AN INTEGRATED CAPITAL EXCHANGE

LAYERED POTENTIAL

ROBERT PETER RENTON

UNIVERSITY OF PRETORIA, 2018
Submitted in fulfilment of part of the requirements for the degree
Master in Architecture (Professional) in the Faculty of Engineering,
Built Environment and Information Technology.

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

study leader

Arthur Barker

year coordinator

Arthur Barker

site

Daspoort Sewage & Waste Water Treatment Staatsartillerie Rd, Daspoort. *(Historic Old Marabastad)*

GPS -25° 44' 1.63", +28° 10' 29.46"

programme

A transactional natural resource facility focused on hybrid interactions between *nature, culture and industry*

research fields

Environment Potential
Heritage and Cultural Landscapes

key words

Natural Capital
Resource exchange
Fruit and vegetable waste
Industrial heritage
Daspoort

UNIVERSITY OF PRETORIA, 2018
Submitted in fulfilment of part of the requirements for the degree Master in Architecture (Professional) in the Faculty of Engineering, Built Environment and Information Technology.

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

LATENT CAPITAL

ARCHITECTURE AS A HYBRID INTERACTION OF NATURE, CULTURE, AND INDUSTRY

A NATURAL CAPITAL RESOURCE EXCHANGE:

DEFINING A MEANS OF ENERGY EXCHANGE TO REPURPOSE NATURAL WASTE AS A PRIMARY RESOURCE.

Robert Peter Renton
13070429

In accordance with Regulation 4[e] of the General Regulations [G.57] for dissertations and theses, I declare that this dissertation, which is hereby submitted 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 dissertation has already been, or is currently being, submitted for any such degree, diploma or any other qualification.

I further declare that this dissertation 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.

Robert P. Renton

To my parents for their support, love and encouragement.

To Arthur for his knowledge, dedication, and fortitude.

To Jani for always believing in my abilities and carrying me through the most difficult times.

TERMINOLOGY

hybrid interaction – accommodate and curate interaction between the separate layers of nature, culture and urban identity, and industry

layered potential – past and present patterns and conditions as possibilities for adaptive reuse.

complex adaptive system – an elastic collection of parts able to absorb change.

critical dependency – capital as a finite resource integral to production

fragmentation – individual freedom within a collective whole.

ABSTRACT

This dissertation developed as a response to an existing condition of separation, fragmentation and a history of a tabula rasa approach to Marabastad's urban heritage. The exploration of latent and layered potentials as an opportunity for hybrid interaction becomes integral in the architectural response proposed in this dissertation.

The first informant for hybrid interaction begins with the thriving fruit and vegetable trade in Marabastad and the latent potential of fruit and vegetable waste as natural capital. As a direct result of this trade, there is a significant amount of subsequent waste of fruit and vegetables. This provides an opportunity to repurpose fruit and vegetable waste as a resource for clean energy production. Not only does this address the topical and severe issue of waste in the direct context, but it addresses a much larger global issue of food waste, food security and resource shortage.

Specific to the context, the reintegration of natural and cultural landscapes that have been lost as a result of shifting states over time is fundamental to recognising and rehabilitating the environment as it is today. Processes of disintegration, relocation, and general decay have become synonymous with the area, combined with a socio-cultural system that is as present as ever. Thus, the context seeks a mid-ground to house a complex adaptive system that is resilient and sustainable. The second informant is made possible only through the dysfunctionality of the urban fabric in its current state, and the opportunities that this presents.

The third informant is embedded in the palimpsest of the industrial landscape as an opportunity for productive processes to form a closed loop system. The industrial heritage of the site remains ingrained in its appearance, and its current function exemplifies fragmentation and isolation. This informant unlocks the possibility of introducing a functioning industrial landscape within the spectrum of a complex socio-cultural system.

This dissertation is as a result of these primary informants integrated and cross-pollinated to inform a model of hybrid interaction of latent potentials. The result is an architecture that focuses on human and social capital as a catalyst for an integrated and interactive natural and productive landscape. Hybridity extends beyond the physical rendition on site, and speaks of a new typology of an architectural infrastructure of connection, flexibility and programmatic evolution grounded in critical dependency.

TABLE OF CONTENTS

01 preface

02 introduction

context & site analysis

03 04

theory

programme

05 concept

06 design development

07 technification

LIST OF FIGURES

01

introduction

NATURAL CAPITALISM

THE 5TH INDUSTRIAL REVOLUTION

"As a general rule, the most successful man in life is the man who has the best information"
- Benjamin Disraeli (Thinkexist, 2018)

The 21st century industrial landscape has been shaped and developed by the preceding industrial revolutions, each powered by its own fuel, whether it was the use of natural resources or the development of colonial industries to give life to the factory and mechanised production; or whether it was the technological development of the Second Industrial Revolution characterised by the implementation of machinery to aid and improve moving assembly lines for mass production (The Economist, 2012). Either way, each development presents its own set of advantages and disadvantages, each utilizing natural resources in a specific way, maximizing output, and to a large extent, not investigating the implications of production methods on future societies and environments.

The result has significantly affected the development of our cities, both positively and negatively, causing not only increased urbanisation and unprecedented strain on our natural resources, but in addition, extreme acceleration of technological advancement. Thus the Third Industrial Revolution manifested as a digital age filled with technologies far exceeding those before it, with the shift to decentralise manufacturing, often with little consideration shown to the valuable resources of human and natural capital.

The Fourth and current Industrial Revolution builds on the third, remaining digital in nature, but significantly changing in scope, velocity and possible systemic impact (Schwad, 2018). The effects of this virtual and complex world are manifold, impacting almost every industry in every country and almost every community in every city. Increased access to information, products, services and global markets are amongst the positive impacts of the Forth Industrial revolution. The negative impacts include reduced job opportunities for unskilled labour through automation, increased social divides and reduced privacy due to social media, and a concentration of economic gain to a small group of privileged individuals while third world countries get left behind and struggle to catch up.

This technological advancement is experience globally, yet is received differently by each community depending on the specific economic, industrial and social customs prevalent to each specific location. Developing countries are often faced with advances in industry and technology that exceed the capabilities and infrastructural resources available. The results thereof include not only inefficient use of resources, but an exponential increase in the amount of waste produced, and a resulting general lag in productivity and efficiency. The issue lies not with the technological and digital changes, but the implementation, adaptation, and change management that serves as the crucial mediator for our cities and communities.

Waste is an extensive and unavoidable by-product of production; whether it be of place, of produce, of manufacture or of life. It serves as a potential capital resource that is currently under-utilised and undervalued, largely as a result of ignorance in society. |It is therefore a logical extension to re-look at waste as a possible resource to facilitate and exploit the potentials and opportunities it holds.

Re-purposing and reusing waste offers an opportunity of steady secondary resource

production. The idea is simple: to close the loops of manufacturing and consumption by designing and implementing systems that turn waste into a valuable form of resource capital. This approach allows for a continuous flow of materials to not only reuse and recycle, but to empower and enable social and ecological restoration alongside economic prosperity (Hawken, et al, 2010).

In order to create cities of resilience and integrated social oeuvre, architecture must not only respond and address issues of infrastructure and enablement, but needs to extend beyond its physical boundary to reinvest natural and human capital into the processes it houses. Only then can architecture truly act as mediator and instigator of inclusive, resilient and durable communities that enable not only systemic restructuring, but integrated natural resource rebalance (Hawken, et al, 2010).

Fig 1.1 The Crystal Palace by Joseph Paxton - 1851 (Merin, 2013)

ARCHITECTURE INFLUENCED BY INDUSTRY

Industrial buildings developed not to impress, as was the tradition with neoclassical architecture at the time of the first industrial revolution, but to be functional and practical for the processes they housed, making use of new technologies and materials that developed and the functional requirements of productive spaces stemming from industrialisation.

The Crystal Palace was design by Joseph Paxton, a gardener and greenhouse builder, for the 1851 Great Exhibition in London. Paxton designed a 10in x 49in prefabricated cast-iron module that was cost effective and incredibly quick to construct. The 564 metre long building took a mere 5 months to erect. The strength and durability of the cast-iron module allowed Paxton to reduce the number of internal supports, which in turn provided flexibility in the plan and increased the amount of natural light (Merin, 2013).

By 1755 Abbé Laugier was advocating "simple, unadorned structures of posts, beams and a roof because that was how man built before architecture became contaminated with the notions of style" (Winter, 1970: 69)

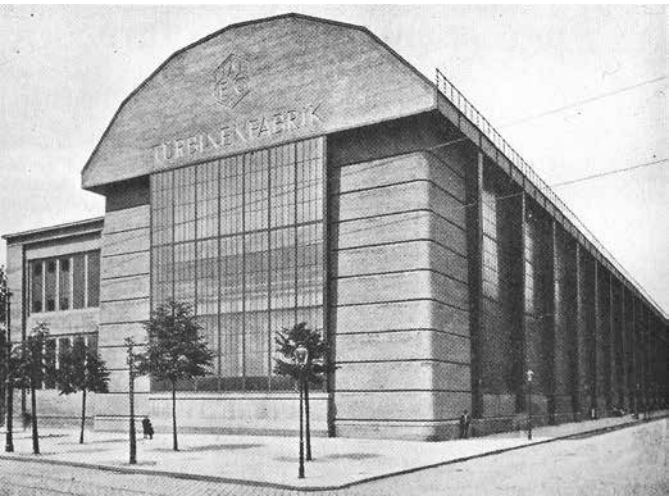


Fig 1.2 (Winter, 1970: 69)

AEG Turbine Hall - Peter Behrens, 1909, Germany.

Commissioned by Herr P. Jordan as a building to represent to corporate image of AEG. This factory is claimed to be the first modern building because of the honest use of concrete, steel and glass without unnecessary adornment. The heavy concrete corners act to ground the building and serve as a subtle reminder of neoclassical tendencies (Winter, 1970: 69).

Fig 1.3 (Pascucci, 2015)

Fagus Fabrik - Walter Gropius & Adolf Meyer, 1911, Germany.

Gropius worked under Behrens while AEG was being built which gave him access to a new stream of industrial architecture which was not encumbered by stylistic perceptions. Gropius design Fagus as a steel framed skeleton which freed the facade, allowing for a complete wall of glass (Winter, 1970: 71).

Fig 1.4 (Winter, 1970: 73)

Van Nelle Factory - Brinkman & Van der Vlugt, 1930, Netherlands.

The van Nelle coffee and tabacco factory is a pure expression of decoration free Dutch constructivism. The multi-storey concrete framed building expressed the complex programme through architectural originality and consistency (Winter, 1970: 73). Brinkman and Van der Vlugt used fungi-form columns to increase the grid spacing and maximise spans.

Fromm Rubber Factory - Arthur Korn, 1930, Germany.

The Fromm rubber factory was commissioned by Jules Fromm, a wealthy Jew who figured out how to make seamless condoms. This three storey steel framed factory was an expression of technological advances. The steel frame was painted red: an infill of white glazed bricks gave the buildings its distinct rectilinear aesthetic and character (Winter, 1970: 73).

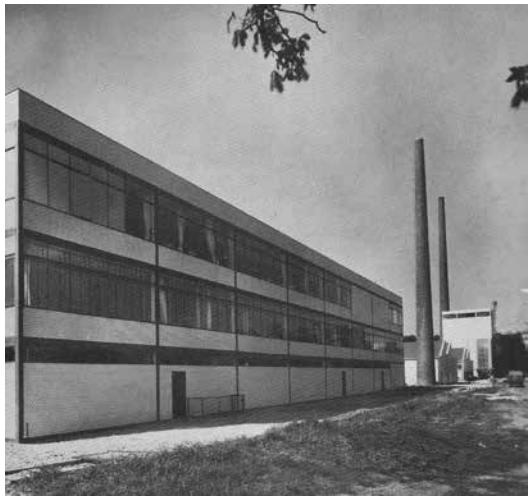


Fig 1.5 (Winter, 1970: 72)

GM Diesel Engine Factory - Albert Kahn, 1937, USA.

Albert Kahn lead much of the development around industrial architecture with his visionary approach to planning and construction. He design in a way that allowed the functions of the building to change over time by placing servicing functions on upper levels while keeping the productive spaces on the ground floor. Kahn was obsessed with economy in cost and maintenance while providing high quality, naturally lit works spaces (Winter, 1970: 89).

Fig 1.6 (Winter, 1970: 92)

U.S. Navy Optical Shop - Ernest Kump, 1941, USA.

A modern framed structure with glass walls and roof rests on a nostalgic concrete base. The 'cathedral-like' volumes accommodated large heavy naval guns while great red cranes moved overhead (Winter, 1970: 79).

Fig 1.7 (Winter, 1970: 78)

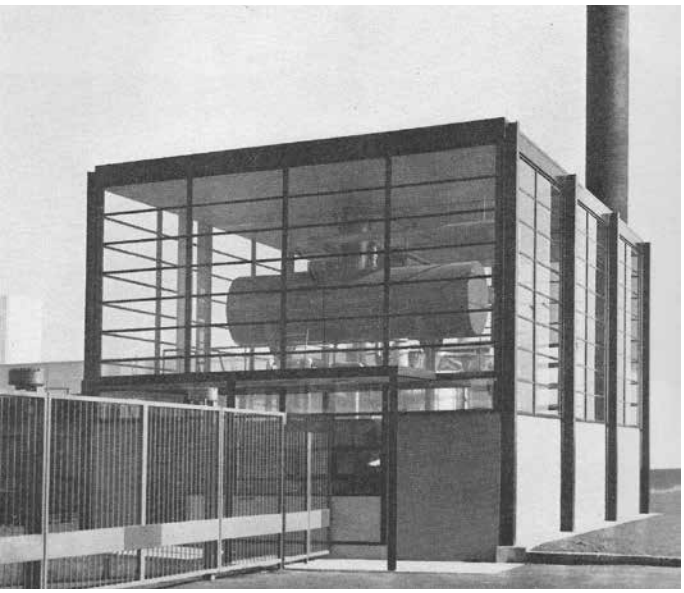


Fig 1.8 (Winter, 1970: 108)

Boiler House - Blasberg & Jais-Nielsen, 1952, Sweden.

The glazed, black framed glass box exposed for all to see. An elegant, geometrically precise industrial building as a gallery for the machinery it houses while offering a direct visual connection to the landscape. The building presented itself honestly and openly, leaving no room for preconceptions (Winter, 1970: 108).

Fig 1.9 (Winter, 1970: 105)

The York Shipley Factory - Arup Associates, 1962, England.

Provision for services and lighting in the ceiling panels provided an unobstructed roof, flooded with natural light (Winter, 1970: 105).

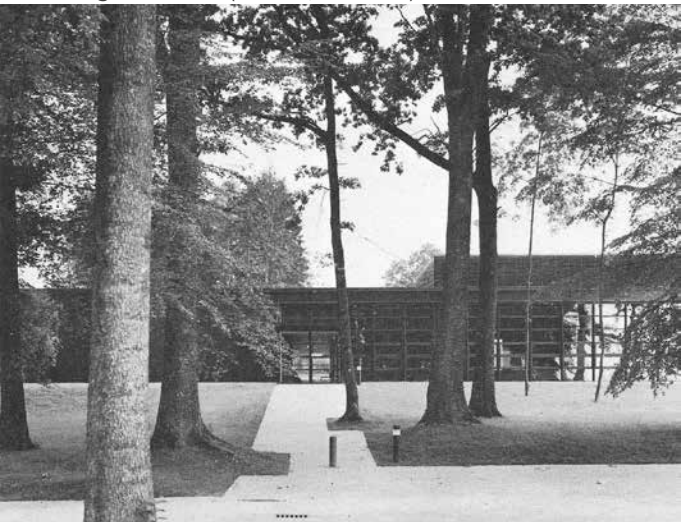


Fig 1.10 (Winter, 1970: 117)

SGS Deutschland Factory - Peter C. Von Seidlein, 1963, Germany.

A beautiful crisp metallic factory nestled between the trees. The building becomes part of the landscape, its stark black lines and reflective glass simultaneously contrasting and mirroring the surrounding woodland (Winter, 1970: 117).

Renault Distribution Centre - Norman Foster, 1983, England.

A 24 by 24 metre module allows for flexibility, adaptability and growth. The 7,5 metre roof height also serves to provide flexibility for internal functions. The structure is articulated through arched steel beams suspended from circular hollow steel columns. The aesthetic of the building is dominated by its technology (Foster, 2009).

Fig 1.11 (Foster, 2009)

Lloyds of London - Richard Rogers, 1986, England.

While not an industrial building, Lloyds of London certainly looks like it could be a factory. Rogers took inspiration from his work at Pompidou with Renzo Piano, designing Lloyds as an inside-out building by placing all the services on the exterior in order to free the internal spaces. This also meant that the services were easily accessible for maintenance and upgrades (Kroll, 2010).

Fig 1.12 (Kroll, 2010)

Zeitz MOCAA - Thomas Heatherwick, 2017, South Africa.

This reimagined grain silo in the heart of the V&A Waterfront was striped and cut back to reveal the character of the building. Heatherwick tried to pay homage to the buildings history throughout the design and construction process by respecting the materiality and function of the building. By cutting through multiple silos to create the atrium he reveals the relationship of the silos with each other and creates a public space that inspires wonder (Keller, 2017).

Fig 1.13 (Keller, 2017)

PROBLEM STATEMENT

The predicates of the first two industrial revolutions have left us with many positive processes and products albeit at the expense of natural capital. Hawken (2013, 10) postulates that the next industrial revolution will be natural capitalism. This means working with the environment to create closed loop industrial systems that rely on the extension of resource potential to eliminate waste.

The aim of this dissertation is to explore the possibilities of an architecture that will facilitate the transactions between nature, culture, and industry to the benefit of socio-cultural, urban and ecological environments. Natural and agro-industrial waste will serve as the medium of interaction, while using the natural systems present on site to extend the possibilities for future growth and minimised resource dependency.

SUB-PROBLEM

The context is that of fractured and disenfranchised cultural communities as the result of Apartheid spatial planning, set in the present state of rapid population growth and increasing urban sprawl. This raises the question of how architecture can occupy unused urban space while connecting people to the natural environment and recognising lost industrial and cultural heritage.

RESEARCH QUESTIONS

GENERAL

A condition of disconnection and under-utilisation of natural capital exists in Marabastad, specifically, Daspoort. Mono-functionality and wasteful processes dominate the cultural landscape of the precinct, presenting distinct opportunities for intervention. The following questions guide the architectural design by posing multi-dimensional answers to the posed questions.

- How can architecture mediate transactions between culture, nature, and industry to the benefit of all three?

- What is the future of natural capitalism in South Africa and how can design accommodate its growth and the transformation of industry?

- How can the latent potential of historical industrial sites be used to contribute to the social environment within an urban context?

- How can organic waste be used to close the loop of consumerism and mitigate unsustainable natural resource demand?

- Waste processing possesses high levels of latent energy. How can perceptions of industrial waste production be re-imagined through the use of latent energy and in so doing, create social interaction and integration with the context?

- How can the intangible heritage of Daspoort be understood to allow the community to take pride and ownership of the existing cultural heritage while creating awareness of that which was?

ARCHITECTURAL

- How can architecture represent or facilitate the rich cultural mixing-pot of Marabastad and create an interface between nature and industry?

- How can architecture re-imagine transactions between the urban and natural conditions to encourage a regenerative attitude as opposed to a degenerative attitude?

- Can the existing industrial processes on site be used in conjunction with new processes to improve waste management and generate interactive architecture?

- What are the possibilities for natural capitalism as a regenerative tool for Marabastad?

RESEARCH METHODOLOGY

The research methodologies used in substantiating this dissertation are focused on understanding the social history, political history, productive history and operative history of the context. The research will therefore frame the dissertation in a continuum of layered potentials and pose future possibilities. As a guide, Hofstee's Constructing a Good Dissertation (2006), is used to inform the categorisation of different tools and methods that will be used to investigate, and thus inform this dissertation.

Extended observation & mapping:

An understanding of the context through the social history is gained primarily through historic aerial photographs at a large scale, and recorded narratives by previous residents at an intimate scale. Site visits are an additional source in this regard. Analysis of historic maps, photographs and proposed urban development frameworks provide information and insight into the various political histories over time.

Site visits and present day photographs provide and up to date understanding of the productive history of the site, supplemented by engineering drawings of the processes of the site from the Daspoort archive. The operative history of the site and surrounding context is understood through the current condition and practices in Marabastad. Research into the existing networks through personal experience informed by secondary data analysis provide further insights into the sites operative history.

The intention of this section is to demonstrate a greater understanding of the site itself, and through such observation, certain amounts of mapping can be done to communicate the information that has been retrieved. This method maps not only the physical, climatic and geological characteristics

of the site, but also considers the heritage value, social value, and cultural value of the site, and is thus able to inform the approach and response of the architecture.

Literature reviews:

Hofstee states that literature reviews are used to "produce a new perspective on what has gone before" (Hofstee, 2006:121). In other words, they act as a means to understand that what has been explored, in this case, in certain theories and critical analysis of certain systems, and can thus help to inform an approach to this dissertation. Hofstee (2006:212) continues to note that when combined with a thesis statement, and a dissertation intention, these literature reviews can be useful in establishing a field of study, and a platform from which to evaluate the study.
Literature reviews on natural capitalism, resilience perspective, and Terrain Vague provide focus for the dissertation and provide support to the architectural response in its context. This will be further explored in the theoretical grounding of this dissertation, and their relevance explored, and in turn, applied to formulate a specific understanding and stance.

Precedent and Case Studies:

An understanding of the programme and the multiple productive processes was ascertained through extensive research and investigation into said programmatic examples. By exploring relevant literature and programmatic precedents, it allowed for the processes and their relation to one another to be understood. These precedents serve as the examples of what has been done before, and what influence the integrated programmatic nature of the proposed architecture. According to Hofstee (2006:123), such studies allow the discovery of principles that have been used in the past, and also, when multiple sources are referenced, common errors are highlighted.
Related architectural precedents will provide an understanding of architectural response to similar contexts or programmes in a continuum of architectural thinking. Thus, these studies allowed for the investigation of a new typology that aims to consolidate functions previously separated. The precedent and case studies act as informants in the making of the progressive experiential nature of this proposed architectural infrastructure.

Applied knowledge:

The above categories of research methods all act as informants for the generation of an over-arching theme and conceptual design approach. They culminated to form a well informed and justified approach to the making of architecture, within the context, and within a continuum of architecture. This approach extended into the detailed making of the building through the establishment of a technical concept that gave way to the full extent of the technical investigation. Essentially, no part of this investigation can be committed, as each and every component contributed and informed the design, whether it be an approach, a decision, or even a thought.

ASSUMPTIONS

The portion of Daspoort Sewerage Works on which the project is proposed is still in use, albeit run-down and disregarded. As such, the assumption is made that the drying beds and old Eastern plant will be decommissioned and available for re-purposing. The Western plant will be expanded and equipped with new systems to increase the efficiency and overall capacity of the plant.

The reintroduction of a furrow system is proposed and fed by the Apies River. It is assumed that the Department of Water and Sanitation approve access to the river for this purpose

Filtered water from the sewerage works is used for certain processes throughout the proposal. It is assumed that access to this water is granted.

LIMITATIONS

This dissertation is an investigation of and response to the intangible narrative of Old Marabastad and while this narrative has been researched and explored through historical texts and images, it is not possible to have a complete understanding of the intricacies and complexities of the site. Therefore, the dissertation responds to the research and available information of the site found through secondary written sources, particularly Tayob (2002) and Clarke (2008).

DELIMITATIONS

While the programme offers the possibility for far reaching impact and acts as a prototype for fruit and vegetable processing, only Marabastad and the immediate context of Daspoort will be considered. Ample resources and latent natural capital exist in this area to support the proposal.

The primary intention of the dissertation is the reintegration of a social interface on what used to be the location of Old Marabastad through production and cultural interaction. The transactions between the industrial programme and cultural heritage are central in the reintegration of the natural landscape into the latent industrial landscape. Some of the proposed industrial programmes are complex and scientific in nature and constitute a dissertation on their own. Therefore, an understanding of the processes is limited to what is important to inform the architectural response and demonstrate the appropriateness of the programme in a broader social and cultural context.

Fig 1.14 Aerial view of Daspoort sewerage works. The eastern plant (below) is to be decommissioned (Google Earth, 2018)

GENERAL ISSUE

THE LAYERED CONDITION

Primarily, architecture creates spaces that can be inhabited and used by people and which in turn, create a sense of place and belonging. Historically, Marabastad belonged to the people who lived there. The streets were alive with residents and shoppers with jazz playing in the background (Clarke, 2008). Various actions by the Apartheid government saw the entire population of Marabastad being relocated to Atteridgeville, Shoshunguve, Laudium and Eersterus at various stages of its tumultuous history.

The people of Marabastad are however more resilient than could have been anticipated and while most of what used to be Marabastad no longer remains, the vibrancy and activity on the street does. This dissertation will celebrate the resilience and energy of the locals through an architecture that is engaging and weaves itself into the complex cultural palimpsest of Marabastad.

The cyclical interaction of natural capital, cultural heritage and latent industrial infrastructure forms the basis for further investigation. All three possess latent potential and require a new hybrid condition to become productive and additive in "cross-scale relations" (Brand et al, 2007: 4) rather than detractive to the context. Resilience theory as posed by Holling (1973:17) informs how each of these systems interact to create longevity and absorb change in the long term, hence future proofing the project.

Natural capital refers to the natural resources present on the site including the Apies River and the ridge. It also encompasses the surrounding context that is currently detractive or neutral, such as food waste produced at the Tshwane market and in Marabastad.

The cultural heritage of the site is mostly lost and intangible as a result of Apartheid planning. This dissertation aims to recognise and express the cultural narrative through re-appropriation of latent industrial infrastructure that, in itself, is a threatened heritage artefact.

URBAN ISSUE

THE POST MODERN CONDITION

The heterogeneity of Marabastad grew, developed, and diminished as a result of Modernity. Modernity brought with it "new modes of production, distribution and consumption of commodities and services" (Elleh, 2011: 49) and developed as a result of industrialisation but more specifically, in South Africa, the discovery of gold. Marabastad became home to many labourers from the rural hinterlands of Southern Africa in search of a better life and greater opportunities (Clarke, 2008). This condition was of course not unique to Marabastad and occurred across Gauteng as new mines were established. Essentially Marabastad was, and is still, a marginalised community.

The individuality of Marabastad is owed to its proximity to the Pretoria CBD. Initially, the government accommodated the influx of labourers by establishing a fine urban grid from the Apies River to the current day Marabastad over a number of years. Labourers moving to the city settled here and created a community platform. Albeit, this was not permitted to last very long. Hierarchical spatial organisations that were biased towards racial segregation and compartmentalisation were enforced by the government under the premise of the overcrowding of Marabastad. The first move came with the construction of the Daspoort sewerage works in 1913 at the confluence of the Apies River and Steenhovenspruit, unsettling the community that lived there. Later through the Group Areas Act of 1950, more people were evicted from their homes and promptly relocated to other prescribed areas (Mabin, 1992). In addition to resettling many communities, in 1967, the Apartheid government proposed a new highway interchange (Fig 1.4) over the Asiatic Bazaar which was never implemented.

The final destruction to the urban fabric, was the construction of the Belle Ombre train loop built in the 1980's. Designed to bring people who were dislocated to Shoshunguve and other townships in and out of the city, the construction of the train loop destroyed what was left of Marabastad, leaving only the Asiatic Bazaar (now referred to as Marabastad).

The urban issues at present are as a direct result of the complex tumultuous history. An estimated 50000 people enter and leave the city everyday through Marabastad, yet no one lives there. This implies that Marabastad is the service entrance to the city and that the land in and around Marabastad is incredibly valuable. This makes the Daspoort Sewerage Works some of the most undervalued prime land in the city. It possesses a rich and hidden history that has purposefully been erased over time, resulting in the loss of its cultural identity as a place of hybrid interaction.

Fig 1.15 Right: 1967 Freeway proposal for Pretoria: Interchange over Asiatic Bazaar (Tayob, 2002: 52).

ARCHITECTURAL ISSUE

THE CONTEMPORARY CONDITION

Marabastad's architectural identity can be categorised into three sections that have changed and developed over time and as a result of the disruptions that it has experienced. The first identity relates to the beginnings of Marabastad around Chief Maraba's kraal on the Apies River. This was an architecture that was very much in and of the landscape. The mud and thatch buildings were of the earth and the people lived with an awareness and respect for the environment that they depended on for their survival.

The second identity developed during Marabastad's most disruptive time and is expressed through an architecture on the landscape. The construction of the waste water treatment plant removed peoples' connection with the river and destroyed the "complex adaptive systems" (Folke, 2006: 257) that developed in spite of the ideological western grain imposed on the landscape. Furthermore, the industrial nature of the treatment plant has very little interaction with the landscape, which is to be expected as it was designed to be purely functional in its architecture.

The third identity is proposed through this dissertation and manifests as an architecture from the landscape. Essentially it is an architecture that aims to accommodate and curate interaction between the separate layers of nature, culture urban identity, and industry. The architecture therefore, is in itself a hybrid interaction between these three layers, and incorporates the interdependency between them, becoming an architectural confluence from the landscape itself.

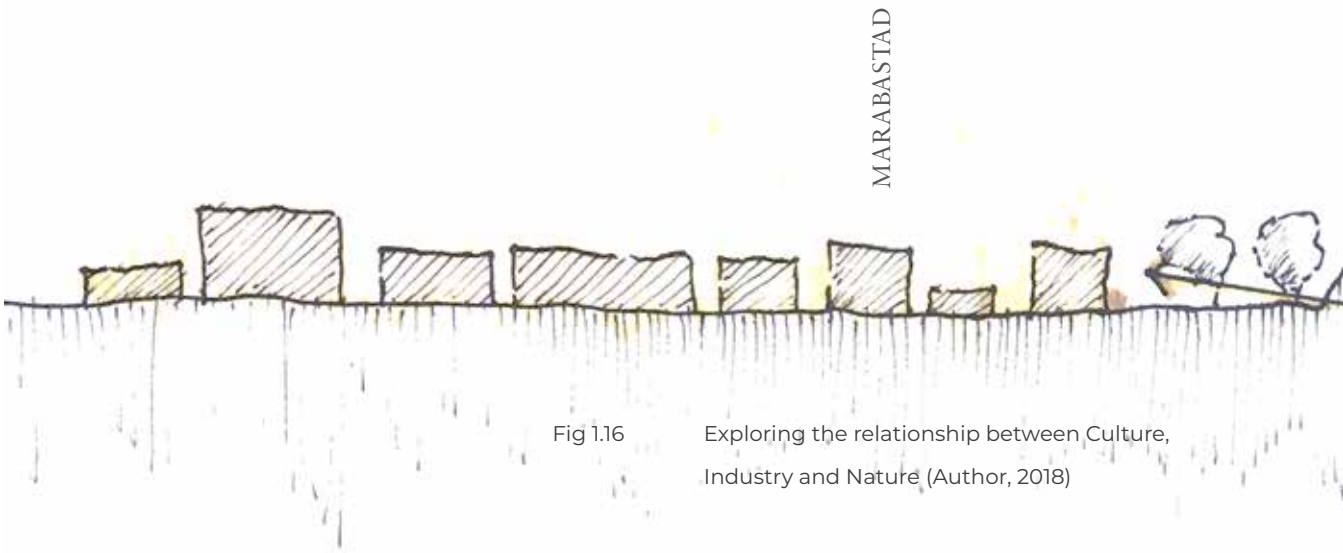


Fig 1.16 Exploring the relationship between Culture, Industry and Nature (Author, 2018)


DASPOORT SEWERAGE WORKS
APIES RIVER AND DASPOORT RIDGE

HERITAGE SIGNIFICANCE

INDUSTRIAL HERITAGE VALUE AS LATENT CAPITAL

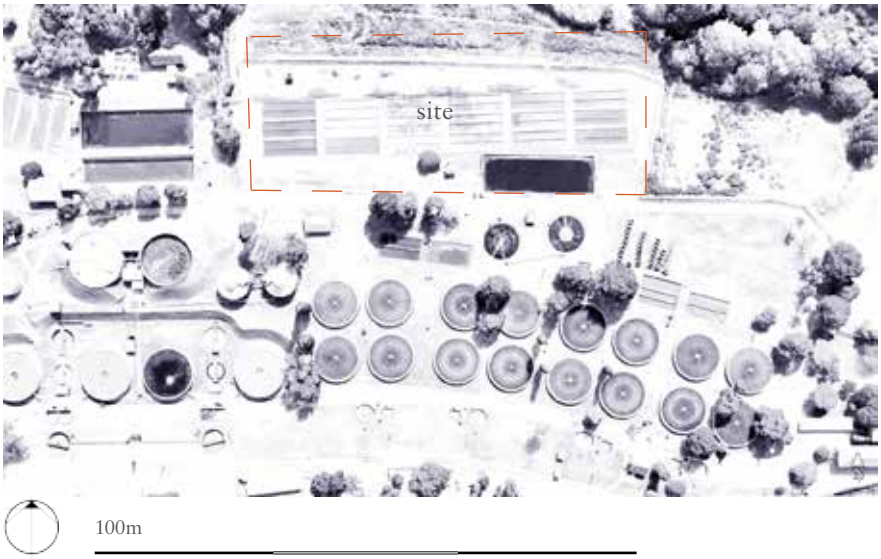
The history of a site alongside that of its people not only helps demarcate meaning, but it allows the site to be understood within the context of its narrative. The International Committee for the Conservation of the Industrial Heritage, otherwise known as the TICCIH Charter (TICCIH, 2003), acts as a tool to not only study a site of possible heritage value, but specifically focuses on industrial heritage and all of its components.

The Charter identifies the importance of industrial heritage, and any area which contains any such buildings or landscapes used for industrial activities, including but not limited to their tangible and intangible manifestations (TICCIH, 2003:170). The chosen site sits in a post-industrial landscape, linked to the Daspoort Sewage Works, on a section decommissioned and essentially non-productive. The remnants of industrial activity are physically evident in the infrastructure on site (Fig 1.6), but the site's ingrained industrial heritage runs deeper than just the tangible. The TICCIH Charter helps to identify the relevance of such sites in terms of their intangible value, ie. the social value it holds pertaining to the story of the lives of ordinary men and women (TICCIH, 2003:171). As the site itself holds a history of multiple uses (from settlement, residential for servers of the city, industrial activity and finally to a decommissioned and latent state) it so too provides an important sense of identity for those who interacted with it. In this history, the relationship between landscape, industry and people changes consistently, each component becoming the primary informant at one point or another. Each state played a crucial role in how the site developed.

A clear mis-balance between these three components is evident on site. Industry has been made the master of the site, regardless of whether it is functional or not, with previous inhabitants displaced and access cut off. The land sits fallow, no longer of service to the people, nor the city. The Charter allows the past to be redressed, where the land once again becomes productive for its people through the implementation of a model of integrated regenerative waste processing. The Charters' goals align with that of the proposal, emphasising its relevance by suggesting that an "integral part of the cultural heritage" is identifying areas of industrial waste which can be reconsidered for the ecological value it may hold (TICCIH, 2003:172). Ecological value refers not only to the enhancement of natural ecosystems on site, but the systemic value of such a context within greater economic and social society. Essentially, the land needs to maintain its functional integrity, and through a renewed industrial and integrated proposal, value can be reinstated as an interpretation of its varied former uses.

Only through such adaption and re-use of resources and site potentials can an industrial heritage site play a role in the economic regeneration of degraded areas such as this (TICCIH, 2003:172). Not only does this allow for site stability, waste re-use, ecological growth and industry as mediator, but it gives way to a potential base for cultural and social stability through recognition and regeneration of the site as a valuable asset for the community.

Fig 1.17 Image location plan (Adapted from Google Earth, 2018)



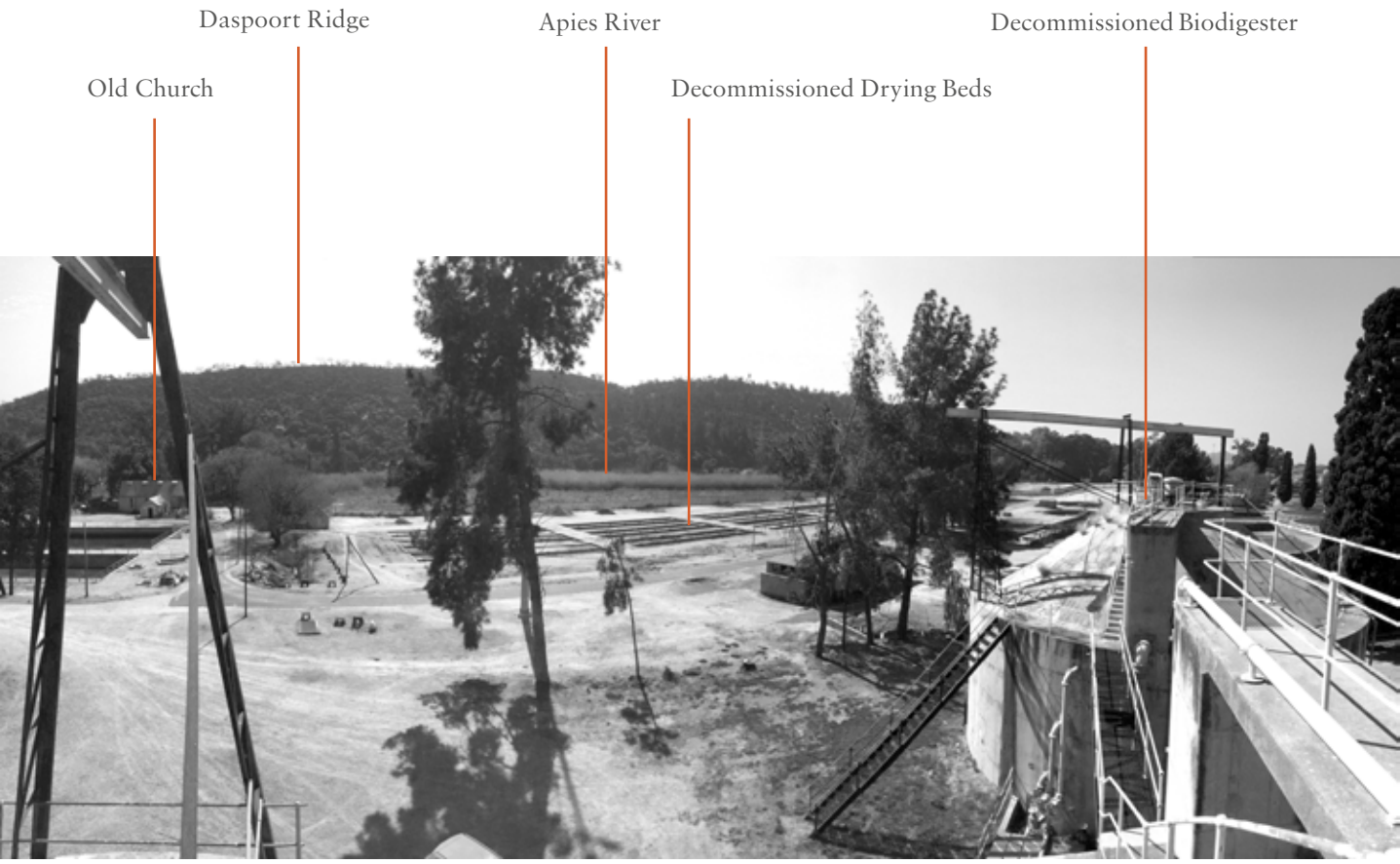


Fig 1.18 Latent infrastructure on site (Author, 2018)

02

context & site analysis

Fig 2.1 Marabastad and Daspoort in the greater context of Pretoria (Adapted from Google Earth, 2018)

OPPORTUNITY

Pretoria houses rich sources of natural capital on its peripheries, close to smaller urban centres such as Marabastad, Eersterus and Mamelodi. Opportunities rich in anticipation present themselves to not only harness these resources, but to re-establish them in the urban environment. The latent potential serves as a chance to reintroduce these natural systems into communities, and through new infrastructural and industrial systems, understand and account for waste production, so as to increase resource productivity and expansion of our natural capital.

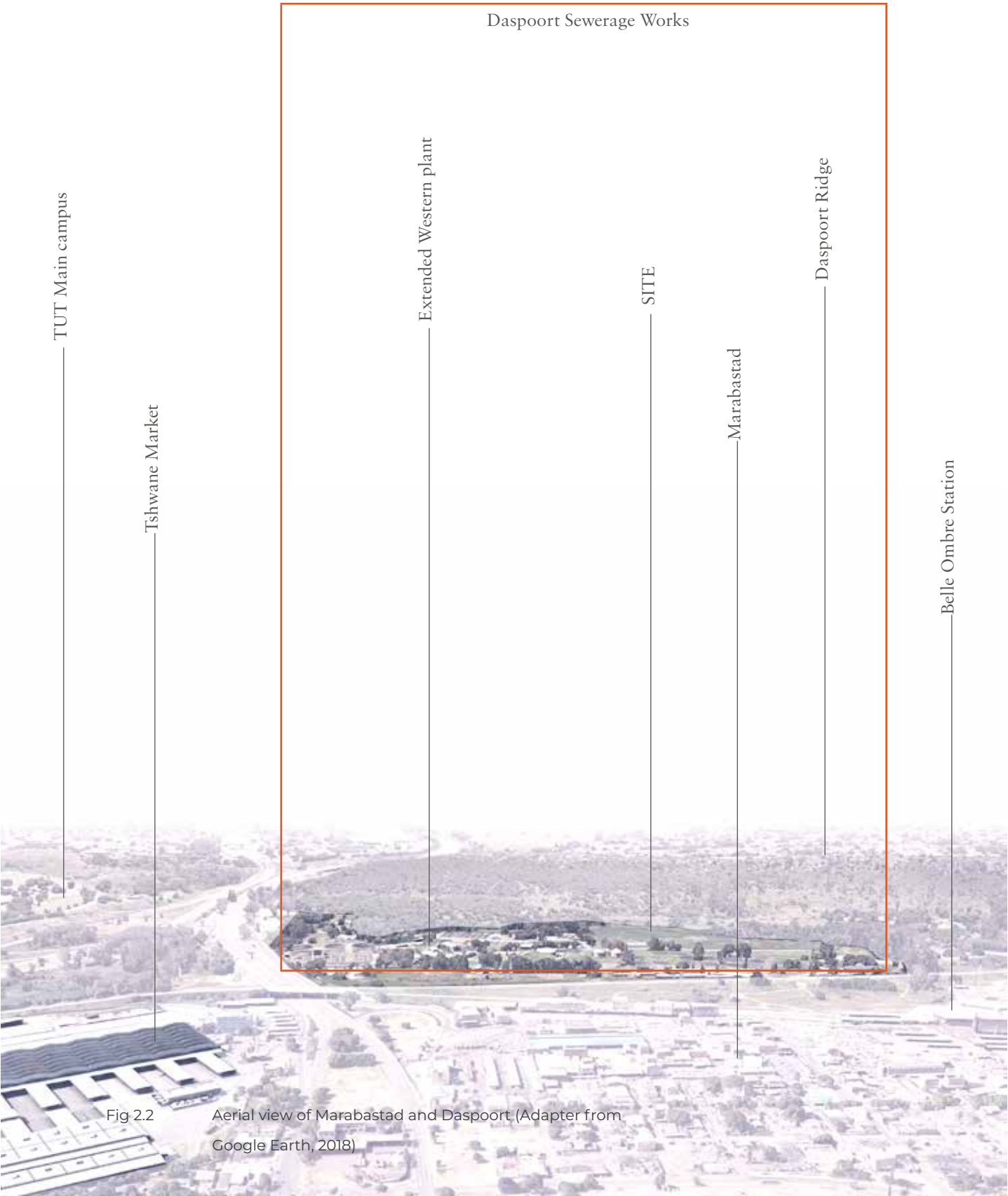


Fig 2.2 Aerial view of Marabastad and Daspoort (Adapter from Google Earth, 2018)

SITE LOCATION

Daspoort Sewage and Waste Water Treatment plant,
Staatsartillerie Rd,
Daspoort.
(Historic Old Marabastad)
GPS -25° 44’ 1.63”, +28° 10’ 29.46”

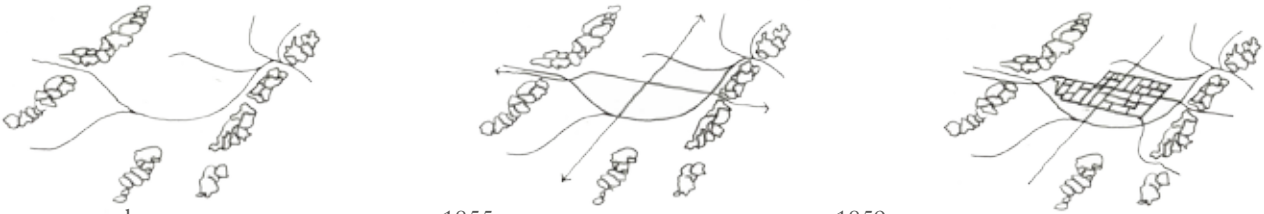
MACRO CONTEXT

PRETORIA AND ITS RESOURCES

Pretoria sits on the rich plains between the Magaliesberg and Bronberg Mountain ranges. Initially founded because of its landscape and resource potential, Pretoria settled as an agrarian society, with its urban orthogonal layout arising from the potentials of the natural environment and a European approach to city planning (Clarke & Corten, 2009:883), (Jordaan, 1989:23). Resulting from the morphology of the natural environment and the surrounding context, Pretoria's grid harnessed the ample water resources to trace water by means of furrows from Fountains Valley to serve the inhabitants of the CBD, and continued through to meet the Apies River to the North (Jordaan, 1989:24).

Fig 2.3 1910 map of Pretoria, notice the grain of Marabastad to the north west of the CBD (UP Space, 2018)

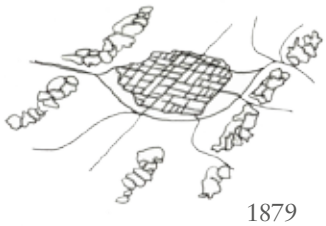
Fig 2.4 Development of Pretoria as a condition of the natural topography (Adapted from Jordaan, 1989)



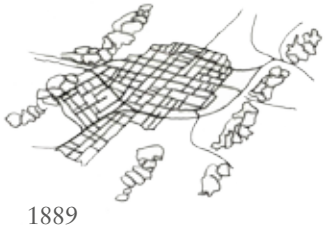
natural 1855 1859

As the city developed to house more people, its nature changed from agrarian to a more economic and administrative purpose (Clarke & Corten, 2009:883). The increased population growth saw the city's sanitation and water systems incapable of responding adequately, and with increased waste production and a severe lack of infrastructure to process it, the furrows were closed to introduce Pretoria's first sewage infrastructure (Jenkins, 1955:45). As waste production continued to increase, waterways seemed to remain the receiver of such waste (Jenkins, 1955:152). The impact thereof was manifold; waste production continued to increase and Pretoria faced one of its biggest adversities that still exists today: How can waste be managed effectively without negatively impacting our most important natural capital: water?

In the early 1900s, a solution was implemented which was intended to stop the situation from getting worse. The Apies River, including certain feeder streams, was covered and forced underground in order to reduce the possibilities of waste dumping (Jenkins, 1955:45). In addition, and largely because of increasing demand for manufactured goods, various industries settled along the open sections of the river to use water, causing the development of the industrial belt still prevalent today. Soon thereafter, the Apies River had to be channelized as a result of severe flooding, the original space provided unable to cope with the influx of water from city runoff. This resulted in the inhabitants of Pretoria losing visual and physical access to one of its most valuable sources of natural capital (Jordaan, 1989:24).



1879



1889

1903

MICRO CONTEXT

NARRATIVE OF MARABASTAD

The narrative of Marabastad began in the late 19th century as one of the first communities to grow on the outskirts of a city in Southern Africa (Clarke, 2008). Situated north-west of Church Square on the southern bank of the Apies River, the kraal of Chief Maraba (Clarke, 2008) provided an opportunity for domestic workers and laborers to form a community close to their jobs in the city (Clarke, 2008). The community grew as the demand for laborers and domestic workers in Pretoria grew. It provided shelter and a place of belonging for those who were otherwise homeless and often far from their families.

By the 1870's, a village-like community was underway, with a school and a church established by the Berlin Missionary Society (Clarke, 2008). This area became known as the Schoolplaats, located just east of Chief Maraba's kraal (Fig 2.5). Schoolplaats consisted of approximately eighty small houses arranged in six rows parallel to the Steenhovenpsruit (Tayob, 2002:31).

Marabastad continued to expand, with additional land being made available just south of the Apies river in the 1880's, approximately the location of the Daspoort Sewage Works today (Tayob, 2002:32). The people of Marabastad relied on the river for water, and used this resource to farm the surrounding land for food. By the 1900's, Old Marabastad had reached its capacity, and New Marabastad was surveyed and laid out to the South. In 1905, Schoolplaats and Marabastad were resurveyed and combined to form a single township (Tayob, 2002:32).

South of Marabastad an Indian community began to settle, and in 1903, the Asiatic Bazaar was formally recognized as an established community (Clarke, 2008). Originally, the Pretoria Town Council intended for the Asiatic Bazaar to be a separate residential and commercial community for Asians away from the CBD of Pretoria (Clarke, 2008). The stands allocated for businesses in the Asiatic Bazaar were 50 by 50 feet, resulting in a dense, yet vibrant urban grain and character, still evident today (Clarke, 2008). Similarly, in the 1890's a coloured community established itself to the south of the Asiatic Bazaar (Clarke, 2008). The name 'Cape Location' was given to this community, referencing their origins in the Cape, and housing a small Muslim Malay community (Clarke, 2008).

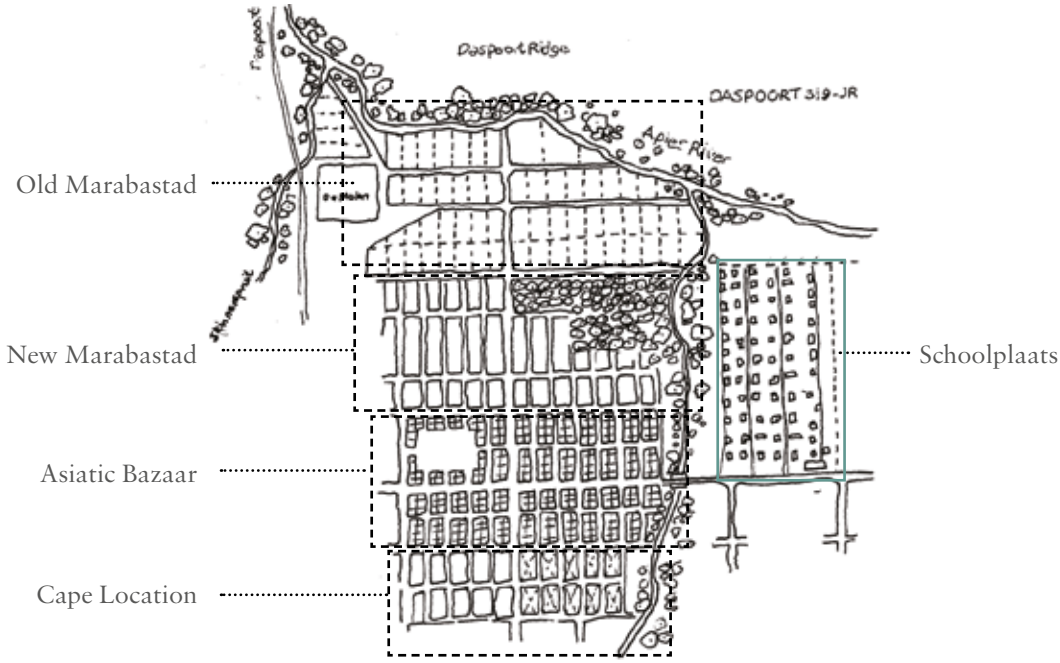


Fig 2.5 Schoolplaats, Old Marabastad, New Marabastad, Asiatic Bazaar, and Cape Location (Author, 2018)

BYLAAG 3: KENNISGEWING VAN ONTRUIMING AAN DIE INWONERS VAN DIE 'KAAPSE LOKASIE'

Stadsraad van Pretoria
City Council of Pretoria

Verw. / Ref. .....

Telefoon: MUNISIPALE SENTRALE
Telephone: MUNICIPAL EXCHANGE
861

AFDELING VAN DIE KLERK VAN DIE RAAD
DEPARTMENT OF THE CLERK OF THE COUNCIL, PRETORIA
8/9/75

Mnr. /mev. /Mej. J. P. ALLY
~~8 NAWAB STR~~
~~KAAP LOKASIE~~

Geagte Mnr. /mev. /Mej.

KENNIS VAN ONTRUIMING 8 NAWABSTR

Die bogenoemde eiendom wat bekend staan as 8 NAWABSTR word vir Munisipale doeleindes benodig en u word hiermee kennis gegee om die genoemde eiendom op/of voor 8 OKTOBER 75 te ontruim.

Daar is alternatiewe huisvesting vir u beskikbaar in Eersterust en om u her= vestiging moontlik te maak moet u hierdie kennisgewing so gou as moontlik na die Dorpsbestuurder te EERSTERUST neem om reëlings te tref vir u nuwe huisvesting.

Die Stadsraad van Pretoria sal onderneem om u huisraad gratis na Eersterust te vervoer. U moet hiervoor so gou as moontlik reëlings tref met mnr. Van Jaarsveldt by KAMER 347 WESBLOK, MUNITORIA.

