Remediator

Restoring the dichotomous relationship between industry and nature through an urban eco-textile mill & dyehouse

- Renée Minnaar -

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Restoring the dichotomous relationship between industry and nature through an urban eco-textile mill & dyehouse

by
Renée Minnaar

Submitted in fulfilment of part of the requirements for the degree
Master of Architecture (Professional)
in the
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Course Coordinator:
Prof. Arthur Barker

Study Leader:
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Project Summary

Address
1 Annet Road, Cottesloe Johannesburg, 2092

GPS coordinates
26° 11′ 24.6″S, 28° 1′ 10.8″E

Programme
Eco-Textile Mill and Dye house

Research field
Heritage and Cultural Landscapes & Environmental potential

Client
Department of Trade and Industry

Theoretical premise
Using regenerative and transformative resilience theory in conjunction with philological restoration in an attempt to regenerate living and socio-economic systems in a post-industrial urban site.

Architectural approach
Using ghosts of industries as mediative archetypes in order to restore the dichotomous relationship between industry and nature resulting from Industrialization.

Declaration

*In accordance with Regulation 4(c)
of the General Regulations (G.57)
for dissertations and theses,
I declare that this thesis,
which I hereby submit for the degree
Master of Architecture (Professional)
at the University of Pretoria, is my own work
and has not previously been submitted
by me for a degree at this or any other tertiary institution.
I further state that no part of my thesis has already been,
or is currently being, submitted
for any such degree,
diploma or other qualification.*

*I further declare that this thesis is substantially my own work.
Where reference is made to the works of others,
the extent to which that work has been used
is indicated and fully acknowledged
in the text and list of references.*

....
Renée Amelia Minnaar

Abstract

Industrialization brought about dramatic changes in many major cities around the world, including Johannesburg. However, rapid technological advancements have resulted in the abandonment of many industrial sites often within the confines of expanding cities as is the case with the old Johannesburg Gasworks.

The repercussions of the hazardous industrial processes of the past are still present on the site in the form of pollution. This, together with South Africa's lack of protection of our industrial heritage, has awoken the fear that these post-industrial artefacts might be in danger of becoming extinct if their value is not recognised.

This dissertation aims to investigate the potential of redundant industrial sites like the old Johannesburg Gasworks to mitigate the environmental and social issues resulting from the past in an attempt to reintegrate the site back into the surrounding urban fabric. Through the understanding and application of environmental and heritage theories, this dissertation hopes to find a means of using architecture as a tool to mediate the dichotomous relationship between industry and nature, resulting from an exploitative world view, and inspire a new archetype for industrial architecture, that is able to inspire mutually beneficial relationships between industry and nature, whilst creating a didactic and dialectical relationship between the existing industrial heritage of the past and the envisioned contemporary architecture of the future.

Acknowledgments

All honour to my Saviour, the Master Creator, for granting me this opportunity and for never failing me...

A special thank you to my best friend and husband, Pieter, for your enduring love, patience, help and understanding. Thank you for believing in me when I didn't believe in myself and for the countless times you wiped my tears assuring me that I could do this. Without you, none of this would have been possible. I am forever grateful for you.

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Thank you to my wonderful parents, Francois and Beverley, for your continuous encouragement, prayer, assistance and love and for teaching us by example what hard work is and for inspiring us to pursue our dreams.

Thank you to my parents-in-law, Pieter and Marina, for all the care packages, motivation and help.

To my amazing friends - thank you for your understanding, assistance and encouragement throughout this journey. My life is so much richer because of friends like you.

The rest of Prof. Barker's crew - Amy, Henry, & Marcus - thank you for all the cake, coffee and advice.
You definitely made tough days better...

Nellis, Jan-Diedeleff and Jan-Paul, thank you for choosing to go on this adventure with me and for all the hours set aside to discuss urban vision, which culminated in laughing and eating fluffy omelets instead.
I am so grateful to each one of you.

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Chapter 1

Preface

01 | Preface

Setting the scene

"Man's attitude toward nature
is today critically important
simply because we have now
acquired a fateful power
to alter
and destroy nature.

But man is a part of nature,
and his war against nature
is inevitably a war against
himself?

[We are] challenged
as mankind has
never been challenged before
to prove our maturity
and our mastery,
not of nature,
but of ourselves."

- Rachel Carson -
(NRDC 2015)

Figure 1.1: Left: Ash Plant (Author 2017) *Figure 1.2: We are Nature II (Relander 2012, edited by Author)*

Many major cities like Johannesburg, have changed as a result of industrialization and are now left with brownfield sites and various other issues of pollution, resulting from hazardous industrial processes (Kirovová & Sigmundová 2014:433).

Rapid technological advancements have resulted in an increasing number of abandoned industrial sites often within the confines of rapidly expanding cities (Heritage council Victoria 2014:10). Industrial sites that are left abandoned often have a digressive effect on the area surrounding it and large inaccessible sites like the old Johannesburg Gas Works often become '*ruptures in the urban fabric*' (Heritage council Victoria 2014:9) detrimentally effecting urban connectivity.

This dissertation hopes to uncover ways in which architecture can act as mediator between industry and nature and to explore the possibility of using environmental theories in conjunction with heritage theories, in order to create a new archetype for industrial architecture that is able to catalyse regeneration of redundant industrial sites.

The old Johannesburg Gas Works will act as experimental subject in the hope to set a precedent for future industrial typologies.

The Site

Location of the old Johannesburg Gasworks

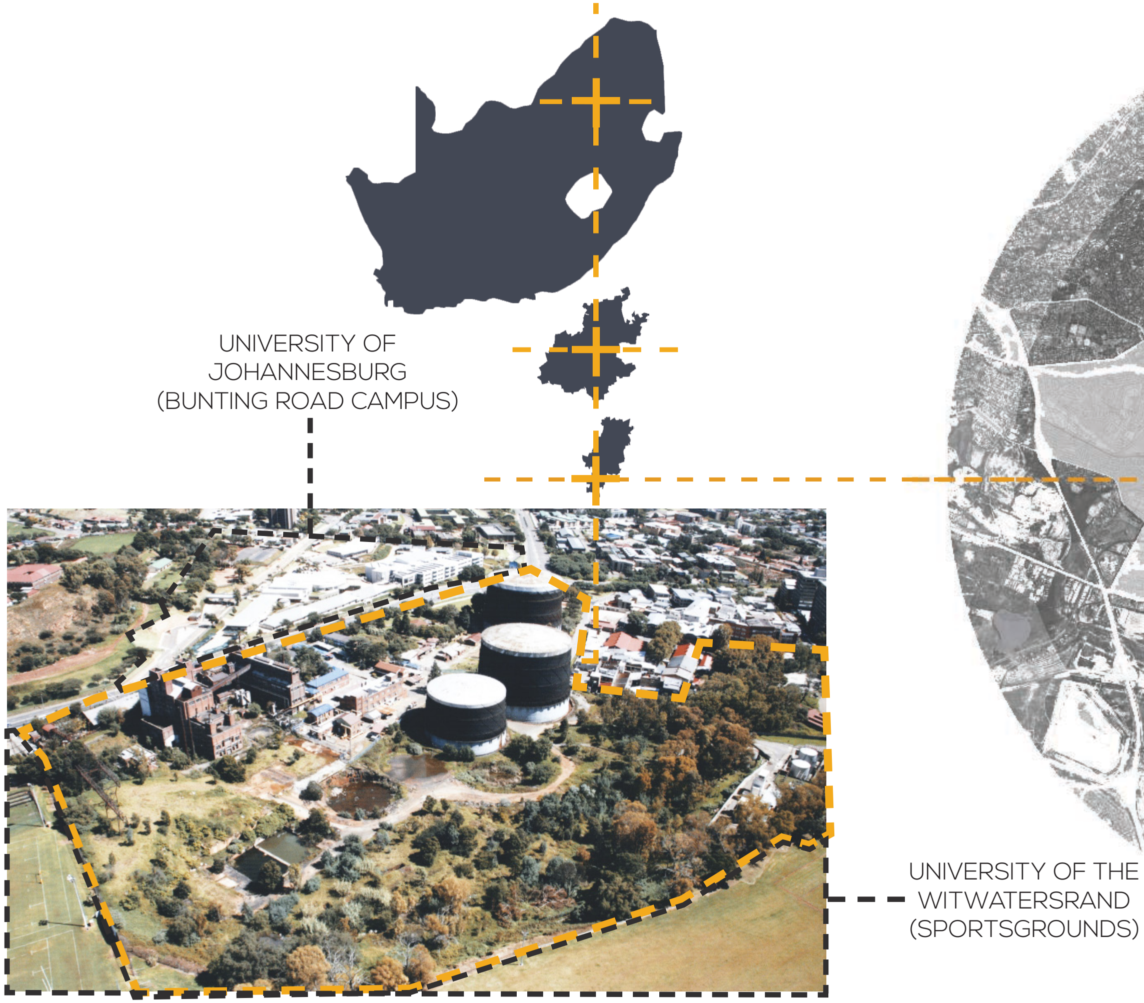

Figure 1.3: Area of focus (Egoli Gas 2009, edited by Author)

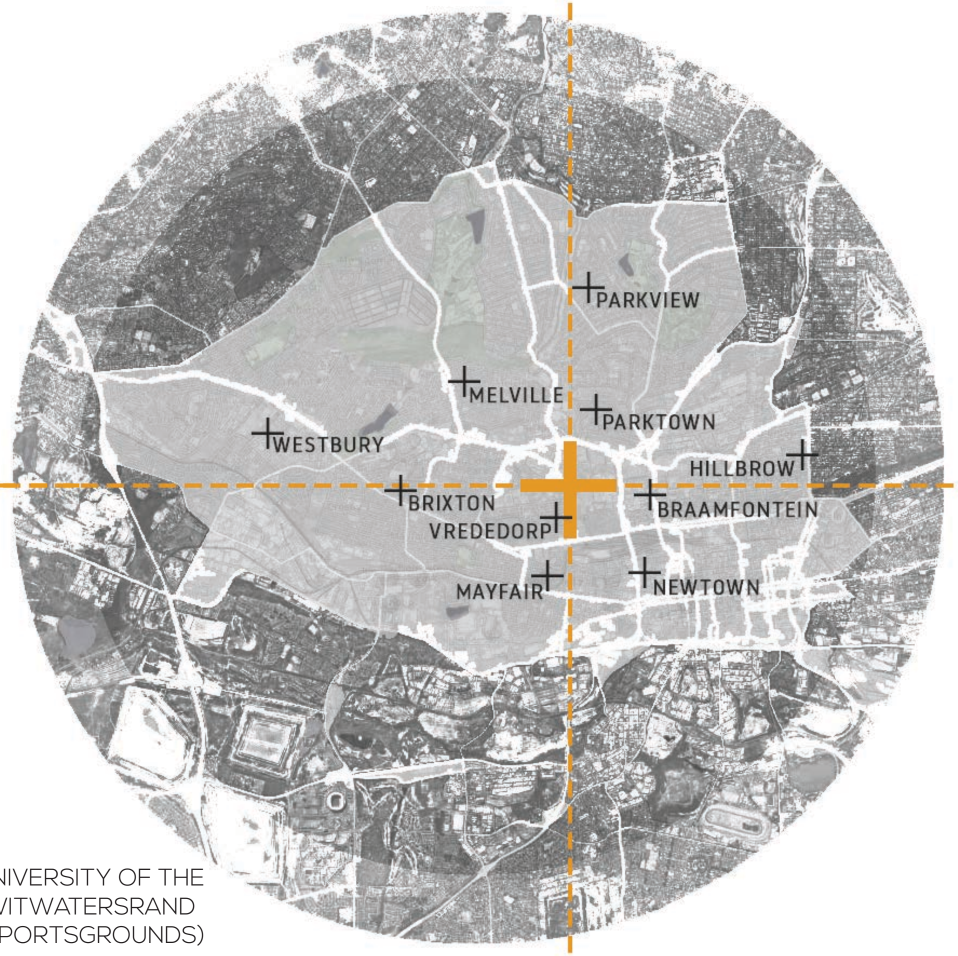

Figure 1.4: Map of Johannesburg (Google Maps, edited by Author 2017)

Figure 1.5: Industrial revolution (Author 2017)

General issue

The disconnection between natural and built environments

According to Pearlmutter (2007:752), there has always been a strong connection of mutual influence between climate and architecture. Architecture's role has been to alter the immediate climate in a very intentional manner in order to provide shelter. Traditionally, architecture was birthed from a comprehensive understanding of the opportunities and stresses of the specific climate it was to insert itself into. However, rapid technological advancement and the abundant availability of fossil fuel have allowed architects to create architecture that is completely isolated from its regional climate. These types of buildings have shaped our current cities and have inadvertently led to a change in local and global climates.

Due to the disconnection between natural and built environments, the physical function of cities and the well-being of their citizens are at risk According to Hes and Du Plessis (2015:12) scientists have warned that if we continue on our current path, natural ecosystems will no longer be able to sustain future generations due to the immense stresses placed on their natural functions.

The reality is that the protection of these services is no longer an optional extra, it is critical (Hes & Du Plessis 2015:12). This solidifies the need for the intricate interactions between nature and the built environment to be understood, in order to reclaim the balance that once existed between these two fields (Pearlmutter 2007:752). According to Fox (2000:3), the way in which we build and live in these environments becomes important, not only for the human race to prosper, but also for the preservation and prosperity of the entire '*non-human*' portion of nature.

Urban issues

The Danger

South Africa, like many other developing countries, has failed to recognize the value of our industrial heritage and this has led to an absence in the protection of heritage with the necessary measures (Läuferts Le Roux & Mavunganidze 2009:533). This has awoken the fear that industrial buildings might be in danger of extinction if attention and awareness of their value are not brought to the table. Industrial heritage buildings, no longer in use, are often left abandoned leading to deterioration and frequently resulting in the demolition of these structures, leaving only '*ruins of the past*' (Läuferts Le Roux & Mavunganidze 2009:533).

The Disconnect

The old Johannesburg Gaswork site currently has no connection to the vibrant socio-economic systems of areas such as 44 Stanley Avenue, the universities or the schools that surround it. The site's isolation is as a result of a very strong natural boundary formed by the typography on the eastern edge, fences to the north, west and south of the site, the hazardous pollution left by the industrial processes as well as the danger resulting from neglect to maintain the structures on site.

Boundary map legend

Strong natural boundary

Man-made boundary - fence

Semi-permeable

Built fabric

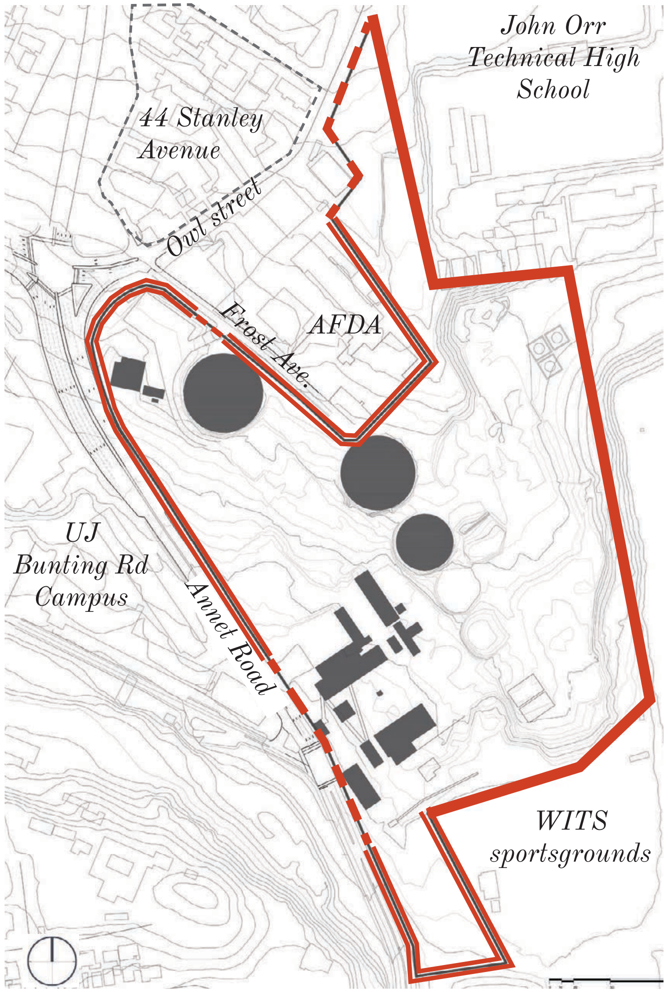

Figure 1.6: Analysis of site boundaries (Author 2017)

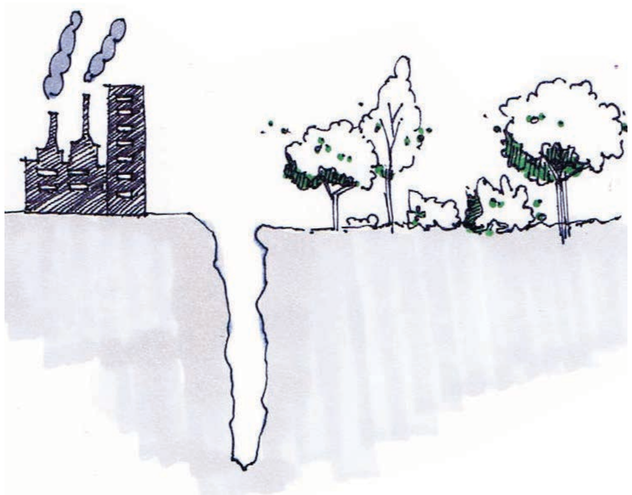

Figure 1.7: Dichotomy between industry & nature (Author 2017)

Architectural issue

The dichotomy between industry and nature

It is impossible to isolate the built environment from natural systems. However, for many years the world view in which nature, humans and their habitats are seen as separate from one another and the idea that nature exists only to serve humanity, has been embraced (Peres, Barker & Du Plessis 2015:1). This has led to the exploitation of natural systems without considering the long-term effects on the vitality of these systems or the well-being of humanity.

The development of the fragmented relationship between industry and nature can be observed through a series of paintings depicted in Figures 1.8-1.10, clearly showing the change in relationship through a progression of time.

Precisionism was a style first practiced by artist Charles Sheeler and Edward Hopper, after the First World War. The term Precisionism was coined in the 1920s and was strongly influenced by Futurism and Cubism with themes like the modernization and industrialization of American landscapes. The focus of the style was to depict real people in real situations. The artists' depictions often expressed a sense of admiration for the industrial era, instead of commenting on the social consequences of industrial development (The Art History Archive [sa]).

The paintings by Charles Sheeler (see Fig. 1.12-1.14) form the pinnacle of the severed relationship between industry and nature, as nature and man are completely absent from his representations of the American landscape.

In order to provide possible solutions to the severed relationship between industry and nature, historic industrial structures and their contribution to this dichotomy need to be understood.

The Evolution of Industry vs. the Devolution of Nature depicted through Art

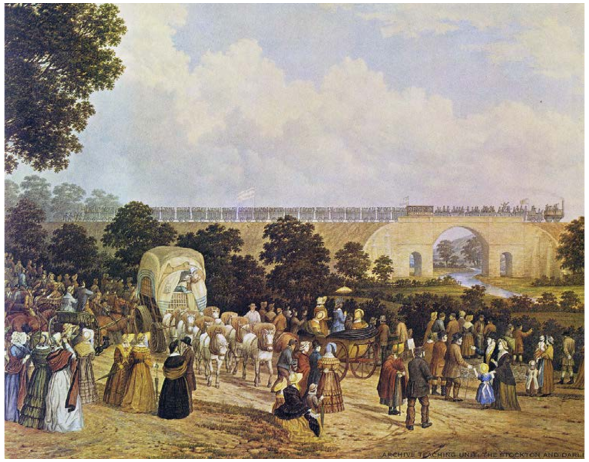

Figure 1.8: The opening of the Stockton & Darlington Railway (John Dobbin 1825)

Coexistence of Industry and Nature

In this painting, dating back to 1825, it is clear that the artist looked favourably upon the Industrial Revolution. With the train positioned in the far background, humans and nature form the main focus of the painting. The lack of dirt and the portrayal of smoke in the scene speak of a time when industry was still seen as a part of nature's cleanliness and purity (Caron, Lindfield & Vandehey 1996).

Figure 1.9: Gare Saint-Lazare : Arrival of a Train (Claude Monet 1877)

Transition to importance of Industry

In Claude Monet's 1877 painting *Gare Saint-Lazare*, industry is romanticised through the beautiful depiction of the smoke stack floating in the air, '*like a natural organism creating clouds on earth*' (Caron, Lindfield & Vandehey 1996). Monet's use of white, grey and blue paint creates the idea of the smoke being one with a cloud-filled sky instead of being hazardous or dirty.

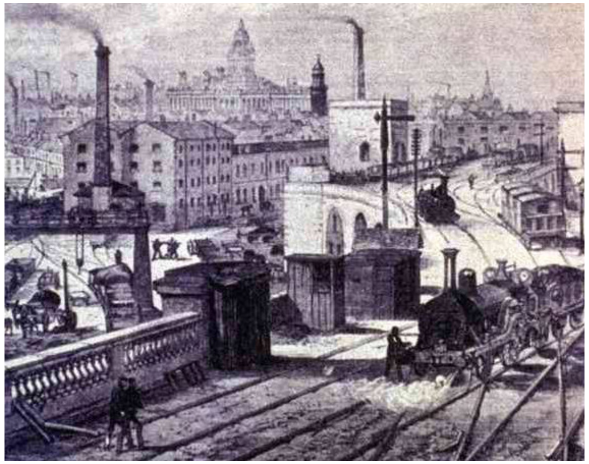

Figure 1.10: Disappearance of Nature (Unkown artist [sa])

Disappearance of Nature

This painting is cluttered with structures. What makes this scene different from the other two paintings is the lack of focus on the trains, instead the train forms part of numerous other man-made products of the Industrial Revolution. The people depicted in this image are small, dark and faceless, perhaps commenting on the lack of impression on their surroundings and their only focus being on their daily routine (Caron, Lindfield & Vandehey 1996).

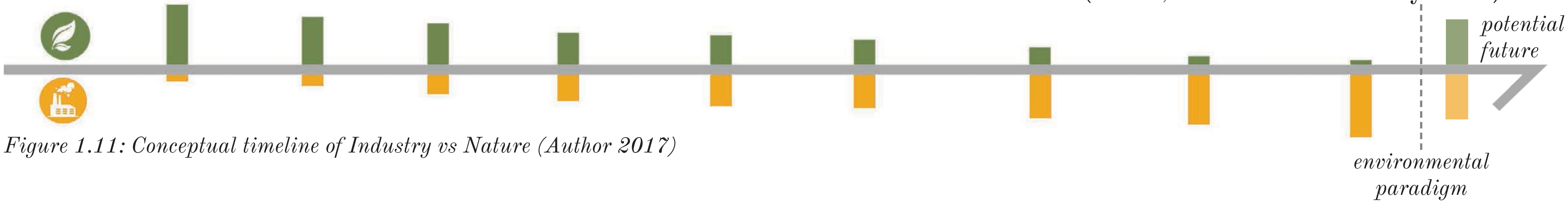

Figure 1.11: Conceptual timeline of Industry vs Nature (Author 2017)

Precisionism - the pinnacle of the severed relationship between industry & nature

Figure 1.12: American Landscape (Charles Sheeler 1930)

Figure 1.13: Classic Landscape (Charles Sheeler 1931)

Figure 1.14: Upper Deck (Charles Sheeler 1929)

Retort house 2

Figure 1.15: Retort house 2 (Author 2017)

Retort house 1

Figure 1.16: Retort house 1 (Author 2017)

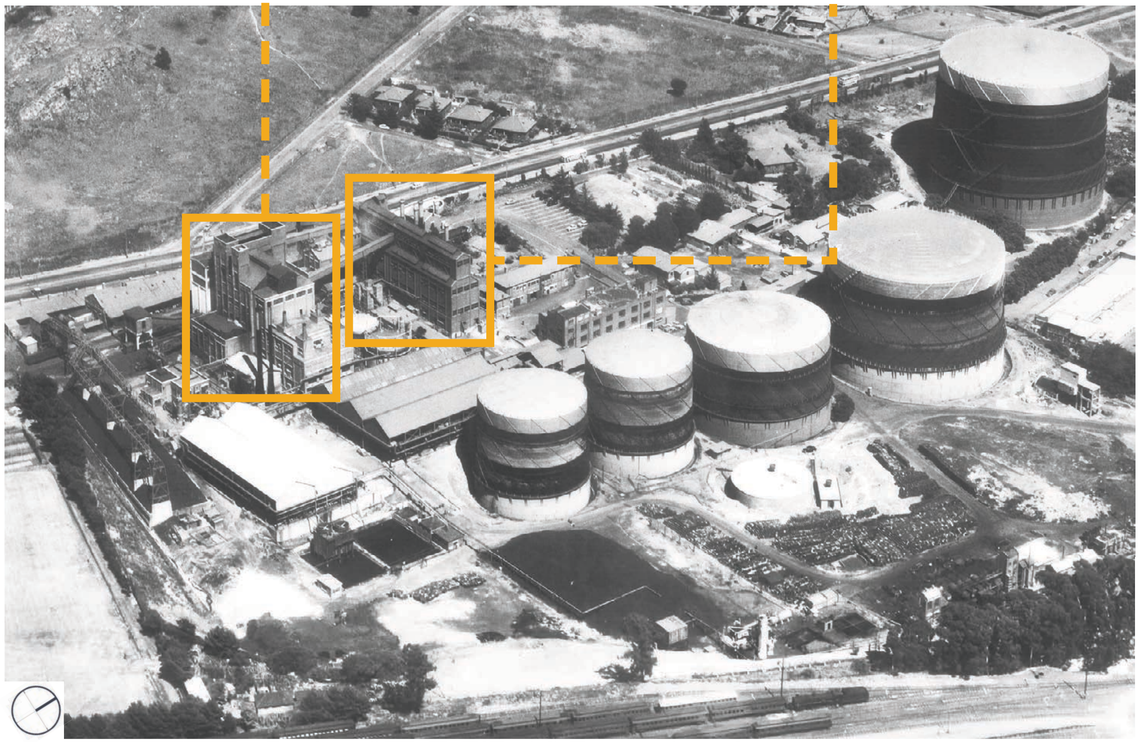

Figure 1.17: Aerial photo of Gas Works in 1960 (City of Johannesburg Gas Department 1960, edited by Author)

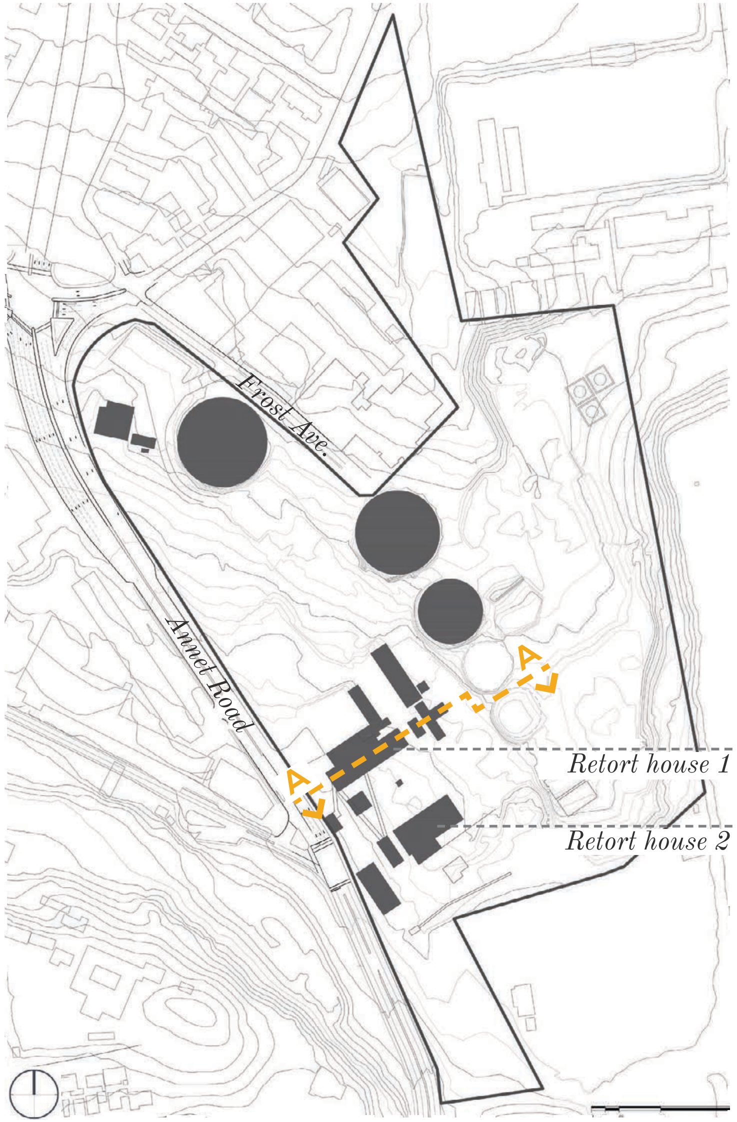

Figure 1.18: Site map showing retort house and site section position (Author 2017)

What function follows form?

