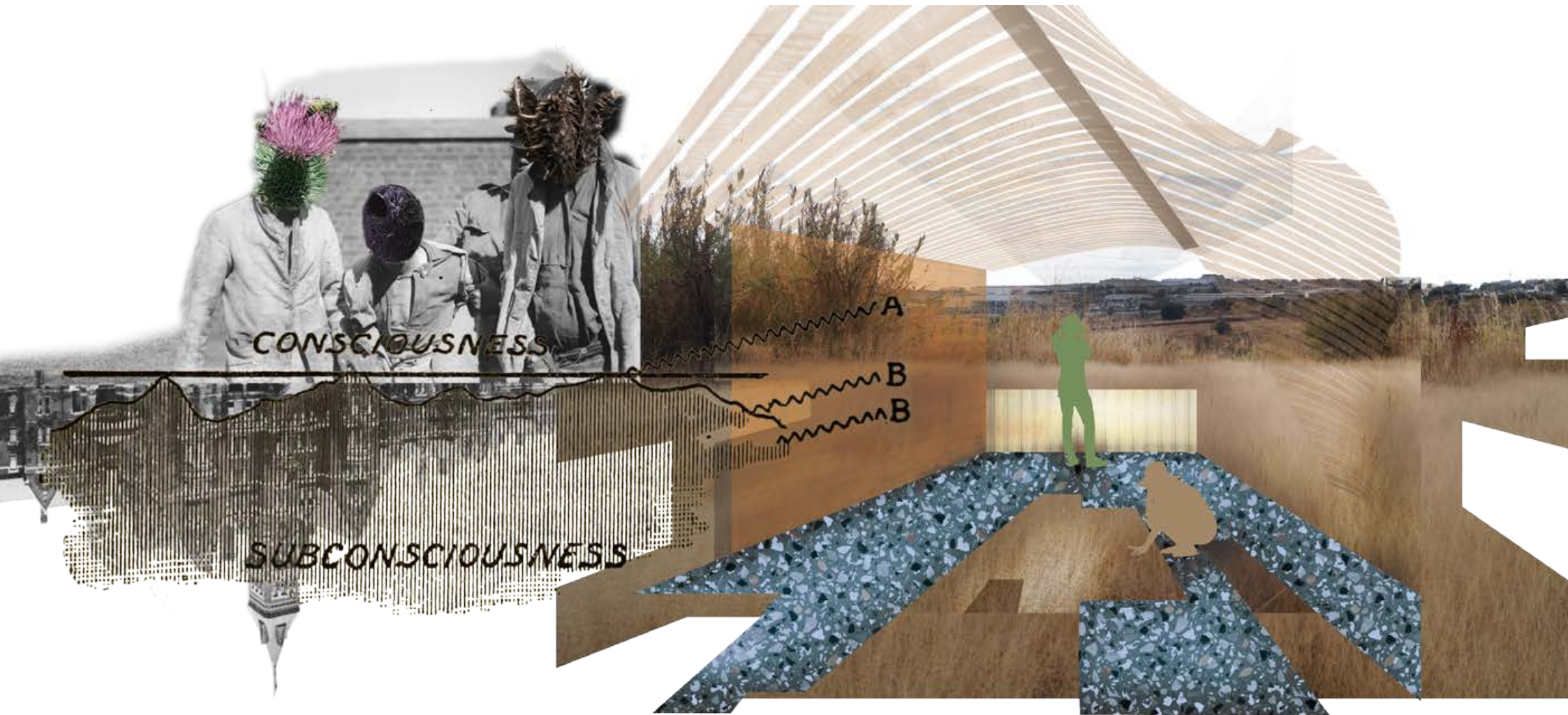




EnvironMental

Using Biophilia to create a mental health support facility in Johannesburg

EnvironMental:Using Biophilia to create a mental health support facility in Johannesburg

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This document is submitted in partial fulfilment for the degree: Master of Architecture (Professional) at the University of the Witwatersrand, Johannesburg, South Africa, 2021.

DECLARATION

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ABSTRACT

In South Africa there is a major issue with a lack of mental health services and accessibility of mental health facilities. In the 2002 Mental Health Care Act it states that mental health care users have a right to quality care. The act looks towards pushing widely distributed community-based services in the form of CMHSs (Community mental health services) as a more effective method of giving everyone access to support for mental health issues. Within the research, I will be looking into how mental health spaces could be created for better clinical outcomes within mental health care users which included the use of complementary therapy in the form of various types of farming. This is investigated through the lens of biophilia and biophilic design. Through desktop research and interviews with professionals and experts in the field of psychology and biophilia information was found to inform a community mental health support facility. As the proposal required expansive views but still remain accessible, Frankenwald was chosen as the site for the intended proposal due to a variety of reasons that are mentioned in the report. This also gave the opportunity to reuse buildings on site to ensure a lighter impact of the design that was informed by biophilic principles. The resulting building uses biophilic principles to ensure the building has a relationship to nature, community and landscape. This will ensure better accessible mental health care that is of high quality that also allows for better clinical outcomes.

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GLOSSARY OF TERMS

MHCU - Mental health care user
CMHS - Community mental health services
IUSS - Infrastructure Unit Support Systems
NGO - Non-governmental organisation
PPP - Public private partnership
ILFI - International Living Future Institute
WHO - World Health Organisation
LVL - Laminated Veneer Lumber
CNC - Computer Numeral Control



1 *Introduction*

1.1. INTRODUCTION

In South Africa there is a major issue with a lack of mental health services and accessibility of mental health facilities. In the 2002 Mental Health Care Act it states that mental health care users have a right to quality care. This Act was put in place to allow for the rights of mental health care users to freedom of movement and association and deinstitutionalised mental health care where at all possible. The act looks towards pushing widely distributed community-based services as a more effective method of giving everyone access to support for mental health issues. This was mentioned and promoted in the National Mental Health Policy Framework and Strategic Plan 2013-2020 as a result of Mental Health Care Act. The network of facilities that provide mental health care starts at the most acute level with a 72-hour assessment period in a specialist mental health unit or special beds in a regional hospital in which the cause can be diagnosed and the patient can be referred for further treatment at the correct (and least limiting) level. An acute mental health breakdown could be caused by trauma including drug overdoses or physical trauma in which case the patient is discharged

to other types of care. In the case of treatable psychiatric conditions such as schizophrenia, bipolar disorder, etc. where a patient requires intensive treatment until the condition has been stabilised, a patient would be admitted to a specialist mental health care ward for 21-days. The idea is that once a condition has been stabilised, patients should go home and attend regular check-ups at outpatient facilities. Some patients who suffer from conditions requiring ongoing care rather than medical supervision may require chronic care facilities. We also see a shift towards more community mental health services (CMHS) and support (Robertson and Szabo, 2017) as this is one of the core objectives stated in the mental health policy and strategic plan. This allows for mental health care users to be in an environment that is familiar socially and physically which improves accessibility to mental health care services while allowing for a higher level of comfort during the treatment process. Community clinics should be widely distributed and should have adequately trained mental health care nurses who can help patients maintain their mental health and can refer

patients in need of higher levels of care, so that only acute patients go to hospitals.

However, after patients' treatment in specialised facilities, there is a severe lack of outpatient facilities. This is due to various reasons including a lack of spaces for outpatient mental health treatment as well as a lack of professionals in the public sector to practice mental health treatment. The lack of effective community support results in mental health care users avoiding taking necessary medication for their mental health conditions which results in re-admission of mental health care users (Gillis et al., 2012), filling the already inadequate facilities. The 2002 Mental Health Care Act requires specific types of spaces for mental health care facilities and the Health department has not even completed refurbishing acute units, let alone building the community facilities required stipulated as a goal in the new act. Due to the general lack of mental health care services, it is likely that a patient would have to wait for months to receive an appointment. This then results in mental health care users

not being able to access mental health care when it is needed. Compounding factors to this can include healthcare facilities that provide these services being too far away and can become unaffordable as those who work would need to take additional time off and pay for transport which then leads to higher costs even if the service is free to use (Stellenberg, 2015). This also affects mental health care users who require chronic day care due to the total lack of facilities for individuals who need chronic day care, either permanently (cf. the Life-Esdimeni crisis) or during the day (for those who do not have access to care provided by loved ones and/or support systems as they cannot be left alone at home safely).

Community-based mental health care requires support from medical practitioners, psychologists, occupational therapists and social workers, and the multi-disciplinary team is currently expanding to include spiritual support. Addressing the spaces and place in which therapy is practiced can also be evaluated and subsequently improved to aid in the process of treatment. The current recommendations supported by the department of

health for outpatient facilities have very broad guidelines for facilities that cater to a variety of patients including mental health. These are however mainly guidelines for practical, physical requirements, while there are theories about the positive role that the sensual quality of spaces may have on effective treatment. One of these is the Biophilia theory, which will be explained in more detail. This research explores how this theory can be used in the design of these spaces to create an optimally supportive environment.

1.2. ACCESSIBLE MENTAL HEALTH CARE

As per the Mental Health Care Act, 17 of 2002, mental health care users have the right to affordable and accessible mental health care without discrimination. Users have the right to privacy and quality health care. The main issue with accessibility is that outpatient services are severely lacking in the public sector in South Africa as compared to the private sector (Lund et al., 2012). Most public mental health care facilities are centralised in large hospitals or mental health care facilities such as Tara Rehabilitation Centre in Sandton and mental health wards in hospitals like Helen Joseph Hospital. This then means that a mental health care user would need to make arrangements and additional costs to be able to access the mental health care which can lead to higher costs due to transport and sacrifices that need to be made for work if they do not live or work close to these facilities. Using community based facilities could be a possible solution to improve accessibility to mental health care services.

CMHS are health care services that are located close to communities to allow for more accessible services closer to those communities (Lund and Flisher, 2009; Robertson and Szabo, 2017). As previously mentioned, the Mental Healthcare Act focuses on establishing more CMHS facilities. These facilities are one of the first points of contact for individuals in conjunction to primary health care clinics. However, many primary healthcare clinics do not provide sufficient or any mental health care services or support frameworks to mental health care users. They would consequently need to be referred to specialised mental health facilities. CMHS's can be used as an appropriate facility to help fill the gap for treatment for mental healthcare users with chronic conditions that do not need to be admitted into centralised facilities.

Research shows that community-based health care in mental health is more effective for mental health care users which means that the facilities are based within the community or in close proximity to the community (Lund and Flisher, 2009).

Having facilities that are community based that allow for more outpatient services would grant mental health care users to still have access to support systems in their own communities without being admitted or make special arrangements to get to centralised facilities such as hospitals that specialise in mental health care. However, due to the government's lack of budget and resources as well as the communities' in which these facilities can be built, other forms of funding should be interrogated to allow for these facilities to be accessible to the public.

Private Public Partnership (PPP) can be used to make quality healthcare more accessible. PPP refers to projects and facilities that are run and funded in partnership between the public and private sector. This bridges the gap between the limited budget of the government to provide quality mental health care services to the public and the ability for the private sector to successfully fund and run projects effectively on behalf of the government. This method of providing healthcare is shown to improve the

quality of healthcare provided as well as improved clinical outcomes for healthcare users overall. This has been observed in developing countries such as Lesotho where the healthcare provided has shifted towards PPP and has been observed as a more effective method to provide quality and accessible health care (McIntosh et al., 2015).



2 *Methodology*

2.1. METHODOLOGY

Within my research, I will be looking into how mental health spaces could be created for better clinical outcomes for mental health care users. This will be investigated through the lens of biophilia and biophilic design. My secondary enquiries include looking at how spaces can reflect the phenomenological change in mental health users during therapy. I will also look at the relationship between psychology and ecology and how can this translate to better spaces for mental health users. This will be achieved through a desktop review of biophilia and understanding the relationship between the concept and mental health. This understanding will inform the method in which I will need to design to achieve a biophilic design. I will also look to experts within the field of mental health and biophilia to help steer the research in the correct direction which would include readings and precedents.

In the scope of architecture, I will need to research spatial requirements for the proposal I will be intending to design through precedents, building standards for mental health care

treatment facilities and guidelines stipulated by the government. Both international and local building standards will be used to inform the design through the lens of biophilia and sustainability. These standards will also guide which materials would need to be used to ensure biophilic architecture is achieved.

I will be looking to my personal experience as a mental health care user in the past to understand the quality of spaces and the needs for mental health care users within mental health treatment spaces. This information is vital as the proposal will look into the user experience of how mental health care users use the spaces within the building and the process that mental health care users go through when seeking treatment. This will also help with ethics as there will be no need to ask actual mental health care users actively using treatment spaces as this would be considered a high-risk group of individuals to interview.

Due to Covid-19, interviews and discussions with experts will be done through digital platforms like Zoom, Skype and Microsoft Teams or telephonically to ensure social distancing. I will send consent forms, questions and other interview material via email to the interviewee to make sure that they are informed. I also will not be able to physically visit existing local mental health facilities due to restrictions imposed by the government lockdown rules as individuals who do not have Covid-19 are not allowed into facilities during the time of the study. When visiting the site, I will ensure that I comply to Covid-19 laws and restrictions at the time such as mask wearing, the use of hand sanitiser and abiding to curfews.



3 *Research Findings and Application*

Biophilia

Biophilic Design

Talk Therapy and Therapeutic Spaces

Accessible Healthcare

Farming and Gardening as Complementary Therapy

Geponics, Aquaponics and Hydroponic Farming

3.1. BIOPHILIA

Biophilia is directly translated as the “Love of Nature”, bio-referring to nature and -philia referring to love. However, Edward O. Wilson, the originator of the concept explains “IF IT exists, and I believe it exists, (it) is the innately emotional affiliation of human beings to other living organisms. Innate means hereditary and hence part of ultimate human nature.” (Edward O. Wilson, 1993 p. 68). The Biophilia Hypothesis takes on multiple forms from the fundamental evolutionary connection humans have to nature where our ancestors would live and survive in natural landscapes, particularly savannah biomes, to present day where we desire to go outside when we are confined to the indoors. The Biophilia Hypothesis also looks at how, as humans, we want various forms of natural resources on a primal level such as food, water, and shelter but also look to nature for aesthetics, intellectual stimulation, and spiritual connection to feel personal fulfilment. These needs relate to Maslow’s hierarchy of needs. Nature’s physical presence alone can subconsciously satisfy our physiological needs such as when a space is stable and can provide sustenance like water or food grown from nature. It can

also fulfil our safety needs as nature is seen as a safe space especially in savannah-like biomes where one can survey the land and establish themselves within the landscape. Rest can also be fulfilled in these spaces like the ability to sit on large boulders to take moments of pause, both physically and mentally. By nurturing nature and harvesting from nature we can fulfil our esteem needs and feel a sense of accomplishment. These needs can then help with self-enlightenment and achieving one’s full potential (McLeod, 2018). Biophilia is also said to be cross-cultural as biophilic ideologies are present in both indigenous knowledge systems as well as western industrialised societies (Kellert, 1993).

Incorporation of biophilic principles within architecture would also speak to the fundamental needs within people by strengthening our relationship to be connected to nature. Due to these very fundamental needs, as per the Biophilic Hypothesis, there has been evidence that spaces that are designed

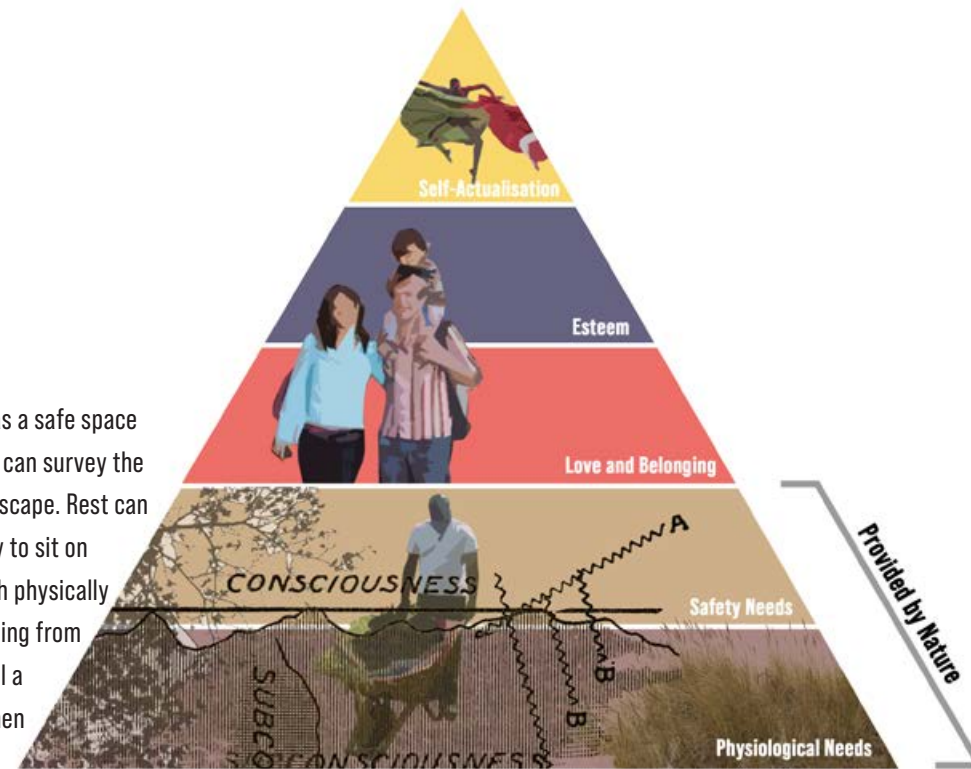


Fig 3.1 - Maslow's Hierarchy of needs

specifically for people to have contact with nature directly or indirectly can improve the wellbeing of individuals. The exposure to nature, contact with plants and experiencing natural weather elements like wind and natural sunlight within spaces has also been seen to be beneficial for stress recovery in both mental health care users in a clinical environment as well as people who reside in such spaces (Ulrich et al., 1991). This relationship between biophilia and health, especially mental health, has been observed in many contexts.

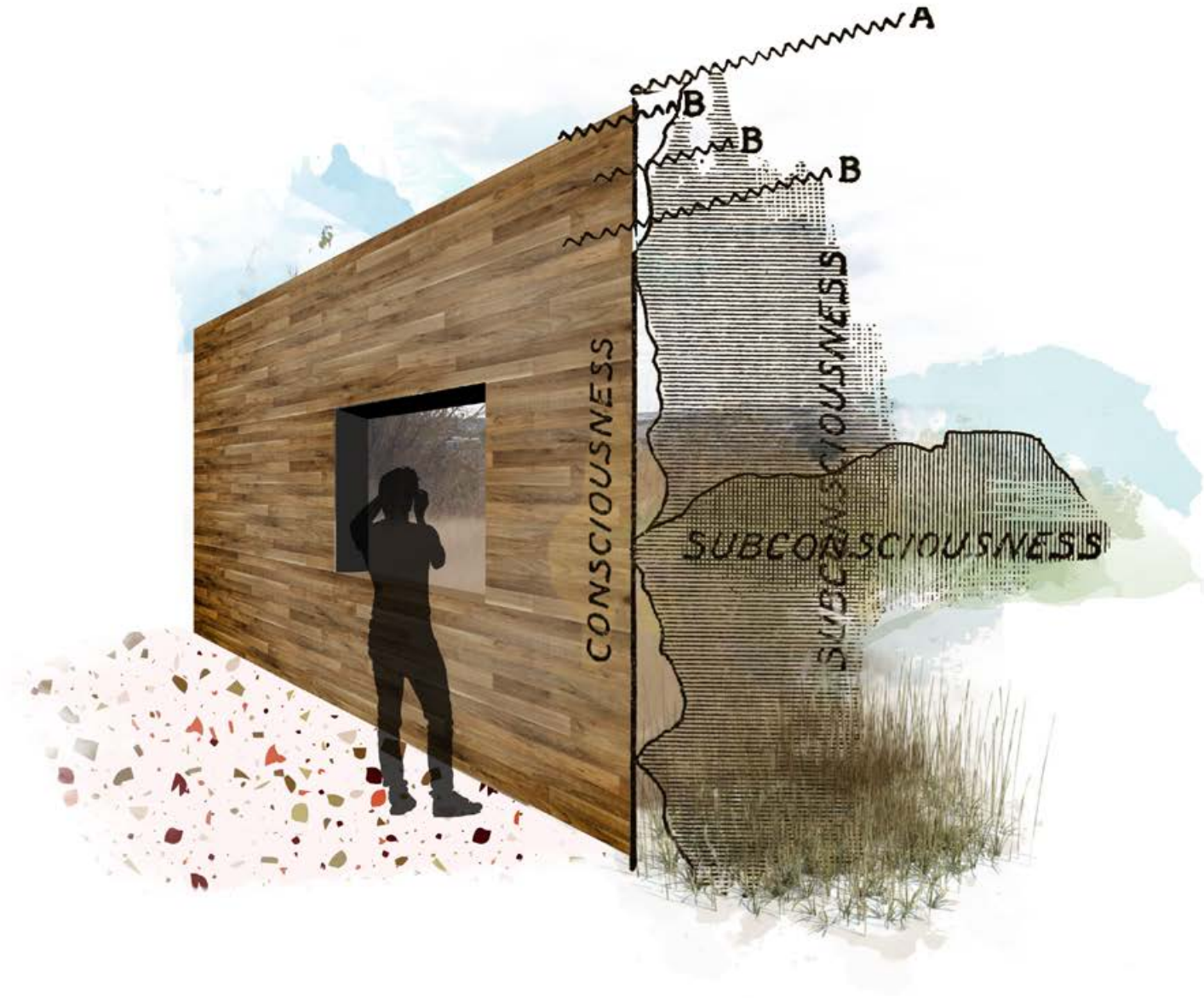


Fig 3.2 - Biophilic Design and Psychology

3.2. BIOPHILIC DESIGN

Biophilic design refers to the application of the Biophilia Hypothesis within design and architecture. Designing according to biophilic theory can take various forms. This includes using natural elements such as plants within spaces and adjacent to buildings or designing buildings that create specific relationships between building users and surrounding landscapes, nature and context. This includes the natural physical landscape where the building is located as well as the social landscape which should be observed together to create strong connections between people and nature. In a physical building, Biophilic theory promotes the use of natural materials that have complex but diverse patterns with surfaces like that of stone and timber, or man-made materials that emulate this complexity found in nature. This complexity in patterns and shapes can also be represented in the way natural light is filtered into spaces (in the form of more complex edges of shadows) have been shown to be aesthetically pleasing as well as have the ability to reduce stress in individuals using the space (Abboushi et al., 2019). With the combination of the already naturally occurring elements

such as sand, stone, and plants of the surrounding area with the architecture, the resulting design is an extension of its surroundings instead of an imposition.

Biophilic design also looks at minimising the impact of buildings on their surroundings using sustainable building methodologies as a core principle of biophilic architecture. This takes form in the idea that to gain the maximum benefits from nature one should take care of nature and ensure its longevity. There is an evident symbiotic relationship between nature and people as nature will thrive due to peoples' care and people would consequently benefit with nature flourishing. Usually, people understand sustainable building to refer to the building's minimal use of resources while operating, however, biophilic design looks into each stage of the building's lifetime from construction to occupation and how each stage impacts the physical environment as well as the social environment. The building has to effectively work with the environment and communities and strive to also enrich these aspects of place.

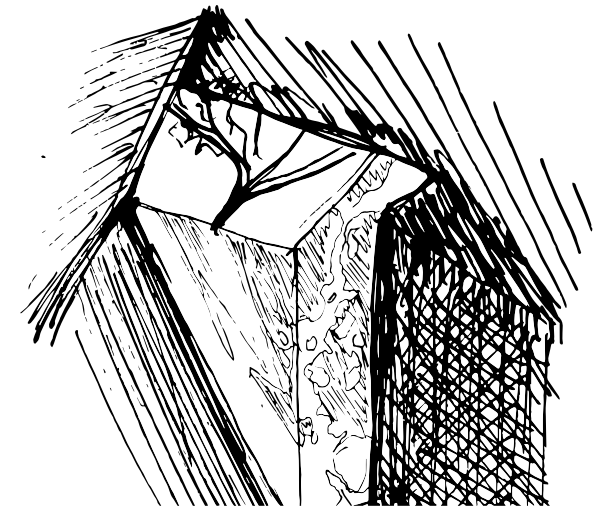


Fig 3.3 - Fractal light and skylights

Biophilic design can be implemented from the inside out where a simple action such as a view to nature can help stress recovery in mental health care users in hospitals as well as reduce recovery times (Roger S. Ulrich, 1993 p. 88).

Biomimicry in design can also be used as a form of biophilic design where elements of the building have taken nature as

intentional direct inspiration for aesthetics of the design [“What Is Biomimicry?,” n.d.]. It can also take the form of taking inspiration from naturally occurring processes like photosynthesis to design solar panels which result in creating food/energy from solar radiation. More complex ecosystems can also be emulated to create more sustainable systems like the use of wetlands to purify water run-off. Biomimicry should take its immediate surroundings as inspiration for it to be effective as this would make the building be an extension of its environment rather than an imposition. These design solutions are found in architectural examples like the Sagrada Familia by architect Gaudi where trees were taken as direct inspiration for the structural systems of the cathedral. This use of biomimicry in creating natural patterns like the ones cast by the stained glass windows in the Sagrada Familia are also found to create positive psychological reactions in individuals experiencing the spaces (Coburn et al., 2019).

Biophilic design principles also look at the longer-term impact on the immediate surrounding environment and the social context of the proposed intervention. These interventions need to be able to work with the environment and the people in surrounding communities creating a space where people can engage with nature as well as giving sustainable social and economic opportunities to communities. Biophilic design should be able to reinforce the relationship between humans and nature and to be able to ultimately benefit each other.

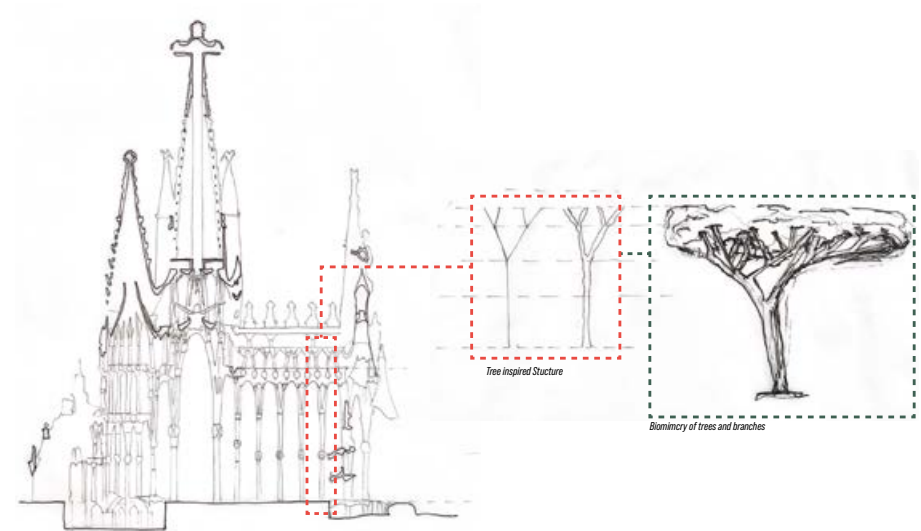


Fig 3.5 - Biomimicry in Sagrada Familia



Fig 3.4 - Creation of Forest Through Biomimicry

3.3. TALK THERAPY AND THERAPEUTIC SPACES

Talk therapy is the preferred method of treatment practiced by therapists in mental health care contexts and is seen as an effective way of treatment for mental health conditions where a therapist will talk to the patient to diagnose the psychological components of a patient's conditions and initiate treatment towards self-recovery (Messas et al., 2018). Talk therapy looks into the how individuals can deal with negative emotions, thoughts, and reactions in their lived experience and making positive changes. The mental health care users' symptoms that may be caused by various forms of mental health conditions can range from mild to severe. However, these forms of therapy are normally practiced within offices or indoors in closed rooms which tend to be detached from nature, its place and consequently its context. In most cases, these rooms will have windows for natural light but will not have attractive views onto nature (Connellan et al., 2013).