Die uwe,

J. C. TALJAARD
DIREKTEUR VAN ASIëR- EN KLEURLINGSAKE
n. KLERK VAN DIE RAAD

Fig 2.6 A Notice of evacuation to residents of the Cape Location (UP Space: v.d waal collection, 2018)

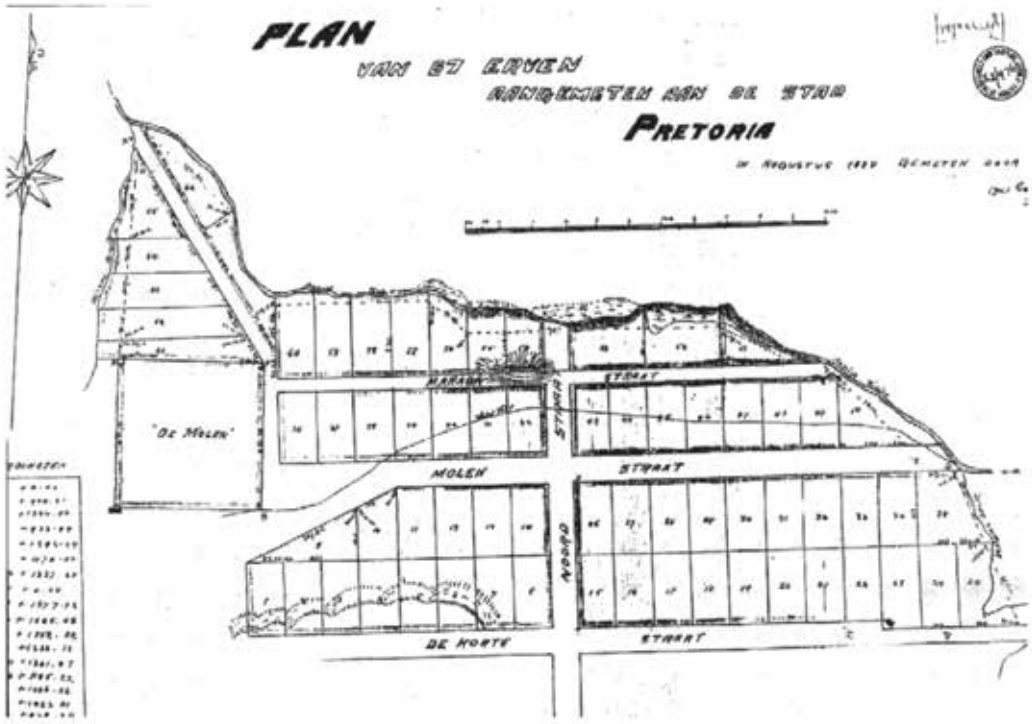


Fig 2.7 In 1888 Gert Greeff planed and laid out 67 where Chief Maraba's kraal was situated, this became Old Marabastad. (Tayob, 2002)

Fig 2.8 Land-use zoning for Asiatic Bazaar, 1978 (UP Space: v.d waal collection, 2018)

Fig 2.9 "The Nawab Miriammen Temple in 6th Street between Grand and Bloed Streets, photographed in 1970." (Clarke, 2008)

SOCIAL HISTORY

Fig 2.10 "Sunday morning in Marabastad. The view north along 6th Street towards Boom Street with Daspoort Ridge in the distance." (Clarke, 2008)

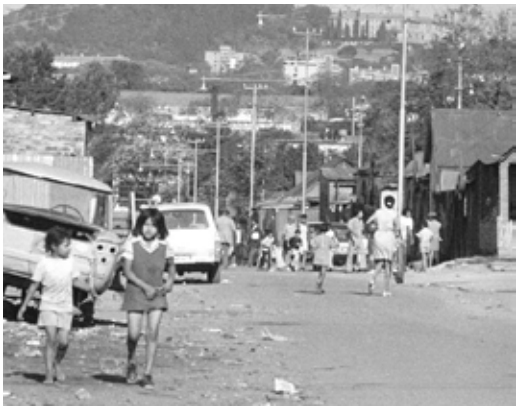


Fig 2.11 The view east along Grand Street with Meintjes Kop and the Union Buildings in the distance. (Clarke, 2008)

Despite the poverty and squalor that resulted from poor planning and absent service provision from government, the greater, all inclusive Marabastad presented a fundamentally strong spirit. The character of Marabastad expressed the resilience of the people, and soon became a stage for political expression (Tayob, 2002:34). A new genre of Jazz called Marabi developed, strengthening the already robust social community. Unsurprisingly, the government at the time became concerned with the population growth and proximity of Marabastad to the city centre. The relocation of Marabastad residents began in 1912, when the Pretoria Town Council moved the residents of Old Marabastad to New Location (Tayob, 2002:33). New Location, later known as Bantule, was situated west of Skinnerspruit, on the grounds of what is now occupied by the Tshwane University of Technology (Tayob, 2002:33). The Daspoort Sewage Works was established the following year on the site of Old Marabastad, and by 1918, the last of the original dwellings were demolished (Tayob, 2002: 33). All that remained was the church and one of the school buildings, which still remain on the site today, albeit in terrible condition.

The de-proclamation of Schoolplaats in 1930, due to overcrowding, significantly contributed to an increased population in New Marabastad. The slum-like living conditions worsened as basic services were still unavailable to the community. The process of clearing New Marabastad began in 1930, ironically, after it was declared a 'slum' under The Slum's Act of 1934. This prompted the relocation of those residents to newly established remote townships such as Atteridgeville and Shoshunguve. By the 1970's, through the implementation of various acts and laws, the National Party (NP) had cleared what was known as New Marabastad, the Cape Location and the Asiatic Bazaar of all its residents (Clarke, 2008). Amazingly, despite its disrupted history, the little of Marabastad that remains standing has maintained its bright and diverse character.

Fig 2.12 Aerial photos of the decline of Marabastad over time. (Tayob, 2002: 49)

1934 1965 1998

Fig 2.13 Noli map indicating the growth and decline of Marabastad (Tayob, 2002: 50)

PRODUCTIVE HISTORY

The establishment of Marabastad and its growth was as a result of the city's need to be serviced in order to function and grow. Marabastad essentially existed as a service zone to the city. Unsurprisingly, its presence beyond service provision was undermined, and in the light of further development, as long as Marabastad remained functional and in service to the city, the nature of that service was irrelevant. It became clear that relocating communities was secondary to improving the efficiency of the all important water reticulation services to the city.

The original water furrows and sewer systems that were initially created for Marabastad were deemed unable to cope with the increased volumes from the city, and by the late 19th century, a site for a new waste water plant was chosen. The confluence of the Apies River and Steenhovenspruit seemed to be a perfect location, and was chosen regardless of the cultural displacement it suggested (Jenkins, 1955:364). Close enough to the city centre to minimise infrastructural costs, and on a low lying region, the site itself could not have been a more perfect match for its purpose. The plans for the plant were submitted in 1904, but construction only started in 1913, once approximately 600 erven of the former residents of Old Marabastad were relocated to Bantule (Jenkins, 1955:364).

As previously mentioned, the construction of this sewage plant was one fundamental step of the many that caused the destruction of Marabastad. Another major contribution was the establishment of the Belle Ombre Railway station, completed in 1981, that, despite its primary function of rail transport, also served as a physical barrier (Tayob, 2002:39). The railway station was constructed to serve as the primary link between black townships situated to the North and the city centre. It became a major influx point, and yet, with it came a significant disconnect to the natural landscape beyond it (Fig 2.13).

Over the years Marabastad, situated to the south of the railway station, has developed into a major transportation node, with approximately 50 000 commuters moving through its structures daily (Tayob, 2002:39). As a result of these high traffic volumes, the informal trade has boomed, with over 18% of the city's informal trade occurring in Marabastad. Fresh fruit, vegetables and clothing make up the bulk of this trade, and sit scattered all over its markets and streets. The urban character of Marabastad has changed from a close knit community, to that of a back door access to the city of Pretoria. It sits as a thoroughfare, rich with history and character, yet no longer serving as a home for its community.

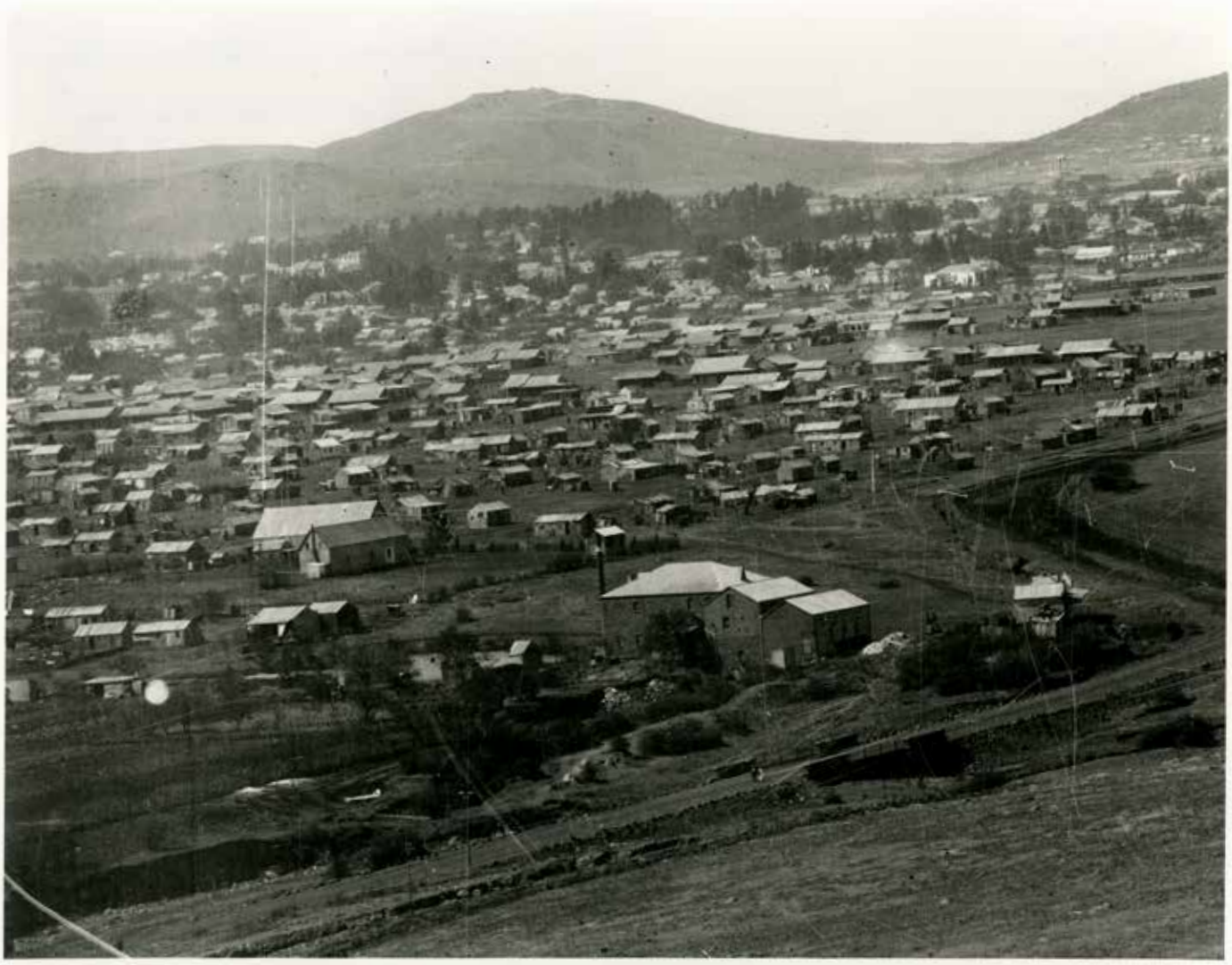


Fig 2.14 Old Marabastad viewed from Daspoortrand, 1905
(UP Space: v.d waal collection, 2018).

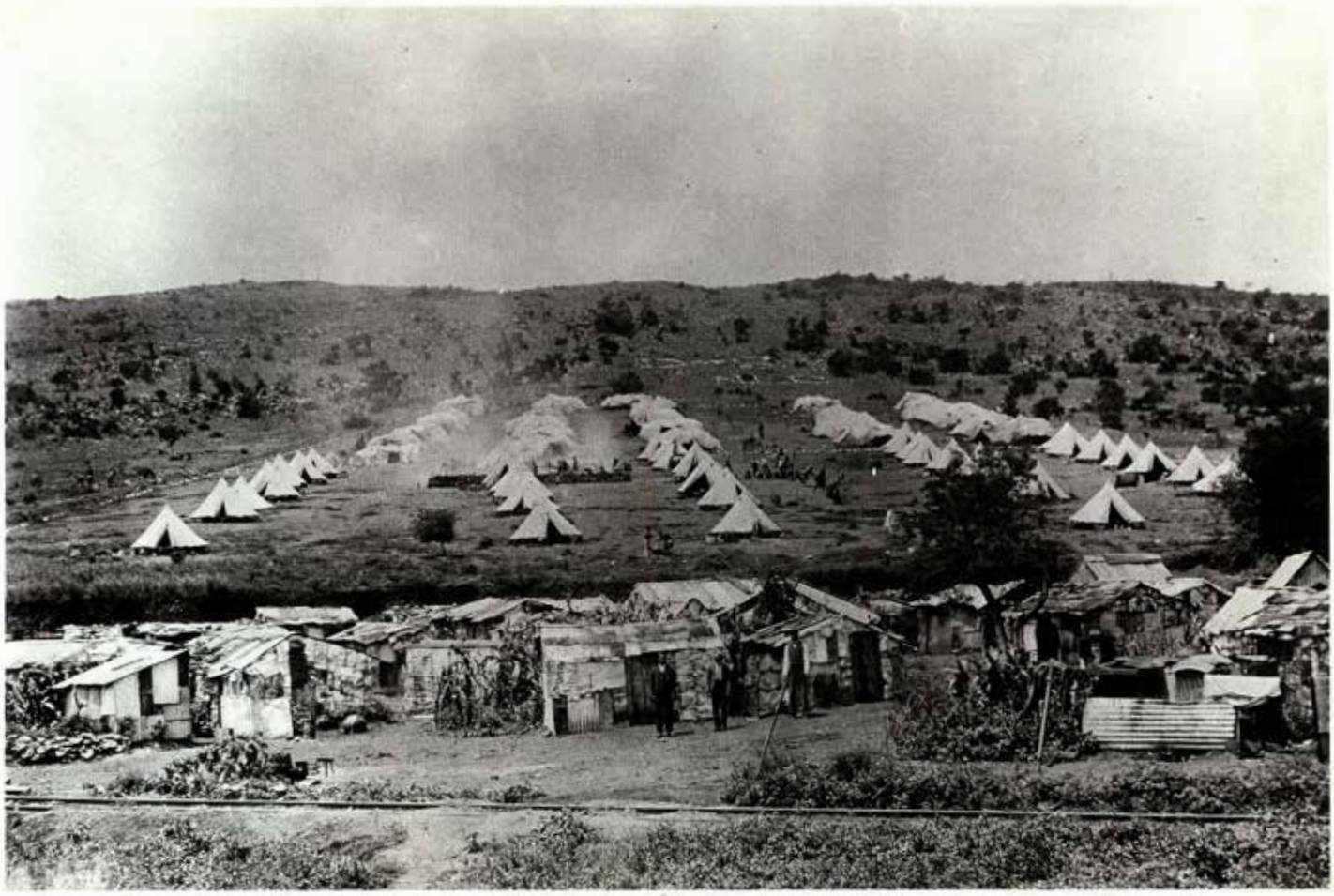


Fig 2.15 British Camp on the lower slopes of Daspoort Ridge across the river from Marabastad – 1900 (this is the approximate location of the proposed site) (UP Space: v.d waal collection, 2018)

Fig 2.17 Shower at work (Clarke, 2008)

"This photograph was taken in a motor vehicle workshop situated near the corner of Grand Street and Jerusalem Street. The motor mechanic, known as Shower, now lives in Atteridgeville. There are still vehicle workshops in this part of Marabastad" (Clarke, 2008)

"One of two horse carts, owned by Shorty Bedhisi, parked on the corner of Grand Street and 7th Street. They were used for transporting fruit and vegetables and also for general cartage in Marabastad. Motor vehicle wheels and tires replaced the original wooden-spoke wheels. The horses were taken down to the Apies River to be washed and brushed and then left to graze in open veld north of Boom Street in the Schoolplaats area." (Clarke, 2008)

Fig 2.16 "Afternoon traffic, the view west along Boom Street into Marabastad, 1973." (Clarke, 2008)

Fig 2.18 Fruit and vegetable horse cart (Clarke, 2008)

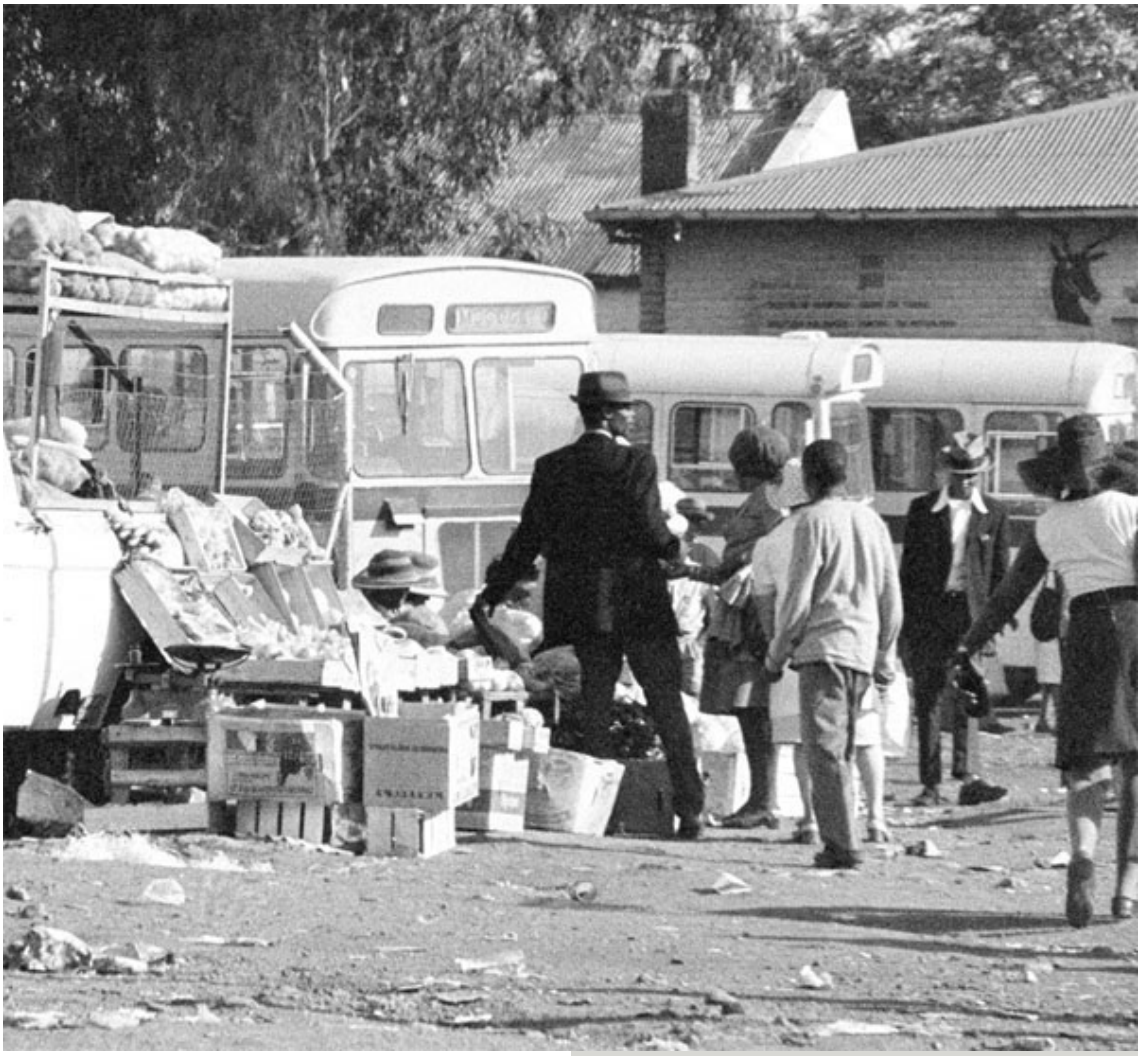


Fig 2.19 Marabastad bus terminus (Clarke, 2008)

"The Marabastad bus terminus in 1973 - and more than thirty years later it remains a major bus terminal. Light trucks were used to transport fruit and vegetables into Marabastad at night from outlying suppliers and were then parked to become street stalls during the day." (Clarke, 2008)

WATER TAP

The water trickled down into tin containers. It seemed an age waiting for a four-gallon tin to fill up. More and more people came to wait, the queue got longer, stretching down in snaky fashion. A few of us small boys were also in the queue.

It trickled into the bucket, or a dish, and the queue grew longer, not able to hear itself any more. You could hear a click of the tongue from the many souls waiting there; a click of helpless disgust and impatience. A pilgrimage at a communal water tap. It was like this in Second Avenue, you knew it must be like that at every other communal tap in Marabastad. Es'kia Mphahlele: Down Second Avenue (Tayob, 2002: 35)

Fig 2.20 2006 scene of vacant land in Marabastad (Clarke, 2008)

"The view in a southerly direction over the vacant land between 5th Street and Jerusalem street where the Royal Theatre used to stand. The trees in the photograph are close to the corner of Bloed Street and Jerusalem Street and may once have been part of a domestic garden. The old military tent is erected daily near the taxi rank by street vendors selling clothing and food." (Clarke, 2008)

Fig 2.21 2018 scene of the same vacant land (Author, 2018)

These images, taken more than ten years apart, tell the storey of Marabastad. No service delivery and scenes of waste and dilapidation have been a norm throughout Marabastad's history.

PRESENT-DAY MARABASTAD
fresh produce trade

The vibrancy and informal fresh produce trade is abundantly apparent throughout Marabastad. Temporary structures and pop-up stalls line just about every street.

Fig 2.22 Shop fronts along Boom Street (Author, 2018)

Fig 2.23 Informal trade dominates Mogul Street (Author, 2018)

Fig 2.24 Informal fresh produce trade near Belle Ombre station (Author, 2018)

Fig 2.25 Wasted tomatoes discarded in Steenhovenspruit (Author, 2018)

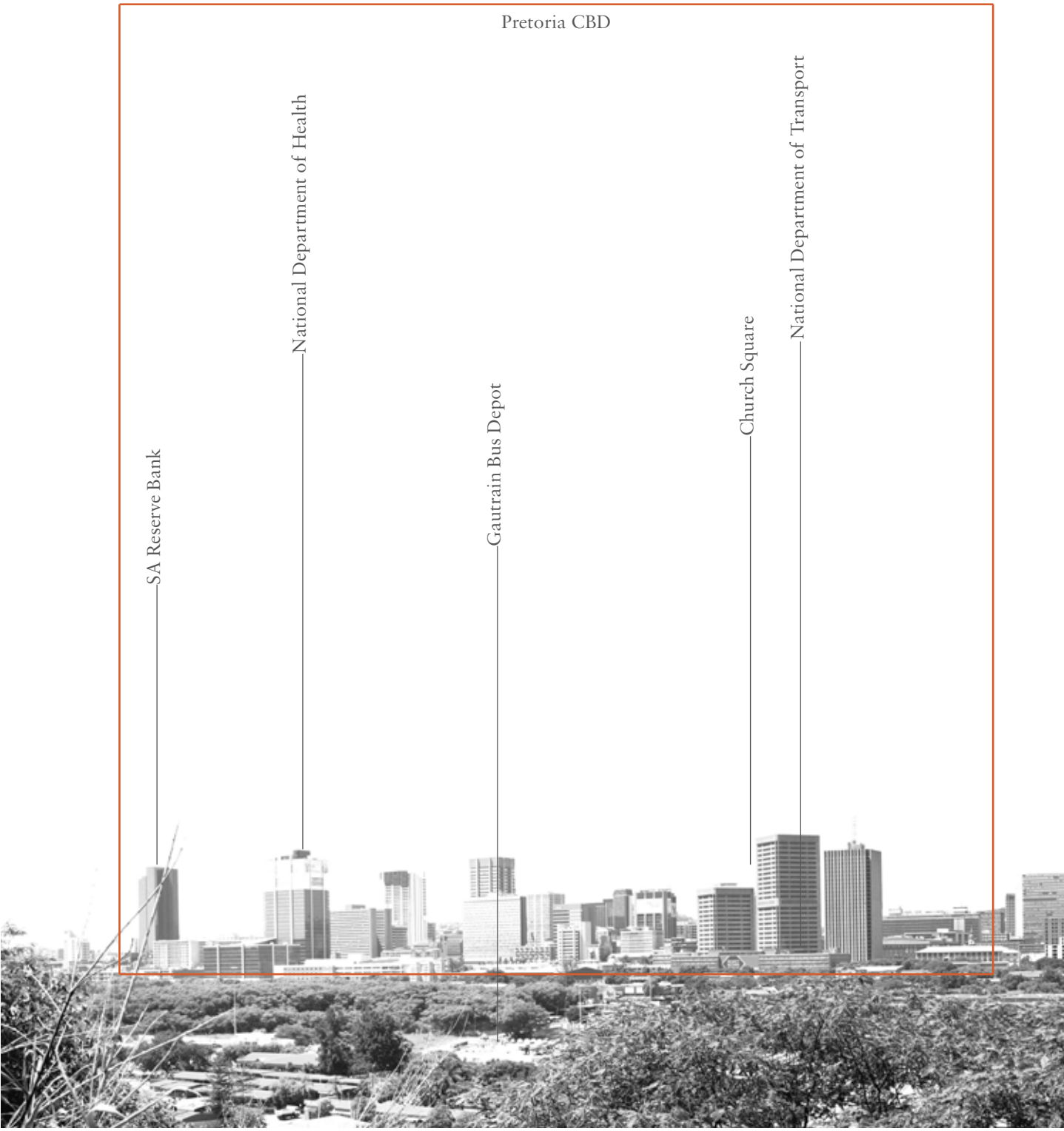


Fig 2.26 Pretoria from Daspoort Ridge (Author, 2018)

Marabastad
Department of Public Service and Administration
Freedom Park
Schubert Park
Voortrekker Monument
Belle Ombre Plaza
Military Health Base Depot
Belle Ombre Station

Fig 2.27 Daspoort is a disconnected island in the urban fabric as a reminder of the fragmentation of Marabastad's history (Author, 2018)

DASPOORT

HISTORY

As an functioning industrial site, Daspoort more than served the intended purpose. It was able to process and filter the sewage as per the city's demands, and for a long time managed to keep up with the set demands. The plant was designed as a natural system, using biofilters (Fig 2.32), sludge digester's (Fig 2.40), and humus tanks as a means to filter the waste water without chemicals. The plant prides itself on continuing to use natural processes with very little chemical addition.

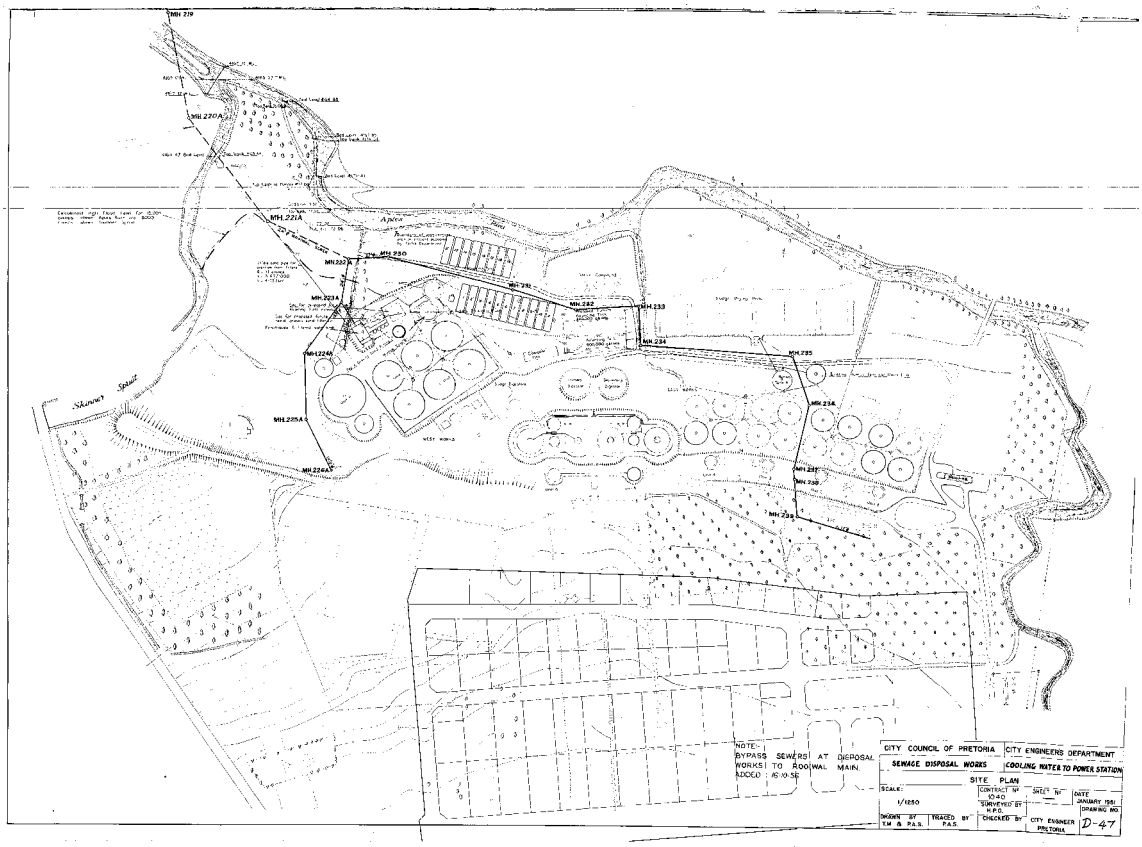
Since the establishment of the plant in 1913, Daspoort Sewage Works is purely industrial in nature, and although still in use, its holds with it the history of what was, and thus presents a slightly more complex landscape than simply that of a functioning industrial plant.

Fig 2.30 1948 aerial photograph of the western suburbs of Pretoria. The Daspoort sewerage works did and still does process the waste water for this area (UP Space: v.d waal collection, 2018).

Fig 2.28 Right top: 1951 site plan of Daspoort waste water treatment plant (Daspoort archives, n.d)

Fig 2.29 Right bottom: 1984 layout for upgrades and additions (Daspoort archives, n.d)

D-47


MH 219
MH 220A
MH 221A
MH 222A
MH 223A
MH 224A
MH 225A
MH 226A
MH 227A
MH 228A
MH 229A
MH 230
MH 231
MH 232
MH 233
MH 234
MH 235
MH 236
MH 237
MH 238
Apies
Skinner Street
NOTE:-
BYPASS SEWERS AT DISPOSAL WORKS TO ROOIWAL MAIN.
MOOD : 16-10-56
CITY COUNCIL OF PRETORIA
CITY ENGINEERS DEPARTMENT
SEWAGE DISPOSAL WORKS
COOLING WATER TO POWER STATION
SITE PLAN
SCALE:- 1/1250
CONTRACT No 10-40
SURVEYED BY H.P.O.
SHEET No
DATE JANUARY 1961
DRAWING NO D-47
DRAWN BY T.M. & P.A.S.
TRACED BY P.A.S.
CHECKED BY
CITY ENGINEER PRETORIA

D-461

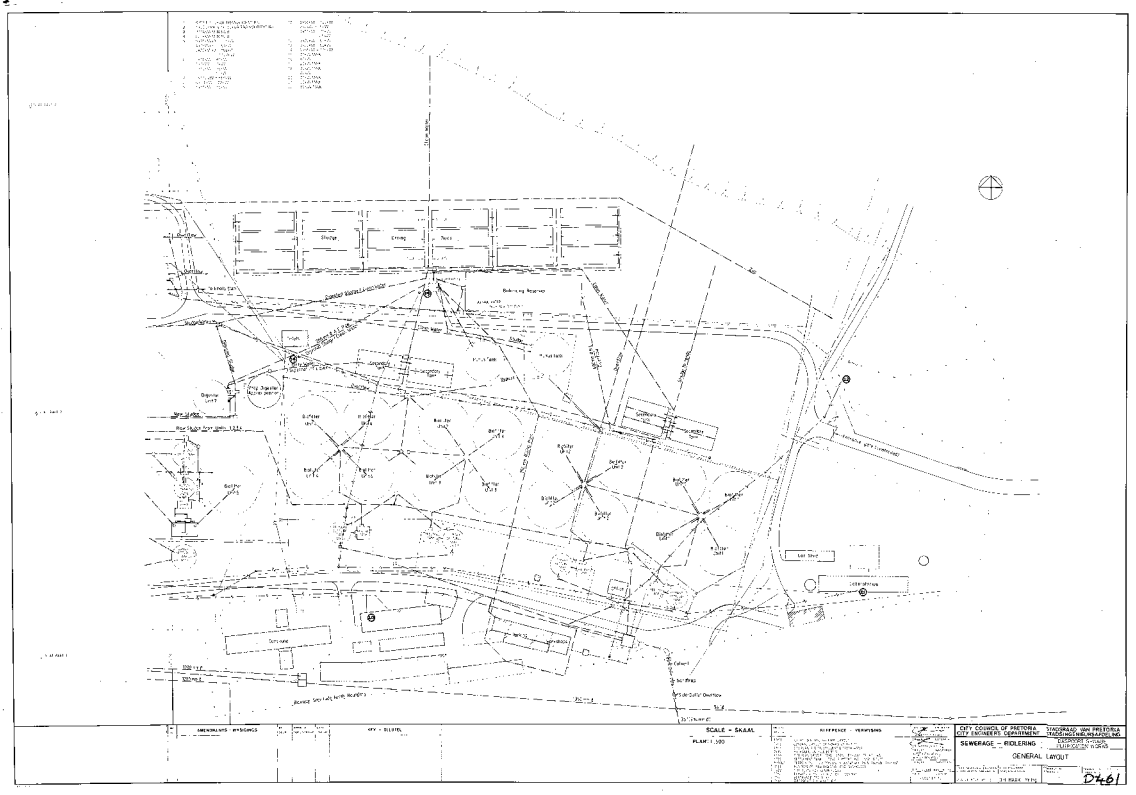

Shop
Drying
Store
Balancing Reservoir
Lab Shop
Garage
Cleaner
Cabinet
Workshop
Sewage Settling Tank Reserve
SCALE = 5x5ft.
PLAN 1:200
CITY COUNCIL OF PRETORIA
CITY ENGINEERS DEPARTMENT
SEWERAGE - RIDERING
GENERAL LAYOUT
D461

Fig 2.31 Pump house adjacent to site (Author, 2018)

Fig 2.32 Original 1913 biofilters (Author, 2018)

Fig 2.33 Overgrown and unused infrastructure (Author, 2018)

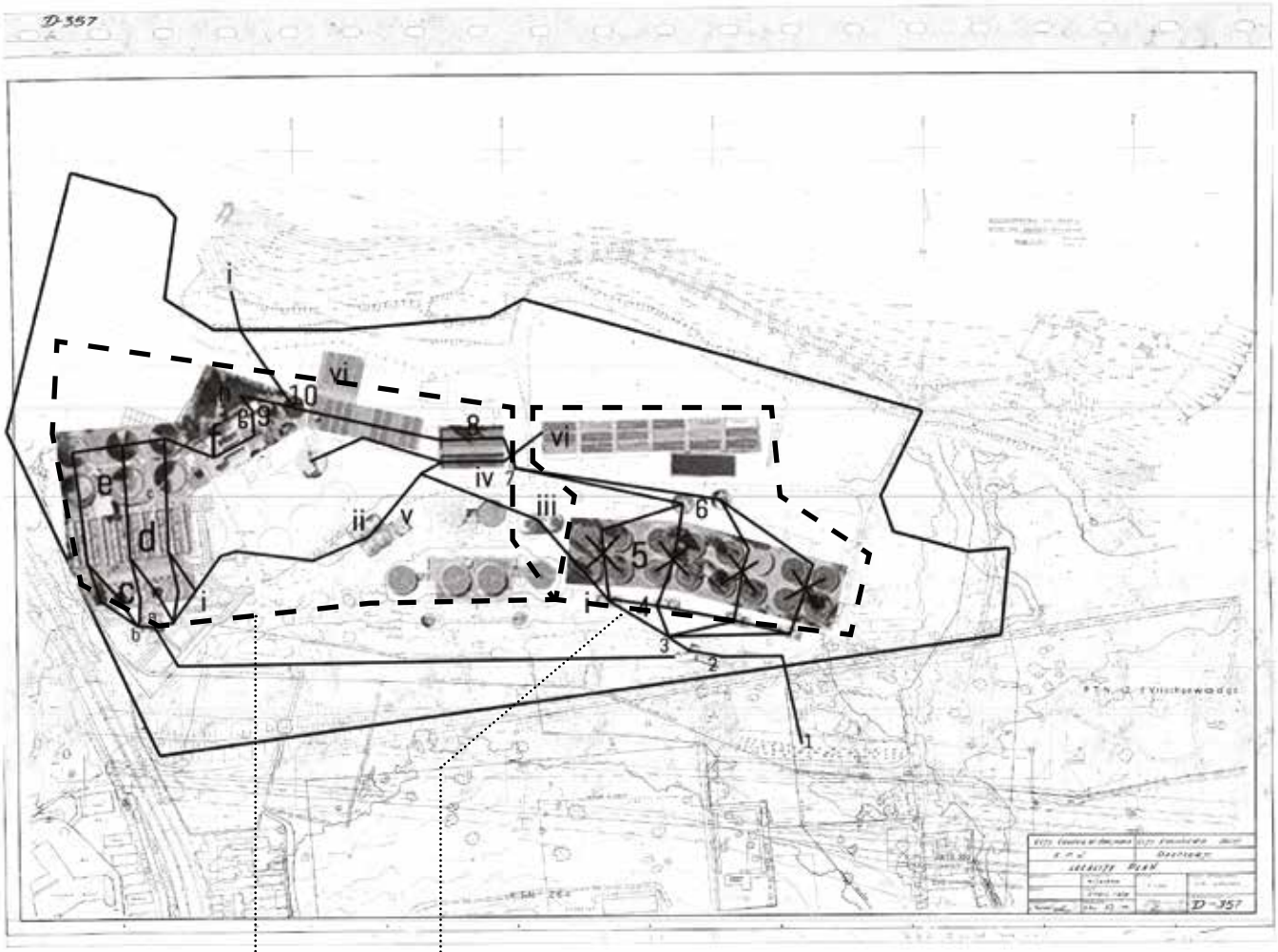
Fig 2.34 Access road into Daspoort (site is on the right) (Author, 2018)

PRESENT-DAY DASPOORT

The 100+ year history of the Daspoort sewerage works has left the landscape scattered with unused, dilapidated infrastructure left to the elements. As new technologies develop that increase the plant efficiency, the revered technologies of 1913 become redundant, and thus the infrastructure that housed them obsolete. The apparently incongruous layout of the plant is testament to this. New infrastructure is built where there is land available and old infrastructure is ignored or demolished to make space for future development. The landscape development has become a cut a paste exercise governed by cost and output. In many ways, the fragmented history of the site has continued through into its current industrial phase as a result of these technological advancements. Many portions of the site remain unused or abandoned, some still usable, and others run to the ground. Large expanses remain open and uncultivated, cause segments of land to remain futile to any use. Thus, the site sits latent with potential, offering bountiful expanses of unused land, and portions of old industrial infrastructure unharnessed and ignored.

Fig 2.35 Settling tanks covered in algae (Author, 2018)

Fig 2.36 sewerage plant functions and processes (adapted from Van Eeden, 2013)



WESTERN PLANT
48 Ml water per day
a. drum screen
b. grit chamber
c. primary settling tanks
d. process dams
e. secondary settling tanks
f. chlorination & distribution
g. UV treatment
h. maturation ponds
i. return to Apies river

EASTERN PLANT
8 Ml water per day
1. inlet (waste from PTA west&CBD)
2. screen: large inorganic waste removed
3. grit chamber: sand/silt/clay removal
4. primary settlement tanks
5. biofilters (nitrification&de-nitrification)
6. secondary settling tanks (humus tanks)
7. chlorination point (e.coli treatment)
8. maturation pond
9. UV radiation
10. return to Apies river

SLUDGE PROCESS
i. primary settling tanks
ii. primary digesters
iii. secondary digester
iv. sludge retention pond
v. furnace (methane gas)
vi. drying beds
vii. compostation plant (decommissioned)

Fig 2.37 Locality plan for eastern plant (adapted from Google Earth, 2018)

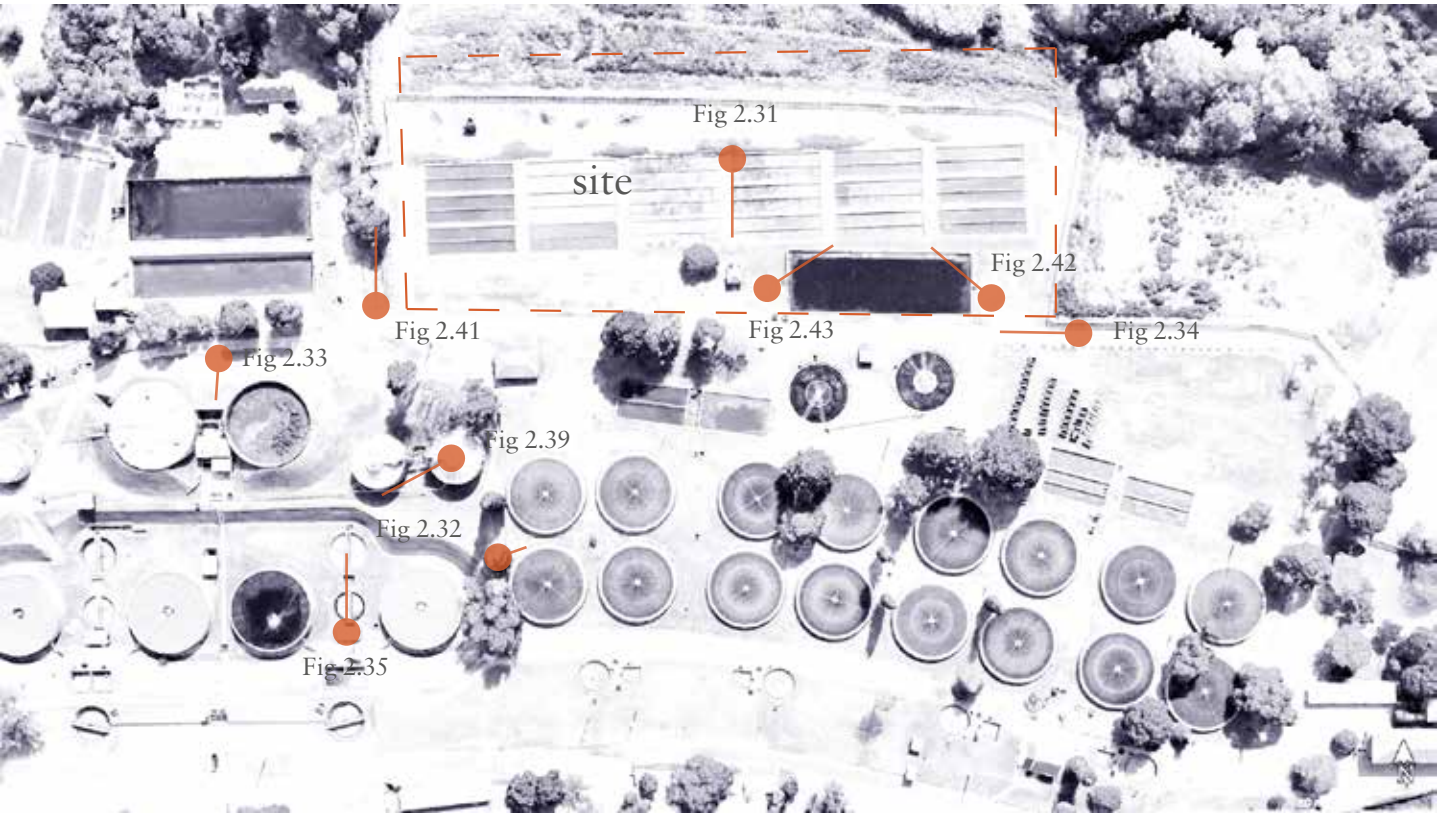


Fig 2.39 View over western plant (Marabastad is in the distance on the left) (Author, 2018)

Fig 2.38 Left middle: The most recently built biodigesters no. 7 & 8 . (Author, 2018)
Fig 2.40 Left Bottom: Overgrown exploded biodigester. (Author, 2018)
Fig 2.41 Right: The old Marabastad furrow. (Author, 2018)

Fig 2.42 Balancing tank overlooking site (Author, 2018)

Expanses of green lawn and trees scattered throughout give the impression of a park rather than a functioning sewerage works. To a large extent, the dilapidated condition of unused portions have allowed the site to become almost overgrown, giving way to the natural landscape, and as a result, a picturesque environment has developed along some of the peripheries.

The proximity of the CBD, Marabastad, Apies River, and TUT is a reminder of the unrecognised value of this land. It sits latent with potential to become much more that an industrial plant, but a socio-cultural site within the landscape that brings value and meaning to its surroundings.

Fig 2.43 Egyptian goose enjoying the balancing tank

Land use and zoning

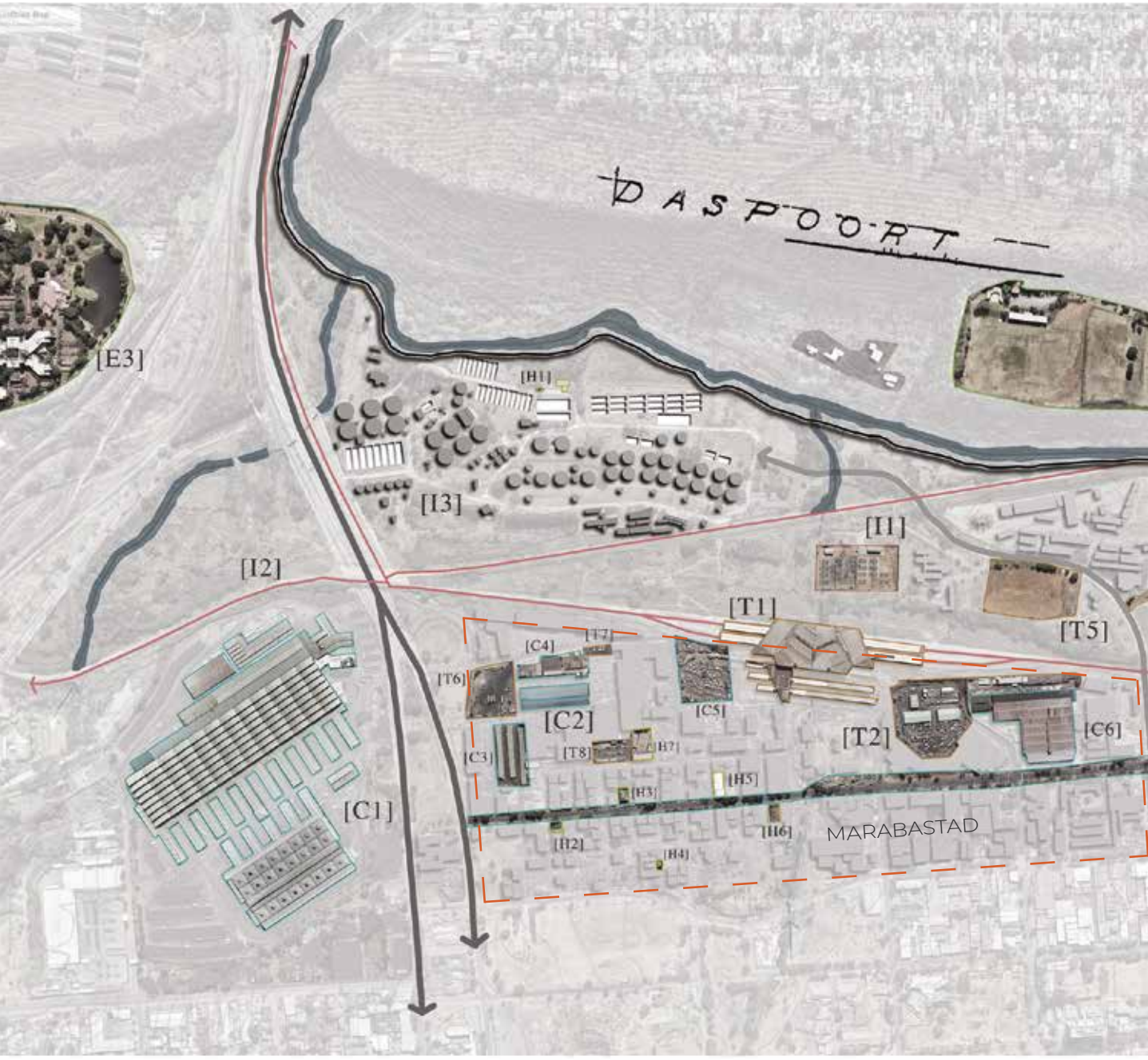


Fig 2.44 Urban land use (adapted from Google Earth, 2018. In conjunction with Pace)

education

E1 Pretoria Zoo
E2 Langenhoven School
E3 TUT

transportation

T1 Belle Ombre Train Station
T2 Belle Ombre bus stop
T3 Putco bus stop
T4 Gautrain bus depot
T5 A Re Yeng bus depot
T6 Bus stop
T7 7th street informal rank
T8 Jerusalem street rank

commerce

C1 Tshwane fresh produce market
C2 Marabastad retail market
C3 Markets stalls
C4 Fruit market
C5 Belle Ombre informal market
C6 Belle Ombre shopping complex
C7 Boom street commercial zone

heritage

H1 Old Marabastad church and school
H2 Columbia dance hall
H3 Ismaili Mosque
H4 Nawab Miriammen Temple
H5 Orient Theatre
H6 Empire Theatre
H7 Mosque of the Pretoria Islamic Society

infrastructure

I1 Municipal power grid
I2 Railway
I3 Daspoort sewerage farm

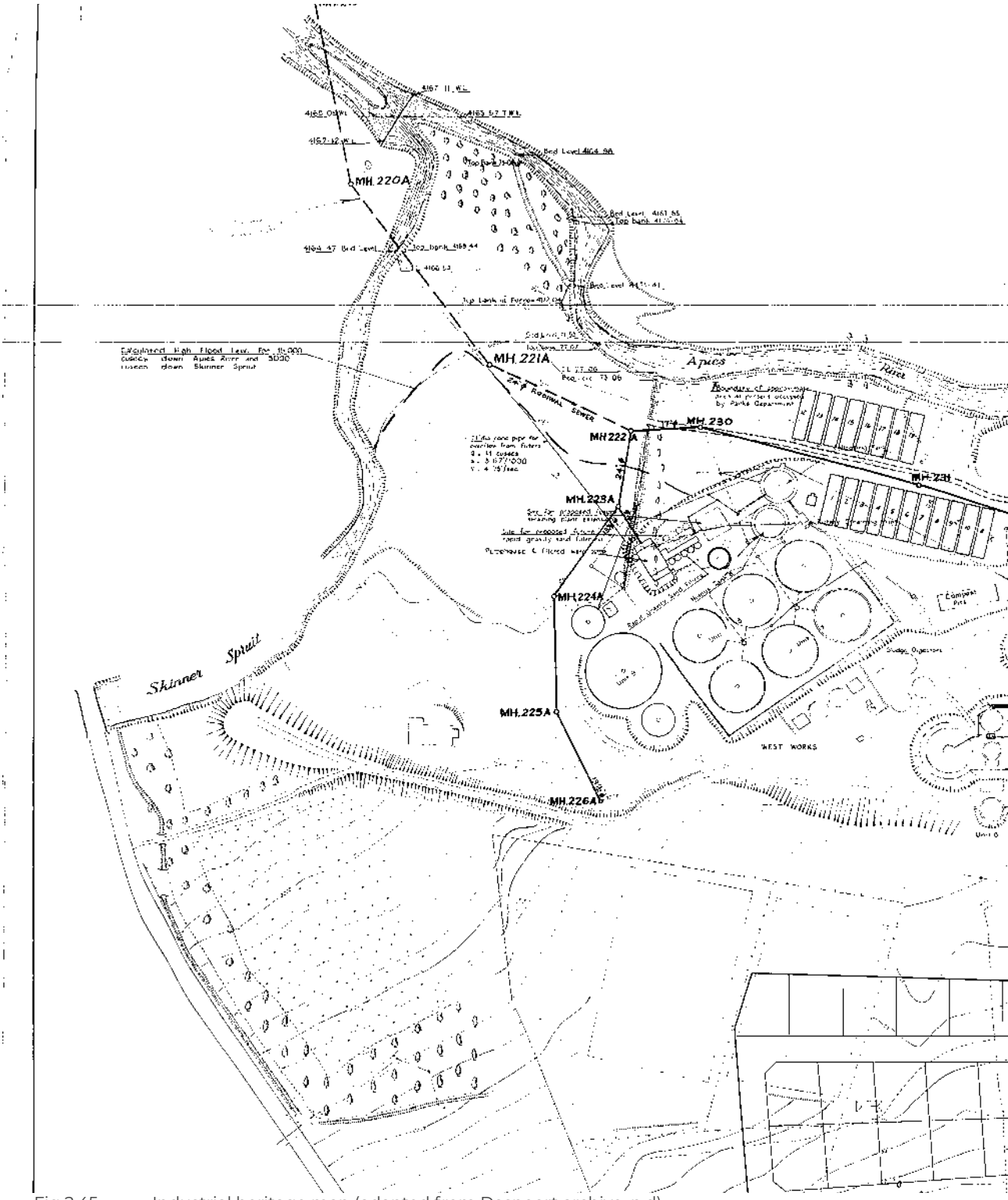


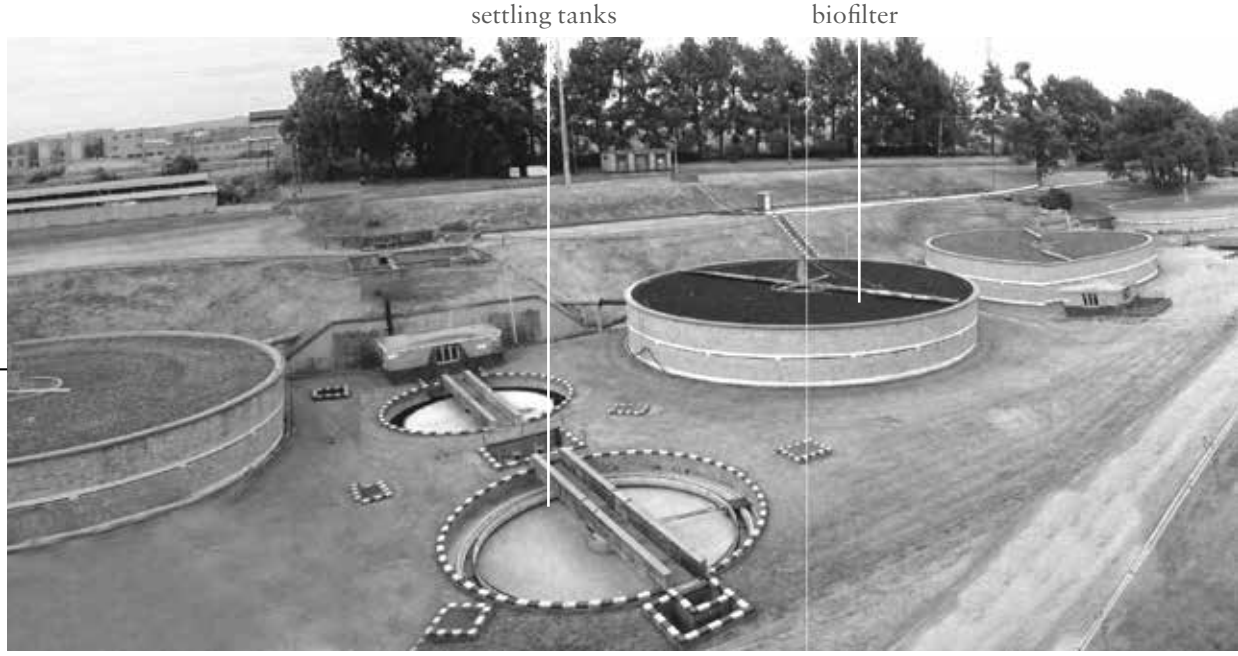
Fig 2.45 Industrial heritage map (adapted from Daspoort archive, n.d)

HERITAGE & VALUE ANALYSIS

The Daspoort Sewage Works presents a complex landscape, rich in its histories and narrative. In order to properly understand the site and its heritage value, its story has to be documented. Only then can the latent potentials it holds be reactivated and reintegrated into its everyday function.

