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BUILDING POSITIVE INTERACTIONS

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BOVINE COMPLEX AT THE PRETORIA SHOWGROUNDS: ARCHITECTURE ADDRESSING THE INTERFACE BETWEEN THE PUBLIC AND THE AGRICULTURAL INDUSTRY

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Research Field: Environmental Potential

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PROJECT SUMMARY

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Research Field:	Environment Potential
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Keywords:	Regenerative architecture, adaptive reuse
Theoretical Premise:	Regenerative theory within an ecological whole systems approach
Approach:	Architecture as the interface between merging industries and the public.

ABSTRACT

The current model of complete separation between different industries, buildings and the public, hampers growth and sustainable development within the city. If connections can be identified between several related programmatic elements, can these work together to share and build common resources that benefit all parties involved?

The showgrounds in Pretoria West currently exist as a void in the urban fabric, A large part of its infrastructure built for, and is now mostly only used for the annual Jacaranda Show that will now longer take place there. The role of the agricultural show within the city, however, remains a meaningful part of how the public interacts with the agricultural industry.

In order to prevent the loss of this relationship and the heritage of the showgrounds, how can a new development around the existing Champion ring retain this role as well as build on the concept of connecting related industries and the public?

The main aim of this dissertation is to investigate how architecture can address the interface between the livestock industry, research, education and the public, so that the collaboration between such programs will result in a reduced environmental impact and be of mutual benefit..

Groei en volhoubare ontwikkeling in stede word belemmer deur skeiding tussen verskillende industrieë, geboue en die publiek. As ons die interaksie tussen verskilende programmatiese elemente kan bepaal en die deel van hulpbronne daarvolgens kan toepas, sal dit nie al die partye bevoordeel nie?

Pretoria Wes se skougronde is tans ‘n lee ruimte binne die omliggende stedelike area. Die meeste van sy infrastruktuur word slegs gebruik met die jaarlikse Jakaranda skou wat nou ook sy einde bereik het. Hierdie landboukundige skou, binne-in in die stad, het tog ‘n betekenisvolle rol gespeel in die publiek se interaksie met die landbounywerhede.

Om te verhoed dat hierdie verhoudings en die geskiedkundige waarde van die skougronde verlore gaan, word daar gekyk hoe die Kampioenring en omliggende infrastruktuur ontwikkel kan word om interaksies te bevorder of bewerkstellig tussen die verwante nywerhede en die publiek.

Die hoofdoel van hierdie verhandeling is om te ondersoek hoe argitektuur die skakeling tussen vee-nywerhede, navorsing, onderwys en die publiek kan aanspreek, sodat daar deur onderlinge samewerking ‘n kleiner impak op die natuur sal wees terwyl almal bevoordeel word.

ACKNOWLEDGEMENTS

Special thanks to:

Francois

Prof. Piet Vosloo and Dr. Arthur Barker

My parents

My friends

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.

Salome Richter

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SECTION 1: INTRODUCTION

"One cannot alter a condition with the same mind that created it in the first place"

- Albert Einstein (n.d.)

1.1: PREFACE

We are at a tipping point in history. If we don't adapt our way of thinking, living and building to take responsibility for the environmental consequences of our actions, we will soon live on a planet that can no longer support us. Humans have already surpassed the carrying capacity of earth (GBCSA, 2016), meaning that our current rate of resource use is greater than what the planet can sustain.

Over the last few decades there has been a strong drive towards promoting green buildings and sustainable architecture. The main focus to date, however, aims no higher than to be "less bad", at most to have a net zero carbon footprint. Although this is a vital bridging step towards more sustainable development, it is not enough to make a positive contribution to a genuinely sustainable world (McDonough and Braungart, 2002).

According to Du Plessis (2011), the core reason for this limited approach to a required level of change is due to the reductionist and mechanistic world view that still dominates our way of thinking. As long as we see man as separate from nature, and nature as a set of systems we can control and use for our own advantage, sustainable development will remain inadequate to cope with the negative impacts we face.

For us to make a real positive difference, we need to adopt a new kind of thinking.

1.2: THE PROBLEM

One of the biggest obstacles in moving beyond sustainable development is the slow social change in shifting the mainstream way of thinking from a consumerist mentality to one of nurturing and regeneration. This is largely due to a lack of awareness and incentive fostered by a society bound in a mechanistic and consumer-driven world view.

One factor contributing to this lack of awareness is the segregation between the public and supporting processes such as agriculture, industry and research. For example, one hardly considers the consequences of the production process of a piece of meat if you are only exposed to the end result in a packet on the shelf in a supermarket. Yet the process of getting that piece of meat on the shelf has a substantial carbon footprint and other impacts which need to be considered within a bigger picture and network of systems in order to enable informed everyday choices and true sustainable development and lifestyle. The annual Jacaranda Agricultural Show (previously known as the Pretoria Show) at the Pretoria Showgrounds is one event that formes a link between the urban population and the agricultural industry, even if only for a few days a year. However, due to various reasons, the Show has been moved to a new location. This leaves the existing facilities open for reinterpretation as to how this role can be filled in a more effective or permanent manner.

Another factor driven by the current mechanistic and consumerist way of thinking, is the "each man for himself" attitude within many industries and the built environment, which results in very little interaction and support between neighbours. Working together to reduce the amount of resources used and waste produced, does not only reduce the environmental impact of these processes, but can also lead to cost saving and mutual benefits.

Mainstream architecture in South Africa further adds to this process of segregation, characterised by hard edges, excessive use of boundary walls and internalised single use buildings. Solving these problems in the built environment is just as important on the road towards a sustainable future as factors such as resource efficiency.

1.3: RESEARCH QUESTION

How can a holistic ecosystems approach be applied in architecture to create a new interface between agriculture, research, education and the public?

Further questions include:

How can architecture be net positive in terms of water, energy and waste by creating positive interactions between building systems, ecosystems and social systems?

What are the opportunities for regenerative development at the Pretoria Showgrounds?

1.4: AIMS

Using architecture to address the *interface* between the livestock industry, research, education and the public, based on the assumption that will result in the collaboration between such programs result a reduced environmental impact and mutual benefit.

1.5: METHODOLOGY

Literature & Precedent Studies

Theoretical studies as well as issues relating to sustainable urban development, climate change, urban housing and green building will be investigated.

Mapping

A study of the area will be conducted to map the urban framework and inform a master-plan within a group framework shared in studio.

Framework

A thorough site investigation will be done through documentation, observation, site sketches and photographs as well as research on the area.

Applied Research

The data collected will be summarised and interpreted in order to formulate a relevant design response. Various ways of responding to the research question will be investigated leading to a tectonic resolution.

Using Building Information Modelling software, energy modelling and the LESES framework as guide, the design's performance is to be analysed and optimised in an iterative process.

1.6: DEFINITIONS

Sustainability

There have been many different definitions of sustainability over the years, each depending on its context.

The Bruntland Report for the World Commission on Environment and Development (1987: 41) described it as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

Worldview

A worldview can be defined as a set of basic assumptions and systems of beliefs that shapes a person's basic perception and way of thinking about the world. It describes the nature and structure of how the world works, providing a framework to guide one's actions and thinking (Du Plessis & Brandon 2014).

Mechanistic Worldview

The mechanistic world view is a result of the scientific revolution of the seventeenth century. It is based on the metaphor of the machine, where nature is seen as a finite set of systems that can be rationally dissected, understood and controlled (Woolf, 1998). This view sees the whole as equal to the sum of its parts with man distinctly separate, or above, nature. This has led to the idea that man can control and therefore use nature to his own advantage, which lies at the heart of our current environmental crisis (Mang & Reed, 2012).

Ecological Worldview

An ecological world view sees the world as an interconnected whole, an interdependent set of systems of which humans form an integral part. This view is based on a holistic understanding of natural processes and systems where humans and nature are partners in the processes of co-creation in a sustainable living system.

Interface

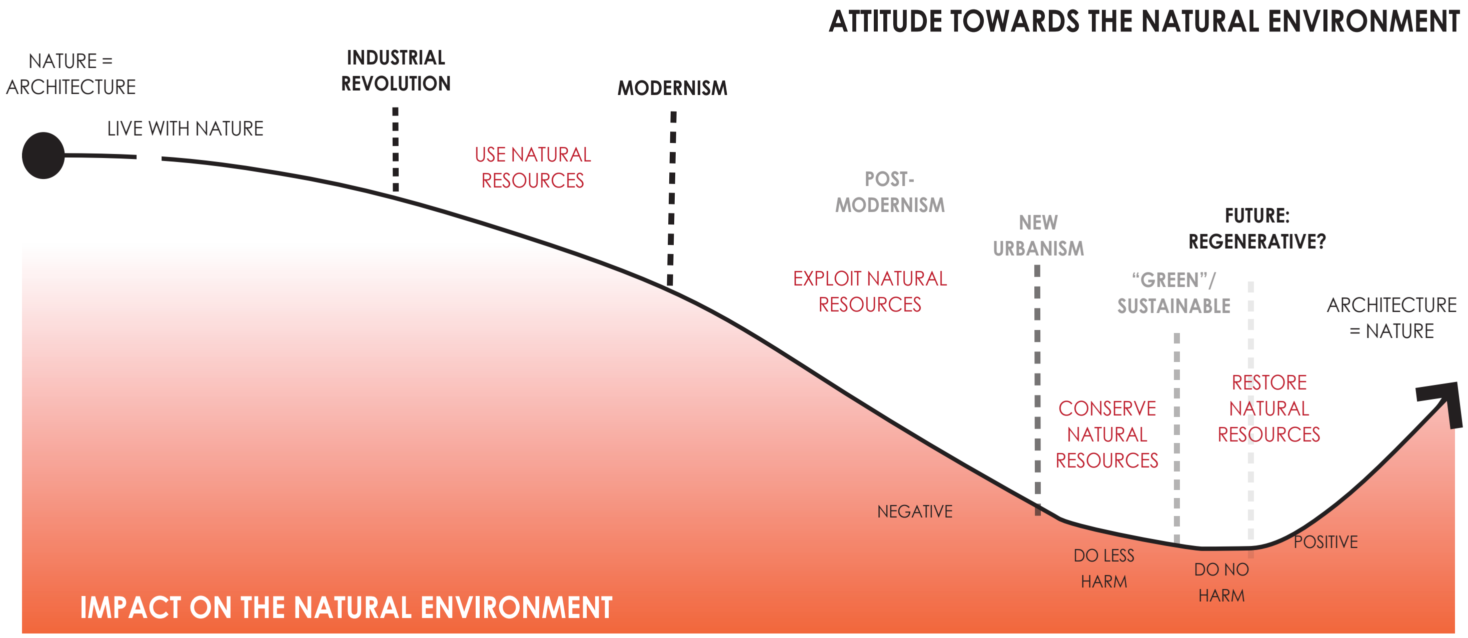
ˈɪntəfeɪs/

noun

1. A point where two systems, subjects, organizations, etc. meet and interact.

SECTION 2: ARGUMENT

This section develops and investigates the theoretical, programmatic and contextual arguments on which to base a design response.



2.1: THEORY

ARCHITECTURE AND SUSTAINABILITY

The idea of sustainable development and the awareness of the impact of human activities on the environment is by no means a new one. During the industrial revolution in the late 18th and early 19th century, the shift, the shift from low intensity manual production to high intensity machine production and the use of oil and coal drastically increased our ecological footprint in the late 18th and early 19th century.

The oil crisis in the 1970s was a turning point in sustainable awareness. The 1980s saw Post-modernism and Critical Regionalism explore vernacular responses to regional context and consideration of place in reaction to the modernist mindset. There was also a renewed interest in finding alternative energy sources.

In recent years, sustainable and 'green building' has become mainstream architectural practice. The manner in which it is implemented, however, is still based on the mechanistic worldview which forms the foundation of our current building industry and way of thinking. The focus remains on doing less harm to a site, or adding 'green' components. It does not take into consideration the complexities of natural systems, because it addresses only a small part of the total system (Mang & Reed, 2015).

A NEW MIND

If the current model of sustainable design is not sufficient to meet the environmental challenges we face, the question is: what is will be? The mechanistic world view is at the root of our present situation and also provides the basis for the current 'green building' models. Therefore, addressing this world view should be the first step in a new direction.

The first step towards a regenerative approach in design is not a change of techniques but a change of mind. This entails a shift from seeing the world as a set of building blocks, which we can manipulate to our own advantage, to seeing nature as an intrinsically interconnected living system. It also means a shift from seeing man as separate and above nature to seeing humans as a part of nature and partners in co-evolution (du Plessis, 2012). The ecological world view sees the world in this way.

Translated to the building industry, this means rethinking everything from the way buildings are planned, constructed and operated to what the role of the architect is and who gets involved in the design process. It also requires a different approach to the site itself; instead of seeing a collection of problems and solutions such as roads, slopes and existing structures, one should see an interconnected web of processes that shape and change the site (Haggard 2002:25).

The three main aspects one has to consider when working with an ecological world view as a basis for design, are the story of place, interactions and relationships as well as the ability to respond to change.

STORY OF PLACE

The first aspect of an ecological approach, is establishing a place-based understanding of the specific site, so that discovering and recognizing its uniqueness of a site form the start of any investigation. This includes studying the social and ecological systems involved as well as the history, climate, geography and larger context towards understand the patterns and dynamics that shape the place. With this knowledge, leverage points in the systems can be identified where small changes can act as catalyst for beneficial change and can be addressed in the design (Mang & Reed, 2012).

Uncovering the story of place is essential for understanding the inner workings of a place as it is now and has been in the past. It is also essential for understanding how the stakeholders are affected by a created change and how a contribution can be aligned with the best interest of those stakeholders to ensure that it is positively received and maintained in the future. A co-evolution can only take place with the willing participation of all of those involved.

INTERACTIONS AND RELATIONSHIPS

The second essential component of working with the ecological worldview is the importance of relationships and interactions. Where the mechanistic approach relied on quantitative measurements of each component of a system and the efficiency of that part, an ecological view focuses rather on the patterns of relationships between parts, how these patterns are sustained and what their future potentials are. The focus thus builds mutually beneficial relationships between systems (Mang & Reed, 2012).

RESPONDING TO CHANGE

The third aspect explored in the ecological worldview, looks at the concept of impermanence and change as the only constants. The predisposition towards change is evident in the sciences from quantum physics to ecology, and the earth's history is testament as to how natural and human systems constantly adapt to changing circumstances (Du Plessis & Brandon, 2014).

The notion of resilience and ability to adapt is therefore vital for an intervention's continued success and relevance within a system. Characteristics such as redundancy, diversity, flexibility and degrees of connectivity are examples of aspects to be explored in the design and management of new systems so as to determine vulnerabilities in the future.

With these three aspects of an ecological worldview as foundation, it is possible to move beyond the traditional approach of sustainability to a regenerative sustainability.

REGENERATIVE ARCHITECTURE

Regenerative design is based on an understanding of the inner working of ecosystems so as to regenerate rather than deplete the underlying life support systems and resources within socio-ecological systems (Mang & Reed, 2012). As Mang explained at the Summit on Regenerative Neighbourhoods (2013), "there is no such a thing as a regenerative building. Buildings should be seen as catalysts towards the generation of regenerative processes".

When applying a regenerative design approach, one starts by finding the core of a system, the uniqueness of a place or thing around which the system orders itself. The next step is to look at the larger context of interconnected systems, and form an understanding of how they are interlinked (Mang & Reed, 2012). This can then inform a design that adds value to the place as a whole.

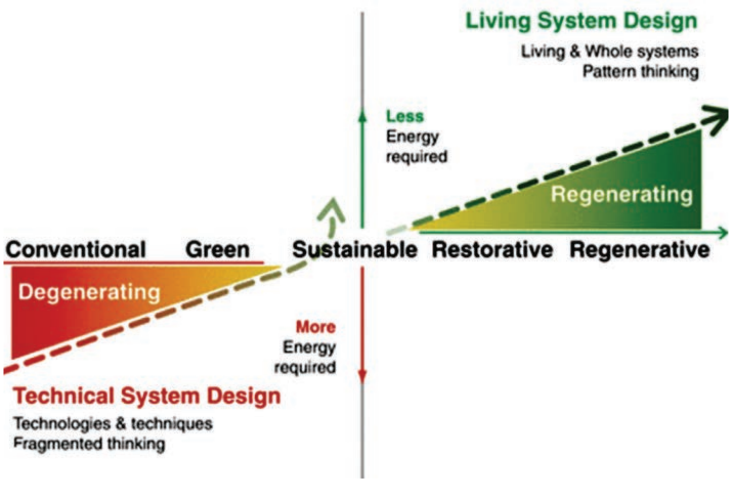
Defining Value

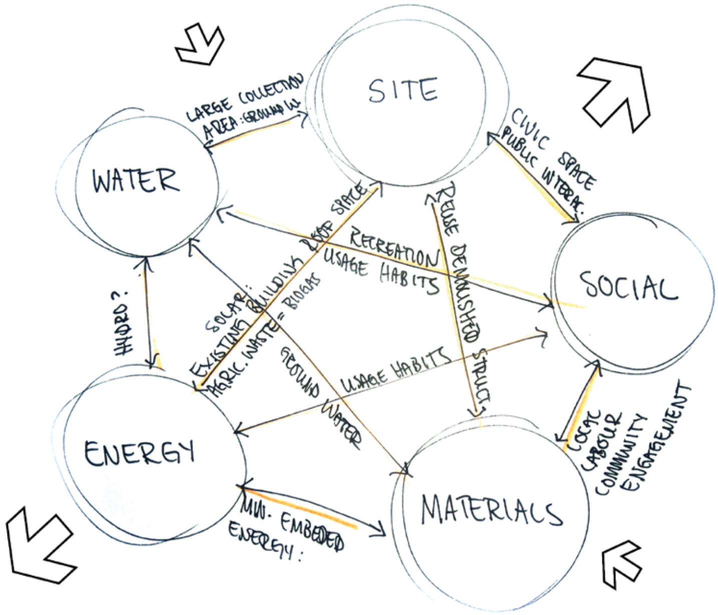
In mainstream architecture, the term 'net-positive' usually refers to buildings that generate more resources or energy than that which they consume or add value to a system by fulfilling more than just their own needs. The Merriam-Webster definition of value is something that holds worth, importance or usefulness, such as monetary or material worth (Merriam-Webster.com, n.d.).

The interpretation of value in the built environment, however, can vary greatly and marks a key difference between the current approach to sustainability and a holistic ecological one. The value of a green building is usually measured in terms of benefits to humans such as financial gain, health or negated negative impact, whereas ecological sustainability looks at value in terms of an ecosystem's capacity to generate and sustain the life and vitality of a certain place (Mang & Reed, 2015).

The concept of adding value within an ecosystem can also be understood through the idea of causation. In an ecosystem, every species plays a specific role that enables other in turn to fulfil theirs. Even if there is no a direct connection, the value of the role of one species lies in the link it forms in the intricate web of life within that ecosystem that allows the whole system to function and thrive (Mang & Reed, 2015).

Understanding and reconciling these definitions in the way that society perceives and measures value within the built environment is a vital step towards a regenerative future.

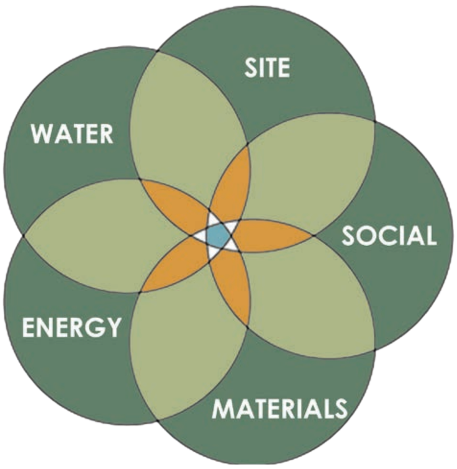


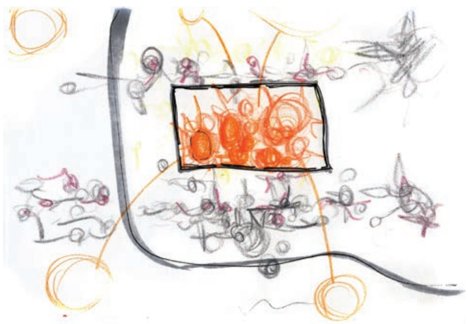


Opposite top: Architecture and our latitude towards the natural environment

Top left: Framework for regenerative sustainability (Mang & Reed, 2012)

Top right: Using interactions between site flows as staring point for net positive interventions (Author, 2017)





Top: Foundation and Flows Lenses summary (CLEAR, 2016)

Above; Diagram showing contained energy (current condition) versus distributed energy (urban vision) in terms of activity on the Pretoria showgrounds and contribution to the surrounding area (Author, 2017)

LENSES

To help professionals apply an ecological approach within the building industry, the Institute for the Built Environment at Colorado State University developed the LENSES (Living Environments in Natural, Social, and Economic Systems) framework. This framework is based on the principles of regenerative design as described by the Regenesis Group (Hes, 2015), where the main aim is to assist practice to shift towards a regenerative approach that aligns our interventions with natural systems. It is not a tool that provides a comparative assessment, but rather a guide to the process of discovering the regenerative, place-based potential of a site and starting the right conversations.

The framework consists of three lenses: Foundation, Flows and Vitality. Each lens offers a layer of investigation into the site to create a holistic understanding towards a place-based solution as well as opportunities for community input and positive interactions.

Foundation Lens

The LENSES platform is rooted in a place-based understanding of the specific site, so as to establish the story of place and an in-depth understanding of what is essentially relevant and needed on the site. The Foundation Lens establishes who the stakeholders in the project are; these will be anyone connected to the project on any level as well as “voiceless” stakeholders such as animals and insects. Looking at the triple bottom line principle, the natural systems are seen as the primary foundation on which the social and economic systems depend (figure 2-4 top).

Flows Lens

The Flows Lens addresses the built environment components. For the purposes of this investigation they have been grouped under the following categories: Site, Water, Energy, Materials, Health and Social aspects (fig 2-4 middle).

Each of these flows can be mapped in a matrix to identify connections as well as positive and negative interactions. For instance, the connection where water interacts with social or energy systems will be addressed in a practical manner in order to positively contribute to the system.

Vitality Lens

The Vitality Lens works in conjunction with the Flows Lens, as the response to each of those aspects are to be analysed to determine whether the resulting impact will be regenerative or degenerative to the system. The aim is for the project to give back more than what it takes from its environment, in a way that can sustainably continue into the future (CLEAR, 2016).

URBAN CONNECTIONS

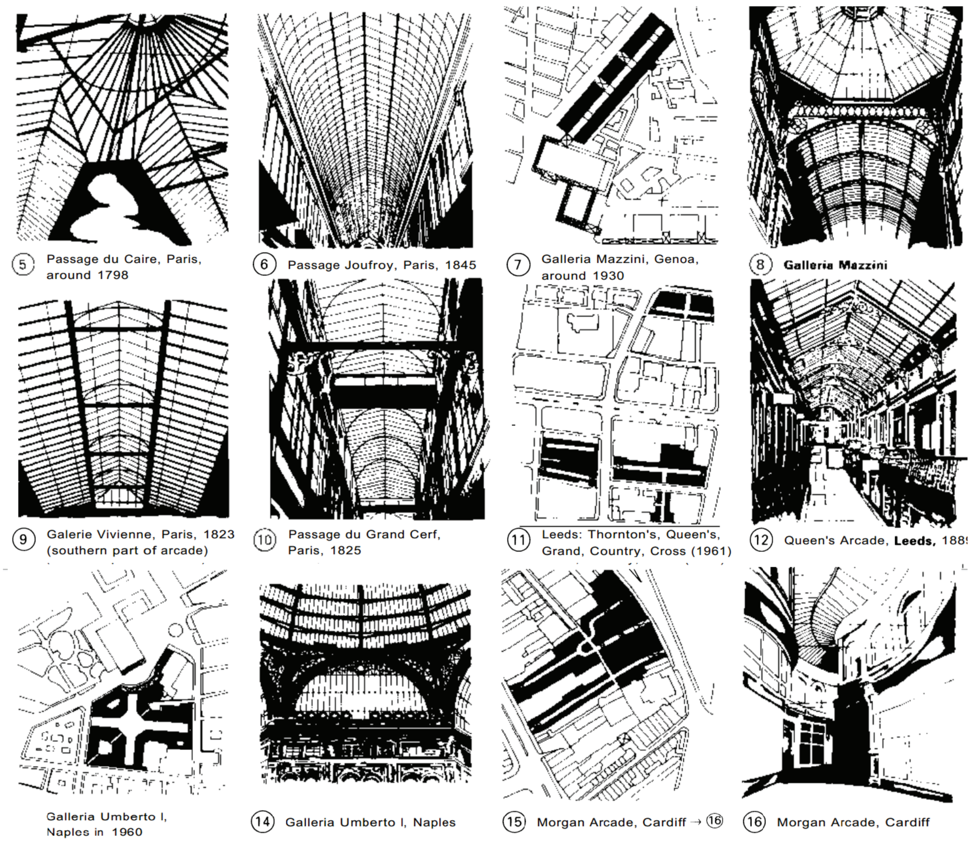
For a single site within an urban context to be nett positive without taking into consideration it's larger context and connections to other processes and building, is a very limited approach. For an area or city to develop regeneratively as a whole, there needs to be an interaction between elements, acknowledging existing connections and positively developing new ones. These connections could include anything from social aspects such as pedestrian circulation and interaction to water, energy production and waste reuse systems.

This idea is to a certain extent addressed by the current model of mixed used developments. Benefits of mixed use developments include greater variety and density within an area, reduced vehicular travel when residences and workplaces are within walking or cycling distance and stronger neighbourhood character (Beyer, 2012).

Figure 2-1: *. Top; Historic examples of arcades (Nuefert, 2012)*

Figure 2-2: *Connecting spaces and uses (Author, 2017)*

Figure 2-3: *Left; the affects of re-interpreting boundaries within the city block (Author, 2017)*

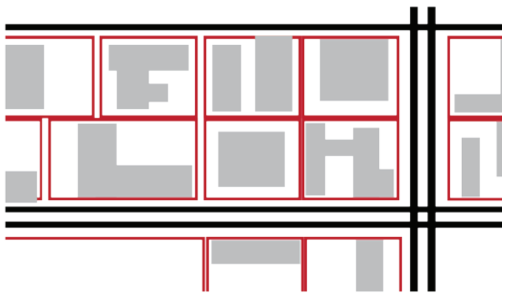


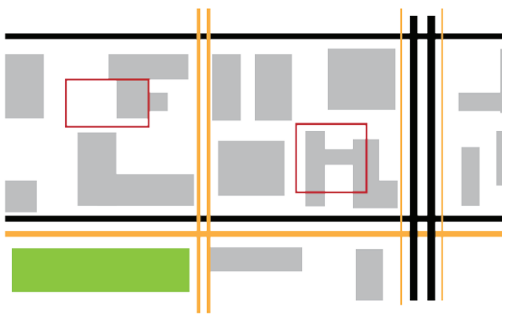
Arcade as urban connecting element

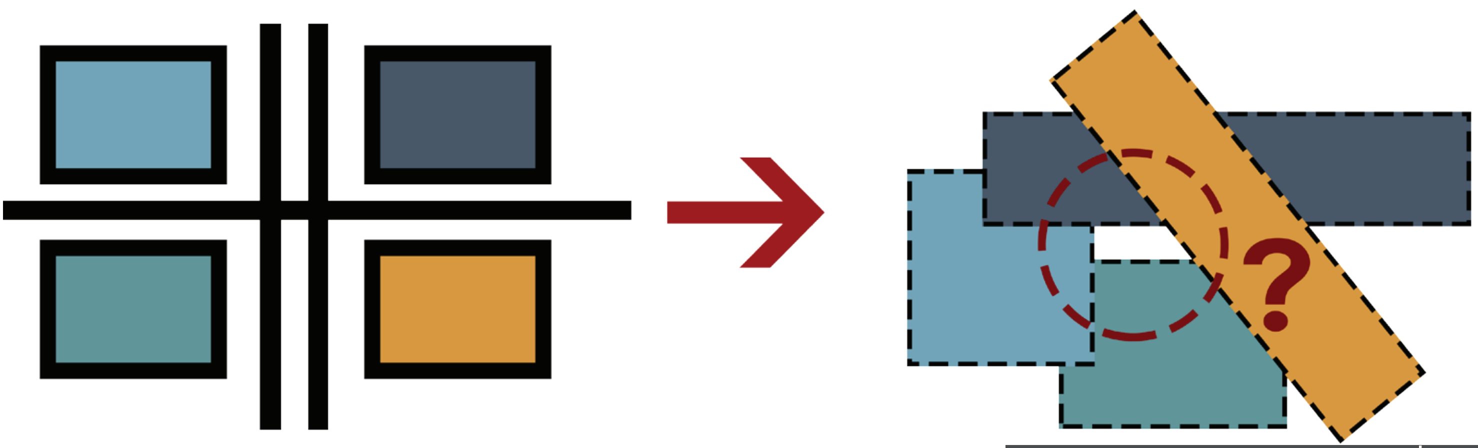
The typology of the glass arcade dates back several centuries as a public connection between buildings and city blocks. With their transparent roofs spanning roads, squares and building interiors, they create a link between public spaces, shops and commercial spaces.

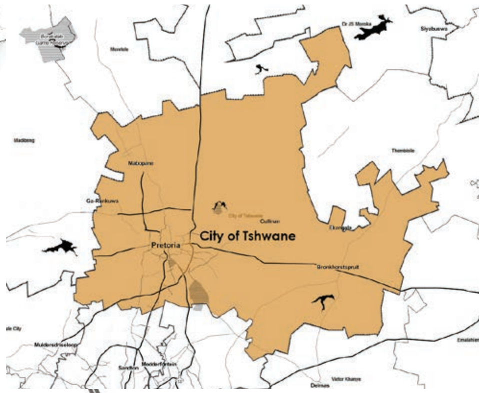
An arcade or gallery can be used to expand on pedestrian zones, provide meeting and lingering spaces as well as to protect against bad weather (Nuefert, 2012).

How can such an element be used to challenge the traditional model of city block boundaries?









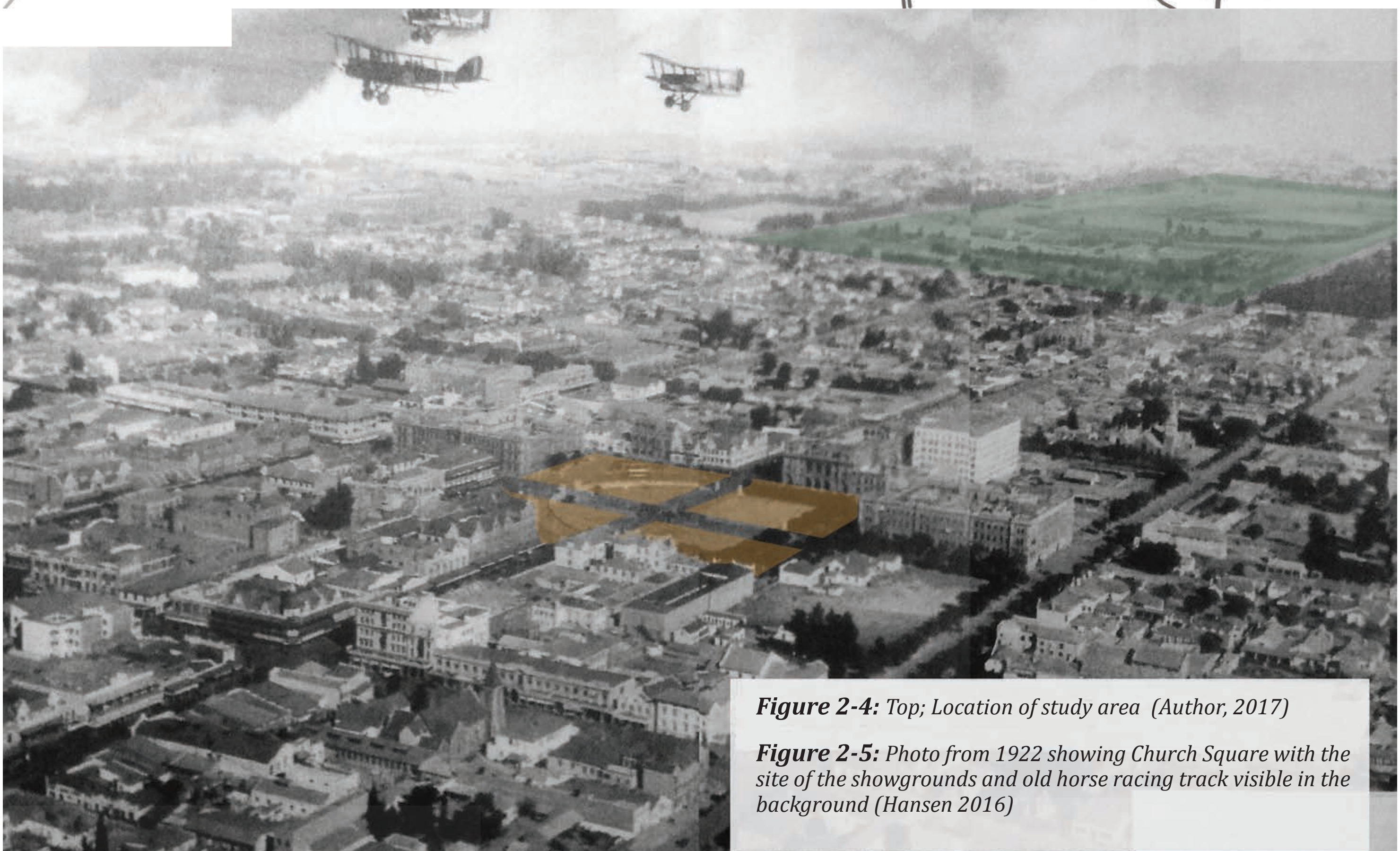
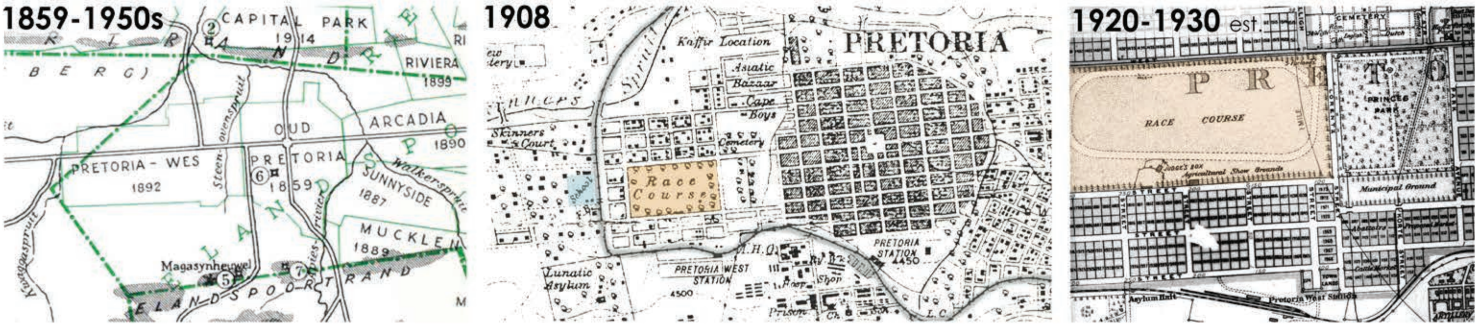
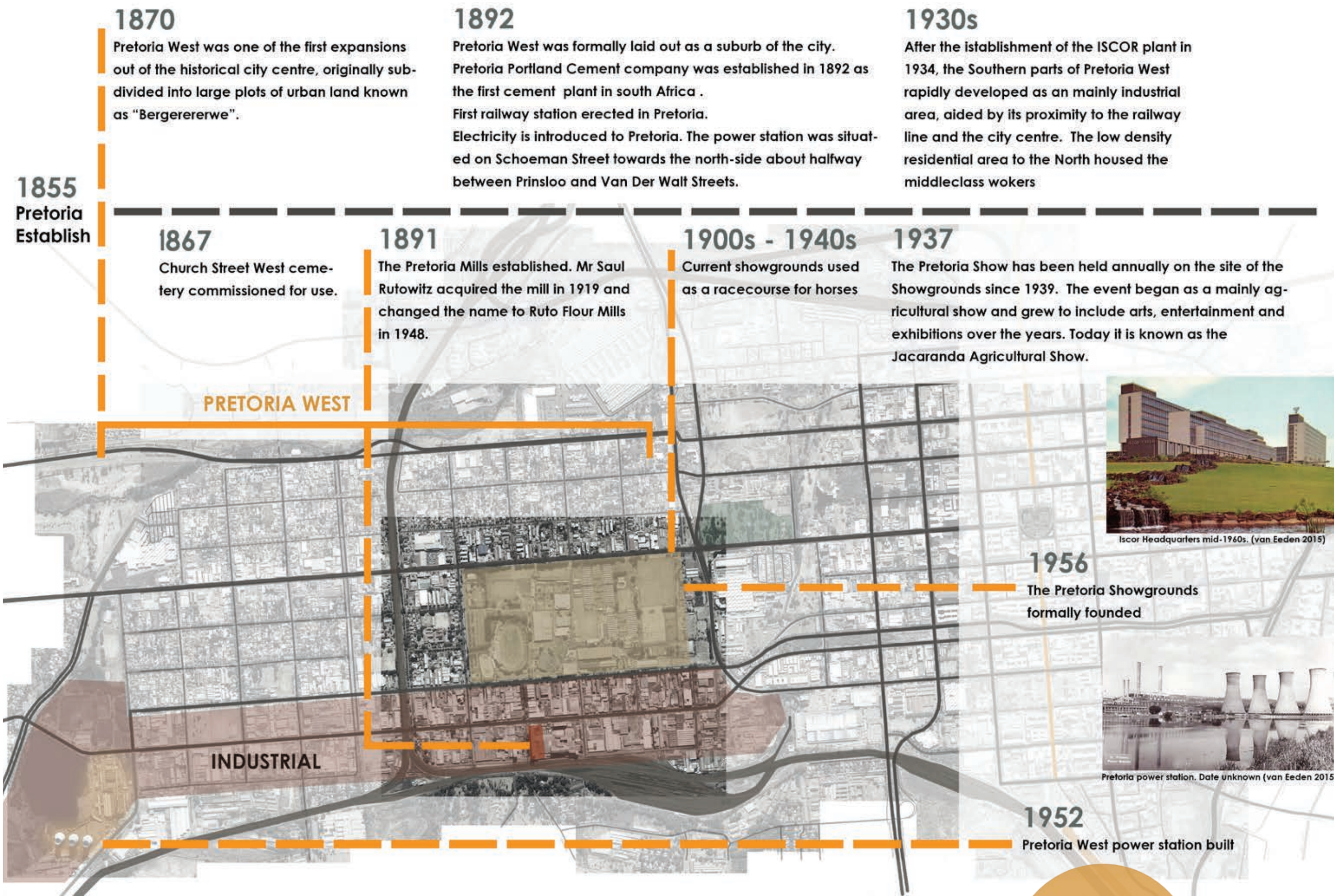
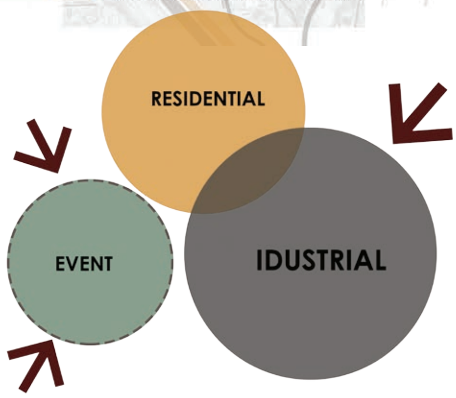


Figure 2-4: *Top; Location of study area (Author, 2017)*

Figure 2-5: *Photo from 1922 showing Church Square with the site of the showgrounds and old horse racing track visible in the background (Hansen 2016)*







2.2: CONTEXT

The site being investigated in this research project is the Showgrounds located in Pretoria West. The region of Pretoria West stands in stark contrast to the rapid development of the east of the city. Described as the "backyard" of Pretoria (Labuschagne, 2016), the urban fabric is largely degraded and underutilized.

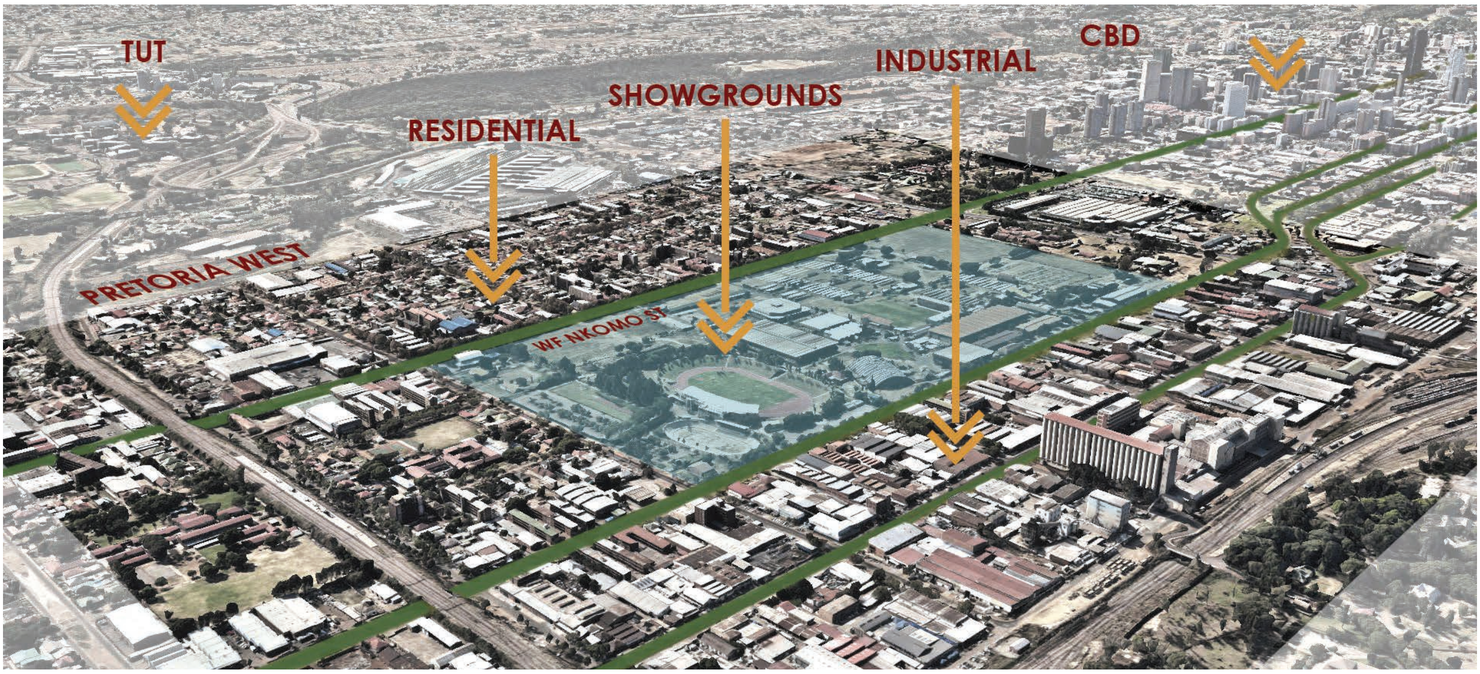
The area is characterised by the industrial stretch along the railway line to the south and the working class medium- to low-rise residential area to the north separated in the middle by the Tshwane Events Centre (hereafter referred to as the Pretoria showgrounds) and Pilditch Stadium (see fig 2-10 & 2-11).

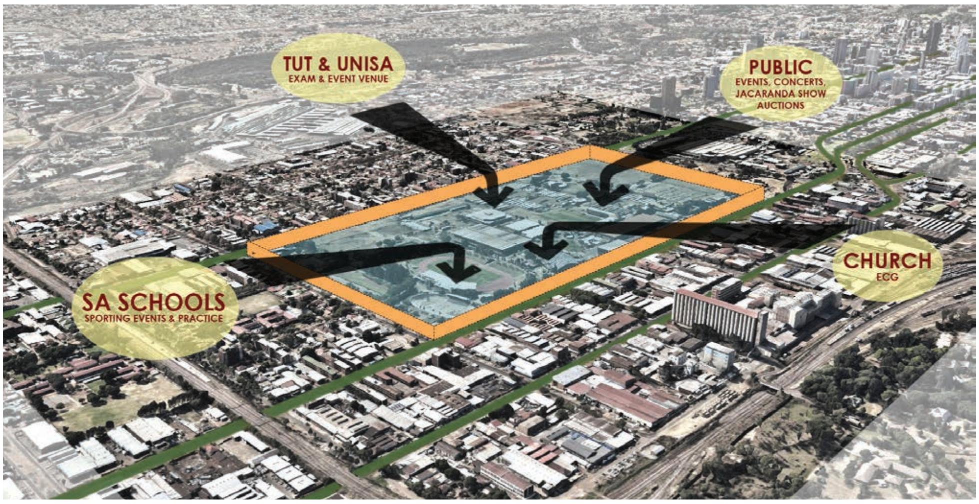
Despite their proximity, these three land-uses seem to function in isolation. In the past, the residential area housed the industrial workforce, but this is to a large degree no longer the case with most of the people working in the area traveling from further out by Metro Rail. Similarly, there are thousands of people coming to the showgrounds and Pilditch Stadium from all over the country for various events on a periodic basis, only to leave with no interaction with the surrounding area. The entire area of the showgrounds is fenced off, with restricted access to separate enclosed areas. The twelve city block area effectively becomes a barrier, a void within the local urban fabric that does little to contribute to the area.

Figure 2-6: *Top: Historic maps of Pretoria showing the racecourse and the agricultural heritage dating back to before 1908. (Van der Waal, nd).*

Figure 2-7: *Above; Historic overview of Pretoria West (Author, 2017)*

Figure 2-8: *Separate elements defining the area (Author, 2017)*





Top; Pretoria West overview (Author, 2017)

Left; Role-players currently making use of the Pretoria showgrounds (Author, 2017)

Opposite Top; Area zoning (Mappable 2017, adapted by author)

Opposite middle; Public transport routes (Author, 2017)

Opposite below; main pedestrian and vehicular flow (Author, 2017)

Opposite right; Limited access to showgrounds (Author, 2017)

These elements also add to the enormous potential of the area. Located only 2km from the CBD and well connected with transport routes, there are considerable opportunities for regenerative development as well as new connections and interactions.

STORY OF PLACE

Using the LENSES framework as guideline, the first step in a regenerative design process is establishing the story of place.