The form of the retort house was dictated by the building's function (see Fig. 1.19-1.20), however the function for which the gasworks was originally built is no longer relevant. The current stagnant character and lack of purpose of the industrial heritage on site has resulted in the buildings becoming a void in the landscape and the site becoming a void in the city. This lack of function to these once functioning buildings beckons the question; what does a building become after it loses the purpose it was originally designed for?

The re-appropriation of the industrial heritage without tarnishing its architectural significance does become important for the preservation of this part of South Africa's heritage for future generations.

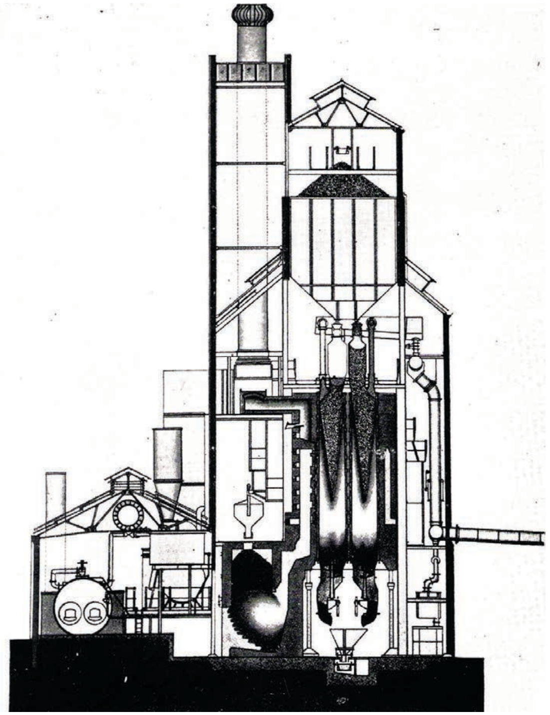

Figure 1.19: Cross section through Retort 1 (City of Johannesburg Gas Department 1940s, edited by Author)

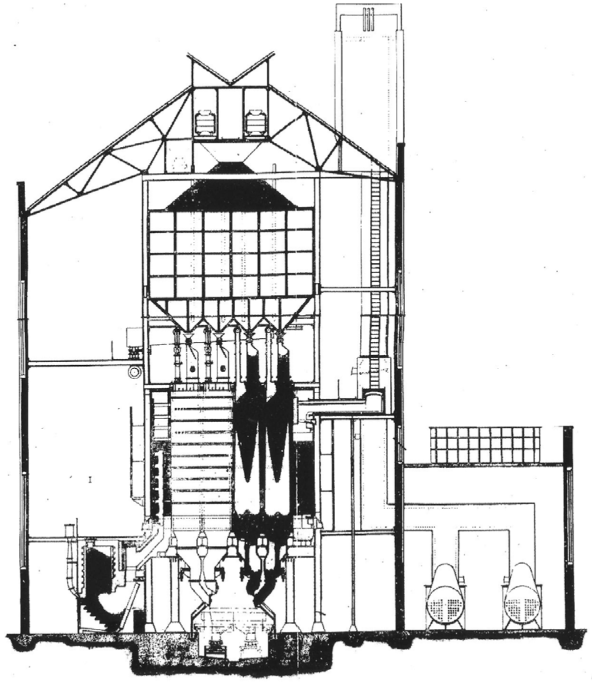

Figure 1.20: Cross section through Retort 2 (City of Johannesburg Gas Department 1950, edited by Author)

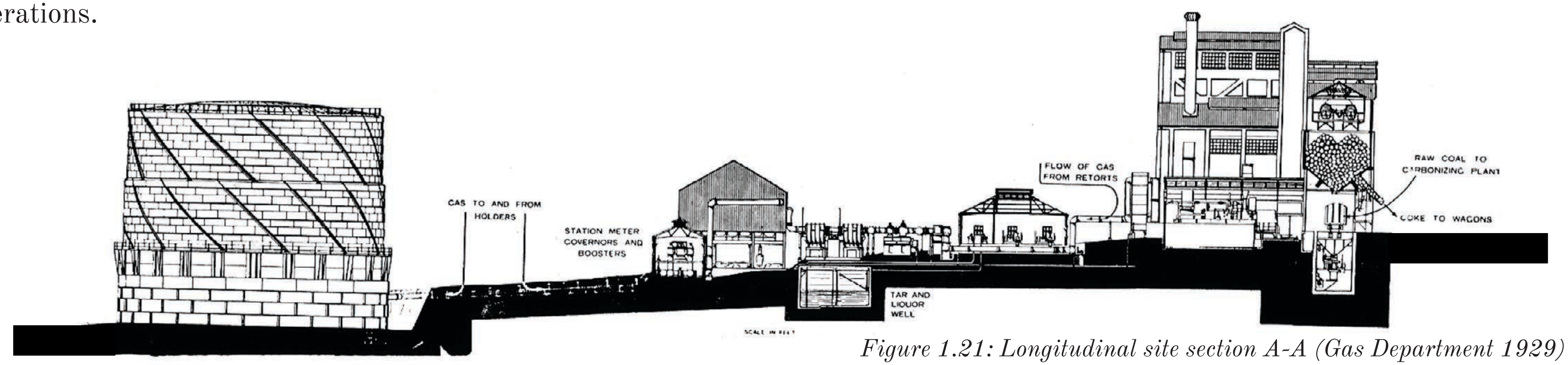

Figure 1.21: Longitudinal site section A-A (Gas Department 1929)

Research questions

Main questions

How can architecture act as remediator in order to restore the dichotomous relationship between industry and nature?

How can architecture be used to mediate past and present identities in such a way that it creates a meaningful architectural dialogue?

How can industrial heritage be reappropriated in order to catalyze regeneration of socio-economic systems?

Sub-questions

How can architecture be used to catalyze regeneration of living systems?

Is philological restoration an appropriate approach to create meaningful and appropriate connections between contemporary and historical buildings?

Does architecture have the ability to resurrect the latent productive potential of a stagnant industrial heritage site through the re-appropriation of unused heritage buildings?

How can architecture be used to re-invent and re-imagine a degraded urban site?

Does a regenerative architectural intervention have the ability to catalyze urban rejuvenation in a city like Johannesburg?

Research methodology

Introduction

The preceding investigation has highlighted the general issue of the disconnection between industry and nature and the repercussions of this dichotomous relationship on the environment. This dichotomy has contributed to a severed connection between the old Johannesburg Gasworks' site and the rest of the urban fabric. The idle, function-driven buildings left on this abandoned industrial site are in danger of extinction, if drastic measures are not implemented to save them. Finding an appropriate strategy for the re-appropriation of industrial heritage buildings has become vital. Parallel to this issue, is the investigation into ways in which architecture can mediate the dichotomous relationship between industry and nature, while identifying the possibility of new means to create industrial architecture that is conducive to the regeneration of living as well as socio-economic systems. The following research methodologies will be applied in order to find possible solutions to the issues raised by this dissertation.

Tools for the accumulation, interpretation and application of research

Historical Research

This will be used to gain comprehensive understanding of the architectural heritage and the importance thereof in order to develop an appropriate approach toward the site and its built fabric as well as to understand the relationship between nature and the architecture that resulted form industry.

Mapping

A thorough analysis of the site and its surrounding context will be needed in order to fully understand the urban and architectural issues as well as the opportunities for an appropriate architectural intervention.

The existing heritage fabric on site, vegetation and circulation will all be mapped through a combination of observation, historic data analysis and computer based research and presented in the form of various maps.

Literature Reviews

This will have to be done in order to gain insight into the architectural theories addressed in this dissertation. A comprehensive understanding of philological restoration, regenerative and transformative resilience theory and the application thereof is needed to validate the work that will be produced.

Qualitative research

Will be conducted in the form of photography and observation in order to gain a comprehensive understanding of the current conditions on site and the current state of each building.

Evaluative Research

The National Heritage Resources Act no. 25 of 1999 of South Africa and the Nizhny Tagil Charter for the protection of industrial heritage, will be consulted to critically evaluate the current built structures on site in order to determine which buildings carry architectural value and which buildings can potentially be altered or demolished.

Collaborative design

As the precinct will be shared by four architects and a landscape architect, collaborative design will play an important part in the development of this dissertation. Collaboration with Tsica Heritage Consultants on the development and the value of the built fabric of the site will also form part of the research methodology.

Case studies / Precedents

Theoretical precedents will be studied in order to gain an understanding of how theory can be applied to design in order to initiate urban regeneration. Local precedents will be studied in order to identify strategies for the re-appropriation of industrial heritage in the South African context. Finally, formal precedents will be studied to gain insight into strategies for achieving the architectural intentions of this dissertation and ways in which architecture can be molded to create sensory experiences.

Limitations & Delimitations

Assumptions

It will be assumed that:

The gas cylinders on site will no longer be used.

Egoli Gas will relocate to another area in Johannesburg.Although the land is owned by Egoli Gas, there is the opportunity for the city of Johannesburg to possibly give them incentives due to the site's position in the Empire-Perth corridor strategy.

Some of the buildings may be demolished according to a heritage assessment conducted by Tsica heritage consultants. According to an assessment made by a structural engineer the heritage buildings are structurally sound (Tsica Heritage Consultants 2011:3). We will therefore assume that the buildings have the ability to be re-appropriated.

Limitations

Site visits will be limited as the site is quite dangerous and only authorized and guided visits are allowed by Egoli Gas. Plans and sections are however available for the existing buildings on site and the group will therefore not be restricted in terms of drawing up the existing buildings or modelling the site.

Delimitations

Due to the time constraints and vastness of the site only four architectural interventions and one landscape intervention will be developed into well resolved architectural projects. The rest of the site will merely be programmed and zoned according to the proposed urban vision, but will not be developed in detail.

Project intentions

The project intends to adopt the 2040 Spatial Development Framework for Johannesburg by transforming the old Johannesburg Gasworks into a future regional node for the Empire-Perth corridor. The project also intends to catalyze urban regeneration through the reactivation and regeneration of the Johannesburg Gasworks with the help of an architectural intervention.

Through the application of theory this project hopes to challenge the ideas of conservation and attempts to create a strong dialogue between the existing industrial heritage of the past and the envisioned contemporary architecture of the future.

Terminology

A guide for understanding

Dichotomy:

"A division or contrast between two things that are or are represented as being opposed or entirely different." (English Oxford Living Dictionary 2017).

Regenerative Design:

Regenerative design as defined by Pamela Mang & Bill Reed in '*Regenerative Development and Design*'.

"*Regenerative Design: a system of technologies and strategies, based on an understanding of the inner working of ecosystems that generates designs to regenerate rather than deplete underlying life support systems and resources within socio-ecological wholes*" (Mang & Reed n.d:2).

Remediator:

"*A person who or thing which remediates something; an agent or provider of remediation*" (English Oxford Living Dictionary 2017).

Retort:

A retort can be defined as a vessel which decomposes substances with the help of heat (Ardictionary 2010).

Industrial Ecology:

Industrial ecology strives to create sustainable and well integrated relationships between industry and nature through a comprehensive understanding of natural systems thinking (Brent, Oelofste & Godfrey 2008:9).

Transformative Resilience:

A theory that is aimed at recovering a system's health through the use of regenerative design (Peres 2016:188).

One-way throughput:

Lyle (1994:5) refers to the 'one-way throughput' as a linear degenerative process in stark contrast to nature's cyclical flows.

TICCIH:

The International Committee for the Conservation of the Industrial Heritage

Philological restoration:

A term originating from the Latin classification of a monument as a document or inscription.

Mordants:

"a chemical that fixes a dye in or on a substance by combining with the dye to form an insoluble compound" (Merriam-Webster 2017)

Chapter 2

Theory

02 Theory

The Great Divide

The current difficulty we are experiencing in dealing with environmental and resource issues, stems from a concept of humans being the measure of all things (Lyle 1994:21). This notion, developed during the Renaissance, has shaped the landscapes and cities we live in today.

Renaissance buildings and landscapes were characterised by human beings assuming a central position within the environment (Lyle 1994:21). This relationship between human and nature can be seen in the strict geometrical layout of Renaissance gardens with a strong axial focus. Isaac Newton, René Descartes and Francis Bacon are just some of the 17th and 18th century thinkers who expanded on this new relationship between humans and nature that shaped a new mechanistic world view where earth was seen as one colossal machine and the idea that nature could be understood through an understanding of even the smallest part.

Figure 2.1. Left: CWG Plant (Author 2017)

Descartes encouraged the collection of knowledge that could then be strategically applied through technology in an attempt to acquire power over nature and ultimately take control of the earth's processes.

Before these ideas could be further developed, fossil fuels and their potential to produce energy were discovered and along with that came the creation of machines that could harness that energy (Lyle 1994:22). This marked the beginning of Industrialization as the instigator for global transformation and unavoidably shaped the '*one-way throughput*'[4] world we know today.

A New Dawn

The 20th century brought about concepts aimed at challenging the assumptions developed in the 17th and 18th century regarding nature's underlying order (Lyle 1994:22). This new understanding of nature, inspired a perception of humanity as part of a complex and intricate world which is less deterministic and predominantly interdependent, bearing almost no resemblance to a machine. The Chaos Theory, Einstein's Theory of Relativity and Heisenberg's Uncertainty Principle are just some of the concepts of nature that emerged during the 20th century. These theories have been critical to the development of a new fundamental concept in the field of environmental design.

John Tillman Lyle (1994:ix) describes environmental design as the point where human behaviour and culture meets the earth's processes in order to create form. For this type of design to occur, connections that became estranged during the Renaissance and completely severed by the Industrial Revolution need to be reconciled. One of these connections is between nature and humans and the other connection is between science and art. Ultimately environmental design strives to provide a platform for humans and nature to meet and for art and science to join forces (Lyle 1994:ix).

A major shift in the field of environmental design has led to an increasing number of designers and builders coming to the realization that the solutions to current issues still elude us, amidst the various technological advances and increasing market demand (Haggard, Reed & Mang 2006:1). The conservation of energy, improvements to the quality of life and the reduction of waste are all qualities of a contemporary sustainable project, however these improvements are only slowing down the rate of degradation to the earth's ecosystems. John Tillman Lyle (1994:4) highlights the alarming rate of resource depletion and environmental degradation resulting from orthodox industrial development, in his book *Regenerative Design for Sustainable Development*. Haggard, Reed and Mang (2006:1) believe that instead of causing mass deterioration in our natural environment, development needs to promote ecological health. Simplification of complex living systems is at the heart of the emergent environmental crisis (Mang & Reed 2012:7) as nature's recurrent recycling of energy and materials has been replaced with linear flows, a degenerative system responsible for '*devouring its own sources of sustenance*' (Lyle 1994:5). In order to promote ecological health, these degrading patterns of linear flows require a radically different approach (Mang & Reed 2012:7).

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Transformative resilience

'Transformative resilience' might be the key to achieving ecological health, as this approach aspires to discover and analyse the latent potential of each site or building in an attempt to identify possible opportunities for systems to share resources similar to the principles of 'industrial ecology' (Peres 2016:186). Re-envisioning these urban processes could result in enriched connections between nature, the built environment and the local community.

Transformative resilience focuses on renewing and recovering a system's health through the use of regenerative design (Peres, Barker & Du Plessis 2015:2) and inspires projects to become '*engines of positive or evolutionary change for the systems into which they are built*' (Haggard, Reed & Mang 2006:1).

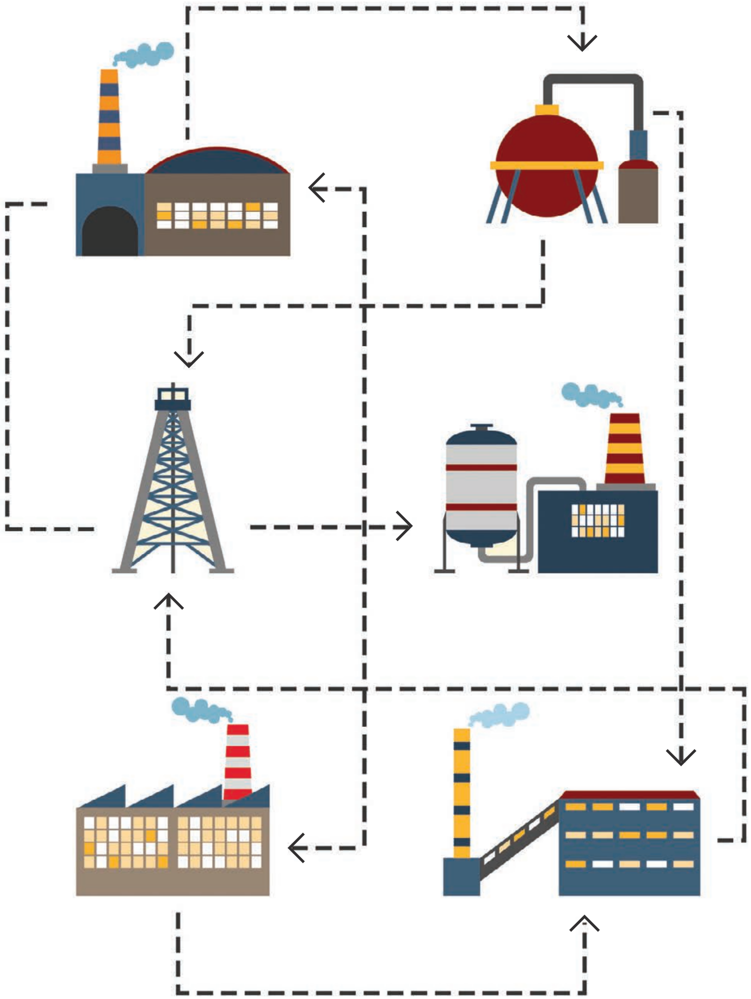


Figure 2.2.: Industrial Ecology (Author 2017, Images sourced from Freepik 2017)

Systems thinking as facilitator for regenerative design

Regenerative thinking is based on the notion that there is no great divide between nature and humans and that instead of ruling above it, humanity is a part of nature. This notion is derived from whole systems thinking; which believes that all things are connected as a single system and that each part of the system is vital in ensuring the health of the entire system (Littman 2009:15).

The beginnings of regenerative design stretch as far back as the 1880s with Ebenezer Howard's expressions of ecological thinking. Other contributors include Patrick Geddes with his take on cities as living organisms in 1915, Arthur Tansley's definition of ecosystems as the interaction between living things with their non-living habitat and even Ludwig von Bertalanffy's work on systems theory in 1968, which would later go on to inspire John Tillman Lyle's work on regenerative design. Charles Krone also made a significant contribution to systems thinking in the 1960s and 1970s which formed the foundation for the Regenesis Collaborative Development Group's research in the 1990s (Mang & Reed 2012:3-5).

The approach to living systems thinking which Charles Krone developed, could be applied to natural as well as human-social systems (Mang & Reed 2012:5). The purpose of the development processes and systemic frameworks Krone created, was to understand communities, businesses and nature as living systems in order to inspire mutually beneficial relationships through well integrated community, industrial and natural processes (see Fig.2.3.)

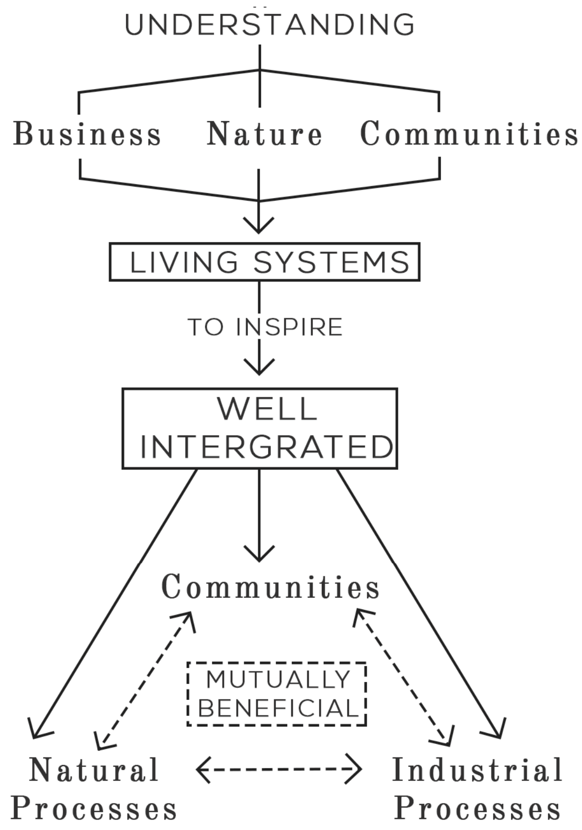


Figure 2.3: Living systems thinking summary diagram (Author 2017)

Regenerative and Industrial systems

Regenerative and industrial systems make use of the same basic processes in order to function, however the way in which they do, differs dramatically (Lyle 1994:24). One of the fundamental differences between industrial and regenerative systems is the way in which industrial systems attempt to bypass natural flows through the extraction of energy or materials like fossil fuels, that have been accumulated by the earth over decades. These processes are classified as degenerative practices as they fail to replenish the sources they exploit. Regenerative technologies on the other hand collaborate with nature's flow systems in order to replenish resources on a maintainable basis respecting the system's functional integrity (Lyle 1994:24). Replacing degenerative linear flows (Fig.2.4) with cyclical flows (Fig.2.5) could ensure continuous replacement of materials and energy used in the operation by means of their own unique functioning processes (Lang 1994 cited in Mang & Reed 2012:7).

