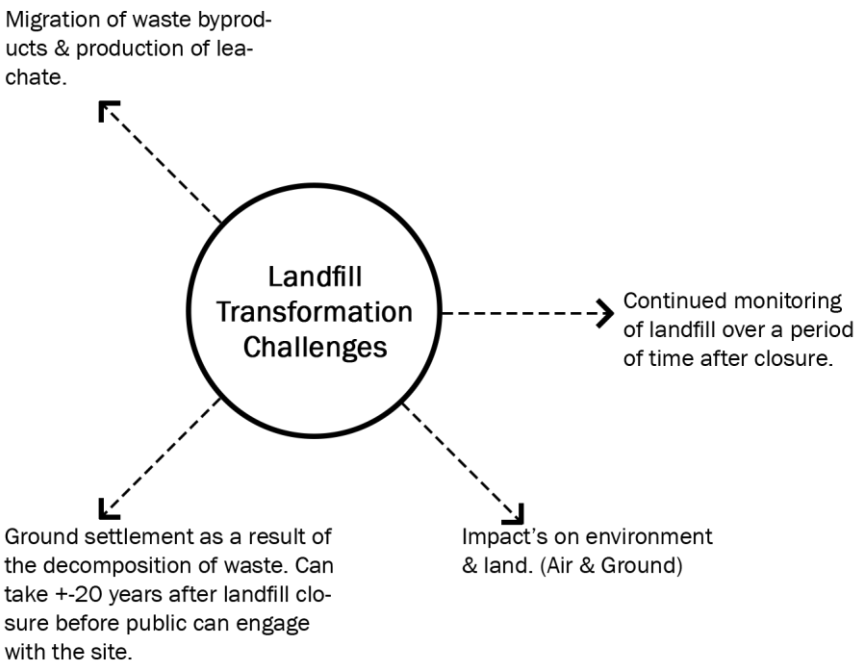


Figure 42: Landfill Transformation Challenges (Author, 2023).

However, these challenges could vary depending on what was buried in the landfill, how it was managed, its rate of decomposition and what classification the landfill carried, for instance the Vissershok Landfill is classed as a landfill for the deposit of municipal solid and hazardous waste.

Approach

Landscape Architect Mira Engler's theory of the eight approaches to waste related design is useful in determining the approach to the use of the landfill once it closes. The choice of approach to the landscape will be determined by whether I want to align the landscape to the building program and how I want to strengthen the designs social aspect and public engagement with the landscape. The remediated landfill can reinforce the publics engagement with the site through social aligned programmes and can aid in the public's understanding of the sites history of earth moving and what happens to our waste, including its process of burial and decomposition, as well as its effects on the community and context (Meyer, 2007:62).

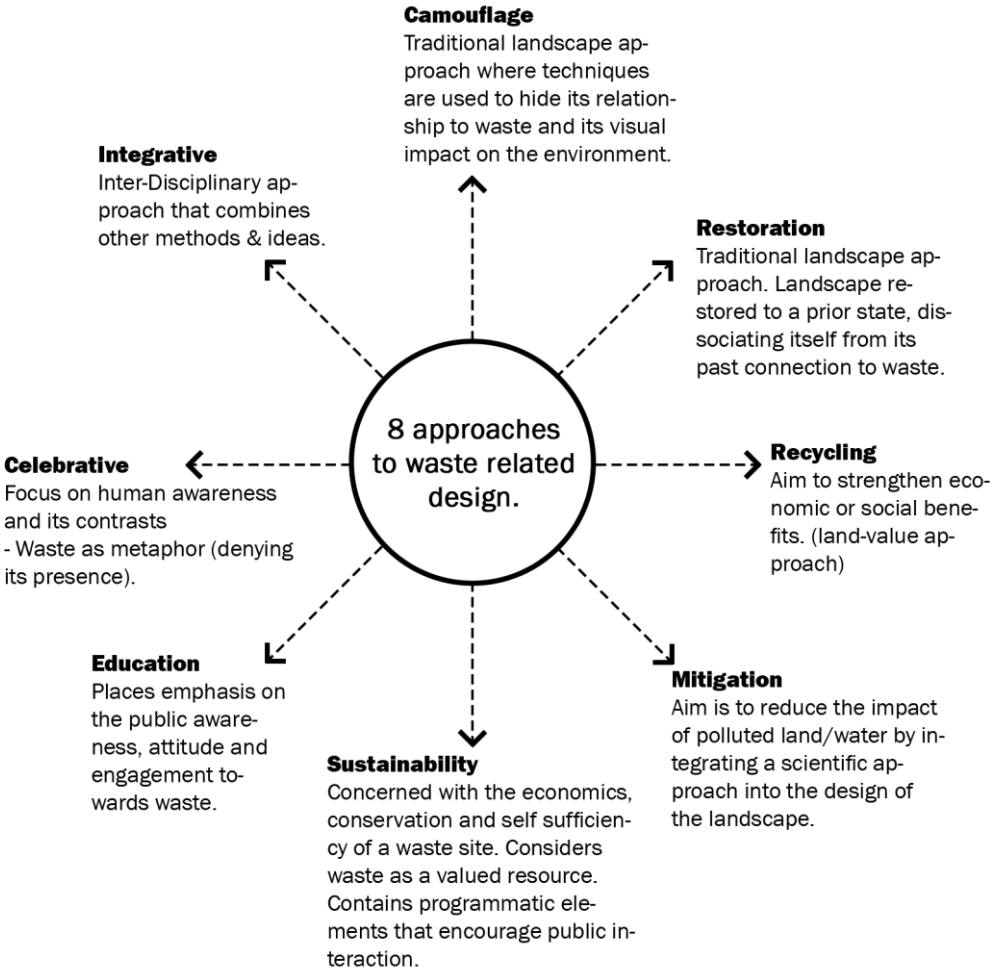


Figure 43: Mira Engler's Eight approaches to waste related design (Author, 2023).

Figure 44: Phase 1: Byxbee Park (Anon, 2023).

Precedence

Byxbee Park, Palo Alto, California, USA (1989-1991) – Hargreaves Associates

The 12 hectare phase one design of Byxbee park by Hargreaves Associates is an example of an integrative approach from landfill to park in that the designer incorporated elements of its past as a landfill by utilizing and bringing to the foreground materials that were buried in the landfill through artifacts and sculptural interventions (celebrative approach) that litter the park as a reminder of its past use (Engler, 1995:21).

Although one could argue that a camouflage approach is incorporated to hide the landfill, there is a sensitivity applied to how to deal with waste sites, for instance the careful selection of hardy native grasses that require no irrigation, the use of no trees and impermeable pathways to prevent the clay capping applied to seal the landfill from being compromised and incorporation of swales to filter stormwater runoff hinting at a restorative & mitigative approach.

Figure 45: Dialogue between interior & exterior (Author,2023).

My intention is not to hide its past use as a landfill from the public, but to see waste in a different light than from its use on the site as a landfill to bury matter. Waste is a social issue that needs to be brought to the awareness of the public. “By masking waste sites, we continue to inhibit public perceptions and restrain public care for waste problems” (Engler, 1995:17). Therefore, my approach to landscape is ‘Integrative’ with an approach of restorative, educative, recycling, and sustainable.

My intention for the site is to restore the damaged biodiversity by removing the alien plant species on the site that are restricting the growth of the fynbos in the area an allow the site to inherit conservation management practices to ensure the growth of the fynbos species flourishes and returns to a healthier state than currently. However, an understanding of novel ecosystems that may have forged with the waste matter on the site must be considered for conservation worthiness in terms of resilient species that have managed to adapt to the current landscape, therefore parts of the landscape where these novel ecosystems take place should be maintained and allowed to continue to grow and serve as reminders of the past use of the site as a landfill and educative in terms of understanding how these ecosystems have forged.

In terms of the landfill a recycling approach will be utilized by capping the landfill with soil to allow for the growth of native plant species over the landfill essentially creating a park, which in many ways will hide the waste that is buried below, however the addition of an educative approach is intended to remind visitors who will be able to hike up the landfill of the awareness of its past use.

With the existing buildings on site intended to breathe new life with new programmatic functions and design interventions that are aligned to integrate the community and educate the public on a landscape currently devoid of public interaction due to their activities, I intend to bring the community and public closer to the issues of waste management, our need to value waste as a raw material and the importance of working with and enhancing the landscape we impose.

Figure 46: The open plan of the largest building on-site (Author, 2023).

Spatial

Since the structure was initially designed for industrial use with one programme, my intention is to incorporate more than one programme with an industrial and social agenda integrated or separated but juxtaposed amongst or between each other forming these in-between spaces. In addition to the potential of introducing social programmes, I am potentially encouraging the public to be more aware of sites such as these, which are usually not widely interactive with public engagement due to its use and issue of health and safety relating to the landfill.

With waste being an issue globally, adaptive reuse may further strengthen the programmatic intension for the site and its awareness in the fight for waste reduction and material reuse. In-between spaces questions what happens to spaces that occur because of formal geometry implications. The spaces that occur in and around new and old building stock to support new functions (Tschumi, 2012:267).

This acts as a useful spatial tool when it comes to working with sites containing existing building stock as they can be used to separate uses and define spaces of public/semi-public to private, with transitional spaces acting as the connectors. The Le Fresnoy National Studio for Contemporary Arts by architect Bernard Tschumi is an example of a project that encumbers the strategy of in-between spaces, whereby the architect utilized a series of abandoned buildings that were earmarked for demolition. Although the buildings weren't in the greatest condition, Bernard Tschumi sought value in the existing buildings through observing the quality of the existing built fabric and there accompanying spaces, including their appropriated use by the community (Tschumi, 2012:261). To preserve these qualities and introduce new technologies to improve the buildings performance the architect comes up with a design strategy of "superimposing a new roof on an old one. Then you activate the in-between region by inserting ramps and walkways that artists, students, and visitors will use" (Tschumi, 2012:265). Although 'connectors' such as ramps, stairs and walkways are a standard requirement in most buildings for the movement of people through spaces, at Le Fresnoy they become something more.

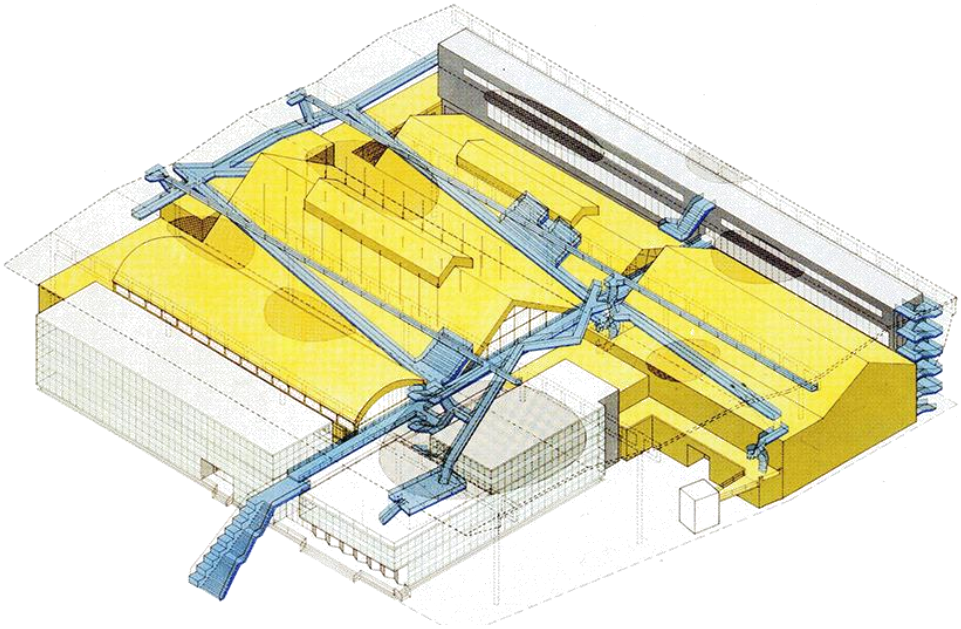


Figure 47: Le Fresnoy Project diagram – Bernard Tschumi (Tschumi, 2012:264).

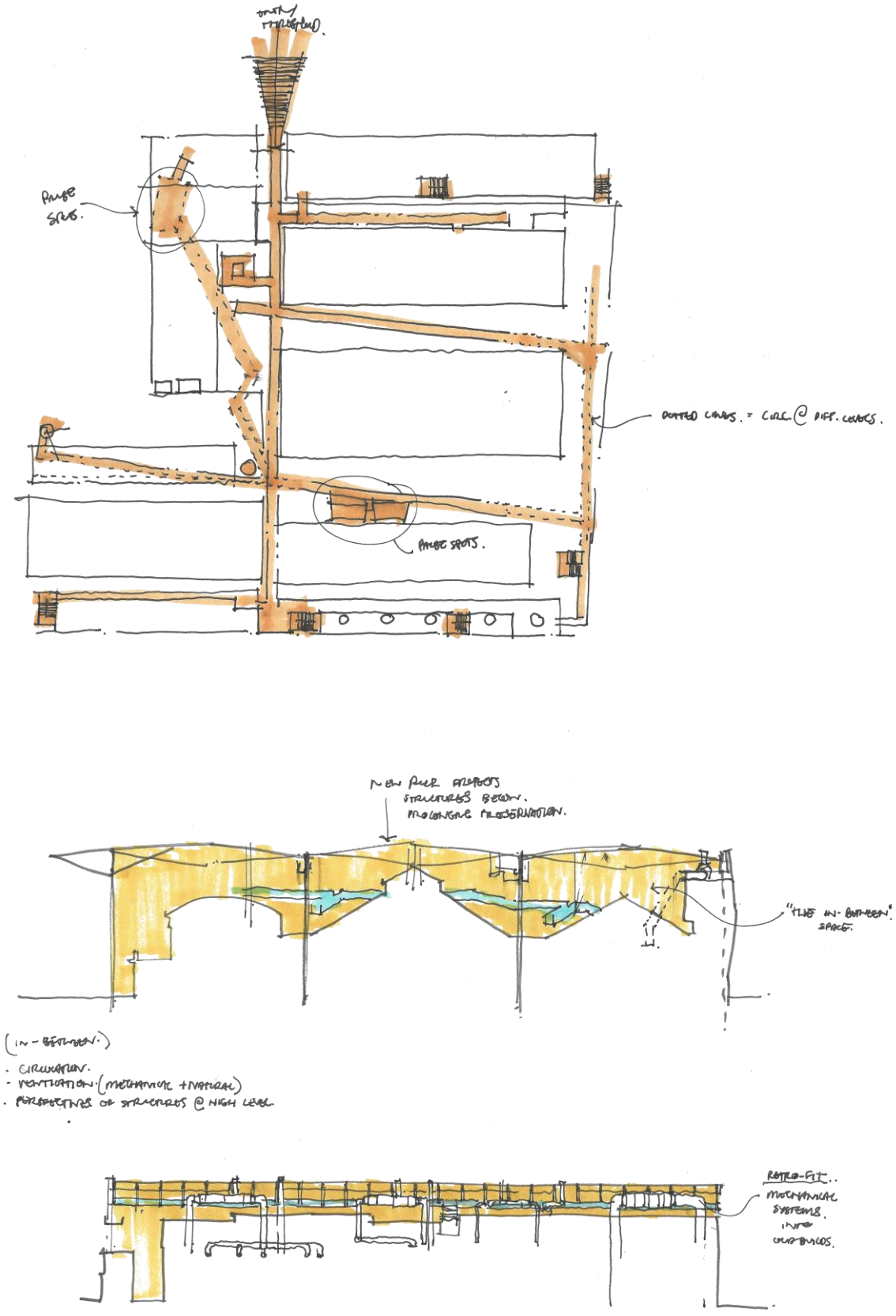


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Figure 49: Image of found object, a Mechanical Device used to move material from one point to another (Author, 2023).