As stipulated in the IUSS guidelines for designing outpatient facilities, having a view to the outdoors (either a natural

landscape or natural features) can greatly reduce stress in mental health care users within the spaces and consequently improves the effectiveness of talk therapy. This lines up with the use of biophilic design parameters as set out by institutes of biophilic design like that of the Living Building Challenge created by the International Living Future Institute ("Living Building Challenge | Living-Future.org," 2020). When mental health care users have views to natural and familiar landscapes, these mental health care users feel more comfortable to speak more openly to their therapists. Additionally the access to views has also seen to be able to reduce stress and anxiety during talk therapy (Cooley et al., 2020; Shepley et al., 2017). The incorporation of natural light, reduction of noise, and more comforting spaces help with reducing stress in mental health care users and consequently support the therapeutic experiences of mental health care users which aligns with the IUSS outpatient facility design guidelines outcomes. However, this also brings in the question of choice for mental health facility users and practitioners, where some individuals would

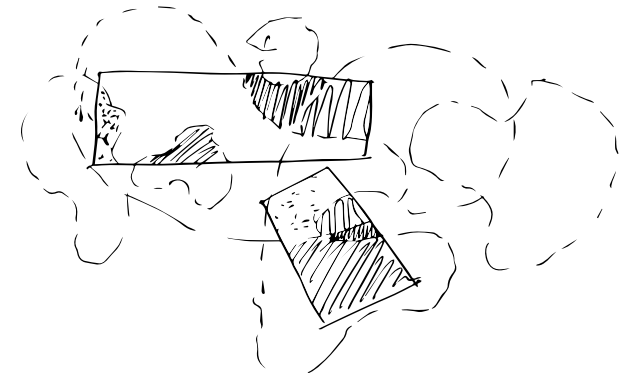


Fig 3.6 - Intersection between euclidian geometry and nature

prefer to be inside to practice therapy but are also given the choice to practice in private outside spaces that connect to the landscape and natural elements of the environment. The addition of incorporating large spaces of landscaping will also allow for talk therapy to be practiced while walking which also greatly improves therapeutic outcomes (Cooley et al., 2020). This would be an architectural challenge that would be addressed in the proposed design scheme. [Fig 3.8]

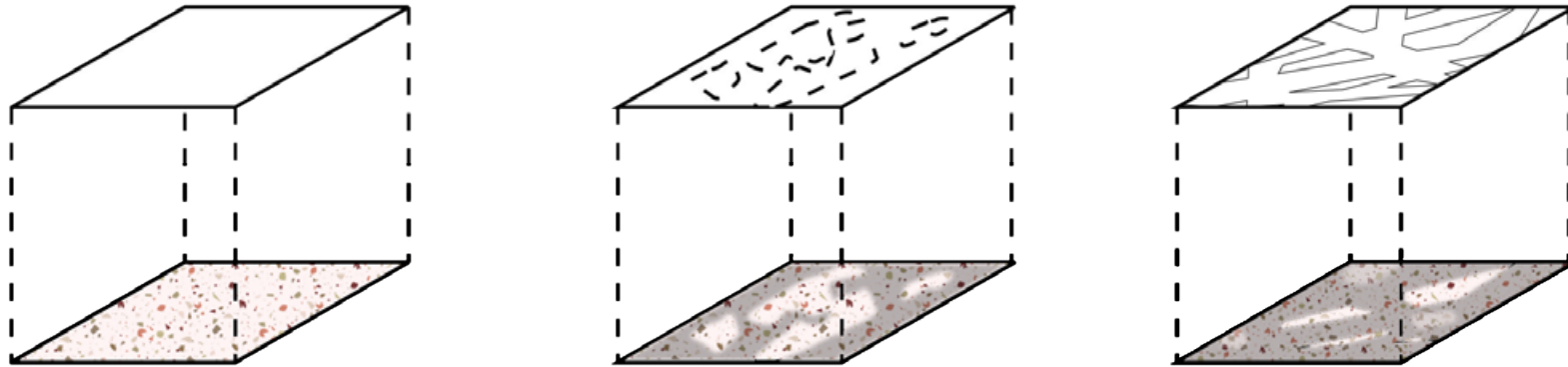


Fig 3.7 - Effect of fractal light in interior spaces replicating that of trees

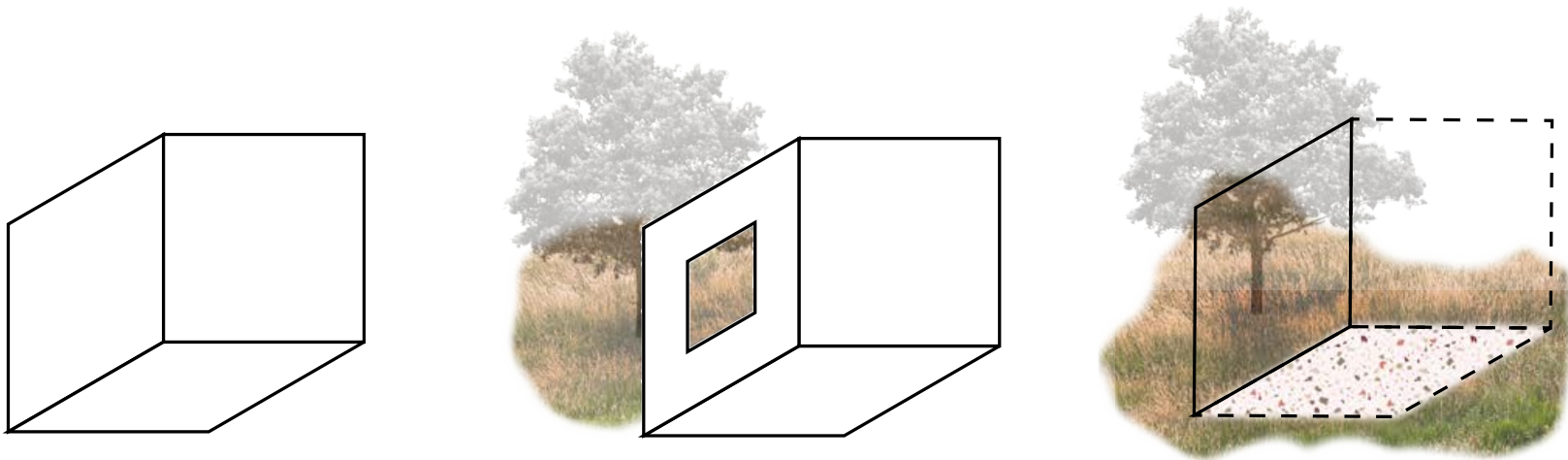


Fig 3.8 - Therapeutic spaces and application of various degrees of biophilia

3.4. FARMING AND GARDENING AS COMPLEMENTARY THERAPY AND DAY CARE

In South Africa there is a lack of mental health day care facilities available for the public for mental health care users (Lund and Flisher, 2009). Day care facilities provide care for individuals who do not have sufficient care or supervision during the day from their social support systems like friends and family at home. These types of day care facilities are based and cater to local communities as additional resources for mental health care users and to allow for them to be better integrated into the communities by giving them opportunities. Day care facilities provide activities to mental health care users under the supervision of professionals like occupational therapists and social workers. Day care facilities allow for mental health care users to be cared for and allow them to engage in therapeutic activities like exercises provided by biokineticists, physical therapy and more engaging activities in the form of gardening and farming.

Engaging in horticultural and agricultural activities has been a proven method of complementary therapy for mental health care users (Clatworthy et al., 2013; Elsey et al., 2016). It allows for mental health care users to engage in activities during the day outside in nature which has been proven to reduce stress. The process of taking care of plants and farming allows for individuals to experience the process of growing and building self-esteem in mental health care users in day care facilities. Building their self-esteem would then result in self actualisation which relates back to the two top levels of Maslow's Hierarchy of Needs (McLeod, 2018). This day care facility could then also provide food for its own use. Mental health care users and day care users should be able to engage in horticultural or farming practices in various levels of complexity which can be easily carried out in a contained urban environment and do not require great physical exertion or expert equipment.

3.5. GEOPONICS, AQUAPONIC AND HYDROPONIC FARMING

These various farming methods require different levels of skill. Geponics or traditional soil-based farming is the least technical method of farming that requires the least amount of skill. They also require traditional tools such as spades and pitch forks to be used to prepare soil for planting. Aquaponic and hydroponic farming is an alternative method of traditional forms of farming using mechanical and chemical systems to provide nutrients to crops grown. Hydroponic farming systems are more effective in terms of yield per area as compared to traditional farming methods. These alternative systems comprise of the following basic components: water reservoir where water is treated with nutrients either through the use of fish and their waste or natural chemical nutrients for plants, and the medium where plants are grown (AlShrouf, 2017).



Fig 3.9 - Geponics

These three farming methods all follow the same principle in terms of the agricultural cycle. Crop Planning – This refers to the planning of the crops that will be grown for a certain season to ensure the highest yield. This does not apply to hydroponics as much due to the very scientific method of growing where the environments are strictly controlled and can be catered to the crops for maximum growth. This is followed by seed purchasing which also looks into the purchasing the seeds for the crops to be grown as well as fertilisers and growing mediums used to grow the plants. These seeds will then be planted. They can either be planted into seed trays in a warm environment to ensure the plants sprout and grow into seedlings to ensure the longevity of the growth of the crop. Once the seedlings have grown large enough and are able to survive better for growth, they will be planted into the various methods of growing. After they are grown and are bearing the produce harvesting will occur. They will then be processed and checked to ensure quality and make sure they are safe for consumption. The processing of the produce requires minimal training which

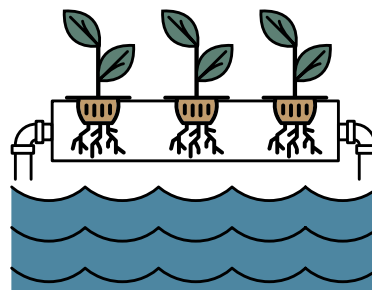


Fig 3.10 - Hydroponics

opens opportunities to mental health care users to partake in these activities and also be remunerated accordingly.

A mixture of all three methods of farming will be implemented as part of the proposed facility. This will ensure activities for mental health care users to engage in various levels of skilled activities. The various types of farming will also allow for a variety of food to be grown as some crops grow effectively in earth and not in mechanical systems like that of hydroponic and aquaponic systems. Traditional earth-based farming will be closer to the mental health facility as this will ensure that mental health care users are supervised to ensure their safety.

A farm could improve accessibility to good quality food for surrounding communities to ensure food security. A farm could also serve as part of a support facility program to allow Non-Governmental Organisations (NGOs) to supervise mental health care users who do not have access to day care as this may be limited within communities. It could provide mental health

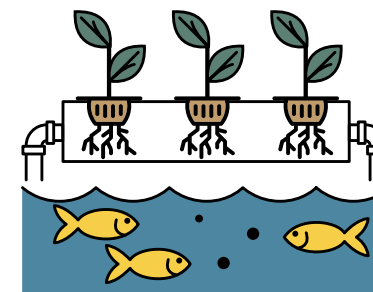
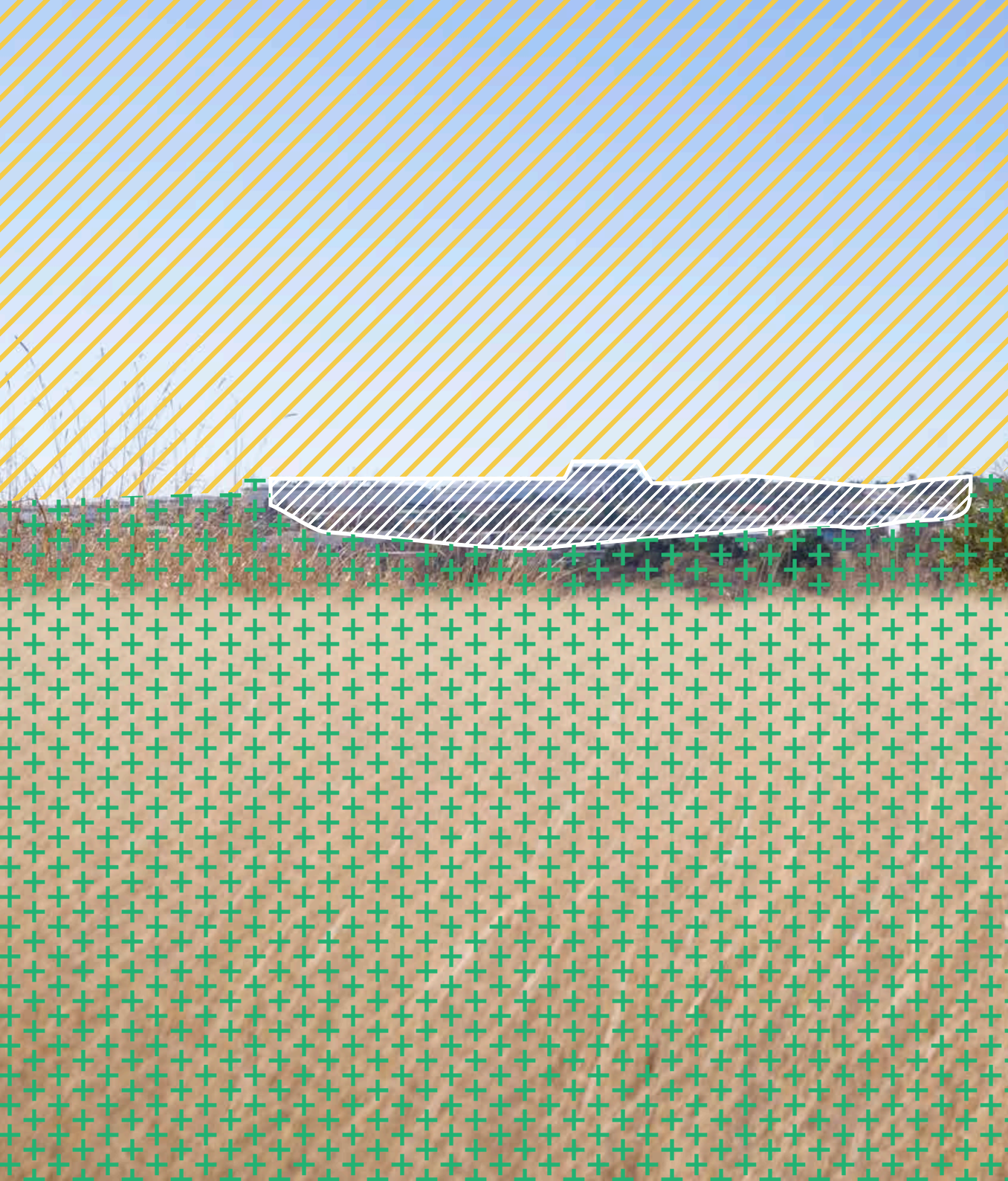


Fig 3.11 - Aquaponics

care users with a platform to engage with these activities in conjunction with the therapy they receive from the professionals in the outpatient facility. Various farming methods can cater to different types of mental health care users depending on their cognitive levels and abilities as certain farming methods would require more intensive and technical training to make sure the facilities run effectively. This will be determined by the mental health practitioners at the facility who treat the mental health care users to ensure that the mental health care users engage in the activities in a safe manner. This will also support the therapeutic outcomes that mental health practitioners want to achieve with their patients. These support facilities and complementary therapies have been shown to improve patient's well-being and mental health conditions that they may have and can reduce stress [Söderback et al., 2004]. This will also empower individuals within the community and allow them to be more independent within their communities. This can allow individuals who experience stigma due to mental health conditions to better assimilate into their communities.



4 *Site*

Site Selection
Site History
Site Information
Site Images

4.1. SITE SELECTION

The site was selected by using list of criteria collated from various already established sustainable standards, namely those written locally by the Green Building Council of South Africa and the criteria in the Living Building Challenge set out by the International Living Future Institute which is an international standard of building sustainable buildings. In addition, the ideas of the Biophilia Hypothesis were also implemented to ensure a thorough application of biophilia within the conception of the design. The following criteria are as follows:

1. Proximity to communities that require mental health care and support services
2. Access or views to savannah landscapes/biomes
3. Proximity to major routes and access to ensure easier access for mental health care users
4. Natural water sources to either use and/or improve within the design and to embed the design within its context.

Once these criteria were established, I looked at two potential sites in Johannesburg. I first looked at Modderfontein as there was potential to plug into the existing structure of bunkers previously used in the testing and storage of dynamite and explosives by the AECL (African Explosives and Chemical Industries). The existing buildings are set in a savannah biome and it had access to other natural features that currently fall under a private property owned by AECL and sold to another property development company and run by a community conservancy group to protect the reserve. However, this site was surrounded by predominantly wealthy communities and privatised health care. It also lacked proximity to major routes for access to ensure easy access to the site. I then also looked at Frankenwald as another potential site.

Frankenwald was considered as a site to base the enquiry as it is surrounded by a variety of communities namely Alexandra, Marlboro Gardens and Kelvin, that have limited access to mental health care and mental health support services. Additionally, the

site is currently owned by the University of the Witwatersrand which opens up an opportunity for the proposed facility to work with the University program. Further research of the site showed that the site was donated on strict terms for the site to be used for “education in perpetuity” which enforced the facility having an education aspect. The site has an anchor point namely the existing buildings to design the new scheme to limit the amount of impact on the site. These buildings are also surrounded by savannah which is imperative as per the Biophilic Hypothesis in addition to the Jukskei river which allows for another type of natural element to integrate into the design. The site was chosen due to its close proximity to public transport nodes including the Gautrain. This facility will consequently be accessible to everyone and also engage with the communities as per the key objectives in the frameworks and strategies for mental health treatment made by the Department of Health.

As Frankenwald is located in the metropolitan area it allows the site to tap into the available workforce within the surrounding

communities which is one of the objectives in the Living Building Challenge. The location also allows for easier access to materials which also reduce the transport costs and potential embodied energy in the materials.

The proposed site is located at a crossroads between three communities, namely Alexandra township to the south, Marlboro Gardens to the south west and Kelvin to the west. These three communities vary in average density population, demographics, and average household income. The Marlboro Gautrain Station is also located to the south of the site with other public transport routes which allow for various methods of access to the site for those far from the site. There are a few primary healthcare clinics located throughout Alexandra with various services, however only one clinic (located 2km from the site) provides mental health services to the community.

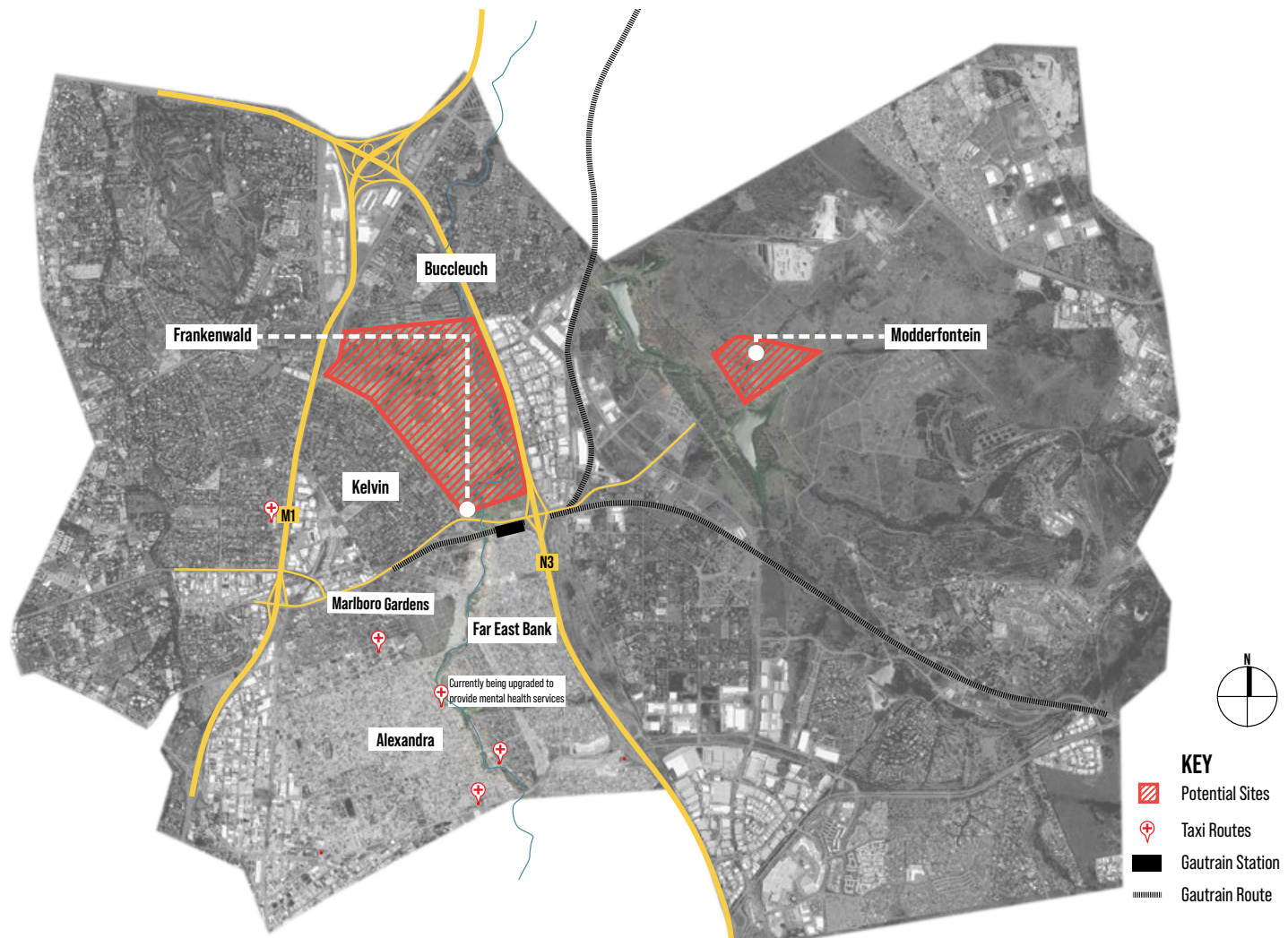


Fig 4.1 - Locality Map and position of existing clinics & Potential Sites

4.2. SITE HISTORY

Frankenwald is a very contentious site. It was donated to the University of the Witwatersrand by mining magnate Sir Alfred Beit in 1905 to be used for “education purposes in perpetuity”. This essentially means that the site should be used for the sole purpose of education either through research or teaching facilities. There are no height zones, building lines, F.A.R or particular zoning allocated to the site except for education. It is currently a farm portion RE/5/37-IR.

Previous Proposals

There have been multiple proposals and different town planning schemes ranging from industrial and commercial to mixed use proposals. It is in the process of being sold to an unnamed developer for them to create plans to use the site. The exact uses have not been specified however the portion of the site that I am proposing to design in will likely be commercial as seen in various proposals. Frankenwald has been identified in the Johannesburg Spatial Development Framework as a metropolitan

sub-centre as a future infill development which will most likely be mixed use.

For my intended proposal, if the land is not sold and still owned by the University of the Witwatersrand, they can choose to instate a long-term lease to the government to allow them to build on the land as the intended client would be the Gauteng Department of Health but run in a Public Private Partnership (PPP) with stakeholders in the private sector. University of Witwatersrand reserves the right to make sure the party that will build on the site will include the University in certain aspects to ensure the site is being used for “education purposes in perpetuity” clause is being met as per original conditions of the donation of the land.

4.3. SITE INFORMATION

The site is proclaimed however the entire site is very expansive and covers multiple hectares. I have chosen a portion of the site that already includes buildings that are in use, namely a meeting/conference building owned by the University

of Witwatersrand that is currently being let out to various companies as well as some spaces are left vacant and unused. There are also factories on the site that are currently let to a plastic distribution company and two others that are currently vacant. There is no defined SG diagram for these buildings (refer to Fig 5.) The site would have to be subdivided and this portion, still owned by the University of the Witwatersrand, will be rezoned for Business 1 as this will allow for the broad range of uses proposed on site.

Environmental Aspects

There has been a lot of research throughout the years conducted on the site to fulfil the site’s designated use. However, no environmental impact assessments have been made available to the public or the owners of the site. There are issues with water quality as the Jukskei River is located on site. The river runs south to north through Alexandra which may have certain impacts on the river’s water quality. There are 50- and 100-year



Fig 4.2 - Transport and access to site

flood lines that need to be considered for the proposed scheme.

Access to Site

The site is located on the corner of Marlboro Drive and North Way. There is a pedestrian bridge over Marlboro Drive that can be used to access the site and access the sidewalks on Marlboro Drive. The site entrance is located on North Way road for vehicles. One entrance allows for smaller vehicles like personal cars and taxis that can be reused in the proposal to the north of the site and an existing entrance is also located to the south which is used by trucks which can also be utilised in the proposal. There is existing parking located on site used by the research facility and a separate parking and loading bays used by the industrial facility to the south.

Establishing new site extents and boundaries

On the site by looking at the contours, furrows can be seen to

the north and the south of the site that allow for water runoff to go towards the river. The furrows have to be preserved so that the proposed project doesn't impede on the naturally occurring drainage on site. To future-proof this naturally occurring furrow, the site boundary will be pushed at least 3m away from the edge of the furrow so that possible future developments would not hinder the effectiveness of the furrow. The building line for the proposal will also sit at the edge of the furrow to make sure the building does not encroach on the existing furrow on site.