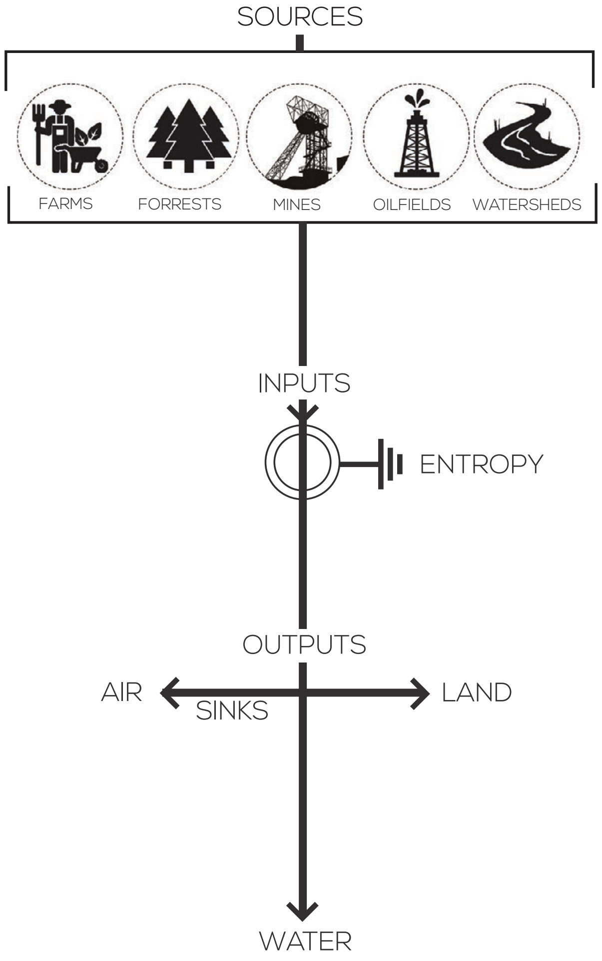


Figure 2.4: Degenerative linear flows (Author 2017, Adapted from Lyle 1994:5)

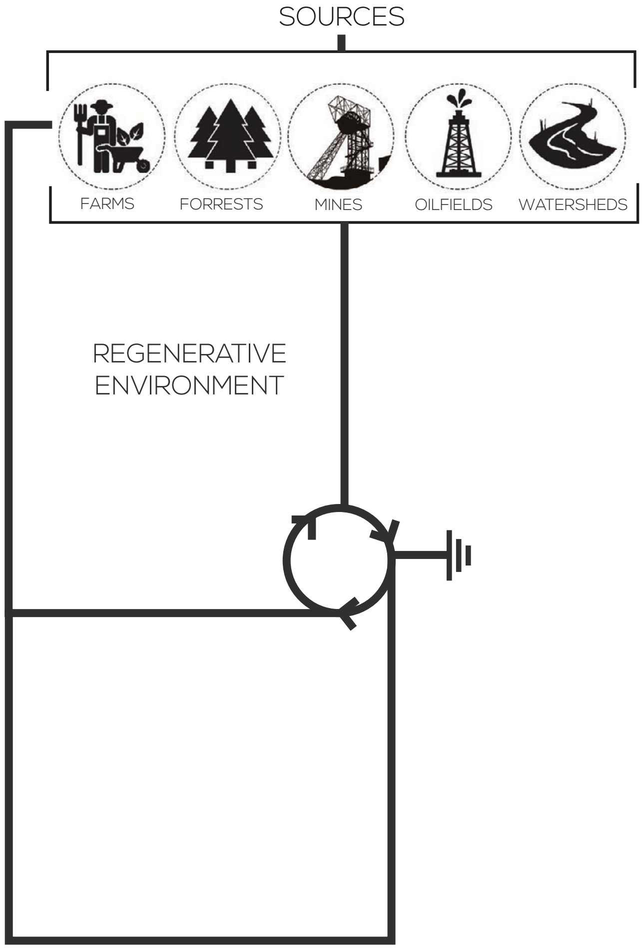


Figure 2.5: Regenerative cyclical flows (Author 2017, Adapted from Lyle 1994:10)

An Ecosystemic approach as conceptual model

In order to create entirely comprehensive architecture, capable of reintegrating into the surrounding urban context, Kirovová and Sigmundová (2014:433) propose that industrial sites be seen as ecosystems comprising various dynamic and complex systems resulting from diverse subsystems with distinguishable metabolic cycles, interacting with one another.

Comparing these industrial sites to ecosystems is not too far removed, as many of these industrial plants were '*operated according to a model of rational metabolic cycles representing technological flows*' (Kirovová & Sigmundová 2014:433).

This could be the key to understanding complex issues and ascertaining sustainable strategies for the re-appropriation of these redundant industrial sites.

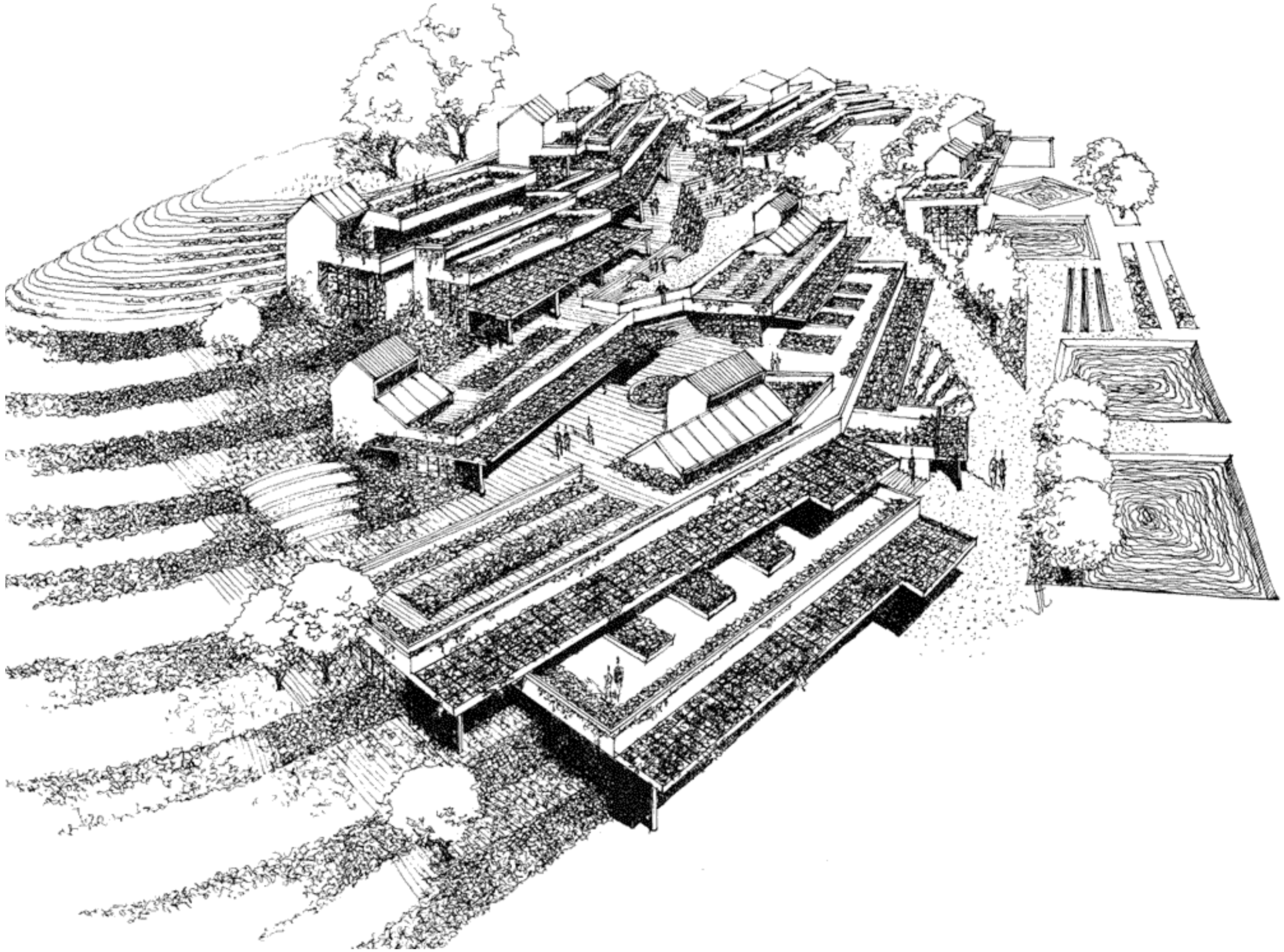


Figure 2.6: Centre for Regenerative Studies perspective sketch (Lyle 1994:279)

Theoretical precedent (Environmental)

The Centre for Regenerative Studies

Lyle (1994:23) categorised ecosystems into three modes of order namely structural order, functional order and locational order. Through an understanding of ecosystems and the three modes of order, a strong conceptual model could be formulated of the world in order to create a solid foundation for regenerative design.

Lyle (1994:23) defines structural order as '*the composition of living and nonliving elements*' this includes soil, rocks, animal and plant species. When considering an ecosystem's structure it is vital to be mindful of all the interactions between living and non-living elements.

Functional order assumes the role as the second mode within an ecosystem. It is defined as '*the flow of energy and materials that distribute the necessities of life to all of the species within an ecosystematic structure*' (Lyle 1994:23).

The energy that a landscape receives from the sun on a daily basis and the transformations it undergoes as it is reflected, absorbed or photosynthesised is a good example of this. Unlike energy, nutrients, water and various other materials do not have a continuous source of supply, instead they are regularly recycled. This cyclical system is also evident in the food web, relating closely to energy flows, as it provides living creatures with the necessary materials for effective body functioning (Lyle 1994:23).

Locational patterns form the third and final ecological order. All ecosystems are unique to their specific location and the number and type of species that can be supported by an ecosystem depends heavily on the environment created by the unique local conditions in the form of soil, climate and topography (Lyle 1994:24).

A single site often comprises of varying conditions such as microclimates and topographical differences creating complex patterns and laying the foundation for opulent patterns of development to transpire. This provides the perfect opportunity for the restoration of lost connections between place and people and the connection between natural processes and people.

The design of The Centre for Regenerative Studies is based around the concept of a human ecosystem. Although the landscape was developed to serve human purposes, the system is ecological in nature and comprises of processes that support life and function the same as natural systems (Lyle 1994:31). The basic principles of ecological order in the form of structural, functional and locational patterns were used in the design of the centre.

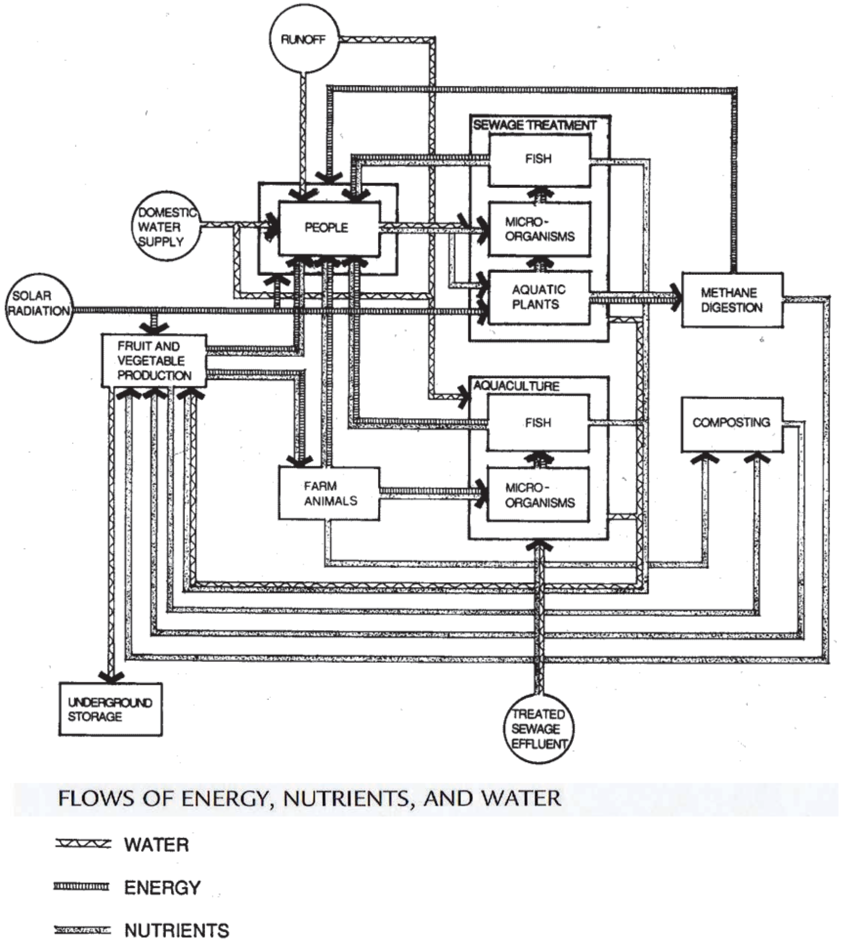


Figure 2.7: Network diagram depicting the functional order of the Centre for Regenerative Studies (Lyle 1994:33)

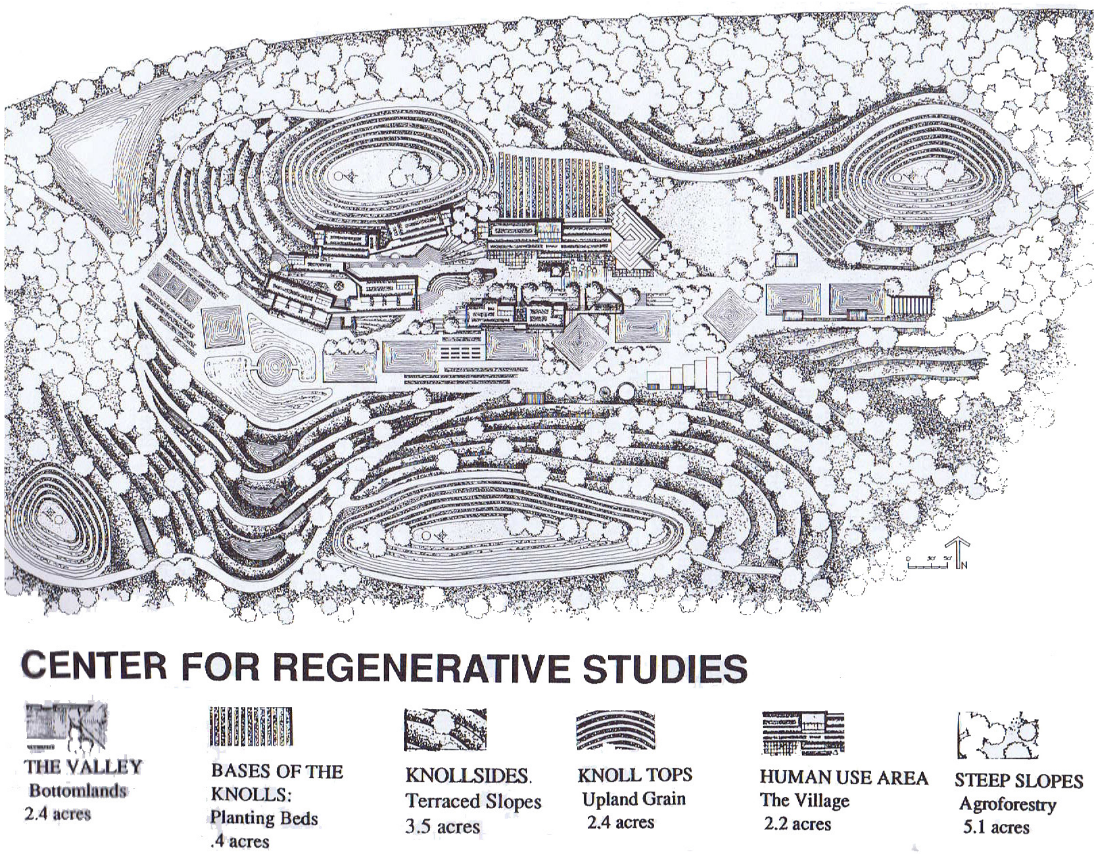


Figure 2.8 Above: Centre for Regenerative studies site plan (Lyle 1994:47)

In terms of structural order, the site was developed according to the principles of interactive diversity, with an array of cultural and biological activities housed on the site (Lyle 1994:31). The crops are grown in a dramatically different manner than conventional industrial agricultural farms. Instead of having single-crop monocultures, the complex topography lent itself to the planting of five different cropping systems consisting of polycultural combinations, encouraging species diversity. The complex polycultural structures need little energy to remain stable and require no chemicals. The rationale behind this type of cropping system is rooted in the regenerative systems' diverse structural nature, which offers various ways of achieving a specific task, at the same time using the interactions between species or elements to strengthen the system in its entirety. This creates a level of resilience within the structure.

The functional patterns of a natural system have the same general operational flow to that of an intricate assembly of diverse species, connected through a network of material and energy flows (Lyle 1994:32).

The species used in these systems are quite diverse and mostly controlled by human management. Figure 2.7 illustrates the various flows of nutrients, energy and water, working together to form a complex functional structure.

After the site's locational patterns were analysed, it was identified as a '*microcosm of the global agricultural landscape*' and through a very selective process, locations on site were identified where the various food-growing conditions could be imitated (Lyle 1994:34). The site was categorized into six areas as illustrated in Figure 2.8 and a specific use was allocated to each, in order to maximize the category's potential. 'Knolltops' were identified as areas for energy generation, 'flatter knollsides' were used for grain-growing and 'knollsides' for terraced agriculture. The 'valley bottoms' were identified as areas for aquaculture and any water-related crops, 'steep slopes' for agroforestry as a means of stabilizing the soil and the 'south-facing knollsides' as the location for the village (see Fig.2.9).

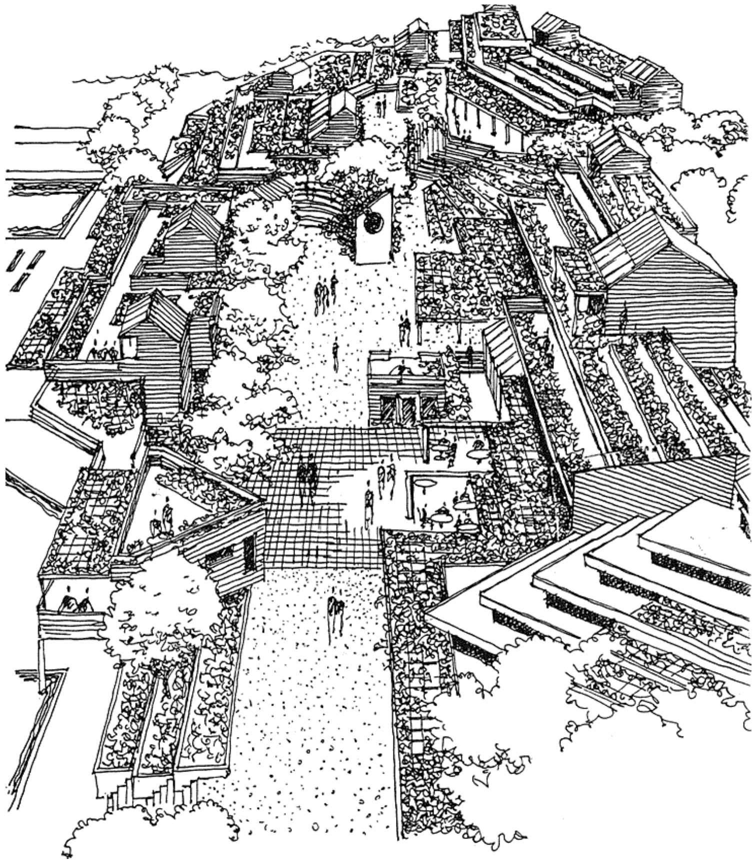


Figure 2.9: Perspective of the village at the Centre for Regenerative Studies (Lyle 1994:136)

Heritage

The value of Industrial Heritage

The value of industrial heritage is multifaceted as it is not rooted purely in the rarity of particular processes, the intrinsic value of the site itself or the historical consequences left by these industrial activities, but also by the invaluable sense of identity asserting significant social value as it exposes fragments of the lives of ordinary men and woman (TICCIH 2003:171).

Kirovová and Sigmundová (2014:433) believe industrial sites have the potential to mitigate and possibly resolve social as well as environmental issues arising from the past. In order for these former industrial sites to be reintegrated into the surrounding urban and socio-economic structure, appropriate principles of sustainability for adaptive re-use need to be identified and applied (Kirovová and Sigmundová 2014:433). By identifying these principles, the possibility of new functions achieving sustainability and catalysing regeneration and habitability of these previous industrial sites, increases.

Unfortunately South Africa, like many other developing countries, has failed to recognize the value of our industrial heritage and this has led to an absence in the protection of heritage with the necessary measures. This has awoken the fear that industrial buildings might be in danger of extinction if attention and awareness of their value are not brought to the table. Industrial heritage buildings, no longer in use, are often left abandoned leading to deterioration and frequently resulting in the demolition of these structures, leaving only '*ruins of the past*' (Läuferts Le Roux & Mavunganidze 2009:533).

The only legislation currently safeguarding these buildings in South Africa is the National Heritage Resources Act no. 25 of 1999 which states "*No person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage resources authority*" (South Africa 1999:58) and the only guideline given in terms of how a building may be altered for re-use is stipulated in the general notice 218 of 2017 published in the Government Gazette (2017:111), which states that in cases where heritage resources are adapted for re-use, it should enhance the life span of the resource and help generate the necessary income to aid in the conservation of said resources. However, measures should be taken to prevent adaptive re-use from impacting the heritage significance of the resource in a negative way. The Nizhny Tagil Charter was specifically developed for the protection of industrial heritage and was adopted in July 2003 by the International Committee for the Conservation of the Industrial Heritage (TICCIH). The charter classifies industrial heritage as the remnants of industrial culture, possessing significant technological, historical, scientific, social or architectural value (The Nizhny Tagil Charter 2003:170). Mines, factories, mills, workshops and sites where energy used to be generated and transmitted can be classified as part of these remnants. The charter emphasises the importance of the material remnants left by this rapid growth in industry and the need for it to be studied and preserved, as it holds significant human value on an international scale (TICCIH 2003:169).

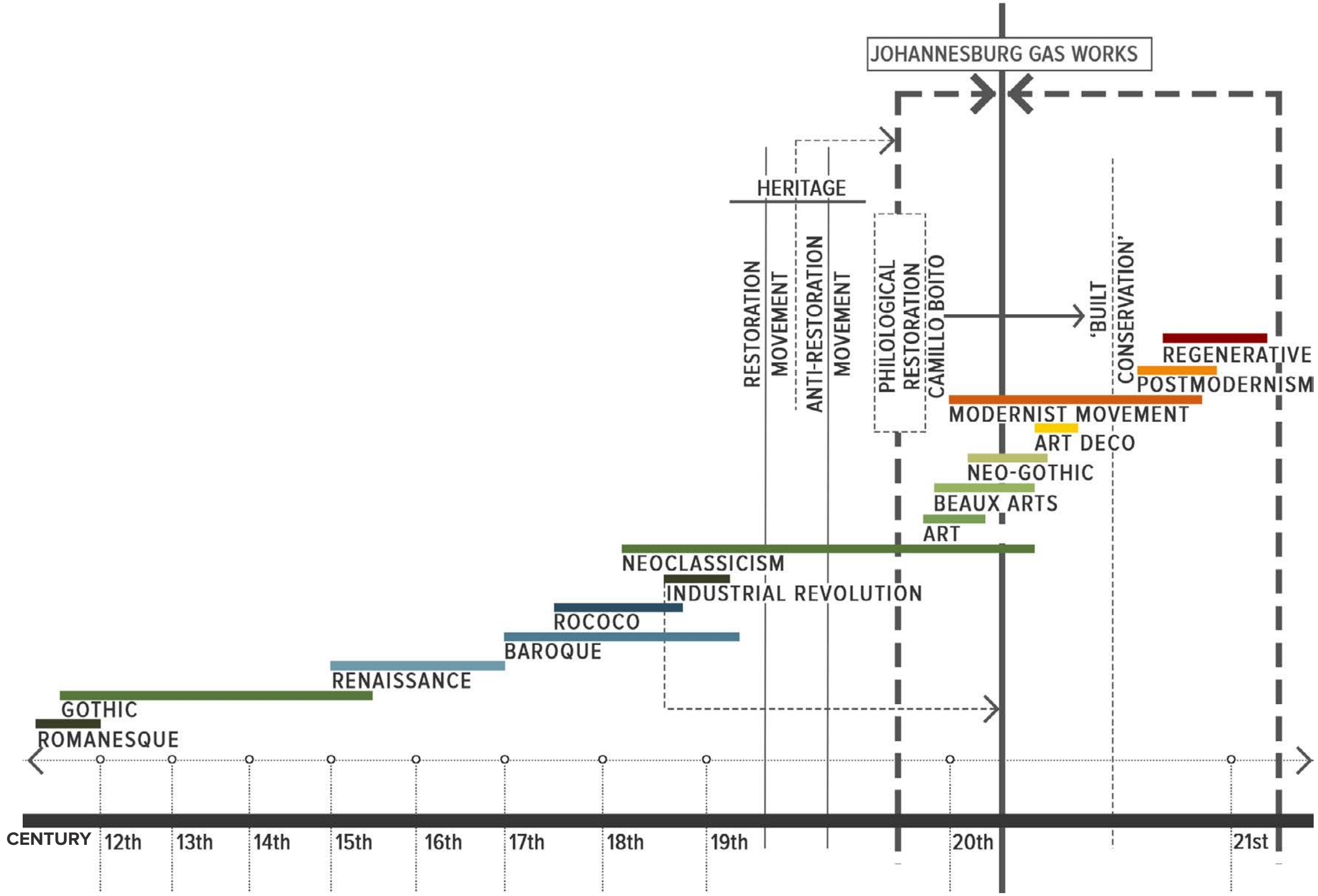


Figure 2.10: Position in the Continuum of Architectural thinking (Author 2017)

Martín-Hernández (2014:42-43) defines preservation as the act of keeping something alive. He argues that preservation is not purely a technique, but rather an approach used to understand the uniqueness of a building or monument in order to make it relevant in the current day and age. The point of departure for preservation is to acknowledge the various transformations buildings or monuments have undergone over time. Preservation protects the sustenance of a building's past exactly through transforming it, however these transformations require special care.

Paolo Torsello, an Italian preservationist, referred to the history of a building embedded in the architectural object itself, as its 'latent form' (Torsello 1989, cited in Martín-Hernández 2014:43). Martín-Hernández (2014:43) believes applying preservation transformations to architectural objects increases the possibility for the object's 'latent form' being exposed.

Henri Bergson believed that "*which does not change does not endure*" (Bergson 1911, cited in Martín-Hernández 2014:43).

Bergson's notion could be interpreted as "*the continuous unfolding of the past into the present and future*" (Martín-Hernández 2014:43) rather than the replacement of one moment in time with another. Retaining identity relies heavily on the ability to adapt the way in which a building or monument's latent form is expressed, in order for it to be understood in the contemporary moment (Martín-Hernández 2014:43).