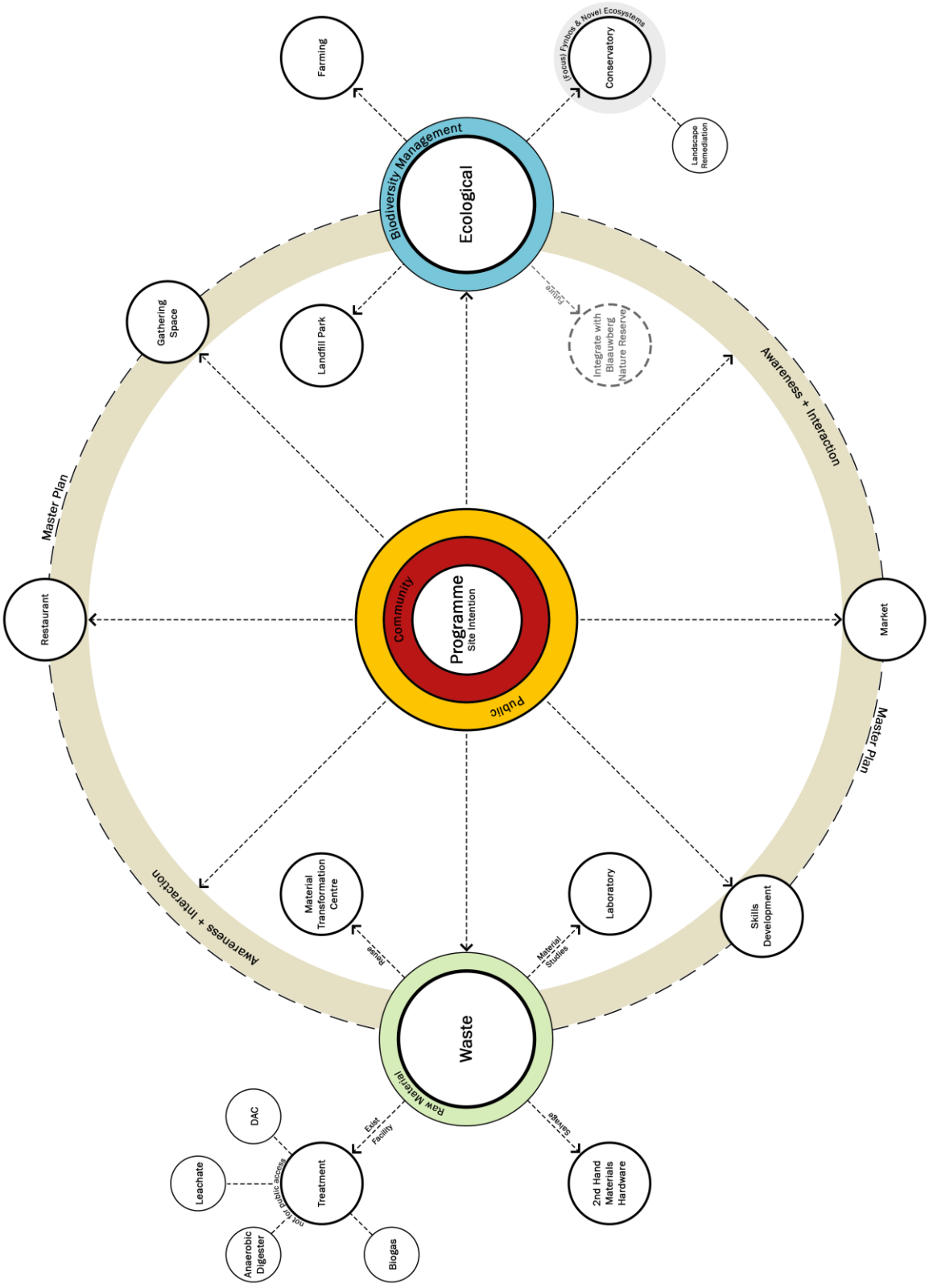


Figure 50: Programme – Master Plan (Author, 2023).

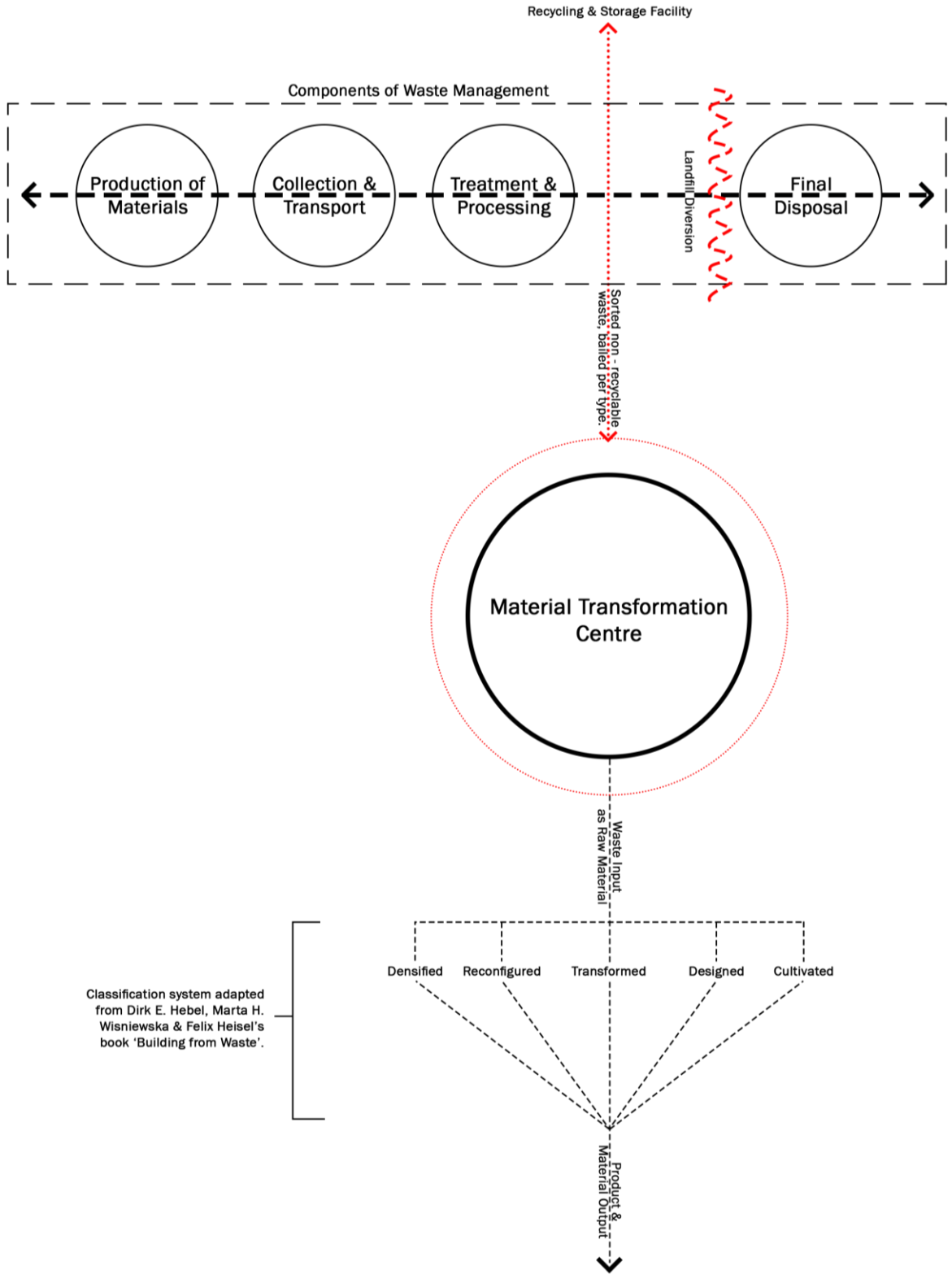
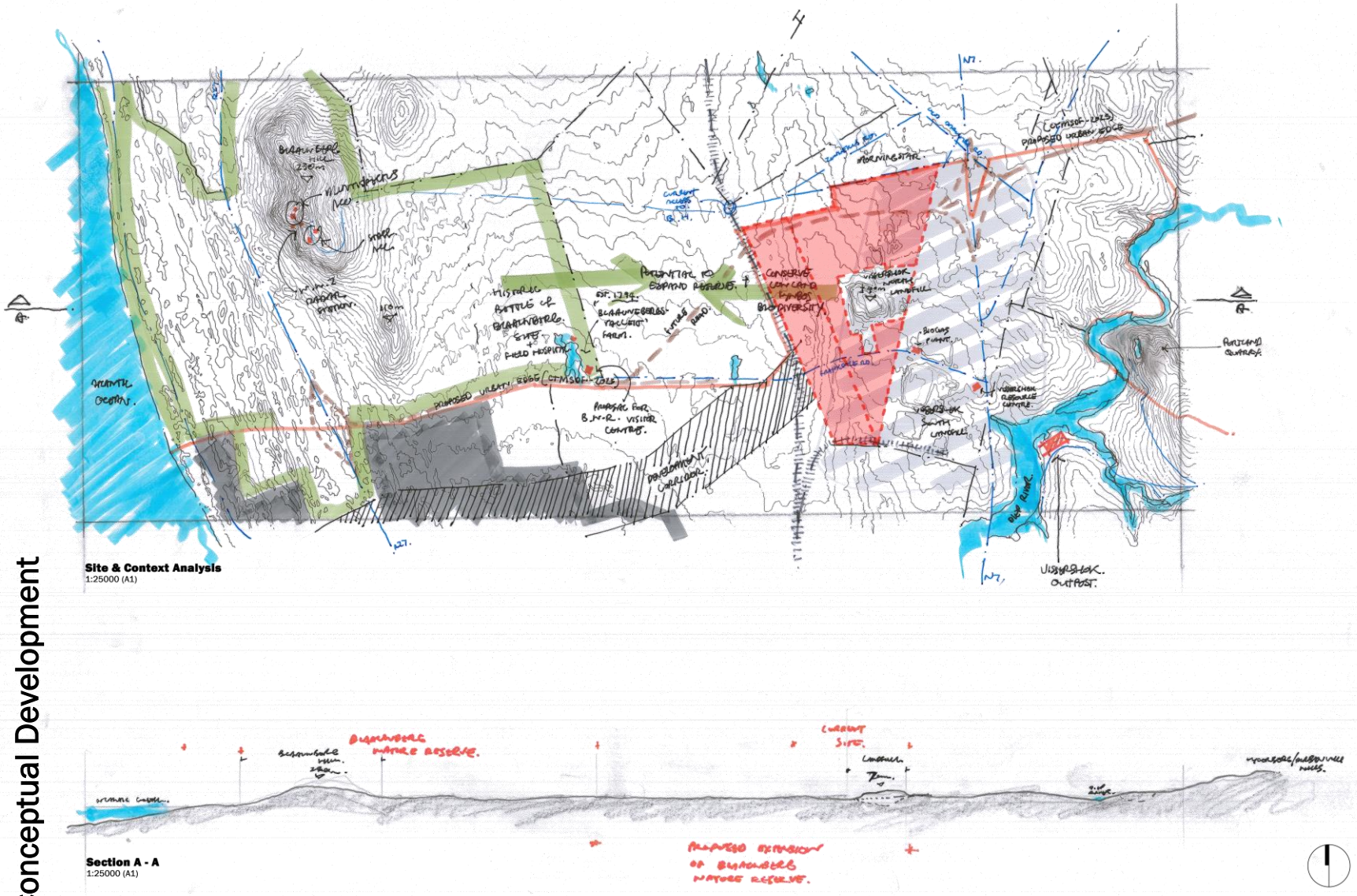


Figure 51: Programme - Transformation Centre (Author, 2023).



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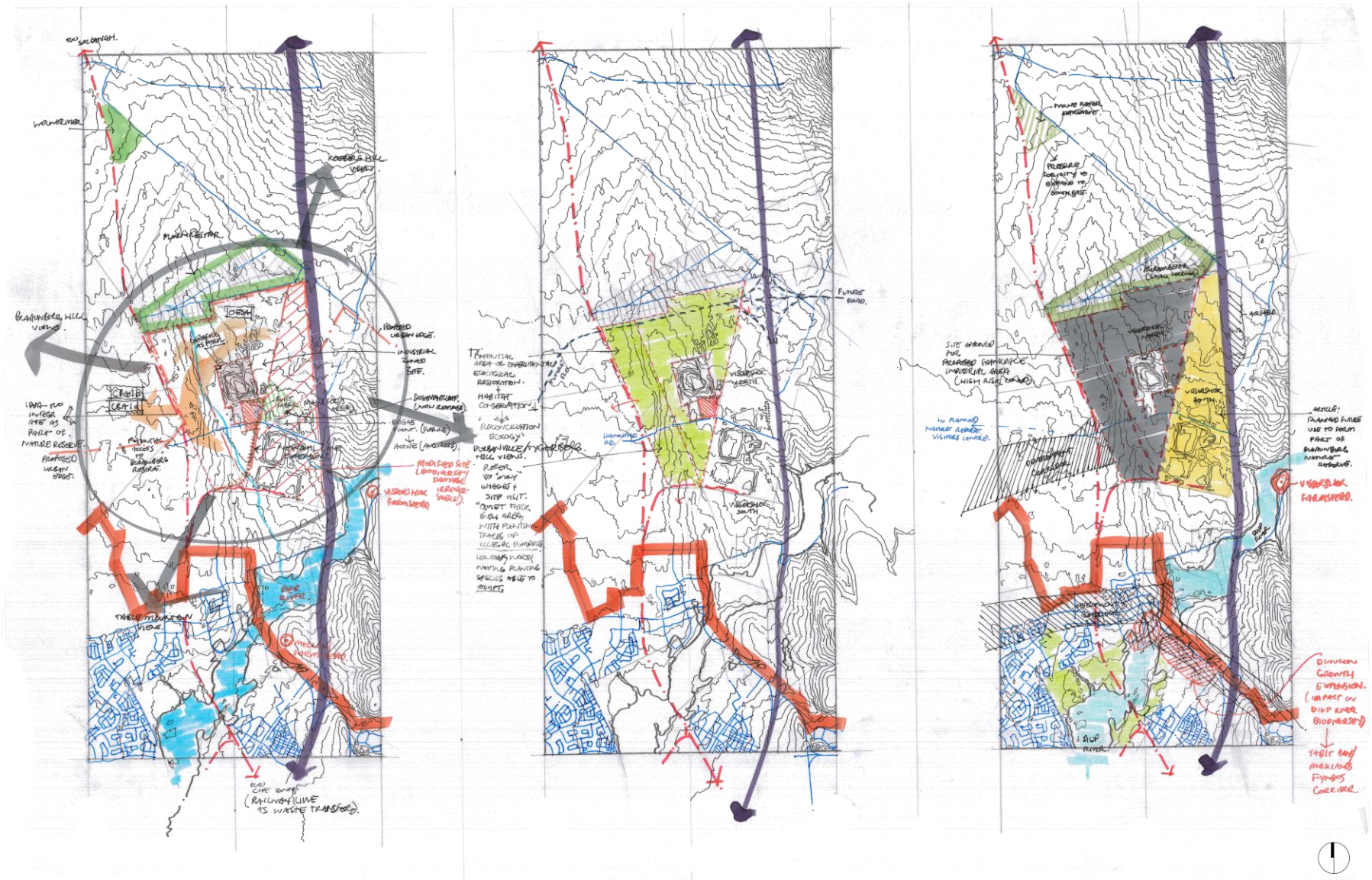

Figure 53: Site Analysis – 1:25000(A1) (Author, 2023).