Fig 4.3 - Views from site through exisisting grassland

4.4. SITE IMAGES



Fig 4.4 - View of existing structures and landscape



Fig 4.5 - Potential area for proposal



Fig 4.6 - Overhanging existing structures on site

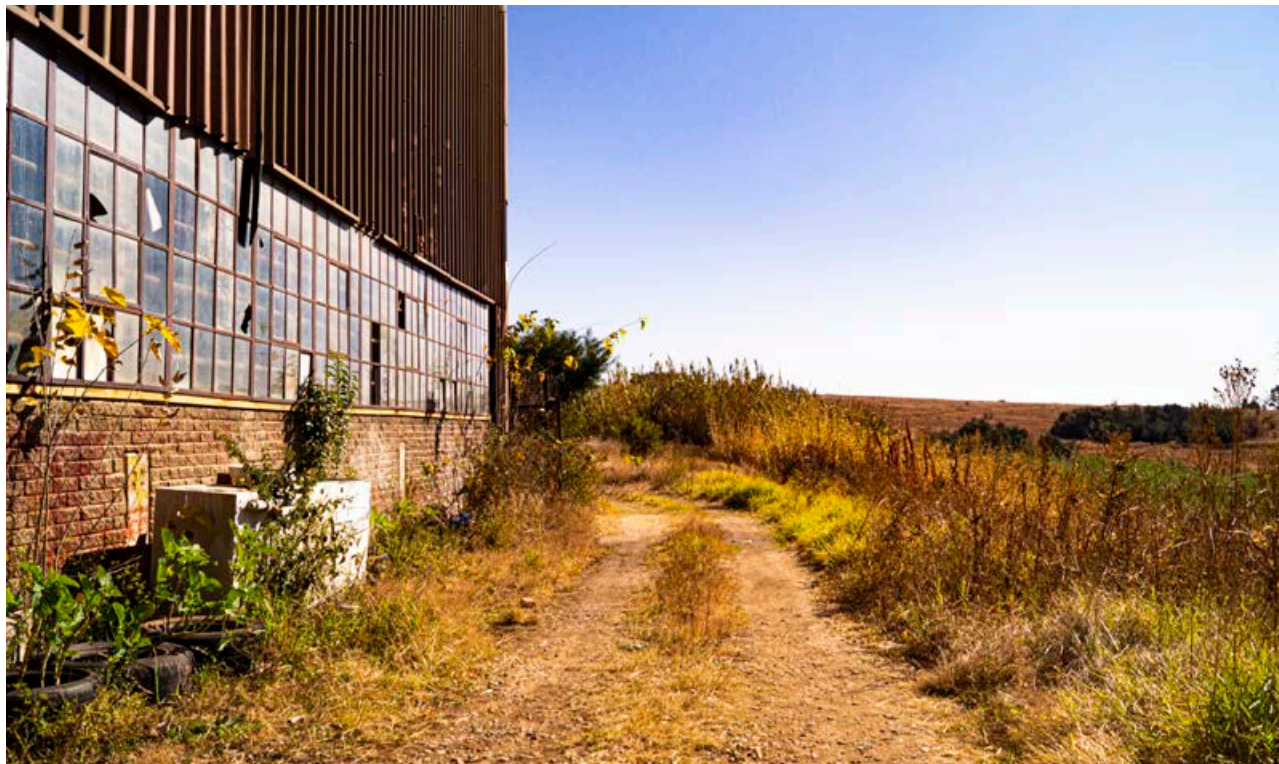


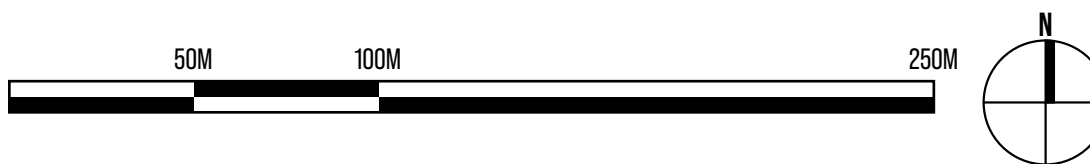
Fig 4.7 - Existing structure and bank

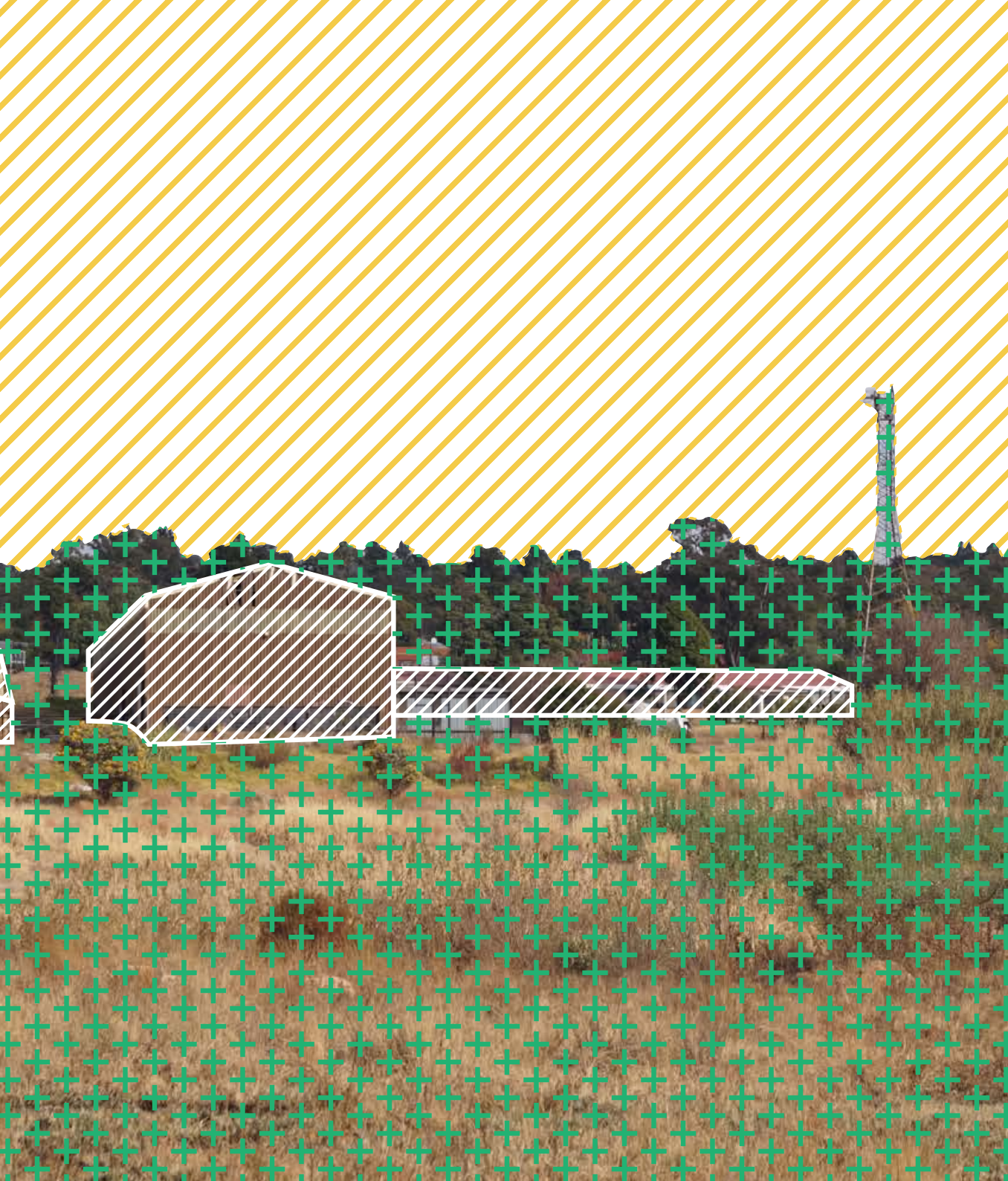


Fig 4.8 - Spaces between existng buildings



Fig 4.9 - Analysis of existing site





5 *Design Brief*

Program
Design Principles and Concepts
Financial Model

5.1. PROGRAM

The proposed program consists of two core components: a mental health support facility and a hydroponic and aquaponic farming facility. Both will influence each other and would benefit from each other. The mental health support facility will be based on precedents as well as the recommended spatial requirements and guidelines for mental health facilities stated in the National Health Act 2003.

The proposed facility will focus on mental health and will use guidelines set out by the IUSS Health Facility Guides which are government issued guidelines for health facilities for the country. The main focus in the IUSS guidelines specifically in terms of mental health therapy is to facilitate spaces that promote therapeutic outcomes and lessen patients stress during therapy. These guidelines, in conjunction with the Biophilia Hypothesis, will enhance the spaces where talk therapy occurs. This new approach to design spaces will also improve therapeutic outcomes (Cooley et al., 2020). The proposed facility will use biophilia and biophilic principles to create spaces that

improve connection to nature and natural elements instead of using mechanical forms of ventilation and lighting and using paintings and pictures of natural landscapes as it stipulated in the IUSS guidelines. This will consequently improve the ability for individuals to express themselves during talk therapy. The concept of biophilia will be extended to the activities and facilities provided to mental health care users and will not be limited to talk therapy spaces to ensure a comprehensive biophilic experience within the facility. Looking at existing frameworks and international standards will help in setting new guidelines for a prototypical facility that can be replicated in its principles in other contexts.

Support Facility

The community health support facility will follow outlines established in the Mental Health Care Act of 2002 as well as published common practices and standards as stipulated by Infrastructure Unit Support Systems for the National Health

Act 2003 in South Africa. This will allow for the outline of what spaces are required for outpatient clinics as well as mental health clinics. Due to the novel nature of the proposed project, these established standards would need to be scrutinised for their validity in the context of a biophilic mental health support facility which includes spatial arrangements as well as stipulated finishes and details. Due to the proposed PPP structure of the support facility, it will be able to offer placements for medical graduates seeking to complete their community service and internship years in the available fields. This will include nursing, psychology, psychiatry and therapeutic sciences consisting of physiotherapists, occupational therapists, social workers and with the addition of biokineticists to teach classes and give exercise to patients. This would allow for the scheme to comply to the use that the site was stipulated to be used for in the terms and conditions laid out by Alfred Albeit as well as allow for the University of Witwatersrand to benefit from the facility. It will also allow for research to occur on the premises for professionals in training who are placed in the

facility as part of the academic program. There will be separate treatment areas for both adults and children for therapy to occur to ensure safety. The support facility's education spaces including meeting spaces and auditorium, which will be used predominantly in the day, can also be used for peer support groups in the evening run by NGOs. These support groups would cater to individuals who suffer from addiction, eating disorders, anxiety and depression.

Therapeutic spaces will comprise of various facilities and will also need to ensure privacy for mental health care users. This centre will also provide a service to help those who need day care such as geriatric care for the elderly who might suffer from conditions such as Alzheimer's. The therapeutic department will also engage with the community by providing services like group classes for physical activity. There will be various sizes of therapeutic spaces from offices where therapy can be practiced in privacy as well as larger floor spaces to allow for equipment to be utilised by professionals like biokineticists and physical activity instructors in order for group classes to occur.

Farming Facility

The farming facility will use geponics (earth-based farming) methods as well as new agricultural methods including aquaponics and hydroponics. This farming facility will also have spaces and facilities that are catered to Non-Governmental Organisations (NGOs) including offices/hotdesking spaces and storage facilities for files and records. This will allow for NGOs to share resources and practice collaboratively. NGOs will also be able to run programs for mental health care users to engage in farming as complementary therapy as previously mentioned, under the NGO's supervision. The farming facility will consist of two novel farming methods, namely aquaponics and hydroponics. The aquaponics system will use native species that are seen in the Jukskei River as an essential part of the system. The storage of the fish for the aquaponic system will be used in a pond that will form part of the aesthetics of the facility that will also enforce the biophilic nature of the facility.

Some of the produce will be sold on the property directly to the public to ensure affordable food is available to be purchased by the community. The market will be located close to the NGOs. The remaining produce will be sold to markets and wholesale to ensure a constant income into the scheme. This will also aid in the funding of the scheme and subsidise the facility with income and food.

The following table shows the accommodation schedule with subsequent areas for each room. I've organised the spaces in separate departments to inform the design.

Adults	No of rooms	Size of Rooms	Total Area
Reception/Waiting room	1	30	30
Duty Room	1	12	12
Administration	1	15	15
Clerks Office	1	15	15
Social Workers	2	16	32
Filing	1	6	6
Staff Room	1	12	12
Kitchen	1	6	6
Ablutions (Staff)+accessible	1	12	12
Nurses Consulting Room	2	16	32
Injection Room	1	8	8
Psychologists office	4	15	60
Doctors Consulting Room	4	12	48
OT Office	2	14	28
Equipment Store	1	20	20
Group Room	1	20	20
Play room	1	20	20
Workshop Room	1	30	30
Family Therapy Room	1	20	20
Ablutions (Patients- Adults)	1	8	8
Cleaners Locker Room	1	10	10
Cleaners Store room	1	6	6
Kitchenette/Cleaners room	1	10	10
Total Area			460
Circulation (+25%)			115
			575

Table 5.1 - Program for adult therapy

NGO Areas	No Of rooms	Size of Area	Total Area
Records Stores	1	6	6
Hotdesking Areas	10	5	50
Lobby	1	15	15
Information Area	1	15	15
			86

Farming	No Of rooms	Size of Area	Total Area
Ablutions	1	20	20
Growing Areas	1	200	200
Plant Rooms	1	20	20
Ablutions	1	20	20
Change rooms	1	60	60
Administration Offices	1	10	10
Sorting and packaging	1	100	100
Store Rooms	1	30	30
			460

Existing Buildings	
Block A	1987
Block B	1288
Block C	502

Table 5.2 - Program for farming facility

Education	No of rooms	Size of Rooms	Total Area
Lecture Theatre	1	50	50
Classroom	2	15	30
Seminar room	1	20	20
Open Discussion Space	1	25	25
Researchers office	3	12	36
Library	1	35	35
Store Room	1	8	8
Filing	1	10	10
Ablutions	1	12	12
Total Area			226
Circulation (+25%)			56,5
			282,5

Table 5.5 - Program for education department

Therapeutic Department	No of Rooms	Size of rooms	Total Area
Lobby Reception	1	20	20
Consulting Rooms	3	12	36
OT Offices	2	14	28
Biokintecisits Office	2	14	28
Physical Therapist	2	14	28
Equipment Store	1	30	30
Workshop Room	1	40	40
Activity Room	1	30	30
Male Changerooms	1	60	60
Female Changerooms	1	60	60
Staff Rooms	1	40	40
Outdoor Activity Area	1	50	50
Total Area			450
Circulation (+25%)			112,5
			562,5

Table 5.3 - Program for therapeutic department

Central Administration	No of Rooms	Size of room	Total Area
Lobby Reception	1	20	20
Security Offices	1	15	15
CCTV Room	1	15	15
Staff Locker rooms	1	30	30
Change rooms Male	1	60	60
Change rooms Female	1	60	60
Store Room	1	6	6
Staff Lounge	1	45	45
Cleaners Room	1	50	50
Total Area			301
Circulation (+25%)			75,25
			376,25

Table 5.4 - Program for central administration

Children	No of rooms	Size of Rooms	Total Area
Reception	1	30	30
Duty Room	1	12	12
Administration	1	15	15
Clerks Office	1	15	15
Social Workers	2	16	32
Filing	1	6	6
Staff Room	1	12	12
Kitchen	1	6	6
Ablutionss (Staff)	1	12	12
Nurses Consulting Room	2	16	32
Psychologists office	4	15	60
Doctors Consulting Room	2	12	24
OT Office	1	14	14
Equipment Store	1	20	20
Group Room	1	20	20
Play room	1	20	20
Activity Room	1	30	30
Workshop Room	1	30	30
Family Therapy Room	1	20	20
Doctors Examination Room	2	16	32
Ablutions (Patients- Adults)	1	8	8
Patient Ablutionss Boys	1	10	10
Patient Ablutionss girls	1	10	10
Cleaners Locker Room	1	10	10
Cleaners Store room	1	6	6
Kitchenette/Cleaners room	1	10	10
Play Area	1	18	18
Store Room	1	10	10
Teachers Room	1	12	12
Total Area			536
Circulation (+25%)			134
			670

Table 5.6 - Program for childrens therapy

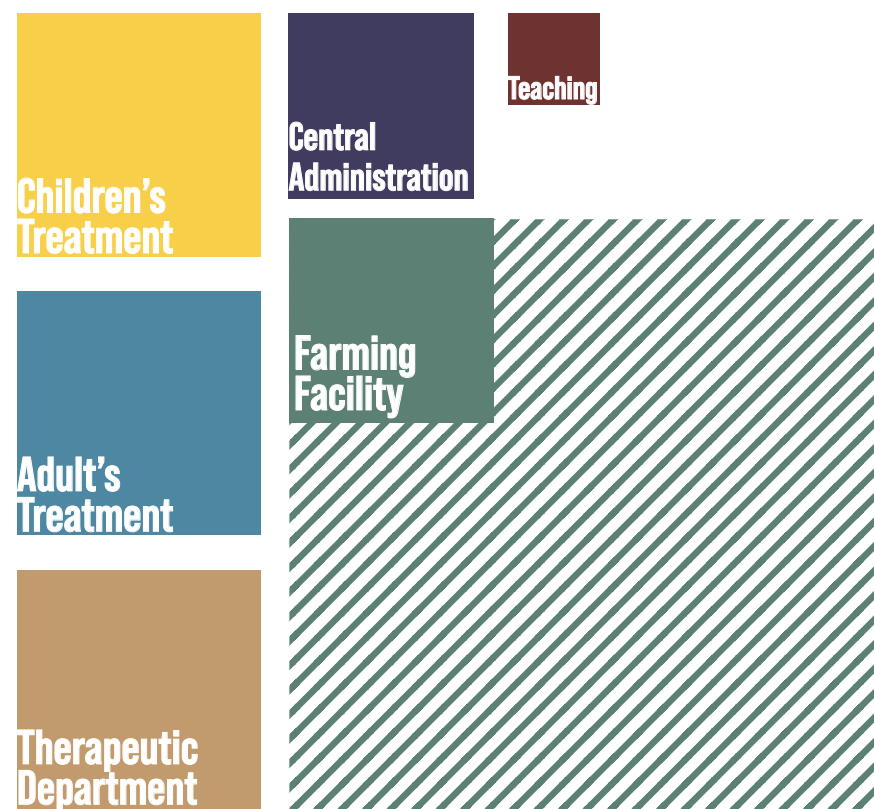


Fig 5.1 - Program sizes relative to eachother

5.2. DESIGN PRINCIPLES AND CONCEPTS

The design of the facility will be based on biophilic principles and will be conceptually based on ideas that are mentioned in the Biophilia Hypothesis as well as other more pragmatic forms of standards in biophilic design in buildings, namely the Living Building Challenge established by the International Living Future Institute ("Living Building Challenge | Living-Future.org," 2020). Consequently, the use of sustainable principles mentioned in the Living Building Challenge will be used to influence the design decisions and the technical aspects of the building. This will include spatial arrangements within the building, spatial qualities, and materials used within the proposed building.

The spaces within the building will all be designed according to biophilic principles. This includes using natural elements such as plants within and between spaces used for therapy. The spaces adjacent to existing buildings and the new proposed building will also need to establish a stronger relationship between building users and the surrounding landscape and place. As a minimum requirement, all spaces will need to have views to the outdoors

onto either natural landscapes or landscaped areas. The spaces will also have access to fresh air directly from outside to be able to feel naturally occurring breezes. The building will have to have a minimum impact on the surrounding natural environment and where impact does occur, there will be a need to off-set that impact through design solutions. The spaces will be constructed using natural materials like timber sourced from ethical sources and materials listed in the RED LIST, as per the Living Building Challenge, will be avoided due to these materials' impact on spaces and possibly making them toxic to people and the environment surrounding the building. The river located on site will also be a part of the design by the use of wetlands to purify and clean the water. This principle of wetlands will also reflect in the aquaponics farming system where indigenous fish and wetland plants will be used to create sustainable ecosystems.

The arrangement of spaces where mental health care users will receive therapy will be adaptable and will allow for choice by the users on where they would like the therapy to be practiced.

These therapy spaces will be private and have access to private outdoor spaces and both forms of space will have access to views to the natural landscape beyond the building's envelope. These spaces will feel secure and private to ensure the comfort of the mental health care user. The building will have various degrees of privacy for individuals using the facility to allow users to feel sheltered and avoid prejudice when using the facilities due to the stigma of mental health. Entrances to facilities will be shared by both mental health care users that come in for an appointment for a limited time as well as day care users who will be using the facilities throughout the day, avoiding discrimination. The waiting areas where users will wait for their appointments will also have access to views and natural elements surrounding the facility as well as a large courtyard in the centre of the facility.

Incorporating complexities in light quality, finishes, and form to mimic the basic effect of natural elements will also be used to create spaces that are more biophilic. This will replicate the

way leaves create more complex light patterns that result in more appealing spaces improving mood and creating positive reactions (Abboushi et al., 2019). This will be applied throughout the building where any therapy occurs as well as in the waiting rooms.

Landscaping and views to landscapes beyond the facility will also be critical as this is a core concept in the Biophilia Hypothesis. There will be two landscapes that will be utilised for the building itself, namely a large courtyard in the middle of the facility surrounded by circulation and a landscaped rooftop area that allows for views beyond the facility which speaks to our evolutionary need to be able to scope large landscapes to feel safe as mentioned in the Biophilia Hypothesis (Gullone, 2000; Kellert, 1993; Ulrich, 1979). This will reinforce the idea of the building being an extension of the landscape rather than an imposition to it. These built landscapes will use only indigenous grasses and trees located around the site to minimise impact and to ensure sustainability of the landscaping. Farming will

also be placed strategically to ensure safe accessibility as well ensure supervision for users who make use of the day care facilities to ensure their safety. These spaces will not be explicitly cut off from the rest of the landscape to allow seamless integration between mental health care users and the public. Pause and meditation spaces of various size will also be a vital core in the landscape design to allow for places for different people to speak to each other regularly and freely. These methods of design will give an opportunity to address stigmatisation of mental health care users and the general public and allow users in different stages of treatment to share their experiences and support each other.

5.3. FINANCIAL MODEL

The project has a few complexities with regards to the way it is funded as there are two components of the scheme, namely a mental health support facility as well as a hydroponic/aquaponic farm. This way both components of the scheme will work

independently in terms of those who are running the facilities but will support each other financially.

The key method of funding of the mental health facility will be through the method of PPP. This is due to the minimal resources the government has in terms of building the facilities and service delivery. This will allow for private companies to be stakeholders in the project and will allow them to build and run quality facilities. (PPP) has been proven as a more effective method to provide services to the public. This form of funding has been proven to be successful in neighbouring Lesotho where the same form of funding was used to develop and construct a medical facility (McIntosh et al., 2015). The facility is run and managed by the private healthcare company and funded by the government. This would also allow for the private sector access to public funded internship programs set out by the government and managed by universities.

The project will focus on using new sustainable technologies

to reduce running costs of the facility in the long run. This will include technologies to reuse water in the facility, reduce energy used from the grid to achieve a net zero building. These technologies will increase the initial costs of construction as well as consultation of necessary consultants that will eventually pay itself off through savings made in the running of the building. The following technologies will be used that will increase the facilities initial costs:

- Installation of solar energy systems including storage
- Installation of green roof to regulate temperature within the building

The farming facility's shop that will sell produce to the public will have spaces for NGOs (Non-governmental organisations) to rent and also allow them to have a space to run their operations. These spaces will be rented out at subsidised rates to allow for NGOs to run effectively. The NGOs will also be there to allow for day care for mental healthcare patients that can engage in work and care for the facility in either the hydroponic farm or traditional farming. The facility's main source of income will be the sale of produce that is grown in the farming facility. Most of the produce will be sold on a wholesale level to be sold within communities and some will be sold on site directly to the public. The sale will cover the operational costs i.e., water, electricity, wages and salaries and the remaining profit will then be distributed into the mental health facility as supplementary income to run the mental health facility.

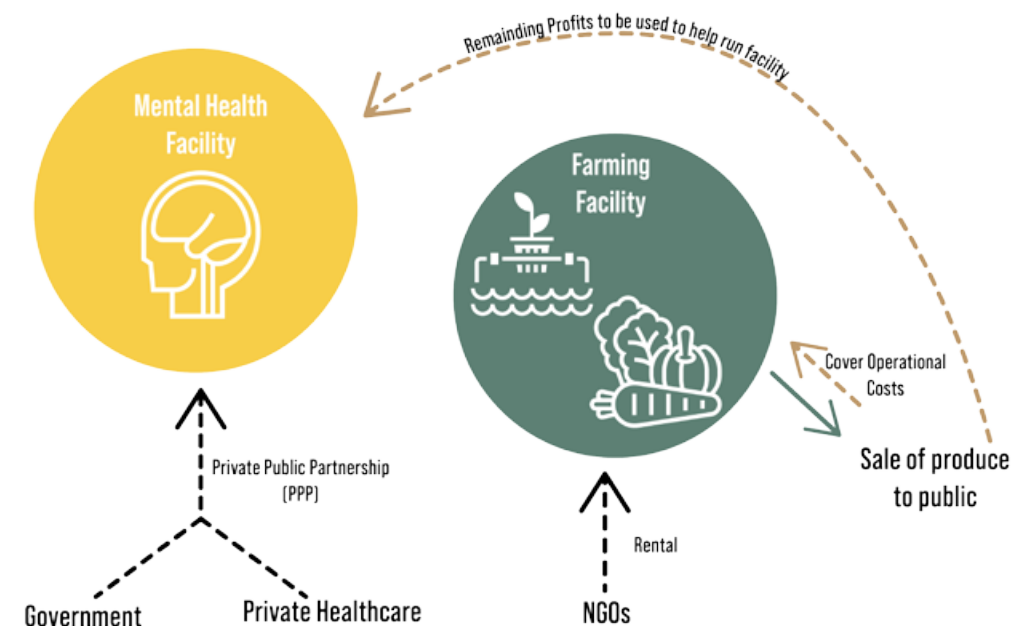
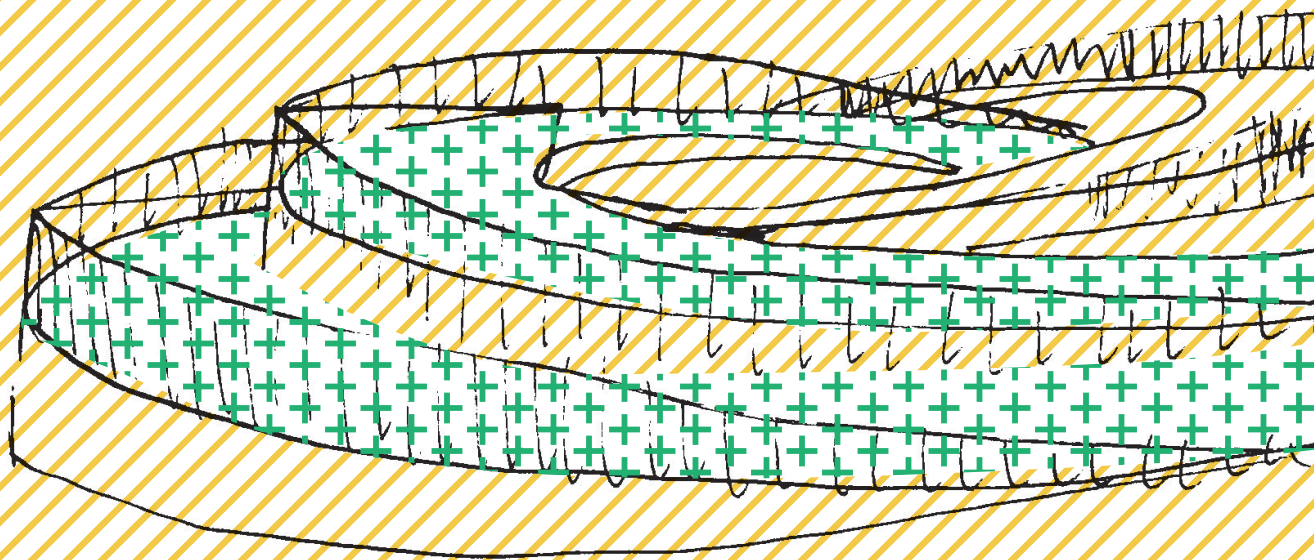


Fig 5.2 - Financial Model flowchart



6 *Precedent Studies*

VEJLE PSYCHIATRIC HOSPITAL

Denmark - Arkitema Architects

DAY CARE OF THE CLINICAL COMPLEX

Tübingen, Germany - MGF Architekten

MUSÉE ATELIER AUDEMARS PIGUET

Le Brassus, Switzerland - BIG, Atelier Bruckner, cche
lausanne

FUTURE AFRICA INNOVATION CAMPUS

Pretoria, South Africa - Earthworld Architects

6.1. VEJLE PSYCHIATRIC HOSPITAL

Denmark
Arkitema Architects

This psychiatric hospital is located in Denmark. It has both in- and outpatient facilities but the central focus is treating inpatient users. The scheme was funded through a PPP program , which allowed the government to use access the private sector to construct the facility additionally the hospital is run through a private hospital management company.

This building also uses some biophilic elements where there is a strong focus for patients to have connections to nature and greater views. This influenced the organisation principles of the facility by using individual courtyards that give the opportunity for views into nature to occur when the patients are in their rooms and common spaces.