Heritage conservation strategies have been widely debated for centuries. The 19th century brought about theoretical discussions regarding adaptive reuse as a means to preserve historic architecture. It was during this time that two opposing orthodoxies on the restoration of historic buildings were formed. The restoration-movement led by the French architect and theorist Eugène Emmanuel Viollet-le-Duc and the anti-restoration movement led by the English art critic Johan Ruskin and his apprentice William Morris (Plevoets & Van Cleempoel 2012:1). Amidst these two radical approaches a 'third way' (Hernández Martinez 2008:249) emerged.

The Italian architect Camillo Boito formulated a new theoretical approach which synthesized these opposing theories of Voillet-le-Duc and Ruskin. His approach became known as 'philological restoration', a term originating from the Latin classification of a monument as document or inscription. This implied that a monument could be seen as a document, constructed to convey a specific message and should therefore not be falsified (Stubbs & Makas 2011:16). Boito was clearly influenced more by the theories of Ruskin and Morris as he advocated conservation over restoration. Boito believed that restoration should only be used in cases where a monument is in grave danger of disappearing and even then, the intervention should be minimal and respect the epoch of the building by not attempting to recreate it stylistically. Boito believed that in order to prevent falsified stylistic recreations, any additions constructed in the restoration process should be done in a distinguishable architectural language, using materials and forms that were unlike those used in the original structure. Boito also advocated the use of contemporary architecture in restorations, possibly as an additional strategy to avoid falsification of the original architectural style (Hernández Martinez 2008:249).

According to Hollis (2003:5) a philological approach to restoration does not focus purely on exposing the aesthetic unity of a historic building, but rather improving the legibility of the diverse fragments that constitute the whole. The consequences of philological restoration are not just prevalent in the debate on conservation, but also in the contemporary field of historic building extensions and alterations. According to Hollis, Italian architect Carlo Scarpa, was one of the most influential practitioners in this field.

Figure 2.11: Preservation through transformation (Author 2017)

Theoretical precedent (Heritage)

Castelvecchio by Carlo Scarpa

The alterations made to the Castelvecchio in Verona by Scarpa are binary (Hollis 2003:5). Scarpa exposed the historic layers of the structure through excavations, which had undergone various alterations over time, and at the same time added new layers to the structure to allow the Castelvecchio to adopt a new function as museum (see Fig.2.12).

The additions made by Scarpa seem to divert from the order prevalent in the old building and the distinctly modernist additions are in 'a dialectical relationship' (Hollis 2003:5) with the old due to the contrast created between the light asymmetrical modernist additions and the existing 'classical stereotomic mass' (Hollis 2003:5) .

Figure 2.13 illustrates the way in which Scarpa makes use of shadow lines and contemporary materials to create a distinct separation between the old and the new (Hollis 2003:5). By doing this, he is able to connect the two eras whilst exposing their inherent differences. This reveals Scarpa's ability to adapt existing buildings to foster new functions while still adhering to the principles of philological restoration.

Philological restoration, preservation and transformative resilience all have underlying similarities. Transformative resilience aspires to discover the latent potential of a building or site as a means to revive it. Preservation, as defined by Martín-Hernández, aims to protect a building's latent form, referring to the history embedded in the building itself, exactly through transforming it, in order to make it legible in the contemporary era. This creates a strong metaphor for a building as a document containing a specific message, linking back to the philological approach to heritage.

These collective theories create a strong visual of post-industrial sites possessing latent form, messages and potential just waiting to be resuscitated. The unifying factor being the stagnant nature in the potential of buildings in need of some sort of reaction to activate, expose or restore them. Regenerative theory could be the catalyst for this type of change.

Figure 2.12: Entrance at Castelvecchio (Tyler 2013)

Figure 2.13: Details of junction between old and new (Tyler 2013)

Locational precedent

Thesen Island - The Turbine Hotel

Background:

Thesen Island is located in the northern part of the Knysna lagoon. The Thesen family, who relocated from Norway to Knysna in 1870, played a vital role in the history of this island as well as the development of Knysna's timber industry (Hart & Halkett 1998:3).

The Thesen family was responsible for the advent of industrialization on the island with the establishment of the Thesen & Co sawmill operations. Milling operations were conducted in the sawtooth building (see Fig. 2.14) and a small power station (see Fig. 2.15) was erected in 1939 to power all the island's operations. (Edwards 2017:89).

For over a 100 years, Thesen Island was a hub for timber milling, power generation and ship building, aiding in the development and prosperity of Knysna. The island was purchased by the Barlow's Group in 1974 and timber milling continued until the 1980s when it was decided to close down all operations due to a decline in the lucrativeness of the business. The industrial buildings and machinery began to decay. The neglect of the island resulted in a wasteland posing serious health risks to the population still residing on the island as well as to the environment (Edwards 2017:90).

Heritage value:

Hart and Halkett (1998:12) acknowledges the fact that South Africa has often failed to comprehend the importance of industrial heritage which has led to an absence in creating the necessary measures to protect these structures.
The old power station, although much smaller in scale than most other power stations, had significant value in terms of its contribution to the socio-economic development of Knysna as well as the industrialisation of the island and its surrounding areas (Edwards 2017:94).

The Turbine Hotel:

The location of the abandoned industrial buildings relative to the sensitive ecology of the Knysna lagoon prompted the need for redevelopment of the island and its abandoned industrial buildings (Louw 2015:928). The island was redeveloped into a 'mixed-use marina' (Louw 2015:928) which is made up of 650 residential units and a central commercial zone referred to as Thesen Harbour Town. It is in this core that the old power station is situated. Outdated technology caused the old power station to become redundant and it was therefore proposed that it be converted into a hotel. The hotel is just one of the many industrial structures in the precinct to be adaptively re-used.

Preservation of the sense of place:

During the conversion of the old power station into the Turbine Hotel, the goal was to retain the sense of place of the powerhouse (Louw 2015:932). This was achieved by retaining as much of the original machinery and piping as possible. The piping was repainted to match the colour of the original pipes and new pipes were added in a different colour palette in order to follow the flow of both the old and new processes. One of the oldest boilers was identified and refurbished with the guidance of heritage professionals. The vaulted furnaces were also refurbished into a bar that now serves the hotel's new conference rooms.

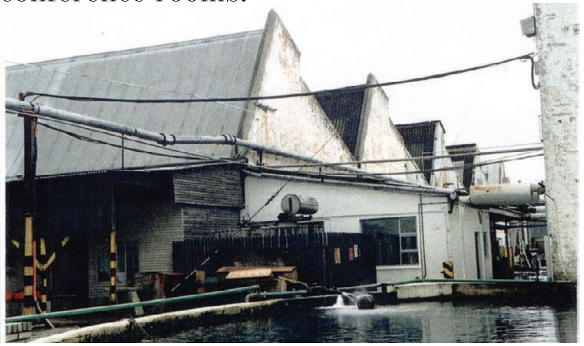


Figure 2.14: Sawtooth building (Hart & Halkett 1998:22)

Figure 2.15: Power station before adaptive reuse (Hart & Halkett 1998:24)

Figure 2.16: The Turbine Hotel (Stay Review 2012, edited by Author)

Chapter 3

Context

03 Context

History of the old Johannesbrug Gas Works

The old Johannesburg Gas Works has a unique character that is dictated by its primary landform and various climatic, historical, social and ecological forces. All these factors contribute to the sense of place that exists on site and provides a way in which to assess its intrinsic potential (Haggard, Reed & Mang 2006:2). It is this agglomeration of factors that creates a dynamic image of potential human activities that could match the land's aspirations in order to create a thriving marriage between natural and built systems.

After the discovery of gold in Johannesburg in 1886, news spread at a rapid rate and the area experienced an unparalleled gold rush (Jones 2003). The area which originated as a tented camp to service the needs of the Witwatersrand mines, managed to establish itself as the largest city in Southern Africa and assume its role as a pioneer of industry, finance and commerce within a mere fourteen years after its establishment. The city's phenomenal growth led to the rapid transformation of Johannesburg as a tented camp, with temporary corrugated iron structures in 1886, to an agglomeration of permanent multi-storey buildings made from brick-and-mortar in 1890 (SAHO 2011).

Gas was the first form of power supplied to the Johannesburg mining camp, which at that point in time, had access to quite rudimentary services. With the rapid growth in population the need for gas became more evident (Tsica Heritage Consultants 2011: 7).

On 15 October 1888 the President of the Transvaal Republic, Paul Kruger, signed a concession giving William Edward Dawson and his business

Figure 3.1: Left: Condensers (Author 2017)

partner John James Hamilton exclusive rights to produce and distribute gas in Johannesburg for the next fifty years. The next 44 months saw the beginning of construction and the acquiring of the necessary machinery for the Gas Works. The first Gas Works in President Street was finally opened in 1892, but unfortunately this was the same year Dawson and Hamilton's company was dissolved and the Johannesburg Lighting Company took over the concession which was extended to 99 years. The Johannesburg Lighting Company commissioned a company in England to design the gas plant and shipped the machinery from England to East London, from where it was transported by ox wagon to Johannesburg (Tsica Heritage Consultants 2011: 7). The President Street Gas Works situated in Newtown first started operating on 23 June 1892 and the plant continued to supply Johannesburg with gas until its closure on 23 December 1928. The need for the expansion of the Gas Works became apparent after World War I as the demand for gas increased. However the President Street site was found unsuitable for expansion and the search for a more appropriate site was initiated (Tsica Heritage Consultants 2011: 7).

After extensive consideration the Cottesloe site was finally deemed an appropriate site for the new gas works. Construction of the new Gas Works started in 1926 and it became operative on 23 December 1928, the same day the President Street Gas Works closed down (Tscia Heritage Consultants 2011: 8). The Cottesloe site had sufficient space, was located on the outskirts of town and according to the engineer's opinion, the slight slope aided the gravitational flow of the liquids involved in the process of making gas. The gas cylinders were positioned on the lowest part of the site out of public view, but the strategy for concealing the cylinders later became ineffective as additional cylinders of a much larger scale were constructed on site (Tsica Heritage Consultants 2011:8). The method of gas production eventually became antiquated and production was ceased with the plant's closure in 1992.

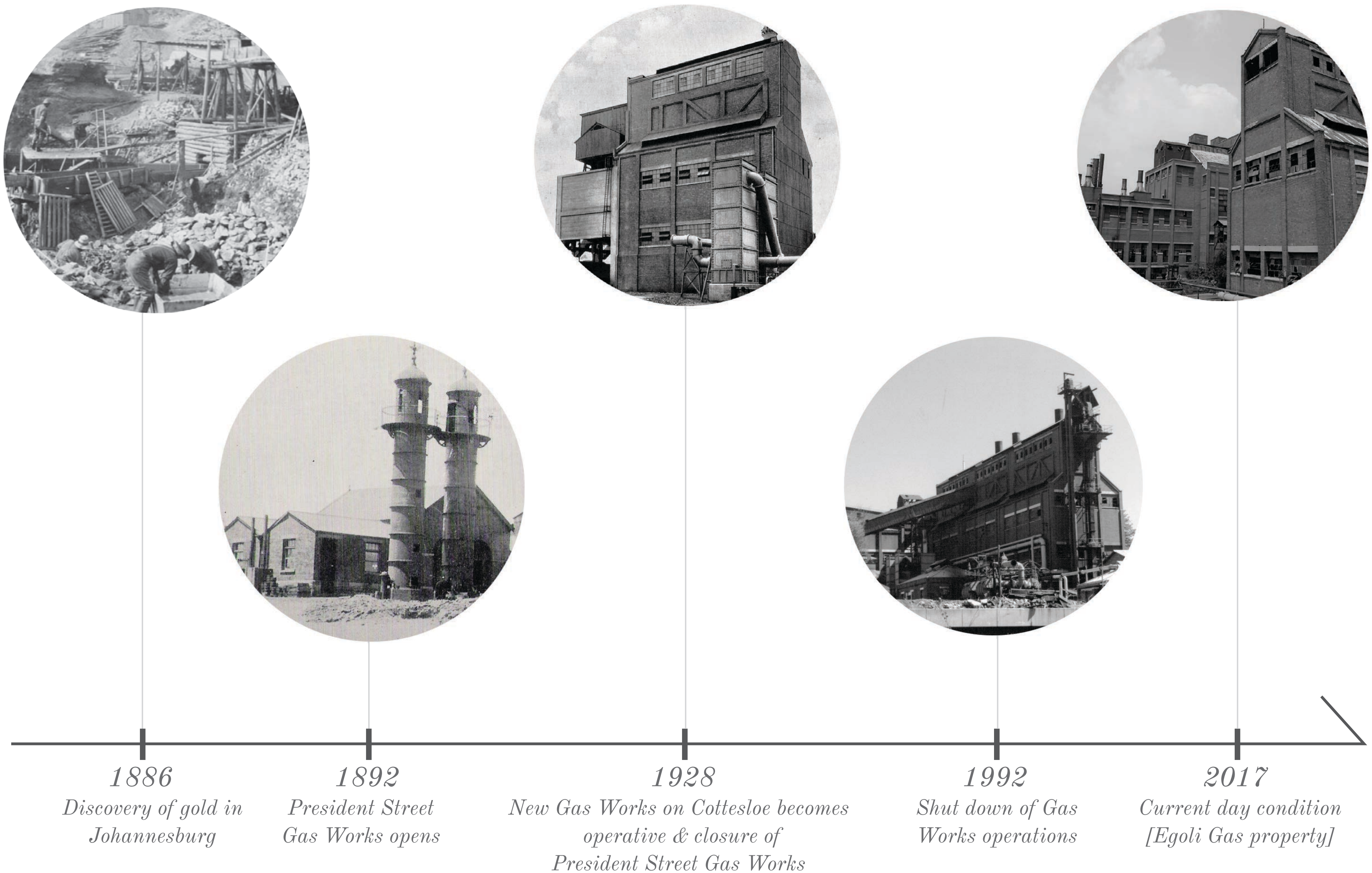


Figure 3.2: Timeline of Gas Works' development (Author 2017)

1960 Aerial photograph of the Johannesburg Gasworks

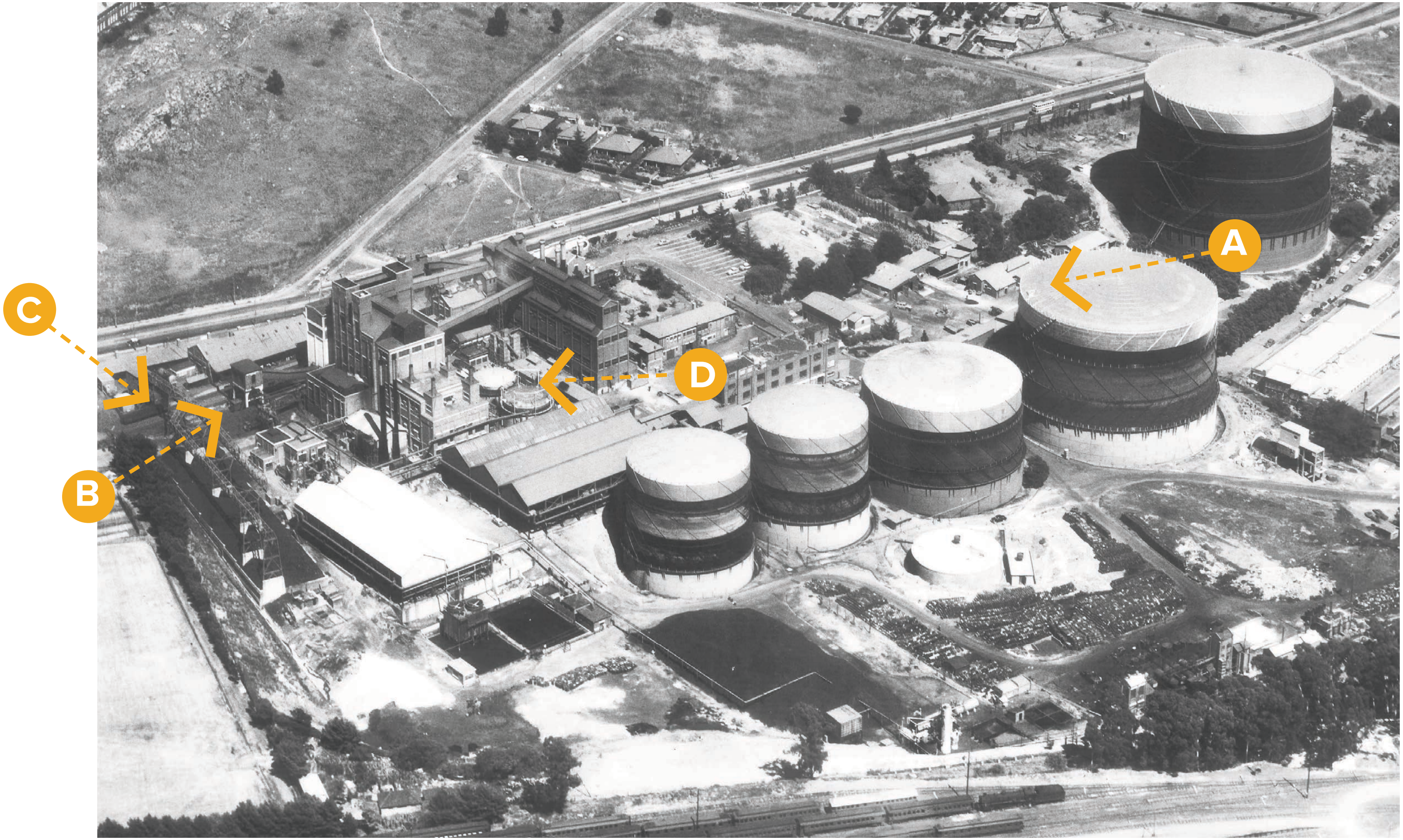


Figure 3.3: Aerial photo of Gas Works in 1960 (City of Johannesburg Gas Department 1960, edited by Author)

Historic images of the Johannesburg Gasworks during the 1950s:

Figure 3.4: View from gasholder towards retort 1& 2 (City of Johannesburg Gas Department 1950's)

Figure 3.5: Coke screening & loading plant (City of Johannesburg Gas Department 1950)

Figure 3.6: Coke handling plant with weighbridge in foreground (City of Johannesburg Gas Department 1950's)

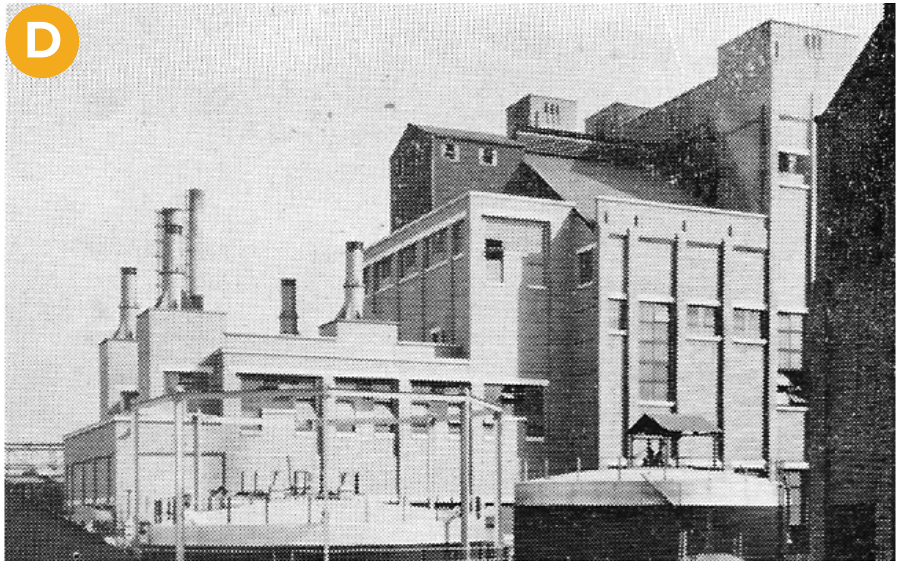
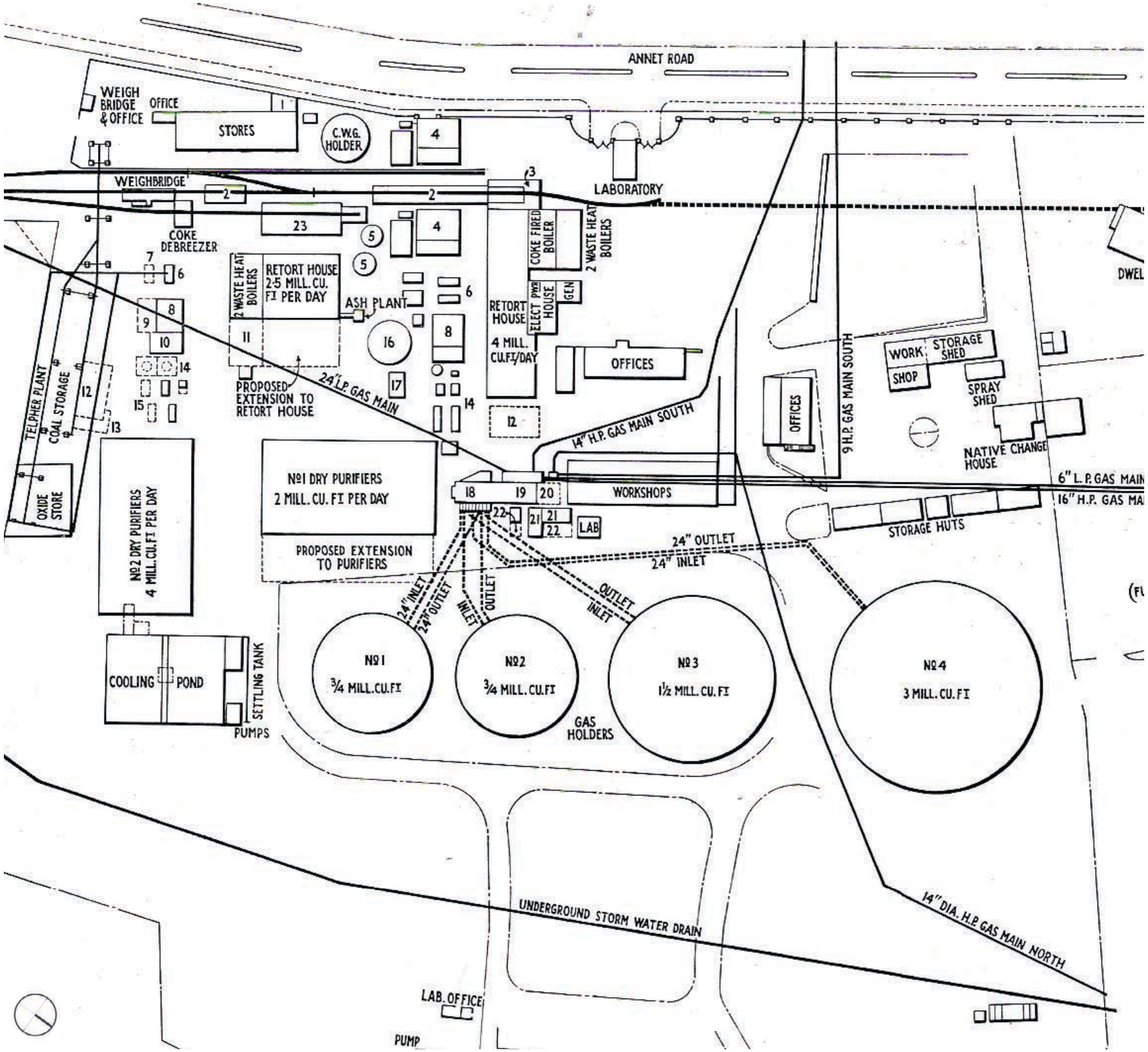


Figure 3.7: Exterior of Tully gasification plant in 1959 (City of Johannesburg Gas Department 1959)

1954 Block plan of the Johannesburg Gasworks



Legend:

1. Oil store
2. Coal hoppers
3. Coke storage (210 tons)
4. C.W.G. plant
5. Fule oil tanks
6. Condensers
7. Future condensers
8. Exhausers
9. Future Exhausters
10. Powerhouse
11. Proposed future boiler house
12. Underground tar and liquor wells
13. Underground pump house
14. Future detarrers
15. Livesey and static washers
16. No. 1 C.W.G. holder
17. Detarrer generator house
18. Meters
19. Boosters
20. Pumps
21. Dehydration plant
22. Future dehydration plant
23. Cake grading and storage

Figure 3.8: Block plan of Johannesburg gasworks (City of Johannesburg Gas Department 1954, edited by Author)

Historic images of the partial demolition of Johannesburg Gasworks during the 1990s:

Figure 3.9: Tully plant and Retort 2 (Peter Finsen 1990s, edited by Author)

Figure 3.10: Tully plant (Peter Finsen 1990s, edited by Author)

Figure 3.11: Retort 2 and Tully plant (Peter Finsen 1990s, edited by Author)

Figure 3.12: Coke grading & storage, Retort 2 and power house (Peter Finsen 1990s, edited by Author)

The Gas Works Today

The expansion of Johannesburg has left the gasworks site nestled between the University of Johannesburg to its west and the University of the Witwatersrand to its east. The buildings on site, some of which date back to as early as the 1920s, are constructed in a Pre-World War II Industrial style (Munro 2016) with the two retort[3] houses constructed from red brick with enormous steel beams stretching from floor to ceiling, reaching a height of up to six storeys (Joburg 2011). Since the closure of the gasworks the buildings have been inactive, desolate and neglected.

The hazardous process of coal to gas has left remnants of its destruction on the Old Johannesburg Gas Works site, in the form of tar and other harmful pollution.

The site is currently isolated and the empty shells of industry are abandoned and left to be consumed by nature and the clutches of time. This creates a visual contrast between the buildings and the landscape, surrendering to that which it once oppressed. This site provides the perfect opportunity for restitution between not only industry and nature but also industrial heritage and the city dwellers. This is in an attempt to reactivate the site's latent potential of being a productive and relevant site once again. Applying the principles of ecosystemic and living systems thinking, the challenge arises for the development of a new typology for abandoned industrial heritage sites such as the Old Johannesburg Gas Works.