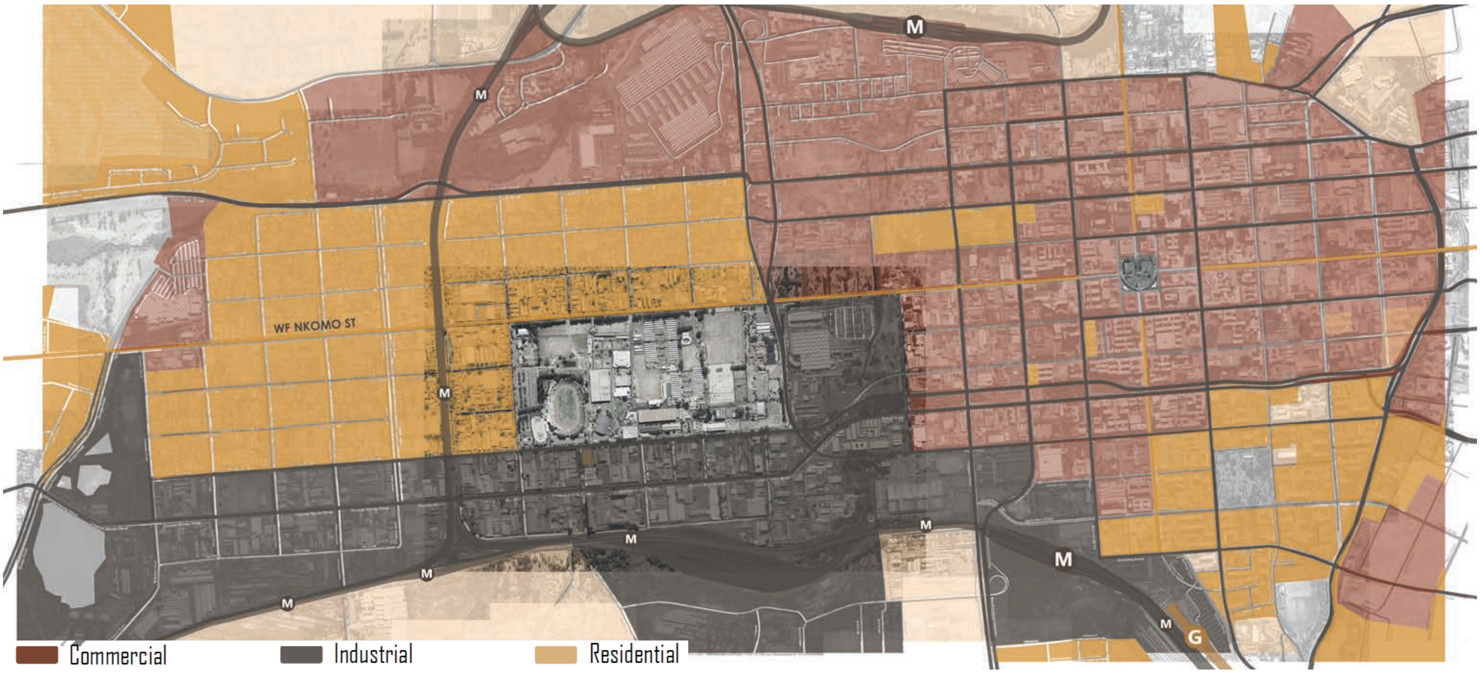
Historic Overview

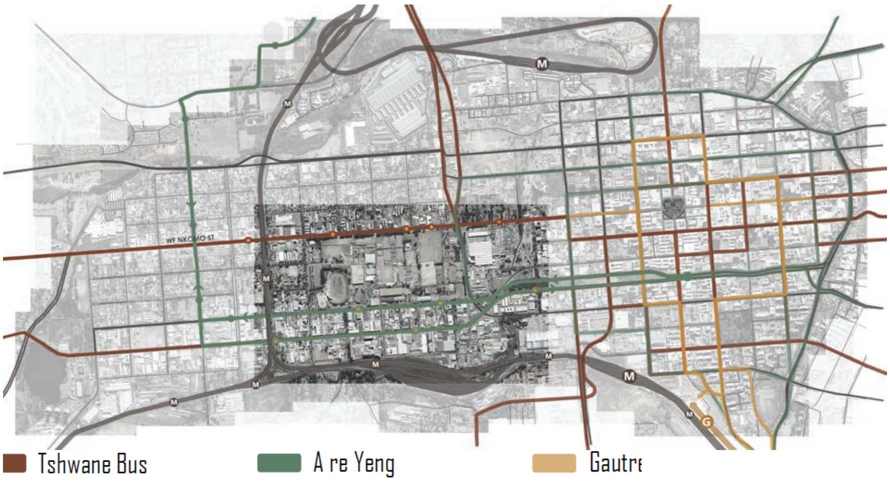
Pretoria West was one of the first expansions out of the historical city centre in 1870, and was formally laid out as a suburb of the city in 1892. The establishment of the Pretoria Portland Cement company and later the ISCOR plant and power station as well as its proximity to the original railway line and city centre, all contributed to the area developing as an industrial area (fig. 2-9).

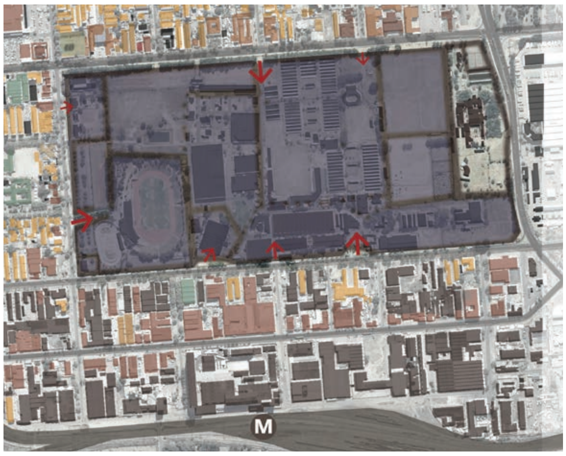
The Pretoria showgrounds site was previously the location for a horse race track, where the first horse race took place in 1874. The site later become home to the annual Pretoria Show, having hosted the agricultural show every year since 1939 (SA History Online, 2011). It was originally a purely agricultural show, but by the 1960s it had expanded to include industrial and commercial exhibitions. Today the Show is a family event featuring everything from livestock, arts and crafts, live entertainment, food and vehicle stands to a fully-fledged theme-park. Throughout its history, however, the main focus of the show was showcasing the best livestock in the country and providing a networking platform for the agricultural industries. During the rest of the year, the showgrounds also host a variety of specific animal shows and auctions ranging from equestrian competitions to cattle auctions.

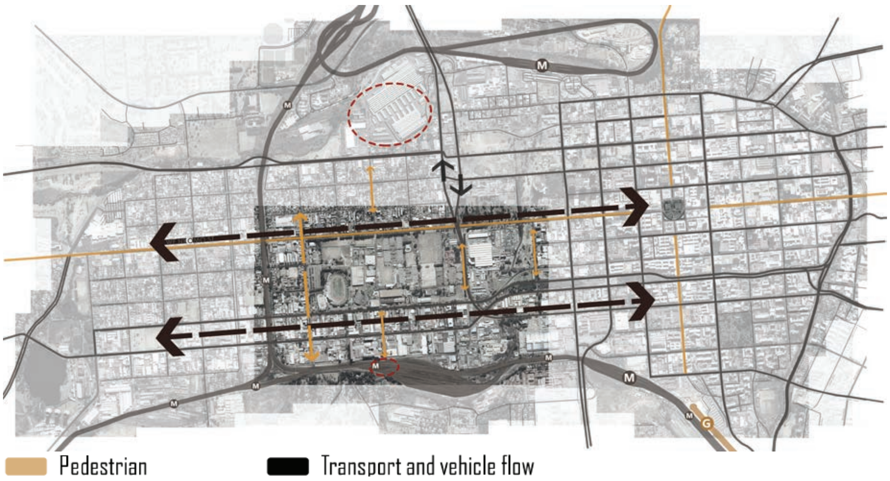
The Tshwane Events Centre that currently occupies the Pretoria Showgrounds operates as a conference and function venue, hosting a large array of events ranging from conferences and business meetings to large concerts, trade shows, film sets and exhibitions. According to their website, the facility boasts a total indoor exhibition space of 40,000m^2 and 45,000 m^2 outdoor exhibition and agricultural areas in over 10 exhibition halls, conference rooms and outdoor sports fields, grand stands, restaurants, an auction ring and a large number of permanent animal pens with show rings.

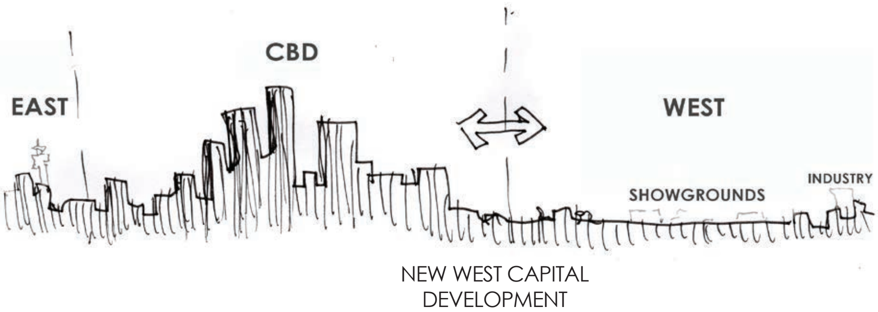
UNISA uses several of the exhibition halls as examamination venues every year and TUT makes use of the facilities for, amongst other events, their freshman's ball every year. The ECG church also currently makes use of several of the exhibition halls for their church services which draw over 20,000 people per week (this is not a permanent arrangement, however, and is only for certain times in the year).









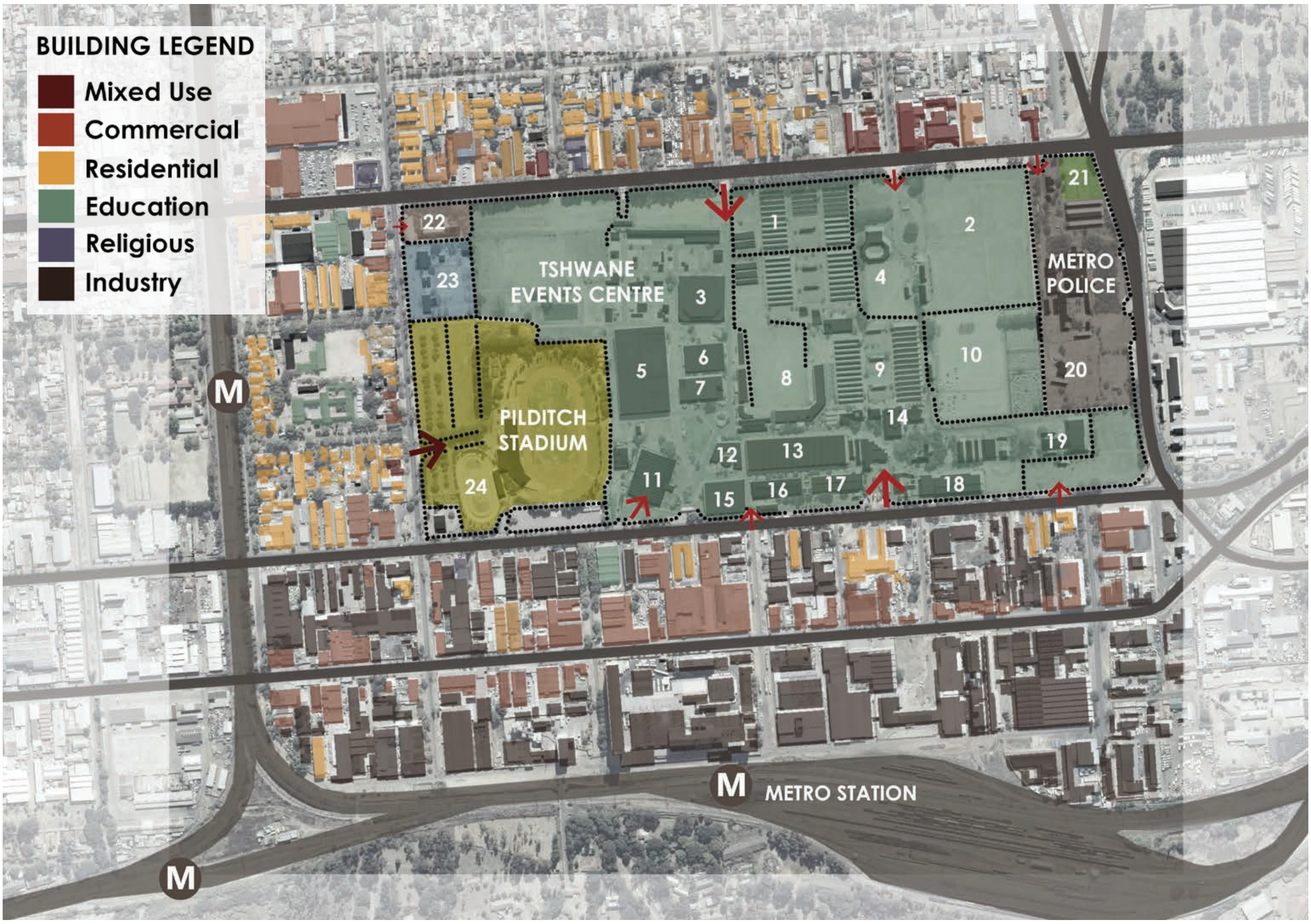


Circulation

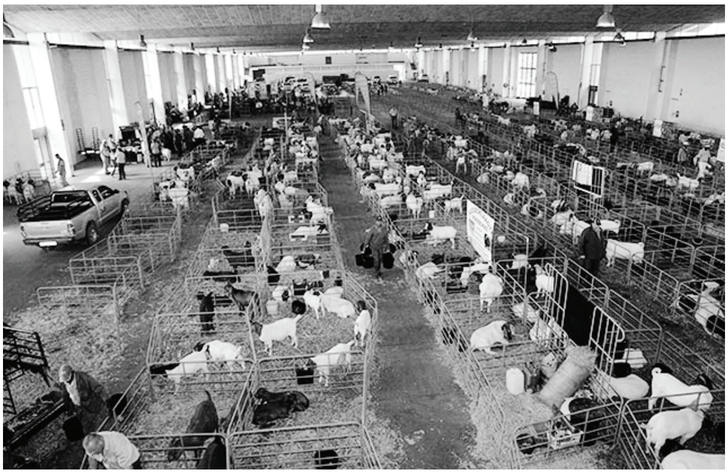
The west of Pretoria is connected to the CBD and outlying areas by bus, train and road networks.

Vehicular and bus routes flow in a predominantly east and west direction along WF Nkomo and Soutter streets. Main pedestrian routes from the bus and metro stations flow along these routes as well as north and south (see figures 2-14,2-14 & 2-15).

The impenetrable block of the showgrounds, however, form a major barrier preventing movement between the Pretoria West Metro station and the industrial/commercial area south of the showgrounds and the residential area as well as WF Nkomo street and the Tswane Market to the north (see fig 2-16).



1. Animal berths
2. Sports fields used for parking
3. Hall L
4. Champion ring - for auctions
5. Hall J - largest exhibition hall floor space of over 11 600m^2
6. Hall G
7. The “Grand Daddy” hall, one of the first building built on the grounds in the 1930’s
8. Hockey field and pavilion
9. Cattle berths and viewing rings
10. Open field
11. “Skilpad Saal”
12. ECG Church
13. Hall C “Exam Hall”
14. West End Theatre
15. Hall H
16. Hall D
17. Hall E
18. National Industrial Chamber
19. Stables
20. Nova Paintball
21. Tennis courts
22. Sports centre for the disabled
23. Old municipal swimming pool (closed).
24. Concrete speedskating track



SHOWGROUNDS

Currently more than a quarter of the area of the showgrounds are open fields that are mostly used for parking during large events, with a further 35,000 m^2 area containing animal pens and show rings. That means an area of over five city blocks within 2km of the city centre are completely undeveloped and inaccessible for most of the year.

These open spaces were necessary for hosting the annual Jacaranda Agriculture Show (previously the Pretoria Show). In 2017, however, for the first time in 78 years, the show was cancelled and is to be hosted on a new site in the future. While plans for the showgrounds are still uncertain, the potential for development and urban regeneration on the site is immense.

The exhibition halls and some of the sports fields can continue to operate in a similar manner under as before as the Tswane Events Centre. The rest of the facilities such as the animals pens, auction rings and parking fields will need to be reinterpreted or completely demolished to make way for new development.

Figure 2-9: *Opposite top: Photograph of an old map of the showgrounds mounted on the wall by gate G3 (Author, 2017)*

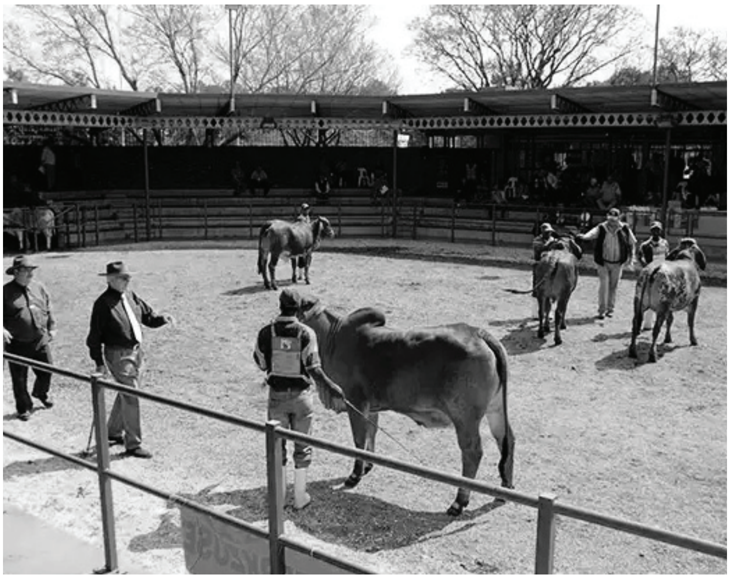
Figure 2-10: *Opposite below; Current condition of the showgrounds (Author, 2017)*

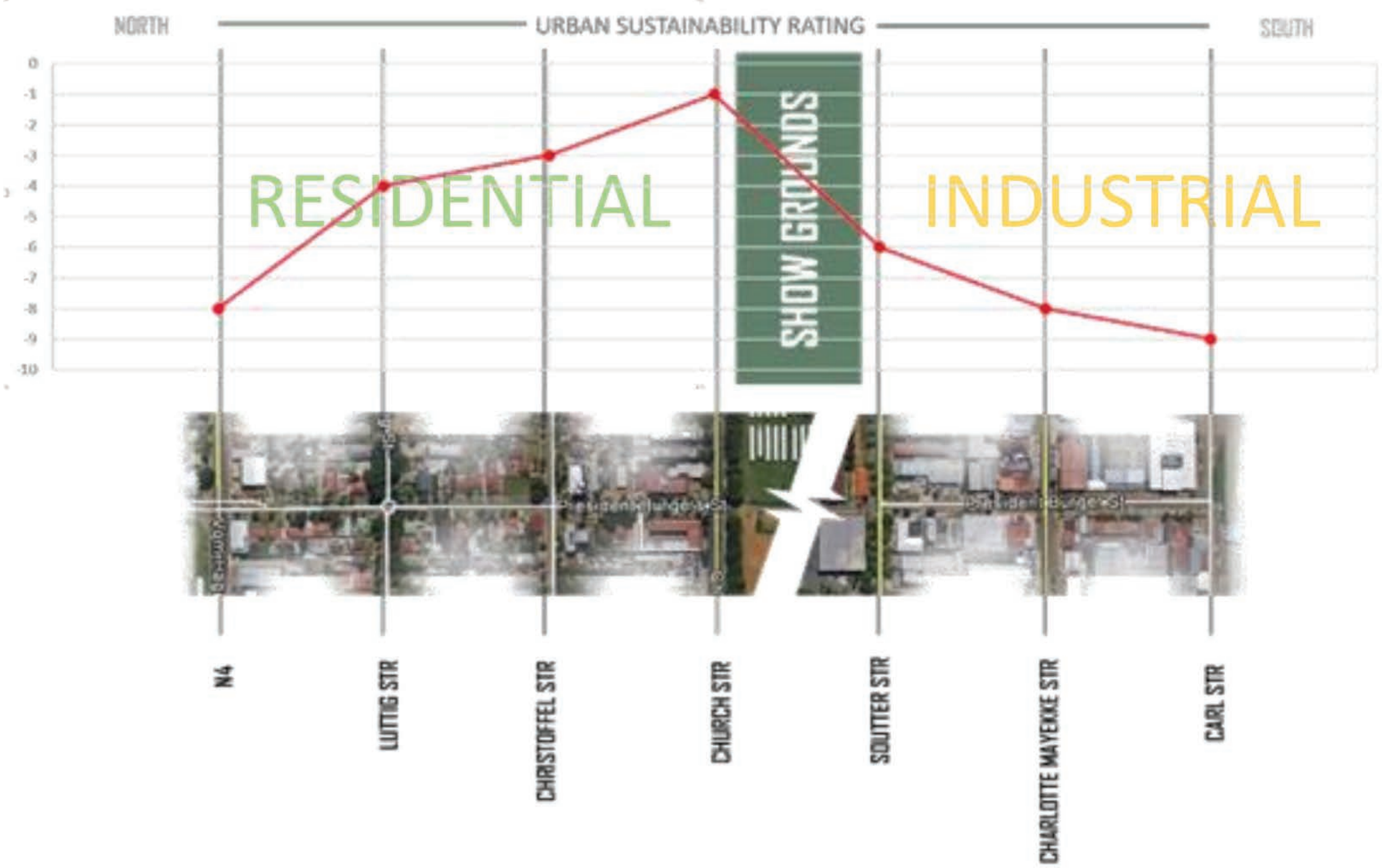
Figure 2-11: *Top and middle left; Photographs of Exhibition hall C and hockey field during the Pretoria Show (Tshwane Events Centre, 2014)*

Figure 2-12: *Top right; Photographs of the Champion ring during the Pretoria Show (Tshwane Events Centre, 2014)*

Figure 2-13: *Right; Judging ring and cattle pens (Author, 2017)*

CHAMPION RING





EVALUATING THE URBAN FABRIC

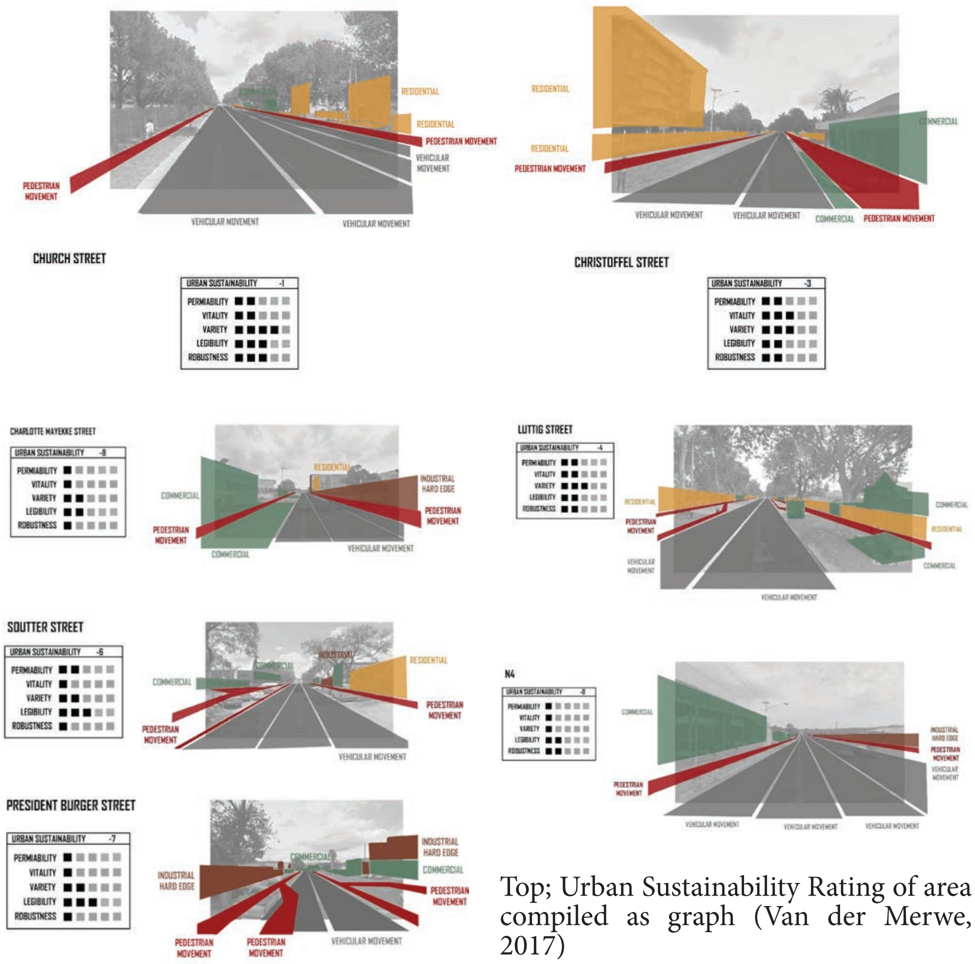
As a way of evaluating the urban fabric and informing an urban vision approach, the rating system developed by Schiller and Evans (2006) was used to assess each street based on five basic urban qualities: permeability, vitality, variety, legibility and robustness (see figures 2-22 & 2-23).

WF Nkomo street achieved the highest rating due to its mixed use nature and public ground plane, but the area as a whole was seriously lacking in each of aspects assessed.

URBAN VISION

Using the urban qualities mentioned above as a baseline to guide the development of an urban vision, various scenarios addressing these aspects were investigated.

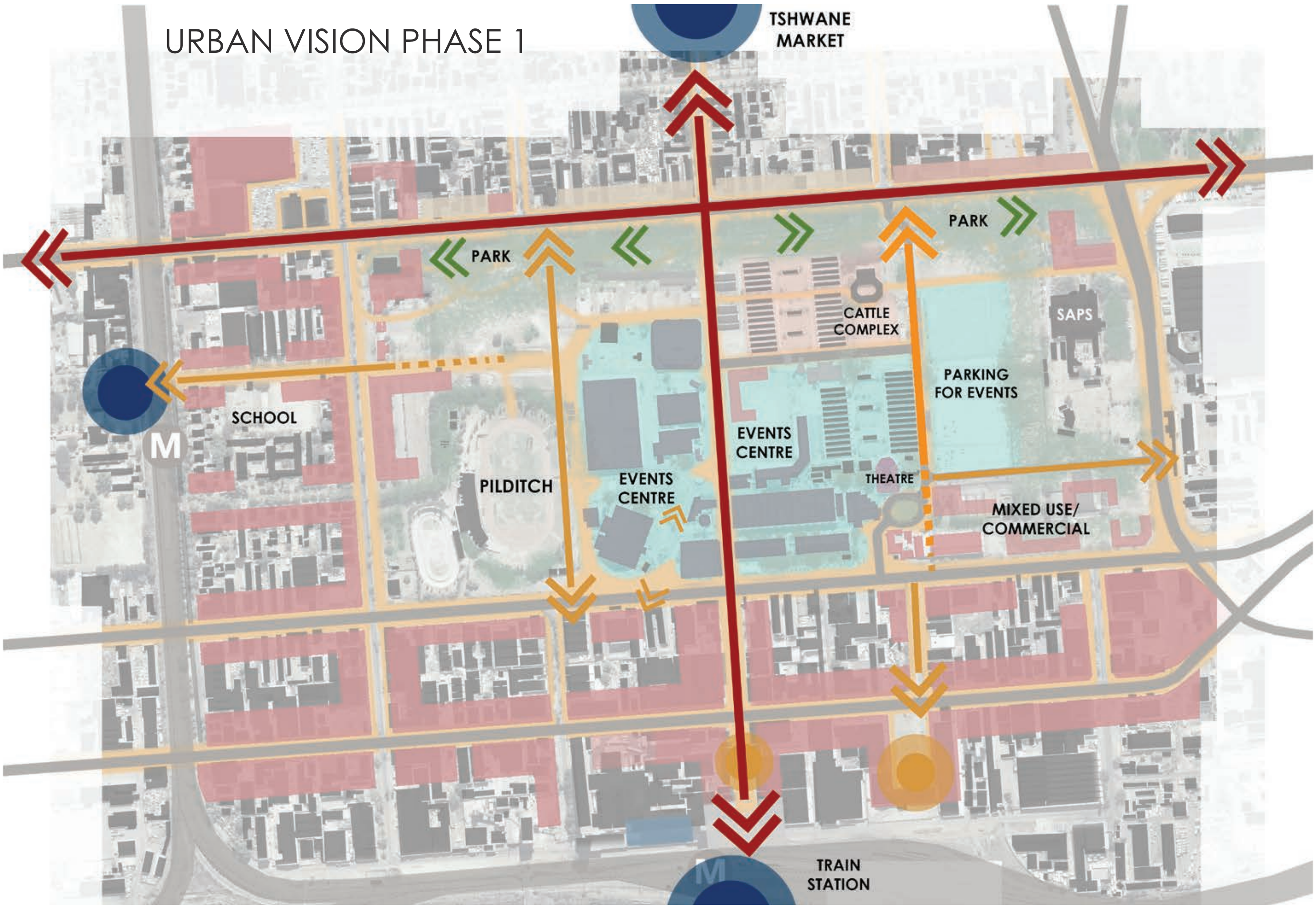
The vision is to develop incrementally, starting with the introduction of new public pedestrian and vehicular routes through the showgrounds and upgrading the existing pedestrian routes. This, together with the introduction of activity nodes at strategic junctions and a series of public parks along WF Nkomo street, will act as instigators to encourage new commercial and other development along all routes.

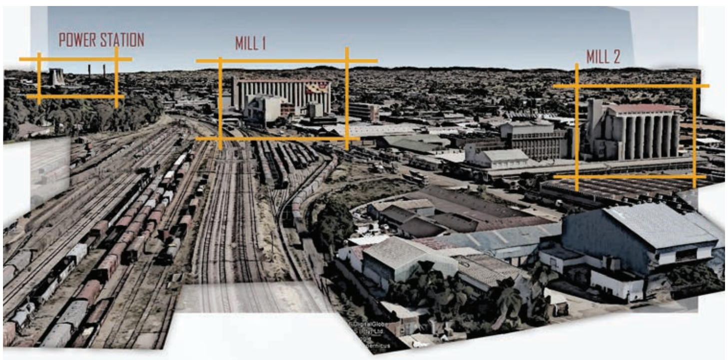


Top; Urban Sustainability Rating of area compiled as graph (Van der Merwe, 2017)

Above; Urban Sustainability Rating of the streets within the study area (Van der Merwe, 2017)

URBAN VISION PHASE 1





Top; Proposed urban vision for the area (Author, 2017)

Middle; Creating through routes and activating boundaries around the showgrounds (Author, 2017)

Above; Landmarks in the area (Van der Merwe, 2017)

Permeability

Due to the size and inaccessibility of the showgrounds and average city block in the area, permeability is a critical weakness. To address this, connections within and between city blocks has to be revised. The urban vision looks at breaking up the showgrounds to allow various routes through the site as well building a new train station and improving pedestrian walkways.

Vitality

There is a distinct lack of public social spaces, or spaces that promote users to interact. To improve vitality in the areas 'active borders' of the public spaces are introduced as well as mixed programmed buildings and new public spaces connected by a series of smaller green spaces. A green belt running the length of the northern border of the showgrounds street is suggested.

Variety

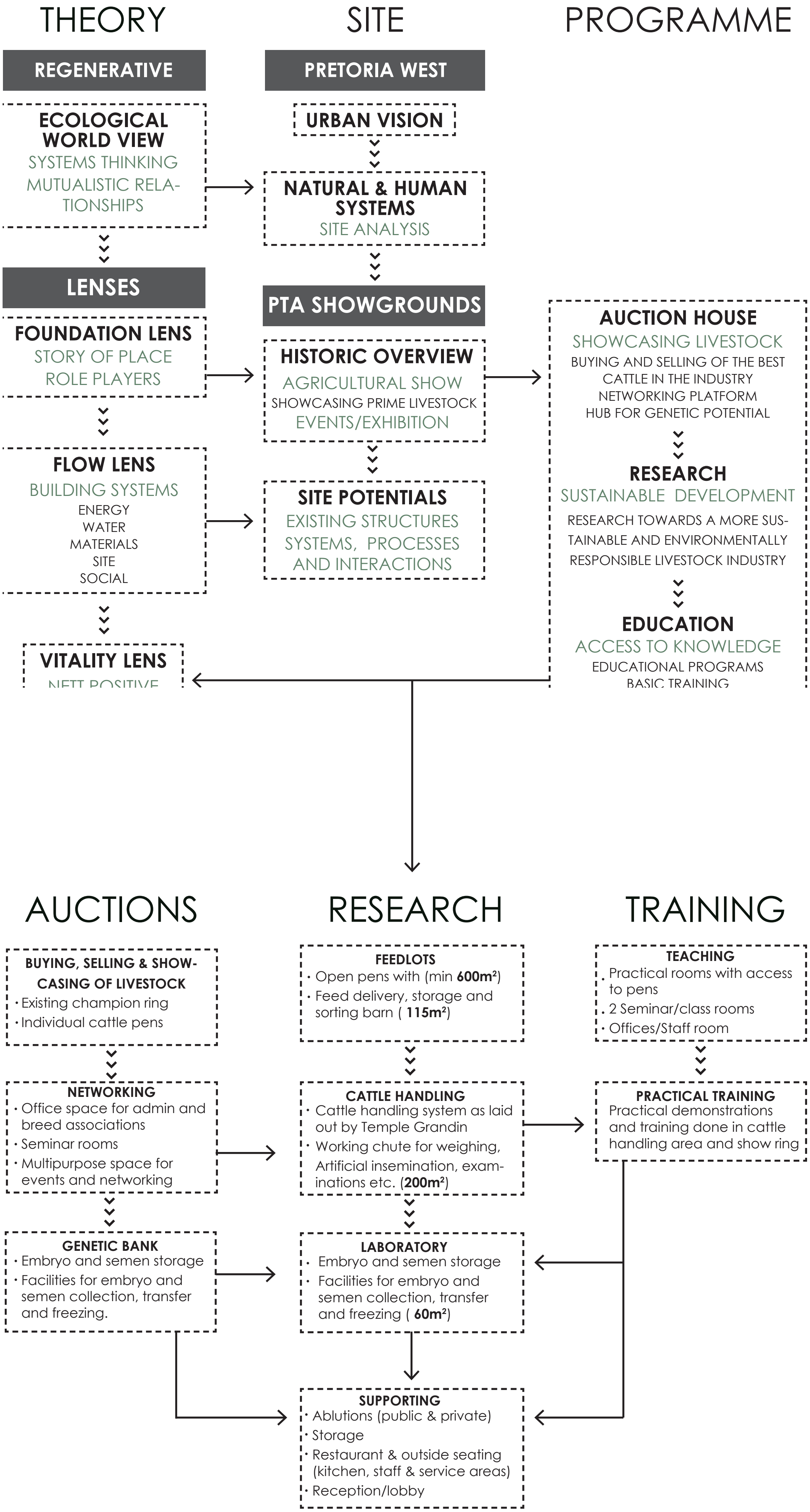
Despite the original single use zoning of much of the area, adaptive reuse of buildings to include a mixture of residential, commercial and industrial uses are already occurring. This diversification is to be encouraged to form mixed use city blocks that will also allow for a continuity of activity over time.

Legibility

The two milling silos and power station to the south serve as landmarks to provide visual orientation and a sense of identity within the area. The streetscape and pedestrian thoroughfares are to be addressed to create a sense of spatial hierarchy and aid movement and orientation.

Robustness

This quality requires an adequate combination and variety of uses over time, the ability to adapt to new functions as urban requirements change as well as implementing the efficient use of resources.



Left; Flow diagram showing the progression from theory and site to program (Author, 2017)

2.3: PROGRAM

The suggested program is based on the story of place and urban vision, filling a part of the role the annual Pretoria Show played in the area and expanding on it to make it relevant into the future. It is based on the argument that the agricultural show had a relevant role in the city as a place where the public could connect with the farming industry. In a small way, this addressed the issue of public awareness of where food comes from and how that fits into a sustainable future. However, instead of a big event once a year, something operating on a permanent basis and is fully integrated into the urban fabric and both public and farming communities, is required.

AUCTION RING

Drawing on the history of the showgrounds as a networking platform for farmers where the country's best livestock was showcased and sold, the idea for the site as a hub for genetic potential was formed. The existing Champion Ring is currently one of very few large livestock action rings in Gauteng and its central location between provinces makes it ideal for this purpose. This can be taken one step further by combining the auction ring with a genetic bank and artificial insemination (AI) service, providing a central hub where farmers can find the best genetic material for improving their breeding stock. Coupled with the genetic bank are supporting services such as laboratory testing for quality and indexing of stock.

To further the scheme as a networking platform for farmers, offices and meeting spaces for various breeder associations will be provided as well as a venue for functions and a restaurant.

RESEARCH

Where the first part of the program considered the story of place and the past, the second part looks at how the cattle industry can adapt in the future. A hub for genetic potential provides a great platform for research into the improvement of bovine genetics. The Champion ring already acts as a platform for displaying the best genetic stock from all over the country, and the gene bank serves as a platform for storing and distributing genetic material.

By integrating these components with each other as well as with a research component, they can share and positively develop these resources instead of each trying to operate separately solely for profit.

The red meat industry has been gaining an increasingly bad reputation for its high contribution to greenhouse gas emissions (D'Silva et al, 2010). The process towards decreasing this negative impact involves both a change in public awareness and research on how the industry itself can change to be more sustainable.

The other aspect to consider is how cattle will have to adapt in a changing climate due to increasing temperatures. For this type of research a feed-lot set up is required with cattle handling facilities where individual feed intake can be controlled through daily measuring and monitoring. This will allow for experimentation with genetic variation in cattle breeds together with different feeding and grazing scenarios.

EDUCATION

The third part of the program is a training facility for small-scale farmers on sustainable cattle farming methods as well as courses dealing with AI and optimising breeding potential. This acts as a platform for making the knowledge and experience gained here accessible to the community and small scale farmers.

2.4: PRECEDENTS

PROGRAMMATIC

The North Dakota State University Beef Cattle Research Complex is a state-of-the-art facility designed to meet the current needs of beef cattle research. The facility caters for the measurement and controlled feed intake of 200 head of cattle, allowing research on cattle nutrition, genomics, reproductive physiology and animal behaviour. The complex includes a 1140m² feeding area, 385m² handling areas and calving pens, 116m² of office and laboratory space and a 480m² feed storage and mixing barn. The straightforward layout with the feeding troughs and covered feeding areas combined to lead directly to the handling area and labs is efficient and makes for easy cattle circulation.

Top Left; overview of NDSU research facilities (Google Maps, 2017)

Top Right; NDSU Cattle Research Complex cattle handling system (NDSU, 2015)

Middle; NDSU Cattle Research Complex feed-lot (NDSU, 2017)

Below Left; Axonometric view of the New Artist Residency showing material and structure (ArchDaily, 2017)

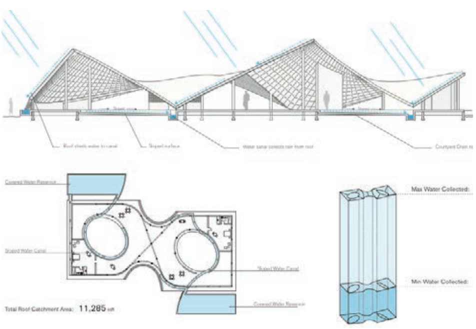
Middle right; The open central space of the New Artist Residency is highly flexible with uses ranging from dance performances to town meetings (ArchDaily, 2017)

Fig 22: Below Right; The undulating form of the roof of the New Artist Residency not only discretely defines the hierarchy of the public spaces below it but is also optimised for maximum rainwater collection (ArchDaily, 2017)

FORMALISTIC

The New Artist Residency in the rural village of Sinthian Senegal by Toshiko Mori is a great example of a community project where the shared vision of an acclaimed international architecture firm and small village came together into something ground-breaking. Through a collaborative process local builders shared their knowledge of working with bamboo, brick, and thatch to be combined with design innovations by Mori. The traditional pitched roof is inverted to allow for the capture of up to 40% of the villagers' domestic water usage from rainfall.

A venue caters for markets, meetings, performances and education. It is a hub for the local community and a place of inspiration, creativity, cultural exchange and hope (ArchDaily, 2017).



SYSTEMS

The Brock Environmental Center in Virginia Beach, USA, designed by SmithGroupJJR, sought to go beyond LEED status, achieving the Living Building certification by the International Living Future Institute as well as net zero CO_2 emissions and zero waste leaving the site. The educational building features a 80-seat conference room, an open-air education pavilion, meeting rooms, exhibit areas and a boat pier with floating docks.

The site development aimed at preserving the local bay ecology, and as part of the Living Building Challenge's requirements, all the building's potable water needs are are met by run-off captured on site through closed loop systems that treat all storm-water, grey-water and black-water. Also more than 100% of the required energy produced through renewable energy sources on site. All toilets are composting and use no water (Whole Building Design Guide, 2017).

Water captured from its butterfly roofs is directed to two 6250 litre cisterns, it is then filtered and disinfected before being used throughout the building.

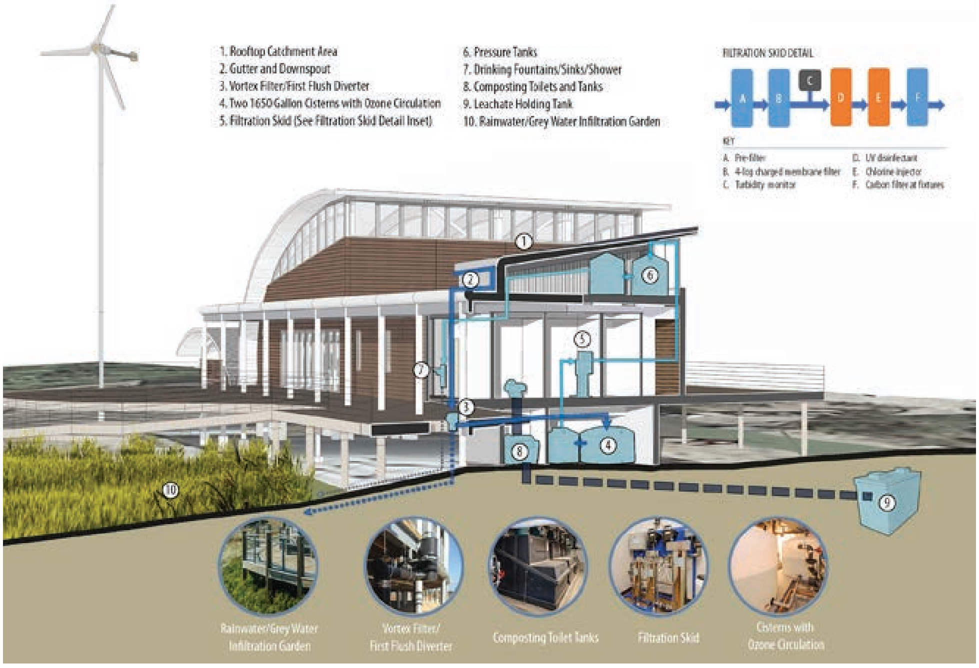


Fig. 23. Top Left; The Brock Environmental Center water systems (Whole Building Design Guide, 2017)

Fig. 25. Middle Left; The Brock Environmental Center approach elevation (Whole Building Design Guide, 2017)

Fig. 26. Middle Right; The Brock Environmental Centre aerial view, (Whole Building Design Guide, 2017)

Fig. 27. Left; Diagram showing the relationship interactions between farmers, the public and animals during the agricultural show.

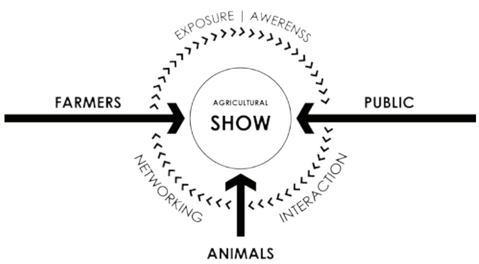
2.5: CONCLUSION

What is evident from the discussion is that there is a need for a change from a mechanistic worldview to an ecosystems worldview in the way we think.

Applying this to architecture and the building industry, however, is no simple task. Previous literature on the subject has looked at what an ecological worldview entails, revolving mostly around three themes: the story of place, interactions and relationships as well as the ability to respond to change. Each of these themes were explored in relation to the Pretoria Showgrounds to come to a relevant program.

By breaking down the process of understanding the site in this way, it is possible to approach the design of a building in such a way that both the building systems and larger ecosystems connected to the site can be net positive and make a positive contribution to the area as a whole.

A building is more than just a set of building blocks that require a certain amount of resources to build and operate. By changing our perception of how a building can add value, as well as our definition of value, architecture becomes not only a tool to reduce our ecological footprint but also a platform for interaction and raising awareness to assist with the required shift in our collective worldview.



SECTION 3: EXPRESSION

This section looks at how the theoretical, programmatic and contextual aspects covered in the previous section are translated into architectural solutions.

3.1: CONCEPTUAL APPROACH

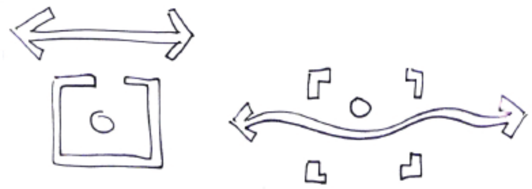
CONCEPT DEVELOPMENT

The design concept is drawn from theory, program and context as follows:

1 - Theory: based on the LENSES framework. The interactions between flows within the project are the focus in generating architecture that contributes positively to a site.

2 - Program: the combination of agricultural, research, educational and commercial activities within one project provides the opportunity to investigate how these activities can interact to be mutually beneficial as well as address their interface with the public.

3 - Context: on an urban scale the aim is to integrate the project into the urban fabric and story of place. Locally, the aim is to identify and positively respond to site potentials such as water, wind, topography, greenery, pedestrian movement and existing infrastructure.



DESIGN INTENTIONS

The integration of different programmes

The main intention is to investigate how architecture can address the *interface* between the livestock industry, research, education and the public, based on the assumption that the collaboration between such programs will result in a reduced environmental impact and mutual benefit.

Creating awareness

The second design intention is to investigate how architecture can be a means to promote awareness around sustainable architecture and industry. The focus was narrowed town to the livestock industry in South Africa based on the site and story of place, and the interaction between the public and the livestock industry, research and training.

Building positive

The third design intention is to create a structure that contributes more to the site than what it takes away, based on the LENSES framework as a guideline. This means making a positive contribution in terms of water, energy, ecological and social systems.