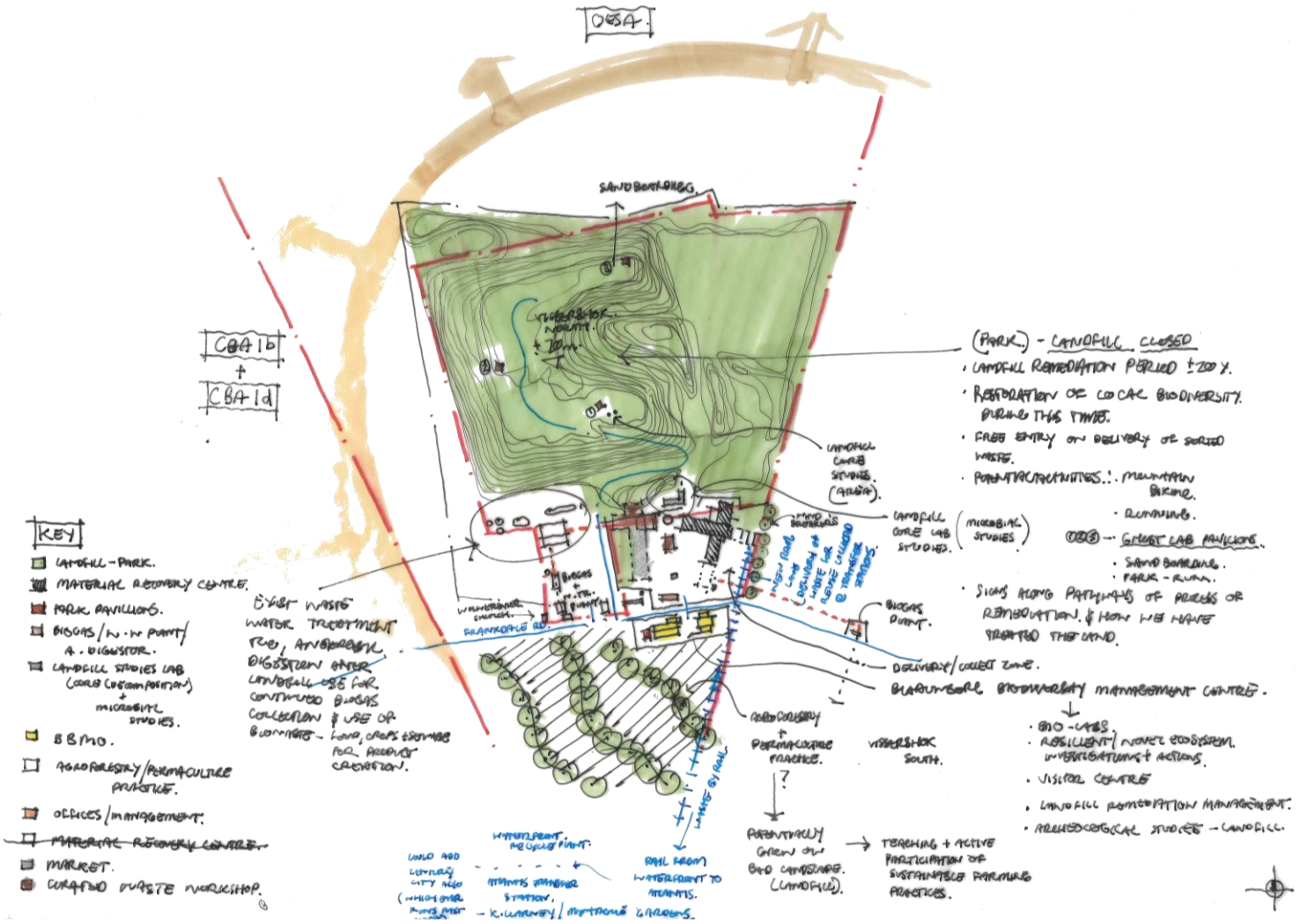

Figure 54: Master Plan Concept (Author, 2023).

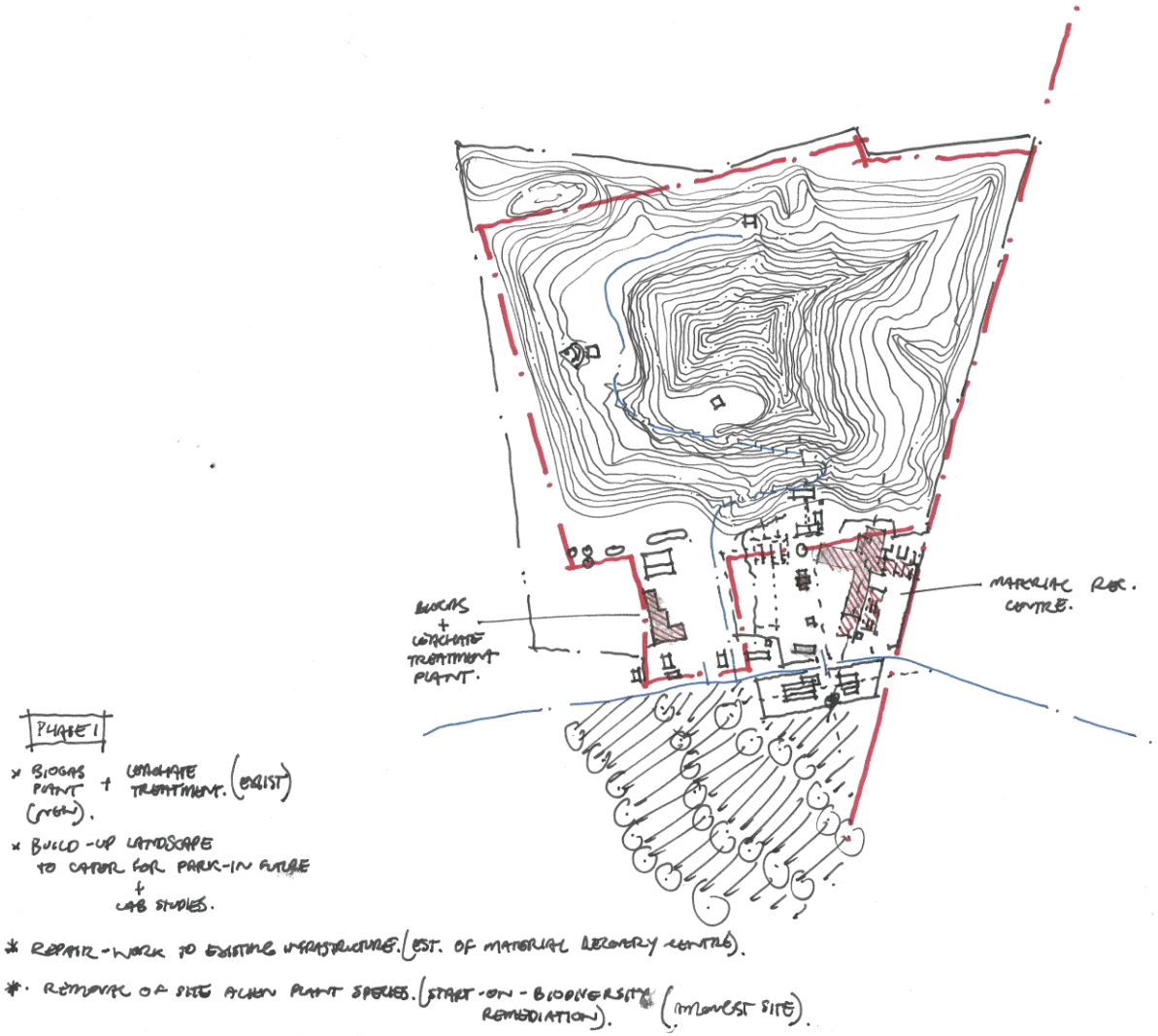

Figure 55: Master Plan – Phase I (Author, 2023).

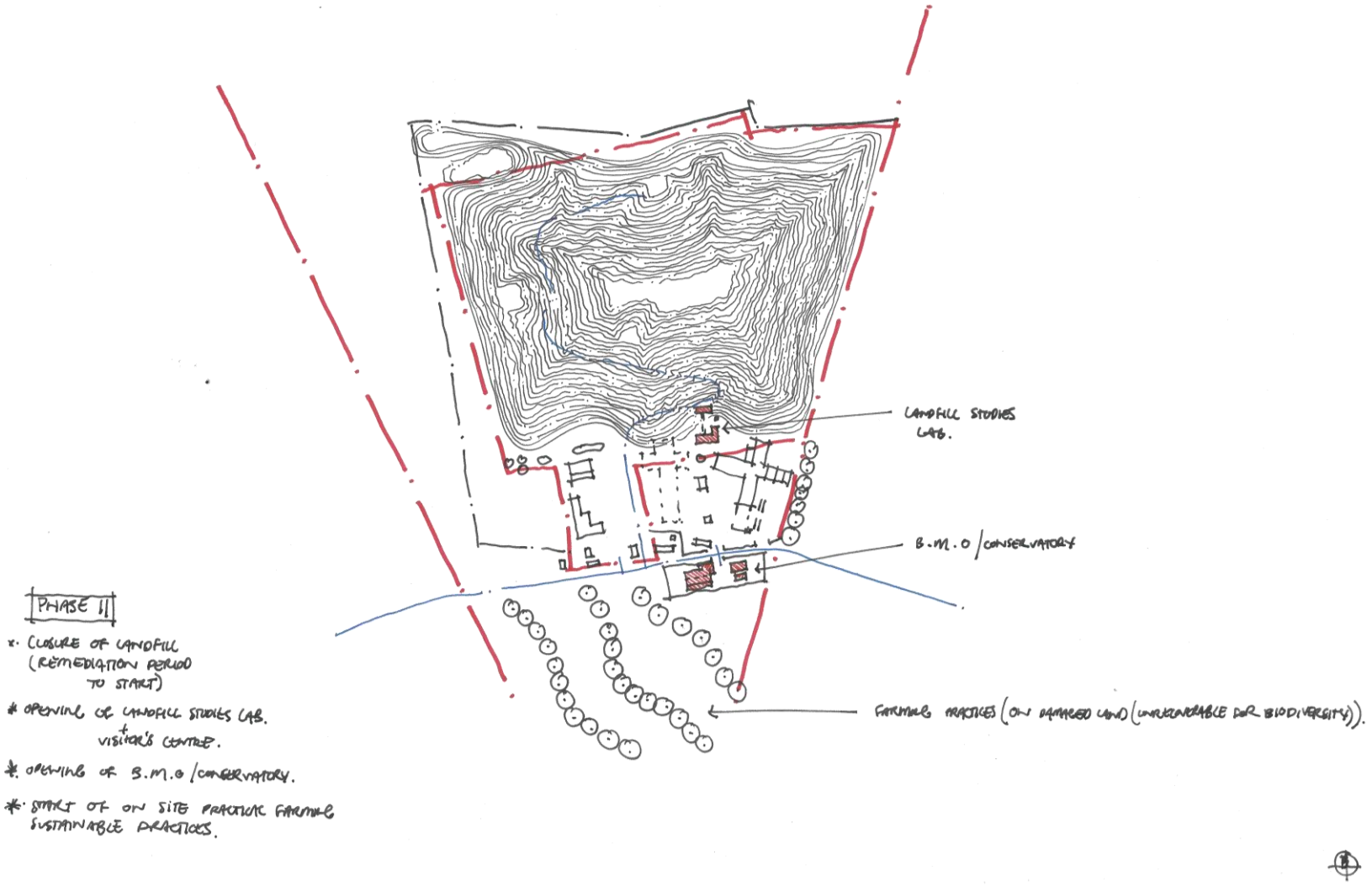

Figure 56: Master Plan – Phase II (Author, 2023).

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Figure 58: Master Plan – Phase III Development (Author, 2023).

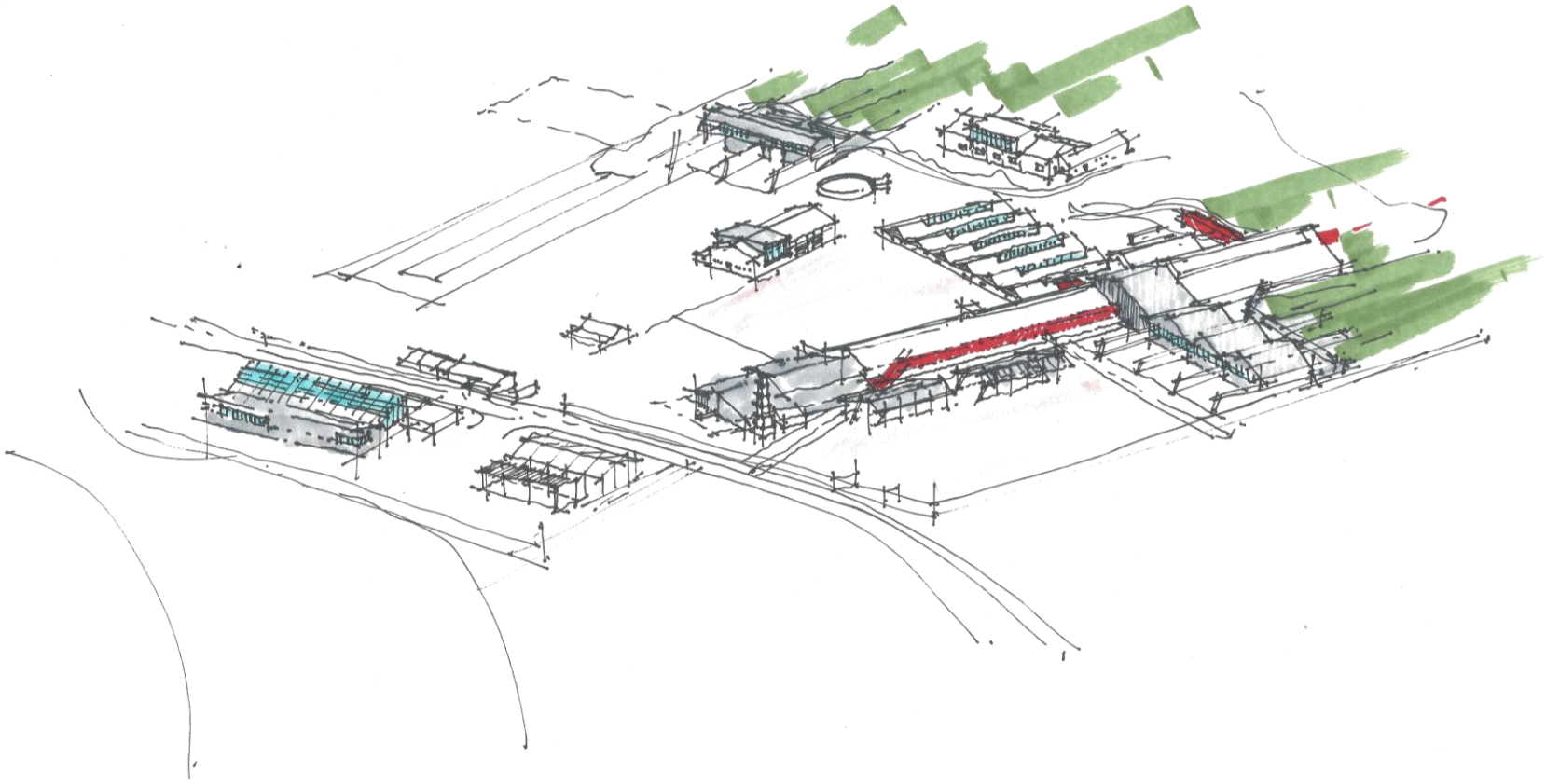


Figure 59: Conceptual Sketch of Design Intervention (Author, 2023).