Heritage consultants are trying to prove the importance of these industrial structures and the vital role they play in providing the city scape of Johannesburg with visual and historical landmarks. Läuferts Le Roux & Mavunganidze (2009:533) believe that including these buildings in the city's regeneration will aid in protecting the cultural heritage of the city. They urge the City of Johannesburg to look beyond its boundaries in order to grasp the importance of re-using industrial heritage (Läuferts Le Roux & Mavunganidze 2009:533).

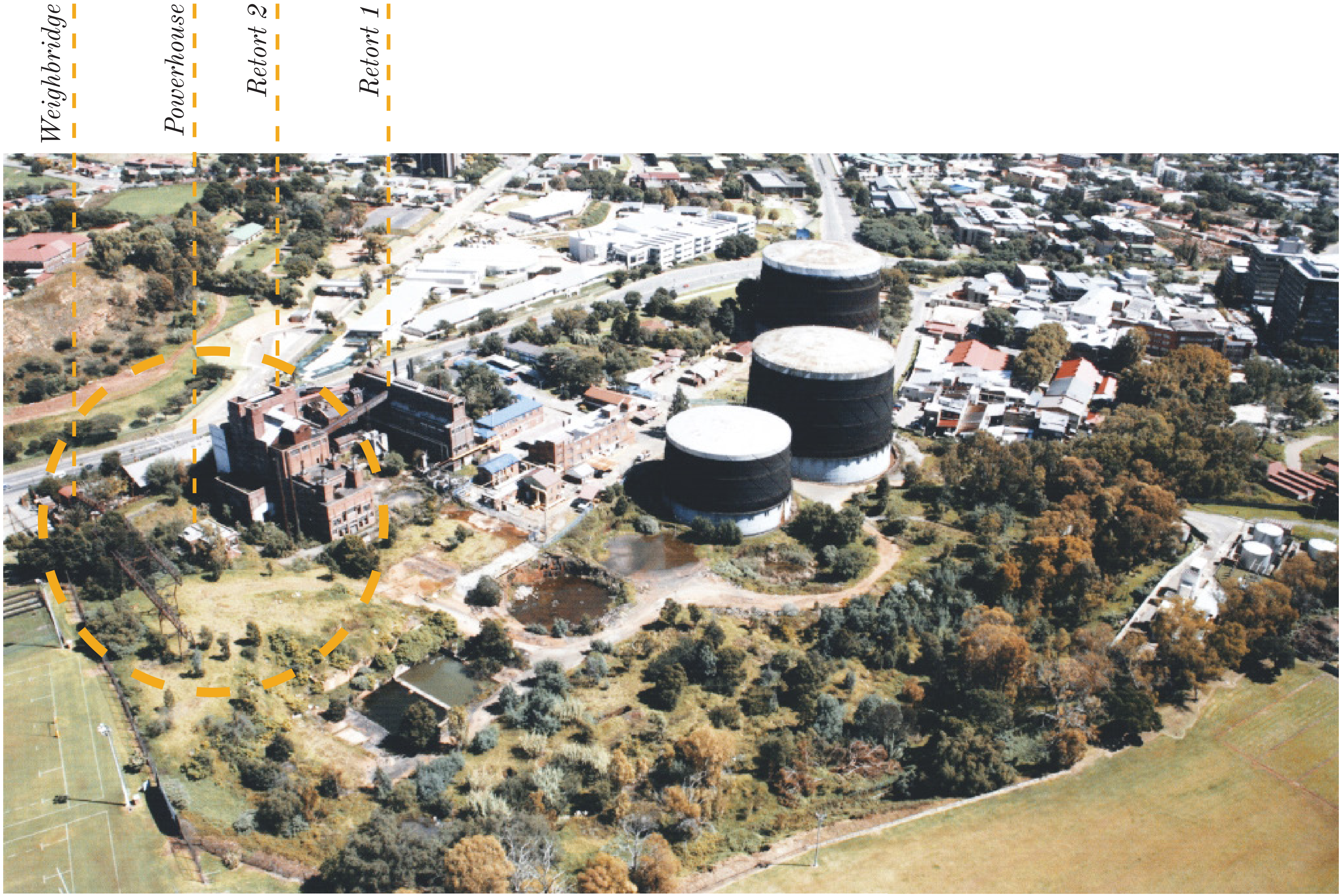


Figure 3.13: Aerial view of Johannesburg Gasworks 2009 (Egoli Gas 2009, Edited by Author)

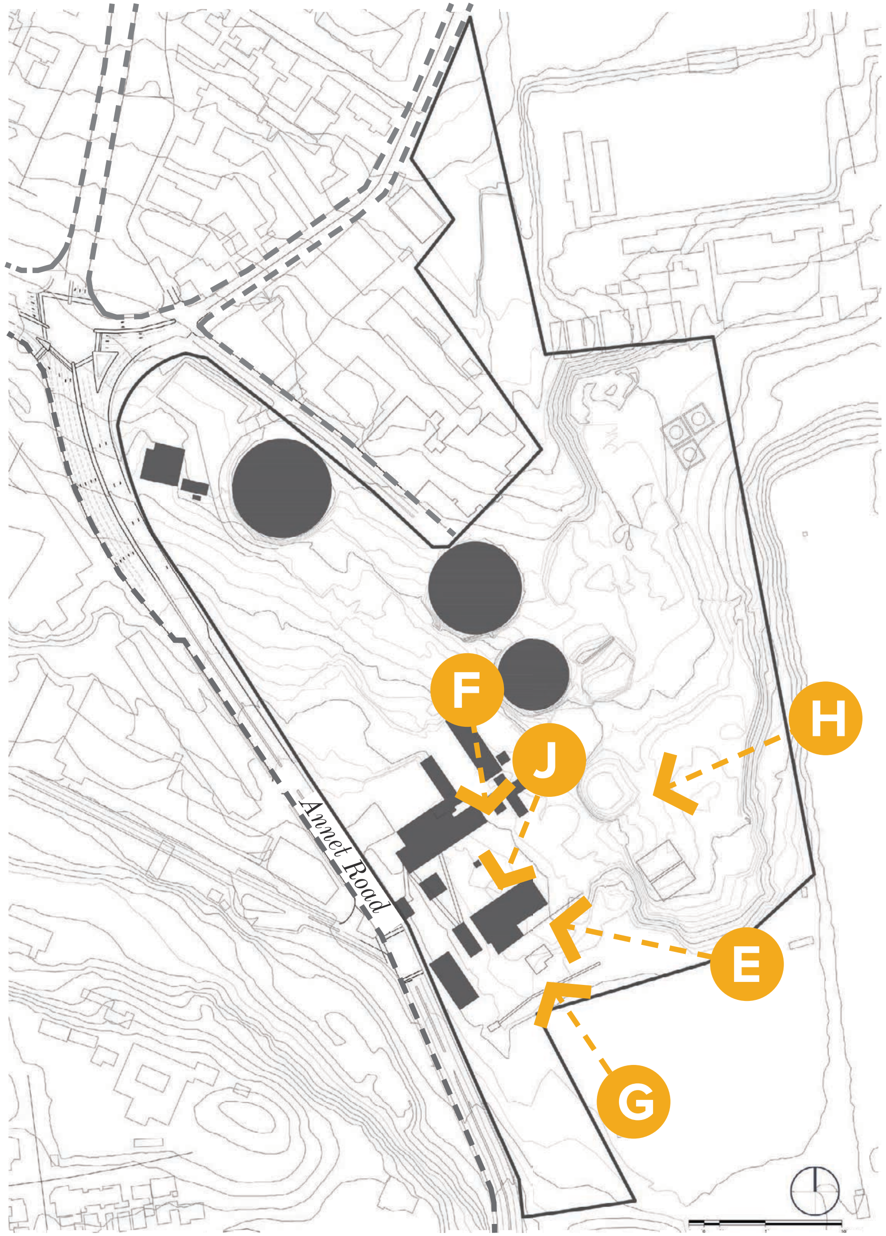


Figure 3.14: Site map of Gas Works (Author 2017)

Figure 3.15: View E (Author 2017)

Figure 3.16: View F (Author 2017)

Figure 3.17: View G (Author 2017)

Figure 3.18: View H (Author 2017)

Figure 3.19: View J (Author 2017)

Figure 3.20: Spatial economy (Author 2017)

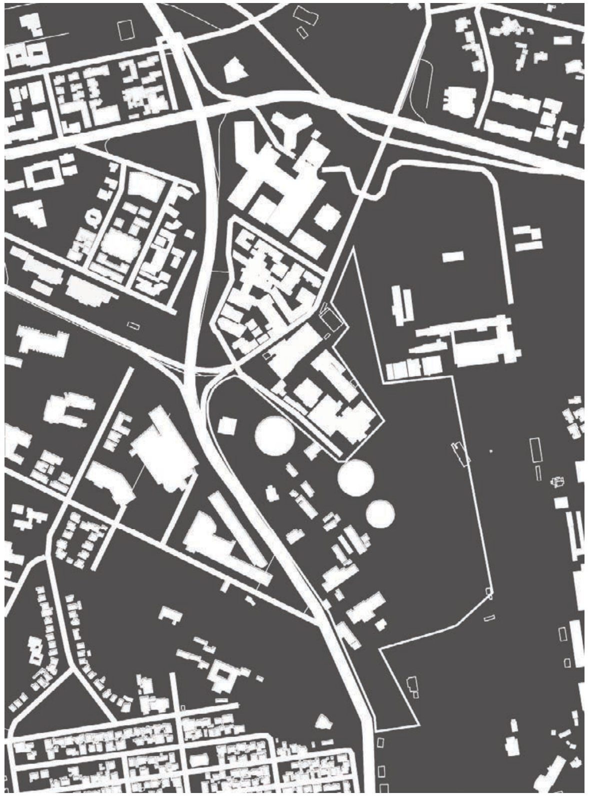


Figure 3.21: Nolli map (Author 2017)

- *Old Johannesburg Gasworks buildings*
- *Educational buildings*
- *Public transport*
- *Residential*
- *Mixed use buildings*
- *CSIR*
- *Commercial*
- *Religious buildings*

The old Johannesburg Gas Works's Latent Potential

When applying regenerative and resilience thinking to create a thriving city, the professional is endowed with the responsibility of identifying certain aspects or systems that may need to collapse in order to make way for new life to sprout from the site's latent potential (Du Plessis 2013:38).

The latent potential of the old Johannesburg Gas Works is rooted in its industrial heritage and its legacy of production. However, the historical process of coal to gas is no longer relevant and the remnants of pollution on site, exposes the dichotomous relationship between industry and nature and exemplifies the need for restitution between these two opposites in order for the system's health to regenerate.

Regenerative projects not only focus on the natural environment, but also strive to deliver new capabilities to the communities that surround them. They understand the need for the integration of economic activities that accompany development into the continuous stability and health of local communities (Haggard, Reed & Mang 2006:1). An appropriate programme for the Old Johannesburg Gas Works will therefore have to be of a productive nature, providing the architecture with an opportunity to mediate between industry and nature whilst regenerating living and socio-economic systems on site.

In order to identify which socio-economic systems to regenerate, the context of Johannesburg's inner city should be analysed to identify shortcomings and opportunities for socio-economic growth.

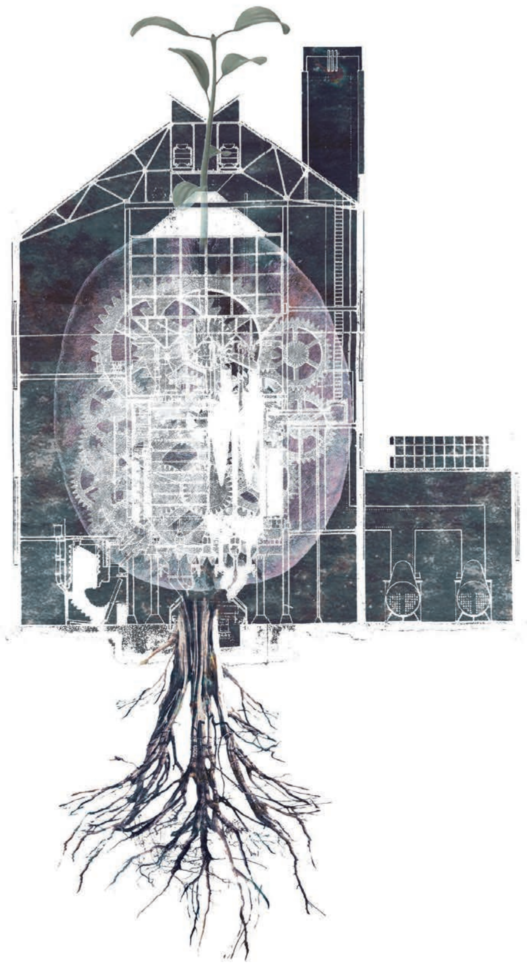


Figure 3.22: Latent productive potential of Gas Works (Author 2017)

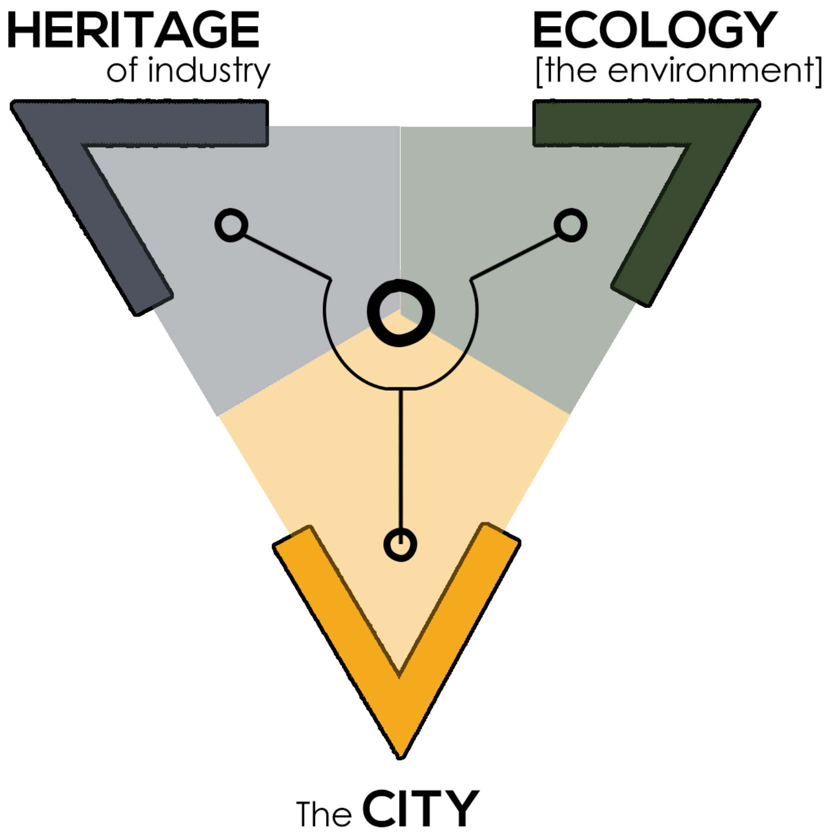


Figure 3.23: Restitutive relationships (Gaswork's group 2017)

Urban Vision

Restitution Park

The current degenerative conditions on site have prompted the need for restitution of various relationships before the site can achieve its maximum regenerative potential. Three dominant categories were identified in the latent potential of the site. These categories include, industrial heritage, ecology and the city dwellers. In order for the site to develop into a future regional node as proposed in the 2040 Spatial Development Framework for Johannesburg, the severed relationships that exist between these main categories need to be restituted. The group proposes that this be achieved through the development of architectural interventions focused on providing a platform for restitution to occur.

The site was analysed and zoned according to the categories most prevalent in that particular zone and the opportunity for restitution between contiguous categories (see Fig.3.25). Each group member was assigned a site from where individual project programmes were developed according to the relationships in need of restitution.

THE CITY TO THE SITE	HERITAGE OF INDUSTRY TO THE PUBLIC	INDUSTRY TO ECOLOGY	LANDSCAPE TO PEOPLE	THE SITE TO THE PUBLIC
THE NEED				
The site is isolated and offers no contribution to the urban experience.	Exposure of the public to significant industrial heritage	Legacy of damage on the natural environment by industry	Open spaces in close proximity to the site are all privatized	The site is inaccessibleto the public
THE REMEDIATIVE APPROACH				
Design the site to be a future regional node for the Empire-Perth corridor to fit into the SDF for Johannesburg. Program site to form part of 6 open space types as defined by JMOSS (ecological, social, institutional, heritage, agricultural and prospective). Provide recreation, conserve natural resources, be ecologically productive, provide environmental, educational and agricultural opportunities and be a viable economic entity to enhance the city's appearance.	Serve people by re-purposing the industrial heritage through the re-use of structures to create the new; as palimpsest to the old. Illustrate layers of history as a way forward In terms of education; exposure to previous privatised processes. Displaying elements & processes by explained signage. Integration into the site & Architecture.	Remediate the polluted areas of the landscape through phytoremediation among other strategies. Use of programs that form mutually benefical relationship with nature. Programs that make use of and strengthen natural production systems.	Providing recreational space (non-privatized) for relaxation, exercise, walking, jogging,cycling, gym Create relationship to land as a provider of consumable resources.	Access & linkage to the site. Connecting nodes (Educational & Social) Connecting transport. Linking edges. Linking as a means of experiencing the site. Creating functions to serve the public and provide accommodation. (City of Johannesburg 2002)

Figure 3.24: Relationships in need of restitution (Gaswork group 2017)

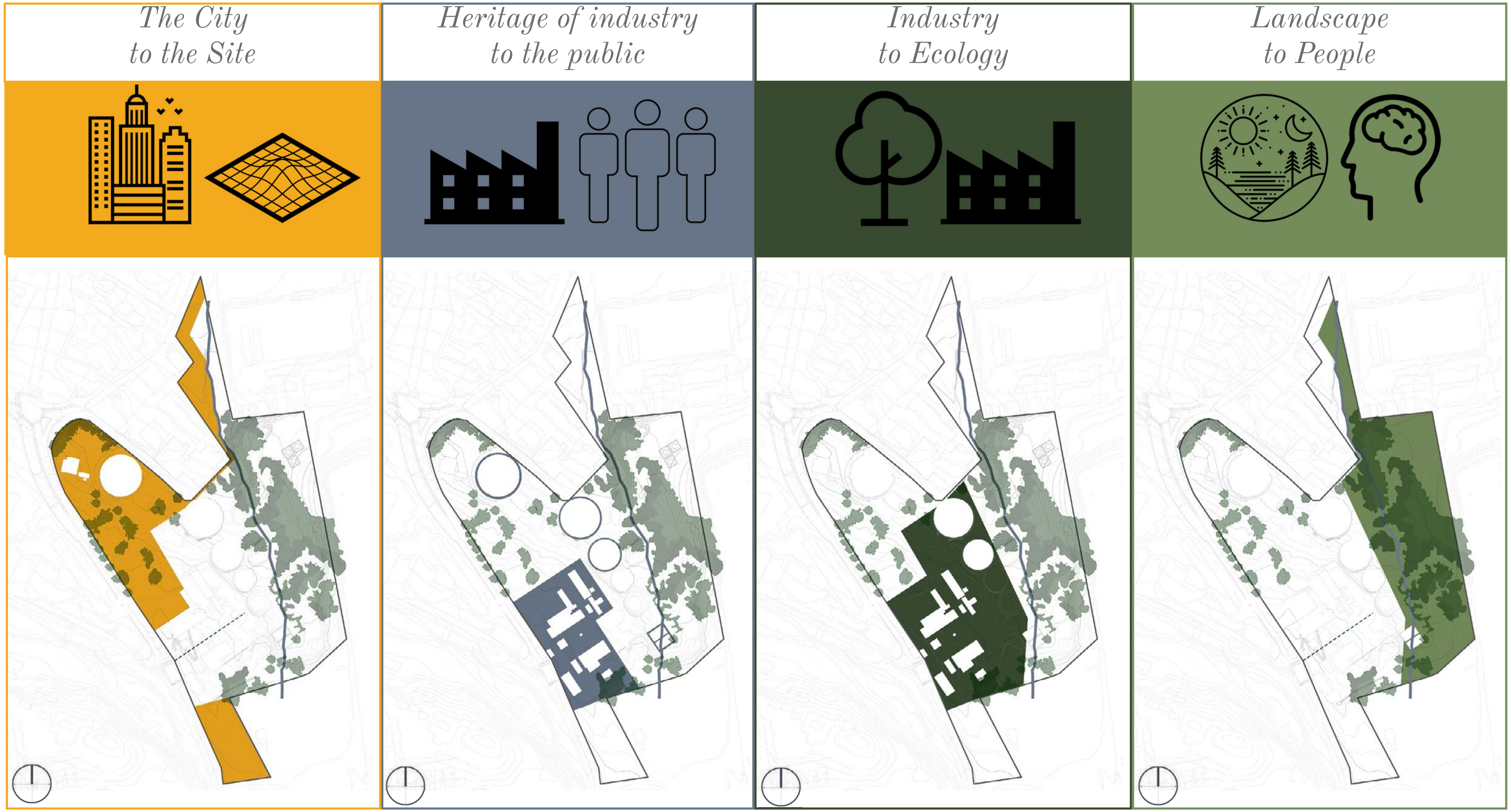


Figure 3.25: Restitution zones (Gasworks group 2017)

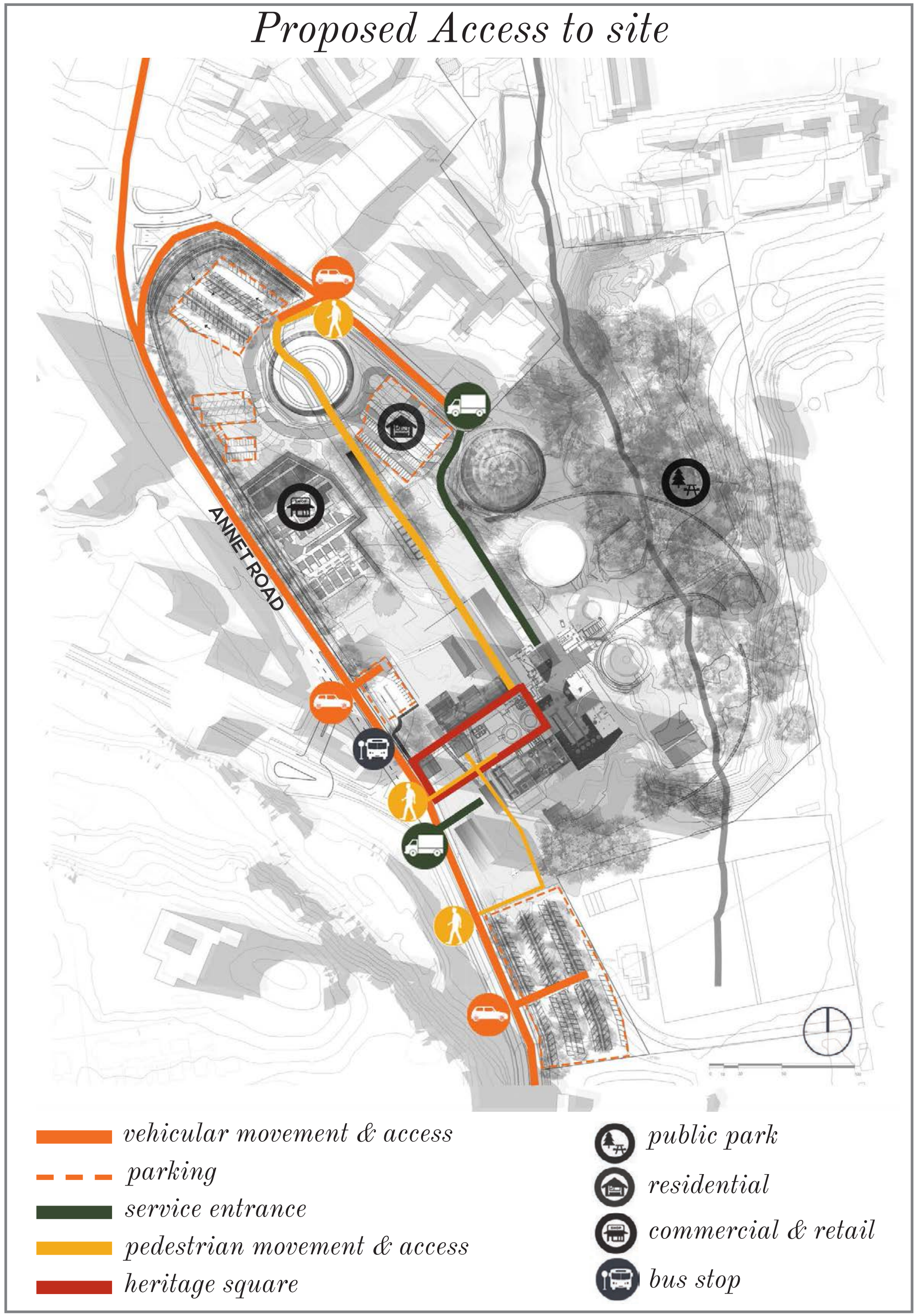


Figure 3.26: Site entrances (Gaswork group 2017)