Fig 6.1 - Plans of Vejle Psychiatric Hospital by Arkitema Architects

The facility is organised into three components namely inpatient treatment, outpatient treatment and administration. It is organised in a way that the inpatient facility entrance is beyond the main entrance where patients would be admitted. This creates a progression in program from public spaces into more private secure spaces for patients to use.



Fig 6.2 - Organisation of Vejle Psychiatric hospital

The facility uses a combination of hierarchy and compartmentalisation for circulation to be able to isolate and protect the building users.



Fig 6.4 - Entry and circulation of facility

The facility uses biophilic principles through the use of views out into the surrounding landscape as well as having courtyards that are seen as safe havens and safe green spaces for patients and the individuals who work at the facility to use.



Fig 6.3 - Facility's connection to natural views



Fig 6.5 - Landscaped entrance to facility

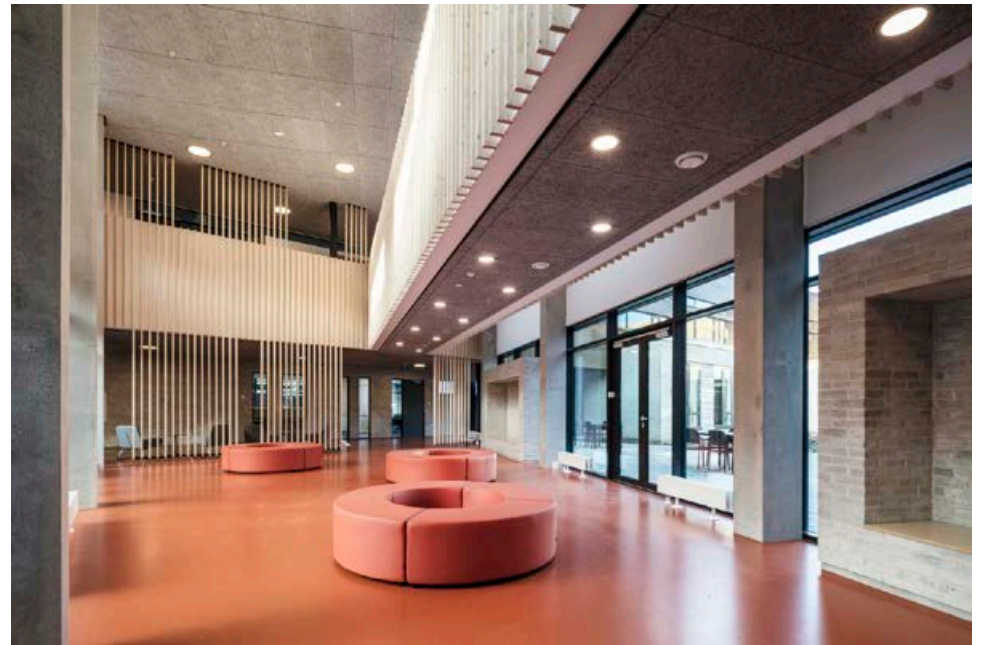


Fig 6.6 - entrance reception area

6.2. DAY CARE OF THE CLINICAL COMPLEX

Tübingen, Germany
MGF Architekten

This day care clinic facility focuses on providing care for various types of patients including mental healthcare users. It includes exercise classes and other services that are provided to individuals in inpatient and outpatients programs.

The main component of the project I enjoyed is the use of material i.e., the timber slats. They generate very calming

environments due to the complex shadows cast. This improves the effectiveness of therapy practiced in these spaces as indicated in previous chapters. Due to the orientation of the spaces, it was required to filter the light effectively to create spaces that have less harsh lighting conditions. The double skin construction with timber and glass might have useful applications within the proposed building.



Fig 6.7 - Outer skin louver facade



Fig 6.8 - Entrance to facility

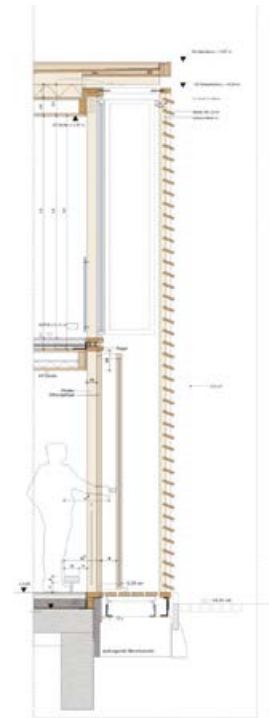


Fig 6.9 - Detail section of outer louver skin



Fig 6.10 - Interior Spaces light quality

6.3. MUSÉE ATELIER AUDEMARS PIGUET BIG, Atelier Bruckner, CCHE Lausanne Le Brassus, Switzerland

This museum and workshops were designed for a swiss watch manufacturing company.

The element in this building that relates to my project is the way the form of the scheme was founded through the program. They placed the program in an ordinary linear manner and took that form and created a spiral. The exploration of how the building also reveals itself from the landscape is interesting. The combination of these two concepts namely the spiral and the landscape aspect results in a design that bases itself in context while achieving an interesting design. This approach to design is what I aim to apply within the process of designing my scheme.



Fig 6.11 - Exterior View of Building

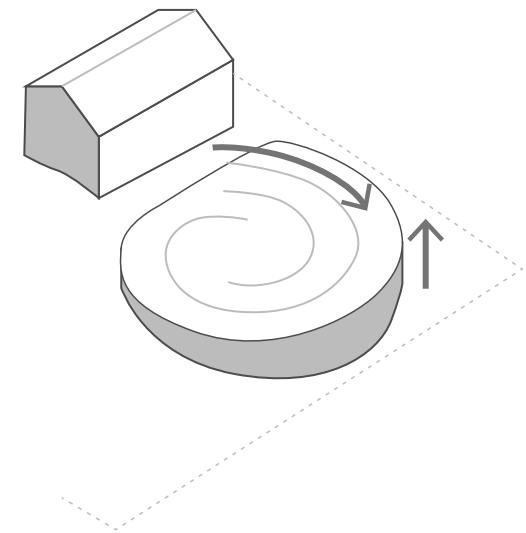


Fig 6.12 - Axonometric of Building form



Fig 6.13 - Extension of form to create safer spaces

6.4. FUTURE AFRICA INNOVATION CAMPUS

Earthworld Architects
Pretoria, South Africa



Fig 6.14 - Interior view of lecture theatre

The Future Africa Innovation Campus is a scheme located in Pretoria, South Africa that combines education buildings residences for students, dining hall and conference centre. I will focus on the conference centre and the dining hall as a precedent.

The building uses free form structure made from plywood which is a very integral element that can be used in my proposal. The frames are made using plywood sheets that are CNC cut and fit together like a puzzle as the panels of plywood are limited to 1200x2400mm pieces. This modular construction allowed for the use of timber in a more cost-effective way as compared to traditional glulam and LVL (Laminated veneer Lumber) which requires more precision and specialised work. They used steel plates to fix the structure to the floor and to timber frames on the opposite side. I chose to focus more on the timber frames and apply them to my scheme and stick to glulam as the that would achieve the best results for the structural layout.

The way that the structure is put together is also something I appreciated. The frames are placed in a cross brace that allows for the building to be free standing when built without the addition of too many members.

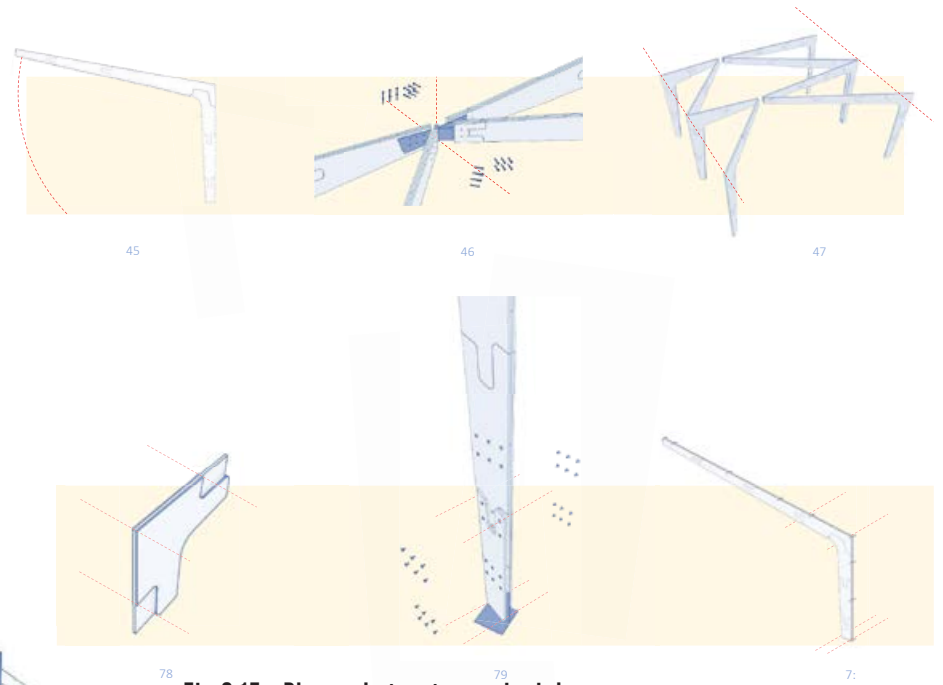


Fig 6.15 - Plywood structure principles

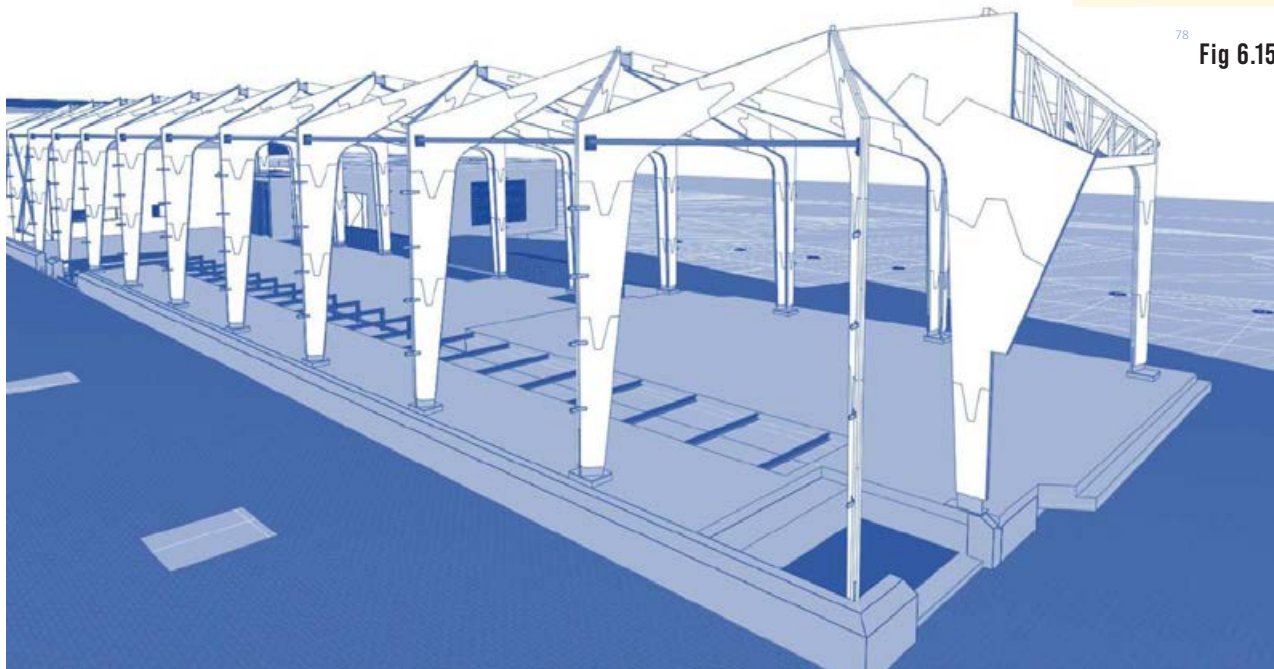
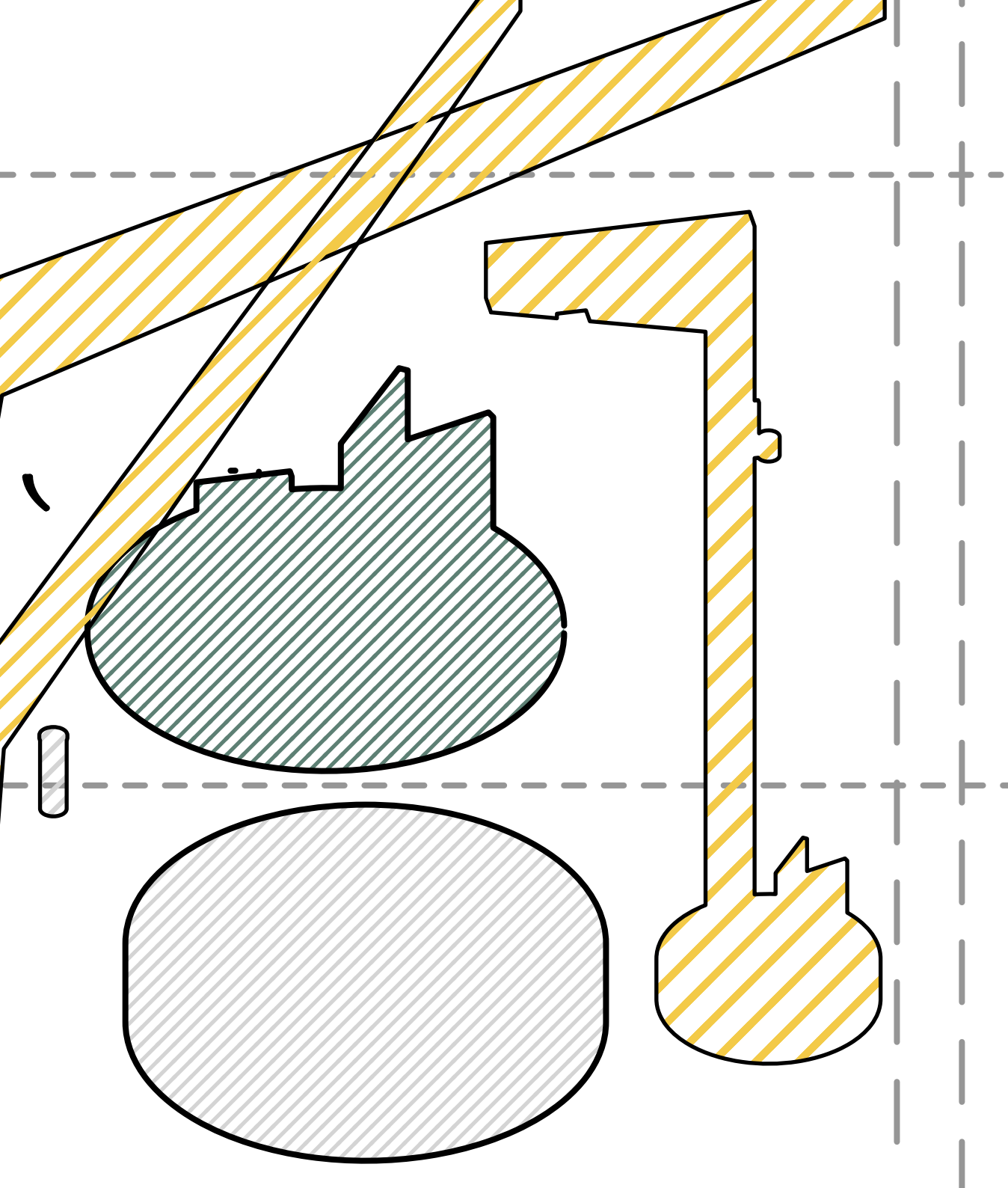


Fig 6.16 - 3D structure



7 *Technical Approach*

Use of Grasshopper scripts
Structure
Farming

7.1. GRASSHOPPER AND RHINO

As part of the building I decided to use programming to aid in the design process. As the building is an irregular shape in plan, I used grasshopper programming to design the structural components. This approach allowed for multiple iterations of different aspects of the building including the structure as well as the structural layouts of the proposal. The capacity to make multiple iterations of structural layouts allows the ability to adjust the layout to best fit the proposed program and the spaces within the building program. The flow chart (fig 7.1) indicates the typical process when using grasshopper and rhino in the process of resolving these aspects through programming. The initial structure was inspired by the Future Innovation Campus by Earthworld Architects which included the use of plywood as a material to create a more accessible material for the structure. I changed the intended structural material to laminated timber which then allowed for more freedom in designing the structural components of the building.

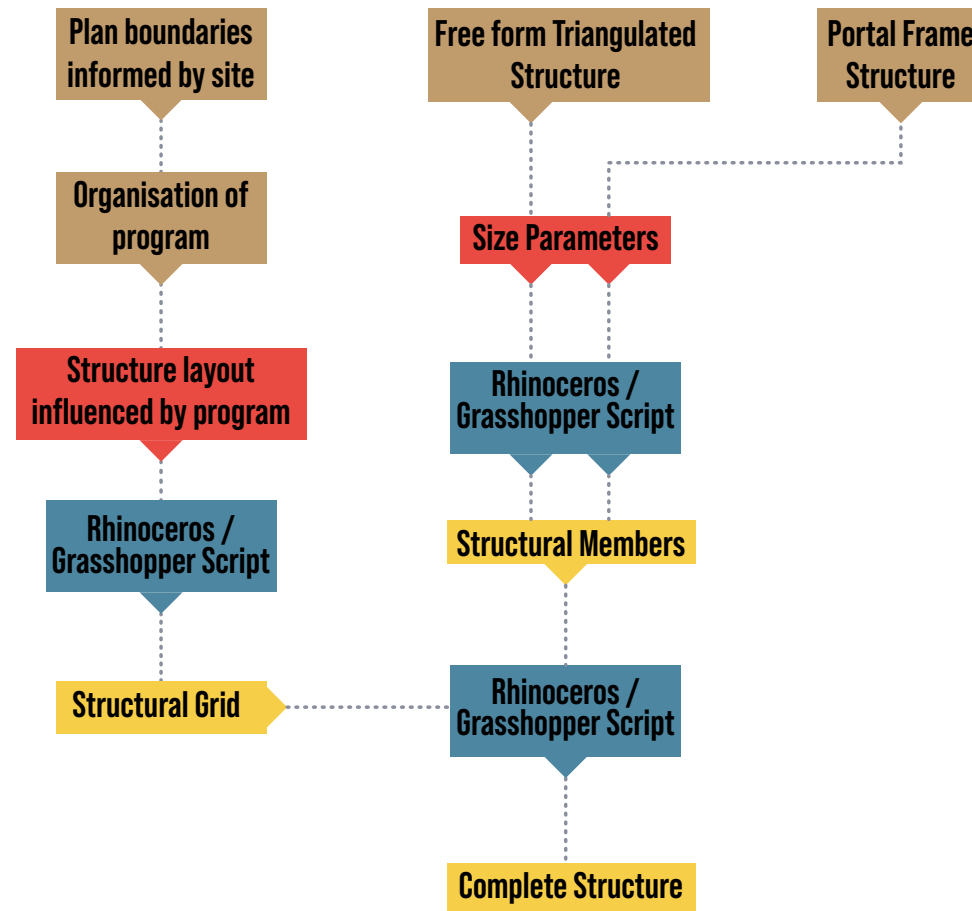


Fig 7.1 - Use of programming with design parameters and for design resolution.

7.2. STRUCTURE

I looked at the Future Innovation Campus as a precedent and how the structure was resolved in the building. The building's structure was constructed using plywood and steel this would be my first attempt into making a structure that would use these same principles. Once I deconstructed the way the structure was put together, I identified the following.

1. Steel was used to anchor the point between different structural components. In this case the floor and other frames at the apex of the structure.
2. The standard 1200x2400mm size of plywood sheeting was used and sandwiched together to create the structure.
3. The principle of cross bracing was used throughout the structure to ensure structural stiffness and a self-supporting structure.

These elements influenced the manner in which I designed the structural system including the layout and the structural

members. However, I opted for a laminated timber instead of plywood as there is more freedom to design the individual components.

Structural Grid

When designing the building footprint and designating the building organisation (fig 7.2) I wanted to make sure that all the spaces within the buildings would have connections to nature. This would be achieved through either the views to the context or to courtyards. The building footprint was derived from the site's physical features namely existing trees, furrows and embankments. This was to ensure minimal impact to the existing site physical attributes and the site's ability to drain rain run-off into the Jukskei River. This also created the opportunity for a large courtyard that was enclosed by the building's footprint.

I then fit the building program into the footprint using different zones namely, adult's treatment, children's treatment,

therapeutic department and the teaching facility (Fig 7.2). The main method in which the spaces were decided on was to make sure that spaces were not wider than 10m from windows to allow for natural light to penetrate the spaces to reduce the necessity for electrical lighting (Fig 7.3). These windows would also have the ability to open to allow for natural ventilation to occur in the spaces. It was imperative that there was visual access to



Fig 7.2 - Placement of program within footprint

the expansive views of the site especially in spaces where talk therapy was to occur. (Fig 7.4). This all resulted in principle of the organisation of spaces where courtyards are sandwiched between enclosed spaces.

When looking at the future innovation campus there is a diagonal structural grid. This allows for the spaces below the structure to be organised freely. The diagonal/triangulated structure is also self-supporting to aid and increase the speed of construction. As the structure is intended to be made from laminated timber, I also explored the use of portal frames.

Structural Layout Iterations

The initial step to design the structural layouts was to designate the position of the program within the footprint taking to account the open courtyard in cutting through the centre. The courtyard will have a diagonal structural grid to allow for complexity in light patterns cast in the courtyards which is

visible and accessible from within the building. The position where the structure connects to the enclosed spaces would then radiate to the external edges of the building. I then connected the adjacent areas with entrances as this gave the opportunity to still allow light into waiting and administrative areas of each program, these were relatively flexible and can move depending on the structural layout. Once these were indicated in plan, I then commenced with the script in Grasshopper to figure out the structural layout. These were the fixed parameters that needed to be adhered to initiate the exploration

1. Due to the program, the treatment spaces needed to be a particular size, so the depth of the space was divided by the intended size to get a fixed size to make sure the size of the spaces were correct in terms of floor area.
2. The courtyard structure will remain diagonal as much as possible to ensure a complex shadow. (basic Principle with grey both sides

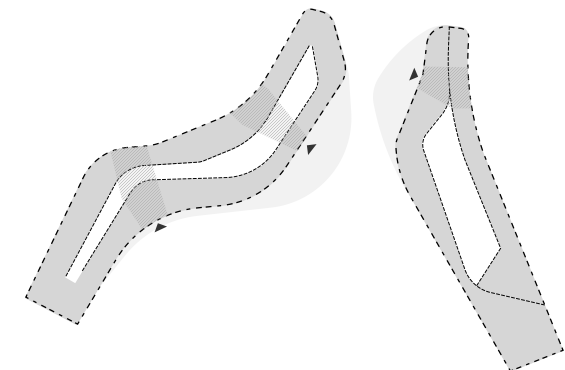


Fig 7.3 - Built Form and Courtyards Principle

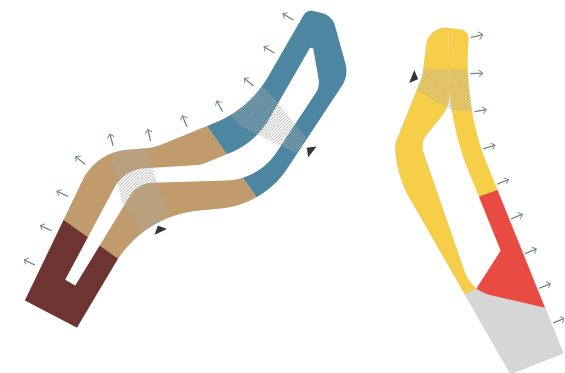


Fig 7.4 - Position of Program in Plan

Iteration 1:

This iteration of the structural grid was to apply the triangulation to the centre courtyard spaces. I triangulated the centre spine of the courtyards and have straight members radiating from the ends to the edges which allowed for the treatment spaces to be perpendicular (Fig 7.5). This was done for both blocks namely the therapeutic, adult treatment and teaching (Block A) and children's treatment and shared canteen area (Block B).

Iteration 2:

This iteration of the structural grid was to take inspiration from Earthworld's project as it was intended to be a free form space frame structure. However, due to the large spans I was not convinced that this structure was not viable, so I first built a model to see if this structure was viable (Fig 7.7). Once I was convinced that this structure could work in practice, I then designed this iteration of structure where the entire building

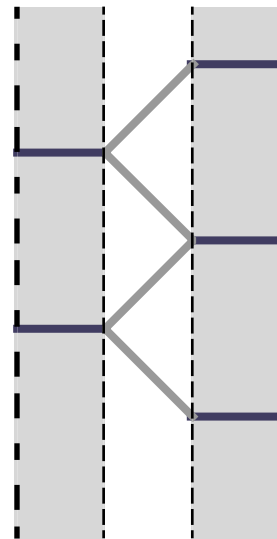


Fig 7.5 - Structural Grid Iteration 1

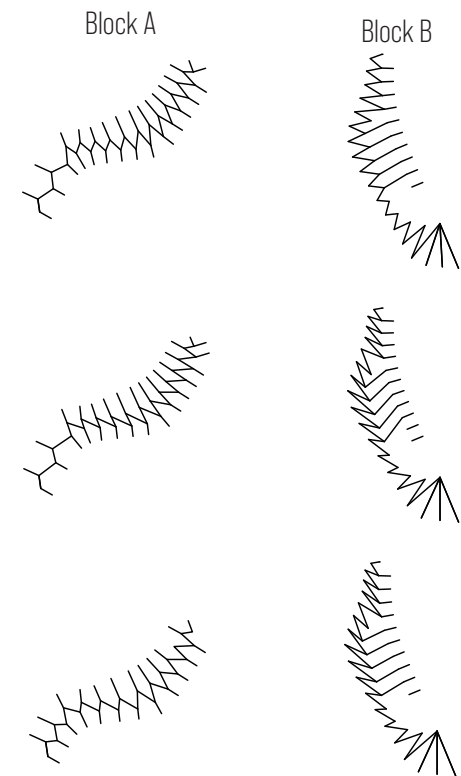


Fig 7.6 - Resulting Structural Grid for scheme

would be triangulated. Due to the nature of the triangulation certain scripts were used to create multiple iterations including evenly dividing the spaces to using scripts that allowed for variable spacing (Fig 7.8). I kept the parameters that kept the size of the spaces where therapy was to occur consistent.

Iteration 3:

This iteration combined the two previous iterations. In certain spaces where the spaces need to be square i.e., therapeutic, ablutions, they will be square and the open spaces to allow for dynamic use such as the multipurpose spaces, exercise spaces and circulation would be triangulate to allow for the spaces below to have the ability to change depending on the use case (Fig 7.10). It was also decided that Block B will have straight portal frames in the centre to allow for classroom spaces and ablutions to be fit in more effectively. The script needed to be adjusted to allow for the different structural lines to be applied in different areas of the buildings to reflect the use of the space.



Fig 7.7 - Cross bracing portal frames (Iteration 1)

Structural Components and Members

Due to the complexity of the building's intended structure and the variety of different pieces that were needed, I needed to find a method where the structural members can be designed automatically in a parametric way. There were two types of structural type of members that I intended to use namely portal frames and free form structure where triangulation is involved. This also allowed if the building were to be built that the structural components can be extracted from the model easily and manufactured off site.