Interface

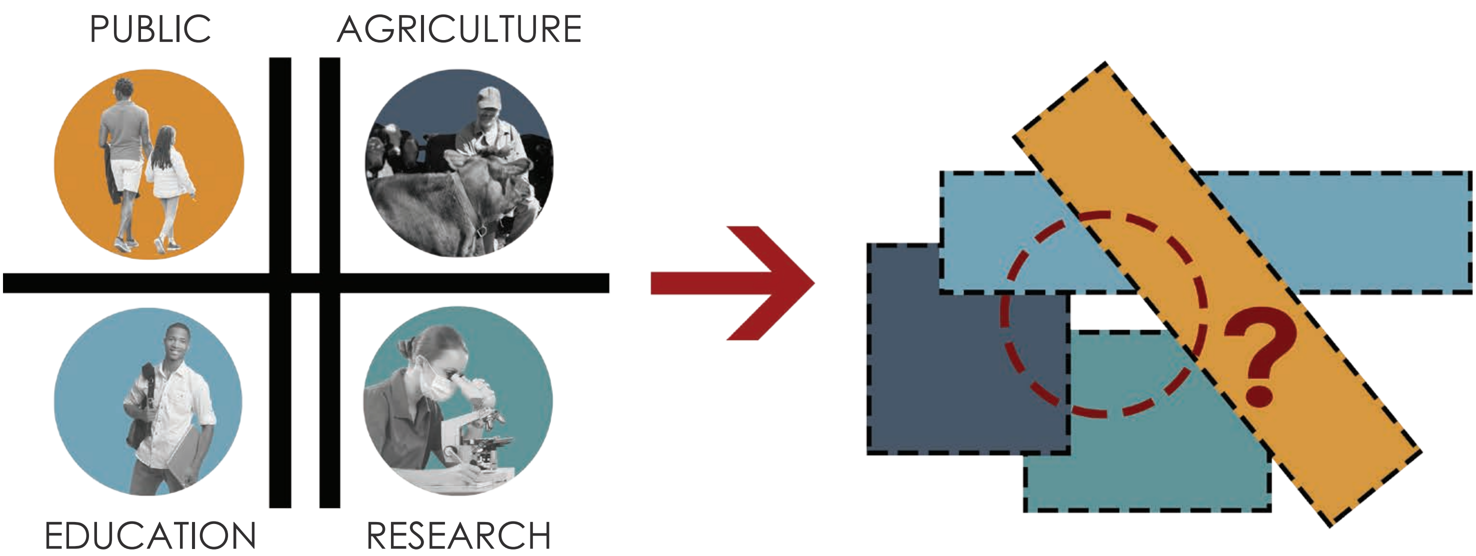
ˈɪntəfeɪs/

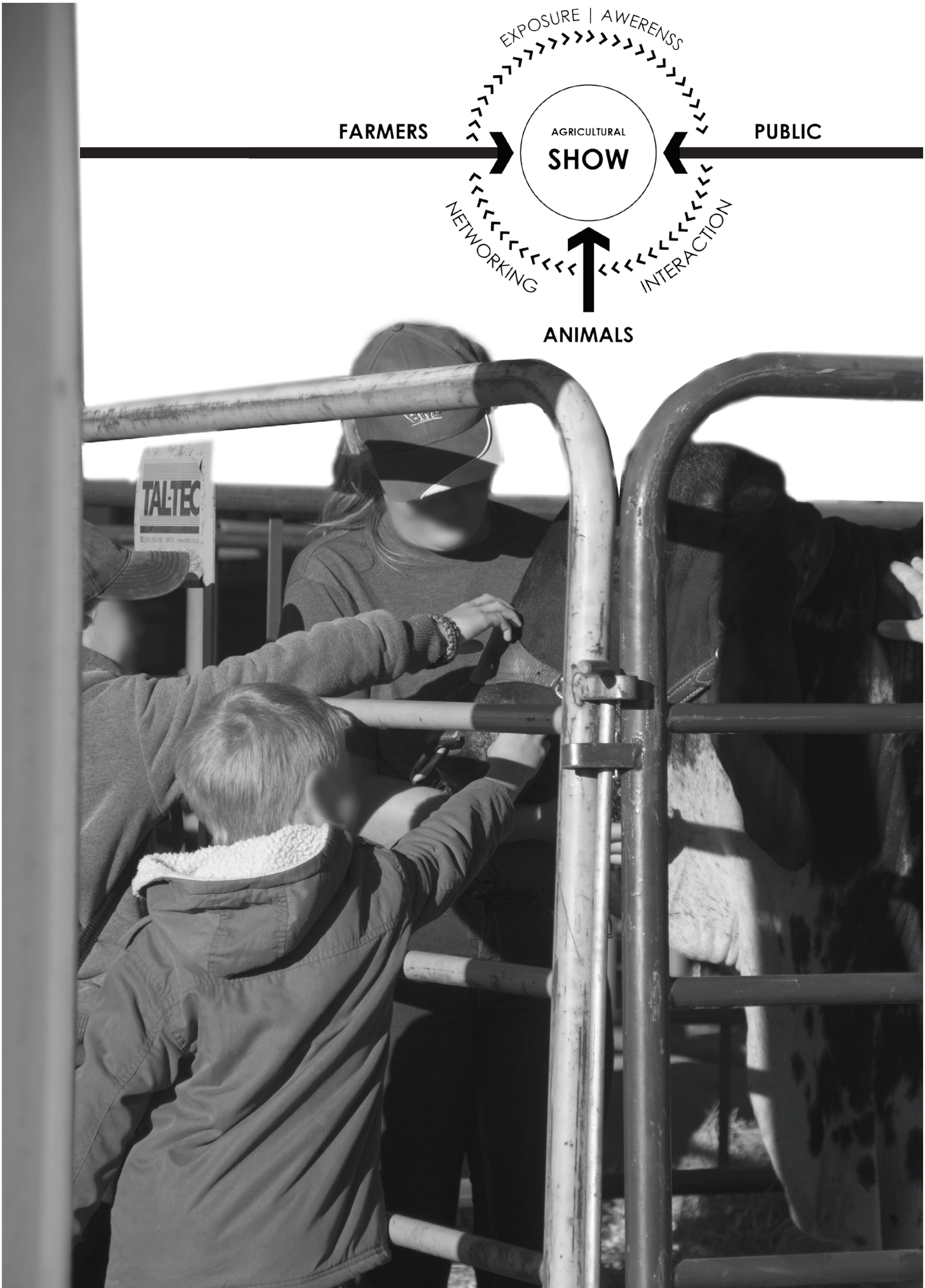
noun

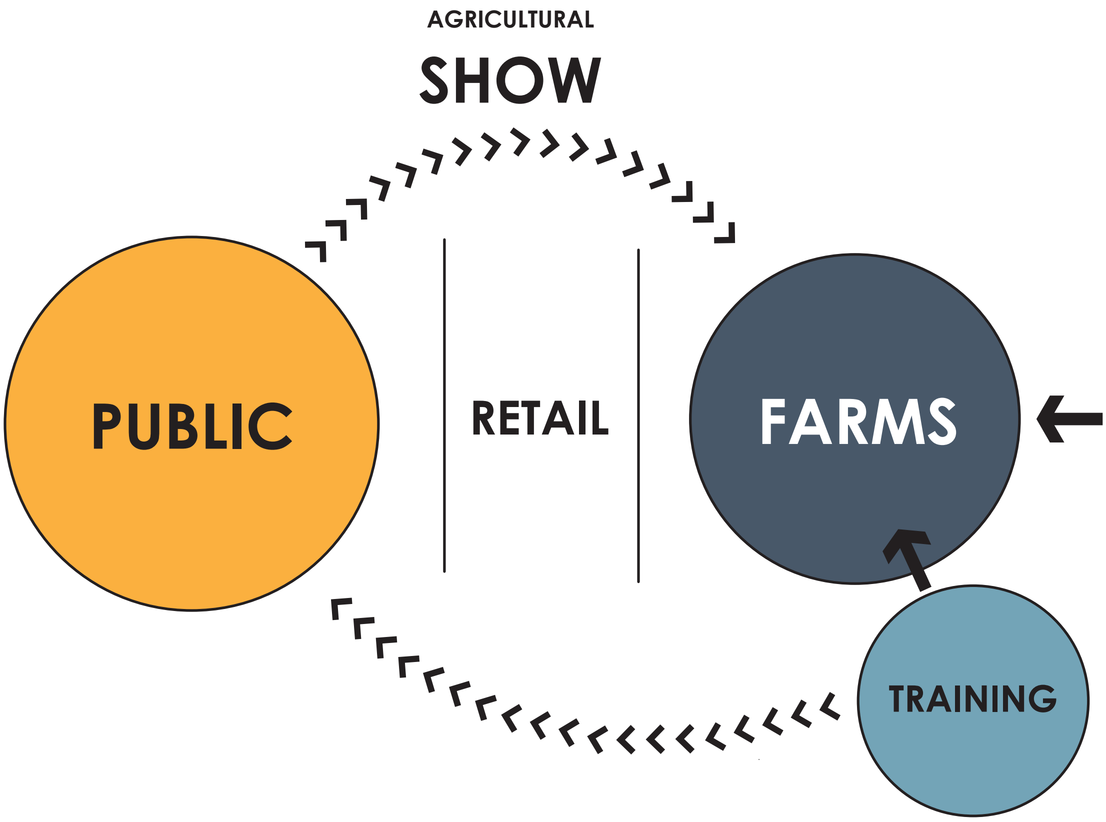
1. A point where two systems, subjects, organizations, etc. meet and interact.

Figure 3-1: *Concept diagrams illustrating a shift from the current separation between the public and industry to a more integrated model, addressing the public interface and building positive (Author 2017)*

Figure 3-2: *Opposite: Relationships created by the annual Pretoria Show (Author 2017)*




EXPOSURE | AWERENSS
FARMERS
PUBLIC
AGRICULTURAL
SHOW
NETWORKING
INTERACTION
ANIMALS
TAL-TEC



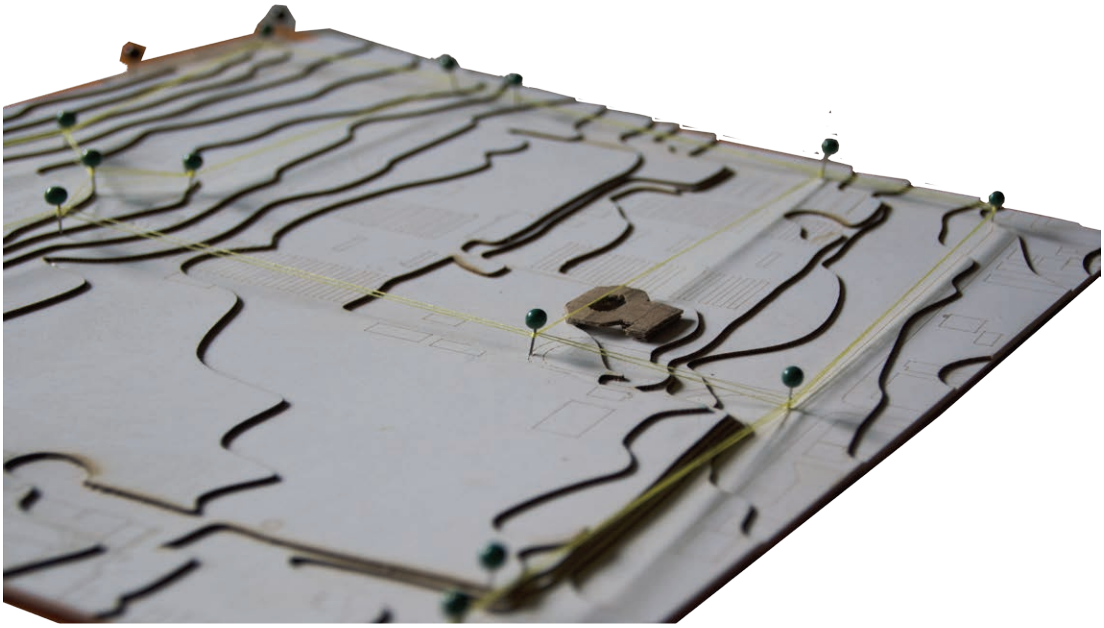


Figure 3-3: *Above; Current model if program interactions (Author 2017)*

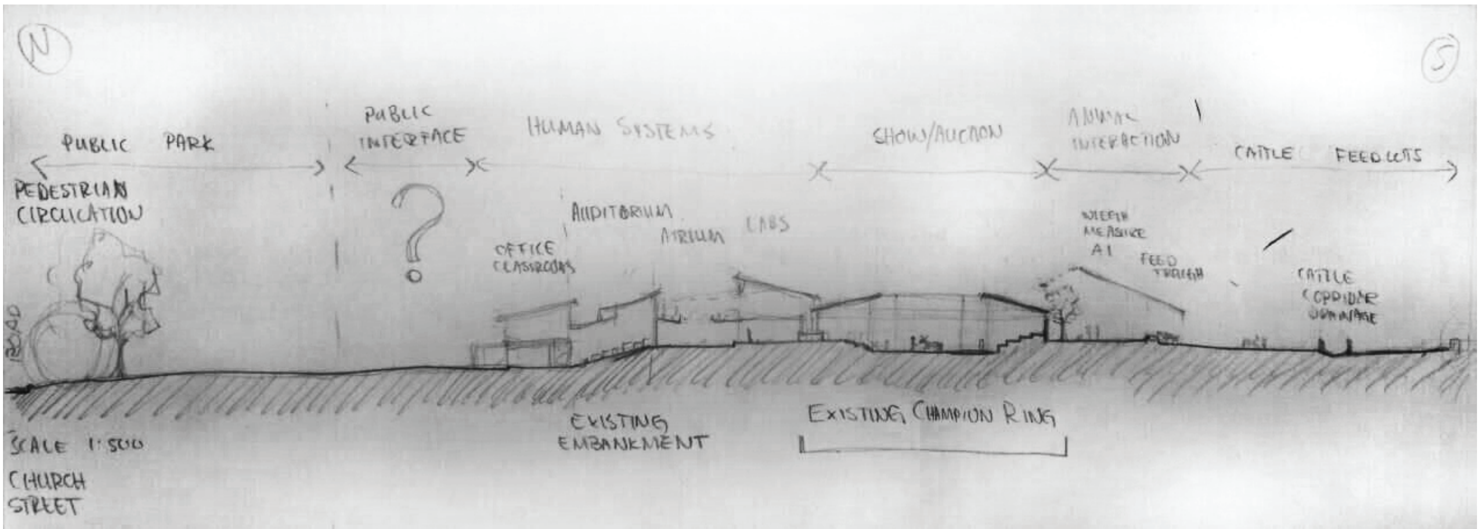
Figure 3-4: *Left; The site with propsed circulation routes (Author 2017)*

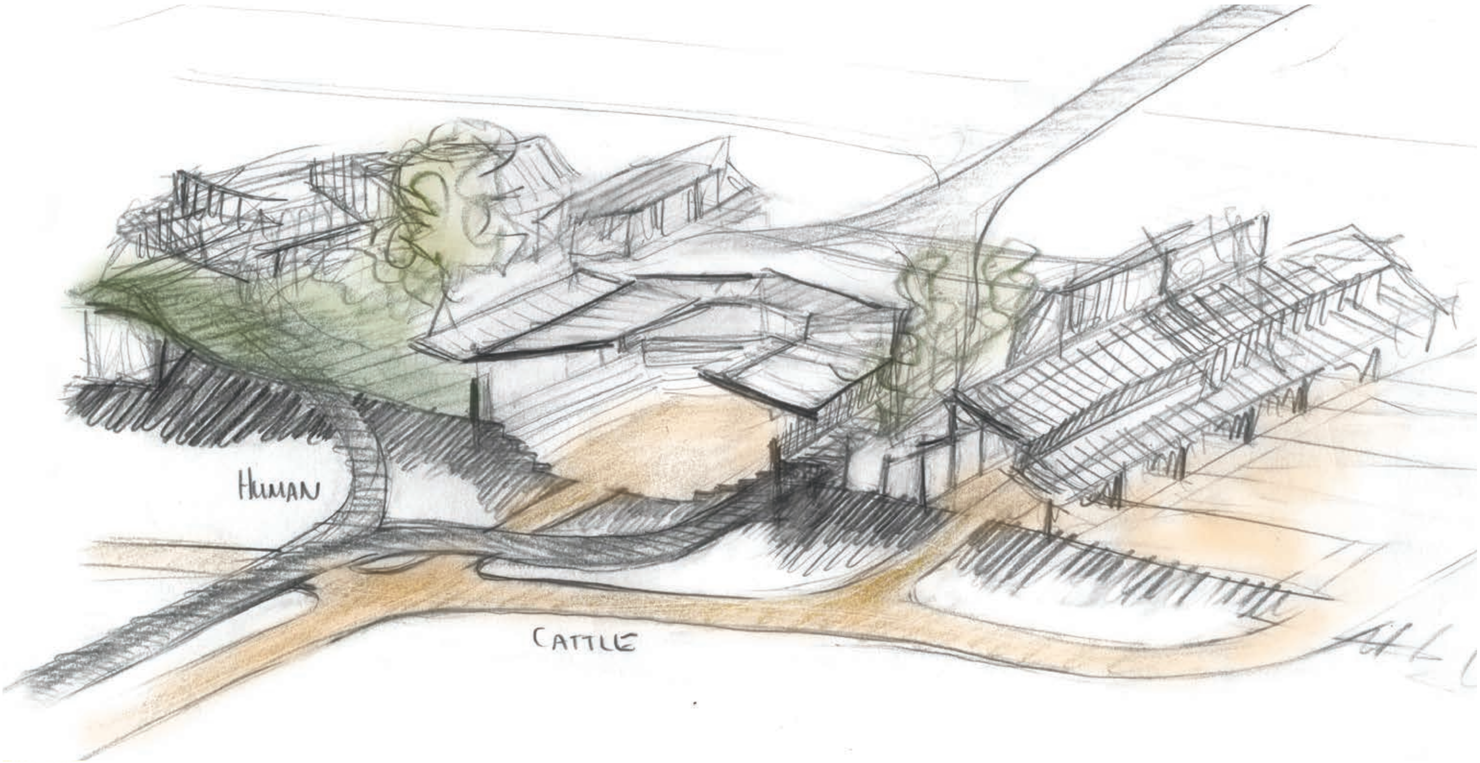
Figure 3-5: *Below; Concept section (Author 2017)*

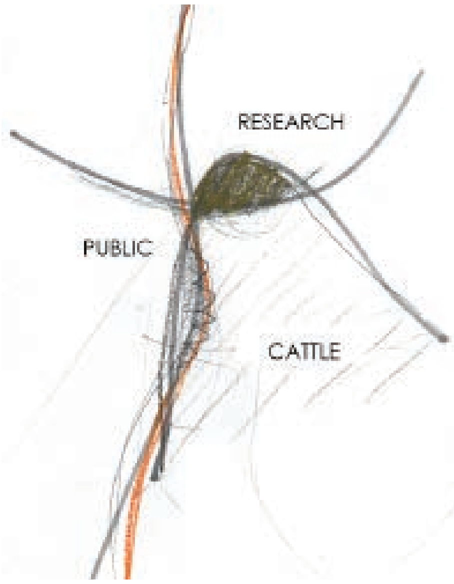
Figure 3-6: *Opposite top; Using the existing site topography around the champion ring and animal pens to inform a vertical separation between the public and cattle related areas (Author 2017)*

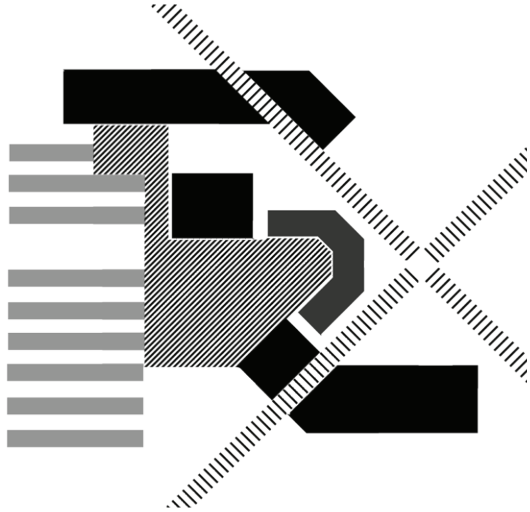
Figure 3-7: *Contained vs distributed energy (Author 2017)*

Figure 3-8: *Opposite middle; The development of the parti diagram (Author 2017)*

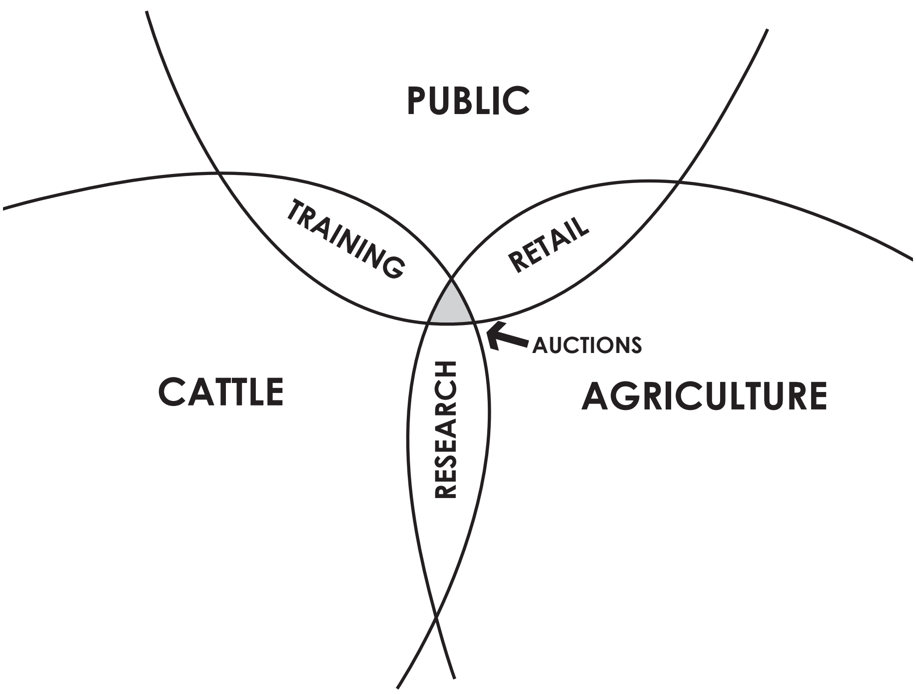








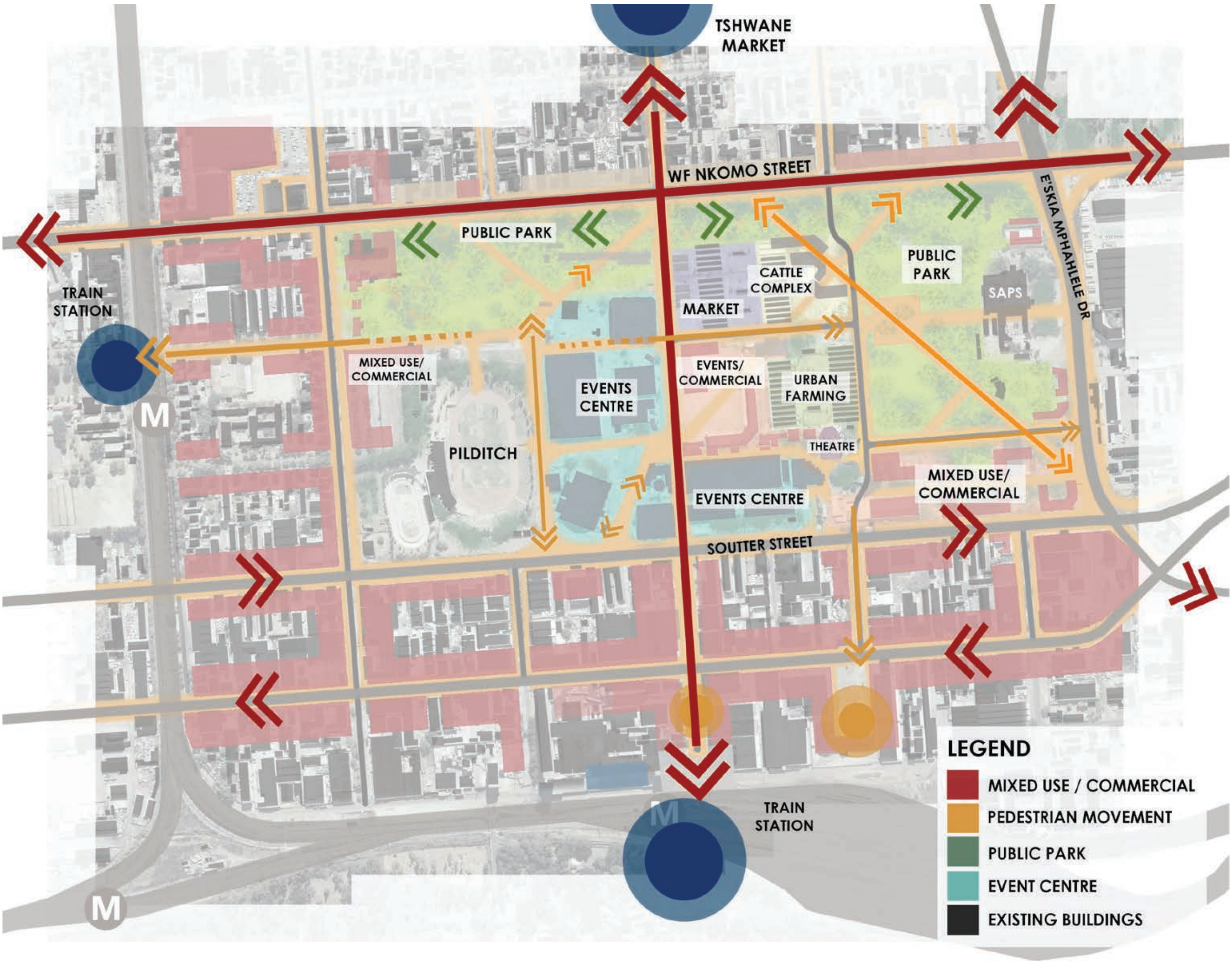
PARTI DEVELOPMENT



The initial conceptual development was driven by the relationship of the three main components of the program, namely cattle auctions/gene bank, research and education, with each other and the public as well as with the site.

Due to the nature of each of these aspects, a direct interaction is not always possible. A prize bull held for auction or genetic collection, for instance, cannot be exposed to the risk of interacting with anyone from the public passing by, but a visual link to the preparation of the bull for auction could be a valuable contribution to public awareness. This, together with the existing topography of the site, led to the idea of separating the public parts of the building and the animal related parts into levels that intersect vertically with visual links (fig 3-6).

The parti diagram developed throughout the year along with the design as a better understanding of the site and program was developed (see fig 3-7).



3.2: DESIGN DEVELOPMENT

SITE INFORMANTS

The design process started with understanding and interpreting the site analysis. This was a rather difficult process because the proposed location next to the existing champion ring was bordered on three sides by mostly undeveloped fields. In the past this space has primarily been used primarily for parking and supporting functions during the annual Jacaranda Agricultural Show and other large events in the past. With the Show being moved to a new location and the future of the showgrounds uncertain, these fields are most likely to be densely developed in the near future.

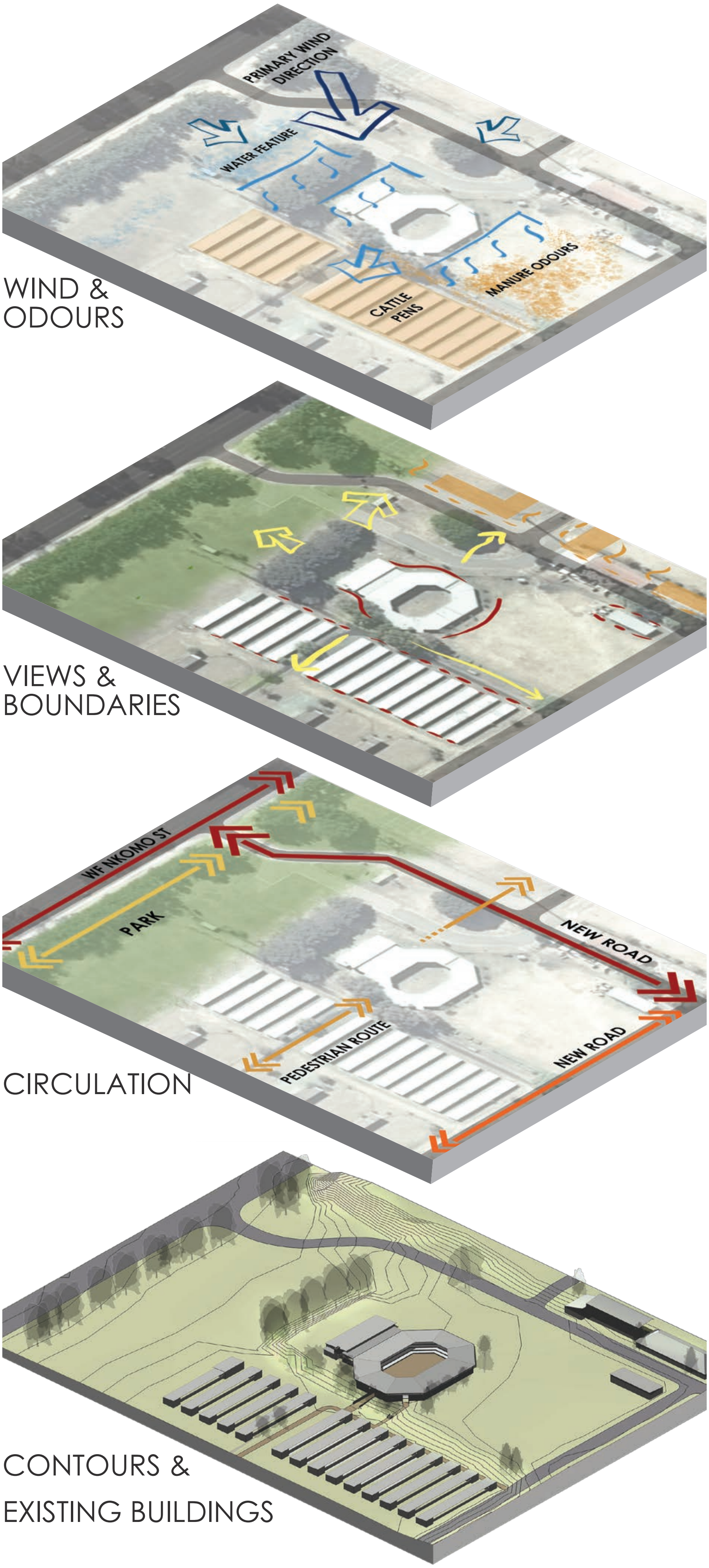
The urban vision developed as part of the Pretoria West 2017 group in studio formed a guideline to a possible approach to developing the showgounds. This led to the design of a new masterplan for the twelve city block area. Two new vehicular routes connecting WF Nkomo Drive to Soutter Street, as well as several pedestrian routes and a series of connected public parks along the northern border along WF Nkomo Drive and down the eastern border next to the SAPS headquarters (see fig 3-9) are proposed. This masterplan, however, also required adjustments through the course of the year.

The main factors around the existing showring to be taken into consideration were the public park to the north, the new vehicular road as the main access point to the east, the open field to the south and the existing rows of pens to the west. The topography of the site is characterized by the park to the north as the lowest point, with the rows of pens on a slight incline to a level 300mm above this. Between the park and the entrance to the Champion ring is a steep embankment raising to a level of 1800mm above the park. The seating of the Champion ring, steps down again to the pens level, with a passage connecting the inside of the Champion ring with the pens' on the lower level (See fig 3-10).

There are several trees on site, including five large Tipu (*Tipuana tipu*) trees along the embankment which are an invasive

Figure 3-9: *The final iteration of the urban vision for the showgrounds*

Figure 3-10: *Existing levels around the Champion ring (Author 2017)*



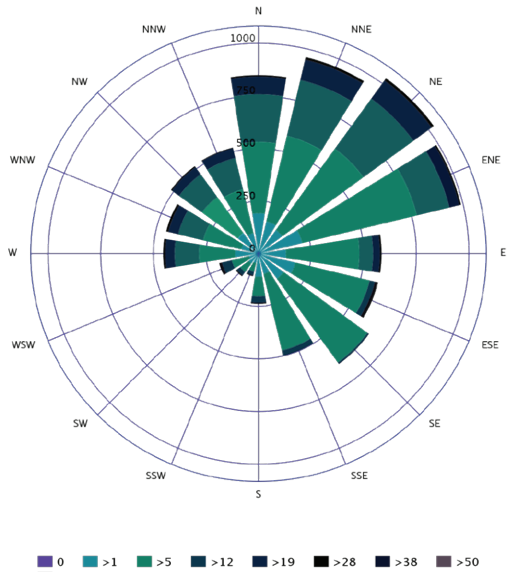


Figure 3-11: *An overview of site influences*

Figure 3-12: *Wind rose for Pretoria*

Figure 3-13: *Photographs of the existing Champion Ring and pens (Author 2017)*

species and are to be removed. Other trees include several Witstinkhout (*Celtis africana*), Karee (*Rhus spp.*) and Akasia thorn trees (*Senegalia spp.*) which are to be undisturbed as far as possible.

The primary summer wind direction from the northeast means that there is the opportunity for air to move over a water feature in the park before passing through and over the building. It also makes it preferable to put the feedlot and cattle handling areas to the south of the champion ring and the public areas to the north.

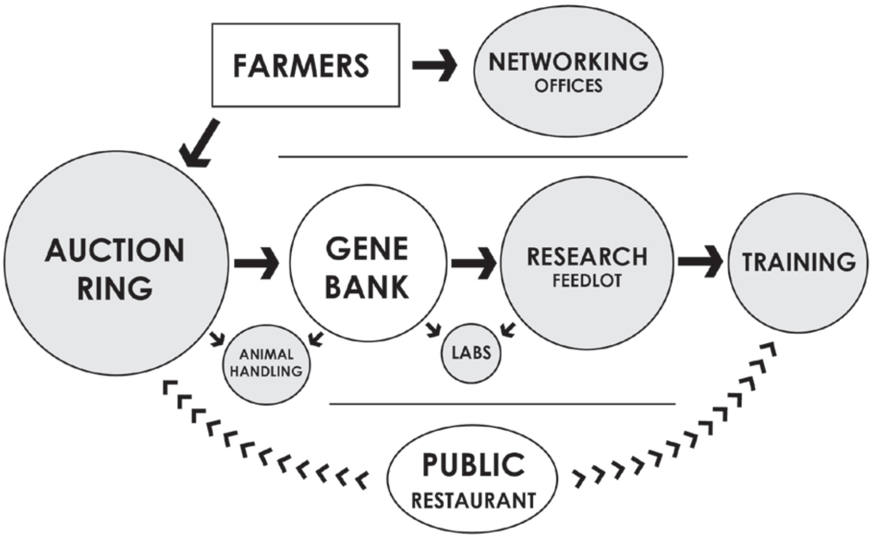
General layout Considerations

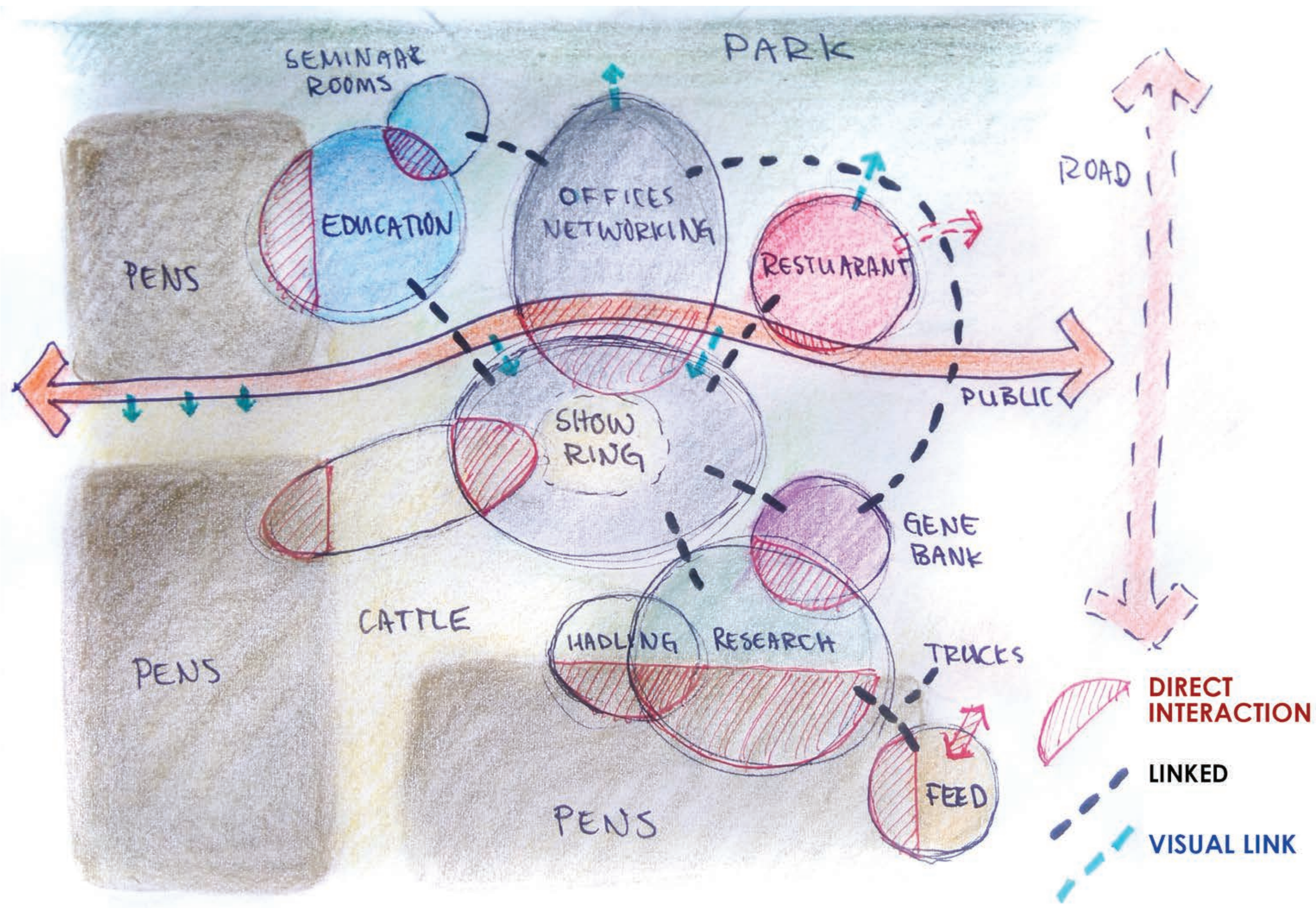
Fig 3-15 and 3-16 look diagrammatically at how the different programmatic elements and elements on site are linked to determine some general layout and spatial requirements. The restaurant is placed on the north eastern side overlooking the park with access from the road for kitchen service entrance. Educational facilities such as the practical classrooms and exam ination rooms need access to the pens and entrance, while the lecturers' offices and theory classrooms can be located further away with a northern front. The feedlot requires a large flat area with shading preferably on the northern side, making the field to the south the ideal location. This also allows for truck access from the road to a feed storage barn.

Figure 3-14: *Left: Trees on site*

Figure 3-15: *Below Diagram exploring the relationships between different programmatic elements (Author 2017)*

Figure 3-16: *Below: Translating the programmatic relationships to spatial relationships that respond to conditions and existing elements on site*





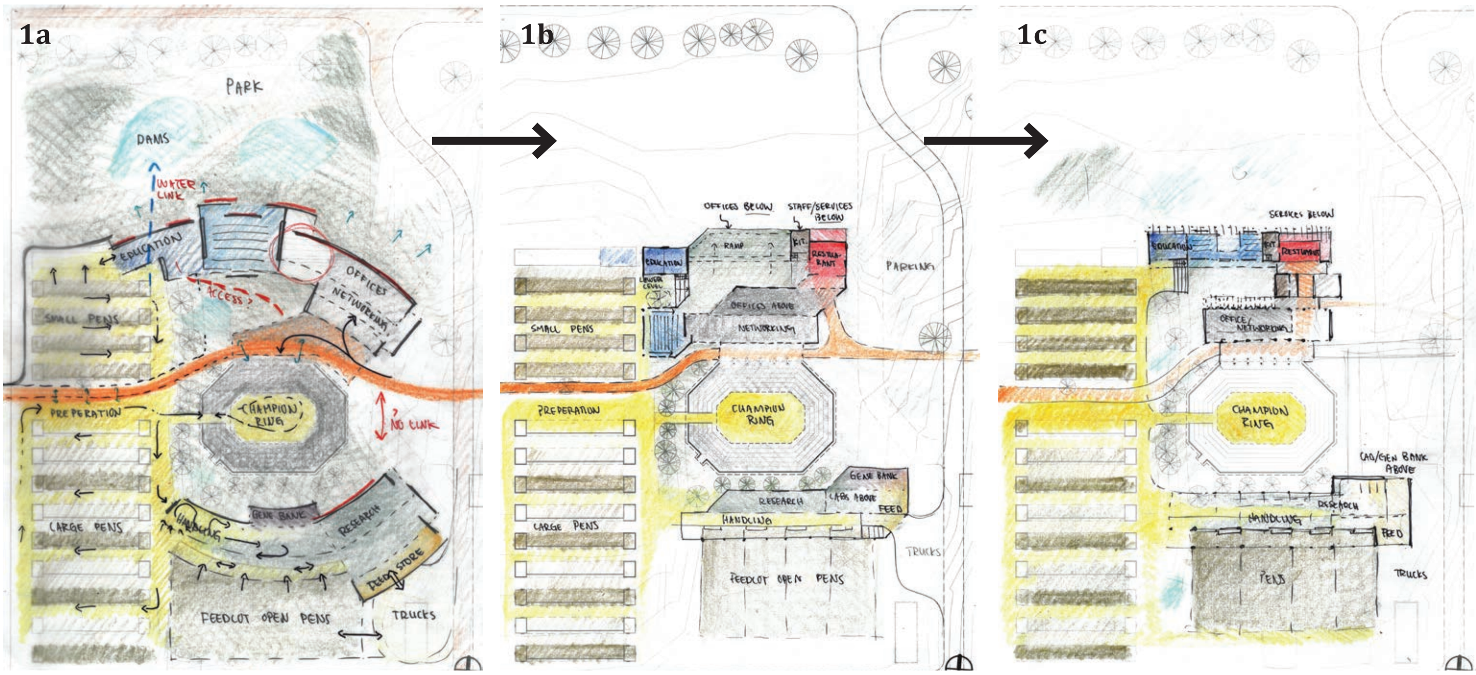


Figure 3-17: *Spacial organization for iterations* **1a**, ***b***, *and* ***c*** *investigating different layouts based on figure 3-12 (Author 2017)*

Figure 3-18: *Bottom left - Layout organization (Author 2017)*

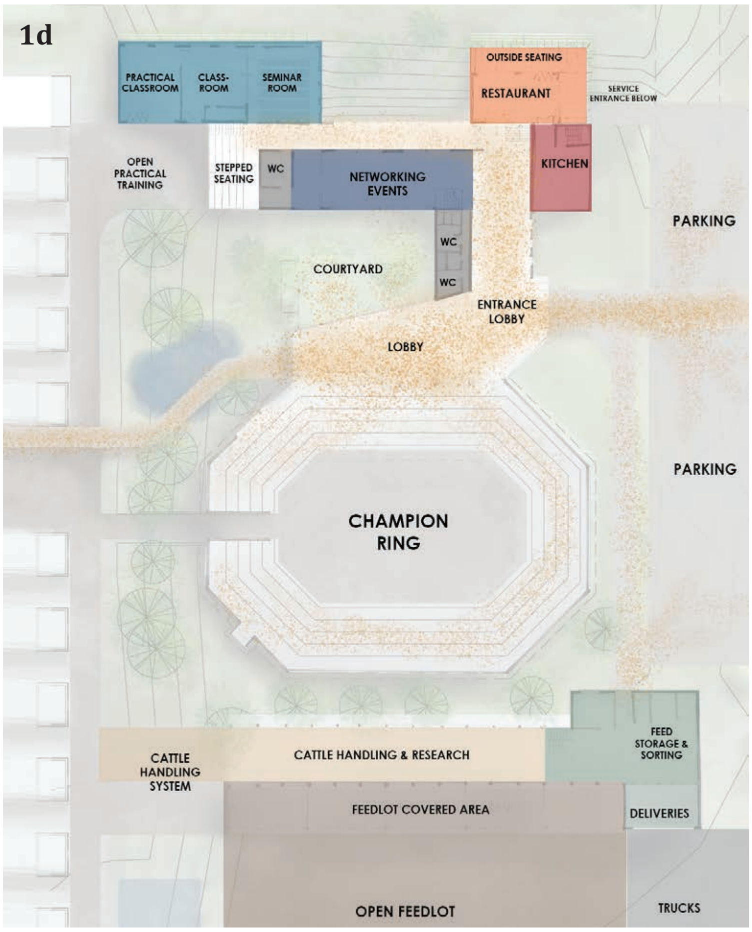
Figure 3-19: *Bottom right - circulation and levels (Author 2017)*

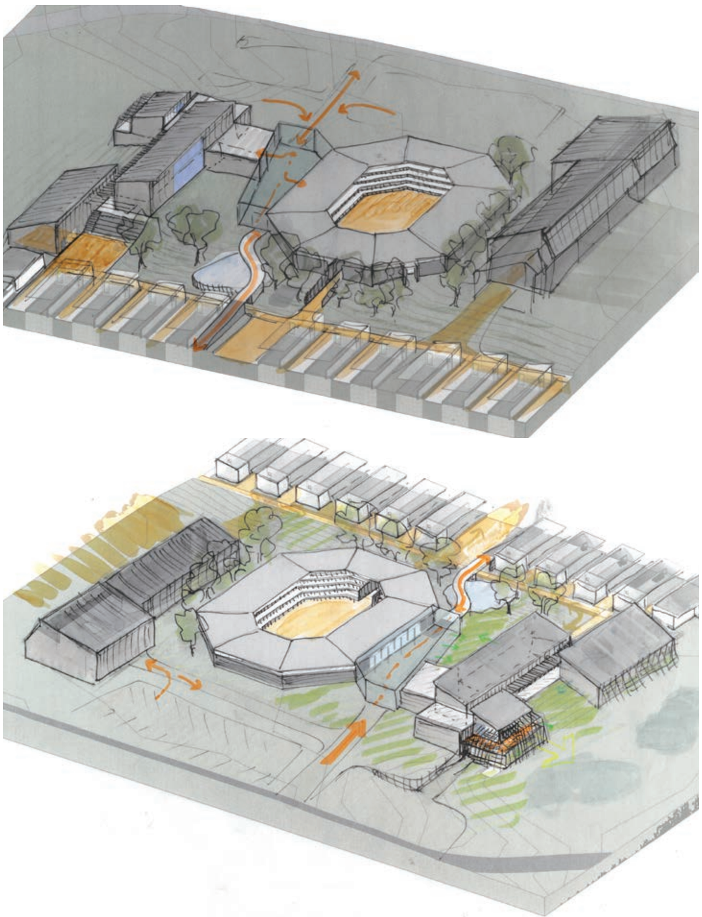
Iteration 1

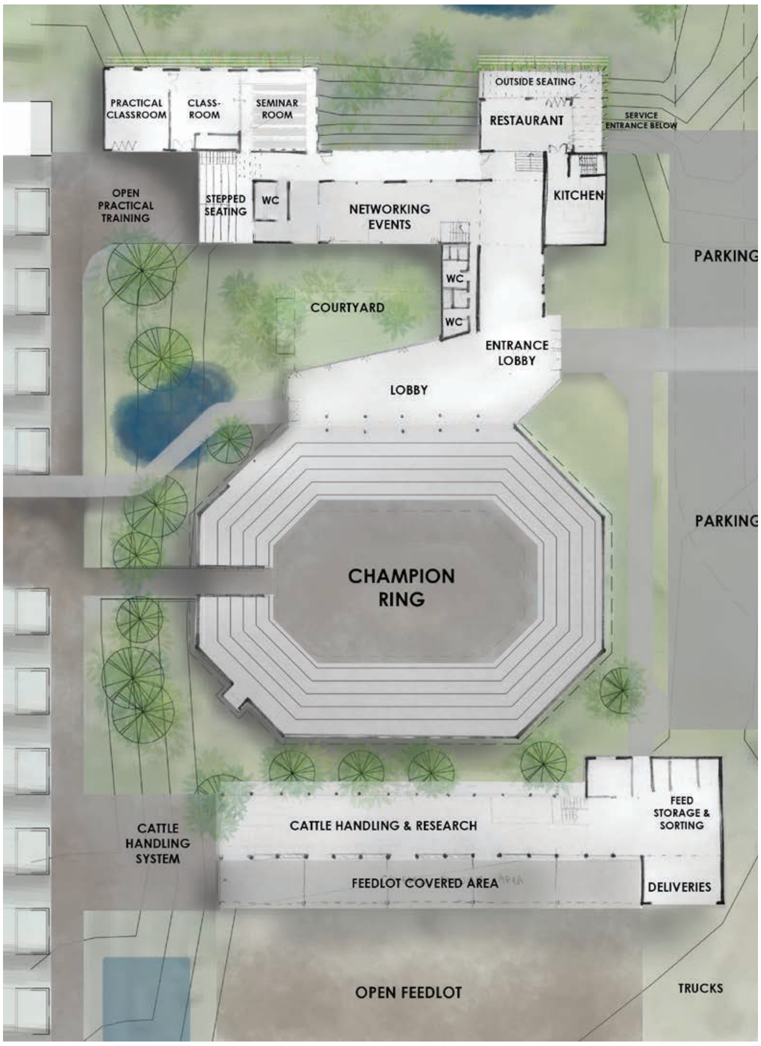
The first few layout iterations were based on the assumption that there would be a pedestrian route passing from the events center between the northern and southern rows of pens, up a ramp to pass over the cattle circulation without interference, past the entrance of the Champion ring and through the main entrance. This gave the public direct access to the restaurant and Champion ring, with a visual link onto the pens and cattle preparation area. In iteration 1 a, c and d the auditorium is placed on the northern embankment. Iteration 1c looked at placing the auditorium on the western embankment and having the courtyard extend over onto the roof of the classrooms below.

