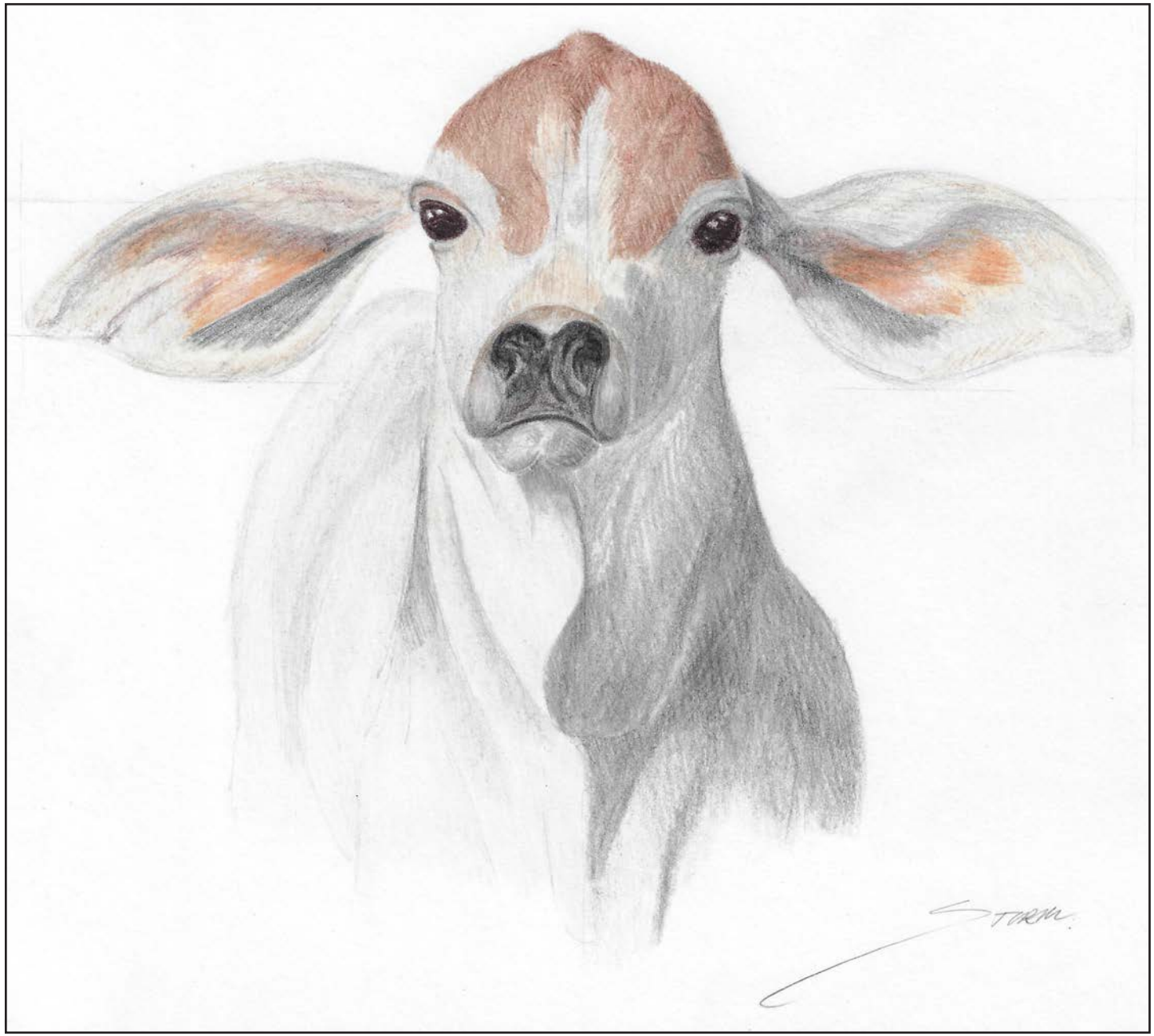
A RENAISSANCE OF AGRI-(CULTURE)

AN INVESTIGATION INTO PERI-URBAN AGRICULTURE AS A CATALYST FOR SUSTAINABLE DEVELOPMENT THROUGH THE INTEGRATION OF HUMAN BEHAVIOUR, NATURAL PROCESSES AND TECHNOLOGY.

BRITTANY STORM NEWTON



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By: ***Brittany Newton***

Submitted in fulfillment of part of the requirements for the degree:
Master of Architecture (Professional)
December 2020

Faculty of Engineering, Built Environment and Information Technology
University of Pretoria

Course Coordinator:
Prof. Arthur Barker

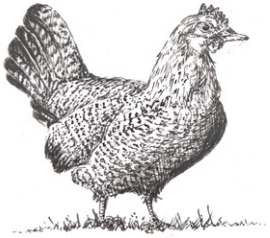
Study Leader:
Abre Crafford

DECLARATION

In accordance with Regulation 4(c) of the General Regulations (G.57) for dissertations and theses, I declare that this thesis, which I hereby submit for the degree Master of Architecture (Professional) at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at this or any other tertiary institution.

I further state that no part of my thesis has already been, or is currently being, submitted for any such degree, diploma or other qualification. I further declare that this thesis is substantially my own work.

Where reference is made to the works of others, the extent to which that work has been used is indicated and fully acknowledged in the text and list of references.



PROJECT SUMMARY

RESEARCH FIELD
Environmental potential

LOCATION
364 Zwartkoppies, Hazeldean Farm, Silverton, Tshwane, South Africa

PROGRAMME
Dairy, Deli and Agricultural Resource Centre

CLIENT
Hazeldean Node & Surrounding Communities
Tshwane Local Government
Clover Milkyway and
Hazeldean Valley Farms

THEORETICAL PREMISE
Using Regenerative theory as a method of ensuring social, economic and environmental sustainability through the integration of human behaviour and processes, ecology and technology

ARCHITECTURAL APPROACH
Investigating the role of Architecture as a trans-disciplinary facilitator in the achievement of regenerative and self-reliant communities through sustainable urban, environmental and spatial design.

ACKNOWLEDGMENTS

To my Mom & Dad,
Thank you for the opportunity to pursue this degree, and for having the patience and understanding to deal with a very 'stressed out' daughter. Thank you for all of your love and support, and for your friendship.

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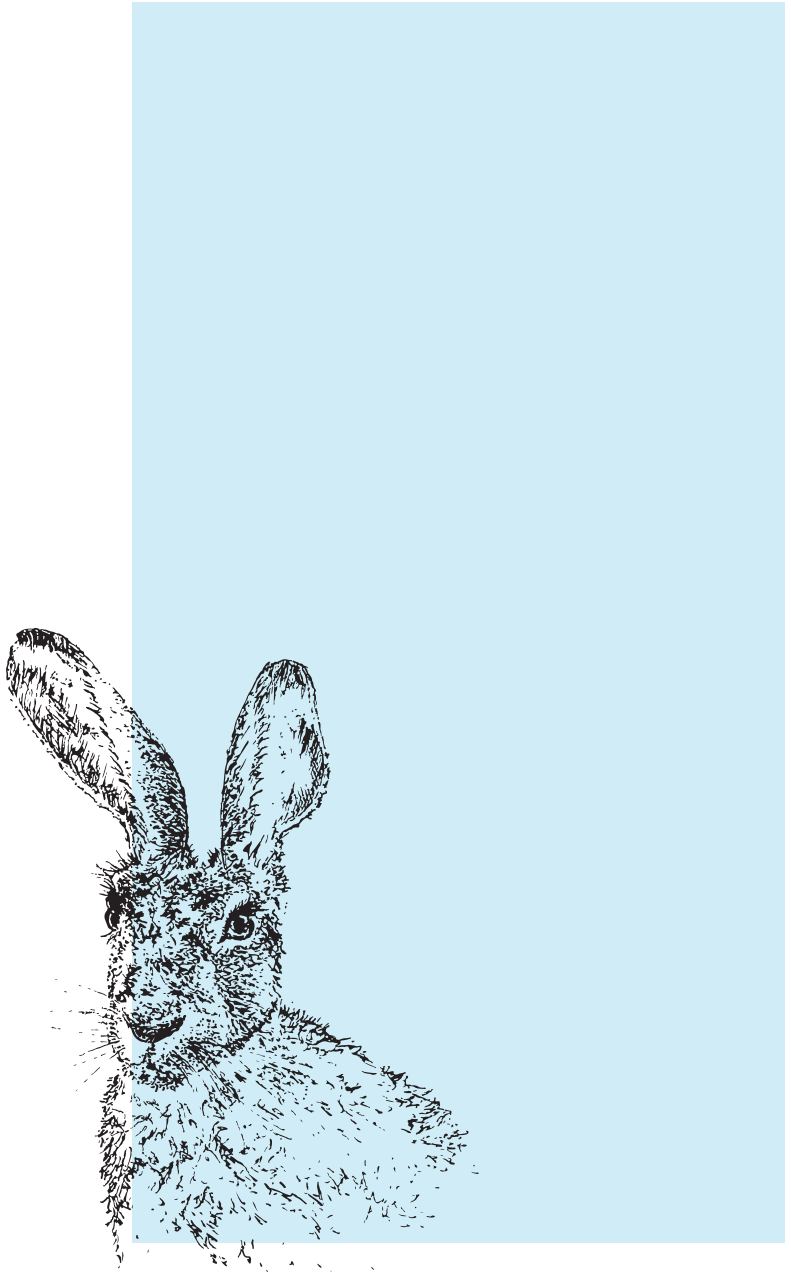
ABSTRACT

The world is currently gripped by the Covid-19 Pandemic, forcing entire countries into total and partial lockdown. Access to fresh and nutritious food has been compromised, unemployment rates have risen and the inequality of living environments across the board is being called into question. Thus, the need for holistic, self-reliant and sustainable mixed-use developments, and the better integration of communities, is steadily rising, particularly in South Africa.

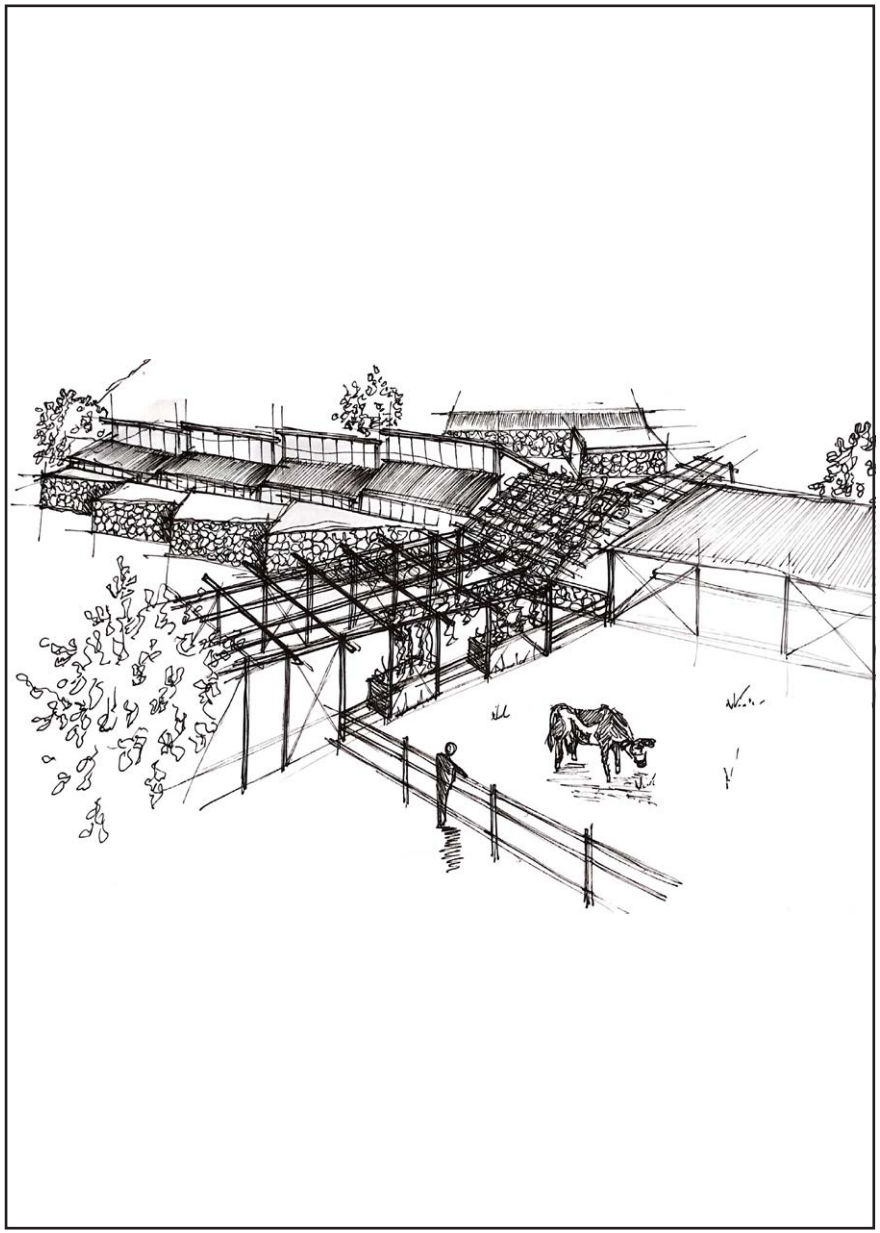
Self-reliant communities allow for the stimulus of local economies, employment opportunity, and poverty alleviation. They also encourage the sustainable use of natural resources, energy harvesting and generation, and climate resilience. In order to ensure food sovereignty and environmental sustainability, society needs to move away from purely industrial agriculture and reintroduce agriculture to communities, allowing people the opportunity to engage directly with healthy, nutritious, locally produced food.

There is an opportunity to investigate the potential for agriculture in the peri-urban environment to provide these solutions through the development of architecture and agriculture hand in hand. This is investigated through an examination of the Hazeldean Node development in Pretoria East. This document investigates the relationship between peri-urban agriculture and the urban environment and its potential to combat these issues through the design of an agricultural precinct hosting a dairy, deli, and resource centre.



CHAPTER 01

INTRODUCING THE PROJECT



01 TERMINOLOGY : ECOLOGICAL

AGRARIANISM - the social / political philosophy relating to the ownership and use of land for agricultural / farming purposes

AGROECOLOGY - each individual farm is treated as an ecosystem, striving to make a positive contribution to the biosphere

ARABLE - typically cereals / grains / legumes & pulses / soya / root & stem tubers / buckwheat / quinoa / amaranth; land that is able to be farmed for agricultural purposes

AQUACULTURE - the farming of fish, algae; implies responsible water consumption

CARBON SEQUESTRATION - long term storage of carbon dioxide and other forms of carbon in the soil in an effort to mitigate climate change

CLIMATE CHANGE - a long-term change in the average weather patterns that define Earth's local, regional and global climates. These changes are primarily driven by human activities such as intensive agriculture and the resultant release of carbon from the soil, and the burning of fossil fuels, which increases heat-trapping greenhouse gas levels in Earth's atmosphere and results in the raising of average surface temperatures (NASA 2020)

ECO-SYTEMIC THINKING - understanding how individual components influence one another within a greater whole (eg. survive / perish)

'ENLIGHTENED AGRICULTURE' - "farming that is expressly designed to supply everyone, everywhere, with food of the highest quality and standards, both nutritionally and gastronomically, without justice or cruelty, and without wrecking the world" (Tudge 2016)

HORTICULTURE - leafy vegetables / fruits / herbs

LIVESTOCK - animals and animal husbandry

MIXED FARMING - all of the above together; plenty of plants, not much meat and maximum variety

ORGANIC FARMING - farming practices that aim to cause no detriment to the environment or human well being; making use of no synthetic compounds or fertilizers and making use of seasonal growth and crop / field rotations

Figure 1: Nguni Cows (Author 2020)

01 TERMINOLOGY : ARCHITECTURAL / GENERAL

CARBON NEUTRALITY - net zero carbon footprint; achieved through the balancing of carbon emissions with carbon removal

ECO-SYTEMIC THINKING - understanding how individual components influence one another within a greater whole (eg. to survive or perish)

FOOD SECURITY - ‘’a condition in which all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life’’ (UN Food and Agriculture Organisation 2006)

FOOD SOVEREIGNTY - the idea that all societies and all individuals too should have control over their own food supply, and control their own agricultural policies

NET POSITIVE - a net positive carbon footprint is achieved through the removal of more carbon emissions than what are released during the building process and lifespan of a building

REGENERATIVE DESIGN - designs that enable communities / cities / buildings to pay back the debt which we take from nature (Girardet n.d.).

RESILLIENT DESIGN - the intentional design of buildings and landscapes in order to withstand and respond to issues such as climate change

SELF-RELIANCE - reliance on one’s own resources rather than those of others, allowing a level of independance to be achieved

URBAN ECOLOGY - the relation of living organisms with each other and their surroundings in the context of an urban environment.

02 Project Summary

Problem Statement:

The need for holistic, self-reliant and sustainable developments and communities is steadily rising today, particularly in South Africa. Thus, the need for ensuring food sovereignty and security, creating job opportunity and producing green energy through a systemic approach is critical.

As a result of this, there is the opportunity to investigate the potential for agriculture in the urban environment to provide these solutions through the development of architecture and agriculture hand - in - hand. Through the investigation of the aforementioned proposal, this document seeks to develop a positive course forward that will support a sustainable approach to the design of developments and peri-urban agriculture.

Project Objectives:

The project seeks to investigate the merging of three focal areas in order to successfully achieve a regenerative environment: **human behaviour and community processes; natural processes, and technology.**

This project proposes a break away from the design and developmental typologies of todays consumerist and disposable society by challenging the conventional farm and the conventional urban development by creating an intervention that acts as a social device, becoming a filter between the environment/farm and the city/community. Self-reliant communities allow for the generation and stimulus of local economies, employment opportunity, energy harvesting and generation, poverty reduction, sustainable use of natural resources and climate resilience.

Assumptions:

1. Soil conditions are favourable for crop and livestock farming
2. The farm has been re-established and the heritage buildings restored
3. The farm once again houses dairy cattle on the property and the Clover Milkyway Dairy remains operational
4. The original Zwartkoppies buildings and Sammy Marks homestead have been preserved and restored where necessary, with new infrastructure put in place focusing on agricultural production and tourism.

Research Questions

1. How can a (mixed) dairy farm act as a catalyst for sustainable, self-sufficient mixed developments?
1a. How can the use of integrated green building systems inform the sustainable design of (mixed) dairy farms in a peri-urban context?
1b. How can this be achieved whilst maintaining an animal - sensitive approach?

2. How can Architecture offer a medium between urban developments and agricultural landscapes?
2a. Is Architecture the solution to the pitfalls of current development and planning practices?

3. How can agriculture and urban development thrive together through the implementation of systemic strategies and solutions?
3a. How can a holistic urban development framework, benefitting an entire community, be achieved? (Providing opportunity for employment, education and training, healthcare, retail, production, residence, food sovereignty and environmental sustainability)

4. Can Heritage preservation be achieved through the use and revival of otherwise derelict and under-utilised infrastructure, and the layering of history in building patterns?

Limitations:

Due to the Covid-19 Pandemic and the resulting lockdown, access to site has been restricted and communication with potential interviewees have been compromised.

Delimitations:

The development plan currently in place for the Hazeldean Node will be used as a base for the development framework of the project, adapting it to the specific needs of the programme.

03 Site Location

The choice of site is the Hazeldean Node development and remaining Zwarkoppies erf. This is due to its proximity to Pretoria as a major city and due to the site already being zoned for mixed use development. Therefore, the opportunity exists to critique the existing masterplan and adapt it to fit the necessary ideology and typology to succeed with this proposal. It is ideally centrally located within a number of existing communities that are otherwise separated from one another, creating opportunities for mutual interest, employment and benefits from ecosystem services. This allows for the intervention to be able to truly highlight the interactions and rebuild relationships between the producer and consumer that have been lost.

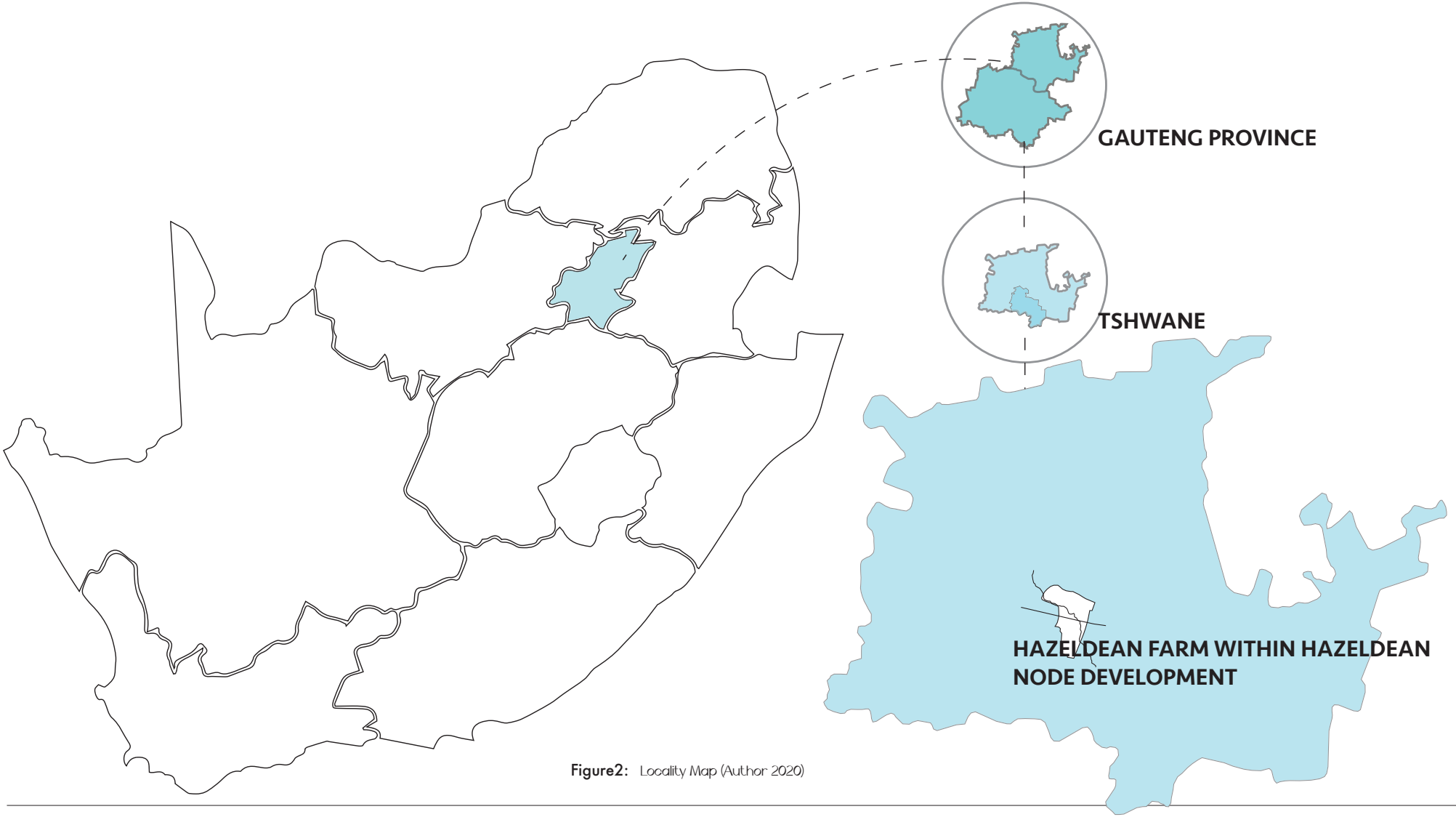


Figure2: Locality Map (Author 2020)

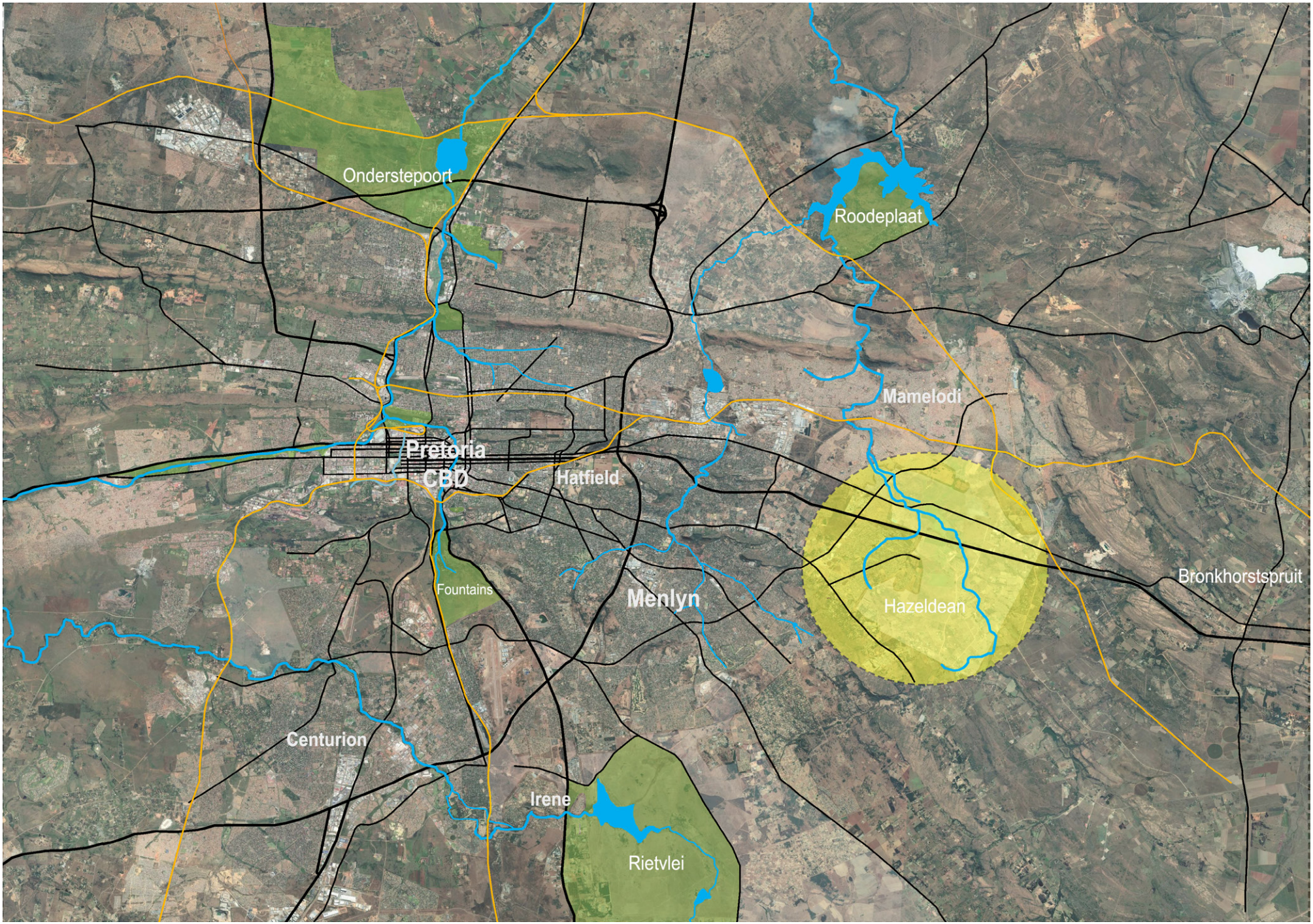


Figure3: Site Location within Pretoria (Adapted by Author from Piek 2020)

04 General Issue

People tend to say that climate change threatens the planet. The Earth itself will survive and recover, as it has every climatic event in it's 4,5 billion years of existence. What is threatened, and what people are truthfully more concerned about, is the welfare of biodiversity and humanity's ability to live on this planet.

A controversial topic, the long-and-short of it is simple: annual temperatures are increasing, extreme weather events are becoming more frequent. The question that this information poses is how this impacts the lives of people today, and what can be done to improve the survival of future generations more comfortable.

Climate change and unsustainable farming practices are intrinsically linked and this has lead to a need for a novel solution to be investigated in order to solve this issue. It is not simply enough to focus on green infrastructure for the urban environment alone and neglect the agricultural sector; a holistic solution to this novel problem needs to be found through the investigation of sustainable, affordable design and practices within the agricultural industry and the urban environment together.

Food waste is a critical issue on both a global, and local, scale. There is an over supply of produce to high income areas, whilst there is an under supply in many poverty stricken areas. Over one third of food produced for global consumption is wasted, much of which never even leaves its packaging. The world is currently gripped by the Covid-19 Virus, forcing entire countries into total and partial lockdown. Retrenchment and unemployment has risen because of this and the current state of living environments across the board is being called into question.

Figure4: Amazon Deforestation (agfuse.com 2018)

05 Urban Issue

South Africa has a population of over 58 million people, and adequate housing is one of the major problems faced by the country today. Urban sprawl is creeping outwards from the cities, taking over the natural landscapes and arable farm-land. The biggest issue with this, is that very few of these new development plans take into consideration the creation of jobs, the provision of adequate and renewable energy, and the potential to obtain food sovereignty within the community itself.

There is a lack of education, skills and qualification amongst the population too, resulting in high levels of unemployment of both youth and older generations, high crime rates and miscreant behaviour. The Covid-19 pandemic has led to severe criticism and concern over the living envi-ronments and conditions of South Africans.

Food security and sovereignty in South Africa is a critical issue of its own but, particularly during the Covid-19 lockdown, access to food was shown to be increasingly dangerous to ones health, and the health of those around one. This is an issue due to limited access to food stores and supplies with-in communities, lack of transport, retrenchments, and reductions in salaries.

As a result of this, many people were not able to buy fresh or storable foods, increasing the food poverty crisis even further.

Figure5: Food Waste (foodnavigator-asia.com 2018)

Figure6: Urban Sprawl (Author 2020)

06 Architectural Issue and Relevance

Development within Gauteng is rapidly becoming oversaturated with housing schemes that are unaffordable and divisive, separating economic classes and further instilling segregation within our communities. These frameworks are monotonous and do not fully, or efficiently, address sustainable living environments. Many of these existing developments follow the consumerist and disposable role set out by society.

The project therefore seeks to critique the current urban planning model in order to create regenerative, self-reliant developments that challenge the current consumerist model.

What this means is that the way we design will need to change; buildings will need to do what buildings do not typically do, yet buildings will no longer be able to stand alone. Through an investigation into the potential for systemic solutions, holistic urban frameworks and regenerative principles, this project seeks to make a start at changing the role of Architecture, and the impact it has on society and the environment, in the future.

The impact of the architect in the design of cities is due to their ability to synthesise seemingly unconnected issues and their interest in solving scenarios for urban futures as, at the end of the day, the impact of urban agriculture is on real spaces, food cultures, and the health and livelihoods of community residents (Viljoen and Bohn 2014).

Ukrainian architect Sergey Makhno (2020) explores life after the pandemic. He makes mention of interventions that are relevant to both society and the architectural profession, such as:

- moving away from high rise apartments in favour of houses with small productive gardens or terraces (allowing self-isolation with access to the natural environment);
- moving towards self-sufficiency in terms of water and electricity with the goal being independence from the outside world;
- urban farming will become the norm with house hold gardens and community farming practices, limiting reliance on the commercial food industry and providing opportunities for food sovereignty; and
- with the rejection of mass industry, local production and economies will be favoured and encouraged (Makhno 2020).

Makhno's observations apply locally in the following ways: i) integration of agriculture and urban development, ii) food sovereignty and security, iii) providing opportunity for employment, education and training, iv) addressing the inequality of living conditions and v) better integration of various communities.

There is therefore a need to investigate a holistic approach to regenerative, self-reliant, mixed-use developments in order to challenge this current model. What this means is that the way we design and the way we approach the design of developments will need to change; the role of architecture will need to be redefined away from 'bespoke building on a plot of land', instead using design to define and create culture. Buildings will no longer be able to stand alone, instead, becoming integrated into the very fabric of the landscape and community in which they are located; thereby questioning the role of Architecture, and the impact it has on society and the environment, in the future.

One of the challenges facing the design profession in this instance is the task of convincing communities of the benefits, qualities and possibilities of food growing architecture and landscapes on a practical level. Another challenge is the task of formalising these practices by writing them into government policy and planning documents.

The role of the architect in this is to intentionally introduce the design and development of systems and processes, landscapes, buildings and infrastructure which the community, farmers and urban population alike, will both need and desire (Viljoen and Bohn 2014).

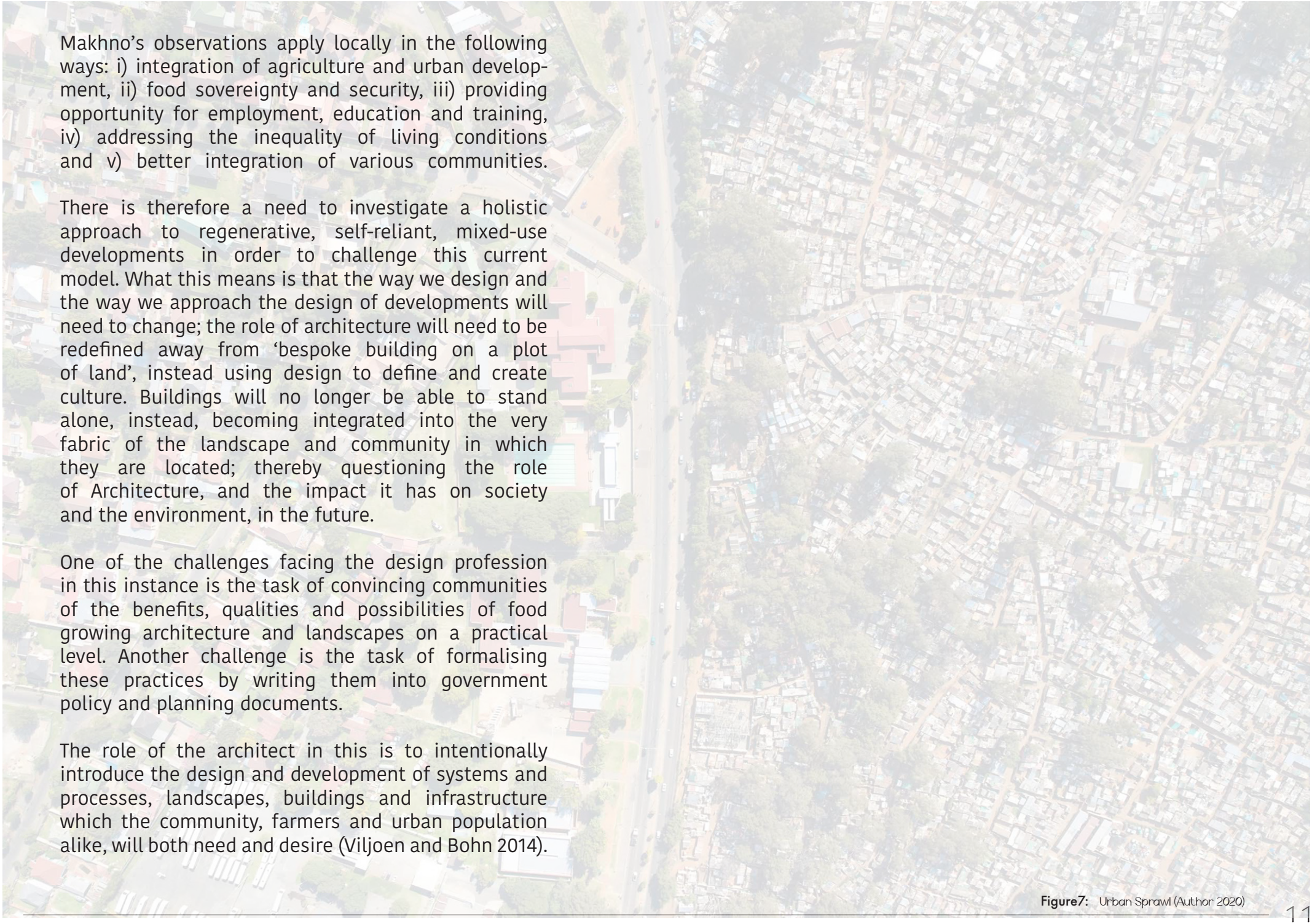


Figure7: Urban Sprawl (Author 2020)

07 Project Methodology

Theoretical Literature Studies

A literature review was conducted in order to establish the current socio-political climate surrounding the site and thus determine a potential way forward for the project.

Mapping

A critique of the current Hazeldean Node Development Plan in conjunction with Abland and Craft Homes was conducted, informing a revised masterplan that takes the socio-political environment into consideration. Micro-analyses of the site allows for a contextual response that is programmatically relevant, sensitive to heritage and responsive to the material palette of the site.

Historical Analysis

A brief analysis of the history of the site was conducterd through literature studies and an interview with the current owners of the Hazeldean Dairy Farm.

Precedent Studies

Precedent studies were conducted on the basis of macro to micro relevance, looking at contextual urban frameworks, concept, programme, spatial design, technology and detailing.

Analysis & critique of existing urban developments

Comparing global north and south developmental schemes and identifying key points to consider in a framework design. Data from case studies tabulated for ease of reference (all to be found in appendix).

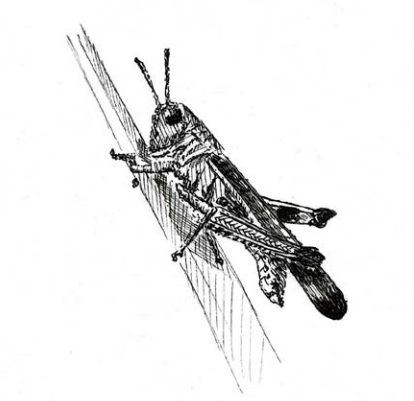


Figure8: Grasshopper (Author 2020)

09 Programme Development

The need for holistic, self-reliant and sustainable developments and communities is steadily rising in South Africa today. Thus, the need for ensuring food sovereignty and security, creating job opportunity and producing green energy through a systemic approach is critical. The reality of poverty is that the food insecure cannot afford access to the land, water, seeds or plants needed to achieve food security and, although many of these resources are offered by the state and NGO's, those most vulnerable largely lack the knowledge and social networks needed to access them (Haysom and Battersby 2016; HeySummit 2020).

The intervention therefore seeks to provide a facility whereby access to these resources is easy. It also seeks to provide a facility that is transparent in the production and processing of dairy and other food products, thereby allowing users to interact with and learn from this environment.

KEY FOCUS AREAS:

- Food Sovereignty & Security
- Access to agricultural resources and training
- Job Creation
- Sustainable Agricultural Infrastructure
- Sustainable Urban Development

PRIMARY PROGRAMME:

- Dairy, Deli & Food production facilities (Sustainable Infrastructure)
- Market for sale of fresh local produce to the community
- Agricultural Resource Hub & Training Facility

SECONDARY PROGRAMME:

- Systemic Solutions: Energy creation (biogas & solar) & Water Harvesting, Treatment and Recycling
- Training and Educational Facilities
- Exposure of Dairy & Dairy production to public

TERTIARY PROGRAMME:

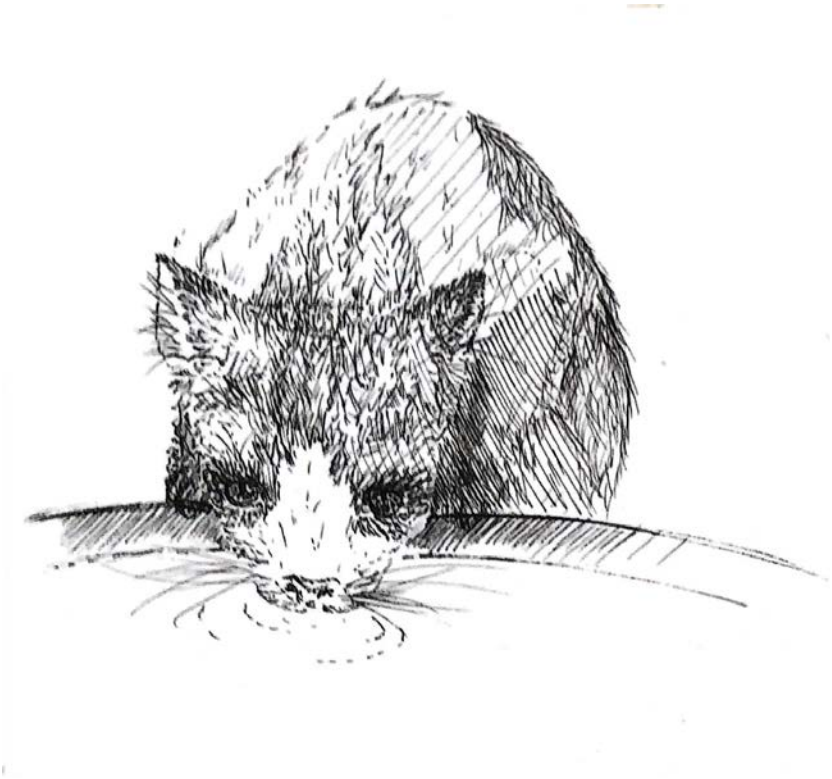
- Recreation, Destination & Outdoor Activity
- Holistic mixed-use Urban Framework
- Heritage Preservation

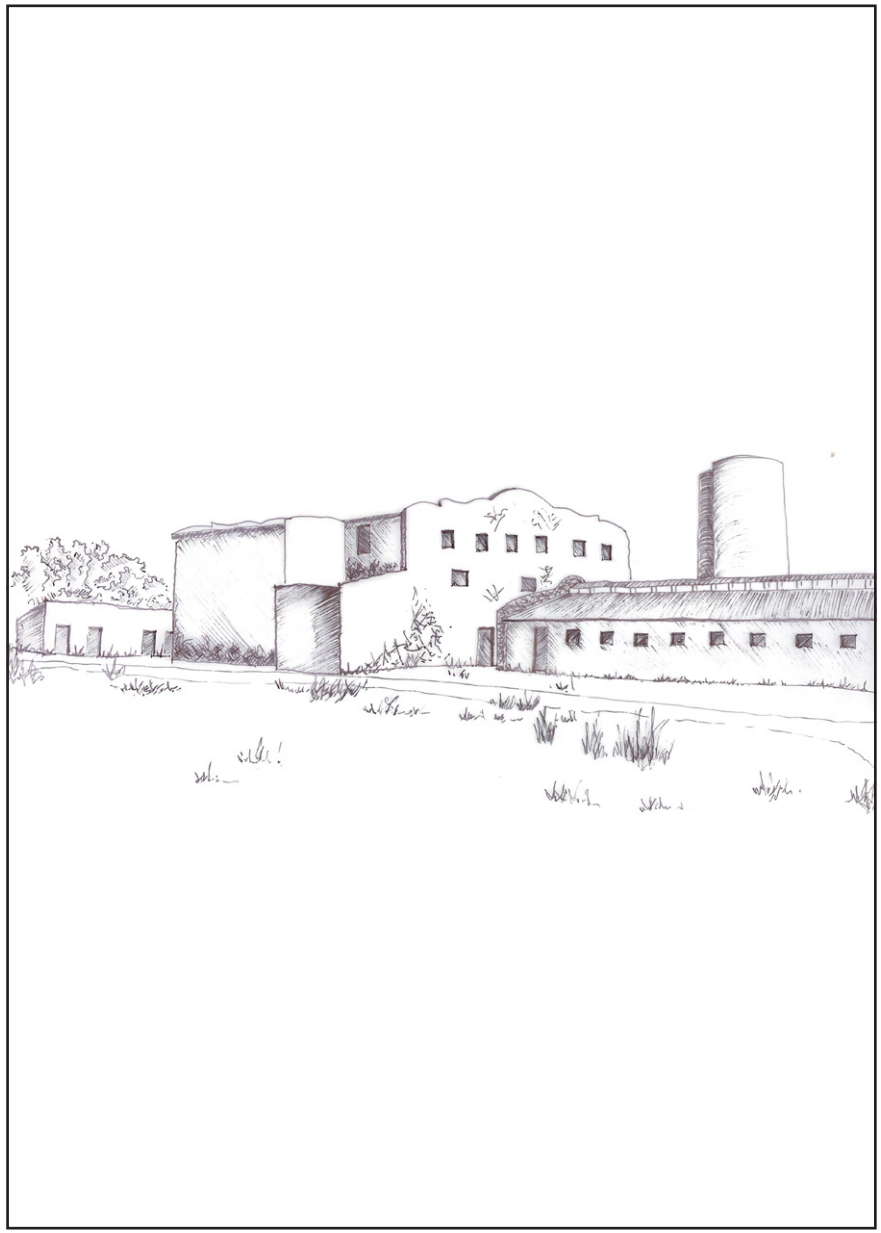
08 Theoretical Approach

This dissertation investigates the role of architecture as provider by ivestigating agriculture and its relationship to climate change, urban development models and food insecurity. The literature review investigated themes such as co-operative economies, land reform policies in South Africa, (peri-) urban agriculture, the Garden City Concept, and continuous productive urban landscapes (CPUL's). These realms are unpacked within the framework of the ecological worldview and regenerative theory. This paper therefore seeks to determine a positive course forward in identifying potential design solutions to the current consumerist paradigm and architectural discourse through the lens of sustainability and the respective economic, social and environmental drivers.

The design intervention seeks to incorporate a systemic approach to the project, incorporating theories of regeneration, urban ecology, self-reliance and eco-systemic design.

Figure9: Existing Heritage Building on site (Author 2020)





CHAPTER 02

THEORETICAL FRAMEWORK & CONTEXT

The Great Work of our generation is to create a post-fossil-fuel and post-consumer economy that is regenerative, fair, durable, resilient, convivial, and democratic. It must be powered by renewable energy. It must be a circular economy that recycles, reuses, or transforms its wastes. Of necessity it will be much more focused on essentials of food, energy, shelter, clean water, education, the arts, and rootedness in place and bioregion. It will be built by local people who cherish and understand their places and the place of nature in a sustainable economy. But it must also be a political economy, a product of revitalised grassroots capability and vision. If it is to flourish, it must regenerate possibilities and capacities that grow from foresight married to practical ecological competence (David W Orr in Mang et al. 2016).

ECOLOGICAL WORLDVIEW & REGENERATIVE THEORY

In order to move away from the mechanistic approach to developing the world we have built around us, we will have to redesign the design process itself in order for it to become developmental. Drawing from Mang and Haggard (2016); the present moment, born of crisis, offers the potential to transform the way that humans inhabit the Earth. The Ecological Worldview represents the paradigmatic shift towards an understanding of the world as a complex living system (du Plessis 2009). This concept has been throughly explored by du Plessis, through the understanding of the world as an interconnected living system, and the approaches of regeneration, reconciliation and restoration toward achieving sustainability as a method of Living Systems Thinking, aimed at sustaining life-enhancing conditions (Reed 2009 in du Plessis and Brandon 2015). Regenerative design therefore applies whole systems thinking in the creation of resilient and equitable systems, thereby integrating the needs of society with the integrity of nature.

du Plessis and Brandon (2015) propose that the Ecological Worldview should not negate or replace the mechanistic paradigm of today but, rather, it should add to the relative knowledge base; with both of these insights providing valuable insights when applied within the appropriate context of analysis and its realm of validity.

Haggard (2012) suggests that a built structure is simply a temporary nexus in the flows of energy, people, materials, ideas and the environment. Therefore, a built structure is essentially a system that is situated in larger ecological and social systems that it influences, and is influenced by. As a result, it demands a dissolution of fixed boundaries between the 'built' and the surrounding environments, and forces the designer to look to its role in the regulation, strengthening (or weakening) and integration of its physical, social, and economic environment.

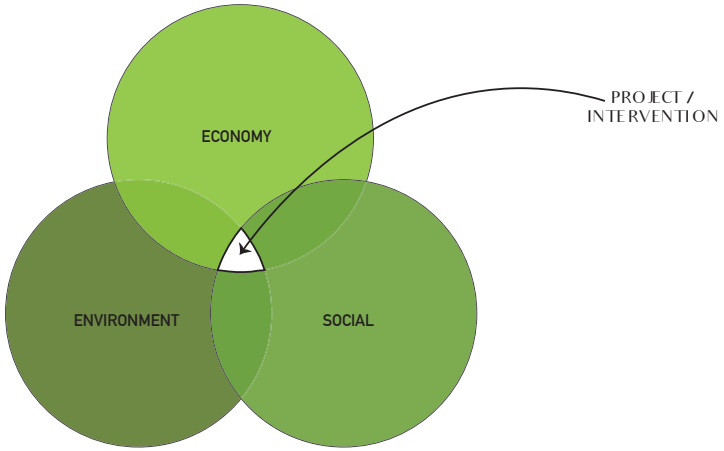


Figure10: 3 Pillars of Sustainability Diagram (Author 2020)

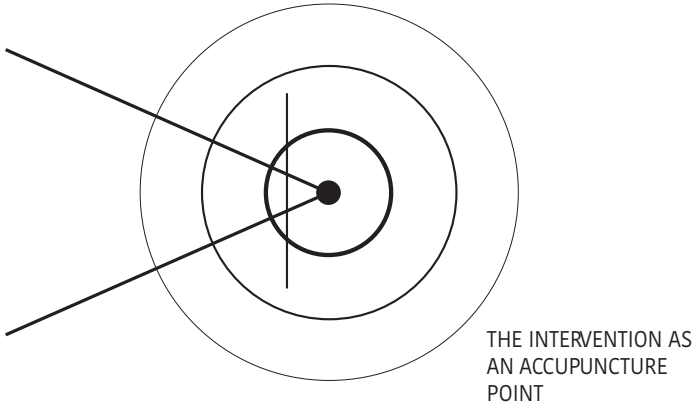


Figure11: Intervention as Accupuncture Point (Author 2020)

The Regenerative Theory aims at improving the capacity of natural, social and economic systems of a place and, so, the solution is not purely architectural; it requires a systemic approach incorporating social, political, and economic reforms alongside stringent and conscious design and planning practices. In summary, the regenerative paradigm determines that a built structure is not an isolated high-performance object in bespoke landscape; instead, it can be seen as a catalyst for larger systemic regeneration and transformation on both a micro (building) and macro (community) level through the improvement of environmental, social and economic systems (du Plessis and Brandon 2015).

There are a number of urban design and planning proposals that aim to integrate productive landscapes into the urban environment. In order to ensure the success of these frameworks, they must be considered holistically thereby taking into account the potential for community self-reliance, environmental factors, economic viability and the resulting role of Architecture in the generation of these regenerative urban and natural environments.

Figure 12: Regenerative Design Principles (Author 2020)

URBAN DENSIFICATION & SPRAWL:

South Africa has a formal population of over 58 million people (Statistics South Africa 2020), and adequate housing is one of the major problems facing the country today. As a result, urban sprawl is still affecting many South African cities, and their surroun ding natural landscapes and arable farmland. The biggest issue with this is that very few of these new development plans take into consideration the creation of long-lasting jobs, the provision of adequate and renewable energy, and the potential to obtain food sovereignty within the community itself.

Realities facing urban transformation in South Africa (Aurecon Group 2017) discusses the impact that rapid urbanisation and increased unemployment will have on a city's ability to provide for its population, and states the fact that lack of access to formal education was the largest factor affecting access to the non-agricultural job sector in 2012.

They suggest that in order to break the cycle of inequality and resultant discrimination, the effect of location of access to education and development opportunities needs to be challenged.

The current spatial model of South African cities is that of compact cities, based on top-down assumptions of movement of people and goods, resulting in cities being characterised by urban sprawl, spatial exclusion and traffic congestion.

Current high density inner city models, though intended to integrate mixed-incomes in a central location, are not able to provide the supplemental income required by many workers today, resulting in more people choosing to reside on the city periphery, moving further away from the city centres.

Aurecon suggests that city investments and development patterns must be planned to avoid creating new vulnerabilities, alongside mitigating the current climatic effects that are impacting our country as a whole (Aurecon Group 2017).

URBAN DECAY OF CITY CENTRES & RESULTANT SPRAWL

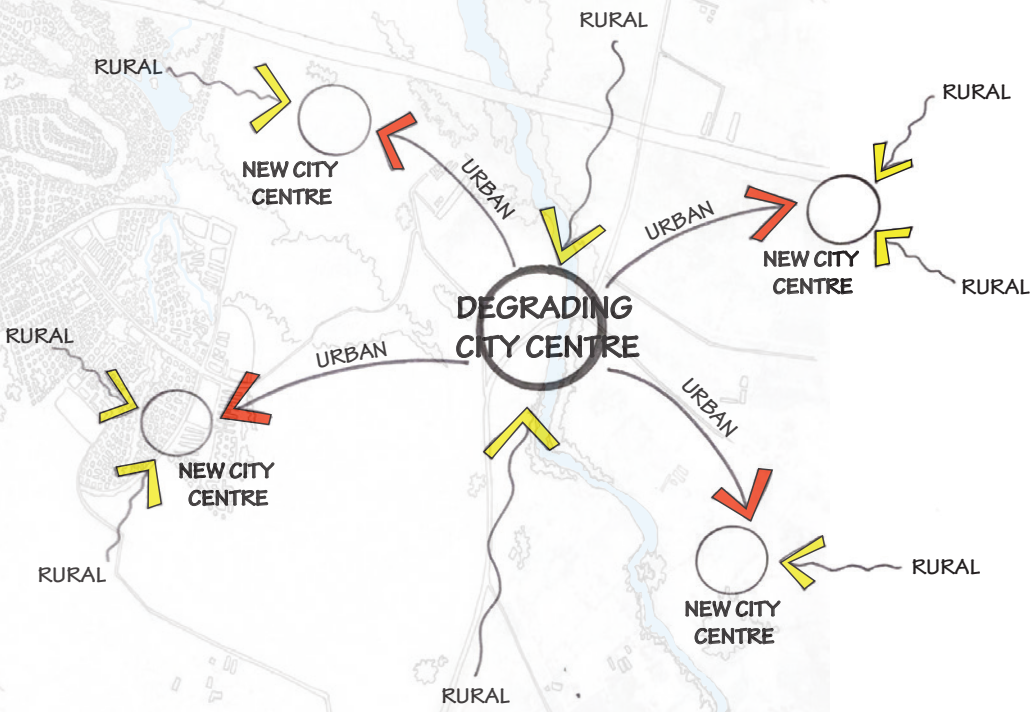
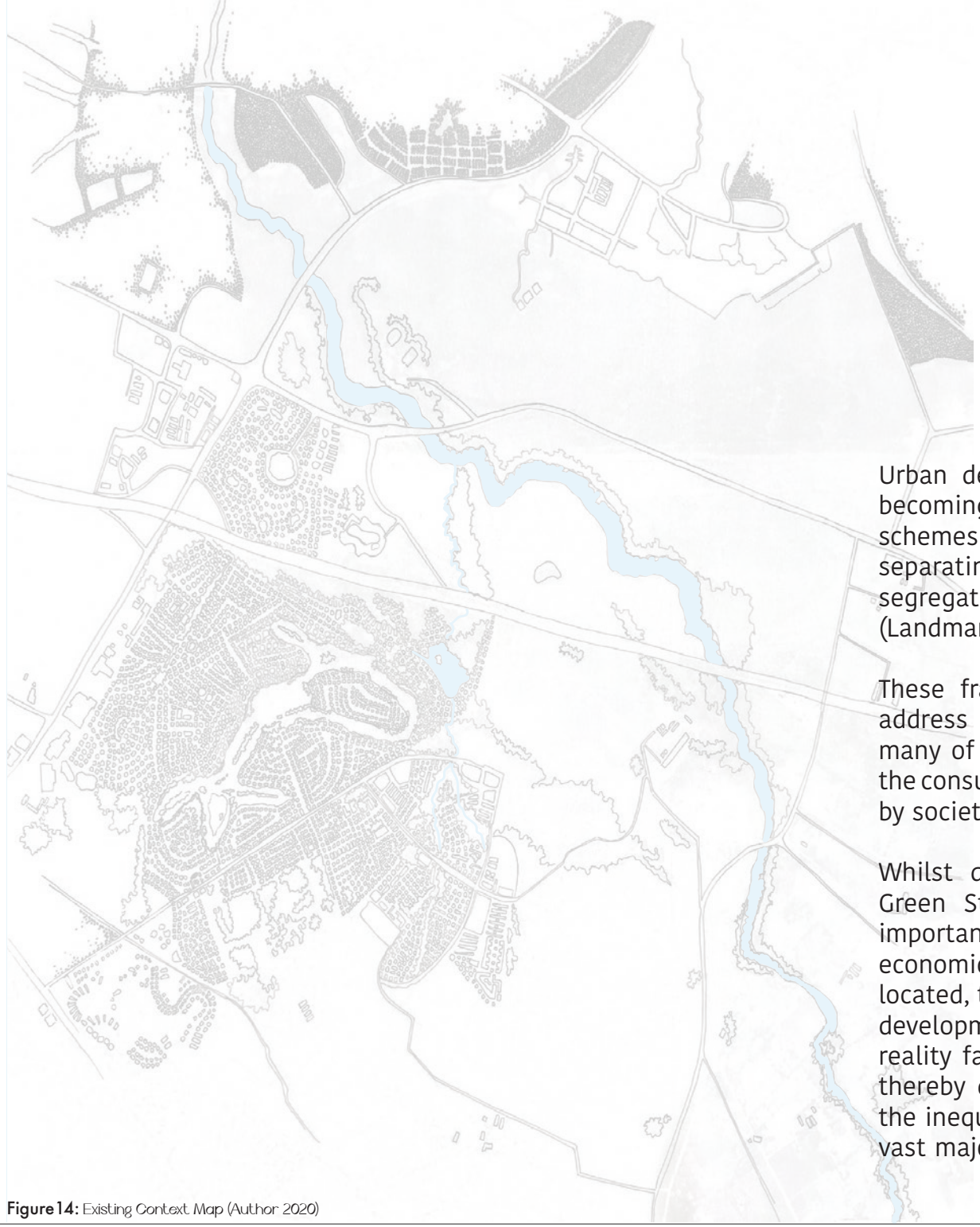


Figure 13: Degradation of City Centre (Author 2020)



Urban development within Gauteng is rapidly becoming oversaturated with housing schemes that are unaffordable and divisive, separating economic classes and further instilling segregational patterns within our communities (Landman 2010).

These frameworks do not fully, or efficiently, address sustainable living environments, with many of these existing developments following the consumerist and disposable norm determined by society.

Whilst developments such as these may be Green Star accredited and may be seen as important investments in supporting the economic nodes in which they are located, they are also examples of inappropriate developments that are disillusioned with the reality faced by the communities around them; thereby disconnecting themselves further from the inequalities and circumstances faced by the vast majority of South Africans on a daily basis.

Figure 14: Existing Context Map (Author 2020)

Karina Landman (2010) describes the spatial characteristics of South African cities as the i) dislocation of the poor to the peripheries, ii) separation of communities through buffer strips and undeveloped land, iii) rigid mono functional zoning, iv) degrading and poorly developed environments, and v) lack of recreational facilities. These conditions have led to a rise in crime rates, resulting in the rise of gated communities which have resulted in the spatial fragmentation of the urban and peri-urban environment.

This has led to the further exclusion of various social classes, many of which cannot afford fortification themselves, worsening socio-economic conditions and contributing to the root cause of crime: poverty. Urban fortification is a part of the larger city system and addresses only the short-term need for security, ignoring the long-term goal for integration and equity. In order to avoid future cities becoming a 'fortress world' through this inappropriate development, alternative interventions that can lead to the revitalisation and better integration of communities should be investigated, by looking for leverage points within this larger city system through which to intervene (Landman 2010). A holistic approach is therefore needed that takes into account social, financial, and environmental capital.

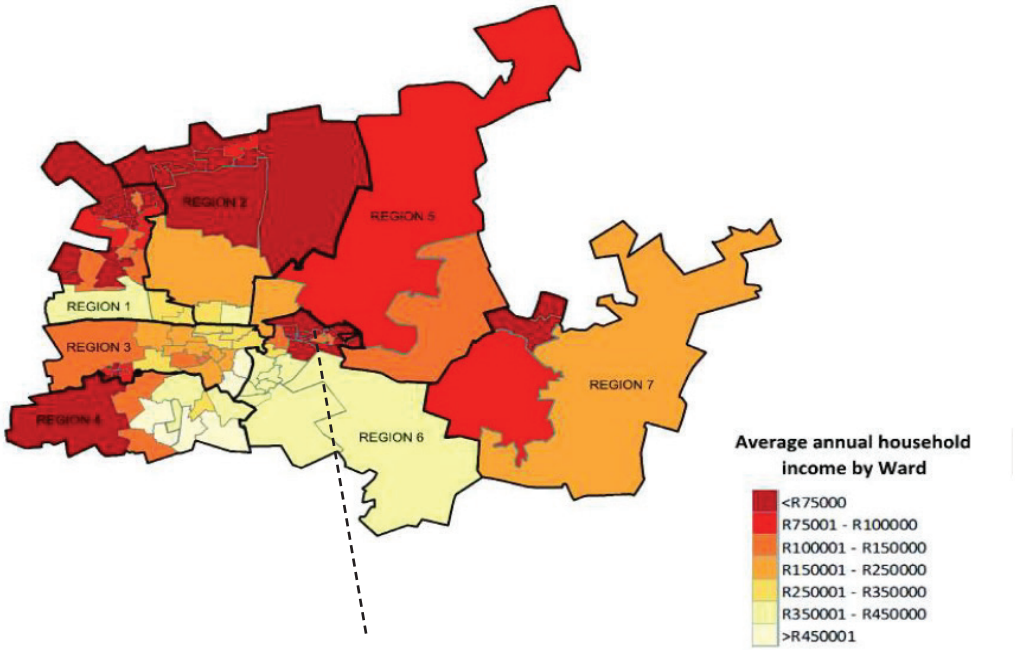


Figure 15: Tshwane Income (Author 2020)

UNSUSTAINABLE FARMING & CLIMATE CHANGE

South African's face vulnerability to climate change in a number of ways. Many areas have limited access to safe drinking water due to a lack of infrastructure and variable rainfall patterns. Agriculture, fisheries and forestry are at risk due to the increase in temperatures, veld fires, long drought periods and variable rainfall further exacerbated by climate change. As an added detriment, this has an economic impact not only on production, imports and exports, but also on the livelihood of many due to a loss of jobs, as roughly 5% of the employed population is directly employed through agriculture (Griffin 2012; South Africa Online 2020).

The agricultural sector is the sector most largely affected by Climate Change. However, unsustainable farming practices is one of the largest contributors, with Agriculture being the largest user of water in the world, using approximately 70% of fresh water drawn worldwide (Capper, Cady and Bauman 2009).

The greatest threat to agriculture with regard to climate in South Africa is the increasing unpredictability of rainfall intensity and distribution, the increase in extreme weather events (droughts and flooding), and the provision of water for livestock and related heat stress (Pereira 2014). The 2018 drought that threatened South Africa and crippled the Western Cape Province made global headlines. Since then, the Eastern and Northern Cape in particular, have had to endure recurring and worsening droughts resulting in higher temperatures, severe water shortages, losses to agriculture, and, as a result of this, inflated food prices (Cuculi 2020).

Colin Tudge calls for an 'Agrarian Renaissance', a radical move away from purely industrialised agriculture, towards small-to-medium sized, co-operative and regenerative urban agroecology farms (Tudge 2017). Regenerative agriculture encourages the growth of organic produce through ethical and local supply chains, zero-waste policies, fair trade and compensation and employee development, as well as encouraging the incorporation of cooperative and social models.

Figure 16: Hazeldean Node Development in Context (Author 2020)

FOOD INSECURITY

The global population is expected to increase to approximately 9,5 billion people by 2050, and the United Nations and the FAO are concerned that without an increase in food production this will be unsustainable. The annual production of both meat and milk is expected to double (to approximately 465 million tons and 1043 million litres respectively) between 2000 and 2050, according to FAO estimates, with the majority of this taking place in low-middle income countries. The major issue with this increase, however, is that in order to sustain the conventional intensive meat and dairy production of today, enough grains would have to be produced to feed these animals - the equivalent of four billion people - resulting in the need to provide enough grains for effectively 13,5 billion people (D'silva et al. 2017; United Nations Food and Agriculture Organisation 2006).

Food waste is a critical issue on both a global and local scale. There is an over supply of produce to high income areas, whilst there is an under supply in many poverty stricken areas. Over one third of food produced for global consumption is wasted, much of which never even leaves its packaging. In a study by Nahman and de Lange (2013) the total losses for South Africa throughout the entire food value chain were estimated to be R61,5 billion per annum; the bulk of this loss occurring during the processing and distribution phases, with roughly R21,5 billion occurring as household waste (Pereira 2014). According to Vishwas Satgar, co-founder of the South African Food Sovereignty Campaign, the number of people suffering from insufficient food supply has increased from 14 million in 2019 to 30 million during the Covid-19 pandemic due to income losses, insufficient social grants and a further exacerbation of food poverty and inaccessibility (Shoba et al. 2020).

Access to such food is not only a matter of the volume produced, but also about how and when people are able to access this food, and what the costs of achieving this are (Southern Africa Food Lab 2020). The problem here is the physical distribution of food resources, favouring bulk provision to commercial supermarkets and booming economies, whilst undercutting smaller players in the market and less affluent areas (Tudge 2017). Due to restricted travel, limited access to food stores and supplies within communities, and limitations placed upon the informal food sector, many families are having to choose what nutritious foods they cut out in favour of non-perishable foods; cutting out mostly fresh fruits, vegetables, and animal products. Alternatively, many are forced to travel to the shops daily, often travelling long distances contrary to lockdown regulations, and putting themselves and others at risk in order to get what items they can. Small scale farmers and community members who tend to community gardens have been largely unable to perform this vital role and have been unable to supply the community members with fresh produce, resulting in much of this produce going to waste (PLAAS 2020).

Figure 17: Field Mouse (Author 2020)
Figure 18: Food Insecurity (Author 2020)

Figure 19: Barn Owl (Author 2020)

THE CALL FOR SELF-RELIANCE AT COMMUNITY LEVEL

Self-reliance at community level can be defined as the capacity of a community to apply the necessary skills to meet essential needs in a sustainable manner and with dignity.

Although self-reliant communities are not necessarily able to fulfil every need, they are able to determine to what extent they rely on external factors, also aiding in achieving a level of economic self-sufficiency through the development of local economies (The Hunger Project 2019).

The Integrated Urban Development Framework set out by Tshwane Local Government seeks to achieve economic inclusivity and social integration; however, the first step in achieving this is to accept that the current model of planning and developing our cities is unsustainable, and that a transformative approach is required (Aurecon Group 2017). The Tshwane Vision 2055 proposes a plan for sustainable human settlements within the city of Tshwane specifically, targeting both formal and informal communities.

Due to the nature of settlements arising out of poverty, such communities are often located without access to clinics, public facilities and green spaces, and are often far from areas zoned for economic opportunity, integration and densification. Thus, in order to combat these issues, sustainable human settlements aim to provide a range of services and amenities that will provide a foundation for mixed-income, mixed land-use, mixed housing, and a move to a low-carbon green economy, that is able to produce food, thereby resulting in self-reliant cities and neighbourhoods (City of Tshwane 2011).