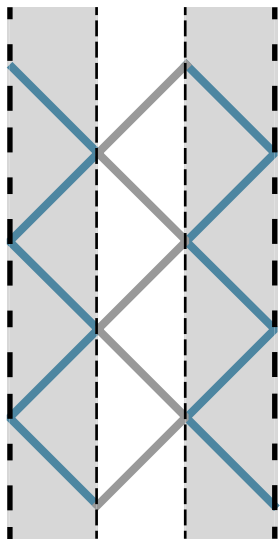


Fig 7.8 - Structural Grid Iteration 2

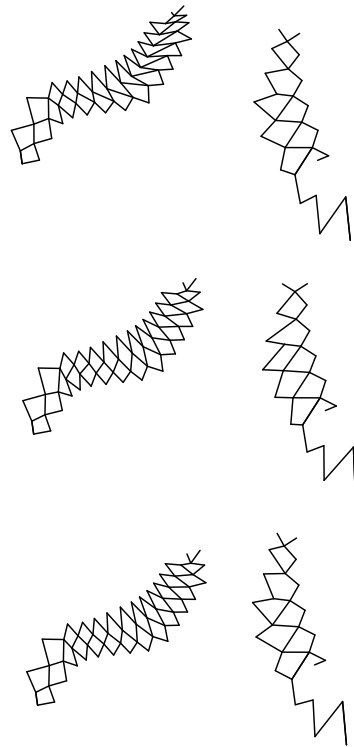


Fig 7.9 - Iteration 2 complete grid

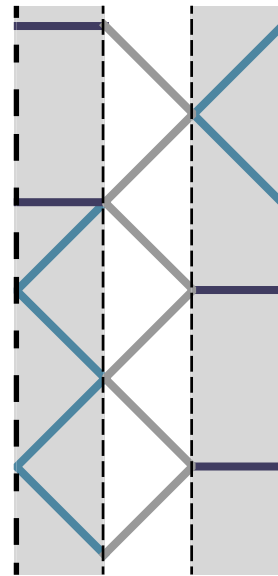


Fig 7.10 - Hybrid structural grid

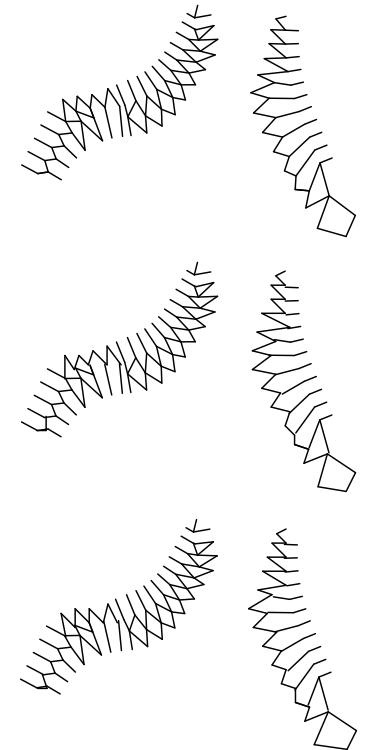


Fig 7.11 - Iteration 3 Complete Grid

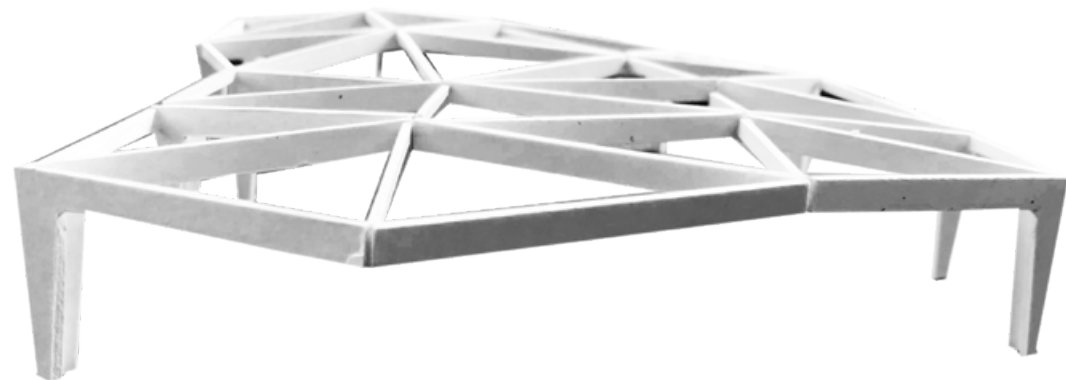
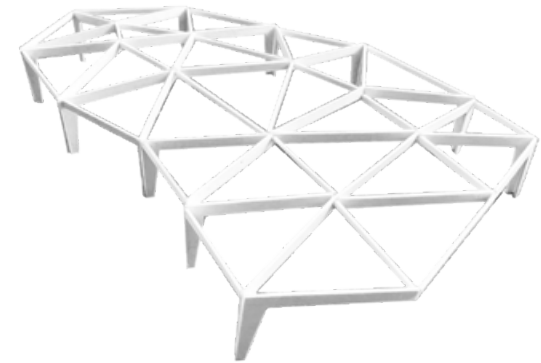
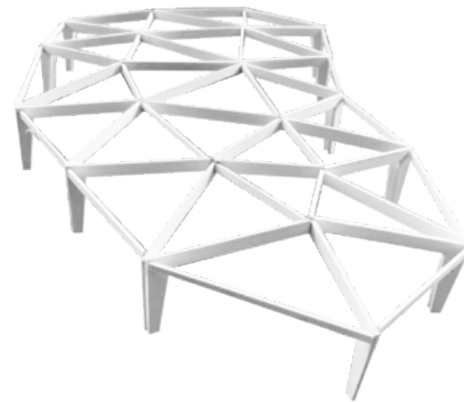
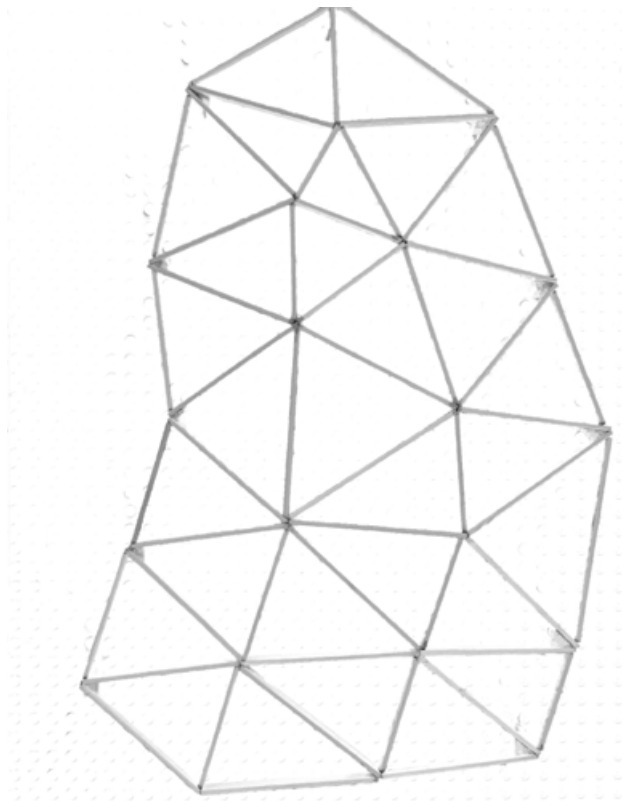


Fig 7.12 - Free Form Space frame structure model

Parameters of Structure

Portal Frames

The portal frames were designed in a way where the structure would be fixed to a floor plate. This floor plate would then be connected to structure that is joined to foundations. The frame's sizes can be adjusted where the dashed lines are located in Fig 7.13, as this can be easily changed if needed when consulting an engineer. The script is also capable of reading the length of the structural line and is then divided by 12 as a standard to figure out the depth of the member. The portal frame was then changed to be a slope (fig 7.16) to allow for drainage as the roof is proposed to be a planted roof at a minimum 1/20 fall to allow for water to be drained beneath the planted roof substrate.

Free Form Structure

The free form structure was designed in a similar manner



Fig 7.13 - First Portal Frame Iteration and Parameters

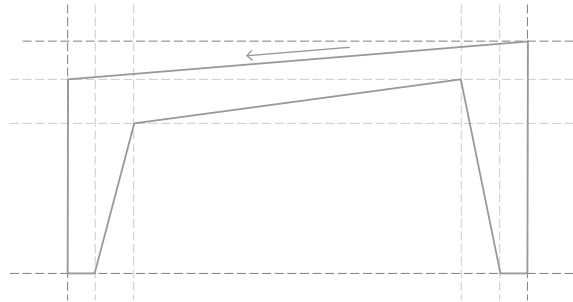


Fig 7.14 - Second Portal Frame Iteration with Fall

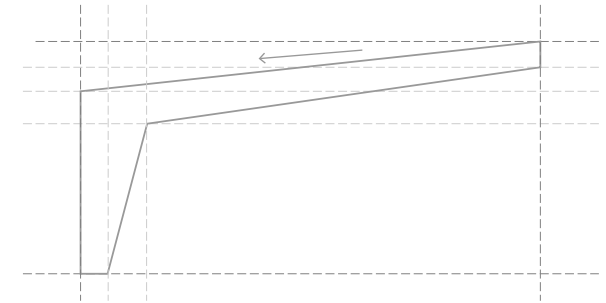


Fig 7.15 - Free Form Frame With Parameters



Fig 7.16 - Center Bracing for Free form Structure

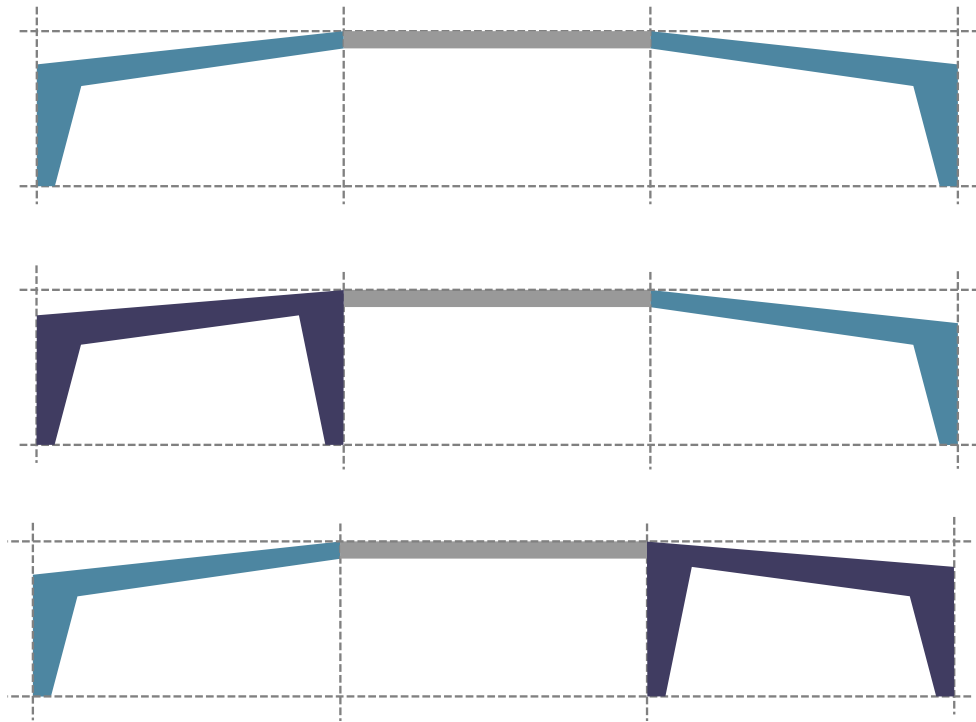


Fig 7.17 - Typical Frame Layouts sections

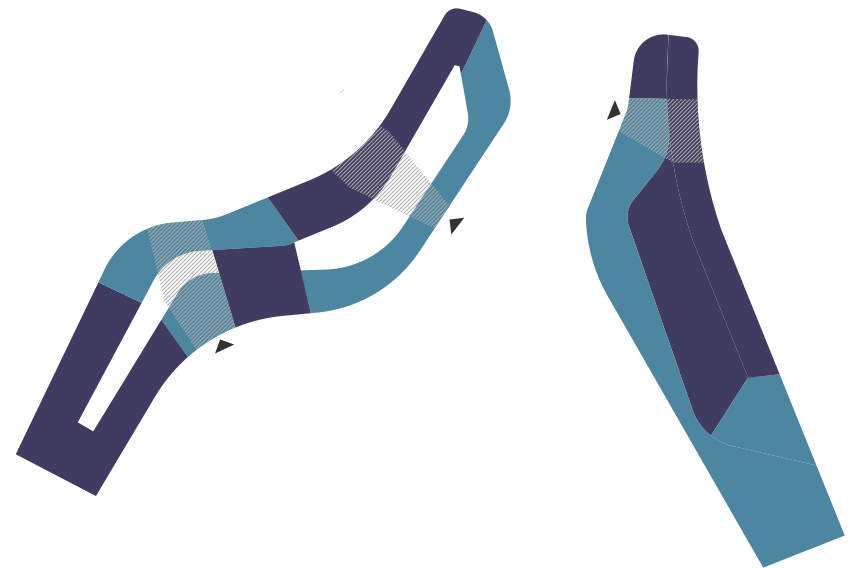


Fig 7.18 - Position of Frames in Plan

however there would not be supports located in the centre and the entire structure would be self-supported with the supports at the end to be the only ones fixed to the floor. The parameters could also be easily changed and adjusted to engineers' specifications as indicated with the dashed lines in fig 7.15. The top of the edge structural components would also be sloped to allow for effective drainage.

Resulting Complete Structure Layout

Once both structural layout and structural scripts were completed, they were combined to result in a completed structure.

I eventually chose the hybrid method of creating the iterations where the treatment areas and ablutions would need to be squared out with portal frames and the free form method would be allocated everywhere else (Fig 7.17)

Materiality

To reduce the amount of the overall CO2 used in the construction of the building, the use of predominantly timber construction will be used in the building. This is because timber was less embodied energy compared to other traditional construction methods i.e. brick, mortar and concrete (Hill and Dibdiakova, 2016). Timber is also used to achieve biophilic design due to its direct connection to nature as well as the soft and natural quality of the material. Oriented Strand Board (OSB) will be extensively used in paneling within the building as it has less embodied energy than that of cementitious based products like plaster board. Due to certain conditions

Other Components

Due to the complexity of the structure, the components that are used to complete the structure including the steel components that would hold the structure together would also be designed

using grasshopper. This would also be automatically modeled in the program and exported to then be manufactured off site. This includes the base plates where the frames would meet the floor and top plates that join the structure together and allow for the planted roof construction to be assembled.

Steel Joints

Heavy timber construction requires steel components to tie the building together and to join the structure to the foundations. As the structural frames positioned in various angles and it would be difficult to assemble the timber structure components on site. The combination of rigid positioning and allowances for rotation would allow for better positioning of the timber components on site. These steel components include a base plates and steel ties. There will also be a particular method in which the structure will need to be assembled to ensure efficient construction. To allow for these joints to be effectively

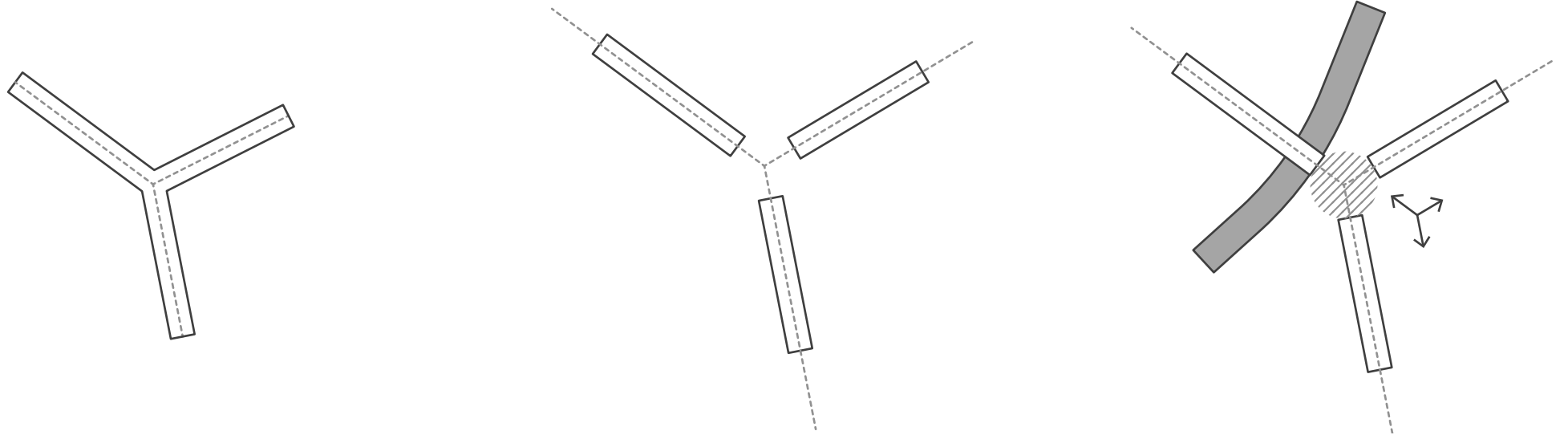


Fig 7.19 - Position of Structural Elements at Layout Intersections

built on site, the main structural frames will need to start away from the intersection to allow space for the steel joints (Fig 7.19).

Base Plates

The base plates include a steel plate with steel vertical fins. These base plates would be manufactured off site as the positioning of the steel fins will align with the structural layout that was designed. The timber frames will have slots and holes where the base plate can be placed into and fixed in place with steel bolts. The plates will also have larger openings where threaded bars can go through and bolted into place.

Top Structural ties

Due to the structure's complexity, there will need to be some form of flexibility to allow the structural components to be placed precisely. The structure will achieve stiffness once all the components are in place due to triangulation. The proposed

solution is to create a hinge joint where the fins/plates will be placed in the structural members bolted then stacked together and pinned. These components, once in place, will then be spot welded to ensure rigidity of the joint. As there are two conditions for these ties to occur namely connecting two components and three components. The plates remain the same size so that the position of the plates inside the frames remain constant to make sure the manufacturing of the frames is easier. These plates are also the same size to aid in efficient manufacturing. The circular hollow sections are cut to allow either the two plates or three as indicated in figxxx. The plates are welded to these circular hollow sections off site and placed into the frames. The pins that join the plates

Resulting Complete Structure

Once all the scripts were completed, the completed structure consists of timber frames, steel ties and foundations. All these components will be manufactured off site to aid in faster

construction on site. There is a particular method in which to assemble the structure and is as follows

1. Place steel plate through rods embedded in concrete pads
2. Place component A (for the edge structure)
3. Bolt in place
4. Place structural components in order from right to left from ensuring the order of the components are correct
5. Pin the steel connections
6. Fix the Vierendeel truss in place using ties on top of the pin

Green Roof construction

As the structure below the roof is made of timber special care needs to be taken to ensure that the soil and water needs to be well protected from the structure to prevent wood rot. The structure consists of purlins joined to the frames, OSB

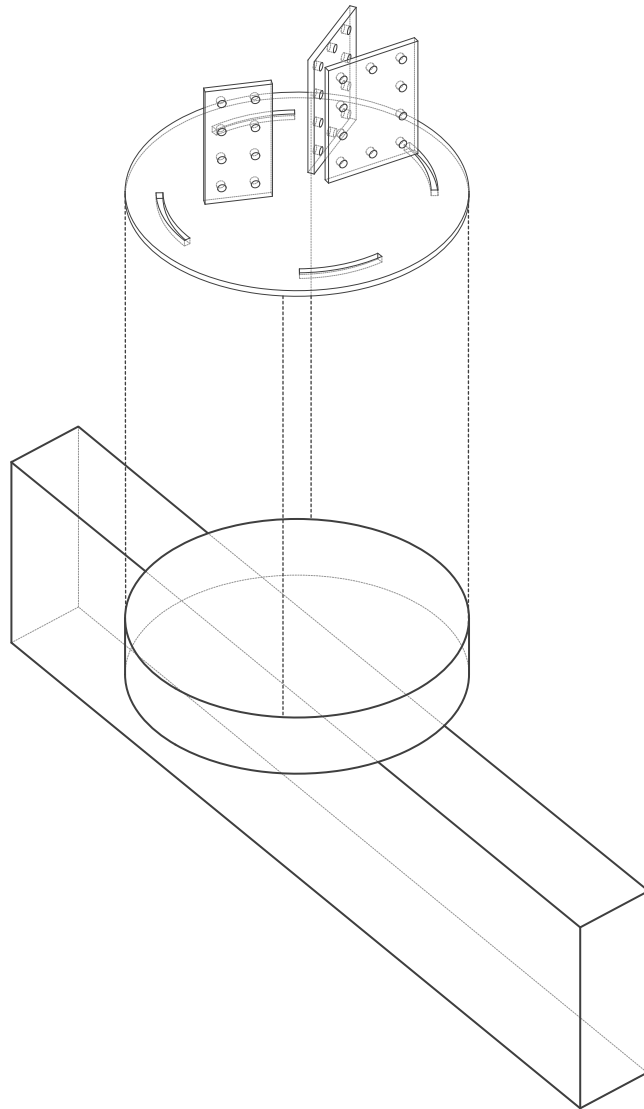


Fig 7.20 - Concrete Foundation and Steel Base Plate

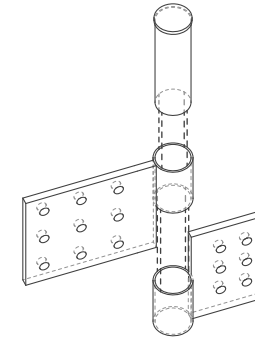


Fig 7.21 - Top Structural Tie - 2 points

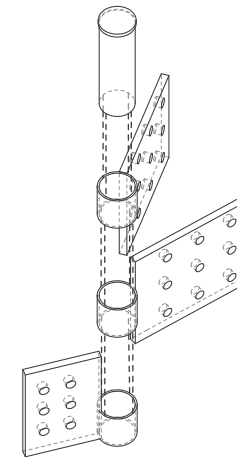


Fig 7.22 - Top Structural Tie - 3 points

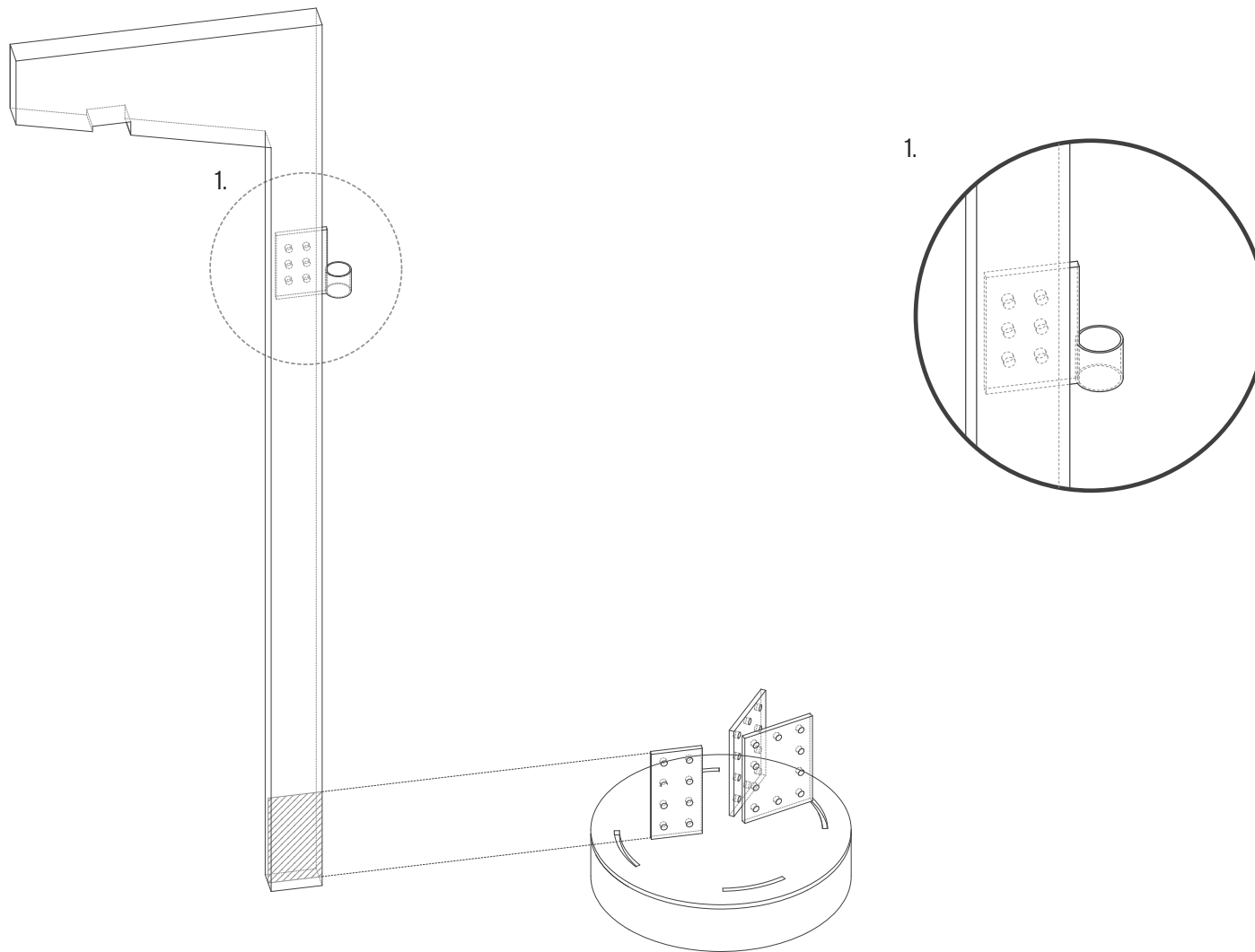


Fig 7.23 - Edge Structure for Ring Beam

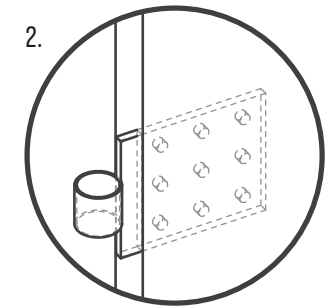
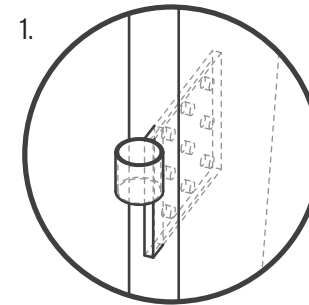
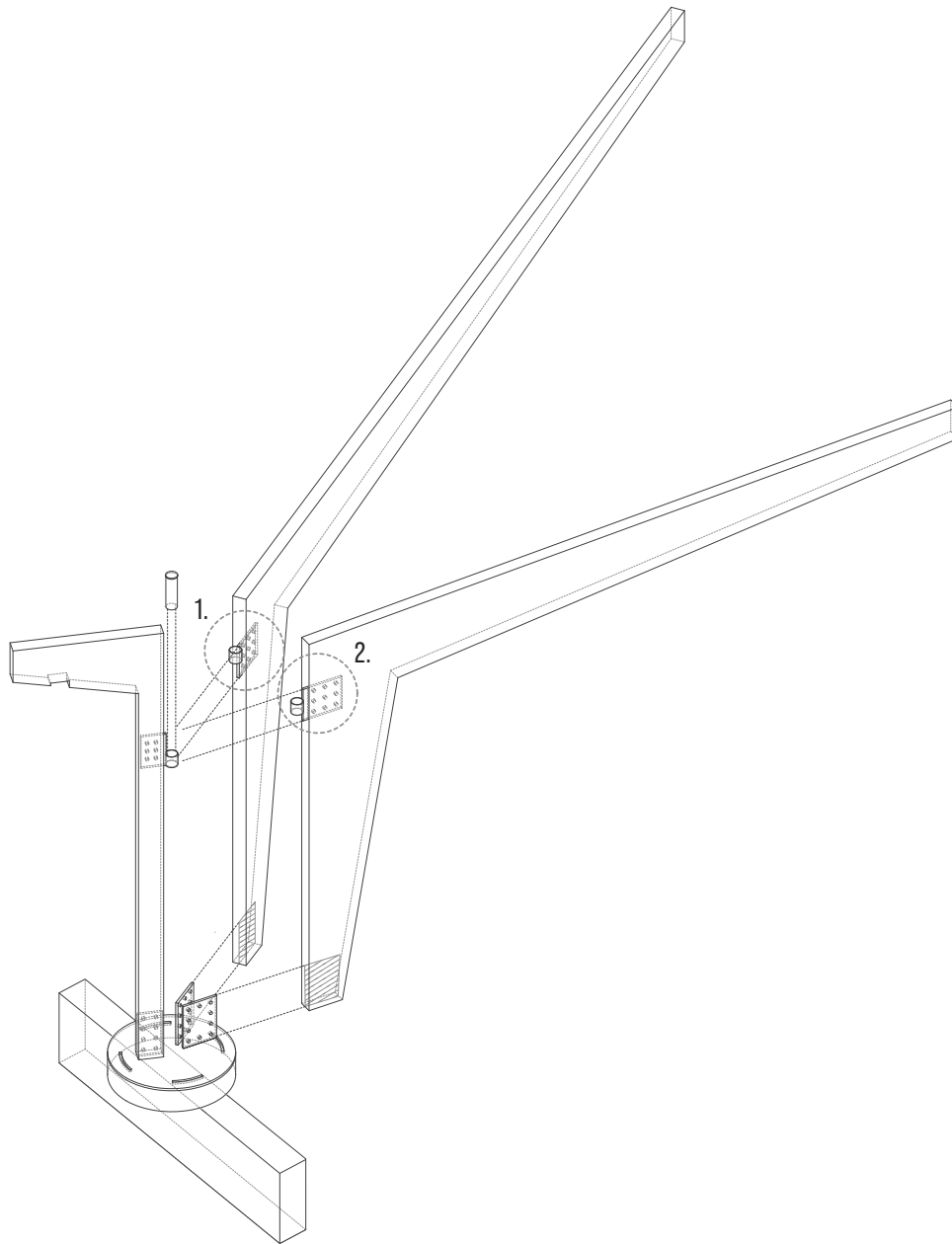