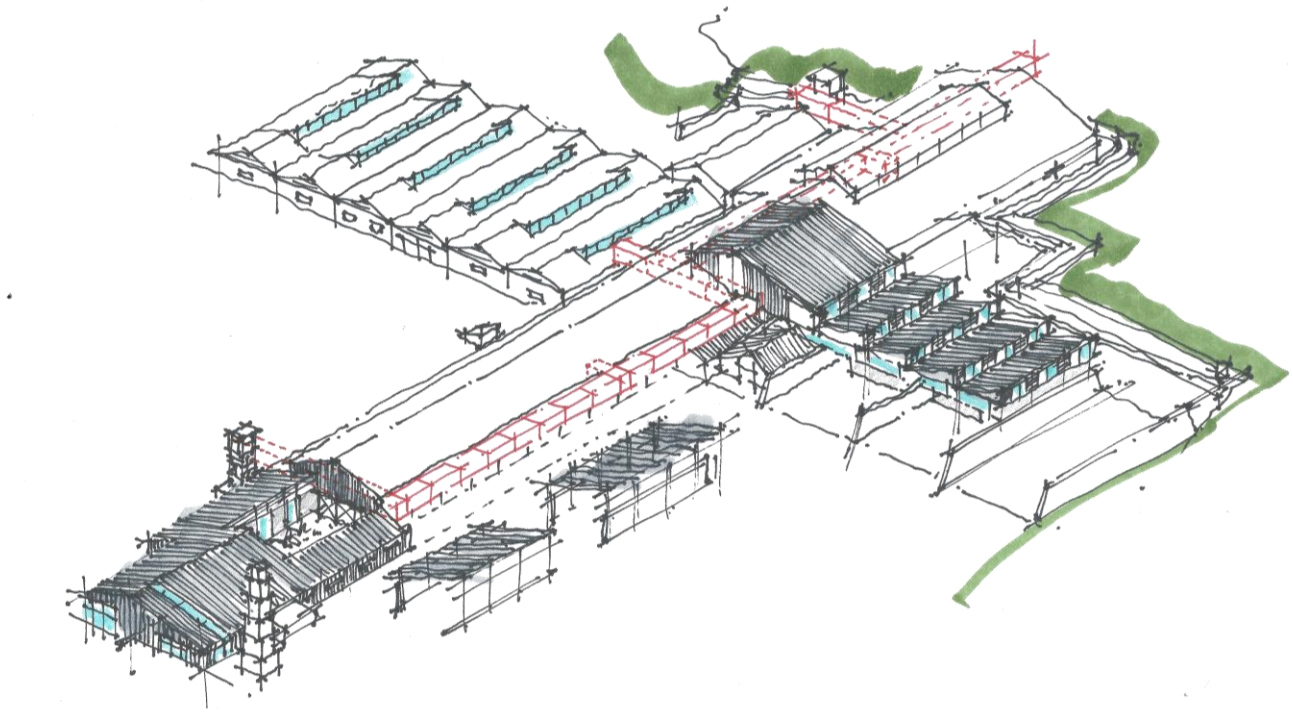
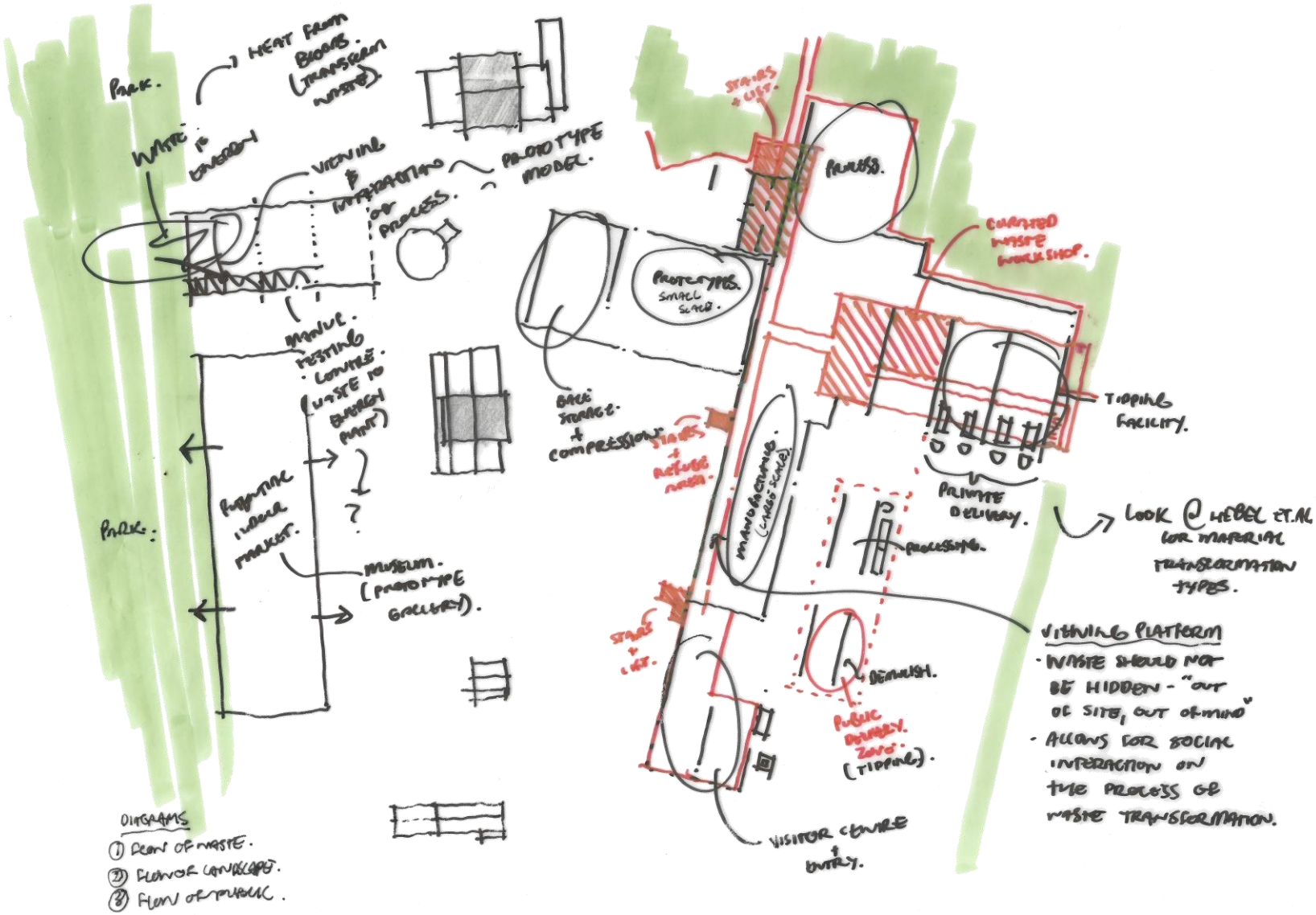


Figure 60: Conceptual sketch of Material Transformation Centre (Author, 2023).



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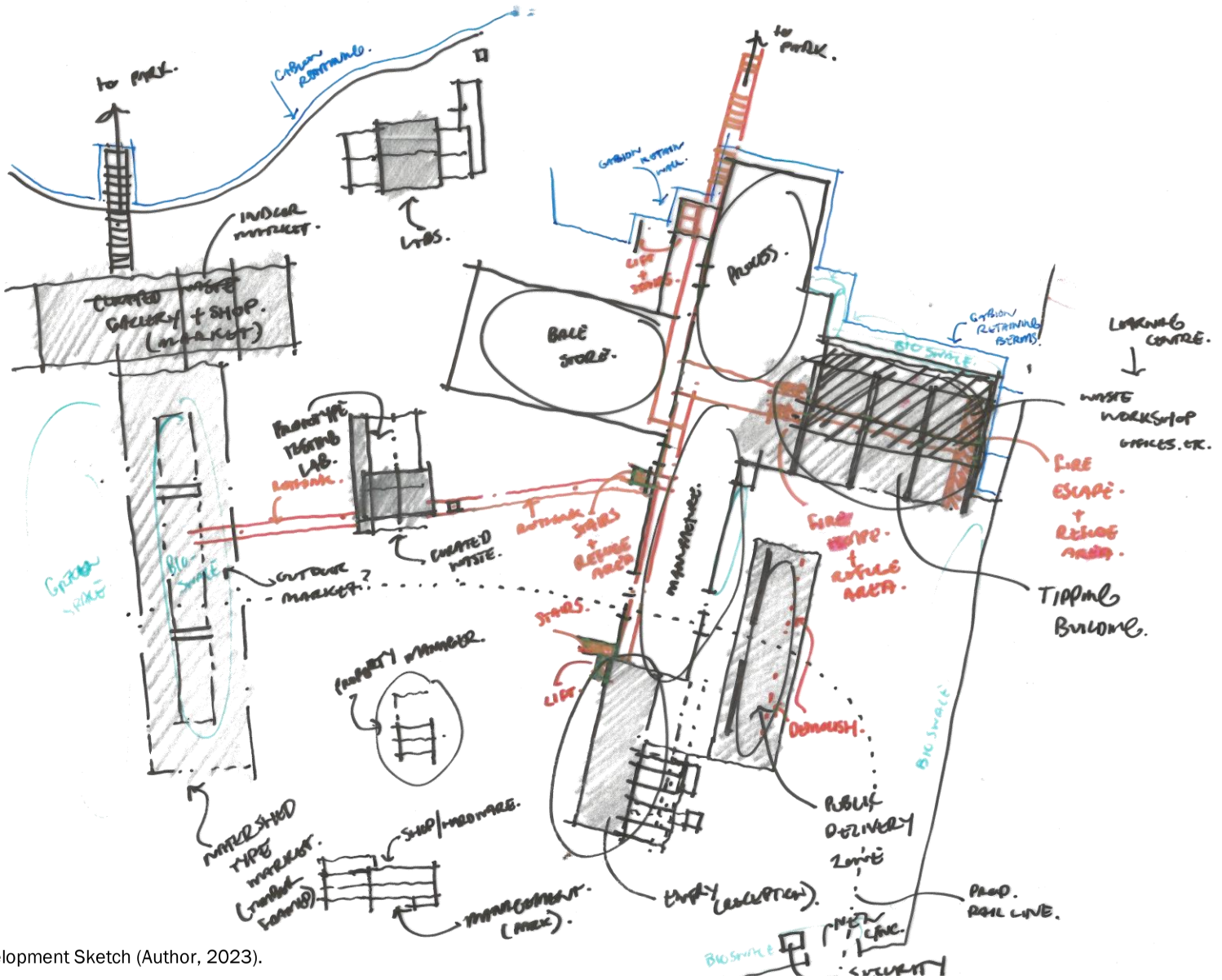

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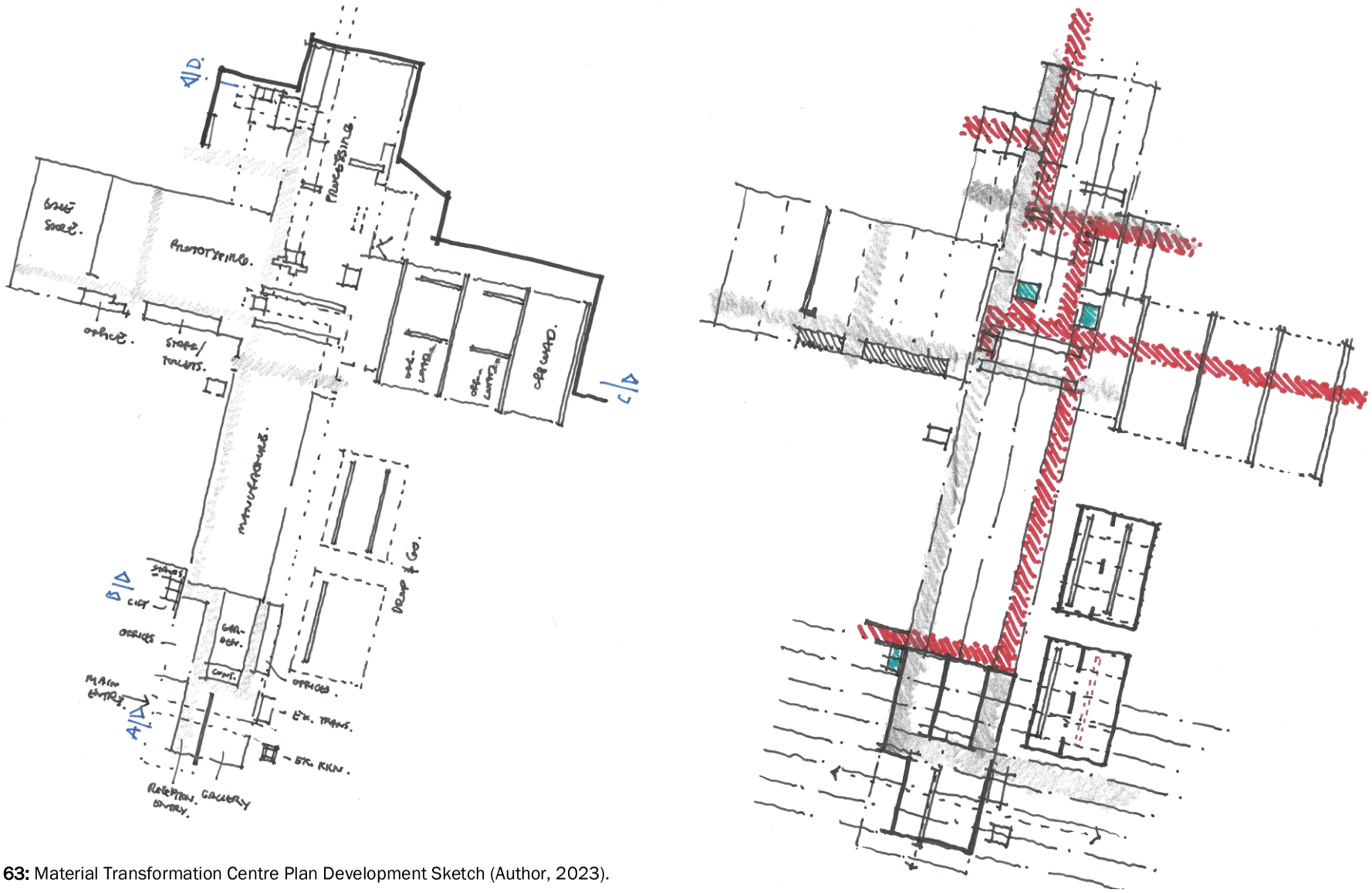


Figure 63: Material Transformation Centre Plan Development Sketch (Author, 2023).

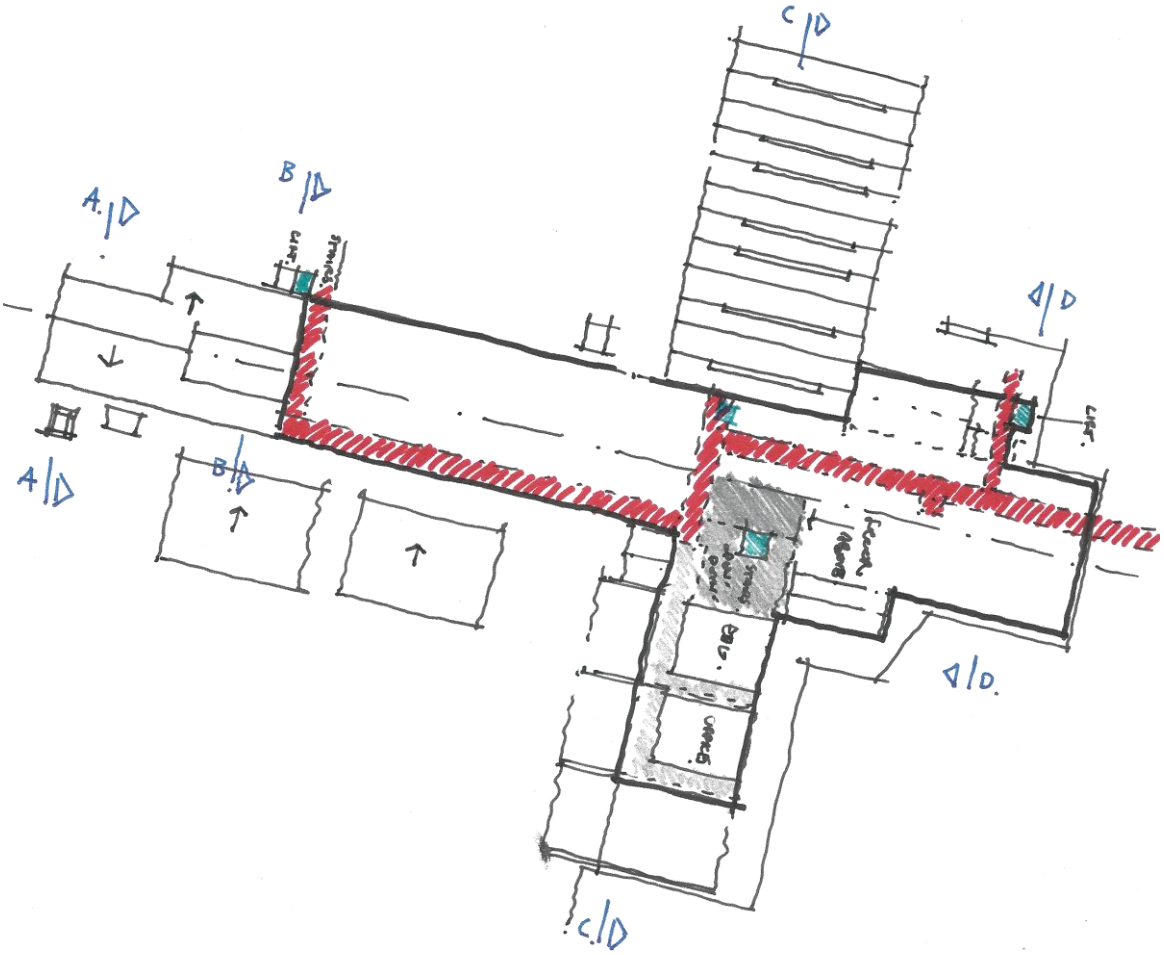


Figure 64: Material Transformation Centre Plan Development Sketch (Author, 2023).