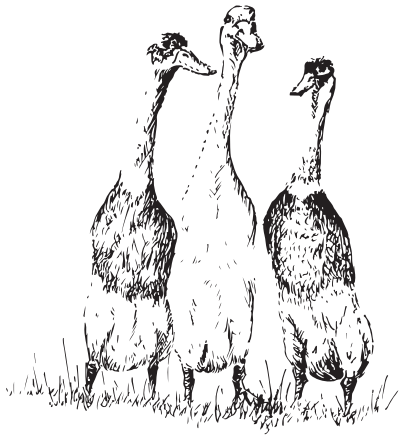


Figure20: Runner Ducks (Author 2020)

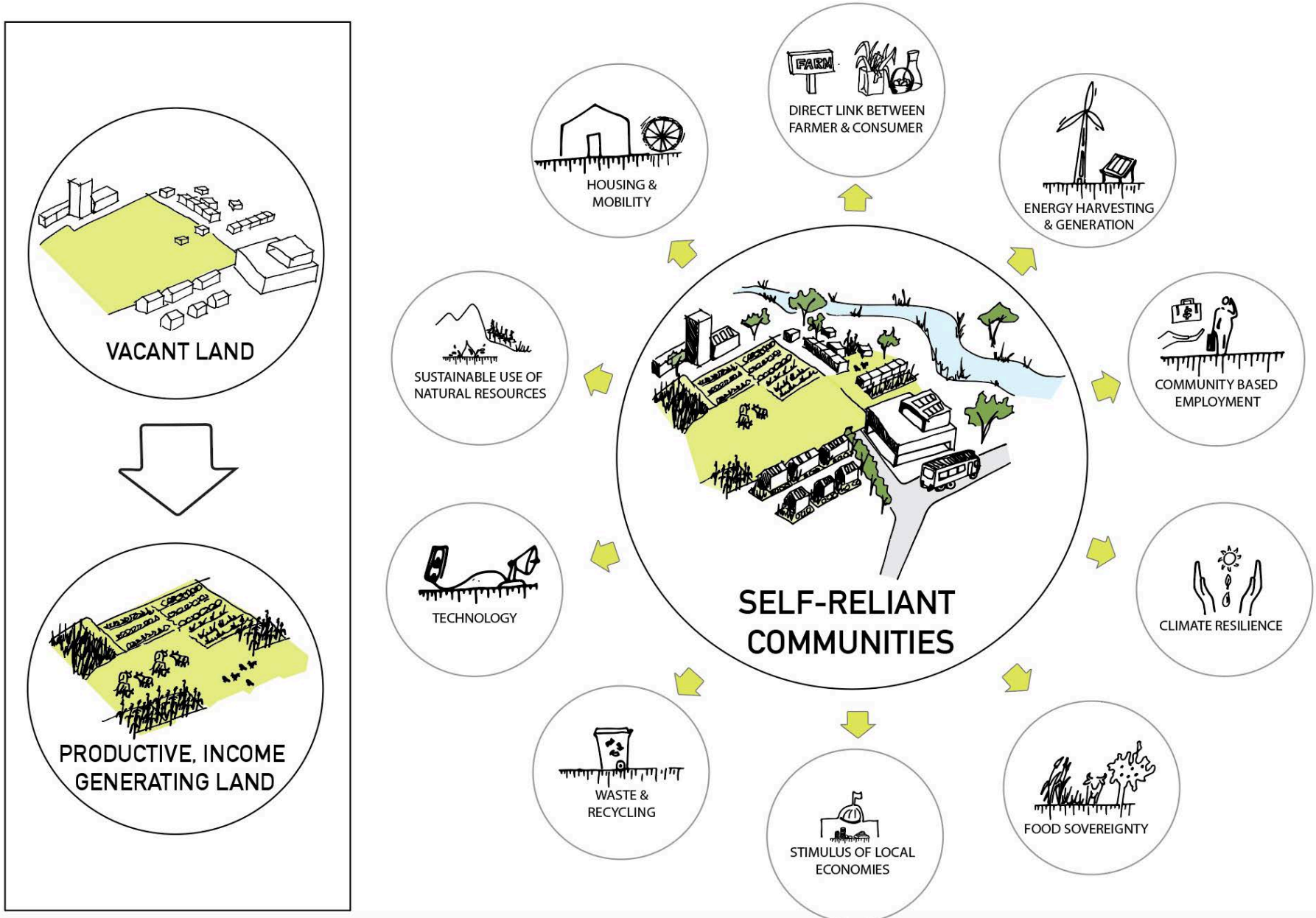


Figure21: Self-Reliant Communities (Author 2020)

CONTEXT - SITE STUDY AND URBAN ANALYSIS

The Hazeldean Node development is located to the East of Silver Lakes and the Blyde, and to the south of the Zwartkoppies Farm, below Mamelodi. The current development plan is centred around the Hazeldean Farm, converting this currently under-utilised arable farmland into a mixed use urban area comprising mostly of residences, a shopping mall and retail park, commercial business hubs and schools (Hazeldean Node 2018).

The plan does not, however, seek to provide housing that is inclusive and affordable, and makes no move to improve the integration of Pretoria East and Mamelodi, despite the potential of its proximity. Instead, it further builds onto the existing sprawl of the city, occupying land that could otherwise be used for the production of food for the surrounding communities.

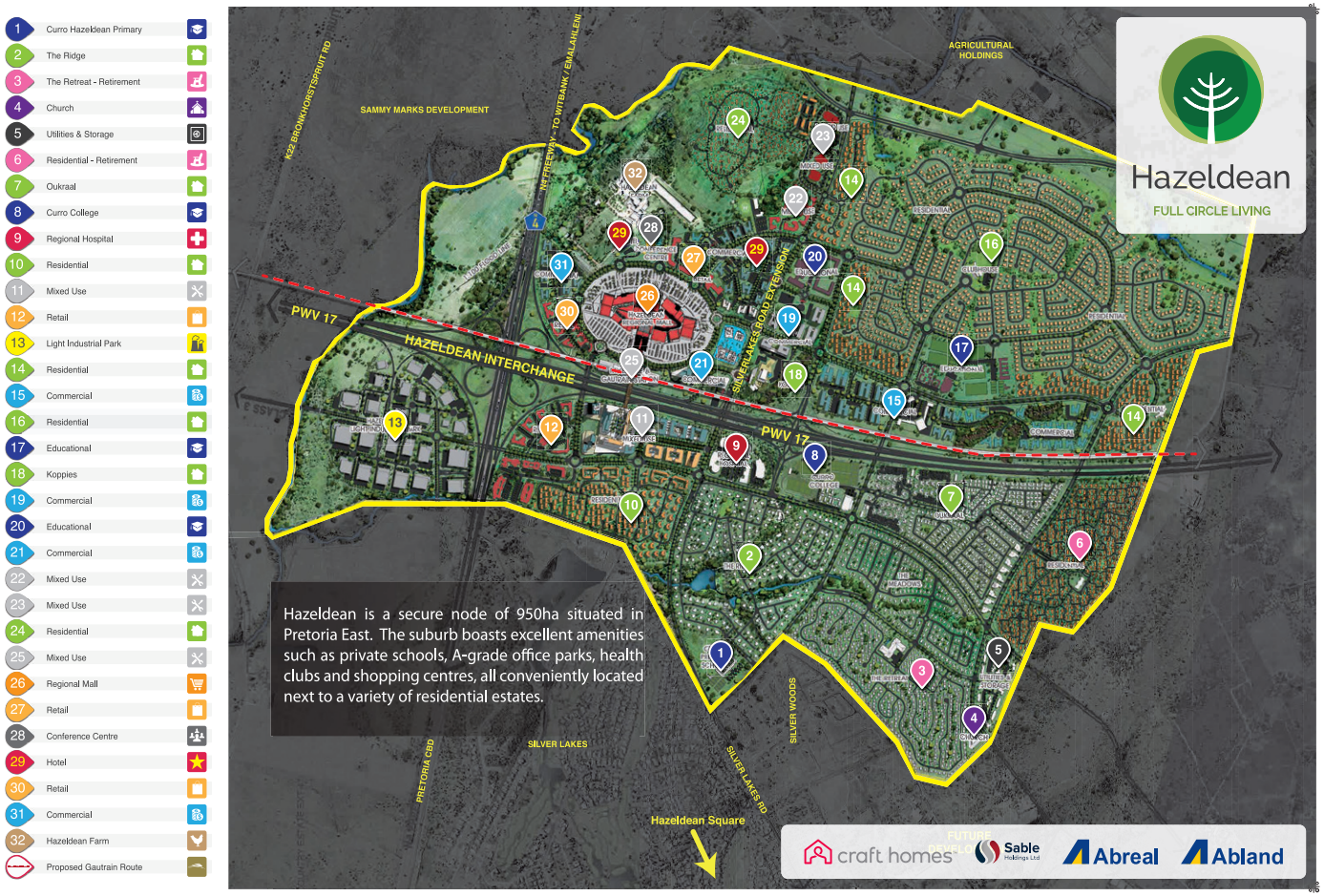


Figure22: Hazeldean Node Development Plan (Abland 2019)

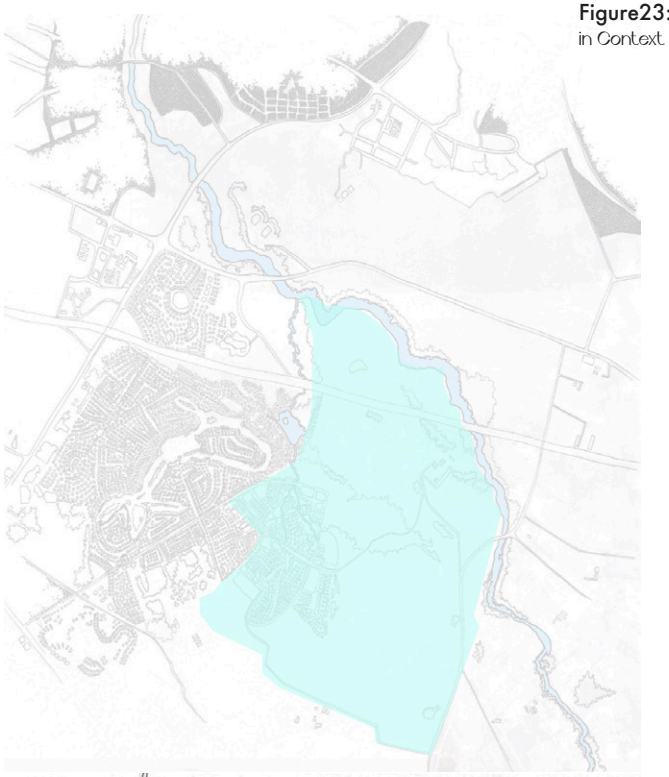


Figure23: Hazeldean Node Development in Context (Author 2020)

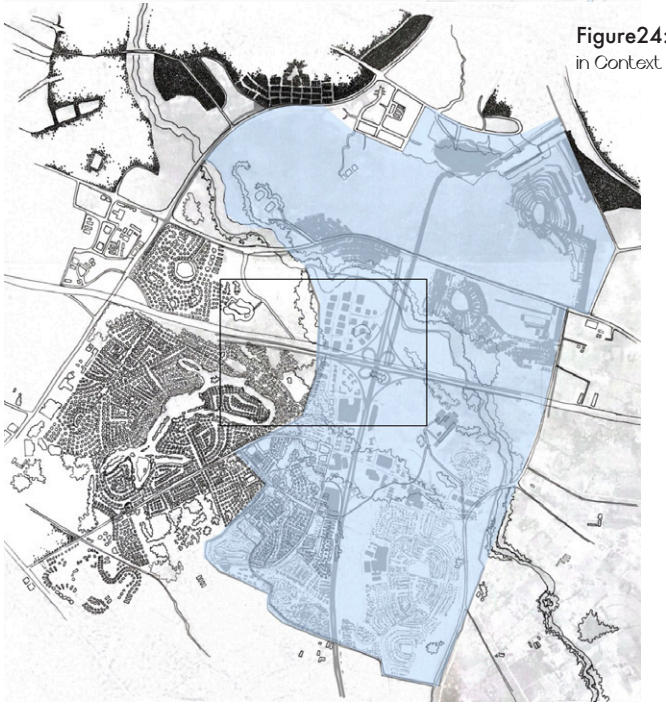


Figure24: Authors Proposed Development in Context (Author 2020)

Figure25: Agricultural Zones in Author's Proposed Context (Author 2020)

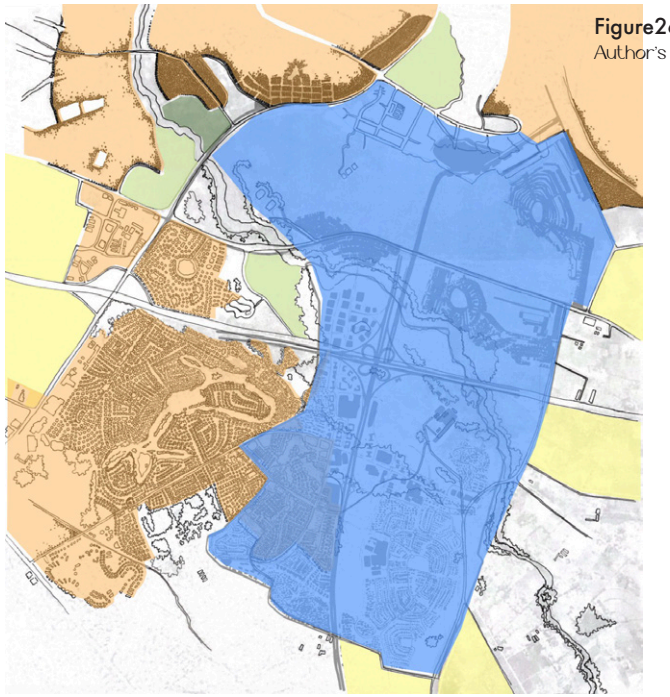


Figure26: Agriculture and Development in Author's Proposed Context (Author 2020)

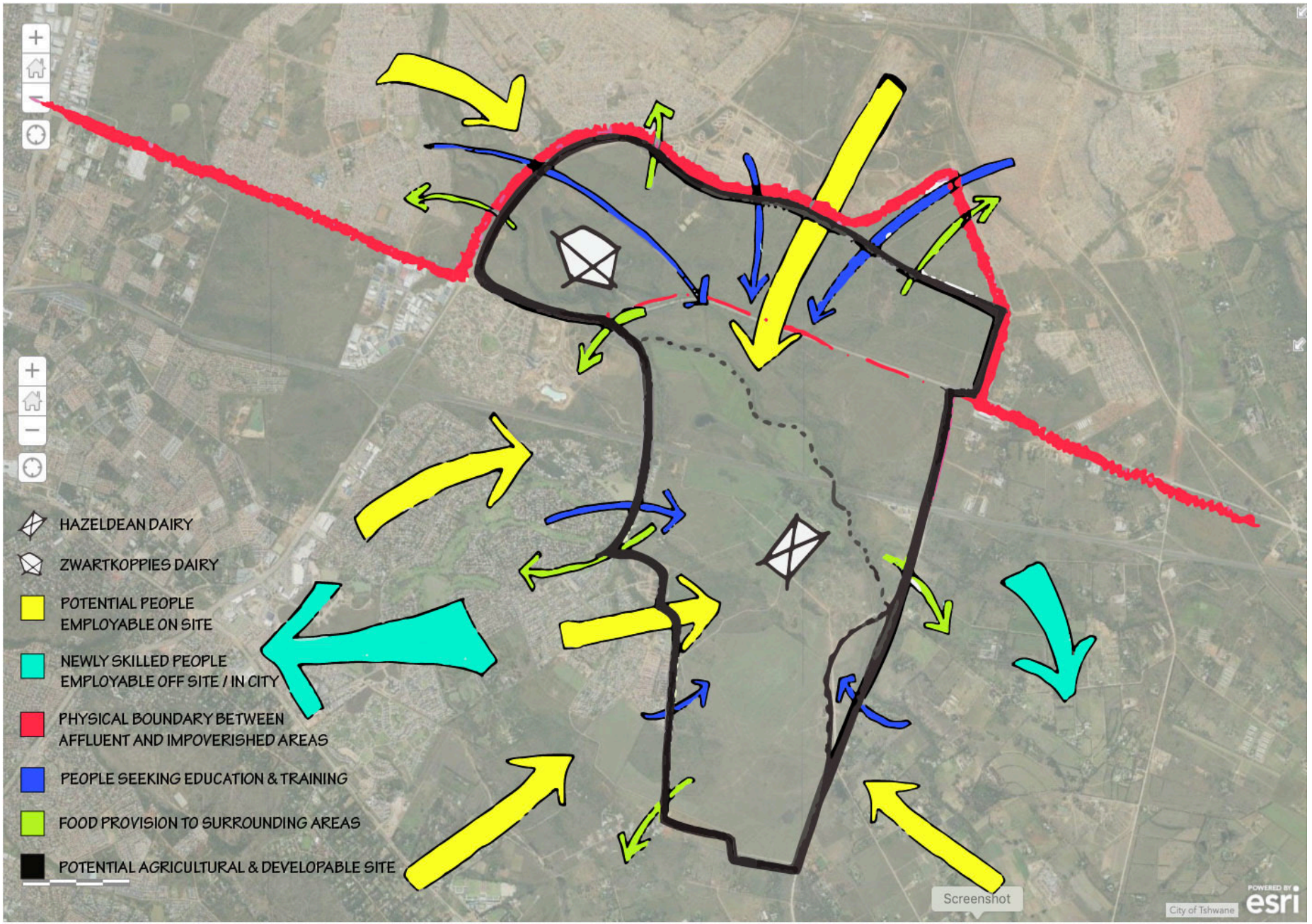


Figure27: Contextual Informants (Author 2020)

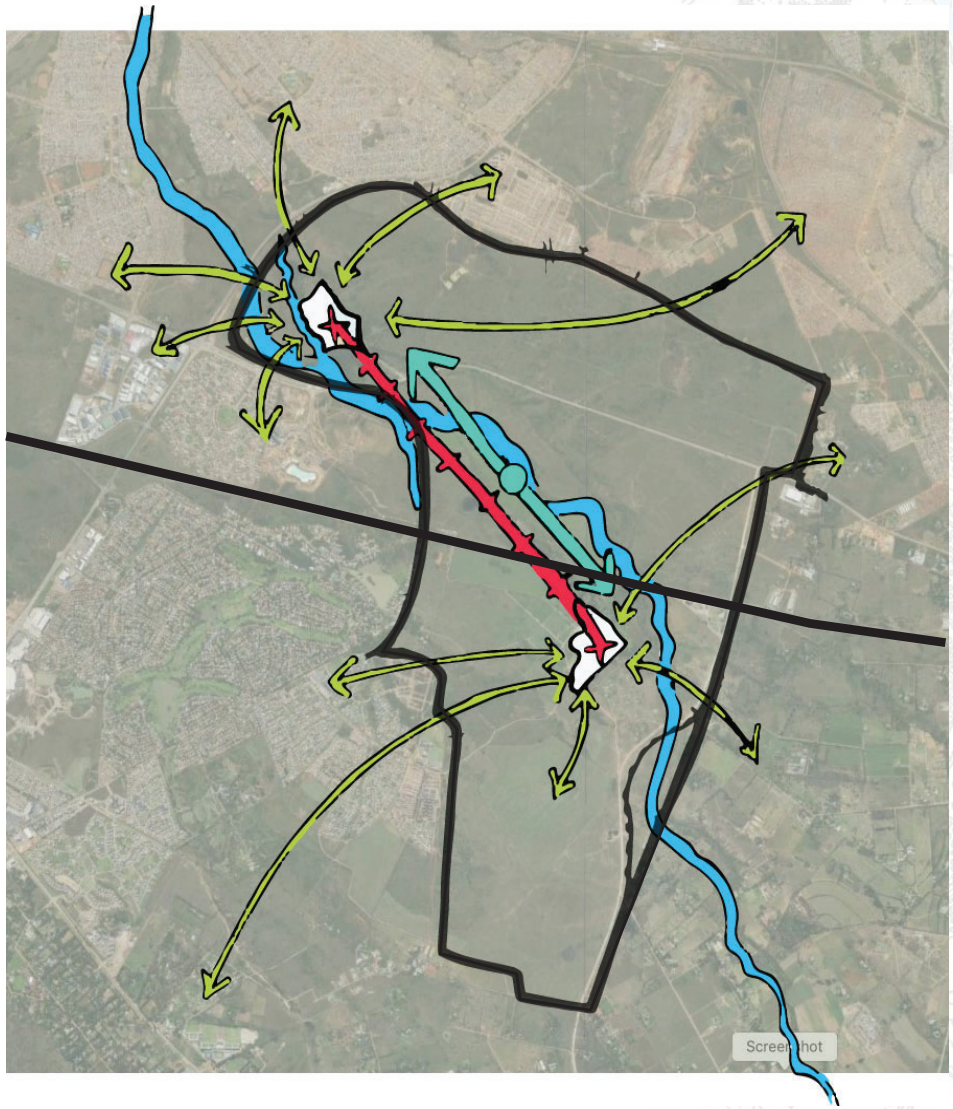


Figure28: Site Concept Diagram (Author 2020)

Factors affecting the site:

The design proposal is located on the Northern boundary between the Sammy Marks Museum (Zwartkoppies Farm) and the proposed Hazeldean Node development, feeding into the surrounding communities.

For the purpose of this proposal, and in following the Tshwane 2055 Vision, it is assumed that the cowhouse and barns on the Hazeldean Farm have been restored and the farm will once again focus mainly on milk production, and the original Zwartkoppies buildings and Sammy Marks homestead have been preserved and restored where necessary, with new infrastructure put in place focusing on agricultural production and tourism.

The famework developed in this proposal hopes to create facilites that will encourage organic human interaction between communities and industries; using agriculture as the medium of connection and integration. It also aims to introduce a social and cultural programme that incorporates food production and civic space as a shared focus for community life, educational experiences and land ownership.

Figure29: Site Location within Framework (Author 2020)

OPPORTUNITIES ON SITE

-LOCATED ALONGSIDE PIENAAR'S RIVER, LOWEST POINT OF DEVELOPMENT RESULTING IN STORMWATER CATCHMENT

-EXISTING INFRASTRUCTURE AND OPERATIONAL DAIRY

-PRODUCTIVE LAND AND RICH AGRICULTURAL HERITAGE

-POST-INDUSTRIAL INTRIGUE

-PERI-URBAN ENVIRONMENT ON AGRICULTURAL BOUNDARY OF TSHWANE

-ONE OF FIVE AGRICULTURAL HERITAGE NODES WITHIN GREATER TSHWANE AREA

-NEW IDENTITY - EMBRACING A PROGRESSIVE APPROACH TO AGRICULTURE

THE CALL FOR PERI-URBAN AGRICULTURE

The rapid urbanisation in South Africa needs to be taken into account and the repercussions that this is having on the food system's ability to provide food to urban and rural dwellers needs to be considered on a national, provincial and municipal level. The review conducted by Pereira (2014) reveals the crucial need to engage with rapid urbanisation on a design and planning scale, as it has resulted in the distancing of people from accessing fresh fruit and vegetables and thereby decreased their dietary diversity, whilst further exacerbating the corporate monetisation of the food system.

Food sovereignty within South Africa may help to ensure that money can be kept within local economies as well as ensuring consistent access to healthy, nutritious food that is locally produced. Many South African's from poverty stricken areas have some level of skill in agriculture, allowing there to be a viable opportunity for job creation and a good first point of entry into the city and job market. This programme also allows for the regional sharing and distribution of resources. In order to ensure food sovereignty and environmental sustainability, society needs to move away from industrial agriculture and reintroduce it to communities, allowing people to engage directly with the food production process.

Jane Battersby (2020) states that the Covid 19 crisis has revealed the failings of South Africa's food system and brought to light how extensive food insecurity actually is. The standard response by local government regarding food insecurity has been to get people to grow their own food when in fact the response should be to challenge the existing food system entirely. This promotion of Urban Agriculture alone, and at the expense of other solutions, is problematic due to a lack of support given to these individuals in respect of possible crop failures and the blanket thinking that those most unable to access food from the formal and informal markets should initiate their own food security through growing food in their own back yards. The reality of poverty is that the food insecure cannot afford access to the land, water, seeds or plants needed to achieve this and although many of these resources are offered by the state and NGO's, the most vulnerable largely lack the knowledge and social networks needed to access them (Haysom and Battersby 2016; HeySummit 2020).

Haysom and Battersby (2016) argue that food insecurity is in fact a systemic issue that requires addressing on both a governance and urban scale through the incorporation of planning policies and urban spatial planning. Cities are therefore integral to the transformation of the food system as they take on the role of creating closed loops between production, consumption and waste (Battersby and Hunter-Adams 2020; Haysom and Battersby 2016).

The IPCC Climate Change and Land Report (2019) suggests urban sprawl may be limiting food security through the loss of arable farmland and Peri-Urban Agriculture. The Peri-Urban Environment is ideally located in close proximity to available labour forces and allowing the direct access of fruit, vegetables and produce to available markets. Peri-Urban Agriculture may aid in the mitigation of climate change due to the reduction in required transport distances, recycling of organic waste and waste water, increasing water filtration and strengthening biodiversity related ecosystem services (Battersby and Hunter-Adams 2020; IPCC 2019). Peri-Urban areas have the potential to act as a belt to contain the city thereby preventing sprawl, such as in the Garden City model.

According to Herbert Girardet (2010), Agroecology intends to promote three goals: the sustainable use of natural resources, the alleviation and reduction of poverty, and climate resilience of both cities and the environment. He argues that while cities were once an 'Agropolis', embedded in their local landscapes, society needs to move away from the current city model of what he terms 'Petropolis' - a city reliant on fossil fuels.

He suggests moving towards an 'Ecopolis' - a regenerative city in which urban consumption supports and regenerates, and all spheres of development are integrated and function systemically. He argues that the largest benefit of such regenerative urbanism is its job creation potential. Therefore, the incorporation of water and energy harvesting, recycling, and generation systems, and the implementation of sustainable peri-urban agricultural programmes may mitigate the impact of poverty and unemployment, encourage climate resilience and ensure opportunities for food security, providing opportunity for education and skills development (Rogers 2015).

The Continuous Productive Urban Landscape (CPUL) concept aids in i) the protection and increase of food diversity as well as the diversity of food retail outlets, ensuring accessibility by foot, cycling or public transport, thus access to 'footfall' of consumers, ii) the promotion of urban agriculture throughout the immediate and extended city at a variety of scales, iii) discouraging food and material waste through the promotion of more socially and ecologically integrated recycling, iv) creating jobs and income for local, community members and producers through sale and investment (Viljoen and Bohn 2014).

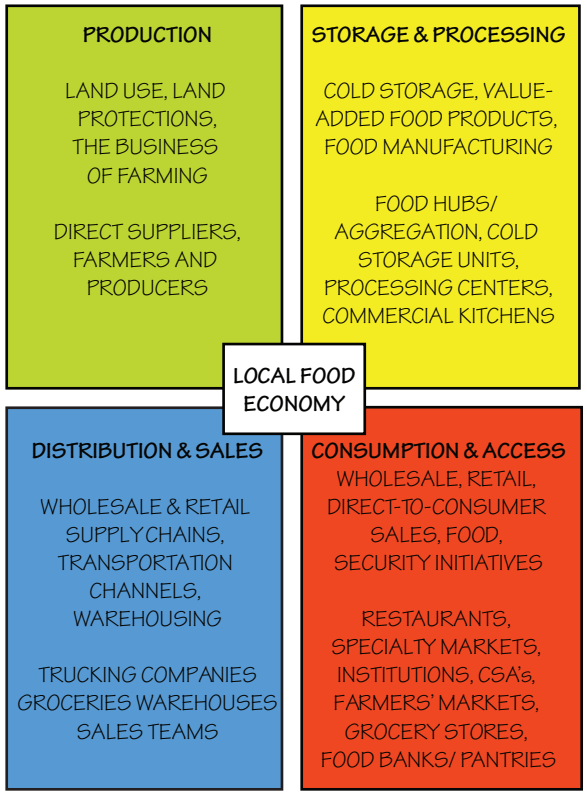


Figure30: Local Food economy (Author 2020)

Figure31: Cattle and Egret (Author 2020)

THEORIES OF INTEGRATION

The concept of growing food within the urban realm has been around in various forms for centuries. The market gardens of the 17th and 18th centuries were an intensive way of life for many, making use of small plots of land within cities that were cultivated to provide fresh produce to the immediate communities. The Industrial Revolution of the 19th century allowed for agriculture to become entirely separate from the city due to the advances in technology, in the form of chemical fertilisers and machinery, and the desire for more land in order to increase yields and provide for an ever growing population. The Second World War in the 1940's resulted in the creation of "Victory Gardens", effectively the market gardens of old, in order to prevent a food shortage and to ensure the constant supply of fresh produce to the American people, since any tinned foods were rationed and almost all vehicles ordinarily used for the transport of food products were being used to transport soldiers and military supplies. These Victory Gardens accounted for approximately 40% of all produce grown within the United States of America during the war. Since then, the notion of community gardens and urban agriculture as a response to growing community development and environmental concerns has increased.

In saying this, Urban Agriculture has only actively been investigated in terms of its spatial design potential for a little over two decades (Herbert Girardet in Rogers 2015). Cities have developed with such rapidity, that the resulting densification and sprawl has lead to the complete isolation of urban communities from 'rural agriculture'. In most cases, urban agriculture has been an attempt to combat this disconnect through the retrospective integration of small scale productive gardens in whatever vacant spaces have been available, occasionally finding solace in the adaptive reuse of old infrastructure. Thus, due to new emphasis placed on the importance of the spatial design of such interventions, Architects are now fortunate enough to have the opportunity to plan for the integration of agriculture into the inter-/ peri-/ urban environment of developing cities (Mang et al. 2016; Viljoen and Bohn 2014).

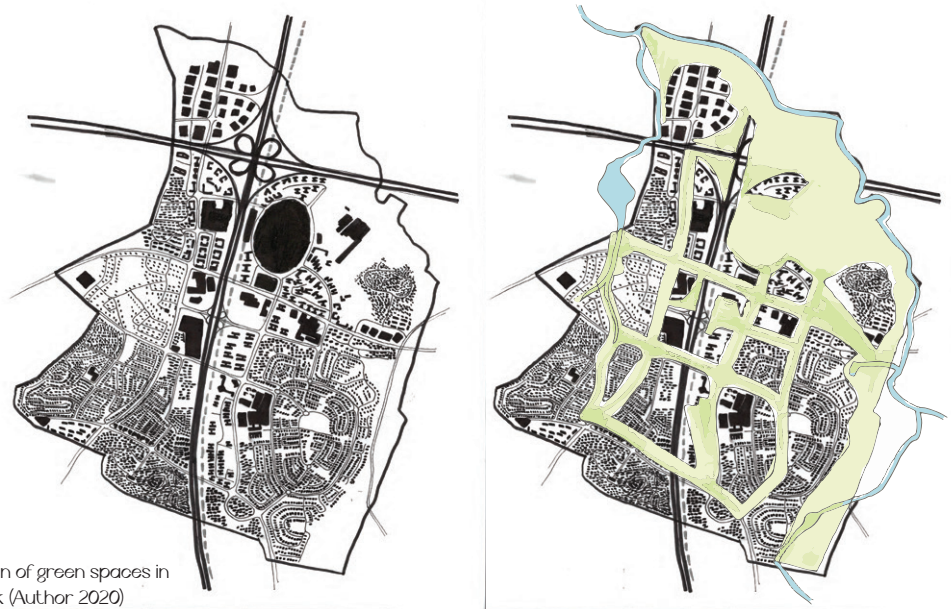


Figure32: Connection of green spaces in Hazeldean framework (Author 2020)

Middlesbrough CPUL Proposal, 2007 (Viljoen and Bohn 2014)

CPULs are made up of: 1- Allotments

2- Continuous Productive Land

3- Food Containers

4- Urban Farms

5- Parks

Figure33: Middlesbrough CPUL Proposal (Viljoen and Bohn 2014)

Continuous Productive Urban Landscapes (CPUL):

Defined by Viljoen and Bohn (2014) as an urban design concept that incorporates the growing of food into the design and planning of cities. In order to enable the successful implementation of Productive Urban Landscapes, the expertise of architects, urban designers, and urban planners will need to come together.

Central to this concept and the creation of open urban space frameworks is the coherent and designed multi-functional productive landscape that both complements and supports the built environment. The CPUL concept refers to urban agriculture as predominantly productive in fruit and vegetable production, due to the high percentage yield per square meter, however, livestock production cannot be excluded from this, provided adequate space and infrastructure is used (Viljoen and Bohn 2014).

The use of mixed (organic) farming methods employs the concept of Ecological Intensification in order to increase productive agricultural outputs (food and ecosystem services) while decreasing the need for external industrial inputs (chemicals and fossil fuels), thus capitalising on ecological systems and processes.

Linking with this, organic urban agriculture encourages biodiversity within cities, enhancing and capitalising on the ecosystem services available. In order to maximise this, the CPUL City makes use of spaces that run between, in, over, and on buildings, creating and making use of ecological corridors and connecting larger habitat patches (Viljoen and Bohn 2014).

Whilst valuable, this theory is more applicable to inner city urban agriculture than to the peri-urban environment.

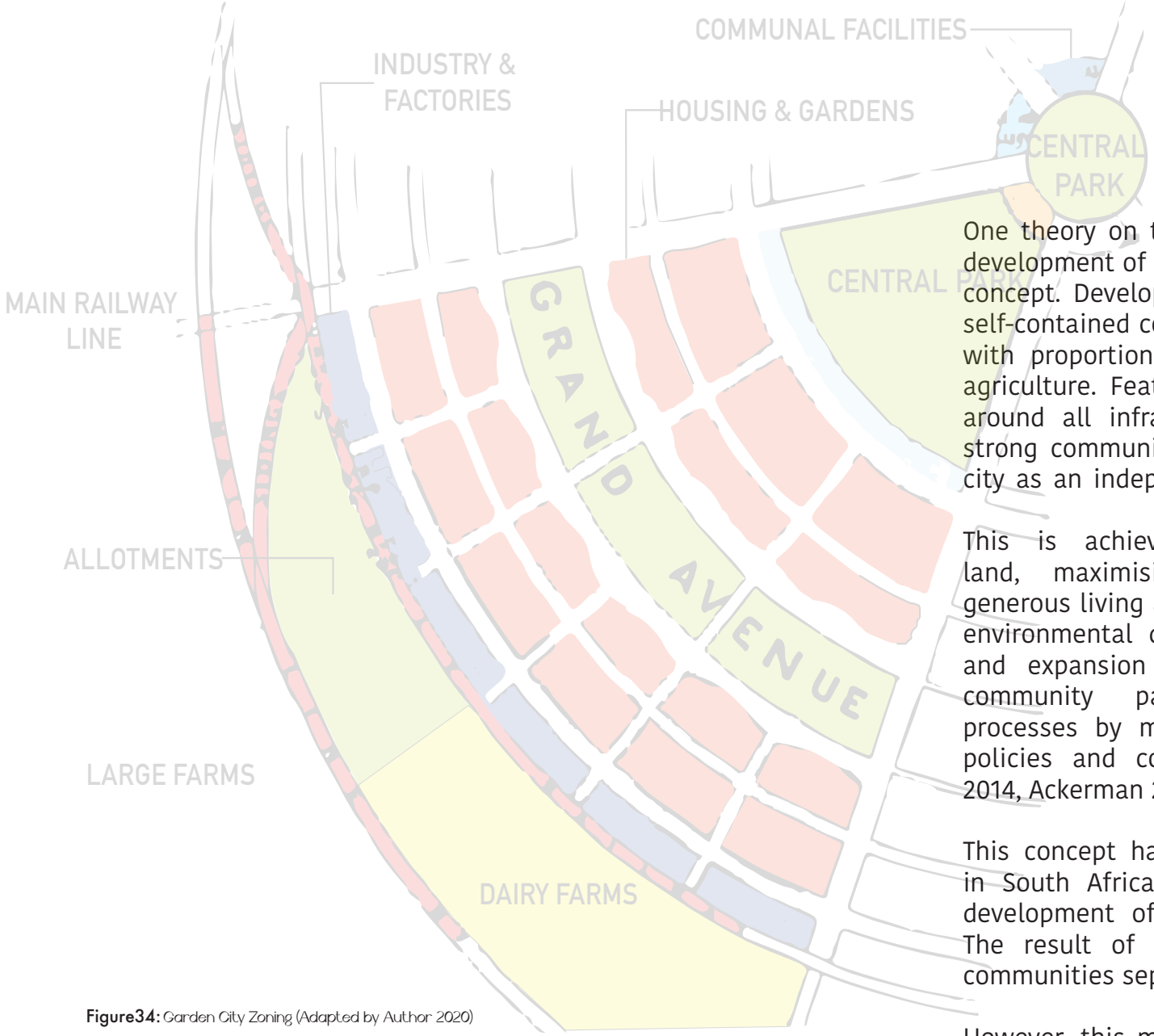


Figure34: Garden City Zoning (Adapted by Author 2020)

THE GARDEN CITY CONCEPT

One theory on the prevention of urban sprawl in the development of cities is Ebenezer Howard's Garden City concept. Developed in 1898, it is defined as planned, self-contained communities surrounded by green belts, with proportionate areas of residence, industry and agriculture. Features of such a city are open spaces around all infrastructure, adequate population size, strong community ties, ordered development and the city as an independent, and largely self-reliant entity.

This is achieved through unified ownership of land, maximising community benefit, providing generous living and working spaces whilst maintaining environmental quality, placing limits on the growth and expansion of the city, and encourages local community participation in decision making processes by making use of collective land reform policies and co-operative development (Wainwright 2014, Ackerman 2020).

This concept has been heavily criticised, particularly in South Africa due to its misappropriation in the development of the Apartheid city planning model. The result of this is extensive urban sprawl and communities separated by land buffers.

However, this misappropriation (with the intention of segregation in mind) is far from the original intention and serves to prove that it is the manner in which a tool is used that determines the success of the action - the Garden City Concept is equally as capable of addressing and combating inequality as it is of creating it.

Whilst seemingly outdated, this concept still holds relevance today and a resurgence in this model can be seen today, due to its relationship with Urban Agriculture as a way to maximise the value that lies in the mixed development of peri-urban land.

A revived generation of this concept by urban planner David Rudlin of URBED won the Wolfson Economics Prize in 2014. As a proposal to achieve the required housing scheme for the British city of Uxcester, the project acknowledges that in order to be successful in the current economic climate, it would need to be developed as part of an existing city with largely established infrastructure, through the addition of substantial urban extensions within a zone of approximately 10km from the main city.

The developments will be connected through public transport infrastructure that will increase mobility for the whole city, without doubling traffic, and housing choice and affordability will be broadened for everyone. The city centre will be revitalised by channelling new demand, creating local employment opportunity, growth and allowing investment in new facilities and, with extreme care being taken in the planning of pedestrian and public movement throughout the area, ensures that one is never further than a five minute walk from a bus or tram stop.

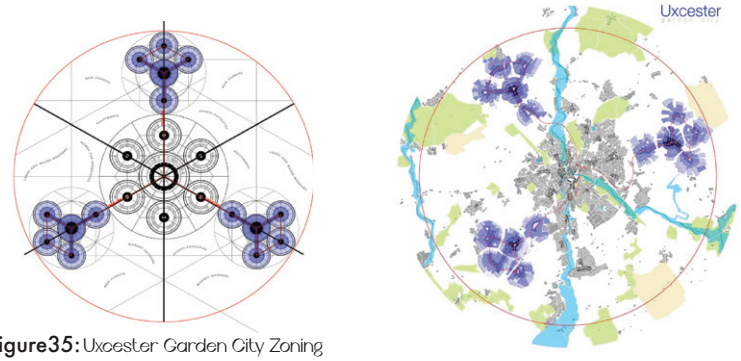


Figure35: Uxcester Garden City Zoning (Urbed 2014)

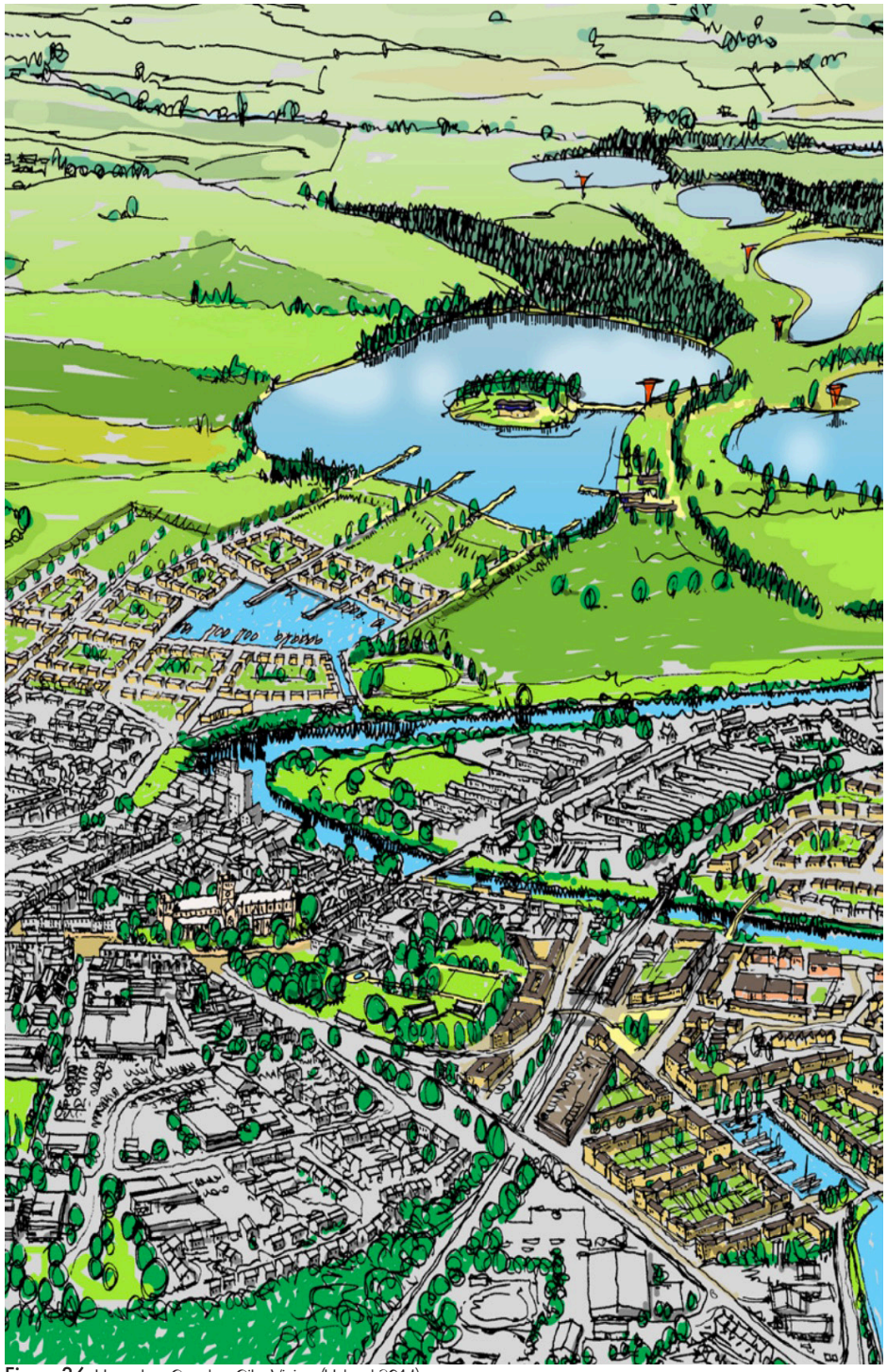


Figure36: Uxcester Garden City Vision (Urbed 2014)

Hendricks Farm
2016; DPZ Co-Design,Canada

-development based on garden City framework
-focus on food production, education and community strengthening within development

The development seeks to seemlessly integrate itself into the pre-existing agricultural precinct and forms part of the development's new mixed-use city center. The project seeks to encourage a healthy lifestyle through on-site food production and outdoor activity, with walking and cycling trails throughout the precinct and surrounding forests. The focus of the project is to stimulate a culture based on land conservation and ownership, and to promote and develop a sense of community through education and the allocation of space for farming, recreation, social interaction and community connectivity.

The approach taken by DPZ Co-Design is to achieve not only healthy living, but to achieve multi-generational living, as well as a social and cultural programme that focuses on food provision and educational experiences (Duany Plater-Zyberk Co-Design 2020).

Figure37: Hendricks Farm Masterplan (Duany Plater-Zyberk Co-Design 2020)

Figure38: Hendricks Farm Masterplan (Duany Plater-Zyberk Co-Design 2020)

The Garden City concept incorporates the concept of Agrarian Urbanism. Agrarian Urbanism is the marriage of New Urbanism (design movement promoting environmentally friendly habits through the creation of walkable neighbourhoods containing a wide range of housing and job types) and Agricultural Urbanism (the intentional building of a community that is associated with a farm). The result of this is an **intentional agrarian society involved in the organising, growing, processing, distributing, cooking and eating of food.** The most successful cities of the future are anticipated to be those that provide a landscape for local food production, and as a result, have a meaningful relationship with growing food close to home. The key to achieving Agrarian Urbanism is through embedding pockets of agriculture within the peri-urban landscape, introducing a mix of housing types, shared community assets and resources, safe children's areas, green roofs and greenhouses, and local corner stores (King 2017; Nairn 2010).

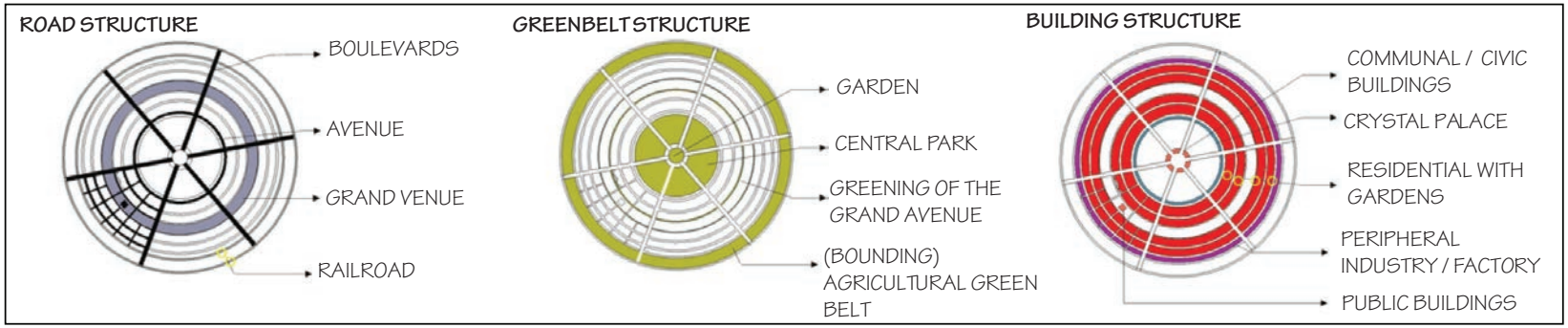


Figure39: Garden City Structure (King 2017)

A fundamental aspect of the proposal is the incorporation of a new economic system which governs and funds the development by setting up what is effectively a social contract, whereby a 'Garden City Trust / Council' is established as the master developer, consisting of local people, authorities, developers, landowners and businesses. This Trust makes use of an initial large, low interest loan from the government to purchase the land at a fair rate from surrounding farmers, still allowing them to maintain shares in the land that will be developed and, through reinvestment of revenues for the plots sold to developers (be they volume house builders or home builders) provide funding for the infrastructure (Rudlin 2014; Sweet 2014).

Eco-cities and Eco-districts are based on the premise of incorporating objectives of sustainable developments, focusing on the integration of ecological, social, and economic goals; and aims to achieve many of the same milestones as the Garden City Concept. It is important to note that developments such as these should be viewed as urban experiments, working towards a long-term sustainability goal (Flurin 2017; Mersal 2017).

ECONOMIC VIABILITY OF PROPOSAL

Food insecurity, poverty and the degradation of city centres resulting in urban sprawl are systemic issues in South Africa (Battersby 2020; Pereira 2014). Land reform in South Africa seeks to rectify the injustices of the past colonial and apartheid land use and distribution policies that are still being felt today. Since the end of Apartheid, very little has been done in order to achieve a restructuring in these policies, and those few who have benefited from the land reform policies have received little government support following the initial redistribution, raising issues of concern about what the implications of this policy are in terms of both long term economic prosperity and food security. This model thus needs to alter its course in the direction of co-operative management and governance in order to effect systemic change. Contrary to land and agrarian reform being fundamentally a governance issue, by shifting power within the food system from corporate interests to community interests, thereby letting marginalised groups have a say in the governance of the food system, an actionable shift can be made towards achieving economic upliftment, an improved urban environment and food sovereignty (Mang et al. 2016; Pereira 2014).

Some suggestions being made to counteract the issue of food waste and inaccessibility are:
• Spatial de-concentration of the food system;
• Support for small-scale farmers and the aggregation of small-scale farmers outputs;
• Provision of supermarkets and food suppliers with produce from small-scale, local producers;
• The collaboration of retailers, farmers and restaurants to ensure minimal food wastage (PLAAS 2020).

Domestic agriculture serves as an important buffer to international market dynamics. Self reliant communities may, through the conversion of vacant land to productive income generating spaces, allow for the generation and stimulus of local economies, create and sustain opportunities for community-based jobs, create a direct link between the farmer and consumer, harvest and generate energy, apply sustainable use of natural resources, and achieve climate resilience. In order to ensure food sovereignty and environmental sustainability, society needs to move away from purely industrial agriculture and reintroduce it to communities, allowing people every day to engage directly with healthy, nutritious food that is locally produced (Pereira 2014; The Hunger Project 2019). Achieving a sustainable future requires the transformation of not only physical infrastructure but of social structures as well. People-centred Economics such as this may, according to E.F Schumacher in his book Small is Beautiful (1973) provide long lasting social and environmental sustainability (Schumacher 1973). ‘Small is Beautiful’ is an idea that continues to appear today – the latest incarnation being farmers’ markets - because it incorporates a fundamental insight into society: the need for economic systems that are understandable by all and are within some level of control of local communities.

Whilst urban agriculture cannot be the sole solution to poverty, it should be considered as one of many possible ones; locally produced food should be a key element due to reductions in transport costs, improved diets of residents and access to fresh, healthy food (City of Tshwane 2011). Non-economic benefits to this strategy include recreational potential and aesthetics, the redevelopment of unproductive land, ecosystem services to cities, environmental education, social empowerment, and social interaction and the strengthening of community ties, both within and across these communities (Reuther and Dewar 2006).

Tshwane Vision 2055 and the NDP 2030 seeks to introduce methods of land reform through the utilisation of land for sustainable development through the introduction of food agriculture, infrastructure development and job creation. Through the introduction of agroprocessing plants and value added services, farmers can be integrated throughout the value chain and the use of all available open space will be maximised. The vision also aims to aggressively pursue various forms of urban agriculture and urban farms in a multitude of ownership and operational varieties. The agricultural sector has the ability to support rural development and transformation in an attempt to stimulate a sustainable rural economy. City assets that support such initiatives are human, economic, social, physical natural, culture and institutional, with entrepreneurship as a critical component to rural economic development (City of Tshwane 2011).

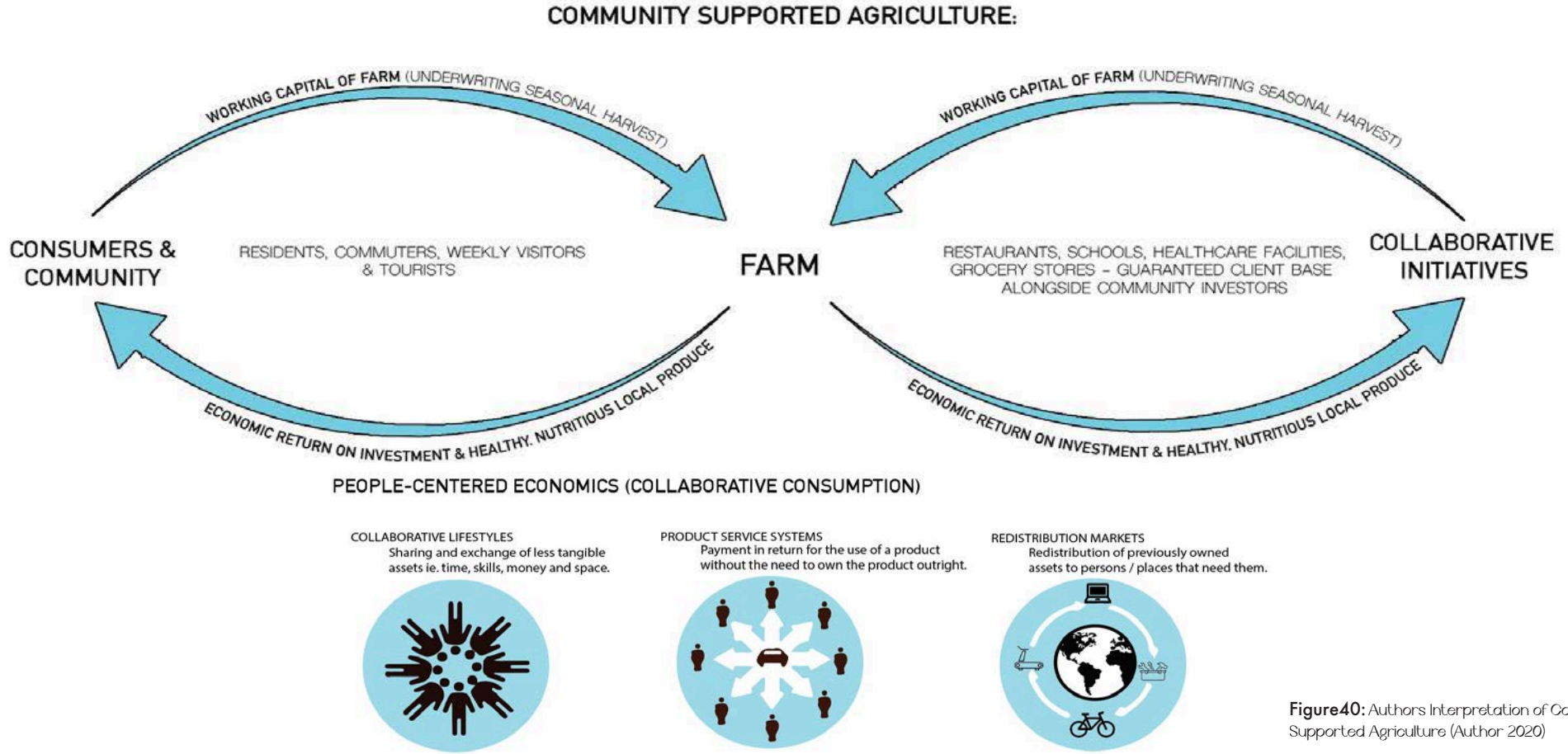
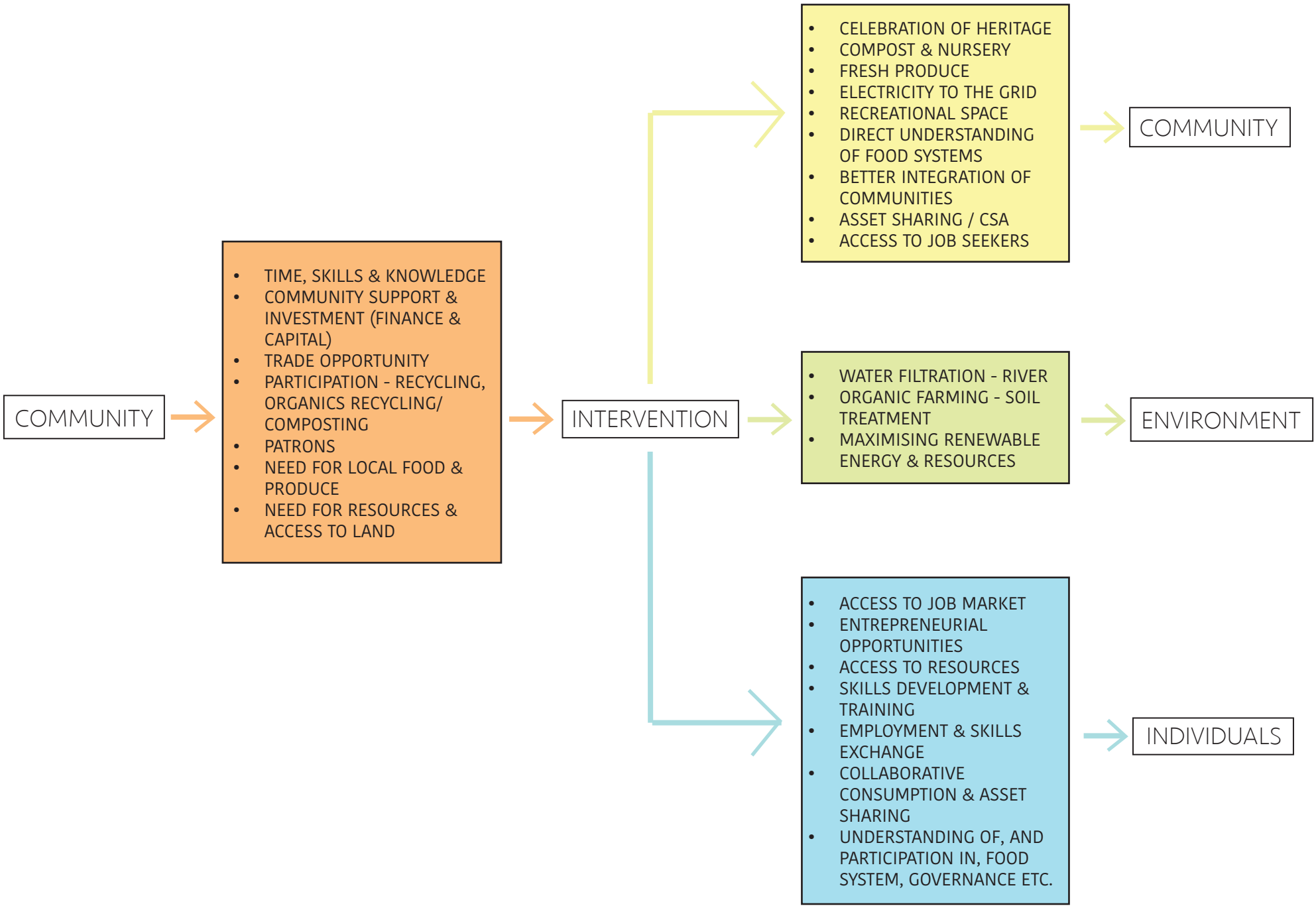


Figure40: Authors Interpretation of Community Supported Agriculture (Author 2020)

The economic model for such interventions provide quick, accessible investment potential, due to the maximising of ecosystem services and due to the intervention absorbing people into the system and filtering them into the city. This may be achieved through large corporate investment as a form of Carbon Tax Relief, and initial government funding, followed by methods of cooperative investment and the basis of community supported agriculture. This allows the community (consumers) to cover the working capital of the farm (underwriting the harvest for an entire season), gaining economic return on investments, and are guaranteed to receive fresh, nutritious, local produce (Hlakanyane 2020; Biodynamic Association 2020). Through collaborative initiatives with local schools, restaurants, healthcare facilities and retailers, a guaranteed client base may be established alongside support from individual home-owners. The South African Urban Food and Farming Trust seeks to provide support for collaborative initiatives that strengthen and build inter and intra community social cohesion and collective agency, improve household food security and nutritional access, conserve and protect natural urban ecosystems, and humanise the built urban environments (ozcf. co.za 2020). Idling Capacity exists across a number of assets, including: products, spaces, skills, capital, utilities, time.

This reaffirms the need for a paradigm shift in the way society lives, works, travels, creates, learns, banks, and consumes, through the introduction of the Collaborative Consumption model and related economies. Collaborative Consumption is the shared/ community utilisation of goods and services, and the formalisation of a collaborative / sharing economy, whereby physical assets can be shared as services, and replacing physical ownership with sharing; therefore enhancing consumer enablement over ownership through direct interaction (Botsman 2017; Wahl 2017). Rachel Botsman (2017) explains this as the move away from hyper consumption and the return to lending/ sharing/ bartering. She uses the example of an electric drill that effectively has a lifespan of 15 minutes per user; which seems silly to own for such a short useful life but, if rented out to people who need it, becomes a worthwhile investment - what most people need is the hole, not the drill (Botsman 2017). The four drivers of this model are technology innovation, a shift in values, economic realities, and environmental pressures.

Regenerative thinking and design is interconnected with the approaches of living / whole systems thinking as well as the New Economy movement. This 'new economy' proposes a restructuring of the current economic system in order to maximise human well-being and environmental conservation; supporting the notion of prioritising people and the planet over economic growth (Fioramonti 2017). The role of design and construction in the development of communities becomes a process of co-creation that continues after physical completion, implementing change through restoration, regeneration and the opening up of new opportunities for growth and develo ment within communities and their ecosystems; while design strategies and materials used should aim to reintegrate human habits and habitats with nature to produce a net-positive impact (du Plessis and Brandon 2015). If one considers the relationship between the socio-political value system, economic realities, and the built environment it can be determined that the notion of Collaborative Consumption can aid in the development of bottom-up strategies, whereby architects and communities define new ways of practice in order to enhance the quality of life.


COMMUNITY
TIME, SKILLS & KNOWLEDGE
COMMUNITY SUPPORT & INVESTMENT (FINANCE & CAPITAL)
TRADE OPPORTUNITY
PARTICIPATION - RECYCLING, ORGANICS RECYCLING/ COMPOSTING
PATRONS
NEED FOR LOCAL FOOD & PRODUCE
NEED FOR RESOURCES & ACCESS TO LAND
INTERVENTION
CELEBRATION OF HERITAGE
COMPOST & NURSERY
FRESH PRODUCE
ELECTRICITY TO THE GRID
RECREATIONAL SPACE
DIRECT UNDERSTANDING OF FOOD SYSTEMS
BETTER INTEGRATION OF COMMUNITIES
ASSET SHARING / CSA
ACCESS TO JOB SEEKERS
COMMUNITY
WATER FILTRATION - RIVER
ORGANIC FARMING - SOIL TREATMENT
MAXIMISING RENEWABLE ENERGY & RESOURCES
ENVIRONMENT
ACCESS TO JOB MARKET
ENTREPRENEURIAL OPPORTUNITIES
ACCESS TO RESOURCES
SKILLS DEVELOPMENT & TRAINING
EMPLOYMENT & SKILLS EXCHANGE
COLLABORATIVE CONSUMPTION & ASSET SHARING
UNDERSTANDING OF, AND PARTICIPATION IN, FOOD SYSTEM, GOVERNANCE ETC.
INDIVIDUALS

APPLICATION OF THEORIES TO HAZELDEAN NODE

This paper proposes that the current development plan consider the following: i) the expansion of the masterplan to include the fertile soils of the Zwartkoppies erf and thus begin filtering development into Mamelodi, ii) include a series of agricultural hubs throughout the site that will service different agricultural needs (such as fruit and vegetable production, dairy production, and cleaning, packaging and distribution of produce), and iii) the removal of the mall and introduction of mixed retail at neighbourhood scale.

There is an opportunity for this development framework to offer long-term employment to local community members, to be an example of sustainable development in today's society, and to allow for the better integration of communities through the act of food security specifically. The Sustainable Food Cities Network provides a set of principles designed to ensure a cities sustainable urban foodscape. These principles include i) health and well-being for all; ii) environmental sustainability; iii) local economic stimulation and prosperity; iv) empowered and resilient communities; and v) fairness throughout the food chain (Sustainable Food Places 2020).

These principles ensure that communities are placed ahead of profit and that a systemic solution is developed by means of conscious design. When small, local businesses are replaced by megastores, local money no longer absorbs into the local economy. Through the incorporation of closed-loop, no-waste systems that utilise the interdependencies within cycles of production and consumption, support is created for independent community traders and retail diversity is preserved in the face of the ubiquitous supermarket / mall (Mang et al. 2016; Viljoen and Bohn 2014). Investing in the area as a central commercial district aids in eliminating the rapid development of malls, particularly in small towns.

The Garden City concept can be applied to the Hazeldean Node in the following ways: the peri-urban nature of the development allows for the existing farmland to be utilised for the production of food that will aid in achieving a level of food security for the surrounding communities as well as the Hazeldean Node itself at the same time acting as a land barrier that will contain developments, preventing sprawl. Due to its close proximity to Pretoria (Tshwane) as a city with existing infrastructure, the framework will be able to utilise and expand upon this, making the transport of goods and services more efficient and the movement of people more reliable.

If one considers the peri-urban location of the Hazeldean Node it can be seen that, as suggested by the IPCC, there is direct access to labour and markets in Mamelodi, helping to stimulate the local economy through employment opportunity in the immediate environment, as well as access to markets in the greater Pretoria east communities.

This allows for the opportunity to make use of Community Supported Agriculture in the undertaking of this peri-urban farm, ensuring a guaranteed consumer base and security of finances, and improves sustainability due to the large scale reduction of transport distances and the potential to maximise the use of natural resources and renewable energy.

The introduction of a governing body (such as the Garden City Trust / Council) that is made up of local government, investors, farmers, developers and community members may aid in ensuring that this framework develops with a holistic vision in mind that will benefit the community as a whole, as well as ensuring the correct and accountable management of community finances and investments.

Viljoen and Bohn (2014) state that whilst urban agriculture will need to produce at a commercial scale in order to successfully impact a communities food needs, it cannot fully meet nor satisfy all of these needs, thus requiring urban food systems to ensure a relationship between the city, its local region and beyond, facilitating integration into the formal value chain (Viljoen and Bohn 2014).

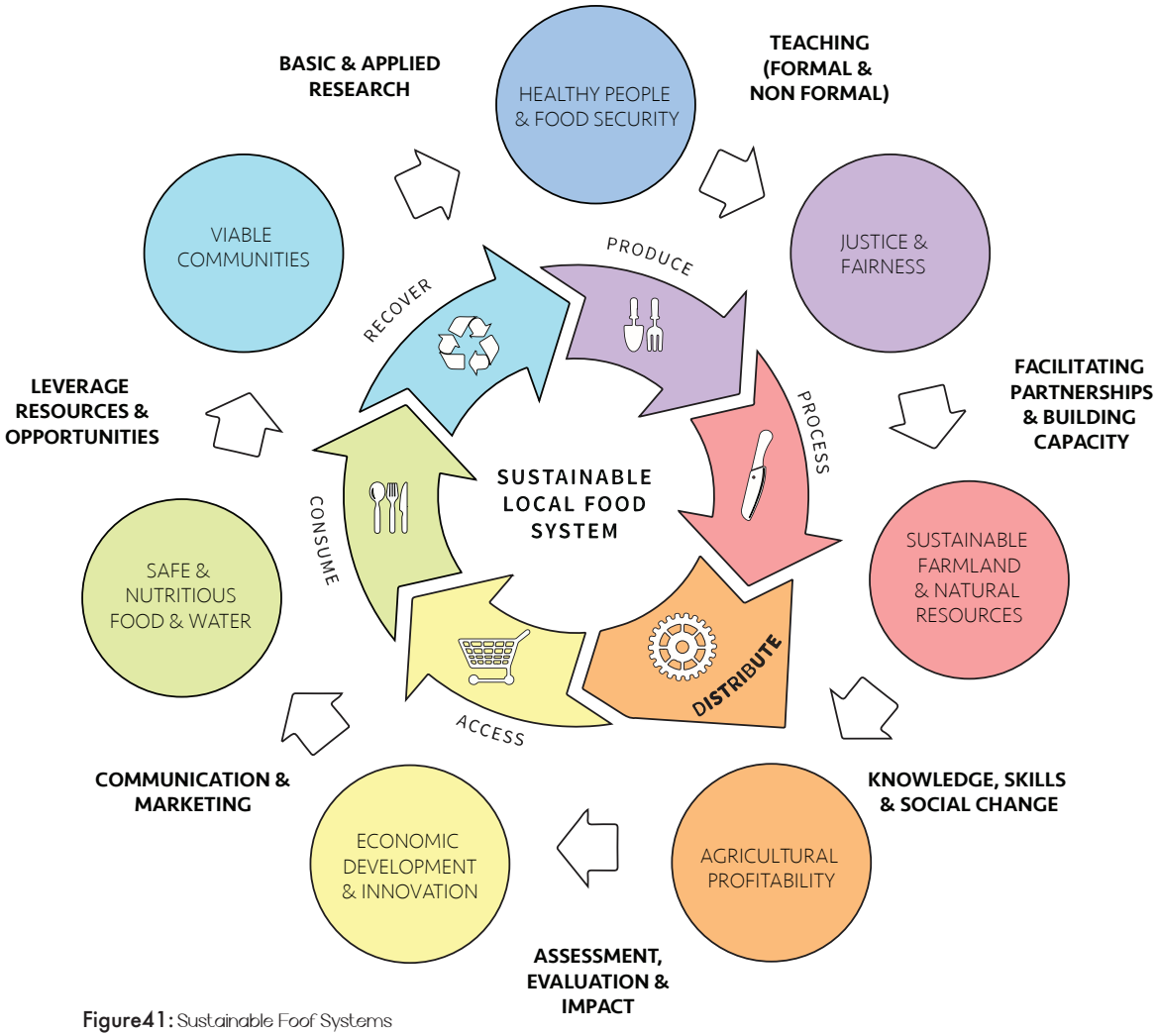


Figure41: Sustainable Food Systems (Adapted by Author 2020)

URBAN VISION DEVELOPMENT

This project proposes a critique of the current Hazeldean Node Development plan in order to create a holistic framework that will connect the various communities found on the eastern urban periphery of Pretoria. In order to do this, the devlopment plan should be expanded to include the arable land on the Zwartkoppies erf, providing more land for productive agriculture and affordable and sustainable development along the peri-urban boundary, mitigating the urban sprawl currently occuring.