The portions on site below indicated with this colour aim to highlight the areas in close proximity to the site that are of great importance to the sites future development. Each section will be explored in the pages to come, as the section to the right of the dashed line, the eastern portion, is explored in greater detail. It is this portion of the site that becomes decommissioned and thus requires regeneration and reintegration.

Fig 2.46 Panoramic view A (see plan) showing the site as is, from the drying beds, past the stone biofilters and through half a biofilter and settling tank. (Author, 2018).



A PANORAMIC VIEW OF DASPOORT

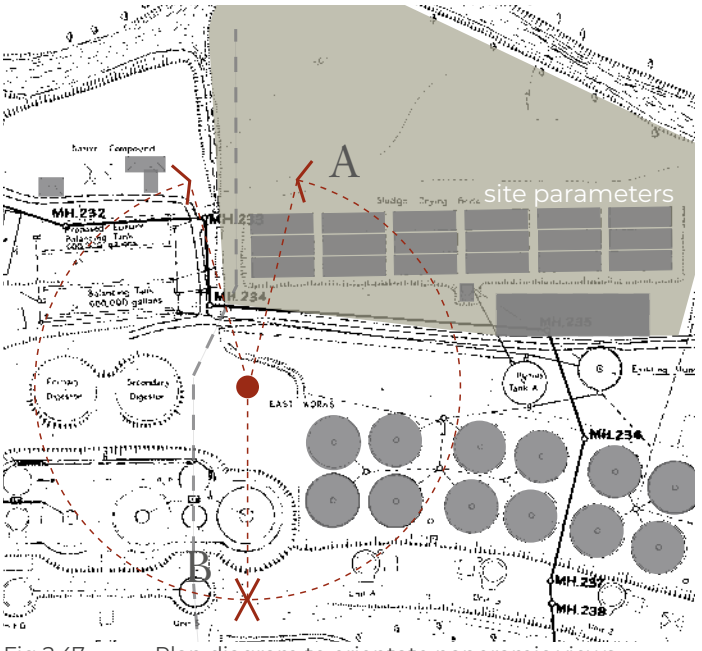


Fig 2.47 Plan diagram to orientate panoramic views

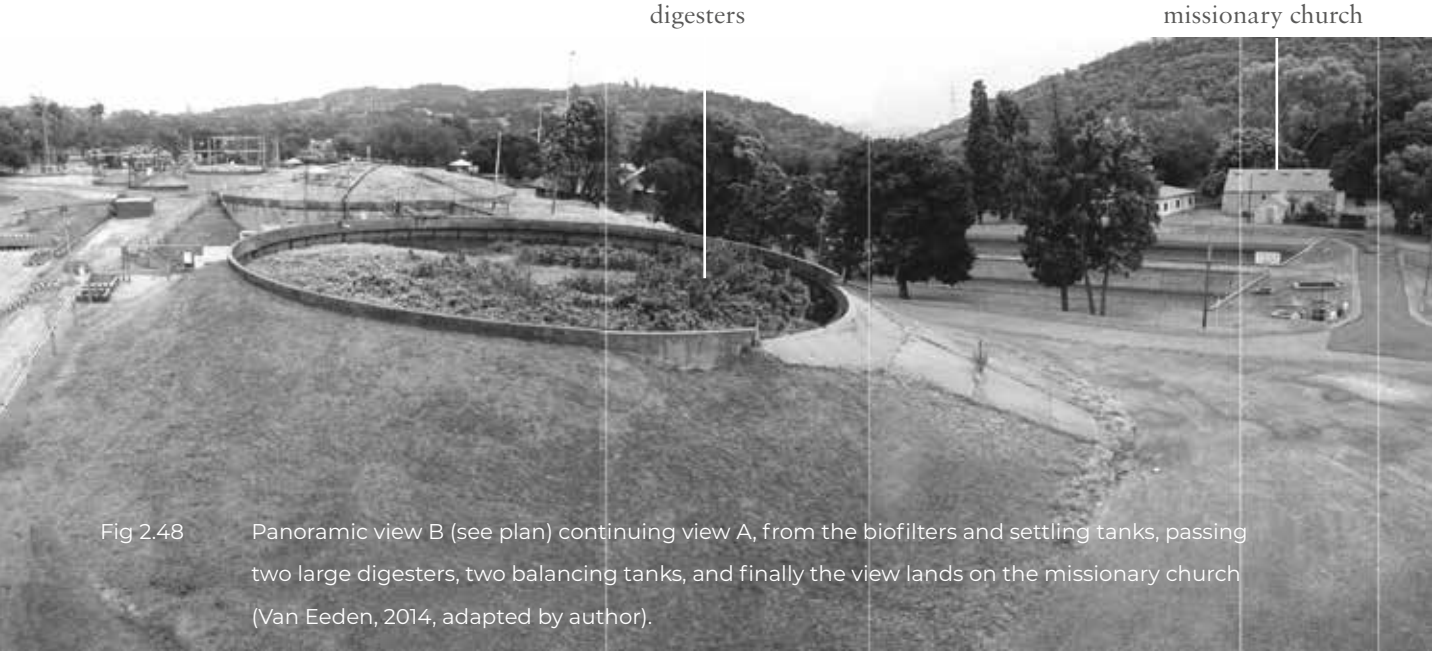


Fig 2.48 Panoramic view B (see plan) continuing view A, from the biofilters and settling tanks, passing two large digesters, two balancing tanks, and finally the view lands on the missionary church (Van Eeden, 2014, adapted by author).

AN APPROACH

As with any project that entails the reintegration of a heritage site into a community of sorts, a certain heritage approach needs to be adopted. Informed by the TICCHI Charter as previously explored, this site is made up of many histories, and as its stands, the most recent use is that of an industrial nature.

From the site investigation, it became clear that some sections of the site need to be left as is. For example, the missionary church as well as the old school have become ingrained into the history of the landscape. Some of the biofilters and settling tanks are still in use, and thus maintain their industrial function. The drying beds, however, are not in use, and become the best example of latent site potential. The intention is to maintain their character in parts, but also to explore the potentials of their footprint and location.

Essentially, the land needs to maintain its functional integrity, and through a renewed industrial and integrated proposal, value can be reinstated as an interpretation of its multifarious former uses.

Fig 2.49 Drying beds. (Van Eeden, 2014)

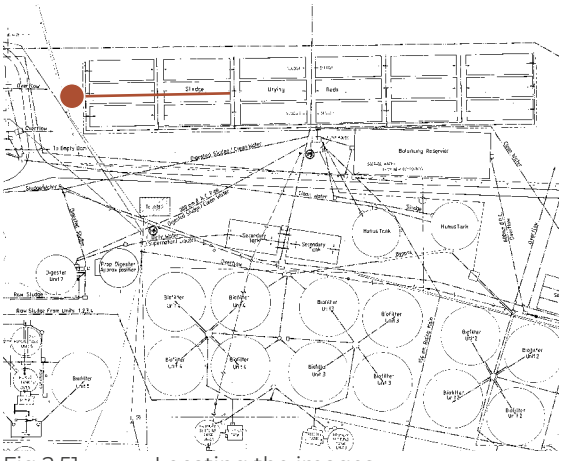


Fig 2.51 Locating the images

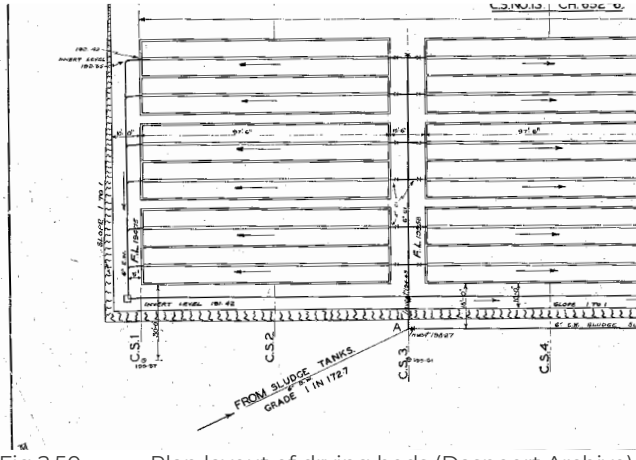
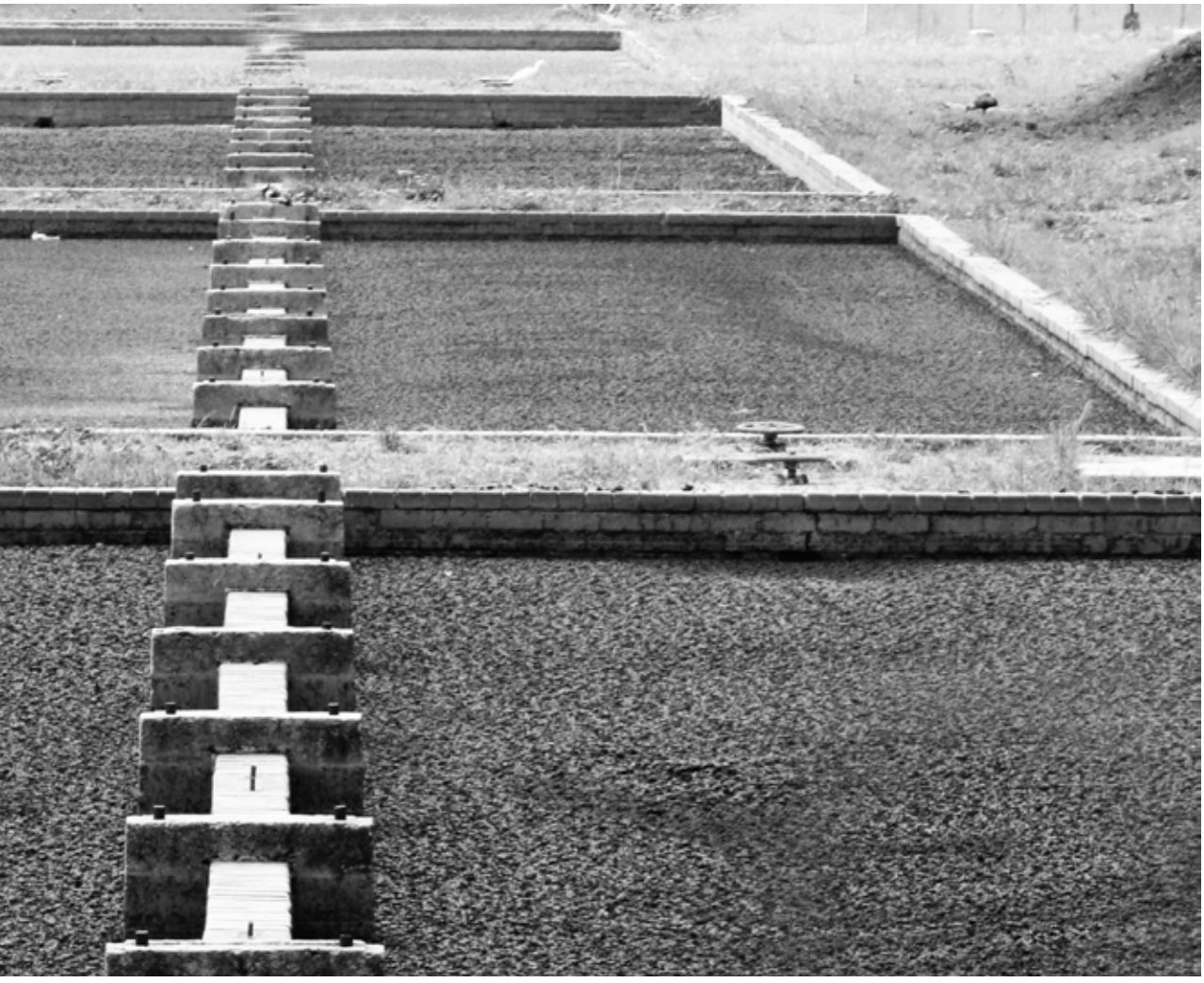
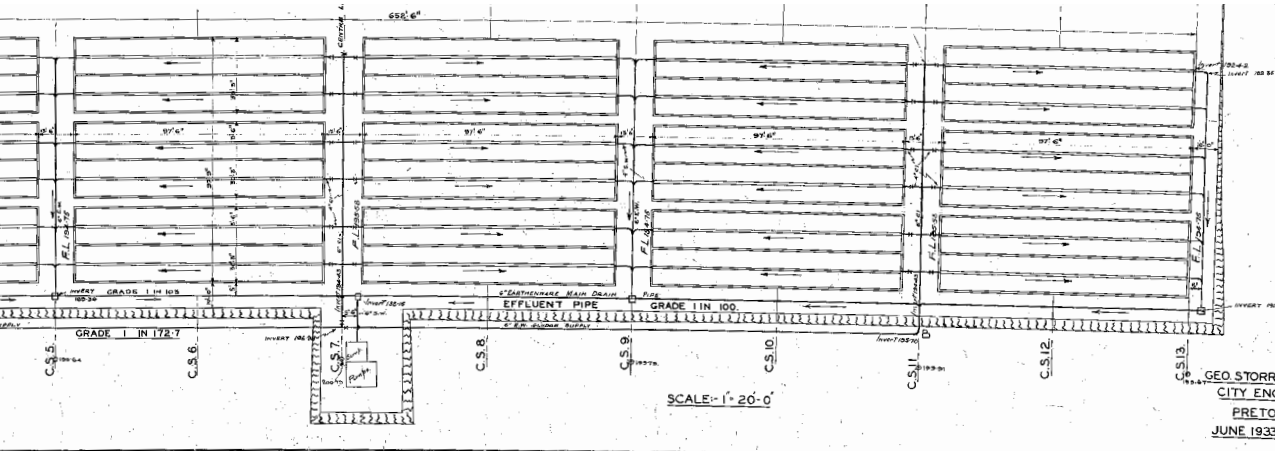


Fig 2.50 Plan layout of drying beds (Daspoort Archive)





THE MISSIONARY CHURCH

The old missionary church presents a character on site, a part of the history of Marabastad that wasn't demolished or eradicated. Beyond the intangible meaning that it contributes, it tells its narrative through materiality. The old, the stone work, still strong in sections, but falling apart in other areas. The additions all in the form of brickwork and corrugated iron roof sheeting. It sits understated on site, tucked in under the trees, almost as if the natural environment has tucked it beneath its wings.

Fig 2.52 The old missionary church (Van Eeden, 2014).

Fig 2.53 Materiality of the old missionary church. The brick, the stone, the roof. (Van Eeden, 2014).

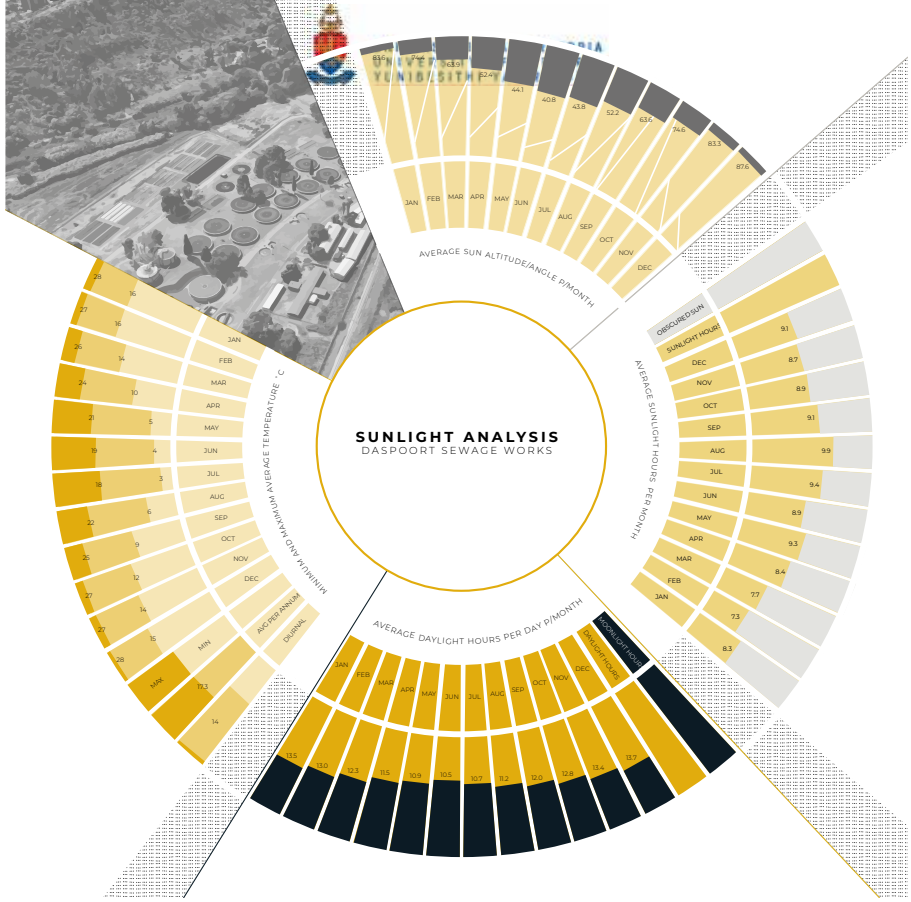


Fig 2.54 Sunlight analysis (Author, 2018)

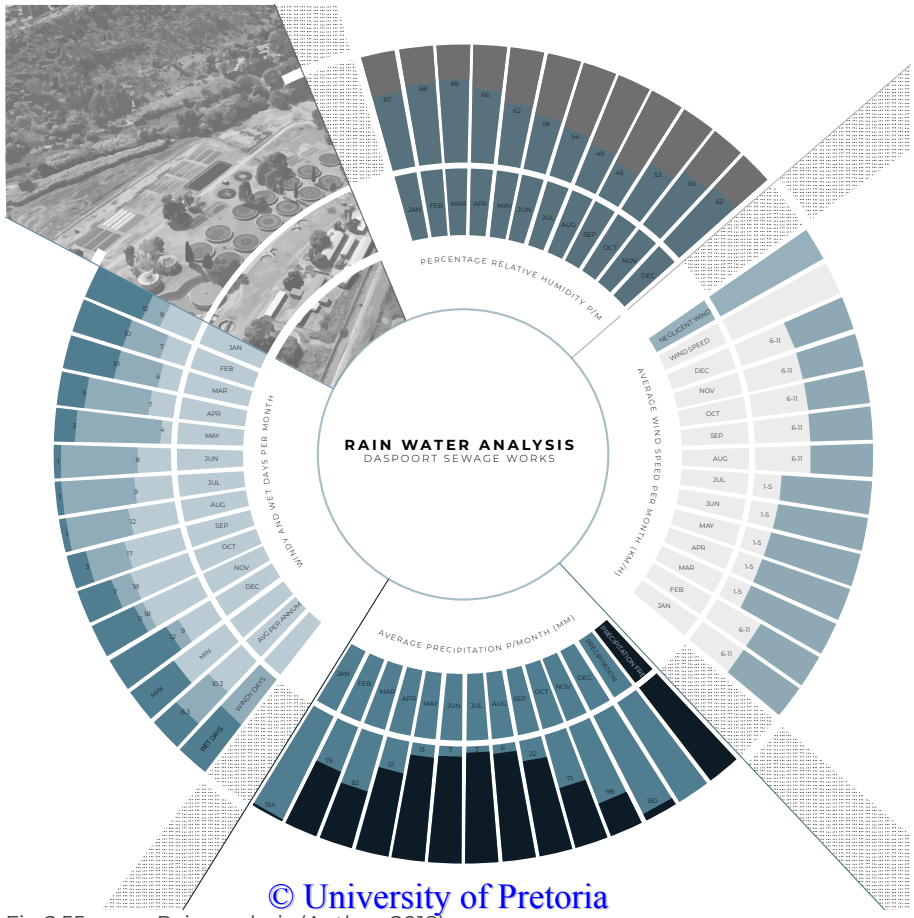


Fig 2.55 Rain analysis (Author, 2018)

CLIMATE ANALYSIS

To design an energy efficient building, it is crucial to implement as many passive design strategies as is possible according to the climatic conditions of the area. Such strategies include solar heating, thermal mass, natural ventilation, geothermal heating and cooling, etc. and can be coupled with mechanically engineered solutions or even hybrid systems so as to improve the efficiency of systems in place.

According to Conradie, the "climate of a location is affected by its latitude, terrain and altitude, as well as nearby water bodies and their currents. Climates can be classified according to the average and the typical ranges of different variables, most commonly temperature and precipitation" (Conradie, 2012:2). Conradie adapts and simplifies a model of 68 different vegetation biomes, identifying Pretoria as sitting on the boundary between two biomes, namely the Central Bushveld and the Moist Highveld Grassland (Conradie, 2012:3). SANS 204 (2011: 30) recognises six main climatic regions within South Africa, of which Pretoria is classified as Temperate interior. For each of these climatic zones, solar exposure factors and various factors are specified, although the exact location of a project within these large classifications is necessary. Refer to chart and table alongside to understand the orientation and solar exposure factors for passive seeing in Pretoria, as per SANS 204 (2011).

According to the Koppen-Geiger classification, Pretoria's climate falls within the spectrum of the Cwa classification, defined as warm temperate, with dry winters and hot summers. According to Conradie, this classification gives light to certain design strategies that can be implemented to maximize passive means of achieving thermal comfort level in buildings (Conradie, 2012:5). Such strategies include passive solar heating, thermal massing in parts, exposed mass and night purge ventilation and also natural ventilation. These methods aim to utilise natural energy as minimise other energy uses.

To fully implement any such strategies, the sun and rain influx and exposure needs to be determined. The complex diagrams alongside indicate the full extent of information gathered on both aspects, respectively.

TIME LINE

the fragmented and disrupted history of Marabastad

An investigation into key events in the development and degradation of Marabastad

Information sourced from : Clarke (2008), Jenkins (1955), Mabin (1992)

1839
First white settlers in Pretoria

1855
Pretoria Established

1870
Chief Maraba sets up kraal on the Apies River to the west of Steenhovenspruit, below Daspoort Ridge

1880
Gold discovered at Witwatersrand

1888
Old Marabastad Established around Chief Maraba's kraal

1888 - 1903
Anglo-Boer War

1904
HD Babcock submits first plans for a sewage reticulation & treatment works

1909
Channelisation of Apies River after 3 drownings due to floods.

1850 | 1870 | 1880 | 1890 | 1900 | 1910

1858
First open water furrow systems laid out along Cardu Deccumanus (grid) in CBD, supplied from Fountain's Valley

1870
Schoolplaats Established by Berlin Missionary Society on Frischgewaagd. It is the first black township in Pretoria

1885
Laws passed restricting Indian property ownership; Bazaars established for non-white trade.

1890
Cape Location proclaimed for Asian community

1900
Black refugees stream to Pretoria; insufficient space in Schoolplaats/ Marabastad New Marabastad develops

1903
Asiatic Bazaar established

1905
Old Marabastad and Schoolplaats combined

1912
Residents of Old Marabastad relocated to Bantule

1918
Tshwane Market established
Last homes in Old Marabastad destroyed

1930
Clearing New Marabastad begins

1934
Slums Act passed. Schoolplaats/ Old Marabastad remnants declared slum. Schoolplaats de-proclaim, inhabitants moved to New Marabastad

1950
Group Areas Act passed

1966-1994
All development banned in Marabastad

1967
Proposed highway interchange over Marabastad

1920 | 1930 | 1940 | 1950 | 1960 | 1970

1938
New road through Daspoort constructed, parts of Marabastad demolished/disconnected from Skinner Spruit.

1970
Last Indian inhabitants in Marabastad relocated to Laudium

1955
New Marabastad demolished

1920
Marabi Jazz develops

1948
Research facilities and Water laboratory develop at Daspoort Sewerage Works.
National Party comes into power.

1919
Es'kia Mphahlele born in Marabastad

1913
Construction begins on Daspoort Sewerage Works
Transvaal Native Lands Act passed

1940
Black inhabitants relocated to Atteridgeville.

1981
Belle Ombre Train Station constructed, intended to serve non-whites exclusively and connect CBD to Shoshunguve

2002
Tayob Urban Development Framework for Marabastad

2013
Daspoort Sewerage Works Centenary

1980 1990 2000 2010 2020

2018
Tshwane Market Centenary year

2007
Title deeds given back to some former residents of Marabastad

1994
Apartheid abolished, ANC come into power

03

theory

RESILIENCE PERSPECTIVE, NATURAL CAPITALISM AND TERRAIN VAGUE

Tools to understanding current conditions as architectural informants

When one considers the complexity of the township of Marabastad, and observes it from the perspective of resilience and the inherent "right to the city" this encompasses, the rhetoric of that ideal becomes apparent (Lefebvre, 1996:173) . Lefebvre (1996: 173) defines this "right to the city" as the "right to freedom, to individualisation, to habitat and to inhabit". Alongside this right is the intrinsic need of any individual and the community to which he or she belongs, to not only participate in the making of the city, but so too to appropriate space, whether it be urban or local.

The history of the site depicts a layered historical condition present within Marabastad; Marabastad as a people, as a culture, as a landscape, and as an industry. The key challenges of this dissertation lie at the intersections and resulting interstices of these aspects, the possible synergies, interaction, encounters, and most importantly, how the architecture stems from this complex landscape as its foundation. To a certain extent, the "complex adaptive systems" either damaged or broken in the past need to be re-established, re-organised and re-adjusted to echo the resilience of the social memory of the people (Folke, 2006:257). Thus the resilience perspective (Folke, 2006:253-267) forms one of three pillars of the theoretical premise for this dissertation. It is critically analysed, accompanied by, and integrated with similar investigation into notions of natural capitalism (Hawken, Lovins & Lovins, 1999: 1-21) as influencer and *Terrain Vague* (de Solá Morales, 2014) as context. These three aspects, once evaluated, are integrated so as to form a concise and focused theoretical grounding.

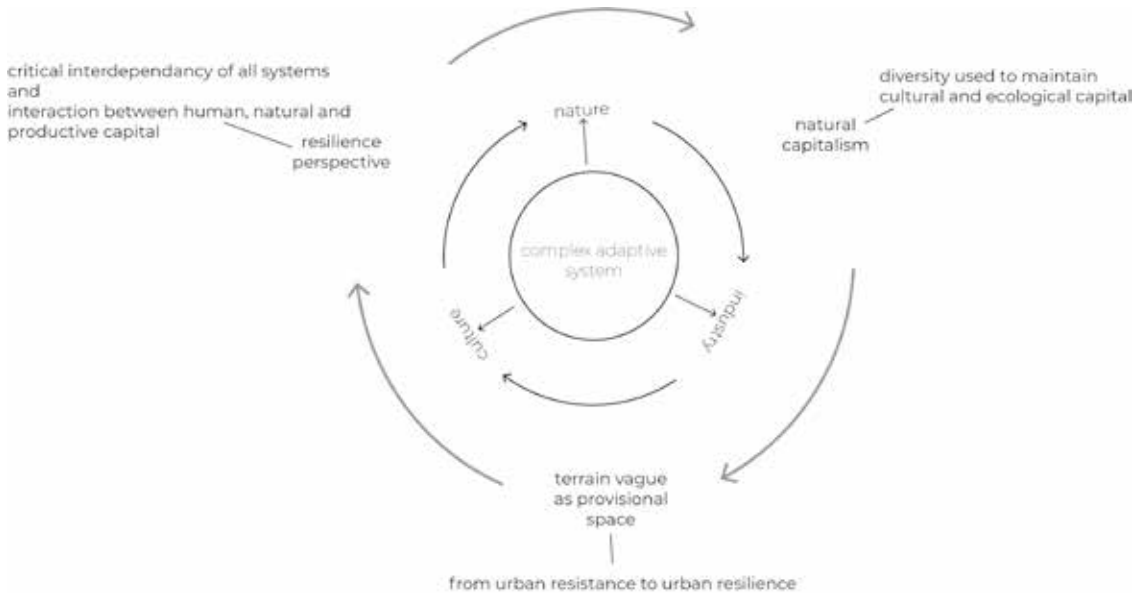


Fig 3.1 A diagram synthesising the theoretical intentions (authors diagram)

Resilience Perspective: Re-defining perceived vulnerability in human–nature/complex systems as being a state of criticality and diversity

The concept of resilience has been defined and adapted to multiple branches in social and ecological systems (Folke, 2006:253). Although its roots are grounded in ecosystems and ecology, the research approach has advanced to understanding certain social processes, networks and learning, and the adaptive capacity of communities in determining their resilience (Folke, 2006:253).

Resilience, as introduced by Holling (1973:17), is defined as "determine[ing] the persistence of relationships within a system and is a measure of the ability of these systems to absorb changes, state variables, driving variables, and parameters, and still persist". Folke (2006:254) explores this notion in that it develops from a supposed stability, with the goal of minimising variability to gain control and fix outcomes, to a system of understanding that attributes high variability and a multi-stable state as being catalytic to existence and resilience of socio-ecological systems. Essentially it allows complex adaptive systems to absorb inherent unpredictability (Folke, 2006:254).

The implication is that the characteristics that deem a system vulnerable are now being viewed as characteristics of criticality (Adger, 2000:349) for a resilient system. The idea of resilience within a synthesised system of human participants, social learning and human–nature relations allowed for the development of "learn[ing] to manage by change" (Folke, 2006:255). As opposed to the reactive nature of previously 'controlled' systems, this method of management and proposed governance accommodates and absorbs disturbances, interactions and behaviour at multiple scales (Folke, 2006:256). Each smaller network becomes part of a larger one, and so too part of an even smaller one, causing various scales of interdependency. This allows for functionality of a system "not only on temporal scales but their interrelations with spatial scales and spatial heterogeneity [that] enables [a] multi-stable behaviour in [an] ecosystem" (Folke, 2006:256).

This system presents itself as complex, both accommodating of the individual and their chosen practice, yet also inherently inter-dependent through a multiplicity of smaller networks (Folke, 2006:256). In effect, this allows the system to absorb disruptions in each pocket of temporal functionality. The rest of the network then works to accommodate and restructure that segment. The system moves from the previous model of linearity, to one that is cyclical and almost rhizomic in nature. Thus, the cultural landscape of Marabastad is understood differently, not by changing it, but rather by re-defining the perspective from which it is studied. "Hence, a complex adaptive system consists of a heterogeneous collection of individual [bodies] that interact locally and evolve in their…behaviours, or spatial disruptions based on the outcome of those interactions" (Folke, 2006:257).

The above is but a part of the analysis and relevance of the resilience perspective on Marabastad. It is necessary to understand Apartheid planning, the Group Areas Act of 1950 (Mabin, 1992), and the formalisation of the 'informality' that was Old Marabastad that implicated the ability of Marabastad's cultural complexity to develop in a flexible and organic manner (Clarke, 2008). The rich cultural heritage ingrained in its people, as well as the implications on the urban fabric, show a sense of tenacity (Clarke, 2008). This tenacity can be understood through the resilience perspective, as the erosion of the tangible and somewhat the intangible was as a result of human action. A combination of top-down approaches was used to eradicate the possibility of permanence, of establishment, and of resilience (Folke, 2006:257).

Nevertheless, because of the persisting socio-cultural identity of the people, they were able continually adapt:

, to forced dispersed interaction, apparent dislodgement, and "far-from-equilibrium dynamics" (Folke, 2006:257). In actual fact, it is these characteristics that not only forced adaptability, flexibility and accommodation of change, but through such advancement, the people of Marabastad were able to become an emblem of resilience and extreme complexity (Clarke, 2008; Folke, 2006:257). Diversity is said to "effect the self-organising ability of complex adaptive systems", both in terms of absorbing disturbance and in re-generating and re-organising the system post-disturbance (Levin, 1999:73). In the context of Marabastad as a people being classified as a complex adaptive system, it is also a socio-ecological system and fits into a larger scheme of place (Levin, 1999:73).

In effect, this exploration implies that any design and development of a site within Marabastad needs to address these aspects of adaptability and flexibility. Regenerative design empowers resilience, and enables the complex adaptive system that is Marabastad to branch out into physical means of creating place. Architecturally, the site must be repurposed to house integrated hybrid activity, where there is interaction between people and social processes, and an undeniable understanding and awareness created of the landscape that surrounds Marabastad. The architectural language of the design intends to emulate access and connectivity, closing the loop between the people, available resources and previously inaccessible industrial processes.

There is cross-scale interplay between the different aspects of this proposal, and in order to design for integration and resilience, the critical interdependency between all components needs to be exploited and understood (Hawken et al., 1999:3) The proposal sits in a heritage-rich landscape of which the people, industry and nature all form key components. The people, i.e. the social system, is now better understood as a community that withstood shocks to their social infrastructure and environment, but this system also constitutes social capital and social memory (Folke, 2006:261).

Fig 3.2 Evolution of land use patterns (Lyle, 1994: 22_

Natural Capitalism: Completed resource engagement and a state of critical inter-dependency

Social capital, including trust, social networks, etc., is also understood as human capital (Folke, 2006: 261; Hawken et al., 1999: 4). According to Hawken et al. (1999: 4), "an economy needs four types of capital to function properly: human capital, financial capital, manufactured capital, and natural capital". Human capital comes in the form of labour and intelligence, culture, and organization. Financial capital consists of cash, investments, and monetary instruments, whereas manufactured capital includes infrastructure, machines, tools, and factories. Natural capital is made up of resources, living systems, and ecosystem services (Hawken et al., 1999: 4).

Typically, industrial systems only place value on the first three aspects with the inclusion of raw natural resources, albeit not natural capital (Hawken et al., 1999: 3). Natural capital consists of all natural resources, ecosystems, living systems, and all services derived directly there-from (Hawken et al., 1999:3). The ignorance of this is prevalent in the industrial development of cities, processes, manufacturing and general human development of infrastructure (Hawken et al., 1999:5). Essentially, the nature of industrial capitalism present in society neglects to assign a value to one of the largest stocks of capital it employs: "it liquidates [it]…and calls it income" (Hawken et al., 1999:5). As a result, "the natural resources and living systems, as well as the social and cultural systems that are the basis of [prolonged] human capital" is ignored (Hawken et al., 1999:5).

Hawken et al. demonstrates the 'recycling services' provided by natural systems: oxygen production (exchange of carbon dioxide and oxygen among plants and animals), biological systems, and lastly that no machine can substitute "human intelligence, knowledge, wisdom, organisational abilities and culture" (Hawken et al., 1999:4-5). Human and natural capital thus go hand in hand, and according to Hawken et al. (1999:6), studies have been done that indicate such capital outweighs the resilience as well as productive value of financial and manufactured capital. It becomes the responsibility of industry to recognise both human and natural capital in its processes and incorporate the earth's living systems if any form of sustainability is to be reached.

These implications lead to inter-dependent networks of industry, where technological advancement is used to effect efficiency in industry. Raw resource removal from the earth, its transport and use, alongside its subsequent replacement by waste, needs to be omitted from industrial processes as the result thereof is the erosion of natural capital (Hawken et al., 1999:6). A new system of recognition and optimal use and re-use of natural and human capital must be implemented. Currently, "the resulting ecological strains are…causing…many forms of [direct and indirect] social distress and conflict…[such as] poverty, hunger, malnutrition, crime, corruption, lawlessness, loss of forests, freshwater, etc." (Hawken et al., 1999:8-9). Hawken et al. (1999:9) poses the question: "What would our economy look like if it fully valued all forms of capital, including human and natural capital?" This dissertation echoes that exact question.

A possible solution is to recognise biological realities, by understanding human capital not as a free and infinite resource, but as an integral valuable factor of production (Hawken et al., 1999:9). More so, it becomes the moral responsibility of industry to realise its critical dependency on the former, and to use the technological state and development available to advance industry through coherent practice and management of both human and natural capital. This forms what Hawken et al. (2000:9) refers to as the "next industrial revolution" summarised by the following four aspects and their envisaged application to the Marabastad project:

A. Radical resource productivity

This concerns the improved use of resources to slow resource depletion, lower pollution and increase and improve employment by engaging in meaningful jobs (Hawken et al., 1999:9). The result: Society is no longer responsible for wasteful use of human and natural capital, but instead significantly reduces subsequent degradation of the biosphere, if not adding back to it.

In effect, this is addressed architecturally through site and programme development. It manifests the notion of creating awareness, and initialises a thought process that involves lowering fresh waste and dumping of produce, and conceptualises waste as a resource. This process is enabled by human awareness and thus, community engagement becomes crucial in the meaningful increase of human and natural capital. This process initiates the activation of waste reuse on site.

B. Biomimicry

At its core, biomimicry is concerned with re-designing industrial systems and processes to change its nature so as to employ the constant reuse of materials (Hawken et al., 1999:9). It closes the loop on waste cycles, and introduces continuity of resources to significantly reduce and re-use waste (Hawken et al., 1999:9).

The implications of this on-site development, starts with understanding the original industrial process on site as being a waste works and processing plant. Although now decommissioned and inactive in terms of its former use, it allows for the re-design of industrial systems to re-imagine processing waste from human processes. It thus becomes an activator, serving as the first step in the continuity of resources that reduce and reuse waste, whilst repurposing the site. As the activator of the activity based processes that happen on site, the reimagining allows for the site to develop from a human waste processing plant, to one that accommodates and

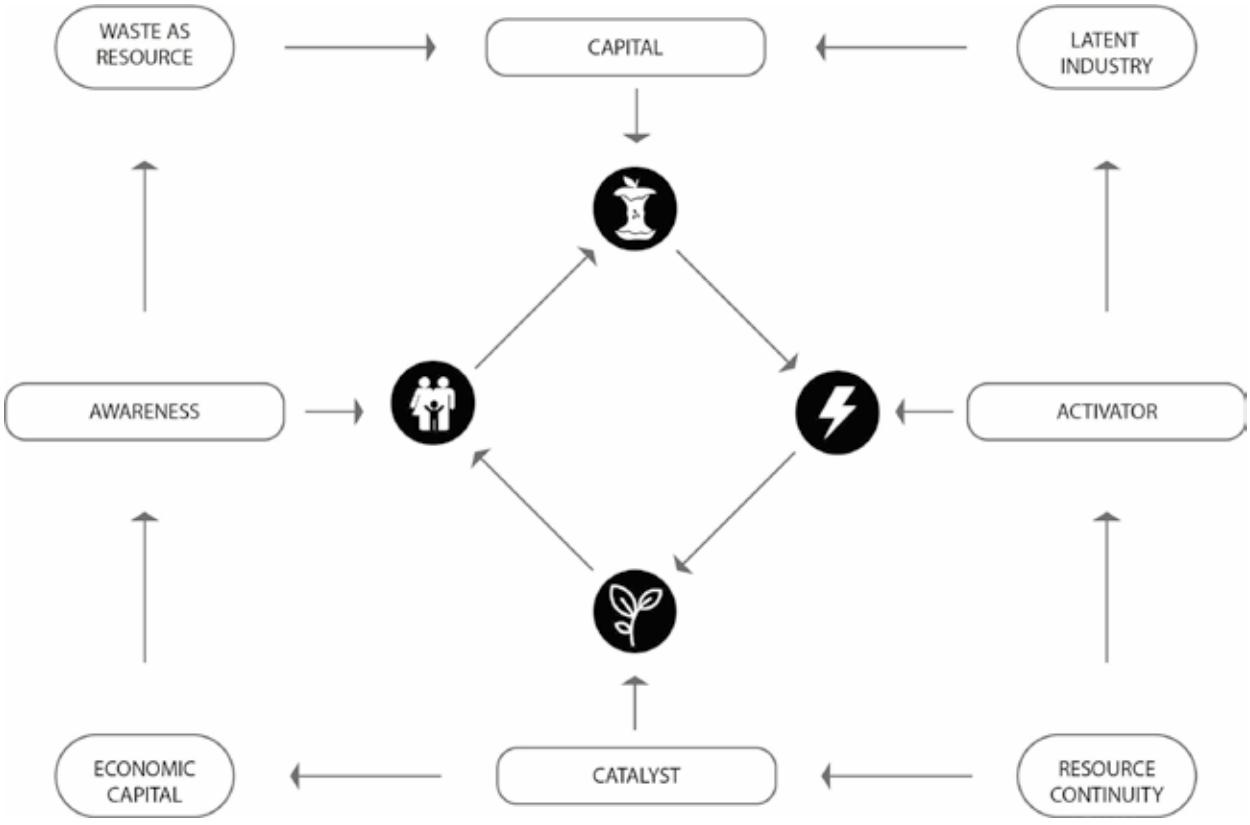


Fig 3.3 Complex adaptive system forming the 'next industrial revolution' (Author, 2018)

utilises processes of human life as a material source.

C. Service and flow economy

This aspect implements a fundamental change in the relationship between consumer and production. Rather than the traditional system of goods production as a means to an end, a system of 'service and flow' of resources is proposed (Hawken et al., 1999:9). This ideal changes the perception of value form the current acquisition-of-goods approach to continuity of resources and quality for well- being (Hawken et al., 1999:10). Again, a closed-loop cycle of material use becomes crucial.(Fig 4.2)

Section A and B indicate the processes of awareness and activation, identifying a change in human function in relation to industry. It implies a human livelihood-centred industry, and in effect a design that allows a graceful and interdependent relationship and understanding to form between human/social culture, site and relevant industrial processes. The human input acts as the catalyst for closing the loop of a waste life-cycle. Waste becomes energy used for food growth and production which is used for community consumption, and again waste is produced, restarting the cycle. (Fig 4.1)

D. Investing in natural capital

"This works toward reversing world-wide planetary destruction through reinvestments in sustaining, restoring, and expanding stocks of natural capital so that the biosphere can produce more abundant ecosystemic services and natural resources" (Hawken et al., 1999:11).

Section D proposes a sustainable and self-sufficient urban industry. It implies the integration and effect of the previous section on site development and architectural design. It speaks of the design as a whole, of integration and continuity, and in its complete form, adds value to the surrounding area, lowering dependency on single-use industry, and initiates the process of reinstating a sense of belonging and access to the community.

The effects of this perspective on society can be discussed at length, but it is more valuable to consider the implications on this project. At this stage, the idea of closed loop cycles and creating repurposed new forms of natural capital acts as a design informant, of not only the forms of capital it will include, but also on the industrial and social programmes, and the cross-relation between all aspects of the proposal. The design has to act as a mediator, a place for the amalgamation of people, social memory, cultural engagement, industrial processing, resource productivity and a general understanding of the value of human, natural and industrial capital in the sustainable and resilient development of an integrated complex socio-ecological system.

To a certain extent, the space thus becomes provisional in nature, whether it be for that of ephemeral interactions, and incidental encounters, or as tangible as resource productivity and waste reuse. The spectrum of impact is thus quite wide.

Terrain Vague as Provisional Space

For a place to become provisional, one can suppose that it assumed a different nature pre-intervention, i.e. not provisional. For the purpose of this argument, 'provisional' has two meanings, the first of which speaks of providing and supplying, essentially of equipping; the second speaks of the interim, temporary, etc. (Alter, 1996; Oxford Living Dictionary, [n.d.]). To avoid confusion, the former definition can be assumed when the word 'provisional' is used, and the latter definition we be denoted by the use of 'interim space'.

The essay *Interim Spaces: Vacant land, Creativity, and Innovation in the Context of Uncertainty* becomes relevant here, where Kamvasinou and Roberts (2014:187-189) consider the value of interim spaces as a solution to marginalised, vacant land in cities. Such spaces were referred to as " Terrain Vagues" by Ignasi de Solá Morales (1995:3); and subsequently theorised as being "open, vacant, leftover…free, available, unengaged" land, often viewed as disintegrated, negative space, non-contributive to social and moral standings of communities. Kamvasinou et al. (2014:189) continues to denote such spaces as containing "evocative potential" and an air of promise as spaces of the possible and of expectation.

Their argument is focused around the idea that terrain vagues can be developed as interim spaces, temporary in nature and programme, and done so by the community that surrounds it (Kamvasinou et al., 2014:187). The urban implication of such engagement is simple: vacant land is re-appropriated to "accommodate a range of activities" required by said community, for which formal planning and funding is difficult to find or simply not available (Kamvasinou et al., 2014:189). Viljoen (2005:35) suggests that "temporary uses of such sites [can] contain clues as to the potential diversity of future activities [that it] might contain". It acts as an inexpensive, bottom-up tool to induce a process of re-understanding, re-appropriating and re-investing social and cultural capital into extensive networks for public space. It becomes a co-production of space and culture as needed and determined by the community it most effects (Kamvasinou et al., 2014:189).

Leftover, derelict urban space thus become a vessel for intervention, where perceived spaces of resistance become spaces of urban resilience (Kamvasinou et al., 2014:189). Social memory and human and natural capital become core values in development and social interaction (Fig 4.3). It also extends the reaction of the community as a complex adaptive system, and allows for further establishment of networks and trajectories. The specific design proposal aims to facilitate the development of this continuous productive urban landscape, and to act as a hub of sorts.

Conclusion

As the origin and termination of connected, re-appropriated urban spaces, this dissertation intends to be 'provisional' in nature, to incorporate notions of resilience in its spatial logic and heterogeneous scale, but also in the programmatic evolution to not only include, but value and ingrain natural and human capital in the nature of its industrial process.

It proposes a new mid-ground for production, resource provision and waste management, with an overarching focus on a flexible, diverse and adaptable macro-ecological complex system: a new hybrid industrial typology grounded in critical dependency.

04

programme

A NATURAL CAPITAL RESOURCE EXCHANGE

Defining a means of energy exchange to repurpose natural fruit and agricultural waste as primary resources.

The industrialisation of production processes over the last century all prioritise one main objective: maximising output. It idealises a society that is goods-acquisition driven (consumerist) yet ignores the implications of its insensitive and unsustainable nature. As a result, the development of an integrated industrial typology is required to emphasise the importance of repurposing and recycling to close the loop on production cycles in order to integrate both resources and processes. A possible solution to the aforementioned challenge is the concept of a Regional Natural Capital Resources Exchange to serve as a typological exploration to implement such an approach in a tangible and understandable format. It localises and create awareness of natural capital as a renewable resource and demonstrates the extent to which energy exchange can affect and induce quality of life.

Understanding the chapter

Fig 4.1 Unused potential energy embedded in fresh produce. (Zinde, n.d.)

FOOD WASTE : food lost due to behavioural issues, essentially the food wasted due to consumer behaviour (von Bormann, 2017:7).

EXCHANGE : "An act of giving one thing and receiving…another in return." (Oxford Dictionaries, 2018)

A PRINCIPAL OF ENERGY EXCHANGE

The idea of exchange stems back many centuries to a system of trade. In its most basic form it can be described as a bartering system, in which one resource is exchanged for another, either as a raw resource or for a secondary product. In this proposal, it encompasses an integrated system of energy exchange. This project proposes a shift in the perceived nature of exchange, a change in its character, to take ownership of an exchange of energy in multiple forms, and propose a design to emulate such exchange. The relationship between such exchanging parts becomes crucial in its implementation. On a macro scale, the focus becomes the interaction between industrial process and culture, between the natural environment and industry, and the social confluence of people and natural place that houses culture.

On a meso scale, the exchange of information and services takes place between people and the physical processes. Interdependent interaction points allow for the activation of in-between spaces, stretching habitation of place from designed and demarcated space to spaces where incidental and collateral means of exchange can occur. Thus the exchange of embedded social and cultural energy can be exchanged and intertwined with that of industrial processes, with a direct affect on perceived and experienced quality of life. This proposed form of industry becomes directly relatable to peoples' ways of life, and essentially engenders a sense of responsibility towards it.

Lastly, on a micro scale, exchange of energy takes place in a tangible format, when natural waste (food, agricultural) is processed and its inherent energy is used to fuel multiple components of an interconnected system. The potential energy is transformed and repurposed through a number of processes to enable and induce the production of different energy resources. Essentially through this exchange, energy becomes a primary resource that can be utilised for all of the processes on site, reducing waste and the reliance on external sources.

This chapter aims to deconstruct the programme housed in the natural capital resources exchange, and create an understanding of each of the cogs that make the larger mechanism work.

Fig 4.2 Typical food waste accumulation due to consumer behaviour (Magill, 2017)

Waste, especially food waste, is a certain and unavoidable by product of human life. Fresh fruit and vegetables make up a part of most peoples' daily lives, whether sourced from supermarkets or informal fresh fruit markets at trade stands. Either way, where there is fresh produce, there will be waste.

As a result of South Africa's history of spatial segregation and restricted habitation areas, there are certain neighbourhoods with a severe lack of municipal service provision often coupled with degradation of infrastructure and built fabric. The result is an area that supports many people, but remains unable to provide suitable quality of life. The issue is exacerbated by a lack of service provision and disregard for area development. A bin is only useful if the network of services that remove and process the waste it holds is in working order.

70% of households source food from informal markets or street vendors

90% of organic waste collected by municipalities is dumped at landfills

66% of all street vendors sell food produce

210kg of food waste is produced per person per year

1/5 th of South Africa's water is used in the growing and processing of food that is wasted

Food waste categorisation

Fig 4.3 Info-graphics explaining food waste in South Africa (adapted from Von Bormann, 2018).

The United Nations Food and Agriculture Organization (FAO) estimates that about 815 million people of the 7.6 billion people in the world, or 10.7%, were suffering from chronic undernourishment in 2016. Almost all the hungry people live in lower-middle-income countries. (2016, World Hunger)

Despite this statistic, it is estimated that 30% of food is wasted annually (von Bormann, 2017:8). This wastage comes at a high cost if one considers the energy, water and cost of disposal it requires. It is clear that food waste contributes to water and electricity crises, and waste to energy conversion can thus aid in reducing the strain placed on those natural resources.

"With every morsel of food that is produced and wasted, the embedded nutrition, energy, water, capital and other resources are also wasted" (von Bormann, 2017:8).

According to the World Wildlife Fund, hereafter referred to as WWF, reducing food waste is one of the most fundamental strategies in improving food scarcity and a sustainable food future (Von Bormann, 2018:8).The strategies and actions required to reduce such waste have already been theorised, but the challenge is implementing these proposals in a manner that is contextually applicable and socially and economically viable. The ideas remain, but the resultant typology is largely context, culture and community driven.