The classrooms and practical examination rooms are placed with access to the northern pens looking out on a “learning courtyard” that makes use of the western side of the embankment for stepped seating leading into the space.

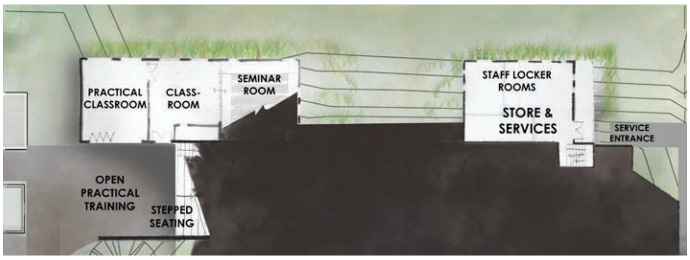
In response to criticisms and advice during the June examination, circulation routes and the relationship between spaces as



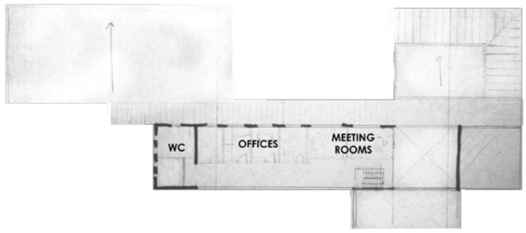




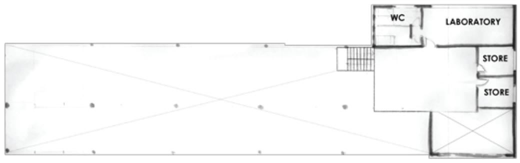
GROUND FLOOR PLAN



LOWER LEVEL FLOOR PLAN



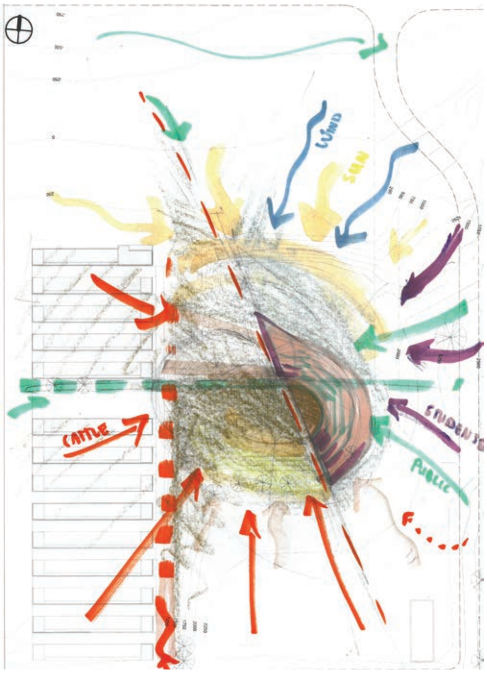
OFFICES FIRST FLOOR PLAN



LABS FIRST FLOOR PLAN

Figure 3-20: *Top; Floor Plans June (Author 2017)*

Figure 3-21: *Below; Marquette model of iteration 1d (Author 2017)*



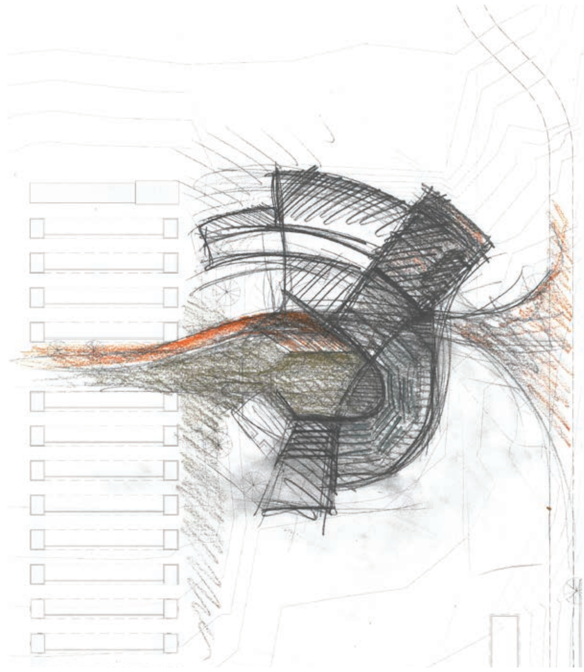


__Figure 3-22:__ Diagram showing the clear distinction between the animal and other influences on site

__Figure 3-23:__ A conceptual exploration in connecting the north ans south wings of the previous design and opening up half of the champion ring to create an "cattle courtyard"

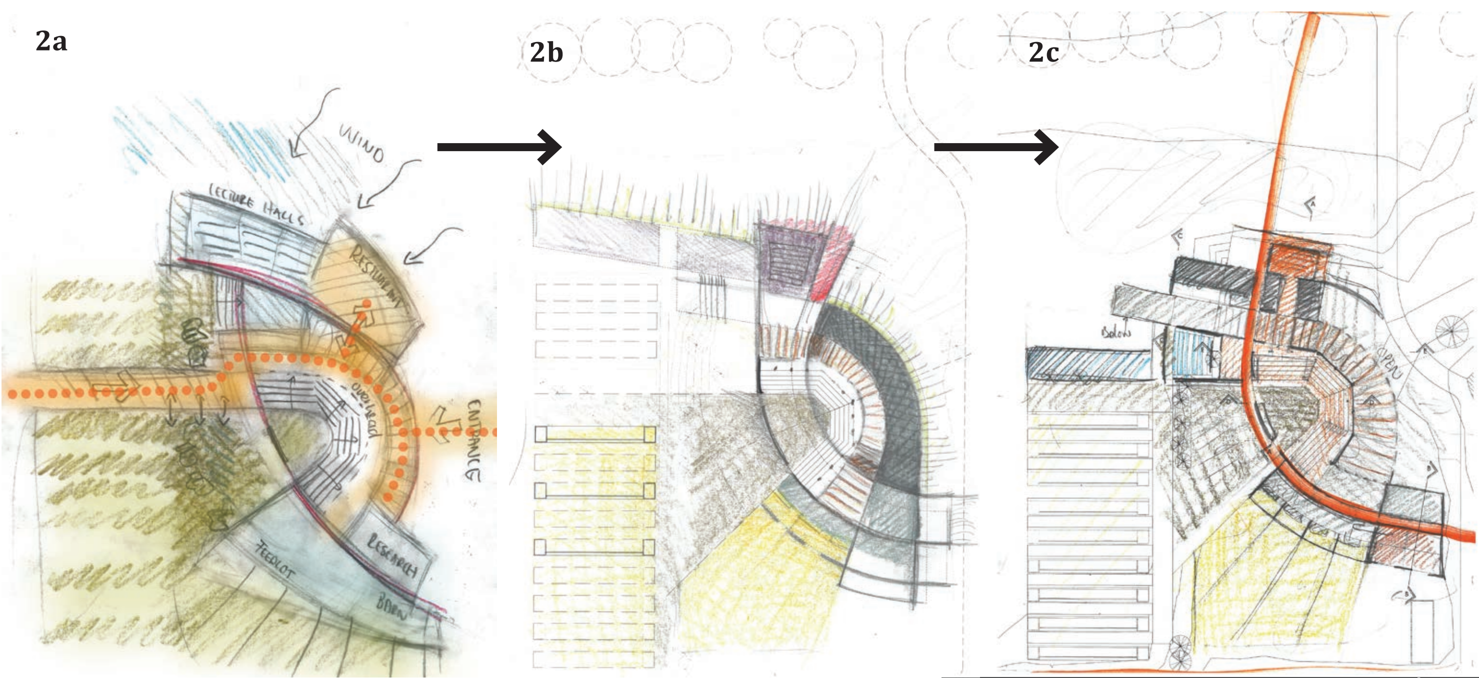
__Figure 3-24:__ Iterations 2a-2c (Author 2017)

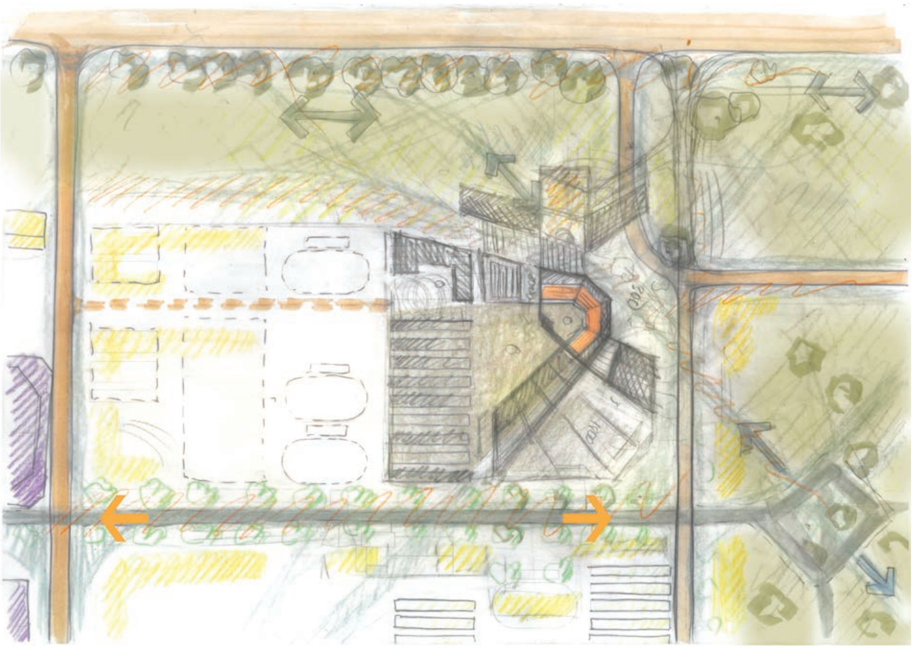
well as the integration of the champion ring with the rest of the project was re-evaluated.

Iteration 2

Fig 3-22 roughly illustrates the division between the animal and other site influences. This line of thinking led to the decision to open up half of the Champion ring to create an"cattle courtyard" separating the auction ring and the pens (fig 3-23). The two organic curves representing the animal and human aspects of the program in the revised parti digram intersect over the auction ring that forms the heart of the scheme. They also serve as a connecting element between the buildings north and south of the Champion ring.

In iteration 2a the previous placement of elements were kept within the new form connected by a covered walkway which also formed the entrance to both sides. Iteration 2b and 2c looked at alternative placements of the auditorium to embrace the wedge geometry to the two curves and extend the educational wing to create a training courtyard between the classrooms and the animal pens. On revisiting the master plan for the showgrounds a pedestrian route running between the pens past the champion ring proved to be an impractical assumption with pedestrian routes just north and south of the site. Iteration 2c explored the idea of a pedestrian route curving from the park, though the building and exiting on the eastern site to the road. This allowed for access to the restaurant as well as a visual link for the public from a higher level onto the "cattle courtyard" and into the cattle handling areas.

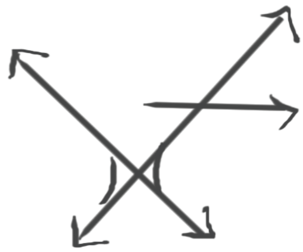




Circulation Patterns

People tend to prefer taking the shortest route from point A to point B, and like to see their destination as far as possible. On public routes, straight paths that allow for a direct line of site along the path helps with way-finding and a sense of safety.

Cattle, according to Temple Grandin, move more easily when along a curved route as it takes advantage of their natural tendency to want to go back towards the direction they came from. It further helps for the walkways and cattle chutes to have solid sides for a limited line of sight, to reduce stress and improve handling efficiency.



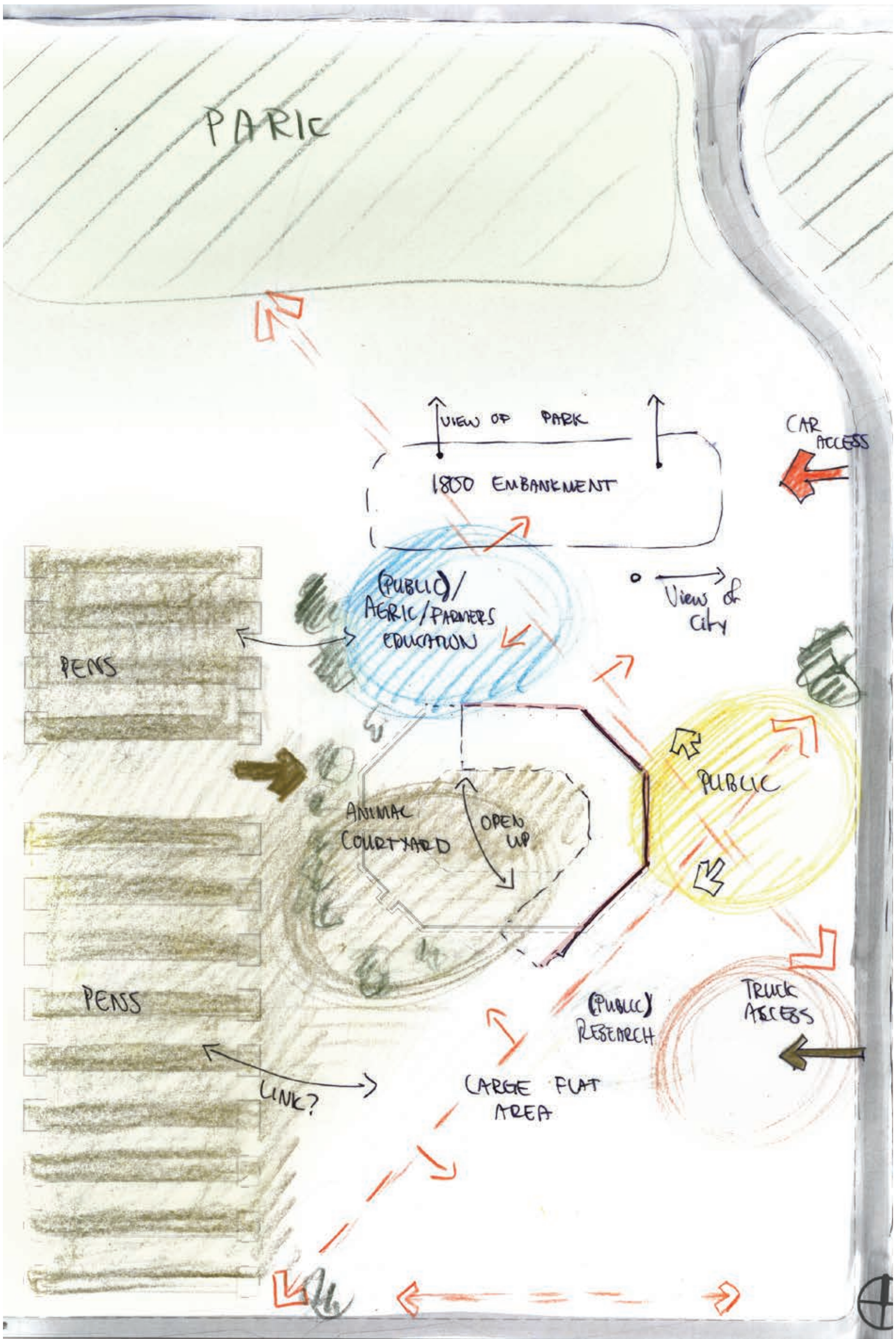
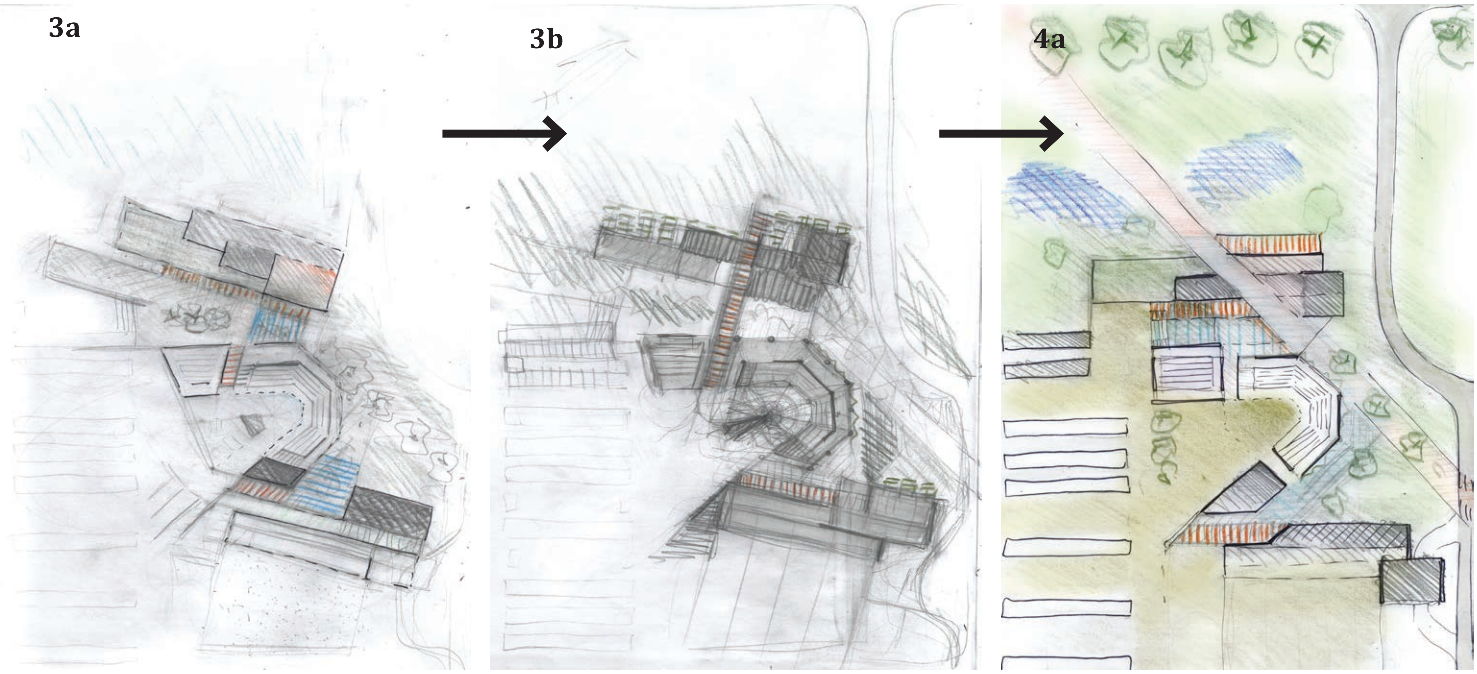
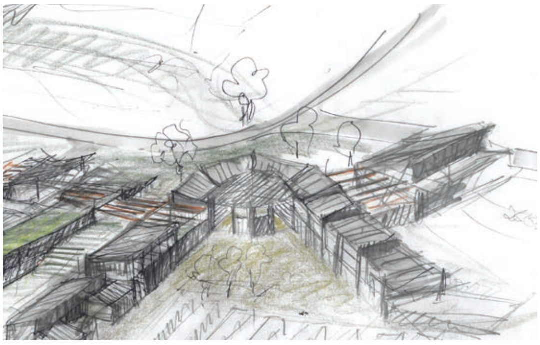


Figure 3-25: *Top right: Diagonal routes across site (Author 2017)*

Figure 3-26: *Left: Revision of site influences (Author 2017)*

Figure 3-27: *Top right: Typical movement patterns for people and cattle (Author 2017)*





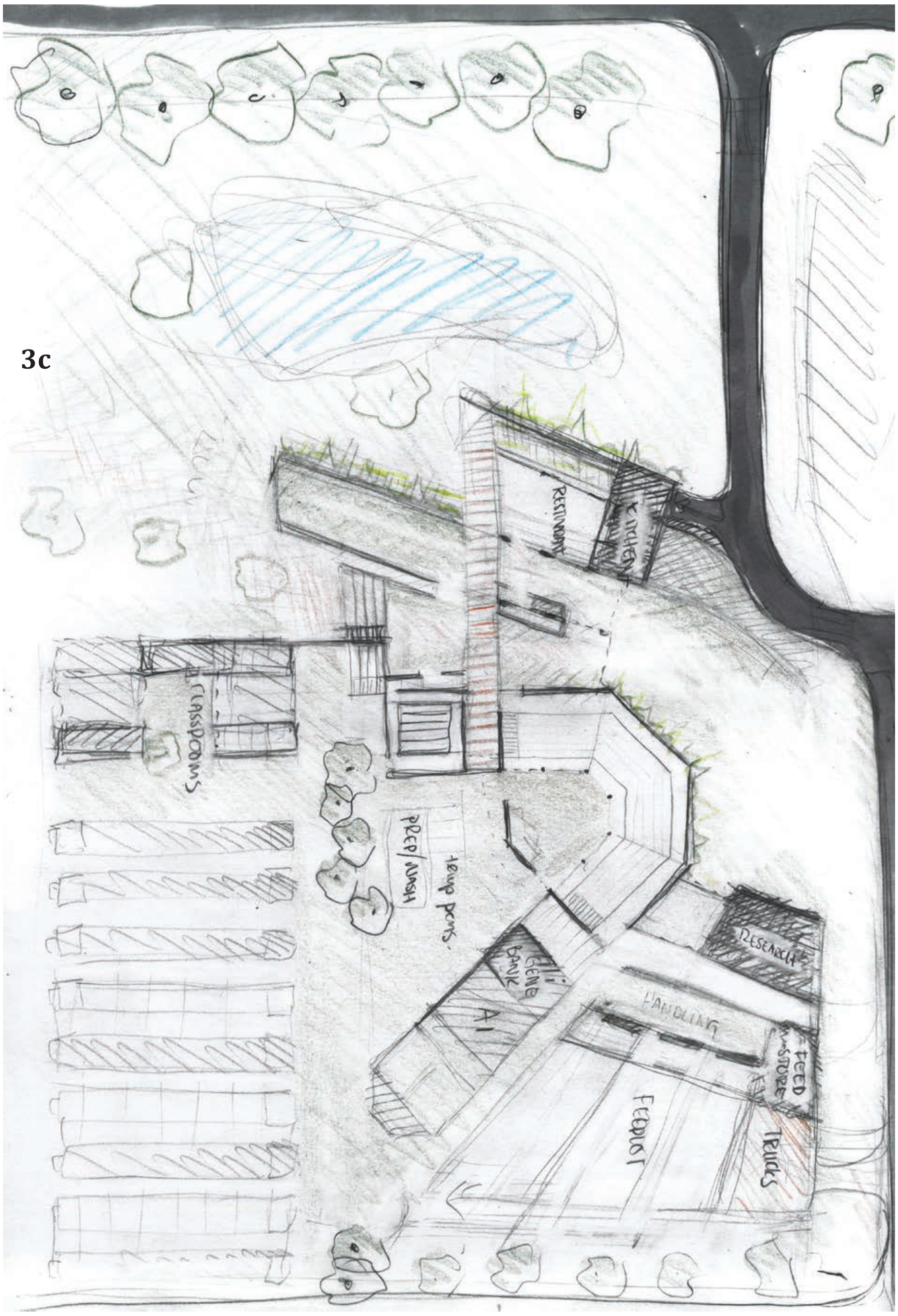


Figure 3-28: *Above - Iteration 3a & 3b has the public route passing between the northern wing and Champion ring, with a connecting pergola. Iteration 4a changes the orientation of the buildings to face north and has the public route pass diagonally though the building*

Figure 3-29: *Left: Iteration 3c has the entrance level courtyard extending to become a roof garden over the classrooms, and the south east side of the Champion ring extending to house the gene bank and laboratory.*

Iteration 3

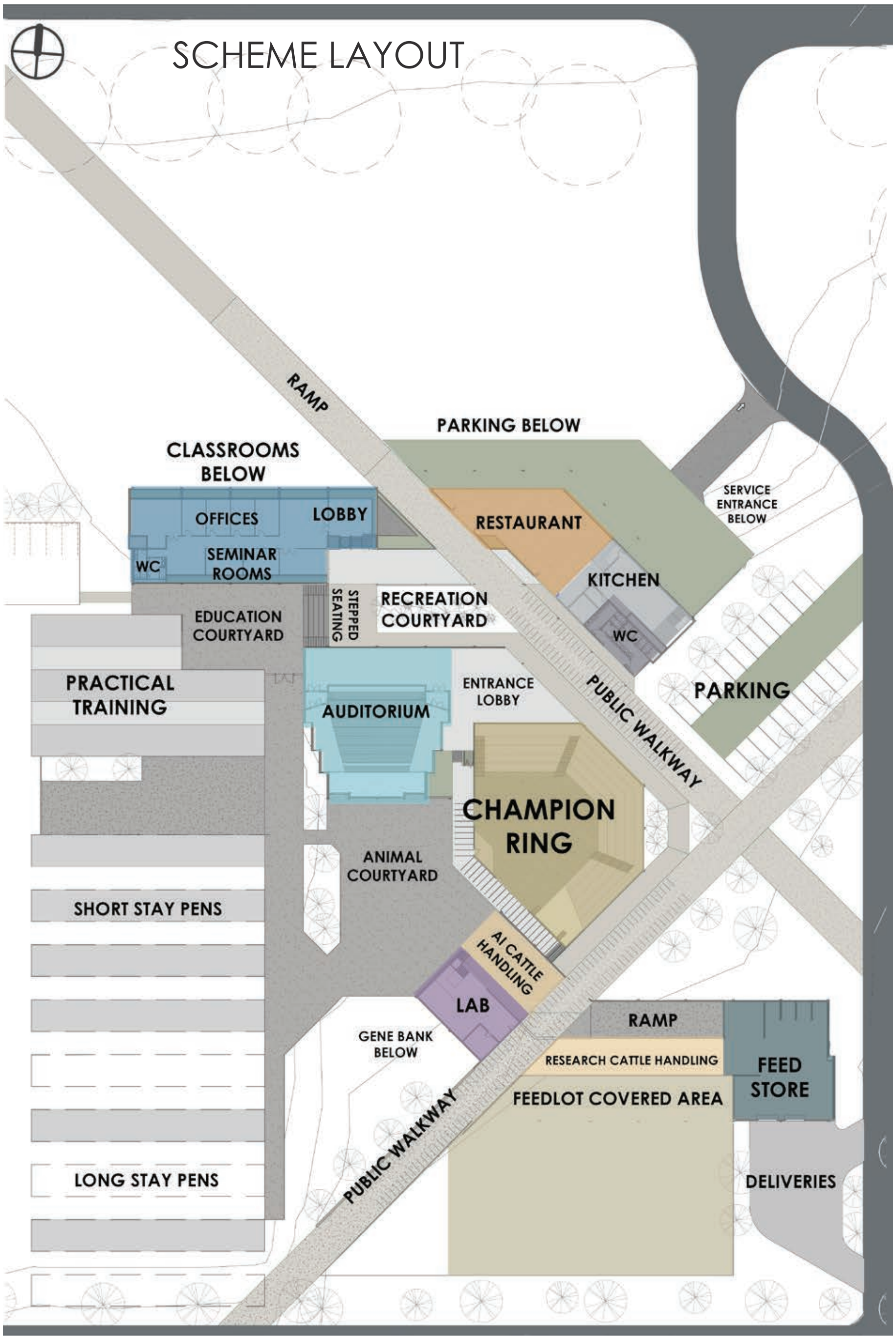
Upon further investigation into the difference between typical movement/circulation routes for humans and cattle (see fig. 3-27), the design was adapted to allow for a straight public route with a line of sight through to the exit on the other side, and curved routes with solid sides for the cattle. Iteration 3 considered the public route passing between the northern wing and the Champion Ring, with a separate deck overlooking the animal courtyard.

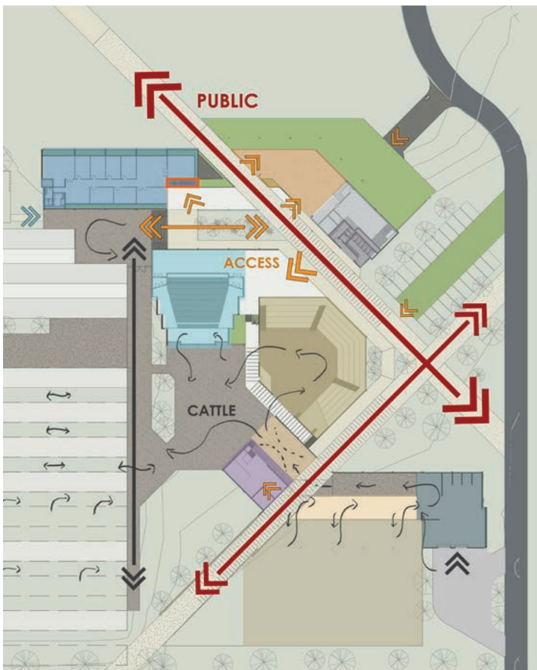
Iteration 4

The fourth iteration has the diagonal public route run straight through the building without changing course. The walkway was shifted so that it separated only the fully public part of the scheme from the rest of the building, so that the classrooms and offices looked directly out onto the animal courtyard and connected to the pens.

This public route formed part of the pedestrian path passing diagonally through the park from the east of the site to the green belt route next to WF Nkomo Drive (see fig 3-31)

This iteration focused on the building orientation and shape for passive design strategies such as solar control and natural ventilation. It further developed the idea of a series of courtyards as connecting spaces between the different programmatic components of the scheme and the varying levels of interaction between these components and the public.





Circulation

The public route passing diagonally through the two wings on either side of the Champion Ring provides access to both sides and a visual link into the auction ring. A central staircase with a lift opening to both sides in the northern wing provides vertical circulation from the basement level to the first floor level and is connected with an overhead walkway to the first-floor seating for the auditorium and Champion ring. Animal circulation forms a series of curves from the truck drop off next to the feed bard, either into the feed-lot area or down the ramp into the "animal courtyard" leading to the pens and lower level of the Champion ring.

Figure 3-30: *Above: Overview of program layout. (Author 2017)*

Figure 3-31: *Left top: Pedestrian routes through the showgrounds (Author 2017)*

Figure 3-32: *Left: Circulation routes and access points (Author 2017)*

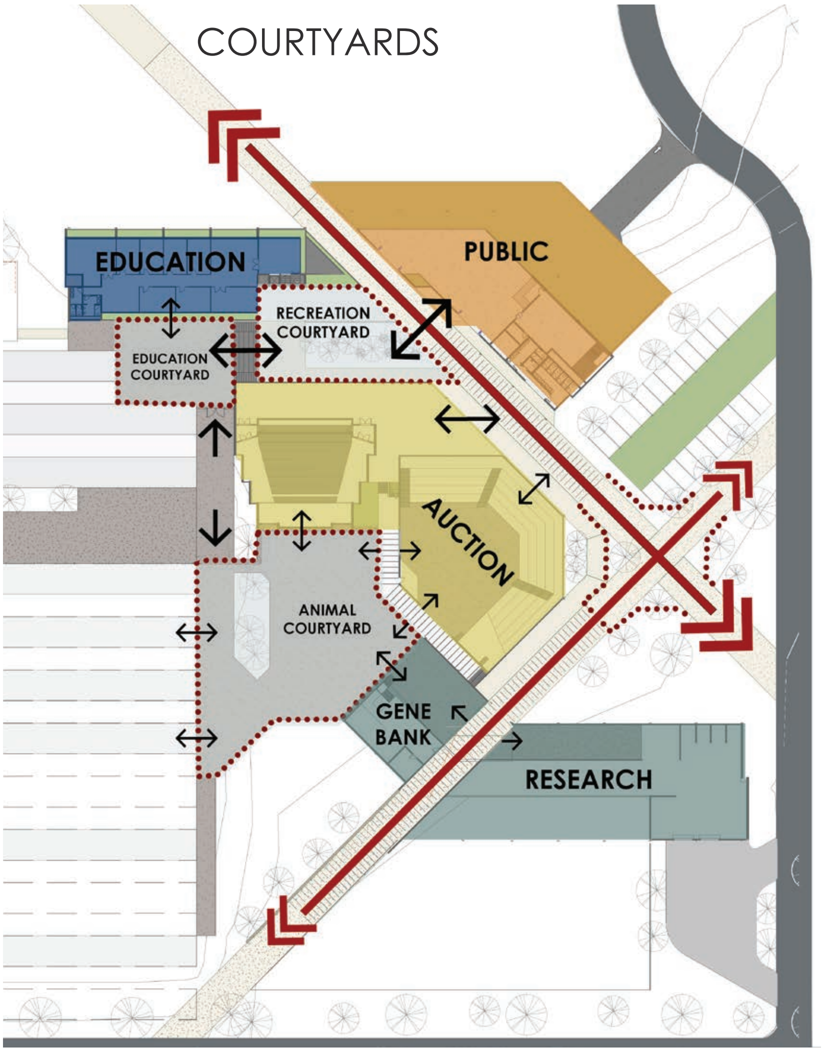
Opposite:

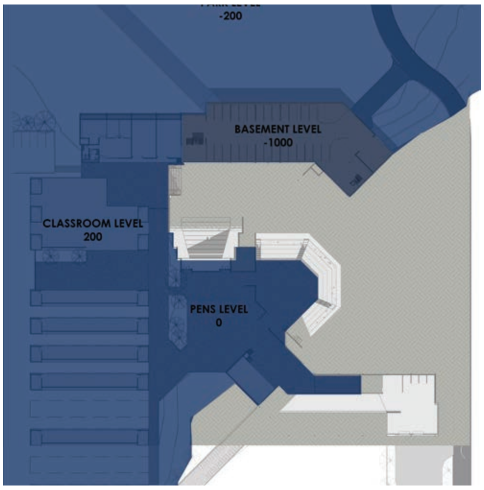
Figure 3-33: *Top: Courtyards as connecting spaces between programmatic elements (Author 2017)*

Figure 3-34: *Bottom: The site divided into three main levels (Author 2017)*

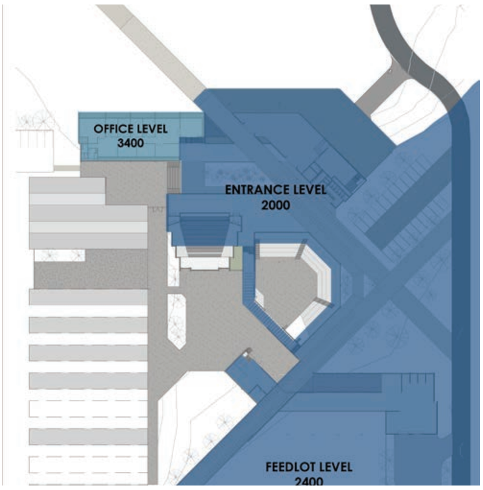
Programmatic components & interactions

The site is divided into four general areas with interlinking courtyards on different levels. The Champion ring forms the heart of the project in terms of location and program, as the element that ties the rest of the programmatic elements to each other. The restaurant, being the most public, is separated from the rest of the scheme by the public arcade. The arcade also leads to the entrance lobby for the Champion Ring and auditorium, the second most public part of the scheme. The lobby and event space flows out onto the central garden courtyard between the north wing and the Champion ring. This courtyard act as a buffer space between the public restaurant and semi private auction and education spaces. The western side of this courtyard drops down a series of stepped seating into the Educational courtyard that separates the formal education areas (the classrooms and lecturers' offices) and the practical training areas that connect with the animal pens. The fourth part is made up of a feed-lot and barn forming the southern wing, linked to the gene bank and animal courtyard by a ramp passing underneath the second pubic walkway. Above the gene bank (on the animal courtyard level) is the laboratory, with an entrance on the same level as the public walkway. From this walkway the public can look down onto animal handling areas through a one way widow, to create a visual link without disturbing the cattle while they are being handled.

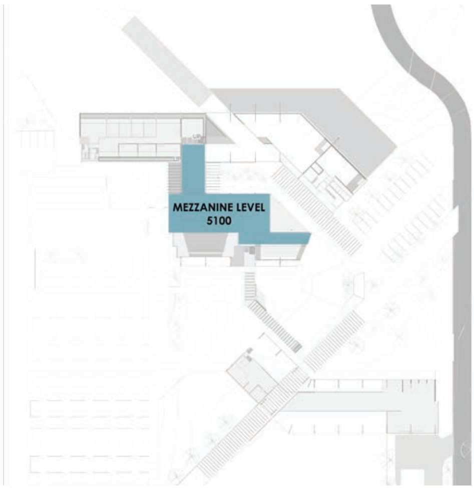




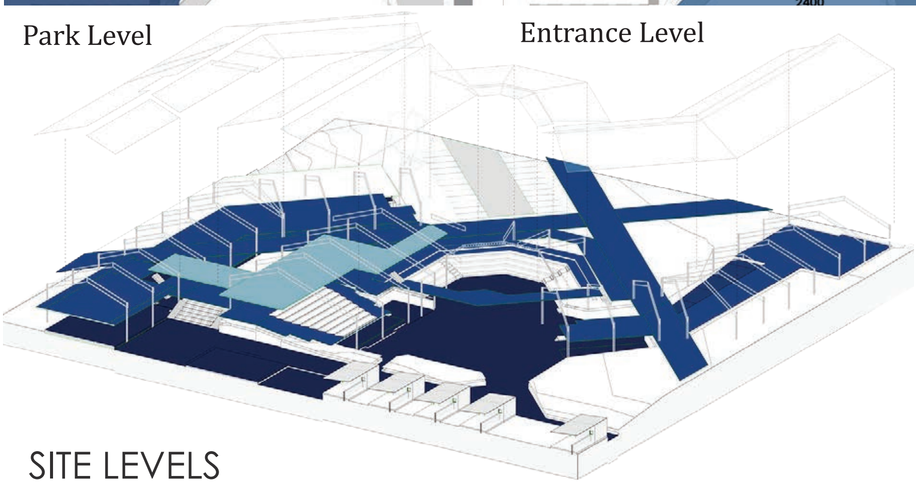
Park Level



Entrance Level



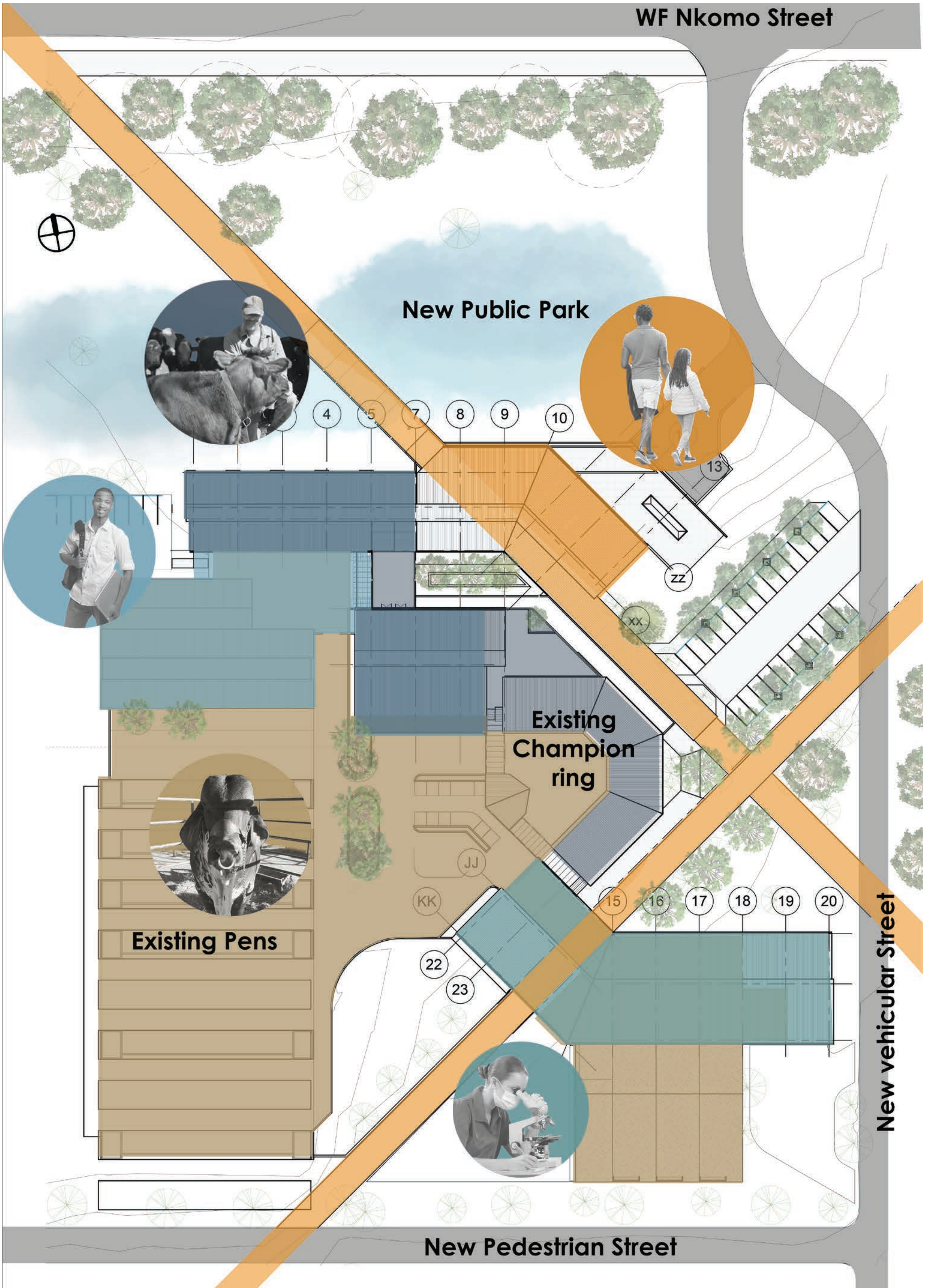
First Floor Level



SITE LEVELS

Levels

The site consists of four main levels, the basement level 500mm below the natural ground level of the park (basement parking), the park and pens level (animal courtyard, classrooms, Champion Ring floor), the entrance level (restaurant, entrance to Champion ring and auditorium, offices and seminar rooms, feed-lot and barn) and the first-floor level (mezzanine seating to auditorium and Champion Ring)


WF Nkomo Street
New Public Park
4
5
7
8
9
10
13
ZZ
XX
Existing Champion ring
JJ
KK
Existing Pens
15
16
17
18
19
20
22
23
New vehicular Street
New Pedestrian Street