Through applying the CPUL principle, green zones were identified and distributed according to use as allotments, productive agriculture, and parks / recreational green spaces.

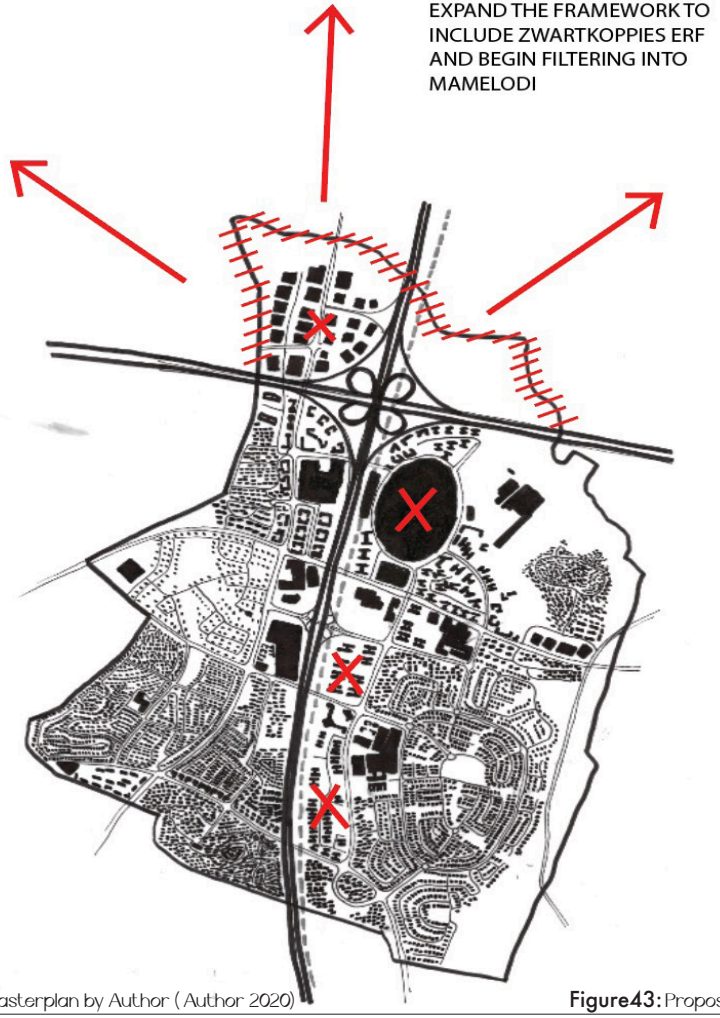


Figure42: Critique of Hazeldean Masterplan by Author (Author 2020)

Figure43: Proposed Distribution of Productive Land (Author 2020)

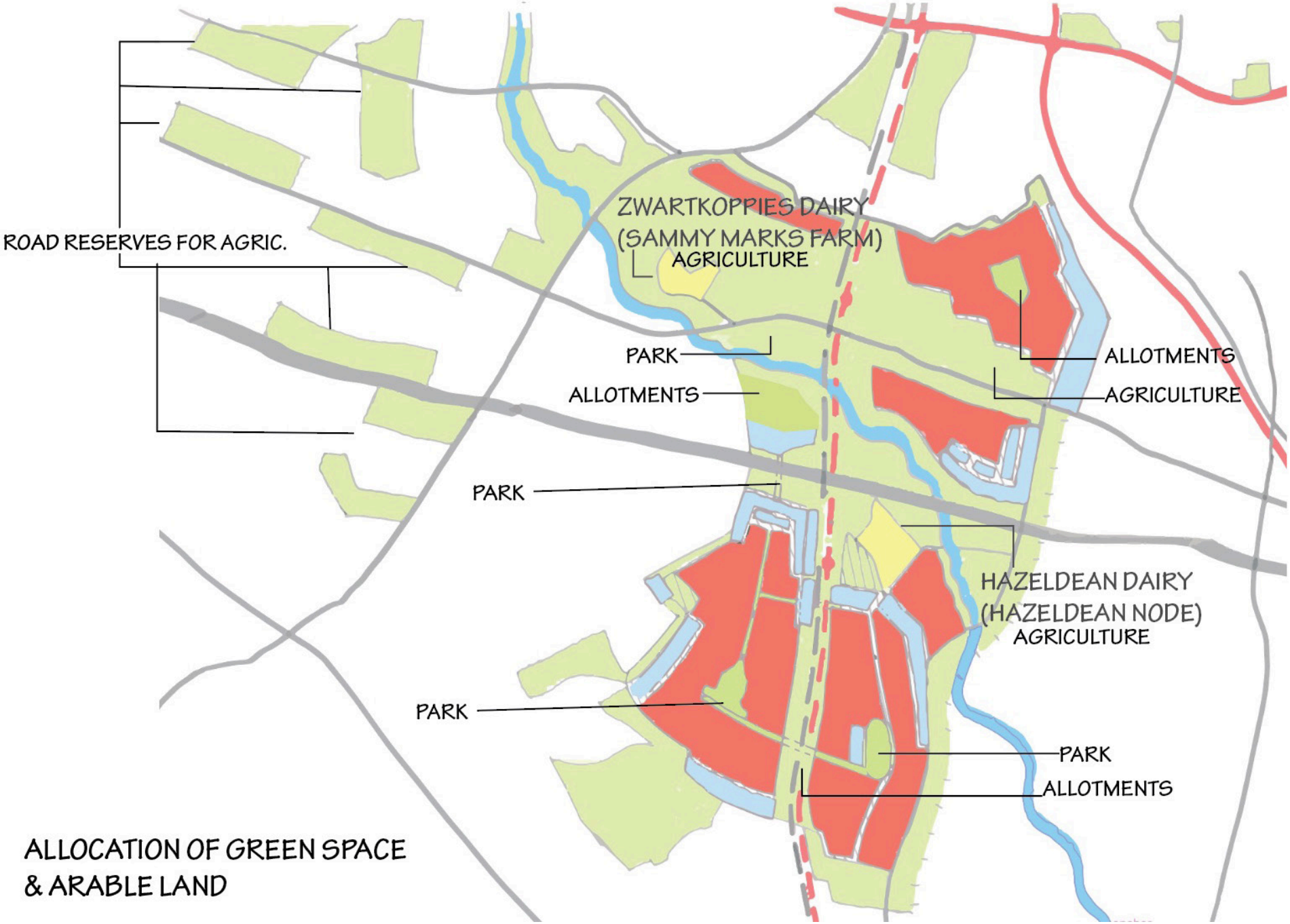


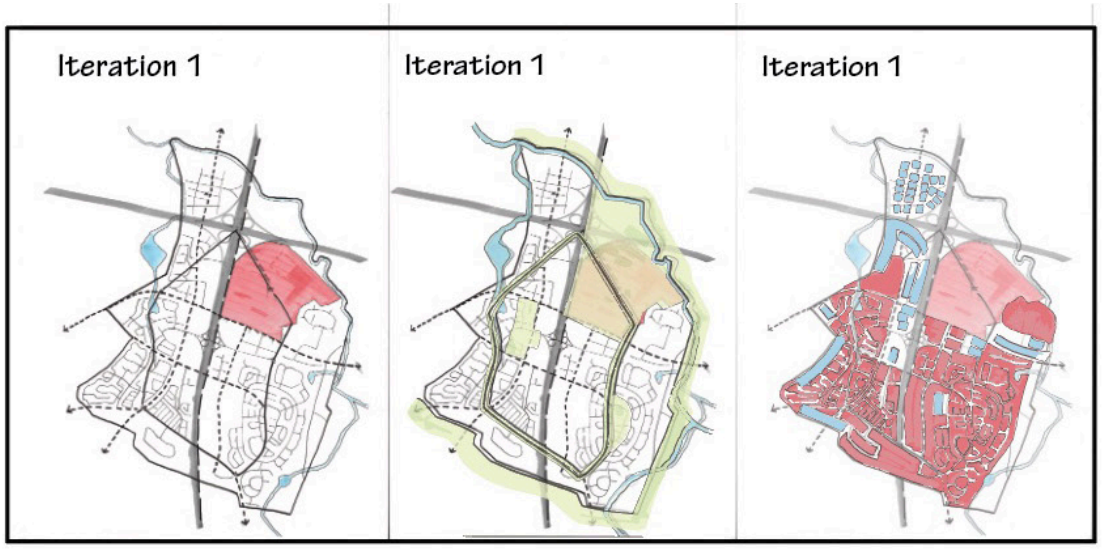
Figure44: Agricultural Zoning (Author 2020)

The Garden City Concept was also adapted and applied to the site in the following ways:

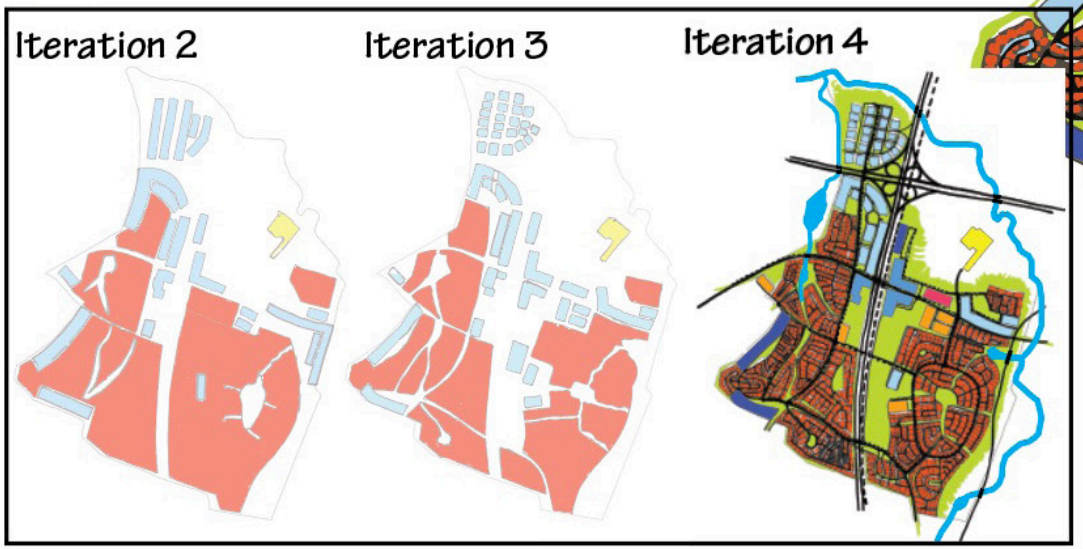
- The development of road structures consisting of advanced public transport infrastructure along main boulevards, where pedestrianisation is encouraged and main railroads connect the satellite city (Hazeldean and surrounds) and its industry to the main city (Tshwane).
-Green belts are integrated into the city; residential belts surround the communal / civic centre, whilst all industry and factory is pushed to the outskirts.

The application of these principles resulted in the removal of the (undeveloped) regional mall to the west of the Hazeldean dairy and the introduction of retail on a local, neighbourhood scale. It became clear that the framework needed to maximise public green space for recreation and pedestrian movement throughout the site. It became clear that the framework needed to be expanded to the North of the Pienaar's river, to include the Zwartkoppies farm and facilitate access to the Mamelodi Community.

Figure45: Nolly Map with Site Overlay (Author 2020)

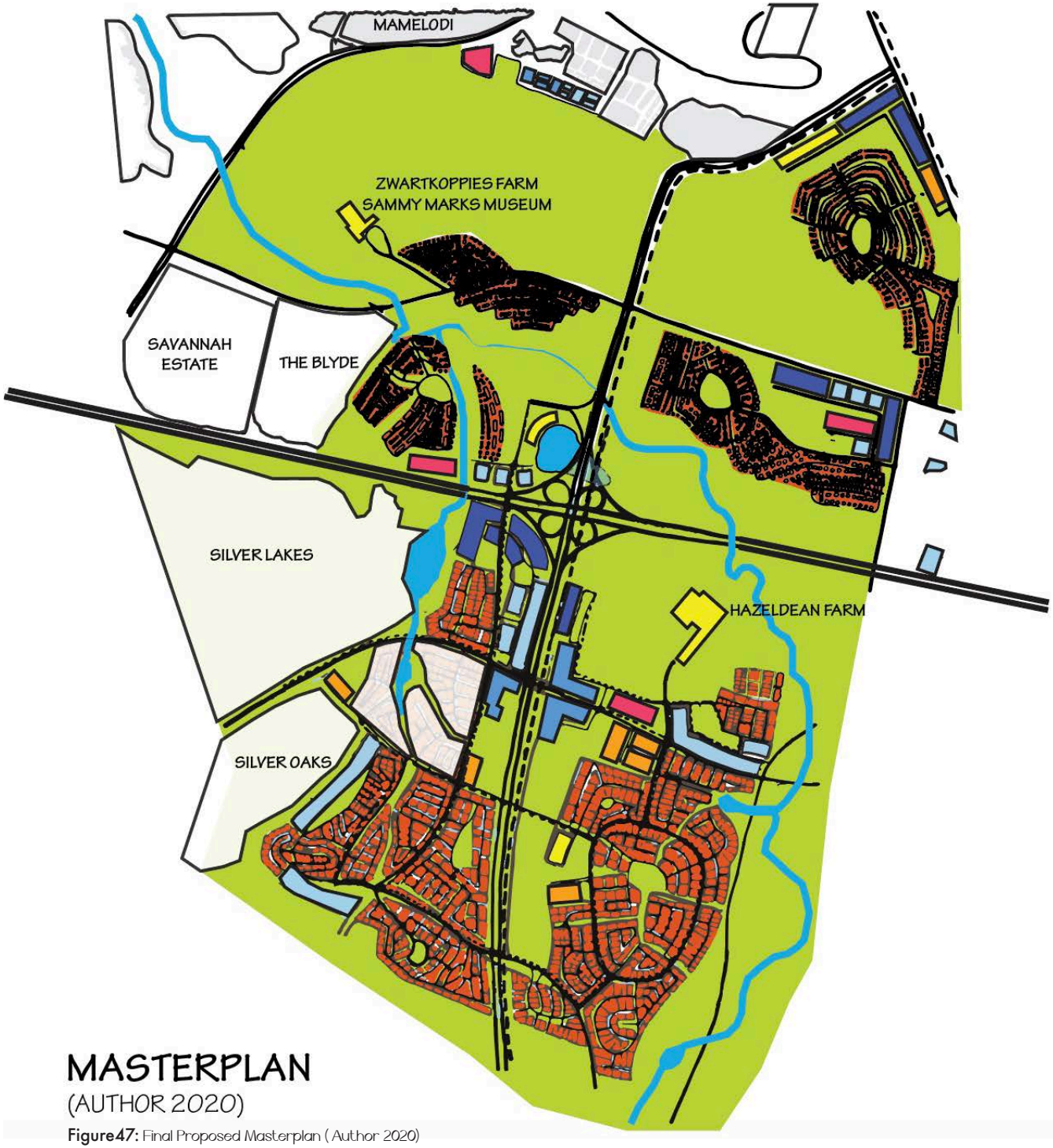


DAIRY
EDUCATION FACILITIES
MIXED RESIDENIAL
RETAIL
INDUSTRY & FACTORIES
PUBLIC INFRASTRUCTURE
COMMERCIAL / BUSINESS
GREEN ZONES & AGRIC.
RAIL & ROADWAYS



(ADAPTED FROM HAZELDEAN NODE MASTERPLAN, AUTHOR 2020)

Figure46: Urban Design Iterations (Author 2020)



MASTERPLAN
(AUTHOR 2020)

KEY

- AGRICULTURAL HUB
- EDUCATION FACILITIES
- MIXED RESIDENTIAL (PROPOSED)
- RETAIL (NEIGHBOURHOOD SCALE)
- INDUSTRY & FACTORIES
- PUBLIC INFRASTRUCTURE
- COMMERCIAL / BUSINESS
- GREEN ZONES & AGRIC.
- RAIL & ROADWAYS
- EXISTING RESIDENTIAL DEVELOPMENTS SURROUNDING, AND WITHIN, MACRO SITE

-EXPANSION OF MASTERPLAN TO INCLUDE ZWARTKOPPIES ERF AND BEGIN FILTERING INTO MAMELODI

-INCLUDE A SERIES OF AGRICULTURAL HUBS THROUGHOUT, SERVICING DIFFERENT AGRICULTURAL NEEDS

-REMOVAL OF MALL AND INTRODUCTION OF MIXED RETAIL AT NEIGHBOURHOOD SCALE

-INTRODUCTION OF CIVIC SPACES SERVICING MULTIPLE COMMUNITIES ACROSS SITE AREA

Figure47: Final Proposed Masterplan (Author 2020)

The famework developed in this proposal hopes to create facilites that will encourage organic human interaction between communities and industries; using agriculture as the medium of connection and integration. It also aims to introduce a social and cultural programme that incorporates food production and civic space as a shared focus for community life, educational experiences and land ownership. The aim of the initiative is to provide education, skills training and development for local community members of all age groups; providing opportunity for economic and urban upward mobility whilst ensuring a level of food security and sovereignty for these communities.

Applying the garden city principles resulted in the removal of the (undeveloped) regional mall to the west of the Hazeldean dairy and the introduction of retail on a local, neighbourhood scale. It became clear that the framework needed to maximise public green space for recreation and pedestrian movement throughout the site. It became clear that the framework needed to be expanded to the North of the Pienaar's river, to include the Zwartkoppies farm and facilitate access to the Mamelodi Community.

- INCLUDE A SERIES OF AGRICULTURAL HUBS THROUGHOUT, SERVICING DIFFERENT AGRICULTURAL NEEDS
- REMOVAL OF MALL AND INTRODUCTION OF MIXED RETAIL AT NEIGHBOURHOOD SCALE
- INTRODUCTION OF CIVIC SPACES SERVICING MULTIPLE COMMUNITIES ACROSS SITE AREA
- INDUSTRY HAS BEEN PUSHED TO THE OUTSKIRTS AND COMMERCIAL NODES HAVE BEEN CREATED.
- MAIN TRANSPORT ROUTE INCLUDING RAIL, CONNECTING MAMELODI AND DEVELOPMENT

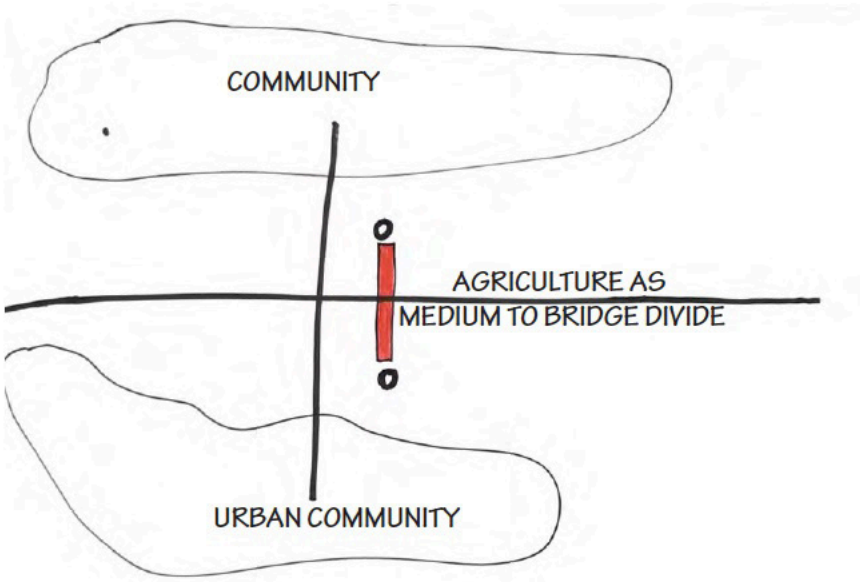


Figure48: Connection Diagram (Author 2020)

AGRICULTURAL HUBS

The focus of these principles is on Agrarian Urbanism. This is the marriage of New Urbanism (design movement promoting environmentally friendly habits through the creation of walkable neighbourhoods containing a wide range of housing and job types) and Agricultural Urbanism (intentional building of a community that is associated with a farm). The result of this is an intentional agrarian society involved in the organising, growing, processing, distributing, cooking and eating of food. The most successful cities of the future are anticipated to be those that provide a landscape for local food production and, as a result, have a meaningful relationship with growing food close to home.

As proposed in this dissertation and in conjunction with the Tshwane 2055 Vision, the original Zwartkoppies buildings and Sammy Marks homestead have been restored where necessary, with new infrastructure put in place focusing on agricultural production and tourism.

The Agricultural Hubs are positioned within the site as follows:

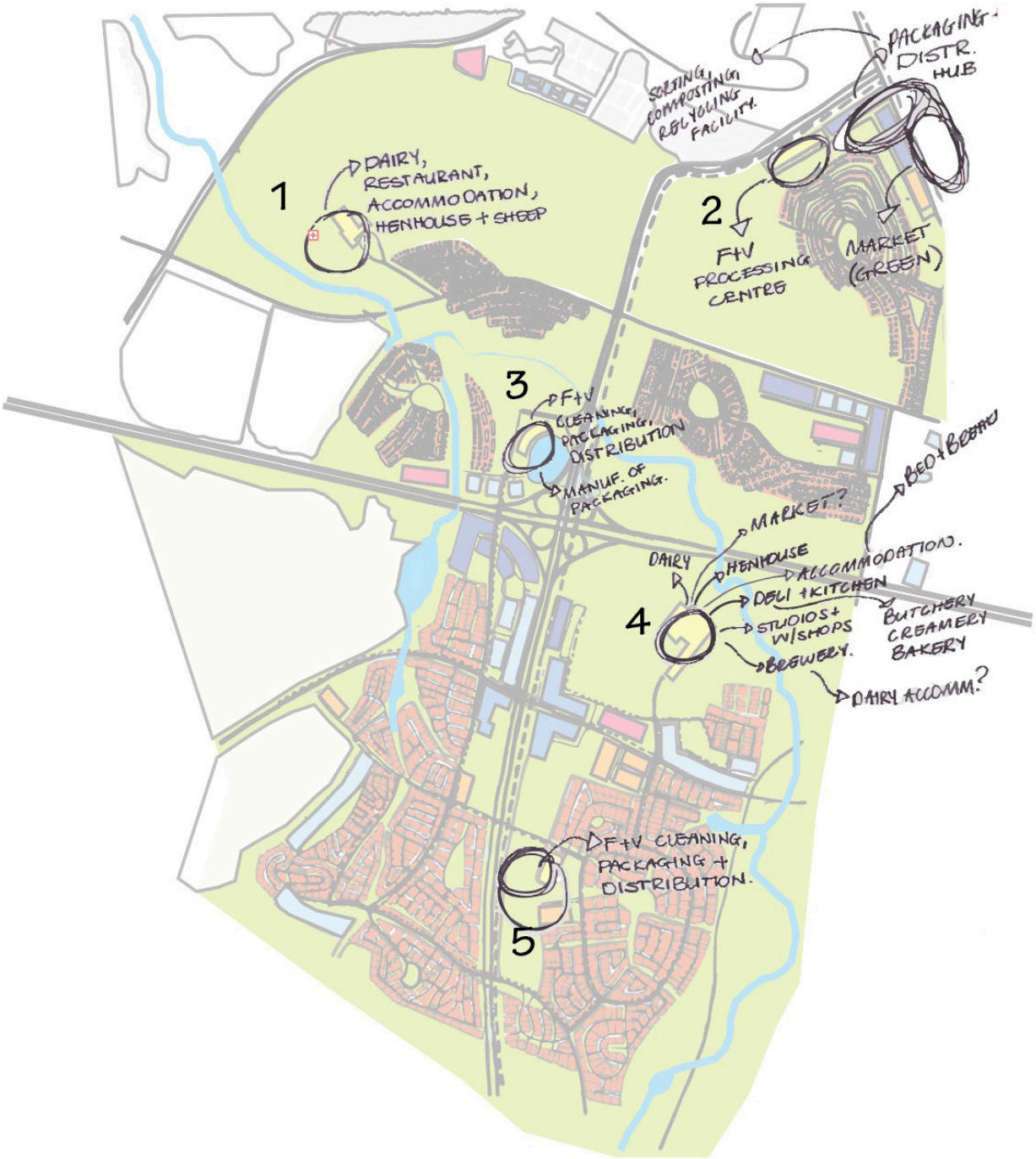
Node 1: Located at the Sammy Marks Homestead within the Zwartkoppies erf.

Node 2: Located at the main train station and vehicular intersection leading into Mamelodi, allowing easy access to rail and ensuring easy sharing and distribution of regional resources.

Node 3: Located alongside a small pocket of large scale productive land and community allotments.

Node 4: Located at the existing Hazeldean farm (selected site for the project design intervention)

Node 5: Located alongside central community allotments



1- DAIRY,
RESTAURANT,
GUEST HOUSING,
LIVESTOCK (SHEEP & CHICKENS),
FRUIT & VEG CLEANING &
DISTRIBUTION

2- FRUIT & VEG PROCESSING
CENTRE,
GREEN MARKET,
SORTING, COMPOSTING,
RECYCLING FACILITY,
PACKAGING MANUFACTURING &
DISTRIBUTION HUB

3 - FRUIT & VEG CLEANING,
PACKAGING & DISTRIBUTION,
MANUFACTURING OF
PACKAGING

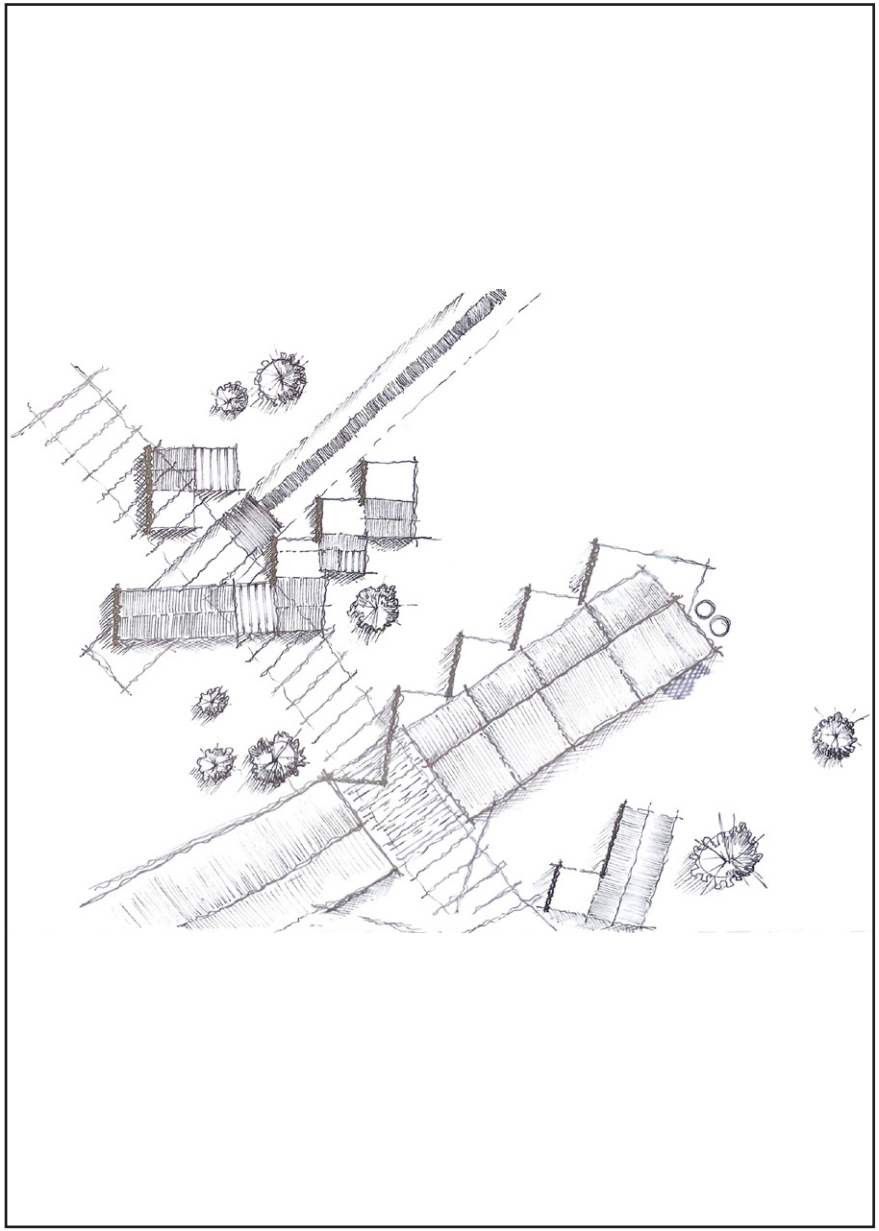
4 - DAIRY,
FRESH PRODUCE MARKET,
DELI, RESTAURANT &
KITCHENS,
BREWERY,
EVENTS VENUE

5 - FRUIT & VEG CLEANING,
PACKAGING & DISTRIBUTION,
ALLOTMEMENTS

Figure49: Distribution of Agricultural Hubs throughout Framework (Author 2020)

CHAPTER 03

BRIEF, PRECEDENTS & PROGRAMME DEVELOPMENT



Project Brief

Urban Brief

Zwartkoppies: There is an opportunity to investigate possible alternatives to the design and developmental typologies of todays urban development model by investigating the relationship between peri-urban agriculture and the urban environment; and the potential for the integration of the two as a sustainable development plan to mitigate urban sprawl and food insecurity, and aid in community self-reliance.

Such interventions should be funded by an initial government grant, whereafter the management would be overseen by a board / council (Hazeldean Community Council) made up of local investors, shareholders, government officials, individual community members, farmers and developers. Community Supported Agriculture would be utilised to undertake the financing of seasonal harvests as well as making use of co-operative economic principles and investment practices.

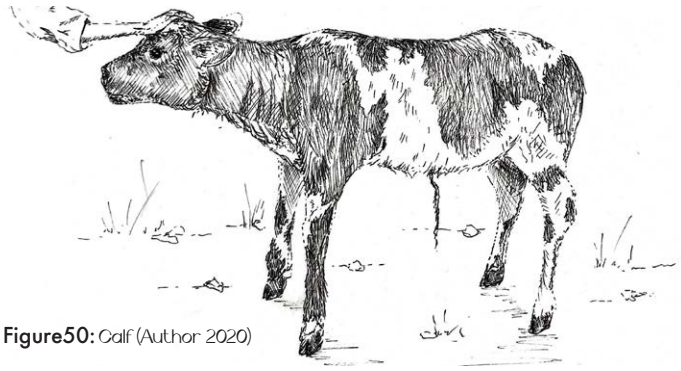


Figure50: Calf (Author 2020)

Precinct Brief

Hazeldean Development, Zwartkoppies and Mamelodi: Self-reliant communities allow for the stimulus of local economies, employment opportunity, and poverty alleviation; as well as encouraging the sustainable use of natural resources, energy harvesting and generation, and climate resilience.

In order to ensure food sovereignty and environmental sustainability, society needs to move away from purely industrial agriculture and reintroduce it to communities, allowing people the opportunity to engage directly with healthy, nutritious, locally produced food.

The integration of peri-urban agriculture (addressing food security and employment opportunity) and urban development models (such as Continuous Productive Urban Landscapes and Garden City concept) was thus investigated, discussing further the socio-economic viability and benefit that an alternative integrated model such as this would offer communities, resulting in the creation of regenerative, self-reliant, mixed developments that challenge the current consumerist model.

Architectural Response - The Programme

The role of the Architect as a transdisciplinary facilitator and knowledge broker in the design, development and application of this alternative model is investigated in this dissertation in order to determine a possible way forward in achieving resilient and self-reliant communities through sustainable urban, environmental and spatial design.

It is important for architects to have an in-depth understanding of issues such as climate change, food systems and political and economic models. The necessity for research through practice and design, in order to generate the knowledge necessary to be more effective as a profession and more inclusive of the above mentioned factors, is a critical step forward in establishing the place of Architects in the future development of towns and cities (Samuel 2018).

If one considers the relationship between politics, economics and architecture at a local and national level, one can see the impact of top-down policies employing 'Starchitecture' in an effort to gain recognition and establish the global presence of a city. In contrast, and what is investigated in this dissertation, is the notion of bottom-up strategies, whereby architects and communities define new ways of practice as independent enablers (Odgers et al. 2015).

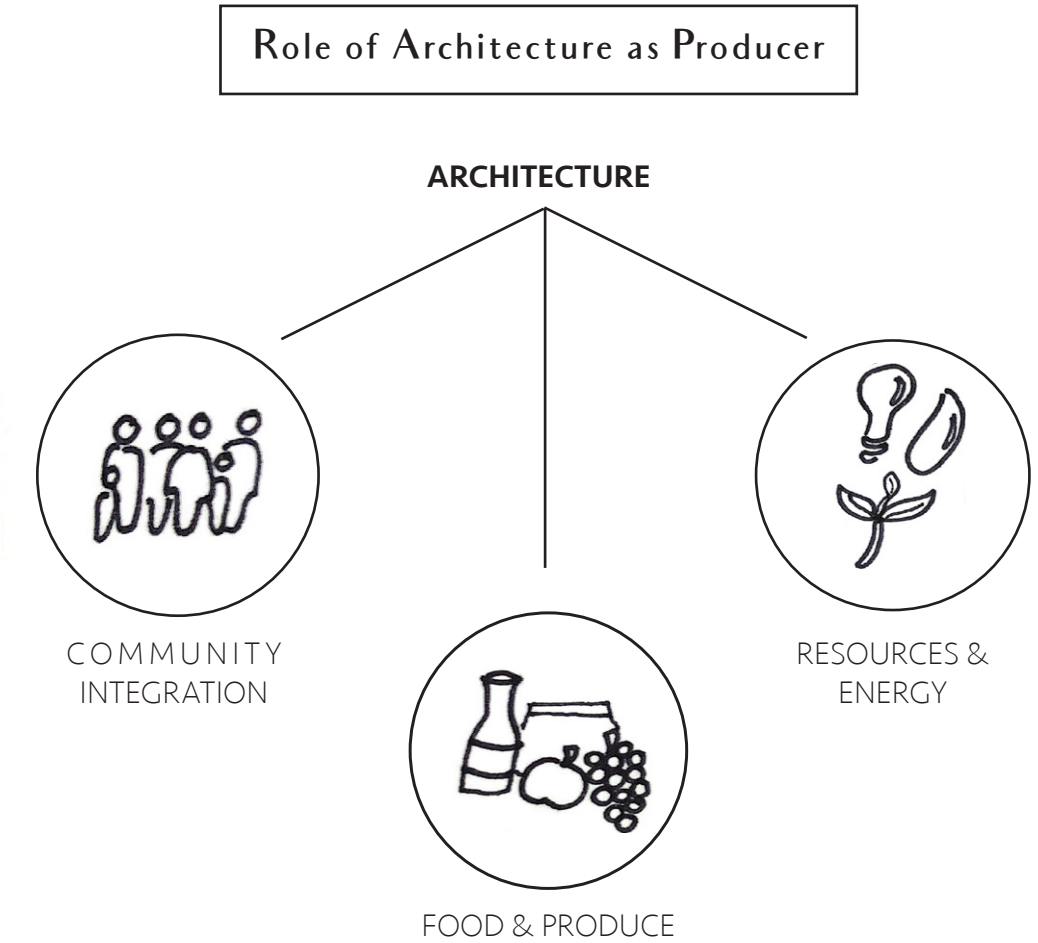


Figure51: Architectural Response (Author 2020)

Clientele

Macro Client:

- Tshwane Local Government; Department of Land Reform,
- Malleson Family and Hazeldean Valley Farms, and
- Hazeldean Community Council (made up of local investors, shareholders, government officials, individual community members, farmers and developers).

Meso Client:

- Clover Milkyway (Dairy)
- The Cow & Clover Precinct
- Fresh Produce Market, on-site Dairy & Deli (The Ayreshire)
- Agricultural Resource Hub (The Clover)

Micro Client:

- Surrounding communities and community members (Mamelodi and Pretoria east) - supporting the farm through community supported agriculture this provides the farm with the necessary financial support, undertaking an entire season of production and providing the security needed for potential crop failures and ensuring a guaranteed client base for the sale of fresh produce.
- Individuals from surrounding communities who are working on the farm and in the dairy, deli and market, as well as individuals that require resources for home crop production and training in this area.

Figure52: Clover Logo (Clover n.d)

Figure53: Hazeldean Valley Logo (Hazeldean Valley Farm n.d)

Figure54: The Cow and Clover Logo (Author 2020)

User Requirements

The framework developed in this proposal hopes to create facilities that will encourage organic human interaction between communities and industries; using agriculture as the medium of connection and integration. It also aims to introduce a social and cultural programme that incorporates food production and civic space as a shared focus for community life, educational experiences and land ownership.

The intervention provides a place to interact with the story of food 'from farm to fork' across all age groups, allowing for active and passive participation in the management and maintenance of the precinct. It provides a common place that services the need of the local communities through the provision of prepared and natural foods, access to seeds, soils and other productive resources, as well as access to equipment, machinery and training in the use of such equipment and the management of productive landscapes.

The intervention aids in the reconnecting of segregated communities through the revitalisation of degrading post-industrial spaces and the re-appropriation of land in an environmentally, economically and socially regenerative manner.

Figure55: Personas (Author 2020)

Overall Programme:

1. Food Sovereignty - a. producing, preparing, packaging, distribution of dairy products;
   b. agricultural resource hub
   c. dairy, deli and open air produce market

2. Skills Development and Training -
   a. dairy oriented
   b. agricultural (compost, crop management, maintenance and food production etc.)

3. Building as Systemic Solutions -
   a. dairy effluent and water treatment
   b. solar electricity generation
   c. biogas digester and composting facility

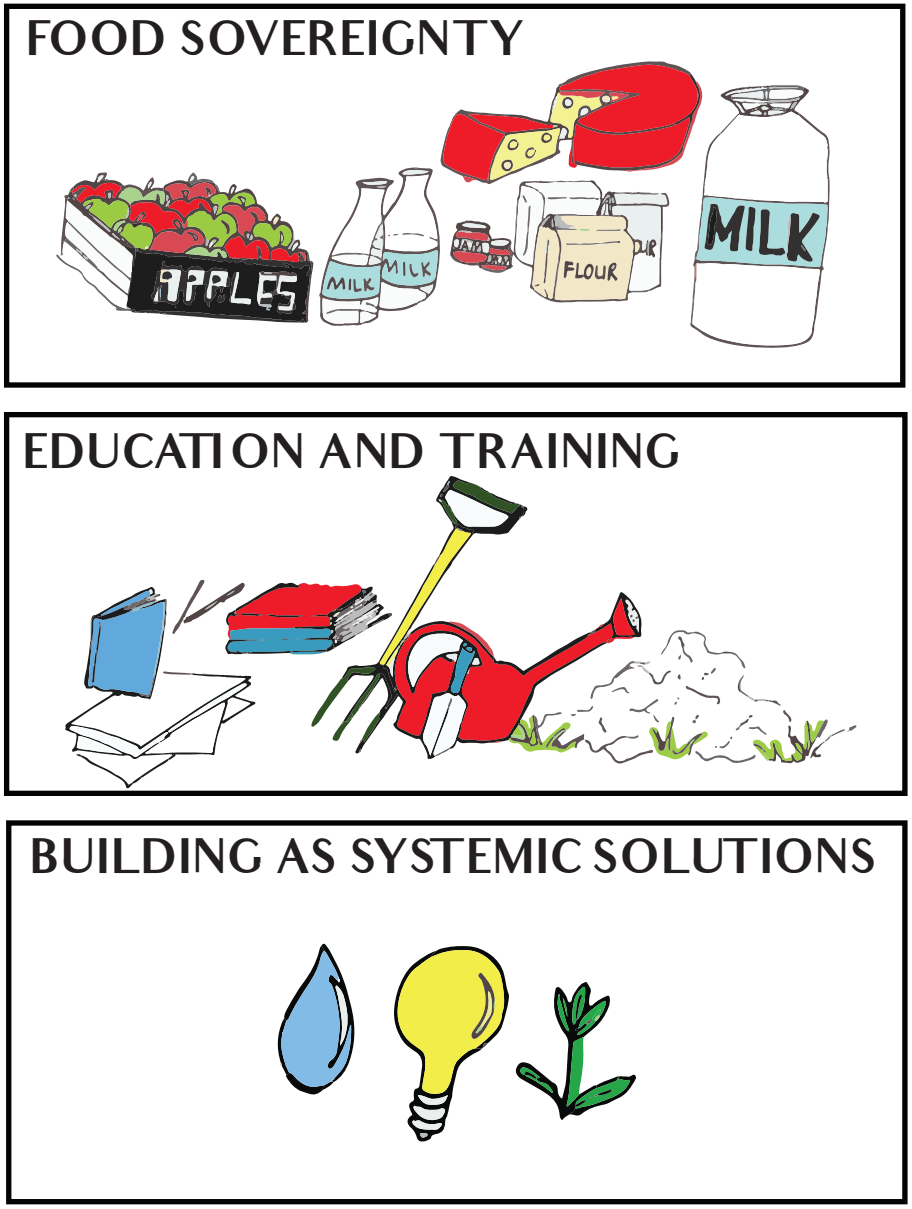


Figure56: Programmes (Author 2020)

Heirarchy of Programmes

THE COW & CLOVER

PRIMARY PROGRAMMES

THE CLOVER

AGRICULTURAL TRAINING & RESOURCE CENTRE

-ACCESS TO RESOURCES
-ACCESS TO TRAINING & SKILLS DEVELOPMENT
-IMMERSION IN AGRICULTURE & PRODUCTION
-FOOD SOVEREIGNTY

THE AYRSHIRE

DAIRY

-PERI-URBAN FARM
-MILKING PARLOUR & PRODUCTION FACILITY
-RELATIONSHIP BETWEEN URBAN & AGRICULTURE
-FOOD SOVEREIGNTY
-PAYS TRIBUTE TO HISTORY OF SITE & AGRICULTURE IN THE TRANSVAAL

DELI

-ACCESS TO FOOD
-TRANSPARENCY IN FOOD PRODUCTION PROCESS

SECONDARY PROGRAMME

WETLAND SYSTEM

-WATER HARVESTING, FILTERING & TREATMENT
-REDISTRIBUTION & RECYCLING AS IRRIGATION
-REINTRODUCTION TO PIENAAR'S RIVER SYSTEM

TERTIARY PROGRAMME

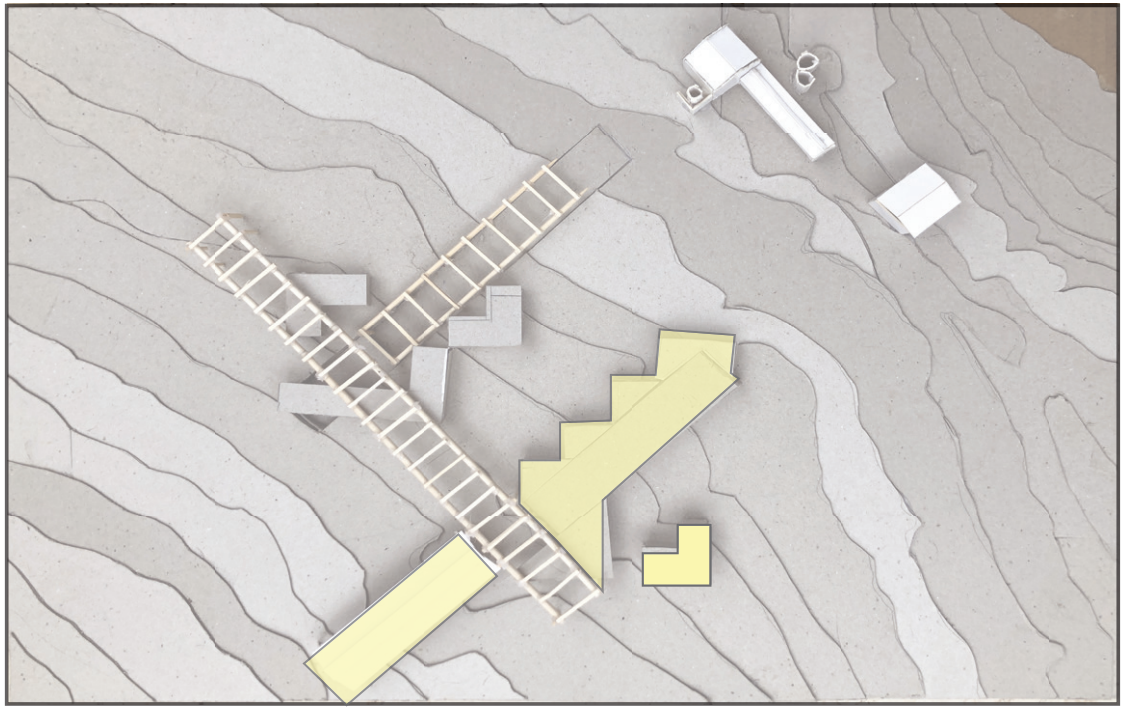
EVENTS VENUE & BREWERY

-RESTORATION & CELEBRATION OF HERITAGE
-PROGRAMME AS PROPOSED BY MALLESON FAMILY
-HAZELDEAN BREWERY (AS PROPOSED BY MALLESON FAMILY

Accommodation Schedule

The project aims to incorporate a spatial quality throughout the entire intervention that achieves the following:

- ***Waterproof Material***.....
- ***Durable Material***.....
- ***Fireproof Material***.....
- ***Safe working conditions***.....
- ***Easily Cleaned***.....
- ***Nonslip Flooring***.....



Dairy

	Spatial Requirements	Electricity	Controlled Water	Controlled Ventilation	Controlled Access	Public Visual Accessibility	Special Requirements
Holding Area	1,4 sqm / cow	✓	✓		✓	✓	Drainage; non-slip, sloped floor
Milking Parlour	12m x 18m	✓	✓		✓	✓	Drainage; non-slip, sheltered
Cooling Area	5000l capacity - 4900 (l) x 2730 (w) x 2370 (h)	✓			✓		Minimum 1 Story
Milk Standardisation	5000l capacity - 1500 (l) x 1200 (w) x 2000 (h)	✓	✓	✓	✓		As Above
Pasteurisation	5000l capacity - 1500 (l) x 1500 (w) x 2000 (h)	✓	✓	✓	✓		As Above
Homogenisation	5000l capacity - 1380 (l) x 1020 (w) x 1220 (h)	✓	✓	✓	✓		As Above
Deoderisation	5000l capacity - 550 (l) x 400 (w) x 850 (h)	✓	✓	✓	✓		As Above
Milk Storage	5000l capacity - 3214 (l) x 2500 (w) x 1980 (h)	✓	✓	✓	✓		As Above
Bottling & Packaging	minimum 270 sqm	✓	✓	✓	✓		As Above

Cheesery

	Spatial Requirements	Electricity	Controlled Water	Controlled Ventilation	Controlled Access	Public Visual Accessibility	Special Requirements
Milk Cooling	600l capacity 920(l) x 1000(w) x 2400(h)	✓	✓	✓	✓	✓	Minimum 1 Story
Cheese Room	minimum 4,8m x 6m	✓	✓	✓	✓		As Above
Whey Drainage	9754(l) x 2032(w) x 1930(h)	✓		✓	✓		As Above
Maturation Room	minimum 5,4m x 6m	✓		✓	✓	✓	As Above
Storage & Ageing	minimum 3m x 4,2m	✓		✓	✓	✓	As Above; can be below ground
Packaging	minimum 6sqm	✓			✓		As Above

Creamery

	Spatial Requirements	Electricity	Controlled Water	Controlled Ventilation	Controlled Access	Public Visual Accessibility	Special Requirements
Working Room	100 - 500l capacity minimum 48sqm	✓	✓	✓	✓	✓	Minimum 1 Story
Packaging	minimum 6sqm	✓		✓	✓		As Above
Storage & Distribution	minimum 6sqm	✓		✓	✓		As Above

Yoghurt

	Spatial Requirements	Electricity	Controlled Water	Controlled Ventilation	Controlled Access	Public Visual Accessibility	Special Requirements
Gel Holding	1000l capacity (fermenter) 1060(l) x 1220(w) x 2700(h)	✓		✓	✓		Minimum 1 Story
Milk Cooling	1000l capacity yoghurt cooler 1800(l) x 1200(w) x 1500(h)	✓		✓	✓		As Above
Flavouring	minimum 3sqm	✓		✓	✓		As Above
Packaging	1000l capacity machine 1250(l) x 820(w) x 2500(h)	✓			✓		As Above

Butchery

	Spatial Requirements	Electricity	Controlled Water	Controlled Ventilation	Controlled Access	Public Visual Accessibility	Special Requirements
Cold / Wet Age-ing Room	4200(l) x 3300(w) x 2400(h)	✓		✓	✓		Minimum 1 Story
Dry Ageing Room	4200(l) x 3000 (w) x 2400 (h)	✓		✓	✓	✓	As Above
Cold Storage	4500(l) x 3900(w) x 2400(h)	✓		✓	✓		As Above
Preparation & Display	6000(l) x 3900(w) x 2400(h)	✓	✓	✓	✓	✓	As Above

Bakery

	Spatial Requirements	Electricity	Controlled Water	Controlled Ventilation	Controlled Access	Public Visual Accessibility	Special Requirements
Preparation Area	minimum 3m x 4,8m	✓	✓	✓	✓	✓	Minimum 1 Story
Resting Area	minimum 2,1m x 3,6m			✓	✓		As Above
Cooling Area	minimum 2,1m x 4,2m			✓	✓		As Above
Storage & Display	minimum 3m x 4,8m	✓		✓	✓	✓	As Above

Produce Market

	Spatial Requirements	Electricity	Controlled Water	Controlled Ventilation	Controlled Access	Public Visual Accessibility	Special Requirements
Cold Storage & Display	6000(l) x 3900(w) x 2400(h)	✓		✓		✓	Minimum 1 Story
Dry Storage & Display	6000(l) x 3900(w) x 2400(h)			✓		✓	As Above

CHEESERY
BUTCHERY
BAKERY

Functional Precedents

Irene Dairy Farm
Irene, Centurion, South Africa

The Irene Dairy has been a cornerstone in the development of the Irene area since its construction in the late 1890's. Since then, the area has grown with housing developments surrounding the dairy and golf course, with the Irene Village in particular remaining a tight-knit community over the course of generations. The dairy is home to approximately 240 milking cows, with several calves and bullocks on the property.

The dairy itself is largely supported by the surrounding communities as well as by surrounding hotels and institutions, ensuring a guaranteed customer base. The farm also hosts a 'Barn' tea garden, a deli, and a restaurant, all of which make use of the dairy products produced on site. The deli is a central platform that is used to sell food products made by local community members, emphasising the importance of cross-cultural interaction and providing support for local small scale farmers.

The public realm is fully integrated into the working farm, allowing people the opportunity to witness the day-to-day operations that occur on site. When the cows are brought to the dairy for milking, they are ushered through the yard filled with visitors and the crowds of people disperse to make room for the animals to pass calmly. The public is also able to view the milking process through the gallery in the milking parlour. The role of water is celebrated on the farm by making visible the processes and movement of water throughout the site through the use of channels, streams, slurry ponds, irrigation ponds, fountains and drinking troughs (Irene Farm 2017).

Figure57: Milking Parlour (Author 2020)

Figure58: Water Channel (Author 2020)

Figure59: Cows at Water Channel (Author 2020)

MOYO Urban Farm & Restaurant
Tsai Design Studio; Cape Town, South Africa

The project seeks to embody the link between modern architecture and sustainable urban farming. It draws inspiration from the traditional African souk, a bustling open air market space, and introduces patrons and pedestrians to the story of food and sustainable technologies, from growth to waste management. The project focused on three main elements of activity and interest: the market arcade, the market stalls, and urban farming with sustainable technologies. The market stalls are aimed at supporting local small scale food traders who specialise in traditional South African cuisine, adding another level of gastronomy to the restaurants location.

The market arcade is the main movement and habitable zone, and was influenced by the souk. It is shaded by a number of solar panels that form the arcades semi-permeable roof, and these panels provide power to the market stalls during the day. The market stalls are clustered in intimate rows that resemble the 'streets' of the souk, and are made of interlocking insulation and timber panels. They are temporary prefabricated units that can be recycled or relocated off site.

The aquaponic farm makes use of recycled PVC pipes to house the produce whilst large tanks hold a number of fish that are necessary to provide nutrients for these aquaponic systems, whilst also providing fish to the the restaurant (Tsai Design Studio 2014).

Figure60: Moyo Urban Farm (Tsai Design Studio 2014)

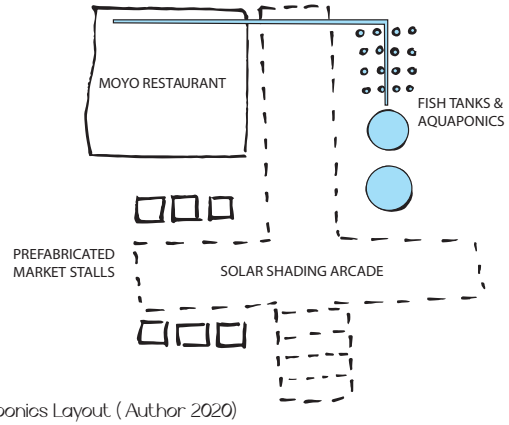


Figure61 : Hydroponics Layout (Author 2020)

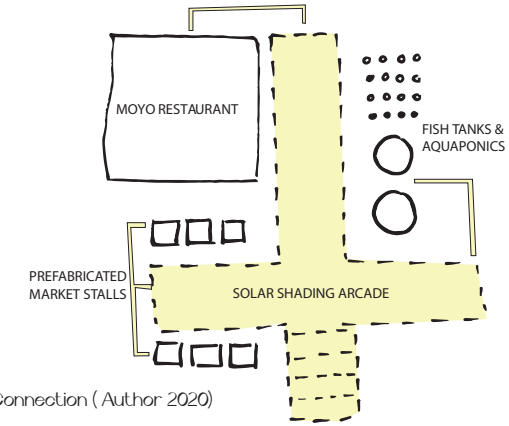
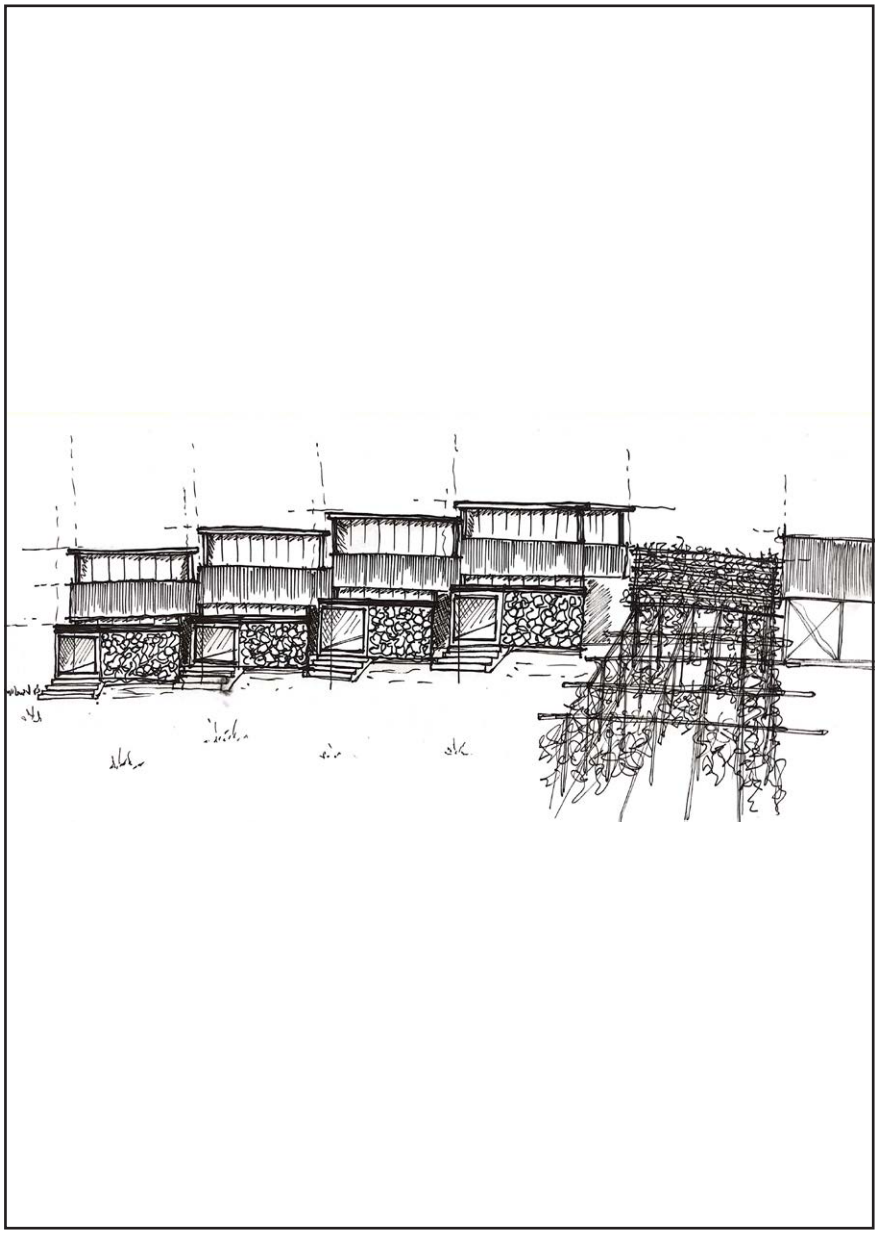


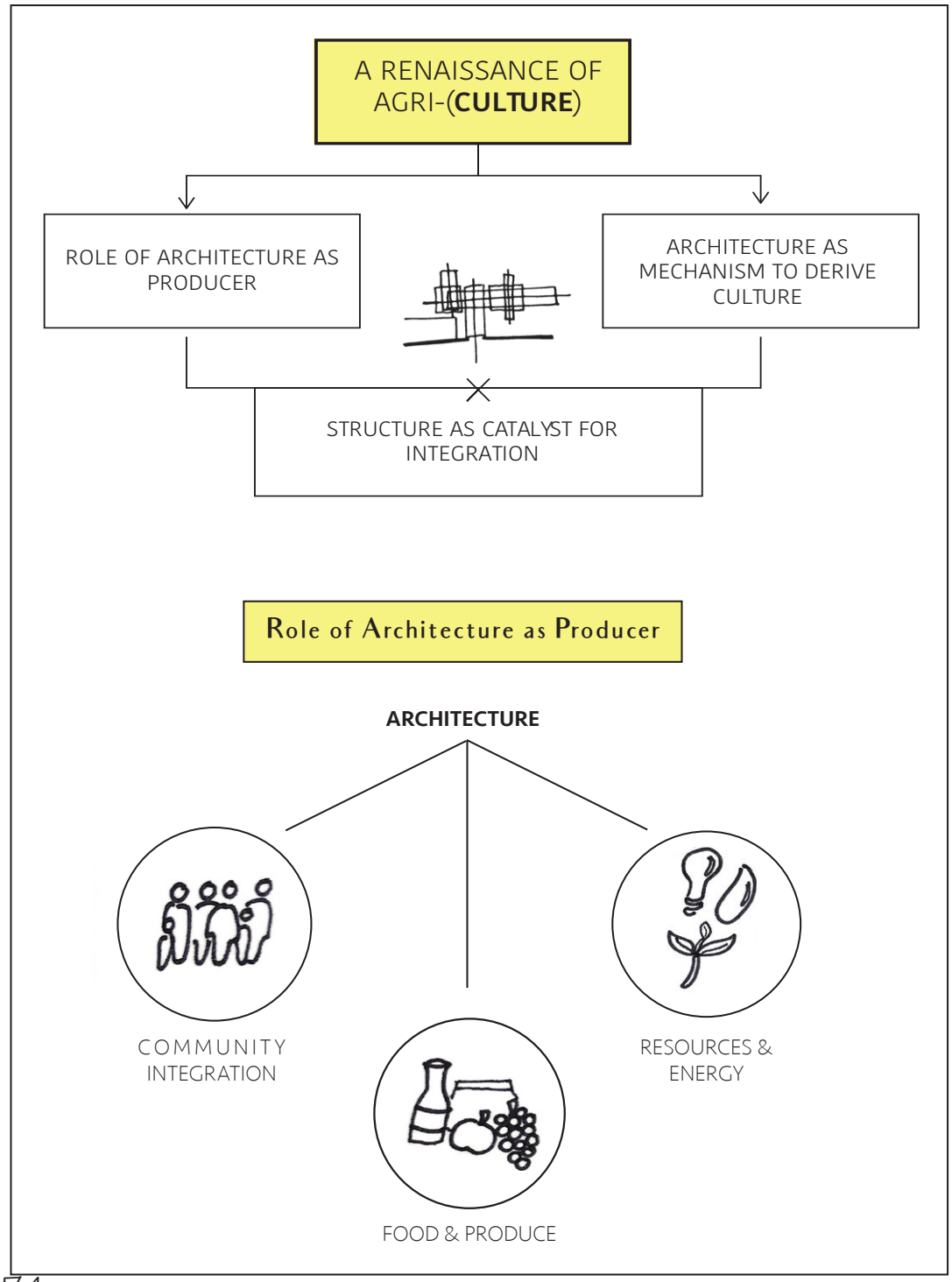
Figure62: Solar Connection (Author 2020)



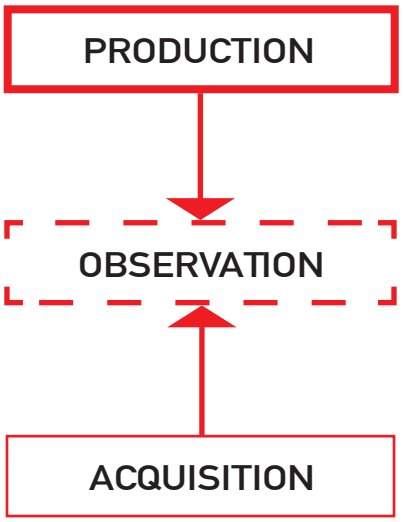
CHAPTER 04

CONCEPT & DESIGN DEVELOPMENT

01 Conceptual Investigation



The concept is that of the revival of Agriculture through the investigation of Architecture as Producer, and as a mechanism to derive culture, using the structure as a catalyst for the integration of people and agriculture.



Acquisition / Consumption Zones are largely enclosed, making use of more stereotomic construction and materials, whilst Productive Zones are tectonic. Observation Zones are lightweight and permeable in terms of construction and materials too.

Conceptual Precedents

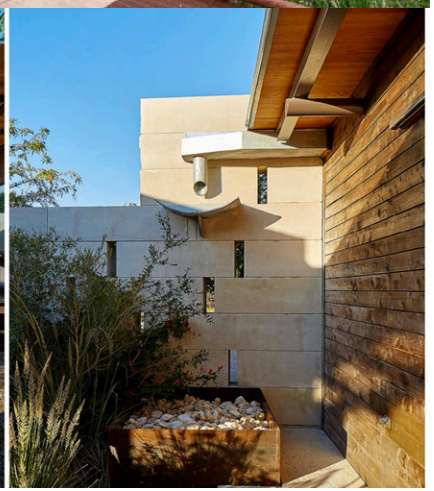
Victoria Yards
Johannesburg, South Africa

Victoria Yards is a post industrial site that has been reclaimed by local creatives with the intention of creating a space for likeminded individuals and a community driven context that will redefine the Johannesburg urban environment. The intervention is focused largely on visual arts and artisanal studios, providing opportunity for skills development and training that will aid in entrepreneurial activity, and it also makes use of productive urban landscaping that provides food for the immediate community.

In order to achieve long term sustainability goals, the intervention focused on the necessity for cultural and behavioural change alongside environmental and infrastructural regeneration. This has been done through the development of a community of likeminded people with a focus on maximising local skills and resources, and the maintenance of the built infrastructure by the community members themselves. The intervention offers the opportunity for organic human interaction across age groups and cultures.

The food gardens that are located on site are tended to by the grounds staff. The produce feeds the residents and staff, whilst all excess produce is sold at the local market, the profits of which are taken by the staff themselves (Victoria Yards 2019).

Figure63: Victoria Yards Garden (Victoria Yards 2018)
Figure64: Victoria Yards Walkways (Victoria Yards 2018)
Figure65: Victoria Yards Produce (Victoria Yards 2018)



Phil Hardberger Park Urban Ecology Center
Lake Flato; San Antonio, Texas, USA

The centre is LEED gold certified and is a model for environmental stewardship through its use of sustainably sourced materials (such as limestone from the park itself) and rainwater harvesting systems. The goal is to educate users on the interactions between, plants, animals and humans in an urban environment. The site also houses a wetland rehabilitation project that harvests the stormwater from neighbouring developments and treating this naturally before it enters back into the natural water system.

The project makes use of solar panels to power the facility and three average sized homes, a bioswale and underground water storage systems, permeable parking and vegetation that is drought resistant, therefore requiring no potable water for irrigation. The project highlights the integration of architecture and landscape through its use of materials found on site, incorporating and celebrating water and water systems throughout the site, and utilising a lightweight rod canopy. The building is elevated slightly from the ground plane, achieving a delicate connection between earth and building. (Phil Hardberger Park Conservancy 2013.)