It is estimated that by 2050, as a result of population growth and unnecessary food loss and waste, food production may have to increase by up to 70% (von Bormann, 2017:8). To achieve this, up to 120,000,000 more hectares of arable land in developing countries will have to be provided (von Bormann, 2017:8). This is problematic when one considers the possibility of 50 million hectares currently in use becoming infertile as a result of unsustainable use and climate change driven water scarcity (von Bormann, 2017:8). The current food production, processing and delivery systems results in considerable loss, with about 1.3 billion tons of edible food produced globally going to waste. Considering food shortages, this poses a topical and instrumental problem for society.

This global issue presents complexity in its magnitude and possible solutions, yet at the core of it, the biggest opportunity at hand is also the simplest. The food "wasted" consists of rotten fruit and vegetables, and if this is considered a resource, it opens doors to many opportunities for repurposing waste as a means of energy harvesting. This allows for the energy put into the growth and production of this produce to be processed and assigned elsewhere. Consequently, one needs to understand the relevance of this issue on a local level. Food waste in Africa, and specifically South Africa, is as a direct result of financial and managerial constraints for certain areas, with emphasis placed on poor infrastructure and lack of technology and transport.

South Africa still faces the issue of poverty and extreme hunger, ironically, 10 million tons of food goes to waste every year, with fruits and vegetables making up 70% thereof. The relation of food waste when compared to other waste (electricity, water, fuel, natural resources, etc.) increases in areas such as Marabastad, and makes up a third of the total waste produced (von Bormann, 2017:8). This statistic, if quantified in Rands, presents an embedded monetary loss of R1 billion per year, equating to approximately the same cost of fuel and diesel used nationally per year (von Bormann, 2017:9).

The innate energy in fruit and vegetable waste could potentially produce enough electricity to power a city such as Johannesburg for 16 weeks (von Bormann, 2017:9). Instrumental to a future of energy efficiency and resource recycling is harvesting all energy possible and harnessing it.
Utilisation of information on food waste in structuring regenerative programmes presents an opportunity to improve food growth and employment within the sector as well as mitigating severe localised food insecurity. Marabastad sits poised with opportunity and unharnessed capital. Not only does it already have an informal food market, but presents and established network of fresh produce influx, and thus, waste.

Fig 4.4 Food waste that can be harvested for embodied energy (Mortimer, 2017).

To harness the potentials of food waste, certain complex processes need to be implemented, of which many are not typically community driven. These processes need to be combined in such a way that communities understand the value of waste repurposing, and are able to not only interact with them, but contribute to them and benefit from them (Fig 5.6). In this way, food waste can be utilised as a resource and essentially becomes a source of natural capital. This extensive process engages with multiple aspects of daily life, and most importantly, allows for energy exchange between community, industry, and nature. Not only does it allow for a continuity of energy but it empowers those without direct access to facilities such as refrigeration or other means to prolong the relative shelf life of food.

In short, the community acts as the catalyst for the entire waste and energy exchange process. The fruit and vegetable waste acts as the enabler and the fuel to the waste as capital production. The process extracts and stores the embodied energy within the fruit waste, and re-assigns it to different auxiliary programs which redirect this energy capital into a constructive and usable format.

These processes of energy exchange enables a system that could decrease waste in Marabastad as well as lower reliance on municipal services. It creates a platform for community engagement so as to re-activate the Old Marabastad. It reconnects the community with the natural ridge and the Apies River that originated the establishment of Marabastad, and redefines the industrial typology as one of inclusion, accessibility and enablement.

PROGRAMME

The programmatic response to the main problems outlined is complex, with a series of components that feed off of each other. To simplify the program structure, each segment is subdivided into either an input, process or output component. Within the subdivision there are primary, and auxiliary programs that combine to form an integrated and closed loop system. The crux of the program is made up of the primary functions, which are all also considered process components.

FOOD FOR FUNCTION

input components

fresh fruit and vegetables

- families and individuals drop off fruit and veg close to but pre waste stage in exchange for remuneration
- enabled: community input

rotten/ spoilt fruit and vegetables

- leads to waste absorbing functions
- enabled: community input

community

PRIMARY FUNCTIONS
process components

AUXILIARY FUNCTIONS
output components

PHILOSOPHY OF EXCHANGE

1. FRESH FRUIT AND VEGETABLE PROCESSING

processing of fresh fruit and veg
waste from Marabastad

2. FRUIT AND VEGETABLE WASTE PROCESSING

food waste processing to extract
embodied energy

3. Community engagement and education

information exchange to empower and enable
community to create their own resources

a. TEST KITCHEN:
exploration of end product use
produce engagement

b. MARKET PLACE:
economic engagement and growth
fresh produce as repurposed goods

c. TASTING ROOM:
experimental stage of produce
repurposement
engagement with produce in
process

d. BIOGAS PRODUCTION:
methane gas extraction as energy
source

e. COMPOST:
reclaimed nutrition from food
waste for new food production
for use in ORCHARD, GREEN
HOUSE and TESTS BEDS

f. EDUCATION PODS
engagement with planting
produce (ORCHARD, GREEN
HOUSE and TESTS BEDS)
tasting room as product

Fig 4.5 Relationship between major aspects of the programme (Author, 2018).

PRECEDENT STUDY : PROGRAMMATIC

Project name: Greenhouse as a Home
Architects: BIAS Architects
Area: 336m2
Location: Xinwu District, Taoyuan City, Taiwan
Year completed: 2018
Nature of precedent study: Programmatic
Climate: Cfa (Humid Sub-tropical climate) according to the Köppen Climate Classification
Annual temperature peak of 31C˚; low 12˚C
Climate classification is the same as Pretoria (Cfa)
Functions: Greenhouse, external space, kitchen, 'lounge', series of habitable spaces combined with observation spaces

Lessons learnt:
- Spaces are shared with nature
- Climatic specific architecture
- Human living space intertwined with that of the plants, organised according to climatic zones.
- Focus on distribution of water and electricity
- Educational programme to integrate planting and programs; allows community to experience integrated variation of climate, landscape and activities from the different zones.
- "They can also develop some sense for the respective interdependencies, that is important for to trigger and develop a culture of sustainability." (Bias Architects, 2018)
- Fresh vegetables picked everyday and cooked for users of the building.

Proposal relevance:
Integration of nature and function, designing for nature to flow into building, and activity to flow out into natural landscape. Integrated planting and educational programs with that of the buildings function. Interdependencies are manifested in a way that users can feel and see the processes that create their surroundings and make systems work. Level changes to create awareness of different functions with different zones of interactions, perceptions of spaces and functions depends on location of user.

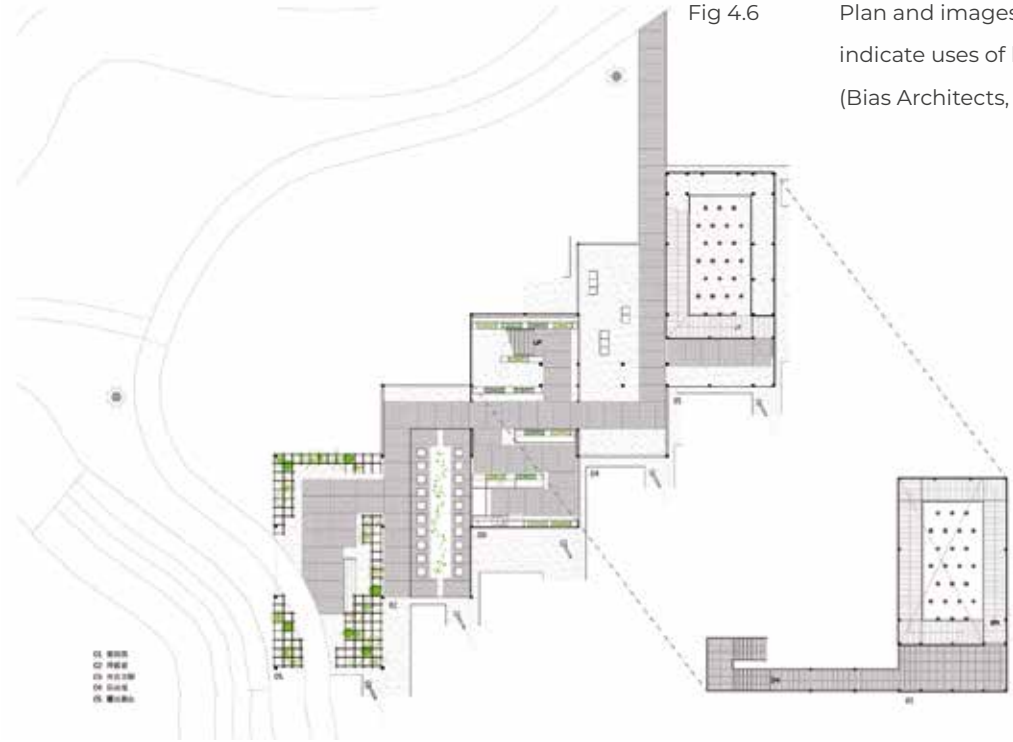
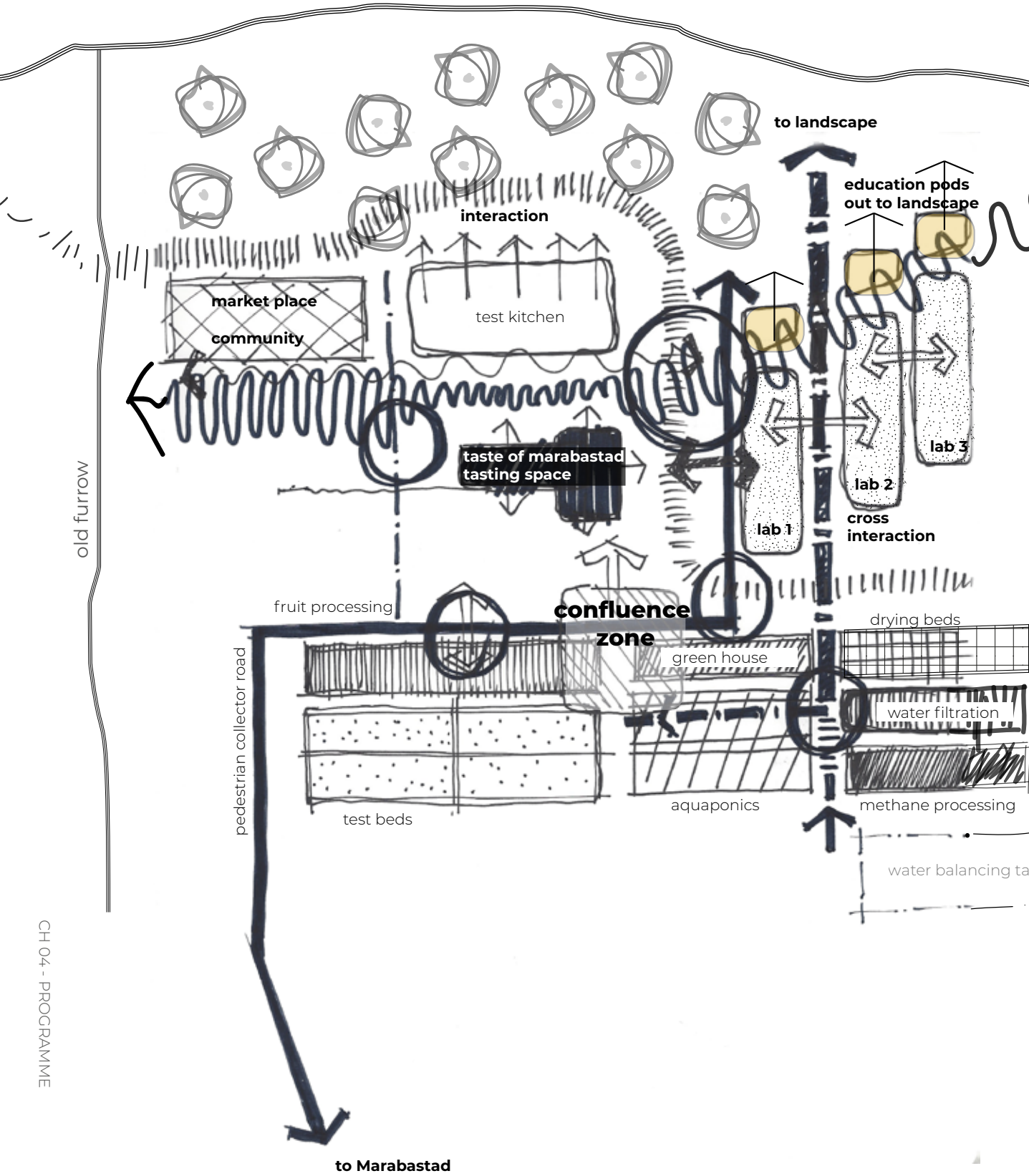
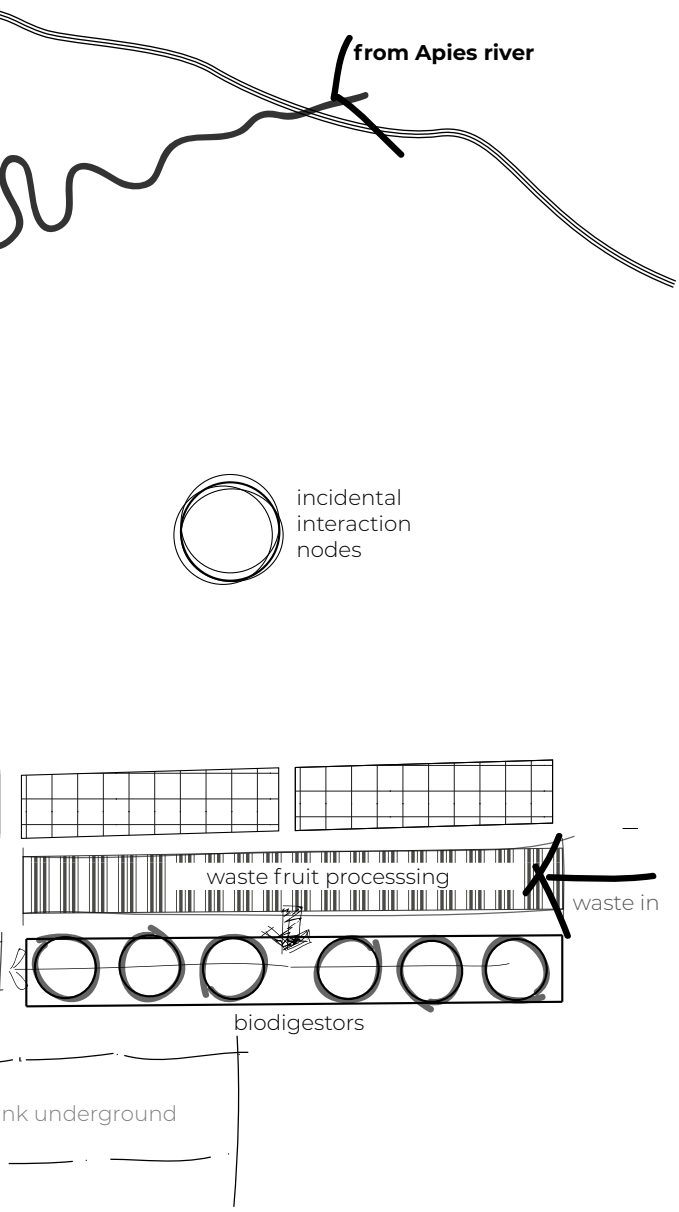


Fig 4.6 Plan and images alongside indicate uses of building (Bias Architects, 2018)

Fig 4.7 Activated pubic space surrounding building(Bias Architects, 2018)


to landscape
education pods
out to landscape
interaction
market place
community
test kitchen
taste of marabastad
tasting space
lab 3
lab 2
lab 1
cross
interaction
old furrow
fruit processing
confluence
zone
drying beds
green house
water filtration
pedestrian collector road
test beds
aquaponics
methane processing
water balancing ta
to Marabastad

A PHILOSOPHY OF EXCHANGE



First and foremost, the notion of exchange denotes the nature of the programme of the building. It serves as the underlying tone for every function of the building. Exchange is manifested in a multiplicity of ways, referring to the physical exchange of energy, physiological exchange with the environment, a cultural exchange with the community, and an embedded sociological approach to exchange.

This component is embedded into every function and will be explored as such within this chapter. As an introduction, the following integrated diagram emulates the nature of exchange of each function.

Fig 4.8 Programme network diagram (Author, 2018)

1.
FRUIT AND VEGETABLE WASTE PROCESSING

This function consists of the collection and processing of food waste i.e. rotten and spoilt fruit and vegetable waste as well as on-site agricultural waste. It aims to fully harvest the energy of spoilt produce, no longer suitable for consumption. The produce is processed in a way that it extracts the embodied energy and produces different forms of usable natural capital. This component is the most crucial element to the entire system as it enables reliance on a localised production of natural capital as an energy source through waste processing. It acts as a prototype of resource and energy cycling. This component is made up of different functions to produce biogas and compost.

Input:
Spoilt produce from Marabastad and surrounds is used as the raw material for this function. It mitigates the need for dumping waste in the Steenhovenspruit as it offers remuneration to consumers who can now drop off their waste. This input component also creates awareness about the latent potential of food stuffs previously seen as useless, and educates the community in the idea of recycling and desired outcome of reducing all forms of waste.

Output:
Auxiliary functions: Biogas is produced from the fermentation of the substrate (waste) in the biodigester, which is further processed to allow for the extraction of methane gas to be used to generate electricity for the building.
The digestate/slurry (processed substrate) gets pumped into the drying beds and becomes compost. This compost again fuels other functions such as the test beds, the greenhouse as well as the orchard on site. From apparent food waste, this deconstructs the embodied energy and repurposes it into multiple other uses, causing little to no energy loss within the cycle of energy exchange.

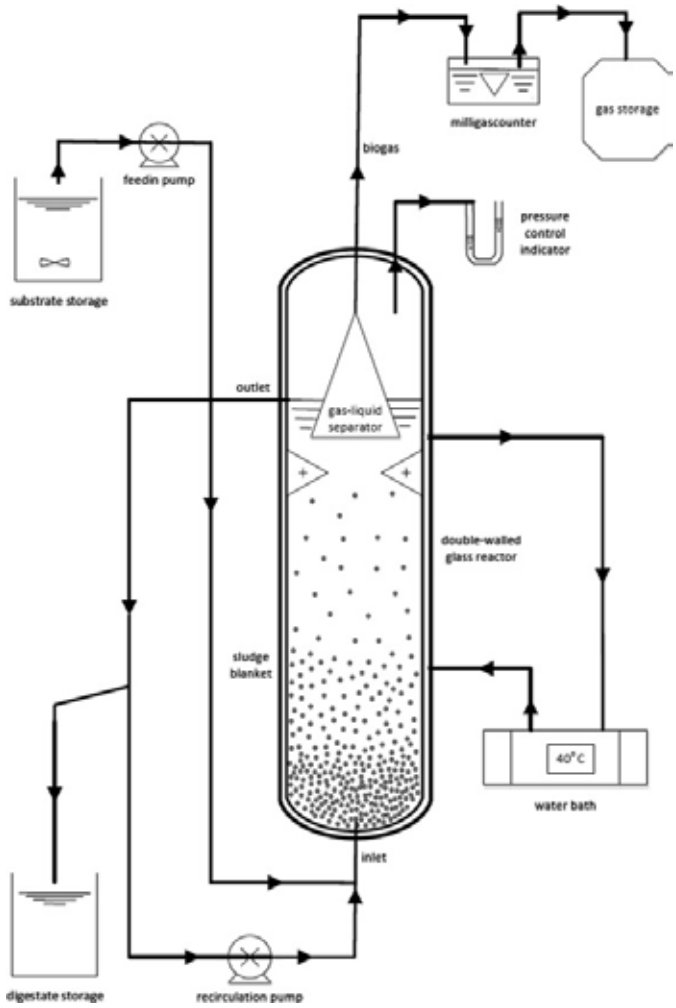


Fig 4.9 Diagram of biodigester processes (Alves de Souza, *et al.*, 2012)

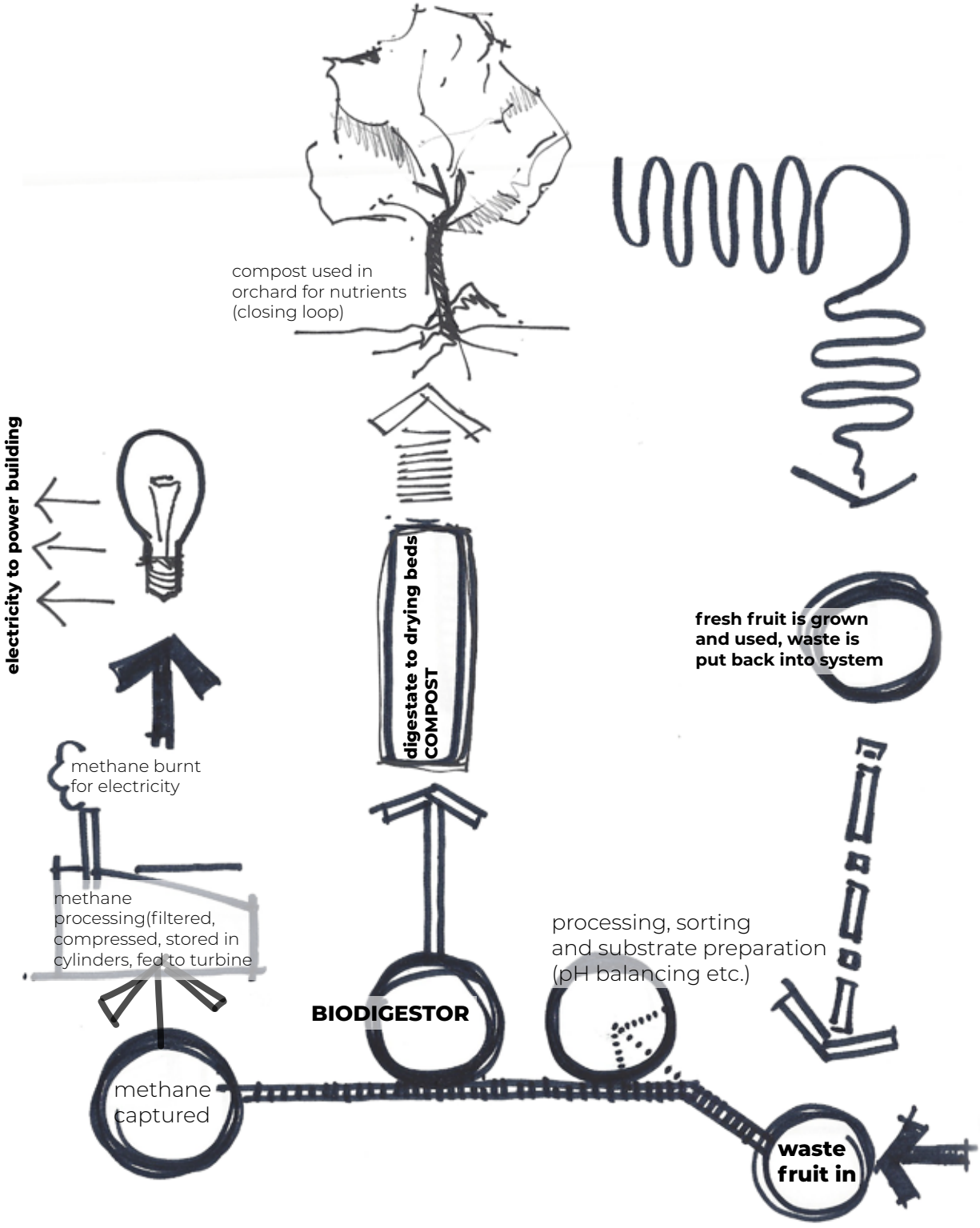


Fig 4.10 Latent energy extraction of fruit and vegetable waste (Author, 2018)

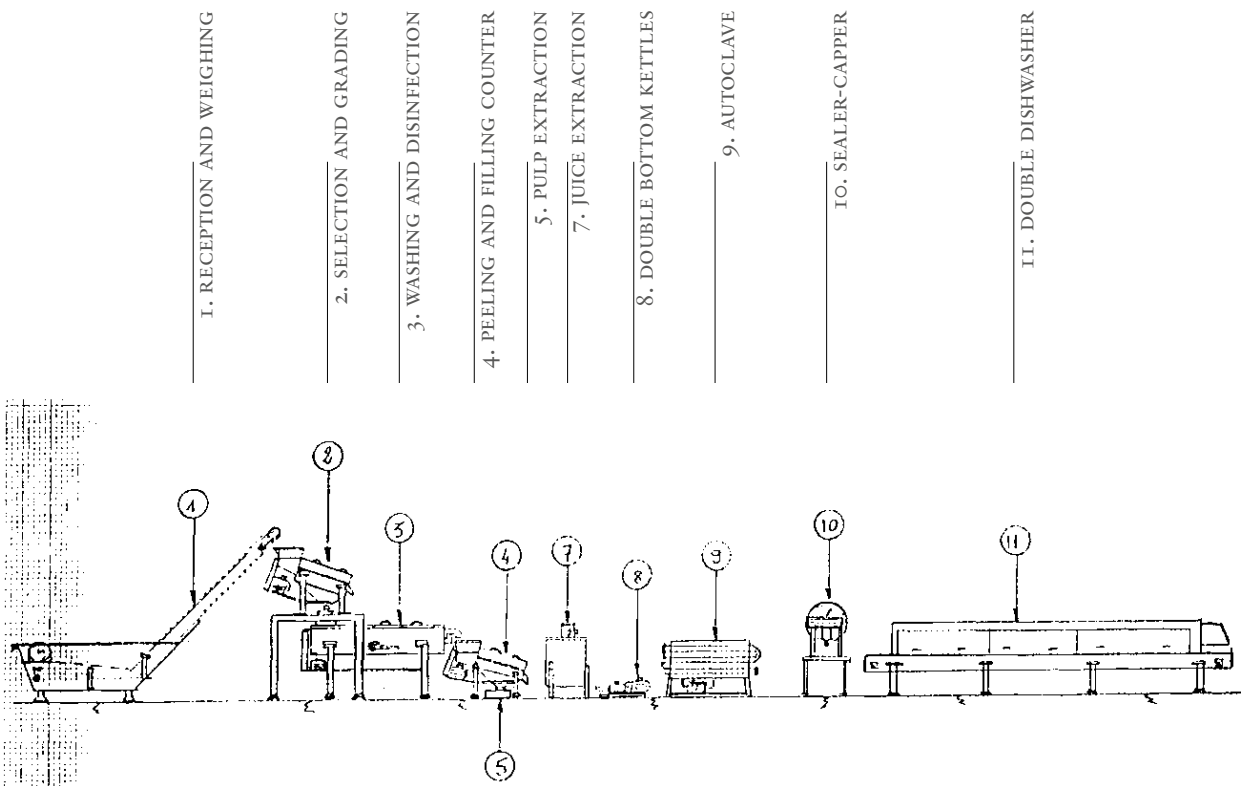
2.
FRESH FRUIT AND VEGETABLE PROCESSING

This function consists of the main collection and processing of fresh fruit and vegetables.
Inhabitants of and visitors to Marabastad can bring their fresh produce to the exchange, whether still sellable or close to its use by date, and receive remuneration in return.
The produce is then processed to extend the relative "shelf life" of the produce and then either sold, tasted or absorbed into other programs.

This component produces products such as tomato paste, tinned fruit or vegetables such as tinned tomatoes, tinned peaches, fruit jams, marmalade and compotes, spreads, etc. Essentially it insures that the embodied energy of the produce delivered is not wasted, but rather transformed and given a different purpose and extended lifetime.

Input:
Community involvement through the delivering and selling of semi-fresh produce to avoid possible waste. Fresh and semi-fresh produce collected is needed to 'power' the processing and ensure a consumable product outcome. The energy and electricity produced in other sections of the building is used for electricity production.

Output:
Test kitchen, market place and the tasting room. These functions allow for the community to engage with the produce after processing and enables an understanding of how fresh fruit and vegetables can be processed to remain nutritious and useful. The tasting room also becomes a means to access the flavours and culture of Marabastad, where vendors can set up their own stands and sell their food to users.



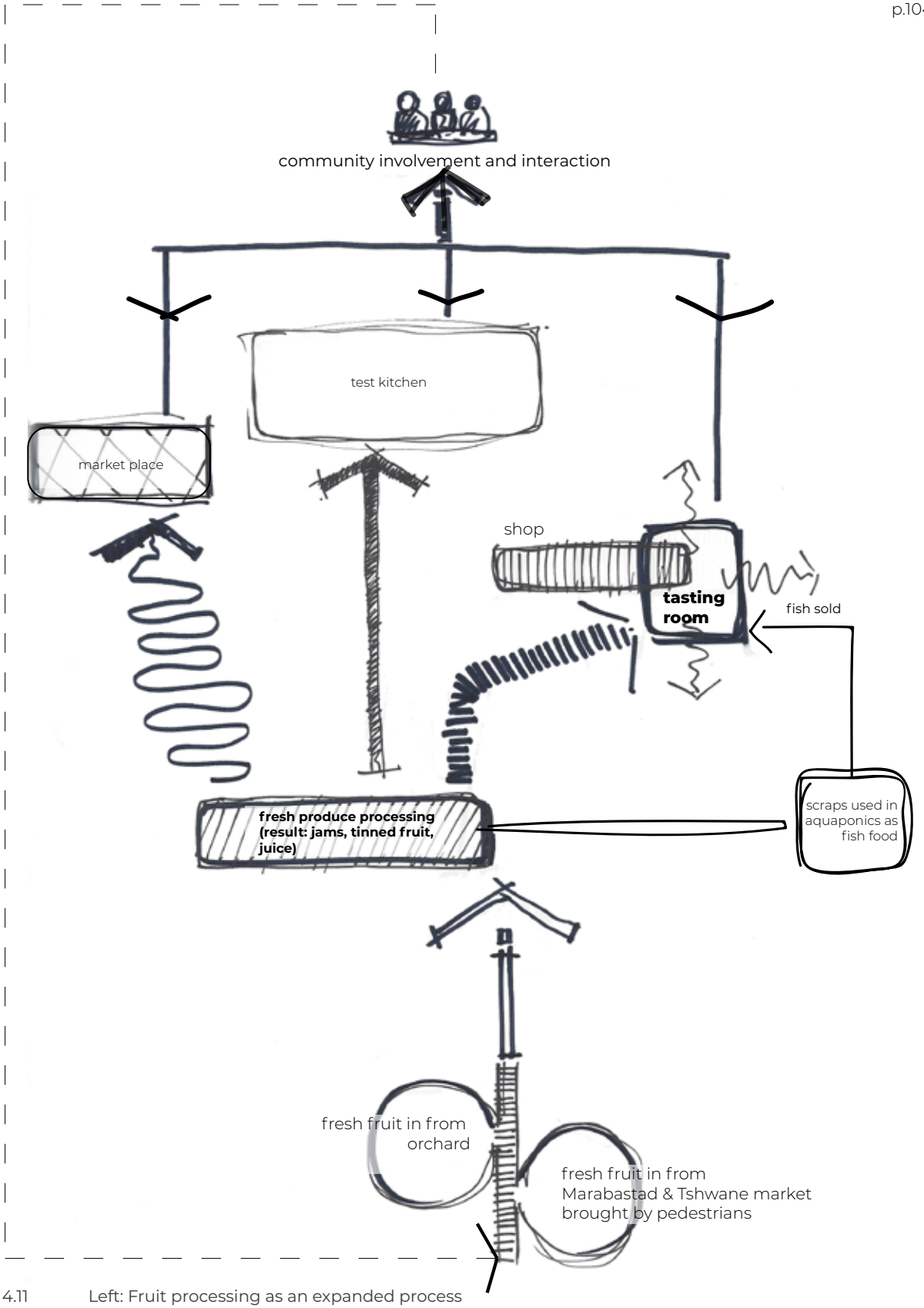


Fig 4.11 Left: Fruit processing as an expanded process (Commission de L'ocean Indien, 2009)

Fig 4.12 Right: Closed loop fruit consumption (Author, 2018)

3.
COMMUNITY ENGAGEMENT AND EDUCATION

This function, besides acting as the enabler of all the other functions in terms of their input, consists of the engagement of the community with almost every process housed within the building. The main priority of this process is to create awareness through education, and becomes an overarching theme for many of the auxiliary programmes.

Education pods

This component is one of the more formalised means of education on site as it consists of classroom-like spaces that allow for direct interaction between the research laboratories and the community. These pods are situated between the research labs and the orchard, and have direct access to all of the surrounding functions. From these pods, people are redirected to different auxiliary functions to learn about the different elements of localised food production and repurposing.

These include:

- Greenhouse and test beds - actual planting and growing of fresh food produce, companion planting, etc.
- Orchard - larger scale planting, efficiency levels, skills to plant larger fruit trees for maximised output
- Fresh produce processing plant - how and when to process fruit and vegetables into other formats to increase usability over a longer period of time
- Tasting room, test kitchen and market place - goods produced on site are made available to community in different formats. The former consists of engagement during a process stage, inputs delivered and opinions voiced are included in processing which stimulates an information bank of exchange. The test kitchen is slightly more interactive in its food delivery, with preparation and serving of food all open to public view. The market place is the most informal and socialised means of interaction within the community. It aims to act as a joyful experience of understanding and awareness of localised food production, processing, consumption and enjoyment. These aspects speaks to the rich cultural relationship with food and the social interaction that takes place around food. These last components also act as the last link of the system, as it closes the loop on production, processing and consumption.

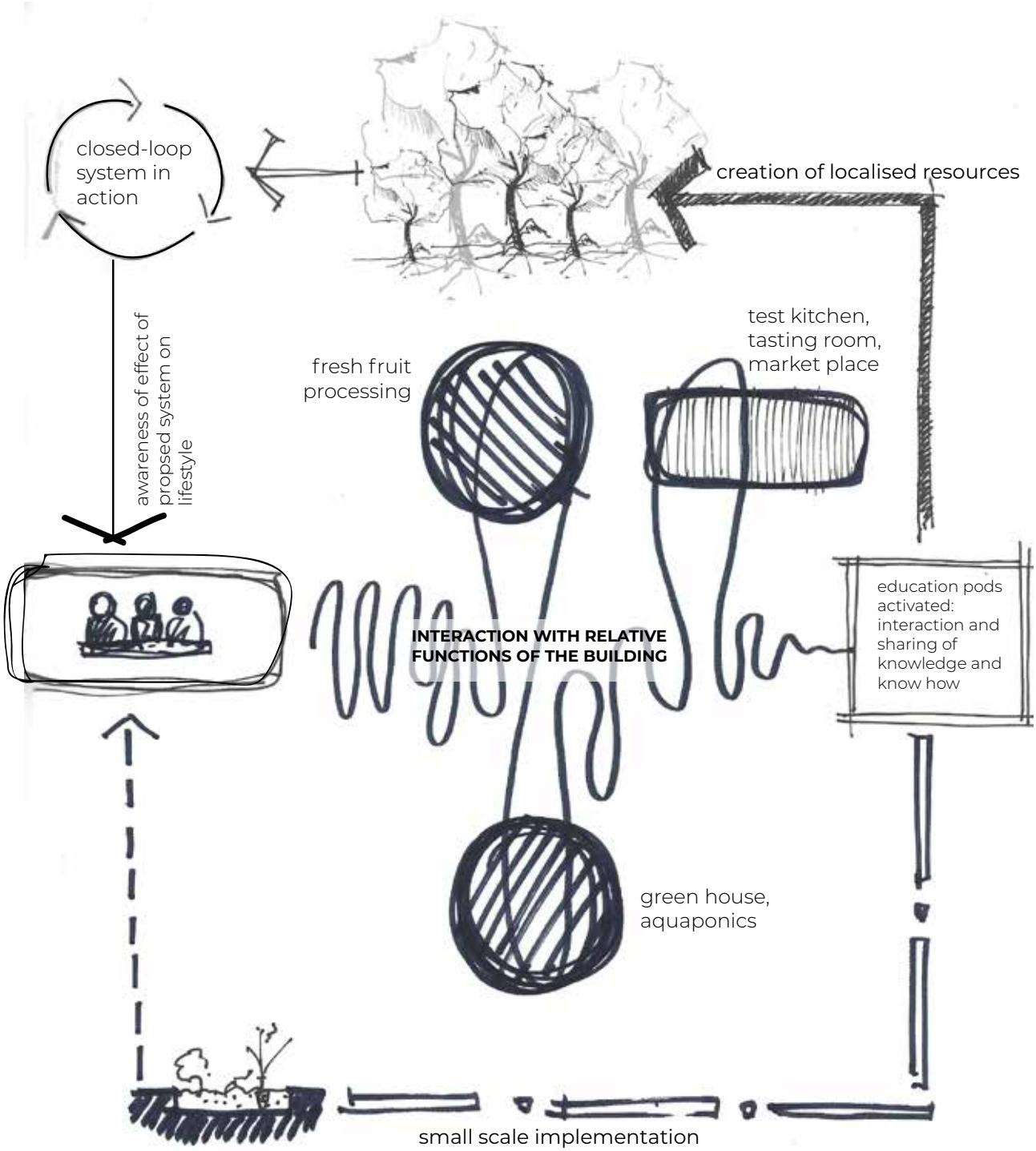


Fig 4.13 Community engagement and with growing sustainable fruit and vegetables (Author, 2018)

PRECEDENT STUDY : PROGRAMMATIC

Project name: wastED
Owners: Community of chefs, farmers, fishermen, distributors, processors, designers, retailers
Location: New York pop-up, London pop-up
Year presented: 2015 and 2017, respectively
Nature of precedent study: Programmatic
Functions: Kitchen, 'waste' reuse and reform
Lessons learnt:
Theme of food waste and re-use, possibilities associated with foodstuffs typically seen as waste.
Curated food for specific occasion, roots taken in overlooked products. e.g. 'ugly' produce, off-cuts, peels etc.
Ingredients-in-the-rough, cosmetic imperfections deem so much food as waste.
New approach to food preparation and what can be used to create good food. Scraps such as fish bones, charcoaled bones, etc. are re-invented into meals.

-Waste-not philosophy, nose-to-tail movement for animal produce consumption.
-"Codifying a way of farming, cooking, and eating that responds to the demands of a landscape" (wastED, 2018)
-Root-to-fruit new approach to produce.

Fig 4.14 All images show typical food waste and 'ugly' food used by wastED (wastED, 2018)

PRECEDENT STUDY : PROGRAMMATIC

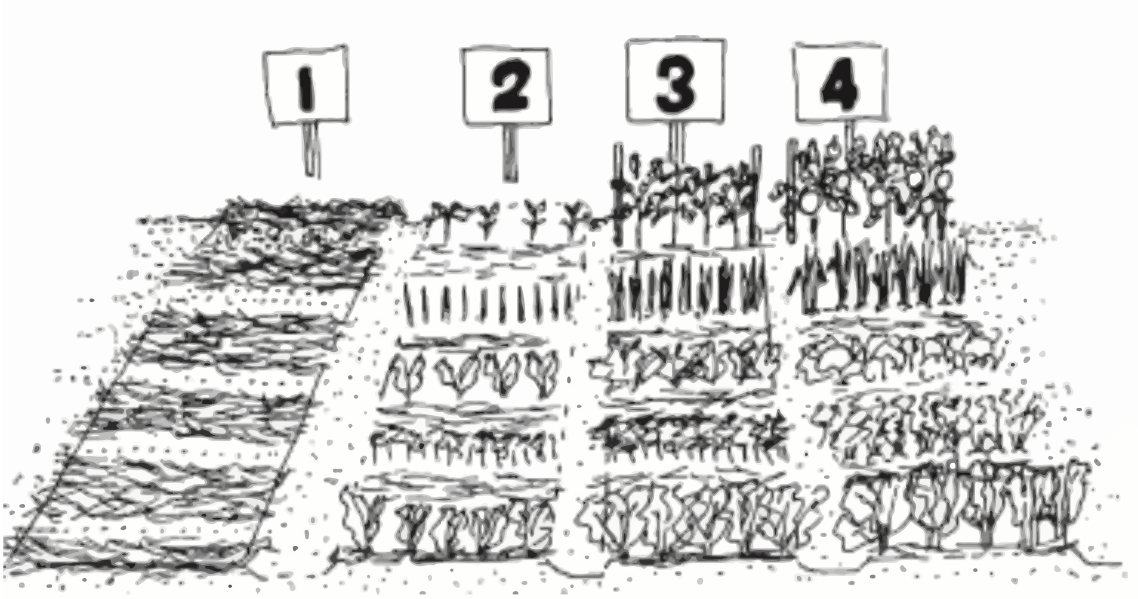


Fig 4.15 Example test plots (Daff, 2013)

Project name: Vegetable production - Making a door garden
Initiators: Department of Agriculture, Forestry & Fisheries
Area: Cape Town
Location: Pretoria, South Africa
Year completed: 2013
Nature of precedent study: Small scale implementation and change
Functions: Home grown vegetable garden with household waste as resource
Lessons learnt:
This small scale initiative introduced the viability and efficiency of a door-sized plot of land as a resource big enough to provide a family of four with fresh vegetables. The outreach programme consisted of providing and teaching those living with food shortages to localise their food resource by growing their own vegetables.
The provided guidelines included the preparation of sub-soil levels with paper, cardboard, kitchen food waste and manure, basically providing a sustainable solution for waste produced (sans plastic and glass), and utilised the potential embedded energy to fuel the growth of plants. Most importantly, the system is relatable, and simple enough to implement without extensive resources or information.

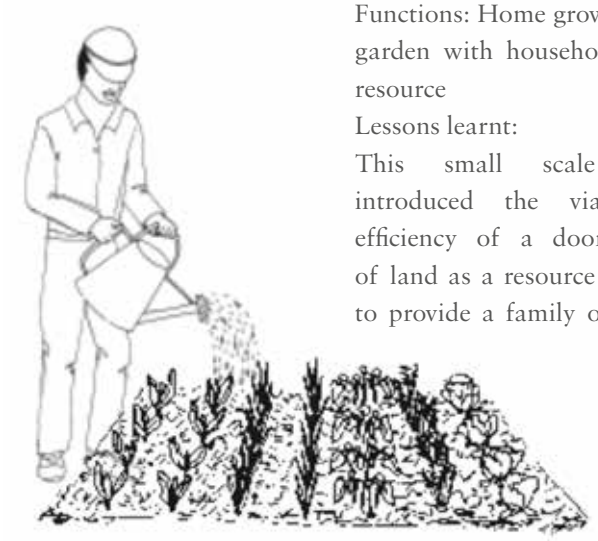


Fig 4.16 Watering test plot diagram from how-to booklet (DAFF, 2013)

PRECEDENT STUDY : PROGRAMMATIC

Project name: Davison Fisheries
Location: Pretoria, South Africa
Year completed: 2013
Nature of precedent study: Programmatic
Functions: Aquaculture farming: African Tilapia fish farm
Lessons learnt:
Fish reared in greenhouse structure within a controlled and constant environment. Facility consists of brood-stock tanks, fingerling tanks, grow-out tanks, quarantine tanks and a water filtration treatment system. Although water dependent, the system only introduces about 1000 litres of fresh water into the system per day to augment loses. It presents a closed-loop system where the water filtration process harvests nutrients and diverts it to pepper fields in close proximity. Other plants are used to absorb any excess nutrients, and fresh water is later recirculated back to the fishery. The system runs on a 10-week cycle where fish are relocated to different tanks, and within 6 months the 10 000 fish that started as fingerlings reach a weight of 1kg each. They are then relocated to grow out tanks, after which they are slaughtered, packaged and dispatched to relevant buyers.
Aquaculture system, as functional as it is, provides no interface with people and doesn't serve as a learning block or educational platform for any community in area. It functions in isolation, and thus has many opportunities to become more relevant in this proposal.

Project relevance:
The relatively closed-loop system serves as an accurate precedent for integrating a green house and an aquaponics system. The water filtration is crucial, and can be expanded to introduce other uses and increase its reach and relevance for the specific site and surroundings. This precedent serves as a good model to understand all the climatic and spatial implications of such a system, and indicates the extent to which the system is dependent on other systems around it. It also highlights an opportunity in the shortcomings of its programme, which is extended water filtration, and the magnitude of plants that can be grown from the nutritious water harvested from the fishery.

Fig 4.17 Photos of Davison fisheries (Büchner, 2013)

PRECEDENT STUDY : URBAN CASE STUDY

Project name: Khayelitsha Service Centre and Pay Point
Architects: Piet Louw, Anton Roux
Location: Pretoria, South Africa
Year completed: 2002
Nature of precedent study: Urban Case Study
Functions: Integration of public civil space with basic services, collection of gathering spaces and opportunities for appropriation.

Lessons learnt:
This precedent addresses the lack of service provision, a striking similarity to one of the issues this dissertation addresses. The buildings are separate, yet serve continuity in language and articulation of public space. Although the actual programme is very different, the relevance for this study lies in the appropriation and presence of community on site. It provides a stage for the occurrence of daily life, for incidental interaction and lingering, providing places to sit and stand and collect. One of the collateral effects is the occupation and ownership of space. The precedent serves as an urban tool in the civic use of space.

Fig 4.18 Photographs of interaction with community and civicc space (Peel, 2016)

ACCOMMODATION LIST

DEFINING FUNCTIONAL AND SPATIAL REQUIREMENTS

	function/space	size	requirements
	FRUIT AND VEGETABLE WASTE PROCESSING	400 m²	
	Collection Sorting Mixing Substrate storage		Delivery of spoilt produce to drop-off zone. Put into sorting machine to remove foreign objects. Machinery consists of a hopper and conveyor belt that transport produce to containers in which pH levels are regulated. Slurry/ substrate is pumped into biodigesters for further processing.
SERVICE	Pump room Equipment store		
SERVICE	Biodigesters Drying beds	6 x 400 m³ 3 x 270 m²	Substrate is pumped into biodigesters and heated to 70°C for anaerobic digestion to take place. Biogas is taken off the top and captured for further processing. Digestate is pumped to the existing drying beds to later be used as compost for orchards and test beds.
	METHANE PROCESSING	270 m²	
PROCESS	Filtration Biological desulphurisation Compressor Washing/ drying Storage cylinder Methane turbine		Biogas from biodigesters is filtered to remove impurities from methane. Methane is then compressed to a pressure of 70mb. Compressed methane is supplied to methane turbines to produce electricity. Heated water is a by-product that is used to heat biodigesters and building.
	Transformer room Control room		
	WATER FILTRATION	270 m²	
PROCESS	Existing 3.8Ml balancing tank as reservoir 100 000l new reservoir Coagulation Flocculation Dissolved air floatation Filtration Disinfection		Water from the sewerage works and river are filtered through various processes. Partially filtered water is used to flush toilets and for biodigesters. Fully filtered water and rainwater are used in fish tanks and for potable water.
	Pump house Rain water attenuation tank Fresh water reservoir Partially filtered water reservoir		

Fig 4.19 Fruit and vegetable waste processing and management (Author, 2018)

Fig 4.20 Biorefinery (W&W International, 2016)

Fig 4.21 Digestate (Market insight, 2017)

Fig 4.22 Methane extraction plant (Flowup, 2017)

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

function/space	size	requirements
AQUAPONICS (FISH)	810 m²	
PROCESS: Brood-stock tanks Fingerling tanks Grow-out tanks Quarantine tanks Holding reservoir (HOT) Fish processing (COLD) sanitation area processing equipment store room cold store packaging		Fish tanks supplied with fresh water that needs to be at 28°C. Nutrition rich water from tanks is then used to irrigate the orchards, greenhouse and hydroponics. Fish processing needs to be kept at 12°C to minimise possibility for flies and to ensure the fish meat remains fresh.
Pump and plant room Equipment store Fish food store		Pump room is sound insulated. Vehicle access provided for collection and deliveries
AQUAPONICS (PLANTS)		
Vertical planters Detenuation tank		Water from fish tanks supplies vertical hydroponic system. Harvested fruit and vegetables are taken to the Fruit processing plant for processing
Equipment store		
Reception and offices Break area Change rooms and toilets		
Public viewing platform		Raised platform allows public the view the space without being endangered
GREENHOUSE AND TEST BEDS	270 m²	
Shared equipment store with aquaponics		Public are given the opportunity to interact and learn about plants and sustainable planting.
Public involvement with growing Testing area requirements Testing best varieties for climate Testing soil and water nutrition	4 x 270 m²	

Fig 4.23 water reticulation and handling (Author, 2018)

Fig 4.24 Greenhouse and companion planting (Meyer, 2017)

Fig 4.25 Aquaponics integrated with planting (Capik, 2013)

Fig 4.26 Hydroponic growing house (Hikayeler, 2015)

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

	function/space	size	requirements
	FRESH FRUIT PROCESSING	610 m²	
PROCESS	Fresh produce reception and weighing Sorting and grading Washing Peeling Extraction/ chopping Cooking Filling Bottling and packaging		Fruit and vegetables from orchard, hydroponics, greenhouse, and test beds are weighed, sorted, washed and processed before being supplied to the test kitchen, tasting space, market or Marabastad
SERVICE	Cold room Store room and first aid Plant room Quality Control		
STAFF	Reception and offices Meeting room Lounge/ kitchenette Change rooms and toilets		
	LABORATORIES	3 x 215 m²	
	Cold store Service ducts Store room		Soil samples, water, produce, substrate, and any other samples related to agriculture are tested and experiments are conducted to establish specific solutions for each case. The labs interact with the education pods to help further learning and research.
STAFF	Reception Adaptable laboratory space Lounge/ kitchenette Offices Cloak room WC's		
	EDUCATION PODS	3 x 60m²	
	Store room		Agriculture Technical Vocational Education and Training courses conducted with practical interaction with different agricultural processes on site.
	reception office kitchenette		
	ATVET learning space		

Fig 4.27 fresh produce handling, processing and reused (Author, 2018)

Fig 4.28 Fruit and vegetable washing (Clarke, J. 2018)

Fig 4.29 Fruit processing plant machinery (Sibla, 2017)

Fig 4.30 Fruit sorting and processing water belt (Getty Images, 2018)

function/space	size	requirements
TEST KITCHEN	400m²	
Yard Cold Store Dry Store Kitchen		'Waste' from fruit and vegetable processing is reimagined as healthy, tasty food creating awareness of the possibilities food waste.
Office Change rooms and WC's Break area		
Reception Test kitchen seating indoor outdoor WC's		Seating under the trees creates direct interaction with the landscape
RECEPTION, SHOP AND TASTING SPACE	230m²	
Store room Kitchenette		Orientation and guidance to different areas of the building. Shop gives visitors the opportunity to purchase produce grown and processed on site Open space provided for vendors to set up stalls and for people to gather and interact.
Office Change rooms and WC's Break area		
Reception Shop Space for food stands WC's		
MARKET	300m²	
Store room		Fresh produce from site as well as Marabastad sold with direct interaction with orchard and nature.
Open space for market stalls Public seating Interaction with orchard WC's		
ORCHARD	500 trees	
Service route for harvesting Equipment Store		Peach trees, fig trees, apricot trees, lemon trees, and apple trees gown in 6 x 4,5m grid.
Office Change rooms and WC's		
Raised walkways		

Fig 4.31 wastED test kitchen in the works (Peskett, 2017)

Fig 4.32 Plant study laboratory (Mendoza, 2018)

Fig 4.33 Fresh produce market display (Gardner, Panthee, n.d.)

Fig 4.34 Fruit tree orchard (Middlefield, 2013)

05

concept

INTRODUCTION

This chapter will delineate the approach of the proposal which aims to re-purpose the role of industry in the rich landscape of Marabastad. The intention is to restructure the opportunities of interaction between the three core aspects identified: nature, industry and culture. The argument formulated aims to create an integrated hybrid typology that is given flesh through contextual problems and needs. It is a proposal that is from the landscape: a landscape of production, a landscape of fragmentation, a landscape of polarities, but most importantly, a landscape of layered and dormant potentials.