Fig 7.24 - Placement of Remaining Components at one point

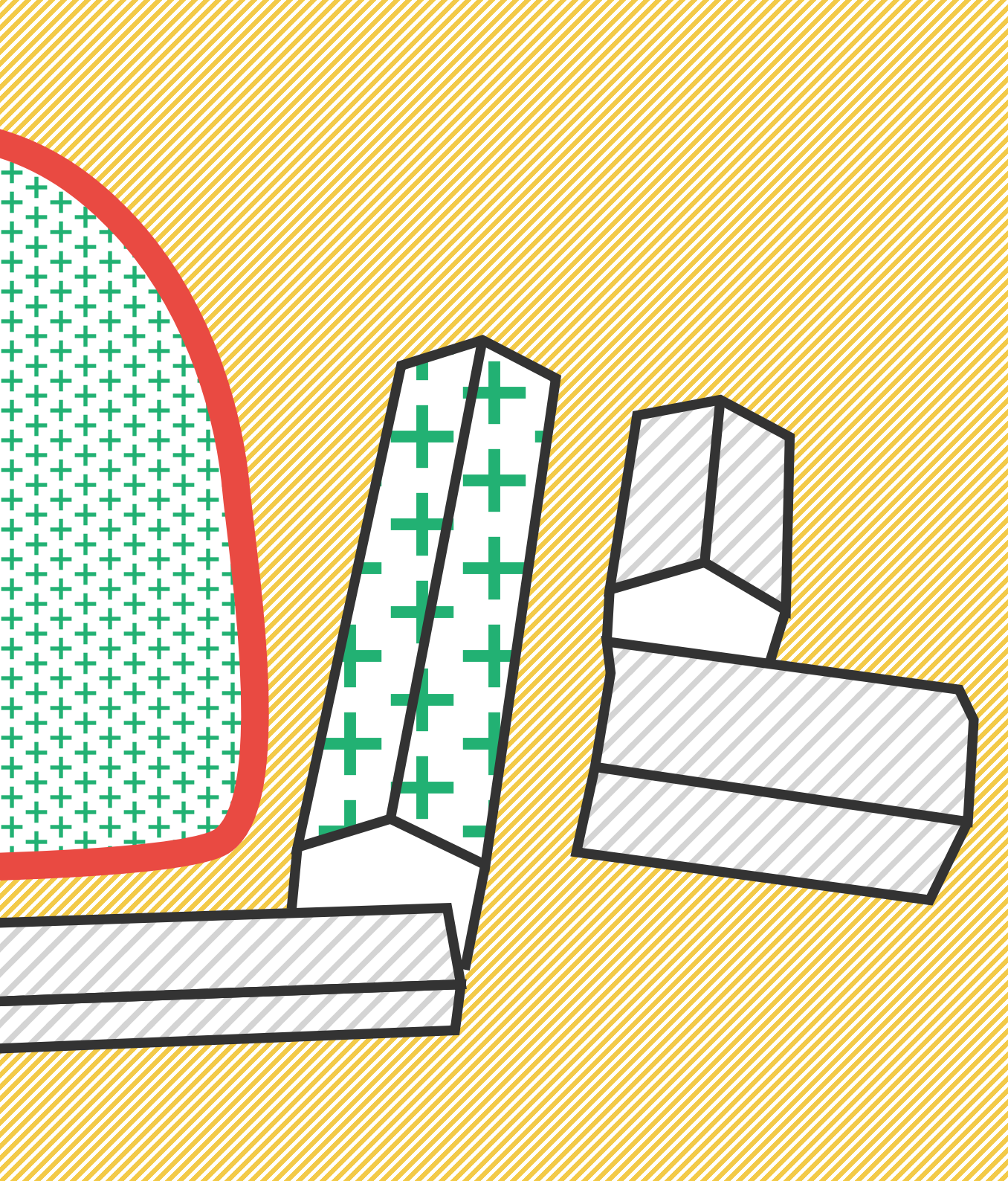
[orientated strand board] to stabilise and create a surface to allow for the various layers for sufficient drainage. The water drains towards the edges and the water is collected in agricultural sub soil drains and taken to the exterior structure to be taken to a water storage tank.

7.3. FARMING

As previously mentioned, any forms of farming consist of 6 stages, planning, seed purchasing, planting, growing, harvesting and packing and selling. These stages inform the process of which the farming facility will work and how the spaces will move be organised to allow for an efficient facility. As this is applied to the existing buildings, careful attention will be taken for the design of the hydroponic and aquaponic farming facilities as they require more technical spaces. Aquaponics will require spaces for pumps for the water to be consistently circulated into and out of the fishponds that provide nutrients for the plants that are grown at the facility. There will be storage areas

for equipment to maintain the pond as well as feed for the fish. The fish that will be used in the ponds as part of the aquaponic systems will be fish that are native to the Jukskei river to better reflect its immediate context. In this context, the Jukskei River contains Sharptooth Catfish (*Clarias gariepinus*) (van Bosch et al., n.d.). This species is well suited for aquaponic farming and has been proposed for use in agriculture in government studies. This is due to the species' ability to breath air as aquaponic systems can lack dissolved oxygen in the system which is vital for other species of fish (Robertson, 2018).

Hydroponics will need an extra clean room to allow for people who use the facility to shower before entering the growing areas. This is done to maintain the closed nature of the growing areas as they are controlled spaces. Mechanical equipment is also required to make sure that water is effectively circulated through the system. Contingencies will be put in place for both systems as they require mechanical equipment which is powered by electricity.



8 *Design Resolution*

My first exploration was understanding the relationship between Euclidian geometry and biophilia. This also showed the potential of complexity in shape to incorporate nature and privacy in therapeutic spaces. Adjusting roof coverings also allows for interesting transparencies and incorporation of nature including sunlight in spaces.

In figure 8.1, I explored the potential of form. I had it work with the existing structures as well as the existing foliage. As I haven't visited the site I wasn't aware that the entrance that I was potentially looking wouldn't work very well as there was a large dip in the landscape.

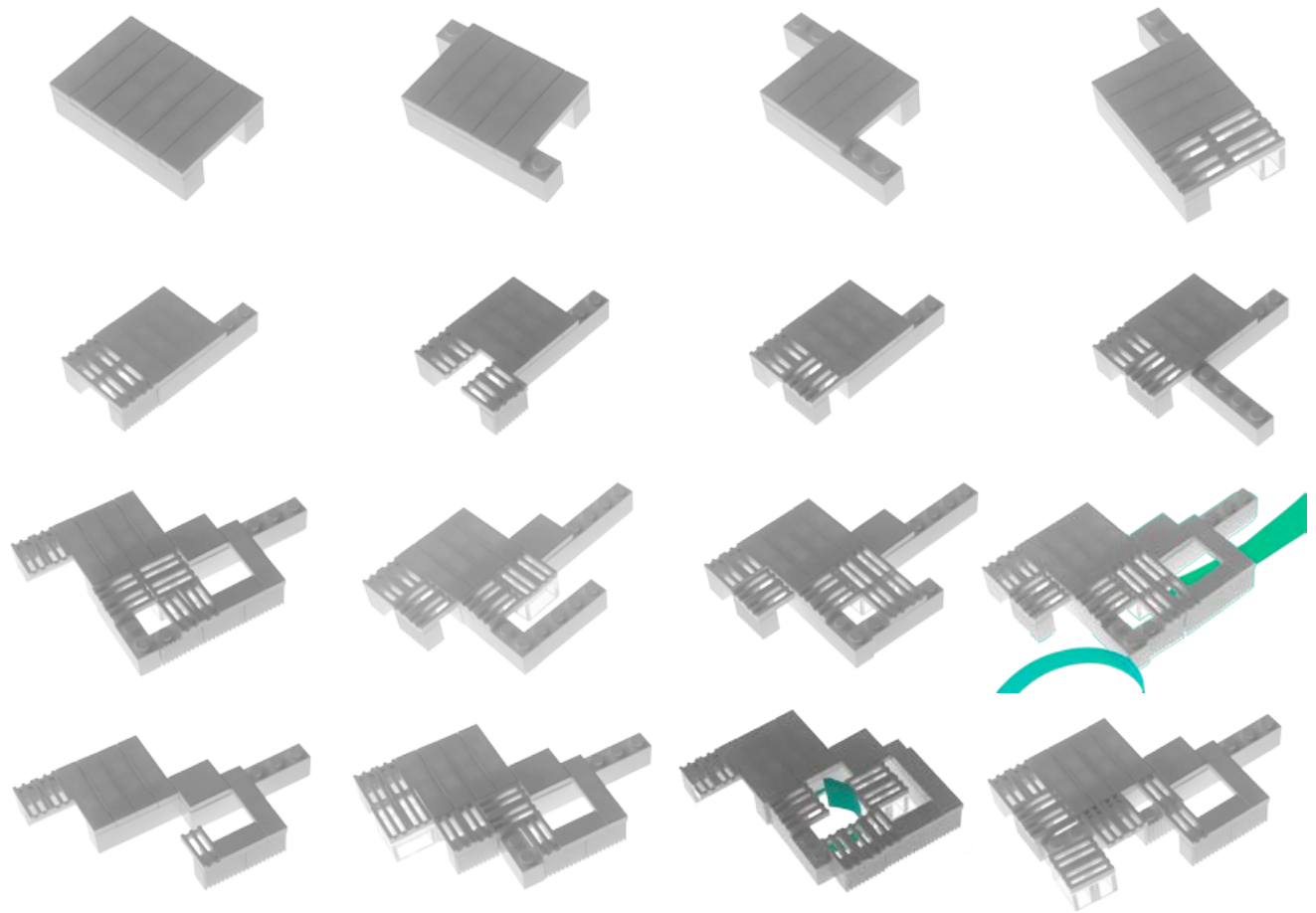


Fig 8.1 - Exploration of form and incorporating Biophilia

I looked at how the in between spaces can be used to inform the design. In this part I noticed the potential use of a courtyard to incorporate natural features in the project and its common spaces. Building on this idea I wanted to have the form follow the biophilia idea that was explored on site. I then explored how the existing buildings can be changed to allow better integrate with the proposed building.

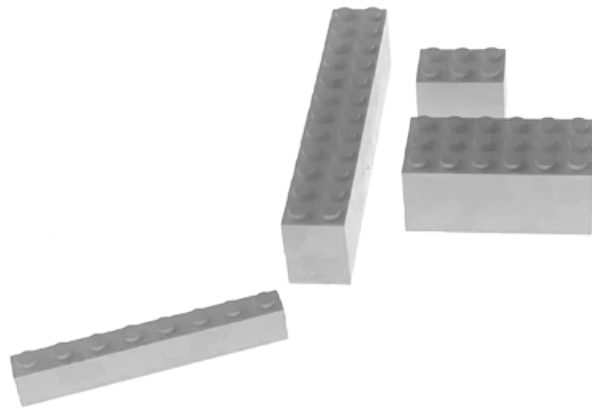


Fig 8.2 - Interaction between existing buildings and nature



Fig 8.3 - Exploration of form with existing structures

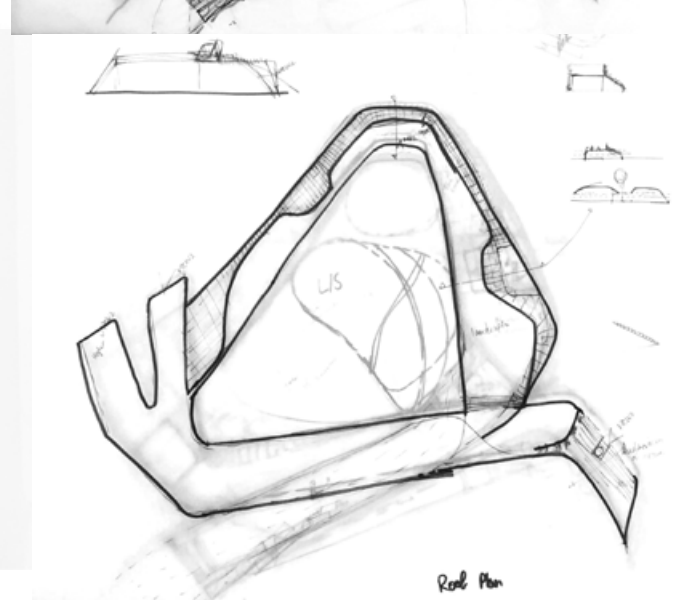
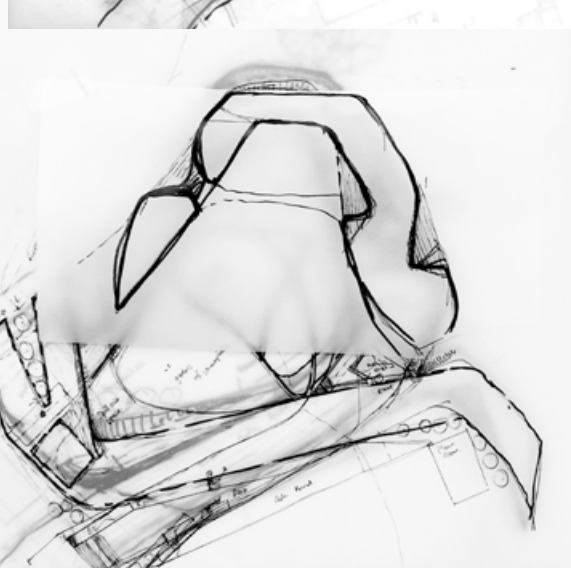
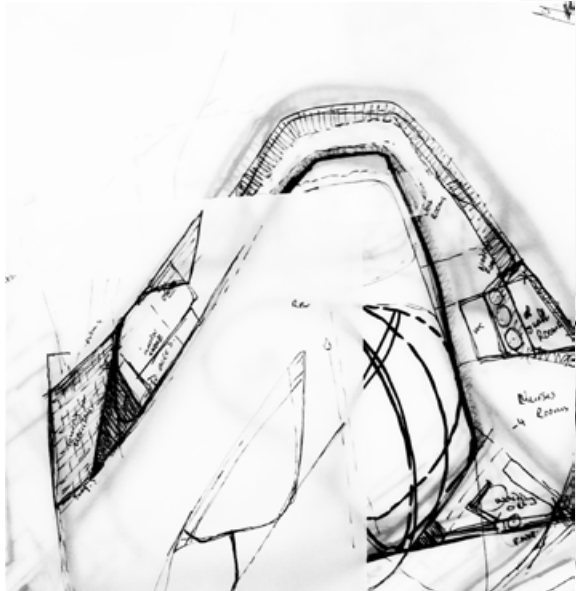
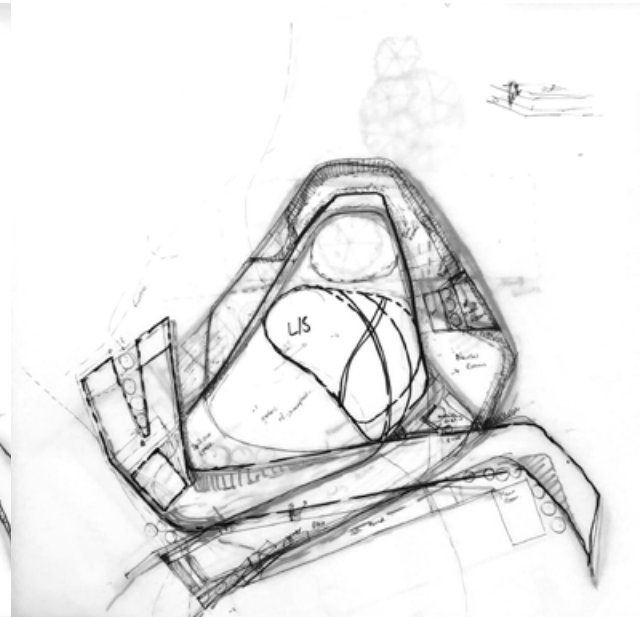
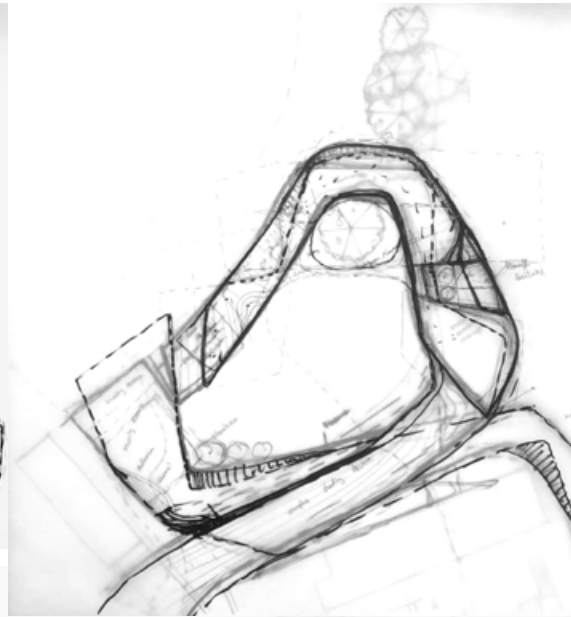
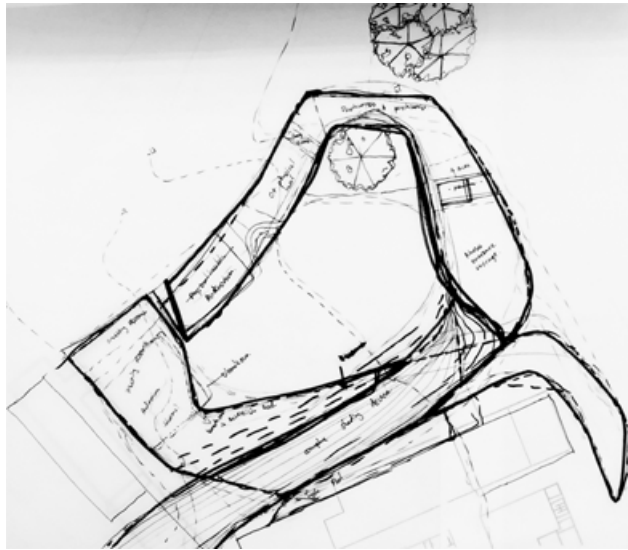
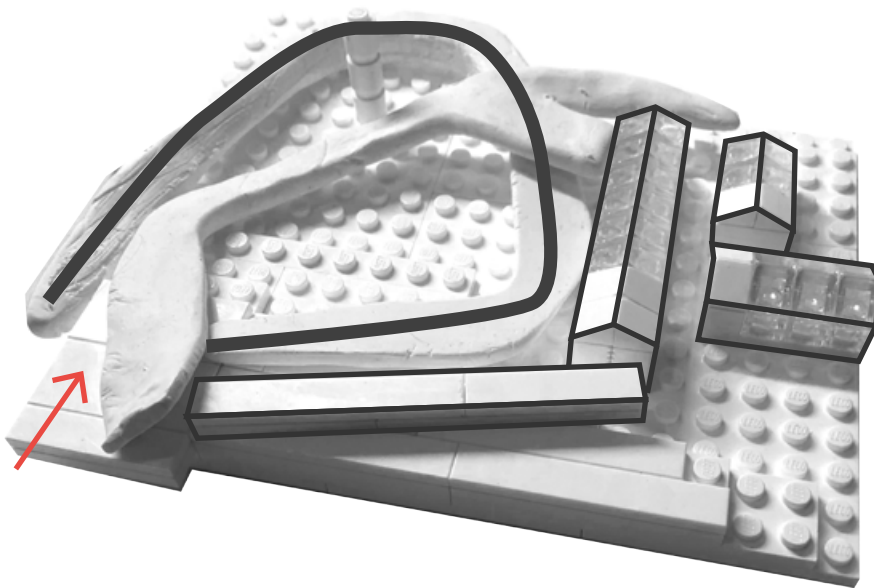


Fig 8.4 - Exploration of form around courtyard



When I was eventually able to visit site as the Covid-19 restrictions affected when I was able to visit the site, I adjusted the massing so that the entrance was located on the edges. This was due to the way the landscape's shape as the other entrance allowed for a more gradual slope to allow for better accessibility.

Fig 8.5 - Exploration of form and context

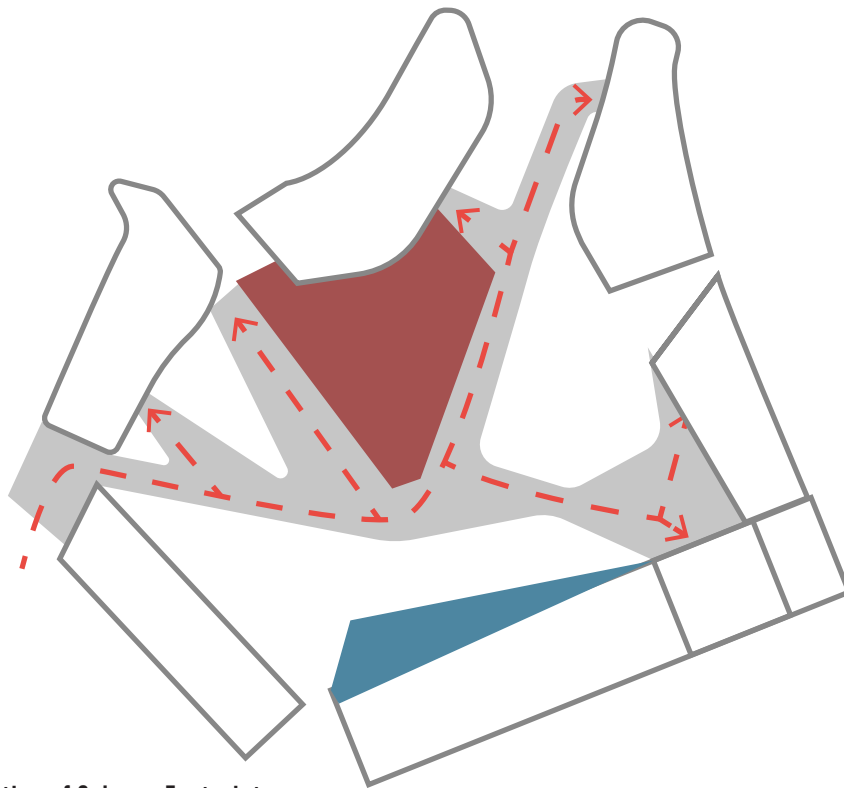
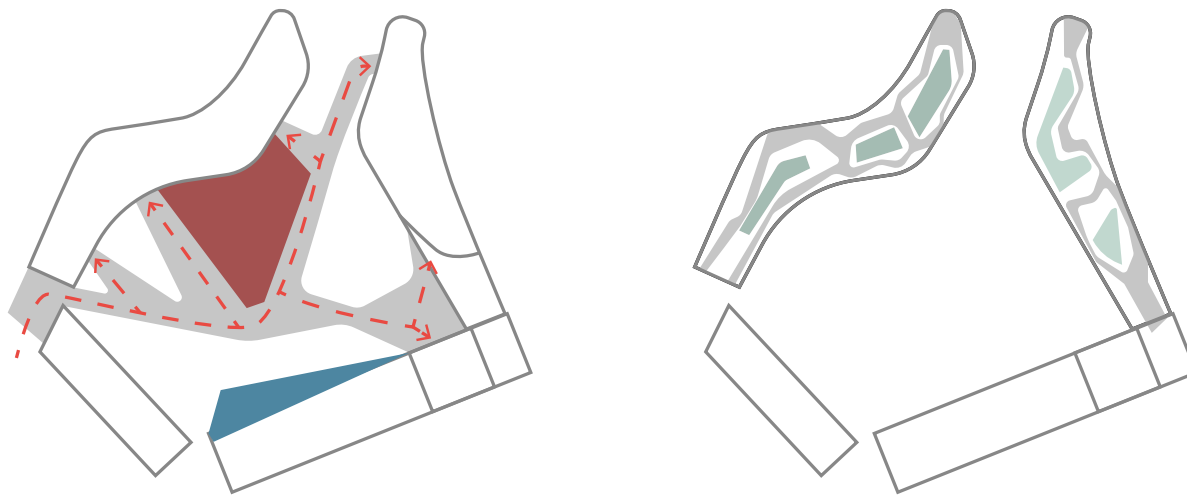


Fig 8.6 - First iteration of Scheme Footprint

Once I had established the where the built form will be placed on site, there was a disconnect of the building and the context around it. The biophilic principles that I set out before including the incorporation of nature into the spaces and blurring nature and the interior thresholds. There was a need to design the landscaping that would inform the way the buildings program would sit. I split the program into 4 sections namely therapeutic department, adult therapy, children's therapy and a central administration. This was the is show in the first attempt of the building footprint as each part of the program was located in separate buildings (fig 8.6). I found this a very ineffective way to place the program within the scheme and decided to consolidate the buildings into 2 distinct forms (fig 8.7).

The program then informed the way I was going to approach the landscape design namely the entrances meeting into one point in a radial design and using the areas in between as different zones that people could



use as public space. I let the existing trees also inform the breaks in the form to allow for the proposal to better integrate into the existing context. However, at this stage of the design I neglected to make sure the furrow located to the north as it had to be left untouched, so the building had to be reduced slightly in size. I also started to design the planted roof to ensure that the building as an extension of the landscape rather than an imposition as per the principles I set out. Due to the nature of the site's slope, I made sure the entrance to the planted roof would be on-grade to the existing building located to the north for better accessibility. The other paths would then lead to a central point to allow for better navigation in the facility. This layout of landscaping was the first attempt. I noted that this layout was too complex and busy and would not allow building users to navigate the landscaping effectively.