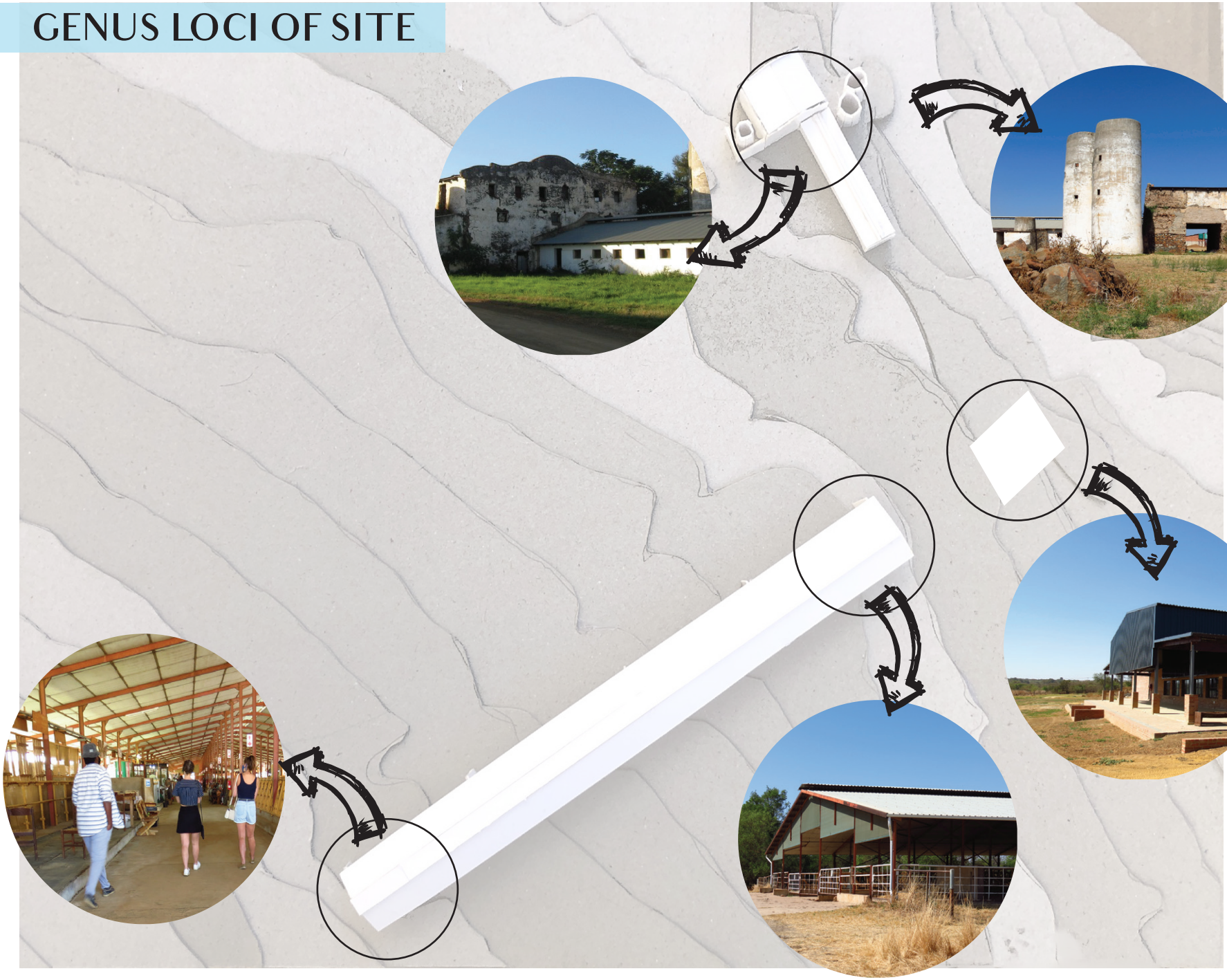
Figure66: Hardberger Park Conference Centre (Lake Flato 2013)

Figure67: Hardberger Park Entry Way (Lake Flato 2013)

Figure68: Hardberger Park Water Feature (Lake Flato 2013)

Figure69: Hardberger Park Roof Drainage (Lake Flato 2013)

GENUS LOCI OF SITE



DESIGN PHILOSOPHY

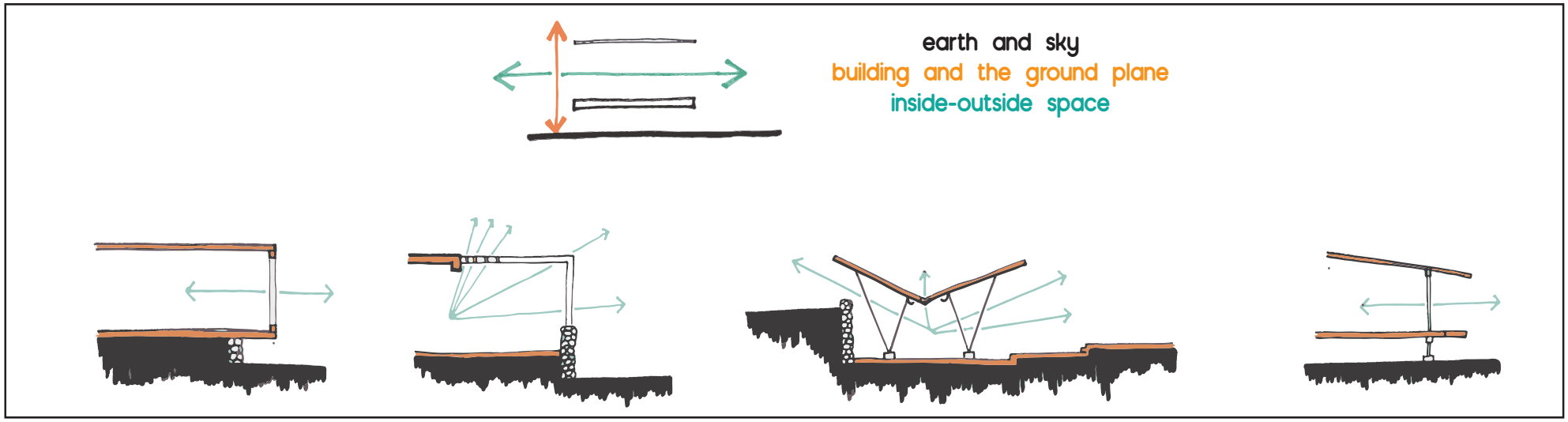
The main design philosophy behind the project is that of connecting the consumer to the farmer / producer and exposing the story of food to the every day consumer.

This is achieved through the implementation of the arcitectural principles of **transparency**, **layering** and **filtering**; maintaining the integrity of the site and existing buildings, using the intervention as a filter and introducing new layers to the existing structure as necessary.

These architectural principles also aid in highlighting:

-Public to Private
-Thresholds
-Height
-Light
-Building as Memory

Figure70: Design Philosophy (Author 2020)



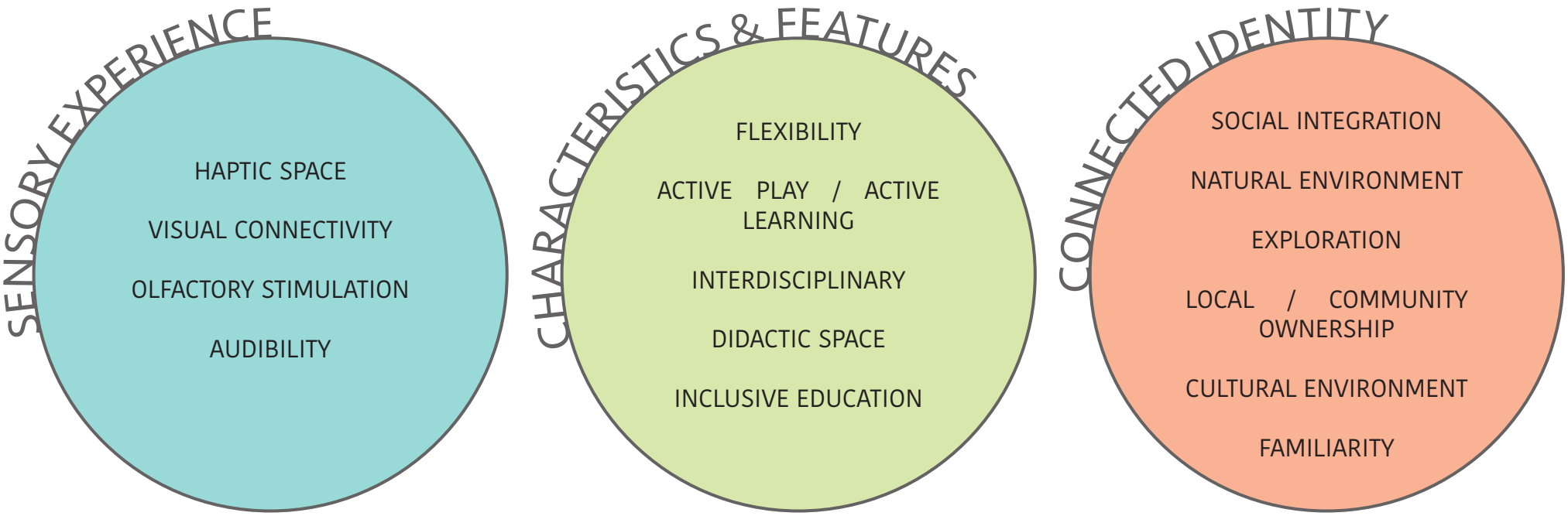
The proposal intends to highlight and celabrate the relationship between man/ society and agriculture/ the environment through the exposure of systems, processes and sustainable technology.

The relationship between earth and sky is crucial in an agricultural environment due to the reliance upon the atmosphere for rain and the earth for ffertile soil. The resultant relationship between the building and the ground plane is thus investigated through the connection of inside-outside space and the connection of both the built structure and, as a result of this, the user, to the earth.

Vistas are highlighted throughout the intervention, focusing on views of productive landscapes, livestock, water collected on site and the original barn structure built by the Malleson family in the 1940's. The framework structure and stripped portal frames are open air and as such create spaces that are largely exposed to the elements.

The building's connection to the ground is investigated through the action of raising, submerging, elevating and placing the buildings on site according to the slope. This highlights the ability for the building to blend into the landscape of the region in terms of its environmental and social sustainability aspects. The buildings connection to the environment is thus highlighted to the user, and is achieved through the maximising of natural light, ventilation and physical immersion in the immediate environment.

DESIGN PRINCIPLES



The design of intervention (titled *The Cow & Clover*) aims to achieve three core principles: an integrative sensory experience, a clear and unique atmosphere associated with the space and an improved connected identity for all users.

The design aims to provide stimulation of the mind and senses, generating interest and encouraging an active engagement with ones physical environment. The use of materials and flexible spaces that are both physically and mentally stimulating is a biproduct of these intentions and result in the creation of an active learning environment.

02 Design Development

Plan Development

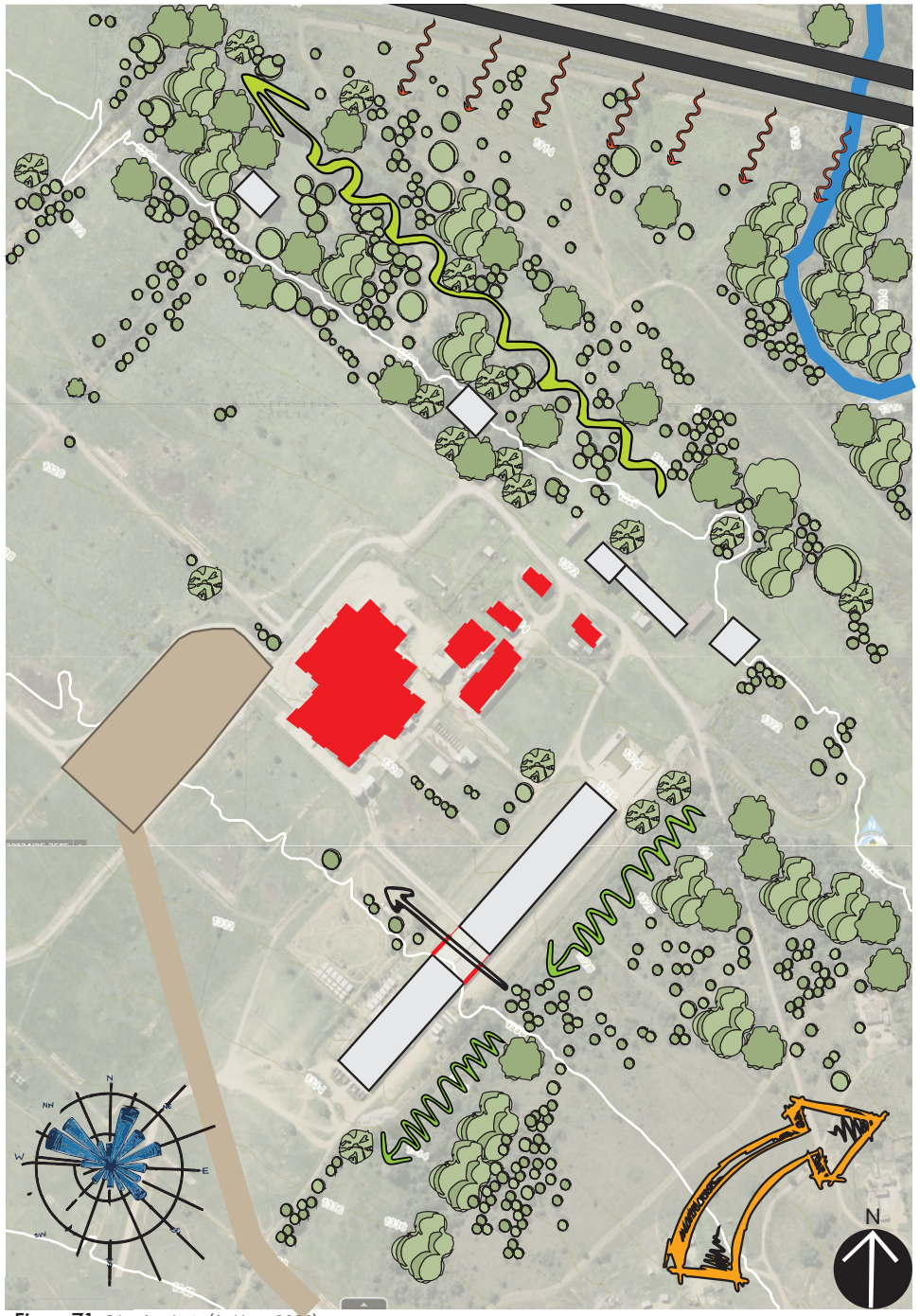


Figure71: Site Analysis (Author 2020)

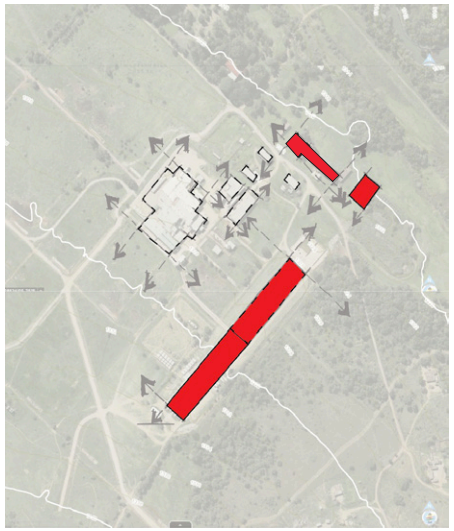


Figure72: Elements to Retain (Author 2020)

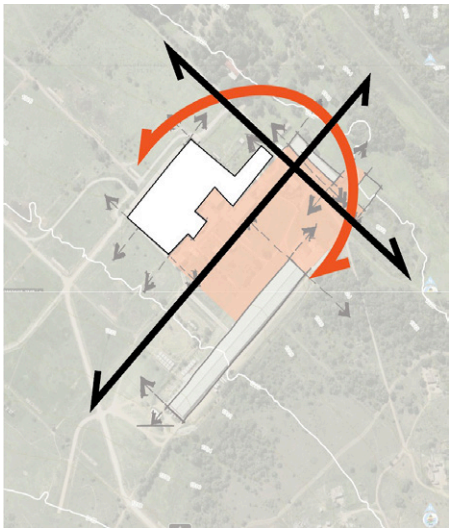
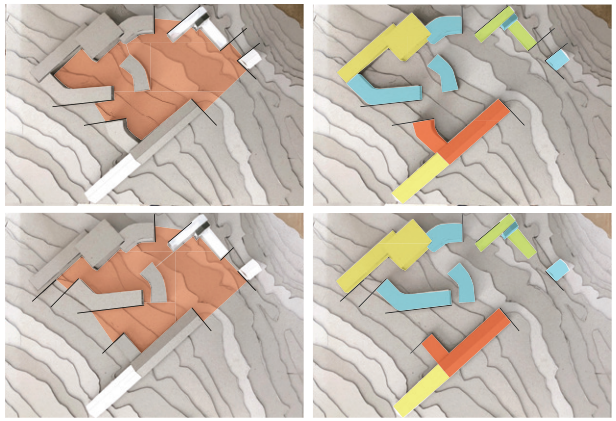


Figure73: Demolished Elements and Resultant Open Space (Author 2020)

The proposal seeks to demolish the existing dairy and farm storage buildings and retain the existing cowhouse structure, new brewery and original barn building.

ITERATIONS AND EXPLORATIONS

Iteration 1



The first iteration explored the incorporation of the cowhouse structure and the redesign of the heritage structure (barn) into the programme.

The relationship between productive zones and retail / consumption was investigated through their proximity and the resulting movement of users throughout the site.

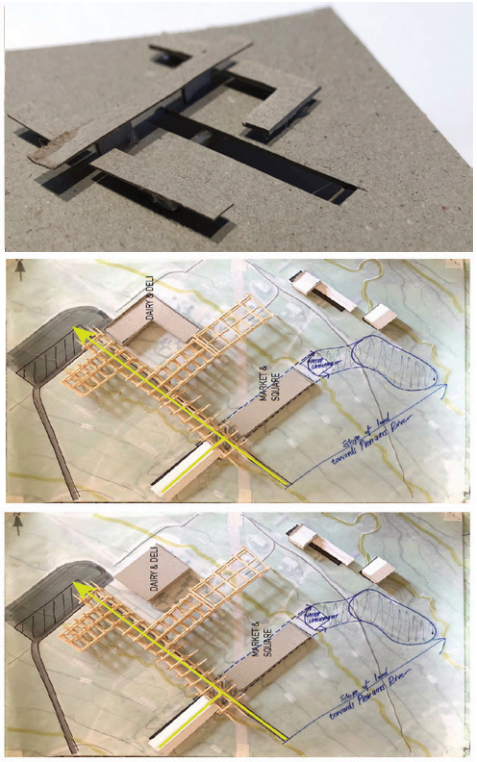
The new buildings were treated as semi-organic (to contrast with the old) and were used on the site as space-making elements to inform the public square.

Iteration 2

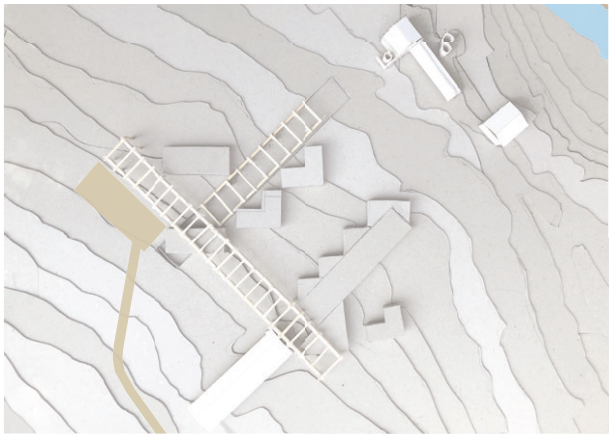
Iteration 2 investigated the separation of the heritage from the project programme and only retained use of the cowhouse structure.

The importance of levels on site were investigated through the submerging and raising of various aspects of the built structure.

The introduction of a framework component that acts as a connective thoroughfare across the site created the opportunity to investigate the use of the structure as a place for active play and learning on site.



Iteration 3

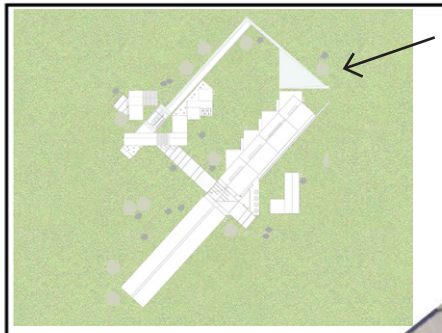


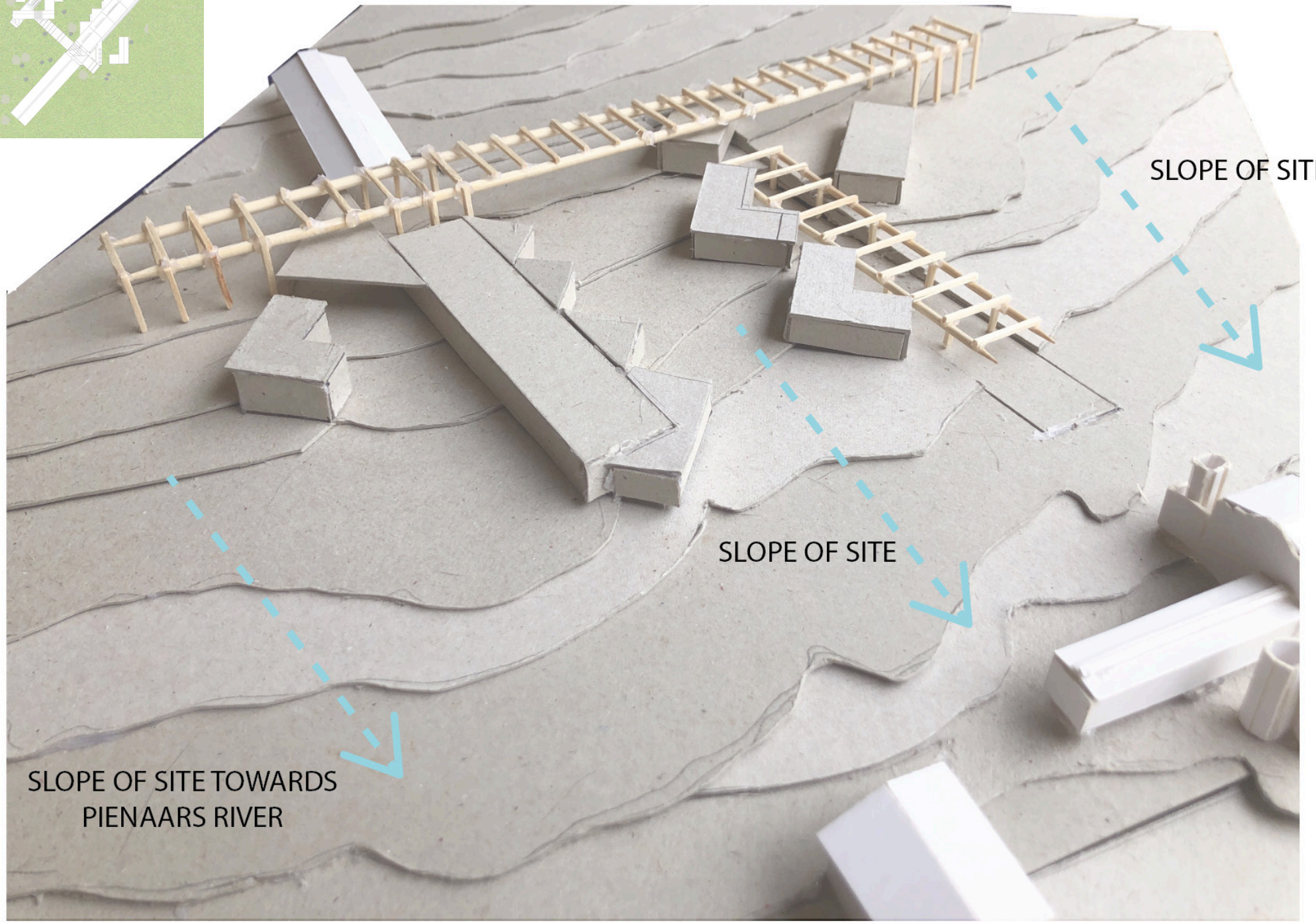
The third iteration retains the framework structure and begins to refine the spatial integrity of the site.

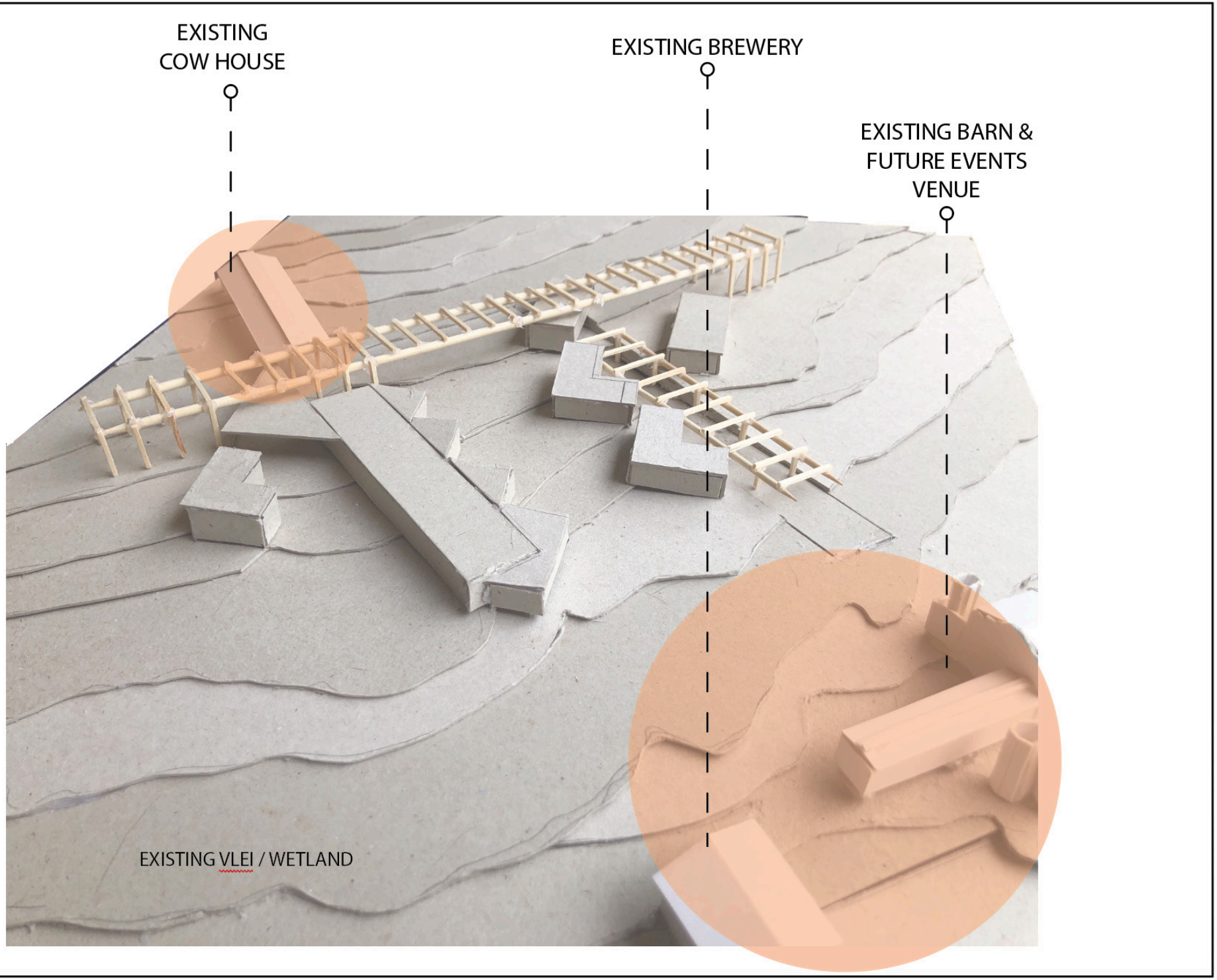
The cowhouse structure was split into two halves, retaining the one half in its original state and restoring its programme to the housing of dairy cattle on site, whilst the other half becomes the new dairy / productive facility.

The orientation of the spaces was investigated through the rotation of pop-out spaces at 45 degrees to the existing line of the building, allowing the blocks to access direct solar gains into the space from the North, as well as highlighting the view of the public / market square and the original Hazeldean Valley barn.

Site
1 : 500



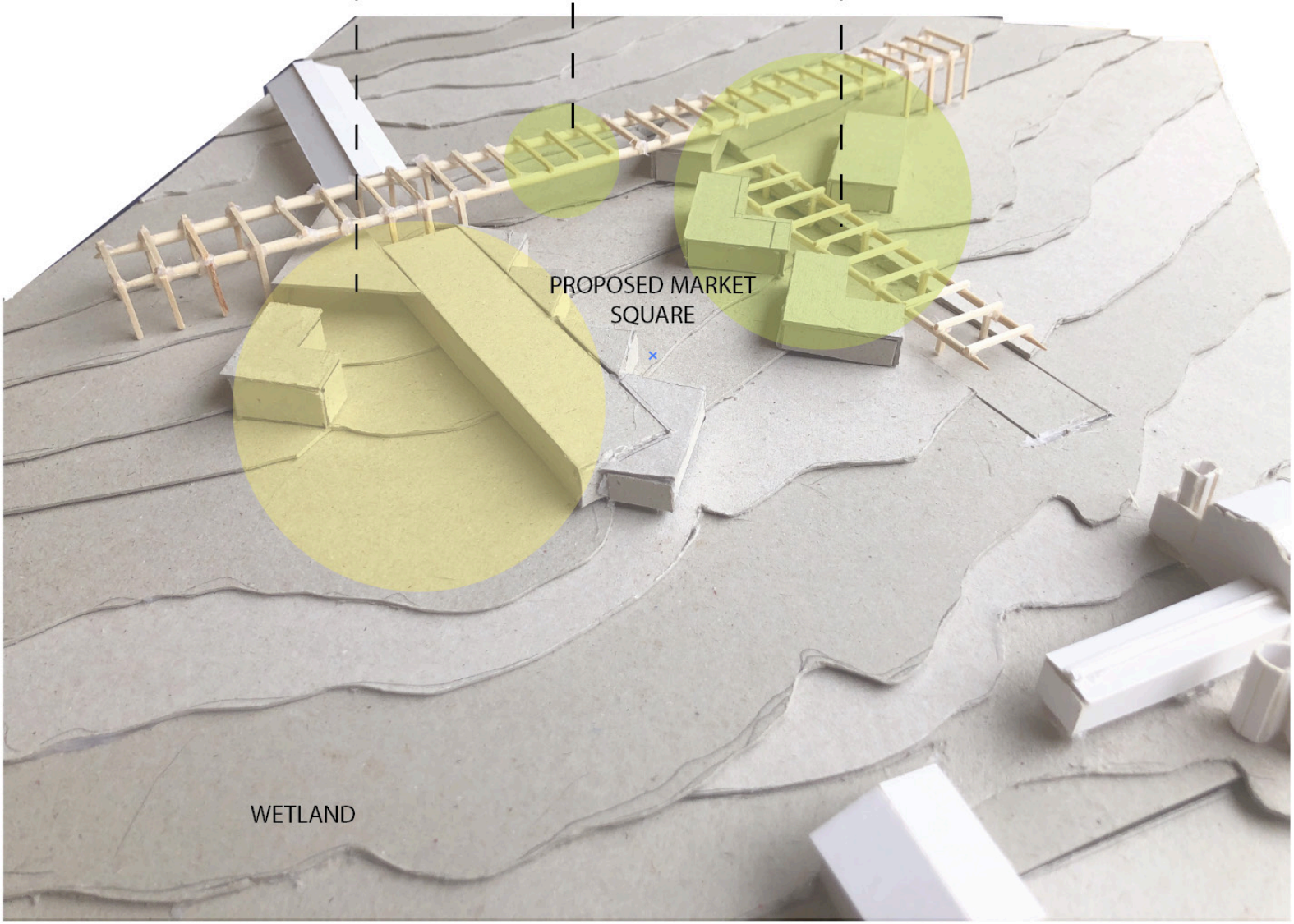

SLOPE OF SITE
SLOPE OF SITE
SLOPE OF SITE TOWARDS
PIENAARS RIVER

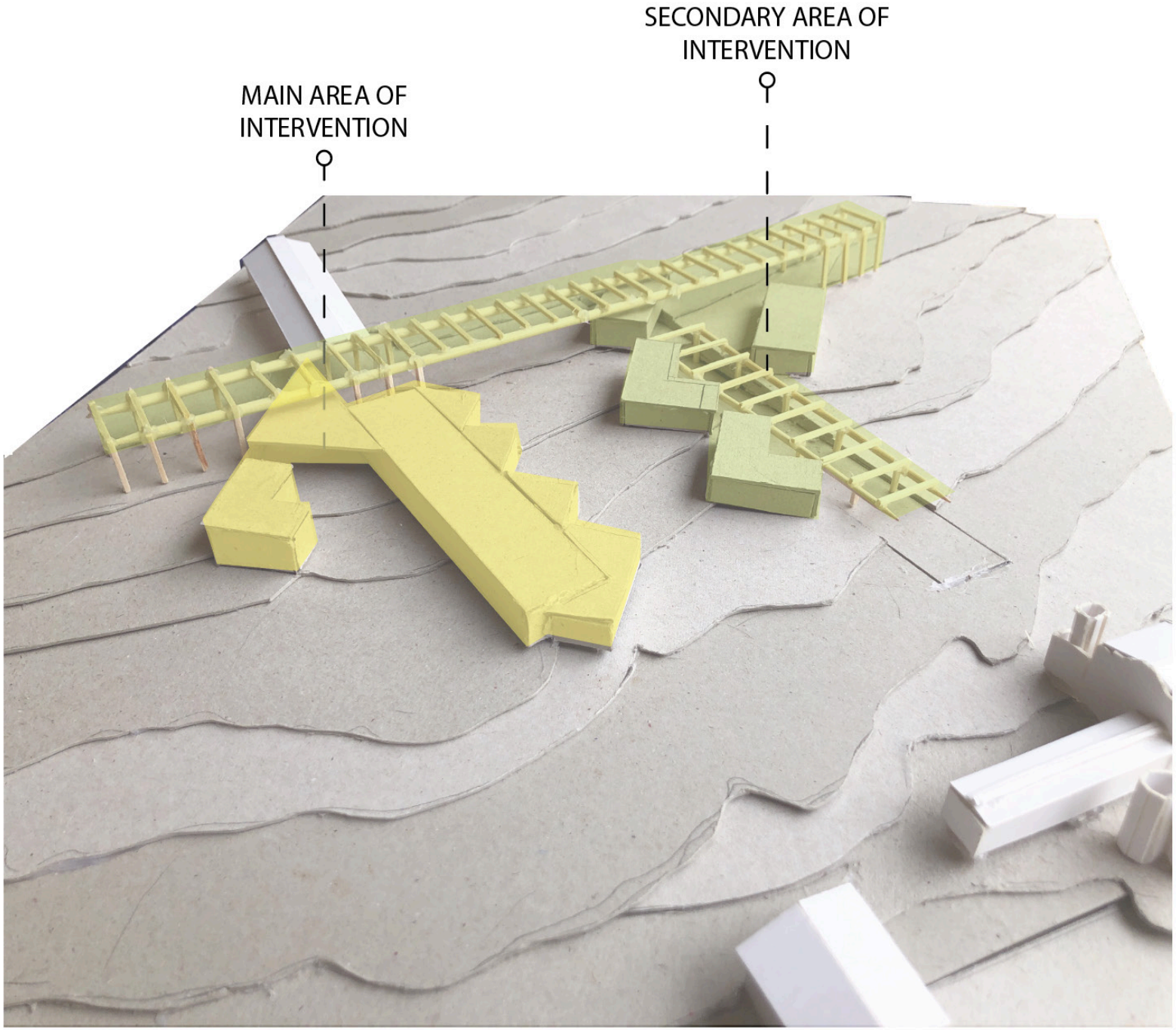

EXISTING
COW HOUSE
EXISTING BREWERY
EXISTING BARN &
FUTURE EVENTS
VENUE
EXISTING VLEI / WETLAND

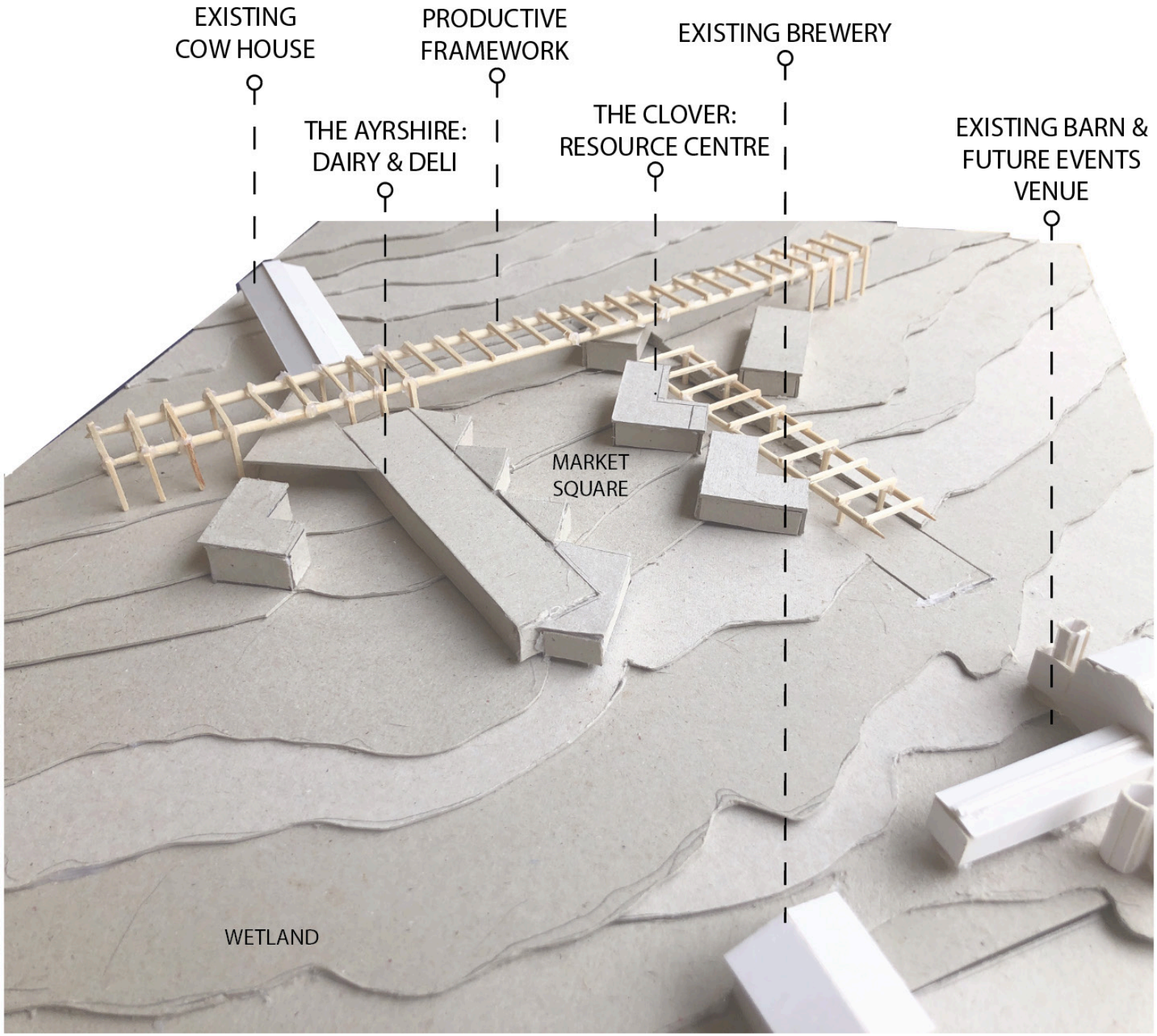
PROPOSED-
PRODUCTIVE FRAMEWORK

PROPOSED- THE AYRSHIRE:
DAIRY & DELI

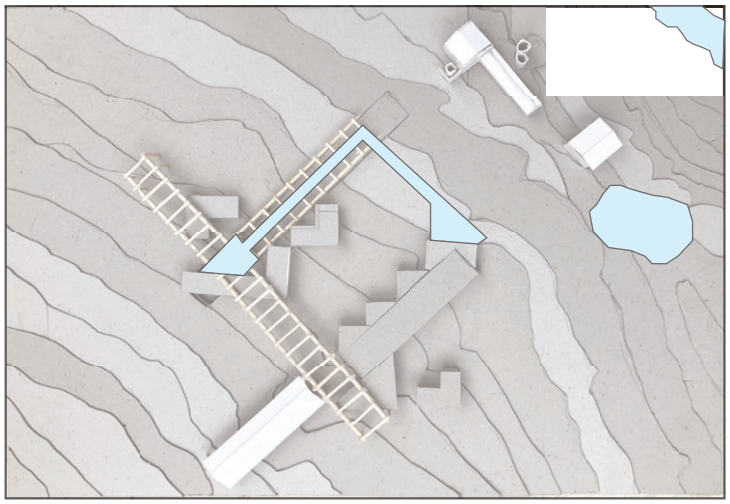
PROPOSED- THE CLOVER:
RESOURCE CENTRE



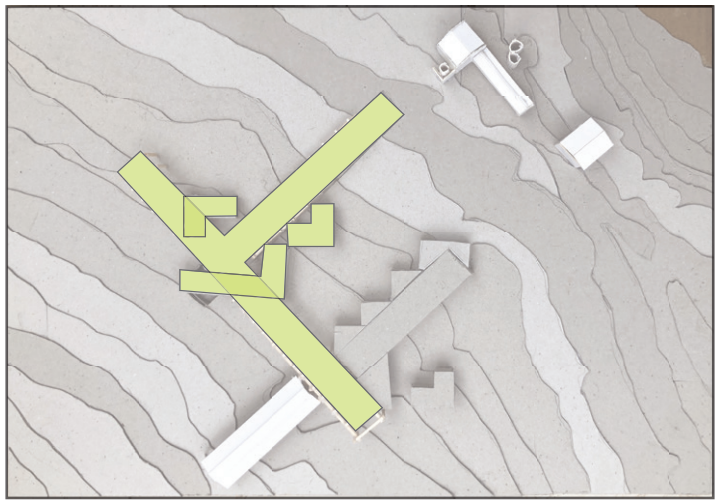

SECONDARY AREA OF
INTERVENTION
MAIN AREA OF
INTERVENTION


EXISTING COW HOUSE
PRODUCTIVE FRAMEWORK
EXISTING BREWERY
THE AYRSHIRE: DAIRY & DELI
THE CLOVER: RESOURCE CENTRE
EXISTING BARN & FUTURE EVENTS VENUE
MARKET SQUARE
WETLAND

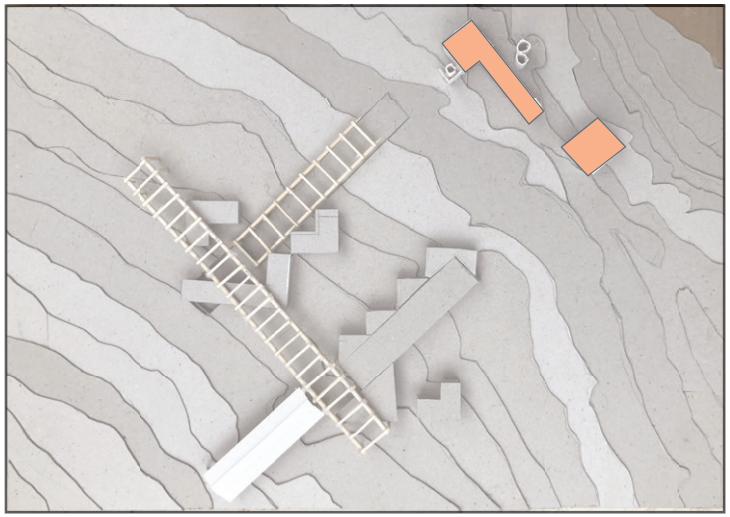
FINAL SITE LAYOUT



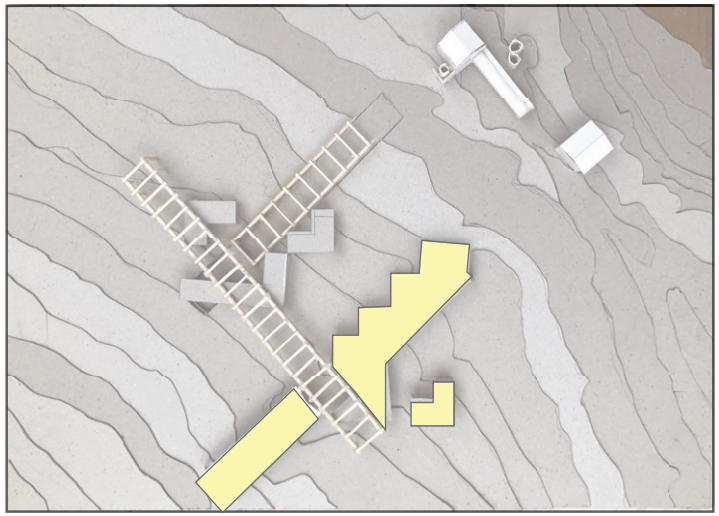
ARTIFICIAL WETLAND &
WATER WAYS



'THE CLOVER' RESOURCE
CENTRE & FRAMEWORK

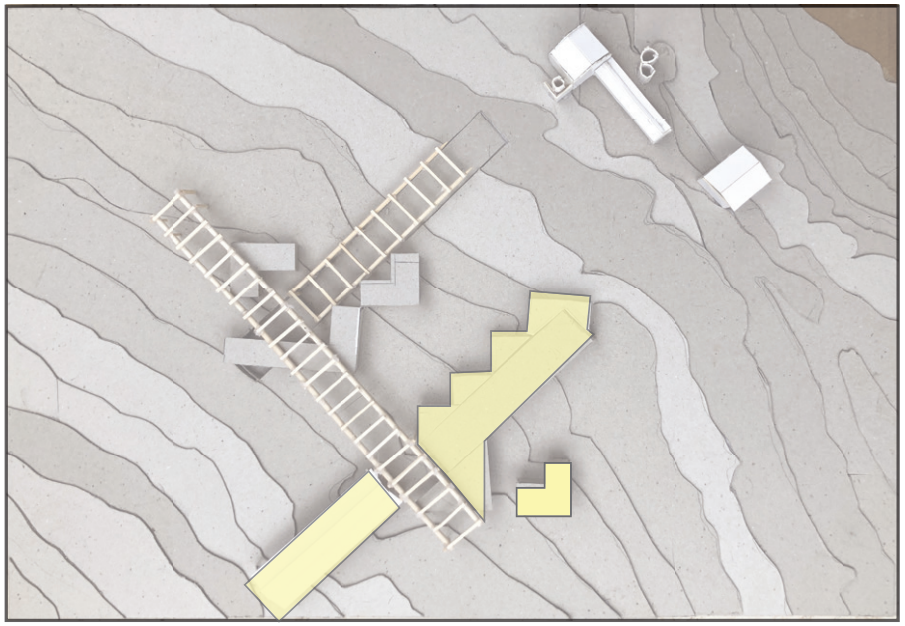


HAZELDEAN VALLEY BARN
EVENTS VENUE & BREWERY



'THE AYRSHIRE'
COWHOUSE, DAIRY & DELI

DAIRY & DELI

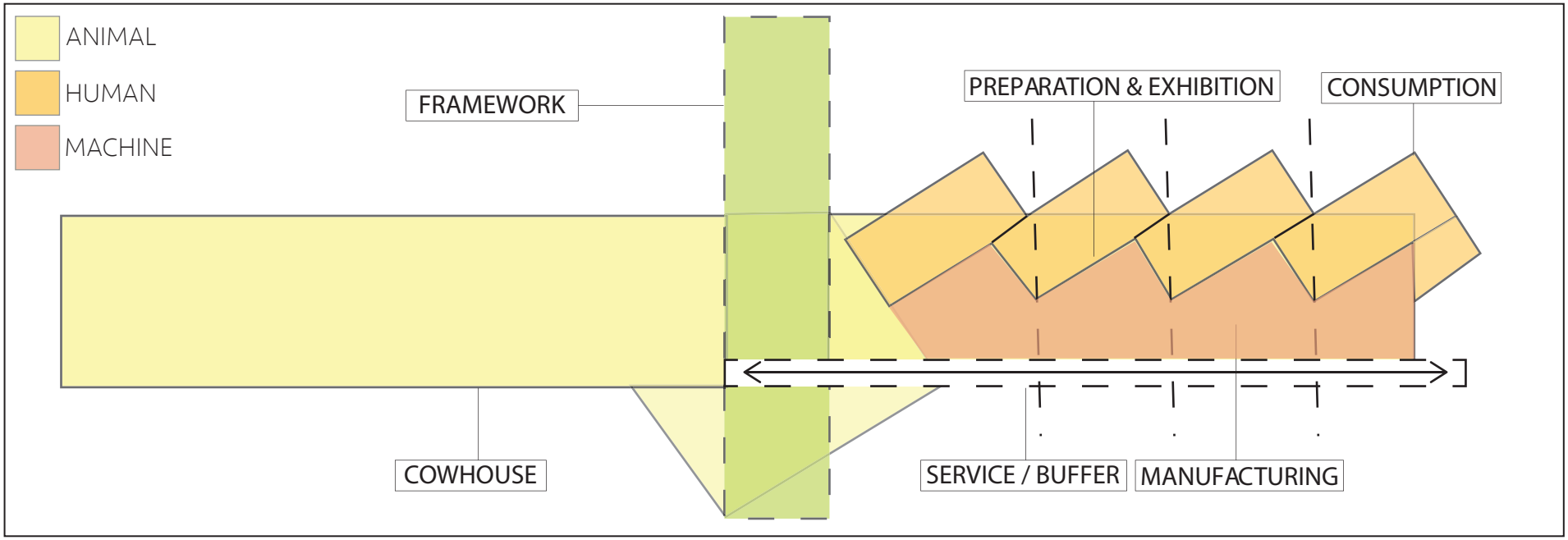


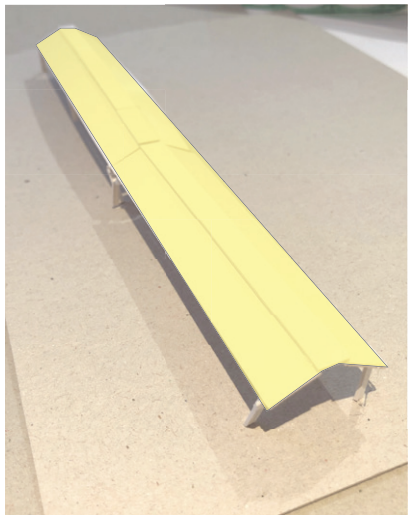
'The Ayrshire' Dairy and Deli are to be divided into three main categories of user: **animal**, **human** and **machine**.

The dairy cattle move between the cowhouse and milking parlour, and are able to move throughout the framework structure when out to graze.

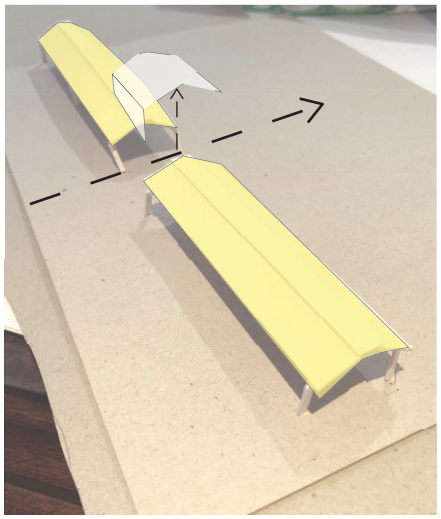
The people are able to view the movement of the cattle whilst remaining separated from them unless in the framework structure, and are guided through the building through the consumption, preparation and exhibition zones. Here they are able to interact with the production of dairy related products, breads and meats. This acts as the front-of-house and interactive zone.

The manufacturing zone is kept to back of house, with restricted access and designated viewing zones for the public. This is there the bulk production and processing of the dairy products occurs.

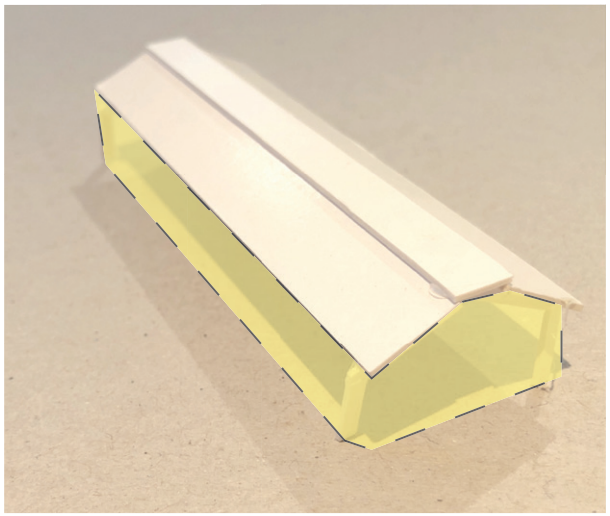




linearity of original structure maintained



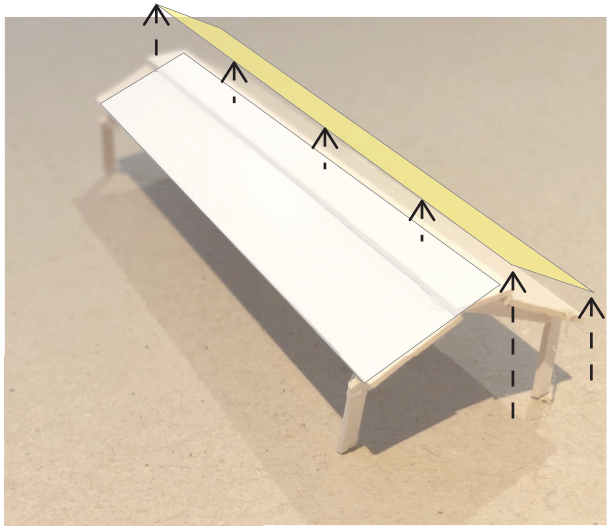
structure 'broken' in centre, and centre portion removed



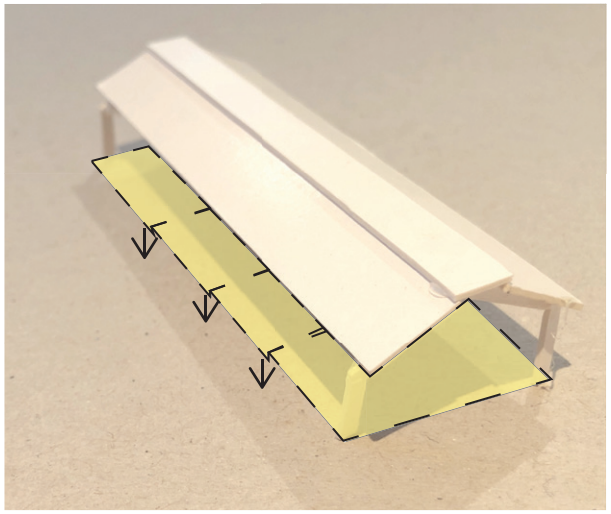
facility structure enclosed

A centre portion of the original cowhouse structure was removed, creating two separate portions of the structure. One half of the structure will house cattle, the other has become the dairy and deli facility.

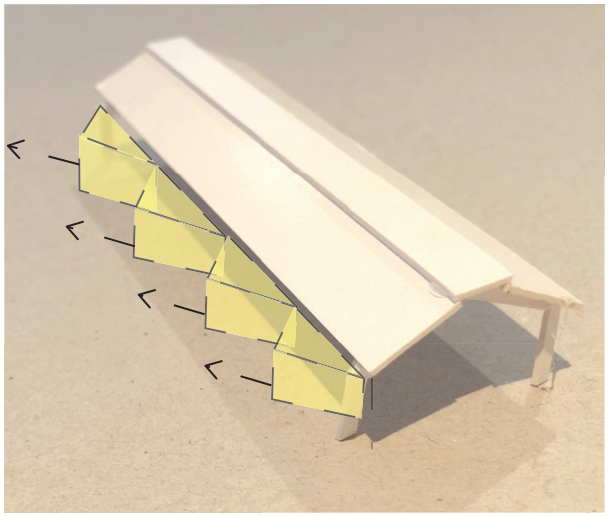
The facility has been adapted through the enclosing of the space, and the leveling and stepping of the previously sloped floor. The roof of the productive part of the facility has been raised in order to create spatial volume and aid in defining outside space.



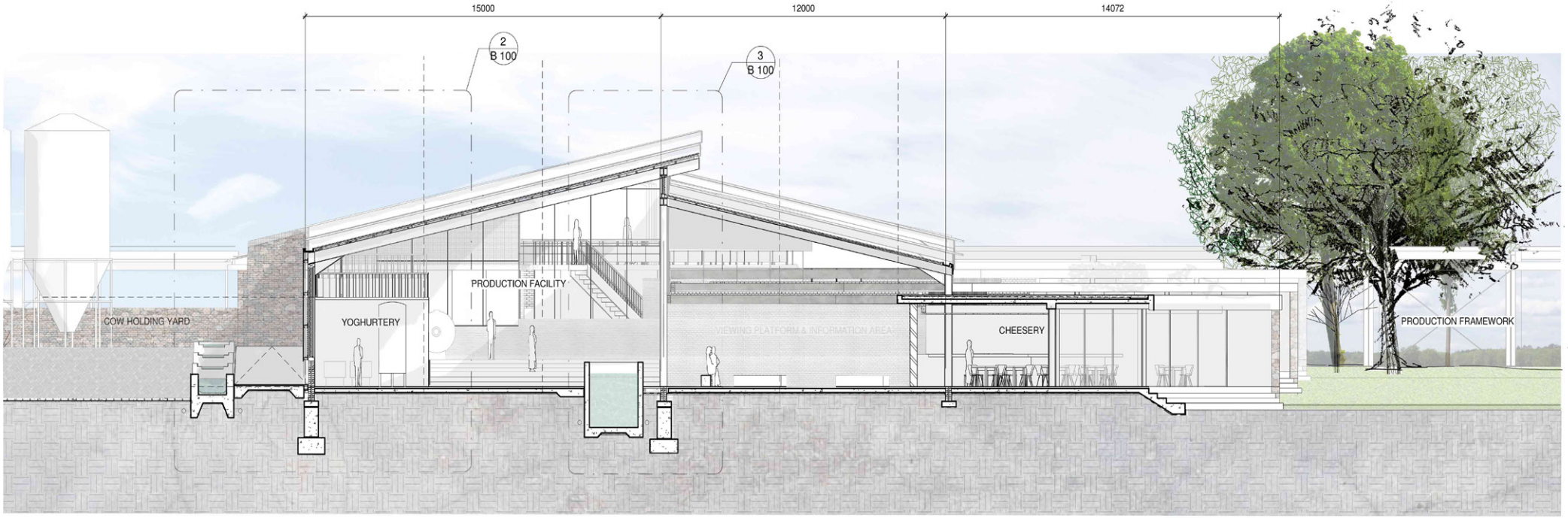
roof of production facility raised



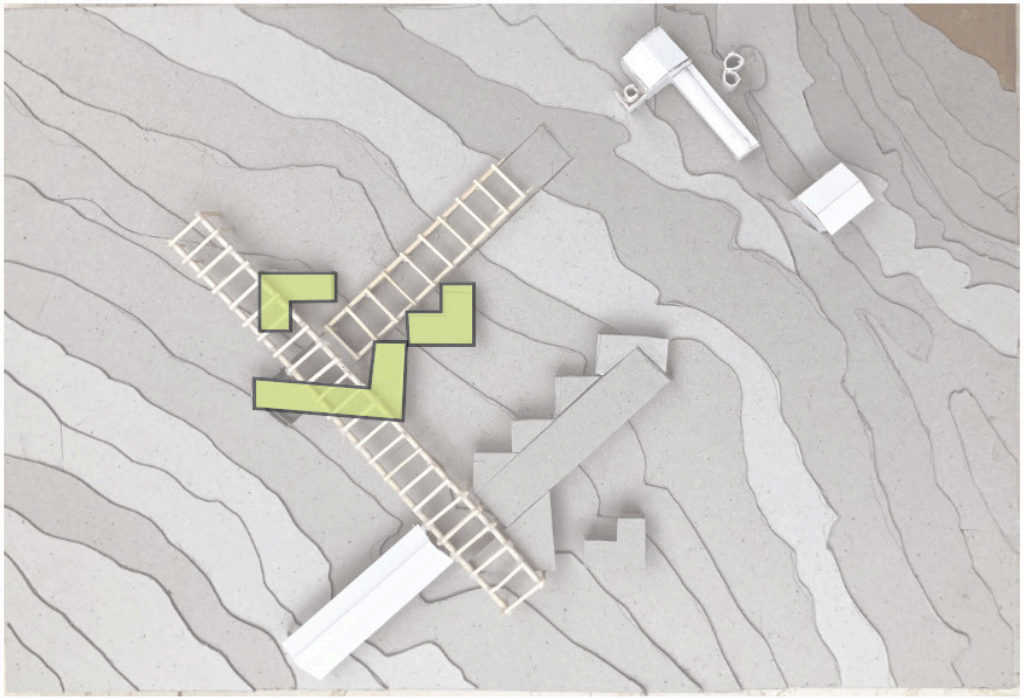
original sloped floor of facility raised, leveled out and stepped to create internal levels

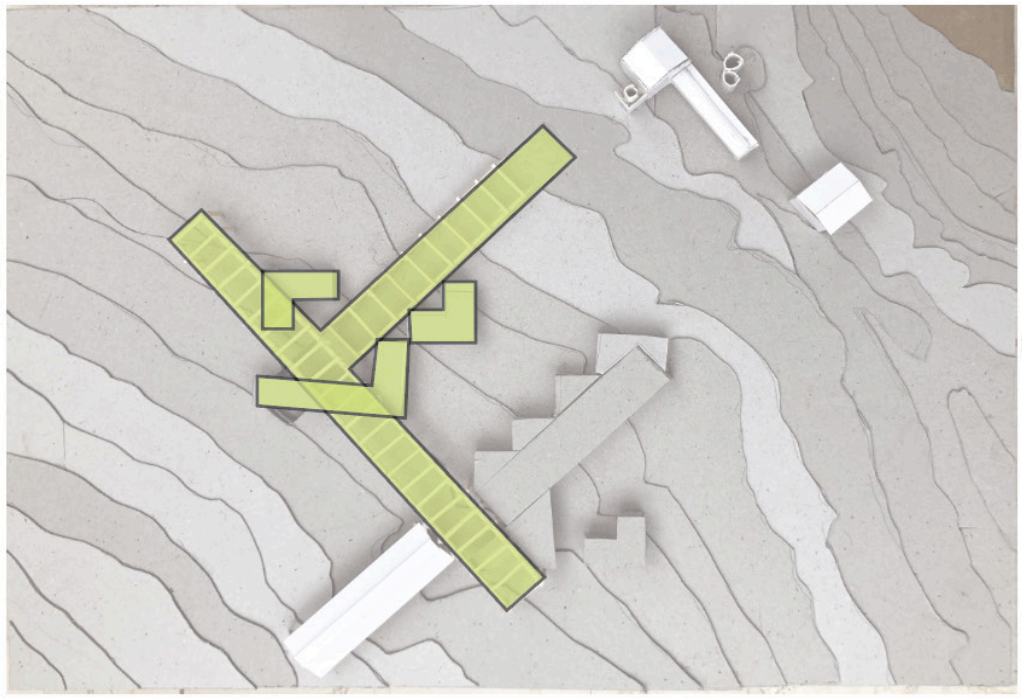


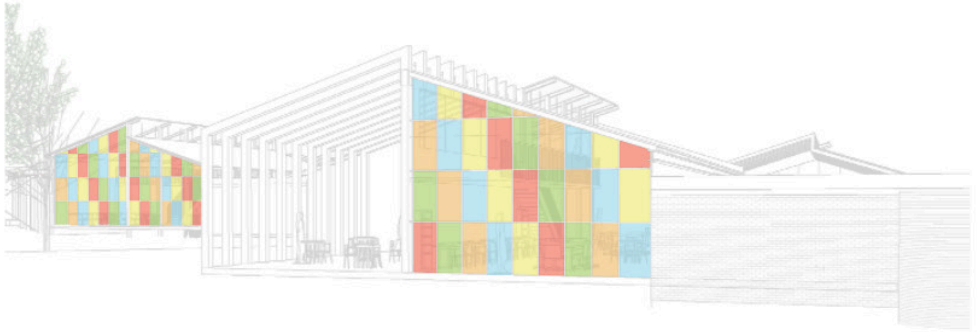
addition to facility traditional pop-out typology

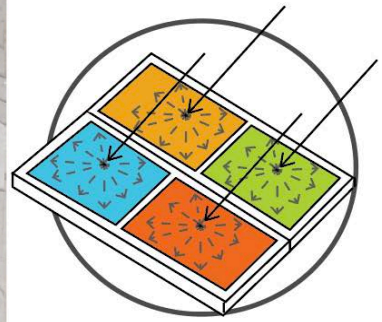


Section A-A
1 : 100

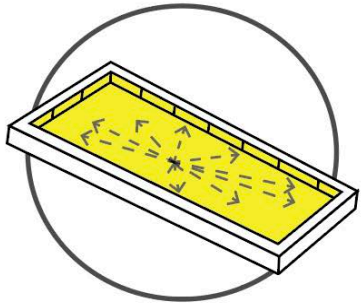




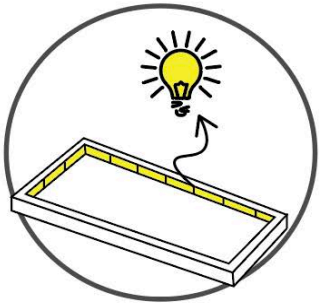




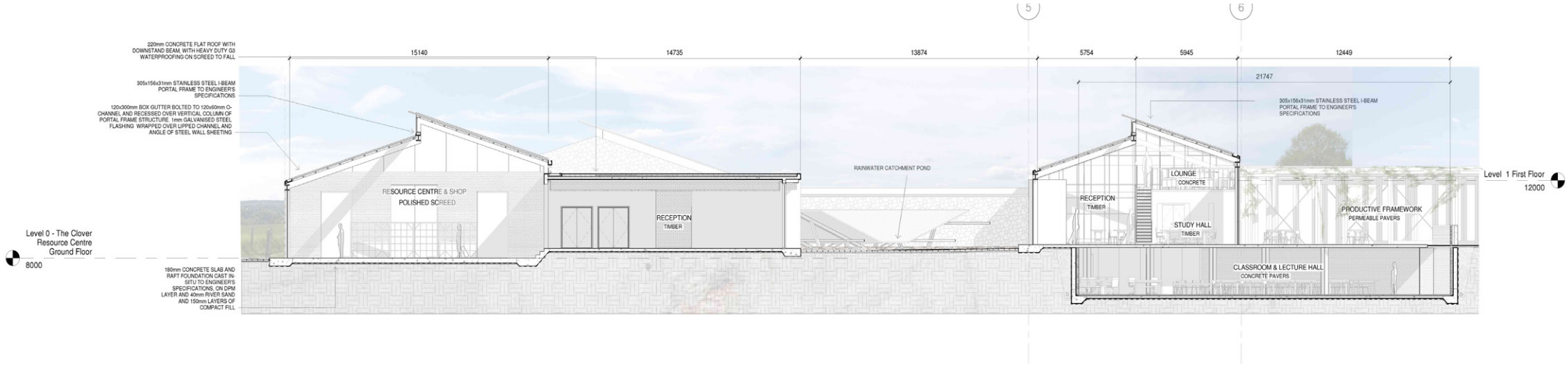
When hit by UV light, the particles absorb and re-emit visible light that is captured along the edges of the panels, due to internal reflection.