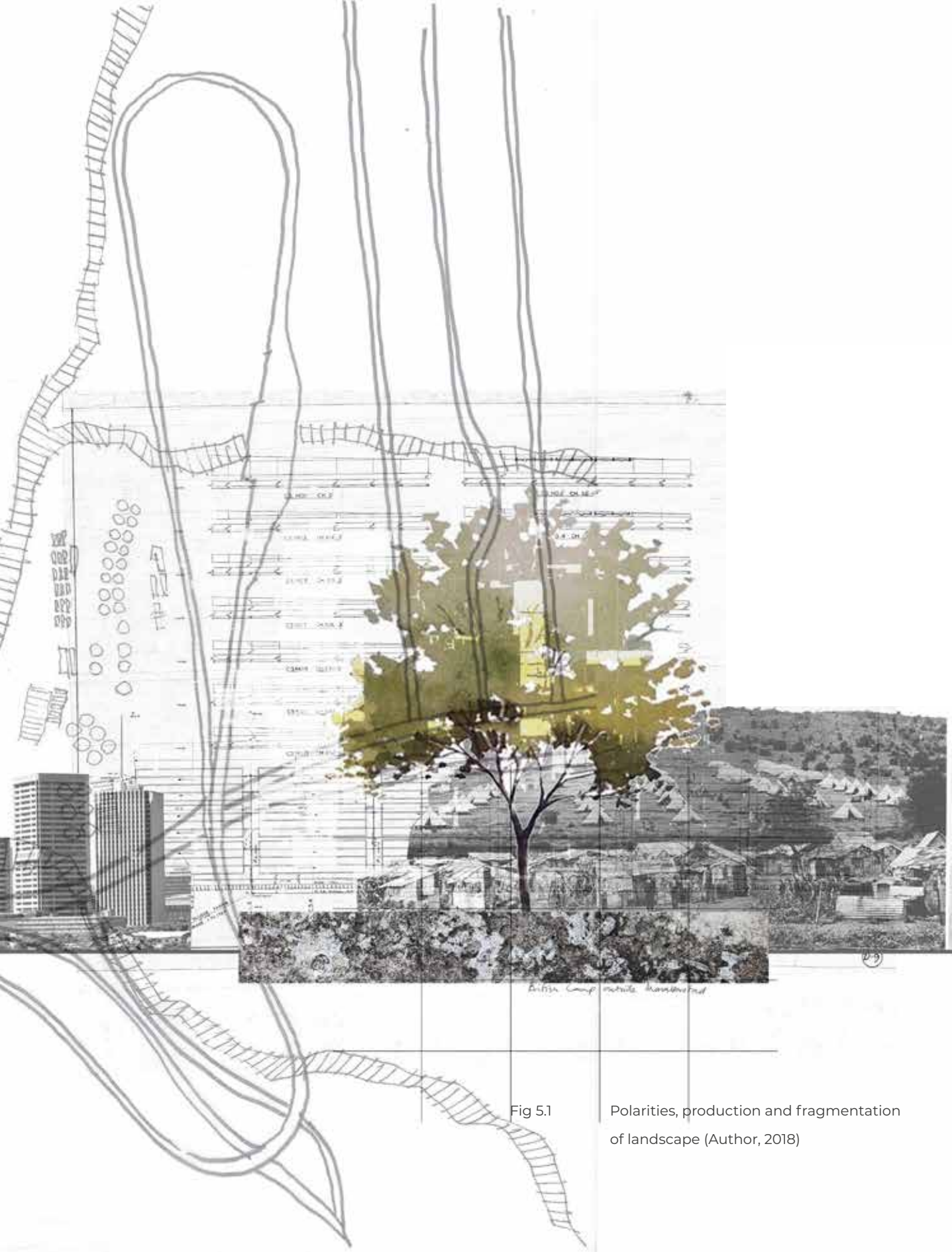


Fig 5.1 Polarities, production and fragmentation of landscape (Author, 2018)

PROJECT INTENTIONS

The project is grounded in and of the site, and thus arises directly from the contextual fabric. The project intentions and proposed solutions stem from the issues identified in chapters 01 and 02. Forming the basis of the section are three different generators called 'activators', 'catalyst components' and 'awareness components'. These three ideas combine to form a series of integrated generators to aid in the formulation of an architectural concept.

Activators

The project's initial exploration was informed by the aspects on site that presented certain issues. Through thorough site and context analysis, as well as a study done regarding the history of the site, the following observations were made:

A. Spatial legacy:

The site is layered with spatial legacy. It presents a rich history, with changing functions and differing occupations. This history is present in the remnants of built fabric and shows the result of forced removals and spatial segregation. An original school and church remains on site, and, although abandoned, show that occupation and habitation made up a part of the sites narrative. The buildings of sewerage works that arose on the site, now sit vacant, no longer contributing to the works as was intended. The nature of the site in its spatial progression changes from an integrated and a land-reliant way of living, to an industrial setting, separated from the community, and finally, to its present day state as a decommissioned plant with no contribution to social, industrial or productive society. Thus, its spatial legacy acts as an activator of design principles that address the memory of previous uses of the site as well as the previous varied relationships between nature, industry and culture.

B. Polarities:

The location of the site in the Daspoort Sewage Works contains many polarities. These polarities largely define the genius loci of the site, presenting characteristics of total contention within one space. Such polarities on site include:

- an unusual proximity to nature considering its proximity to the CBD, but with little interaction with the natural landscape, much less the utilisation of the natural environment to provide for the community of Marabastad;
- a programme proposed to provide services to the people, but not currently in use for the suggested purpose, it now sits distant from people and the community, and inadvertently blocks the Apies River close to the ridge from any possible use;
- a split in historical and current function, and the relationship between the isolated industrial nature of Daspoort and the vibrant nature of its commercial neighbour, Marabastad;
- its proximity to the inner city of Pretoria, yet repelling any pedestrian or any idea of possible habitation; and,
- the Belle Ombre Train Station as paradoxical as it is, designed to be a node of influx and access to the city, yet also acts as one of the largest separators in the landscape.

These notions all indicated the contested nature of this site, and in it, many opportunities to be activators in a dynamic and accessible design process.

The project is grounded in the site, and thus stems directly from the contextual fabric. The project's intentions and proposed solutions stem from the issues identified in chapters 01 and 02. Forming the basis of the section are three different generators called 'activators', 'catalyst components' and

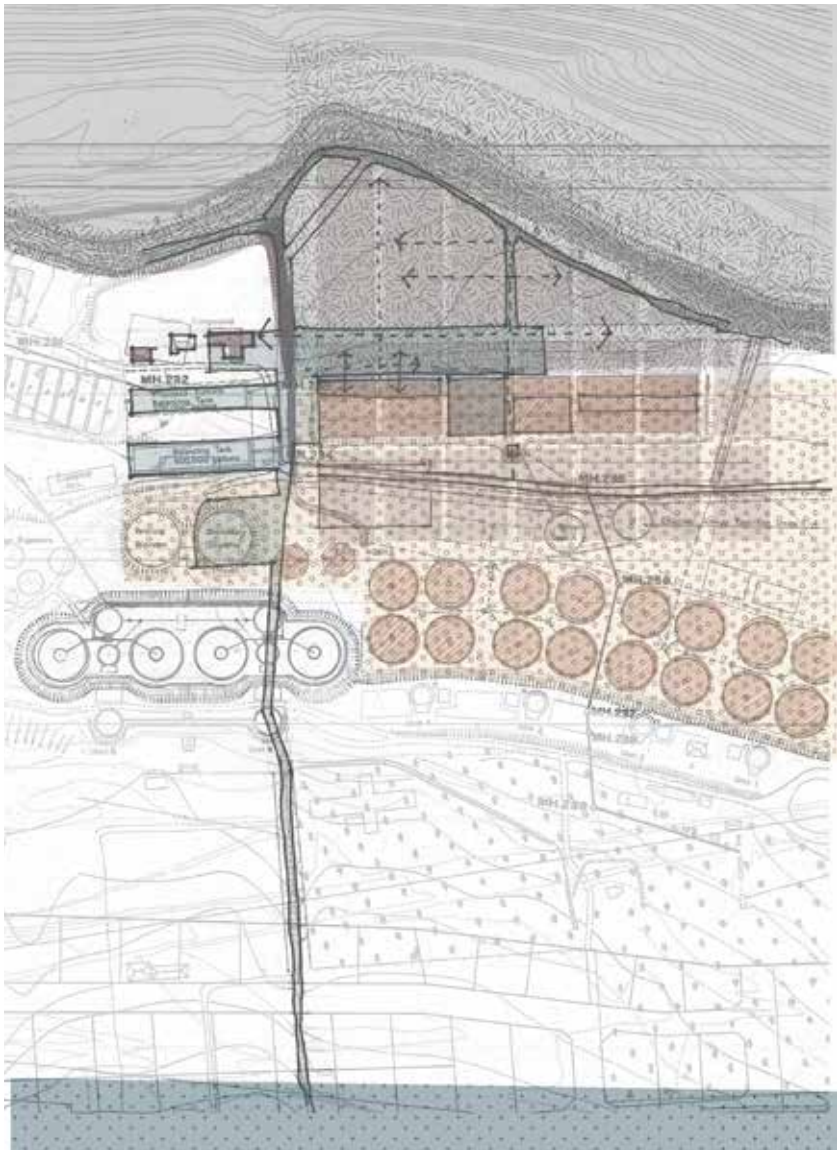


Fig 5.2 Layered condition as opportunity for exchange (adapted from Daspoort archive, n.d)

'awareness components'. These three ideas combine to form a series of integrated over-arching generators to aid in the formulation of an architectural concept.

C. Fragmentation:

When considering the environment of Marabastad, we can observe the logic of 'separation and distancing' in action. The city of Marabastad, amongst all the struggles faced in terms of power, ethnicity, culture, decentralisation and a sense of peripheral blocking, presents a canvas rich with opportunity, yet bearing the markings of those struggles.
One can observe the effects of racial segregation by taking account of the travel time for each person to get to the city. One can observe the vast variety of financial and economic positions of inhabitants as a result of ethnic and cultural 'constraint' and limitation. One can observe the effects of decentralisation, which have transformed our city into a largely commercial based node, that doesn't accommodate a live-in approach, and banishes its inhabitants come night fall. As a whole, the society the city nurtures is a segregated and disconnected one, it speaks of fragments that are unrelated and inconsistent with community place-making.

In the article "The Contemporary European Urban Project: Archipelago City, Diffuse City and Reverse City", by Paolo Viganó, contributor Colin Rowe explores the notion of the fragment, determining that it, in fact, allows for the "coexistence of heterogeneity and freedom" (Viganó, 2013:659). His work highlights the importance of allowing individual freedom within a collective environment, and how each city-inhabitants' individual ways and means, can act as contributor fragments to a larger whole (Viganó, 2013:658). Rowe theorised that this allowed for the conception of a city in parts, ultimately unifying the fragments within the larger sphere of creating communal territory (Viganó, 2013:658).

The fragment can thus be utilized as a segment of a whole, and when equipped with the correct program and sensitive articulation, it can connect to form a greater urban and collective territory.
It is this vision that brings together the pieces and creates an opportunity for growth and revitalisation within the dysfunctional pockets of the Marabastad/Daspoort complex. It requires an innovative exploration of the fragment, in order to understand and project the possibilities of the development and conception of a communal territory combining past of memory and present interaction.

Catalyst Components:

Nurture the possible.

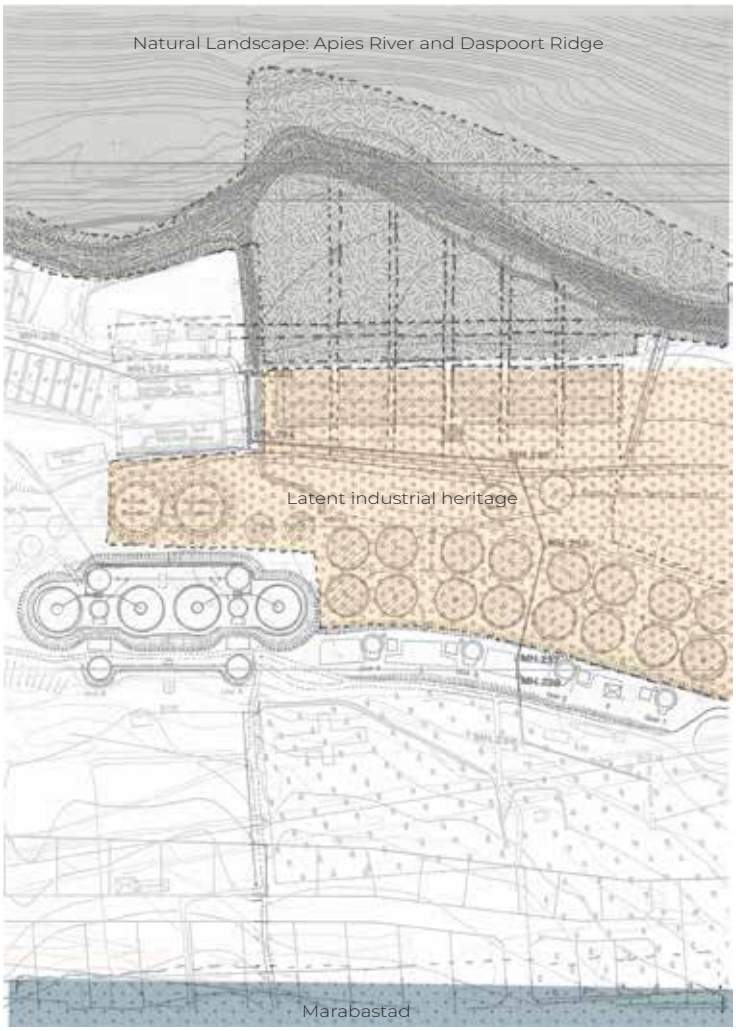
The latent possibilities evident in the context and greater surroundings makes the possibility for value to be harnessed and localised in the landscape of Marabastad. The latent industrial infrastructure serves as the platform for this proposed growth and reinvestment of resources into its direct context. The intention is to take the infrastructure, waste and lost heritage (everything that is present on site) and insert an architectural proposal to begin a process of regeneration. The architecture becomes the intersection, the catalyst, and thus enables the manifestation of something new, whether it be tangible or intangible, but quintessentially, closes the loop on local resource reliance.
This architectural proposal provides the platform for the reintroduction and reconnection of the site to the community of Marabastad.

Awareness Component:

Waste as a resource.

The final generating component relates directly to the possibilities associated with awareness within a community. The goal is to use the influx of people and inherent community that is a by-product of appropriation and occupation of space, and activate the larger goal of waste as a resource through awareness. The relative awareness within the community stems beyond basic selling and buying of fresh produce, which is one of the main public interfaces, but delves deeper into the closed-loop system of the whole proposal.

Essentially the aim is to use interaction to create greater awareness surrounding the energy exchange that takes place throughout the different functions, from fresh and spoilt fruit processing, to methane extraction and output to electricity, and smaller aspects such as digestate that is used as compost and 'processed' water from the fish tanks in aquaponics harvested and re-used for its high nutritional value. The awareness component thus stretches beyond the extents of the building, through activation of the education pods, the sharing of knowledge and information enables intimate scale implementation and involvement.



It is this component that is largely intangible in its manifestation, and acts as both a generator and the generated. It becomes an interconnected network of exchange, where knowledge, interaction and implementation serve as equal parts to a greater interconnected system. The intention is that it remains partly ephemeral, as the presence of people within the system ebbs and flows, the system is driven to change and alteration.
It takes on a complex nature of interconnectivity and uncertainty, and through this interaction, a complex adaptive system emerges as the generating force. Awareness of waste as a resource becomes the by-product of a closed-loop system of exchange and reciprocal action.

Fig 5.3 nature, culture and industry as separated
(adapted from Daspoort archive, n.d)

PRECEDENT STUDY : PROCESS

Project name: Centre for Regenerative Studies
Design team: C.R.S Design Team, John Tillman Lyle
Location: Pomona, California, United States of America
Year completed: 2013
Nature of precedent study: Process
Functions: Water filtration, methane processing, composting, aquaponics, fruit and vegetable production, provision to community

Lessons learnt:
The nature of this precedent serves as the most applicable case study for a closed-loop system, in which every process is dependent on and feeds the other. The diagram shown indicates how complex and integrated the processes are, and thus shows how interdependent the nature of a programme of processes like this can be.
This precedent allowed for a greater understanding of such an extensive network of processes, and also allowed for some shortcomings to be identified. Given the age of this precedent, as well as the difference in location, it enable the implementation of a similar programme and network of processes on the chosen site.

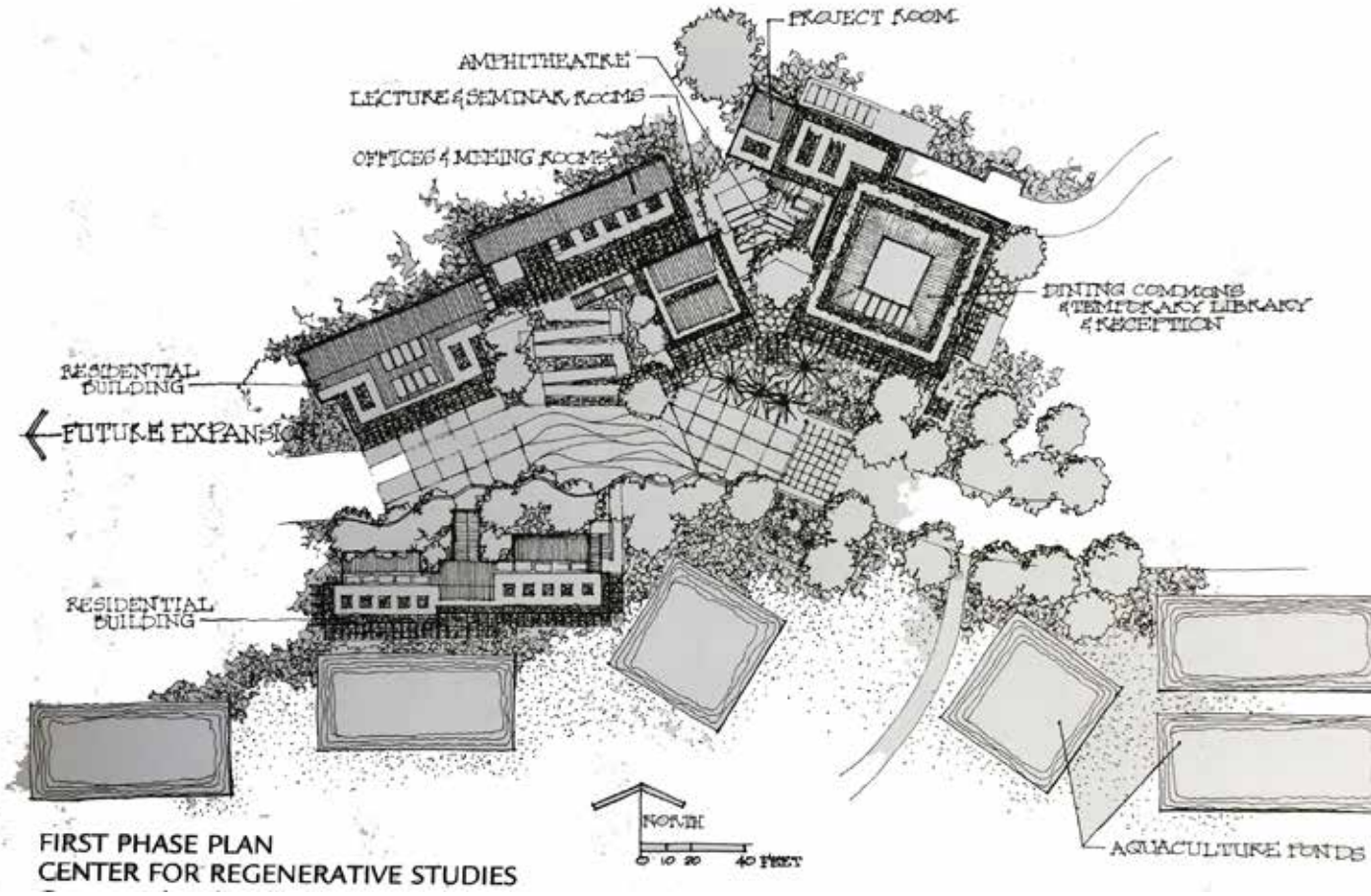


Fig 5.4 Plan for centre (Lyle, 1994: 76)

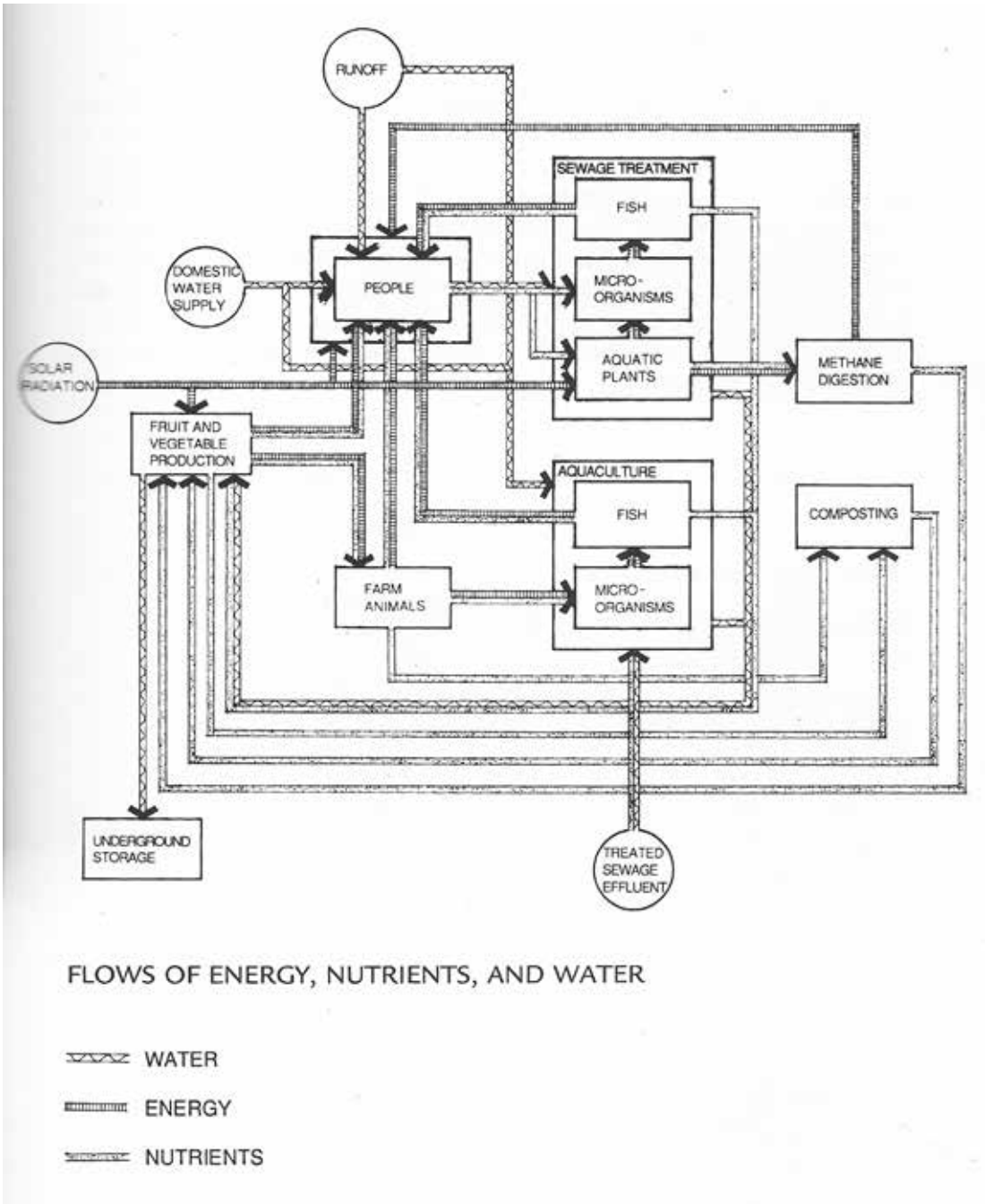


Fig 5.5 Diagrams showing layout and processes of centre (Lyle, 1994: 32)

CONCEPTUAL IDEAS

Today, spaces of absence are a significant concern in many of South African cities. Resulting from a range of contributing factors, this void stems mainly from changes in political and social circumstances as well as shifts in power and urban order, affecting the occupation and presence of the site, and thus tends to serve a non-contributive role within its micro society. The condition of place on site has changed drastically over the last century, changing from an architectural condition of the landscape (informal mud and thatch kraal), to an architectural condition on the landscape (sewage works presenting no architectural relation to the landscape and simply sits in and on it); and lastly, to a proposed future condition of an architectural condition from the landscape. The latter suggesting a closed loop system that recognises and utilises latent natural capital and resources available, as well as harvesting resources to create a localised food and energy resource exchange.

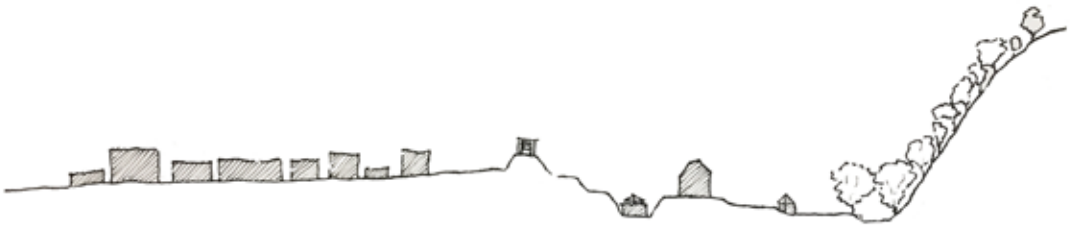
Fig 5.6 Changing condition of place over time (Author, 2018)

pre 1800's – natural landscape

1850's – of the landscape

1890's – of the landscape

post 1920's – on the landscape



present – separated from the landscape

CONCEPTUAL APPROACH

The final architectural concept synthesises the explored information into a strategy that not only informs and drives the development of the site, but addresses the articulation of interaction points between the currently separated notions of industry, culture and nature.

All the conceptual scenarios below have an under-arching theme connected to the activation and harvesting of the layered potentials of the site, of the infrastructure, of the community, and of the processes that enable the interaction and interconnection of the above.

A Connection of Layered Potentials:

By using the complexity of layered potential as an idea, the concept of the connection and interaction of nodes of layered potential within the landscape serves to inform a new architectural typology. When activating the embodied energy of different components, the programme comes to life, extending beyond its physical realm of processing and place-making, but extends through different means of energy exchange to implicate connection and activation beyond its walls. Thus, this proposal acts to activate the latent capital on site, and act as the catalyst for integration, understanding, and localised resource growth, processing and development.

Implications:

The programme as explored in chapter 05 outlines the conceptual approach in terms of the actual functions of the building. It looks at the connection of multiple functions in the greater process of resource repurposing and the closing of the loop between waste, energy production, relative growth and community consumption. The building has the responsibility to provide access routes, to lead the pedestrian into its core and expose the functions it houses. The functions then enter the realm of conscious understanding of its users, and initiates an understanding of a holistic system. This system works like a network, interconnected and interdependent, and ultimately, demonstrates the value of waste.

Furthermore, the building must not only house but exemplify the process, its interconnected nature, and reflect the internal relationships to the architectural rendition of the skins that encapsulate them.

The programmes are also layered in terms of their placement in the building, placing the 'softest' form of industrial process, at the forefront of the approach of the building. The intention of this approach is to confront users with a sense of familiarity, a recognition of the site's history, with an openness and a scale directly relatable to the Marabastad pedestrian. The design proposal flanks many of its sides with a natural layer, with distinct designed access ways for pedestrians, almost making their presence part of that landscape. The connectivity and access between 'fragmented' buildings on site becomes crucial to understanding the building.

Along these routes of connectivity, the pockets of potentials are realised in their relative production houses and interstitial spaces. As pedestrians move through the building, they are confronted with opportunities of coincidental and indirect means of interaction between community, programme and architecture. The architectural approach aims to carefully used materials to articulate the understanding of the building as one moves through the layers. With the processing components being largely industrial, this working typology needs to be restructured to change its access, approach and

Fig 5.7 Marabastad street front (Author, 2018)

facade to become softer, connected and accessible on a tangible level. The cultural relevance of the fabric of Marabastad is continued in the buildings' material response, picking up the coincidental colonnades formed by the columns along multiple verandas on street fronts, as well as extended and emphasised overhangs to indicated places of dwelling. The scale of the different buildings and the relationships between them speak of the rhythm of occasional two-storey buildings that project out of the dense but low fabric of Marabastad, accentuating the horizontality in its connecting elements.

The proposal intends to continue its structural logic beyond the edges of function, and establish a continuity and connection to the natural environment that surrounds it. It is this connection to nature that allows the pedestrian to dwell not only in the building itself, but beyond is edges, and extend habitation to the landscape.

The intention is to uncover and expose the potentials of the proposal, including the potentials of the actual site, the potentials of the waste recycling in the programme, the potentials of food growth, the potentials of closing the loop and localising food resources, the potentials of community engagement and socio-cultural buy-in, the potentials of interconnected industry and nature, and the potentials of varying materiality and architectural articulation to create a platform for the discovery and activation of such potentials.

06

design development

EXISTING LAYERS

Natural, Industrial and Cultural Layers

The architectural intentions are established and demonstrated in this chapter with the assistance of the conceptual informants mentioned in chapter 5. Existing and past patterns, thresholds, barriers and conditions are reimagined to create phenomenological spaces of belonging through a new typology that transforms the site into a resource.

The investigation began by layering conceptual plans over the existing and past patterns of the site. This was followed by detailed sketch plans to refine the layout and interaction between cultural palimpsest, industrial heritage, and the natural landscape. Maquettes and three dimensional modelling provided additional insight into scale and spatial relationships.

Industrial Heritage Layer

The industrial objects lie dormant and forgotten as a result of technological advancements over the history of the sewage works. They now provide new value as objects that become productive and integrated into the natural and cultural grain of the site. The industrial heritage stretches beyond the physical objects that have been forgotten. It tells the storey of Pretoria's growth and development and acts as a reminder to the technology

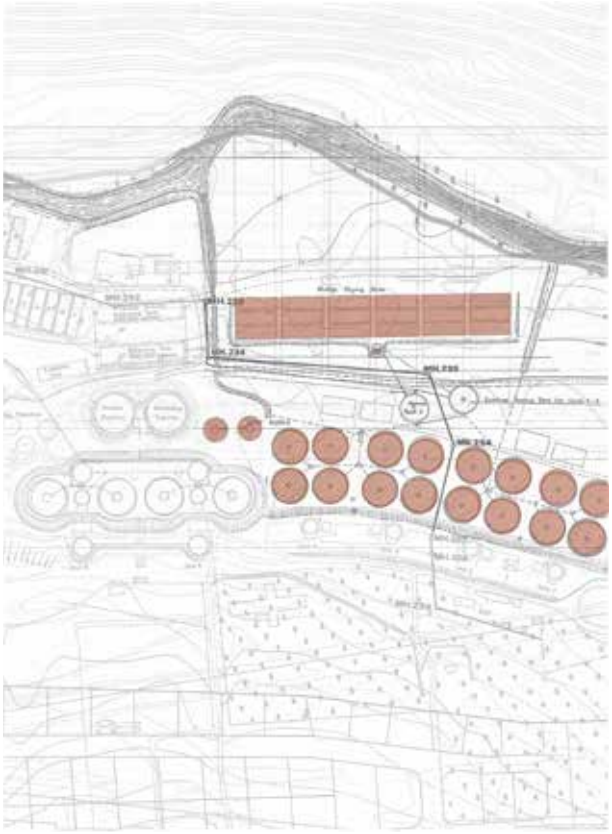
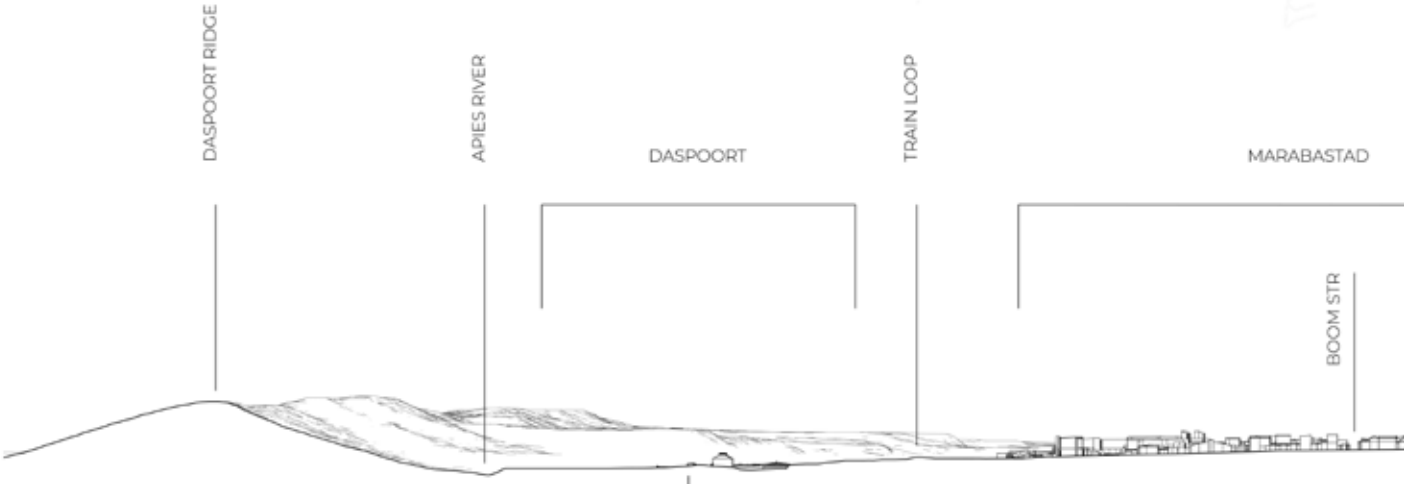


Fig 6.8 latent industrial heritage (adapted from Daspoort archive, n.d)

Fig 6.9 Conceptual section exploration (Author, March 2018)



Natural Landscape Layer

The natural landscape is undervalued and disconnected from the city. The stark juxtaposition of the apparent undisturbed nature of the site and the vibrancy and hustle of Marabastad offers a unique opportunity for interaction and engagement and can serve as a productive resource for the city.

Cultural Heritage Layer

The cultural heritage of the site is long forgotten and barely evident. The church and school building are the only remaining physical artefacts that suggest the site has a hidden history. The old roads and erven as a superimposed layer provide a guide to understanding the forgotten grain of the site. It was important to account for all the past conditions of the site in order to create a solution that has future value.

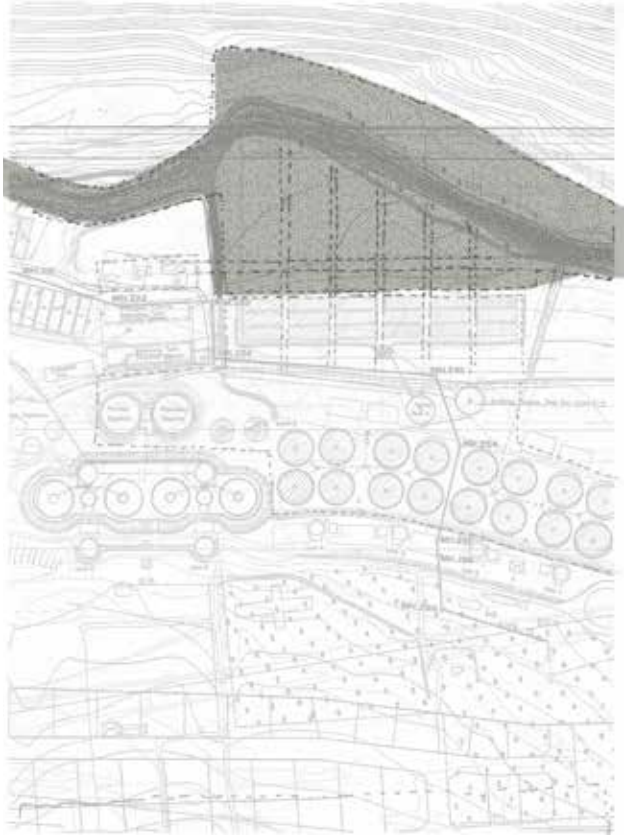


Fig 6.10 Disconnected river and ridge (adapted from Daspoort archive, n.d)

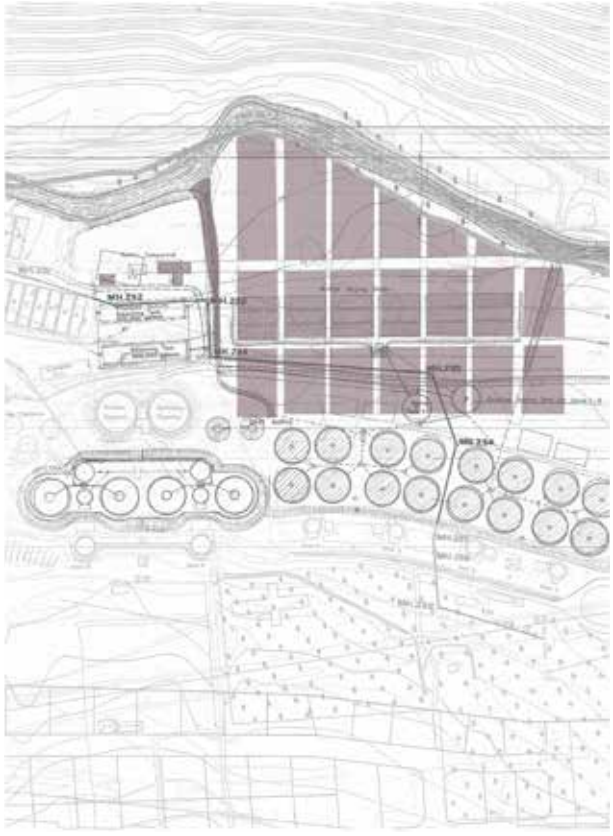
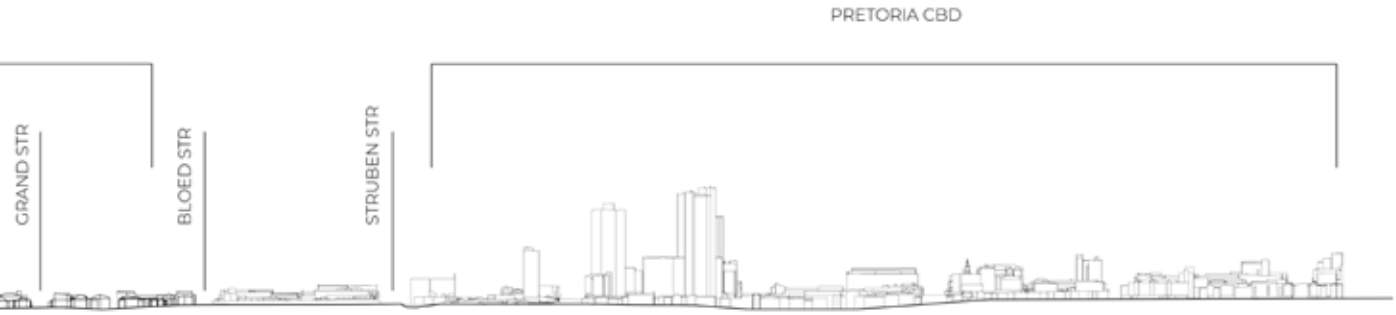


Fig 6.11 forgotten cultural heritage (adapted from Daspoort archive, n.d)



The spatial legacy, polarities and fragmentation of the site inform how the architecture is articulated in creating a place of meaning and resilience. Contesting the mono-functionality of the site by introducing a complex programme that is derived from the site and surroundings allows for experiential interaction and exchange. A journey from Marabastad to the site allows the public to interpret and understand the past and present conditions of the site by moving from the urban through the industrial and into to natural. This experiential journey is echoed in the architecture though material use, scale and the buildings interaction with the natural landscape.

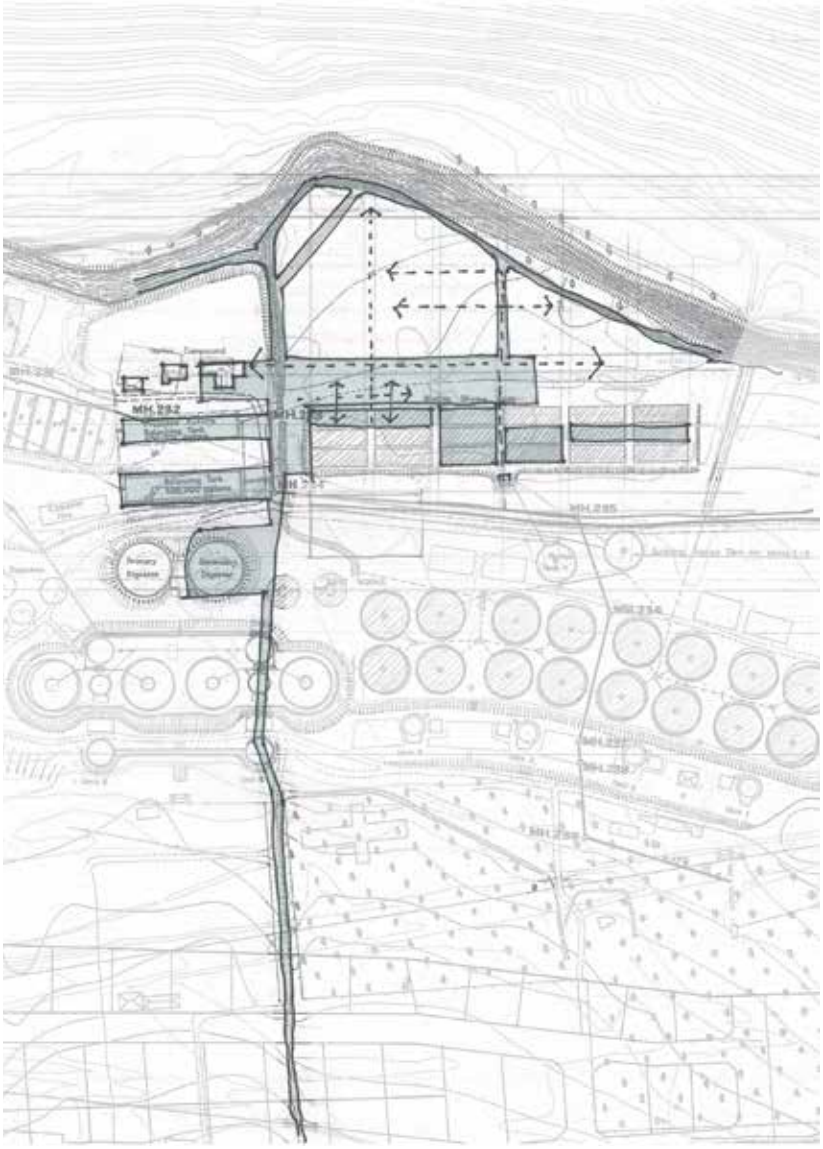


Fig 6.12 Experiential journey from Marabastad to Apies River (adapted from Resobeit archive, n.d.)

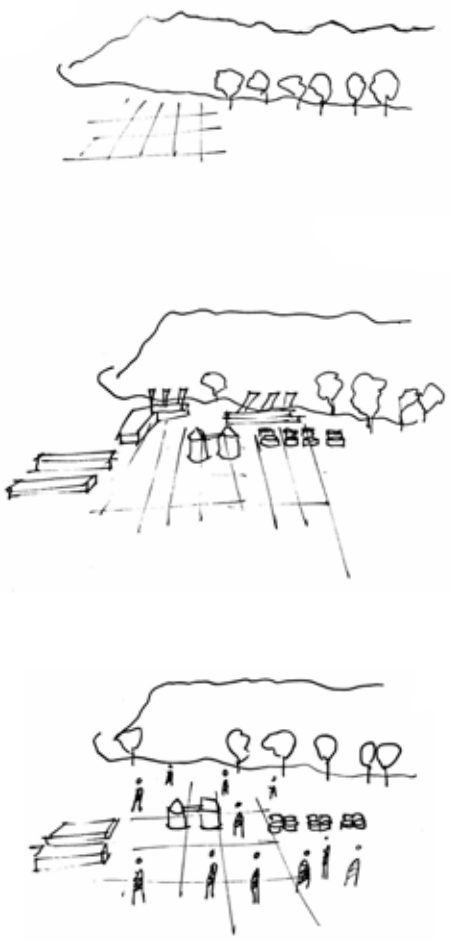


Fig 6.14 An exploration of the changing condition of the site (Author, 2018)

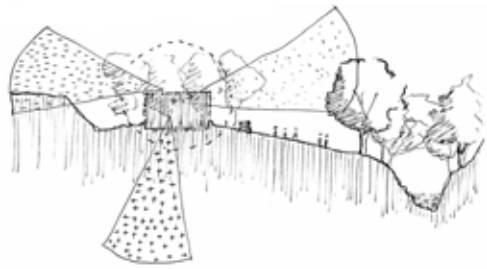


Fig 6.15 imagined possibilities for interaction (Author, 2018)

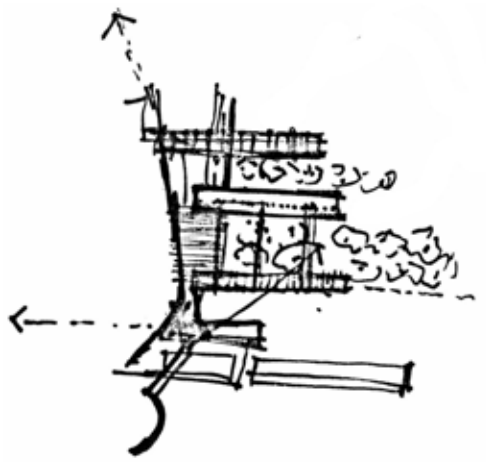


Fig 6.13 Diagram exploring interaction with landscape (Author, 2018)

Fig 6.16 Iteration 01 (Author, March 2018)

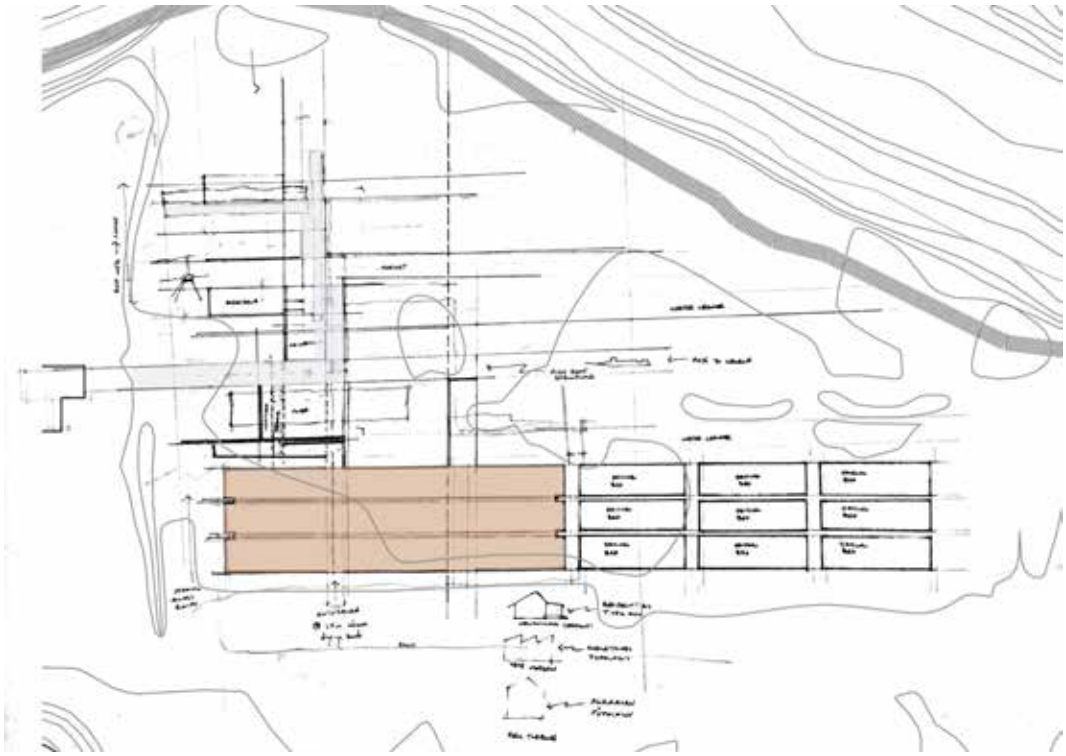


Fig 6.17 Iteration 02 (Author, April 2018)

Iteration 01:

The first layout explored the notion of the building as a continuation of the route from Marabastad. The focus was very much on the buildings intersection with the landscape while respecting the cultural heritage layer. The route through the building (highlighted in grey) wove though the landscape to create moments of exploration as views and vistas were revealed around turns and through openings. The experiential quality of the journey was paramount. This iteration placing little focus on the industrial heritage (highlighted in red) and limited the site as a productive landscape.

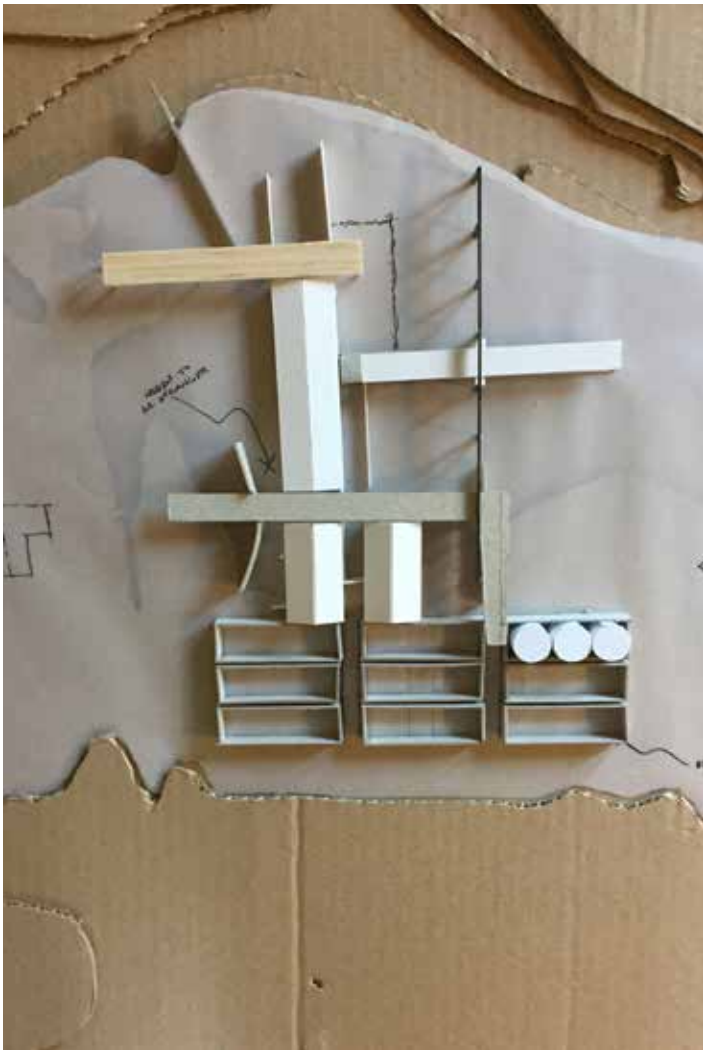


Fig 6.18 Process model 01 (Author, May 2018)

Iteration 02:

The layout began to shift laterally to engage more with the natural landscape and industrial heritage. The route became more defined with courtyards being introduced to encourage interaction and informal gathering. The productive and social function were separated to create a better flow of resources and to better define the experiential journey as a transition from culture to industry to nature. The productive function were place to the south to interact with the industrial heritage while to social functions merged with nature.

The model explored the scale and architectural interaction of spaces with the site.