Fig 8.7 - Exploration of relationship between landscaping and building form

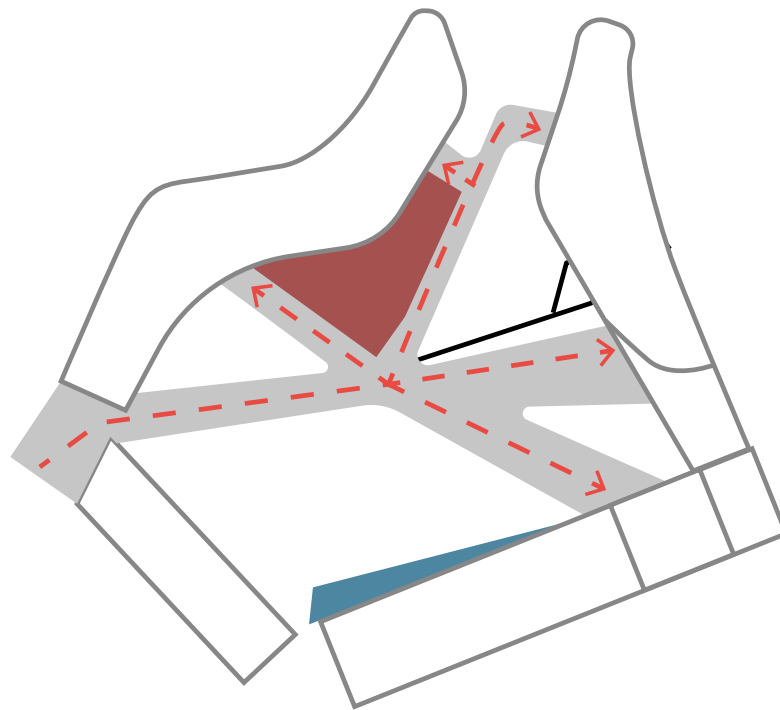


Fig 8.8 - Landscaping layout exploration and connections to entrances

The final iteration of the landscaping I decided to strip down the landscaping to essential components namely:

- Large open field
- Water storage for the farming facility that doubles as a water feature
- Clear navigation paths
- Traditional Farming area for day care users
- Opportunities to view open landscape

I used the existing connections and distilled the design that resulted in the final landscape design (fig 8.9)

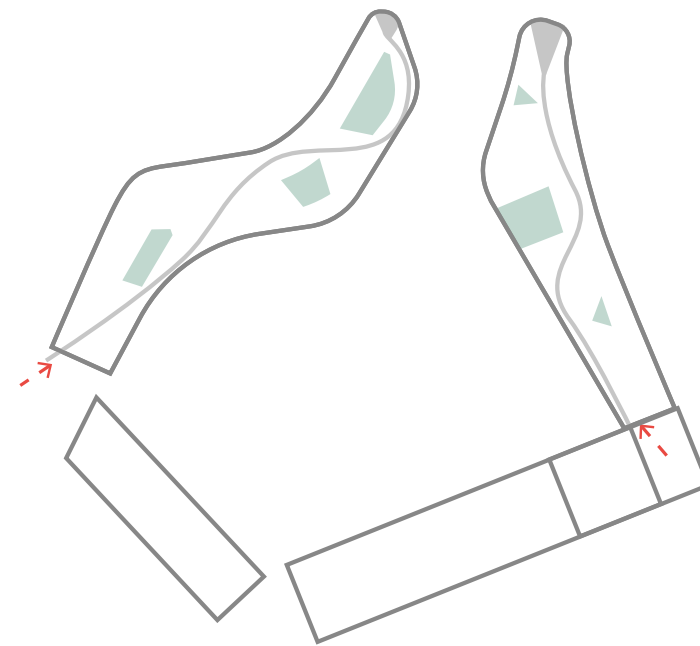
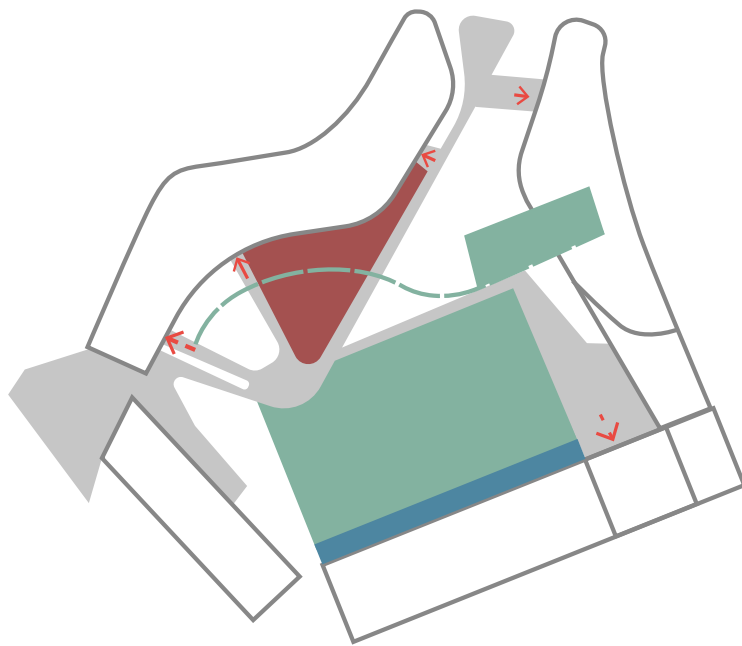
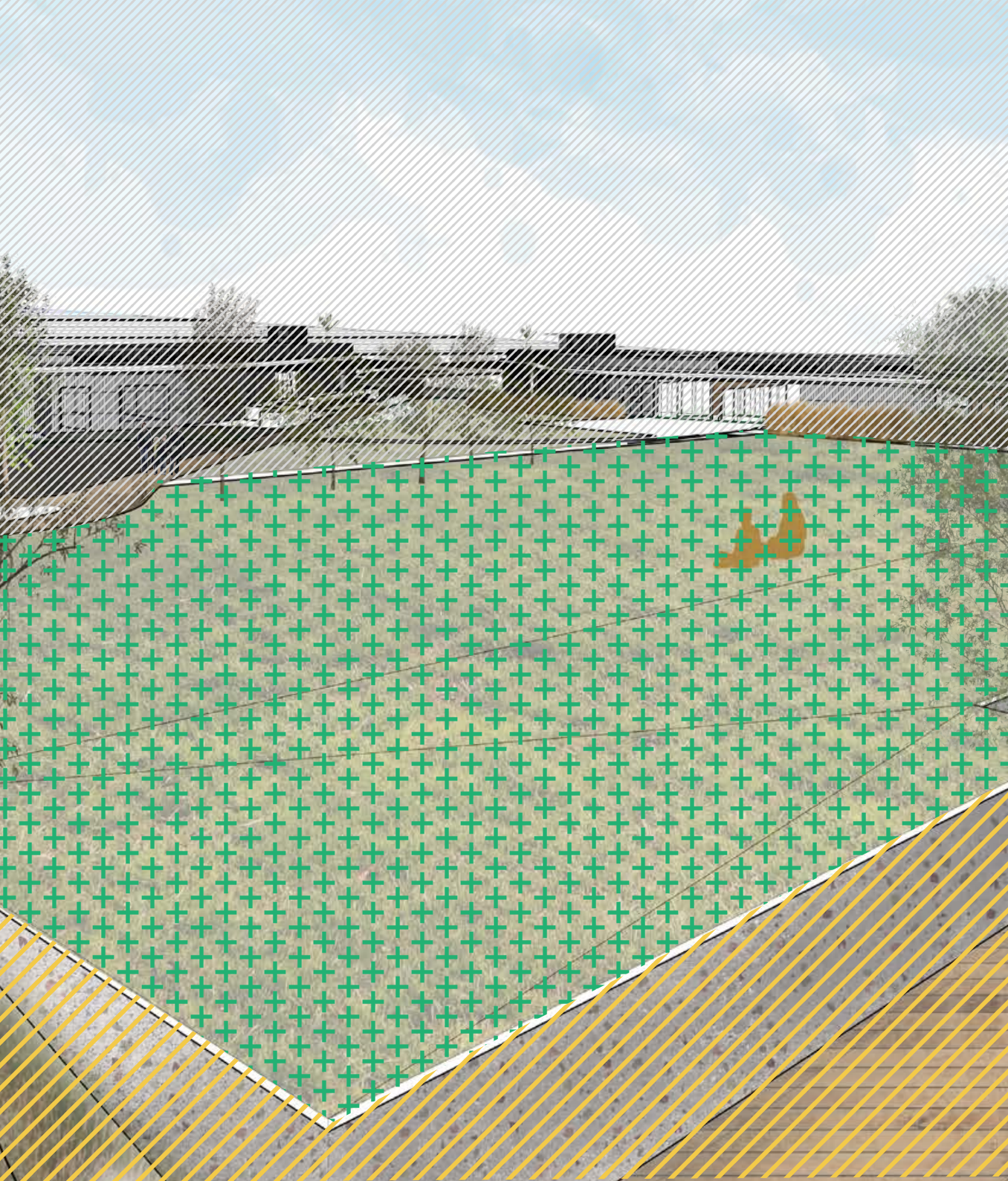


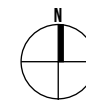
Fig 8.9 - Final Exploration of Facility's Landscape



9 Proposal



Fig 9.1 - Site Plan



Planting Types

Flowering plants



Aloe greatheadii var *Davyana*

Grasses



Aristida junciformis (nGongoni grass)



Hyparrhenia hirta (L.) Stapf (Common thatching grass)

Trees



Celtis africana (White Stinkwood)



Dombeya rotundifolia (South African wild pear)

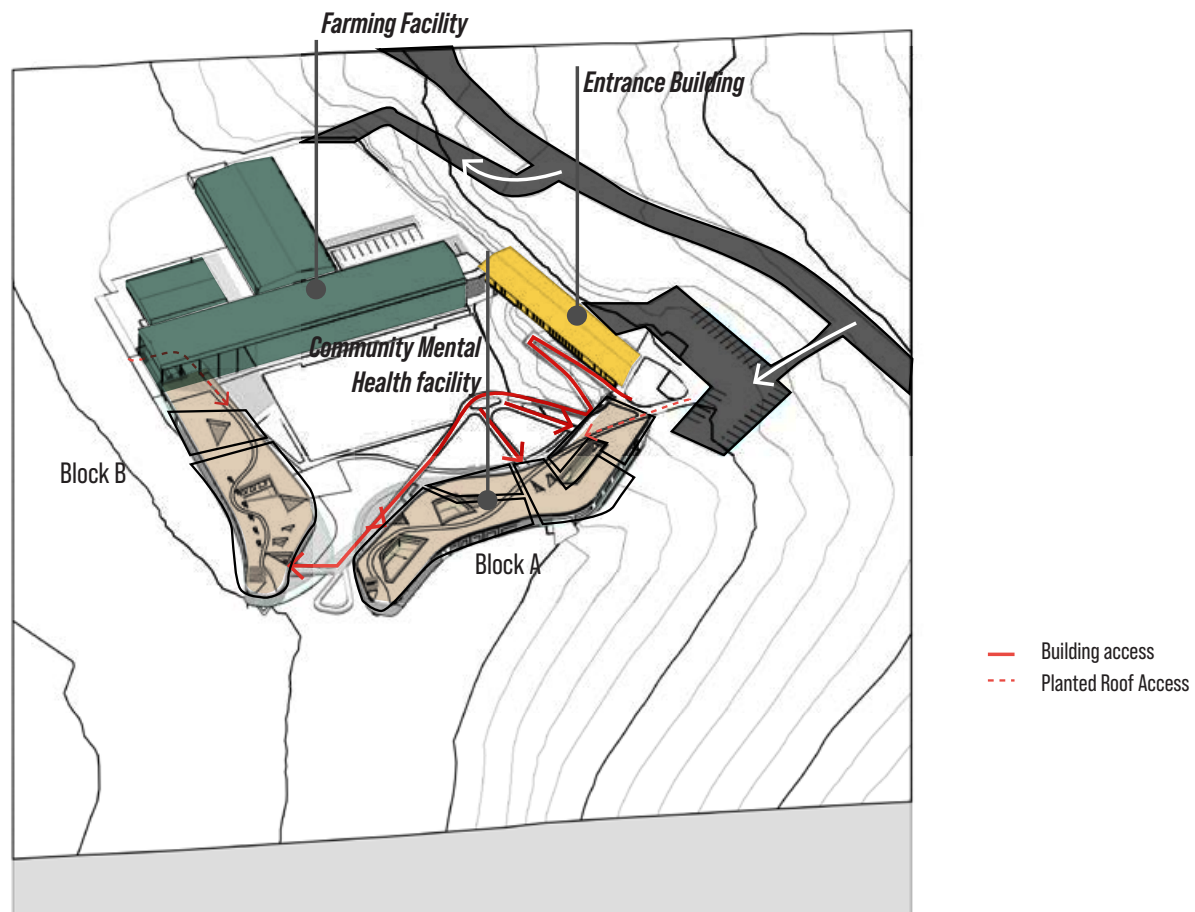
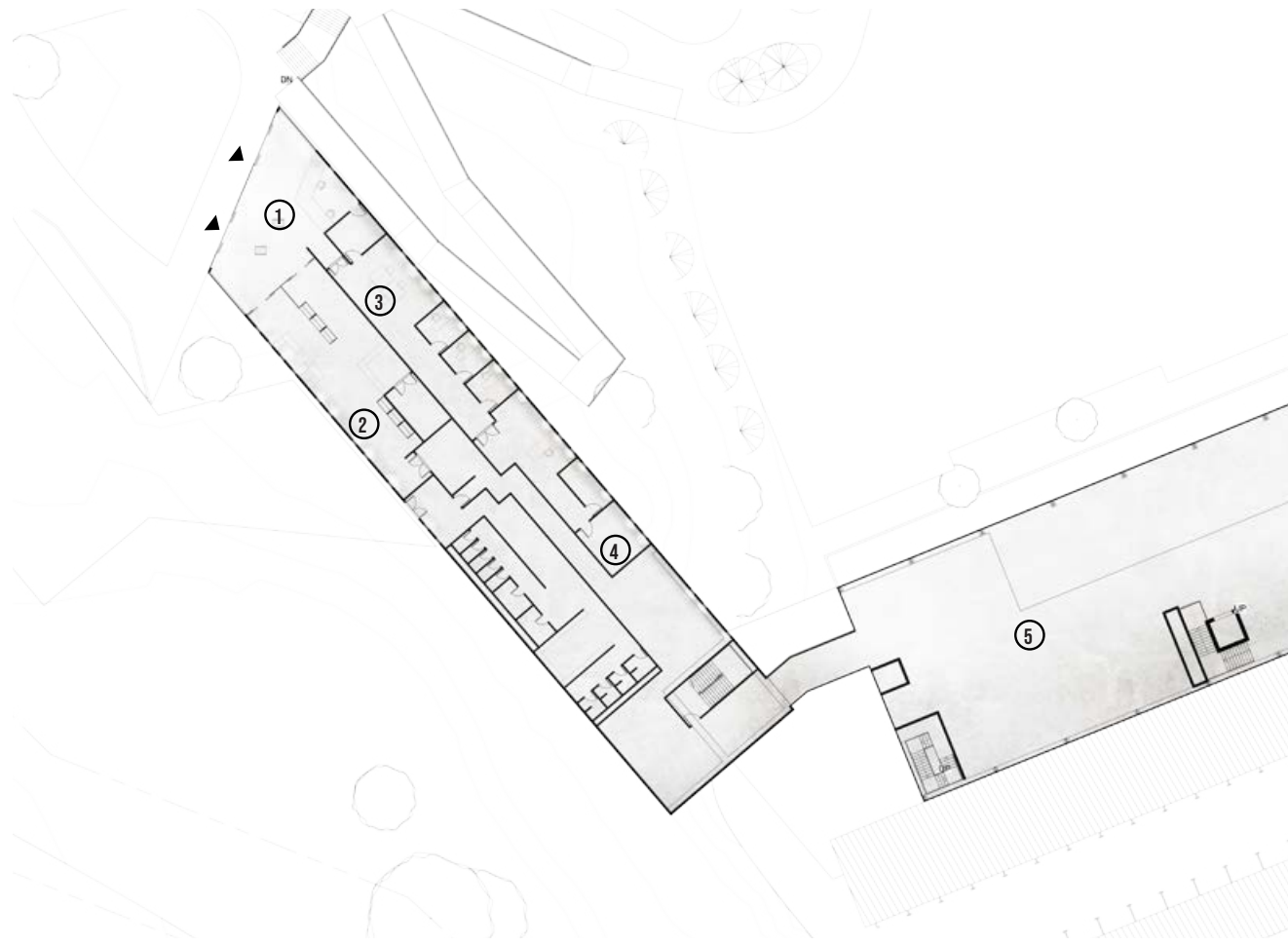


Fig 9.2 - Axonometric showing General Layout



- 1. Information Center
- 2. Pharmacy
- 3. NGO Offices
- 4. Security Offices
- 5. Farming Facility