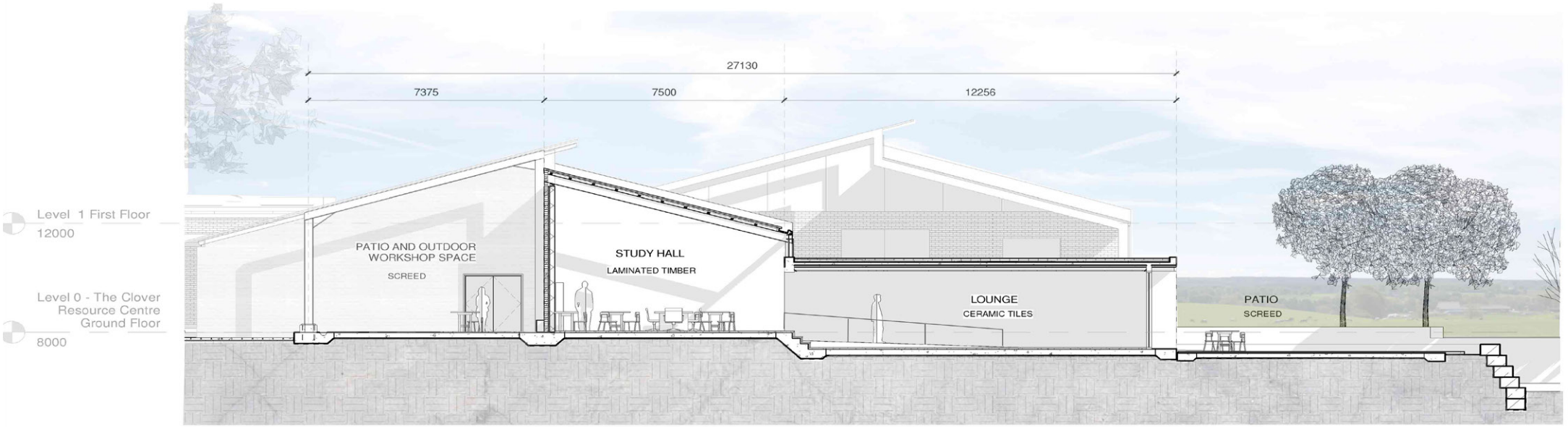
PV cells are placed along the internal edges of the panel.



Captured light is then converted into DC electricity. Regulating circuits are needed to process the voltage output to allow battery charging, storage and direct utilisation of electricity.

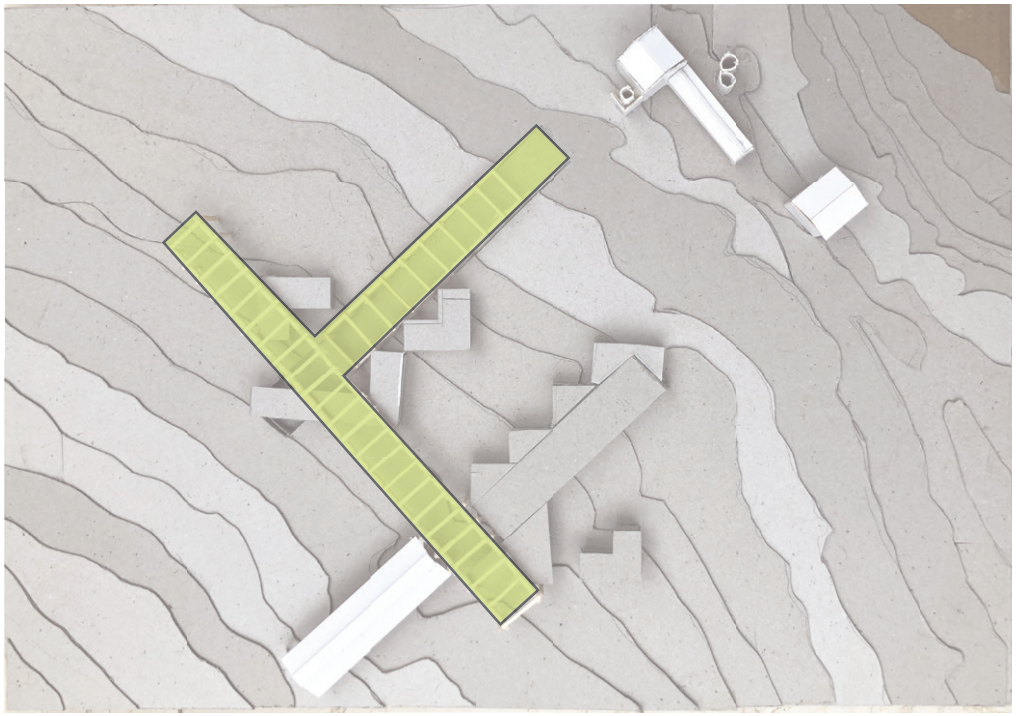


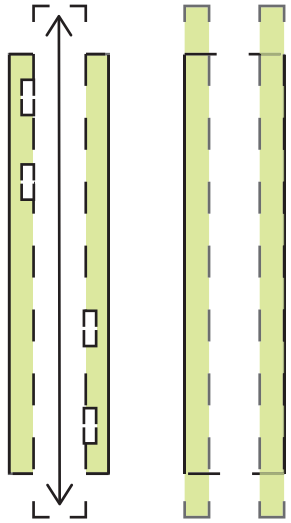
Section B-B
1 : 100

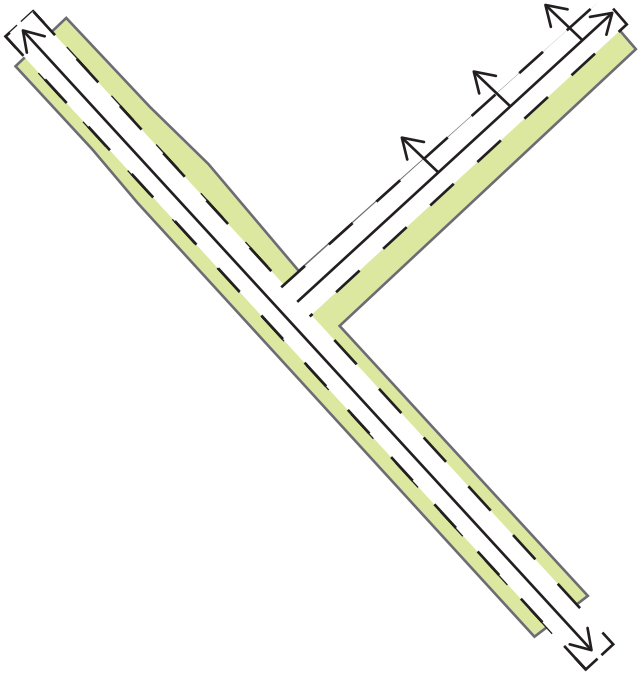


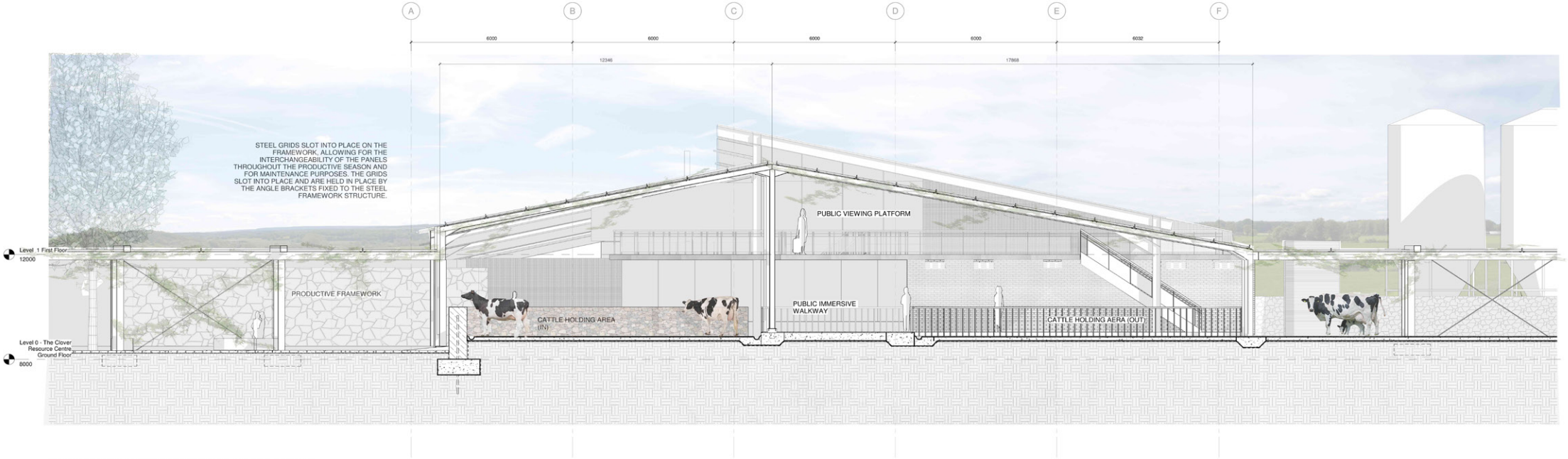
Section C-C
1 : 100

RESOURCE FRAMEWORK



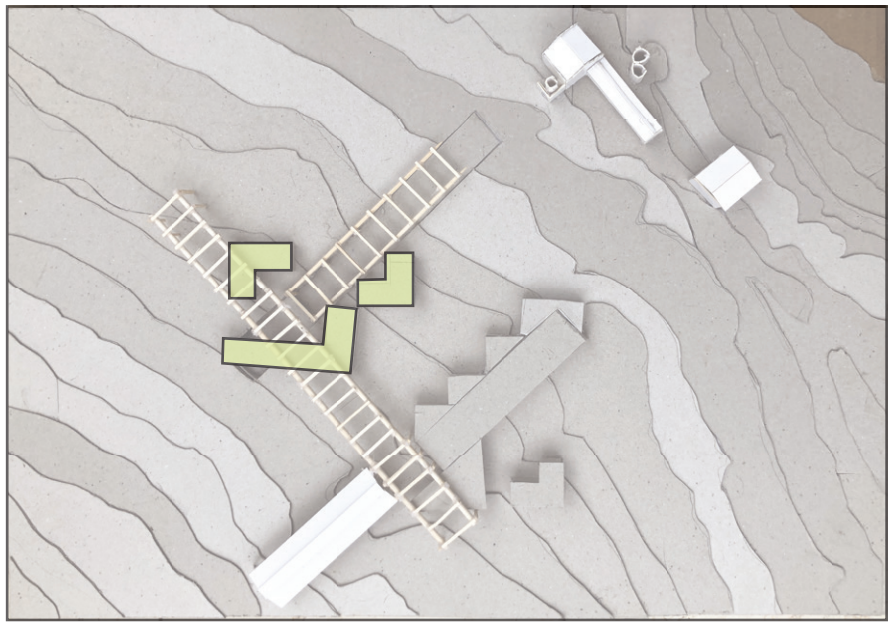


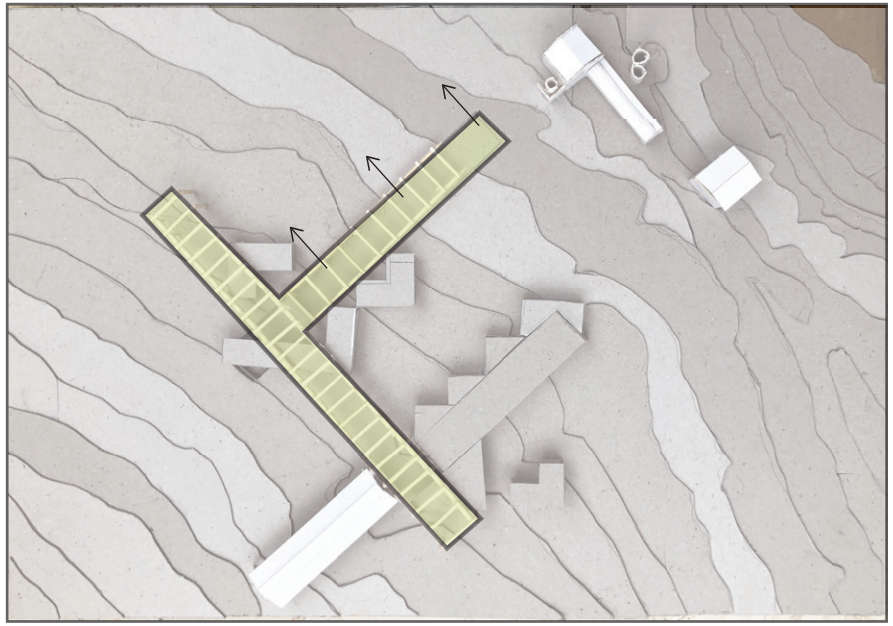




SECTION THROUGH PRODUCTIVE FRAMWORK
1 : 50

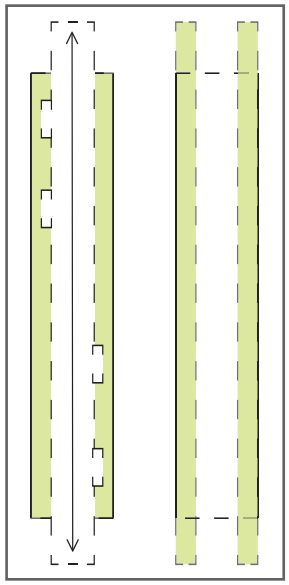
RESOURCES CENTRE & FRAMEWORK

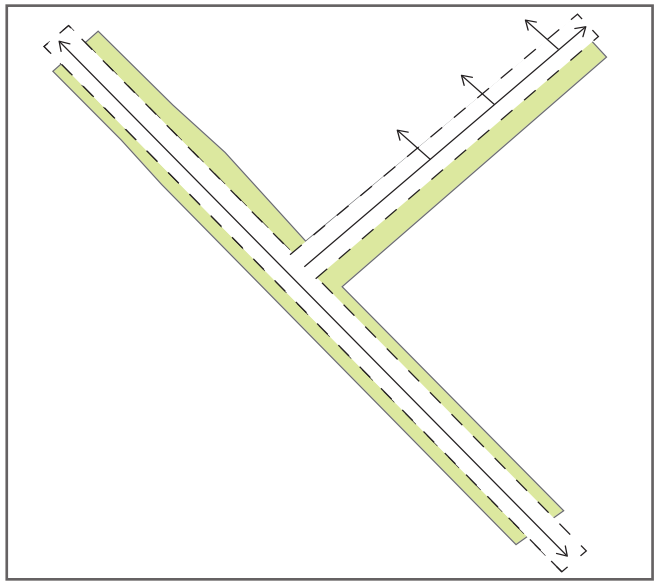




The resource centre is the area of the site where community members will be able to come and collect necessary resources and receive training for home productive gardening.

The framework is a lightweight, permeable steel structure with timber and steel cable infill that intends to create an interactive and immersiveplayscape for users. The bulk of the framework is above ground, whilst the element that stretches towards the heritage structure is submerged, making use of gabion retaining structures and collecting rainwater from the site, channeling the water to the retention pond and wetland.

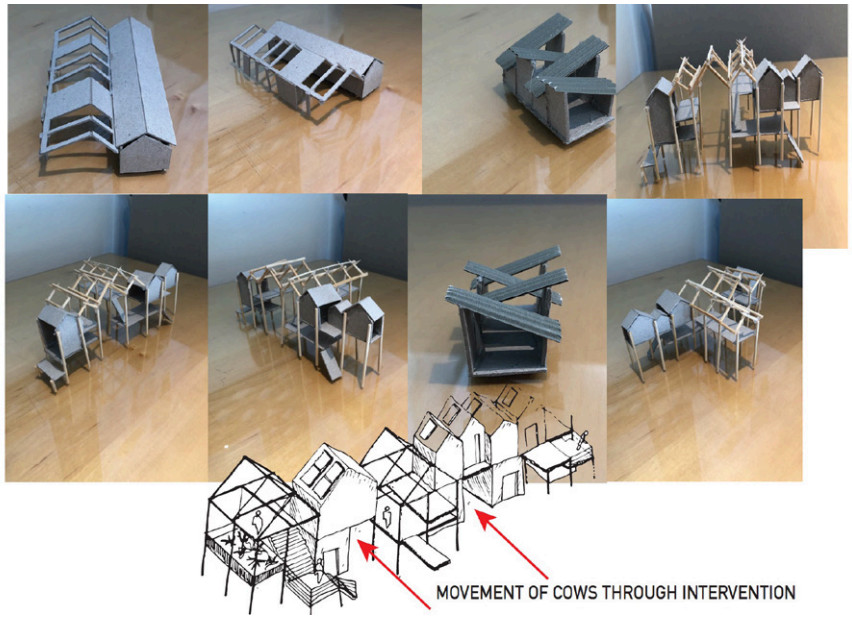




The main pedestrian thoroughfare is based on the original route of the dairy cattle on site as they were moved from the cowhouse to the original dairy and milking parlour. The edges of the structure are multifunctional, able to be used as a play space, information and observation nodes, and breakaway seating for users. The structure forms a productive framework for the growing of climbing plants such as grapes, butternut or cucumbers.

DESIGN ITERATIONS

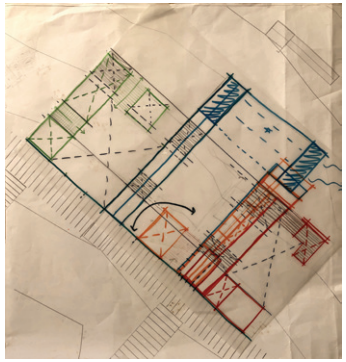
Iteration 1



Iteration one explores a series of spatial and aesthetic typologies for the project, investigating the impact of transparency, permeability, and the connection between inside and outside space.

This exploration led to the initial development of frame-type structures integrated within and arrounding the building .

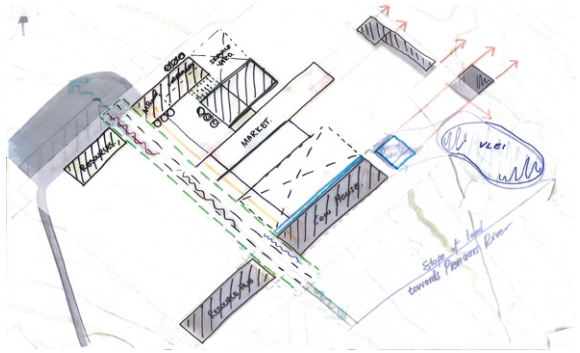
Iteration 2

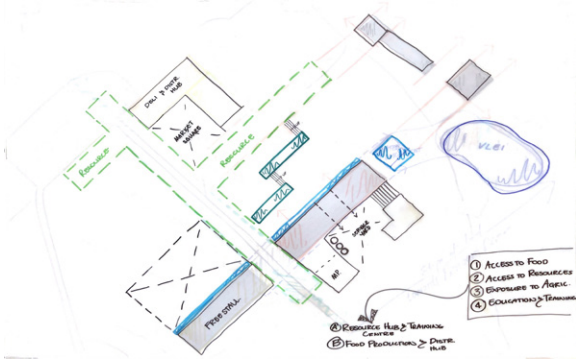


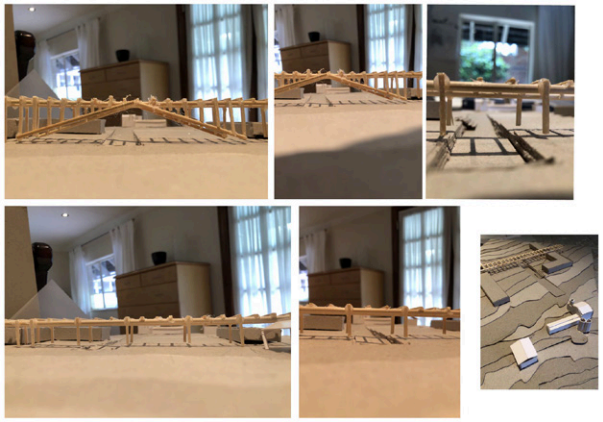
The second iteration explored potential layouts for 'The Clover' and 'The Ayrshire'.

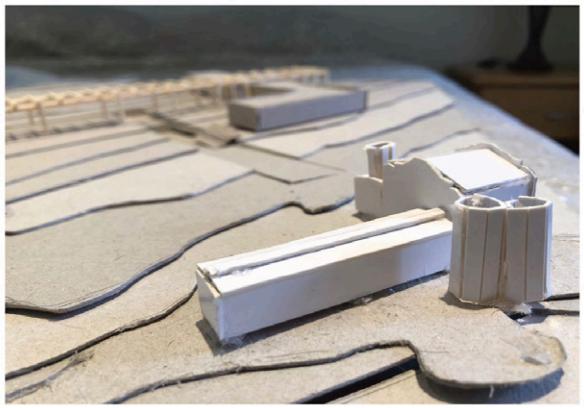
The results were rigid, tight spaces with little opportunity for dynamic movement or experience.

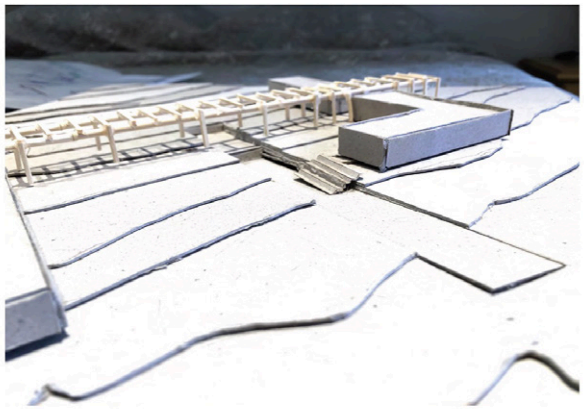
However, important guiding visual lines were identified that were then carried into further investigations,.







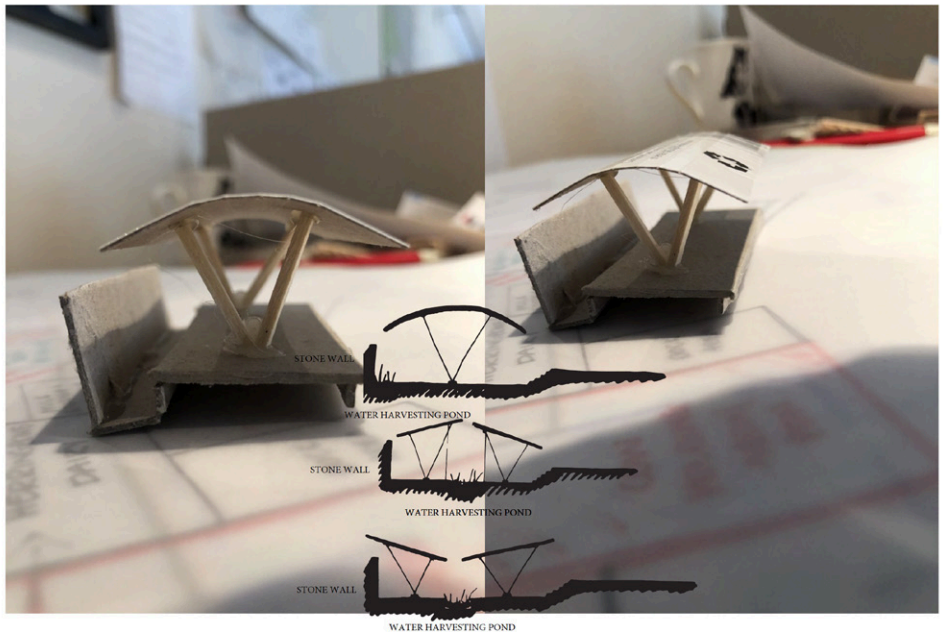


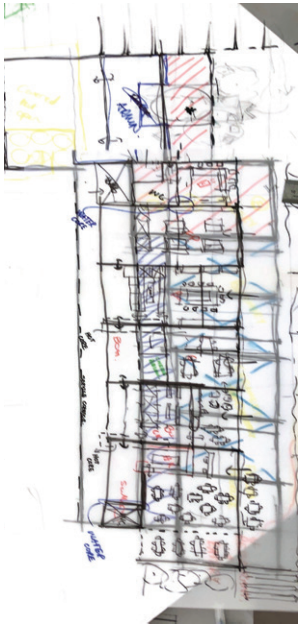


The third iteration investigated the framework structure and its ability to hide or expose the heritage structure on site. As a result of this, an element of the framework extends toward the old barn, and the floor plane is submerged in the landscape, intending to not detract from the visual access from the building behind it.

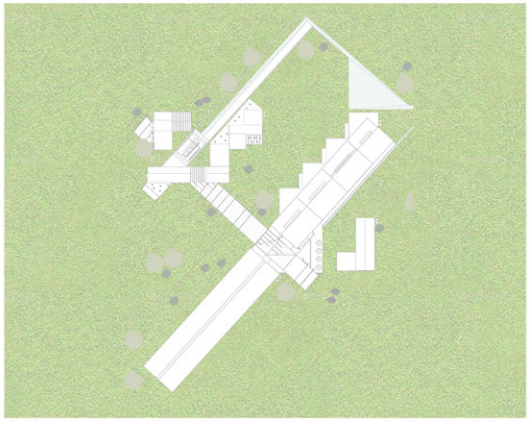
This element became the main artificial waterway on the site, acting as a source for 'The Clover' and as a means of rainwater collection and filtration system on site.

'The Ayrshire' required access to solar gains due the orientation of the original structure and as such led to the investigation of pop-out structures that would draw light into the building. This box was extruded from the main structure, in typical farm-addition fashion. In order to achieve the correct orientation, this box then had to be split into smaller sections and then rotated by 45 degrees to the existing grid pattern of the structure.

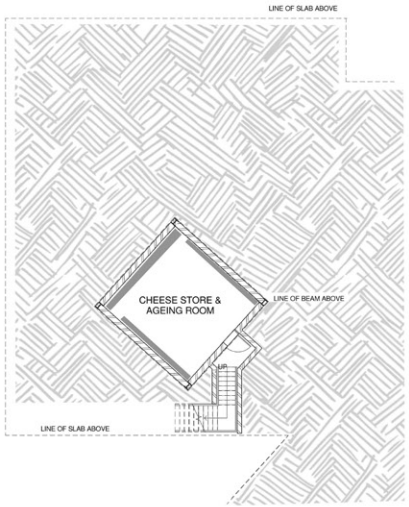




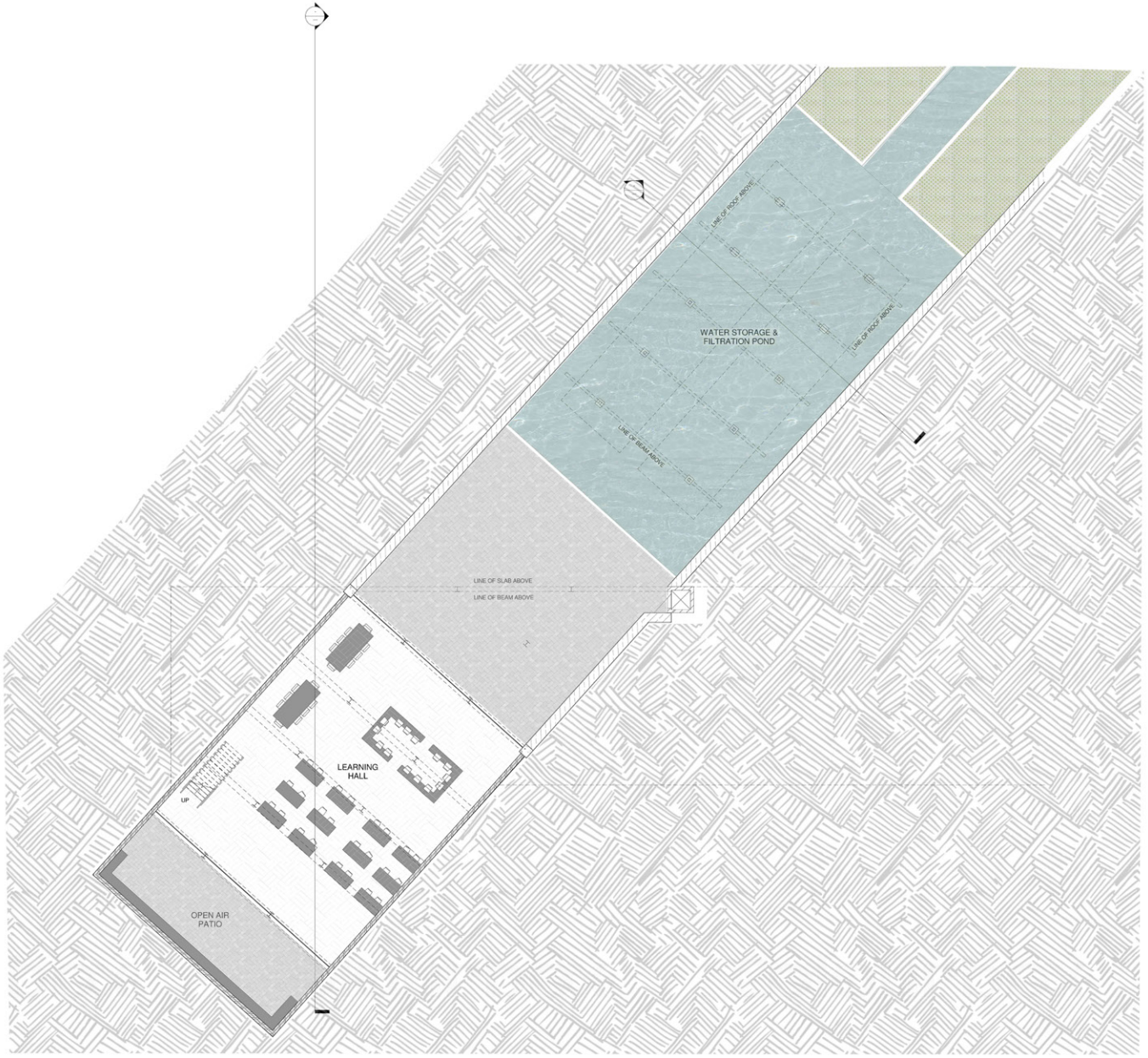
FINAL DESIGN EXPLORATION



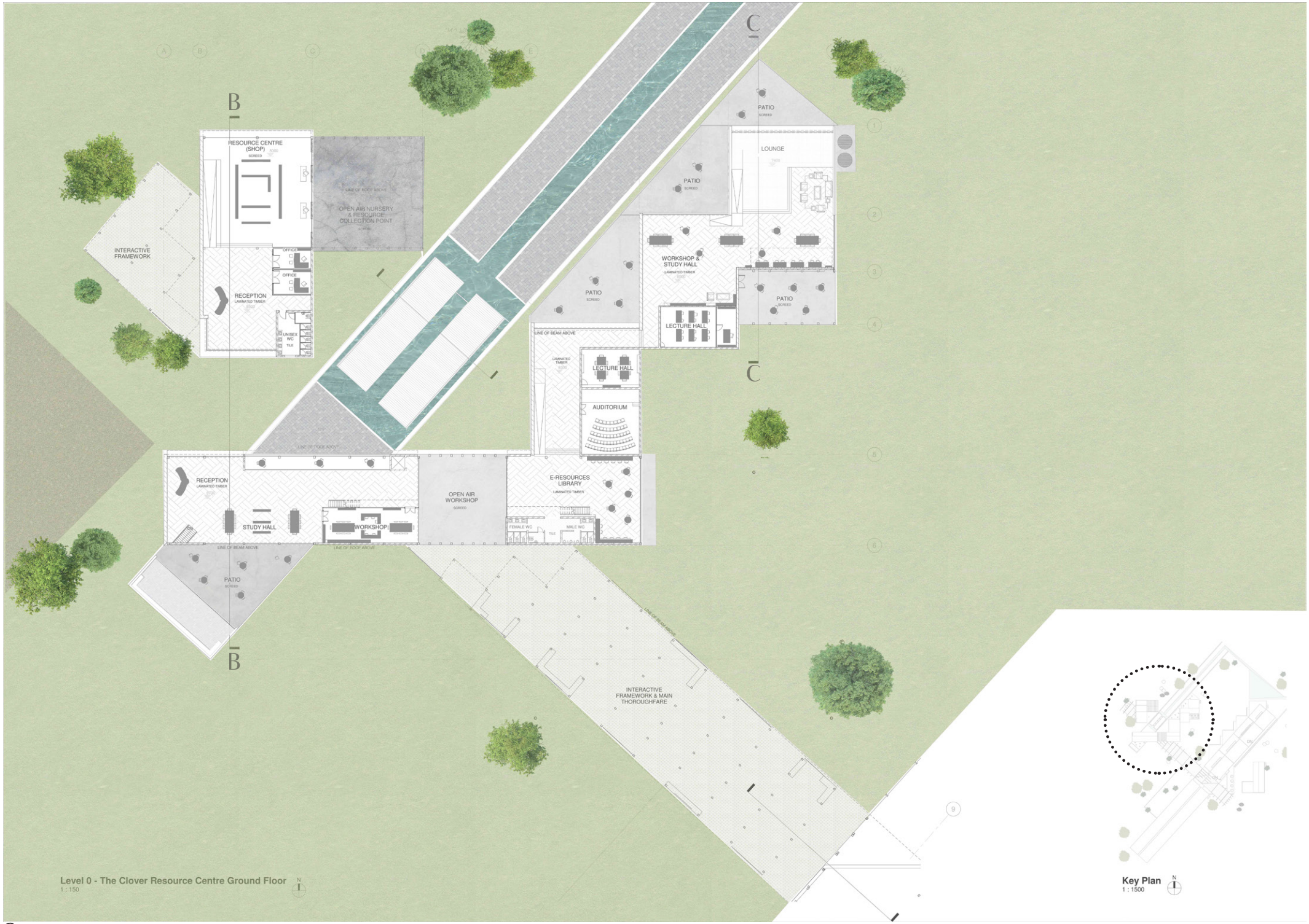
Key Plan
1 : 1500



Level -1 Basement: Cheese Ageing Room
1 : 100

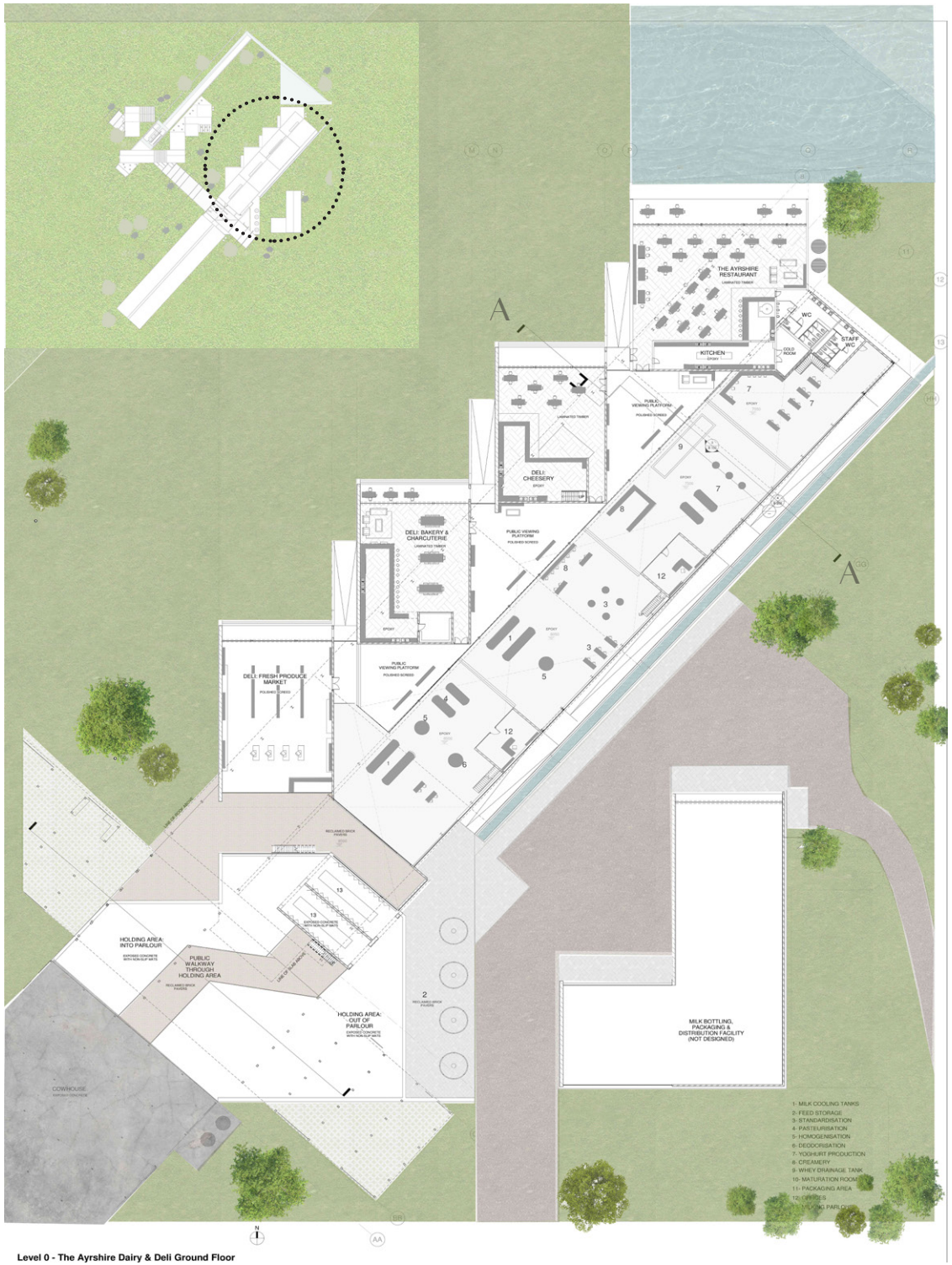


Level -1 Basement: Learning Hall & Water Storage
1 : 100

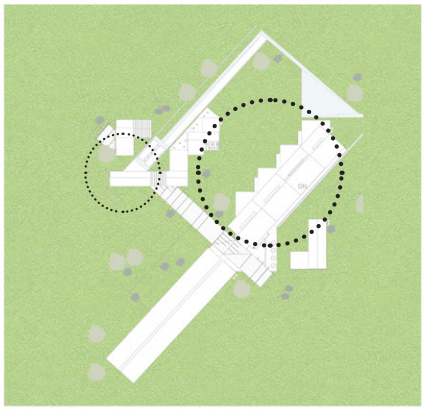


Level 0 - The Clover Resource Centre Ground Floor
1 : 150

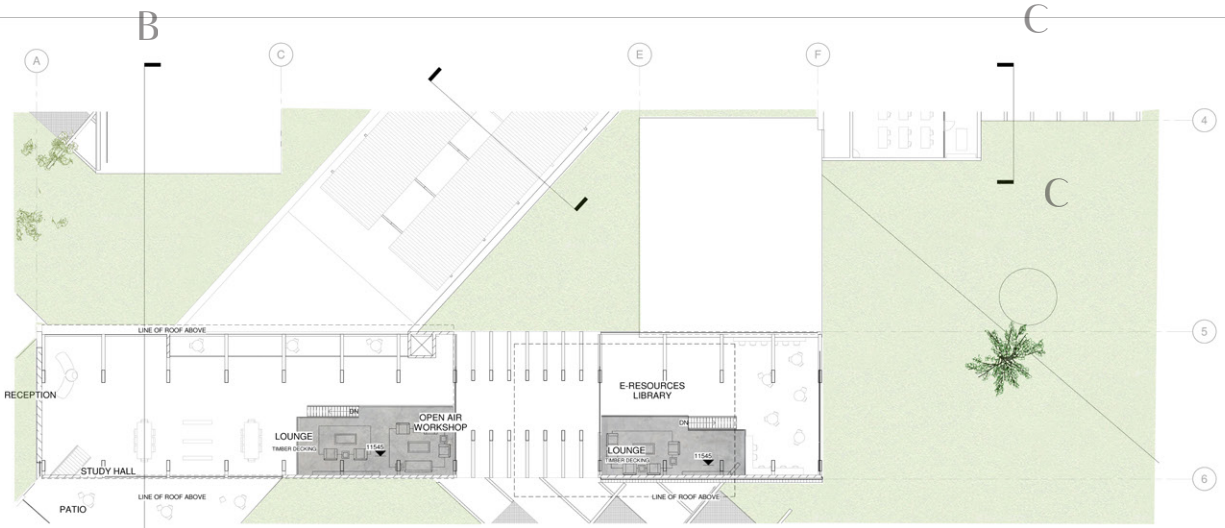
Key Plan
1 : 1500



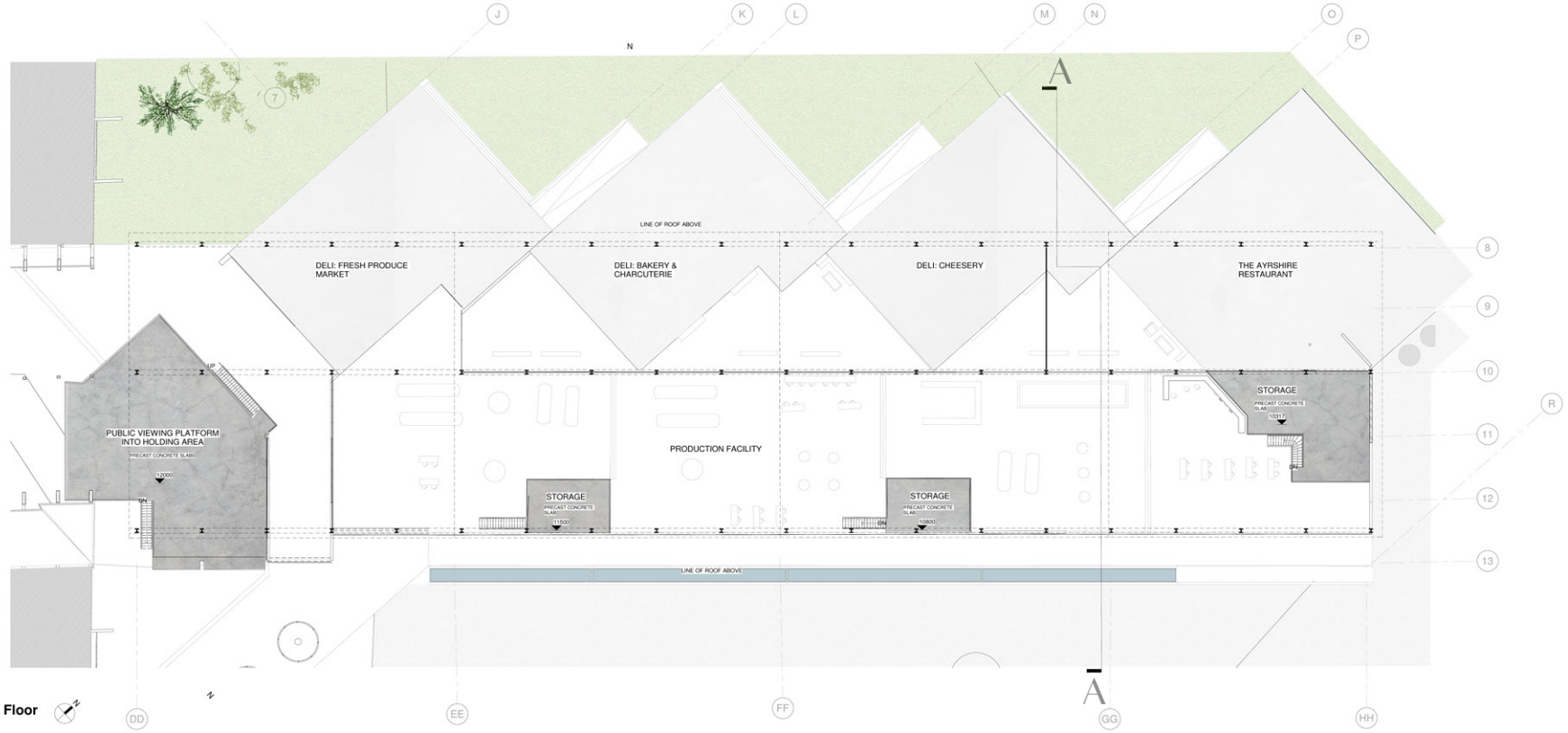
Level 0 - The Ayrshire Dairy & Deli Ground Floor



Key Plan
1 : 1500



Level 1 First Floor
1 : 150



Level 1 First Floor
1 : 150

Figure74: Indicative Render - Framework meets the Ayrshire Facility (Author 2021)

Figure75: Indicative Render - 'The Clover' Greenhouse (Author 2021)

Spatial Precedents

Figure76: VAC Library (Farming Architects 2018)

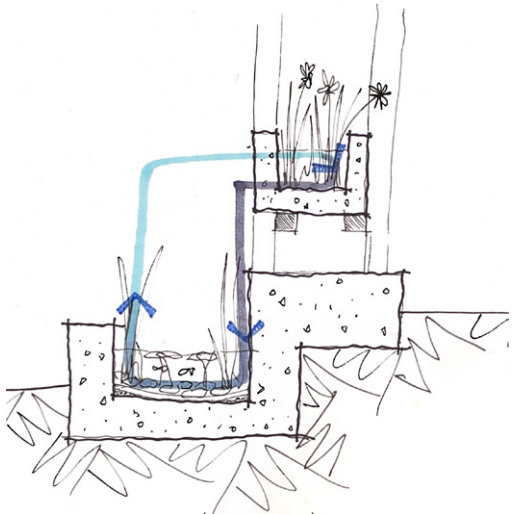


Figure77: Water Recycling Diagram (Author 2020)

VAC- Library
Farming Architects; Hanoi, Vietnam

The architect defines this as “a special project that carries the traditional Vietnamese horticulture, aquaculture & animal husbandry, from rural to urban areas”. The project takes the role of library and re-associates it with physical, haptic learning by immersing adults and children alike in this interactive urban farming framework, exposing the processes of growth, life, death and waste management in a mini eco-system.

The waste produced by the fish and chickens is used to fertilise the plants, whilst many of the plants themselves in turn purify the water. Solar panels are used to light the space and to power the pond pumps where necessary, as most of the water uses gravity to flow naturally.

The structure makes use of a modular timber structure that is climbable set on a concrete foundation. The modularity aids in spatial organisation and movement of people, at the same time creating a flexible and adaptable structure that can be filled in over time (Farming Architects 2018).

Cornell Teaching Dairy Barn
Erdy McHenry Architecture; 2012, Ithaca, New York, USA

The LEED certified project required that the dairy operate in the same manner as the traditional dairy barns in New York State at the same time providing a platform from which to teach students on the functional, organisational and operational aspects of running a dairy. Due to the public viewing of the building, the intervention needed to be both modern and an example of exemplary and sustainable design.

The design process revolved around achieving a certain number of predetermined factors that are were deemed critical to the success of the project, such as:

- Optimize Cow Comfort
- Increase Herd Flow Efficiency
- Allow Natural Ventilation of Freestyle Barn
- Reduce Energy Consumption
- Provide Interactive Classroom / Learning Spaces (Erdy McHenry Architecture 2014)

The majority of these factors were centred around the well-being of the animal, highlighting the important role that animal health and well-being play in the production of dairy.

The project also works in harmony within its site in order to best respond contextually, maximising the use of natural cross ventilation and other passive design strategies in conjunction with appropriate high-tech solutions. By doing this, Corness University claims to have noticed a 35% reduction in energy usage alone.

The programmatic layout of the building places the cattle and their related spaces on the ground floor, whilst the classrooms are located on the first floor, overlooking the milking parlour and barn area, in order to provide unrestricted visibility without compromising the functionality of the spaces (Architect Magazine 2015; Erdy McHenry Architecture 2014).

Figure78: Cornell Teaching Dairy (Erdy McHenry 2014)

Figure79: Cornell Teaching Dairy Interior (Erdy McHenry 2014)

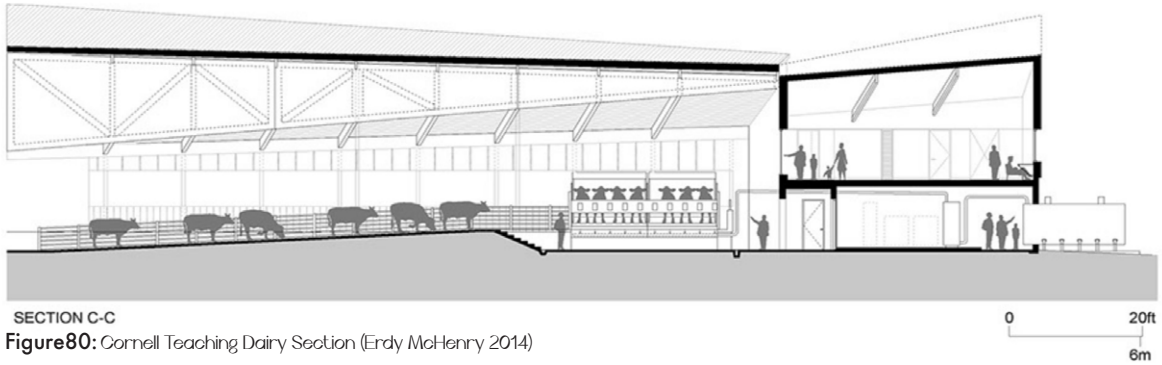
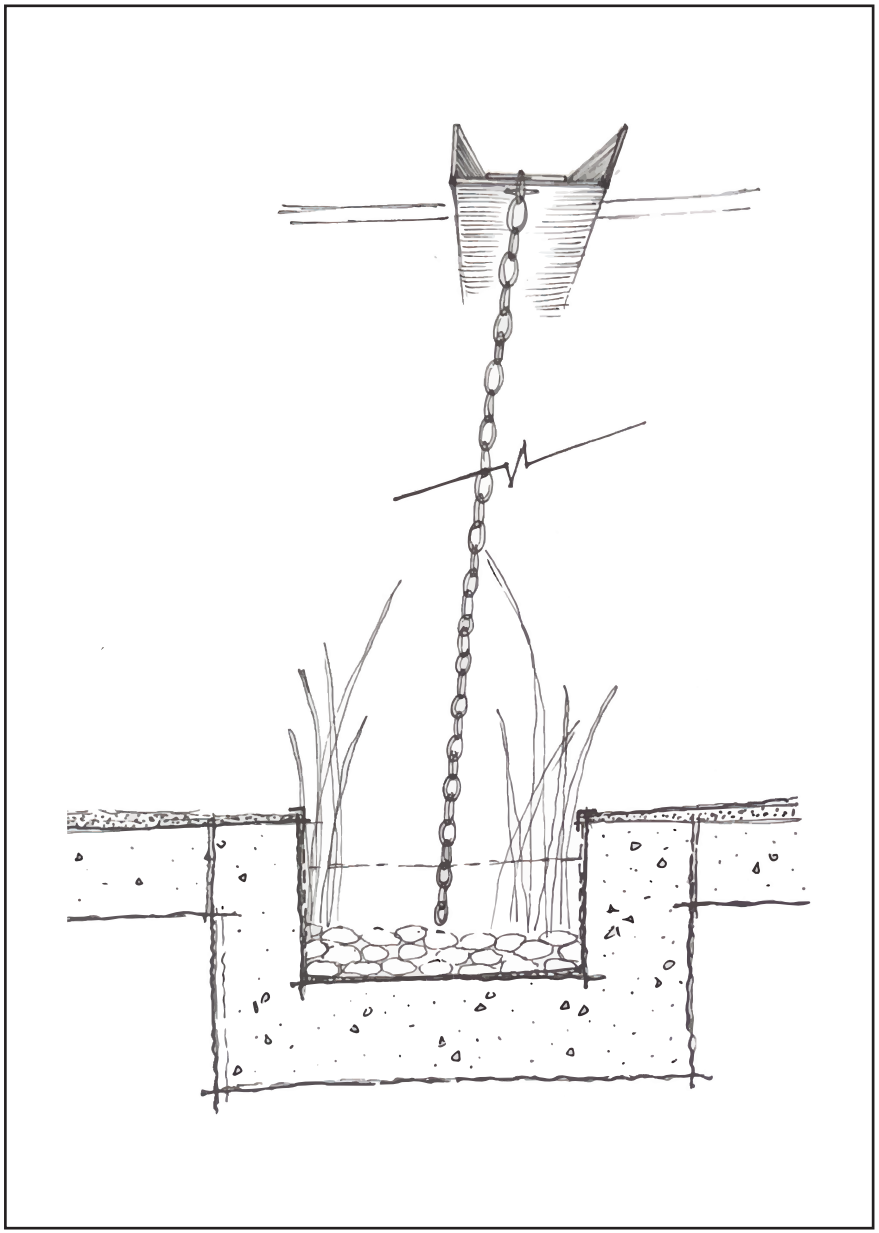


Figure80: Cornell Teaching Dairy Section (Erdy McHenry 2014)



CHAPTER 05

TECHNIFICATION

Dixon Water Foundation Josey Pavillion
Lake Flato; Decatur, Texas, USA

The project seeks to mirror the positive and restorative impact that cattle have on the landscape and achieves the target of being a fully restorative 'living building' as per the Living Buildings Challenge. The project becomes a demonstration site for the sustainable management of watersheds, providing a place for the education of the importance of water in todays society.

The building sources all materials from within the United States of America, using 100% salvaged or sustainably sourced timber. The pavilion generates 100% of its energy on site, as well as treating all collected water on site, recycling grey water where necessary and returning the rest to the natural water cycle. The intervention also maximises the use of passive systems for ventilation and shading for the management of solar radiation; making use of large overhangs, pivot and sliding doors that allow cool air to be pulled into the building, and a cupola in the roof that draws the heat from the building through the creation of negative pressure systems.

The form of the pavilion speaks to the surrounding prairies and aims to be as unobtrusive on the landscape as possible. The timber structure sits on a stepped concrete plinth in the landscape, allowing some areas to be used as eating and others to blend almost seamlessly into the landscape (Josey 2016).

Figure83: Josey Pavillion (Josey 2016)

Figure81: Josey Pavillion Clasroom (Josey 2016)

Figure82: Josey Pavillion (Lake Flato 2016)

Sustainability Targets and Ratings

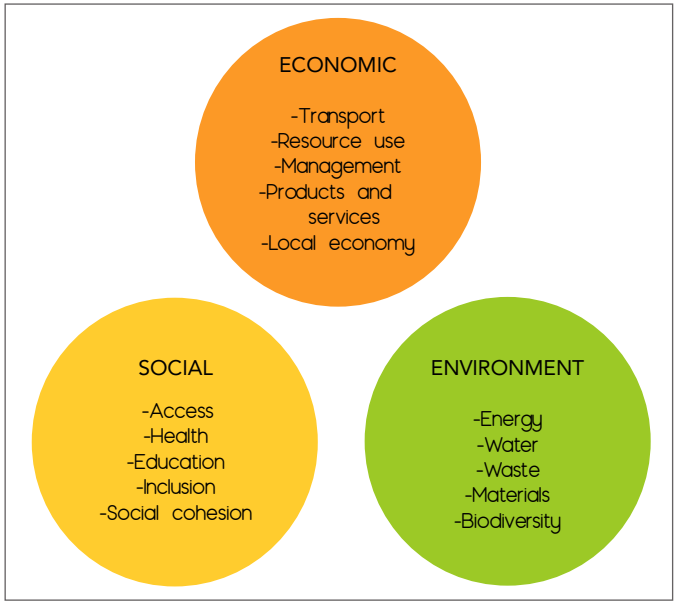


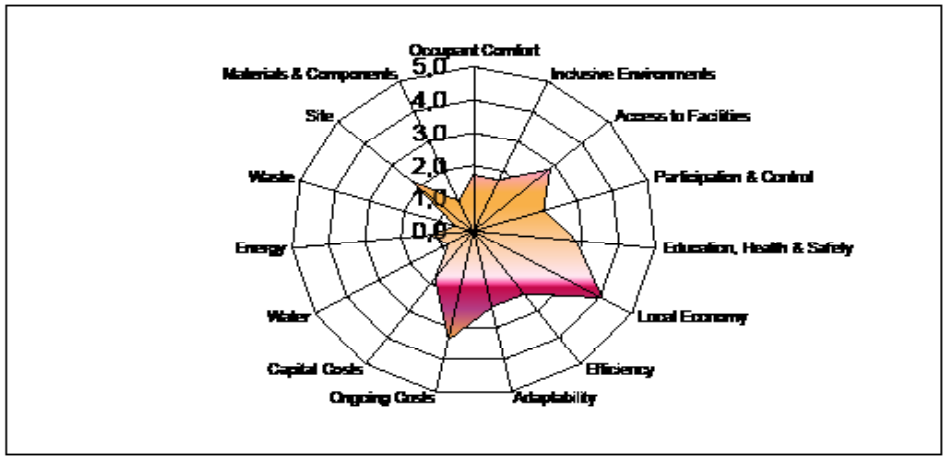
Figure84: SBAT Principles (Adapted by Author 2020)

The Sustainable Building Assessment Tool (SBAT) is a tool that is intended to provide an indication of the success of the design of a building in terms of a holistic approach to sustainability, taking into account all three spheres (social, economic, environmental).

The intention here is to compare the condition of the current site with the proposed intervention, identifying where key improvements will be made toward a more sustainable project and precinct.

The proposed 'Cow and Clover' precinct aims to provide long-term improvement to the current community through the provision of a facility that focuses on green energy usage, social accessibility and inclusivity, and rejuvination of the site and surrounding environment.

Hazeldean Cowhouse & Clover Milkyway Dairy (Existing)

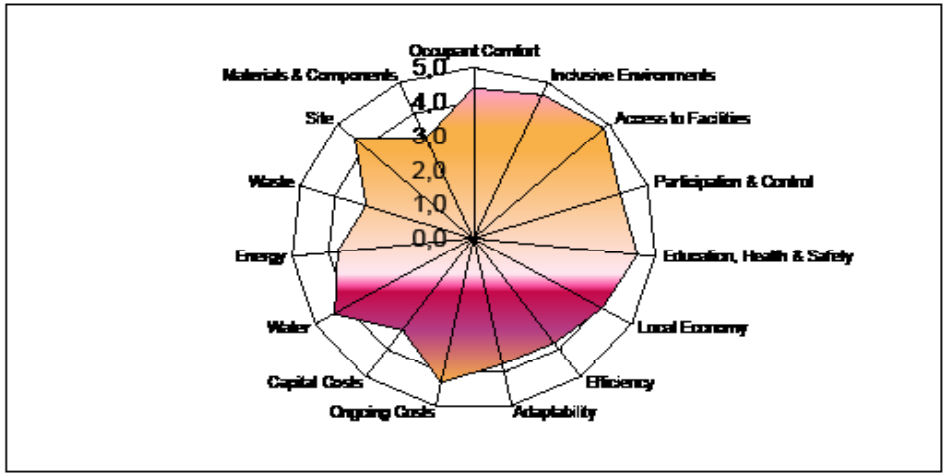


Social	2,2	Economic	2,8	Environmental	1,2
Overall	2,0	Classification	Very Good		

Figure85: SBAT Existing (Author 2021)

The Cow & Clover Deli & Resource Centre (Proposed)

PROJECT		ASSESSMENT	
Project title:	The Cow and Clover	Date:	Dec-20
Location:	Hazeldean Farm	Undertake B. Newton	
Building type:	Resource & Commercial Center	Company / organisation:	
Internal area (m2):		Telephone:	Fax:
Number of users:		Email:	

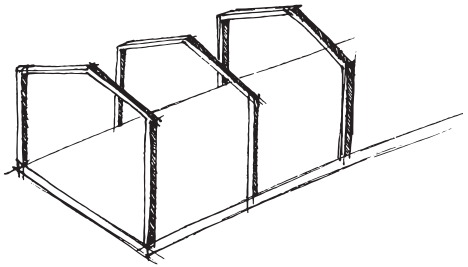


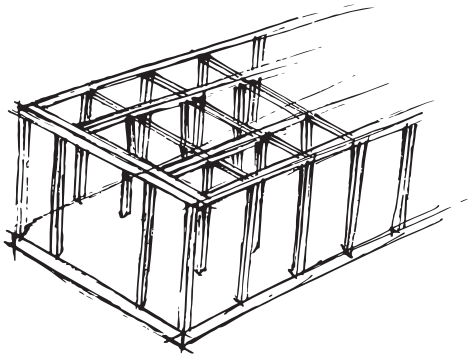
Social	4,5	Economic	3,8	Environmental	3,8
Overall	4,0	Classification	Very Good		

Figure86: SBAT Proposed 'The Cow and Clover' (Author 2021)

PRIMARY STRUCTURE

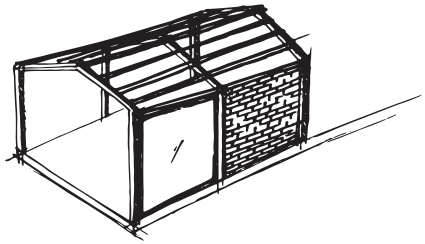
The primary structural and support elements lay the framework for the intervention. The use of steel allows for a modularity and adaptability that will provide the freedom to grow and shrink over time as the function of the spaces changes.

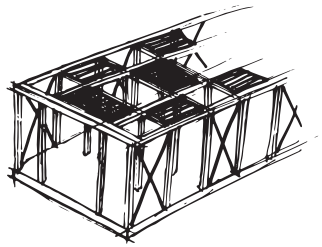


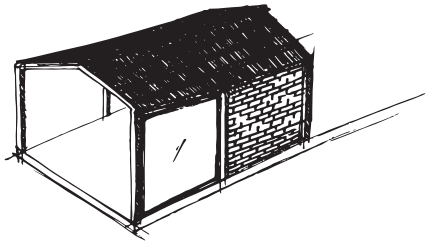


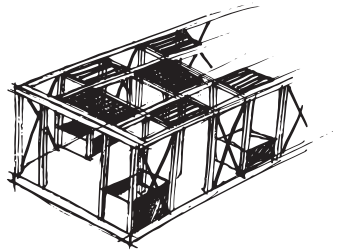
SECONDARY STRUCTURE

The secondary structure relates to the infill of various materials, such as timber, brick and glass, responding to the climatic conditions and spatial requirements of the various functions and programmes.



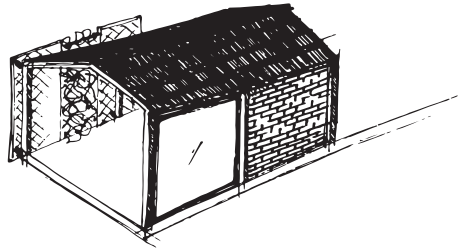


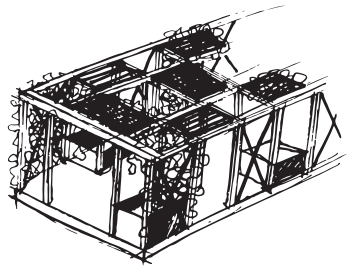




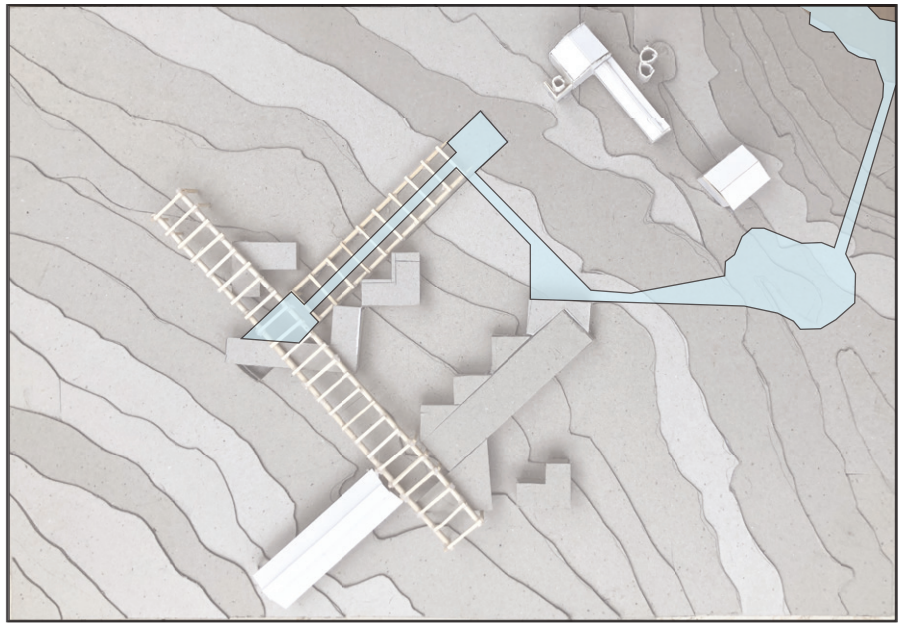
TERTIARY STRUCTURE

The use of screens and shading devices, as well as growing panels for productive gardening. make up the tertiary structure of the building, relating directly to the seasonal and functional requirements of the space relating intimately with the user.

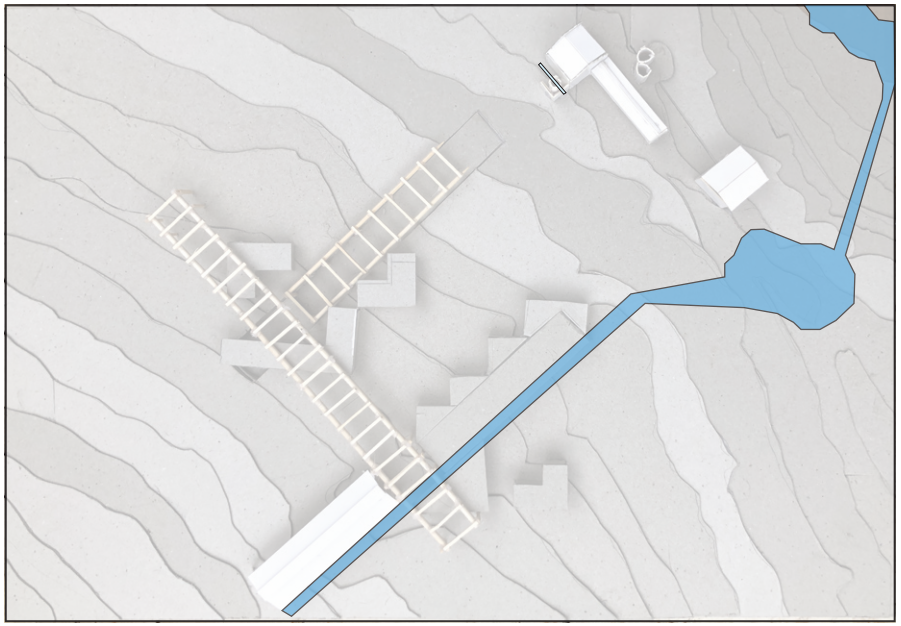




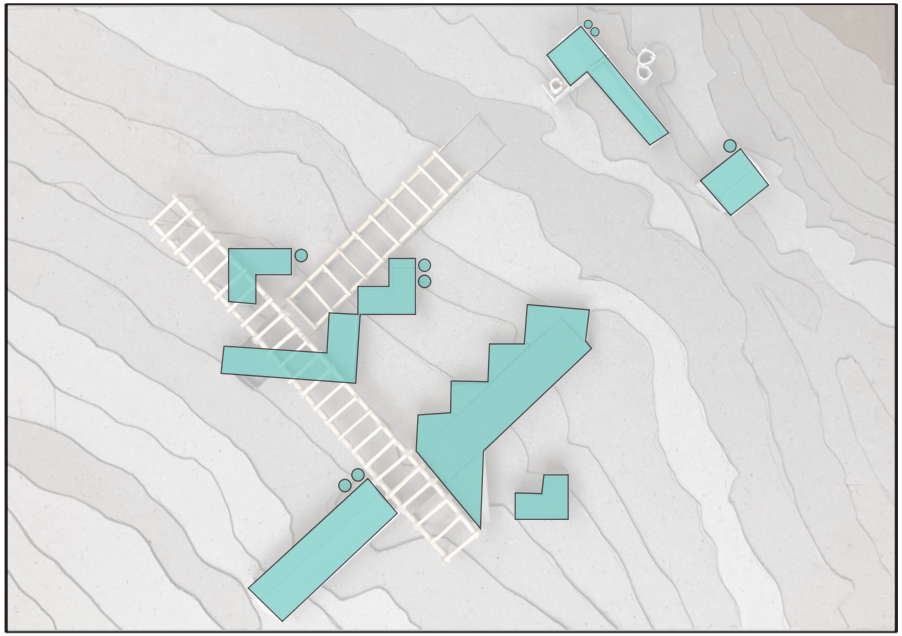
SYSTEMS ON SITE



Rain Water Harvesting (Wetlands)



Dairy Effluent Collection & Recycling

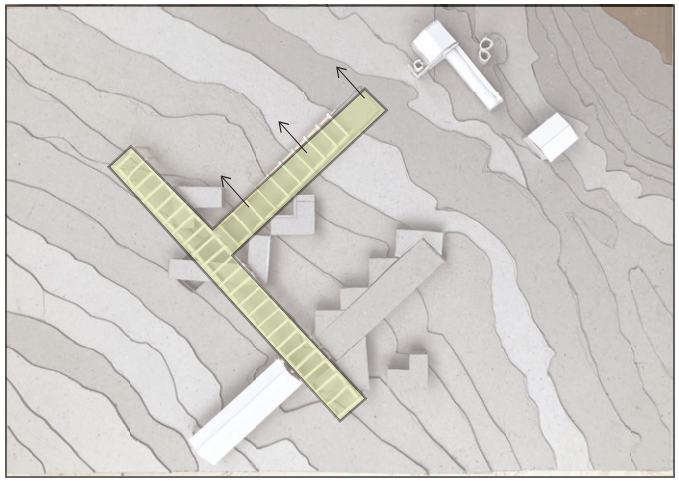


Rain Water Harvesting (Grey Water and Irrigation)

Rainwater will be collected on site in artificial wetlands that will allow for the filtering and purification of the water before it is released into the Pienaar's river.