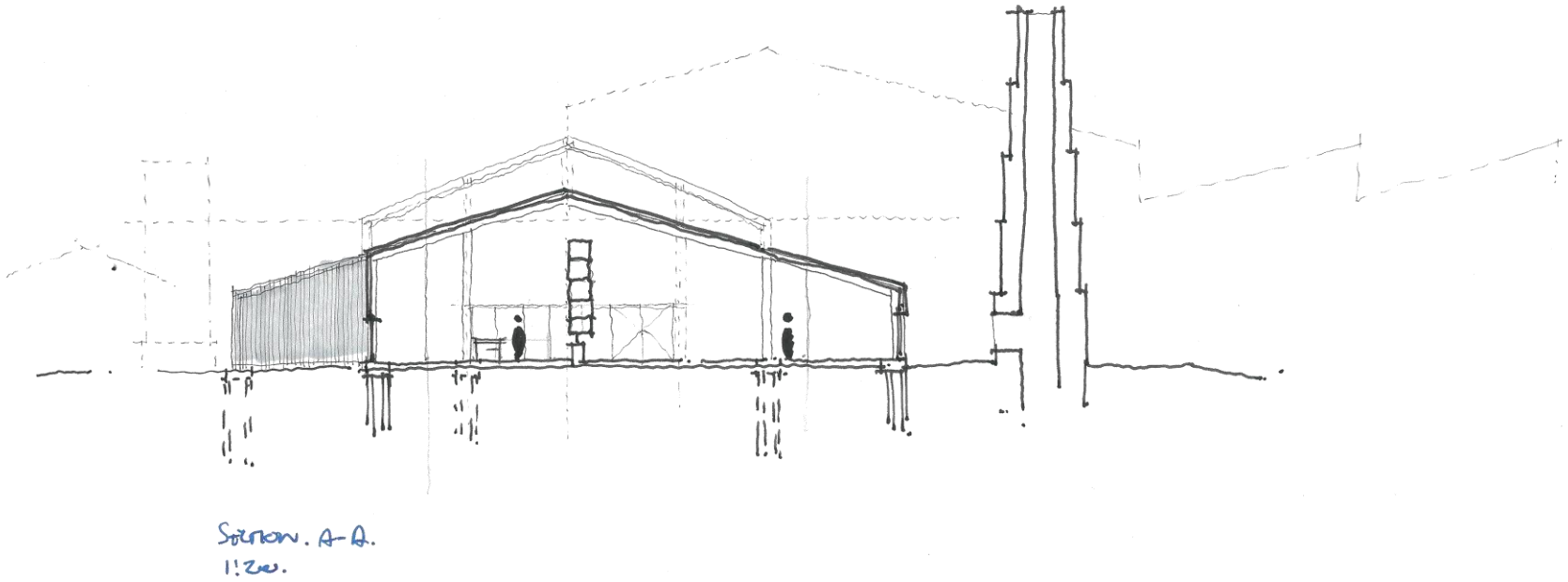
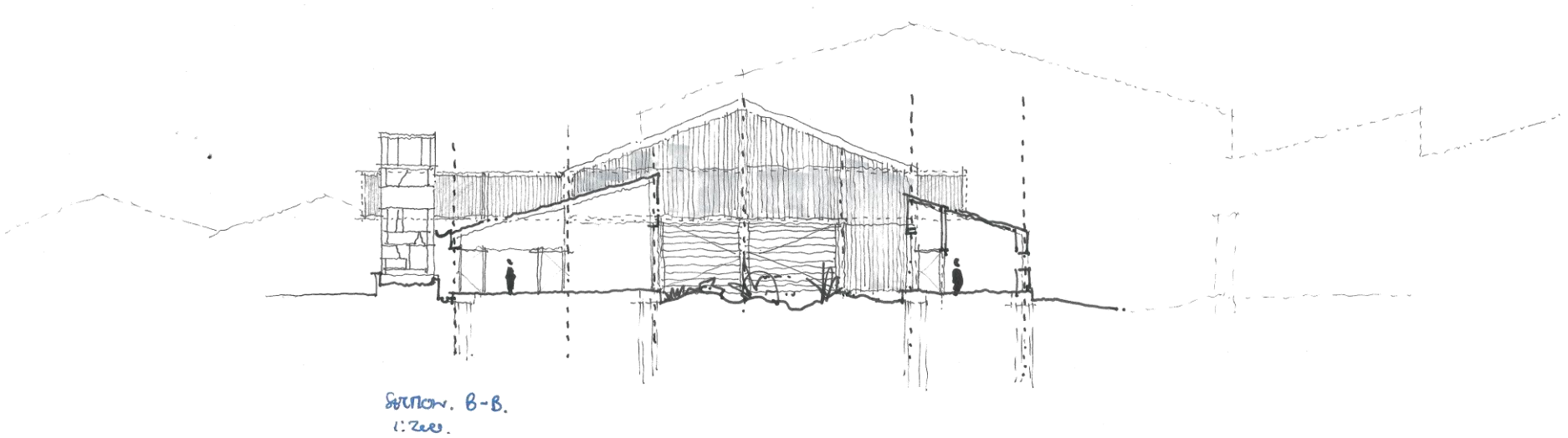


Figure 65: Sectional Sketch Studies (Author, 2023).



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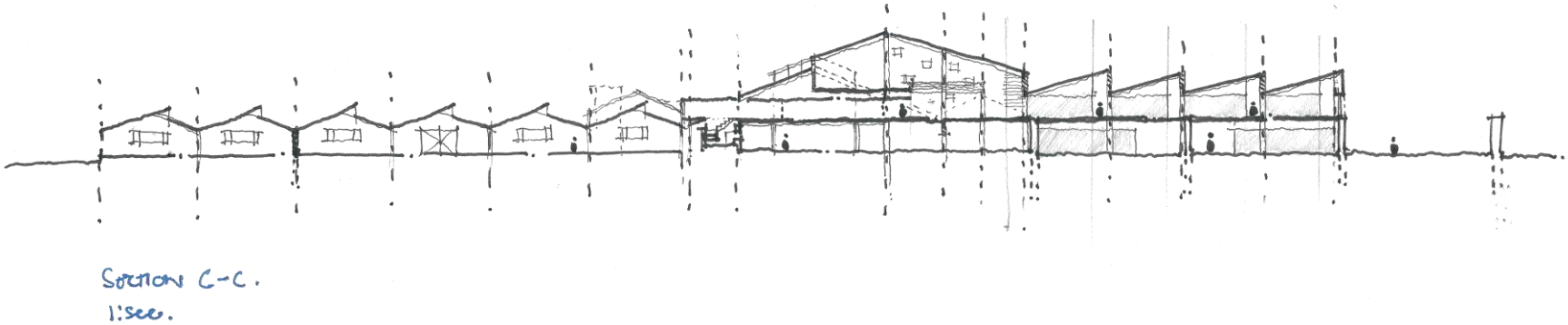

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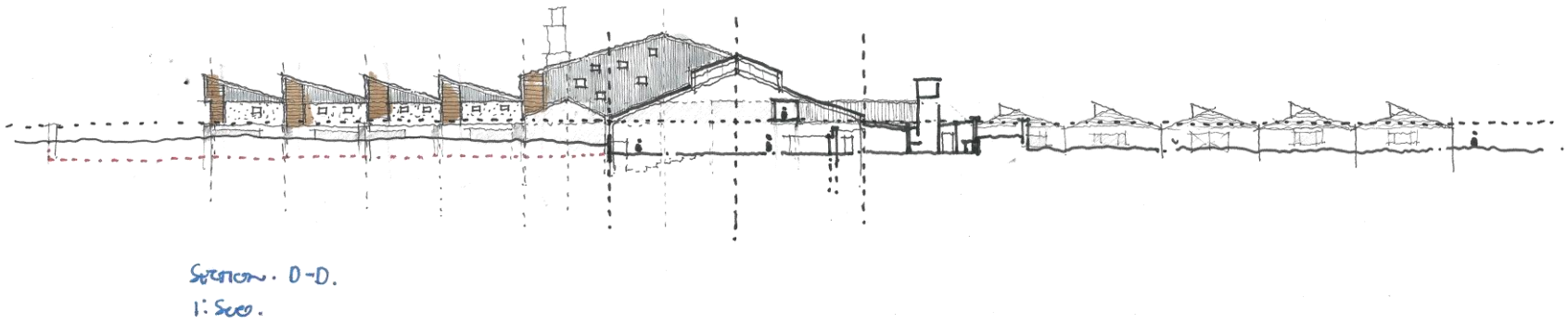


Figure 68: Sectional Sketch Studies (Author, 2023).

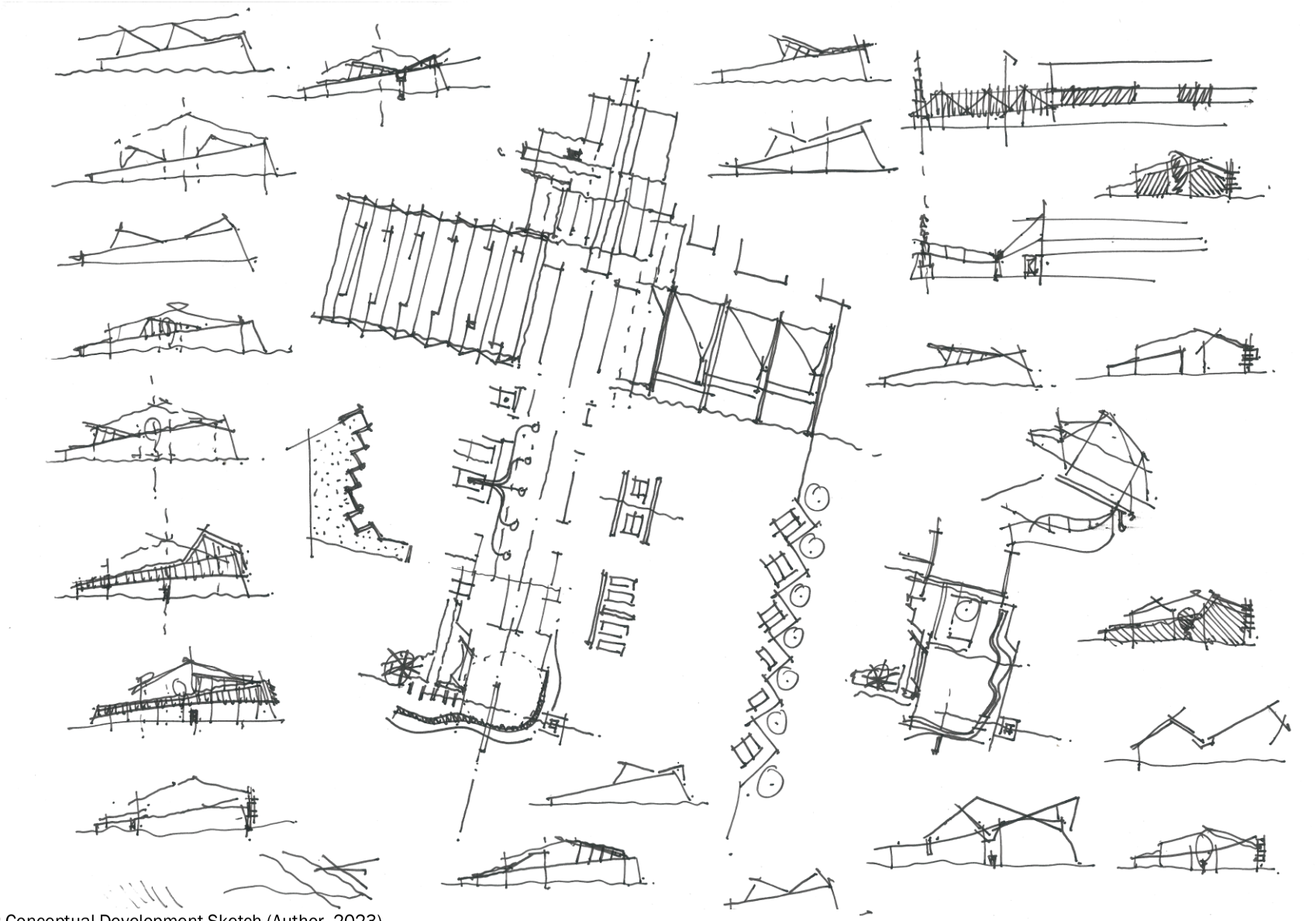


Figure 69: Conceptual Development Sketch (Author, 2023).

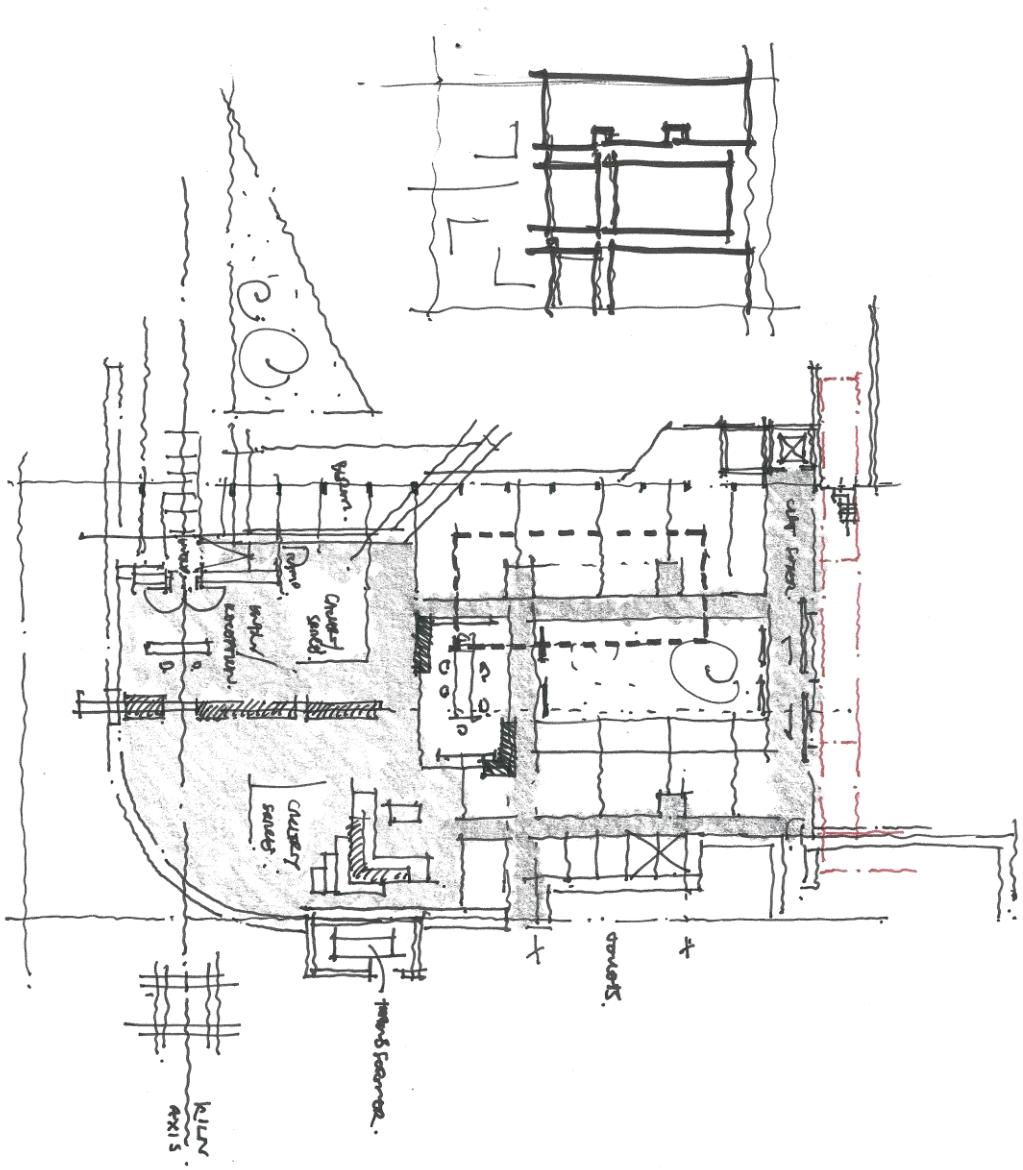
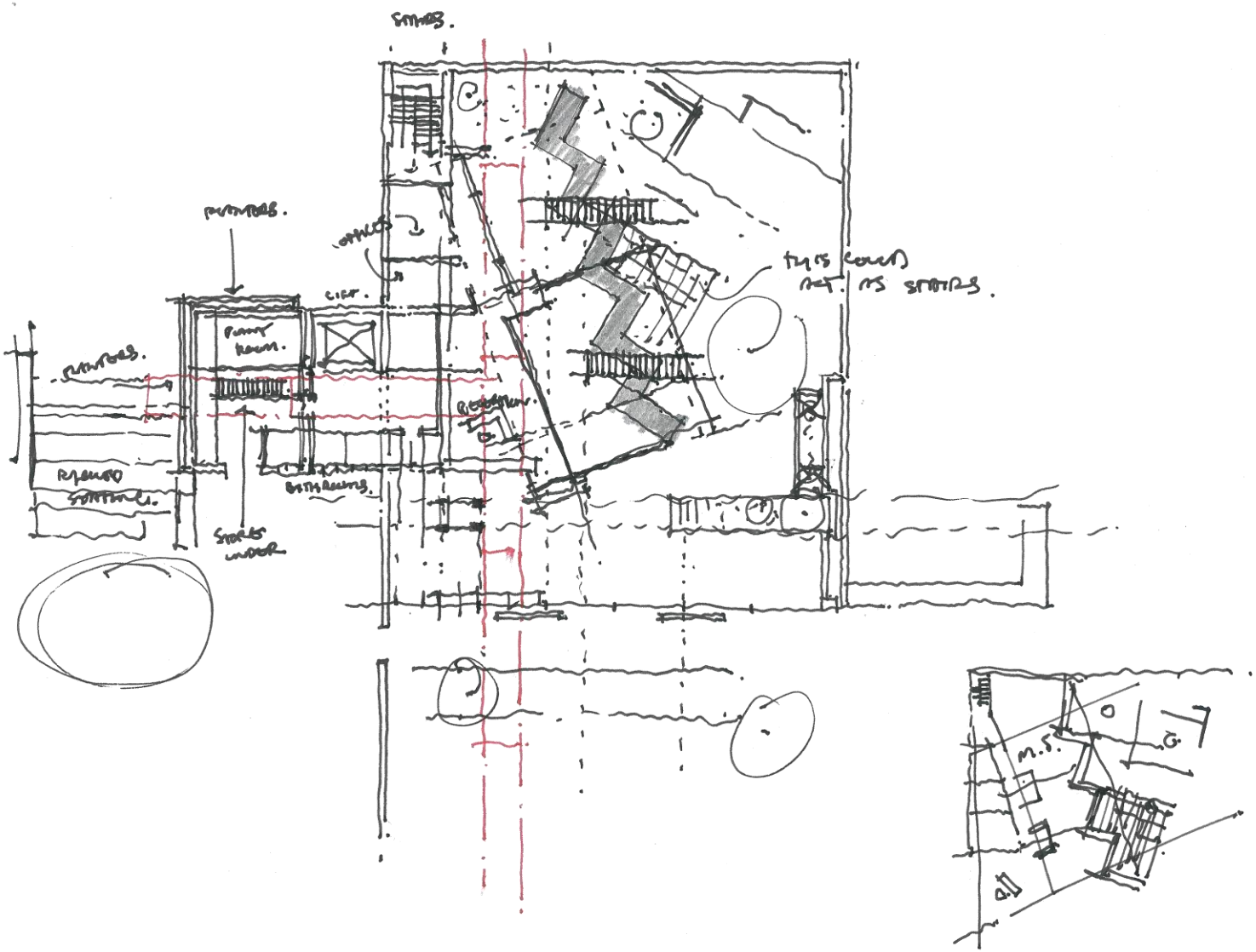