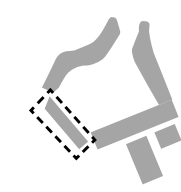


Fig 9.4 - Entrance Building

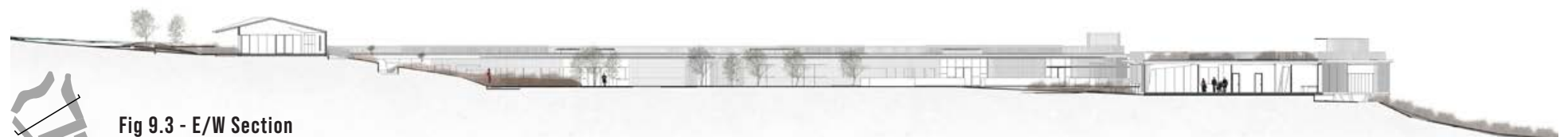


Fig 9.3 - E/W Section





Fig 9.5 - View of entrance building on arrival



Fig 9.6 - View of entry to courtyard



Fig 9.7 - South Aerial View of Proposal



Fig 9.8 - Landscape Plan





Fig 9.10 - Perspective of Landscaping

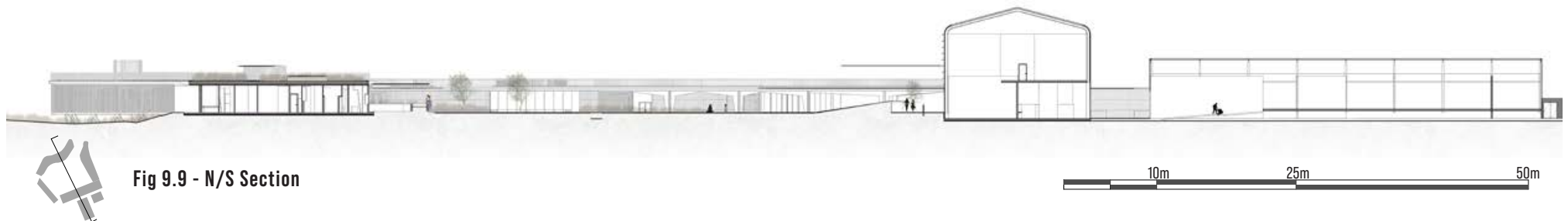


Fig 9.9 - N/S Section



Fig 9.11 - Block A Plan



1. Education Department
2. Therapeutic Department
3. Day Care Facility
4. Adult Therapy Department
5. Multipurpose Space

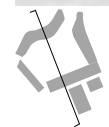


Fig 9.12 - N/S Section



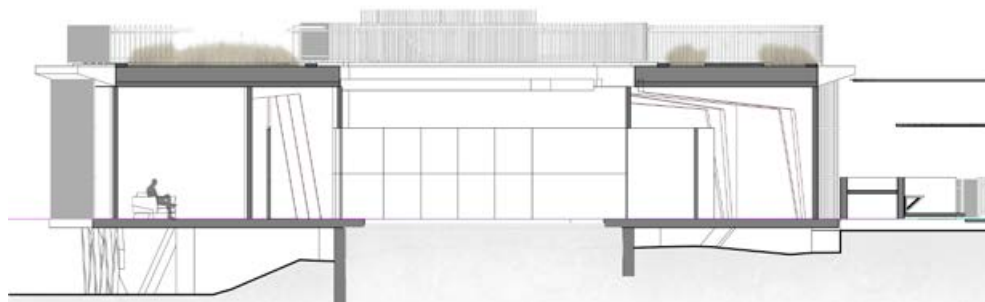


Fig 9.14 - Section C



Fig 9.13 - Perspective of Reception

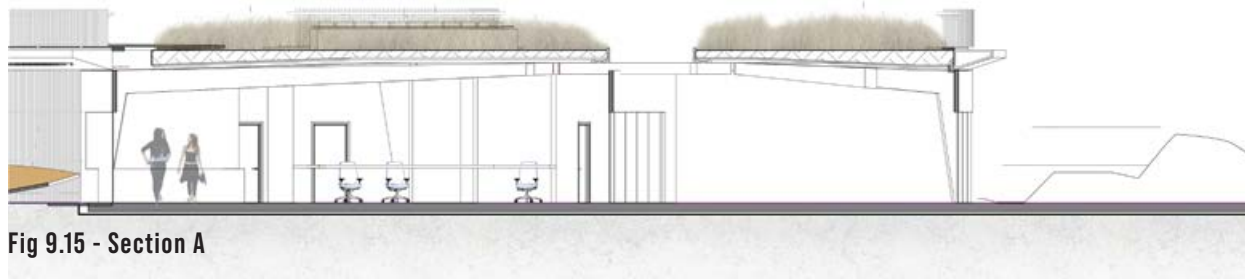


Fig 9.15 - Section A

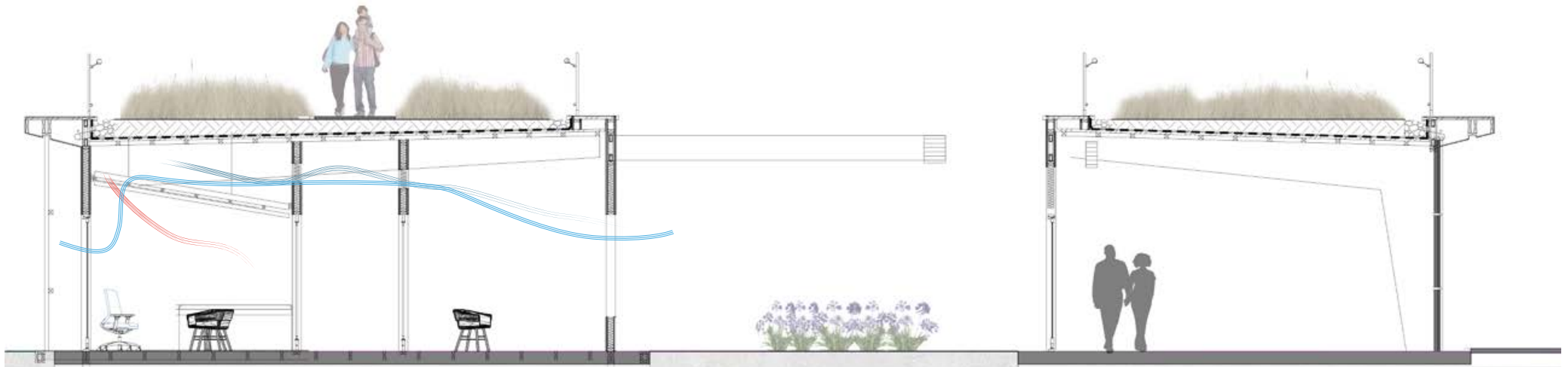


Fig 9.16 - Section B

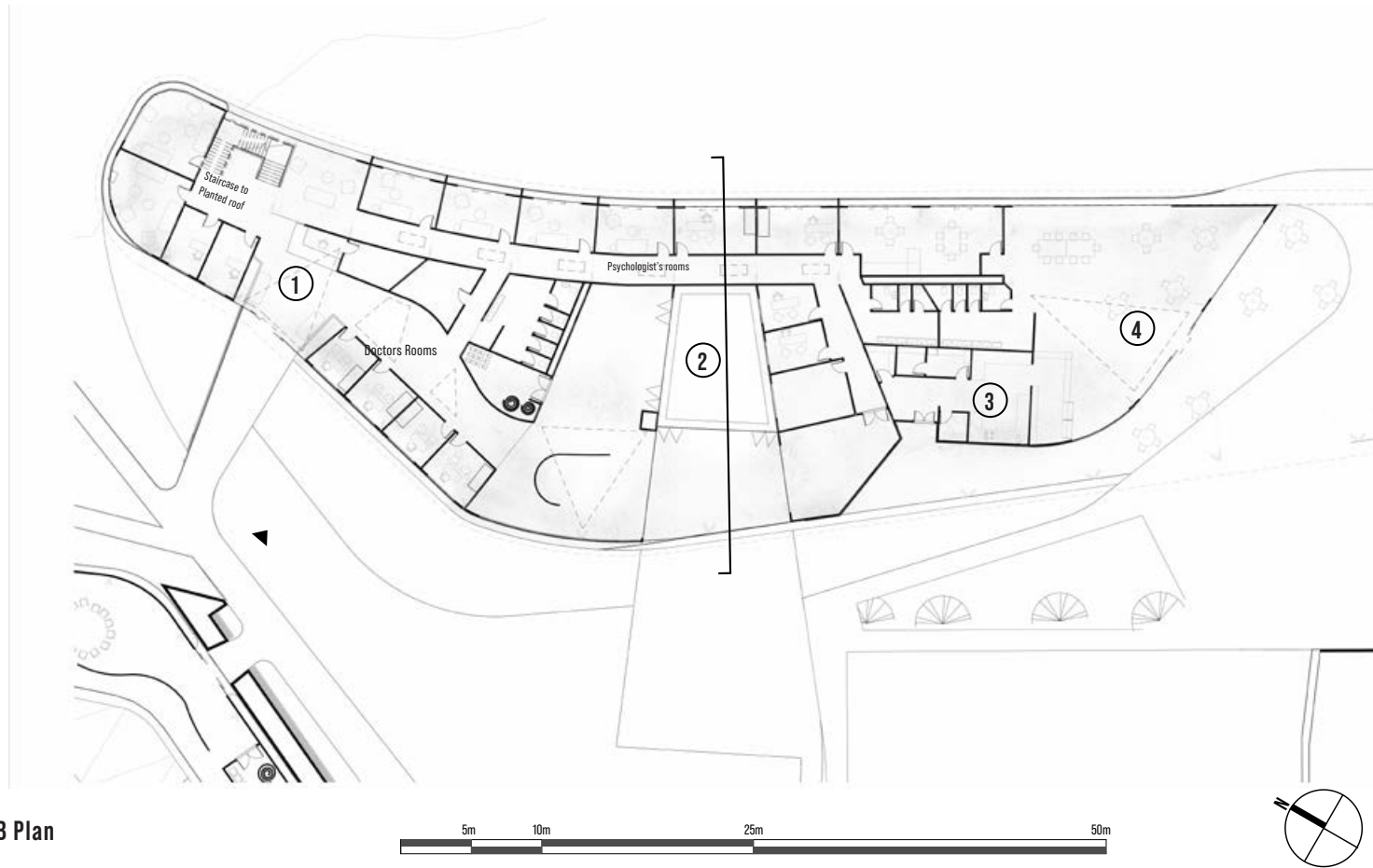


Fig 9.17 - Block B Plan

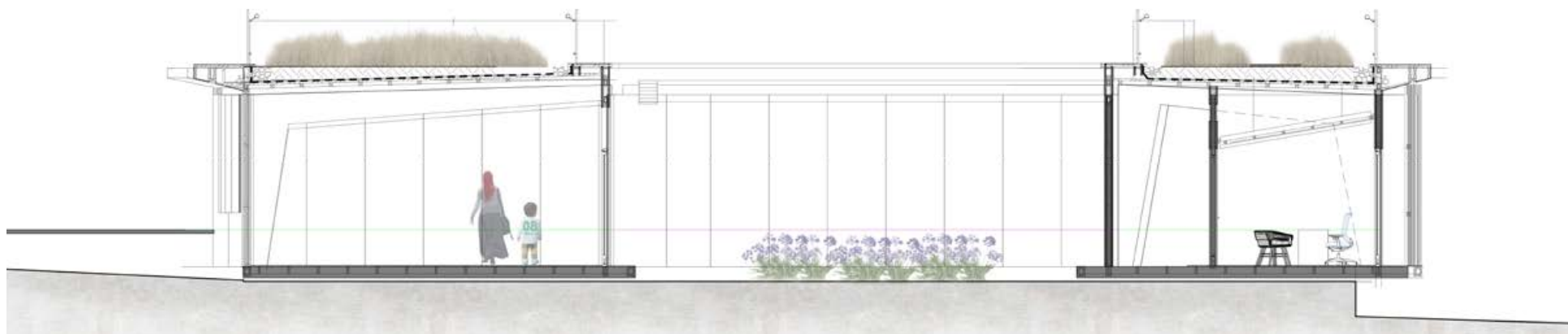


Fig 9.18 - Section





Fig 9.19 - Interior Perspective of Treatment Rooms

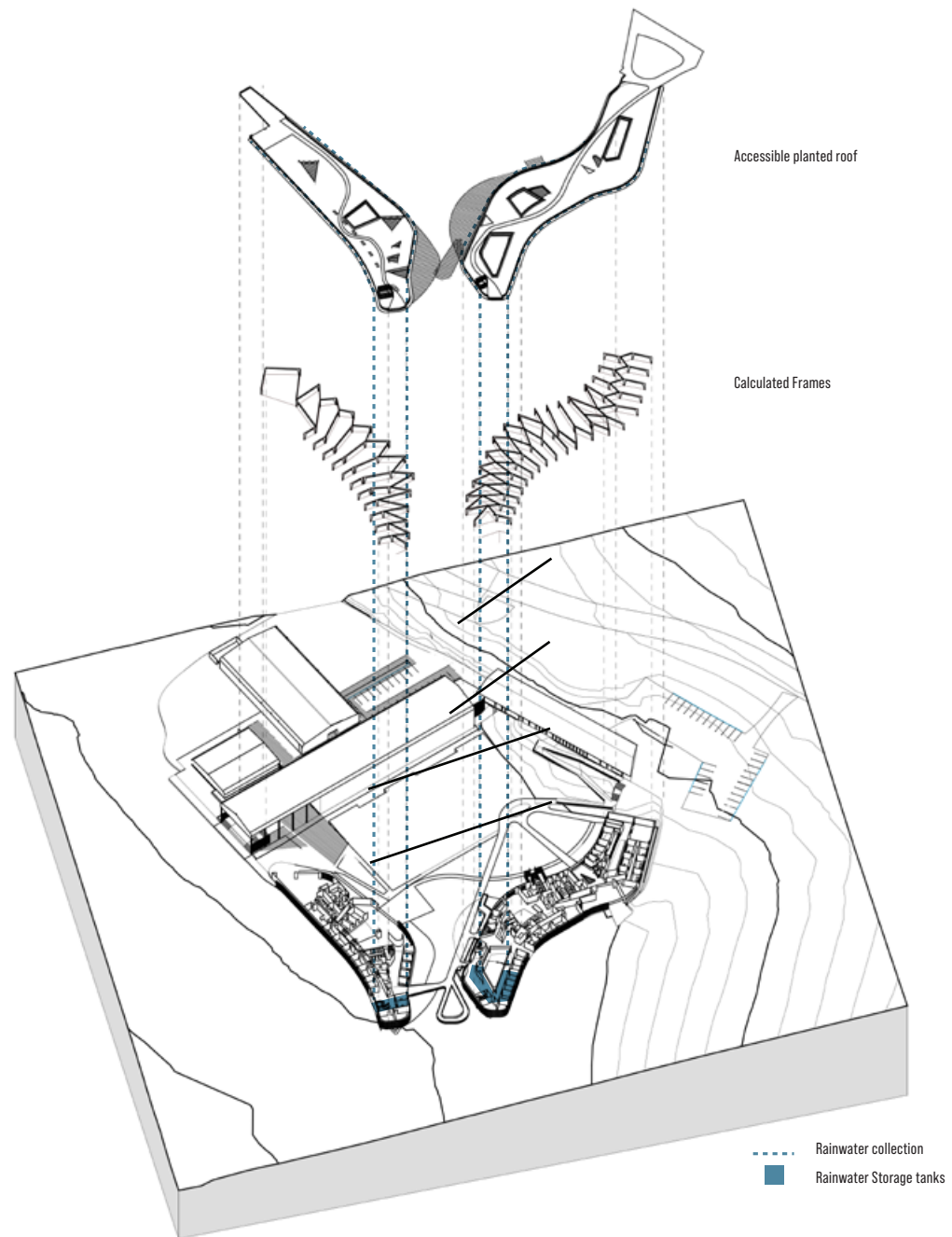


Fig 9.20 - Axonometric of Overall design

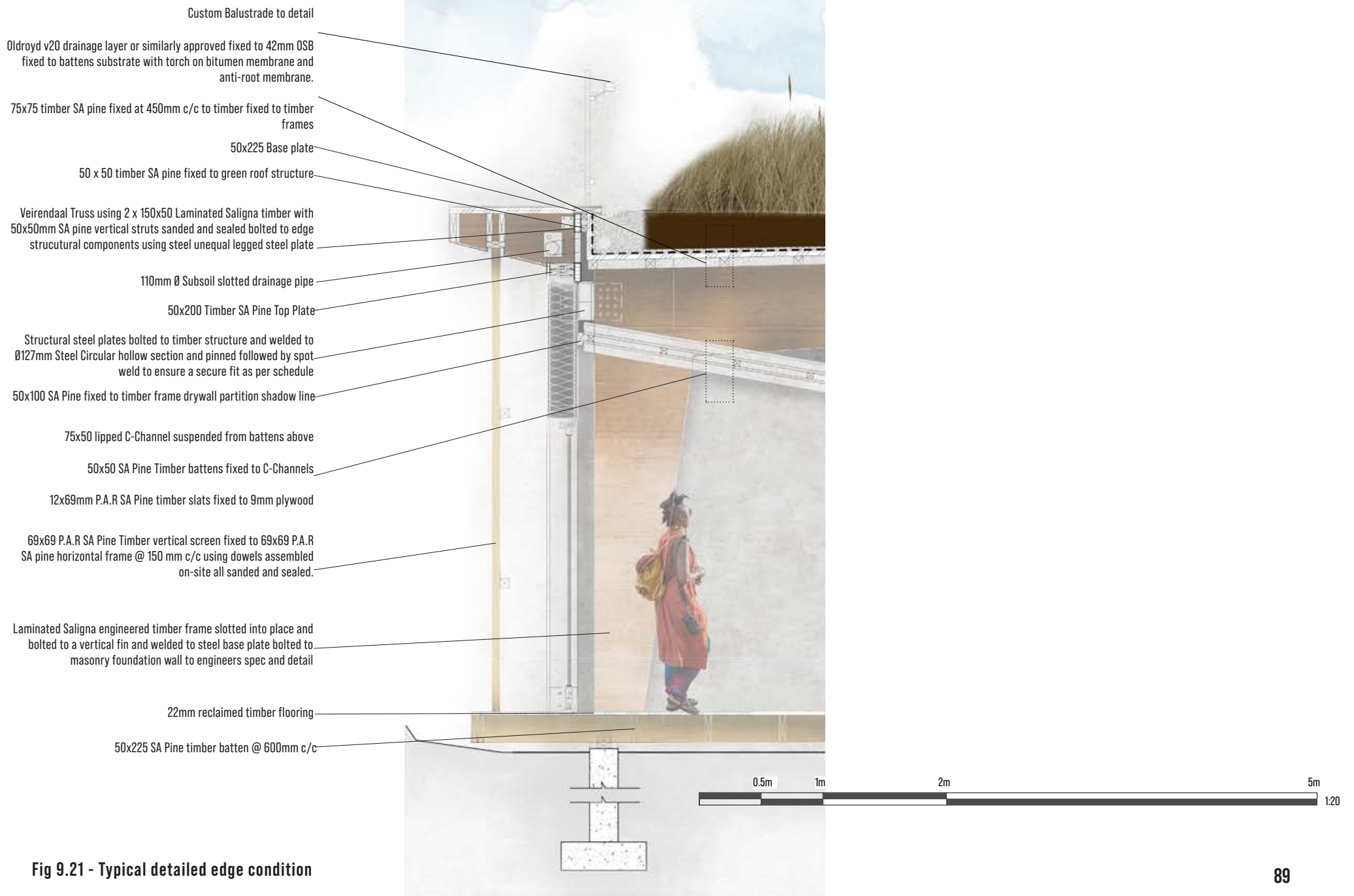


Fig 9.21 - Typical detailed edge condition

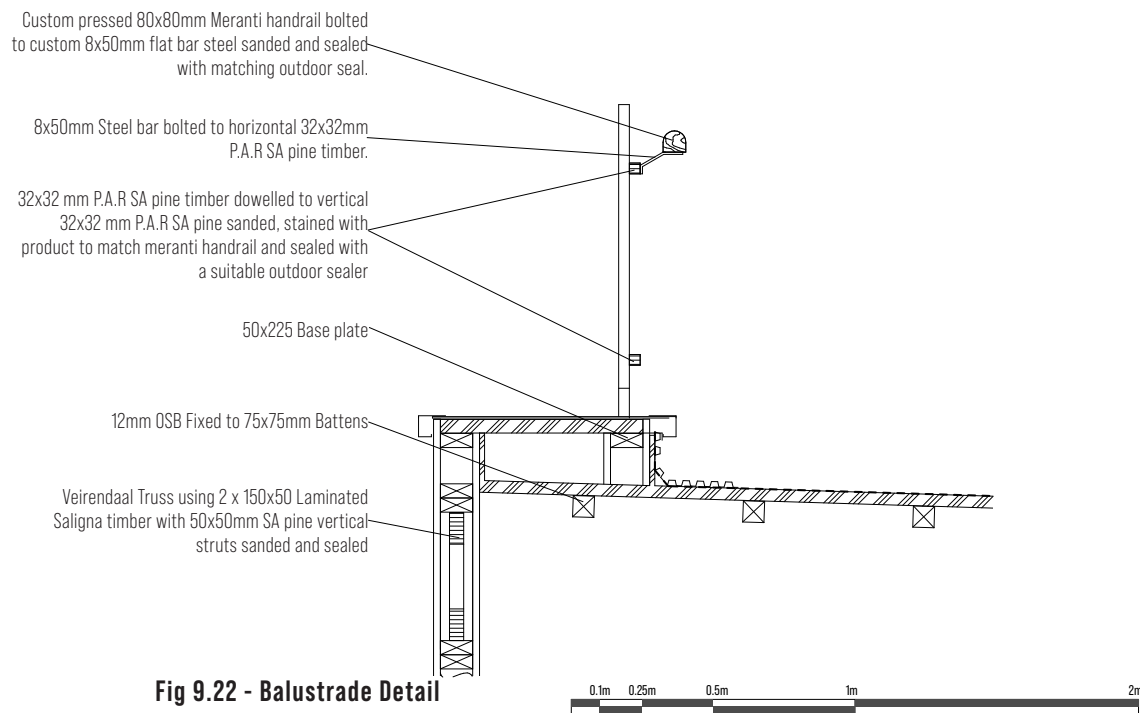


Fig 9.22 - Balustrade Detail

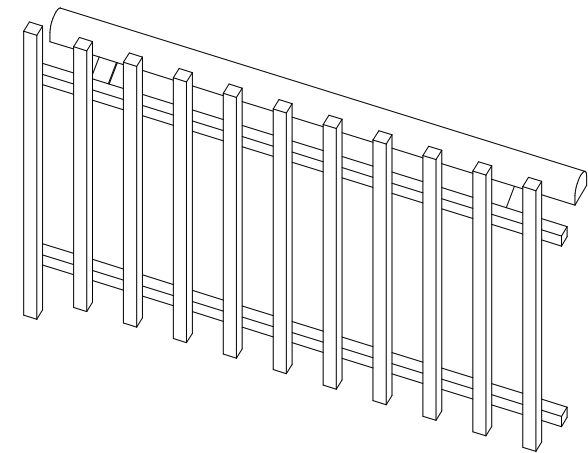


Fig 9.23 - Balustrade Axonometric



Fig 9.24 - View from Accessible Roof to Landscape

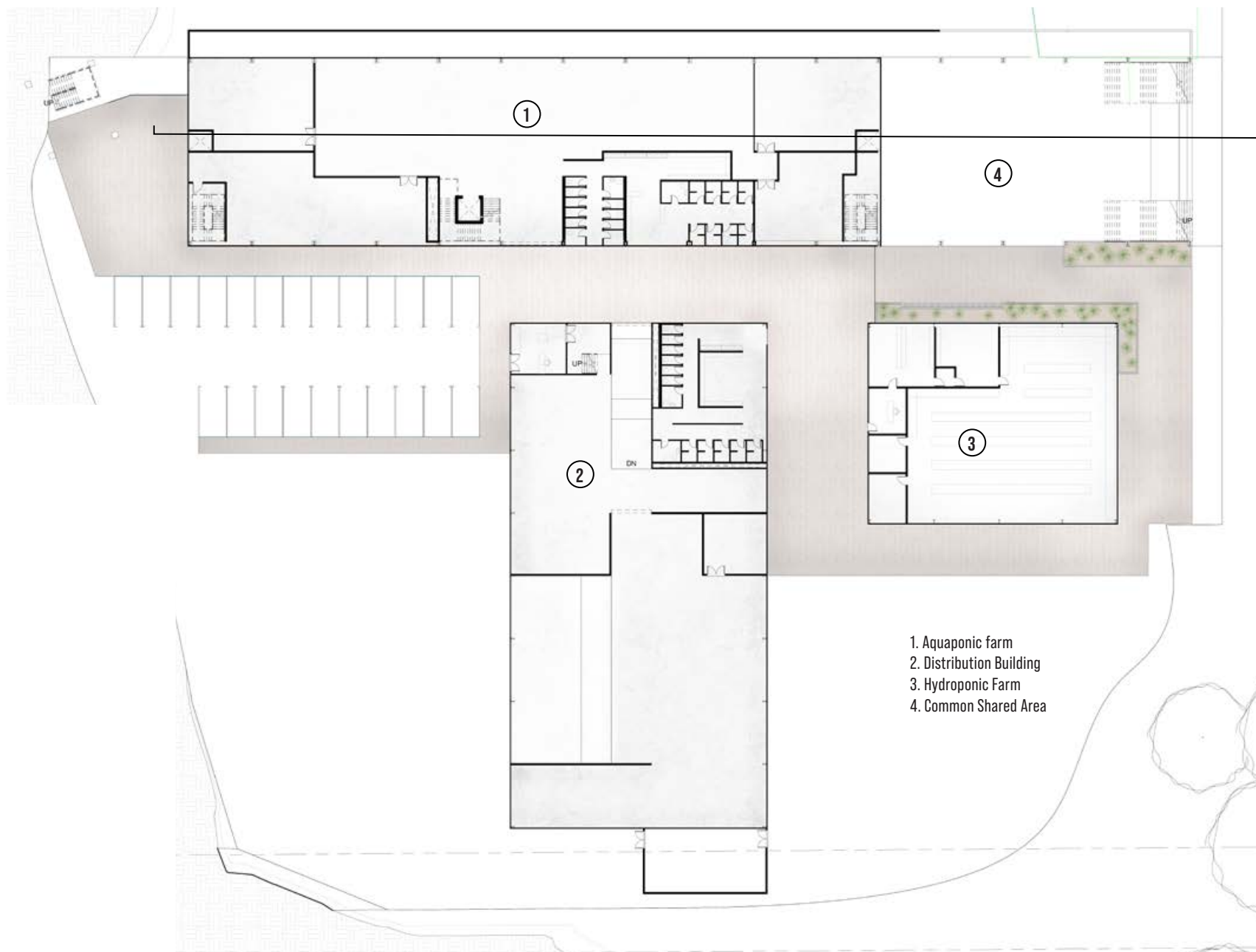


Fig 9.25 - Farming Facility Plan

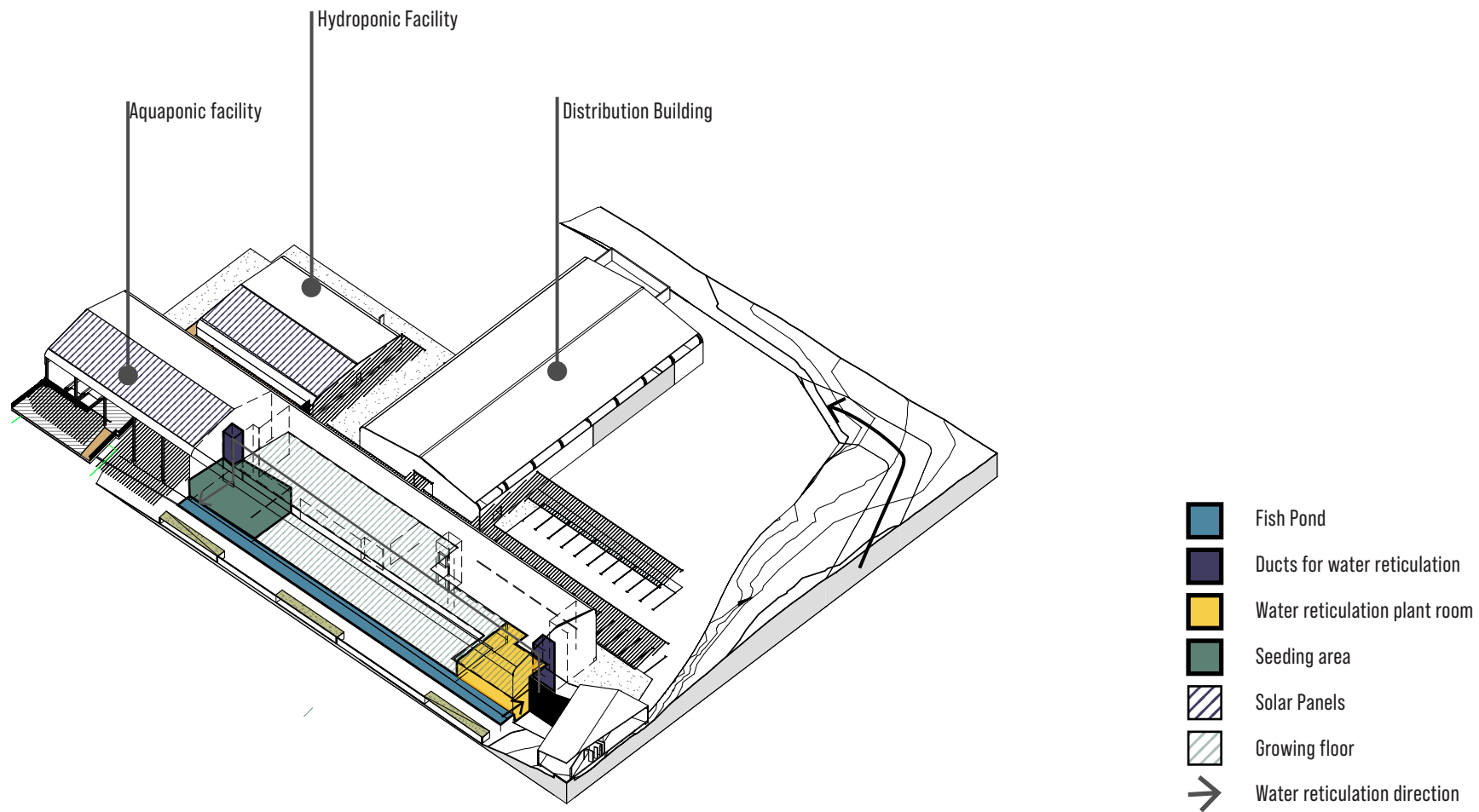


Fig 9.26 - Axonometric of Farming Facility

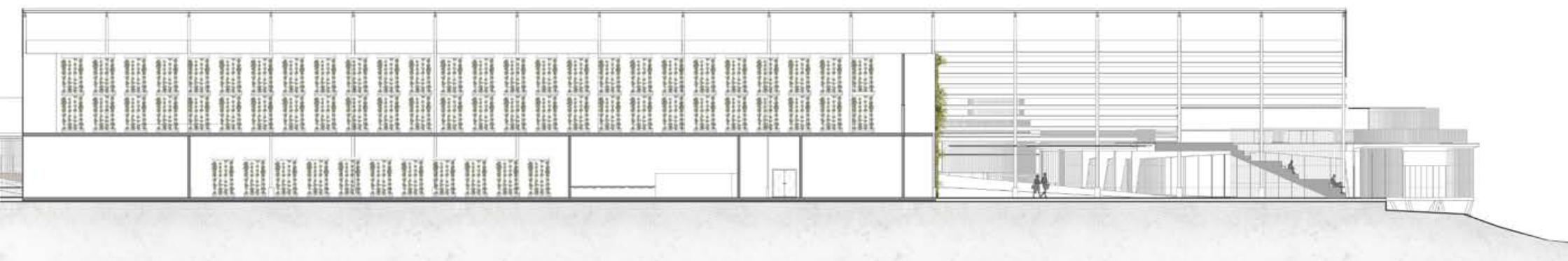


Fig 9.27 - Section Through Farming Facility





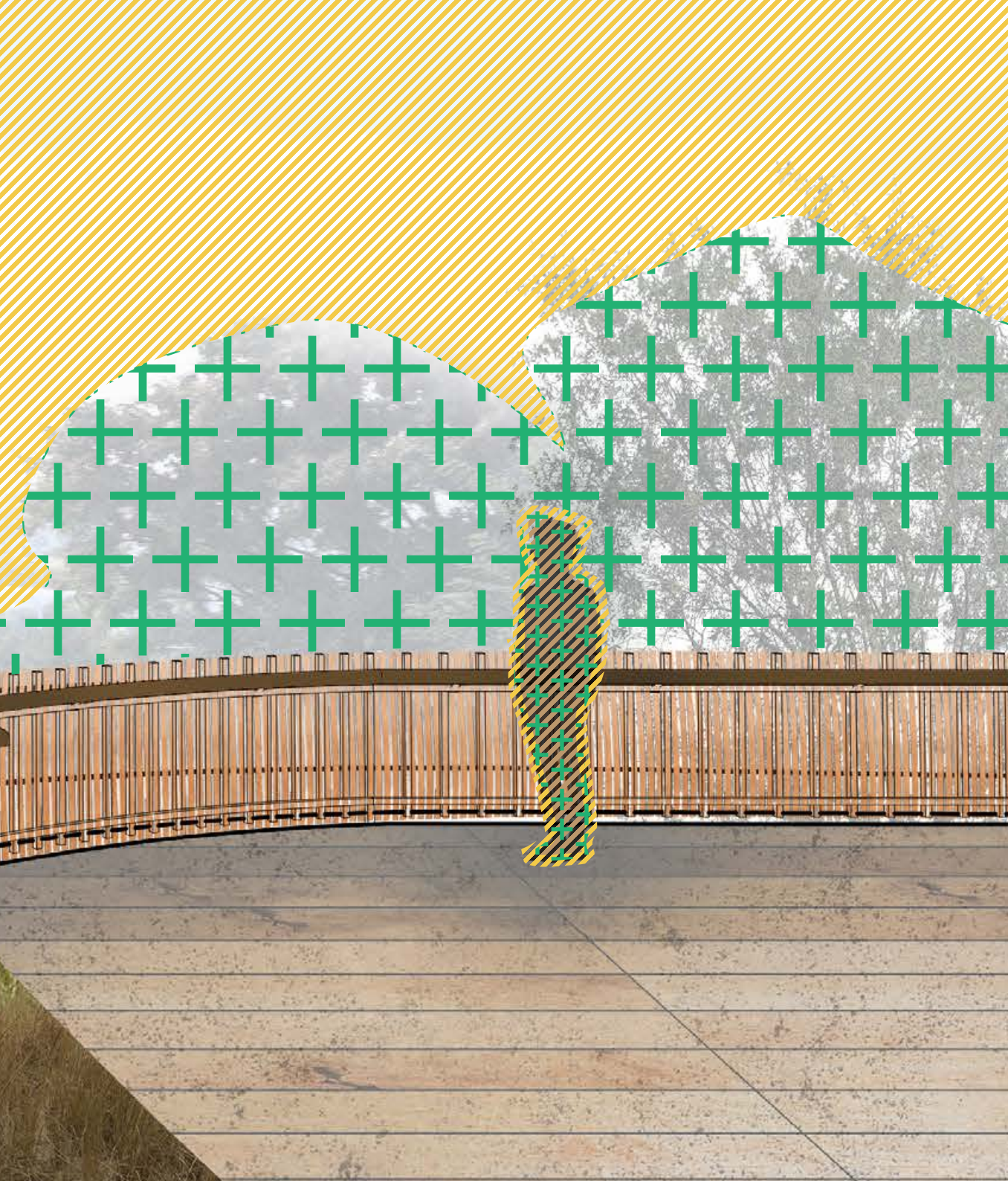
Fig 9.28 - Common Seating Spaces to Views of landscape



Fig 9.29 - Exterior Adult therapy



Fig 9.30 - View of Courtyard



10 *Conclusion and Reflection*

10.1. CONCLUSION & REFLECTION

It is apparent that in South Africa there is a lack of publicly available mental health care services. Most of these services are based in large regional hospitals. The question remains, what happens to those who are in need of chronic care instead of acute conditions that require hospitalisation. In my proposal I looked at the application of CMHSs as a method to provide quality mental health care as it is a type of facility that the Department of Health is aiming to implement as part of the National Mental Health Strategic Plan. However, implementing CMHS facilities are only a type of facility and does not address the quality of the spaces or the care that is provided to the mental health care users and the strategic plan also does not address where these facilities should be placed. By creating a facility that works within both the public and private sectors and can be implemented in a variety of different contexts. This will ensure that the facilities built are managed correctly which would address the limited resources of the public sector.

The principles implemented in the proposal namely, ensuring the context's place and nature is seen throughout the project from the exterior and interior spaces results in spaces that aid in treatment outcomes for MHCUs. The building had to be adjusted throughout the process as it was imperative that the building footprint responds to the immediate landscape. The scheme could have had improvements

through ensuring less distinctive thresholds between the landscape and the interior spaces. The use of landscaping as a method of wayfinding through the facility also successfully shows the application of biophilic principles within the proposed scheme. The way in which the building responds to its site namely the accessible roof above the facility as an extension was done successfully. The placement of therapeutic spaces on the periphery of the site also makes use of the natural views which reflects the Biophilia Hypothesis.

With the guidelines I have set within the scope of my building I was able to achieve a building that does not only provide spaces to allow for community based mental health care services to be practiced but also create spaces that can help in achieving better therapeutic outcomes through proven precedents and research. These biophilic principles including visual and physical access to nature is a principle that can easily be replicated in varying contexts from urban to rural areas. The program of the building can also be easily scaled and adjusted to suite its context where in the case of my proposal it was decided to create a larger facility to cater the large communities within the context.

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