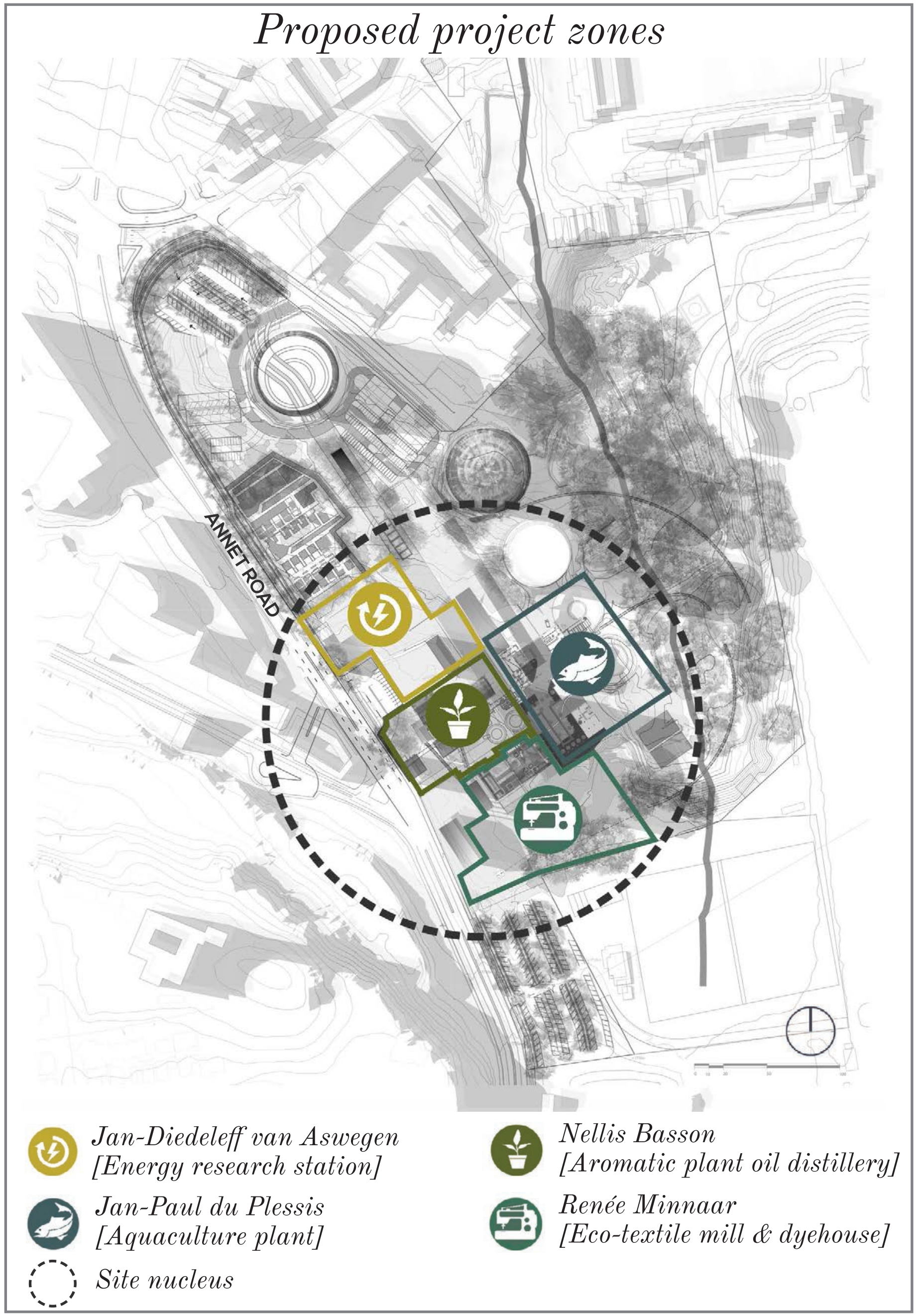


Figure 3.27: Site project zones (Gaswork group 2017)

Site zones

Figure 3.28: Site zones (Gaswork group 2017)

Restitution Park Urban Vision Plan

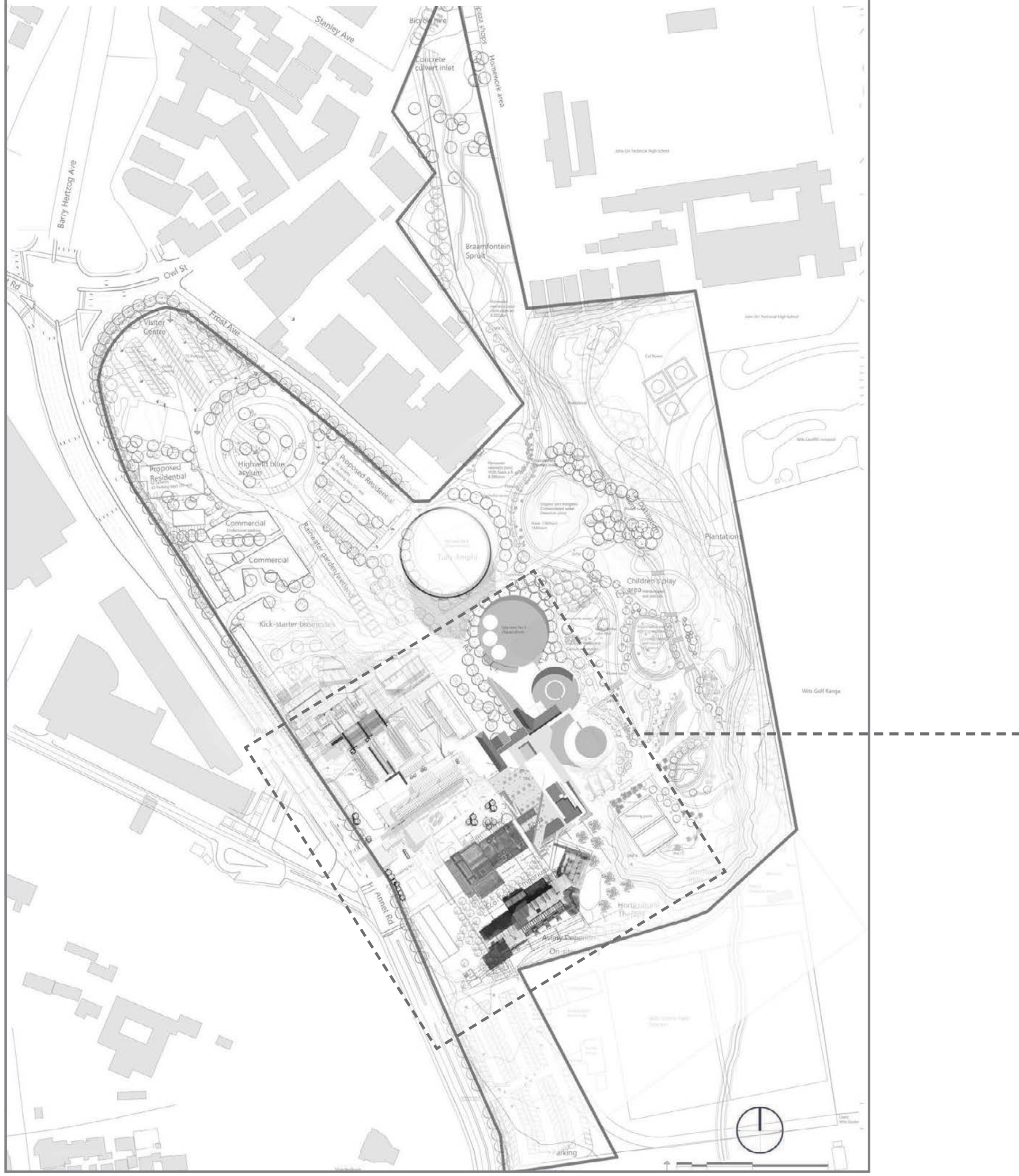


Figure 3.29: Urban Vision Plan (Gaswork group 2017)

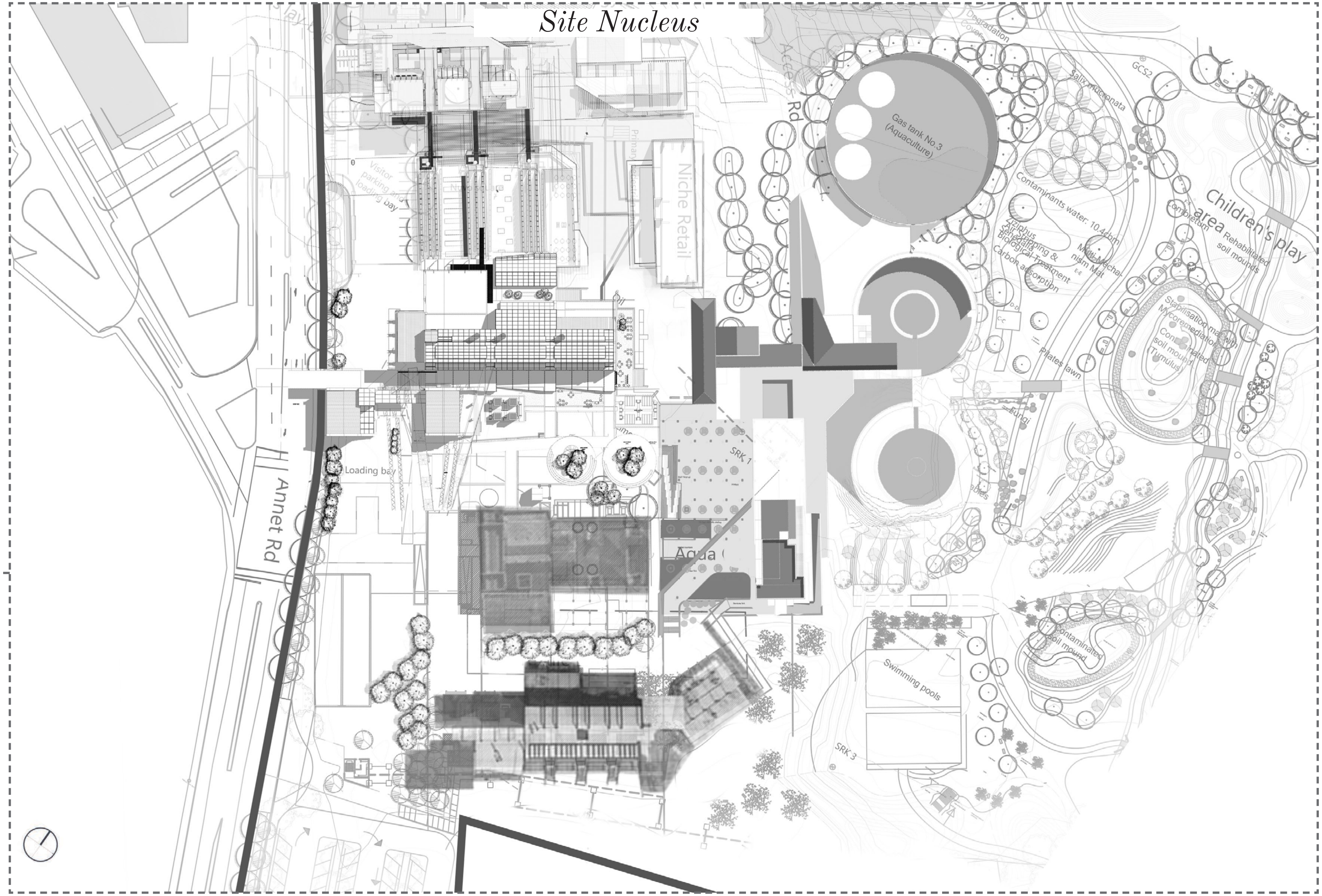


Figure 3.30: Site Nucleus Plan (Gaswork group 2017)

Resource & waste exchange

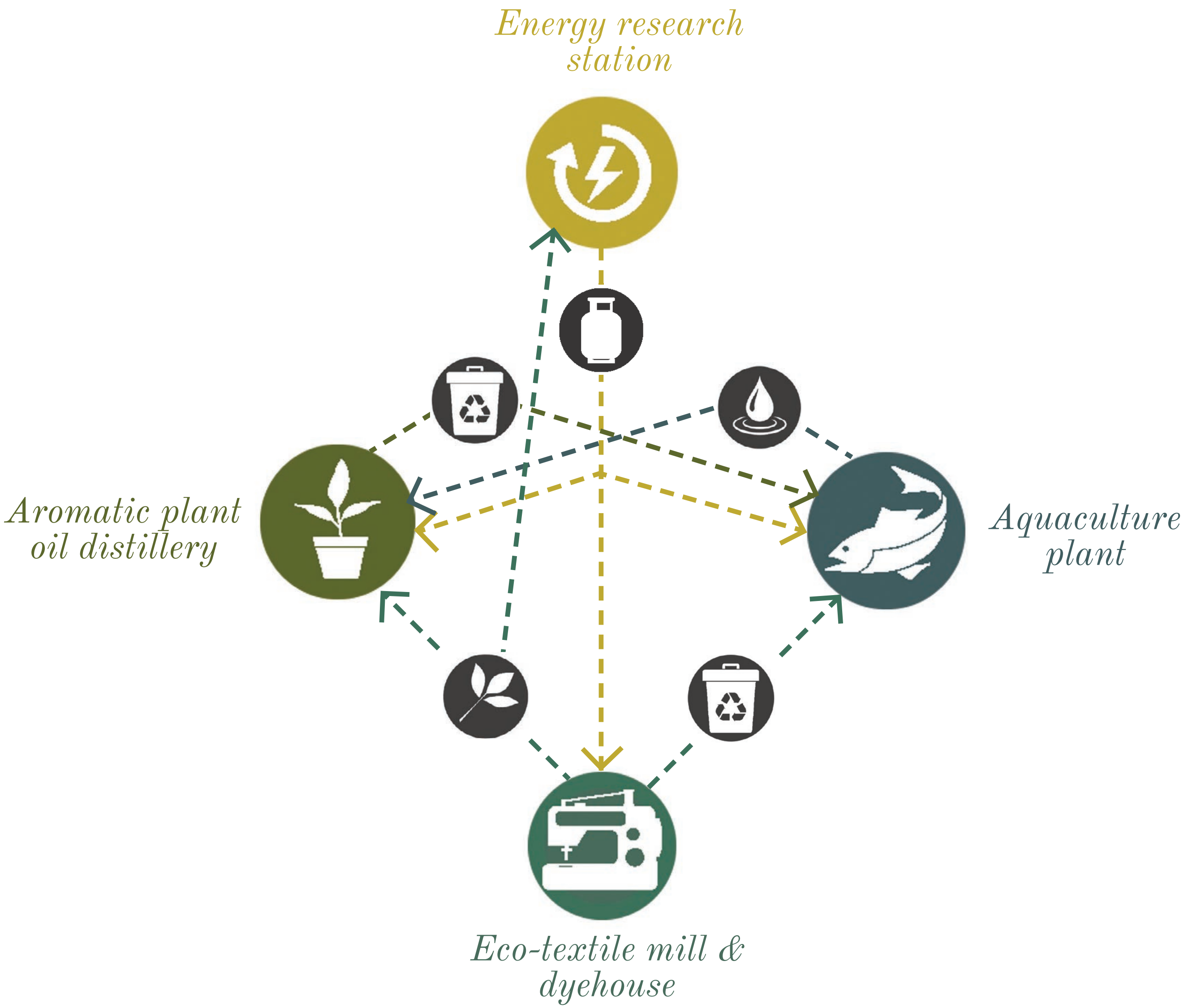


Figure 3.31: Resource and waste exchange (Author 2017)

Industrial ecology strategy

In order to prevent industry from dominating and polluting the surrounding ecology once again, the urban vision proposes a strategy to share resources and waste which is similar to the principle of industrial ecology. This strategy ensures waste reduction and resource optimization through the implementation of mutually beneficial relationships between the proposed new industries on site.

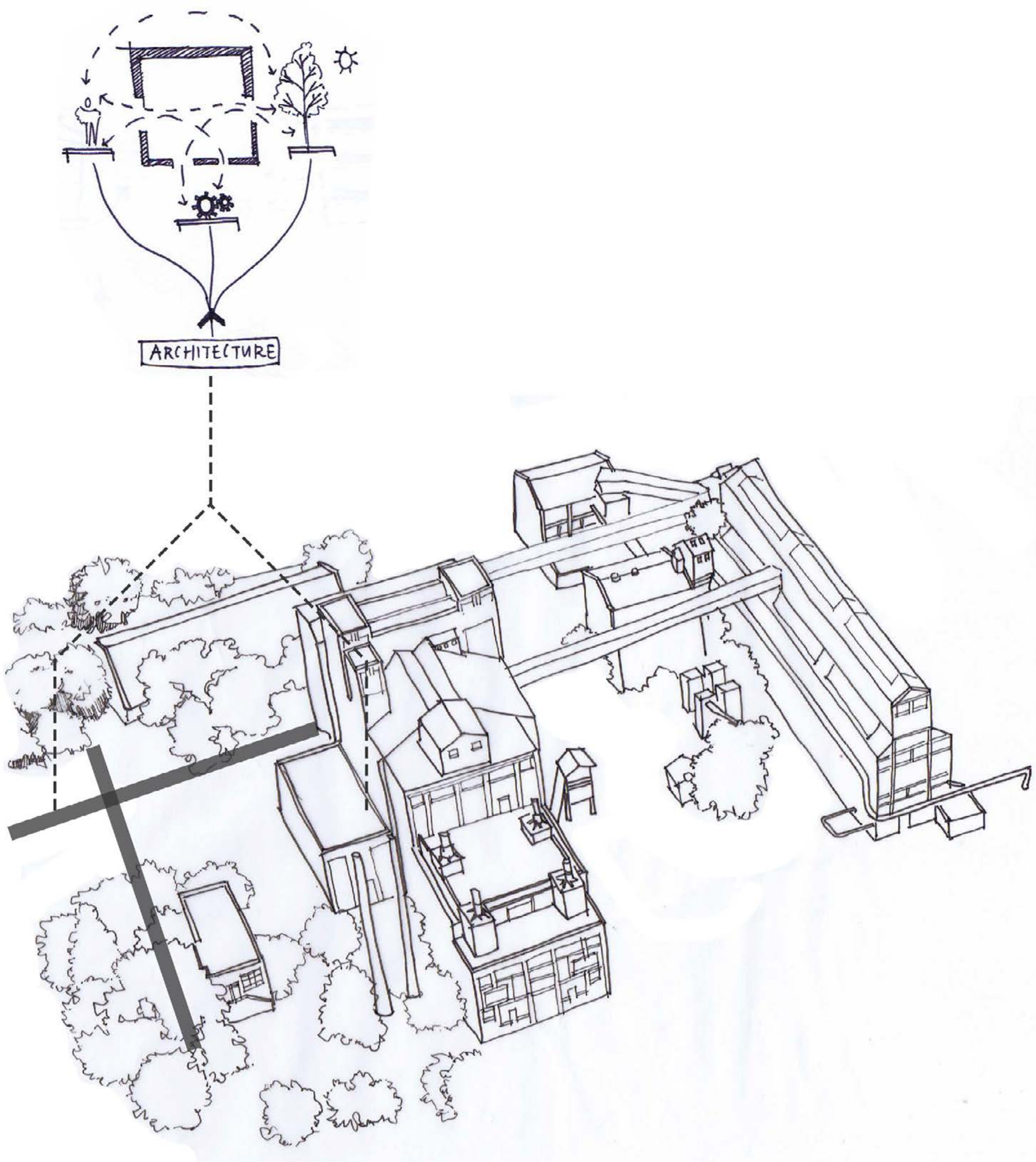


Figure 3.32: Mediation between industry and nature on site (Author 2017)

Site Vision

Mediation between industry & nature

From the preceding chapters it is evident that a new approach to industry is needed in order to prevent future industries from making the same mistakes and negatively impacting the environment that surrounds it. This project aims to use architecture as a tool to mediate between industry and nature with the hope of inspiring new archetypes of industries on abandoned industrial sites. In order for the site to regain its productive potential and to allow for the restitution between the three relationships identified in the urban vision, the repercussions of the old industrial process in the form of pollution needs to be remediated and a new approach is needed to prevent future industries from going down the same destructive path as conventional industrial processes.

This project hopes to inspire a new more mutually beneficial relationship between industry and nature through design. The architecture therefore hopes to act as a platform where interactions between industry and nature can occur, as well as to expose and celebrate the regenerative systems that feed these industrial processes.

Site justification

Southern edge of the Gasworks precinct

A site analysis of the old Johannesburg Gasworks clearly highlighted the need for restitution between various relationships in order to allow regeneration to sprout from the site's latent potential. The urban vision identified various zones on the site where restitution between the most prevalent relationships in that area could occur. The relationships in need of restitution include industry, ecology and the city dwellers.

The proposed project vision aims to mediate between industry and nature. These project intentions therefore coincide with the objectives set out in the urban vision. The proposed project site was chosen according to the zone where industry and nature is most prevalent. The southern edge of the site provides the greatest opportunity for mediation between these opposing entities, due to the dominant presence of both industrial artefacts and natural vegetation.

The southern edge (see Fig. 3.30) consists of an agglomeration of industrial buildings consisting of retort 2, the tully plant, the old powerhouse, the coke storage bunker and the telpher plant's weighbridge. This area creates a strong visual of nature's resilience, as nature encroaches on the existing built fabric amidst the disruption caused to the site by the old industrial processes in the form of pollution.

The motivation behind working with an existing building includes the opportunity to analyse and understand the dichotomy that exists between industry and nature and architecture's role in this severed relationship, in order to provide better architectural solutions for future industries. The re-use of existing buildings also contributes to the principles of regenerative design as it aids in the reduction of waste and resource consumption while retaining the genus loci of the place (Heritage council Victoria 2014:14).

As highlighted in the theory chapter, Kirovová and Sigmundová (2014:433) believe that industrial sites have the potential to resolve or mitigate social and environmental issues from the past that have often caused these urban industrial sites to become isolated from the rest of the vibrant urban fabric. Kirovová and Sigmundová (2014:433) argue that in order to reintegrate these sites into the surrounding context, suitable principles of sustainability for adaptive re-use need to be applied.

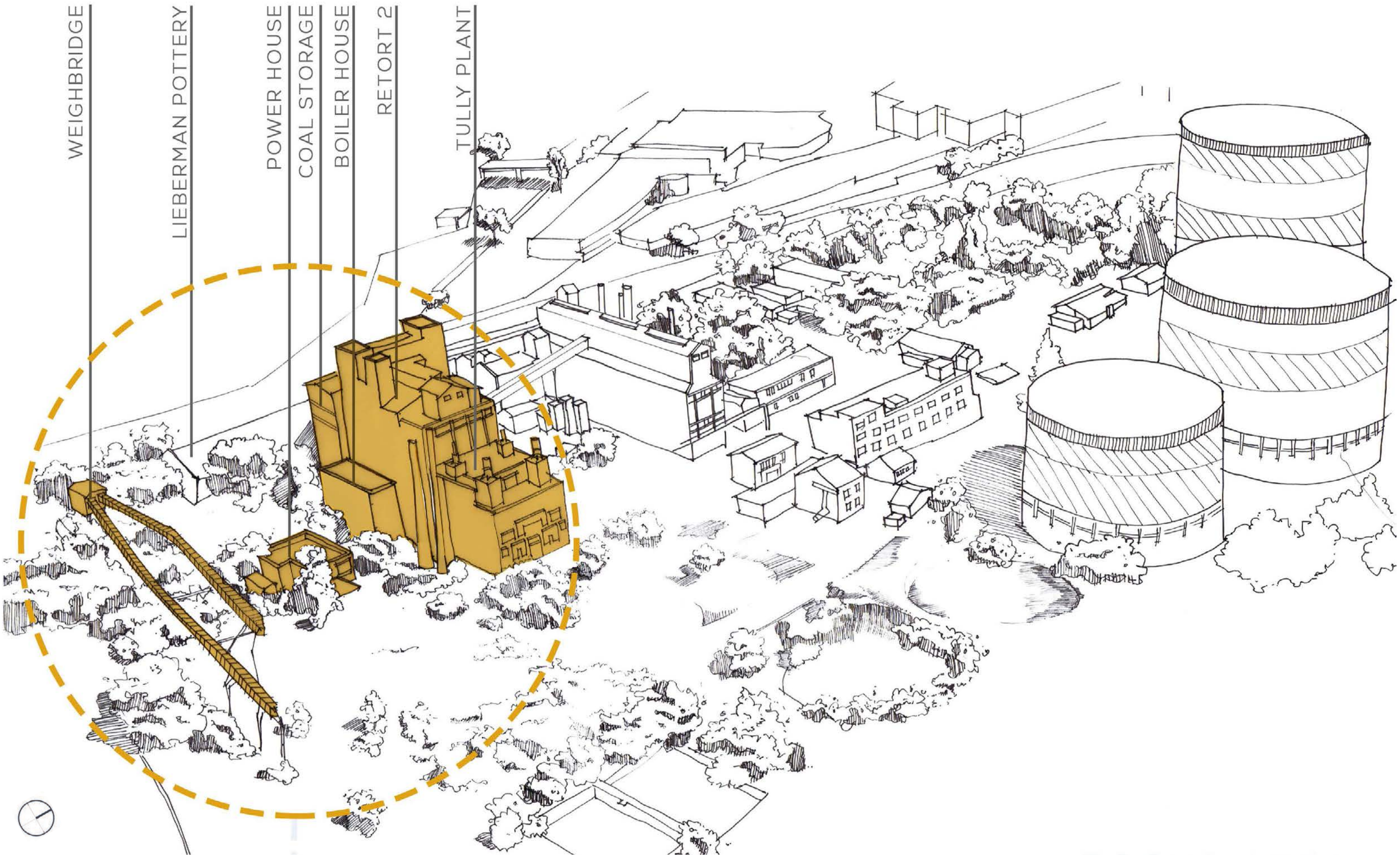


Figure 3.33: Project site position (Author 2017)

The historic process

From coal to gas

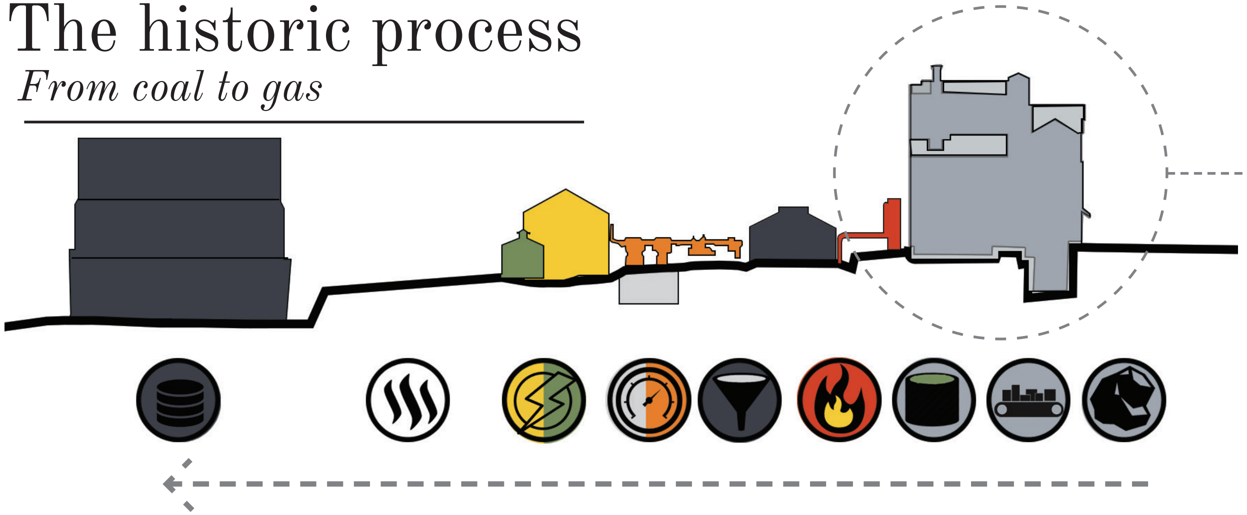
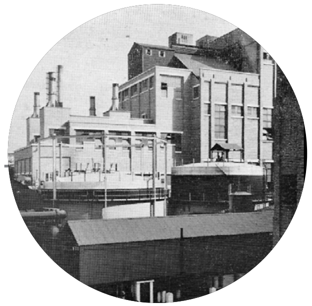


Figure 3.34: Visual representation of the coal to gas process (Gasworks Group 2017)

Retort house 1
Built - 1927

Figure 3.35: Retort 1 (Gasworks Group 2017)



Retort house 2
Built - 1950

Figure 3.36: View of Retort 2 & Tully plant (The old Johannesburg Gas Works book 2015:42)

Coal was brought to site by rail. The raw coal was then taken to the carbonising plant (retort) from where it was transported by means of a bucket conveyor system to the coal bunkers, situated at the top of each retort. Each retort contained one coke extractor which regulated the rate at which the coal passed through the retort. Once inside the coal bunker, the coal was isolated from air while it was roasted, causing the coal to become pliable and to gravitate downward inside the retort. The pliable coal was then heated further, causing it to chemically break down into tar, coke and 'foul gas'. The coke chambers were positioned directly below the coke extractors to accumulate the coke excreted from the chemical process. The coke had to be removed every two hours and placed onto a rubber conveyor belt, from where it was sprayed with water to cool it off and then taken to the coke grading plant, situated right next to the retort. The coke bunkers equipped with chutes, allowed lorries to easily access the excreted coke for dispatch. A portion of the coke was kept in order to feed the producers, which were responsible for heating the retorts.