Rainwater will also be collected on site through sloped roofs and permeable paving. Water will be stored in tanks to be used as grey water within the facility and as irrigation for the productive gardens immediately within the precinct.

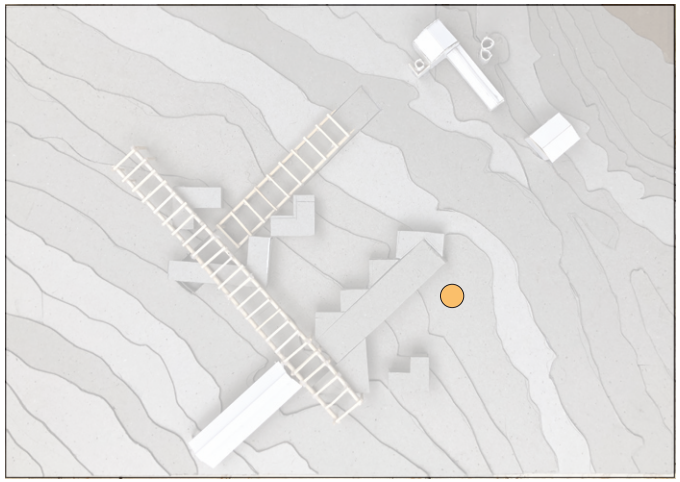
More than 200 000l of effluent water is produced in the processing of the dairy products alone (Water Icon Industrial Water Treatment Solutions 2013). Thus, the effluent water from the processing will go to the dissolved air floatation unit that exists on site before being released into the artificial wetland and being used as irrigation for the site.



Productive Framework

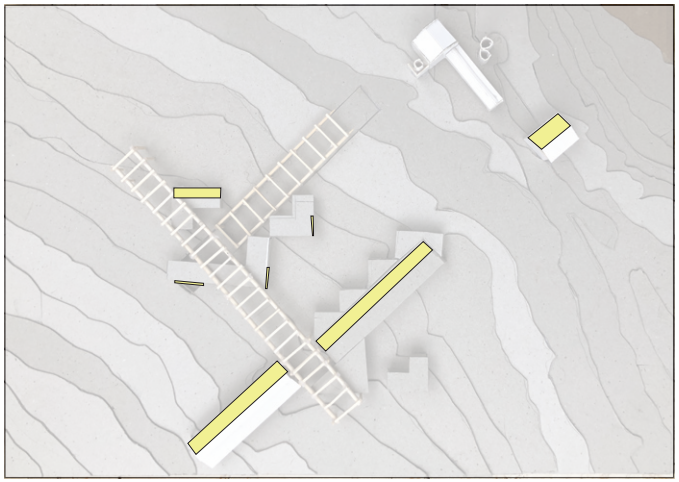
The productive framework provides an immersive opportunity for users to be exposed fully to productive gardening. The framework will allow for climbing plants to grow along the structure, highlighting the growth from seed to edible fruit.

Thus, the framework requires access to water (irrigation and purification) and natural light to achieve plant growth. Food produced is harvested by the public and the restaurant, and organic waste is sent to the biogas digester and compost heap.



Biogas Digester

Organic waste generated on site from the restaurant and the productive framework will be used to generate electricity (to be used in conjunction with solar power) and butane gas (for the restaurant and geysers) in a biogas digester. 85% of the manure generated from the dairy herd will be allocated to the digester, whilst the remaining 15% will be used for composting material.



Solar Panels & Energy Generation

Solar Panels will be placed on the Northern and North-Western slopes of the roofs and will be used to generate the bulk of the electricity needed to run the intervention.

The use of Aureus Panels will be incorporated into the building facades to maximise the generation of electricity.

Calculations:

AVERAGE RAINFALL COLLECTION FOR SITE

ROOF AREA (sqm) x AVE. ANNUAL RAINFALL (mm) x 0.9 =
5800 x 650 x 0.9 = 339,3 cu. m / 12 =
28.3 litres / month average

STORAGE TANK REQUIREMENTS
FOR RAINFALL

Internal diameter (m) x filling height (m) = 6 x 3,2 allows for 90 500 litres

Dissolved Air Floatation Water Treatment Plant	
Total input feed flow rate	10m^3/hr
DAF re-cycle flow rate required	1m^3/hr
DAF desludge flow rate to waste	0.225 m^3/hour
Output flow rate	<4 m^3/hour
Raw Water Source	Industrial Effluent
Operation	Automatic/Manual
Hours/days of Operation	24 hours/day 260 days/year

Figure87: DAF Table (Water Icon Industrial Water Treatment Solutions 2013)

ELECTRICITY GENERATING CAPACITY

Per Annum= X kWh
Total solar panel area: 4500 sqm
Solar panel yield: 15%
Solar radiation: 2732
Losses: 0.75

E = A x R x H x PH
=4500 x 0.15 x 2732 x 0.75
=1 383 075 kWh per annum

BIOGAS GENERATING CAPACITY

25cu.m biogas plant requires
minimum 45 cattle to fill;
(10kg/day produced per dairy heifer)
1cu.m biogas = 4.698kWh electricity
& 1cu.m biogas = 0.620kg butane

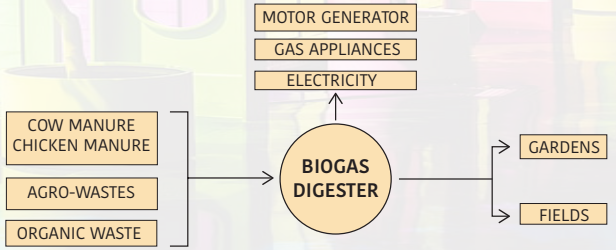


Figure88: Biogas Digester System (Author 2020)

INTEGRATION OF SYSTEMS

The intervention is nested within the larger system of the urban framework, showing the integration of sustainable and passive systems to achieve self-reliance and sustainability.

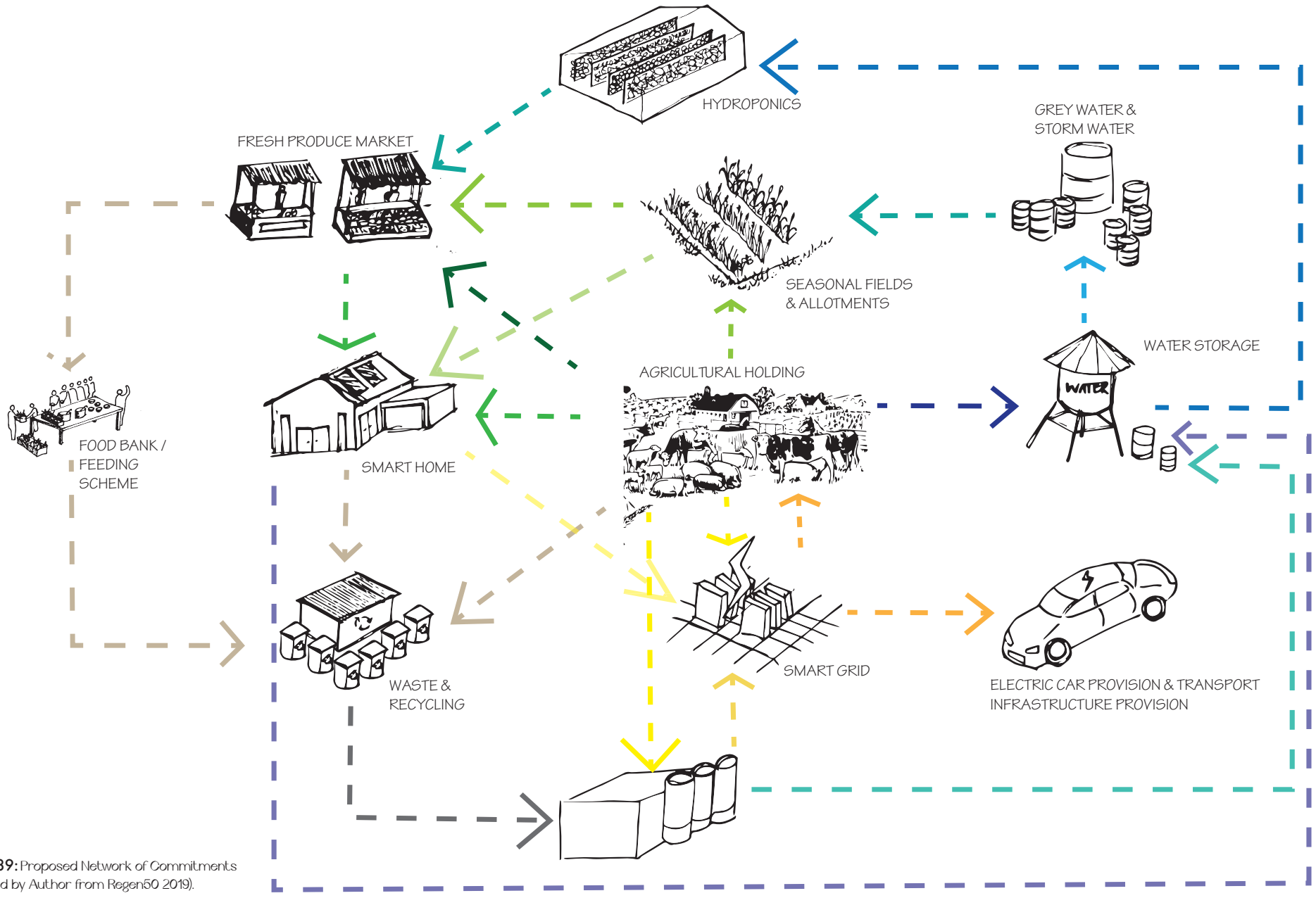
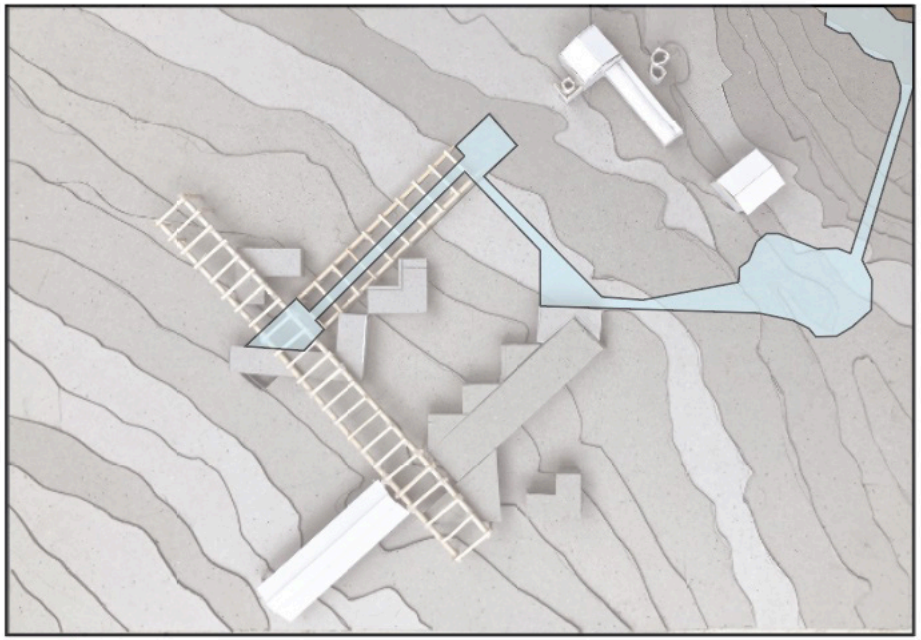


Figure89: Proposed Network of Commitments (Adapted by Author from Regen50 2019).

SYSTEMS ON SITE



Rain Water Harvesting (Wetlands)

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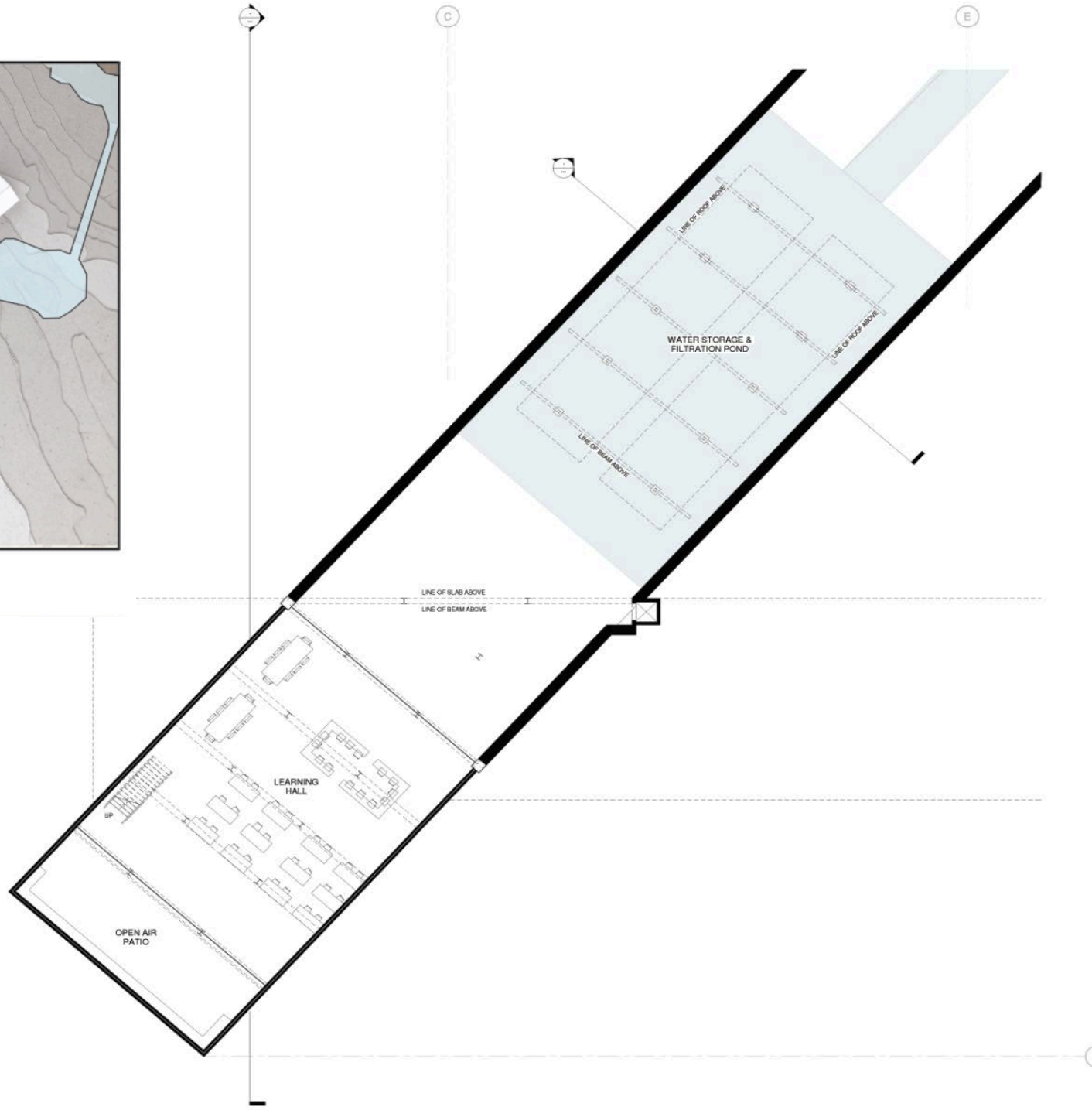
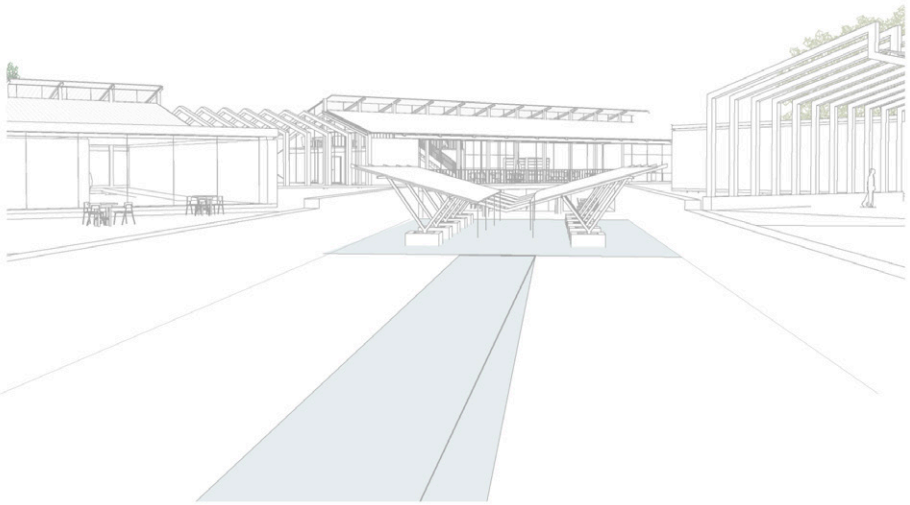
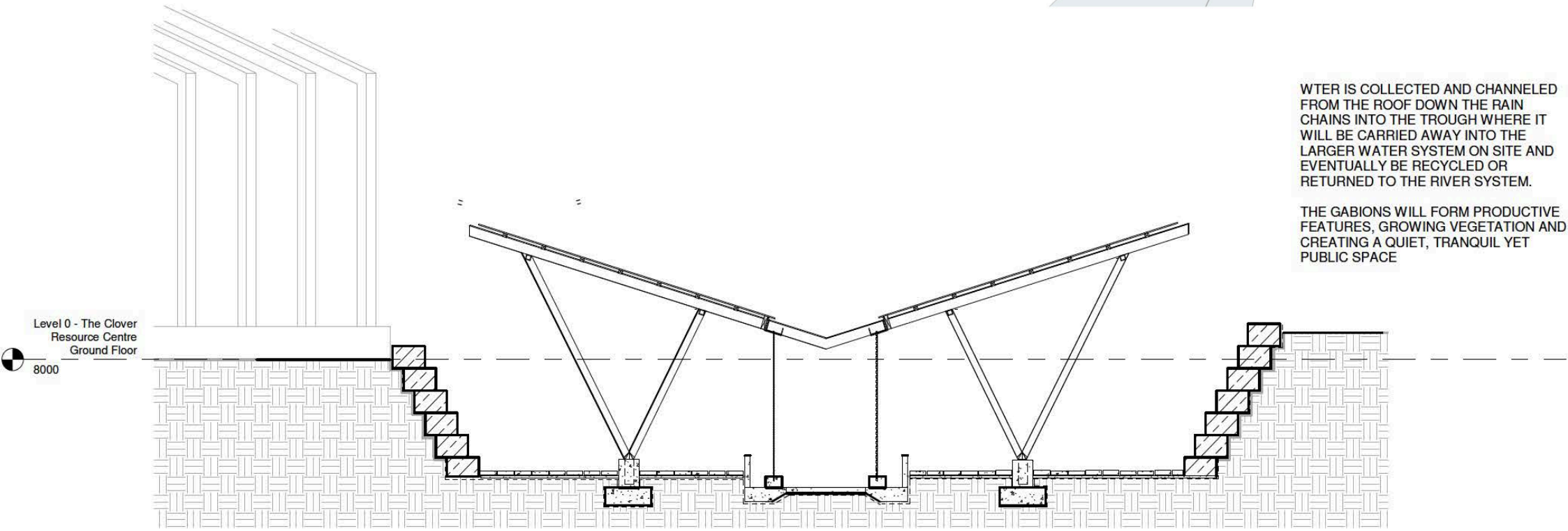


Level -1 Basement: Learning Hall & Water Storage
1 : 100



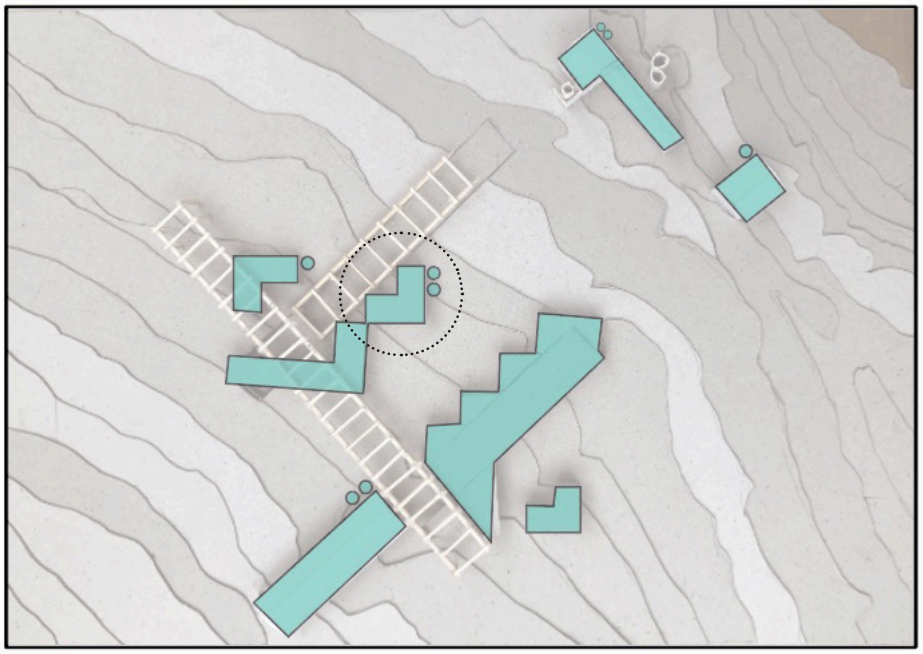
WTER IS COLLECTED AND CHANNELED FROM THE ROOF DOWN THE RAIN CHAINS INTO THE TROUGH WHERE IT WILL BE CARRIED AWAY INTO THE LARGER WATER SYSTEM ON SITE AND EVENTUALLY BE RECYCLED OR RETURNED TO THE RIVER SYSTEM.

THE GABIONS WILL FORM PRODUCTIVE FEATURES, GROWING VEGETATION AND CREATING A QUIET, TRANQUIL YET PUBLIC SPACE

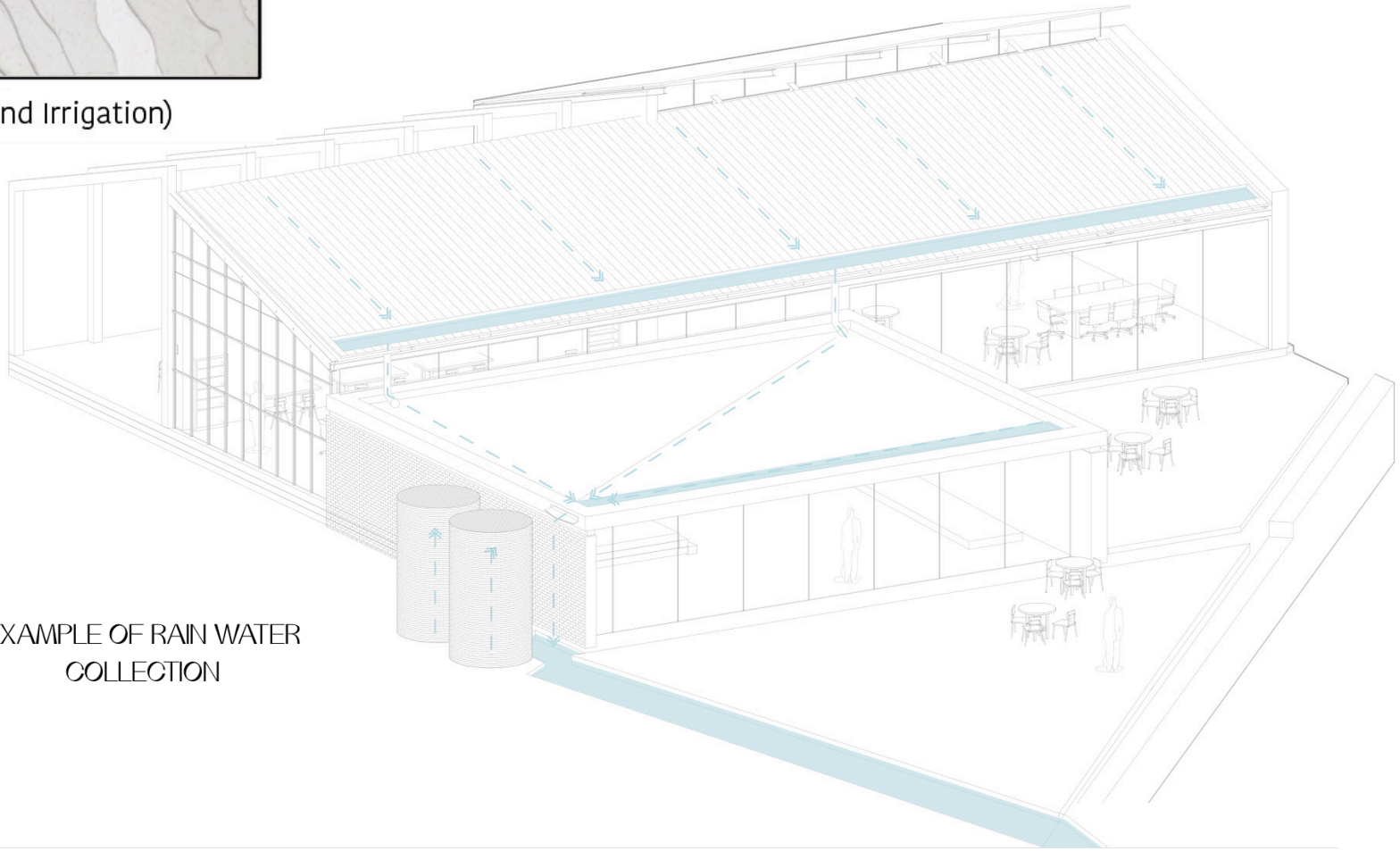


SECTION THROUGH RAINWATER COLLECTION POND

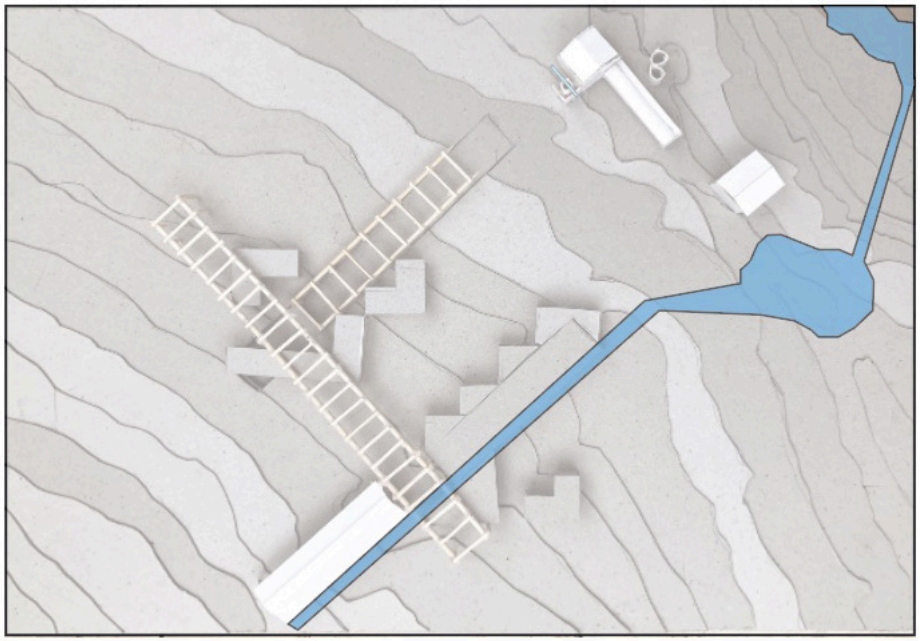
1 : 50

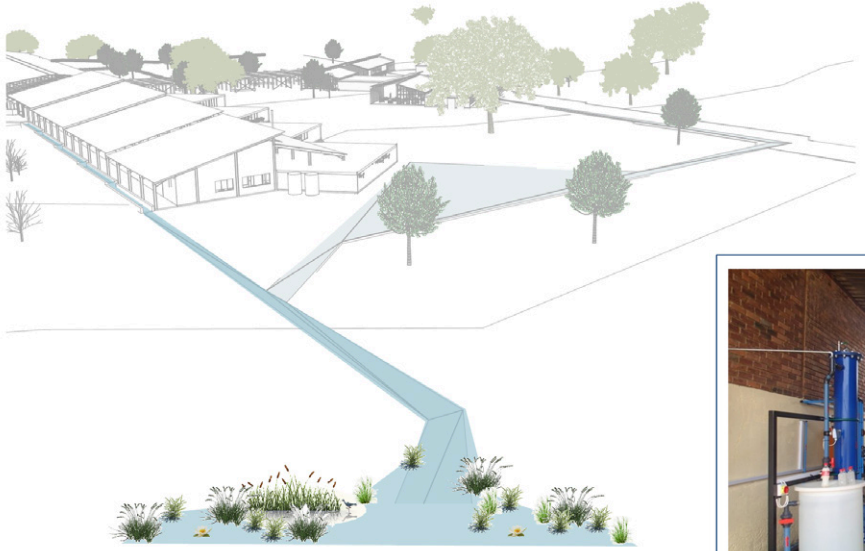


Rain Water Harvesting (Grey Water and Irrigation)



EXAMPLE OF RAIN WATER COLLECTION





Dairy Effluent Collection & Recycling

Complete DAF Unit

Dissolved Air Floatation Water Treatment Plant	
Total input feed flow rate	10m³/hr
DAF re-cycle flow rate required	1m³/hr
DAF desludge flow rate to waste	0.225 m³/hour
Output flow rate	<4 m³/hour
Raw Water Source	Industrial Effluent
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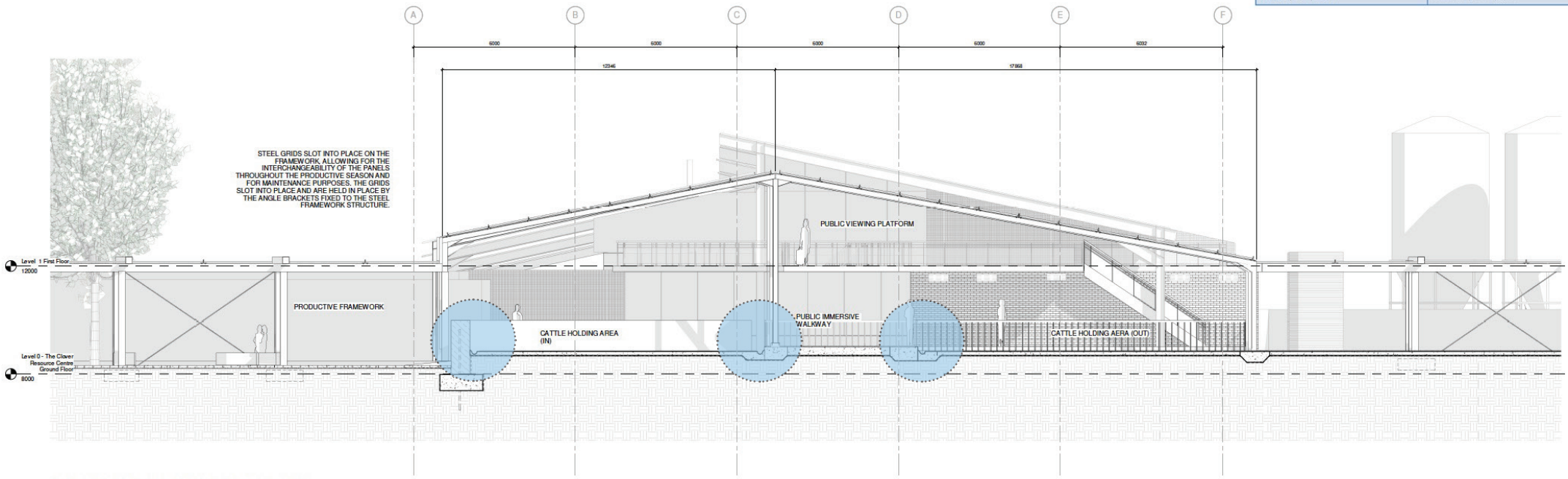
Hours/days of Operation	24 hours/day 260 days/year



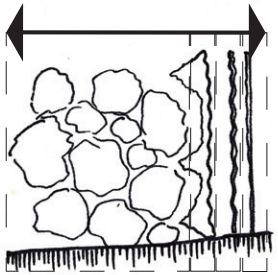
SECTION THROUGH PRODUCTIVE FRAMWORK

MATERIALS

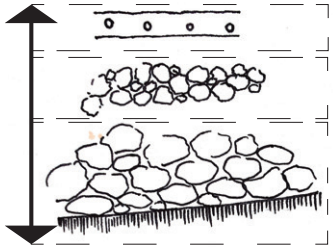
The materials used will pay homage to the traditional layers of construction and materials on site (such as the farm typology appropriate to the mid 1800's) and will use the equivalent technology that is appropriate today. Materials will be locally sourced as far as possible, while the use of pre-fabricated elements will play a critical role in the adabtability of the built and framework structures. Steel elements will be sourced from local steel workers in the Pretoria East vicinity.

The use of materials sourced directly from the site will be preferable, such as reclaimed steel and brick, natural stone, and the use of organic waste products such as 'cowcrete' and crop wastes, as a material for construction. Other materials that can be sourced from neighbouring agricutural holdings and recyling facilities will be used as well, such as wool for insulation and timber for construction and finsihes.

EXPLORING EXISTING TYPOLOGIES ON SITE

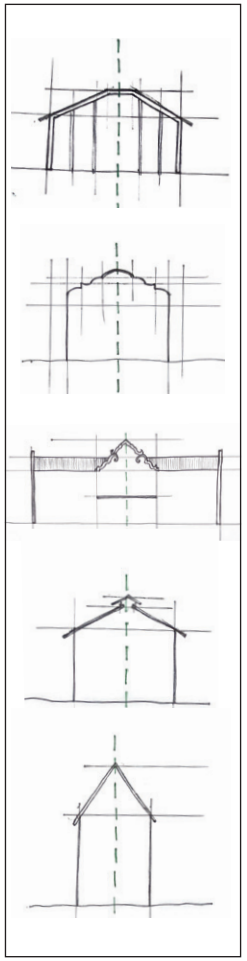


LAYERS: MATERIALS



LAYERS:
CONSTRUCTION

There are two main typologies on the site being the horizontal (usage of materials) and the vertical (method of construction). In both, the stone is the key stereotomic and base element, and as such, will continue to be for the proposal. The use of this natural element that was located on site will be a key feature in the current project in an effort to pay homage to not only the traditional construction used, but also the method of using unskilled labour and, as a result, encouraging skills development and facilitating opportunities for local maintenance.



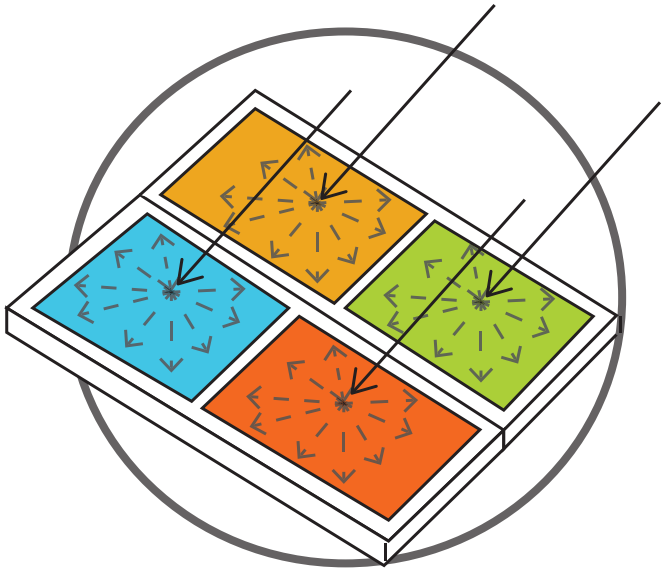
AUREUS SOLAR PANELS

The AUREUS solar panel is the 2020 winner of the James Dyson Sustainability Award.

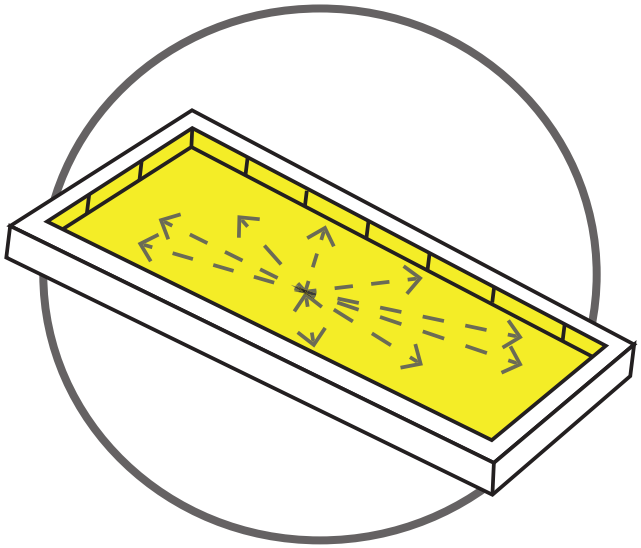
The panels were created as a solution to the need for cleaner energy and as a response to food wastes in Singapore. The resin panels are stained with pigment extracted from 9 key waste agricultural crops (such as spinach and turmeric) to absorb stray UV light from sunlight and convert it to a clean, renewable form of electical energy. The panels are made up of red, orange, green, yellow and blue dyes, 80% of which are extracted directly from crops.

Inspiration was drawn from the Aurora Borealis, where high energy UV / Gamma rays are degraded to a low energy state, creating visible light by luminescent particles in the atmosphere. Similar forms of luminescent particles are found in the pigments of certain agricultural crops, these are extracted and refined and suspended in a resin substrate, forming the core technology of this system.

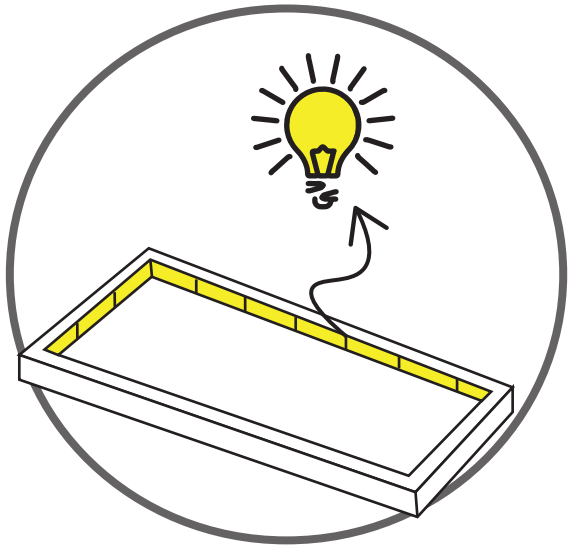
This technology has created the opportunity to build solar farms vertically, and to maximise available space on the building facade to do so, as the panels harvest direct, reflected and refracted light, meaning that it can be located in both sun and shade.



When hit by UV light, the particles absorb and re-emit visible light that is captured along the edges of the panels, due to internal reflection.

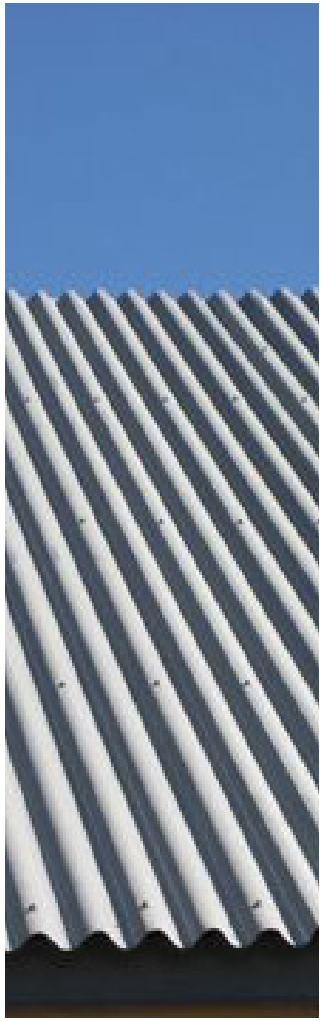


PV cells are placed along the internal edges of the panel.

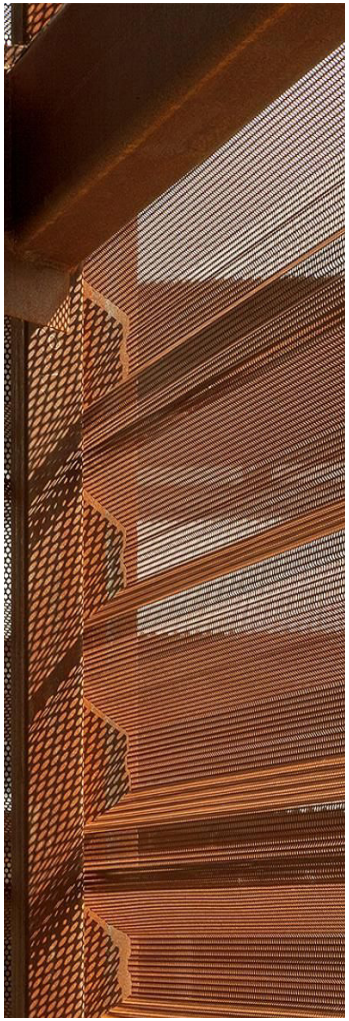


Captured light is then converted into DC electricity. Regulating circuits are needed to process the voltage output to allow battery charging, storage and direct utilisation of electricity.

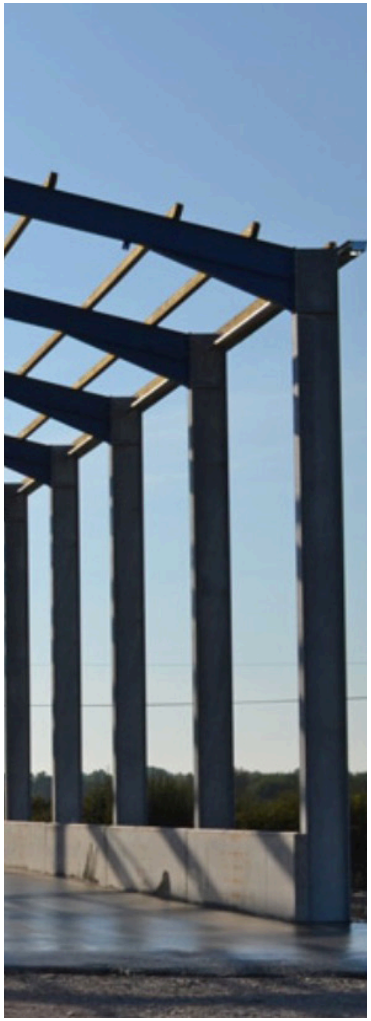
MATERIALS PALETTE



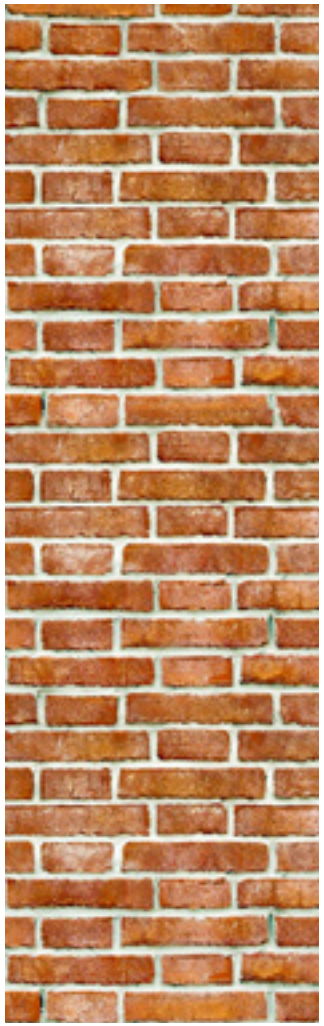
Corrugated iron roof sheeting



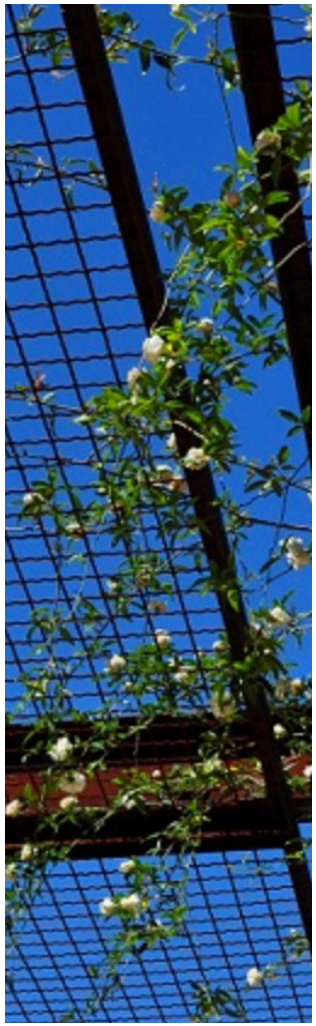
Perforated metal sheeting for selected exterior walls



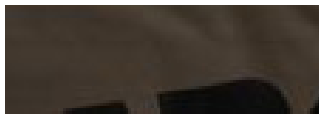
Steel Portal Frame with galvanised steel beams and purlins

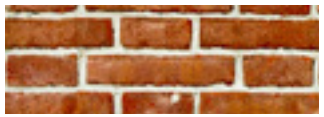


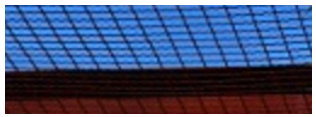
Paint-washed stock bricks and face brick

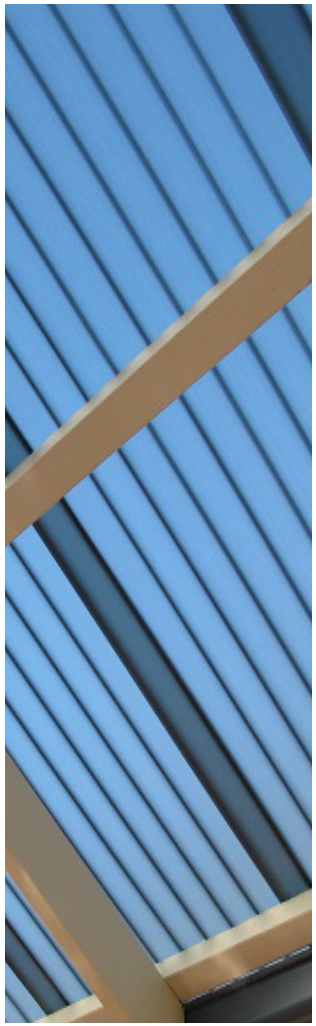


Galvanised steel grid panels for framework

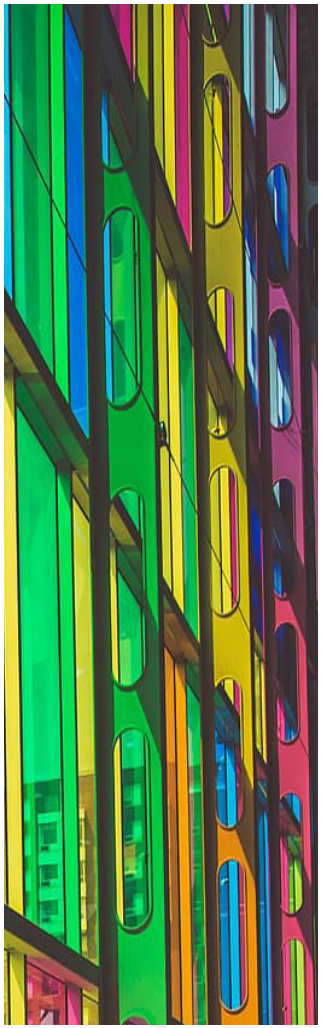








Transparent corrugated polycarbonate roof sheeting



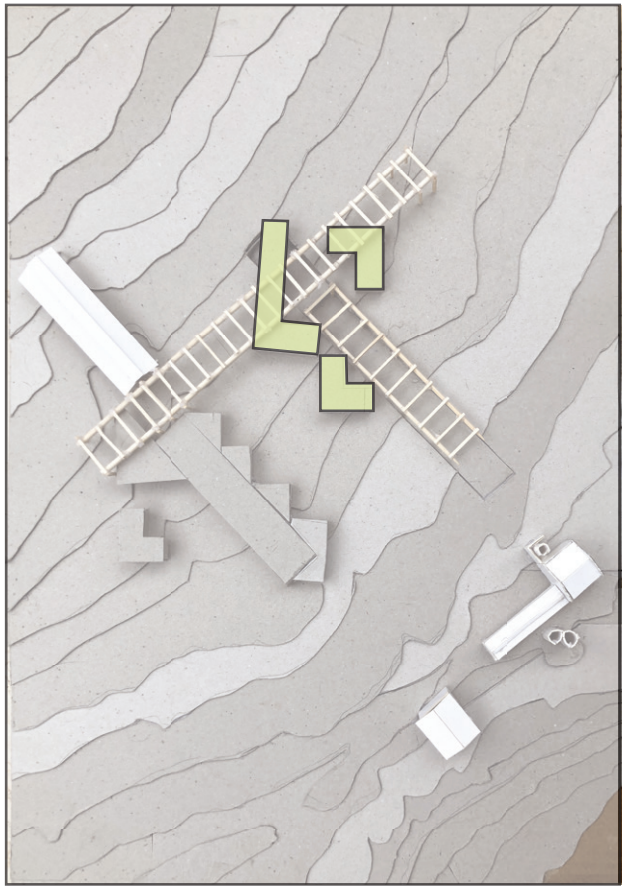
AUREUS solar panels

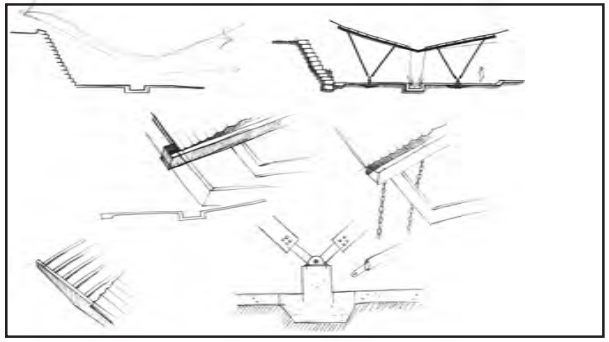
Precast and In-situ concrete

Reclaimed building rubble and stone gabion structure

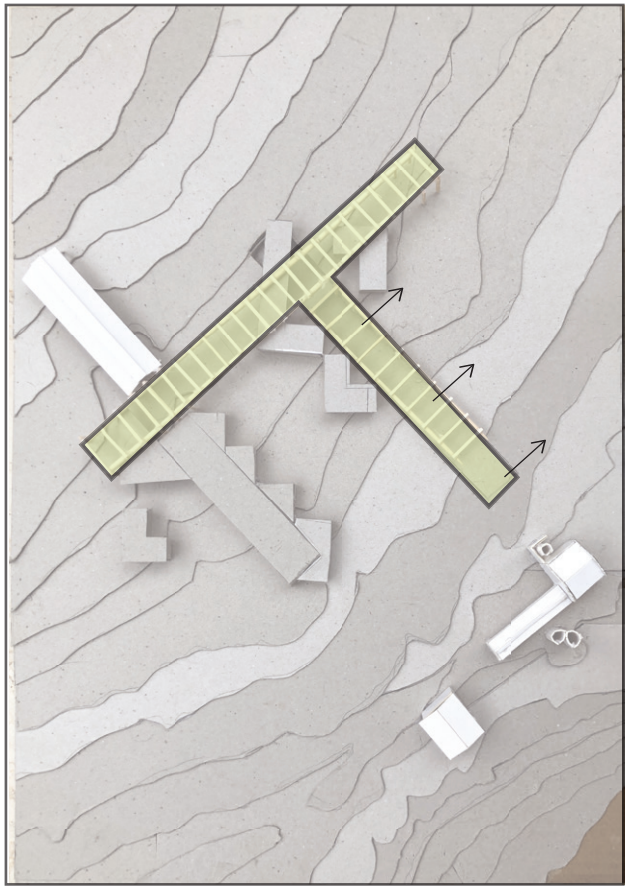
Galvanised steel columns

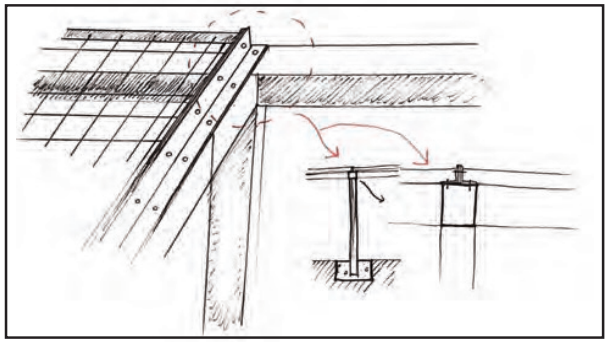
RESOURCES

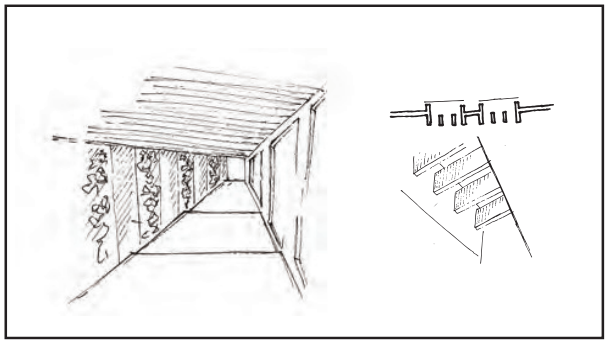


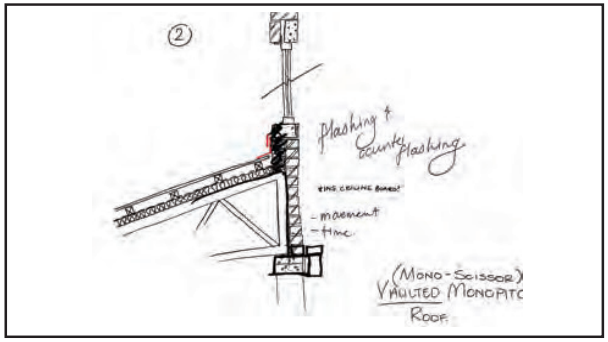


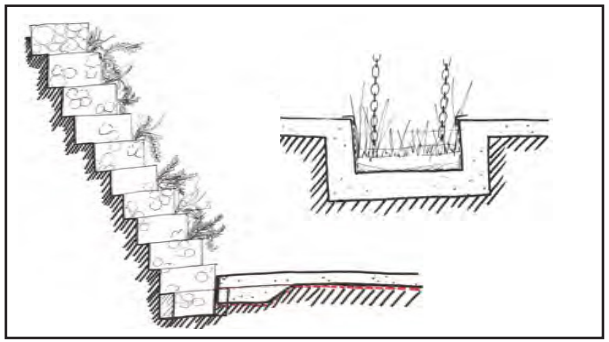
FRAMEWORK

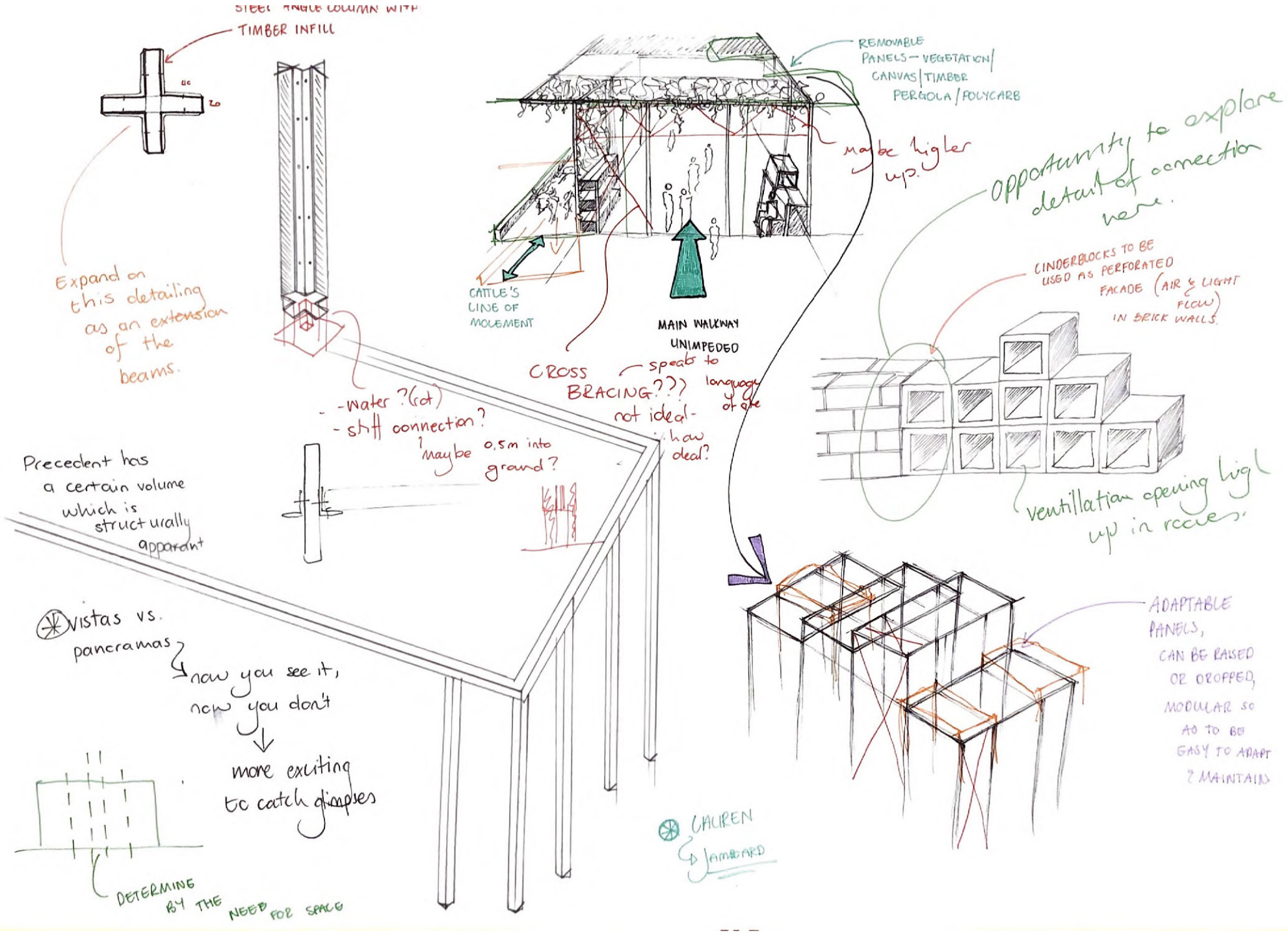


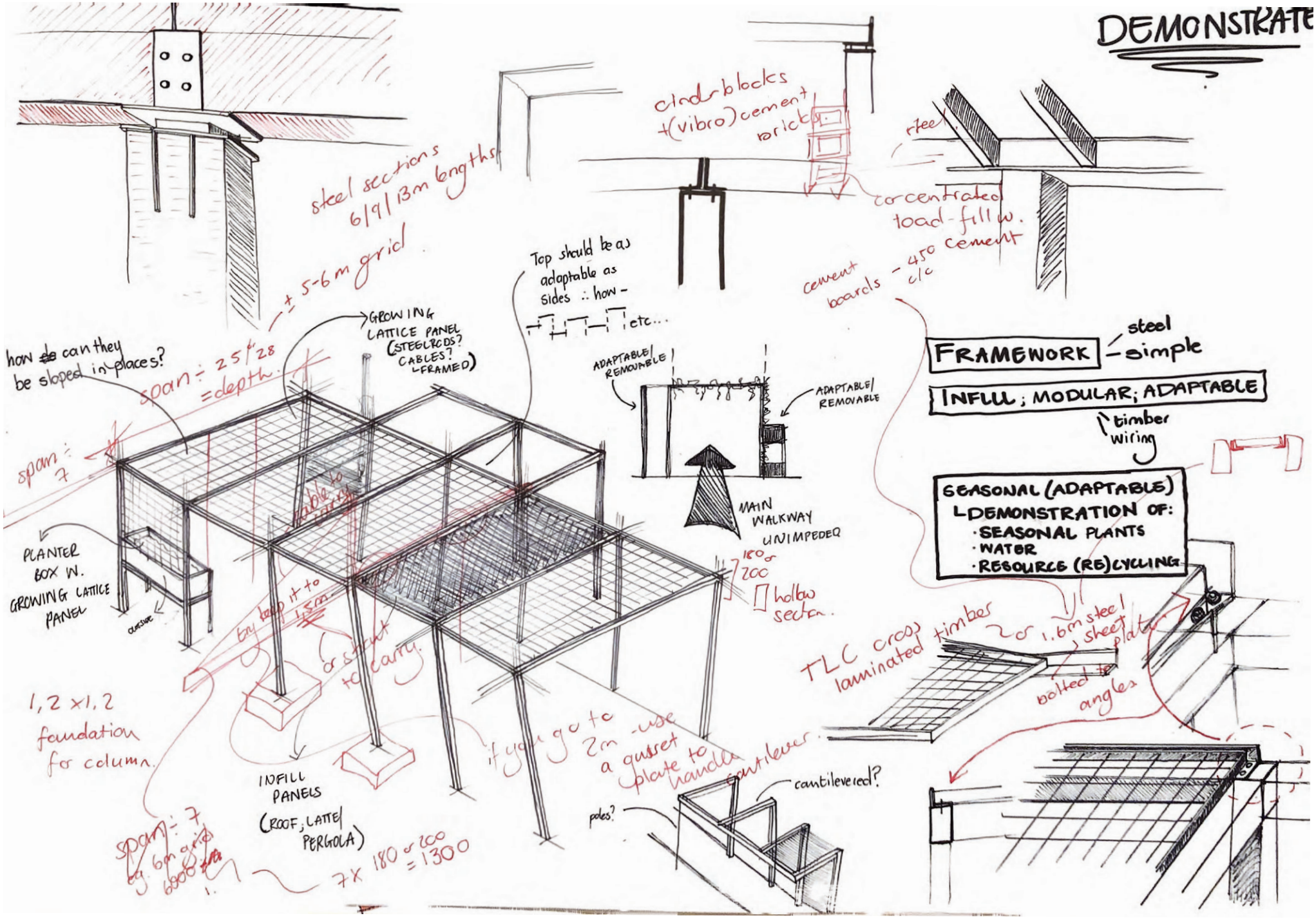


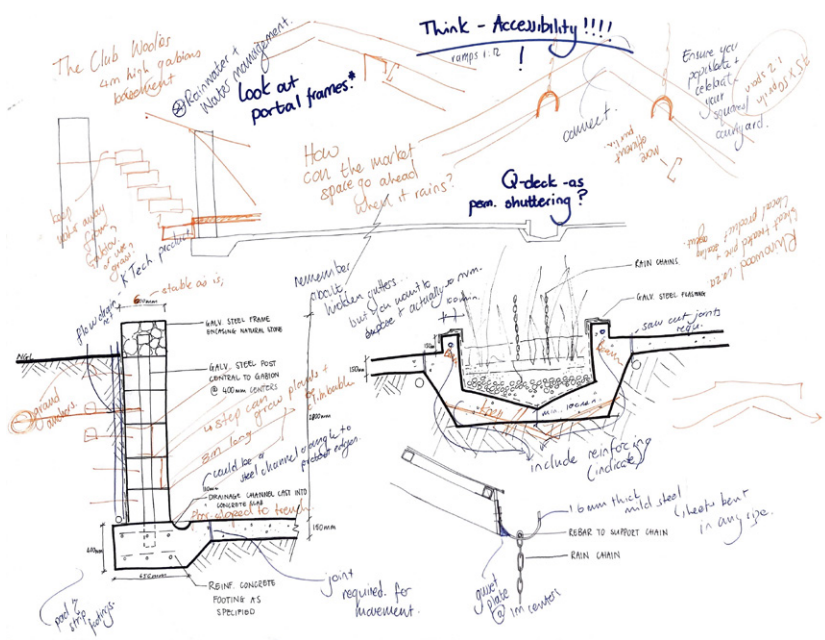


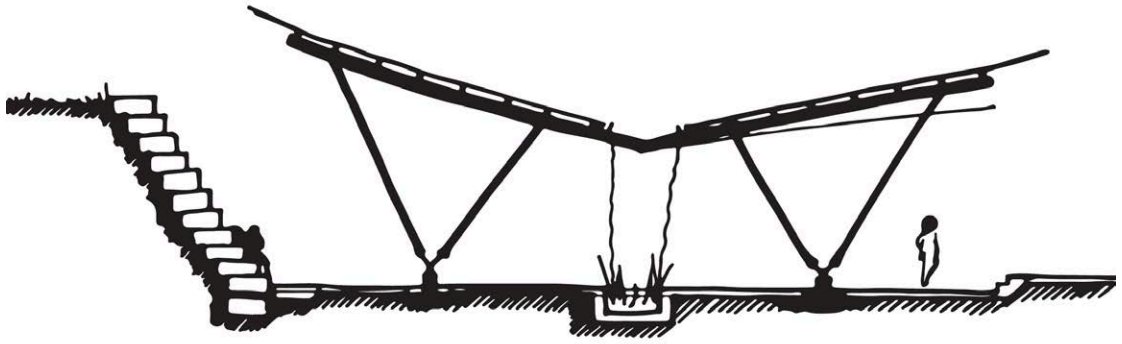


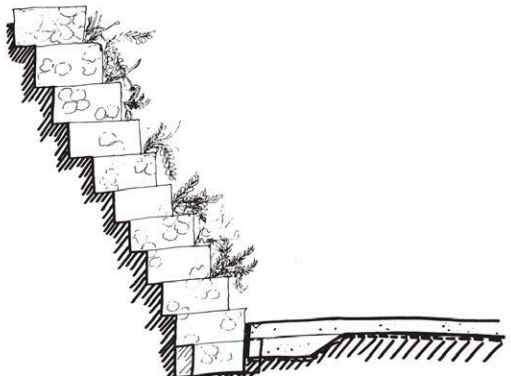


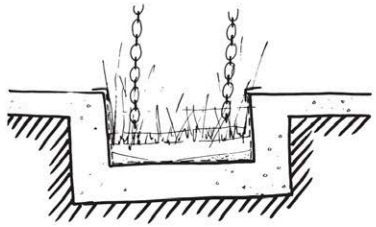

STEEL ANGLE COLUMN WITH
TIMBER INFILL
Expand on this detailing as an extension of the beams.
REMOVABLE PANELS – VEGETATION / CANVAS / TIMBER PERGOLA / POLYCARB
maybe higher up.
CATTLE'S LINE OF MOVEMENT
MAIN WALKWAY UNIMPEDED
CROSS BRACING??? speaks to language of site
not ideal - how ideal?
- water ? (rot)
- stiff connection?
maybe 0.5m into ground?
Precedent has a certain volume which is structurally apparant
vistas vs. panoramas
now you see it, now you don't
more exciting to catch glimpses
DETERMINE BY THE NEED FOR SPACE
opportunity to explore detail of connection here.
CINDERBLOCKS TO BE USED AS PERFORATED FACADE (AIR & LIGHT FLOW) IN BRICK WALLS.
ventillation opening high up in rooves.
ADAPTABLE PANELS, CAN BE RAISED OR DROPPED, MODULAR SO AS TO BE EASY TO ADAPT & MAINTAIN
LAUREN
LAMBOARD