Figure 70: Plan Development Sketch (Author, 2023).



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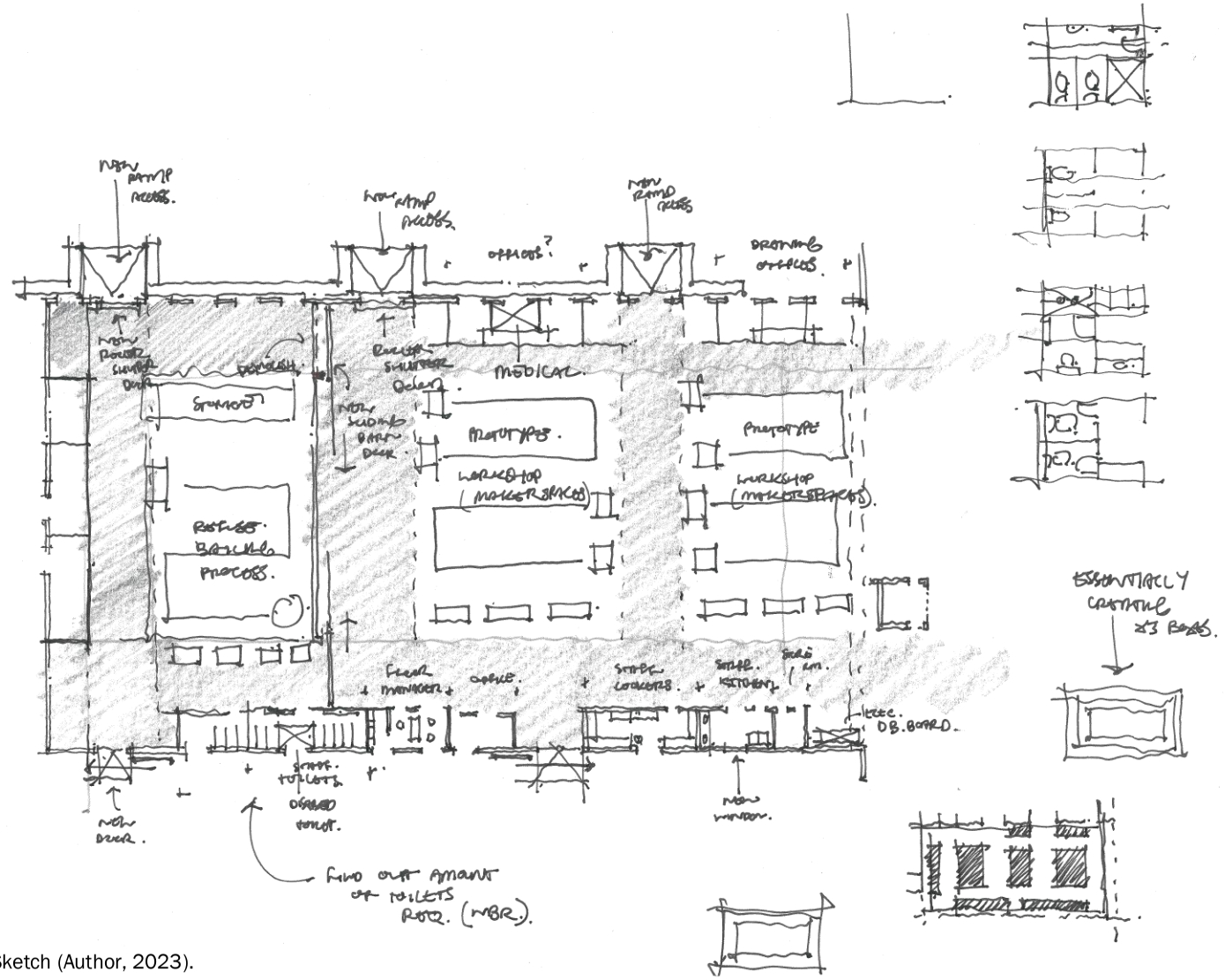

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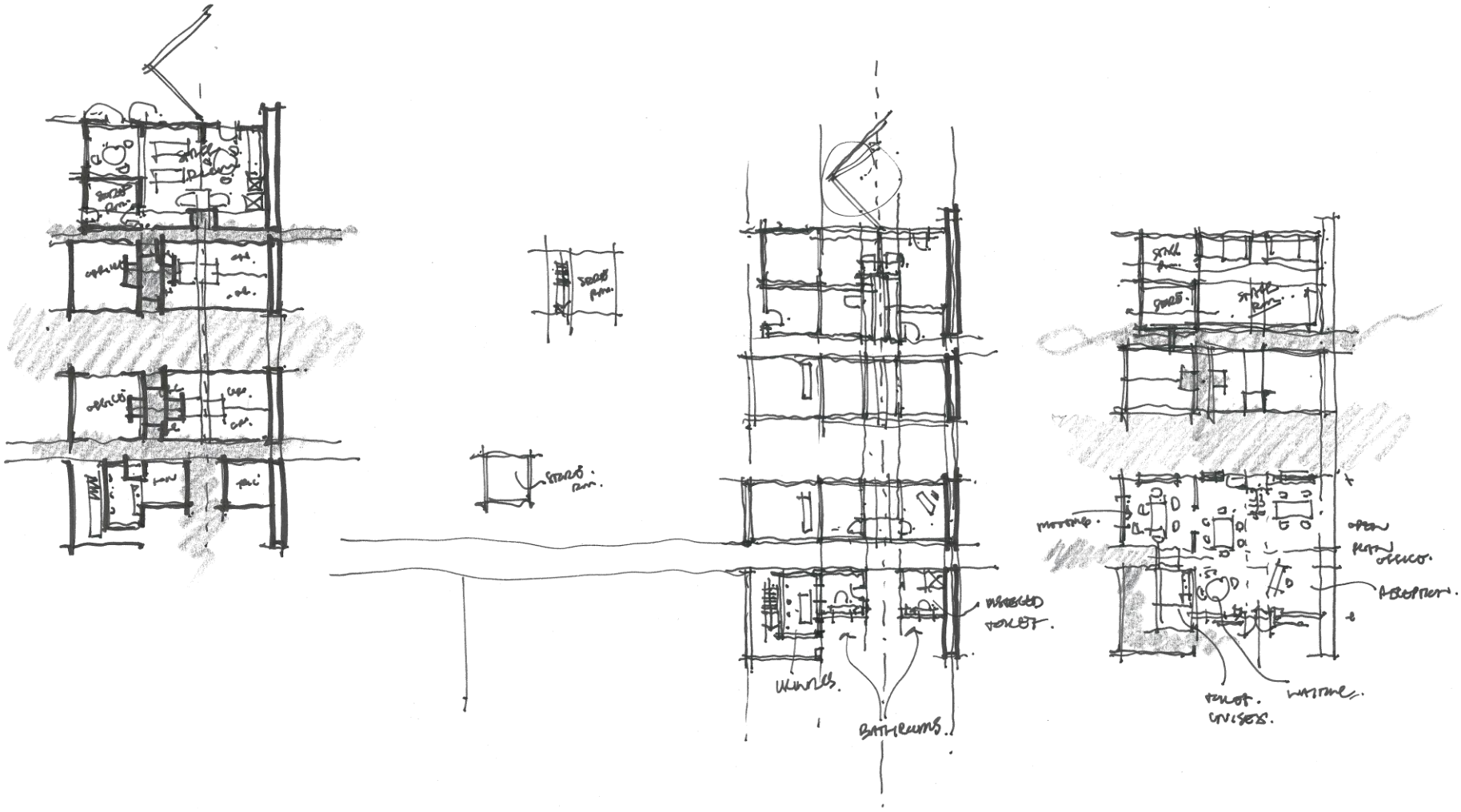


Figure 73: Plan Development Sketch (Author, 2023).

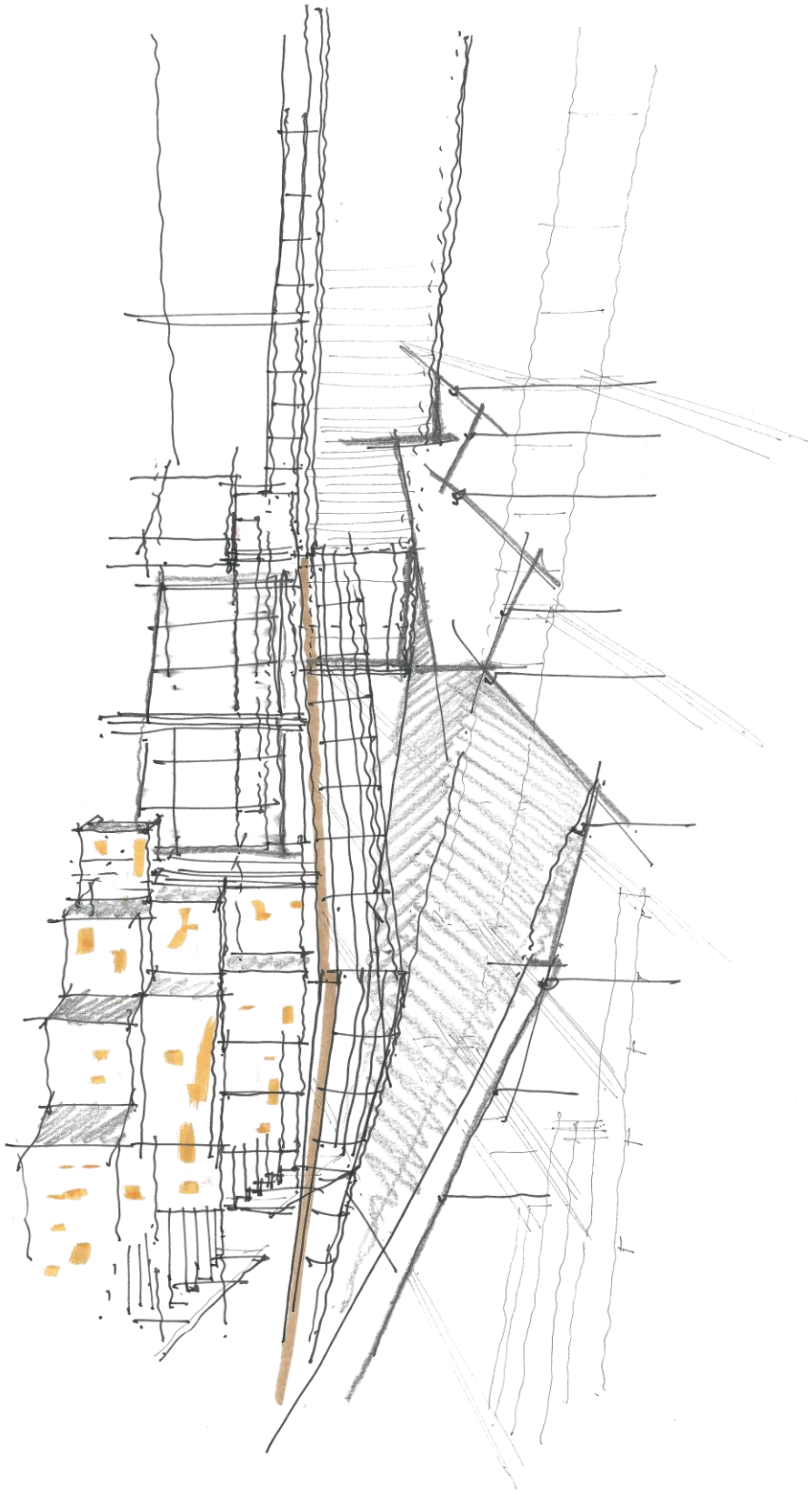
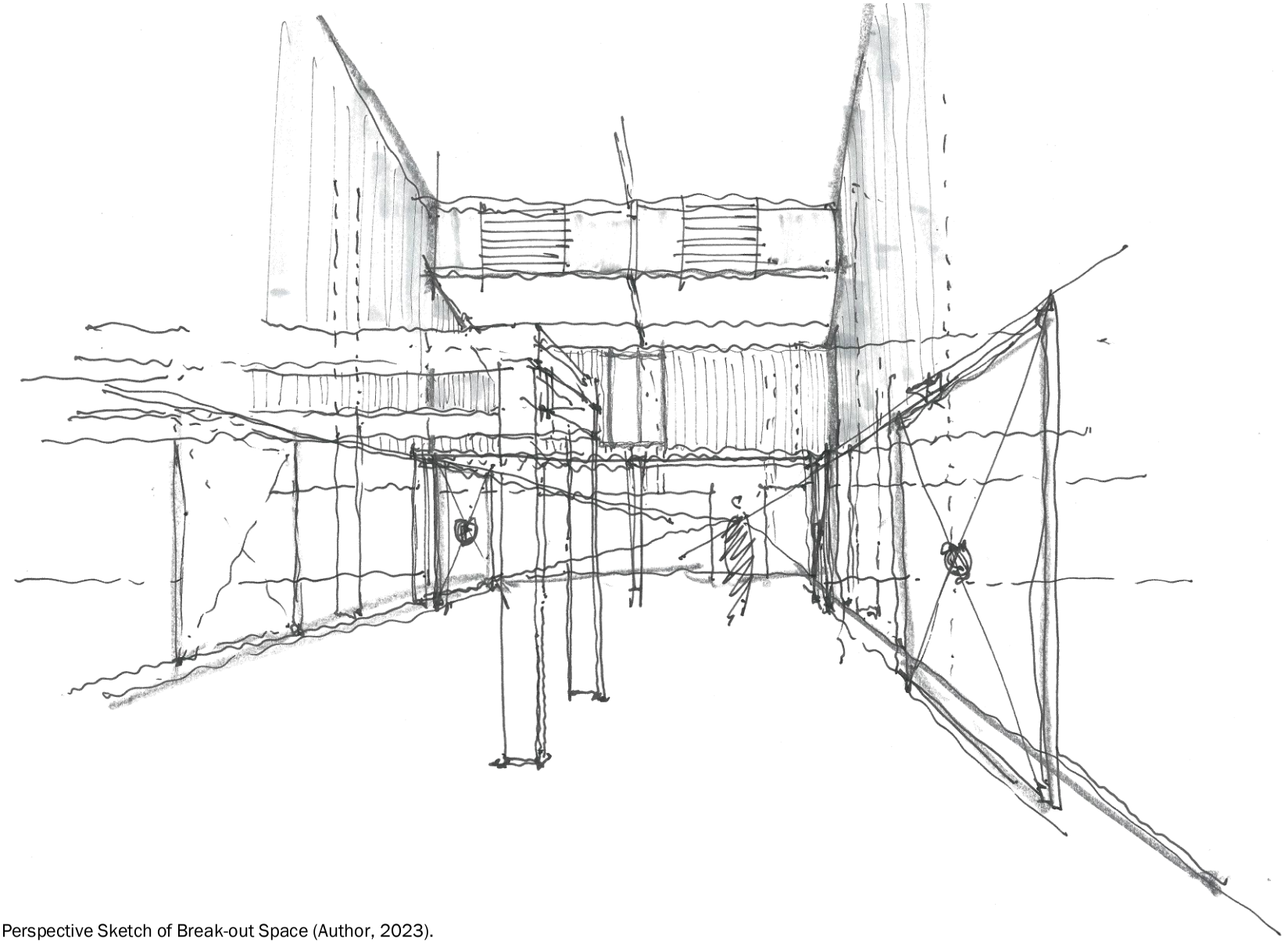