The 'foul gas' produced during the coal roasting process was then partially cooled down with the help of water sprays. This process caused tar vapour to condensate and flow along with the water to the tar and liquor wells. The extant gas then passed through the retort house governor, a machine responsible for controlling the vacuum in each retort. From here the gas was sent to the condensers in order to cool the gas down to air temperature causing it to condensate and separate into tar and 'gas liquor', which could then join the flow from the retort to the tar and liquor wells. Finally the gas was sent through the exhausters in order to gain the necessary pressure difference to drive the gas into the gas holders (Läuferts Le Roux & Mavunganidze 2015:23).

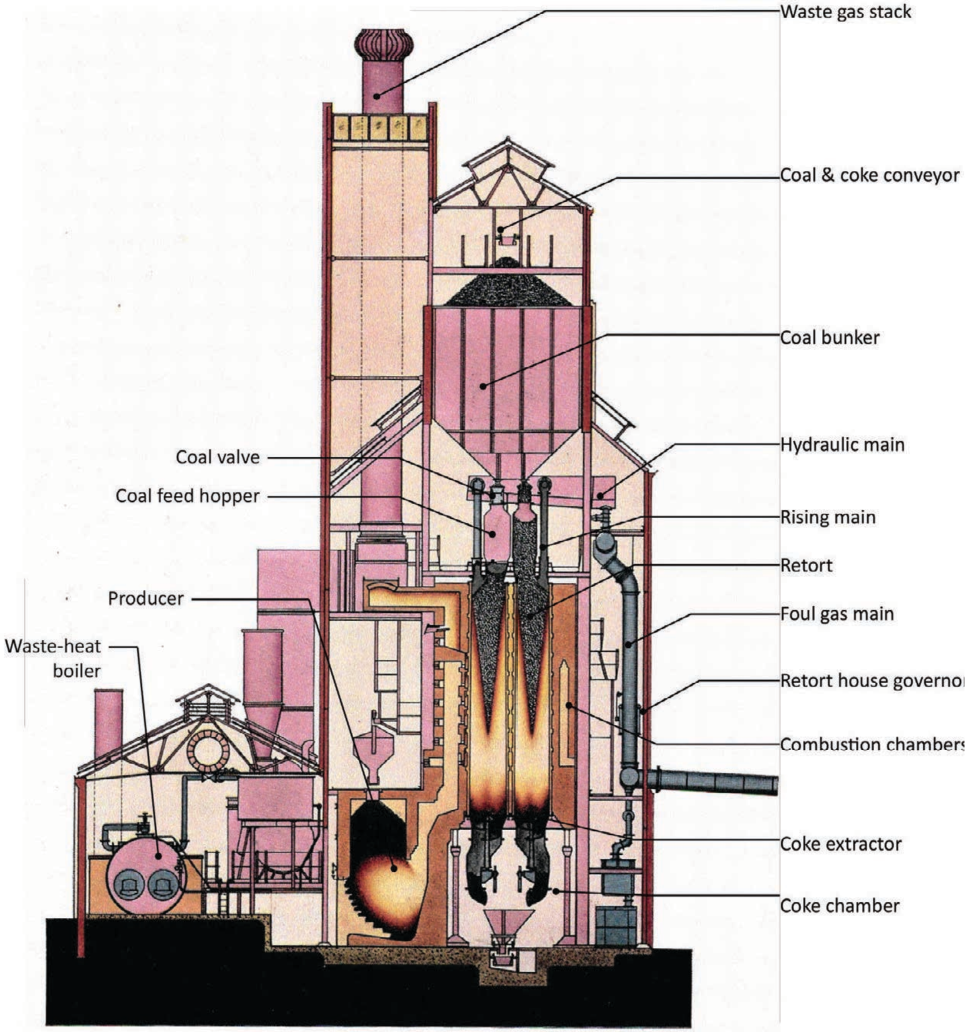


Figure 3.37: Cross section through Retort 1
(City of Johannesburg Gas Department brochure 1929:15, labels by Peter Finsen)

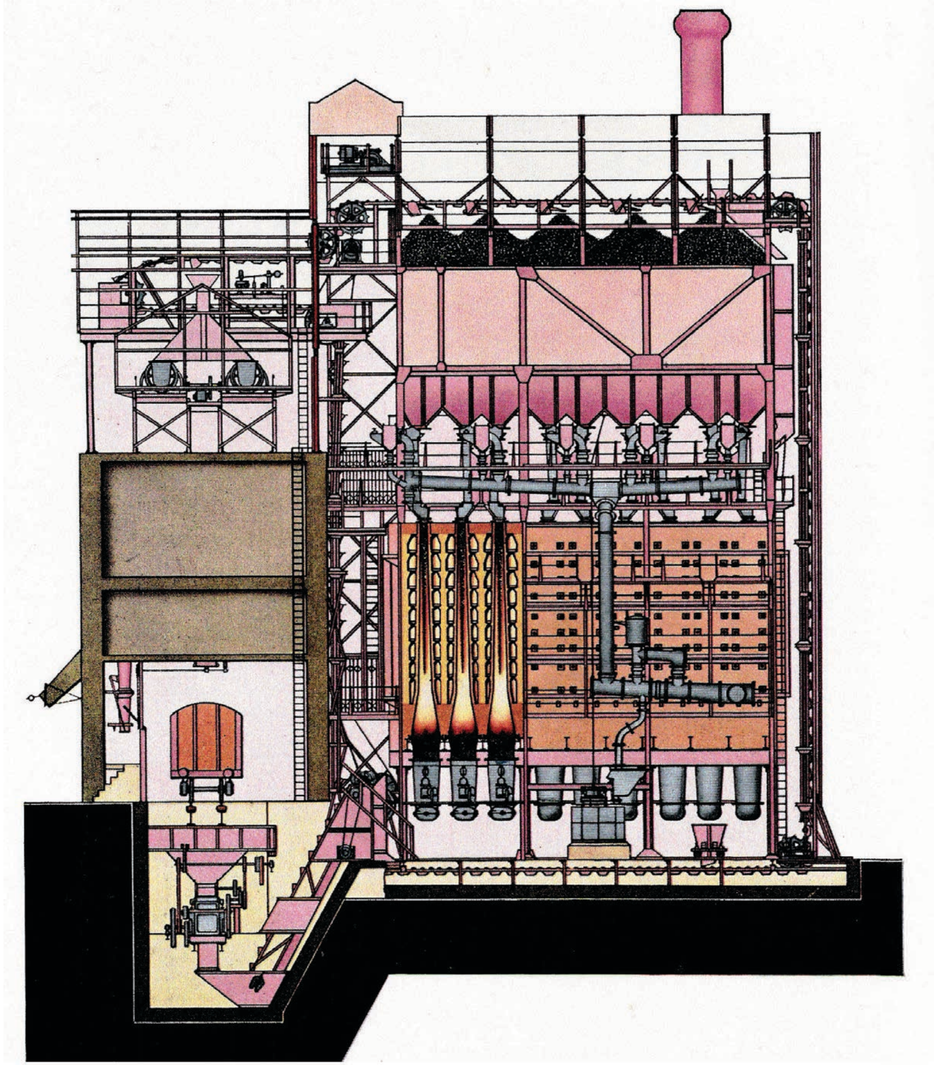


Figure 3.38: Longitudinal section through Retort 1
(City of Johannesburg Gas Department brochure 1929:21)

Heritage analysis

of extant and demolished fabric on site

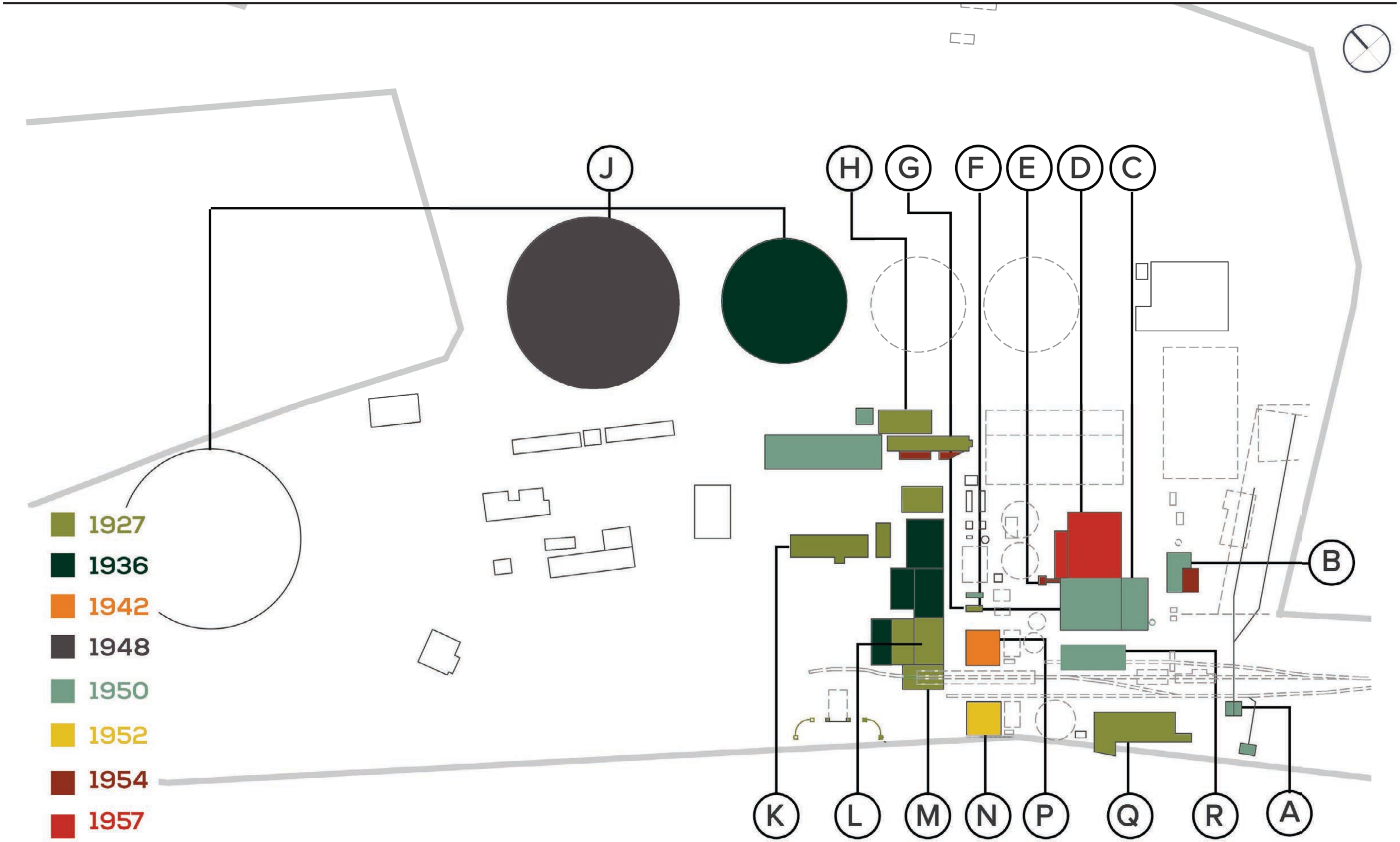


Figure 3.39: Heritage Analysis Map of Old Johannesburg Gas Works (Author 2017)

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Project specific heritage fabric

A WEIGHBRIDGE

AGE: 67 YEARS

SIGNIFICANCE:

FUNCTIONAL

B: EXHAUSTER & POWER HOUSE

AGE: 67 YEARS

SIGNIFICANCE:

ARCHITECTURAL

C: BOILER HOUSE

AGE: 67 YEARS

SIGNIFICANCE:

ARCHITECTURAL
FUNCTIONAL

D: TULLY PLANT

AGE: 60 YEARS

SIGNIFICANCE:

FUNCTIONAL
ARCHITECTURAL
HISTORICAL
SOCIAL

E: ASH PLANT

AGE: 63 YEARS

SIGNIFICANCE:

FUNCTIONAL

F: RETORT 2

AGE: 67 YEARS

SIGNIFICANCE:

FUNCTIONAL
ARCHITECTURAL
HISTORICAL
SOCIAL

G: CONDENSERS

AGE: 90 & 67 YEARS

SIGNIFICANCE:

FUNCTIONAL
HISTORICAL

H BOOSTERS, PUMPS & WORKSHOPS

AGE: 90 YEAR (POSSIBLY NOT ORIGINAL)

SIGNIFICANCE:
HISTORICAL
FUNCTIONAL

J: GAS HOLDERS

AGE: 69 - 81 YEARS

SIGNIFICANCE:

FUNCTIONAL
HISTORICAL
SOCIAL

K: OFFICES

AGE: 90 YEARS

SIGNIFICANCE:

HISTORICAL
ARCHITECTURAL
SOCIAL

L: RETORT 1

AGE: 90 YEARS

SIGNIFICANCE:

ARCHITECTURAL
HISTORICAL
SOCIAL
FUNCTIONAL

M:COKE STORAGE

AGE: 90 YEARS

SIGNIFICANCE:

FUNCTIONAL

N: NO.2 C.G.W PLANT

AGE: 65 YEARS

SIGNIFICANCE:

FUNCTIONAL
ARCHITECTURAL

P: NO.1 C.G.W PLANT

AGE: 75 YEARS

SIGNIFICANCE:

FUNCTIONAL
ARCHITECTURAL
HISTORICAL

Q: STORES

(LAUFERTS LE ROUX 2010)

AGE: 90 YEARS

SIGNIFICANCE:

HISTORICAL
ARCHITECTURAL

R: COKE GRADING & STORAGE

AGE: 67 YEARS

SIGNIFICANCE:

FUNCTIONAL
[ONE OF TWO, POSSIBILITY OF DEMOLISHING IT]

Figure 3.40: Heritage Analysis - images of buildings on the old Johannesburg Gas Works Site (Author 2017)

Site specific heritage analysis

Industrial heritage process value

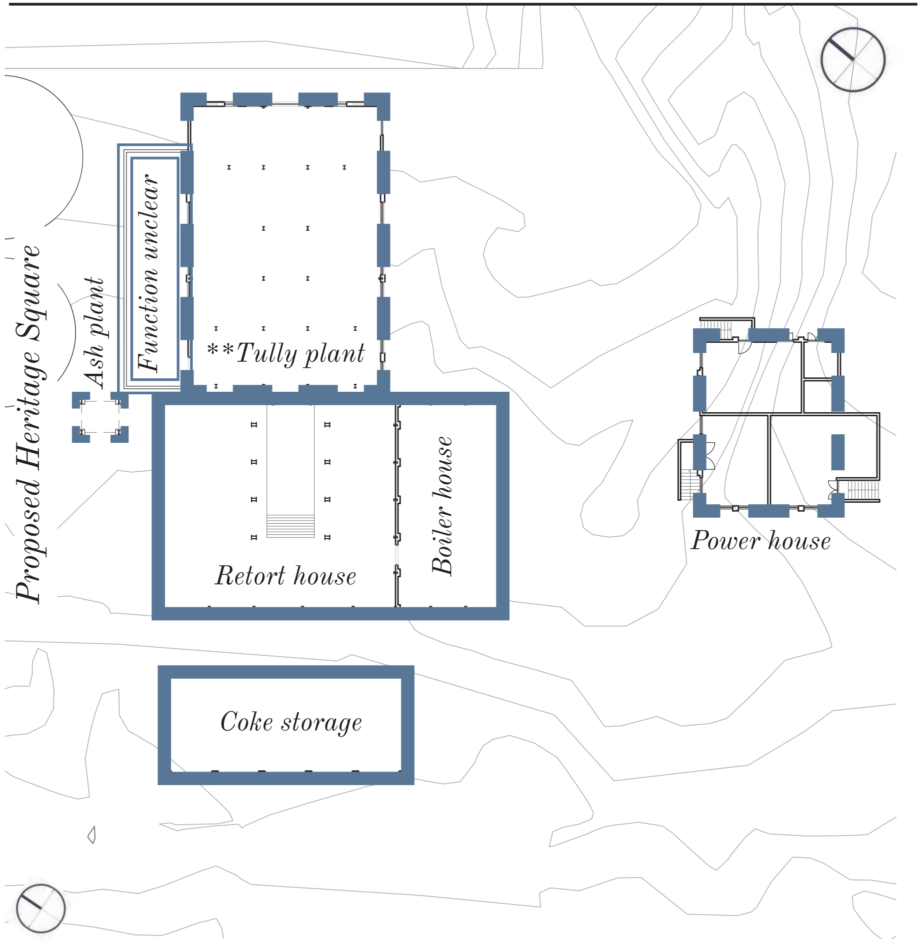


Figure 3.41: Industrial process value (Author 2017)

Primary
Secondary
Tertiary

Architectural heritage value

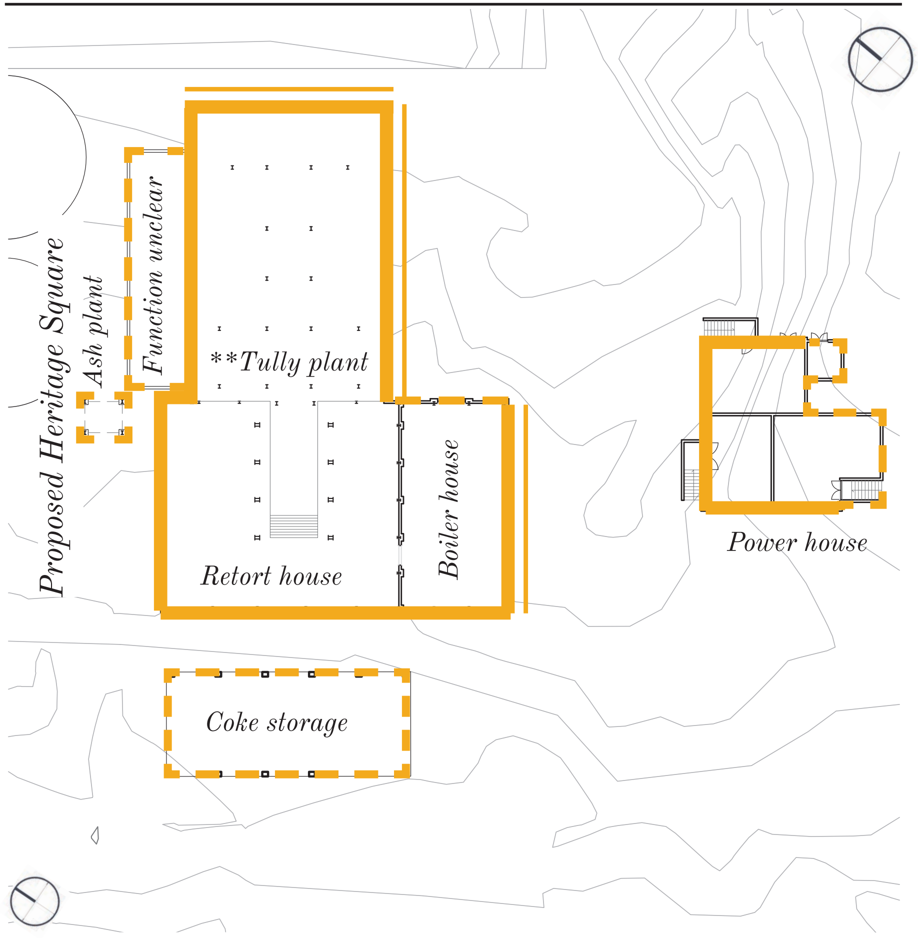


Figure 3.42: Architectural heritage value (Author 2017)

Primary
Secondary
Tertiary

***Tully plant constructed in 1957. The tully plant served the same purpose as the retort house, however it made use of newer technology.*

Vegetation growth between 1992-2017 on proposed site

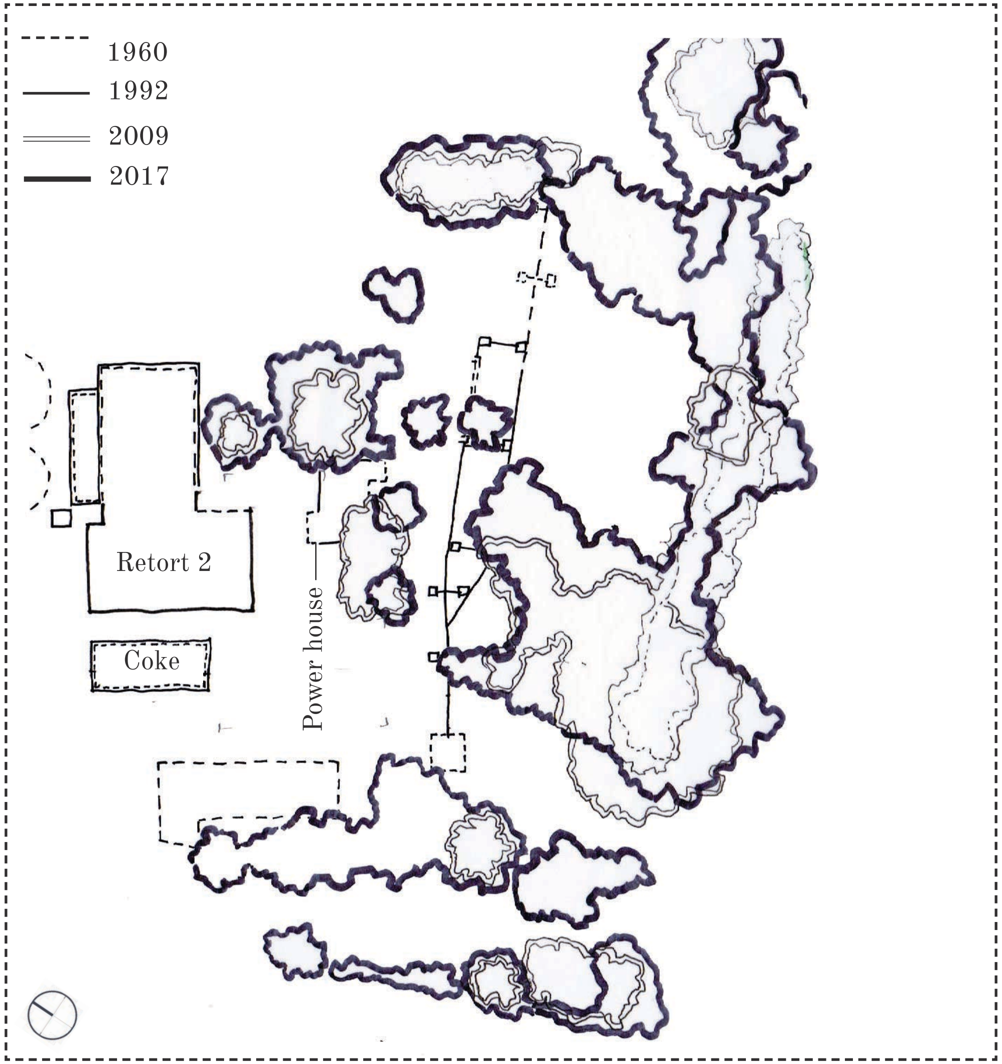


Figure 3.43: Map illustrating vegetation growth over time (Author 2017)