SITE 3D

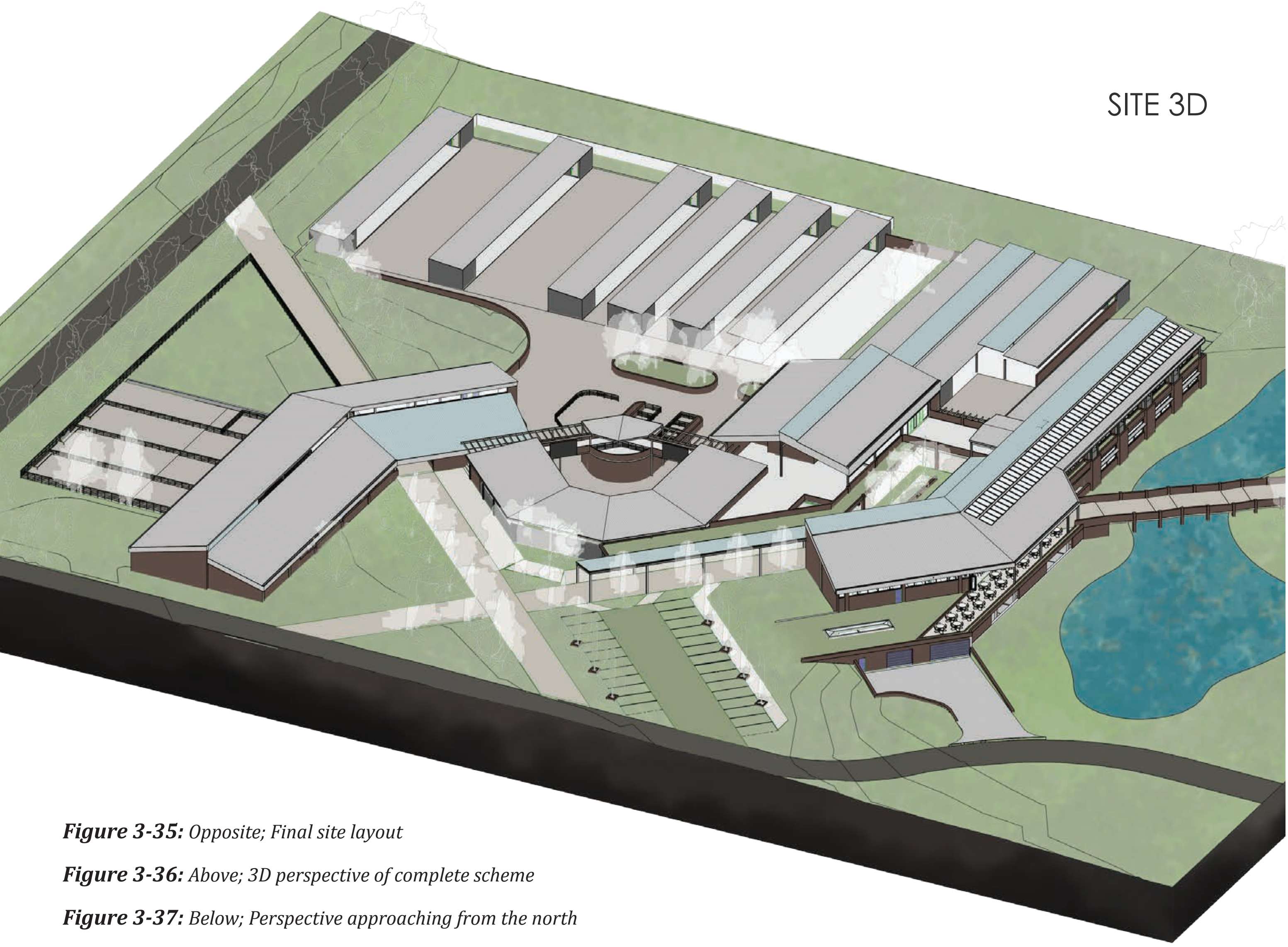
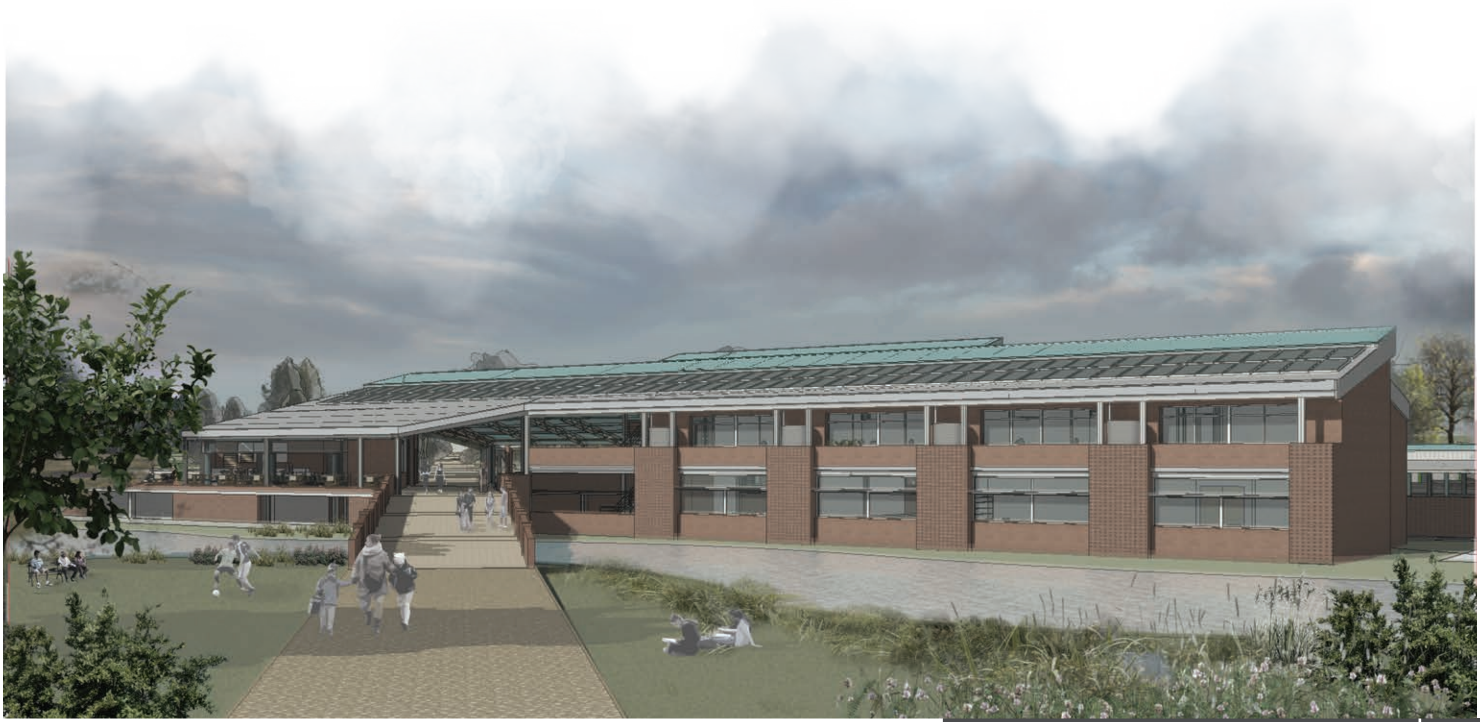


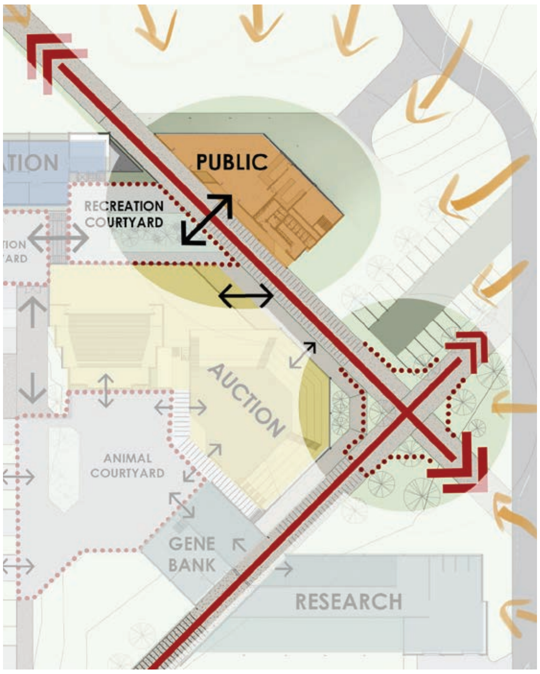
Figure 3-35: *Opposite; Final site layout*

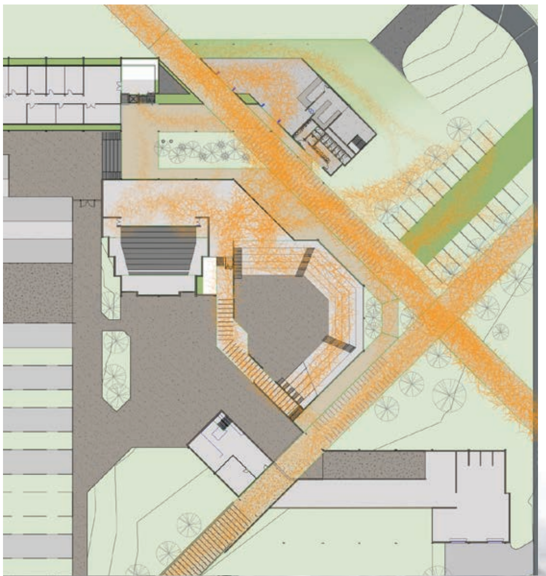
Figure 3-36: *Above; 3D perspective of complete scheme*

Figure 3-37: *Below; Perspective approaching from the north*

NORTH VIEW







ZONE 1: PUBLIC

Arcade:

The arcade forms part of a public walkway that cuts across the two parks introduced to the showgrounds (see fig 3-35), and is open throughout the day and night. It also acts as point of entry to the restaurant and champion ring. The arcade keeps a direct line of sight from the main entrance to the park to the north and the road to the south. Both walkways are paved with a cobble paver suitable for heavy foot traffic, used only along these routes to further define the public arcade from the connecting spaces. When there is an auction taking place, the public can look into the Champion ring from the arcade walkway, and can also branch off onto the raised walkway overlooking the cattle courtyard where the animals are prepared for auction.

Restaurant:

From the restaurant entrance lobby, a double volume seating area flows out onto a semi covered outside seating area overlooking the park. The exposed trusses and shed aesthetic is contrasted with finer finishes inside as well as indoor planters and ample natural light from the clerestory windows running the length of the building. The back of the bar has a window looking into the kitchen preparation area that customers can look into, but the scullery and store is shielded form view. The service entrance and waste area are placed in the basement, with a staircase linking it to the scullery.

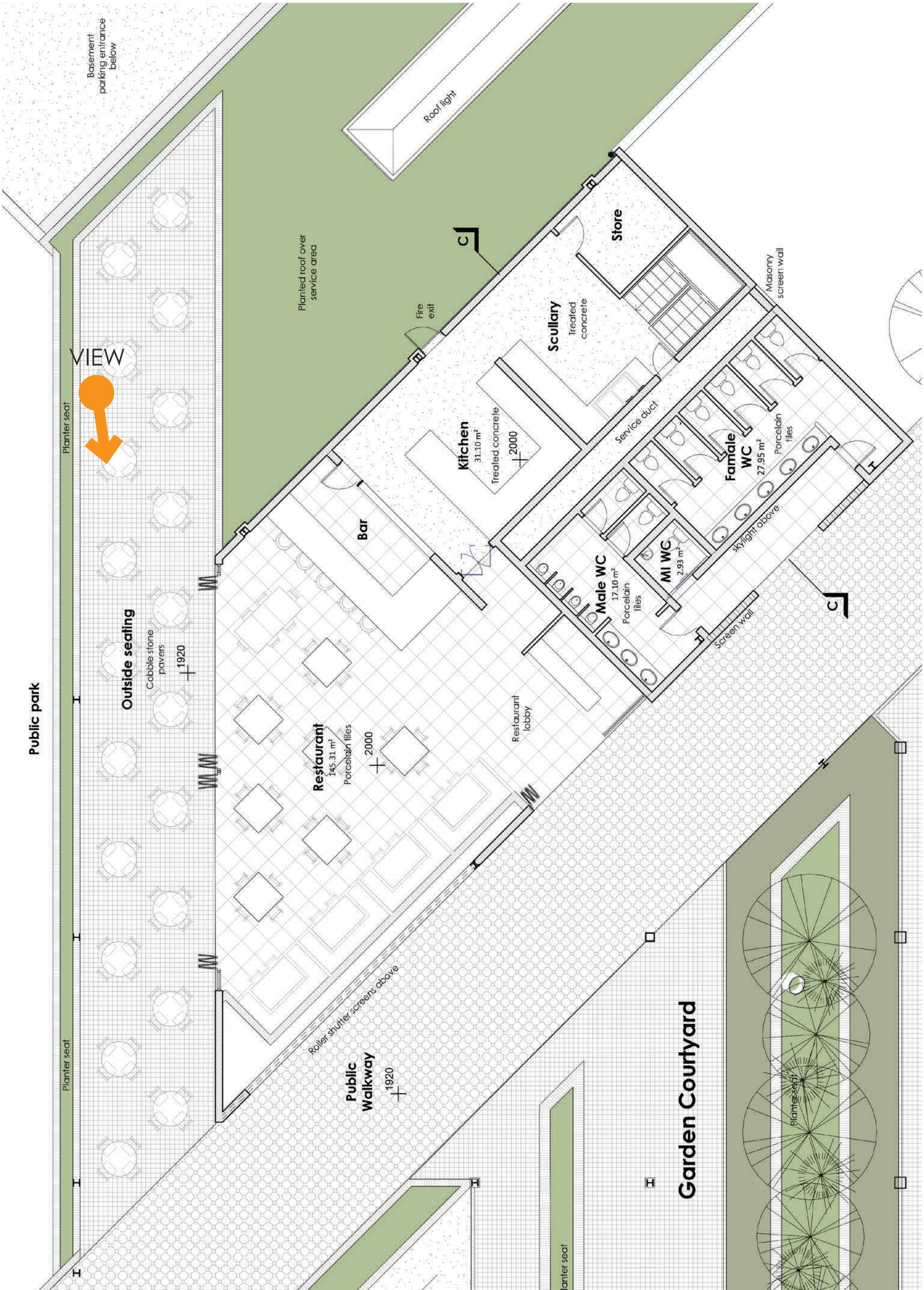
Ablutions:

The ablution block next to the restaurant kitchen serves both the restaurant and Champion ring/auditorium, with an entrance directly onto the arcade.

Figure 3-38: *Left; Public zone location and movement (Author 2017)*

Figure 3-39: *Below: Perspective of the restaurant outside seating (Author 2017)*

Figure 3-40: *Opposite; Restaurant, kitchen and ablution block on plan (Author 2017)*


VIEW
Basement parking entrance below
Roof light
Planted roof over service area
Fire exit
Store
Scullary
Treated concrete
Masonry screen wall
Kitchen
31.10 m²
Treated concrete
2000
Service duct
Female WC
27.95 m²
Porcelain tiles
Bar
Male WC
17.10 m²
Porcelain tiles
MI WC
2.93 m²
skylight above
Screen wall
Planter seat
Public park
Outside seating
Cobble stone pavers
1920
Restaurant
145.31 m²
Porcelain tiles
2000
Restaurant lobby
Roller shutter screens above
Public Walkway
1920
Garden Courtyard
Planter seat

ZONE 2: AUCTIONS & NETWORKING

Champion ring:

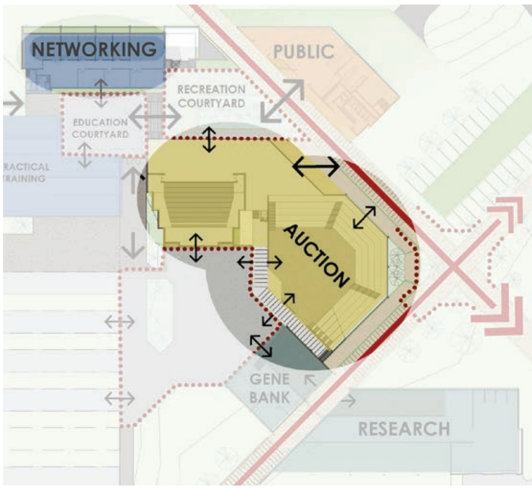
Half of the existing Champion ring is kept with a few minor adjustments, such as lowering side walls to allow the public to look in during auction, upgrading the seats using the existing concrete terraces and replacing the aging metal roof sheeting. The auctioneer stand was moved to the new western side of the ring on the raised level of the walkway. Auctions take place in much the same way they as in the past, but the program now extends to include the gene bank with genetic material of cattle on show for sale on an permanent basis. With the offices of various breed associations and networking facilities connected to the auction ring, auctions will also take place on a much more regular basis. Linking the auditorium, auction ring and garden courtyard is an open space that can be used for events. That, together with the entrance lobby, act as a spill over space for before and after auctions or lectures. Between the Champion ring and auditorium, half a flight of stairs leads up to the walkway that overlooks the cattle courtyard. Another flight leads back up to the first floor level event space, upper level seating for the auditorium and Champion ring, as well as a walkway to the northern wing offices.

Auditorium:

The auditorium makes use of the existing level difference of the demolished part of the Champion ring. It's entrance leads out of the event space, and is easily accessible to both students from the educational courtyard and the public from the main entrance. The seating steps down to a lower level, where two doors opening onto the cattle courtyard make it possible for cattle to enter the one and exit the other. The auditorium can thus be used for lectures or auctions, and therefore the floor of the lower level is suitable for cattle and can be easily washed out.

Offices:

The office wing is half a level up from the restaurant, above the classrooms. This wing consists of offices on the northern side overlooking the park and seminar rooms to the south. The passage is lit from above by a clerestory window,



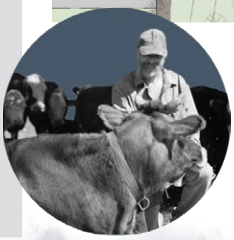
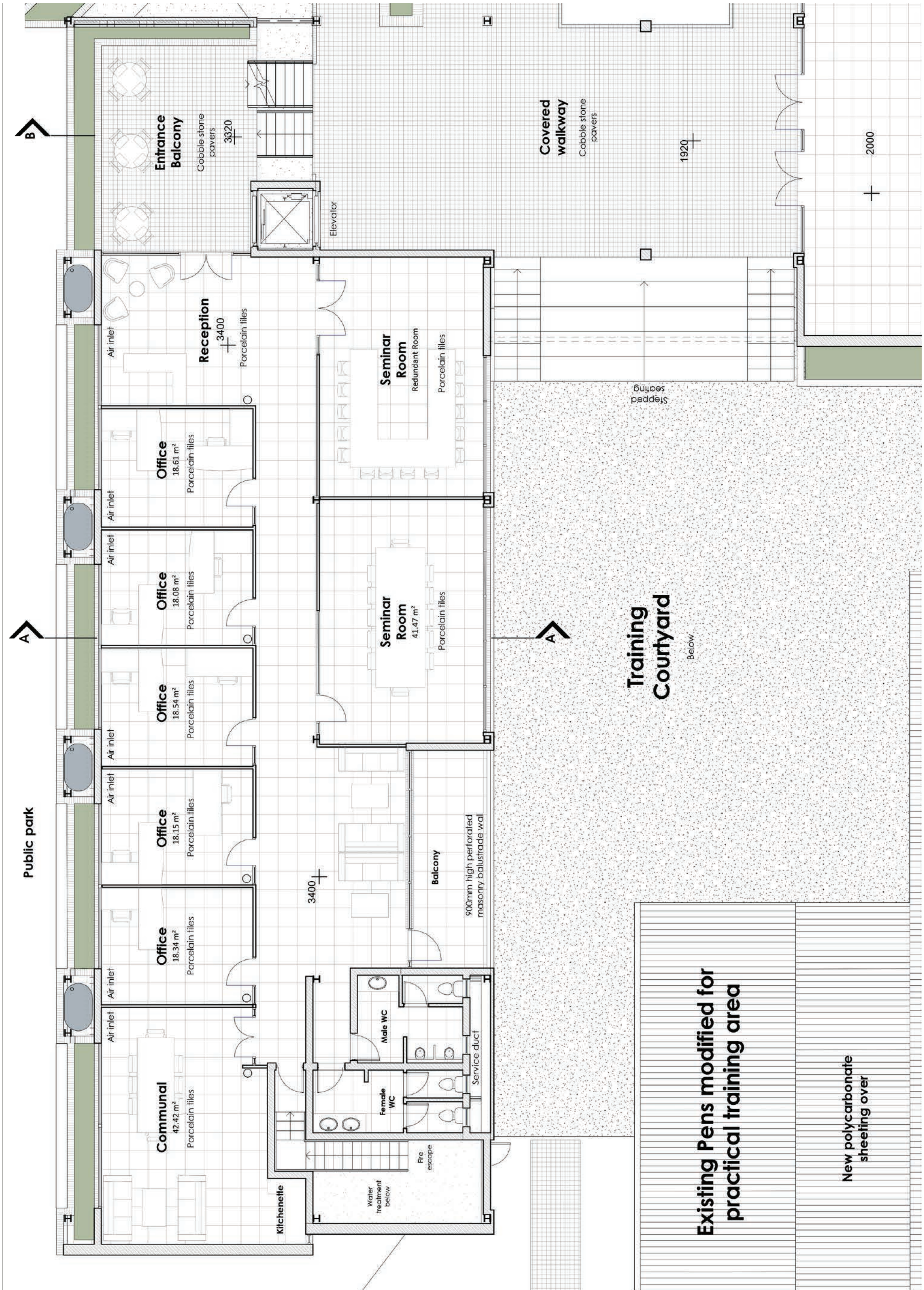
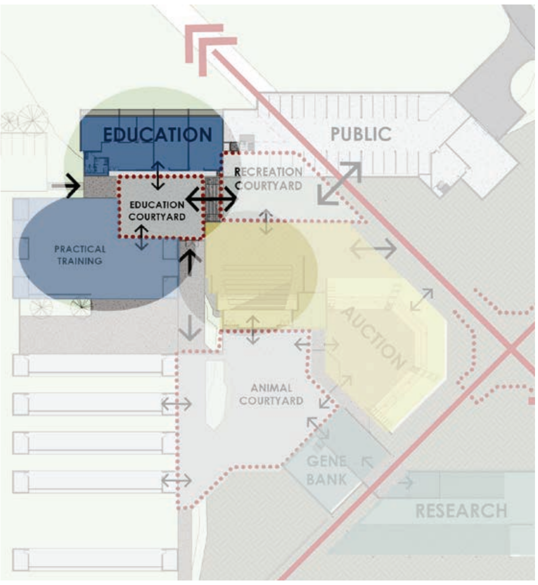


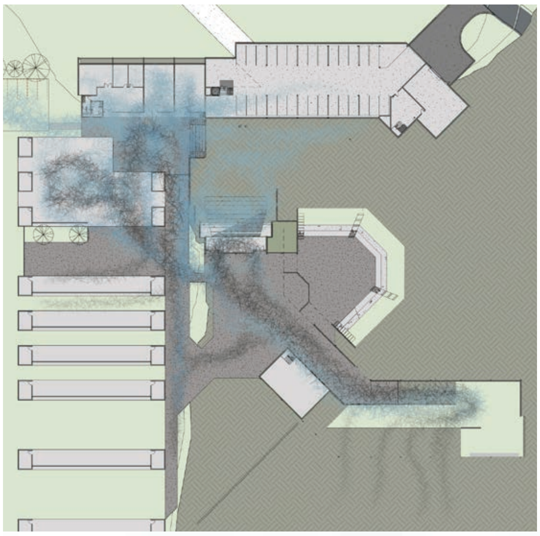
Figure 3-41: *Above; Auctions and auditorium location and movement (Author 2017)*

Figure 3-42: *Below; Perspective of the Champion ring (Author 2017)*

Figure 3-43: *Opposite; Champion ring and auditorium on plan (Author 2017)*


Public park
Entrance Balcony
Cobble stone pavers
3320
Elevator
Covered walkway
Cobble stone pavers
1920
2000
Reception
3400
Porcelain tiles
Air inlet
Seminar Room
Redundant Room
Porcelain tiles
Stepped seating
Office
18.61 m²
Porcelain tiles
Office
18.08 m²
Porcelain tiles
Seminar Room
41.47 m²
Porcelain tiles
Office
18.54 m²
Porcelain tiles
Training Courtyard
Below
Office
18.15 m²
Porcelain tiles
3400
Balcony
900mm high perforated masonry balustrade wall
Office
18.34 m²
Porcelain tiles
Male WC
Female WC
Service duct
Communal
42.42 m²
Porcelain tiles
Fire escape
Water treatment below
Kitchenette
Existing Pens modified for practical training area
New polycarbonate sheeting over





ZONE 3: EDUCATION

Classrooms and offices:

The educational courtyard is on the same level as the park and cattle pens, with two classrooms, offices and ablutions on the one side and a practical training area on the other. The courtyard can be used as a teaching space too, with students seated on the steps leading up the garden courtyard. Lecturers and students have a separate entrance and parking space accessed by a private road, or those arriving by public transport will enter through the arcade and past the garden courtyard.

Practical Training

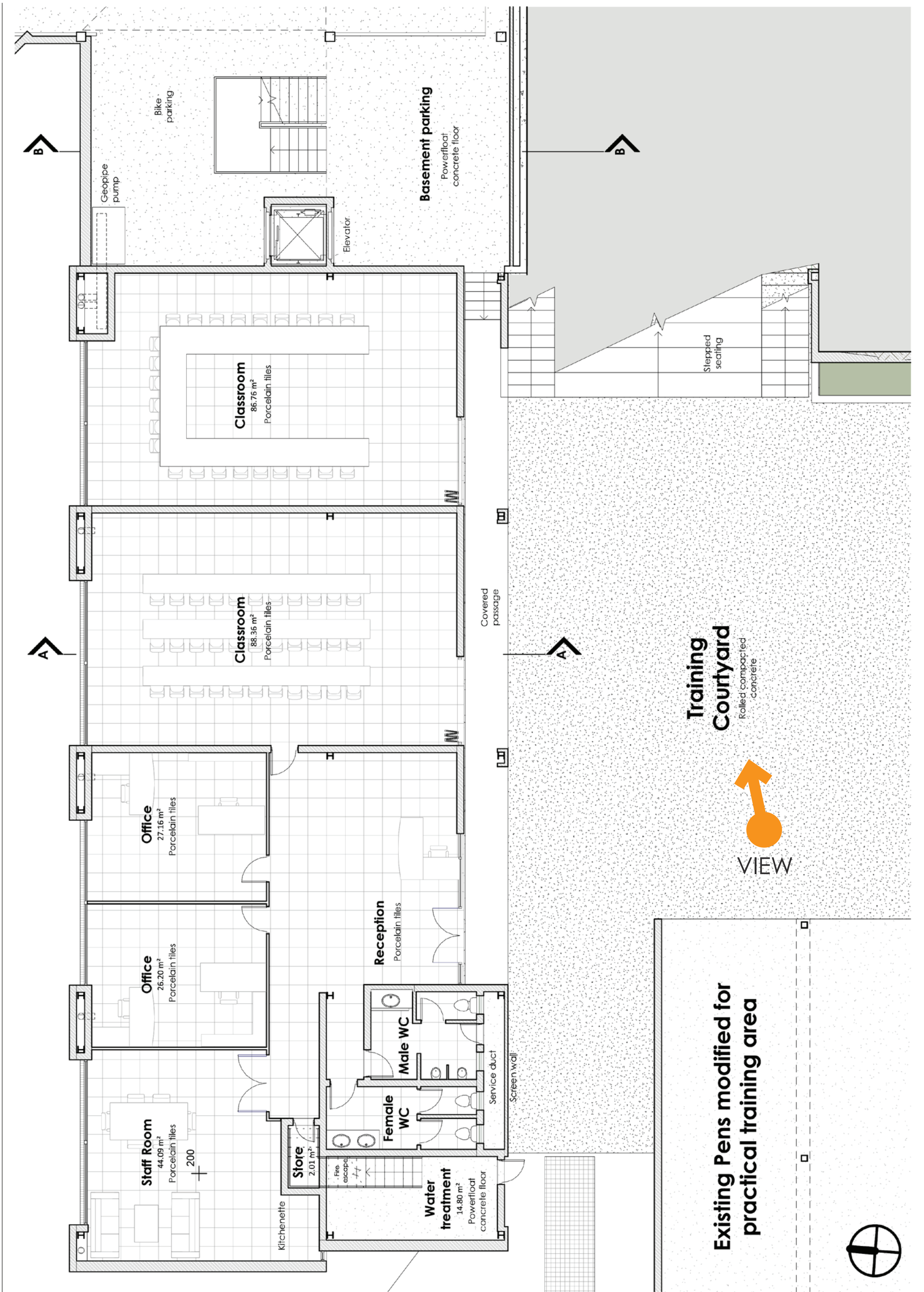
Three rows of pens are modified to be used as a practical training area. Unnecessary columns and side bars are removed (to be reused for the main structure's lattice beams), and a new roof is added to the sections between rows.

Practical training will be done with cattle from the feed-lot, so for practical lessons cattle will be walked from the north wing, down the ramp and through the cattle courtyard to the training area.

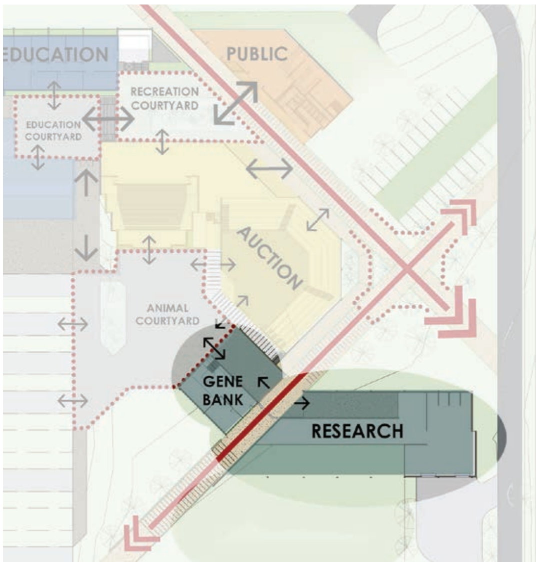
Figure 3-44: *Education zone location and movement (Author 2017)*

Figure 3-45: *Opposite; Classrooms and training areas on plan (Author 2017)*

Figure 3-46: *Below; Perspective of the education courtyard (Author 2017)*



Bike parking
Geopipe pump
Basement parking
Powerfloat concrete floor
Elevator
Classroom
86.76 m²
Porcelain tiles
Classroom
88.36 m²
Porcelain tiles
Covered passage
Stepped seating
Training Courtyard
Rolled compacted concrete
VIEW
Office
27.16 m²
Porcelain tiles
Office
26.20 m²
Porcelain tiles
Reception
Porcelain tiles
Male WC
Female WC
Service duct
Screen wall
Staff Room
44.09 m²
Porcelain tiles
200
Store
2.01 m²
Fire escape
Water treatment
14.80 m²
Powerfloat concrete floor
Kitchenette
Existing Pens modified for practical training area



ZONE 4: RESEARCH & GENE BANK

Feed-lot:

The1060m^2 relatively flat feed-lot area is divided into three pens, each with a feed trough under a covered section to the north and a water trough on the southern end. This is to encourage cattle to walk up and down on a daily basis. Having the roof cover to the north maximizes the amount of shade it provides, and enables the staff to fill the feed troughs from directly within the barn using varying feed mixes that are stored and mixed in the feed barn. All the research cattle need to be weighed and measured on a daily basis using a crush system placed in the barn between the ramp and feed trough. The finishes for the barn wing is focused on cattle, with rough, hard wearing floors and solid steel sides for the handling systems according to the principles laid out by Temple Grandin (steel seating from the old pavilion is to be recycled for this).

Gene Bank and Laboratory

The gene bank is located on the lower level of the southern wing opposite the Champion ring. Semen and embryo collection as well as artificial insemination (AI) takes place in the handling area in front of the gene bank. Genetic material is taken up to the laboratory on the floor above the gene bank for analysis, documentation and freezing, and the stored in liquid nitrogen vats in the gene bank below.

The laboratory is fairly simple; besides the specialised equipment and chemical resistant counter tops, the room itself does not need to very specialised.

Figure 3-47: *Research related movement (Author 2017)*

Figure 3-48: *Opposite; Feedlot, laboratory and gene bank on plan (Author 2017)*

Figure 3-49: *Perspective of research feed-lot (Author 2017)*

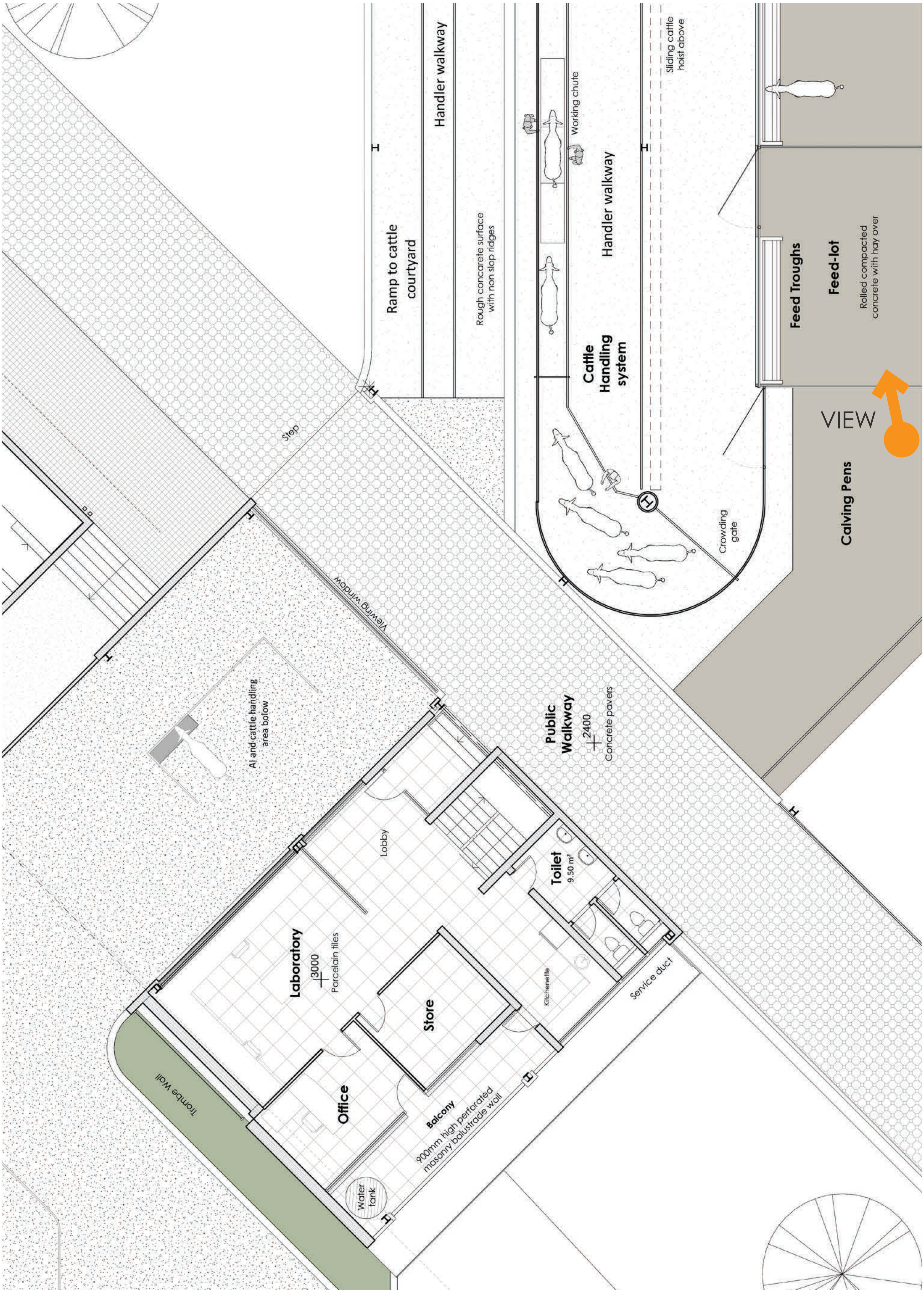
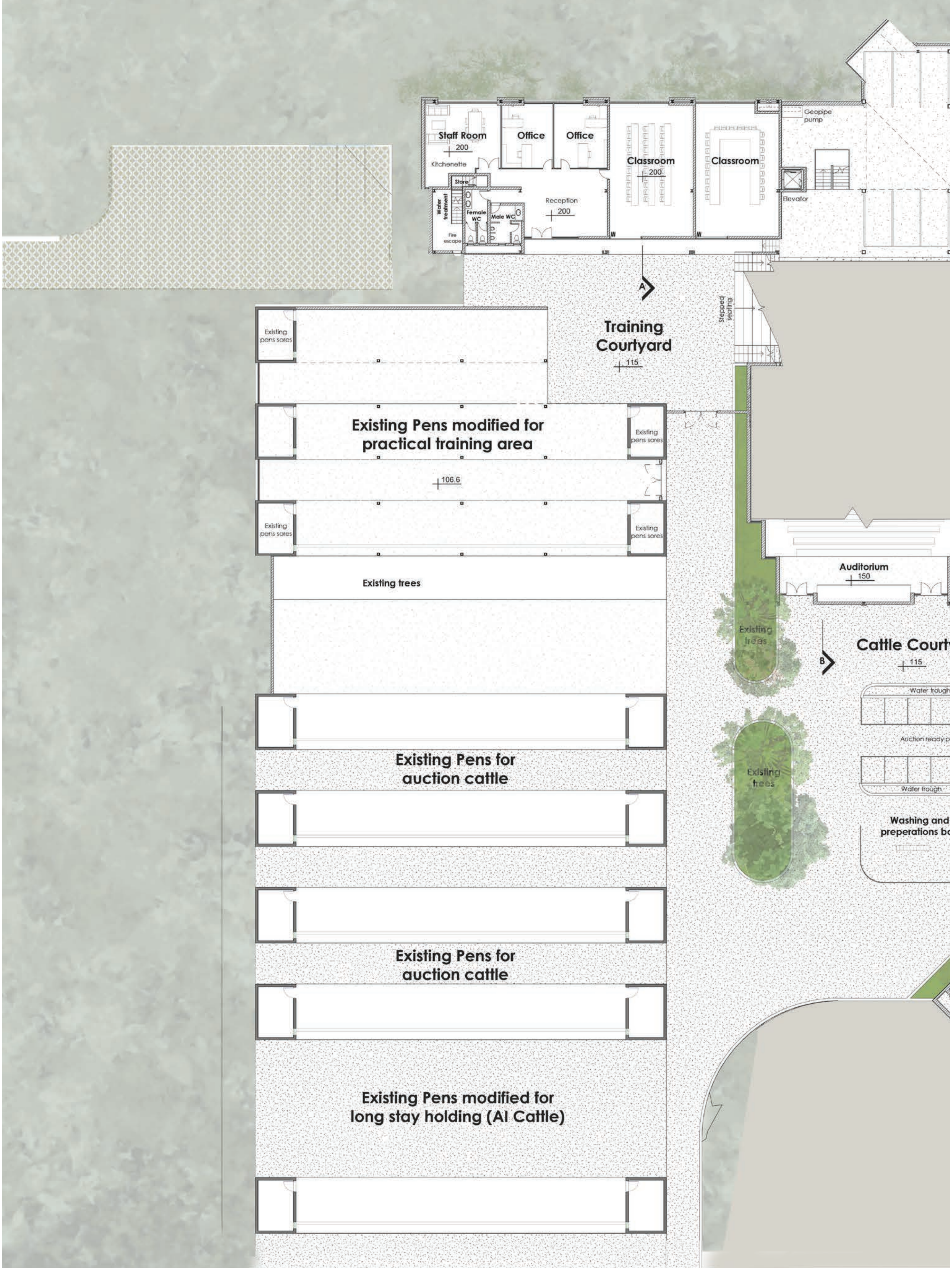
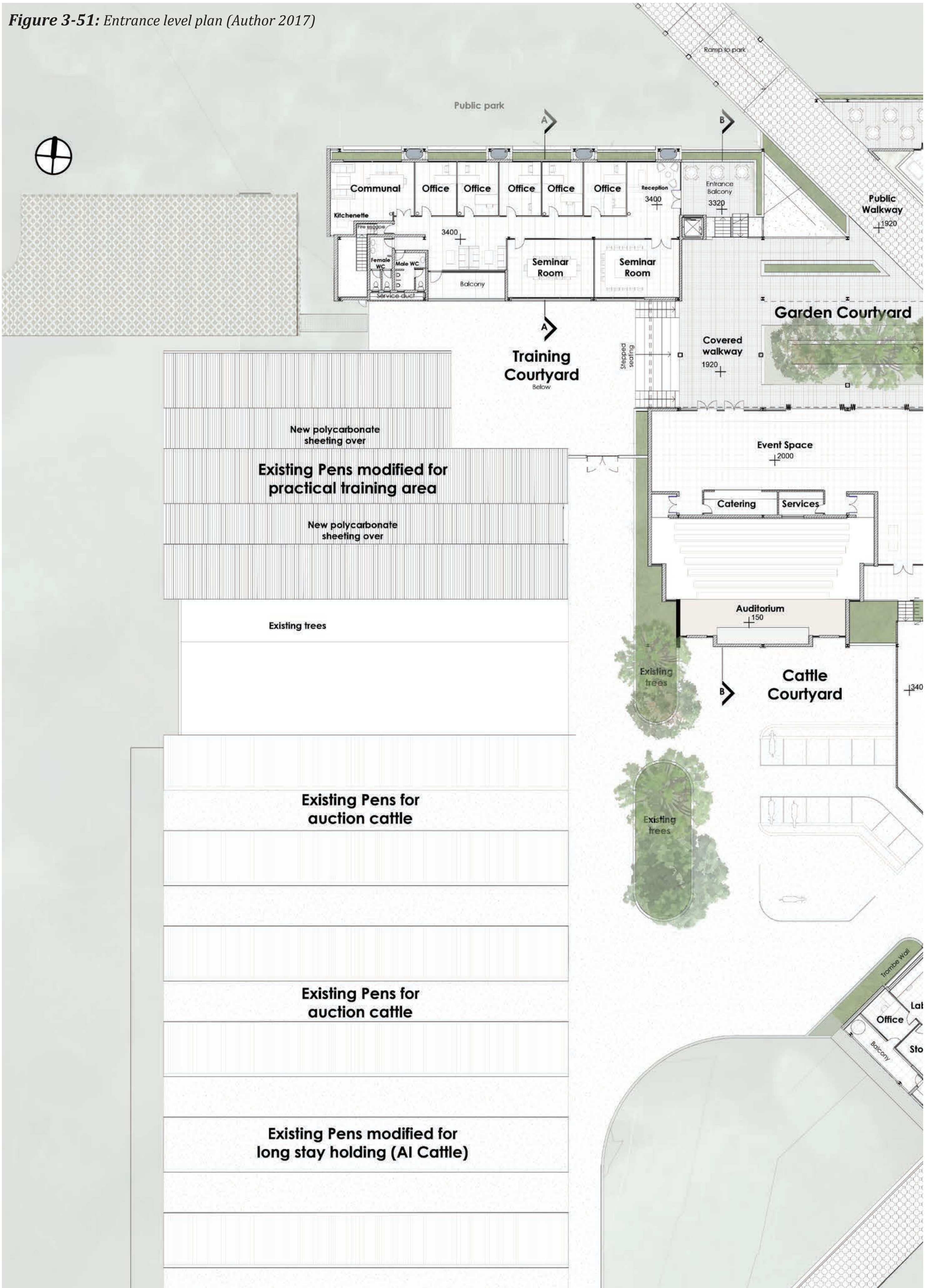

Handler walkway
Ramp to cattle courtyard
Rough concarete surface with non slop ridges
Working chute
Sliding cattle hoist above
Handler walkway
Cattle Handling system
Feed Troughs
Feed-lot
Rolled compacted concrete with hay over
VIEW
Calving Pens
Crowding gate
Step
Viewing window
AI and cattle handling area below
Public Walkway
2400
Concrete pavers
Lobby
Toilet
9.50 m²
Laboratory
3000
Porcelain tiles
Store
Kitchenette
Service duct
Office
Balcony
900mm high perforated masonry balustrade wall
Water tank
Trombe wall

Figure 3-50: *Park and basement level plan (Author 2017)*




Basement parking entrace
Restaurant deliveries
Basement Parking
1920
Waste & Services
1920
Water treatment
Fresh air intake from garden
Auditorium
150
Existing Champion Ring seating & roof structure
Cattle Courtyard
115
Champion Ring
115
Water trough
Rainwater storage tank
Auction ready pens
Water trough
Washing and preperations bay
Seating and roof extended
AI and cattle handling area
Trombe Wall
Store room
200
Working Counter
Water Filtration
Female locker room
Service duct
Male locker room
Genetic material storage
115
Handler walkway
Cattle Ramp

Figure 3-51: *Entrance level plan (Author 2017)*




Public park
Basement parking entrance below
Outside seating
1920
Restaurant
145.31 m²
2000
Bar
Planted roof over service area
Restaurant delivery area below
Public Walkway
1920
Fire exit
Kitchen
2000
Restaurant lobby
Scullary
Store
Male WC
MI WC
Female WC
Service duct
Skylight above
Screen wall
rtyard
1920
Public parking
Pedestrian Crossing
Entrance Lobby
2000
Existing entrance columns
Public Walkway
View into Champion ring
Existing Champion Ring seating & roof structure
3400
Screen
Champion Ring
115
Auctioneer stand
Existing Champion Ring seating & roof structure
New vehicular road
Screen
Walkway over champion ring entrance
Seating and roof extended
Public Walkway
Trombe Wall
Laboratory
Office
3000
Lobby
Store
Balcony
Kitchenette
Toilet
Viewing window
Step
2400
Pedestrian Crossing
Ramp to cattle courtyard
Feed storage
Cattle Handling system
Crowding gate
Working chute
cattle hoist above
18500
Feed Troughs
Feed Troughs
Feed Barn
Calving Pens
Feed-lot