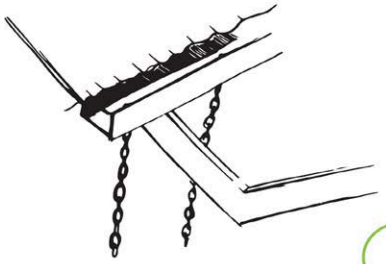

DEMONSTRATE
steel sections 6/9/13m lengths
± 5-6m grid
cinder blocks + (vibro) cement brick
steel
concentrated load - fill w. cement
cement boards - 450 c/c
how can they be sloped in places?
span ÷ 25 / 28 = depth
GROWING LATTICE PANEL (STEEL RODS? CABLES? FRAMED)
Top should be as adaptable as sides ∴ how - etc...
ADAPTABLE/ REMOVABLE
ADAPTABLE/ REMOVABLE
MAIN WALKWAY UNIMPEDED
180 or 200
hollow section
FRAMEWORK - steel - simple
INFILL; MODULAR; ADAPTABLE
timber wiring
SEASONAL (ADAPTABLE) DEMONSTRATION OF:
· SEASONAL PLANTS
· WATER
· RESOURCE (RE)CYCLING
PLANTER BOX W. GROWING LATTICE PANEL
span ÷ 7
by loop it to 1.5m
or strut to carry
TLC cross laminated timber
2 or 1.6m steel sheet plate
bolted to angles
1,2 x 1,2 foundation for column
INFILL PANELS (ROOF; LATTE/ PERGOLA)
if you go to 2m - use a gusset plate to handle cantilever
cantilevered?
poles?
span ÷ 7 by 6m grid
7 x 180 or 200 = 1300

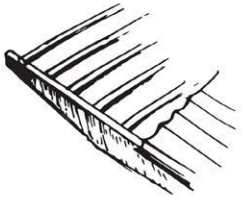

Think - Accessibility !!!!
The Club Woolies 4m high gabions basement
Rainwater + Water management.
Look at portal frames.*
How can the market space go ahead when it rains?
Q-deck -as perm. shuttering?
connect.
Ensure you populate + celebrate your squares/ courtyard.
K Tech product
stable as is;
GALV. STEEL FRAME ENCASING NATURAL STONE
GALV. STEEL POST CENTRAL TO GABION @ 400mm CENTERS
step can grow plants + climbable
3m long
could be a steel channel arranged to protect edges.
DRAINAGE CHANNEL CAST INTO CONCRETE SLAB
Pre-sloped to trench
REINF. CONCRETE FOOTING AS SPECIFIED
joint required for movement.
pad & strip footings.
remember wooden gutters but you want to decrease & actually 50mm.
RAIN CHAINS
GALV. STEEL FLASHING
saw cut joints req.
include reinforcing (indicate)
16mm thick mild steel (sheets bent in any size.
REBAR TO SUPPORT CHAIN
RAIN CHAIN
gusset plate @ 1m centers

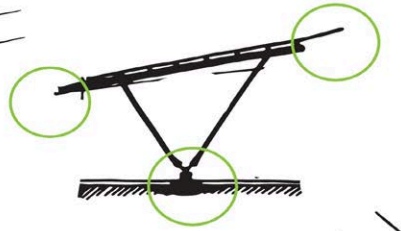


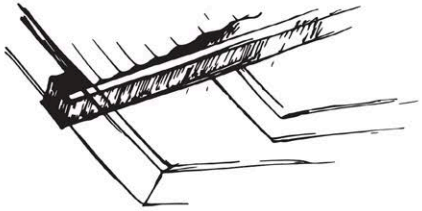


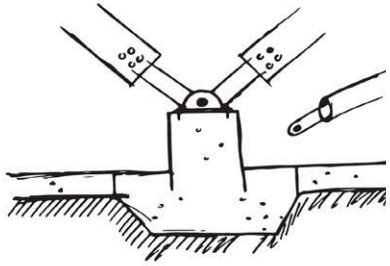


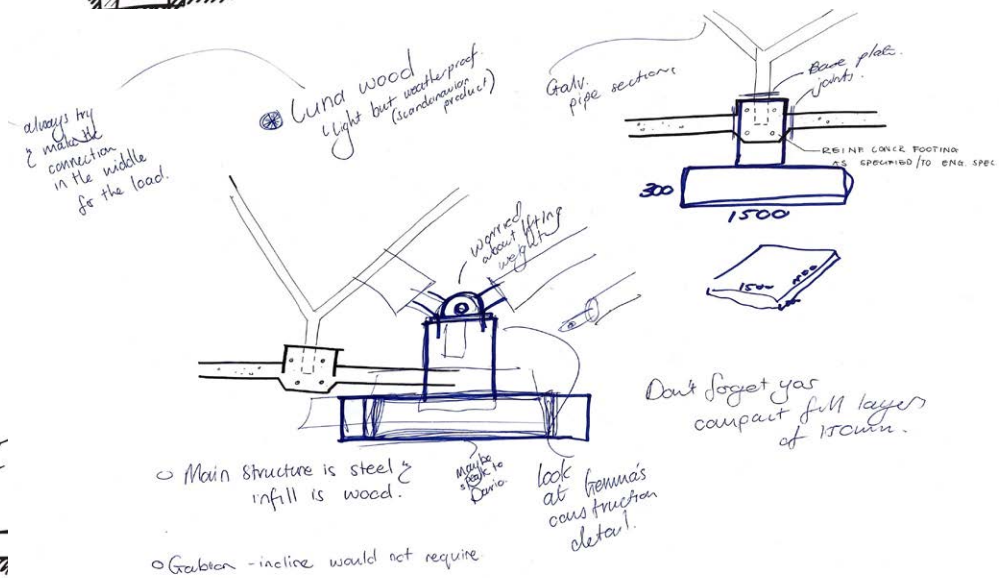




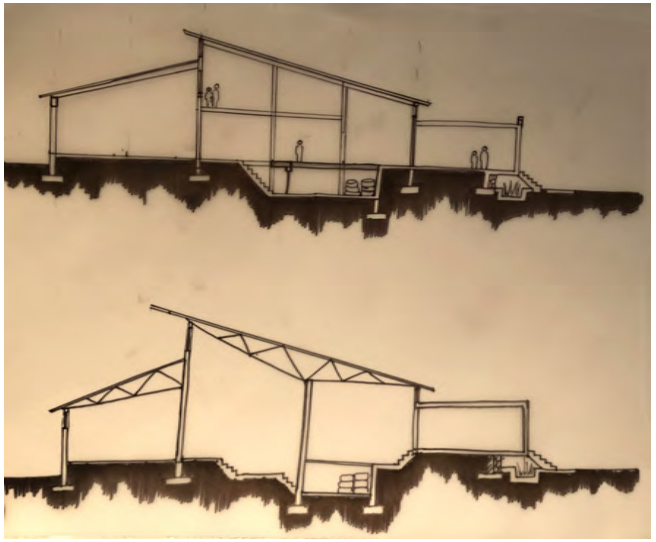


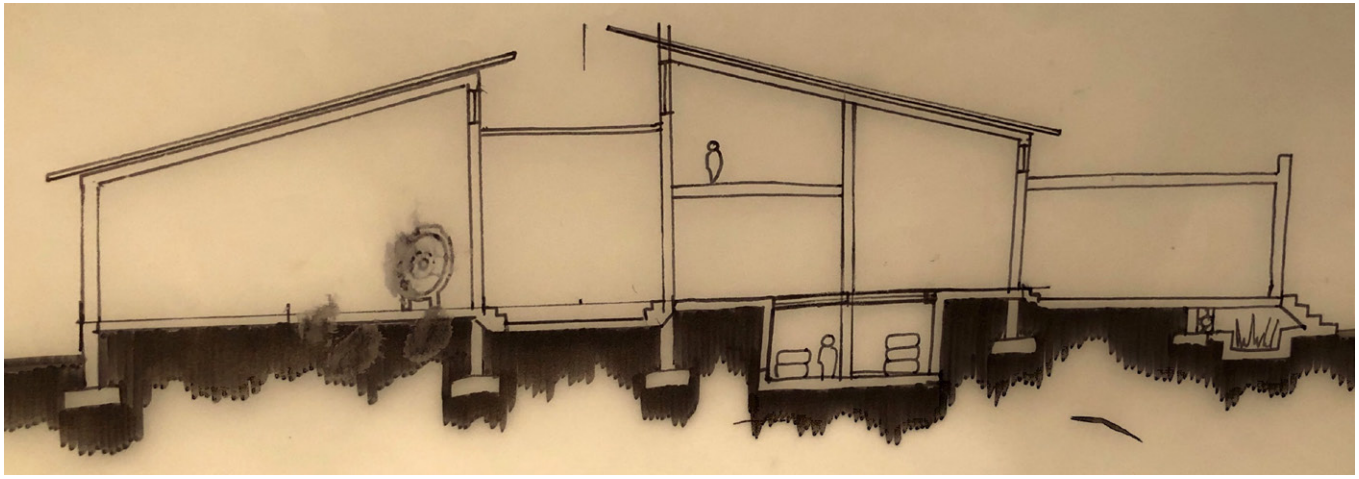


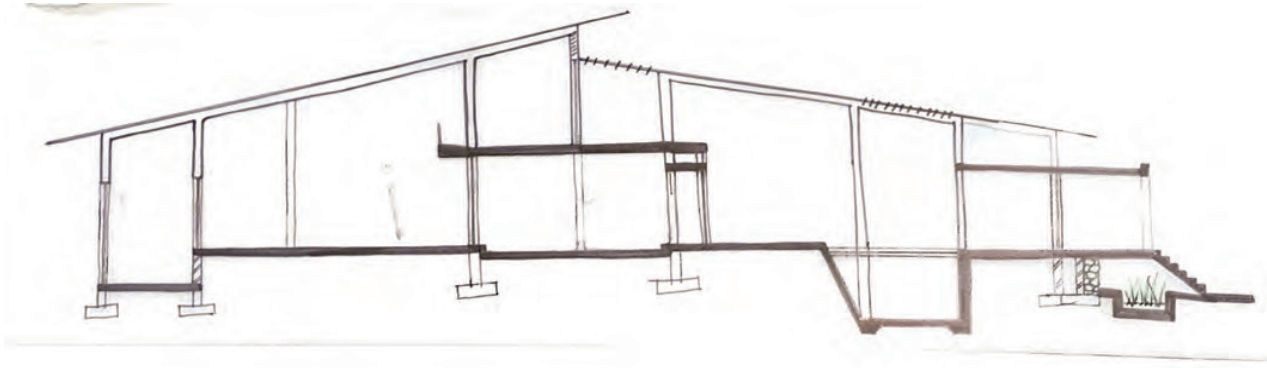


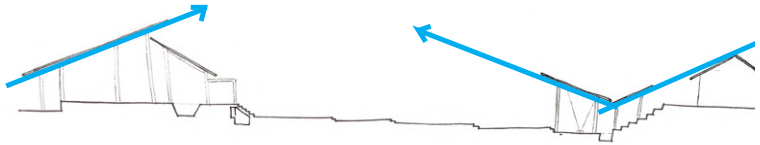

always try & make the connection in the middle for the load.
Luna wood (light but weatherproof (scandinavian product)
Galv. pipe sections
Base plate.
joints.
REINF. CONCR. FOOTING AS SPECIFIED /TO ENG. SPEC
300
1500
worried about lifting weight
Don't forget you compact full layers of 150mm.
Main structure is steel & infill is wood.
maybe speak to Dario.
look at Gemma's construction detail.
Gabion - incline would not require

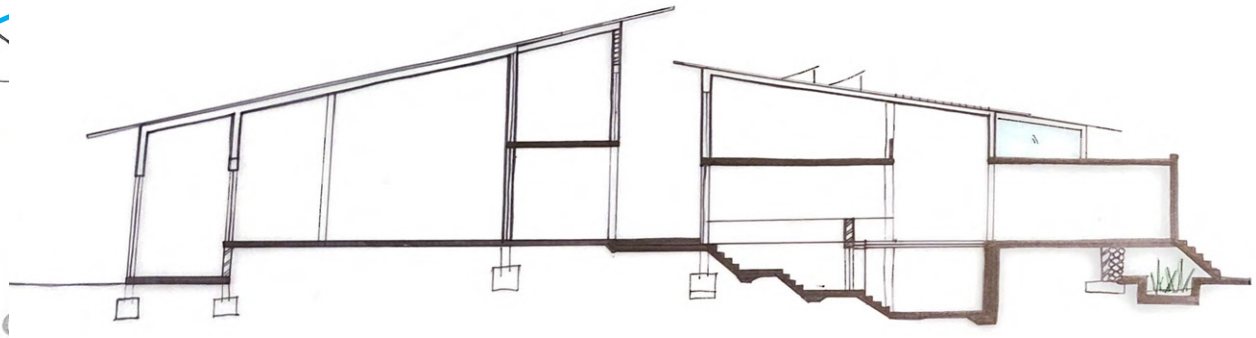
ITERATION 1

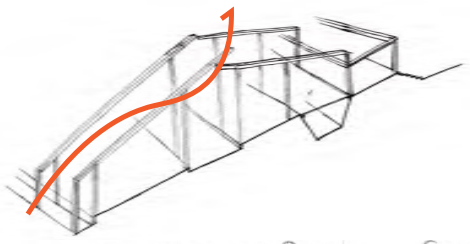






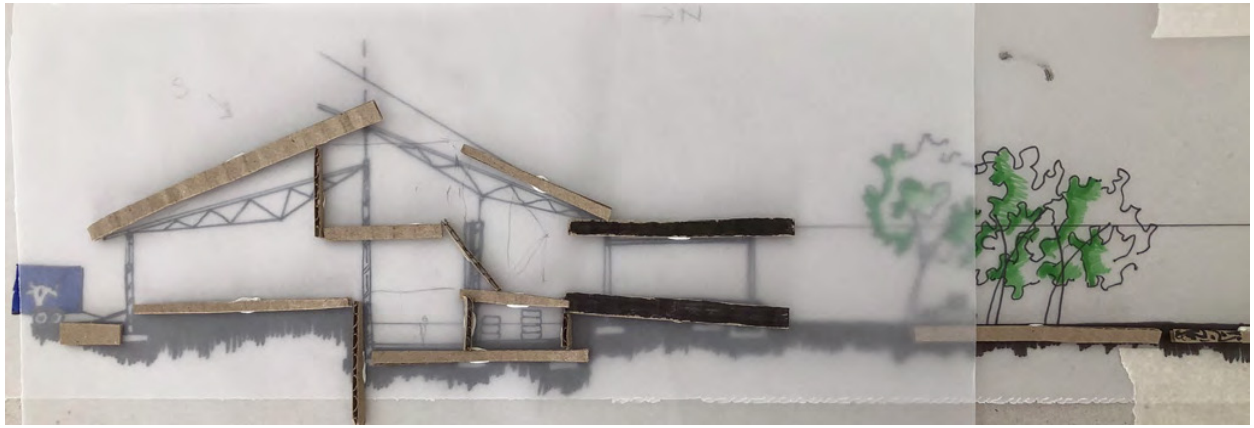


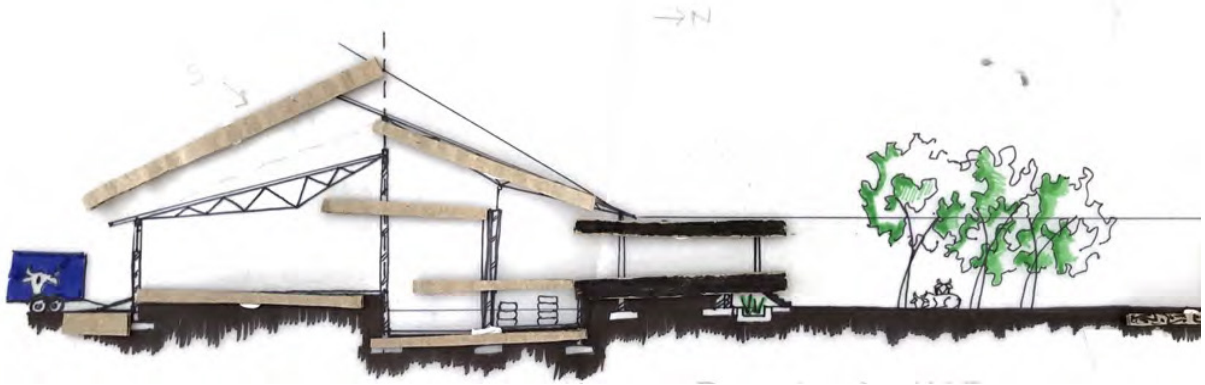


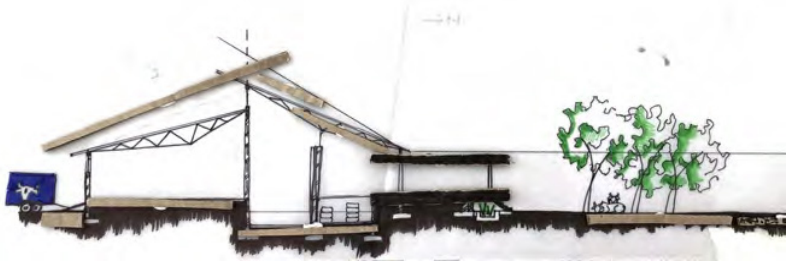


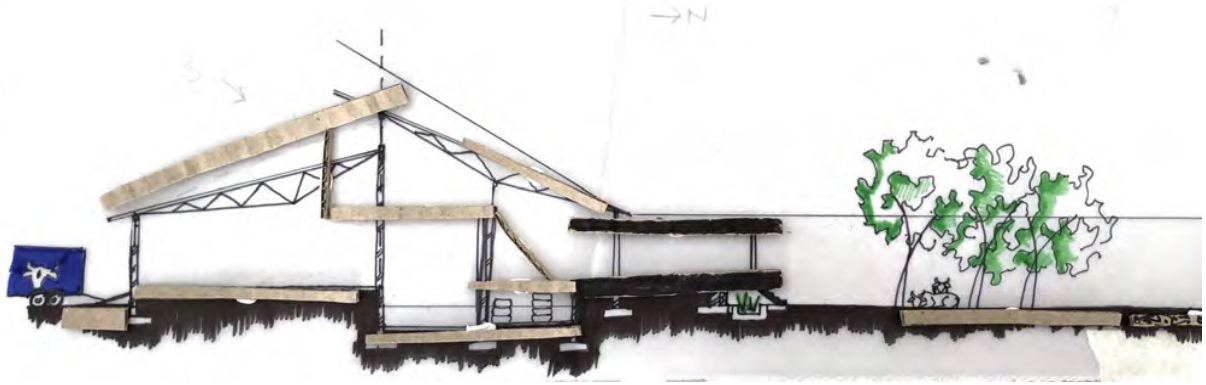
ERVICE EXHIBITION & PREP CONSUMPTION MOVEMENT PUBLIC

ITERATION 2









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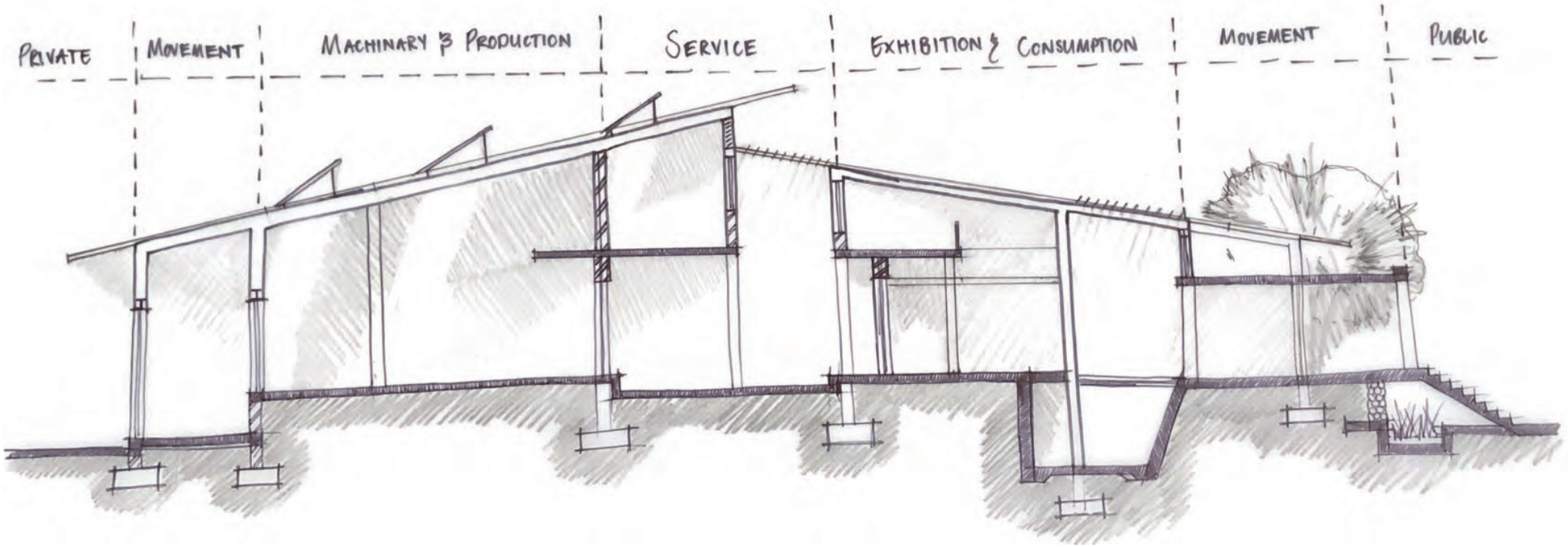
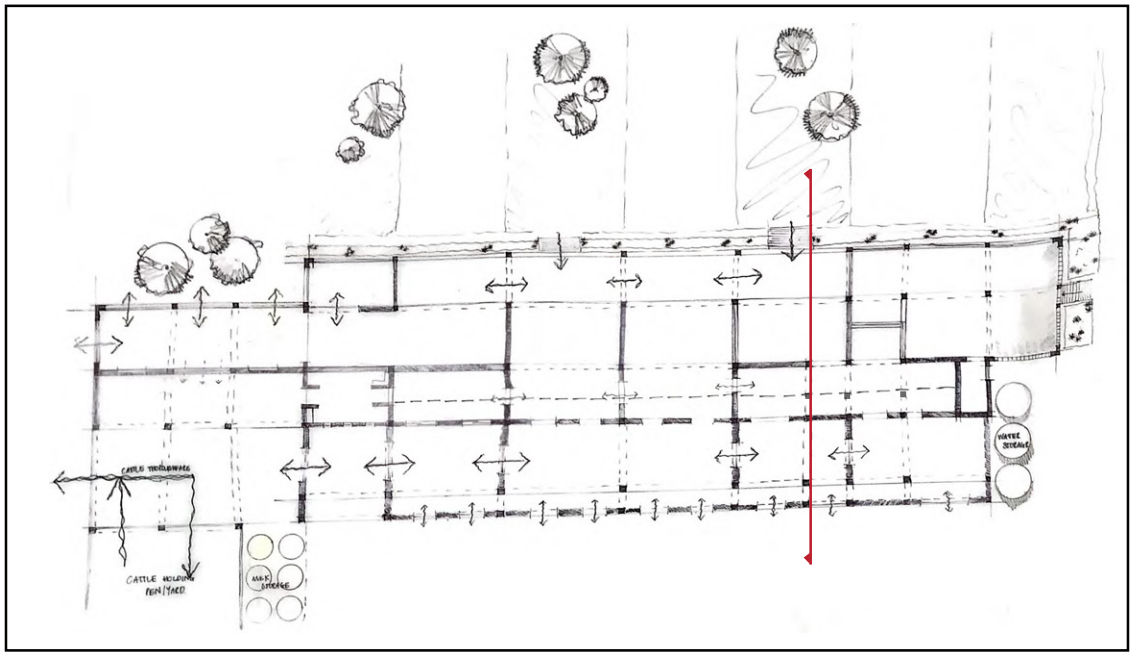
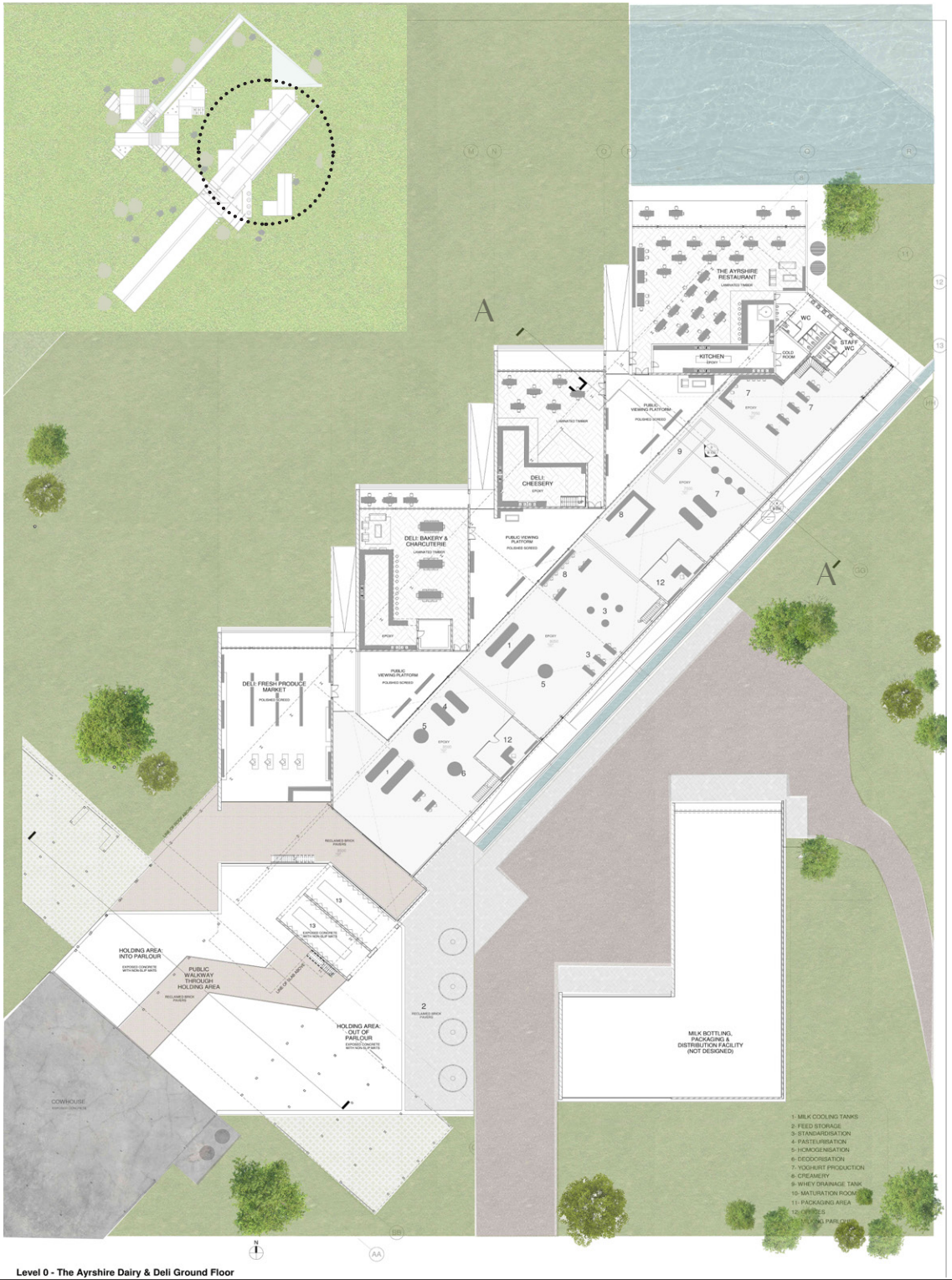
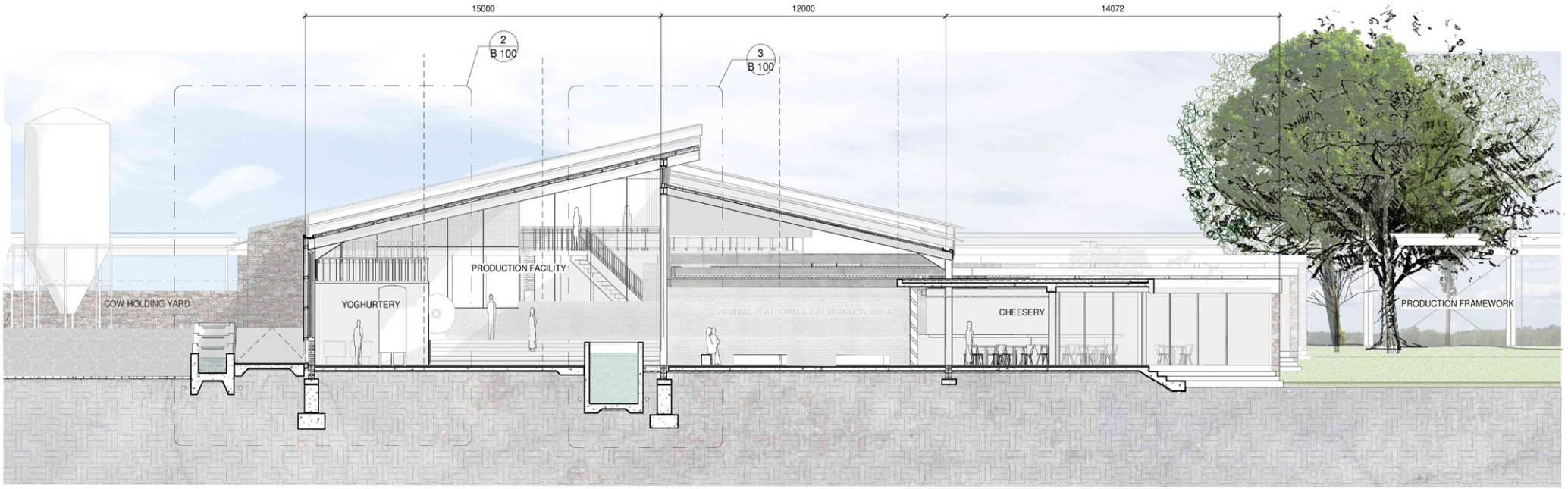

PRIVATE
MOVEMENT
MACHINARY & PRODUCTION
SERVICE
EXHIBITION & CONSUMPTION
MOVEMENT
PUBLIC





Level 0 - The Ayrshire Dairy & Deli Ground Floor



Section A-A
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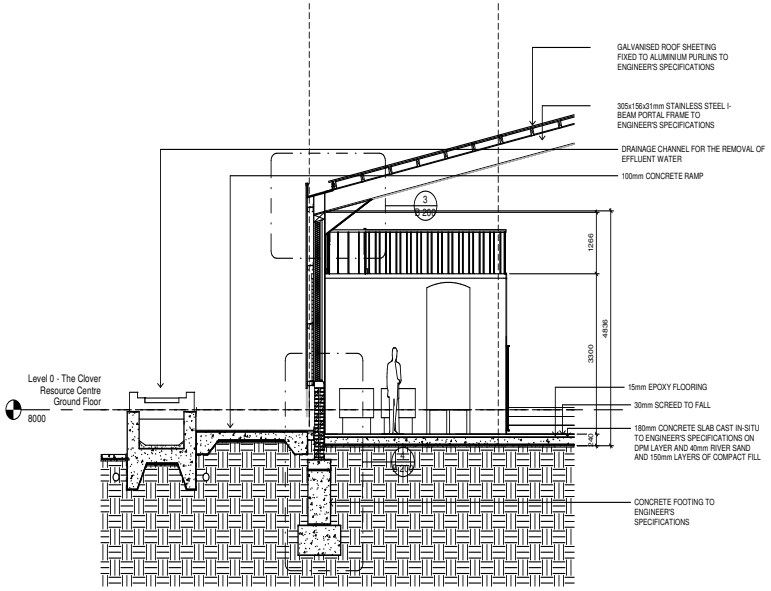

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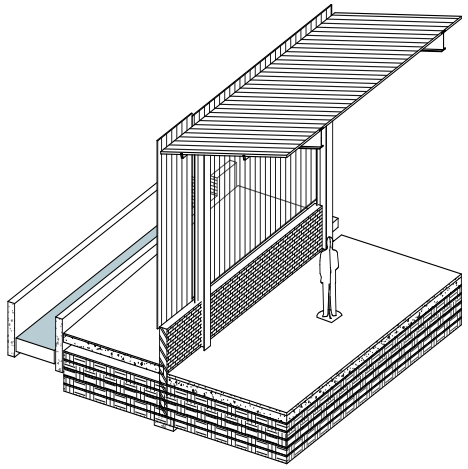

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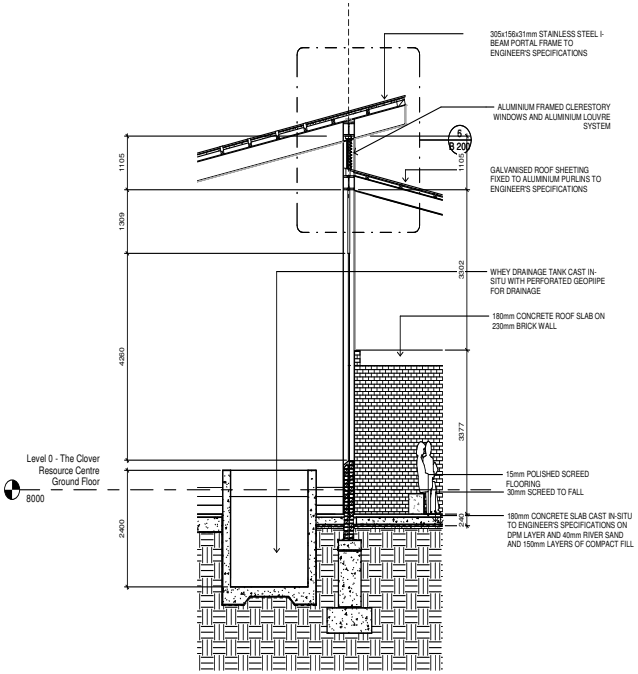

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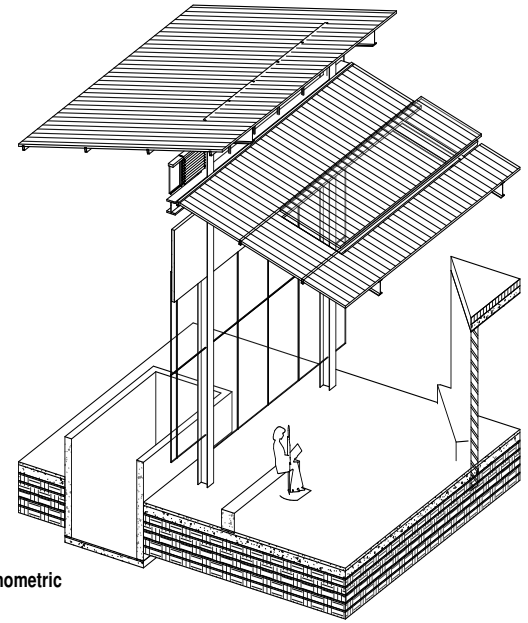
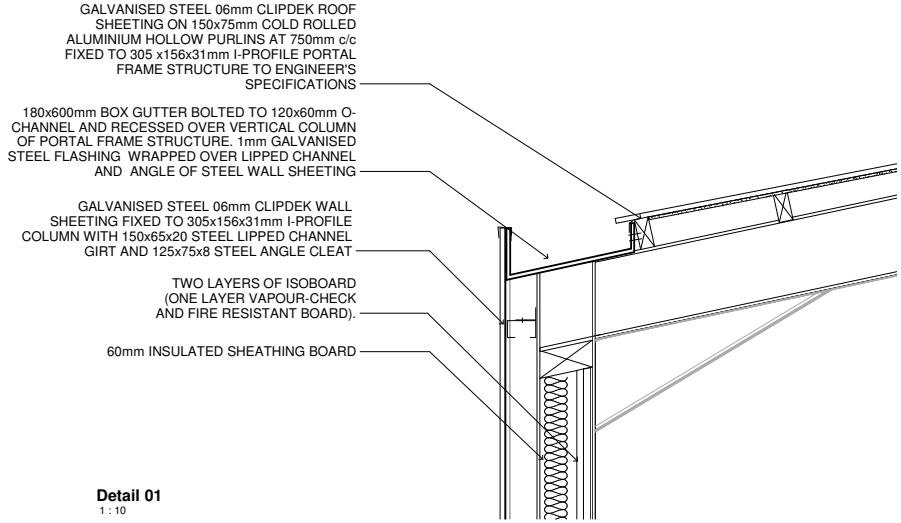


Section A-A Axonometric



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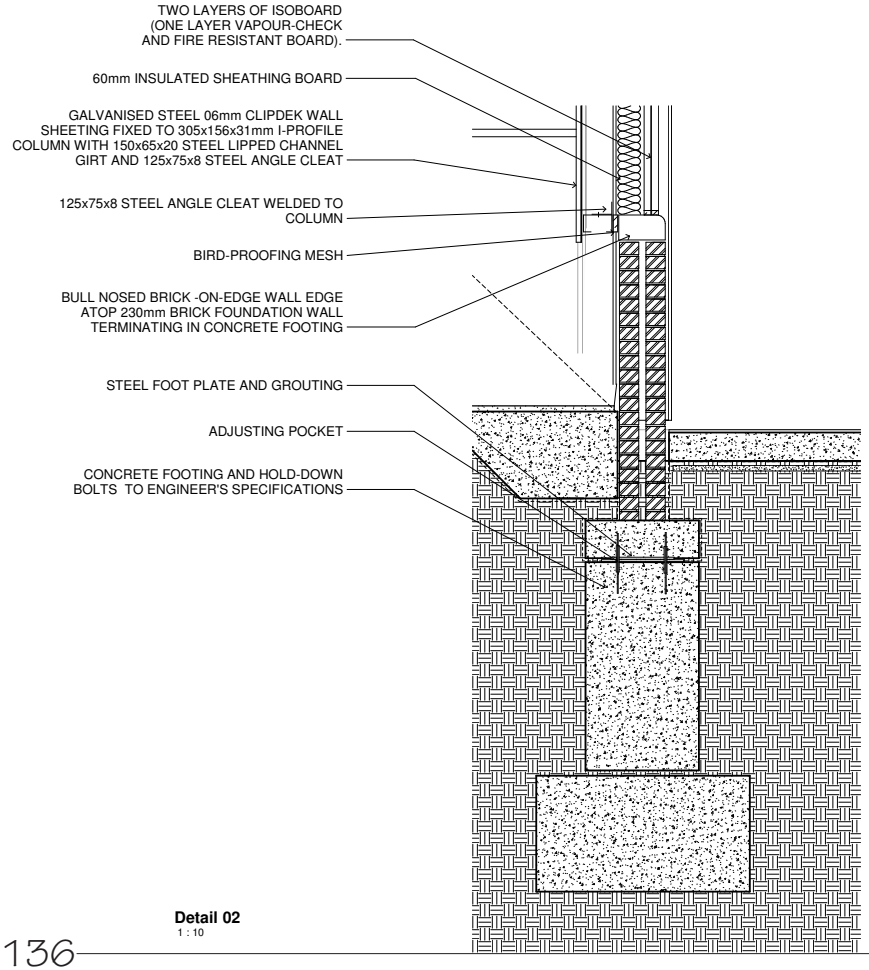

Detail 02
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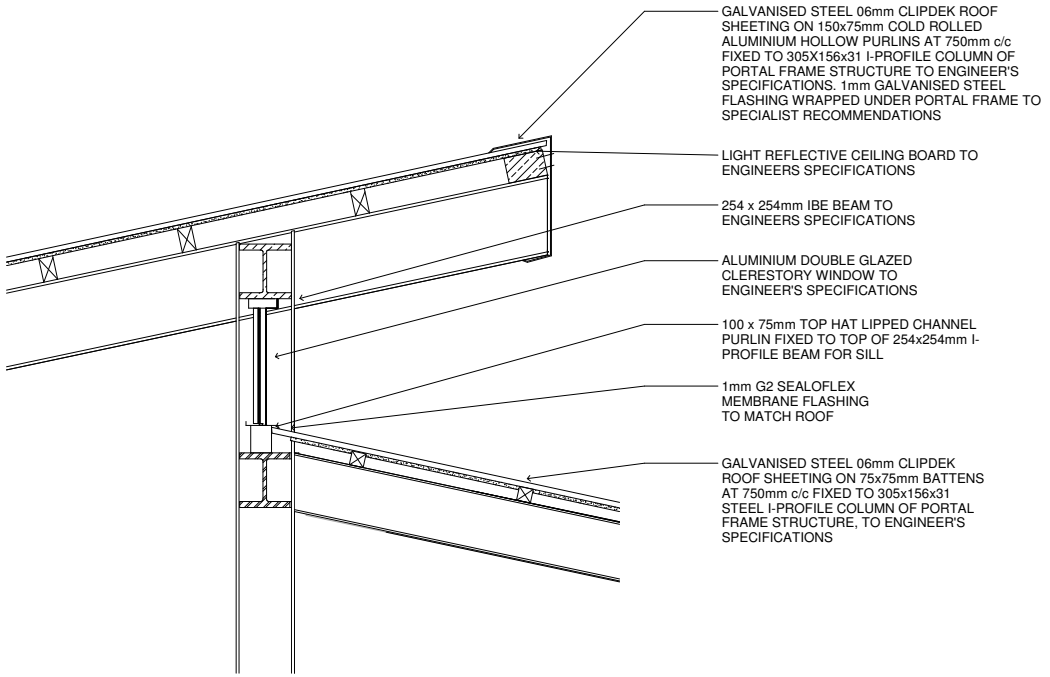

Detail 03
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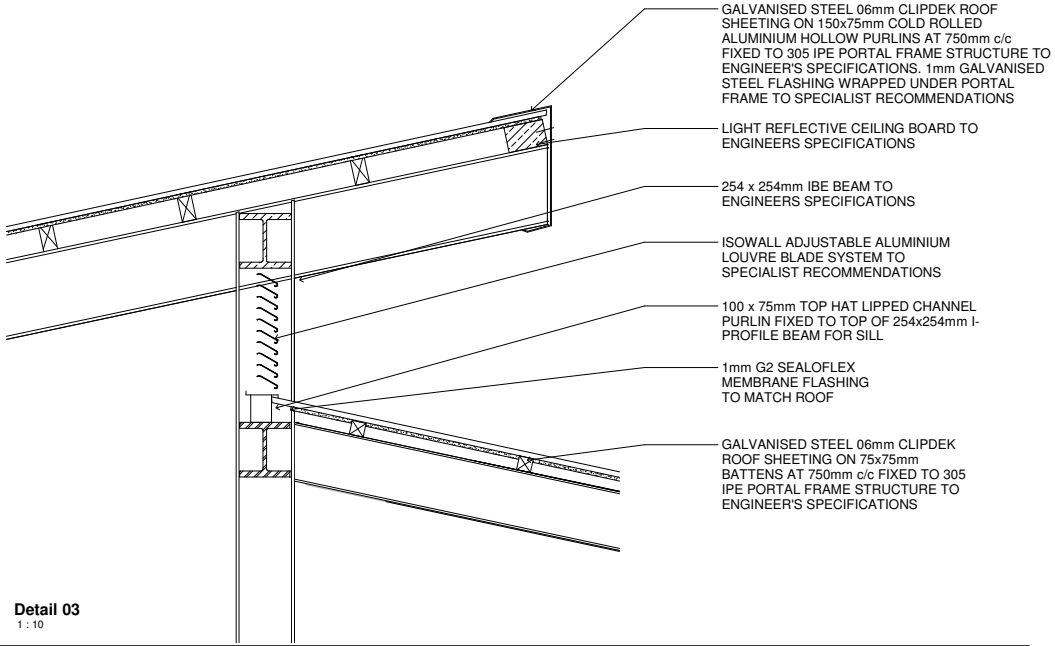
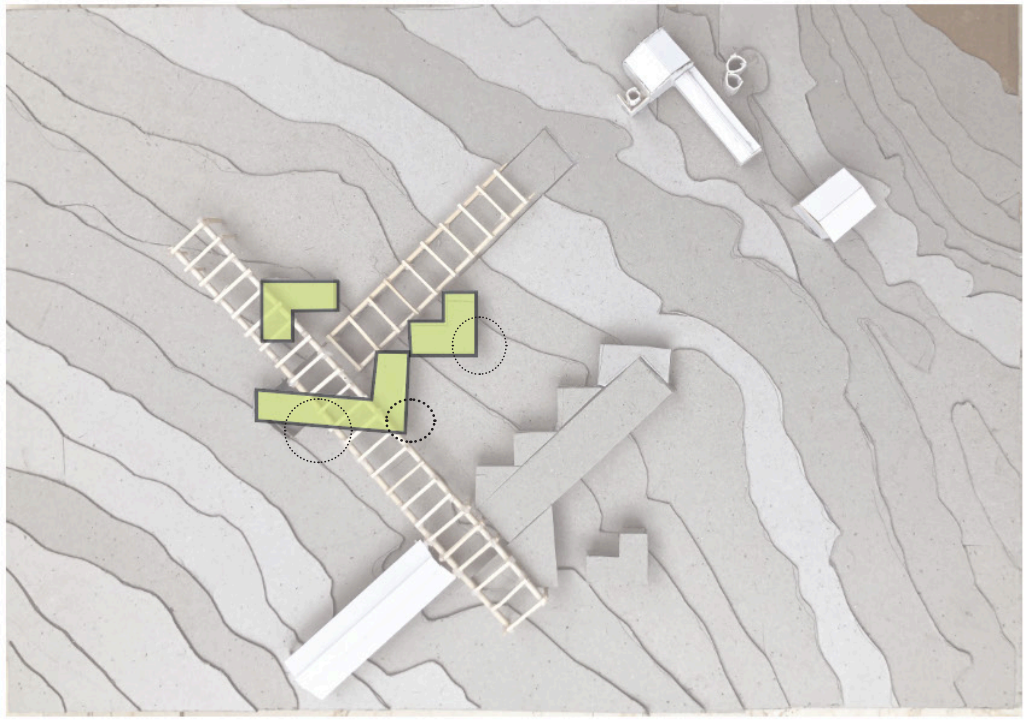
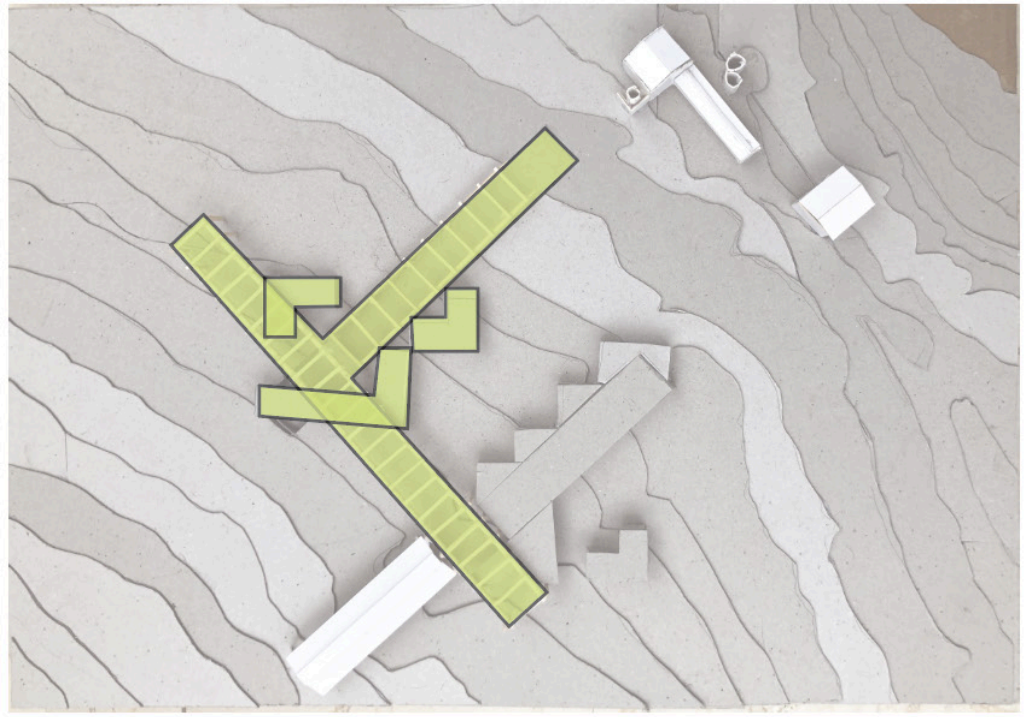
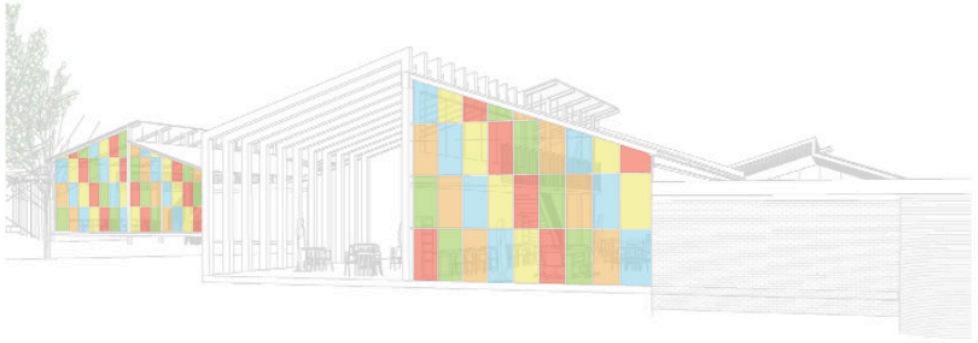


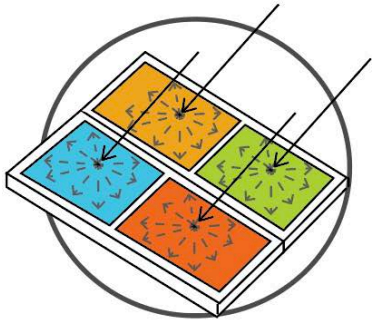
Detail 03
1 : 10

RESOURCES CENTRE: THE CLOVER

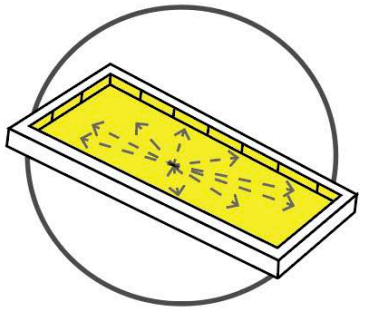




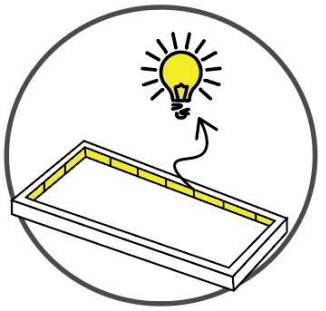




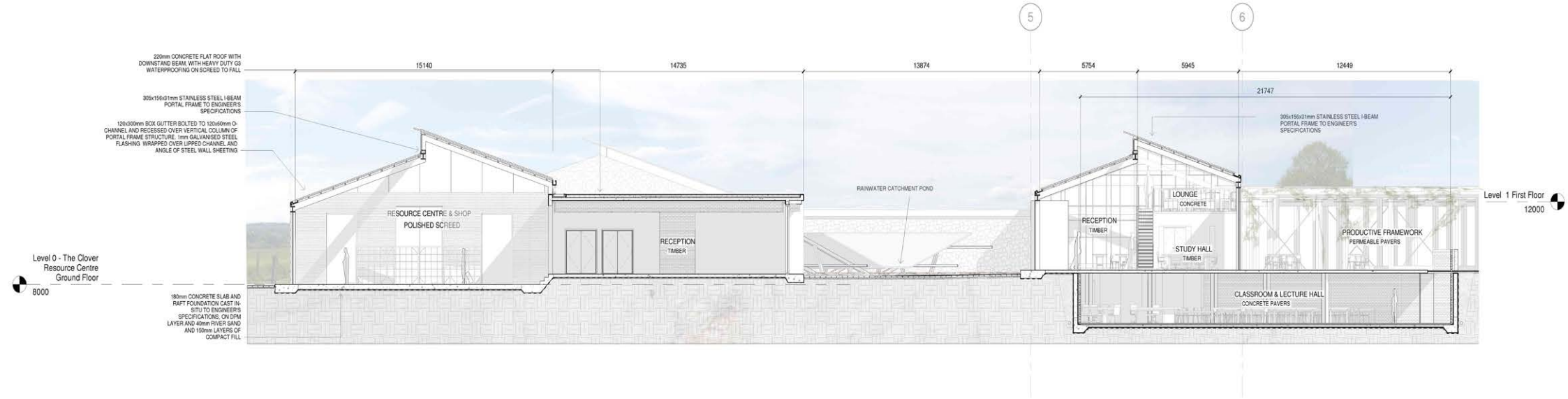
When hit by UV light, the particles absorb and re-emit visible light that is captured along the edges of the panels, due to internal reflection.



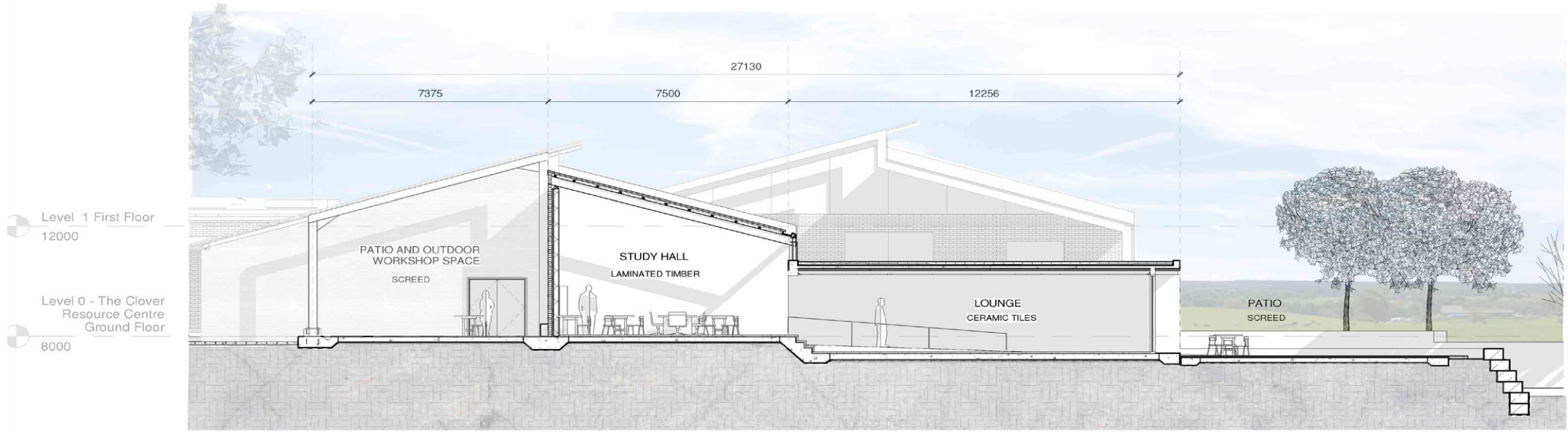
PV cells are placed along the internal edges of the panel.



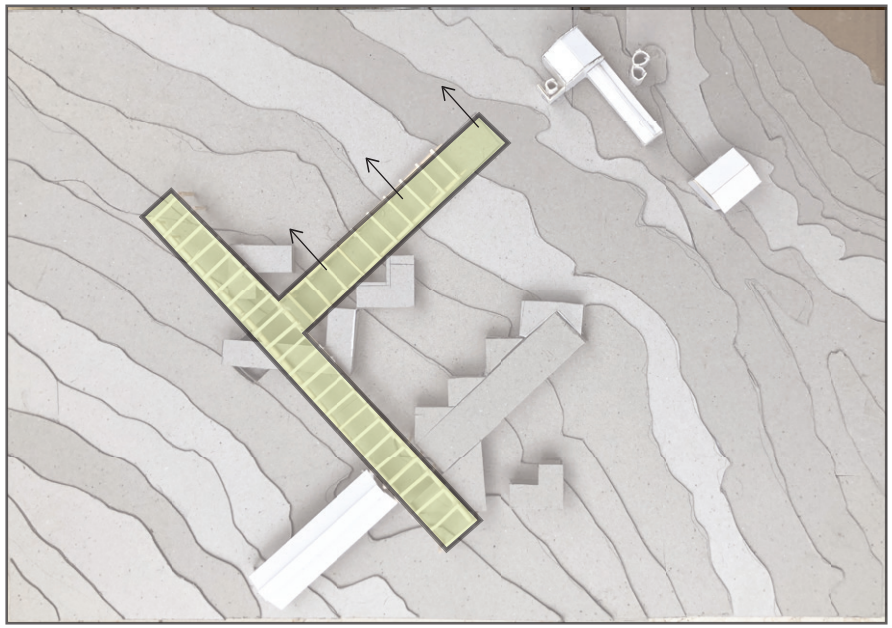
Captured light is then converted into DC electricity. Regulating circuits are needed to process the voltage output to allow battery charging, storage and direct utilisation of electricity.

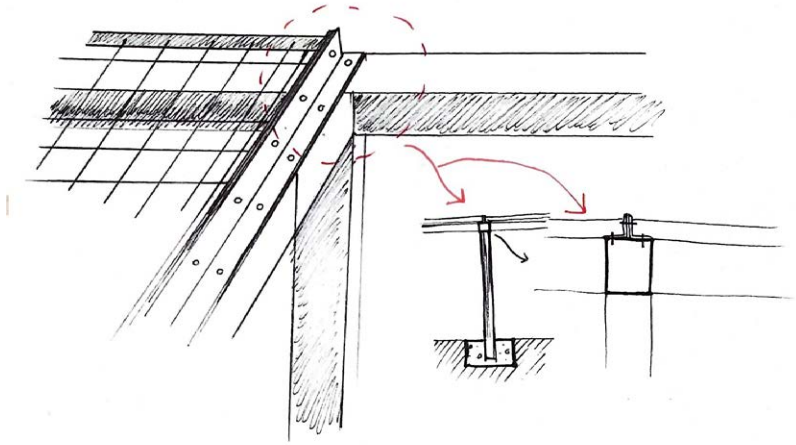


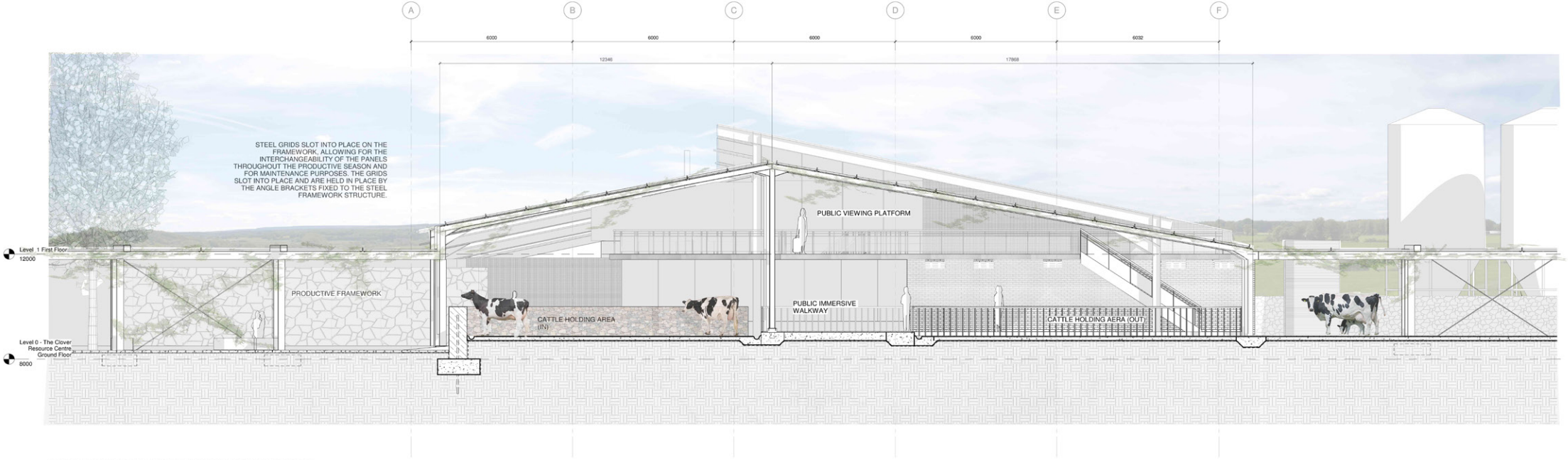
Section B-B
1 : 100



Section C-C
1 : 100



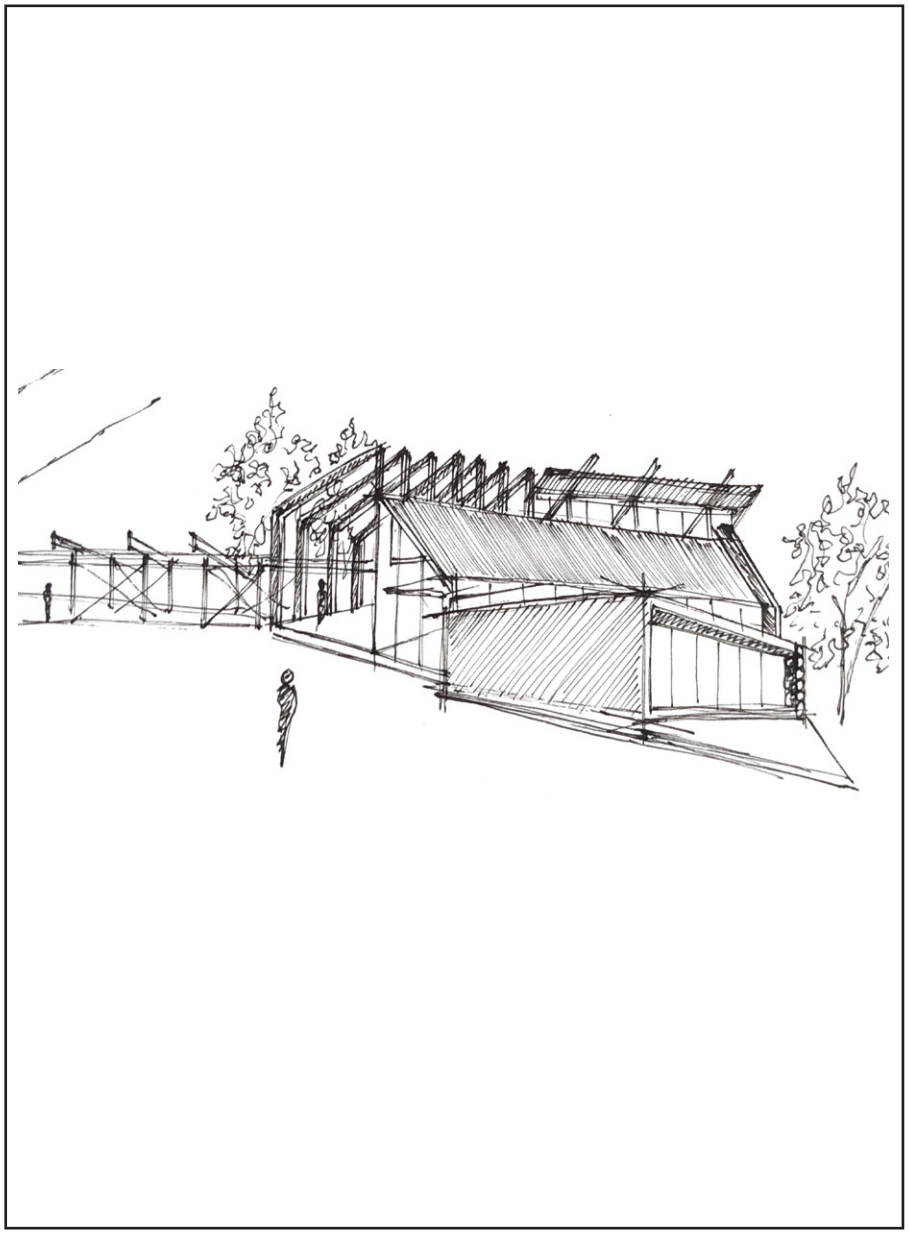




SECTION THROUGH PRODUCTIVE FRAMWORK
1 : 50

CHAPTER 06

PROJECT SYNTHESIS & REFLECTION



REFLECTION

This project aimed to highlight potential solutions to the current socio-political climate in South Africa through the design of the urban environment. The work seeks to develop a positive course forward that will support a sustainable approach to the integration of community developments and peri-urban agriculture, resulting in an interdependent, symbiotic relationship between man, the built, and natural environments.

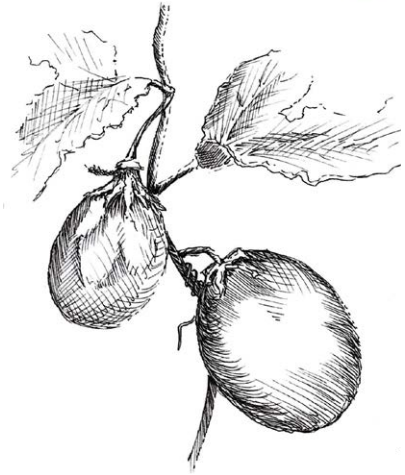
Regenerative design requires designers to consider and incorporate each of the three pillars of Sustainability: Economics, Environment and Society through a systemic approach that incorporates social, political, and economic reforms alongside stringent and conscious design and planning practices. It has the potential to perform the role of a catalyst for larger systemic regeneration and transformation of micro and macro environments through the creation and improvement of environmental, social and economic systems.