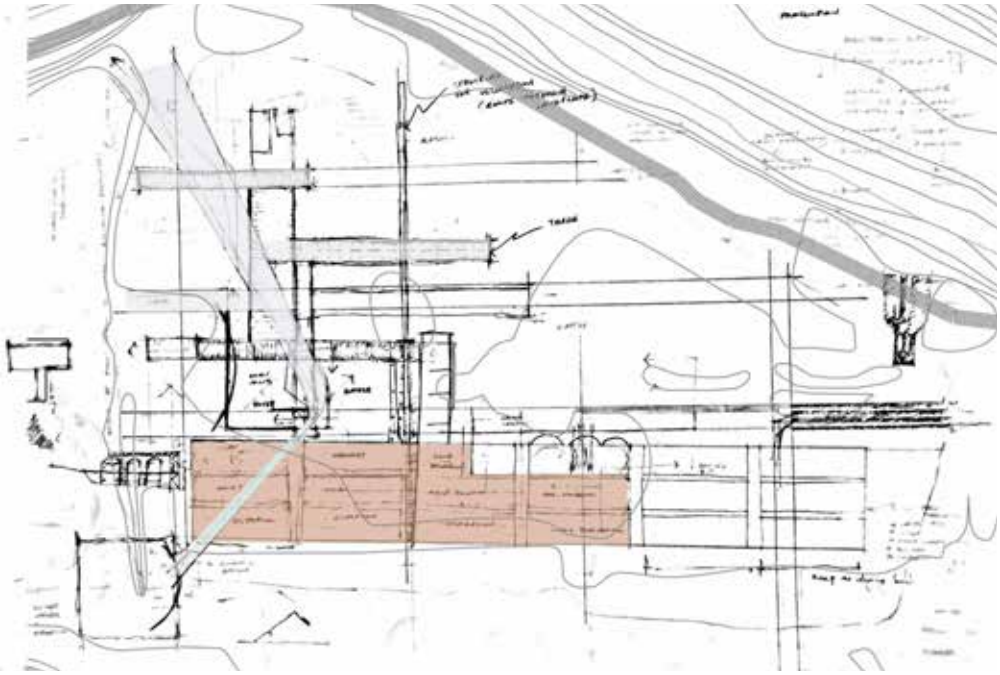


Fig 6.19 Iteration 03 (Author, April 2018)

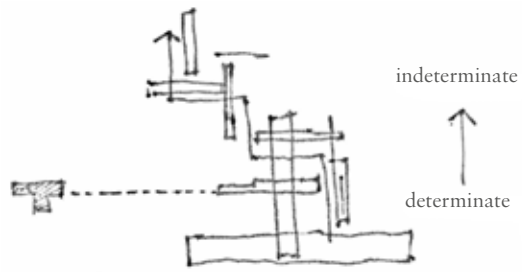


Fig 6.21 Diagram of layered function in the landscape (Author, March 2018)

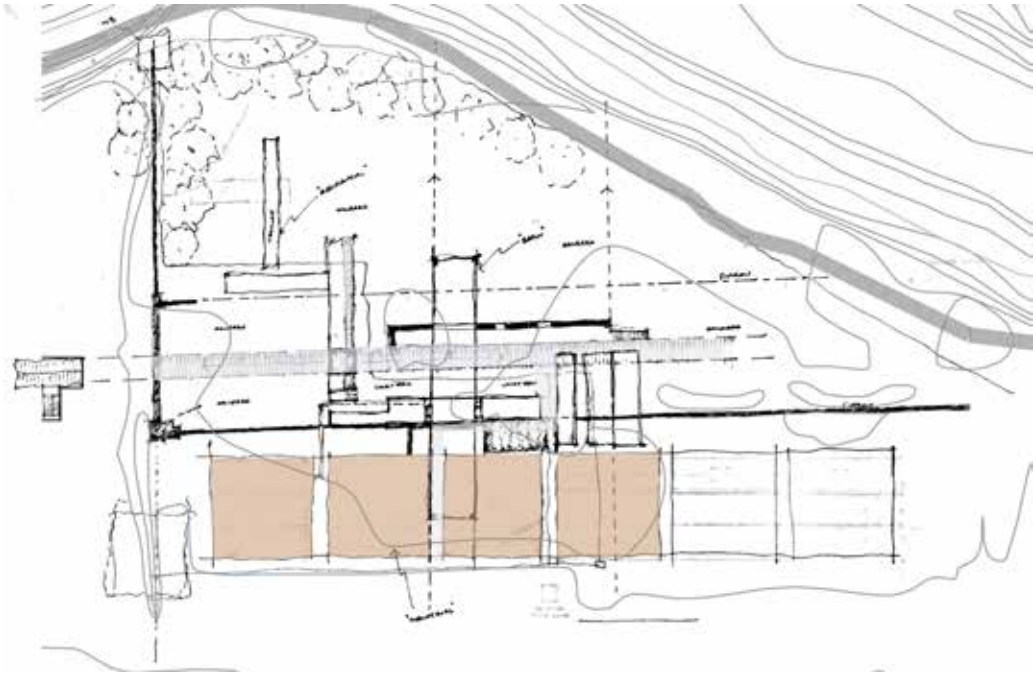


Fig 6.20 Iteration 04 (Author, May 2018)

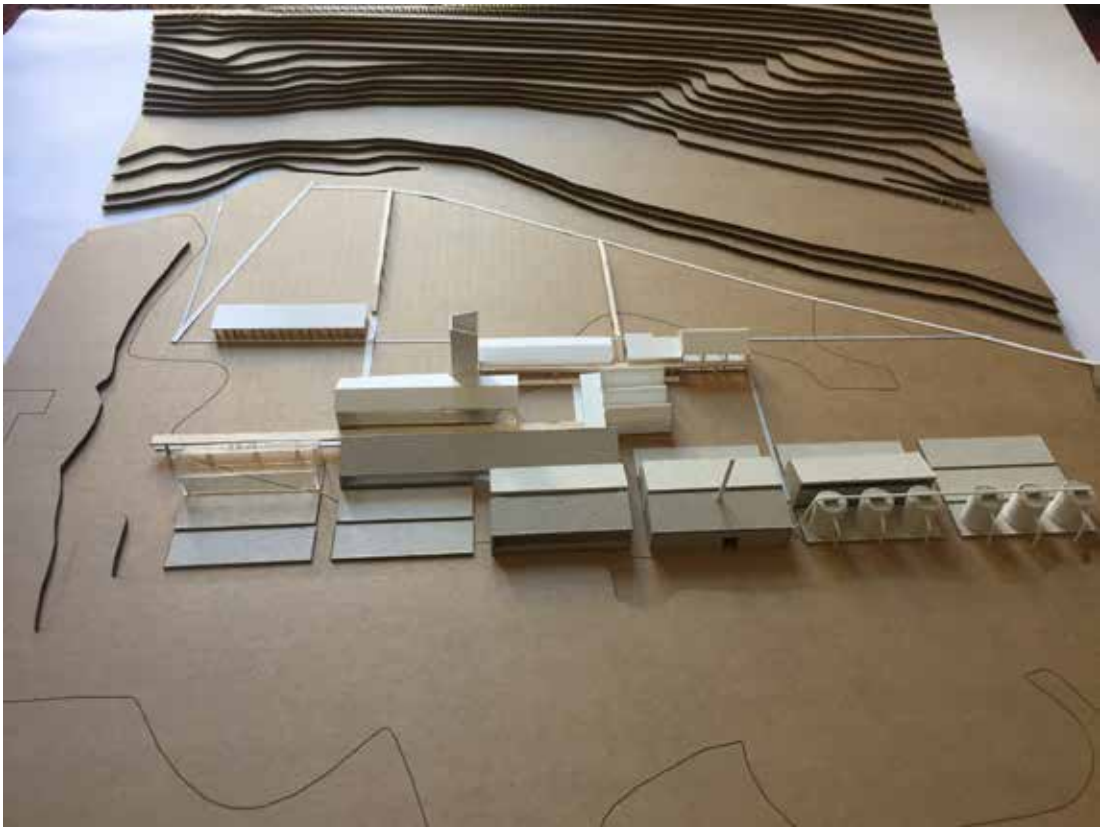


Fig 6.22 Process model 02 (Author, June 2018)

Iteration 03:

The productive spaces grew to occupy more of the drying beds to account for an increase in the complexity of the programme. Two courtyards were defined to focus movement and activity and separate the experiential quality into two distinct characters, namely, production and consumption.

The layout of the productive spaces was slightly confused and the flow needed to be revised.

Iteration 04:

The intention was to create greater harmony and integration by fragmenting the layout and reducing the overall scale by separating functions. The landscape could now filter between the buildings and become intrinsic to the spatial experience.

The integration of the productive spaces and the industrial heritage was fragmented to illustrate the contrast between the drying beds in their original condition and the drying beds as adapted for production.

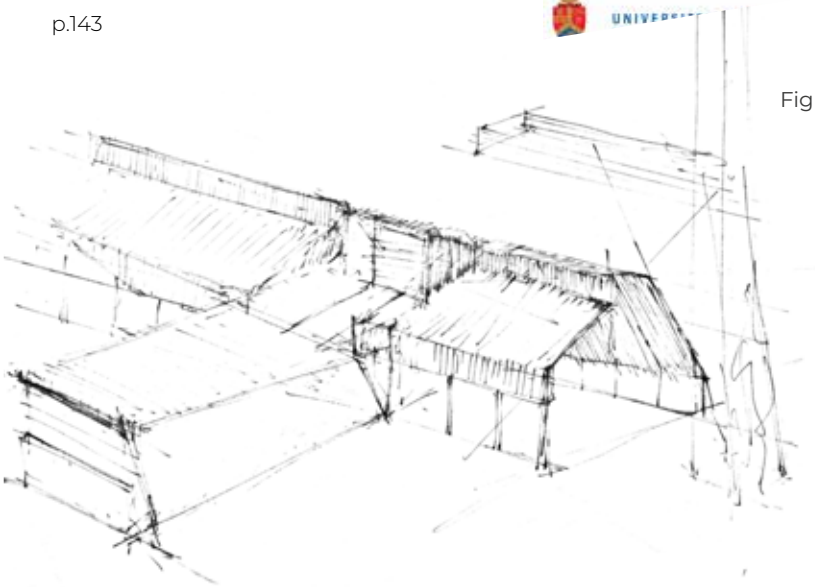


Fig 6.24 Conceptual typological exploration (Author, March 2018)

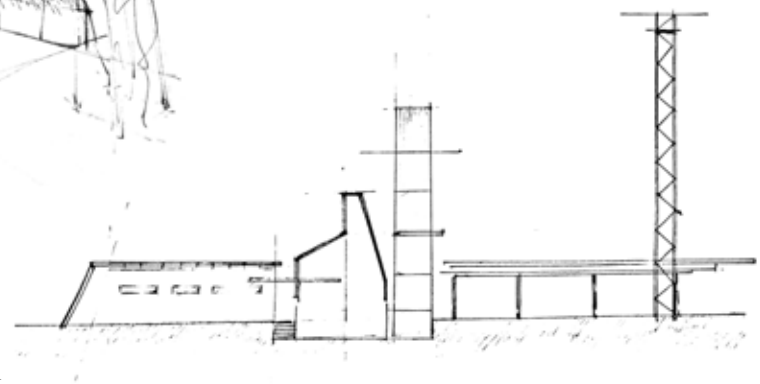


Fig 6.26 Section exploration 02 (Author, March 2018)

Section Development:

An investigation of how the architecture and landscape interact as well as the climatic and experiential response developed into a typology that was derived from the industrial requirements of the programme and the in-between spaces that encourage interaction and exchange.

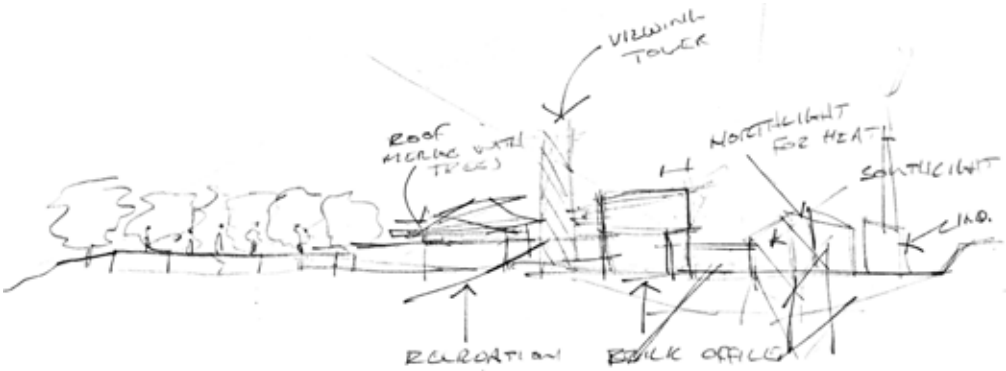


Fig 6.25 Conceptual section exploration (Author, March 2018)

Fig 6.23 Section exploration 01 (Author, March 2018)

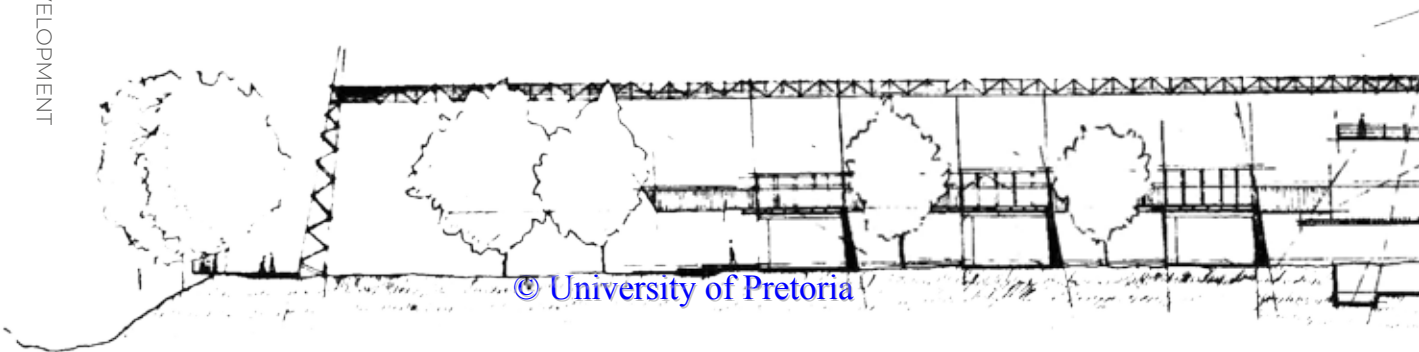
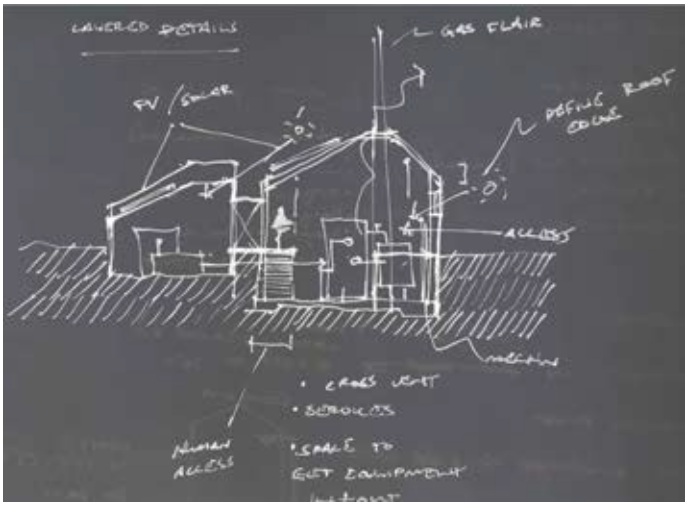
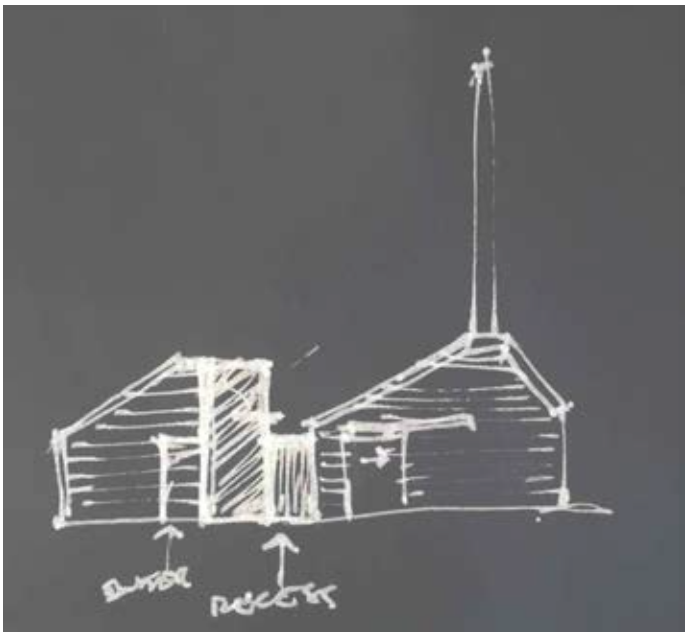
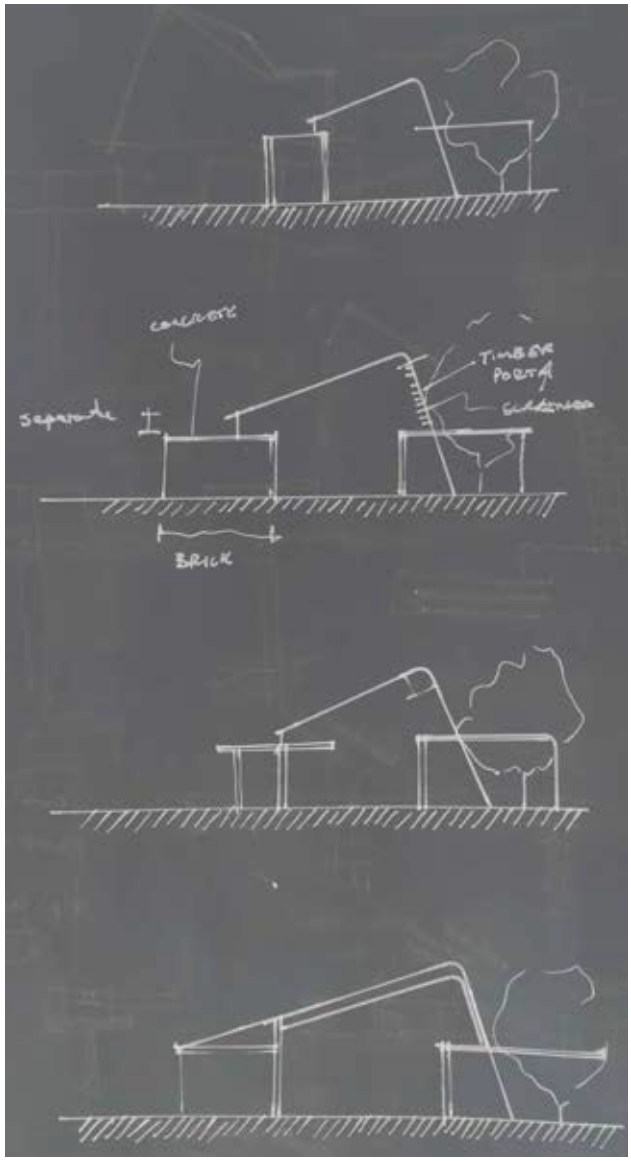


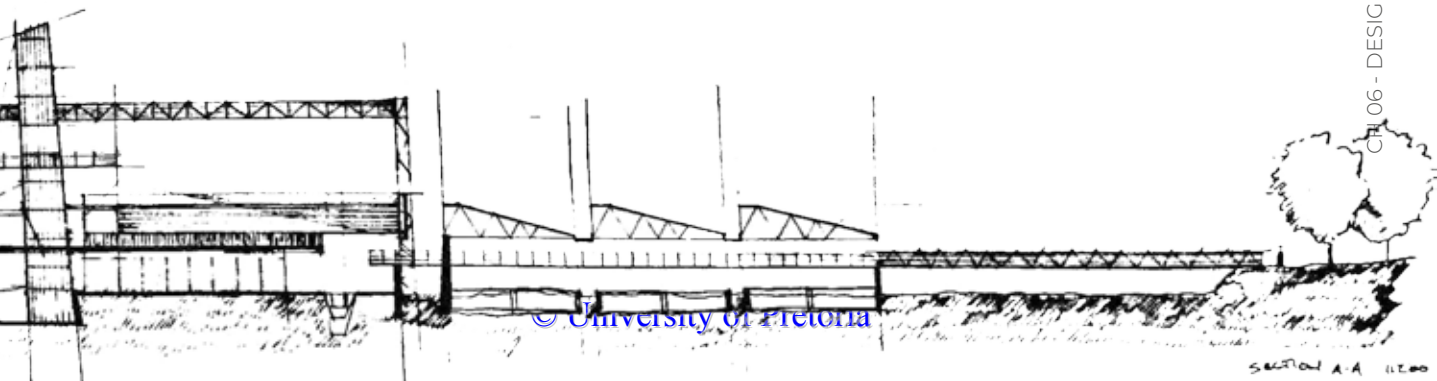
Fig 6.27 Section and elevation exploration for methane processing and water filtration (Author, 2018)

Fig 6.28 Section exploration for Test kitchen (Author, 2018)









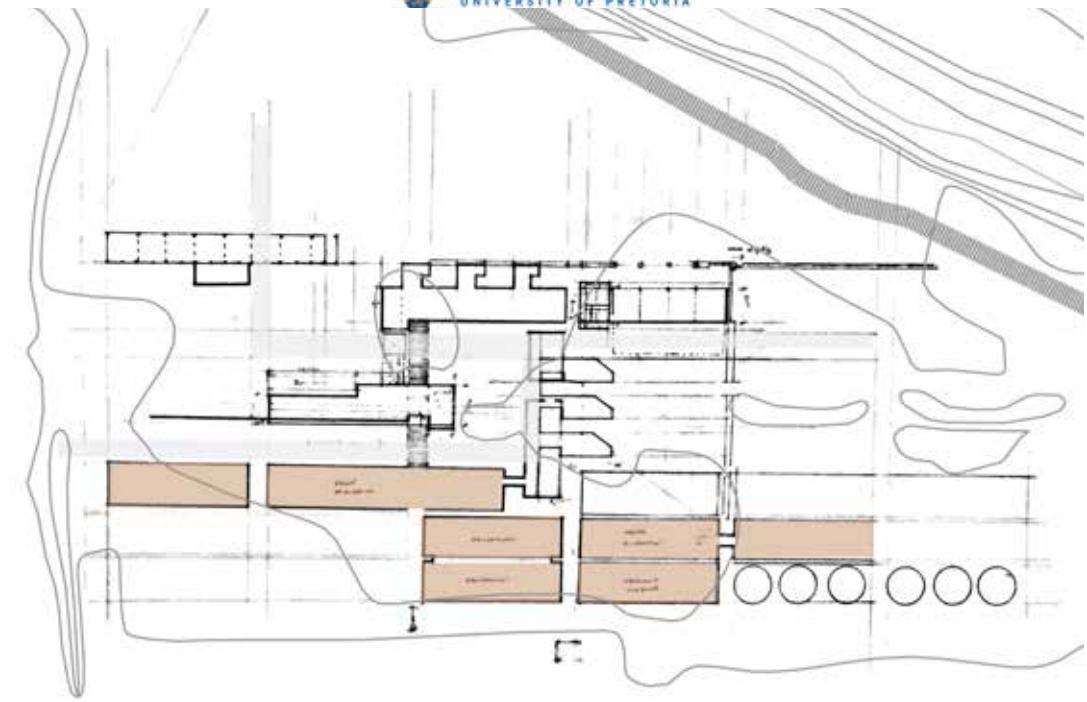


Fig 6.29 Iteration 05 (Author, May 2018)

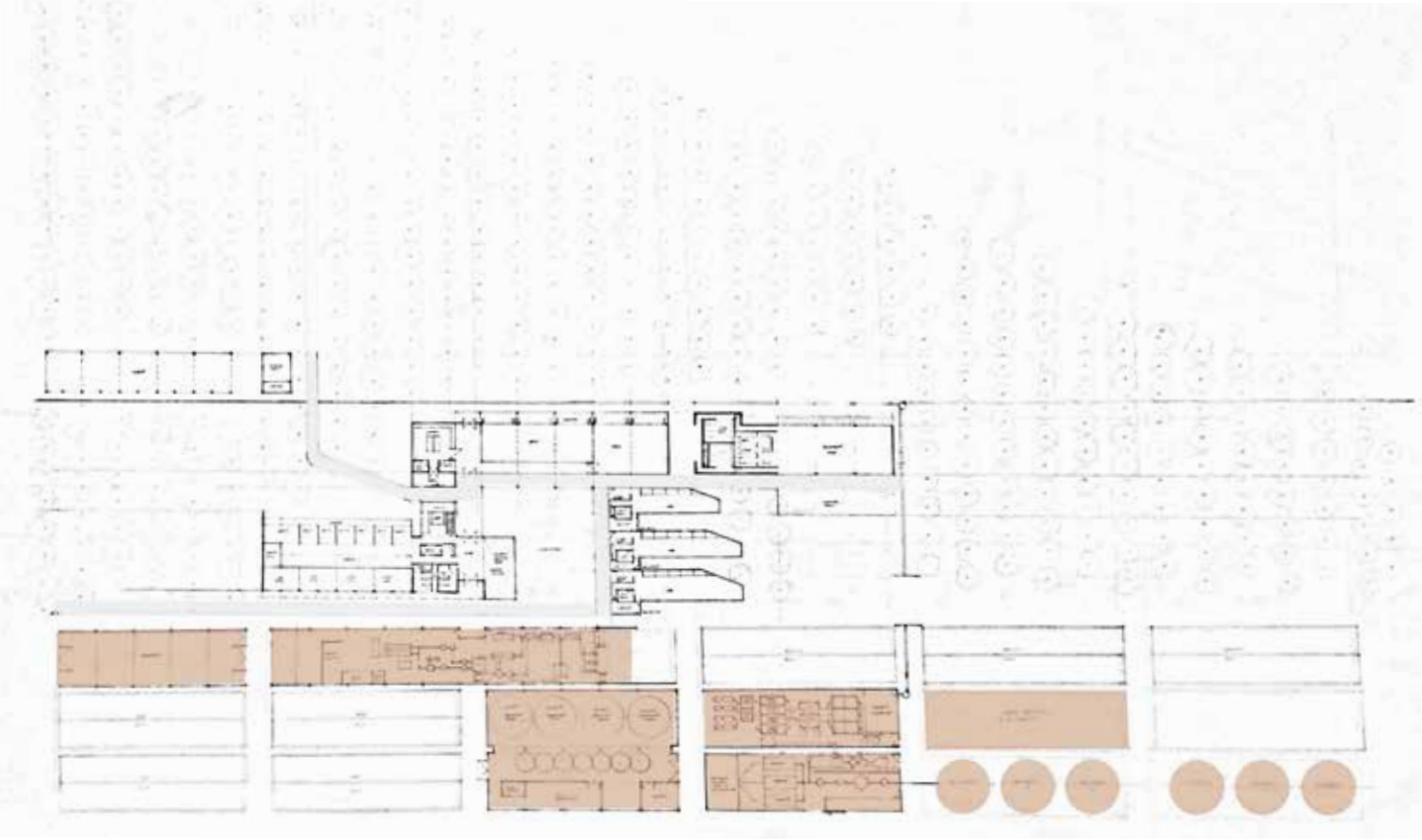


Fig 6.30 Iteration 06 (Author, June 2018)

Iteration 05:

The laboratories and education spaces were arranged along the northern edge to have direct interaction with the landscape and orchard. The productive spaces were rearranged so that the fruit processing and aquaponics had direct interaction with the public spaces while the water filtration, methane turbines and fruit and vegetable waste processing were separated to the east.

Iteration 06:

This iteration looked at the rearrangement of the social spaces so that the test kitchen and hall opened onto the orchard while the laboratories moved closer to the productive part of the building. At this point the design lacked proper integration with the landscape.

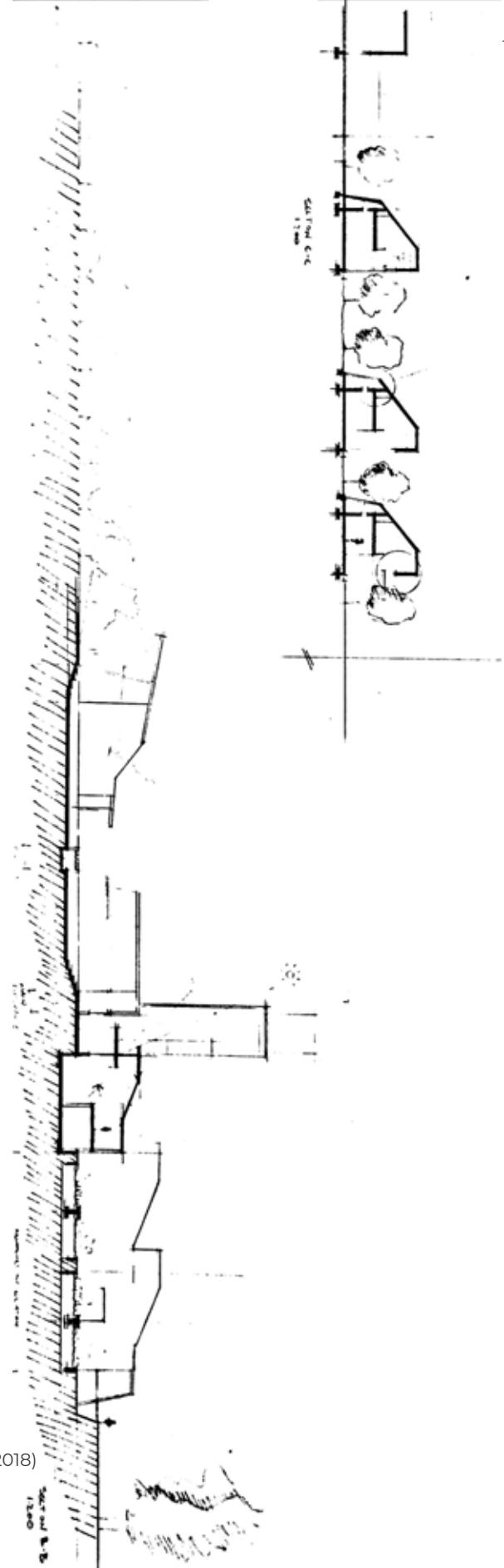
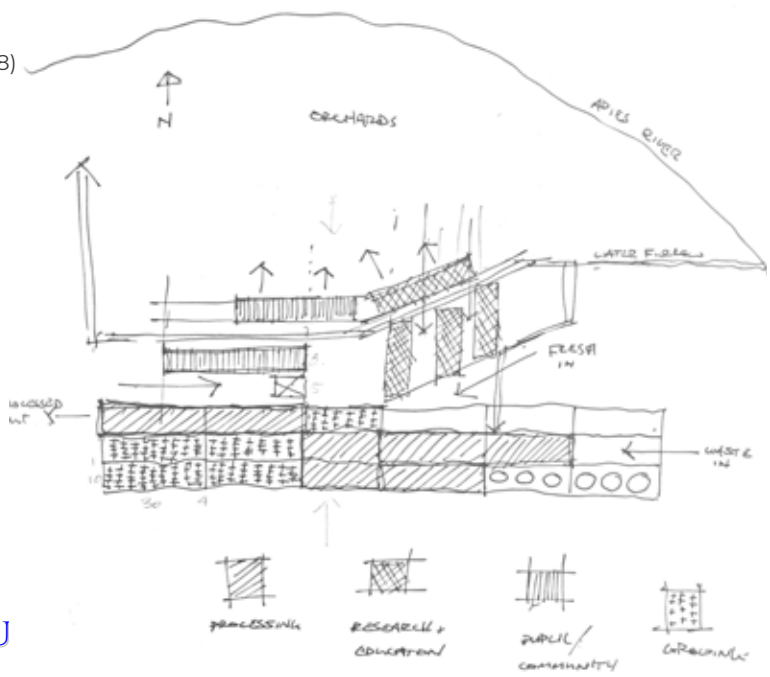


Fig 6.31 Section development (Author, August 2018)

Fig 6.32 Final hand drawn iteration (Author, 2018)

Fig 6.33 Diagram of functional arrangement (Author, 2018)



Iteration 07:

The final hand drawn iteration resolved the interaction between building and landscape by rotating the laboratories and education pods to line up with the rows of trees in the orchard. `the test kitchen and tasting space also shifted to align with the grid of the orchard to allow some lines of tree to extent between the buildings.

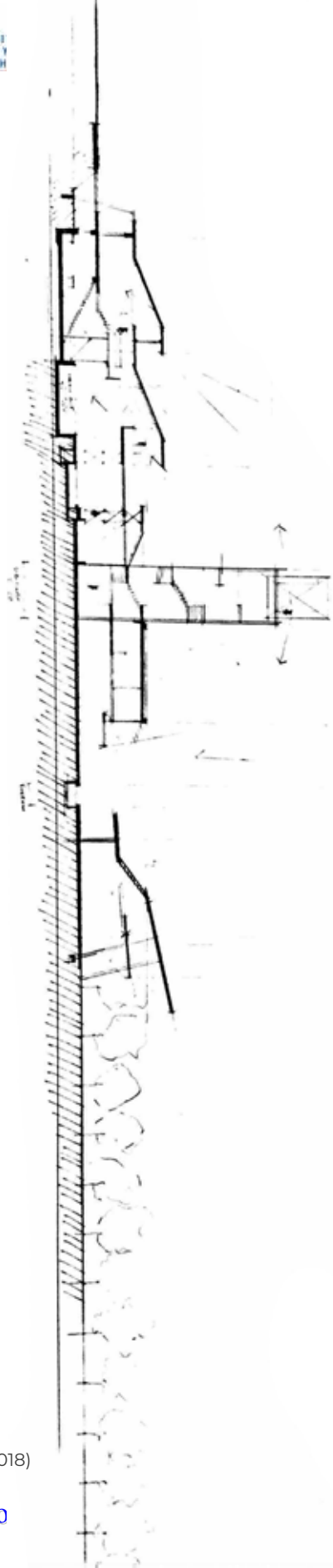


Fig 6.34 Section development (Author, August 2018)

Fig 6.35 Section model 01 view from east (Author, 2018)

Fig 6.36 Section model 01 view from west (Author, 2018)

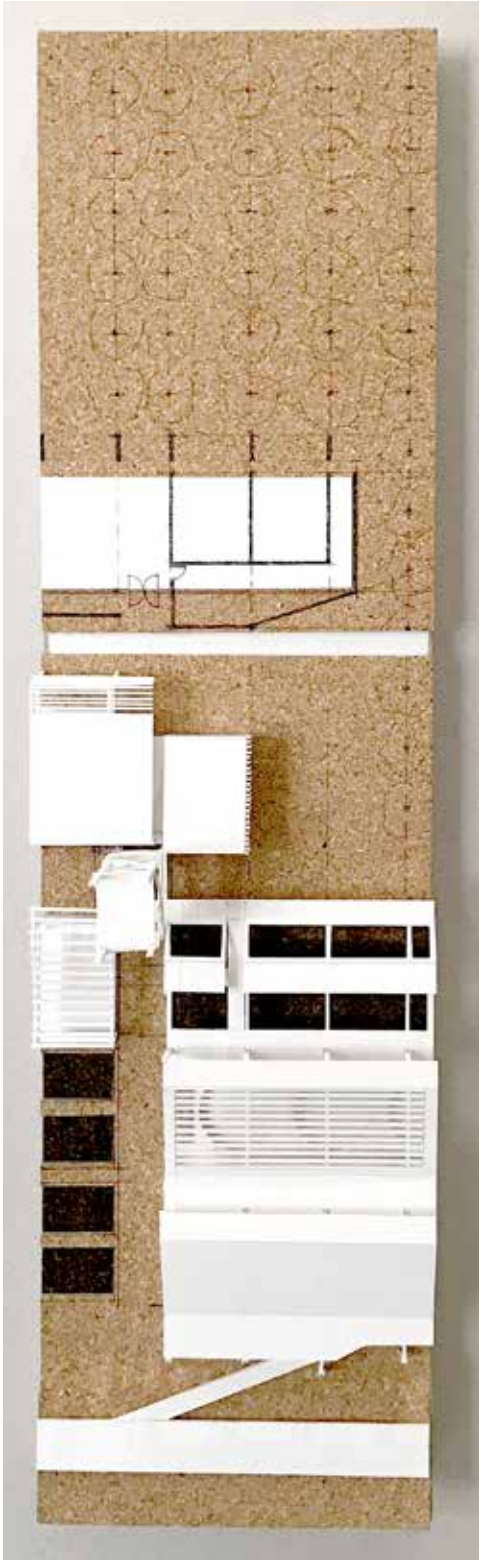


Fig 6.37 Development of section model 01 (Author, 2018)

Design Development through Section Models:

Dividing the design into sections allowed for a continuous process of exploration and refinement while being able to refer to previous iterations, and yet have a complete model of the building. It also allowed for exploration and development of the section and provided a clear indication of the relationship of the scale between production, social interaction and landscape.

The first section cut through the aquaponics, greenhouse, public square, tasting space and test kitchen.

Fig 6.38 Section model 02 from east (Author, 2018)

Fig 6.39 Section model 02 from west (Author, 2018)

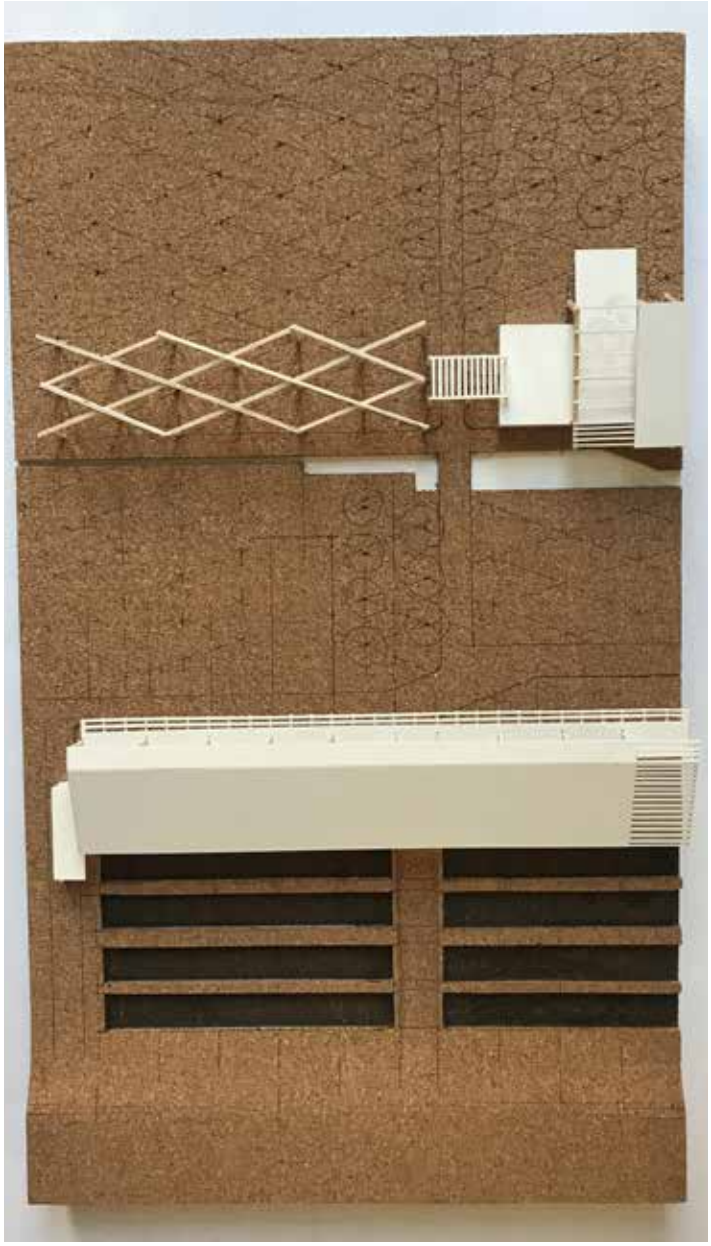
Fig 6.40 Development of section model 02 (Author, 2018)

Section Model 02:

The second section model was taken through to the west of the first and shows the laboratories, a portion of the aquaponics and greenhouse and the water and methane filtration. This model assisted with the design of the furrow from the river and the service route into the orchard.

Fig 6.41 Section model 03 from east (Author, 2018)

Fig 6.42 Section model 03 from west (Author, 2018)



Section Model 03:

The third model is taken though the western most edge of the building. It shows the fruit processing plant in its entirety as well as the test beds to the south, and market and test kitchen to the north.

Fig 6.43 Development of section model 03 (Author, 2018)

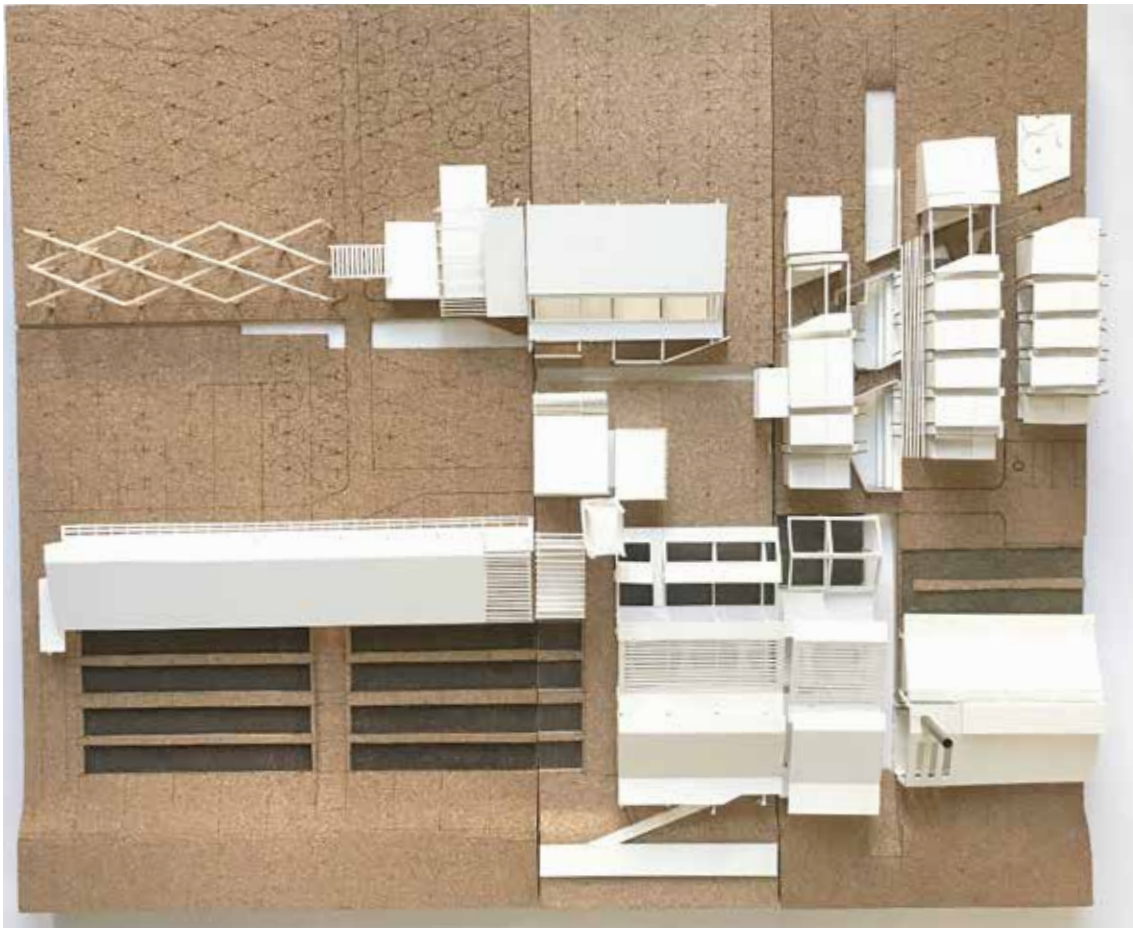


Fig 6.44 Section models 1,2,3 on plan (Author, 2018)

Fig 6.45 Section models 1,2,3 view from west (Author, 2018)

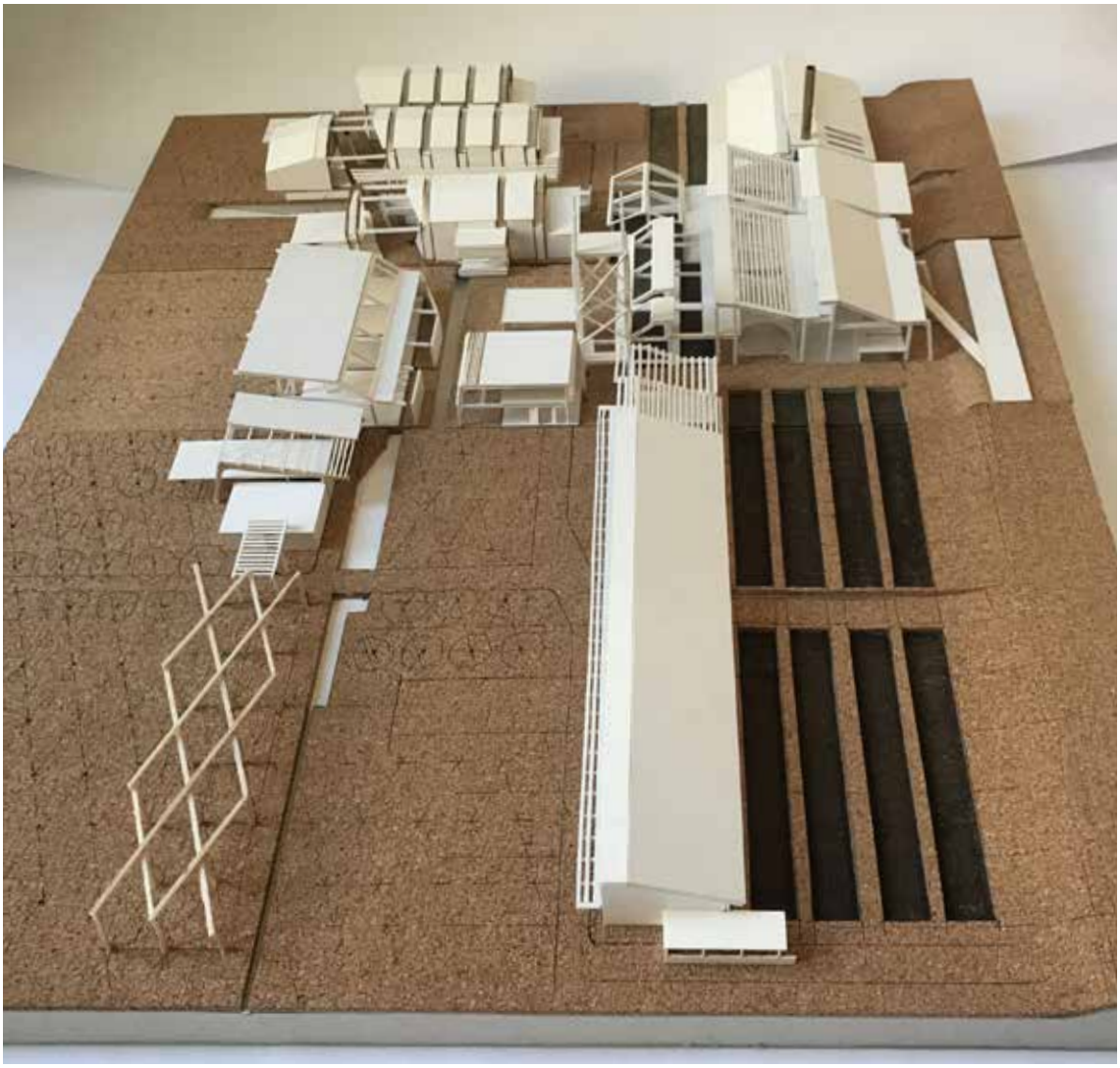
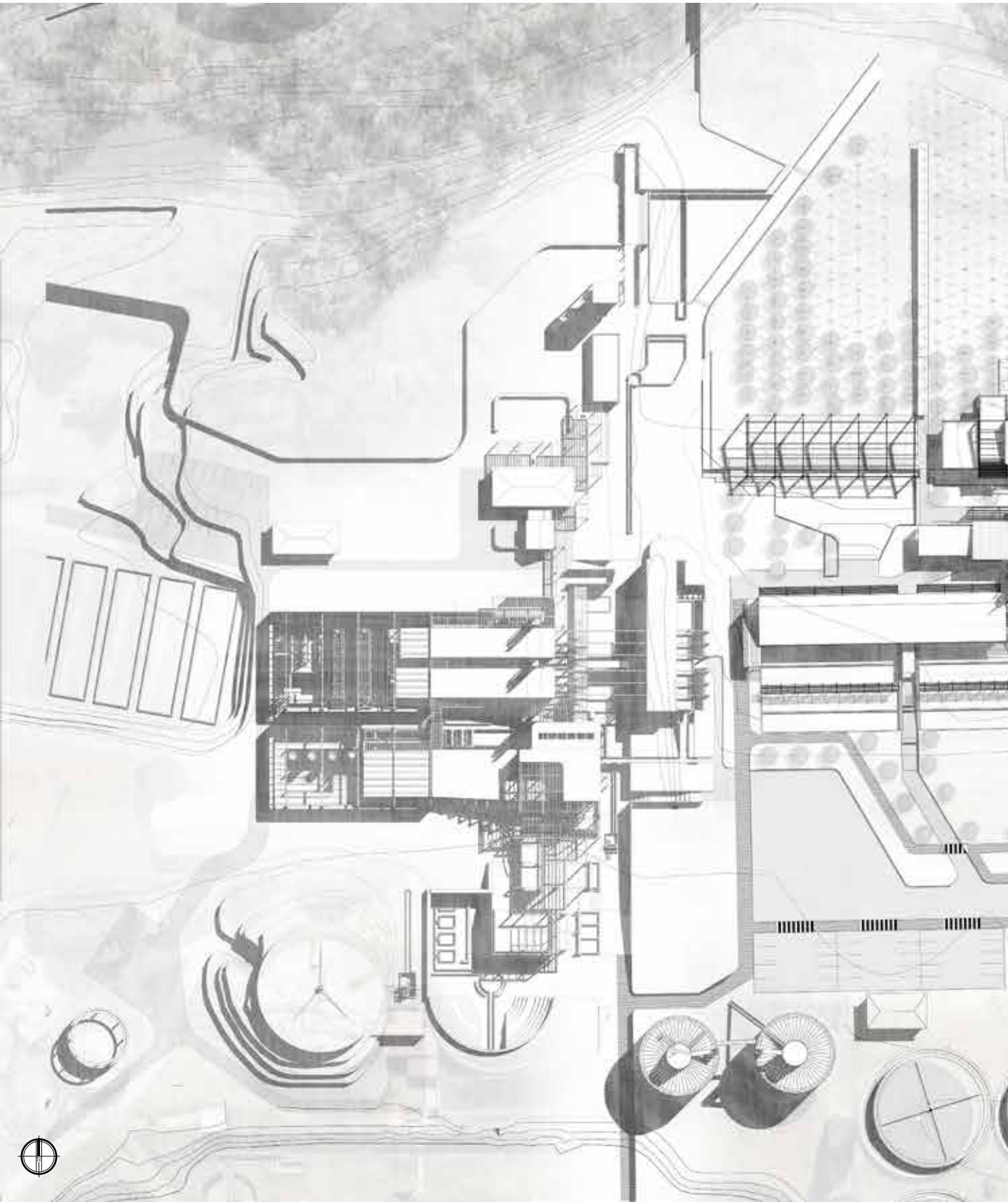
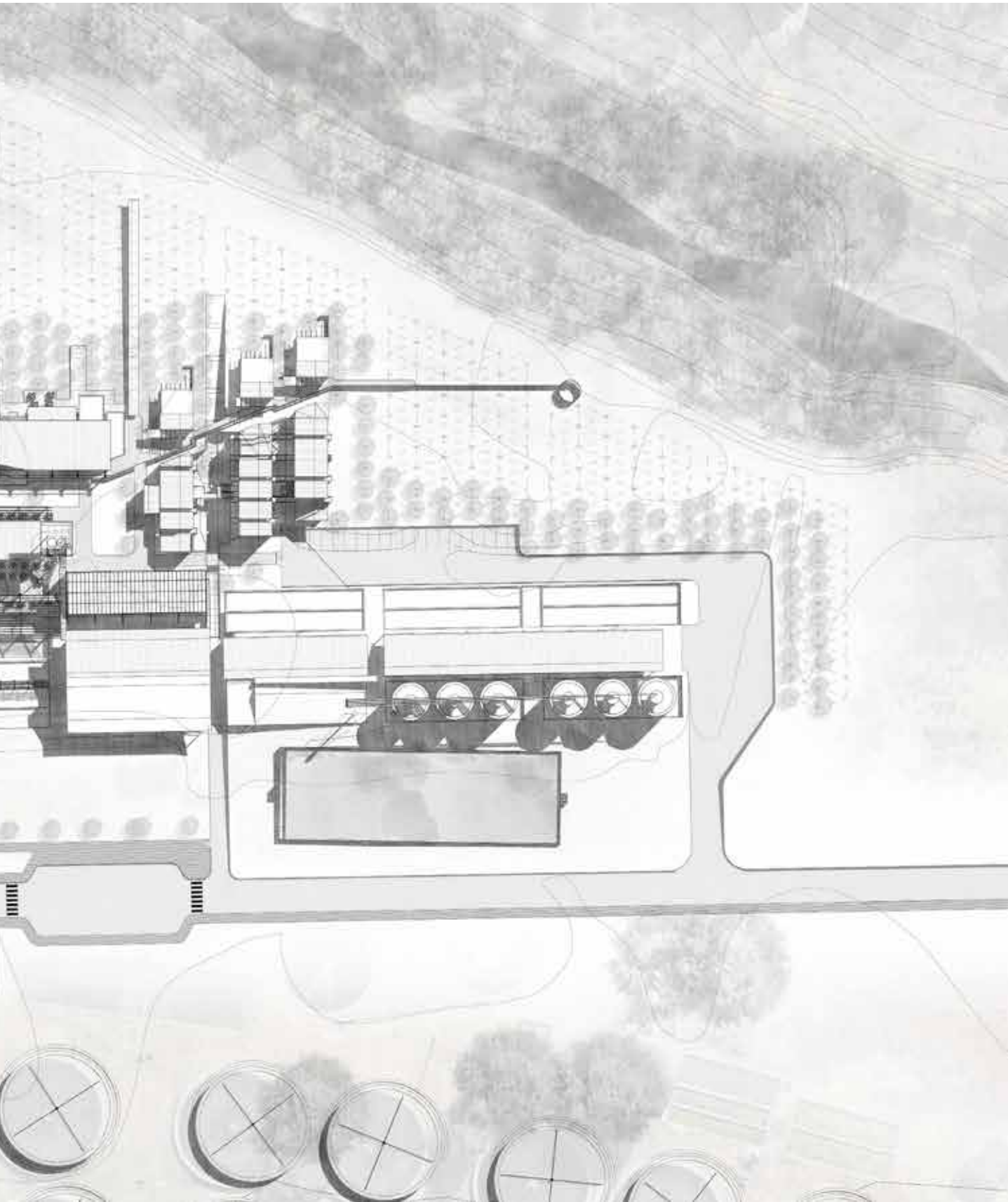


Fig 6.46 Section models 1,2,3 birds eye from west (Author, 2018)

Fig 6.47 Section models 1,2,3 view from east (Author, 2018)