Figure 74: Perspective Sketch of Visitors Workshop (Author, 2023).



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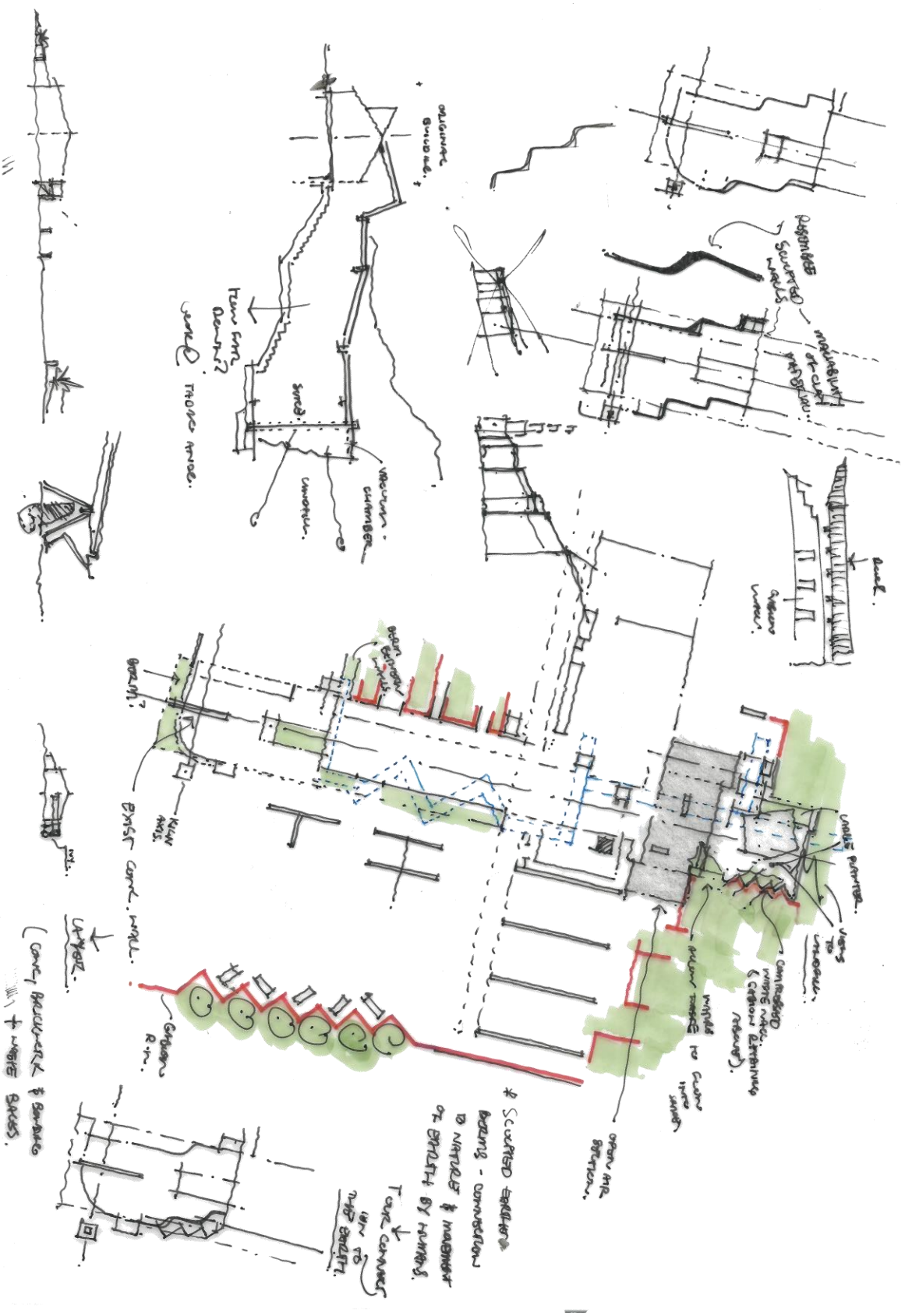


Figure 76: Conceptual Development Sketch (Author, 2023).

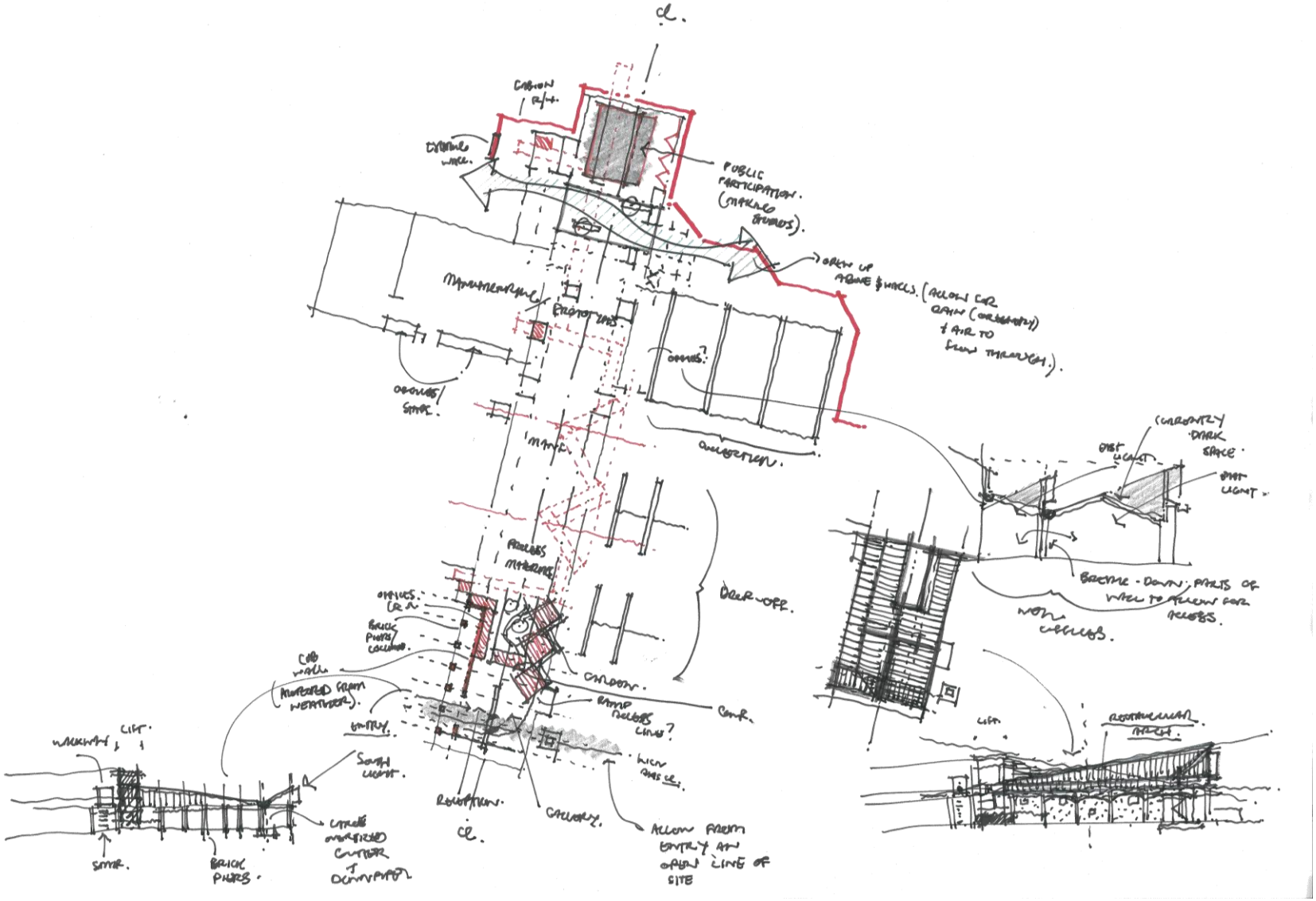
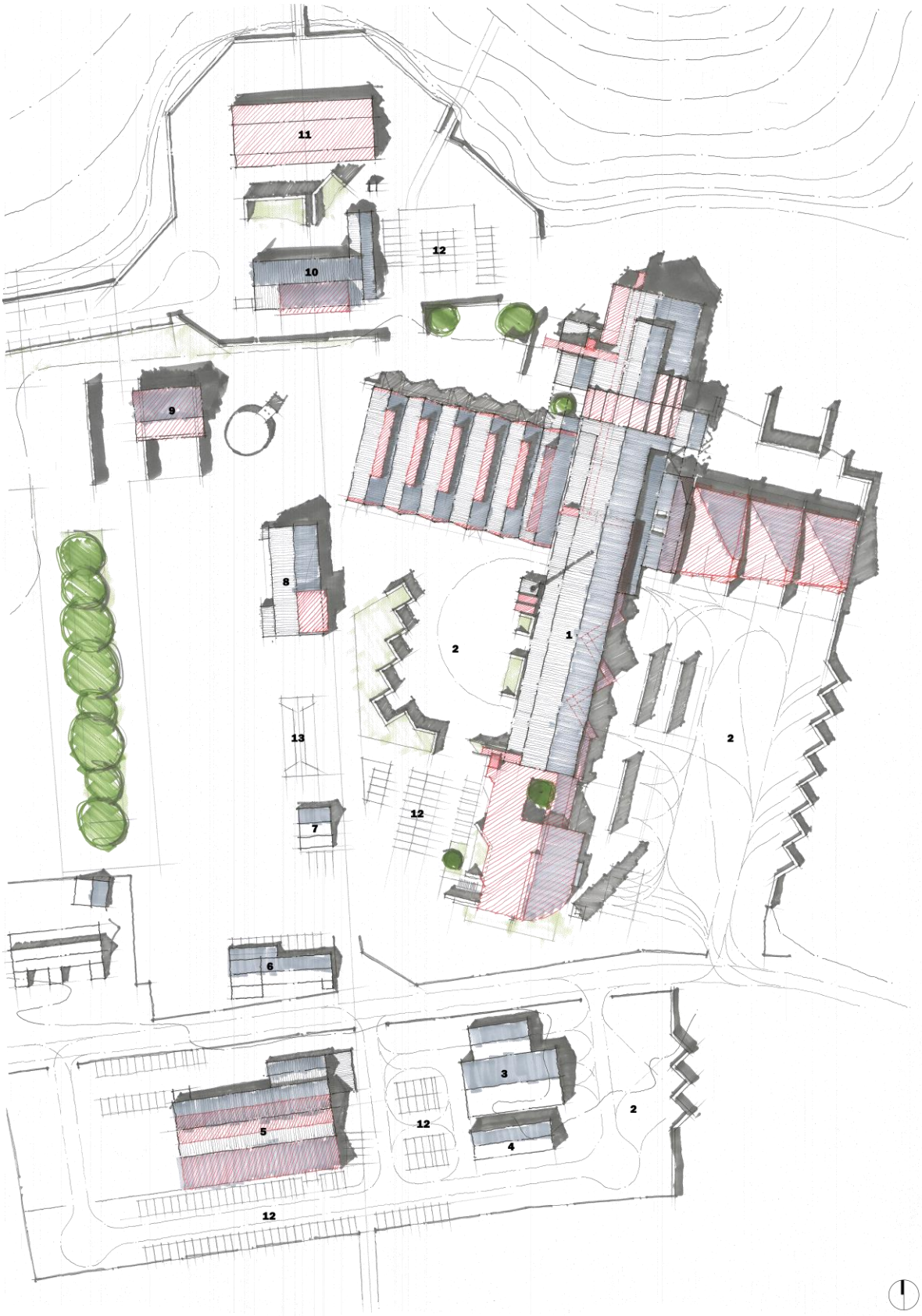
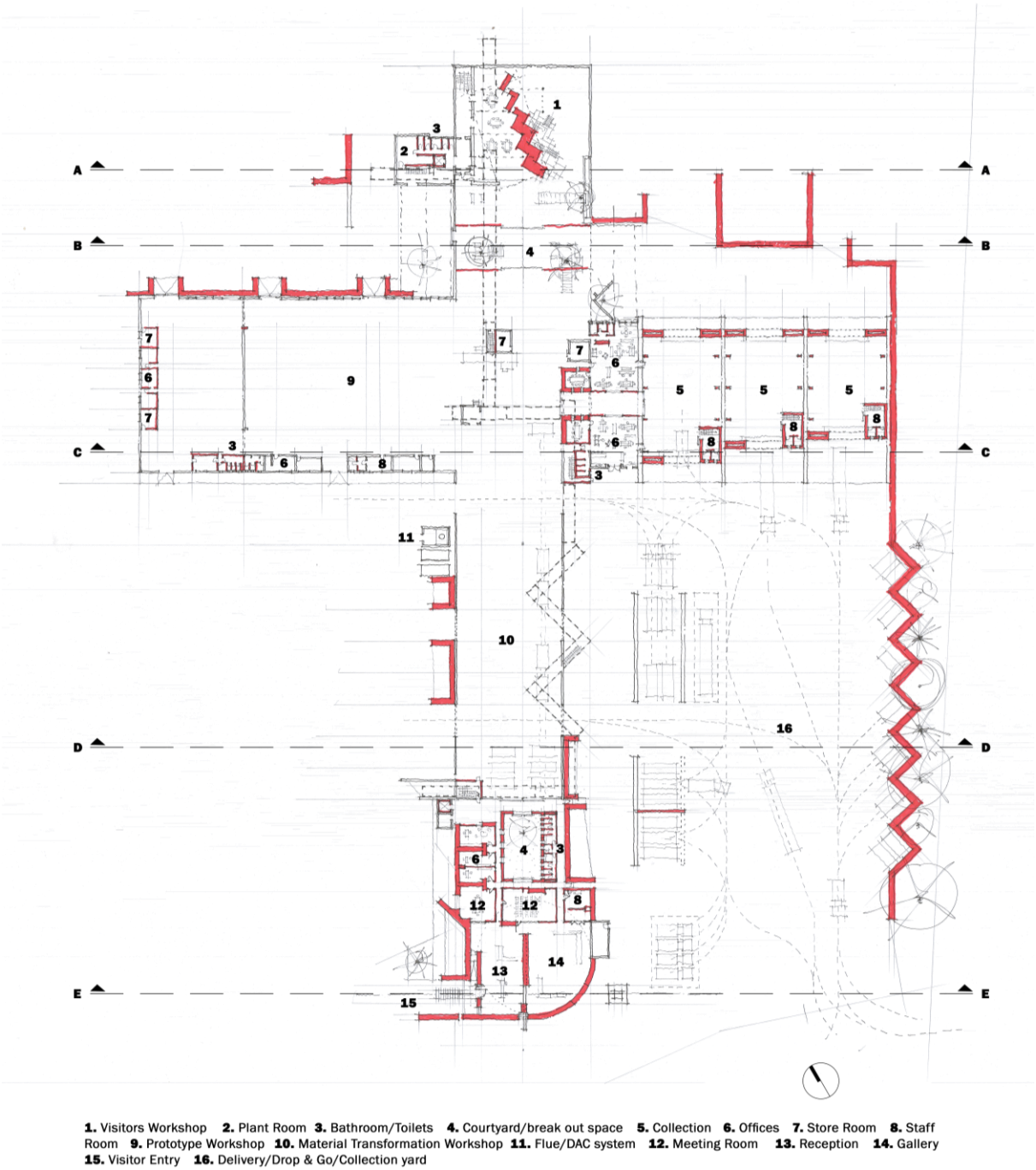


Figure 77: Conceptual Development Sketch (Author, 2023).