Figure 3-52: *First floor plan (Author 2017)*

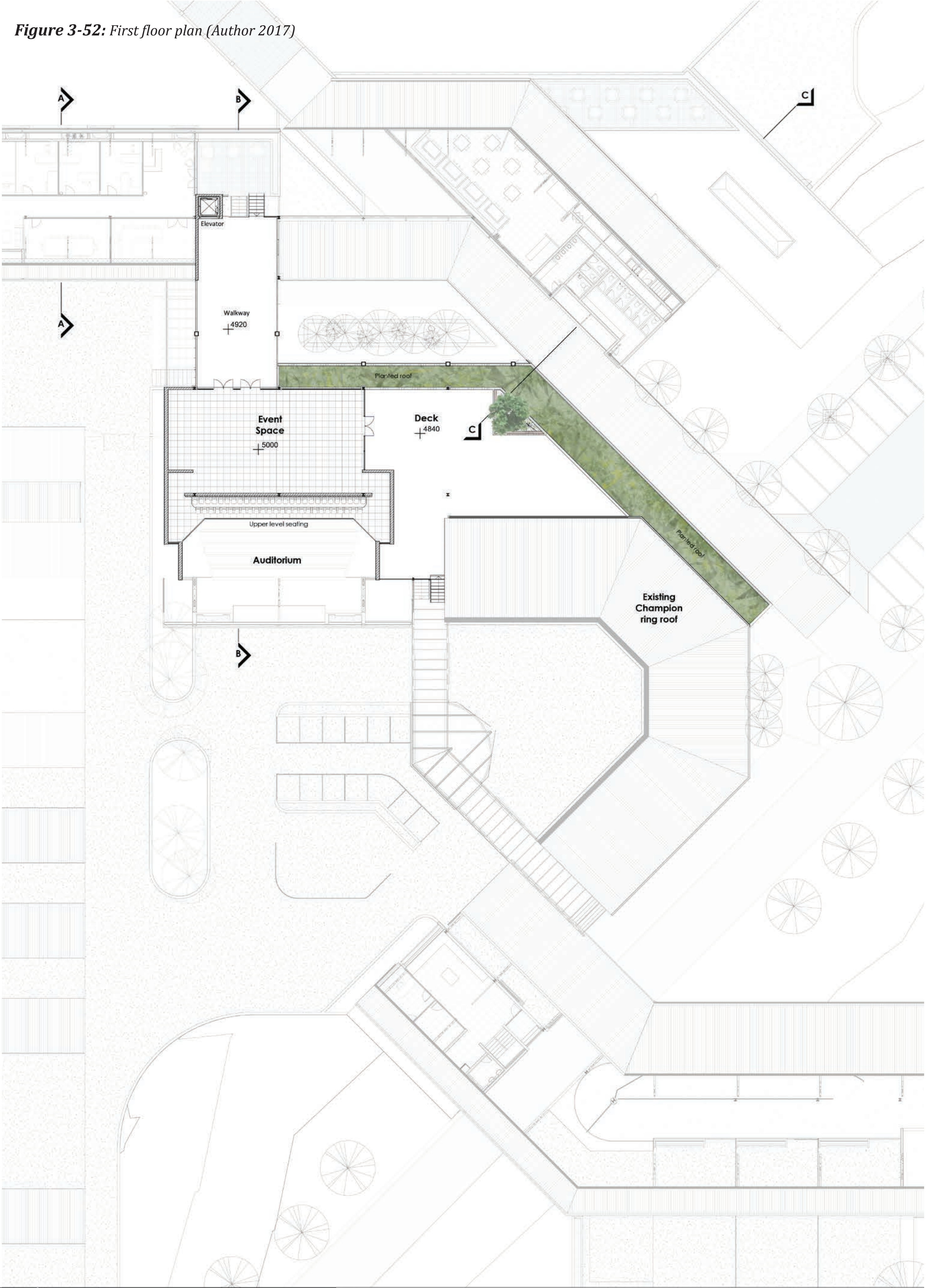
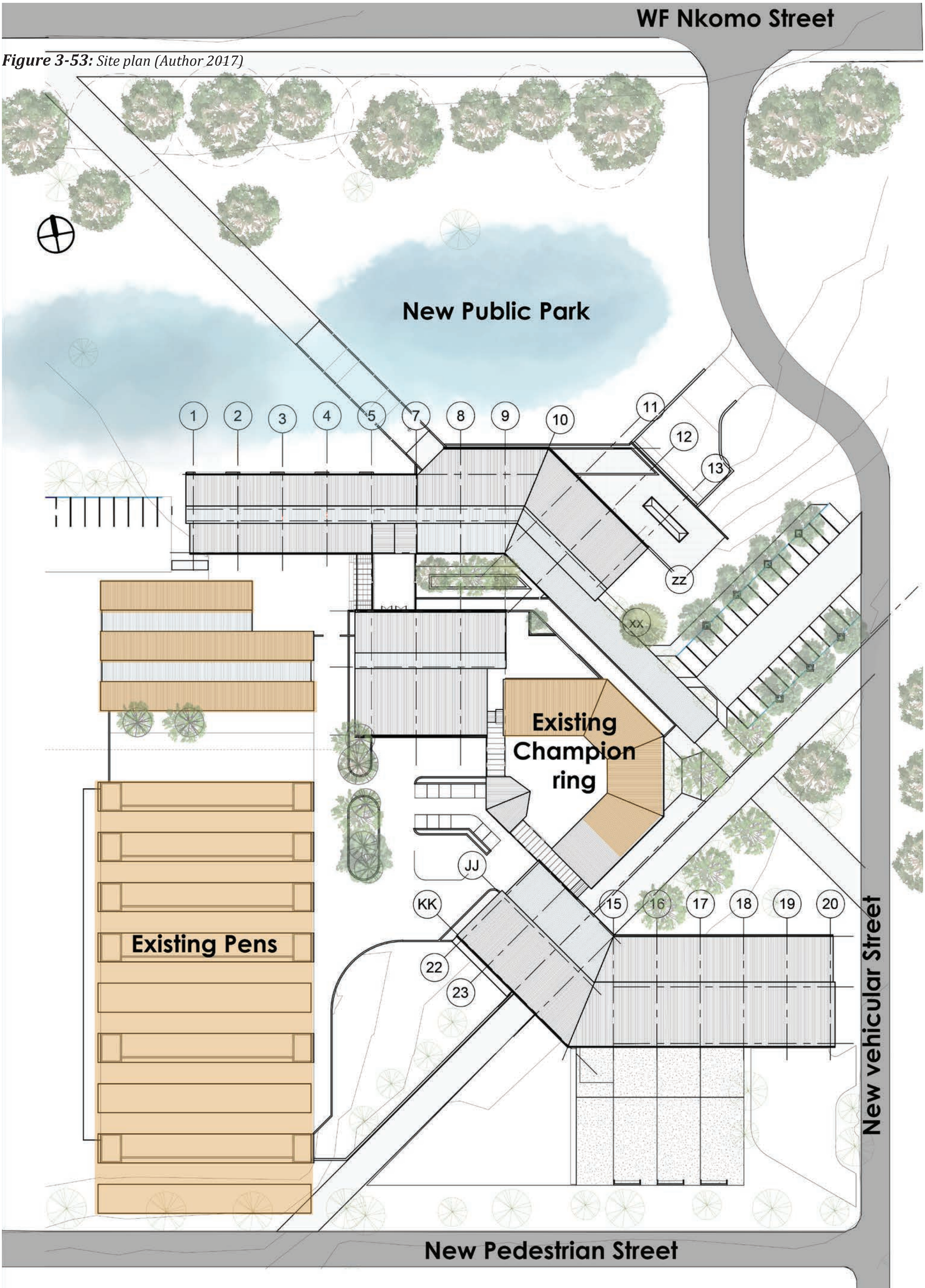
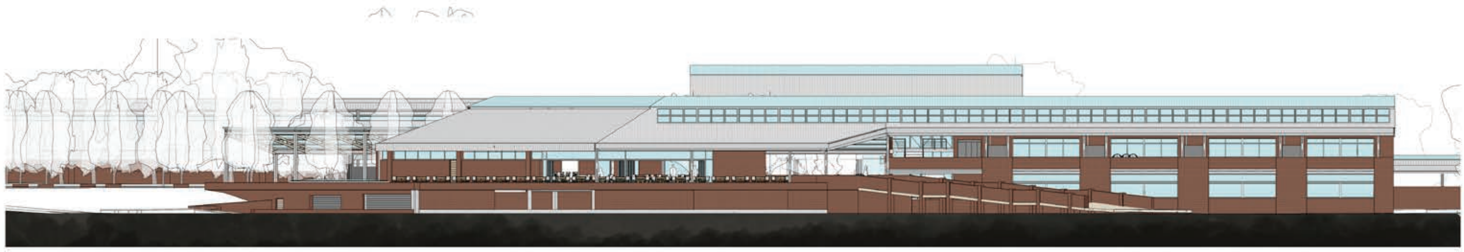
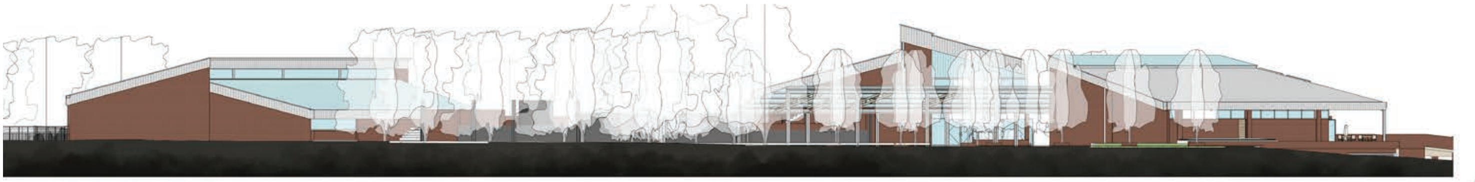


Figure 3-53: Site plan (Author 2017)



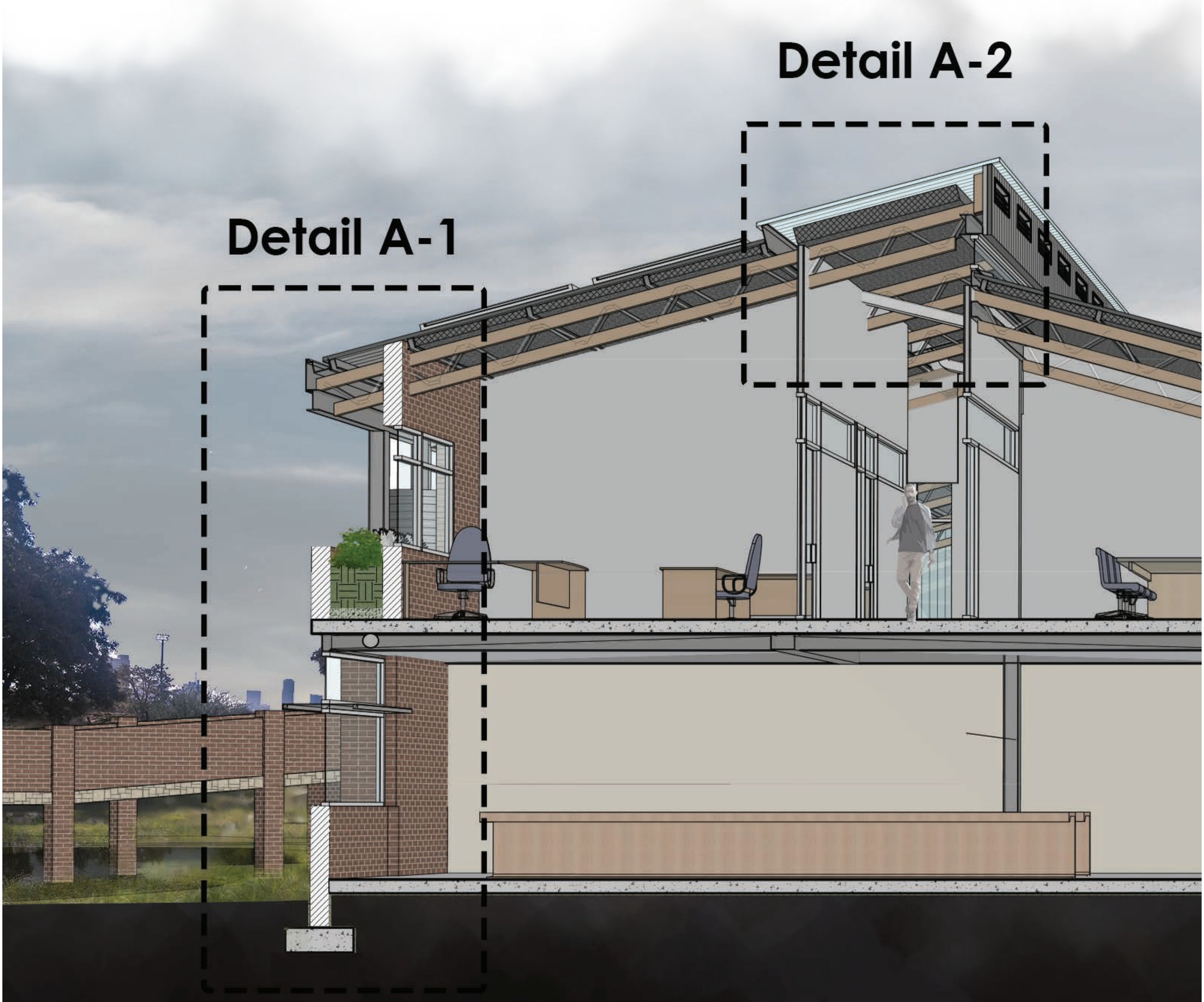


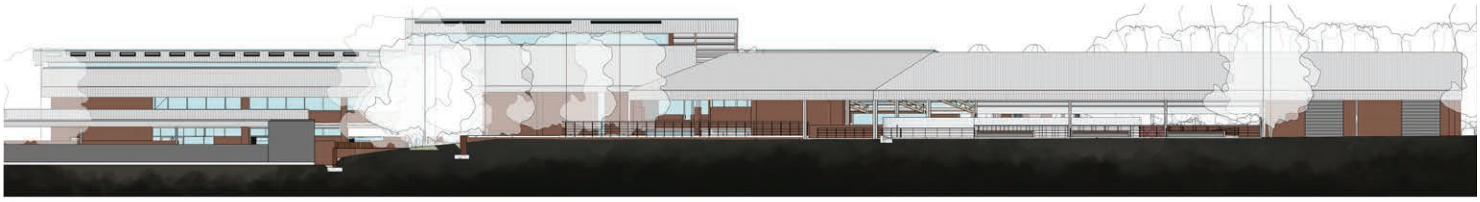
NORTH ELEVATION



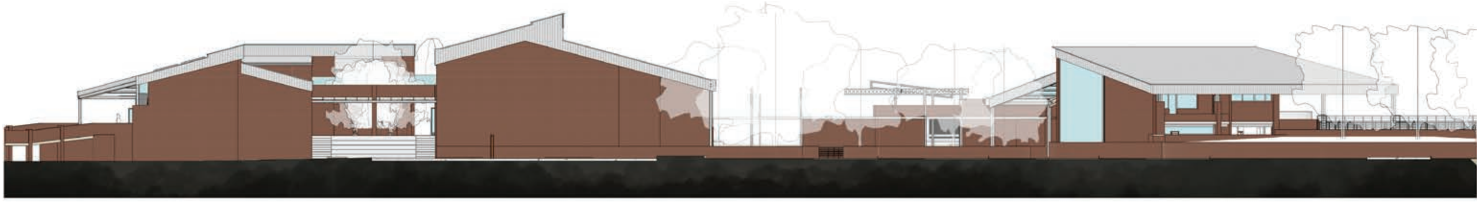
EAST ELEVATION

SECTION A



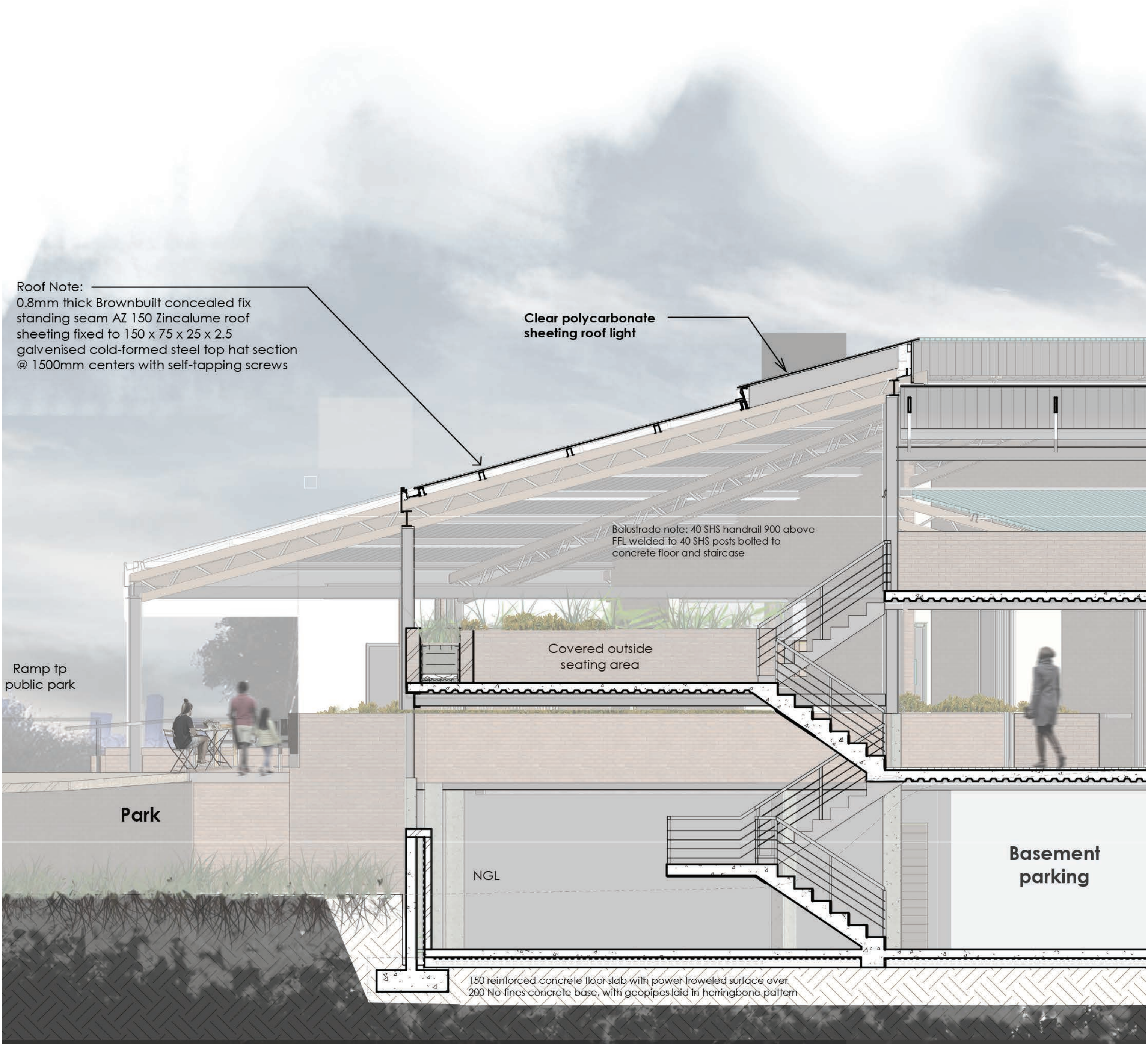


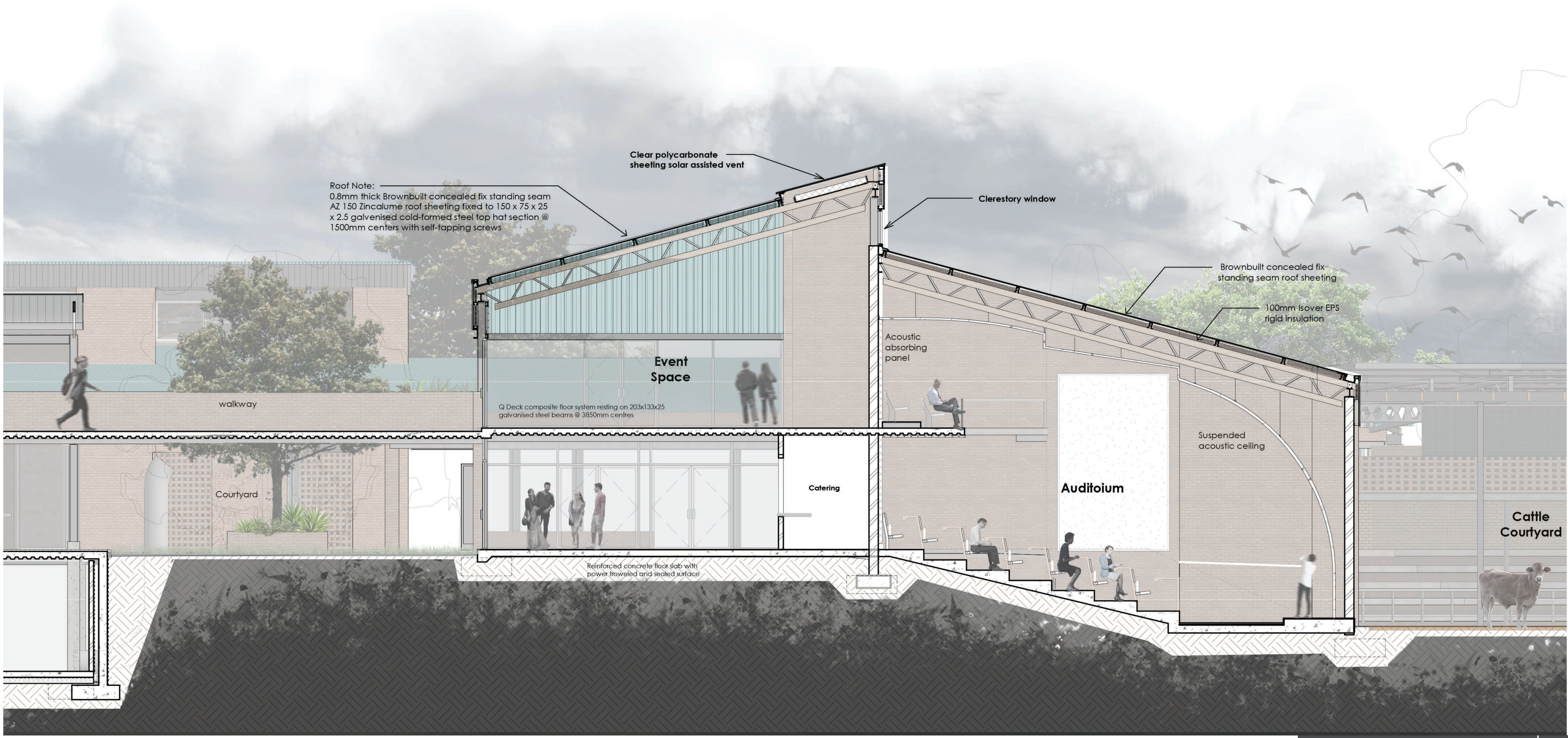
SOUTH ELEVATION

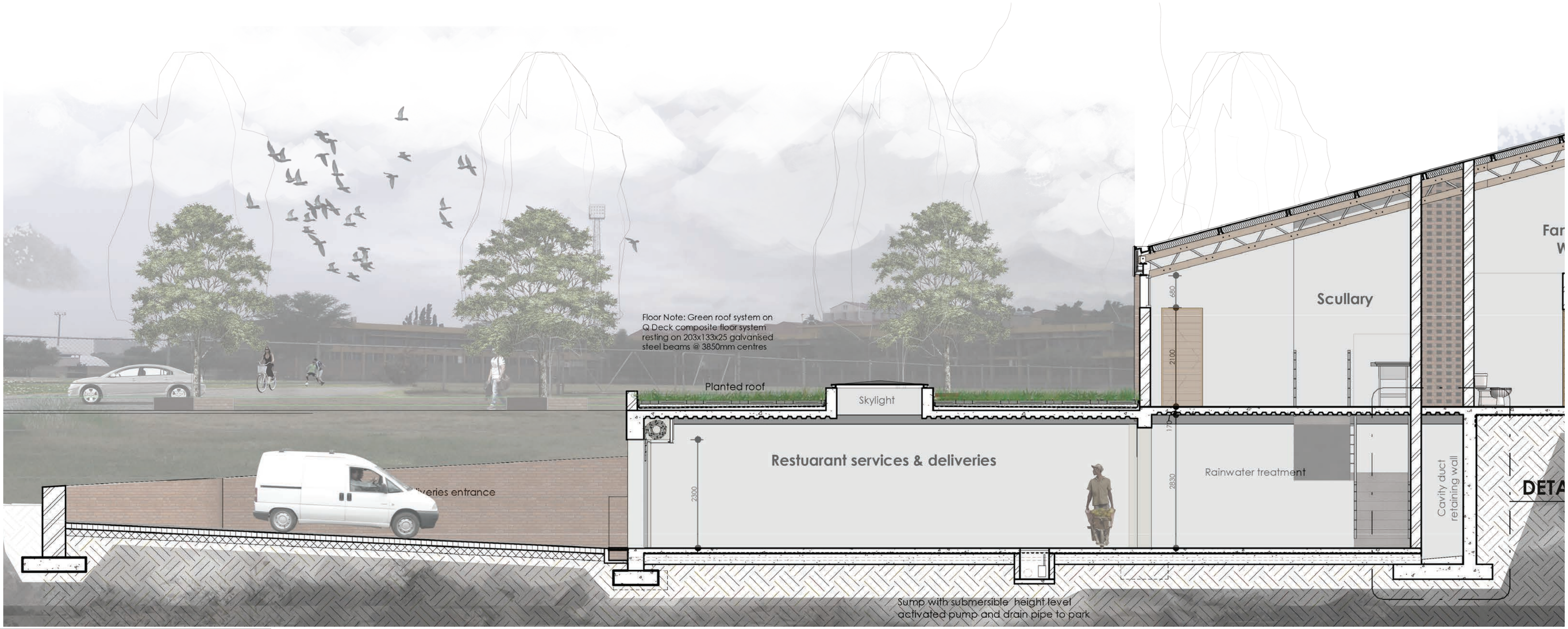


WEST ELEVATION

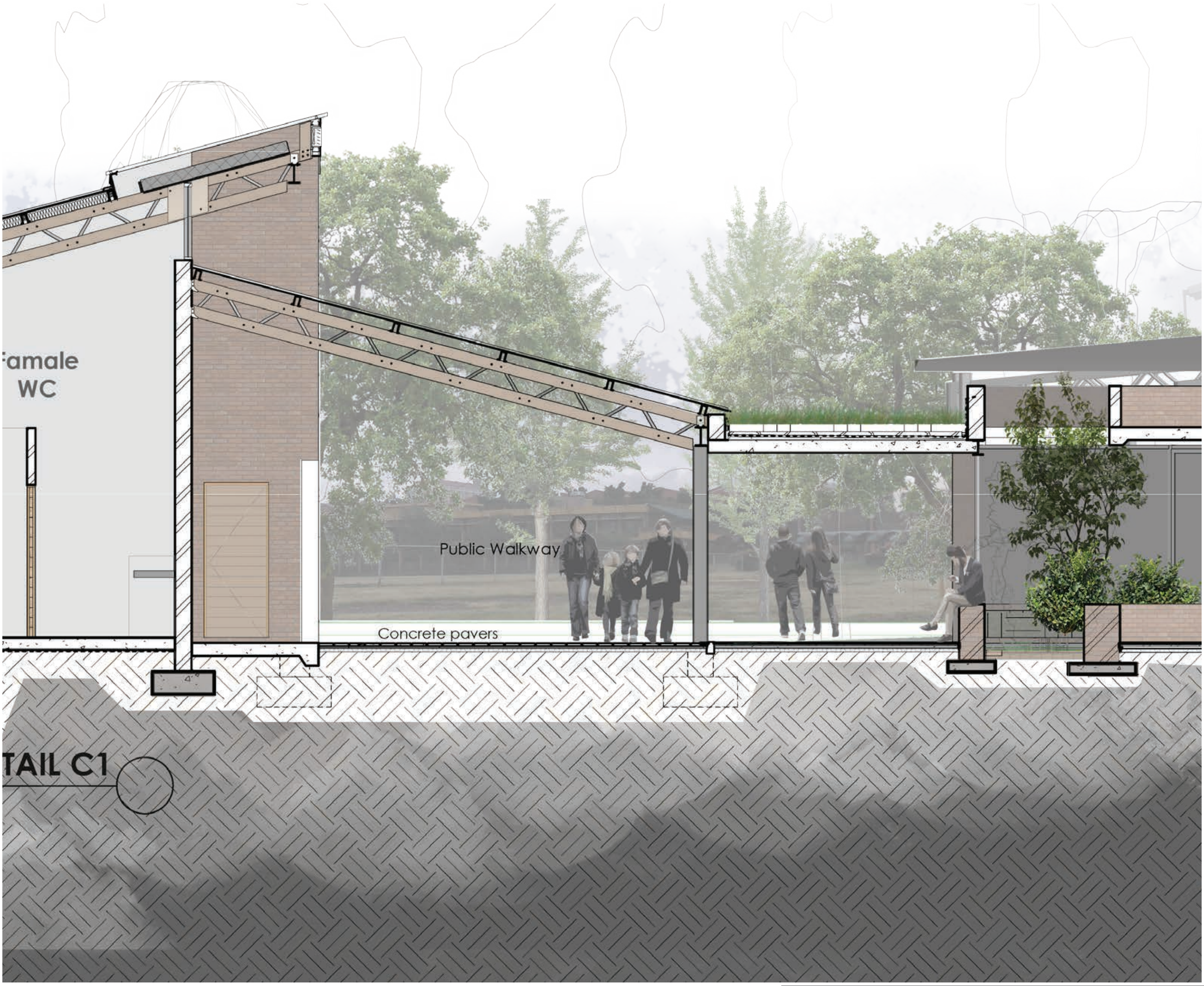
SECTION B

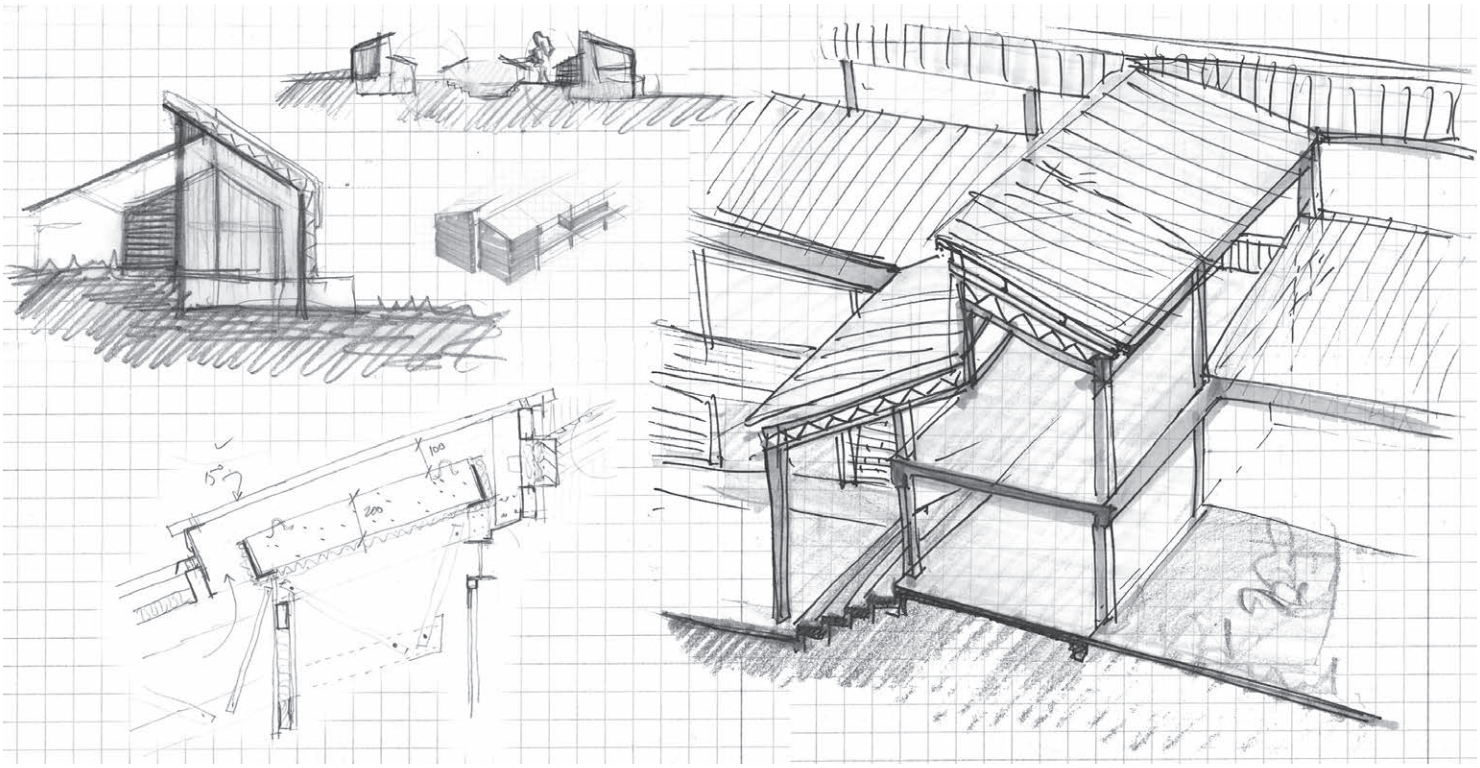

Roof Note:
0.8mm thick Brownbuilt concealed fix standing seam AZ 150 Zincalume roof sheeting fixed to 150 x 75 x 25 x 2.5 galvenised cold-formed steel top hat section @ 1500mm centers with self-tapping screws
Clear polycarbonate sheeting roof light
Balustrade note: 40 SHS handrail 900 above FFL welded to 40 SHS posts bolted to concrete floor and staircase
Covered outside seating area
Ramp tp public park
Park
NGL
Basement parking
150 reinforced concrete floor slab with power troweled surface over 200 No-fines concrete base, with geopipes laid in herringbone pattern


Clear polycarbonate sheeting solar assisted vent
Roof Note:
0.8mm thick Brownbuilt concealed fix standing seam AZ 150 Zincalume roof sheeting fixed to 150 x 75 x 25 x 2.5 galvanised cold-formed steel top hat section @ 1500mm centers with self-tapping screws
Clerestory window
Brownbuilt concealed fix standing seam roof sheeting
100mm Isover EPS rigid insulation
Acoustic absorbing panel
Event Space
walkway
Q Deck composite floor system resting on 203x133x25 galvanised steel beams @ 3850mm centres
Suspended acoustic ceiling
Catering
Courtyard
Auditoium
Cattle Courtyard
Reinforced concrete floor slab with power troweled and sealed surface


Floor Note: Green roof system on Q Deck composite floor system resting on 203x133x25 galvanised steel beams @ 3850mm centres
Planted roof
Skylight
Sculllary
Restuarant services & deliveries
Rainwater treatment
Cavity duct retaining wall
2300
2830
2100
680
Sump with submersible height level activated pump and drain pipe to park

SECTION C





3.4: TECHNICAL DEVELOPMENT

TECHNICAL CONCEPT

The technical approach looks at reinterpreting the agricultural barn typology and simple steel frame to address awareness through the interface between public and agricultural spaces.

Materials

The structural steel girders makes use of reclaimed steel from the demolished pens next to the site, lowering the structural system's embedded energy.

Bricks used for walls can be sourced locally and are thermally efficient as well as economic and appropriate to the site. Contrasting elements such as clear and translucent polycarbonate sheeting are used to articulate public and private spaces and allow for varying amounts of light and solar heat gain.

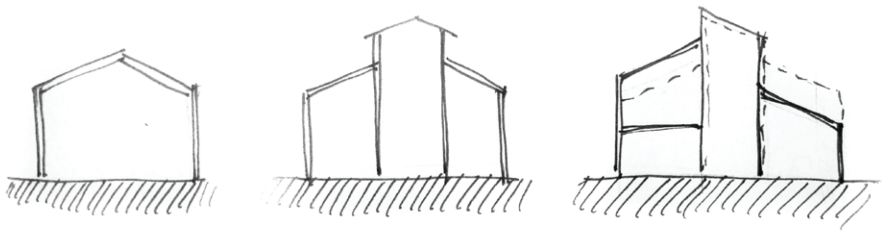
Systems

The building systems are approached according to the flows in the LENSES framework. These consist of site, water and energy systems as well as materials and well-being aspects. Each of these will be iterated to result in an positive contribution of the building to the site. This will include a grey-water systems, photovoltaic and bio-gas from manure as well as passive heating and cooling and planting within the building

Figure 3-54: *Top; conceptual skectes (Author, 2017)*

Figure 3-55: *Left; Existing structural systems and steel round hollow sections from the existing pens that can be reused as the internal members of a lattice truss system (Author, 2017)*

Figure 3-56: *Below; A diagramatic representation of how the typical barn section was developed (Author, 2017)*

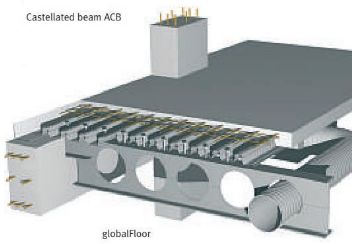


MATERIALS

Structure:

Beams and columns from hot rolled steel sections, primed and finished with paint system.

Concrete basement columns and footings.

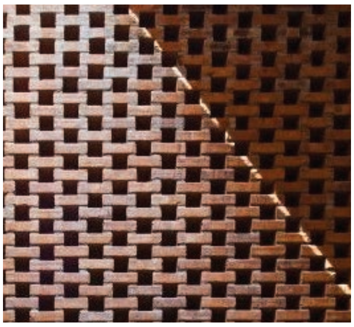


Truss system:

Lattice girder from reclaimed 50mm round hollow steel sections, with ends flattened, bolted between two 152x38 SA pine beams

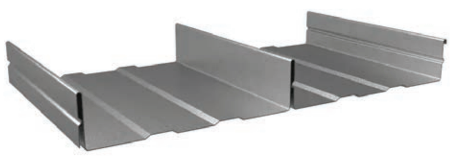
Walls:

Redwood facebrick (From Rosema Factory, Gauteng)



Roof:

Brownbuilt concealed fix standing seam AZ 150 Zincalume roof sheeting, light grey



Floor surfaces:

Feed-lot: Rolled compacted concrete with hay over

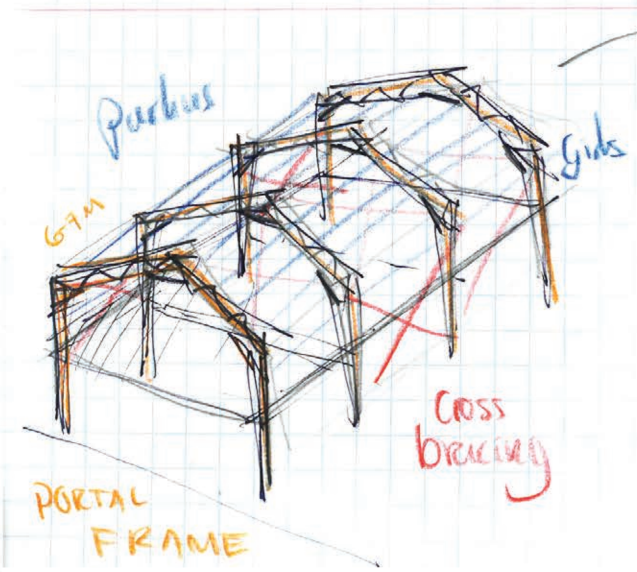
Offices, lobby & restaurant: Porcelain tiles

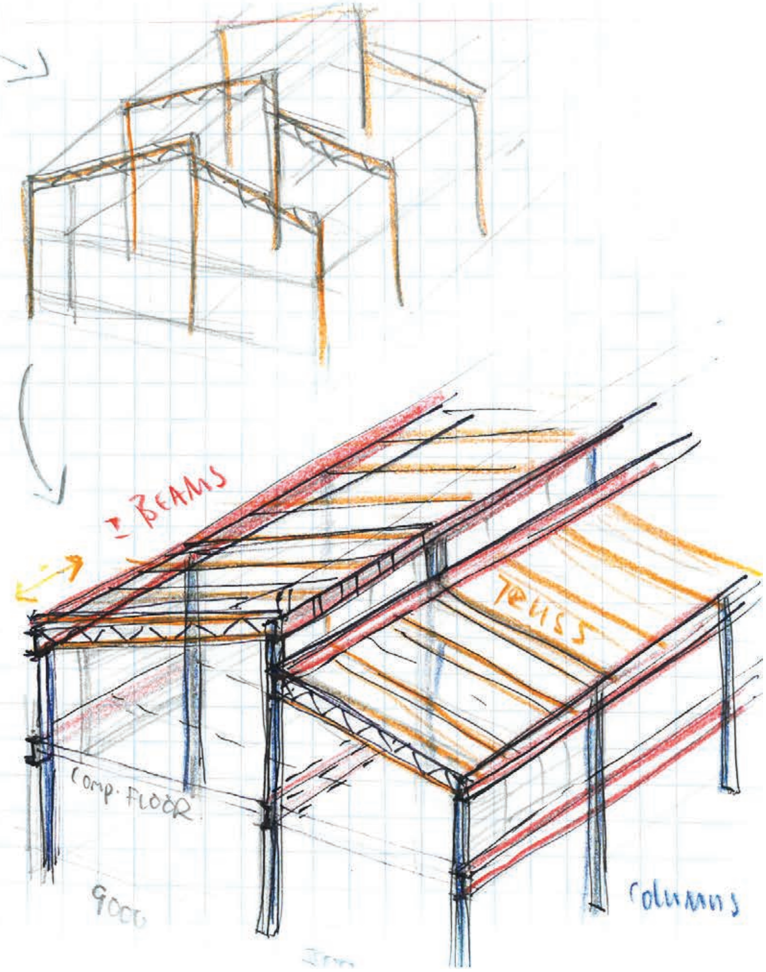
Paving:

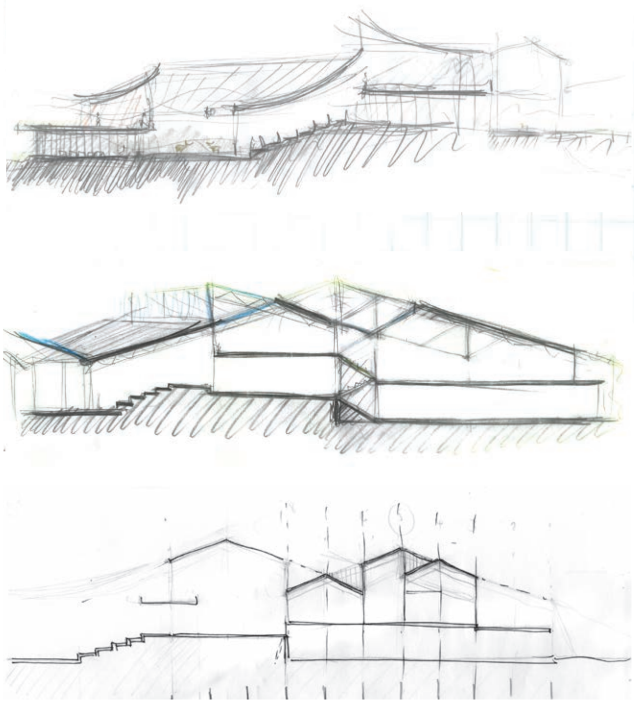
Concrete pavers: interlocking for main public walkway, cobbles for other walkways

Parking: permeable pavers

STRUCTURE DEVELOPMENT







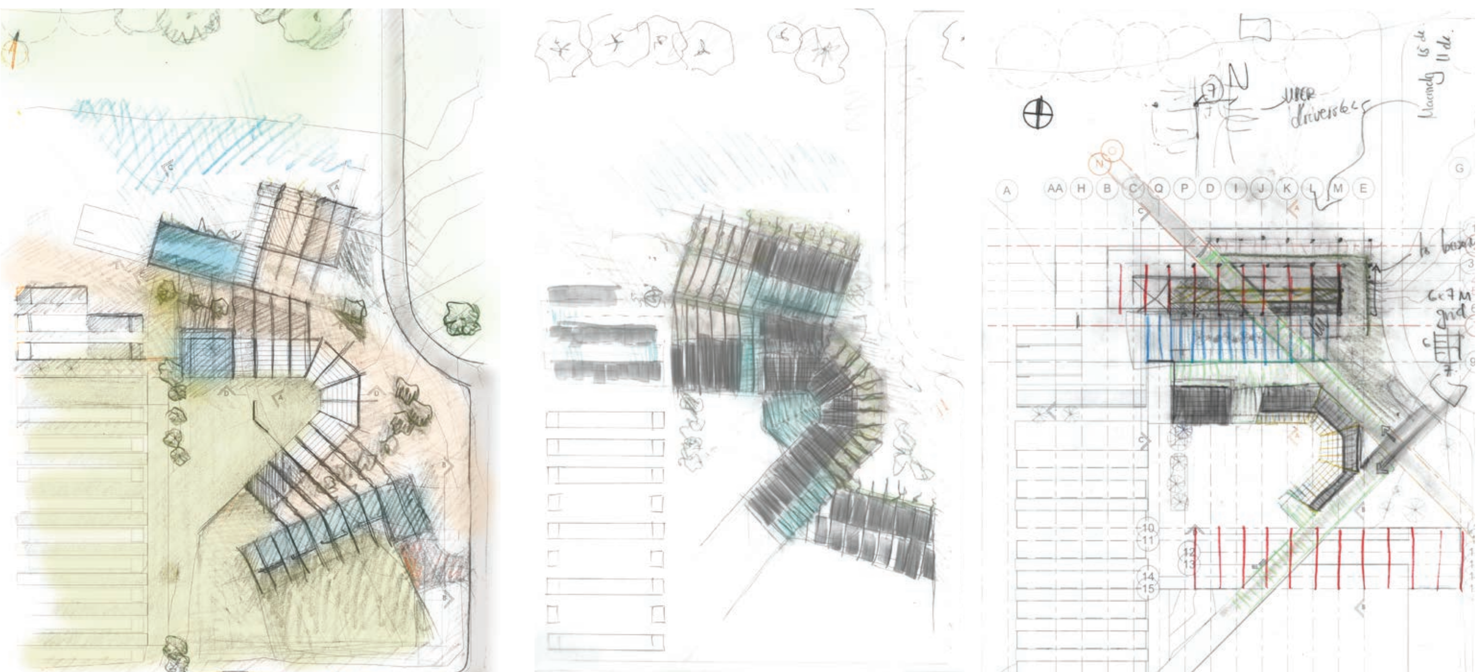
SECTION DEVELOPMENT

Figure 3-57: *Above; Development of the structural system from a steel portal frame to a beam and truss system (Author, 2017)*

Figure 3-58: *Left; Conceptual section sketches*

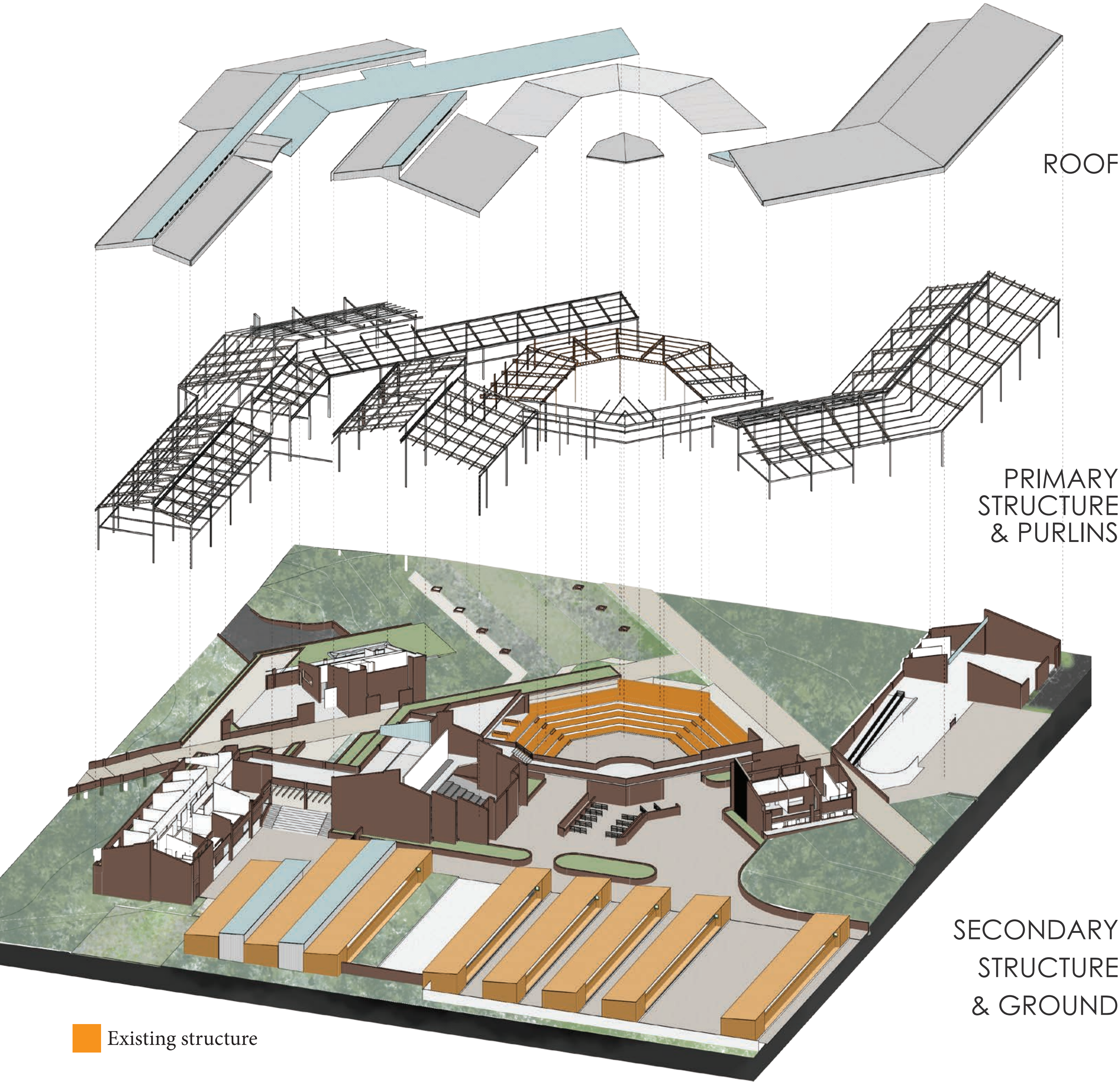
Figure 3-59: *Below; Development of grid and beam system on plan iterations 2-3 (Author, 2017)*

Figure 3-60: *Opposite; 3D Section of final construction system (Author, 2017)*

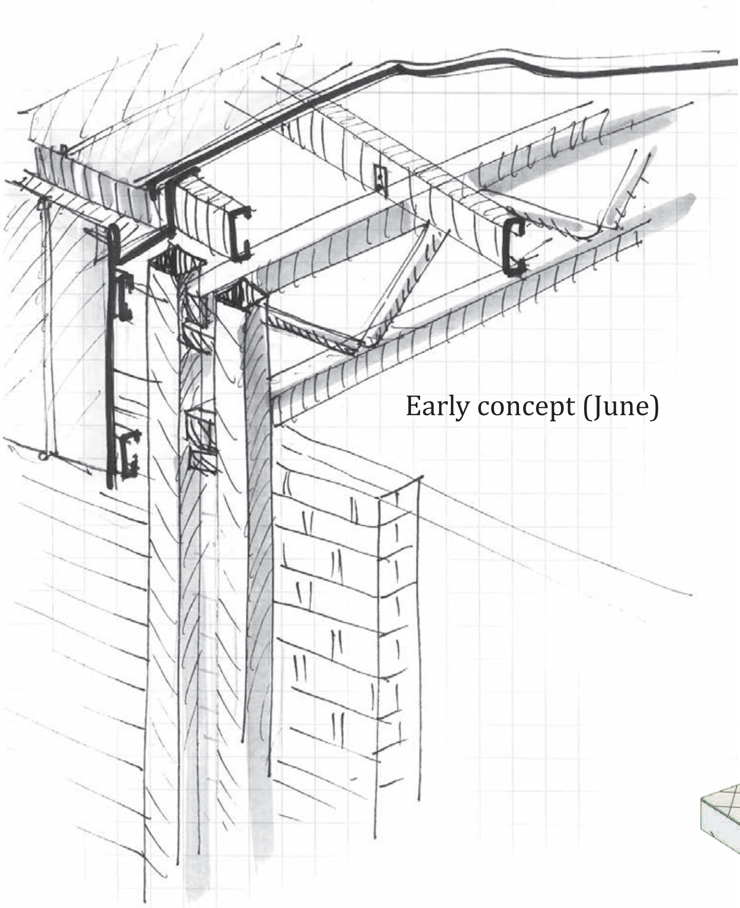


STRUCTURAL SYSTEM

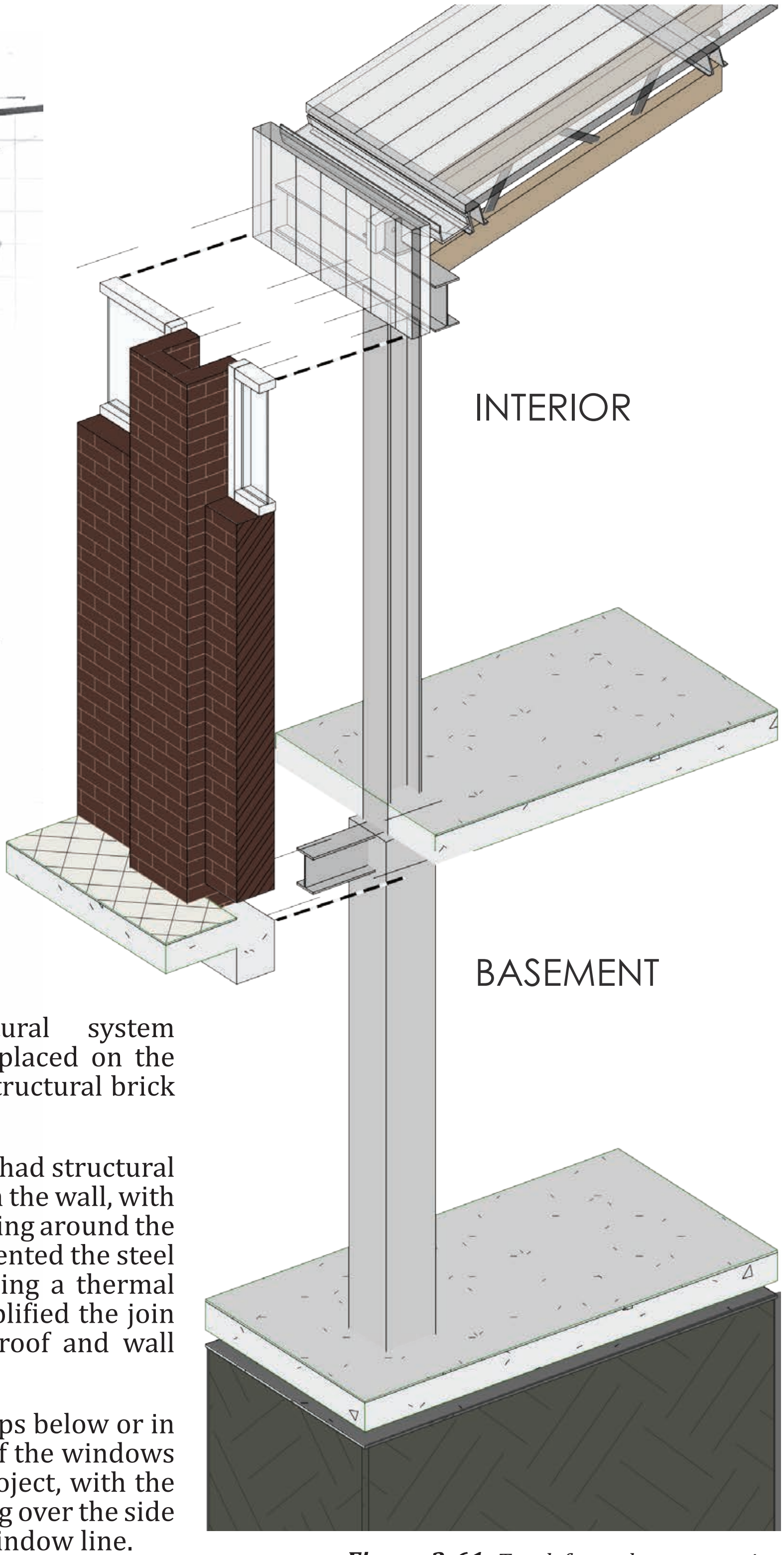
The structural system references the existing champion ring structure on site, which features steel columns, girders and castellated beams with brick infill walls and IBR roof sheeting. These systems and the basic barn typology are reinterpreted in response to the program, the theoretical argument and environmental systems. This is achieved by stepping the steel frame and roof vertically to accommodate the program and spatial requirements and varying the infill brickwork and concrete floors for appropriate thermal mass. The concrete roof of the basement level acts as an extension of the entrance level ground plain, stepping down to the lower park level, with the upper levels making use of suspended flooring systems.