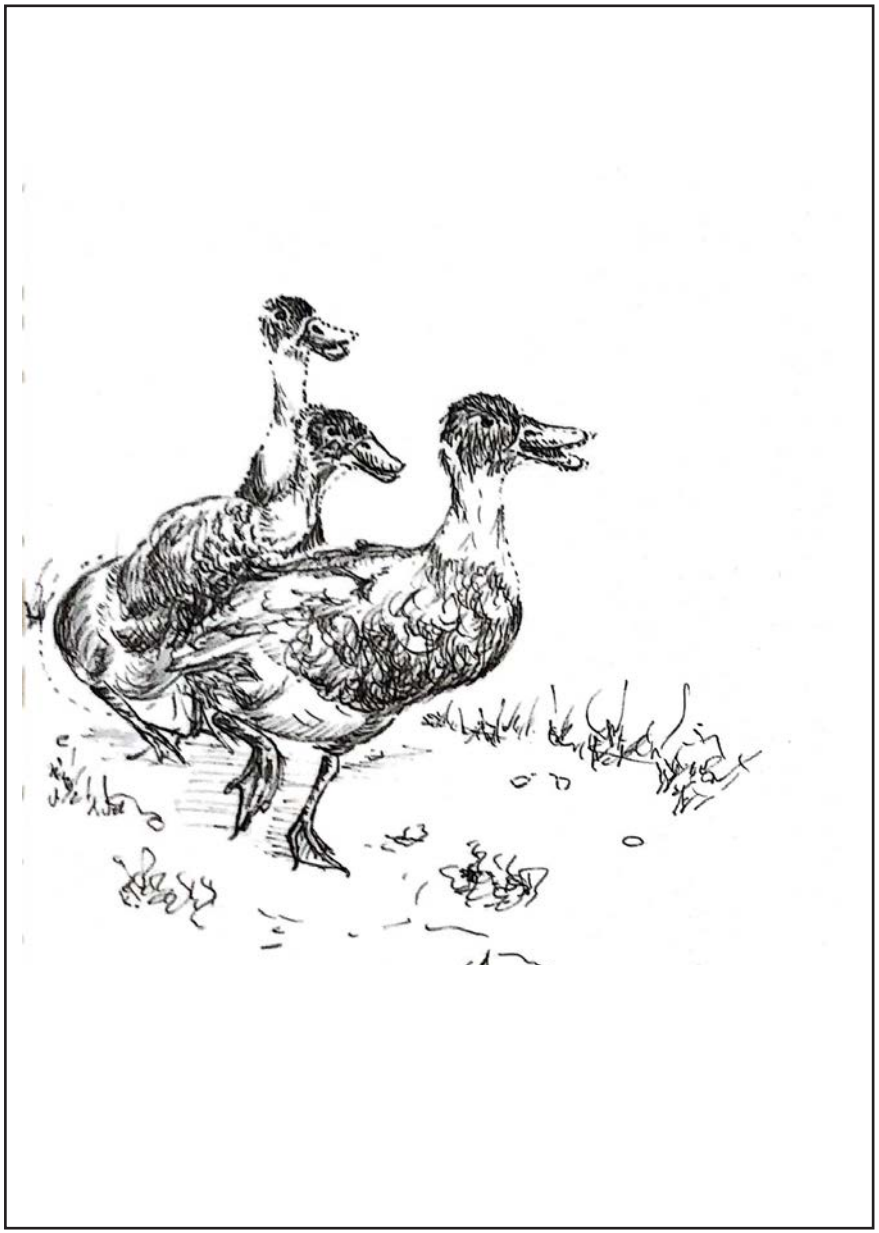
The Garden City model, although one that can be easily manipulated, may provide a way forward in the design of cities in the future due to its consideration of, and dependencies upon, socio-political and environmental models that inform urban design. Through the integration of Architecture, Urban Design and Agriculture, holistic, self-reliant and sustainable mixed-use developments, and the better integration of communities, can be achieved.

In a world of increasing unpredictability, humans must learn how to respond, and creatively find solutions that will not simply sustain communities, but will enable them to thrive. There is no doubt that there is an overabundance of options for what could be implemented, yet the problem now lies in determining what should be. The regenerative paradigm can be seen as a catalyst for larger systemic regeneration and transformation through the improvement of environmental, social and economic systems. Thus, to successfully access and employ the power of this rapidly changing field, designers must endeavour to find the relationships amongst these varied strategies and combine them.

The Great Work of our generation is to create a post-fossil-fuel and post-consumer economy that is regenerative, fair, durable, resilient, convivial, and democratic. It must be powered by renewable energy. It must be a circular economy that recycles, reuses, or transforms its wastes. Of necessity it will be much more focused on essentials of food, energy, shelter, clean water, education, the arts, and rootedness in place and bioregion. It will be built by local people who cherish and understand their places and the place of nature in a sustainable economy. But it must also be a political economy, a product of revitalised grassroots capability and vision. If it is to flourish, it must regenerate possibilities and capacities that grow from foresight married to practical ecological competence (David W Orr in Mang et al. 2016).

What is needed, going forward, is design based research and research through design that will investigate the efficiency of the theories proposed in this paper relative to developing communities in South Africa, such as the Hazeldean Node; in the long run determining an appropriate response to the sustainable design of urban and peri-urban environments thereby aiding in the achievement of food security, self-reliance and sustainability, and ensuring a better quality of life for all.





CHAPTER 07

REFERENCES & APPENDIX

REFERENCES

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APPENDIX

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This article was written as part of the curriculum for the MProf Architecture degree. The bulk of the article has been integrated to form this dissertation document.

RE-URBANISING AGRI-(CULTURE)

BRITTANY STORM NEWTON

ABSTRACT

The world is currently gripped by the Covid-19 Pandemic, forcing entire countries into total and partial lockdown. Access to fresh and nutritious food has been compromised, unemployment rates have risen and the inequality of living environments across the board is being called into question. Thus, the need for holistic, self-reliant and sustainable mixed-use developments, and the better integration of communities, is steadily rising, particularly in South Africa.

Self-reliant communities allow for the stimulus of local economies, employment opportunity, and poverty alleviation. They also encourage the sustainable use of natural resources, energy harvesting and generation, and climate resilience. In order to ensure food sovereignty and environmental sustainability, society needs to move away from purely industrial agriculture and reintroduce agriculture to communities, allowing people the opportunity to engage directly with healthy, nutritious, locally produced food. There is an opportunity to investigate the potential for agriculture in the urban environment to provide these solutions through the development of architecture and agriculture hand in hand. This is investigated through an examination of the Hazeldean Node development in Pretoria East. This paper examines possible alternatives to the design and developmental typologies by investigating the relationship between peri-urban agriculture and the urban environment; and the potential for the integration of the two as a sustainable development plan to mitigate urban sprawl and food insecurity, and aid community self-reliance.

This literature review article seeks to develop a positive course forward that will support a sustainable approach to the integration of community developments and peri-urban agriculture. It aims to contribute to the architectural discourse by highlighting interdependent, symbiotic relationships between man, the built, and natural environments as a means to combat the effects of poverty, segregation and food insecurity through Architecture and Urban Design.

INTRODUCTION

The Covid-19 pandemic is leaving people throughout South Africa in a state of constant fear of the future. One of the largest crises being exposed by the government ordered lockdown is that of food insecurity and economic inequity amongst South Africans (Shoba et al. 2020). On the 27th of March 2020 South Africa's economy and general productivity came to a grinding halt due to the implementation of stay-at-home orders and the closing of all industries except certain essential healthcare, agriculture, food outlet stores and emergency services. As a result of this, and notwithstanding slightly more lenient levels having been progressively implemented, South Africans have to all intents and purposes been confined to their residences - a combination of apartments, housing and informal settlements. Many people have lost employment, whilst others have had to undergo reductions in salaries, severely impacting the families that they support. The government has introduced relief measures in the form of food parcels to severely impoverished areas with limited access to food stores, and social grants are being increased and distributed in an attempt to mitigate the impact (Jordaan 2020; Southern Africa Food Lab 2020).

Developments in the Global South are focused on the provision of housing and accommodation for the many millions of people affected by poverty and poor living conditions; however, the vast majority of commercial housing estates currently under development are unaffordable and divisive, further separating economic classes and instilling segregation within our communities (Landman 2010). Many developments are intended to be mixed-use, with provisional opportunities for retail, education and business development, yet these initiatives are largely superficial, catering to the financial requirements of the developer as opposed to needs of community members. A large focus is on affordable construction costs and materials, with little consideration of food provision and sovereignty; the intention being to increase the density of the site to the maximum, leaving little space for food production and public recreational parks within these developments themselves.

Cities have developed with such rapidity, that the resulting densification and sprawl has led to the complete isolation of urban communities from 'rural agriculture'. Food Poverty is becoming increasingly visible in the Global South, becoming an issue of both human health and social justice (Battersby 2020). Food waste is a critical issue on both a global and local scale. Over one third of food produced for global consumption is wasted, much of which never even leaves its packaging (Reset.org 2020). In order to ensure food sovereignty and environmental sustainability, society needs to look to reintroduce agriculture to communities, allowing people to engage directly in the food production process, and ensure access to nutritious food sources, even in times of crisis. The introduction of organic, peri-urban agriculture allows for skills training and educational opportunities too (Haysom and Battersby 2016).

This paper discusses the need for community self-reliance as a method of combatting systemic issues experienced by communities today, such as urban sprawl, the impact climate change has on the food system, and food insecurity. The proposed development framework for the Hazeldean Node in Pretoria East is examined through its relationship to urban development and the resulting divide between communities, food insecurity and economic condition, as well as in terms of its potential to develop according to sustainable urban design principles.

The integration of peri-urban agriculture (addressing food security and employment opportunity) and urban development models (such as Continuous Productive Urban Landscapes and Garden City concept) is thus investigated, discussing further the socio-economic viability and benefit that an alternative integrated model such as this would offer communities, resulting in the creation of regenerative, self-reliant, mixed developments that challenge the current consumerist model. The role of the Architect as a trans-disciplinary facilitator and knowledge broker in the design, development and application of this alternative model is discussed in order to determine a way forward in achieving resilient and self-reliant communities through sustainable urban, environmental and spatial design.

The Ecological Worldview poses the idea that the challenges faced by sustainability and regenerative thinking is as much about psychology and human spirit as it is about the environment and technology. Achieving sustainability means equipping the constructed world, and human activity, with the capability to absorb inevitable change and with the ability to be sufficiently able to adapt and progress (du Plessis 2009; Mang et al. 2016). The Regenerative Theory aims at improving the capacity of natural, social and economic systems of a place. Regenerative design therefore makes use of a number of specific premises, on a micro and macro scale, and is the reinvention of localism, and the re-conceptualisation of places as nodes within open networks of exchange, creating a benchmark from which communities will flourish.

METHODOLOGY

This research paper undertook a literature review of seminal texts on agriculture and its relationship to climate change, urban development models and food insecurity. The literature review investigated themes such as co-operative economies, land reform policies in South Africa, (peri-) urban agriculture, the Garden City Concept, and continuous productive urban landscapes (CPUL's). It also unpacks these within the framework of the ecological worldview and regenerative theory. This paper therefore seeks to determine a positive course forward in identifying potential design solutions to the current consumerist paradigm and architectural discourse through the lens of sustainability and the respective economic, social and environmental drivers.

DISCUSSION

ECOLOGICAL WORLDVIEW & REGENERATIVE THEORY

In order to move away from the mechanistic approach to developing the world we have built around us, we will have to redesign the design process itself in order for it to become developmental. Drawing from Mang and Haggard (2016); the present moment, born of crisis, offers the potential to transform the way that humans inhabit the Earth. The Ecological Worldview represents the paradigmatic shift towards an understanding of the world as a complex living system (du Plessis 2009). This concept has been throughly explored by du Plessis, through the understanding of the world as an interconnected living system, and the approaches of regeneration, reconciliation and restoration toward achieving sustainability as a method of Living Systems Thinking, aimed at sustaining life-enhancing conditions (Reed 2009 in du Plessis and Brandon 2015). Regenerative design therefore applies whole systems thinking in the creation of resilient and equitable systems, thereby integrating the needs of society with the integrity of nature.

du Plessis and Brandon (2015) propose that the Ecological Worldview should not negate or replace the mechanistic paradigm of today but, rather, it should add to the relative knowledge base; with both of these insights providing valuable insights when applied within the appropriate context of analysis and its realm of validity.

Haggard (2012) suggests that a built structure is simply a temporary nexus in the flows of energy, people, materials, ideas and the environment. Therefore, a built structure is essentially a system that is situated in larger ecological and social systems that it influences, and is influenced by. As a result, it demands a dissolution of fixed boundaries between the 'built' and the surrounding environments, and forces the designer to look to its role in the regulation, strengthening (or weakening) and integration of its physical, social, and economic environment.

The Regenerative Theory aims at improving the capacity of natural, social and economic systems of a place and, so, the solution is not purely architectural; it requires a systemic approach incorporating social, political, and economic reforms alongside stringent and conscious design and planning practices. In summary, the regenerative paradigm determines that a built structure is not an isolated high-performance object in bespoke landscape; instead, it can be seen as a catalyst for larger systemic regeneration and transformation on both a micro (building) and macro (community) level through the improvement of environmental, social and economic systems (du Plessis and Brandon 2015).

There are a number of urban design and planning proposals that aim to integrate productive landscapes into the urban environment. In order to ensure the success of these frameworks, they must be considered holistically thereby taking into account the potential for community self-reliance, environmental factors, economic viability and the resulting role of Architecture in the generation of these regenerative urban and natural environments.

THE CALL FOR SELF-RELIANCE AT COMMUNITY LEVEL

Self-reliance at community level can be defined as the capacity of a community to apply the necessary skills to meet essential needs in a sustainable manner and with dignity. Although self-reliant communities are not necessarily able to fulfil every need, they are able to determine to what extent they rely on external factors, also aiding in achieving a level of economic self-sufficiency through the development of local economies (The Hunger Project 2019).

The Integrated Urban Development Framework set out by Tshwane Local Government seeks to achieve economic inclusivity and social integration; however, the first step in achieving this is to accept that the current model of planning and developing our cities is unsustainable, and that a transformative approach is required (Aurecon Group 2017). The Tshwane Vision 2055 proposes a plan for sustainable human settlements within the city of Tshwane specifically, targeting both formal and informal communities. Due to the nature of settlements arising out of poverty, such communities are often located witHout access to clinics, public facilities and green spaces, and are often far from areas zoned for economic opportunity, integration and densification. Thus, in order to combat these issues, sustainable human settlements aim to provide a range of services and amenities that will provide a foundation for mixed-income, mixed land-use, mixed housing, and a move to a low-carbon green economy, that is able to produce food, thereby resulting in self-reliant cities and neighbourhoods (City of Tshwane 2011).

The Hazeldean Node development is located to the East of Silver Lakes and the Blyde, and to the south of the Zwartkoppies Farm, below Mamelodi. The current development plan is centred around the Hazeldean Farm, converting this currently under-utilised arable farmland into a mixed use urban area comprising mostly of residences, a shopping mall and retail park, commercial business hubs and schools (Hazeldean Node 2018).

The plan does not, however, seek to provide housing that is inclusive and affordable, and makes no move to improve the integration of Pretoria East and Mamelodi, despite the potential of its proximity. Instead, it further builds onto the existing sprawl of the city, occupying land that could otherwise be used for the production of food for the surrounding communities. It is anticipated that the current dairy operations on the Hazeldean Farm will be terminated in the near future and the remaining infrastructure will continue to be used as a hosting facility for the weekly 'Cowhouse Market'. Whilst the land itself is of high agricultural value, it will require much preparation and treatment for the soil to reach the maximum yield for production ("Hazeldean Valley Interview" 2020).

CURRENT ISSUES AFFECTING SOUTH AFRICAN COMMUNITIES TODAY

1. URBAN DENSIFICATION & SPRAWL:

South Africa has a formal population of over 58 million people (Statistics South Africa 2020), and adequate housing is one of the major problems facing the country today. As a result, urban sprawl is still affecting many South African cities, and their surrounding natural landscapes and arable farmland. The biggest issue with this is that very few of these new development plans take into consideration the creation of long-lasting jobs, the provision of adequate and renewable energy, and the potential to obtain food sovereignty within the community itself.

Realities facing urban transformation in South Africa (Aurecon Group 2017) discusses the impact that rapid urbanisation and increased unemployment will have on a city's ability to provide for its population, and states the fact that lack of access to formal education was the largest factor affecting access to the non-agricultural job sector in 2012. They suggest that in order to break the cycle of inequality and resultant discrimination, the effect of location of access to education and development opportunities needs to be challenged.

The current spatial model of South African cities is that of compact cities, based on top-down assumptions of movement of people and goods, resulting in cities being characterised by urban sprawl, spatial exclusion and traffic congestion. Current high density inner city models, though intended to integrate mixed-incomes in a central location, are not able to provide the supplemental income required by many workers today, resulting in more people choosing to reside on the city periphery, moving further away from the city centres. Aurecon suggests that city investments and development patterns must be planned to avoid creating new vulnerabilities, alongside mitigating the current climatic effects that are impacting our country as a whole (Aurecon Group 2017).

Urban development within Gauteng is rapidly becoming oversaturated with housing schemes that are unaffordable and divisive, separating economic classes and further instilling segregational patterns within our communities (Landman 2010). These frameworks do not fully, or efficiently, address sustainable living environments, with many of these existing developments following the consumerist and disposable norm determined by society. It can be argued that Balwin Properties flagship luxury-lifestyle estate, The Blyde, in Pretoria East, is an example of such a development. Boasting a 1,5Ha man-made 'crystal lagoon' (approximately the size of two rugby fields) holding 35 million litres of water, the estate houses a 6-star Green Star lifestyle centre with sports and restaurant facilities, and is in close proximity to many healthcare, retail and commercial business districts (Patrick 2018; Balwin Properties 2020). Whilst developments such as these may be Green Star accredited and may be seen as important investments in supporting the economic nodes in which they are located, they are also examples of inappropriate developments that are disillusioned with the reality faced by the communities around them; thereby disconnecting themselves further from the inequalities and circumstances faced by the vast majority of South Africans on a daily basis.

Karina Landman (2010) describes the spatial characteristics of South African cities as the i) dislocation of the poor to the peripheries, ii) separation of communities through buffer strips and undeveloped land, iii) rigid mono functional zoning, iv) degrading and poorly developed environments, and v) lack of recreational facilities. These conditions have led to a rise in crime rates, resulting in the rise of gated communities which have resulted in the spatial fragmentation of the urban and peri-urban environment. This has led to the further exclusion of various social classes, many of which cannot afford fortification themselves, worsening socio-economic conditions and contributing to the root cause of crime: poverty. Urban fortification is a part of the larger city system and addresses only the short-term need for security, ignoring the long-term goal for integration and equity. In order to avoid future cities becoming a 'fortress world' through this inappropriate development, alternative interventions that can lead to the revitalisation and better integration of communities should be investigated, by looking for leverage points within this larger city system through which to intervene (Landman 2010). A holistic approach is therefore needed that takes into account social, financial, and environmental capital.

2. UNSUSTAINABLE FARMING & CLIMATE CHANGE

People tend to say that climate change threatens the planet. What is threatened, and what people are truthfully more concerned about, is the welfare of biodiversity and humanity's ability to live on this planet, without damage. A controversial topic, the long-and-short of it is simple: annual temperatures are increasing, and extreme weather events are becoming more frequent. The question that this information poses is how this impacts the lives of people today, and what can be done to make the lives of future generations more comfortable.

South African's face vulnerability to climate change in a number of ways. Many areas have limited access to safe drinking water due to a lack of infrastructure and variable rainfall patterns. Agriculture, fisheries and forestry are at risk due to the increase in temperatures, veld fires, long drought periods and variable rainfall further exacerbated by climate change. As an added detriment, this has an economic impact not only on production, imports and exports, but also on the livelihood of many due to a loss of jobs, as roughly 5% of the employed population is directly employed through agriculture (Griffin 2012; South Africa Online 2020).

The agricultural sector is the sector most largely affected by Climate Change. However, unsustainable farming practices is one of the largest contributors, with Agriculture being the largest user of water in the world, using approximately 70% of fresh water drawn worldwide (Capper, Cady and Bauman 2009).

Globally speaking, conventional agriculture is an ever growing concern due to the prevalent use of chemical pesticides and fertilisers, monocultural crop production, the burning of fossil fuels, animal husbandry, deforestation and the general misuse of natural resources. The three major concerning Greenhouse Gases (GHG) are Carbon Dioxide (CO2), Methane (CH4) and Nitrous Oxide (N2O). In saying this, it is important to note that agriculture (including the livestock sector and the land use practices to produce animal feed) accounts for only 20-25% of global Greenhouse Gas emissions expressed as CO2 whilst the burning of fossil fuels and industrial processes account for 65% (D'Silva et al. 2017; United Nations Food and Agriculture Organisation 2006; Hannappel 2017). It is estimated that the total GHG emissions for all food related activity is 32%, largely attributed to the transport of food and food related produce. On the other hand, agriculture as a whole contributes to approximately 30-40% of anthropogenic CH4 levels and approximately 65% of N2O emissions globally, both of which are responsible for retaining heat in the atmosphere (United Nations Food and Agriculture Organisation 2006).

The greatest threat to agriculture with regard to climate in South Africa is the increasing unpredictability of rainfall intensity and distribution, the increase in extreme weather events (droughts and flooding), and the provision of water for livestock and related heat stress (Pereira 2014). The 2018 drought that threatened South Africa and crippled the Western Cape Province made global headlines. Since then, the Eastern and Northern Cape in particular, have had to endure recurring and worsening droughts resulting in higher temperatures, severe water shortages, losses to agriculture, and, as a result of this, inflated food prices (Cuculi 2020).

There are a number of solutions proposed to address the ecological impact of climate change. The reduced consumption of animal products (meat and dairy) and the increased consumption of fruits and vegetables that are locally produced through peri-urban agriculture may provide a resilient and lasting solution to minimising food-related GHG emissions (D'Silva et al. 2017; Viljoen and Bohn 2014).

Colin Tudge calls for an 'Agrarian Renaissance', a radical move away from purely industrialised agriculture, towards small-to-medium sized, co-operative and regenerative urban agroecology farms (Tudge 2017). Regenerative agriculture encourages the growth of organic produce through ethical and local supply chains, zero-waste policies, fair trade and compensation and employee development, as well as encouraging the incorporation of cooperative and social models.

3. FOOD INSECURITY:

The global population is expected to increase to approximately 9,5 billion people by 2050, and the United Nations and the FAO are concerned that without an increase in food production this will be unsustainable. The annual production of both meat and milk is expected to double (to approximately 465 million tons and 1043 million litres respectively) between 2000 and 2050, according to FAO estimates, with the majority of this taking place in low-middle income countries. The major issue with this increase, hoWever, is that in order to sustain the conventional intensive meat and dairy production of today, enough grains would have to be produced to feed these animals - the equivalent of four billion people - resulting in the need to provide enough grains for effectively 13,5 billion people (D'silva et al. 2017; United Nations Food and Agriculture Organisation 2006).

Colin Tudge is hugely critical of the consumerist and commercial nature of agriculture today. He argues that the world was already producing enough to provide food energy and protein to 14 billion people. Food production is driven by the markets, and despite evidence showing that we already have more than enough, production is ever increasing due to higher possible financial returns. The Neoliberal economy has driven agriculture to maximise production at the minimum cost, regardless of how much is actually needed (D'silva et al. 2017; Tudge 2017).

Food waste is a critical issue on both a global and local scale. There is an over supply of produce to high income areas, whilst there is an under supply in many poverty stricken areas. Over one third of food produced for global consumption is wasted, much of which never even leaves its packaging. In a study by Nahman and de Lange (2013) the total losses for South Africa throughout the entire food value chain were estimated to be R61,5 billion per annum; the bulk of this loss occurring during the processing and distribution phases, with roughly R21,5 billion occurring as household waste (Pereira 2014). According to Vishwas Satgar, co-founder of the South African Food Sovereignty Campaign, the number of people suffering from insufficient food supply has increased from 14 million in 2019 to 30 million during the Covid-19 pandemic due to income losses, insufficient social grants and a further exacerbation of food poverty and inaccessibility (Shoba et al. 2020).

Access to such food is not only a matter of the volume produced, but also about how and when people are able to access this food, and what the costs of achieving this are (Southern Africa Food Lab 2020). The problem here is the physical distribution of food resources, favouring bulk provision to commercial supermarkets and booming economies, whilst undercutting smaller players in the market and less affluent areas (Tudge 2017). Due to restricted travel, limited access to food stores and supplies within communities, and limitations placed upon the informal food sector, many families are having to choose what nutritious foods they cut out in favour of non-perishable foods; cutting out mostly fresh fruits, vegetables, and animal products. Alternatively, many are forced to travel to the shops daily, often travelling long distances contrary to lockdown regulations, and putting themselves and others at risk in order to get what items they can. Small scale farmers and community members who tend to community gardens have been largely unable to perform this vital role and have been unable to supply the community members with fresh produce, resulting in much of this produce going to waste (PLAAS 2020).

THE CALL FOR PERI-URBAN AGRICULTURE

The majority of poorer, small-scale farmers and informal traders are being marginalised by the increasing power and dominance of the corporate sector. The rapid urbanisation in South Africa needs to be taken into account and the repercussions that this is having on the food system's ability to provide food to urban and rural dwellers needs to be considered on a national, provincial and municipal level. The review conducted by Pereira (2014) reveals the crucial need to engage with rapid urbanisation on a design and planning scale, as it has resulted in the distancing of people from accessing fresh fruit and vegetables and thereby decreased their dietary diversity, whilst further exacerbating the corporate monetisation of the food system.

Food sovereignty within South Africa may help to ensure that money can be kept within local economies as well as ensuring consistent access to healthy, nutritious food that is locally produced. Many South African's from poverty stricken areas have some level of skill in agriculture, allowing there to be a viable opportunity for job creation and a good first point of entry into the city and job market. This programme also allows for the regional sharing and distribution of resources. In order to ensure food sovereignty and environmental sustainability, society needs to move away from industrial agriculture and reintroduce it to communities, allowing people every day to engage directly with the food production process.

Jane Battersby (2020) states that the Covid 19 crisis has revealed the failings of South Africa's food system and brought to light how extensive food insecurity actually is. The standard response by local government regarding food insecurity has been to get people to grow their own food when in fact the response should be to challenge the existing food system entirely. This promotion of Urban Agriculture alone, and at the expense of other solutions, is problematic due to a lack of support given to these individuals in respect of possible crop failures and the blanket thinking that those most unable to access food from the formal and informal markets should initiate their own food security through growing food in their own back yards. The reality of poverty is that the food insecure cannot afford access to the land, water, seeds or plants needed to achieve this and although many of these resources are offered by the state and NGO's, the most vulnerable largely lack the knowledge and social networks needed to access them (Haysom and Battersby 2016; HeySummit 2020).

Haysom and Battersby (2016) argue that food insecurity is in fact a systemic issue that requires addressing on both a governance and urban scale through the incorporation of planning policies and urban spatial planning. Cities are therefore integral to the transformation of the food system as they take on the role of creating closed loops between production, consumption and waste (Battersby and Hunter-Adams 2020; Haysom and Battersby 2016).

The IPCC Climate Change and Land Report (2019) suggests urban sprawl may be limiting food security through the loss of arable farmland and Peri-Urban Agriculture. The Peri-Urban Environment is ideally located in close proximity to available labour forces and allowing the direct access of fruit, vegetables and produce to available markets. Peri-Urban Agriculture may aid in the mitigation of climate change due to the reduction in required transport distances, recycling of organic waste and waste water, increasing water filtration and strengthening biodiversity related ecosystem services (Battersby and Hunter-Adams 2020; IPCC 2019). Peri-Urban areas have the potential to act as a belt to contain the city thereby preventing sprawl, such as in the Garden City model.

According to Herbert Girardet (2010), Agroecology intends to promote three goals: the sustainable use of natural resources, the alleviation and reduction of poverty, and climate resilience of both cities and the environment. He argues that while cities were once an 'Agropolis', embedded in their local landscapes, society needs to move away from the current city model of what he terms 'Petropolis' - a city reliant on fossil fuels. He suggests moving towards an 'Ecopolis' - a regenerative city in which urban consumption supports and regenerates, and all spheres of development are integrated and function systemically. He argues that the largest benefit of such regenerative urbanism is its job creation potential. Therefore, the incorporation of water and energy harvesting, recycling, and generation systems, and the implementation of sustainable peri-urban agricultural programmes may mitigate the impact of poverty and unemployment, encourage climate resilience and ensure opportunities for food security, providing opportunity for education and skills development (Rogers 2015).

The Continuous Productive Urban Landscape (CPUL) concept aids in i) the protection and increase of food diversity as well as the diversity of food retail outlets, ensuring accessibility by foot, cycling or public transport, thus access to 'footfall' of consumers, ii) the promotion of urban agriculture throughout the immediate and extended city at a variety of scales, iii) discouraging food and material waste through the promotion of more socially and ecologically integrated recycling, iv) creating jobs and income for local, community members and producers through sale and investment (Viljoen and Bohn 2014).

The concept of growing food within the urban realm has been around in various forms for centuries. The market gardens of the 17th and 18th centuries were an intensive way of life for many, making use of small plots of land within cities that were cultivated to provide fresh produce to the immediate communities. The Industrial Revolution of the 19th century allowed for agriculture to become entirely separate from the city due to the advances in technology, in the form of chemical fertilisers and machinery, and the desire for more land in order to increase yields and provide for an ever growing population. The Second World War in the 1940's resulted in the creation of "Victory Gardens", effectively the market gardens of old, in order to prevent a food shortage and to ensure the constant supply of fresh produce to the American people, since any tinned foods were rationed and almost all vehicles ordinarily used for the transport of food products were being used to transport soldiers and military supplies. These Victory Gardens accounted for approximately 40% of all produce grown within the United States of America during the war. Since then, the notion of community gardens and urban agriculture as a response to growing community development and environmental concerns has increased.

In saying this, Urban Agriculture has only actively been investigated in terms of its spatial design potential for a little over two decades (Herbert Girardet in Rogers 2015). Cities have developed with such rapidity, that the resulting densification and sprawl has lead to the complete isolation of urban communities from 'rural agriculture'. In most cases, urban agriculture has been an attempt to combat this disconnect through the retrospective integration of small scale productive gardens in whatever vacant spaces have been available, occasionally finding solace in the adaptive reuse of old infrastructure. Thus, due to new emphasis placed on the importance of the spatial design of such interventions, Architects are now fortunate enough to have the opportunity to plan for the integration of agriculture into the inter-/ peri-/ urban environment of developing cities. In an urbanising province, the optimal use of high potential agricultural land in close proximity to cities and towns is critical to the resilience of food systems under conditions of climate change; thereby incorporating Peri- Urban agriculture as a proactive response to climate change (Mang et al. 2016; Viljoen and Bohn 2014).

Continuous Productive Urban Landscapes (CPUL) are defined by Viljoen and Bohn (2014) as an urban design concept that incorporates the growing of food into the design and planning of cities. In order to enable the successful implementation of Productive Urban Landscapes, the expertise of architects, urban designers, and urban planners will need to come together. Central to this concept and the creation of open urban space frameworks is the coherent and designed multifunctional productive landscape that both complements and supports the built environment. The CPUL concept refers to urban agriculture as predominantly productive in fruit and vegetable production, due to the high percentage yield per square meter, however, livestock production cannot be excluded from this, provided adequate space and infrastructure is used (Viljoen and Bohn 2014). The use of mixed (organic) farming methods employs the concept of Ecological Intensification in order to increase productive agricultural outputs (food and ecosystem services) while decreasing the need for external industrial inputs (chemicals and fossil fuels), thus capitalising on ecological systems and processes. Linking with this, organic urban agriculture encourages biodiversity within cities, enhancing and capitalising on the ecosystem services available. In order to maximise this, the CPUL City makes use of spaces that run between, in, over, and on buildings, creating and making use of ecological corridors and connecting larger habitat patches (Viljoen and Bohn 2014).

While valuable, this theory is more applicable to inner city urban agriculture than to the peri-urban environment.

One theory on the prevention of urban sprawl in the development of cities is Ebenezer Howard's Garden City concept. Developed in 1898, it is defined as planned, self-contained communities surrounded by green belts, with proportionate areas of residence, industry and agriculture. Features of such a city are open spaces around all infrastructure, adequate population size, strong community ties, ordered development and the city as an independent, and largely self-reliant entity. This is achieved through unified ownership of land, maximising community benefit, providing generous living and working spaces whilst maintaining environmental quality, placing limits on the growth and expansion of the city, and encourages local community participation in decision making processes by making use of collective land reform policies and cooperative development (Wainwright 2014, Ackerman 2020).

This concept has been heavily criticised, particularly in South Africa due to its misappropriation in the development of the Apartheid city planning model. The result of this is extensive urban sprawl and communities separated by land buffers. However, this misappropriation (with the intention of segregation in mind) is far from the original intention and serves to prove that it is the manner in which a tool is used that determines the success of the action - the Garden City Concept is equally as capable of addressing and combating inequality as it is of creating it.

Whilst seemingly outdated, this concept still holds relevance today and a resurgence in this model can be seen today, due to its relationship with Urban Agriculture as a way to maximise the value that lies in the mixed development of peri-urban land. A revived generation of this concept by urban planner David Rudlin of URBED won the Wolfson Economics Prize in 2014. As a proposal to achieve the required housing scheme for the British city of Uxcester, the project acknowledges that in order to be successful in the current economic climate, it would need to be developed as part of an existing city with largely established infrastructure, through the addition of substantial urban extensions within a zone of approximately 10km from the main city. The developments will be connected through public transport infrastructure that will increase mobility for the whole city, without doubling traffic, and housing choice and affordability will be broadened for everyone. The city centre will be revitalised by channelling new demand, creating local employment opportunity, growth and allowing investment in new facilities and, with extreme care being taken in the planning of pedestrian and public movement throughout the area, ensures that one is never further than a five minute walk from a bus or tram stop.

A fundamental aspect of the proposal is the incorporation of a new economic system which governs and funds the development by setting up what is effectively a social contract, whereby a 'Garden City Trust / Council' is established as the master developer, consisting of local people, authorities, developers, landowners and businesses. This Trust makes use of an initial large, low interest loan from the government to purchase the land at a fair rate from surrounding farmers, still allowing them to maintain shares in the land that will be developed and, through reinvestment of revenues for the plots sold to developers (be they volume house builders or home builders) provide funding for the infrastructure (Rudlin 2014; Sweet 2014). Eco-cities and Eco-districts are based on the premise of incorporating objectives of sustainable developments, focusing on the integration of ecological, social, and economic goals; and aims to achieve many of the same milestones as the Garden City Concept. It is important to note that developments such as these should be viewed as urban experiments, working towards a long-term sustainability goal (Flurin 2017; Mersal 2017).

The Garden City concept incorporates the concept of Agrarian Urbanism. Agrarian Urbanism is the marriage of New Urbanism (design movement promoting environmentally friendly habits through the creation of walkable neighbourhoods containing a wide range of housing and job types) and Agricultural Urbanism (the intentional building of a community that is associated with a farm). The result of this is an intentional agrarian society involved in the organising, growing, processing, distributing, cooking and eating of food.

The most successful cities of the future are anticipated to be those that provide a landscape for local food production, and as a result, have a meaningful relationship with growing food close to home. The key to achieving Agrarian Urbanism is through embedding pockets of agriculture within the peri-urban landscape, introducing a mix of housing types, shared community assets and resources, safe children's areas, green roofs and greenhouses, and local corner stores (King 2017; Nairn 2010).

APPLICATION OF THEORIES TO HAZELDEAN NODE

This paper proposes that the current development plan consider the following: i) the expansion of the masterplan to include the fertile soils of the Zwartkoppies erf and thus begin filtering development into Mamelodi, ii) include a series of agricultural hubs throughout the site that will service different agricultural needs (such as fruit and vegetable production, dairy production, and cleaning, packaging and distribution of produce), and iii) the removal of the mall and introduction of mixed retail at neighbourhood scale.

There is an opportunity for this development framework to offer long-term employment to local community members, to be an example of sustainable development in today's society, and to allow for the better integration of communities through the act of food security specifically. The Sustainable Food Cities Network provides a set of principles designed to ensure a cities sustainable urban foodscape. These principles include i) health and well-being for all; ii) environmental sustainability; iii) local economic stimulation and prosperity; iv) empowered and resilient communities; and v) fairness throughout the food chain (Sustainable Food Places 2020).

These principles ensure that communities are placed ahead of profit and that a systemic solution is developed by means of conscious design. When small, local businesses are replaced by megastores, local money no longer absorbs into the local economy. Through the incorporation of closed-loop, no-waste systems that utilise the interdependencies within cycles of production and consumption, support is created for independent community traders and retail diversity is preserved in the face of the ubiquitous supermarket / mall (Mang et al. 2016; Viljoen and Bohn 2014). Investing in the area as a central commercial district aids in eliminating the rapid development of malls, particularly in small towns.

The Garden City concept can be applied to the Hazeldean Node in the following ways: the peri-urban nature of the development allows for the existing farmland to be utilised for the production of food that will aid in achieving a level of food security for the surrounding communities as well as the Hazeldean Node itself at the same time acting as a land barrier that will contain developments, preventing sprawl. Due to its close proximity to Pretoria (Tshwane) as a city with existing infrastructure, the framework will be able to utilise and expand upon this, making the transport of goods and services more efficient and the movement of people more reliable.

If one considers the peri-urban location of the Hazeldean Node it can be seen that, as suggested by the IPCC, there is direct access to labour and markets in Mamelodi, helping to stimulate the local economy through employment opportunity in the immediate environment, as well as access to markets in the greater Pretoria East communities. This allows for the opportunity to make use of Community Supported Agriculture in the undertaking of this peri-urban farm, ensuring a guaranteed consumer base and security of finances, and improves sustainability due to the large scale reduction of transport distances and the potential to maximise the use of natural resources and renewable energy. The introduction of a governing body (such as the Garden City Trust / Council) that is made up of local government, investors, farmers, developers and community members may aid in ensuring that this framework develops with a holistic vision in mind that will benefit the community as a whole, as well as ensuring the correct and accountable management of community finances and investments.

Viljoen and Bohn (2014) state that whilst urban agriculture will need to produce at a commercial scale in order to successfully impact a communities food needs, it cannot fully meet nor satisfy all of these needs, thus requiring urban food systems to ensure a relationship between the city, its local region and beyond. Thus, the proposed integration of peri-urban agriculture in the Hazeldean Node does not eliminate the need for large scale commercial agriculture, rather, it seeks to limit reliance upon it, and form an integrated and supportive food system that lends itself to emphasising human potential, and allows communities to be self-reliant and facilitates integration into the formal value chain (Viljoen and Bohn 2014).

ECONOMIC VIABILITY

Food insecurity, poverty and the degradation of city centres resulting in urban sprawl are systemic issues in South Africa (Battersby 2020; Pereira 2014). Land reform in South Africa seeks to rectify the injustices of the past colonial and apartheid land use and distribution policies that are still being felt today. Since the end of Apartheid, very little has been done in order to achieve a restructuring in these policies, and those few who have benefited from the land reform policies have received little government support following the initial redistribution, raising issues of concern about what the implications of this policy are in terms of both long term economic prosperity and food security. This model thus needs to alter its course in the direction of co-operative management and governance in order to effect systemic change. Contrary to land and agrarian reform being fundamentally a governance issue, by shifting power within the food system from corporate interests to community interests, thereby letting marginalised groups have a say in the governance of the food system, an actionable shift can be made towards achieving economic upliftment, an improved urban environment and food sovereignty (Mang et al. 2016; Pereira 2014).

International food price shocks are felt throughout the economy, right down to local wholesale and retail prices, due to South Africa's open market. Following the two major food price crises of 2002/03 and 2007/08 respectively, local government failed to introduce major policy responses. As a result of this lack of response, 'second-class' policy interventions dealing directly with the relief of food price inflation and the resulting inaccessibility of poor households has grown to an almost unmanageable extent today. These relief measures include policies of welfare payments, school feeding schemes and food parcels (Kirstin 2012 in Pereira 2014). Some suggestions being made to counteract the issue of food waste and inaccessibility are:

- Spatial de-concentration of the food system;
- Support for small-scale farmers and the aggregation of small-scale farmers outputs;
- Provision of supermarkets and food suppliers with produce from small-scale, local producers;
- The collaboration of retailers, farmers and restaurants to ensure minimal food wastage (PLAAS 2020).

Domestic agriculture serves as an important buffer to international market dynamics. Self-reliant communities may, through the conversion of vacant land to productive income-generating spaces, allow for the generation and stimulus of local economies, create and sustain opportunities for community-based jobs, create a direct link between the farmer and consumer, harvest and generate energy, apply sustainable use of natural resources, and achieve climate resilience. In order to ensure food sovereignty and environmental sustainability, society needs to move away from purely industrial agriculture and reintroduce it to communities, allowing people every day to engage directly with healthy, nutritious food that is locally produced (Pereira 2014; The Hunger Project 2019). Achieving a sustainable future requires the transformation of not only physical infrastructure but of social structures as well. People-centred Economics such as this may, according to E.F Schumacher in his book Small is Beautiful (1973) provide long lasting social and environmental sustainability (Schumacher 1973). 'Small is Beautiful' is an idea that continues to appear today – the latest incarnation being farmers' markets - because it incorporates a fundamental insight into society: the need for economic systems that are understandable by all and are within some level of control of local communities.

The same might be said about local food systems, with adaptive local food systems being defined as a collaborative network that integrates practices of sustainable food production, processing, distribution, consumption, and waste management intending to enhance the environmental, economic, and social health of a particular area (Community-Wealth.org 2012; Joubert 2018). Architect Teddy Cruz, at the Creative Time Summit in 2009, stated that what is required today is the negotiation of a new economy and micro-politics between the top-down economics and politics of development and the bottom-up social activism of neighbourhoods, creating out of these dynamics new micro-policies and micro-economies at neighbourhood level (Mang et al. 2009)

The provision of agricultural infrastructure, investment opportunity, the security of a consumer body and the creation of employment within the sector, allows for the possibility to begin rectifying this situation. Whilst urban agriculture cannot be the sole solution to poverty, it should be considered as one of many possible ones; locally produced food should be a key element due to reductions in transport costs, improved diets of residents and access to fresh, healthy food (City of Tshwane 2011). Non-economic benefits to this strategy include recreational potential and aesthetics, the redevelopment of unproductive land, ecosystem services to cities, environmental education, social empowerment, and social interaction and the strengthening of community ties, both within and across these communities (Reuther and Dewar 2006).

Tshwane Vision 2055 and the NDP 2030 seeks to introduce methods of land reform through the utilisation of land for sustainable development through the introduction of food agriculture, infrastructure development and job creation. Through the introduction of agro-processing plants and value added services, farmers can be integrated throughout the value chain and the use of all available open space will be maximised. The vision also aims to aggressively pursue various forms of urban agriculture and urban farms in a multitude of ownership and operational varieties. The agricultural sector has the ability to support rural development and transformation in an attempt to stimulate a sustainable rural economy. City assets that support such initiatives are human, economic, social, physical, natural, culture and institutional, with entrepreneurship as a critical component to rural economic development (City of Tshwane 2011).

An example of such an initiative is the Neighbourhood Farm and Market in Cape Town. Consisting of a series of small scale market gardens throughout the suburbs of Cape Town, the aim of the initiative is to provide education, skills training and development for local community members of all age groups; providing opportunity for economic and urban upward mobility whilst ensuring a level of food security and sovereignty for these communities. Many of the sales staff operating the markets (located at local schools and hospitals) are studying both full and part time degrees and courses. The farm aims to ensure the supply of fresh, organic food for the surrounding communities, at the same time ensuring the guaranteed sale of produce to schools and health care facilities. Profits from the sale of produce are distributed back into the community through the building of classrooms and other school infrastructure, and the employment of the local community members who are encouraged to pursue an entrepreneurial garden and market of their own in new communities with their learned skills; which aids in stimulating the local economy (NeighbourhoodFarm.org 2020).

The economic model for such interventions provide quick, accessible investment potential, due to the maximising of ecosystem services and due to the intervention absorbing people into the system and filtering them into the city. This may be achieved through large corporate investment as a form of Carbon Tax Relief, and initial government funding, followed by methods of cooperative investment and the basis of community supported agriculture. This allows the community (consumers) to cover the working capital of the farm (underwriting the harvest for an entire season), gaining economic return on investments, and are guaranteed to receive fresh, nutritious, local produce (Hlakanyane 2020; Biodynamic Association 2020).

Through collaborative initiatives with local schools, restaurants, healthcare facilities and retailers, a guaranteed client base may be established alongside support from individual home-owners. The South African Urban Food and Farming Trust seeks to provide support for collaborative initiatives that strengthen and build inter and intra community social cohesion and collective agency, improve household food security and nutritional access, conserve and protect natural urban ecosystems, and humanise the built urban environments (ozcf.co.za 2020).

Idling Capacity exists across a number of assets, including: products, spaces, skills, capital, utilities, time. This reaffirms the need for a paradigm shift in the way society lives, works, travels, creates, learns, banks, and consumes, through the introduction of the Collaborative Consumption model and related economies. Collaborative Consumption is the shared/ community utilisation of goods and services, and the formalisation of a collaborative / sharing economy, whereby physical assets can be shared as services, and replacing physical ownership with sharing; therefore enhancing consumer enablement over ownership through direct interaction (Botsman 2017; Wahl 2017). Rachel Botsman (2017) explains this as the move away from hyper consumption and the return to lending/ sharing/ bartering. She uses the example of an electric drill that effectively has a lifespan of 15 minutes per user; which seems silly to own for such a short useful life but, if rented out to people who need it, becomes a worthwhile investment - what most people need is the hole, not the drill (Botsman 2017). The four drivers of this model are technology innovation, a shift in values, economic realities, and environmental pressures.

Regenerative thinking and design is interconnected with the approaches of living / whole systems thinking as well as the New Economy movement. This 'new economy' proposes a restructuring of the current economic system in order to maximise human well-being and environmental conservation; supporting the notion of prioritising people and the planet over economic growth (Fioramonti 2017). The role of design and construction in the development of communities becomes a process of co-creation that continues after physical completion, implementing change through restoration, regeneration and the opening up of new opportunities for growth and development within communities and their ecosystems; while design strategies and materials used should aim to reintegrate human habits and habitats with nature to produce a net-positive impact (du Plessis and Brandon 2015). If one considers the relationship between the socio-political value system, economic realities, and the built environment it can be determined that the notion of Collaborative Consumption can aid in the development of bottom-up strategies, whereby architects and communities define new ways of practice in order to enhance the quality of life.

THE ARCHITECTURAL ISSUE AT HAND

The role of architects has today been largely forgotten by society and the construction industry as a whole; with many seeing architects as over-priced stylists, questioning their need above that of an engineer at all. Architects, however, are essential due to their unique skill set, empathy and knowledge, making them indispensable when it comes to solving social and spatial issues (Samuel 2018). One possible interpretation of Architecture, simply put, is the dialogue between people and the surrounding physical and social environments. Architects are trained to see the built environment in terms of its impact on the \environment, social wellbeing and economic activity; making their role crucial to the cause. The role of architecture as a trans-disciplinary facilitator and knowledge broker is crucial in designing and developing resilient and self-reliant communities. Architects are the translators, producers, reorganisers and collaborators across jurisdictions and communities, due to their unique idealistic ability to see the world as it should be.

It is important to realise that when approaching novel problems, it will not help to apply the same standard solutions. A novel problem requires novel solutions, an insight taken from the Casuist way of thinking; delving into the particulars of the situation and, through comparisons of two related and opposing, yet accepted standards, determine a solution applicable to the novel problem. This requires a move away from 'silos thinking', where professionals tend not to think outside of their own discipline, or share resources and information with others.

Interdisciplinary collaboration and knowledge sharing is imperative in impacting a positive effect on future community development in South Africa. For this very reason, it is important for architects to have an in-depth understanding of issues such as climate change, food systems and political and economic models. The necessity for research through practice and design, in order to generate the knowledge necessary to be more effective as a profession and more inclusive of the above mentioned factors, is a critical step forward in establishing the place of Architects in the future development of towns and cities (Samuel 2018).

The role of architecture in providing a framework within which social and economic transformation is embedded is a crucial consideration. Architects are equipped with the ability to physically synthesise the political and economic environments around them in the form of the built environment for one very important reason; the aspect around which Architecture revolves is people - human needs and human relationships. How people experience the world, what impacts and determines their day-to-day lives, what the realities of their physical environment entails, are what determine and inform the spatial design of architects (Schumacher 1973). Architectural historian Timothy Hyde aptly states that Architecture, by profession, is a humanities discipline (Moore 2019). If one considers the relationship between politics, economics and architecture at a local and national level, one can see the impact of top-down policies employing 'Starchitecture' in an effort to gain recognition and establish the global presence of a city. In contrast, and what is investigated in this paper, is the notion of bottom-up strategies, whereby architects and communities define new ways of practice as independent enablers (Odgers et al. 2015).

The role of the architect in the design of cities is due to their ability to synthesise seemingly unconnected issues and their interest in solving scenarios for urban futures as, at the end of the day, the impact of urban agriculture is on real spaces, food cultures, and the health and livelihoods of community residents (Viljoen and Bohn 2014). Ukrainian architect Sergey Makhno (2020) explores life after the pandemic. He makes mention of interventions that are relevant to both society and the architectural profession, such as:

- moving away from high rise apartments in favour of houses with small productive gardens or terraces (allowing self-isolation with access to the natural environment);
- moving towards self-sufficiency in terms of water and electricity with the goal being independence from the outside world;
- urban farming will become the norm with household gardens and community farming practices, limiting reliance on the commercial food industry and providing opportunities for food sovereignty; and
- with the rejection of mass industry, local production and economies will be favoured and encouraged (Makhno 2020).

Makhno's observations apply locally in the following ways: i) integration of agriculture and urban development, ii) food sovereignty and security, iii) providing opportunity for employment, education and training, iv) addressing the inequality of living conditions and v) better integration of various communities.

There is therefore a need to investigate a holistic approach to regenerative, self-reliant, mixed-use developments in order to challenge this current model. What this means is that the way we design and the way we approach the design of developments will need to change; the role of architecture will need to be redefined away from 'bespoke building on a plot of land', instead using design to define and create culture. Buildings will no longer be able to stand alone, instead, becoming integrated into the very fabric of the landscape and community in which they are located; thereby questioning the role of Architecture, and the impact it has on society and the environment, in the future.

One of the challenges facing the design profession in this instance is the task of convincing communities of the benefits, qualities and possibilities of food growing architecture and landscapes on a practical level. Another challenge is the task of formalising these practices by writing them into government policy and planning documents. The role of the architect in this is to intentionally introduce the design and development of systems and processes, landscapes, buildings and infrastructure which the community, farmers and urban population alike, will both need and desire (Viljoen and Bohn 2014).

At the forefront of regenerative design and development today is the International Living Futures Institute; their mission being to lead the transformation toward a civilisation that is socially just, culturally rich, and ecologically restorative (International Living Futures Institute 2018). The institute has a number of programmes including the Living Futures Challenges - comprising of Living Buildings, Living Community, Living Food, and Living Product Challenges. The focus of all these initiatives is on the relationship between impact and effort, and is measured through a number of predetermined conditions and performance areas (Petals) such as: Limits to Growth, the intent of which is to curb sprawl, restore natural ecosystems, and protect productive agricultural land and ecologically sensitive areas from the negative impacts of development; Urban Agriculture, improving accessibility to fresh food and on-site production; Water and Energy Petals, aiming for net-positive and zero-carbon impacts; and Responsible Materials and Sourcing, to name a few (International Living Futures Institute 2018).

The Regenesis Group, in their book Regenerative Development and Design (2016), propose that the challenges of our time will be solved through widespread adoption of design practices that are capable of assessing and responding to the world's living complexity through three fundamental principles: Living Systems Thinking (the process of understanding the interrelatedness and influence of things within a greater whole), Permaculture (designing, implementing and maintaining permanent natural systems in order to cultivate land and livestock through resilience and regeneration), and Developmental Change Processes (changes that occur throughout all spheres of a project across its lifespan). The neoliberal mechanistic way of thinking today is a result of mismanagement and a failure in understanding the limits to resources in the pursuit of human gain. On the other hand, the Ecological Worldview poses the idea that the challenges faced by sustainability and regenerative thinking is as much about psychology and human spirit as it is about the environment and technology. Achieving sustainability means equipping the constructed world, and human activity, with the capability to absorb inevitable change and with the ability to be sufficiently able to adapt and progress (du Plessis 2009; Mang et al. 2016). Architect Teddy Cruz does exactly this through four key ideas: i) by focusing more on the flow and exchange of inhabitants than on physical building, ii) drawing on the multiple intelligences of communities and leaving open the potential for that intelligence to source future evolution, iii) the stimulation of collaborations with the potential to create new political processes and economic frameworks, and iv) design with the intent of growing value-generating capacity (Mang et al. 2016).

CONCLUSION

This paper aimed to highlight potential solutions to the current socio-political climate in South Africa through the design of the urban environment. The work seeks to develop a positive course forward that will support a sustainable approach to the integration of community developments and peri-urban agriculture, resulting in an interdependent, symbiotic relationship between man, the built, and natural environments.

Regenerative design requires designers to consider and incorporate each of the three pillars of Sustainability: Economics, Environment and Society through a systemic approach that incorporates social, political, and economic reforms alongside stringent and conscious design and planning practices. It has the potential to perform the role of a catalyst for larger systemic regeneration and transformation of micro and macro environments through the creation and improvement of environmental, social and economic systems.

The Garden City model, although one that can be easily manipulated, may provide a way forward in the design of cities in the future due to its consideration of, and dependencies upon, socio-political and environmental models that inform urban design. Through the integration of Architecture, Urban Design and Agriculture, holistic, self-reliant and sustainable mixed-use developments, and the better integration of communities, can be achieved.

In a world of increasing unpredictability, humans must learn how to respond, and creatively find solutions that will not simply sustain communities, but will enable them to thrive. There is no doubt that there is an overabundance of options for what could be implemented, yet the problem now lies in determining what should be. The regenerative paradigm can be seen as a catalyst for larger systemic regeneration and transformation through the improvement of environmental, social and economic systems. Thus, to successfully access and employ the power of this rapidly changing field, designers must endeavour to find the relationships amongst these varied strategies and combine them.

The Great Work of our generation is to create a post-fossil-fuel and post-consumer economy that is regenerative, fair, durable, resilient, convivial, and democratic. It must be powered by renewable energy. It must be a circular economy that recycles, reuses, or transforms its wastes. Of necessity it will be much more focused on essentials of food, energy, shelter, clean water, education, the arts, and rootedness in place and bioregion. It will be built by local people who cherish and understand their places and the place of nature in a sustainable economy. But it must also be a political economy, a product of revitalised grassroots capability and vision. If it is to flourish, it must regenerate possibilities and capacities that grow from foresight married to practical ecological competence (David W Orr in Mang et al. 2016).

What is needed, going forward, is design based research and research through design that will investigate the efficiency of the theories proposed in this paper relative to developing communities in South Africa, such as the Hazeldean Node; in the long run determining an appropriate response to the sustainable design of urban and peri-urban environments thereby aiding in the achievement of food security, self-reliance and sustainability, and ensuring a better quality of life for all.

Comparative Analysis of Global North and Global South Developments

THE FOLLOWING PAGES CONTAIN A NUMBER OF CASE STUDIES FROM THE GLOBAL NORTH AND SOUTH.

KEY ELEMENTS OF THE DEVELOPMENTS HAVE BEEN HIGHLIGHTED ACCORDING TO THE TABLES IN THE DOCUMENT, HIGHLITING IMPORTANT CONSIDERATIONS TO MAKE WHEN ADVANING TO THE FRAMEWORK DEVELOPMENT PHASE. THESE ELEMENTS INCLUDE THE PURPOSE OF THE DEVELOPMENT, SUSTAINABLE PRACTICES IMPLEMENTED, CONSIDERATION OF FOOD SECURITY AND RECREATIONAL ACTIVITIES PROVIDED.

GLOBAL NORTH: MEGA-CITY DEVELOPMENTS

Developments in the Global North are primarily focused on the incorporation of advanced technology systems in order to ensure 'smart cities' that target living conditions, business development and energy generation.

Self-sufficiency in terms of energy and water usage and generation is a primary concern and is therefore incorporated into the design. Food sovereignty and security however, is not a large concern, with many interventions incorporating "urban agriculture" as a nice-to-have, instead of an essential and critical need to provide fresh produce for the community.

TOYOTA WOVEN CITY - JAPAN

TOYOTA & BIG

Set at the base of Mt Fuji, the Woven City is intended to be a global benchmark for sustainable, technologically driven development. Making use of hydrogen cells and solar panels of many of the rooftops, means that the city will be fully self-sufficient in terms of energy usage. There is a focus on the incorporation of the environment through the use of native vegetation, however, despite the inclusion of aquaponic systems, there is little focus on food security.

Mobility is of the utmost importance, with a focus on multi-transport options, such as vehicular, pedestrian and autonomous (vehicular) zones. Materials will be locally sourced and the construction methods will be traditional Japanese wood construction.

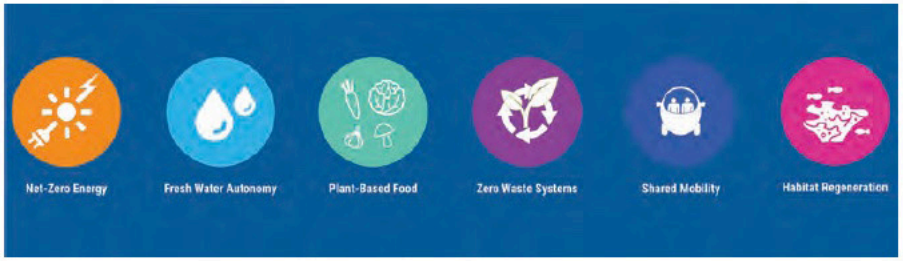
The focus of the development is to be a 'living laboratory' encompassing educational, residential and business facilities (CORPORATION, n.d.).

OCEANIX CITY - NOT YET LOCATED

OCEANIX & BIG

Oceanix City is a vision for the future of sustainable development through the introduction of self-sufficient floating cities. The development will be designed to generate its own energy through the use of rooftop solar panels, while materials will be locally sourced and, wherever possible, prefabricated or grown on the islands (bamboo). There is a huge focus on food security (due to the proximity of the ocean development to land) and this ensures that the centre of each platform is dedicated to communal, plant-based farming.

The development is intended to be mixed use, incorporating residential, educational, recreational and commercial districts, and is intended to function fully at the same time as conserving the marine environment around it (Oceanix n.d.).



NEIGHBOURHOOD - 2 Ha
300 pax

VILLAGE - 12.2 Ha
1 650 pax

CITY - 75 Ha
10 000 pax

(adapted by author)

SMART FOREST CITY - MEXICO

STEFANO BOERI ARCHITETTI

Previously intended to be a shopping mall, the latest development plan now takes the form of a self-sufficient, multi-purpose city. Energy is produced through a perimeter ring of solar panels and irrigation is through the water channel, connected to the ocean. Vegetation is introduced specifically, making use of open land, rooftops and walls, as well as agricultural fields that ensures a level of food sovereignty to those who use it.

This development will consist of residences for roughly 130 000 people, and will focus largely on education in terms of technology and living experiments that allow for constant learning. Although the development stands out, use of vegetation ensures that it integrates itself with the landscape as much as possible (FOREST CITY n.d.).

TORONTO TOMORROW - CANADA

SIDEWALK LABS & HEATHERWICK STUDIOS

The development is seen as an opportunity to redesign two of the existing waterfront neighbourhoods within the city. The design is driven by a focus on people and how their daily lives can be improved through the use of technology, materiality and building design that will encourage the use of outdoor, public spaces. Commercial spaces will be integrated with the residential areas, and transport within the city will be focused on the use of bicycles and public transport.

In terms of sustainability, the development seeks to create roughly 44 000 jobs, make use of recycling, storm water management and a 'smart grid' for efficient heating and cooling of buildings, hopefully allowing the development to produce 89% fewer greenhouse gas emissions that currently produced in downtown Toronto (Sidewalk Labs 2019).

UNION POINT - USA

LSTAR VENTURE ELKUS MANFREDI & SASAKI

Previously a US Navy airfield, this property is now intended to become a smart city, targetting residential, commercial and high-tech solutions. The city will be designed in a way that will incorporate high-tech systems that will provide data collection opportunities to monitor and improve peoples ways of life, from a large scale right down to the internal temperature of their home.

What this development has that the others do not, is a focus on recreation in the form of sports and exercise opportunities, not simply public plazas and squares. It is zoned in such a way that residential areas are separate to the commercial business districts, and these zones are connected by an intermediate educational and recreational (sports) zone.

Transport within the city intends to focus on autonomous vehicles, driver-less vehicles and bicycle networks, connecting all districts and helping to improve walkability is a safe, clean and well inhabited environment.

There is no mention of sustainable design practices being implemented, although it is assumed that solar panels will be introduced to available roof spaces in order to generate some electricity for use within the city.

Through the introduction of vegetation on ground as well as roof level, the buildings will be integrated into the natural environment, resulting in the total footprint of the development occupying only one third of the site, leaving almost 1 000 Ha for green space and hiking trails (Smart City Boston 2017).

MADINAT AL IRFAM - OMAN

OMRAN & ARUP

This development plan is one with a long term focus, aiming for completion by 2060 (40 year plan). Its intention is to stand as a benchmark for sustainable design in water scarce countries, whilst also being a leading example of technological development that is cognizant, and respectful, of its specific context, environment, heritage, culture and economy.

The development strives to draw its design language from the existing architecture and landscape, paying close attention not only to topography, but to the cultural and historical use of the dry river channels. These river channels will be used in places to restore the natural watercourses and, in others, to generate agriculture that will ensure food sovereignty for the people of the city.

The use of local materials, local and traditional design principles and construction methods ensures that the development does not become a 'globally gentrified' solution to a local problem. Instead, attention is paid to the details of both the built and natural environments, and this existing vernacular is respected, preserved, and enhanced. Views throughout the city are paramount, connecting the users to their built and natural environments. The development also focuses largely on the ability for the city to be walkable, allowing the need for vehicular transportation to be limited. The use of dense, mixed-use building typologies and programmes ensures a diversity of activity, users and businesses within different areas of the city, encouraging the users to walk to where they need to go in a safe and clean environment. It is also intended to provide public transport at a larger scale, connecting Madinat al Irfam to Muscat as a whole.

One of the pillars of the development is ensuring responsible consumption throughout the city, aiming to consume half the amount estimated to be used by a city of comparable size. Energy the will be generated through the use of solar panels, whilst water will be harvested, treated and recycled for irrigation of the urban farms, all of which will help to lessen the dependence of the development on non-renewable resources (Arup n.d.).

GLOBAL SOUTH: MEGA-CITY DEVELOPMENTS

Developments in the Global South are focused on the provision of housing and accommodation for the many millions of people affected by poverty and poor living conditions. Many of these devlopments look to include opportunities for education and business development too, however, the focus is not on advanced technology, but on (relatively) affordable construction costs and materials. There is very little consideration of food provision and sovereignty, and the intention is to increase the density of the site to the maximum, leaving little space left over for green or public recreational parks and facilities within these developments themselves.

Daggafontein Mega City

Lanseria Airport City

The four development proposals listed here are 4 of 30 proposed low cost and afforable housing developments in the Gauteng region .

These developments are mainly focused on providing housing for many who are currently affected by the Apartheid settlement patterns, but there is a large focus on providing a range of educational facilities, including schools, tertiary education and training facilities.

They will also form commercial hubs, targeting businesses of all sizes with the aim of boosting the economy. However, there is no provision for agriculture, urban farming or otherwise, and therefore no attempt is made at ensuring food security or sovereignty to the people within these communities (Writer, n.d.).

John Dube Mega City

Cullinan Mega City

EKO ATLANTIC MEGA CITY - NIGERIA

This development in Nigeria is one of the largest taking place in Africa currently, drawing global investments and participation and intending to become one of the leading technological cities in Africa and the Global South, by targetting many of the same principles as mentioned in the Global North.

The development incorporates residential buildings, office parks and commercial centres, retail facilities, tertiary education institutions that are focused on technology and business, water treatment plants and energy generating facilities.

The aim of the development is to be completely independent with regards to its power generation and supply through the use of solar panels and natural gas (processed in an air cooled tower to ensure conservative water usage in the process), and to be water conscious through treatment and reuse of water in and around the development.

Transport within the city is a combination of pedestrian promenades, marinas, and roads for public and private transport. Provision for the parking of private vehicles is made, and a city wide bus network is in place.

There is an arboretum consisting of roughly 200 000 trees planted outside of the city, and indigenous trees and vegetation will also be incorporated within the city. However, there is no zoning for urban farming or agriculture in or nearby the city (Eko Atlantic n.d.).

CASTLE GATE PRECINCT - PRETORIA

Atterbury's Castle Gate Precinct is built on a previously vacant piece of land situated along the the N1 highway outside Pretoria and is intended to be a multi-purpose development that includes an office park, medical facilities, hotel, residential units, a retail / lifestyle centre, and protected green spaces dedicated to outdoor recreational activities. It is hoped that 22 000 jobs will be permanently created through this development. There is no planning for urban farming or agriculture on the precinct.

Along with the development itself, there is the intention of upgrading the road infrastructure surrounding the precinct in order to help improve the surrounding community and access. It is expected that all buildings in the development will make use of solar panels in order to generate enough energy to power the entire development (BUSINESSTIMES n.d.).

THE BLYDE - PRETORIA EAST

Balwin Properties' The Blyde is a development in the East of Pretoria that consists of multiple story residences, a lifestyle centre and a 1,5 Ha lagoon (holding roughly 35 000 litres of water (Patrick 2018)).

The development targets middle income families and individuals, offering an exclusive resort-type estate. Although the water that is used for the lagoon is supposedly sourced from boreholes, there is no harvesting of stormwater done on site, and although there are solar panels incorporated, it does not generate enough energy to power the development entirely.

Community green spaces are provided for residents usage, and no attempt at urban farming or agriculture has been made (Patrick 2018).

HAZELDEAN NODE - PRETORIA EAST

The heart of the Hazeldean Node is the old Hazeldean Dairy and Farmland. In the family since the 1870's, the Hazeldean Farm became home to the first Ayershire dairy heard in Pretoria in 1840, whereafter it soon became the largest producer of milk for Woolworths in South Africa. In 2008, the cattle were sold off to various other dairies in the greater Gauteng area due to difficulty in food production for the cattle on the land itself and an unavailability of grazeable land anywhere else at the time. However, Clover subsequently took over the dairy that is on the farm and is currently still in operation there.

Farming on the property was thereafter abandoned and the family has subsequently invested in trying to develop the land along with Abland and Craft Homes. It is currently being used as a weekend market and outdoor recreational facility.

The development plan is typical to that of developments within South Africa currently, consistng of a range of housing typologies targeting mostly the middle to high income bracket, a shopping mall, separate retail facilities to the mall, and office parks. It also offers educational facilities (pre-primary to tertiary institutions), healthcare facilities, retirement facilities and a church.

The old farm buildings that are considered heritage structures are intended to be restored and converted into a luxury wedding / function venue with accommodation in the old manor houses.

The concept of small community food gardens has been investigated, although this is as a nice - to - have, and is not considered to be a priority. There is no intention within the current development plan to return livestock to the area or revert back to agriculture at any point
(HAZELDEAN DAIRY INTERVIEW 2020).

Final Theory

by BS (Brittany) Newton

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