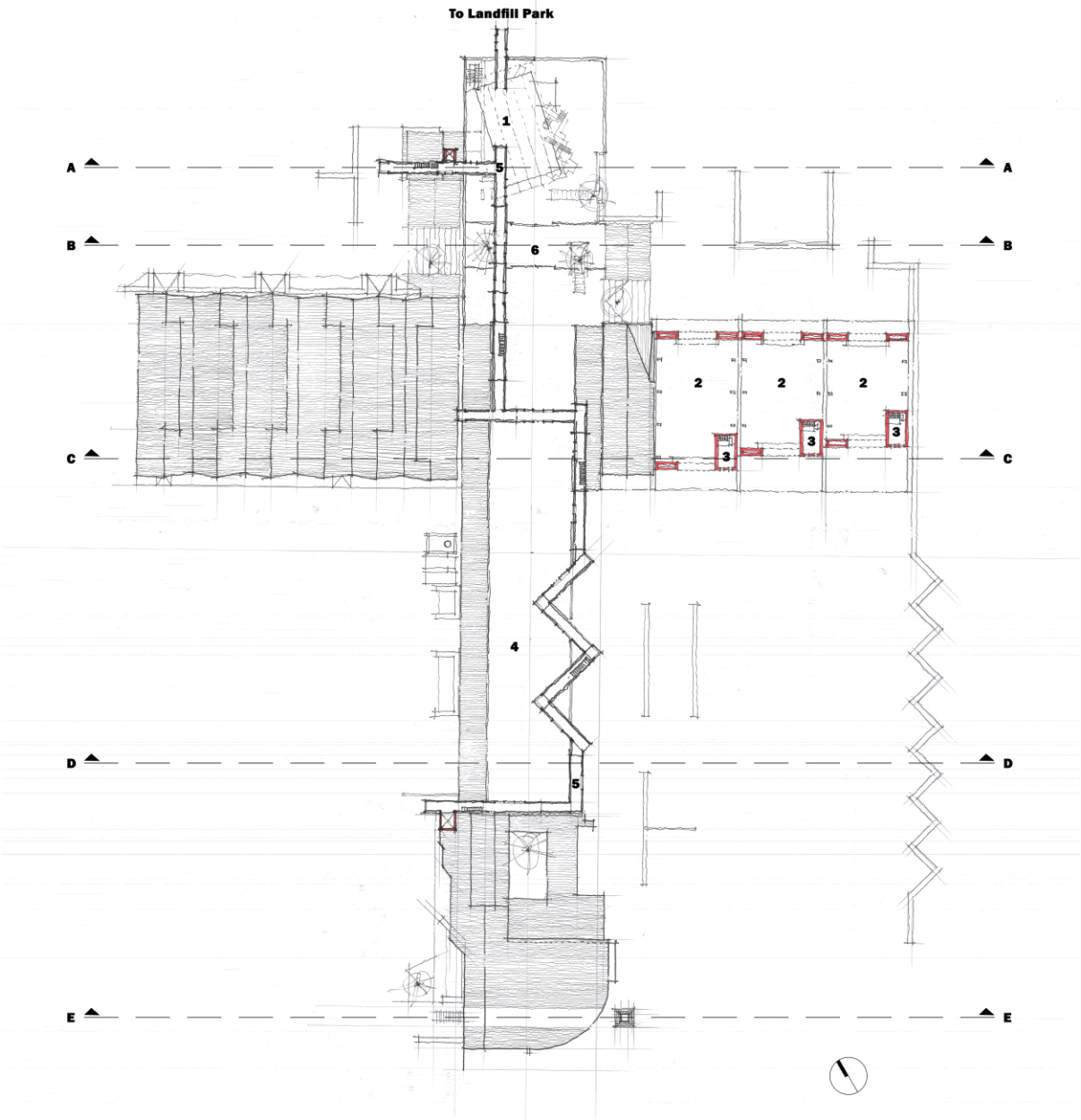
1. Material Transformation Centre **2.** Collection/Delivery Yard **3.** 2nd Hand Materials Hardware **4.** Farm Workshop **5.** Conservatory/Restaurant **6.** Management Offices **7.** Caretakers Place **8.** Prototype Testing Centre **9.** Park Management/BDM offices **10.** Materials Studies Lab **11.** Material Decomposition Studies Centre **12.** Vehicular Parking **13.** Bus Parking

Figure 78: Site Plan – 1:500(A1) (Author, 2023).



1. Visitors Workshop **2.** Plant Room **3.** Bathroom/Toilets **4.** Courtyard/break out space **5.** Collection **6.** Offices **7.** Store Room **8.** Staff Room **9.** Prototype Workshop **10.** Material Transformation Workshop **11.** Flue/DAC system **12.** Meeting Room **13.** Reception **14.** Gallery **15.** Visitor Entry **16.** Delivery/Drop & Go/Collection yard

Figure 79: Ground Floor Plan – Material Transformation Centre – 1:400(A1) (Author, 2023).



1. Public Workshop **2.** Material/Product Collection Area **3.** Staff Room **4.** Material Transformation Workshop **5.** Lift/Stair accessed visitors viewing walkway **6.** Covered external/internal breakout space

Figure 80: First Floor Plan - Material Transformation Centre - 1:400(A1) (Author, 2023).

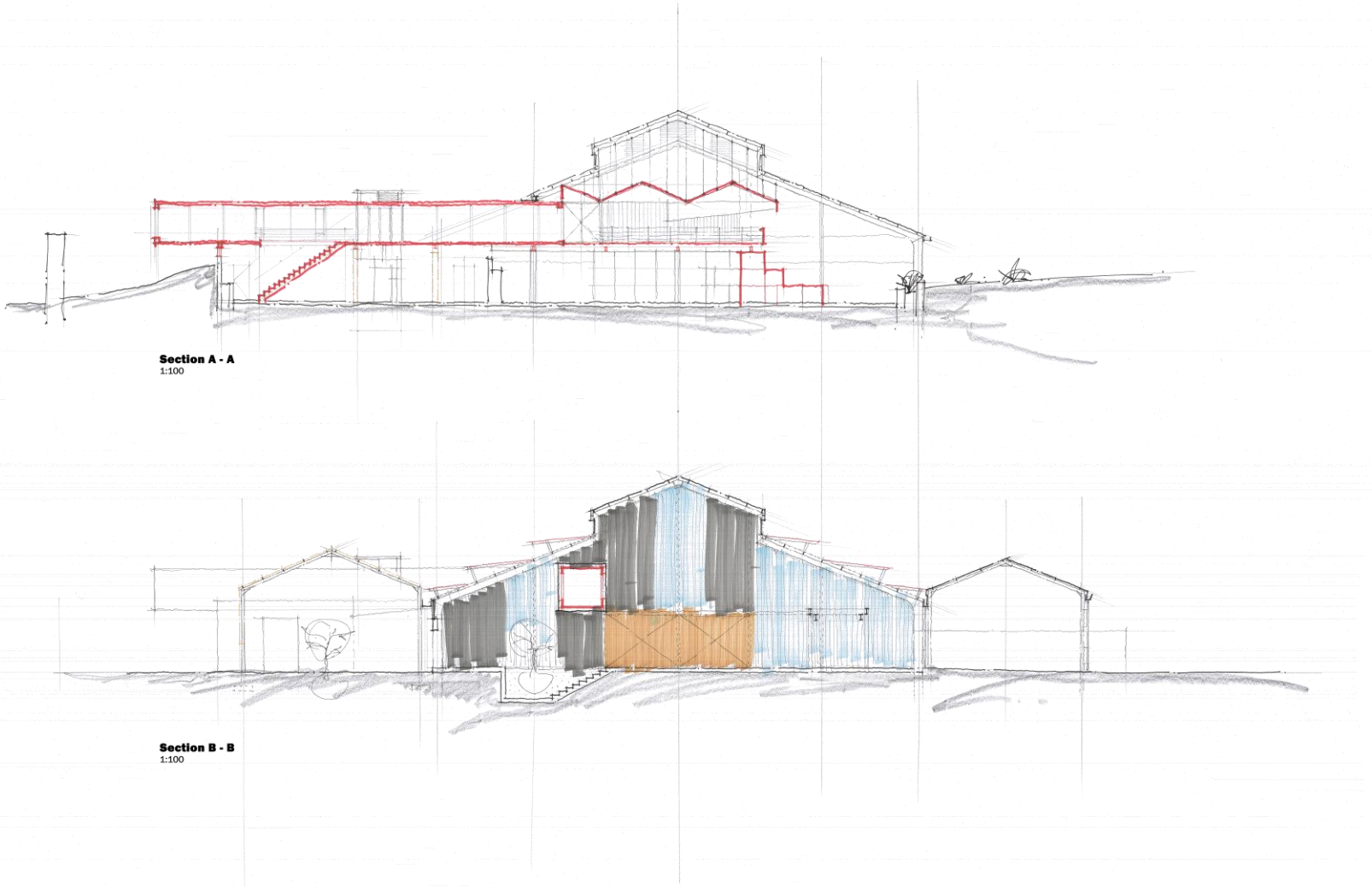


Figure 81: Sections – 1:100(A1) (Author, 2023).

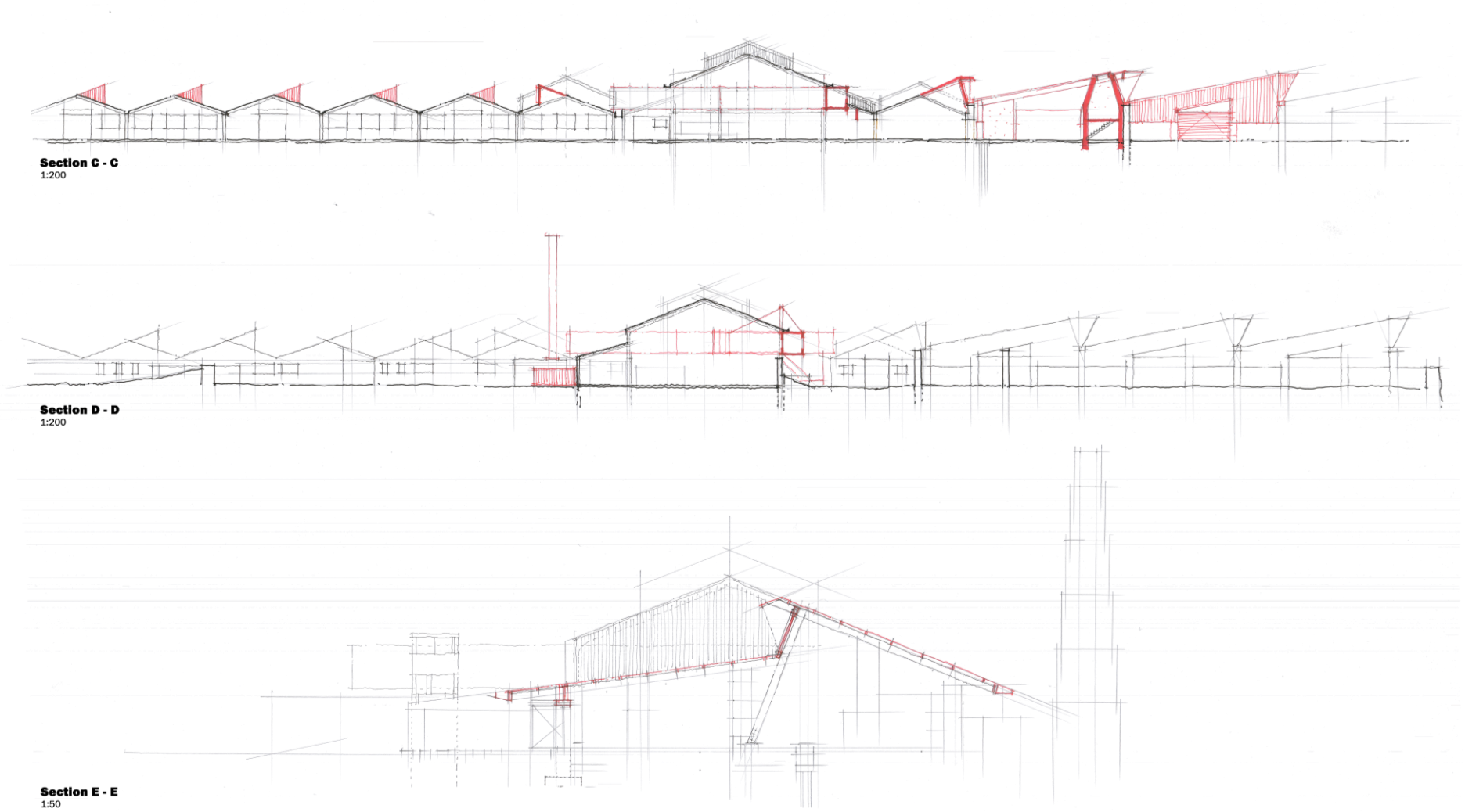


Figure 82: Sections – 1:100(A1) (Author, 2023).

UNIVERSITY OF CAPE TOWN
IYUNIVESITHI YASEKAPA • UNIVERSITEIT VAN KAAPSTAD

2023/06/12

EBE/00177/2023

RE: Research Ethics Committee Project Approval Letter

Dear Warren Hoffman,

Your application for ethics review of your project titled

Re-Fuse

has been reviewed and evaluated by the

APG:School of Architec,Planning&Geomatic Research Ethics Committee (REC).

Based on the information supplied your application has been successful and is approved.

You may proceed with your research project titled:

Re-Fuse

Please note that should:

(i) any serious or adverse effects to participants occur and/or,

(ii) aspect(s) of your current project change and/or

(iii) any unforeseen events that might affect continued ethical acceptability of the project occur then you should immediately report this to the approving REC. You may be required to submit an amendment to this application, in order to determine whether the changed aspects increase the ethical risks of your project.

Please note the following additional conditions associated with this approval:

(i) The reviewer is wondering about the balance of interviewees, between professionals and residents of the surrounding area (Wolwerivier), i.e. only one interview planned with residents (not sure about with workers -- will there be such?) whilst 9 other interviews are planned with the site's owner and various other professionals. Of course, representativity is not the aim of such small-sample qualitative studies, but this proportion does raise the question of who is heard and who isn't. Perhaps relatedly, of the interviews have very many questions (raising questions of feasibility), while others (including the community representative) only a few.

Regards,

APG:SchooPlease discuss this aspect with your supervisor.

Research Ethics Committee

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