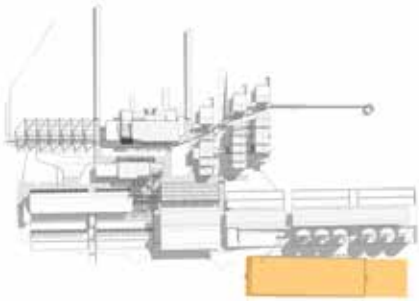
SITE PLAN





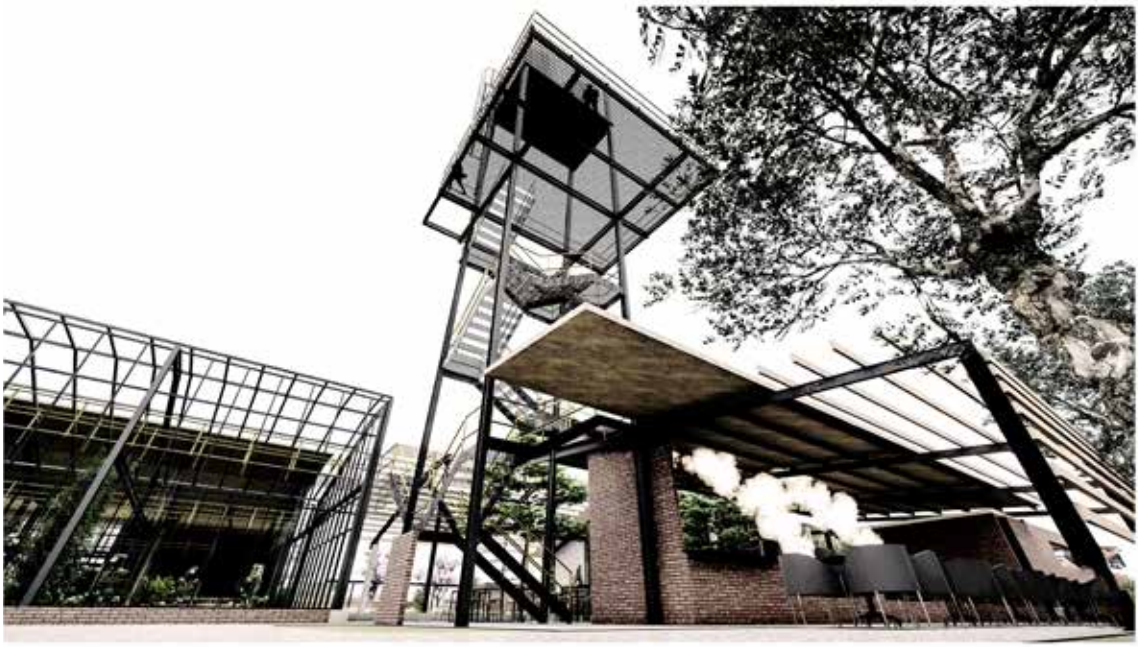
FINAL RENDERS

approach from the east

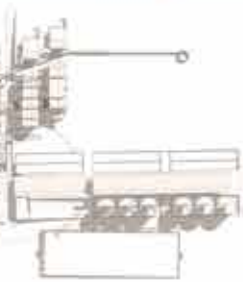


public square

viewing tower and tasting pavilion



test beds



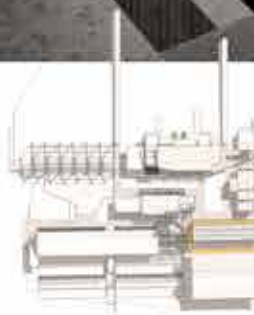
tasting pavilion

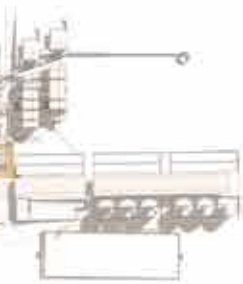
greenhouse

aquaponics

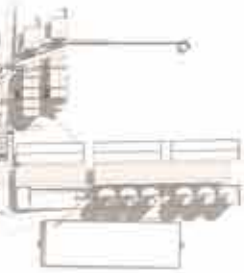
access walkway to fruit processing

viewing walkway

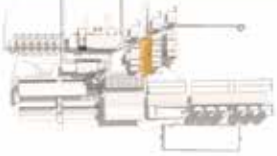




fruit processing



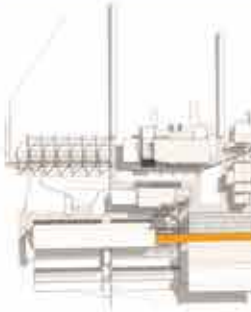
laboratories from the south

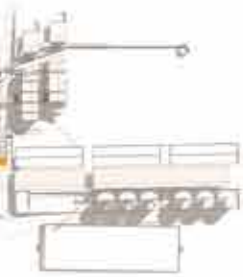


laboratories from the north

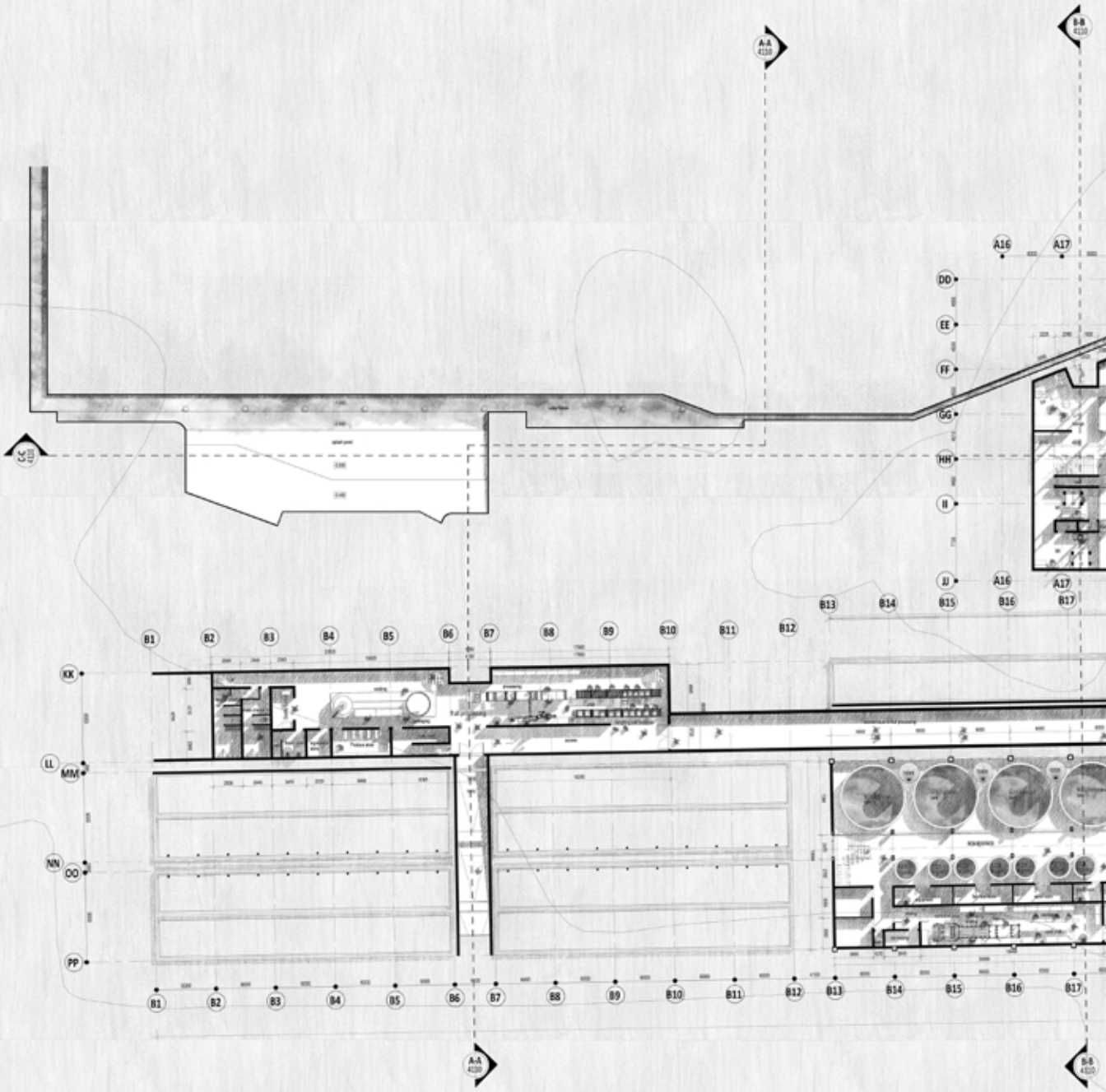
water filtration and methane processing

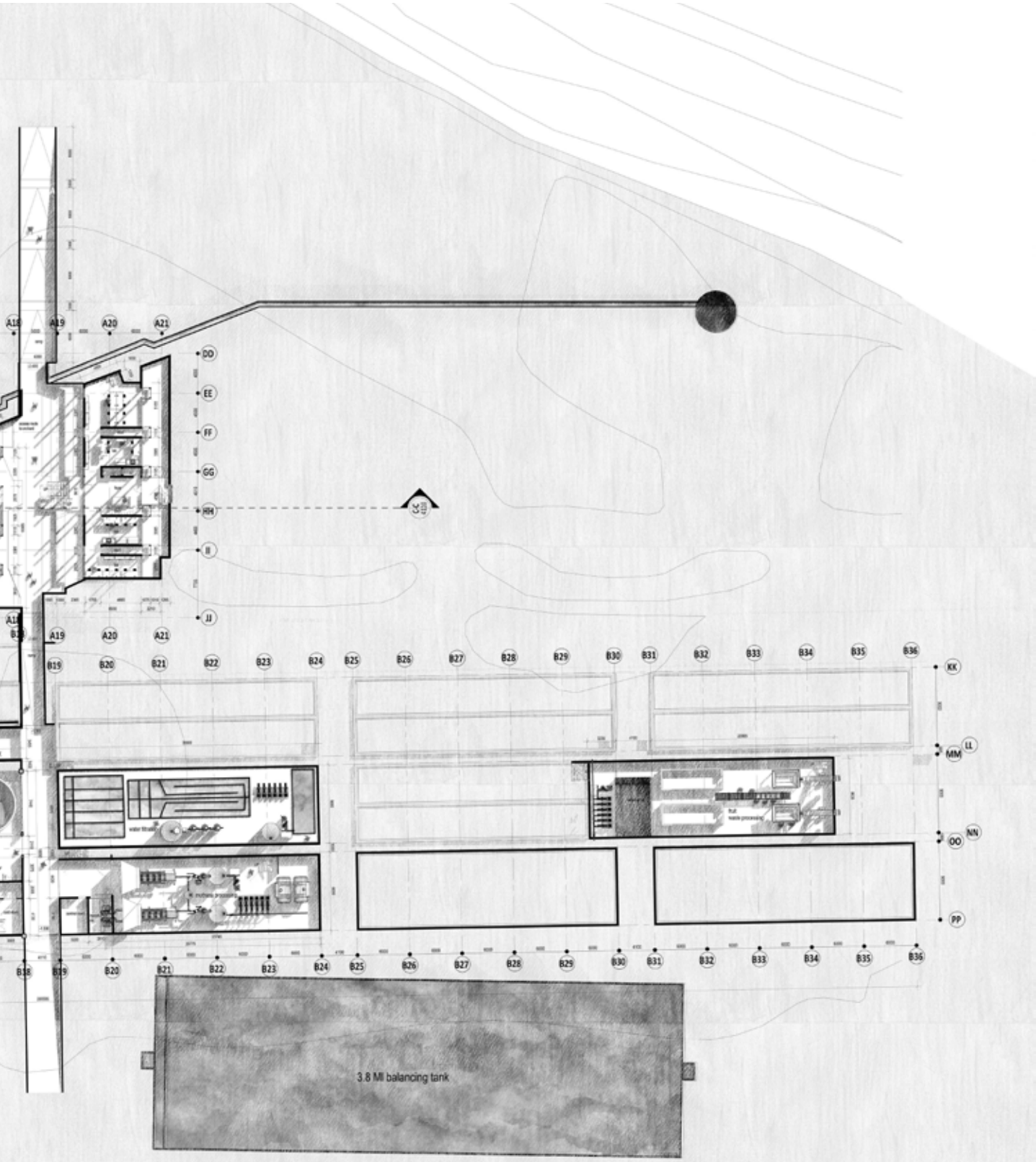
access walkway looking east



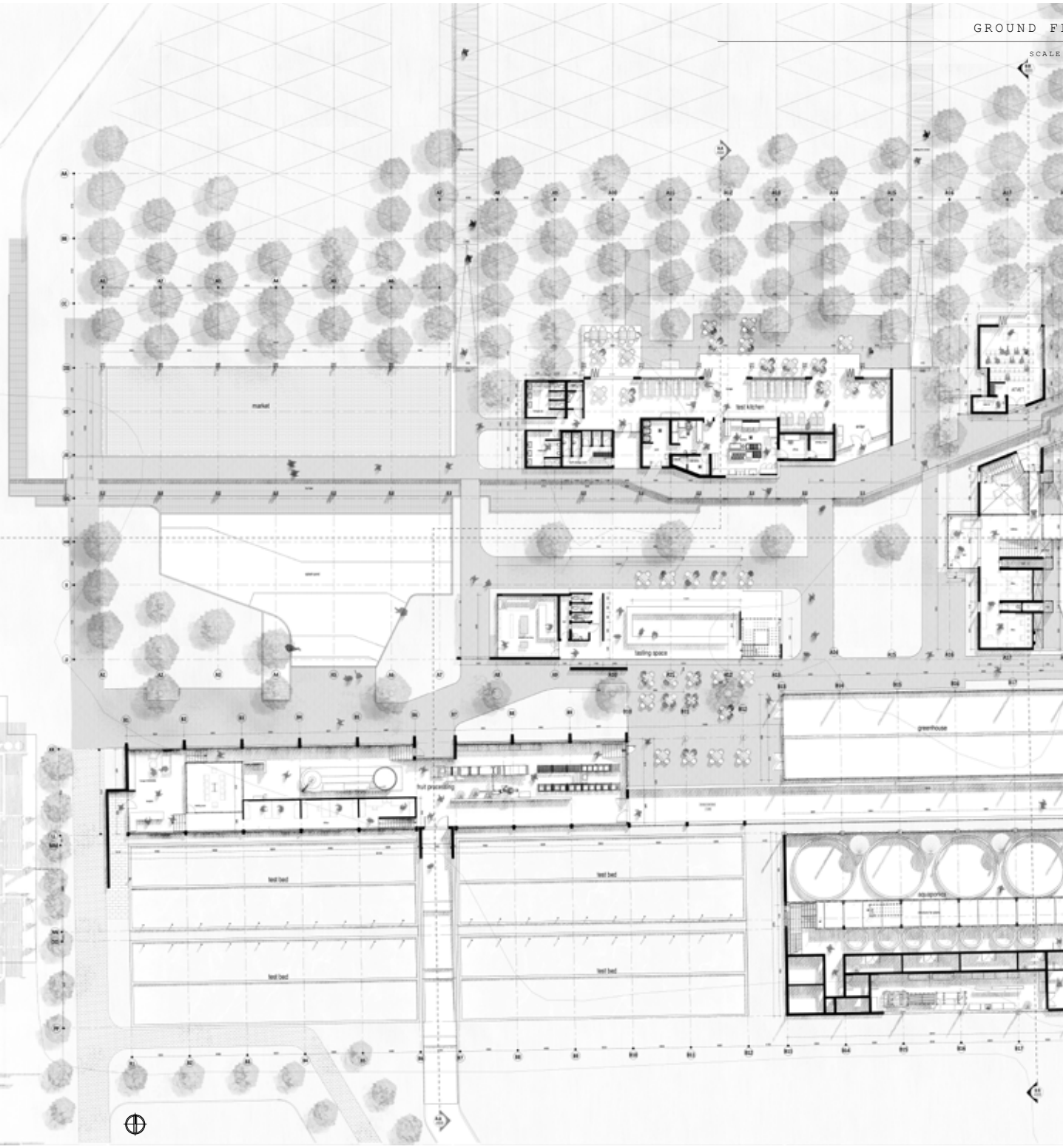


lower ground floor plan



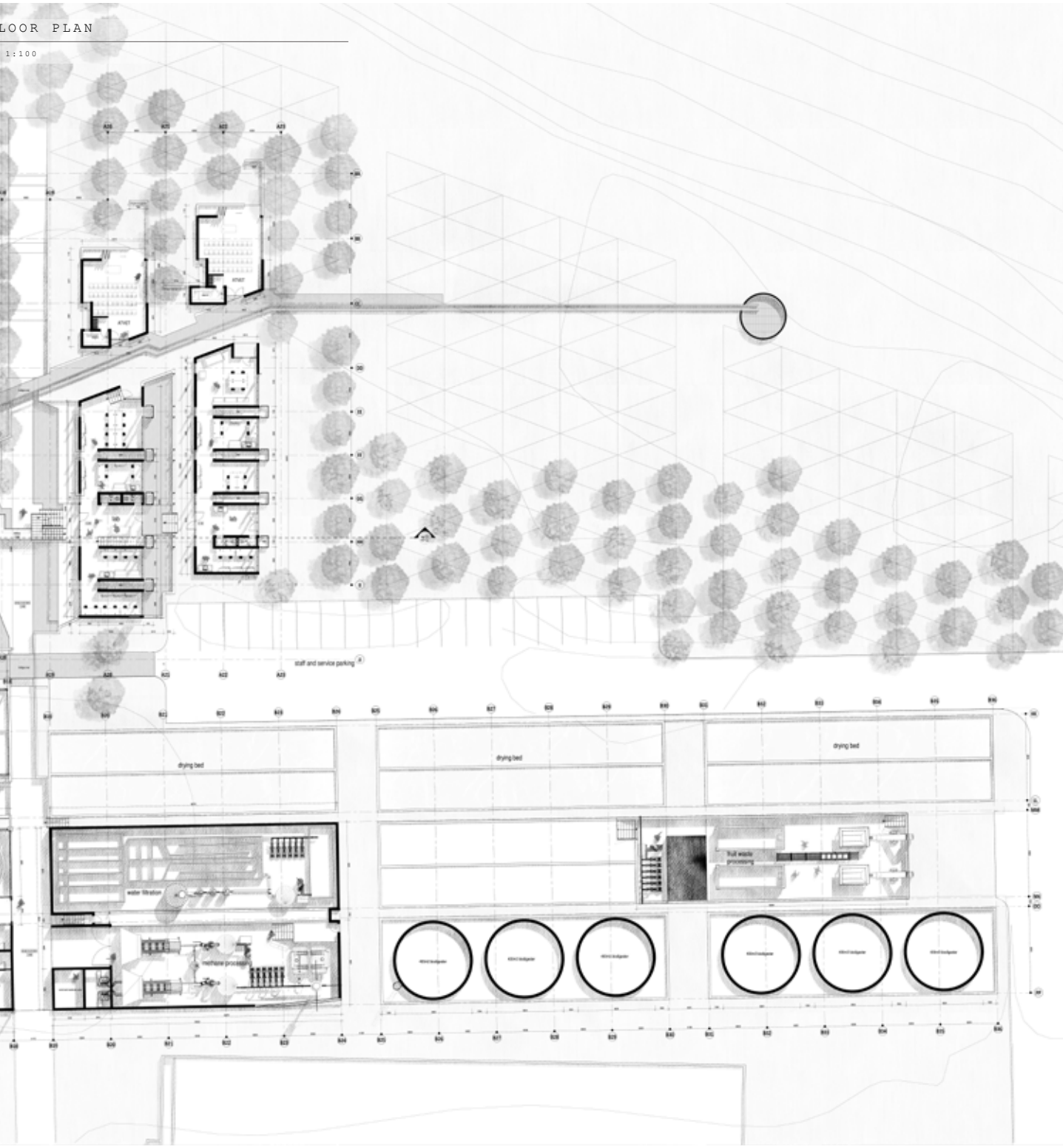

A18
A19
A20
A21
DD
EE
FF
GG
HH
II
JJ
B19
B20
B21
B22
B23
B24
B25
B26
B27
B28
B29
B30
B31
B32
B33
B34
B35
B36
KK
LL
MM
NN
OO
PP
3.8 Ml balancing tank

ground floor plan



LOOR PLAN

1:100



SECTION A-A

showing fruit processing, public square and test kitchen

WESTERN E

SCALE

EASTERN E

SCALE

ELEVATION

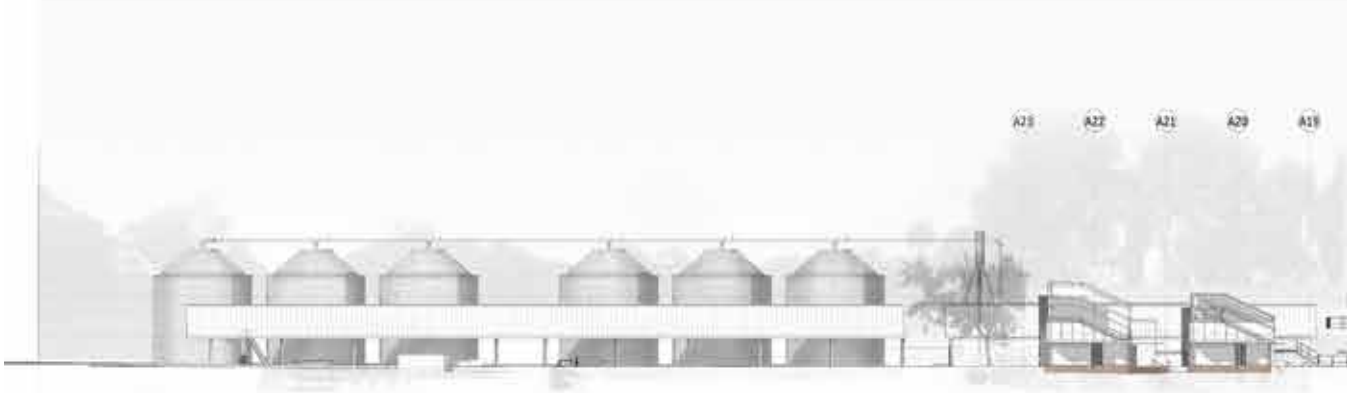
1:200

ELEVATION

1:200

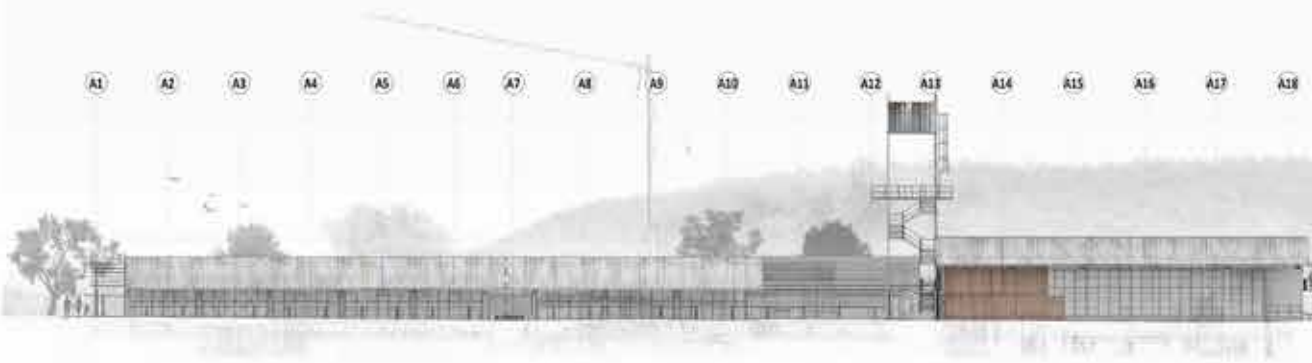
NORTHERN

SCALE



SOUTHERN

SCALE



ELEVATION

1:200

ELEVATION

1:200

07

technification

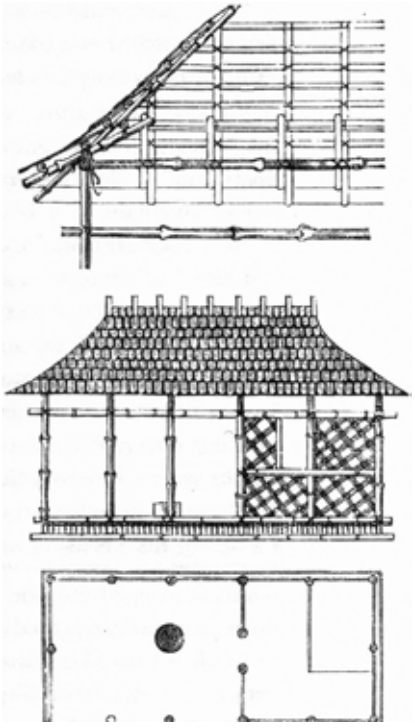
INTRODUCTION

The structural investigation of the proposed hybrid socio-industrial typology is grounded in a technical concept that comes as a logical progression and extension of the design concept defined. To summarise, the project emerges as an extension and reactivation of the natural landscape, through the re-introduction of a cultural presence by means of a socio-industrial programme. Essentially, the project re-appropriates the idea of an industrial typology into a socio-cultural fabric, and reconnects it to the fragmented natural landscape.

The narrative of the landscape sits fragmented, forgotten, yet it used to be ingrained in the community. The narrative of industry was introduced into that landscape, aimed at service provision, yet achieved very little social integration. The project thus performs a progressive function, a mid-ground for reintroduction of nature, culture and industry into a layered an progressive rendition of site and programme.

The technical investigation is grounded in this logic, and adopts the progression of ideas from Kenneth Frampton architectural opposites: stereotomics and tectonics. The intention of this chapter is to develop the project to a level of conceptual construction detail. The goal is to understand the logic of the building, and see these concepts extend beyond the experiential route and into the flesh of the building, to the connections between buildings, and internally within each fragment. As a result, the layered progression of each skin, each component, will be understood and exemplified. The most important aspects will be highlighted to communicate ideas, intentions and the physical manifestation of the concept.

THE LAYERED PROGRESSION:



04 the enclosing layer

LIGHTWEIGHT ENCLOSING MEMBRANE becomes the all enclosing connector.
INTERPRETATION - the connection between buildings, and the connectic from the culture of Marabastad to tl landscape beyond.

03 the structure above

FRAMEWORK serves as the lightweig enclosing body.
INTERPRETATION - the structural connection to the steel progression the building, horizontally and verticall

02 the core

THE HEARTH serves as the heart of tl building.
INTERPRETATION - the programme, tl culture, and socio-typological progression becomes the core.

01 the grounding

EARTHWORK serves as the grounding, the base, the origin.
INTERPRETATION - the drying beds become the grounding and solidity the project.

Fig 7.1 Interpretation of Semper's Four Elements of Architecture (Chang, 2016)

TECHNICAL CONCEPT

The technical concept develops from the investigation of the stereotomic and tectonic, within the spectrum of Gottfried Semper's 'Four Elements of Architecture', specifically looking at the relationship that forms between elements in the progression from stereotomic into tectonic. These two opposing elements meet, and form an intersection, a meeting point. Similarly, the project acts as the mediator, of culture, nature and industry, components that sit opposite to one another, and often fragmented.

The technical concept looks at defining the lens through which this project finds its technical grounding. In considering the progression of the experiential route towards, through and beyond the building, the technical logic considers the progression of industrial function, to cultural and into the natural fabric, and thus considers the progression of typology from solidity and coarse grain, to a lighter, appropriating fabric of enclosure to define the significance of this experiential progression. The proposed architecture expresses this relationship between multiple polarities ingrained in its bones by looking not only at the connection between elements, but at the journey and progression towards those connections. It looks a connecting fragments, and creating a contextual language that speaks of the site and programme, recognising the solidity and earthwork present on site, and extending these aspects into the vertical members and enclosing membranes.

This is expressed in the materiality of the structure, taking its cues from the site on which it stands. The intention is to show how the landscape weathers and 'adapts' materials to embed it into the fabric of the site. The logic of materiality speaks to the technical concept as each component adopts a role within the progression of the building over time.

THE ROLE OF MATERIALITY

Stereotomic - massing, concrete, solidity and brickwork
Speaks to the consistency, to the solidity on site, the presence of the histories, and the grounding for the programmes.

Tectonic - lightweight additions, steel and roof sheeting, coverage
Allowed to weather and be changed by the elements, mimicking the structures on site, and speaking of the progression to a system that changes and adapts. It becomes a loose translation of the ability of the building to allow change, and become a complex adaptive system programmed to emulate change.

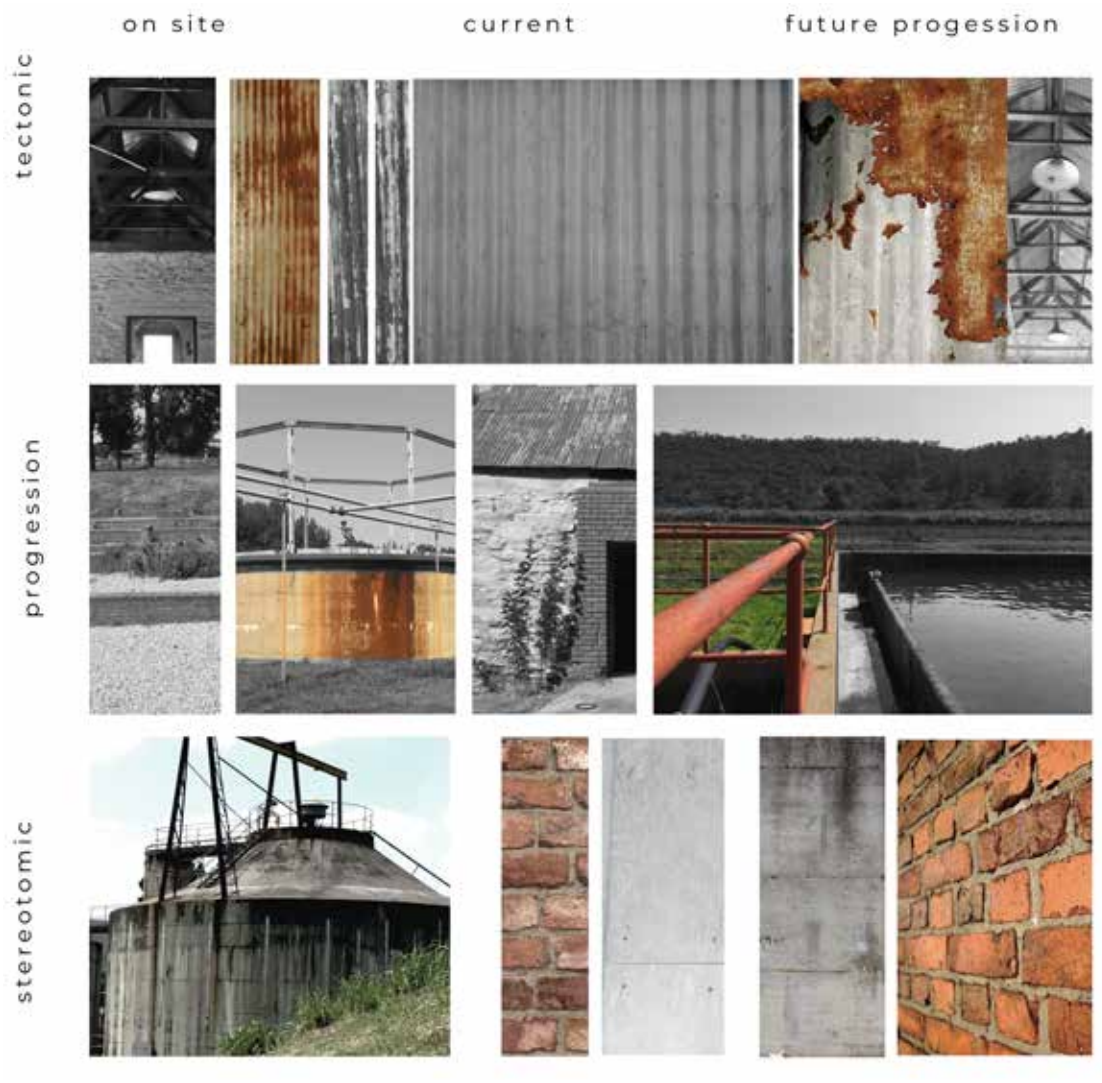


Fig 7.2 Materiality explored, progression through site (Author 2018)

ACCESS AND CIRCULATION:

A NARRATIVE

The proposed architecture stretches horizontally over the full expanse of the drying beds. It leaves some as is, with minor additions to improve access and add function, others it rises from, and becomes a vertical rendition of the footprint below. Essentially, the drying beds act as one of the major regulating grids, with each function comprising of one or more consolidated drying beds. Thus, each function can be expressed as part of a unit, a greater system. The building is designed to be accessed along the most prevalent pedestrian route from Marabastad. The route transverses the previously separating railway line, and moves over functioning infrastructure on the Daspoort site (See photo alongside, and diagram for route). It then kinks with the landscape towards the right, and lines up with the North-South axis of the drying beds.

As the pedestrian approaches, the first encounter is with that of the test beds, a planted version of the now dilapidated drying beds, inhabited with many species of plants and brimming with community members. The first building encountered is the fresh fruit and vegetable processing, that stretches along two lengths of drying beds, and beyond to the right sit concrete beacons, containing something not yet discovered. The fruit and vegetable processing sits slightly sunken into the landscape, yet extends vertically to take ownership of its location. To the West of the building, along its thinner facade, extends a lightweight roof structure that encapsulates some of the main path. It opens the side of the building to the pedestrian, yet allows for passers by to feel welcomed without forcing entry. As one passes around the corner of the first building, the site opens up to the right, with large expanses of open space, free yet contained by the surrounding buildings. It is from this perspective that the pedestrian is able understand the first approach of the building as each component plays its part.

The market sits informal, across the way, non-obtrusive, and almost intertwined with the natural landscape. Its grain is fine and sensitive, dissolving into that which is beyond. Alongside it sits the test kitchen and tasting room, lightweight and open, yet still shows signs of enclosure and containment. It serves as the logical progression from the natural environment to habitable spaces of security and cultural activity. All of this, still only within the pedestrians visual experience, as the route takes the pedestrian along the northern edge of the fresh fruit and vegetable processing, revealing the programme through panels of glass in-between large concrete fins. As the pedestrian further moves into the site, the programmes start revealing themselves, and the logic of the structure becomes self explanatory.

The route continues past the first building, and continues to encounter the green house that is in line with the route, again there is an understanding of the technicality of the building: The planted green house, clear, open and accessible, sits in direct contrast with the glimpses of industry beyond it. To the south of the green house, i.e. beyond the greenhouse, sits the aquaponic and hydroponics plant, with a solid and grounding presence. Its grain is coarse, and heavy, and speaks an industrial language. Though, as a result of it being superseded by the green house, and inhabited by hydroponic planting, the lens through which it is viewed is softened, and the perception of industry starts to change. Not only has the pedestrian been allowed access to largely industrial functions, each time the intensity of it is intercepted by a humanising

function, whether it be integration of natural landscape, or the involvement and resultant benefit of that involvement with fresh fruit drop off and subsequent remuneration.

The route spills into a surrounded courtyard, with a clear circulation core leading to a viewing tower, a clear route into the landscape, and another building to the East not yet discovered. As the pedestrian moves through the courtyard, the unknown building to the right opens its walls with panels that protrude out and reveal pockets of windows into the functions beyond. Its entrance is open, although it is a laboratory, intimate social gathering spaces spill out onto the courtyard. As a result of its narrow footprint, the pedestrian is able to see through the laboratory, to a window of activity and further exploration. As the pedestrian looks North, the orchard unfolds beyond that of the Labs and the Test kitchen. And so, the pedestrian route continues into the landscape towards the Apies River.

Upon return, the building again is viewed from a different perspective. Disappearing again are the stereotomic industrial houses, and instead the user encounters and architecture from the landscape. The Laboratories are transitioned into the landscape with light-weight timber and steel structure, inhabited by community members once again, and resembling a gathering space of sorts. These are the education pods, where knowledge is shared, and interaction is the core function. The Test Kitchen to the right opens to the orchard, and reflects the landscape into its fabric. The market is again simultaneously visible and disappearing. And all at once, through the experiential progression, the pedestrian is once again made a part of the site, ingrained into its history, present and future.

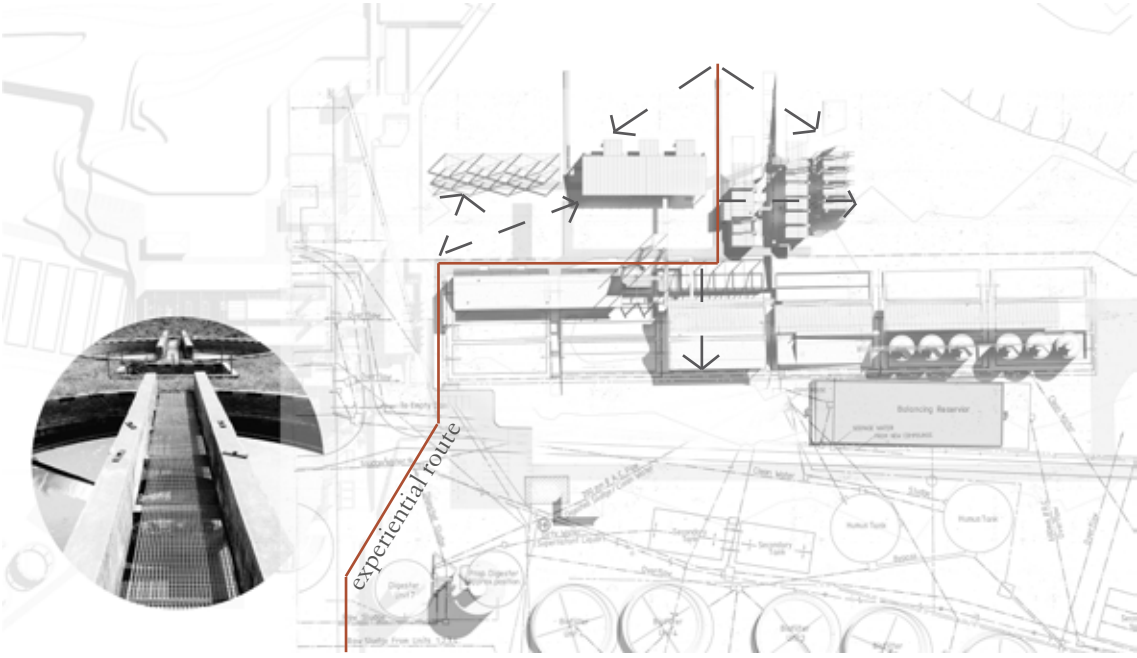
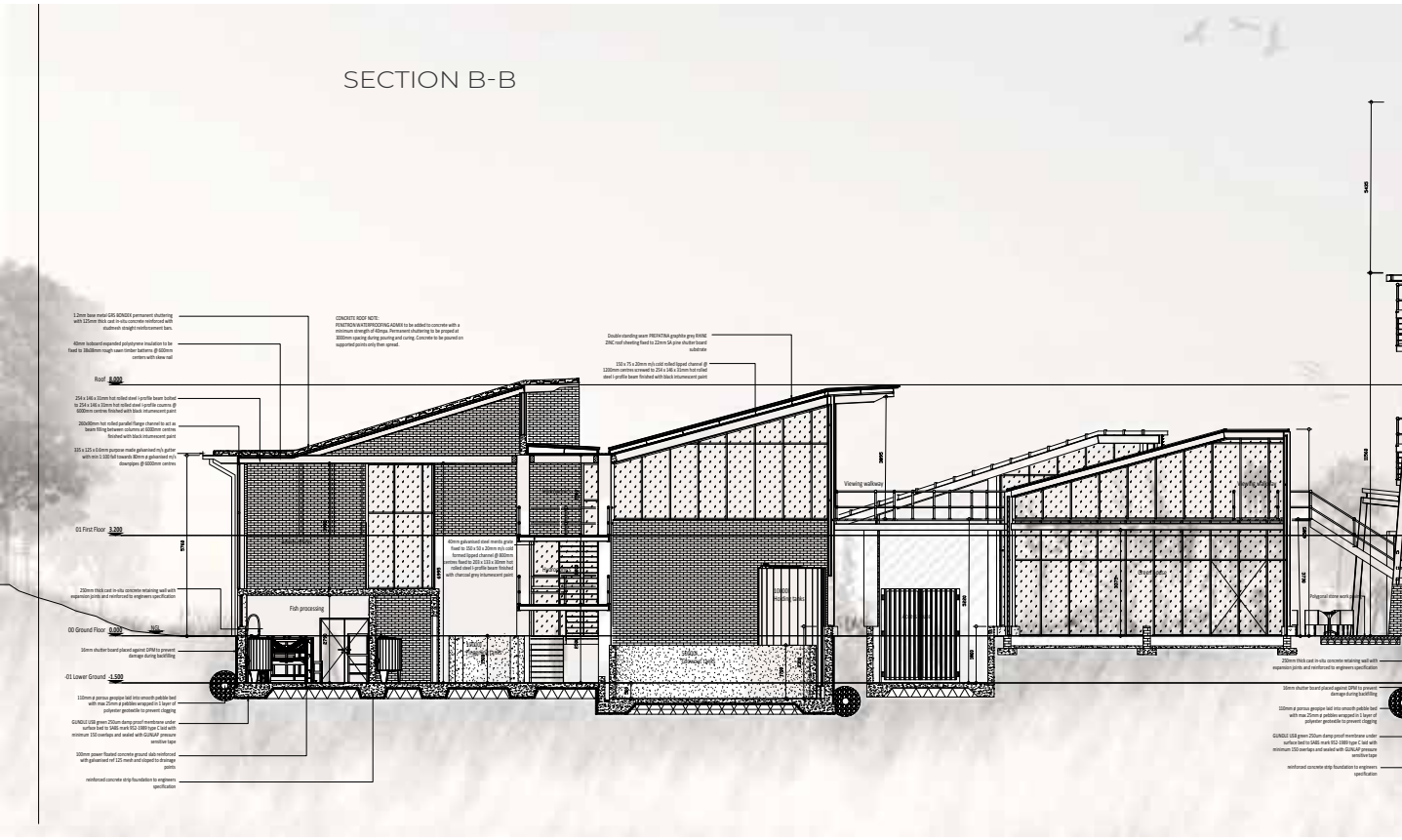
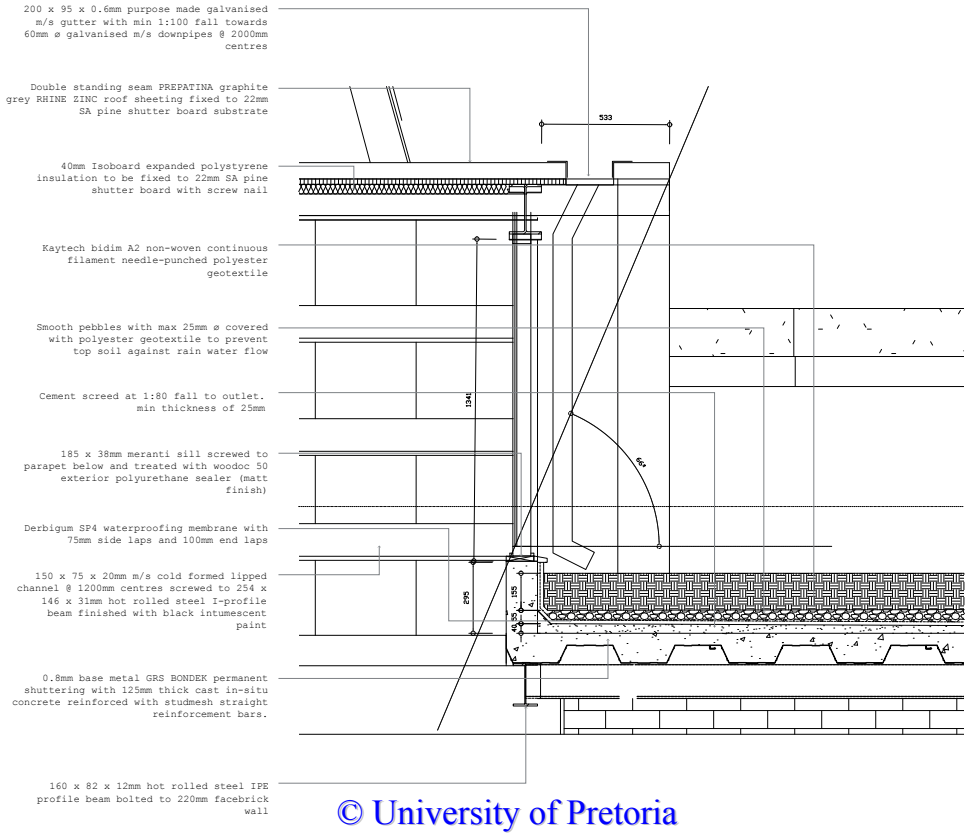
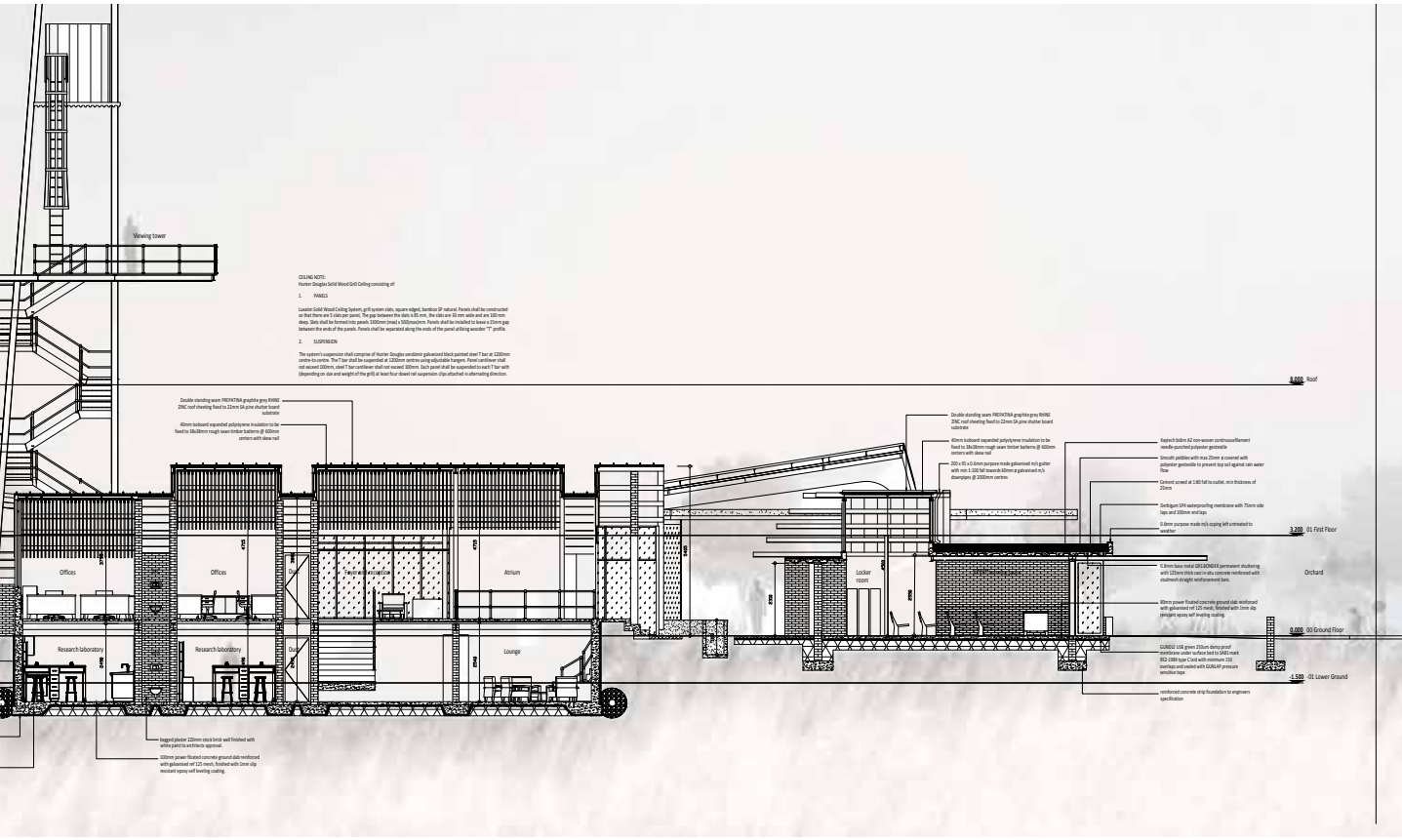


Fig 7.3 Experiential route (Author, 2018)