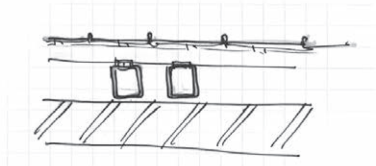


POSITION OF COLUMNS & WALLS

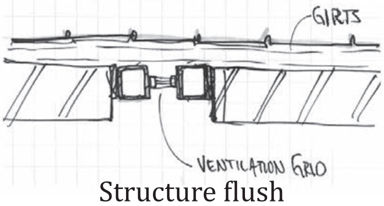


Early concept (June)

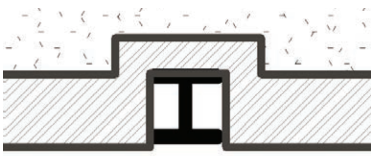




Structure outside



Structure flush



Structure flush & enclosed to prevent thermal bridge

The initial structural system had the columns placed on the outside of a non structural brick skin.

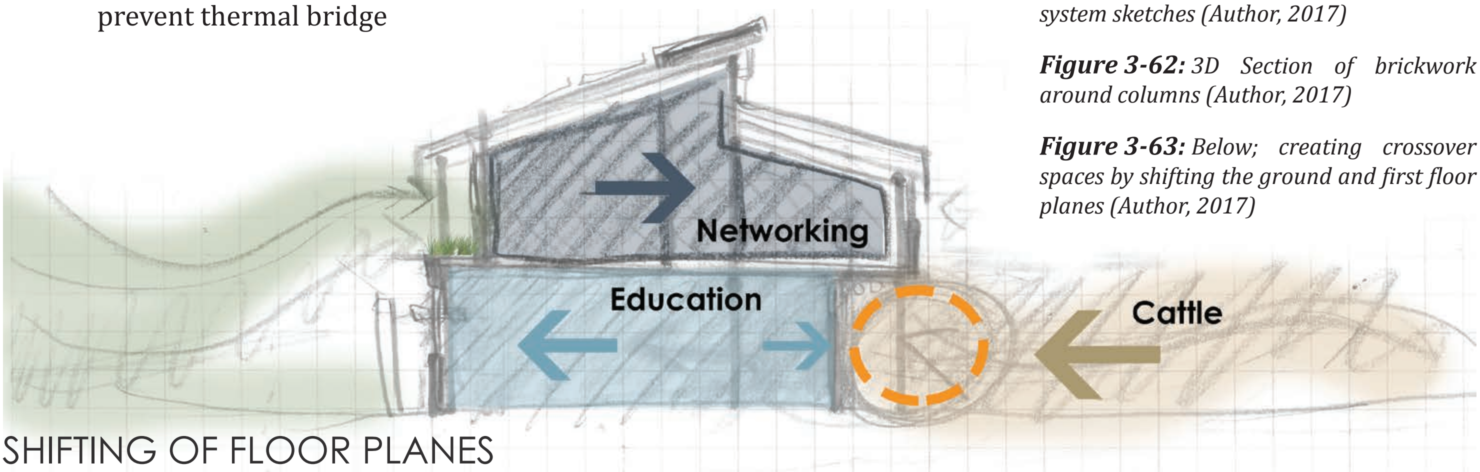
The final iteration had structural columns flush with the wall, with a brick skin wrapping around the exterior. This prevented the steel column from causing a thermal bridge, and simplified the join detail where the roof and wall meets.

The brickwork stops below or in line with the top of the windows throughout the project, with the steel roof extending over the side to the top of the window line.

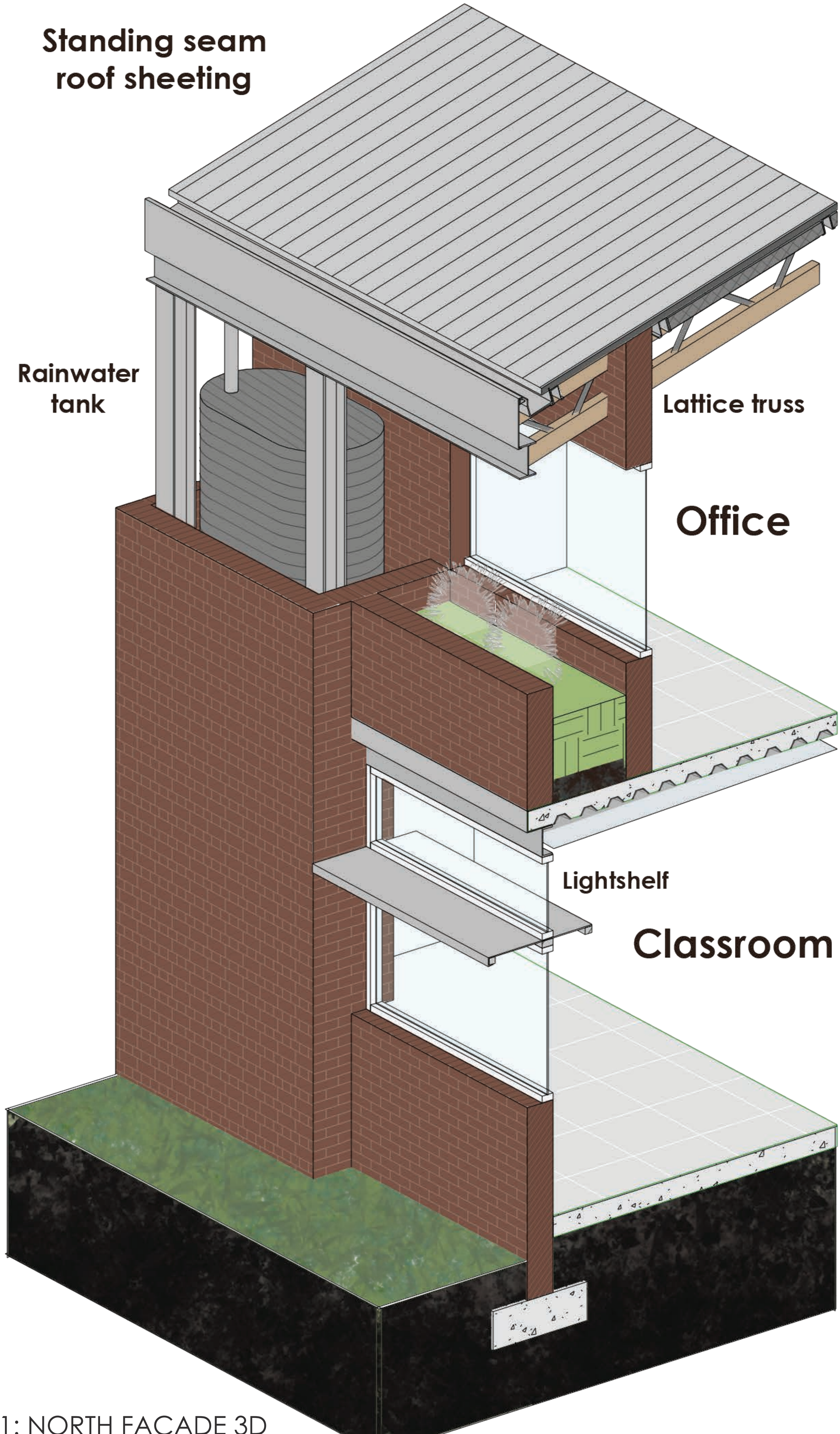
Figure 3-61: *Top left; early construction system sketches (Author, 2017)*

Figure 3-62: *3D Section of brickwork around columns (Author, 2017)*

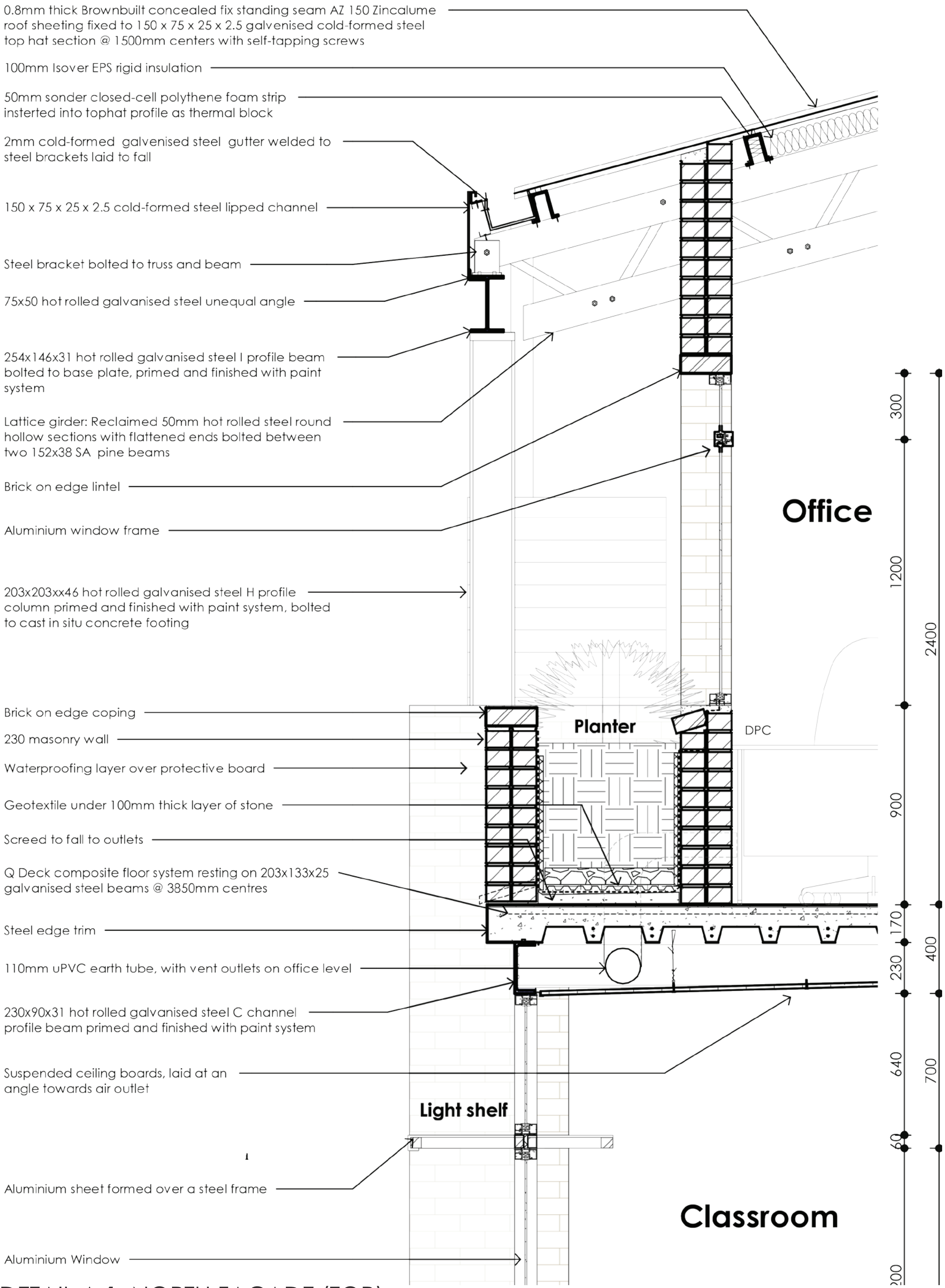
Figure 3-63: *Below; creating crossover spaces by shifting the ground and first floor planes (Author, 2017)*



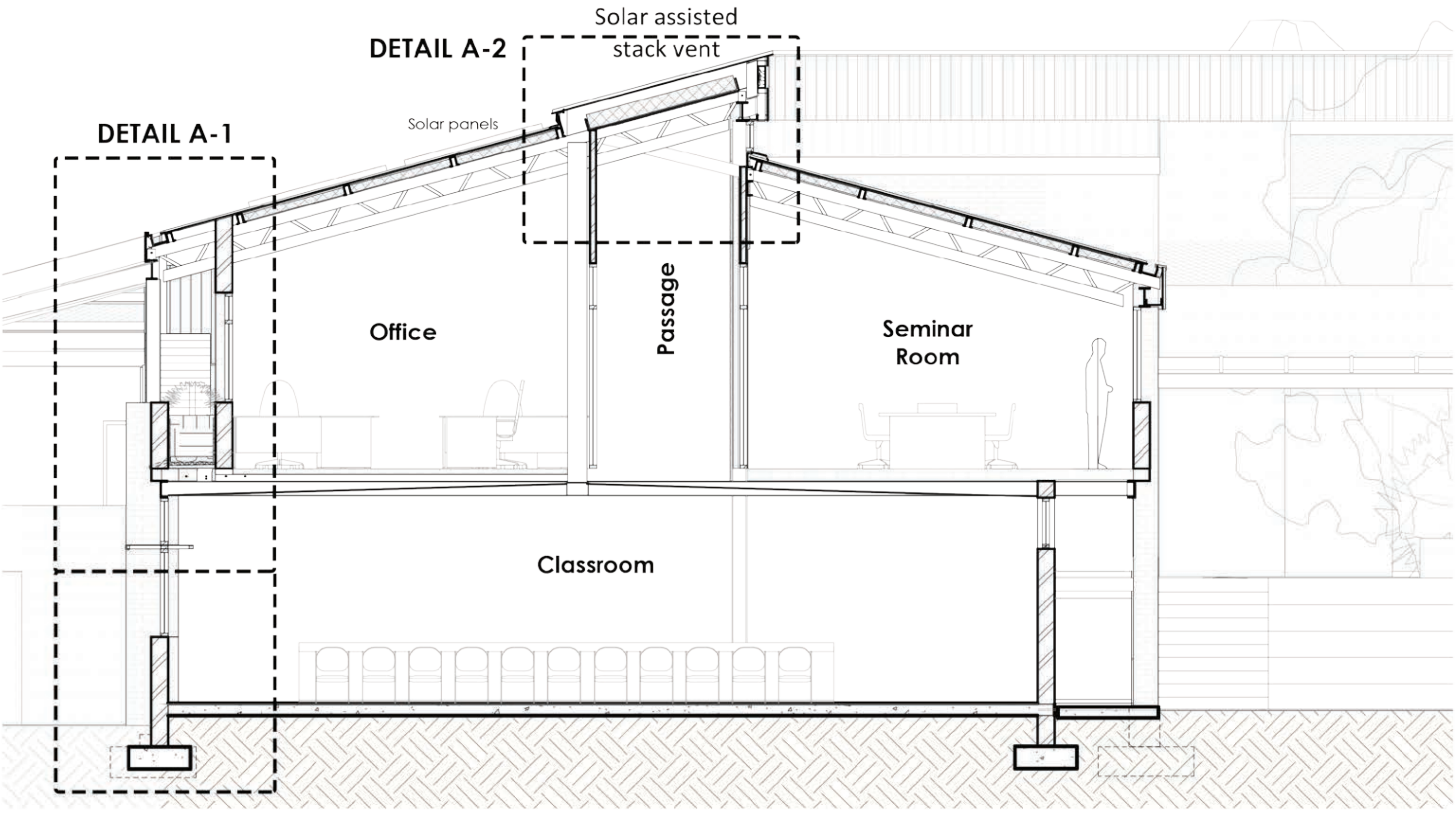
SHIFTING OF FLOOR PLANES



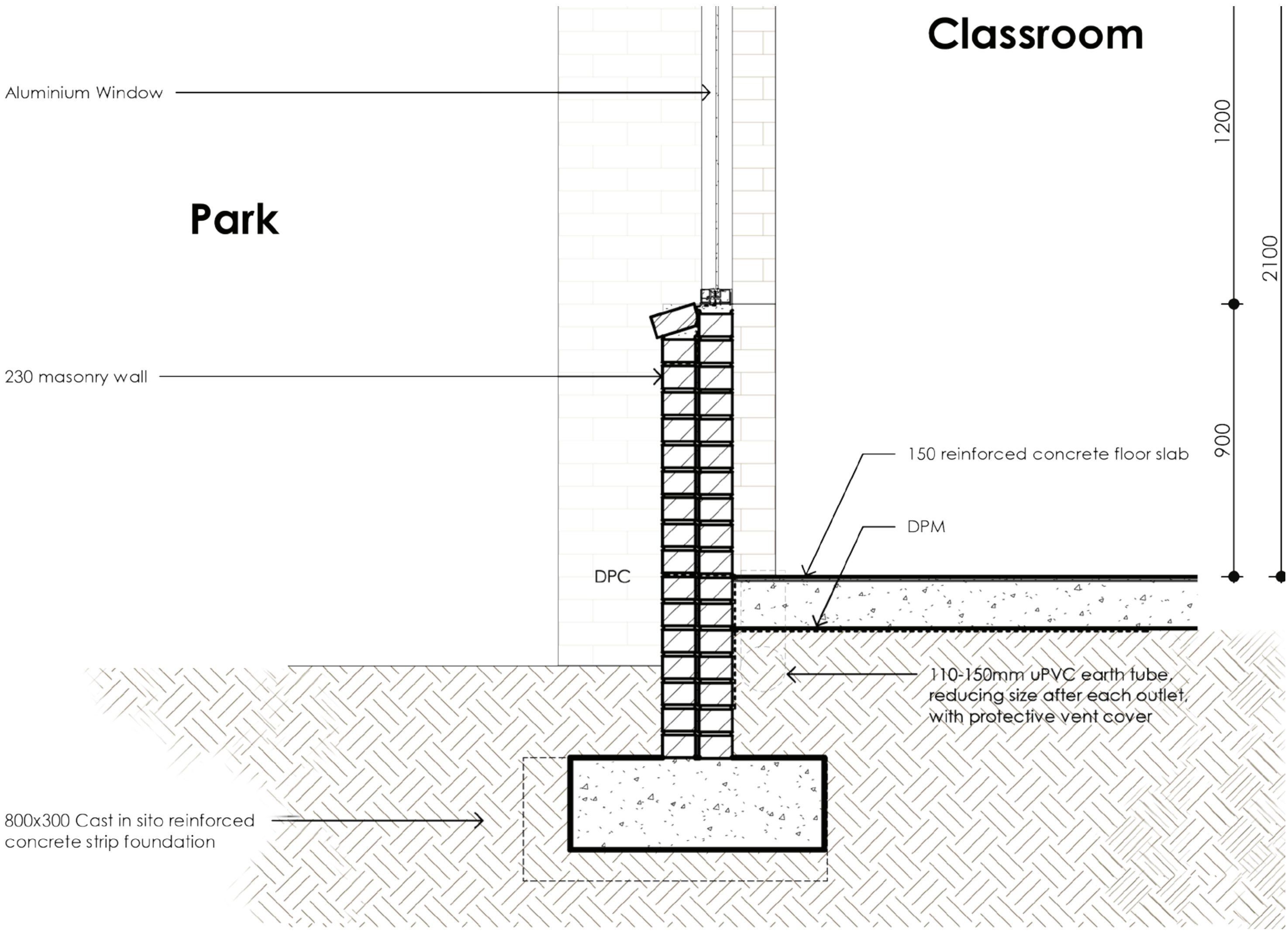
DETAIL A 1: NORTH FACADE 3D



DETAIL A 1: NORTH FACADE (TOP)

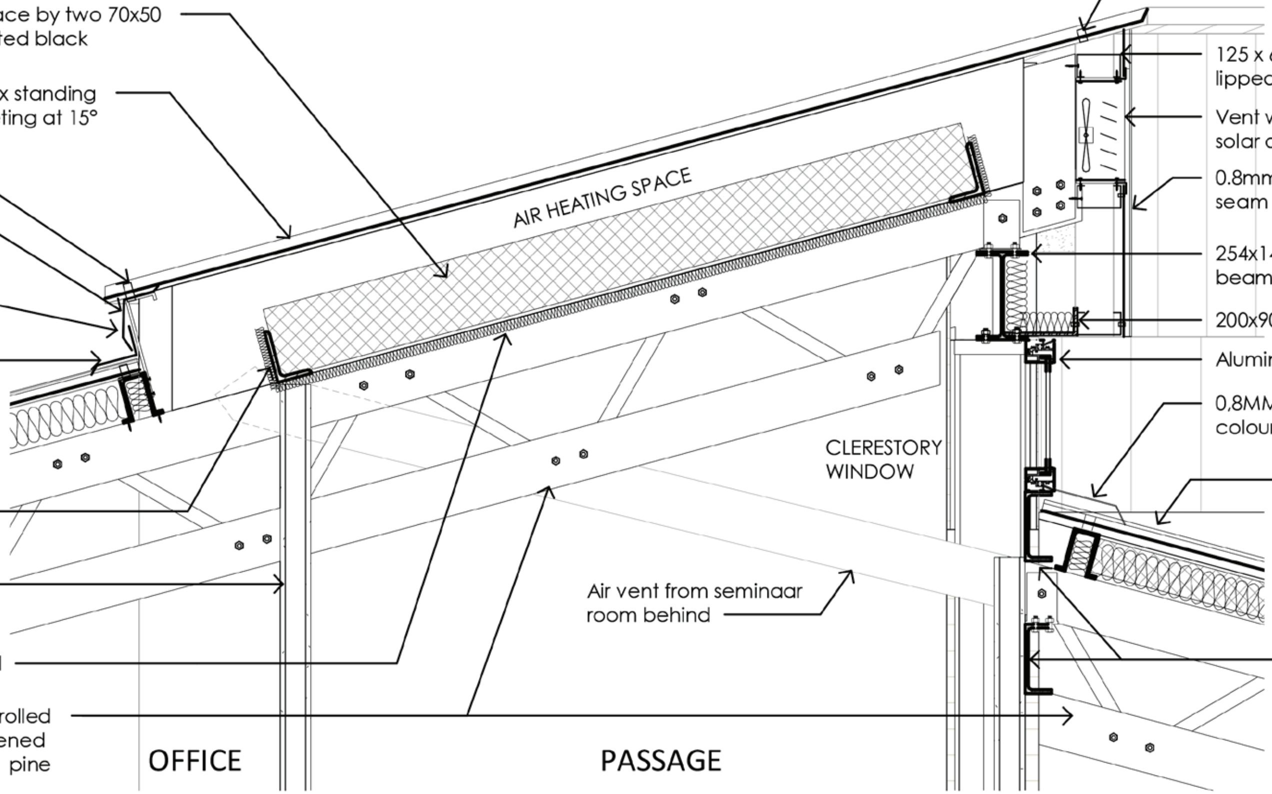


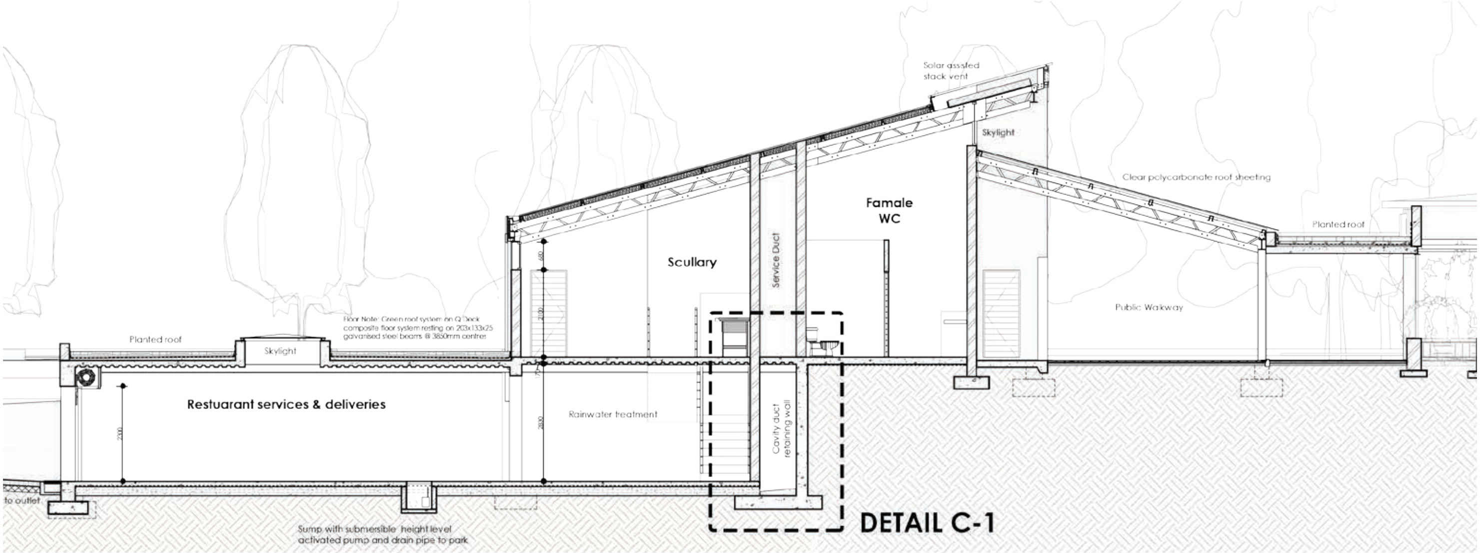
SECTION A - CLASSROOMS AND OFFICES



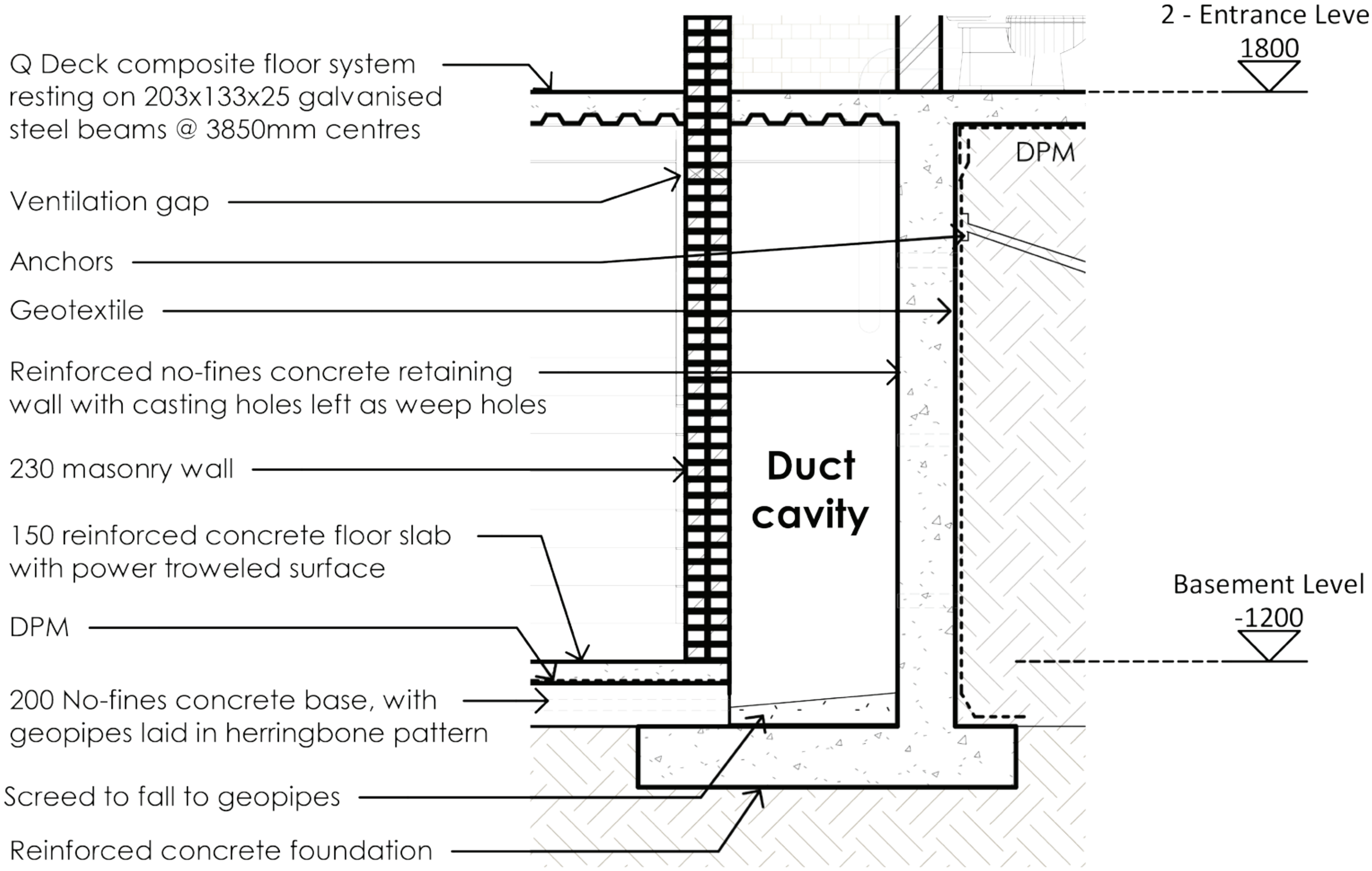
DETAIL A 1: NORTH FACADE (BOTTOM)