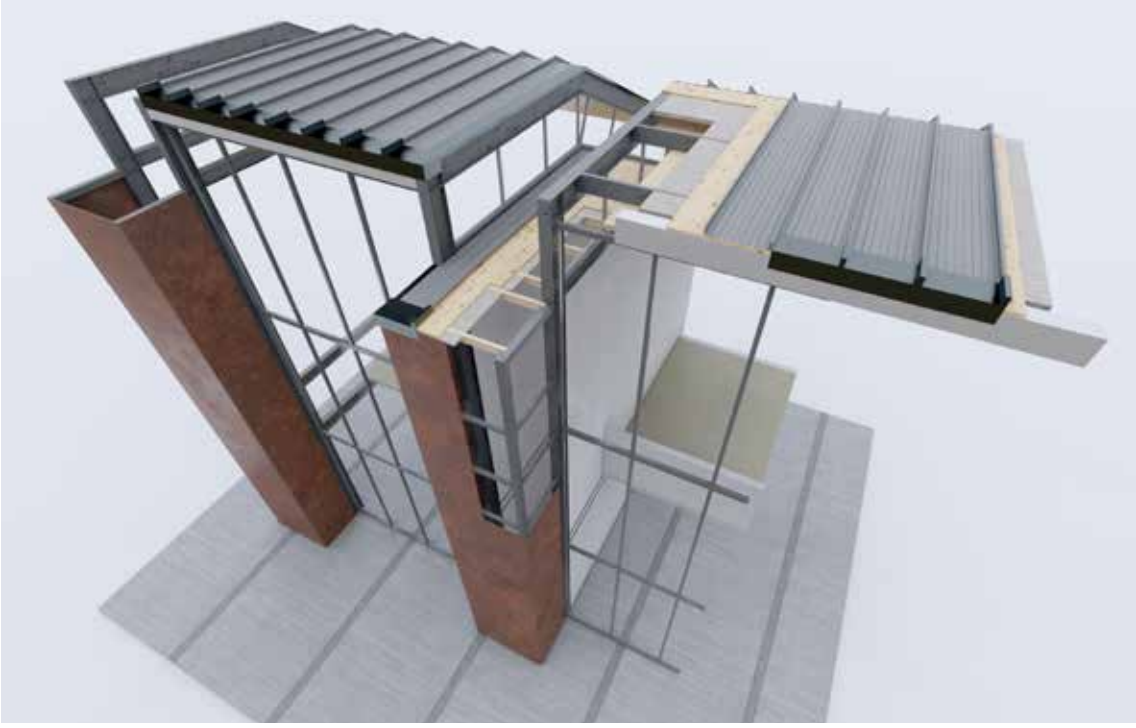


1:10 EDUCATION SPACE PLANTED ROOF DETAIL

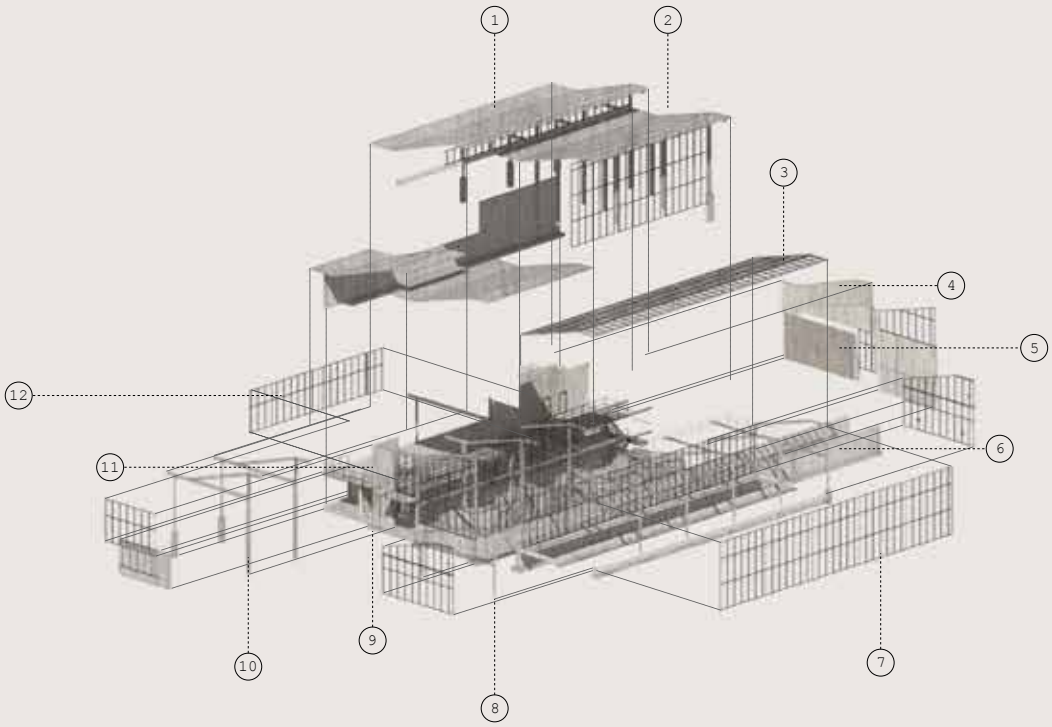




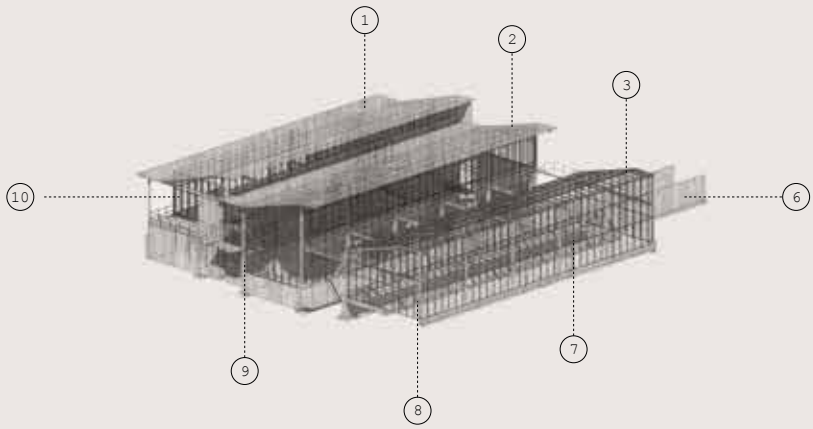
laboratory facade detail



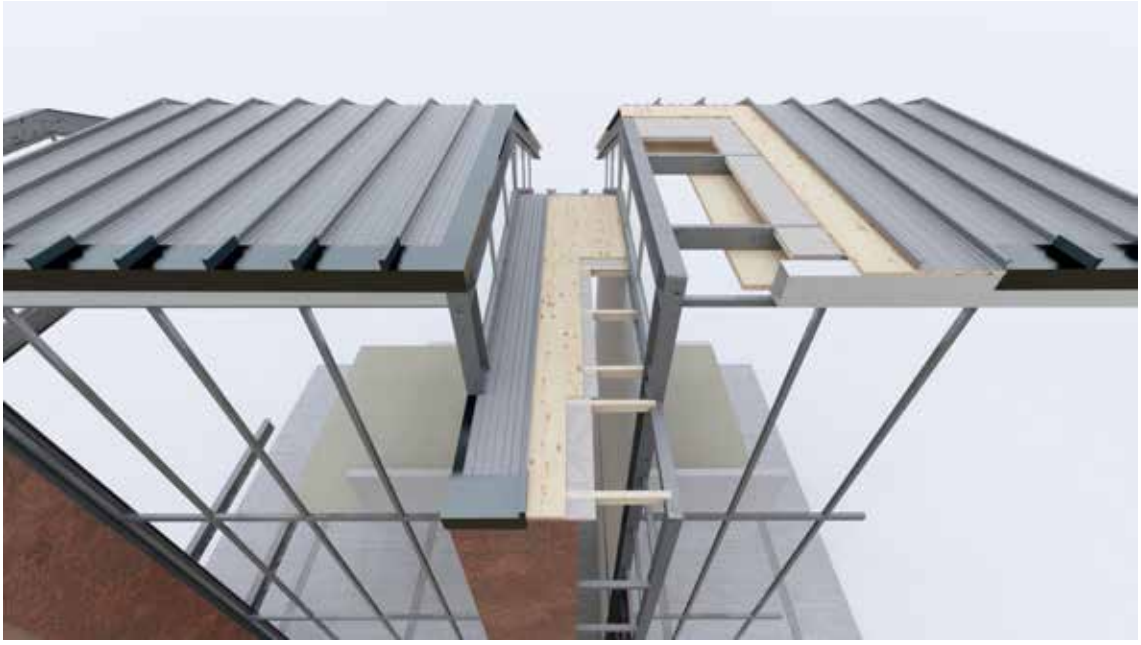
EXPLODED ISOMETRIC STRUCTURAL SYSTEM



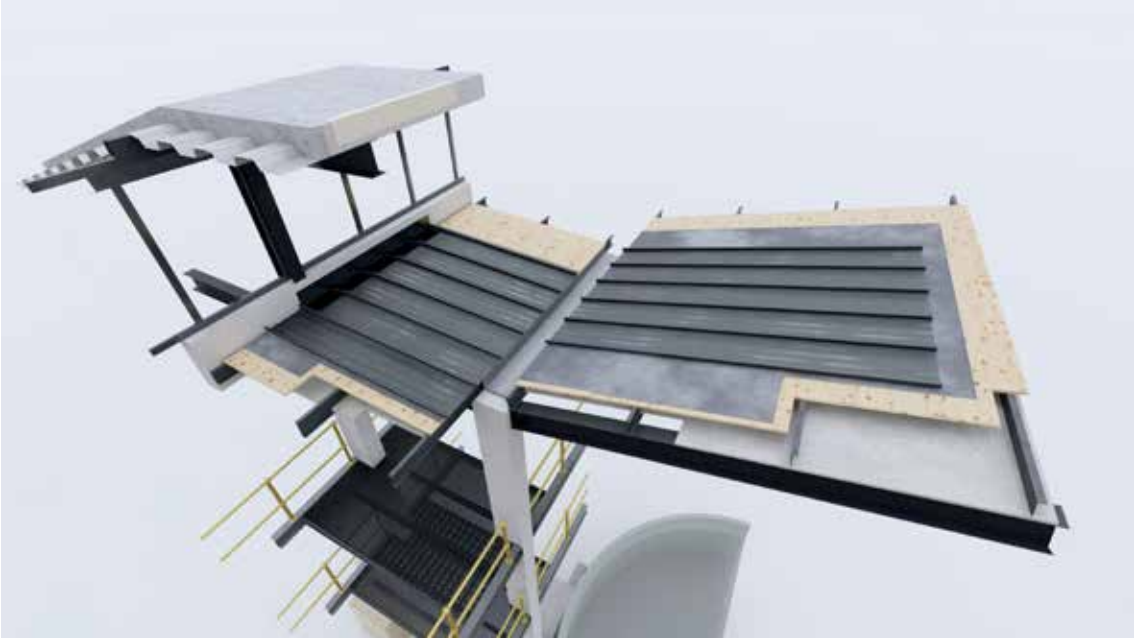
1. 125 MM COMPOSITE CONCRETE ROOF WITH PENETRON ADMIX
2. GRAPHITE GREY PREPETINA RHINE ZINC ROOF SHEETING (REFER TO AQUAPONICS DETAIL 1)
3. STICK SYSTEM CURTAIN WALL CONTINUED OVER GREENHOUSE AS ROOF STRUCTURE WITH 9mm GLASS
4. 200MM CAST IN-SITU OFF SHUTTER CONCRETE WALL
5. 230 MM FLUSH JOINTED FACEBRICK WALL
6. 200MM REINFORCED CONCRETE RETAINING WALL
7. STICK SYSTEM CURTAIN WALL
8. 203 X 133 X 30 MM HOT ROLLED STEEL I-PROFILE COLOUMN
9. REINFORCED CONCRETE STRIP FOUNDATION TO ENG. SPEC.
10. 400 X 250 MM REINFORCED OFF-SHUTTER CONCRETE COLUMN
11. 150 MM COMPOSITE CONCRETE FLOOR WITH EPOXY FINISH
12. STICK SYSTE CURTAIN WALL WITH 6MM LAMINATED GLASS



detail of laboratory roof



detail of aquaponics roof



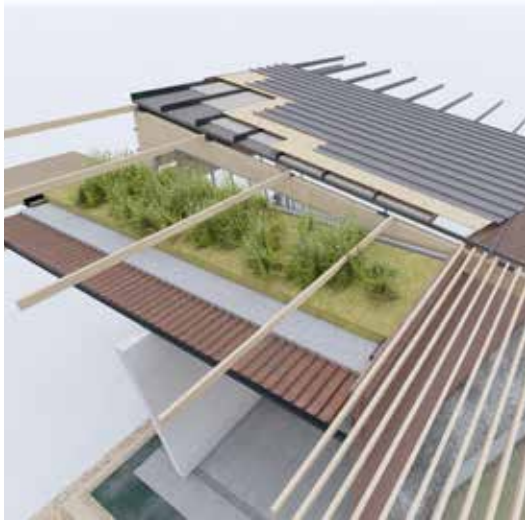
3D DETAILS

TEST KITCHEN DETAIL 1

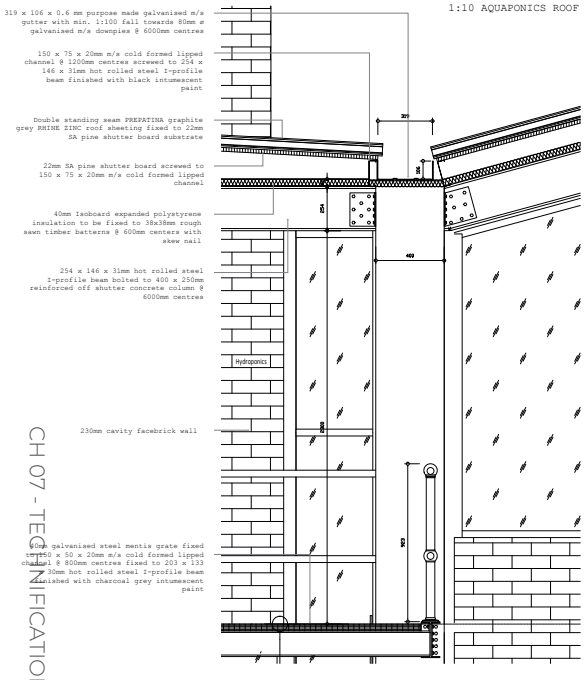
FRAGMENTATION OF STRUCTURE AND LAYERING OF MATERIALS TO CREATE SEAMLESS INTEGRATION WITH NATURE

TEST KITCHEN DETAIL 2

EXPOSING THE FUNCTION OF MATERIALS THROUGH SEPARATION

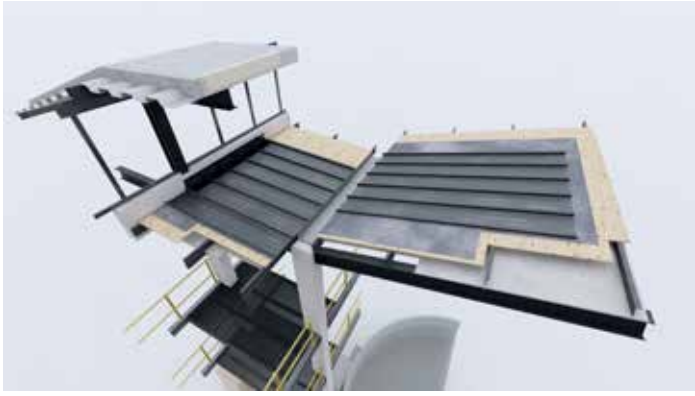


1:10 AQUAPONICS ROOF DETAIL



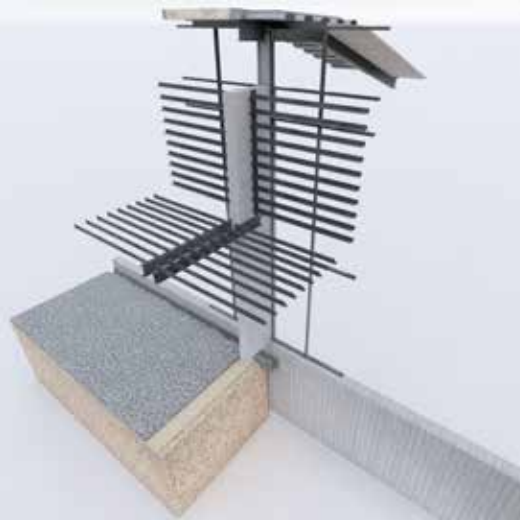
AQUAPONICS DETAIL 1

THE TECTONIC LOGIC IS DERIVED FROM THE STEREOTOMIC BASE THAT IS THEN LAYERED TO BECOME OPEN AND ALLOW LIGHT IN



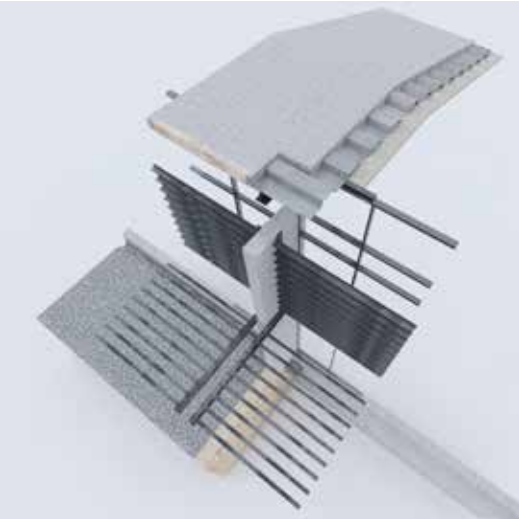
FRUIT PROCESSING DETAIL 1

BRISE SOLEIL ON THE NORTHERN FACADE TO ALLOW LIGHT IN WHILE REDUCING GLARE

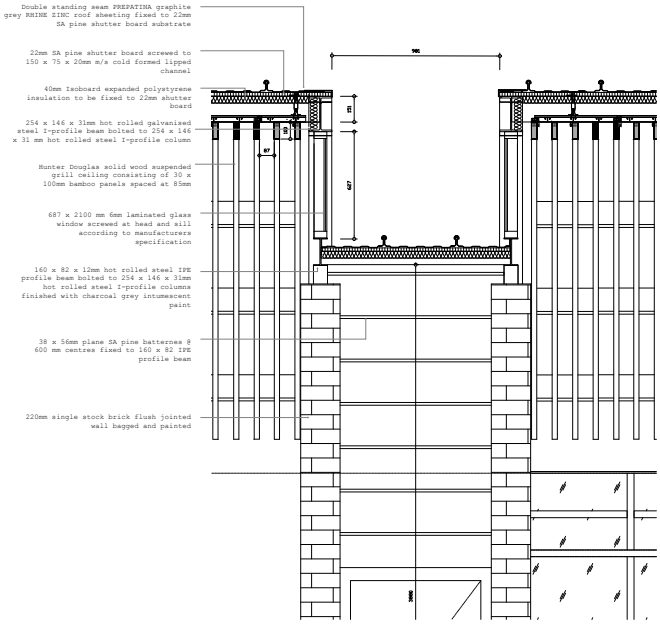


FRUIT PROCESSING DETAIL 2

STEEL AND CONCRETE ARE USE TO ACCENTUATE THE INDUSTRIAL TYPOLOGY AND PROVIDE LONGEVITY FOR THE BUILDING



1:10 LABORATORY ROOF DETAIL

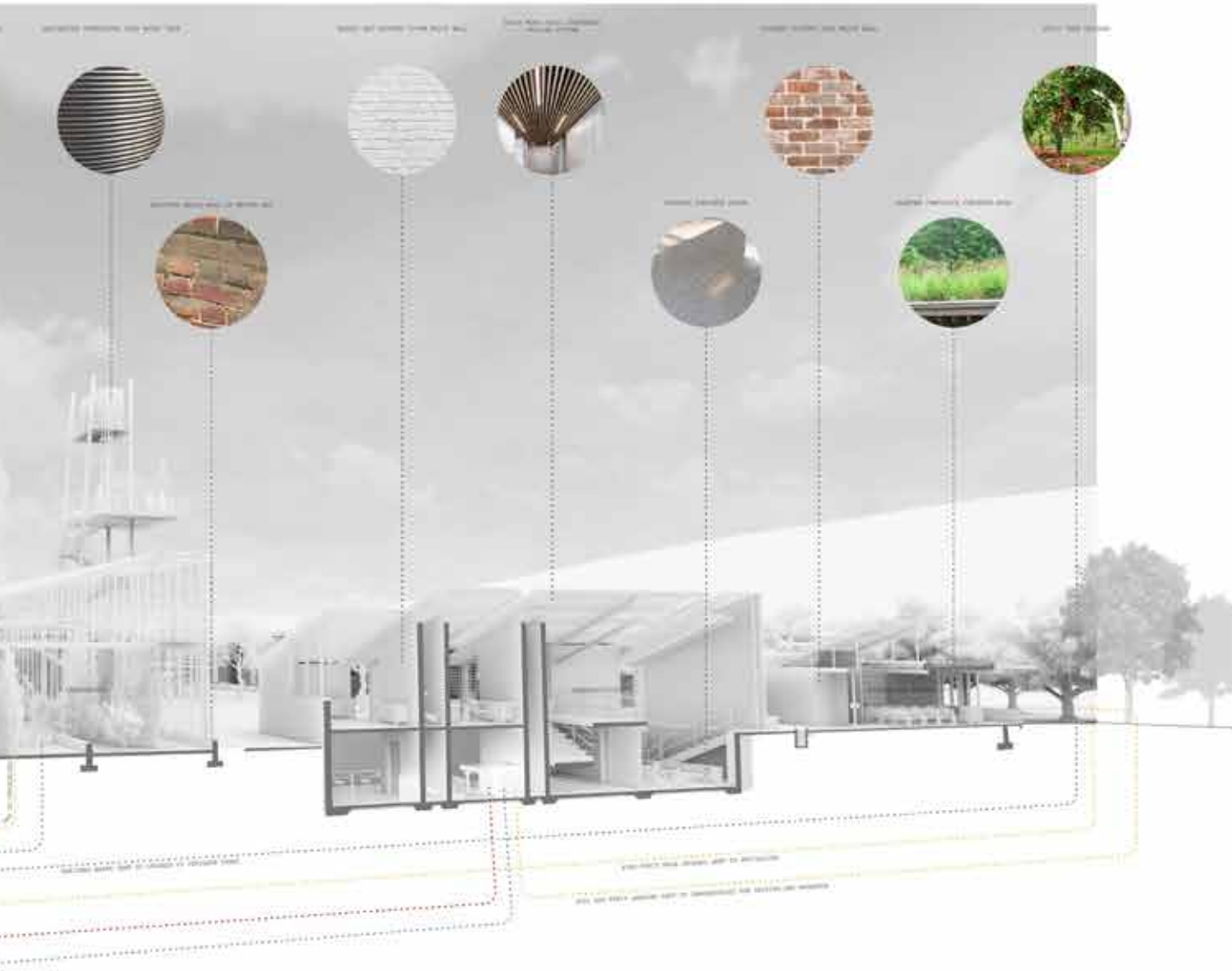


LABORATORY DETAIL 1

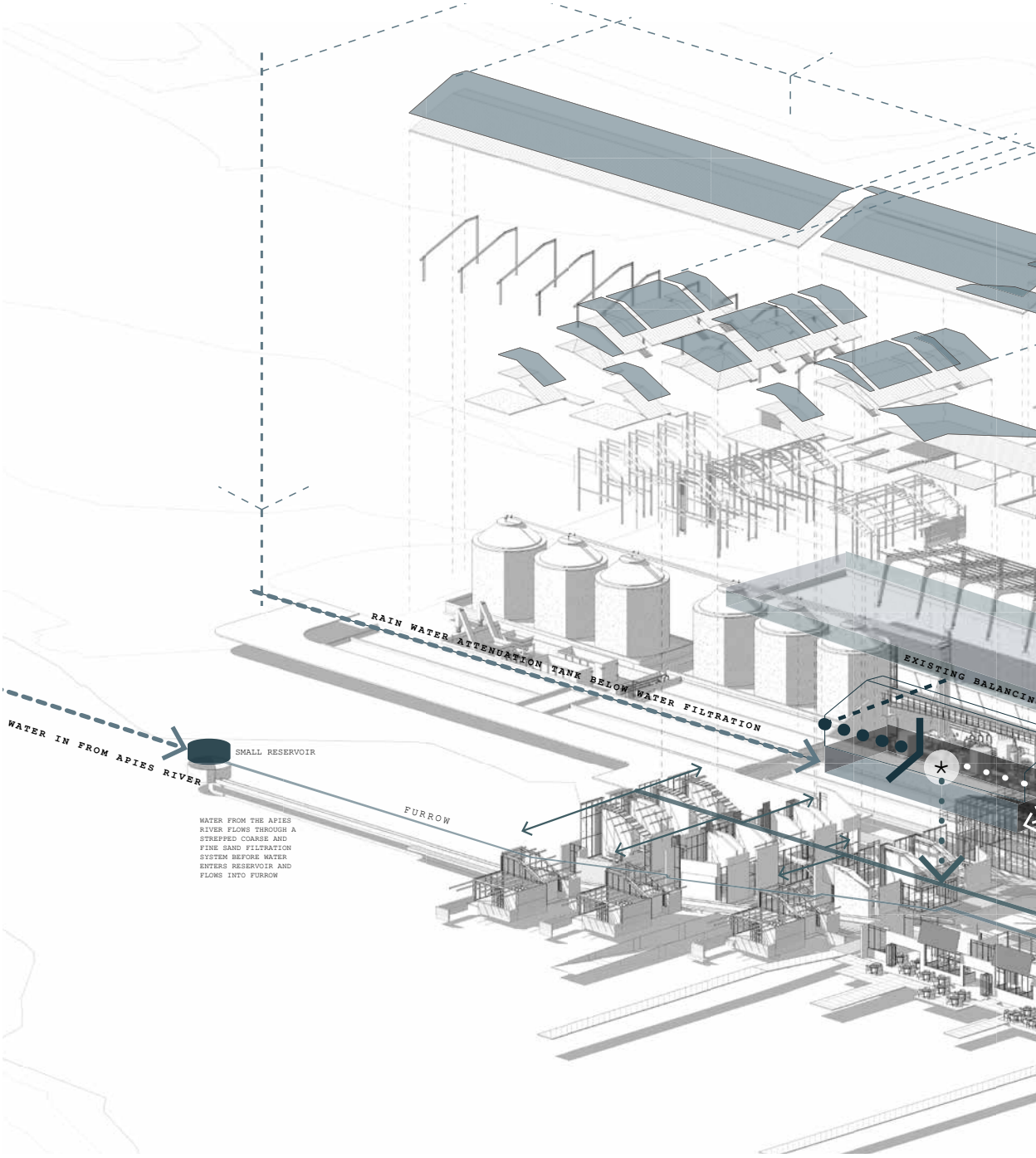
DUCTS ARE PLACE BETWEEN LABS TO ALLOW FOR FLEXIBILITY OF FUNCTION AND ACCOMMODATE FUTURE TECHNOLOGIES

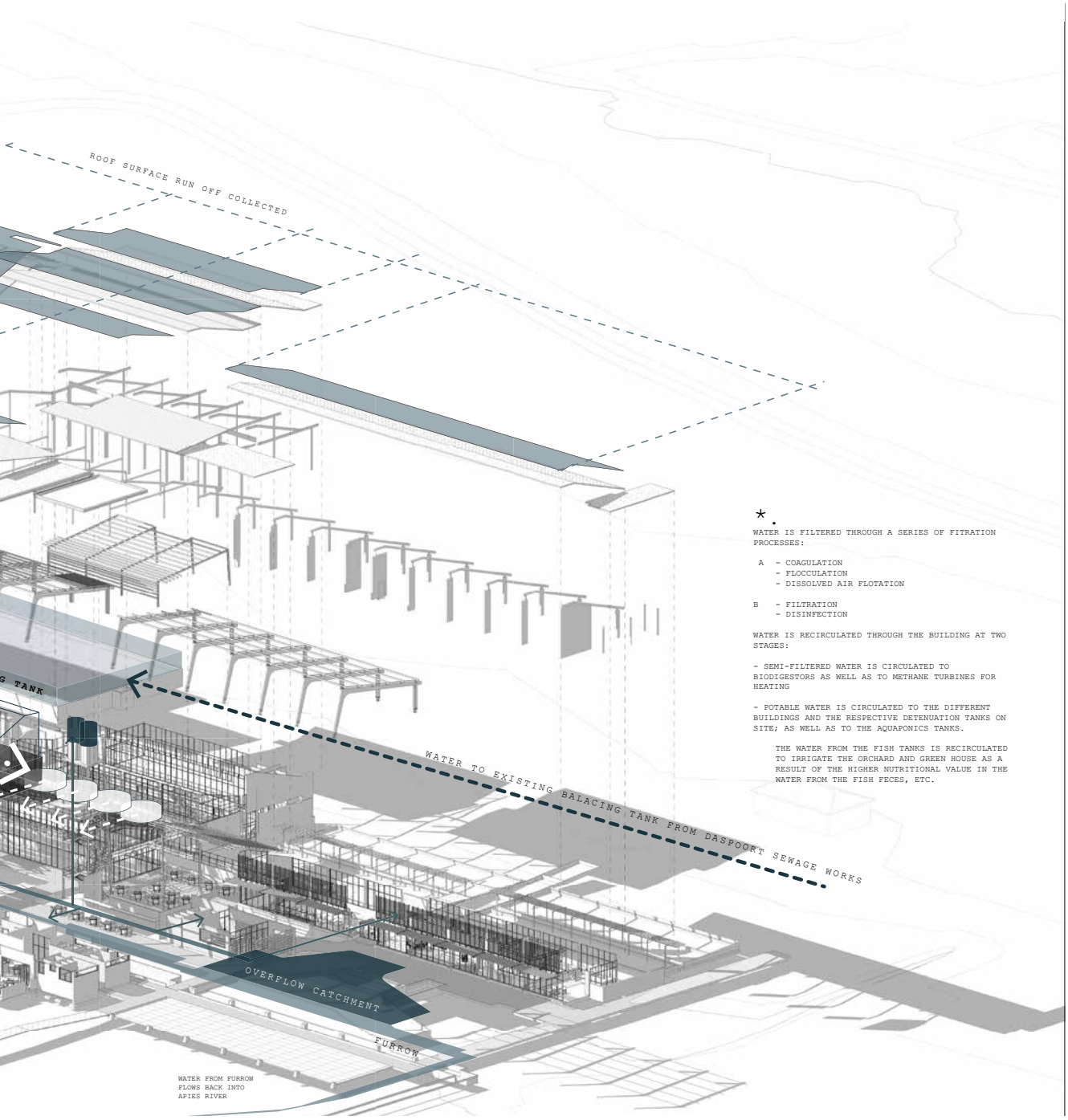
PERSPECTIVE OF SECTION B-B

a diagrammatic explanation of systems and materials through the aquaponics, greenhouse, laboratories and education space



EXPLODED ISOMETRIC WATER SYSTEMS DIAGRAM





*.

WATER IS FILTERED THROUGH A SERIES OF FITRATION PROCESSES:

A - COAGULATION
- FLOCCULATION
- DISSOLVED AIR FLOTATION

B - FILTRATION
- DISINFECTION

WATER IS RECIRCULATED THROUGH THE BUILDING AT TWO STAGES:

- SEMI-FILTERED WATER IS CIRCULATED TO BIODIGESTORS AS WELL AS TO METHANE TURBINES FOR HEATING

- POTABLE WATER IS CIRCULATED TO THE DIFFERENT BUILDINGS AND THE RESPECTIVE DETENUATION TANKS ON SITE; AS WELL AS TO THE AQUAPONICS TANKS.

THE WATER FROM THE FISH TANKS IS RECIRCULATED TO IRRIGATE THE ORCHARD AND GREEN HOUSE AS A RESULT OF THE HIGHER NUTRITIONAL VALUE IN THE WATER FROM THE FISH FECES, ETC.

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

WATER CALCULATIONS

RAIN WATER CALUCLATIONS

NATURAL RESOURCES EXCHANGE

AREA CALCULATIONS

Catchment	Area, A (m²)	Runoff Coefficient,	
		C	C (weighted)
Roof	3395	0.9	0.69
Paving	1038	0.8	0.19
TOTAL	4433		0.88

RAINWATER YIELD CALCULATION

Month	Ave. rainfall, P (m)	Yield (m³) (Yield = PxAxC)
January	0.154	598.4286
February	0.075	291.4425
March	0.082	318.6438
April	0.051	198.1809
May	0.013	50.5167
June	0.007	27.2013
July	0.003	11.6577
August	0.006	23.3154
September	0.022	85.4898
October	0.071	275.8989
November	0.098	380.8182
December	0.15	582.885
ANNUAL AVE.	0.674	2844.4788

ALT SOURCE (Sewage works and river)

Month	Source 1 (m³/ month)
January	200
February	200
March	200
April	200
May	200
June	200
July	200
August	200
September	200
October	200
November	200
December	200
ANNUAL AVE.	2400

IRRIGATION DEMAND

Month	Planting area (m²)	Irr. depth / week (m)	Irr. depth / month (m)	Irrigation demand (m³/ month)
January	1790	0.05	0.3	537
February	1790	0.05	0.3	537
March	1790	0.05	0.2	358
April	1790	0.04	0.15	268.5
May	1790	0.03	0.1	179
June	1790	0.03	0.1	179
July	1790	0.03	0.1	179
August	1790	0.03	0.15	268.5
September	1790	0.03	0.2	358
October	1790	0.05	0.3	537
November	1790	0.05	0.3	537
December	1790	0.05	0.3	537
			ANNUAL TOTAL	4475

ALT DEMAND

Month	Entity (Persons)	Entity demand / day (l)	Alt demand (m³/month)	Aquaponics (m³/ month)
January	100	15	46.5	30
February	100	15	42	30
March	100	15	46.5	30
April	100	15	45	30
May	100	15	46.5	30
June	100	15	45	30
July	100	15	46.5	30
August	100	15	46.5	30
September	100	15	45	30
October	100	15	46.5	30
November	100	15	45	30
December	100	15	46.5	30
		ANNUAL TOTAL	547.5	360

WATER BUDGET

Month	Yield (m³)	Demand (m³)	Monthly balance
January	798.4	613.5	184.9
February	491.4	609.0	-117.6
March	518.6	434.5	84.1
April	398.2	343.5	54.7
May	250.5	255.5	-5.0
June	227.2	254.0	-26.8
July	211.7	255.5	-43.8
August	223.3	345.0	-121.7
September	285.5	433.0	-147.5
October	475.9	613.5	-137.6
November	580.8	612.0	-31.2
December	782.9	613.5	169.4
ANNUAL AVE.	5,244.5	5,382.5	

WATER BUDGET (ACCUMALATIVE)

Month	Yield (m³)	Demand (m³)	Monthly balance	Vol. water in tank (m³)
January	798.4	613.5	184.9	323.1
February	491.4	609.0	-117.6	205.6
March	518.6	434.5	84.1	289.7
April	398.2	343.5	54.7	344.4
May	250.5	255.5	-5.0	339.4
June	227.2	254.0	-26.8	312.6
July	211.7	255.5	-43.8	268.8
August	223.3	345.0	-121.7	147.1
September	285.5	433.0	-147.5	-0.4
October	475.9	613.5	-137.6	0.0
November	580.8	612.0	-31.2	-31.2
December	782.9	613.5	169.4	138.2
ANNUAL AVE.	5,244.5	5,382.5		

TOTAL YIELD

Month	Total Yield (m³/ month)
January	798.4286
February	491.4425
March	518.6438
April	398.1809
May	250.5167
June	227.2013
July	211.6577
August	223.3154
September	285.4898
October	475.8989
November	580.8182
December	782.885
ANNUAL TOTAL	5244.4788

TOTAL DEMAND

Month	Total demand (m³/ month)
January	613.5
February	609.0
March	434.5
April	343.5
May	255.5
June	254.0
July	255.5
August	345.0
September	433.0
October	613.5
November	612.0
December	613.5
ANNUAL TOTAL	5382.5

IRRIGATION REQUIREMENTS FOR ORCHARDS, TEST BEDS & GENERAL

Assumed :	AMOUNT	m² /tree/mm	mm / w	mm/week
Fruits trees	450	1		
Peaches	150	3.8/d	26.6	3990
Apricots	150	1.1/d	7.7	1155
Figs	150	0.8/d	5.6	840
Test beds area	1140	0.3	2.1	2394
Miscellanious	200	0.4	2.8	560
	1790		mm/w pe	8939
				TOTAL
			avg mm/\	5

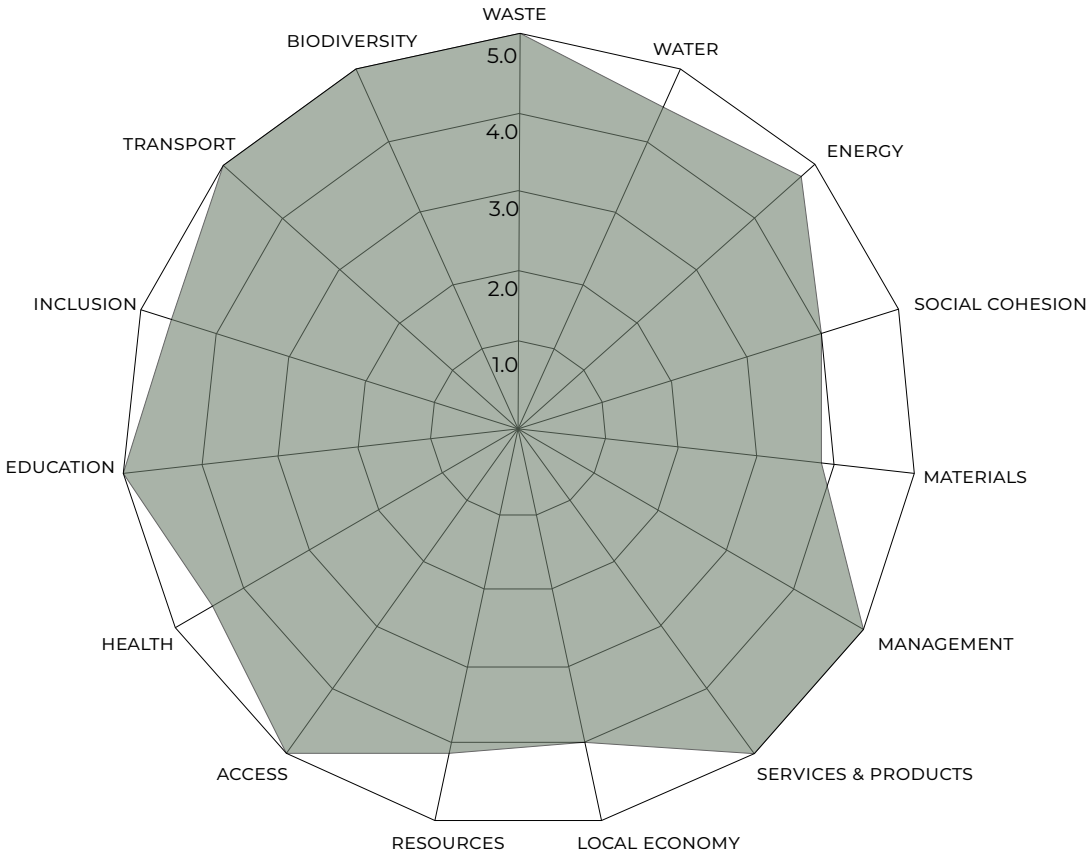
SBAT ANALYSIS

SBAT(SUSTAINABLE BUILDING ASSESSMENT TOOL) ANALYSIS

Project title:	Natural Capital ResourceS Exchange
Location:	GPS -25° 44' 1.63", +28° 10' 29.46"
	Daspoort Sewage Works, North of Marabastad
Typology:	Hybrid socio-industrial infrastructure
Area:	4500m²

PROJECT SUMMARY

ENVIRONMENTAL:	4.5
ECONOMIC:	4.7
SOCAL:	4.7
OVERALL:	**4.6**



08

conclusion

This conclusion is two-fold, the first, from a critical thinking perspective, and a means to analyse the proposal academically; the second adopts a slightly more personal tone, as the goal is to share my opinion and perspective of my own work, as presented, and that which never made it on to paper. The intention here is to provide a window into my mind's eye, and personally analyse the process, and then make certain recommendations as to which aspects of the project required more in-depth study, iteration and articulation.

A NATURAL CAPITAL RESOURCE EXCHANGE : defining a means of energy change to repurpose natural waste as a primary resource

This dissertation was an enquiry into how architecture could act as a mediator, as the mid-ground for production, resource provision and for waste management, yet simultaneously address the complexity of the site and community, and focusses on a flexible, diverse and adaptable macro-ecological complex system. Moreover, the ingrained culture of waste, and the potentials that presents, developed the crux of this project. This led to an investigation into the nature of the site, its industrial and social history, and specifically into the notions of embedded resilience and heterogeneous spatial logic of the context itself. The result of the investigation is this dissertation, a means to formulate a solution in the form of an architectural response; a response that continues the programmatic evolution demanded by the context and site, and most importantly, an architectural response that is grounded in critical dependency.

By applying principles of resilience, exchange, inter-dependency, and essentially closing the loop - an inherent potential of place was discovered, and through the programmatic exploration, a new hybrid industrial typology dependent on nature and culture developed. This typology re-appropriates the integration of industry and culture, and not only re-established the dependency on natural resources, but provides a fully independent means of creating its own natural capital. The proposed architecture emulates incidental and collateral interaction between all functions. It allows for complete interaction, to enable understanding and security of resource provision and localised food security. It enables the community to rehabilitate the natural landscape, and re-appropriate the site in its industrial evolution to processing food waste so that it once again becomes functional. This time, however, the architectural and programmatic rendition enables the community to serve the site, to serve themselves, and to 'close the loop' on their own energy lifecycles. The proposed architecture commemorates the intangible histories ingrained in the site, but even more so, cultivates the new, the possible, and the latent potentials presented throughout culture, site and industry. It is the networks already present that allowed the architectural proposal to manifest as a fully self-sustaining, complex adaptive system.

The design becomes a programmatic prototype, an exploration of what functions are required to make a 'closed-loop' system fully functional, but, it goes beyond that. It is directly contextual and specific in the nature of the design. In considering the contextual problem of redundant industry and technology, the question arises as to how the architectural proposal will sustain its integrity and relevance. The nature of the design provides opportunities for re-appropriation and adaptation, however, the intention is that future developments will gain its fuel from the same sources as this project: the ingrained networks of culture and community. The industrial processes become a supporting, yet a critical by-product of human life. The proposal sustains that it is these networks that will continue into the flesh of the new socio-industrial typology presented, and remain

prevalent in the future adaptations that change its appearance and functionality, however that may be. The new industrial typology proposes an architectural infrastructure of its time and place, from its context, and a place-bound platform for community.

A NATURAL CAPITAL RESOURCE EXCHANGE : my thoughts

The predominant feeling associated with this time of the year is both invigorating and exhausting. The amount of energy, time and brain power that goes into a dissertation such as this one is unfathomable, to say the least. It becomes an extension of who you are as a person, which is all the more reason for a section dedicated to the reflection of the year that has passed.

There are so many aspects of this proposal that I believe more than achieved what I set out to do. In considering the problem statement and analysing the project, it is clear that many of the problems and issues identified were addressed, of which some are highly successful. The proposal successfully taps into the latent energy potential of the natural capital present on site and in Marabastad. I believe that it not only addresses that issue, but provides an articulated and sophisticated solution to such a process. It returns the energy to the system and community in a sensitive and all encapsulating manner.

The processes as a whole are fully self-sustaining, and require no reliance on municipal service provision whatsoever. This means that the building in the full sense of the word, is for the people and very much from the landscape. This notion of landscape extends beyond the natural environment, as the urbanity of Marabastad and the way of living presented by present day society is considered just as much as any river, earth or tree was.

In this regard, the building integrates the functions it houses and the involvement of the community with those processes. It presents a sensitive response to the landscape and the community. I find myself proud of the level of integration that is present within this architectural place-making. I also believe in the new hybrid identity that the dissertation presents, and the combination and consideration of multiple typologies that went into the consideration of what this new typology would have to contain in order to addresses the specific identity of the context. This, I believe, is evident within the architectural rendition of this dissertation, and shows the acute effect of site and context on this design process. I believe the building is contextual, and specific, not only to the site, but to the community it aims to serve, and the processes it houses within its walls.

In considering the project as a whole, no amount of research could answer the following questions I have about this proposal: Is it resilient enough? Is it future proof? These questions relate directly to the inherent dependency on community and the socio-cultural functions that are proposed on site. Although the waste processing and latent energy repurposing will work within the proposed system, the ultimate success of such a proposal lies in the interaction and integration of community into the functions and coincidental social spaces. I believe that it would be successful within the context and histories encapsulated on site.

Recommendations:

In some ways the size and scope of the project got away from me, not intentionally, but because of what the site and type of project required. In hindsight I would reduce the scope to allow a more focused design and approach. I remember telling myself at the start of the year that I would not do a large scheme, I should have listened…

09

references

REFERENCES

Adger, W. N. 2000. *Social and ecological resilience: Are they related? Progress in human geography*. 24 (3). pp. 347-364.

Alter, K. 1996. *Notes on a Provisional Architecture. ACSA Annual Meeting: Theory and Criticism*. 84. pp. 301-307.

Alves de Souza, M., Chaguri, M. P., Castelini, F.R., Junior, J., Vidotti, R. M. 2012. *Anaerobic bio-digestion of concentrate obtained in the process of ultra filtration of effluents from tilapia processing unit*. [online] Available at: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S1516-35982012000200002, Accessed 8 June 2018.

BIAS Architects. 2018. *Greenhouse as a Home*. [online] https://www.archdaily.com/902060/greenhouse-as-a-home-bias-architects, Accessed: 08 September 2018.

Brand, F.S. & Jax, K. 2007. *Focusing the meaning(s) of resilience: Resilience as a descriptive concept and boundary object*. Ecology and society. 12(1). pp. 23-38

Büchner, I.C. 2013. *Latent Potential: a post-industrial artefact*. [online] Available at: https://repository.up.ac.za/handle/2263/32801, Accessed: 22 September 2018. p. 76-77

Capik, C. 2013. *Aquaponics: The next big thing in agriculture*. [online] Available from: https://agfundernews.com/aquaponics-the-next-big-thing-in-agriculture.html/ Accessed: 10 October 2018

Chang, J., Stranger, T. 2016. *Collection highlight: Gary Guy Wilson and the primitive hut, by Tyler Stanger and Jimmy Chang*. [online] Available from: https://www.library.unlv.edu/whats_new_in_special_collections/2016/10/collection-highlight-gary-guy-wilson-and-primitive-hut Accessed: 12 October 2018

Clarke, J. 2018. *Wastewater treatment for an fruit and vegetable processing plant*. [online] Available from: https://biocellwater.com/blog/ Accessed: 10 October 2018

Clarke, J. 2008. *A Glimpse into Marabastad*. [online]Available at: http://www.aglimpseintomarabastad.co.za/preface.html, Accessed 10 April 2018.

Clarke, N. Corten, J. 2009. *Regenerating Pretoria's historical core*. [online] Available at: http://openarchive.icomos.org/1302/1/IV-3-Article1_Clarke_Corten.pdf, Accessed: 15 April 2018.

Commission de L'ocean Indien. 2009. *Recycling as a waste treatment option*. [online] Available at: http://www.commissionoceanindien.org/archives/environment.ioconline.org/fr/solid-waste-management/recycling-as-a-waste-treatment-option.html, Accessed 8 June 2018.

Conradie, D. 2012. *South Africa's Climatic Zones: Today, Tomorrow* [online] Available from: http://researchspace.csir.co.za/dspace/bitstream/handle/10204/6064/Conradie2_2012.pdf;jsessionid=FE31CE142E8D6013FF9C253B25F5A176?sequence=1 Accessed: 05 October 2018.

DAFF. 2013. *Vegetable production - making a food garden*. [online] Available at: https://www.daff.gov.za/docs/Infopaks/MakingDoorGardenLnD.pdf, Accessed: 10 September 2018.

de Solá Morales, I. 2014. Terrain Vague. In: M. Mariani & P. Barron, ed. *Terrain vague: Interstices at the edge of the pale*. New York: Routledge. [online] Available at: https://books.google.co.za/books/about/Terrain_Vague.html?id=gU99AgAAQBAJ&printsec=frontcover&source=kp_read_button&redir_esc=y#v=onepage&q&f=false. Accessed 10 June 2018.

Disraeli, B. 2018. *Benjamin Disraeli quotes*. [online] Thinkexist.com. Available at: http://thinkexist.com/quotation/as_a_general_rule-the_most_successful_man_in_life/154850.html, Accessed 23 March 2018.

Elleh, N. 2011. Perspectives on the architecture of Africa's underprivileged urban dwellers. *Social Dynamics*, 37(1), pp.43-77.
Folke, C. 2006. *Resilience: The emergence of a perspective for socia-ecological systems analyses*. Global environmental change. 16. pp. 253-367.

Flowup. 2017. *General industrial*. https://flowup.biz/product/[online] Available from: Accessed: 10 October 2018

Foster, N. 2009. *Renault Distribution Centre | Foster + Partners*. [online] Fosterandpartners.com. Available at: https://www.fosterandpartners.com/projects/renault-distribution-centre/ Accessed 18 Sep. 2018.

Gardner, R., Panthee, D. n.d. *Scientists breed better fresh market tomatoes*. [online] Available from: http://fedbyscience.org/stories-of-discovery/scientists-breed-better-fresh-market-tomatoes Accessed: 10 October 2018

Getty Images, 2018. *Transported by water*. [online] Available from: https://www.gettyimages.com/videos/fruit-juice-food-processing-factory?sort=mostpopular&offlinecontent=include&phrase=fruit%20juice%20food%20processing%20factory Accessed: 10 October 2018

Grobbelaar, L. 2010. *New Royal Theatre: The Marabi Theatre as Locus for Cultural Reproduction*. University of Pretoria.

Halbwachs, M. 1950. *The collective memory: Space and the collective memory*. [online] Available at: http://web.mit.edu/allanmc/www/hawlbachsspace.pdf , Accessed: 21 April 2018.

Hawken, P., Lovins, A. and Lovins, L. 2013. *Natural capitalism*. New York: Routledge. pp 1-21.

Hikayele. 2015. *FarmOne7*. [online] Available from: http://hikayeler.me/indoor-garden-nyc/garden-city-hotel-in-long-island-ny-the-best-photo-indoor-nyc-amazing-decor/ Accessed: 10 October 2018

Holling, C.S., 1973. *Resilience and stability of ecological systems*. Annual review of ecology and systematics. Vol 4. pp. 1-23.

Holm, D. 1989, "Pretoria: Dreams and Deeds", *Architecture SA,* vol. May/June, pp. 17.

Hornstein, S. 2011. *Losing site: Architecture, memory and place*. {online} Available at: https://books.google.co.za/, Accessed: 21 April 2018.

Jenkins, G. (ed) 1955. *Pretoria 1855 - 1955*. Die Stadsraad van Pretoria, 1st edn, Wallach's P. & P. Co. Ltd., Pretoria.

Jordaan, G.J. 1898. *Pretoria as 'Urbs Quadrata*. Architecture SA, vol. May/June, pp. 26.

Kamvasinou, K. & Roberts, M. 2014. Interim spaces: Vacant land, creativity, and innovation in the context of uncertainty. In: Manuela Mariani & Patrick Barron, ed., *Terrain vague: Interstices at the edge of the pale*. New York: Routledge. [online] Available at:https://books.google.co.za/books/about/Terrain_Vague.html?id=gU99AgAAQBAJ&printsec=frontcover&source=kp_read_button&redir_esc=y#v=onepage&q&f=false, Accessed: 21 July 2018.

Keller, H. 2017. *Thomas Heatherwick Gives AD a Tour of the Zeitz MOCAA | Architectural Digest*. [online] Architectural Digest. Available at: https://www.architecturaldigest.com/story/thomas-heatherwick-cape-town-zeitz-mocaa-south-africa Accessed 18 Sep. 2018.

Kroll, A. 2010. *Gallery of AD Classics: Lloyd's of London Building / Richard Rogers - 2*. [online] ArchDaily. Available at: https://www.archdaily.com/90668/ad-classics-lloyds-of-london-building-richard-rogers/5037ec6828ba0d599b0004a4-ad-classics-lloyds-of-london-building-richard-rogers-image Accessed 18 Sep. 2018.

Lefebvre, H. 1996. *The right to the city*. Oxford: Blackwell. pp. 173.

Lovins, A. 1999. *Natural capitalism: The next industrial revolution*. [online] Available at: http://library.uniteddiversity.coop/Money_and_Economics/Natural_Capitalism-The_Next_Industrial_Revolution.pdf, Accessed 23 March 2018.

Lyle, JT. 1994. *Regenerative design for sustainable development*. John Wiley & Sons: Hoboken.

Mabin, A. 1992. *Comprehensive segregation: the origins of the group areas act and its planning apparatuses*. Journal of Southern African Studies, 18(2), pp. 405

Magill, B. 2017. *Cutting food waste to help the climate*. [online] Available at: http://www.climatecentral.org/news/new-jersey-cutting-food-waste-to-help-climate-21644, Accessed 7 June 2018.

Market Insight. 2017. *Ternienergia*. [online] Available from: http://marketinsight.it/2017/02/13/ternienergia-dopo-il-ridisegno-strategico-parte-lexecution/ Accessed: 10 October 2018

Mendoza, E. (2018). *Hydroponics*. [online] Available from: https://www.reddit.com/r/ImaginaryTechnology/comments/9ejzdo/hydroponics_by_eddie_mendoza/ Accessed: 10 October 2018

Merin, G. 2013. *Gallery of AD Classics: The Crystal Palace / Joseph Paxton - 11*. [online] ArchDaily. Available at: https://www.archdaily.com/397949/ad-classic-the-crystal-palace-joseph-paxton/51d49a1fb3fc4b583400020b-ad-classic-the-crystal-palace-joseph-paxton-image Accessed 18 Sep. 2018.

Meyer, N. 2017. *Detroit hospital takes a real step towards healing, builds first organic hospital green house*. [online] Available from: http://www.valhallafit.com/health-news/detroit-hospital-takes-real-step-towards-healing-builds-first-organic-hospital-greenhouse/ Accessed: 10 October 2018

Middlefield, O. 2013. *Fresh fruit orchard*. [online] Available from: http://navalwiki.info/definition-of-berry-patch.asp Accessed: 10 October 2018

Mortimer, A. 2017. *Exploring food waste, responsibility and obligation*. [online]. http://sydney.edu.au/environment-institute/blog/exploring-food-waste-responsibility-obligation/, Accessed 7 June 2018].

Oxford Dictionaries. 2018. *Exchange*. [online] Available at: https://en.oxforddictionaries.com/definition/exchange, Accessed 7 September 2018.

Oxford Living Dictionary. [n.d.] *Provisional*. [online] Available at: https://en.oxforddictionaries.com/definition/provisional, Accessed: 05 May 2018.

Pascucci, D. 2015. *Gallery of AD Classics: Fagus Factory / Walter Gropius + Adolf Meyer - 1*. [online] ArchDaily. Available at: https://www.archdaily.com/612249/ad-classics-fagus-factory-walter-gropius-adolf-meyer/53de8597c07a804455000039-ad-classics-fagus-factory-walter-gropius-adolf-meyer-image Accessed 18 Sep. 2018.

Peel, D. 2016. Me[a]ting the beef bar. [online] Available at: https://repository.up.ac.za/bitstream/handle/2263/53339/Peel_Chapter6_2016.pdf?sequence=6 p. 117-123

Peskett, J. 2017. *The Collaborative kitchen*. [online] Available from: http://www.foodserviceequipmentjournal.com/electrolux-strikes-deal-to-kit-out-selfridges-rooftop-pop-up/ Accessed: 10 October 2018

SANS 204. 2011. *Energy efficiency in buildings*. [online] Available from: http://www.woodybpower.biz/Sans%20204.pdf Accessed: 10 August 2018.

Schwad, K. 2018. *The urgency of shaping the Fourth Industrial Revolution* [online] Available at: https://www.weforum.org/agenda/2018/01/the-urgency-of-shaping-the-fourth-industrial-revolution/, Accessed: 20 March 2018.

Sibla, S. 2017. *Automatic semi-fruit dehydration plant*. [online] Available from: https://www.indiamart.com/proddetail/semi-automatic-fruit-dehydration-plant-19199735673.html Accessed: 10 October 2018

Tayob, A. 2002, *An Integrated Urban Design Framework for Marabastad*. 2nd. ed. Aziz Tayob Architects Inc & Meyer Pienaar Tayob Architects & Urban Designers., Pretoria.

TICCIH. 2003. *The Nizhny Tagil Charter for the Industrial heritage*. hrcak.srce.hr/file/122740, Accessed 4 July 2018.

The Economist. 2012. *The third industrial revolution*. [online] Available at: https://www.economist.com/leaders/2012/04/21/the-third-industrial-revolution, Accessed 25 March 2018.

UP Space. 2018. *Van der Waal Collection*. [online] Available at: https://repository.up.ac.za/handle/2263/52033, Accessed 24 May 2018.

Viljoen, A. 2005. *Continuous productive urban landscapes: Urban agriculture as an essential infrastructure*. Brighton: University of Brighton.

Von Bormann, T. (Ed.) 2018. *Food Loss and Waste: Facts and Futures*. [online] Awsassets.wwf.org.za. Available at: http://awsassets.wwf.org.za/downloads/WWF_Food_Loss_and_Waste_WEB.pdf, Accessed 8 June 2018.

wastED. 2018. *WastED*. [online] Available at: https://www.wastedlondon.com/scrapbook, Accessed: 29 August 2018.

Water & Waste International. 2016. Video: *Billund biorefinery - The waster water treatment plant of the future?* [online] Available from: https://www.waterworld.com/articles/wwi/2016/09/video-billund-biorefinery-the-wastewater-treatment-plant-of-the-future.html Accessed: 10 October 2018

Weatherbase. 2018. *Taoyuan City, Taiwan*. [online]. Available at: https://www.weatherbase.com/weather/weather-summary.php3?s=26286&cityname=Pretoria,+South+Africa, Accessed: 27 September 2018.

WikiArquitectura. 2012. *Van Nelle Factory - Data, Photos & Plans* - WikiArquitectura. [online] Available at: https://en.wikiarquitectura.com/building/van-nelle-factory/ Accessed 18 Sep. 2018.

Winter, J. 1970. *Industrial Architecture*. London: Studio Vista Limited, pp.71-117.

World Hunger. 2016. *World Hunger News: Poverty Facts, Statistics*. [online] Available from: https://www.worldhunger.org/world-hunger-and-poverty-facts-and-statistics) Accessed 05 October 2018.

Zinde, I. n.d. *Potatoes: South Africa's sales drive in pre-selected townships*.[online] Available at: http://www.potatoes.co.za/SiteResources/documents/Campaign%20in%20photos.pdf, Accessed 8 June 2018.

10

appendix

final pin-up