Detail section A2 - Solar stack





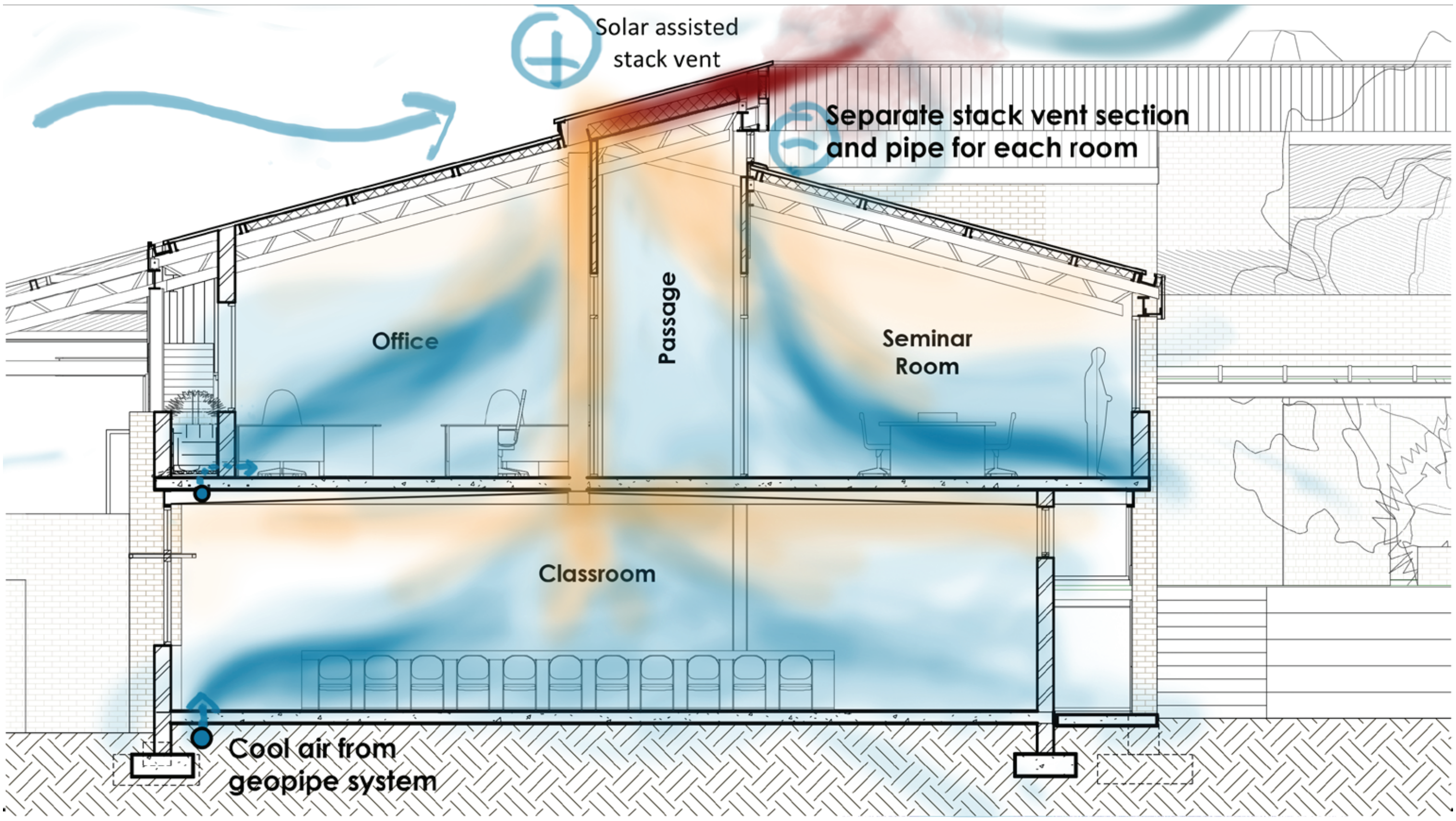
SECTION C - KITCHEN AND ABLUTION BLOCK



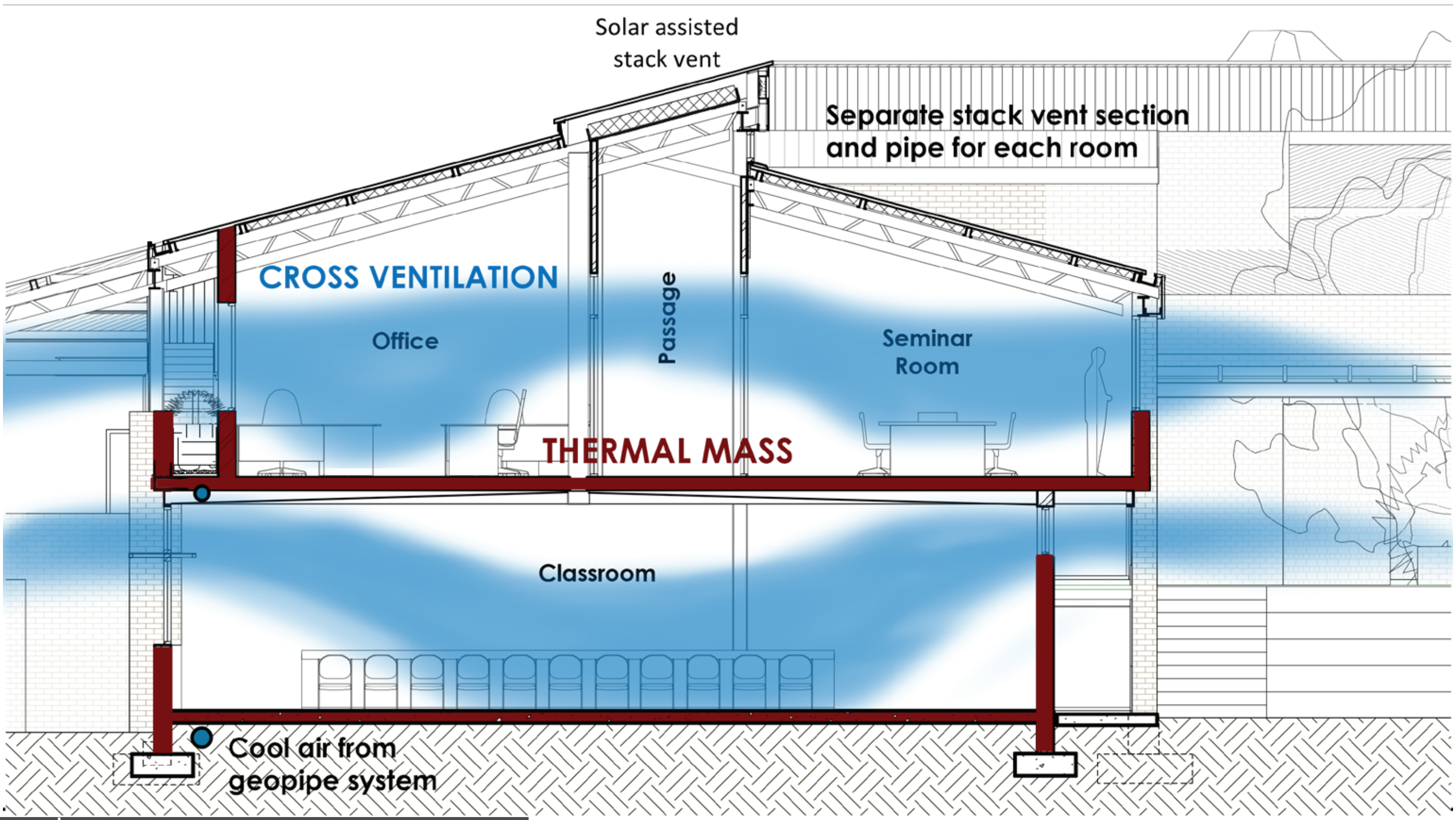
DETAIL SECTION B1 - RETAINING WALL DUCT

SYSTEMS

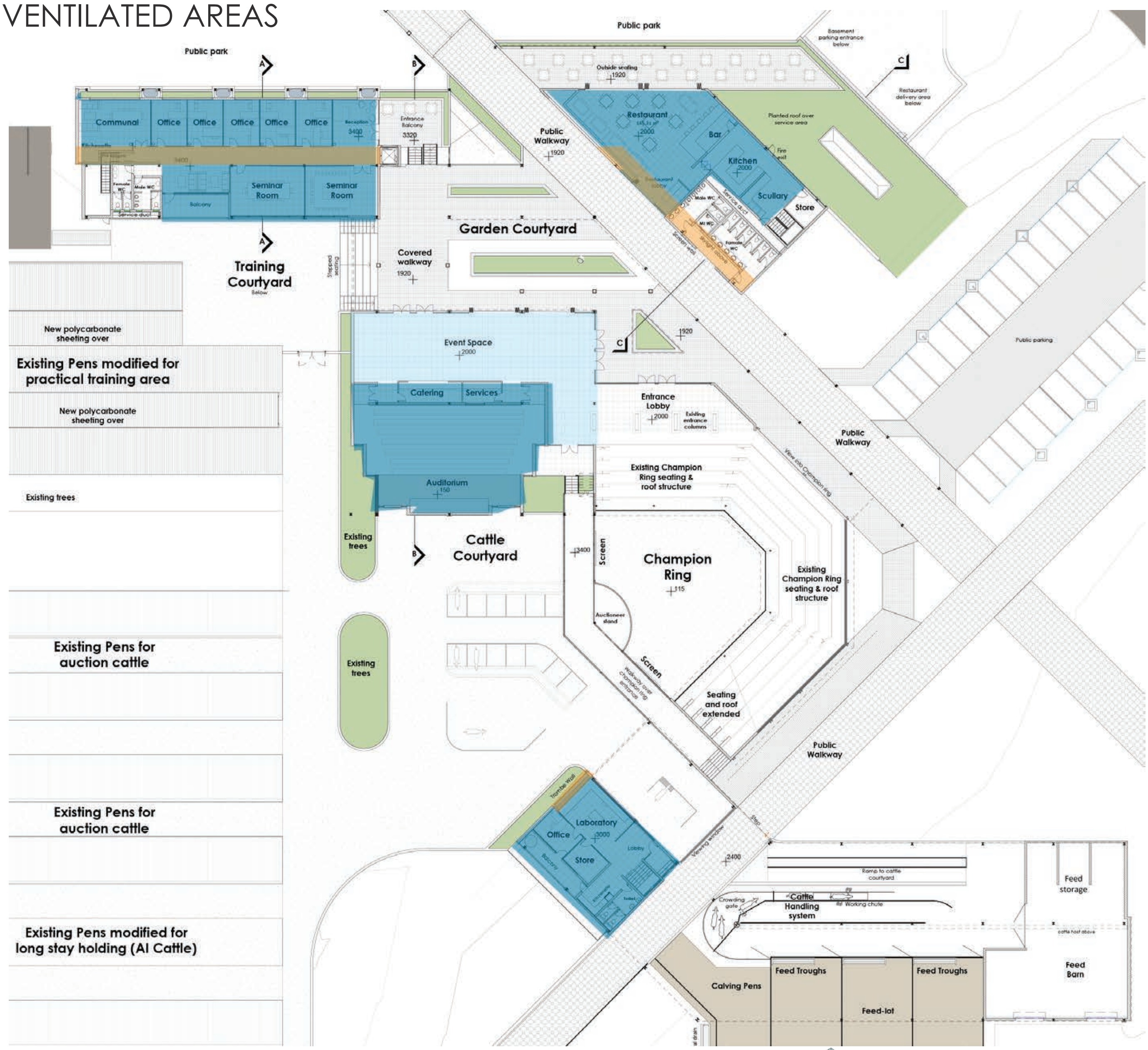
DAYTIME VENTILATION



NIGHT HEAT VENTING



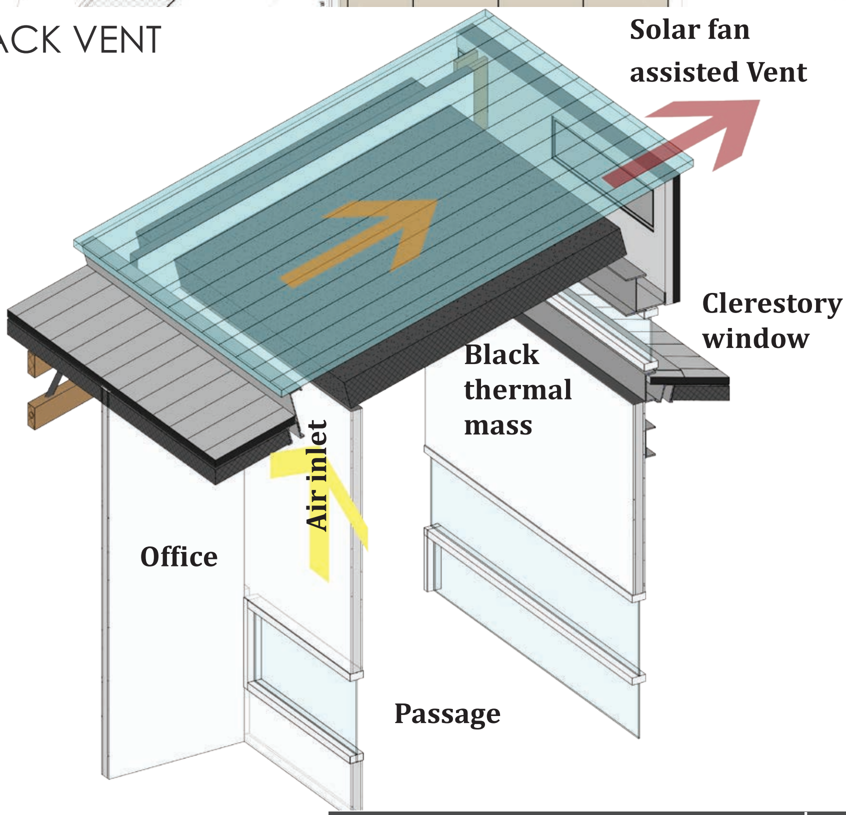
VENTILATED AREAS

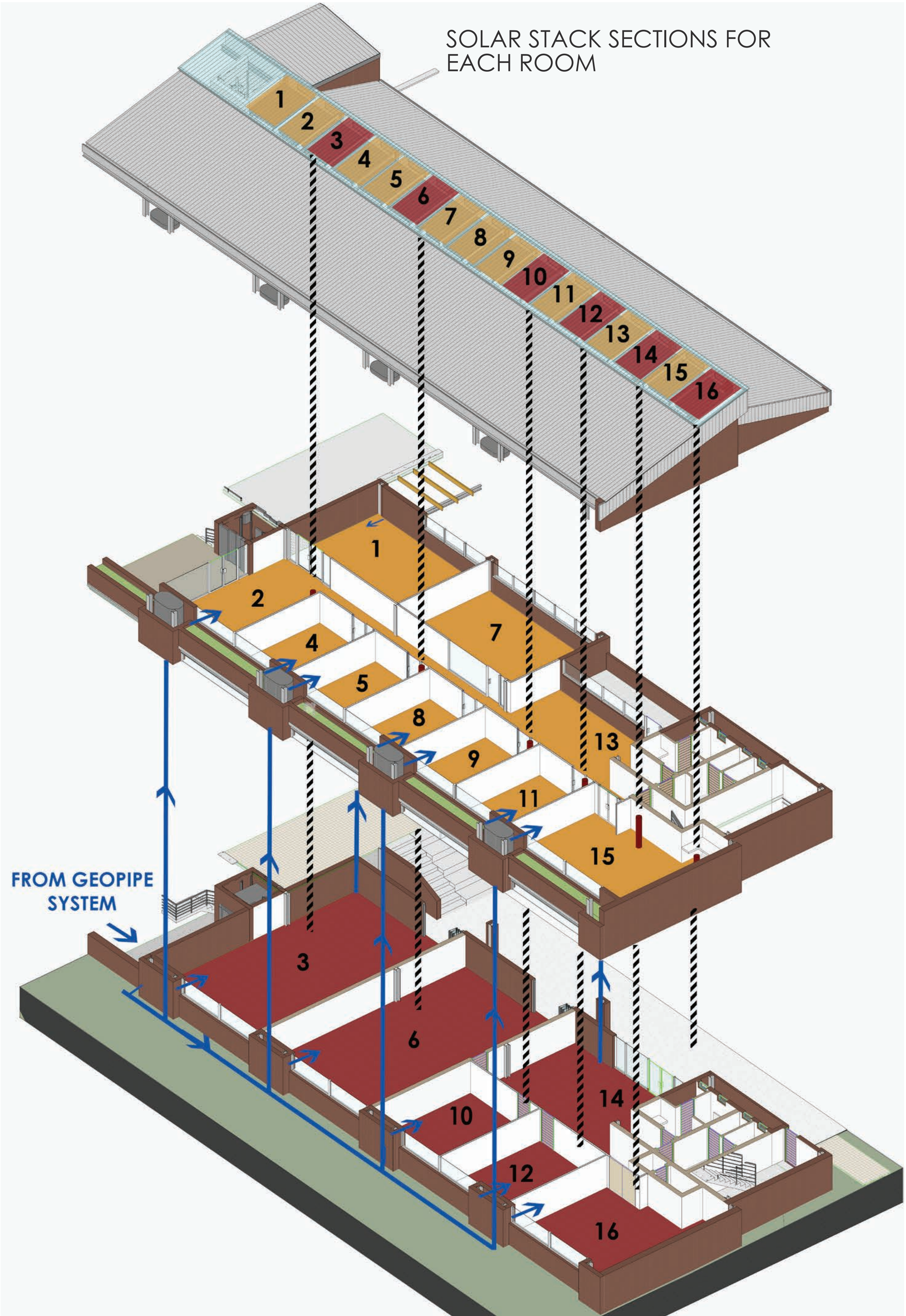


SOLAR ASSISTED STACK VENT 3D AXONOMETRIC

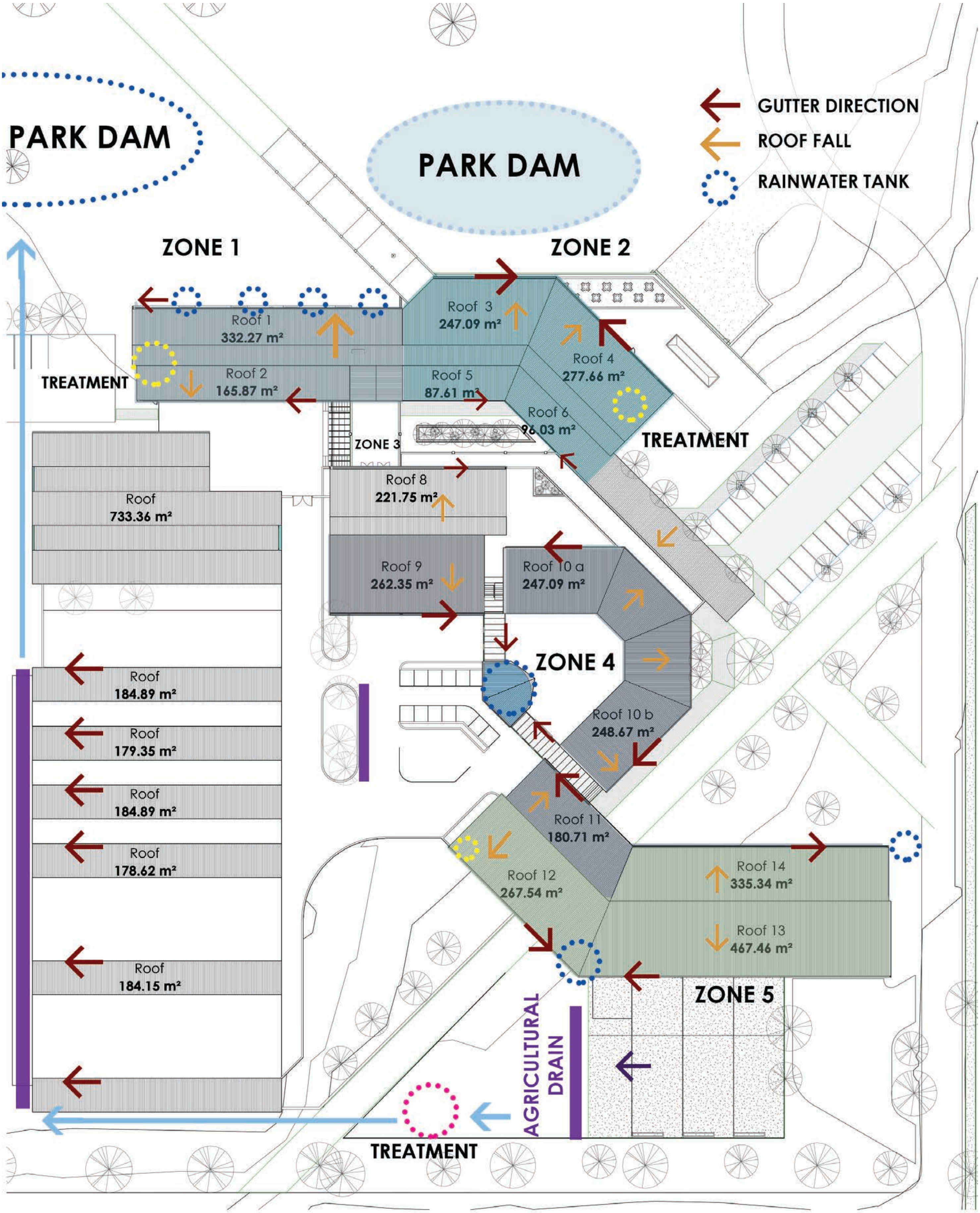
The plan layout was adjusted to keep the ventilated spaces to a minimum. This was achieved by placing the circulation core, ablutions and service areas separate from the habitable rooms such as the offices, classrooms and auditorium. The solar assisted stack vent stretching the length of the roof is split into sections so that each room or area is ventilated by its own section.

At night certain windows are opened automatically so enable cross ventilation to cool north wing of the building.

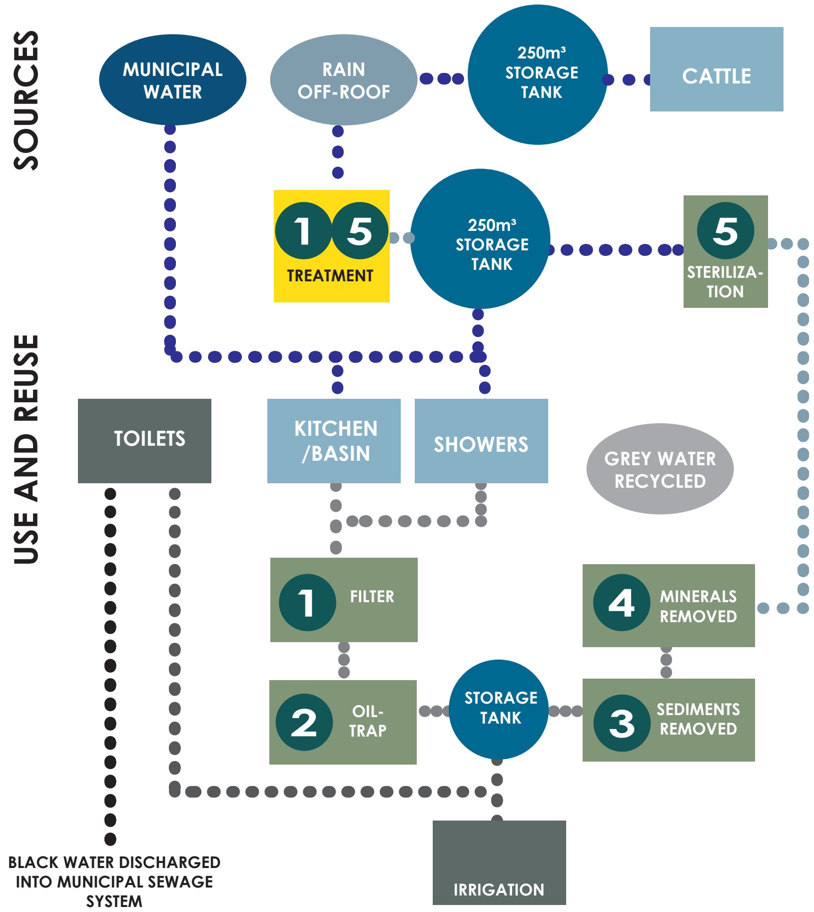



SOLAR STACK SECTIONS FOR EACH ROOM
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
FROM GEOPIPE SYSTEM

RAINWATER HARVESTING



RAINWATER TREATMENT PROCESS



ROOF AREAS

		Total (m²)		Gutter Size (cm²)
Zone 1				
Roof 1	332			23.06
Roof 2	166			11.53
		498.00		
Zone 2				
Roof 3	247			17.15
Roof 4	278			19.31
Roof 5	88			6.11
Roof 6	96			6.67
		709.00		
Zone 3				
Roof 7	113			7.85
Roof 8	221			15.35
		334.00		
Zone 4			1541.00	
Roof 9	262			18.19
Roof 10a	247			17.15
Roof 10b	248			17.22
Roof 11	181			12.57
		938.00		
Zone 5				
Roof 12	267			18.54
Roof 13	467			32.43
Roof 14	335	1069.00		
		3548.00		
Pens	900			

Refer to appendix B for rainwater tank calculations

Water use

Nuber of People:

Offices:	15	**Restaurant & CR public:**	300
Students:	30		

Number of Cattle

Feedlot:	80.00
Pens	40.00

Annual Rain (l) 284 458

Zone 1: Offices & Training

	Per Day (l)	Monthy Total	Annual Total
Offices:			
Basins/sink	15	6 844	82 125
Toilet *(5l/flush)*	20	9 125	109 500
Classrooms			
Basins	8	7 300	87 600
Toilet	15	13 688	164 250

Zone 1: Offices & Training

Roof Area (m²):	498
Potable water needed:	
Per month	14 144
Per Year	169 725
Tank size:	55 000
Filtration Process:	Process 1-5

Water required for WC flushing (l)

Zone 1: Office	
Per month	**50 313**
Per Year	273 750
Greywater from taps per month:	**14 144**
Additional requred:	36 169
Zone 2: Ablution block	
Per month	**27 500**
Per Year	330 000
Greywater from taps & kitchen p m	**40 238**

Zone 2: Restaurant & Ablution

Ablution Block:			
Basins	0.3	2 738	32 850
Toilet	5	27 500	330 000
Restaurant:			
Kitchen	90p x 20*l*	37 500	450 000

Zone 2

Roof Area (m²): 360+115+230 =	705
Potable water needed:	
Per month	27 500
Per Year	330 000
Tank size (l):	250 000
Filtration Process:	Process 1-5

Recycled water

Irrigation

60 x small planter plus 2 x large planters

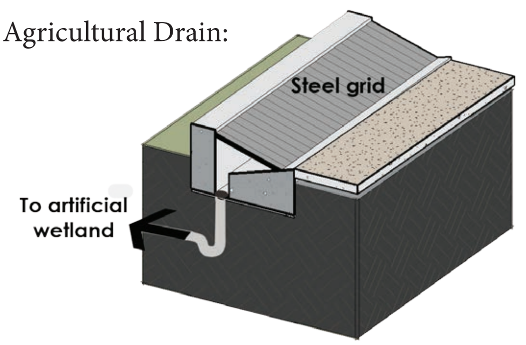
Zone 3: Laboratory & feedlot

Basins	28	852	10 220
Feedlot			
Cattle Drinking	20	48 667	584 000
Pens Washing	20	24 333	292 000
Pens			
Cattle Drinking	15	18 250	219 000

Zone 3

Roof Area (m²):	1 069
Water needed:	
Per month	73 000
Per Year	876 000
Tank size (l):	
Filtration Process:	Filter 1 only

Agricultural Drain:



SUN ANGLES AND NATURAL LIGHT

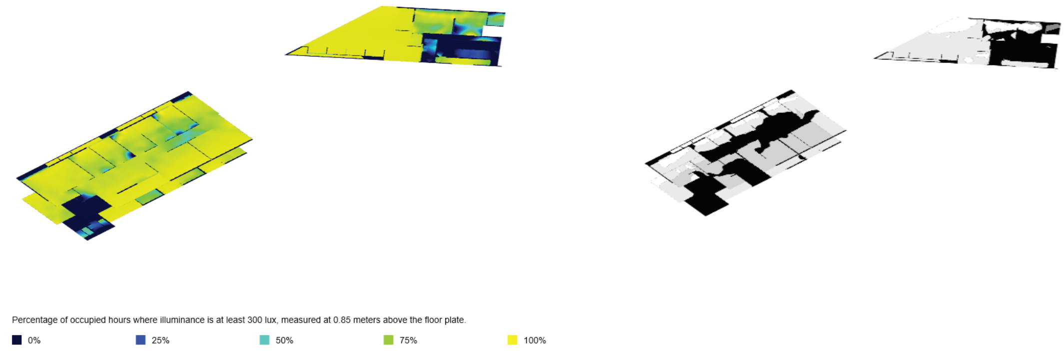
All habitable rooms in the building have access to natural light during the day. This is achieved by means of a clerestory window running the length of both wings, allowing light into the passage and ablution blocks.

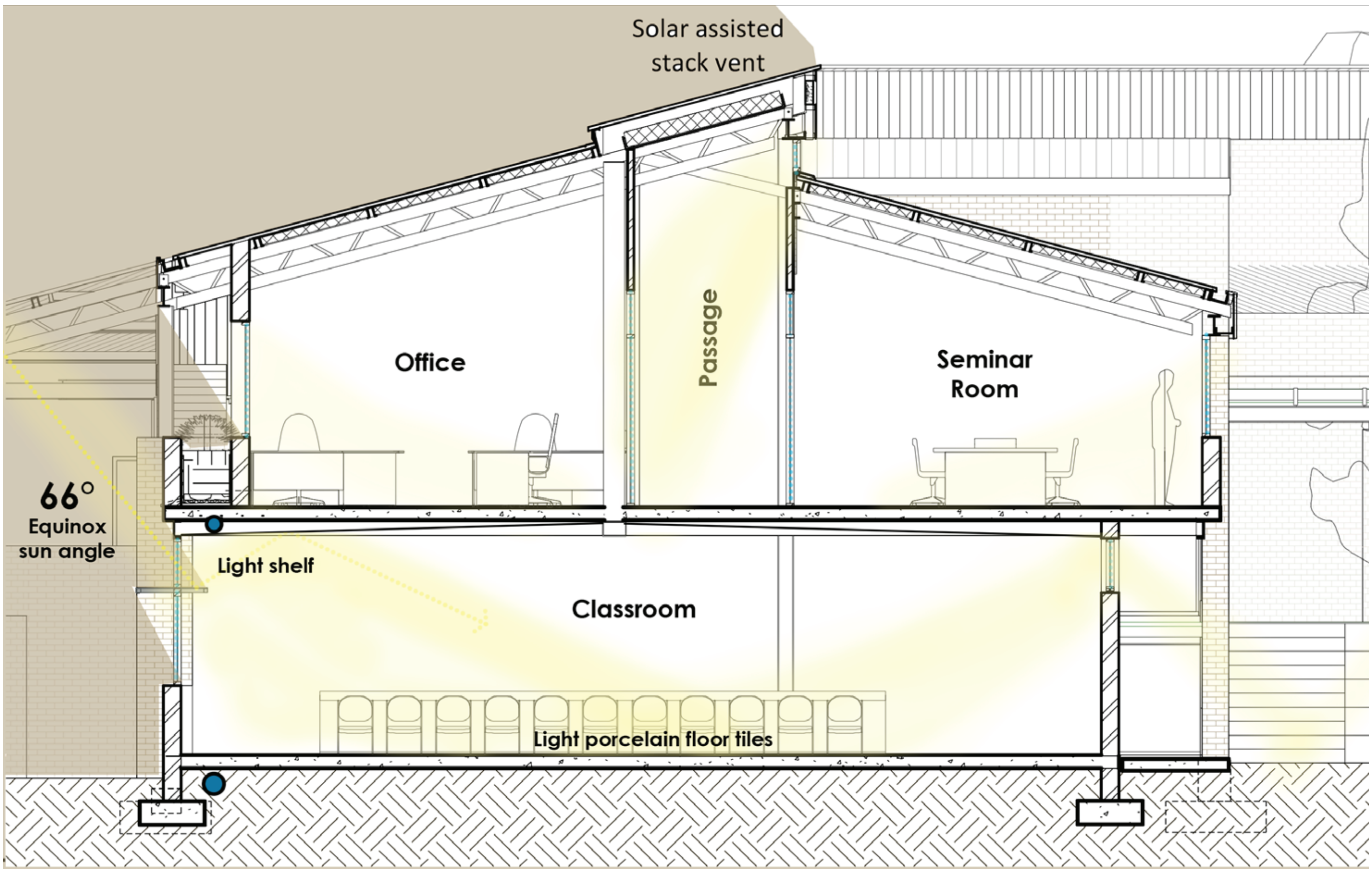
The overhang along the northern side is calculated to allow sun in during winter months but to block unwanted solar gain from spring till autumn. The shading device on the northern side of the classrooms also acts as a light shelf to scoop light into the fairly deep space.

DAYLIGHTING

Figure 3-67: *Left; Daylighting studies (Author, 2017)*

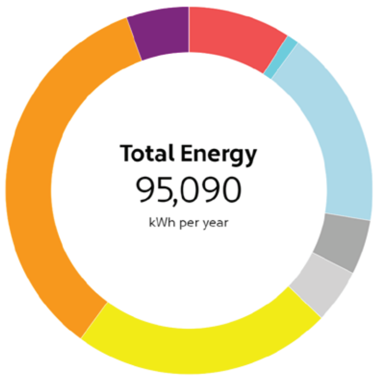
Figure 3-68: *Below; Sun angles on section*





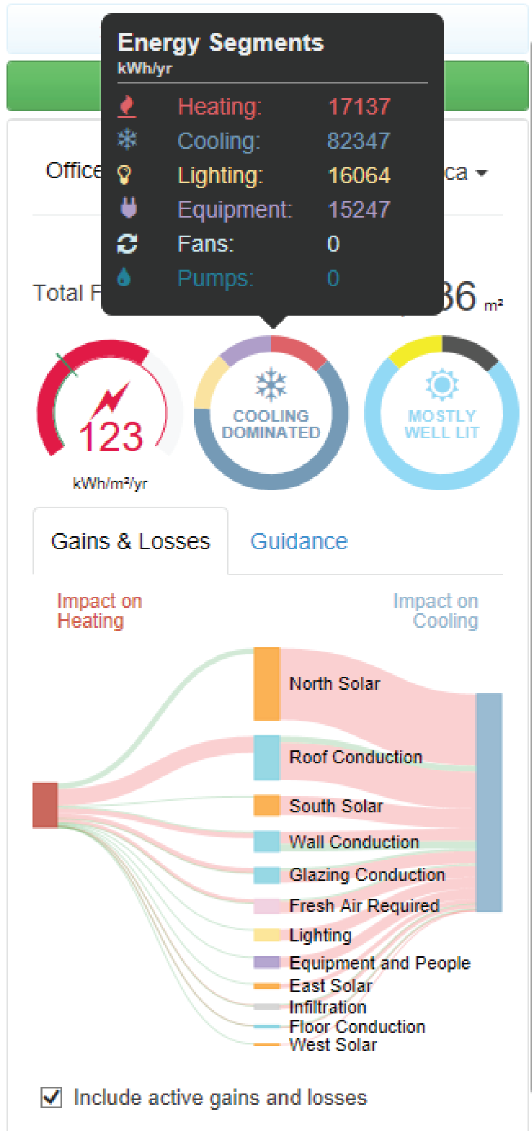
SEFAIRA PERFORMANCE ANALYSIS - NORTH WING ONLY

ITERATION 1 - BASELINE SANS VALUES



Segment	kWh per year	% of total use
Heating	**8,613**	**9 %**
AHU	0	0 %
Zones	8,612	9 %
Humidification	1	0 %
Cooling	**17,641**	**19 %**
AHU	0	0 %
Heat Rejection	1,000	1 %
Zones	16,641	18 %
Fans	**9,124**	**10 %**
AHU	4,591	5 %
Zones	4,533	5 %
Interior	**54,442**	**57 %**
Lighting	21,728	23 %
Equipment	32,714	34 %
Pumps	**5,270**	**6 %**

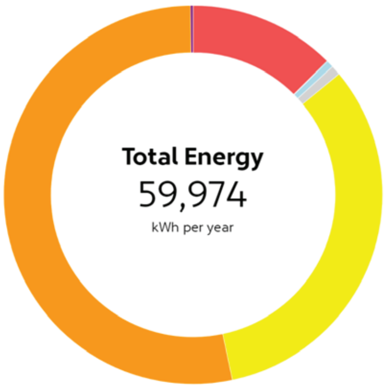
Sefaira for Revit | Real Time Analysis



ITERATION 2 - IMPROVED

Improved insulation values, cross ventilation and geopipe air system was included. Unventilated "zones" such as the entrance lobby and circulation core removed.

Annual Energy Use

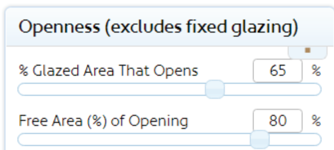


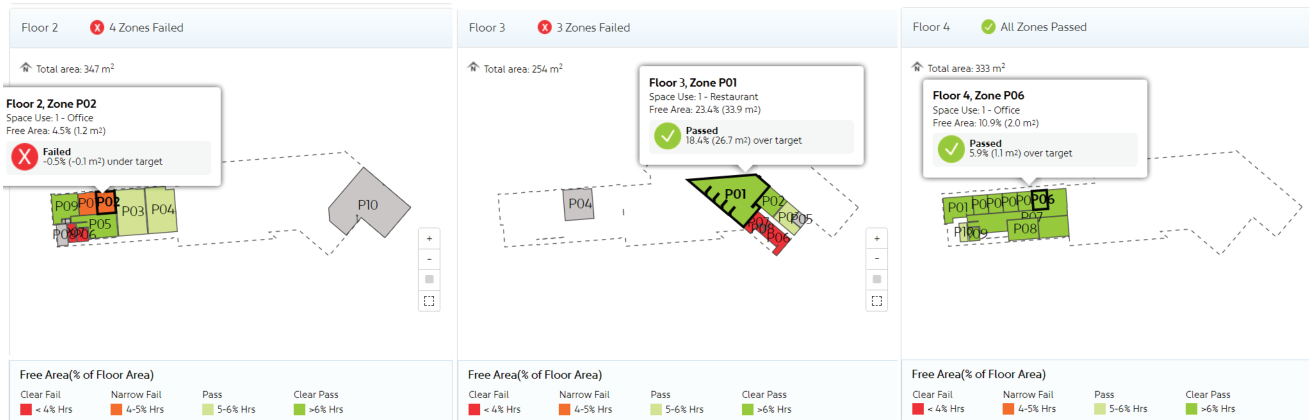
Segment	kWh per year	% of total use
Heating	**7,514**	**13 %**
AHU	0	0 %
Zones	7,514	13 %
Humidification	0	0 %
Cooling	**383**	**1 %**
AHU	0	0 %
Heat Rejection	26	0 %
Zones	357	1 %
Fans	**501**	**1 %**
AHU	0	0 %
Zones	501	1 %
Interior	**51,440**	**86 %**
Lighting	19,591	33 %
Equipment	31,849	53 %
Pumps	**136**	**0 %**

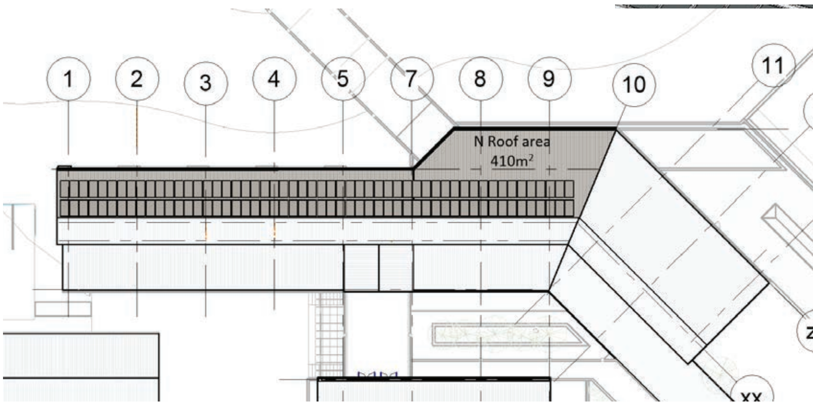
Cattle Complex - Iteration 1. Produced by S Salome Richter from University of Pretoria, 21 Nov 2017 @ 02:18:49

FREE AREA ASSESSMENT

This test showed that most rooms had window openings suitable for natural ventilation. This means that the window free area is more than 5% of the floor area per room.







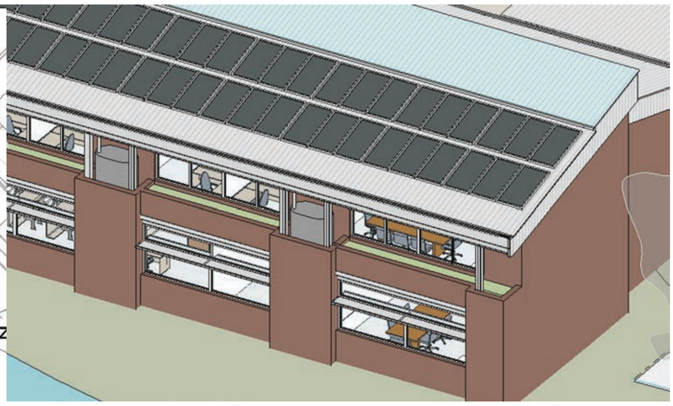


Figure 3-69: *Top left; Roof area for solar panels (Author, 2017)*

Figure 3-70: *3D of solar panels (Author, 2017)*

Figure 3-71: *Left; Energy generated by 320m2 of solar panels based on a 15degree fixed panel (PV Watts, 2017). This shows that enough electricity can be generated to cover the building's operational energy demand as calculated by the sefaria analysis.*

RESULTS

87,637 kWh/Year*

Month	Solar Radiation (kWh / m^2 / day)	AC Energy (kWh)	Energy Value ($)
January	6.32	7,754	N/A
February	6.05	6,813	N/A
March	6.05	7,487	N/A
April	5.52	6,842	N/A
May	5.37	6,792	N/A
June	5.05	6,349	N/A
July	5.30	6,900	N/A
August	5.82	7,529	N/A
September	6.11	7,475	N/A
October	6.26	7,959	N/A
November	6.16	7,572	N/A
December	6.49	8,163	N/A
Annual	**5.88**	**87,635**	**0**

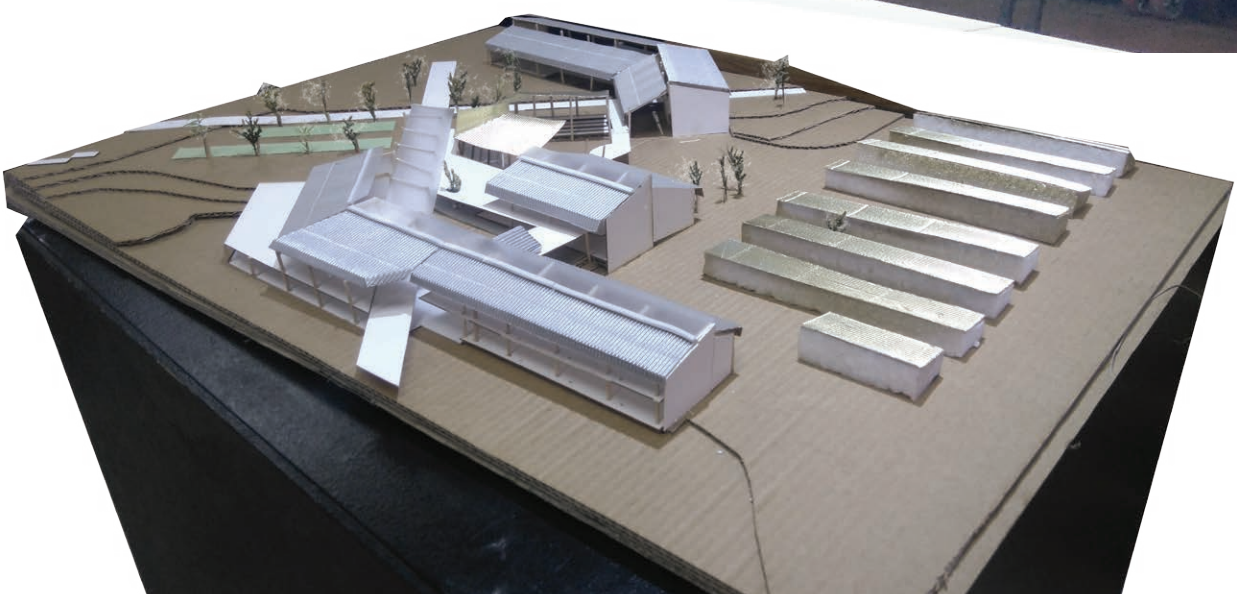
Location and Station Identification

Requested Location	JOhannesburg	
Weather Data Source	(INTL) JOHANNESBURG, SOUTH AFRICA	12 mi
Latitude	26.13° S	
Longitude	28.23° E	

PV System Specifications *(Residential)*

DC System Size	49.8 kW
Module Type	Standard
Array Type	Fixed (open rack)
Array Tilt	15°
Array Azimuth	0°
System Losses	9%
Inverter Efficiency	96%
DC to AC Size Ratio	1.1

FINAL REVIEW



SECTION 4: REFLECTION

"One cannot alter a condition with the same mind that created it in the first place"

- Albert Einstein (n.d.)

4.1: CONCLUSION

With the end of the Jacaranda agricultural show at the Pretoria showgrounds, there is both a void in the urban fabric and immense potential to reinterpret how the showgrounds can develop to contribute positively to the area.

By taking into consideration the story of place and the existing infrastructure, the combined program of an auction ring, gene bank with AI service, research and education all makes perfect sense for the site. By combining these programs, not only can they share resources such as the building facilities and access to genetic material, but they work together to achieve more than what they each could on their own. By sharing systems such as rainwater harvesting, grey-water filtration and passive heating and cooling strategies, the capacity of these systems are also increased.

Addressing the interface between these different programmatic elements had more that one possible solution, and several iterations were explored. The final iteration makes use of a series of courtyards as connecting elements between programmatic clusters, with varying levels of interaction and separation between people and cattle as well as varying degrees of privacy.

The fist step to a new mind is creating awareness of the current mindset and the need for change

- Author 2017

4.2: LIST OF FIGURES

Figure 2-1: . Top; Historic examples of arcades (Nuefert, 2012)

Figure 2-2: Connecting spaces and uses (Author, 2017)

Figure 2-3: Left; the affects of reinterpreting boundaries within the city block (Author, 2017)

Figure 2-4: Top; Location of study area (Author, 2017)

Figure 2-5: Photo from 1922 showing Church Square with the site of the showgrounds and old horse racing track visible in the background (Hansen 2016)

Figure 2-6: Top: Historic maps of Pretoria showing the racecourse and the agricultural heritage dating back to before 1908. (Van der Waal, nd).

Figure 2-7: Above; Historic overview of Pretoria West (Author, 2017)

Figure 2-8: Separate elements defining the area (Author, 2017)

Figure 2-9: Opposite top: Photograph of an old map of the showgrounds mounted on the wall by gate G3 (Author, 2017)

Figure 2-10: Opposite below; Current condition of the showgrounds (Author, 2017)

Figure 2-11: Top and middle left; Photographs of Exhibition hall C and hockey field during the Pretoria Show (Tshwane Events Centre, 2014)

Figure 2-12: Top right; Photographs of the Champion ring during the Pretoria Show (Tshwane Events Centre, 2014)

Figure 2-13: Right; Judging ring and cattle pens (Author, 2017)

Figure 3-1: Concept diagrams illustrating a shift from the current separation between the public and industry to a more integrated model, addressing the public interface and building positive (Author 2017)

Figure 3-2: Opposite: Relationships created by the annual Pretoria Show (Author 2017)

Figure 3-3: Above; Current model if program interactions (Author 2017)

Figure 3-4: Left; The site with propsed circulation routes (Author 2017)

Figure 3-5: Below; Concept section (Author 2017)

Figure 3-6: Opposite top; Using the existing site topography around the champion ring and animal pens to inform a vertical separation between the public and cattle related areas (Author 2017)

Figure 3-7: Contained vs distributed energy (Author 2017)

Figure 3-8: Opposite middle; The development of the parti diagram (Author 2017)

Figure 3-9: The final iteration of the urban vision for the showgrounds

Figure 3-10: Existing levels around the Champion ring (Author 2017)

Figure 3-11: An overview of site influences

Figure 3-12: Wind rose for Pretoria

Figure 3-13: Photographs of the existing Champion Ring and pens (Author 2017)

Figure 3-14: Left: Trees on site

Figure 3-15: Below Diagram exploring the relationships between different programmatic elements (Author 2017)

Figure 3-16: Below: Translating the programmatic relationships to spatial relationships that respond to conditions and existing elements on site

Figure 3-17: Spacial organization for iterations **1a**, ***b***, and ***c*** investigating different layouts based on figure 3-12 (Author 2017)

Figure 3-18: Bottom left - Layout organization (Author 2017)

Figure 3-19: Bottom right - circulation and levels (Author 2017)

Figure 3-20: Top; Floor Plans June (Author 2017)

Figure 3-21: Below; Marquette model of iteration 1d (Author 2017)

Figure 3-22: Diagram showing the clear distinction between the animal and other influences on site

Figure 3-23: A conceptual exploration in connecting the north ans south wings of the previous design and opening up half of the champion ring to create an “cattle courtyard”

Figure 3-24: Iterations 2a-2c (Author 2017)

Figure 3-25: Top right: Diagonal routes

across site (Author 2017)

Figure 3-26: Left: Revision of site influences (Author 2017)

Figure 3-27: Top right: Typical movement patterns for people and cattle (Author 2017)

Figure 3-28: Above - Iteration 3a & 3b has the public route passing between the northern wing and Champion ring, with a connecting pergola. Iteration 4a changes the orientation of the buildings to face north and has the public route pass diagonally though the building

Figure 3-29: Left: Iteration 3c has the entrance level courtyard extending to become a roof garden over the classrooms, and the south east side of the Champion ring extending to house the gene bank and laboratory.

Figure 3-30: Above: Overview of program layout. (Author 2017)

Figure 3-31: Left top: Pedestrian routes through the showgrounds (Author 2017)

Figure 3-32: Left: Circulation routes and access points (Author 2017)

Figure 3-33: Top: Courtyards as connecting spaces between programmatic elements (Author 2017)

Figure 3-34: Bottom: The site divided into three main levels (Author 2017)

Figure 3-35: Opposite; Final site layout

Figure 3-36: Above; 3D perspective of complete scheme

Figure 3-37: Below; Perspective approaching from the north

Figure 3-38: Left; Public zone location and movement (Author 2017)

Figure 3-39: Below: Perspective of the restaurant outside seating (Author 2017)

Figure 3-40: Opposite; Restaurant, kitchen and ablution block on plan (Author 2017)

Figure 3-41: Above; Auctions and auditorium location and movement (Author 2017)

Figure 3-42: Below; Perspective of the Champion ring (Author 2017)

Figure 3-43: Opposite; Champion ring and auditorium on plan (Author 2017)

Figure 3-44: Education zone location and movement (Author 2017)

Figure 3-45: Opposite; Classrooms and training areas on plan (Author 2017)

Figure 3-46: Below; Perspective of the education courtyard (Author 2017)

Figure 3-47: Research related movement (Author 2017)

Figure 3-48: Opposite; Feedlot, laboratory and gene bank on plan (Author 2017)

Figure 3-49: Perspective of research feedlot (Author 2017)

Figure 3-50: Park and basement level plan (Author 2017)

Figure 3-51: Entrance level plan (Author 2017)

Figure 3-52: First floor plan (Author 2017)

Figure 3-53: Site plan (Author 2017)

Figure 3-54: Top; conceptual skectes (Author, 2017)

Figure 3-55: Left; Existing structural systems and steel round hollow sections from the existing pens that can be reused as the internal members of a lattice truss system (Author, 2017)

Figure 3-56: Below; A diagramatic representation of how the typical ban section was developed (Author, 2017)

Figure 3-57: Above; Development of the structural system from a steel portal frame to a beam and truss system (Author, 2017)

Figure 3-58: Left; Conceptual section sketches

Figure 3-59: Below; Development of grid and beam system on plan iterations 2-3 (Author, 2017)

Figure 3-60: Opposite; 3D Section of final construction system (Author, 2017)

Figure 3-61: Top left; early construction system sketches (Author, 2017)

Figure 3-62: 3D Section of brickwork around columns (Author, 2017)

Figure 3-63: Below; creating crossover spaces by shifting the ground and first floor planes (Author, 2017)

Figure 3-67: Left; Daylighting studies (Author, 2017)

Figure 3-68: Below; Sun angles on section

Figure 3-69: Top left; Roof area for solar panels (Author, 2017)

Figure 3-70: 3D of solar panels (Author, 2017)

Figure 3-71: Left; Energy generated by 320m2 of solar panels based on a 15degree fixed panel (PV Watts, 2017). This shows that enough electricity can be generated to cover the building's operational energy demand as calculated by the sefaria analysis.

4.3: REFERENCES

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4.4: APPENDICES

APPENDIX A - RAINWATER HARVESTING TANK SIZE CALCULATIONS

Rainwater calculations for roof catchments

Zone 1

Roof catchment required (m²)	297.14	*Annual water consumption l*	169 725			*Daily building consumption*	465
Roof catchment proposed (m²)	498.00	*Average Annual Rainfall mm*	696	*Tank Size assumption*	55 000	*Water for firefighting*	-

Zone 1	Average rainfall mm	Litres generated	Average water consumption	Difference	Volume of Water in Tank (Litres)	Overflow
Month						
January	135	56 299	14 415	41 884	20 000	
February	110	45 716	13 020	32 696	52 696	-
March	75	30 901	14 415	16 486	55 000	14 182
April	40	16 085	13 950	2 135	55 000	2 135
May	15	5 503	14 415	- 8 912	46 088	-
June	8	2 540	13 950	- 11 410	34 678	-
July	5	1 270	14 415	- 13 145	21 533	-
August	5	1 270	14 415	- 13 145	8 388	-
September	20	7 619	13 950	- 6 331	2 057	-
October	70	28 784	14 415	14 369	16 426	-
November	108	44 870	13 950	30 920	47 346	-
December	105	43 600	14 415	29 185	55 000	21 531
Total	**696**	**284 458**	**169 725**	**114 733**		37848.70

Zone 4

Roof catchment required (m²)	894.61	*Annual water consumption l*	511 000			*Daily building consumption*	1 400
Roof catchment proposed (m²)	938.00	*Average Annual Rainfall mm*	696	*Tank Size assumption*	250 000	*Water for firefighting*	10 000

Zone 2	Average rainfall mm	Litres generated	Average water consumption	Difference	Volume of Water in Tank (Litres)	Overflow
Month						
January	135	106 041	43 400	62 641	200 000	
February	110	86 108	39 200	46 908	246 908	-
March	75	58 203	43 400	14 803	250 000	11 711
April	40	30 297	42 000	- 11 703	238 297	-
May	15	10 365	43 400	- 33 035	205 262	-
June	8	4 784	42 000	- 37 216	168 046	-
July	5	2 392	43 400	- 41 008	127 038	-
August	5	2 392	43 400	- 41 008	86 030	-
September	20	14 351	42 000	- 27 649	58 381	-
October	70	54 216	43 400	10 816	69 198	-
November	108	84 514	42 000	42 514	111 712	-
December	105	82 122	43 400	38 722	150 433	-
Total	**696**	**535 786**	**511 000**	**24 786**		11711.30

Zone 2

Roof catchment required (m^2)	577.73	*Annual water consumption l*	330 000			*Daily building consumption*	904
Roof catchment proposed (m^2)	709.00	*Average Annual Rainfall mm*	696	*Tank Size assumption*	120 000	*Water for firefighting*	-

Zone 2	Average rainfall mm	Litres generated	Average water consumption	Difference	Volume of Water in Tank (Litres)	Overflow
Month						
January	135	80 152	28 027	52 125	100 000	
February	110	65 086	25 315	39 771	120 000	19 771
March	75	43 993	28 027	15 966	120 000	15 966
April	40	22 901	27 123	- 4 223	115 777	-
May	15	7 834	28 027	- 20 193	95 584	-
June	8	3 616	27 123	- 23 507	72 077	-
July	5	1 808	28 027	- 26 219	45 858	-
August	5	1 808	28 027	- 26 219	19 638	-
September	20	10 848	27 123	- 16 276	3 363	-
October	70	40 980	28 027	12 953	16 315	-
November	108	63 881	27 123	36 758	53 073	-
December	105	62 073	28 027	34 046	87 119	-
Total	**696**	**404 981**	**330 000**	**74 981**		35737.18

Zone 5

Roof catchment required (m^2)	1022.41	*Annual water consumption l*	584 000			*Daily building consumption*	1 600
Roof catchment proposed (m^2)	1069.00	*Average Annual Rainfall mm*	696	*Tank Size assumption*	250 000	*Water for firefighting*	-

Zone 2	Average rainfall mm	Litres generated	Average water consumpti	Difference	Volume of Water in Tank (Litres)	Overflow
Month						
January	135	120 850	49 600	71 250	200 000	
February	110	98 134	44 800	53 334	250 000	3 334
March	75	66 331	49 600	16 731	250 000	16 731
April	40	34 529	48 000	- 13 471	236 529	-
May	15	11 812	49 600	- 37 788	198 741	-
June	8	5 452	48 000	- 42 548	156 193	-
July	5	2 726	49 600	- 46 874	109 319	-
August	5	2 726	49 600	- 46 874	62 445	-
September	20	16 356	48 000	- 31 644	30 801	-
October	70	61 788	49 600	12 188	42 989	-
November	108	96 317	48 000	48 317	91 306	-
December	105	93 591	49 600	43 991	135 297	-

APPENDIX B - SANITARY REQUIREMENTS

Design Classification						Sanitary Requrements						
						Male				Female		
Programmatic Function	Class of Occupancy		Population Requirements	Area (m²)	Max design population	WC	Urinal	WHB	Shower	WC	WHB	Shower
Auctions												
Champion Ring	A2?	Theatrical and indoor sport	Number of fixed seats or 1 person per m²	840	300	2	4	3		6	4	
Cattle Pens												
Entrance/ Foyer												
Gene Bank & Research												
Cattle handling - embryo and semen collection, weighing, measuring etc.												
Labs - embryo and semen analysis, processing and freezing	J1	High risk storage	1 person per 50 m	183	4	1		1		1	1	
Embryo and semen storage	J2	Moderate risk storage	1 person per 50 m									
Feed-lot open pens												
Feed sorting and storage	J2	Moderate risk	1 person per 50 m	270	2							
Networking and Offices												
Office space	G1	Offices	1 person per 15m² or fixed seats	244	10	1		1		1	1	
Seminar Rooms	G1		1 person per 15m² or fixed seats	105	15							
Event space	B3											
Training												
Classrooms	A3	instruction	1 person per 5m² or fixed seats	390	60	1	1	1		2	1	
Practical rooms	A3	Places of	1 person per 5m² or fixed seats		10							
Auditorium	A3	Places of	1 person per 5m² or fixed seats	320	110					add. 2	add. 1	
Restaurant												
Restaurant	A1		1 person per 1m² or fixed seats	285	90	CR	CR	CR		CR	CR	
Kitchen				90								2