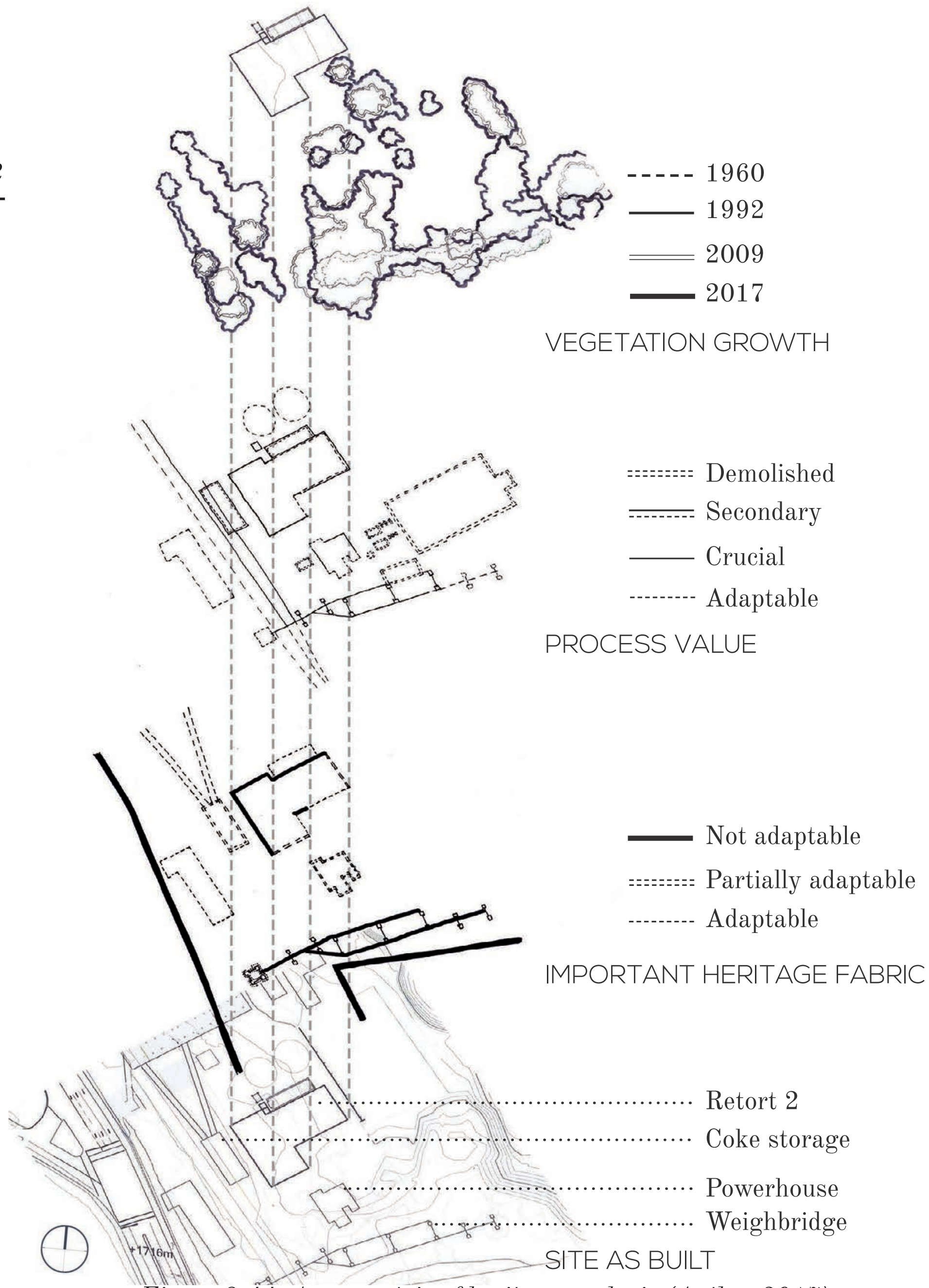


Figure 3.44: Axonometric of heritage analysis (Author 2017)

Retort 2, Tully plant & Boiler house

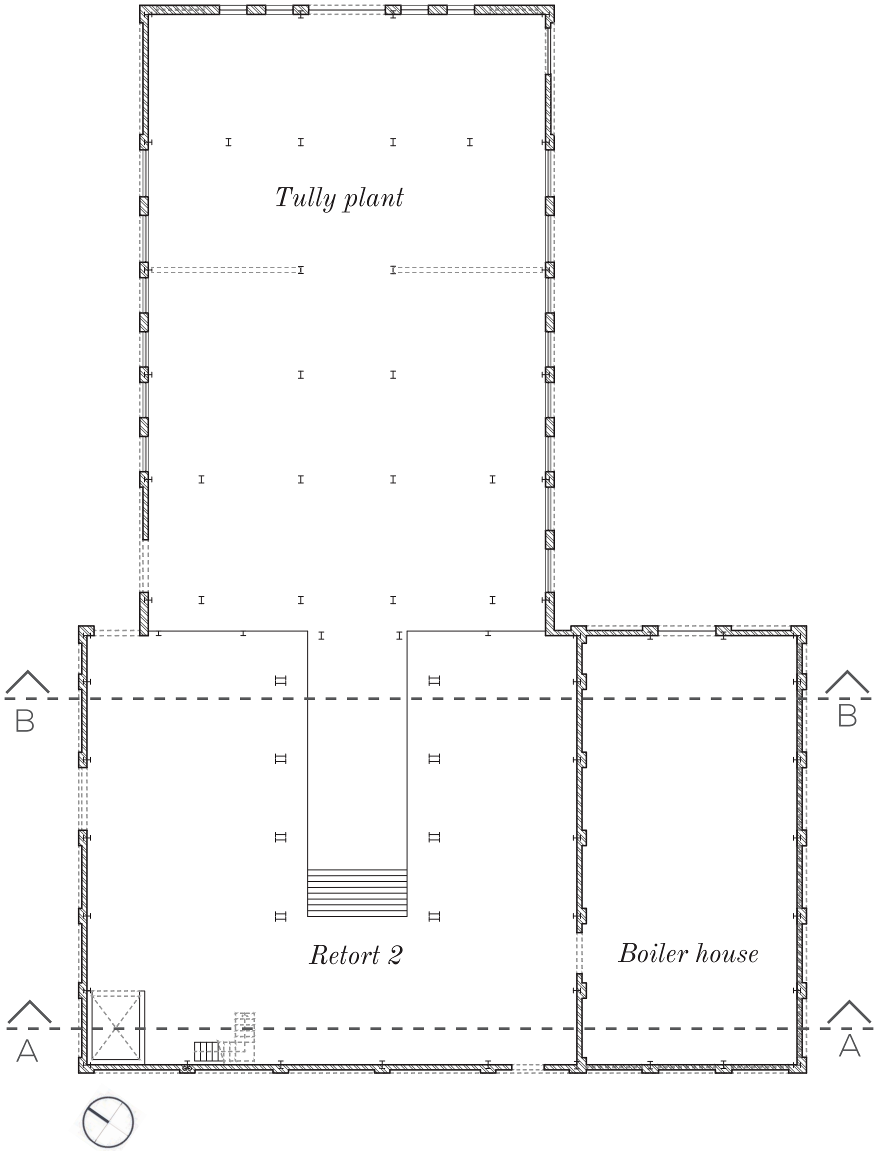


Figure 3.45: Retort 2 plan - not to scale (Author 2017)

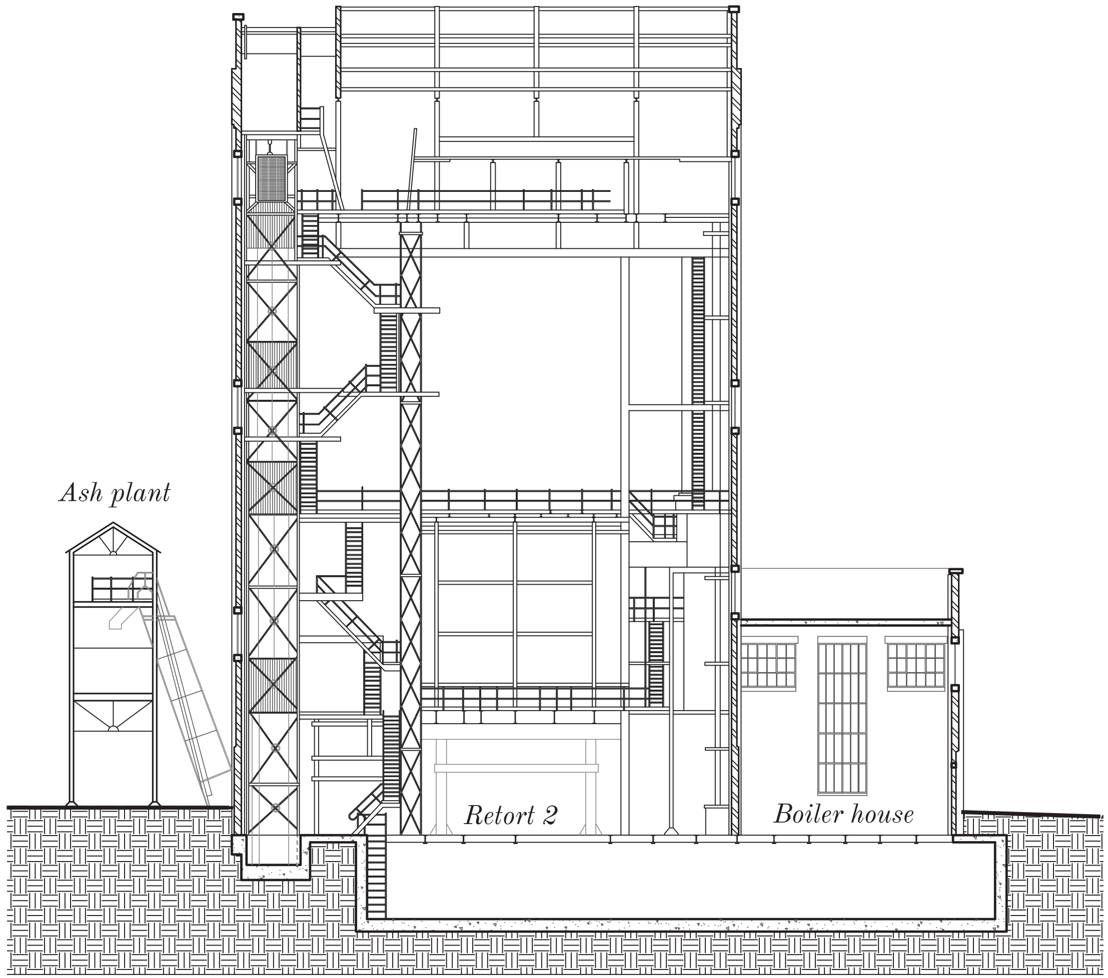


Figure 3.46: Retort 2 section A-A - not to scale (Author 2017)

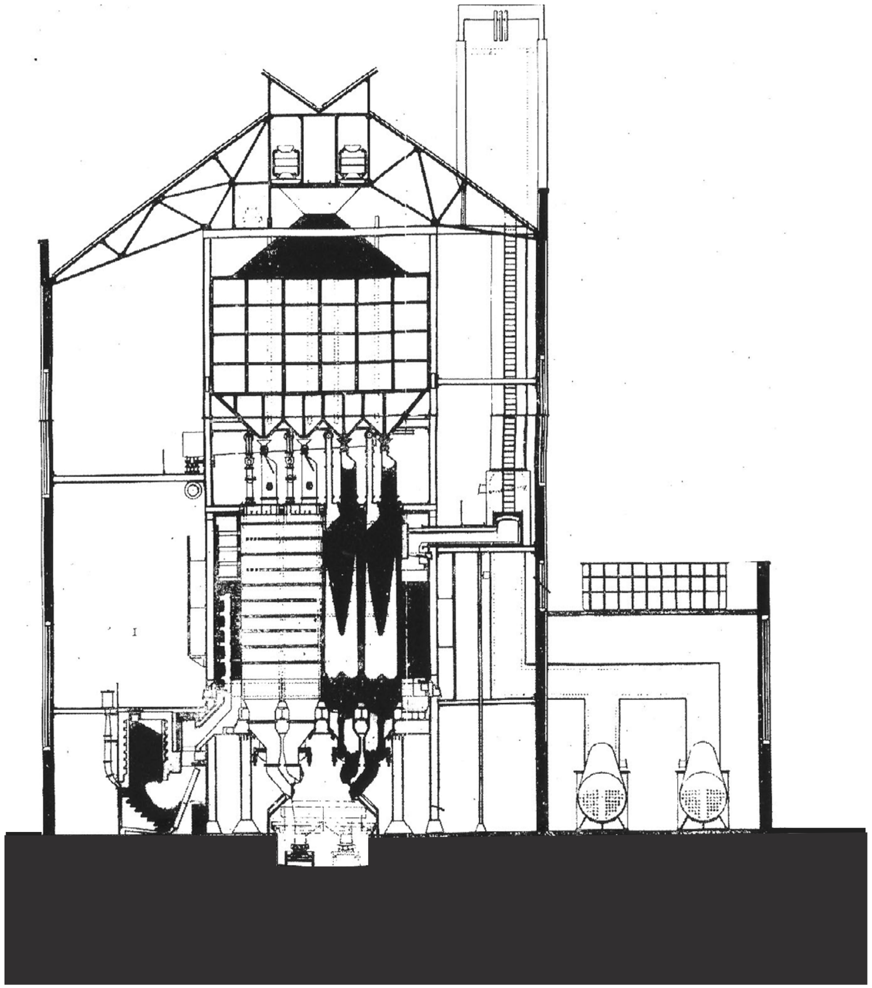


Figure 3.47: Retort 2 Section B-B - not to scale (City of Johannesburg Gas Department 1950, edited by Author)

Power house

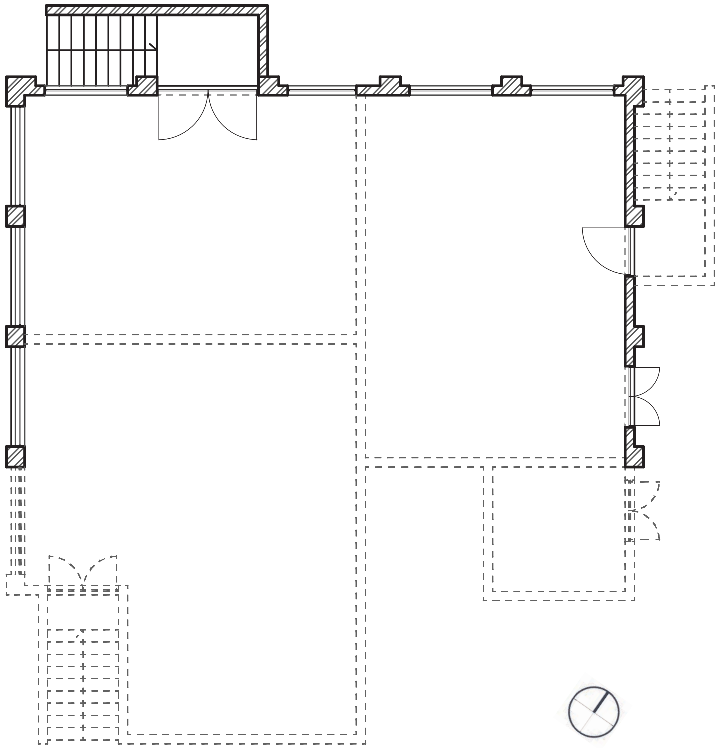


Figure 3.48: Powerhouse plan - not to scale (Author 2017)

- - - Demolish

All interior walls to be demolished in order to allow for maximum floor area to grow plants for the use in the dye house. The southern edge of the powerhouse to be demolished in order to allow for a connection to the new proposed building. The aesthetic and structural integrity to be kept on the northern facade.Roof to be demolished in order to allow for a new glass roof to allow maximum sunlight for the growing of plants.

Site analysis

Vegetation & pollution

Figure 3.49: Vegetation map (Gasworks Group 2017)

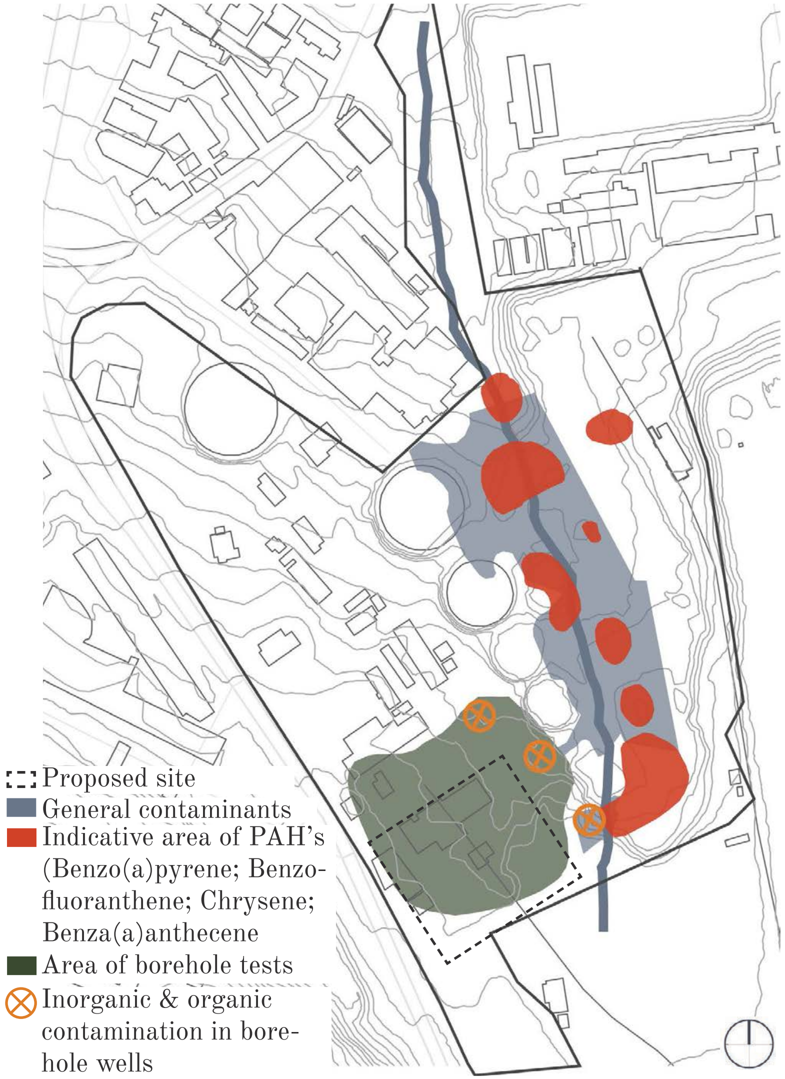


Figure 3.50: Areas of contamination (Gasworks Group 2017)

Site Solar study

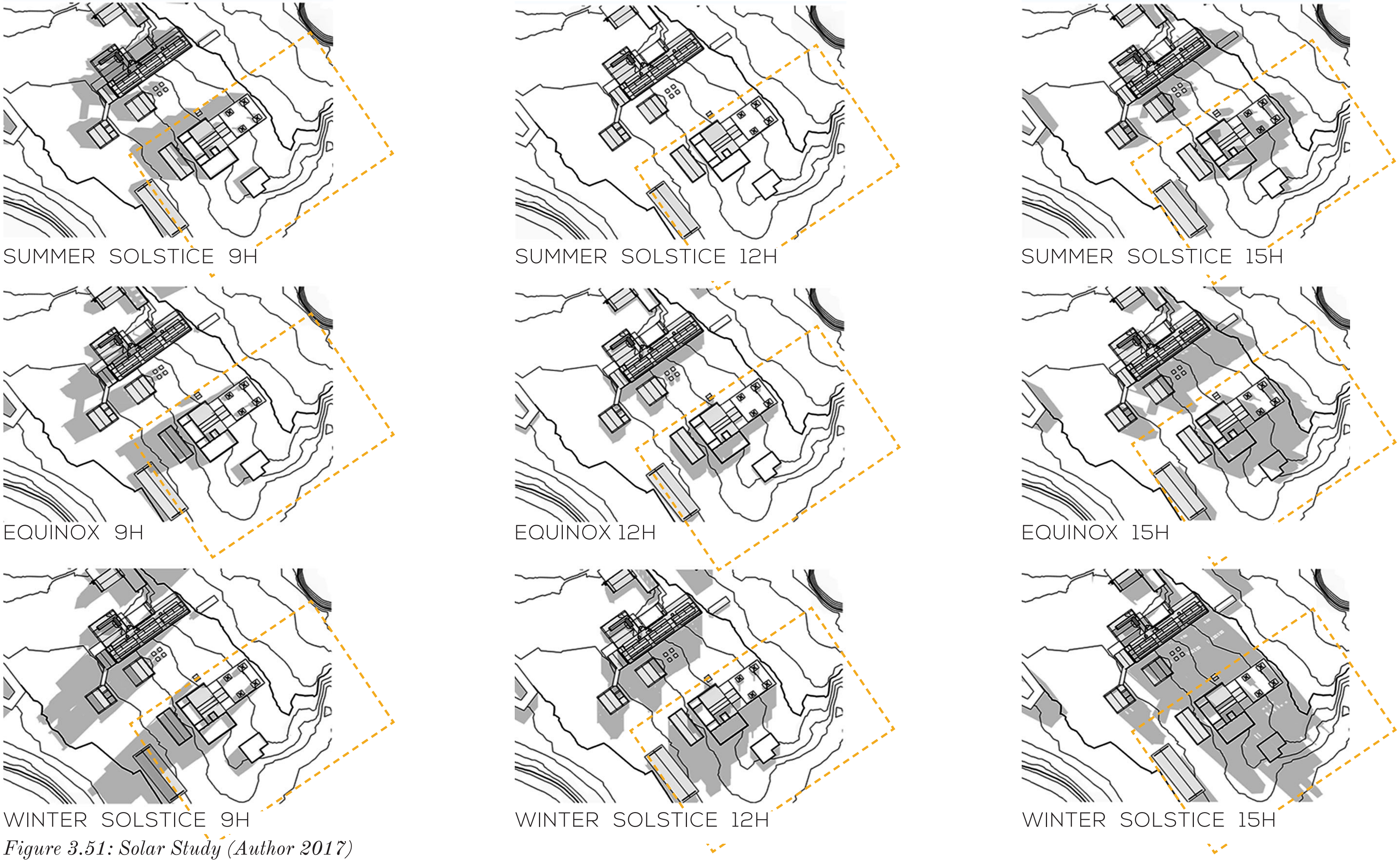


Figure 3.51: Solar Study (Author 2017)

Braamfontein Climate Analysis

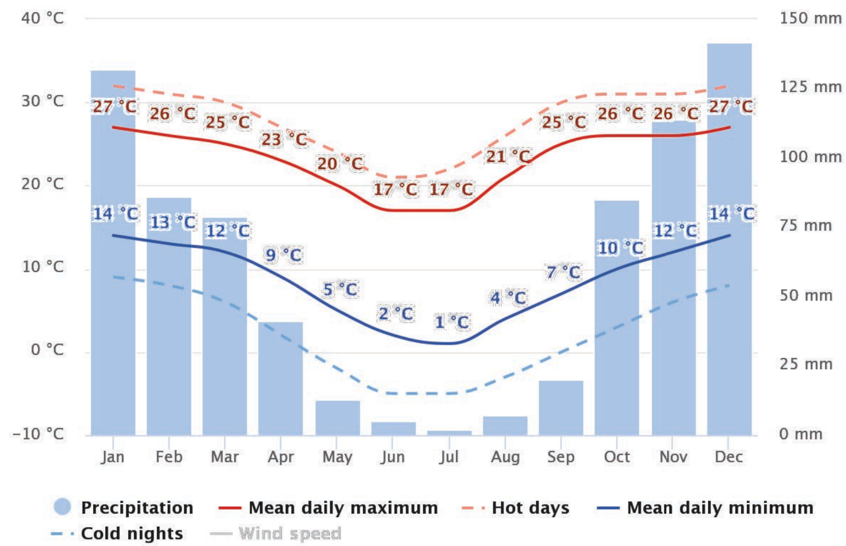


Figure 3.52: Average temperatures (Meteoblue 2017)

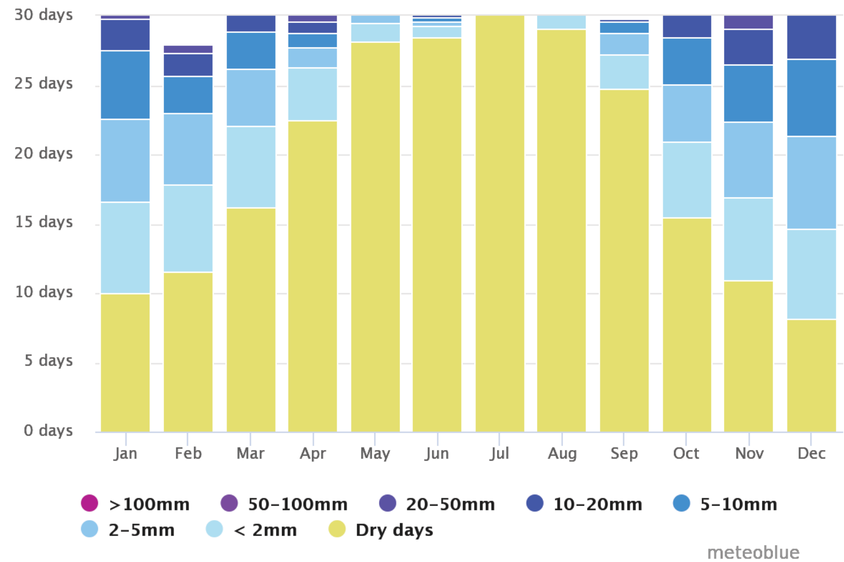


Figure 3.53: Average percipitation (Meteoblue 2017)

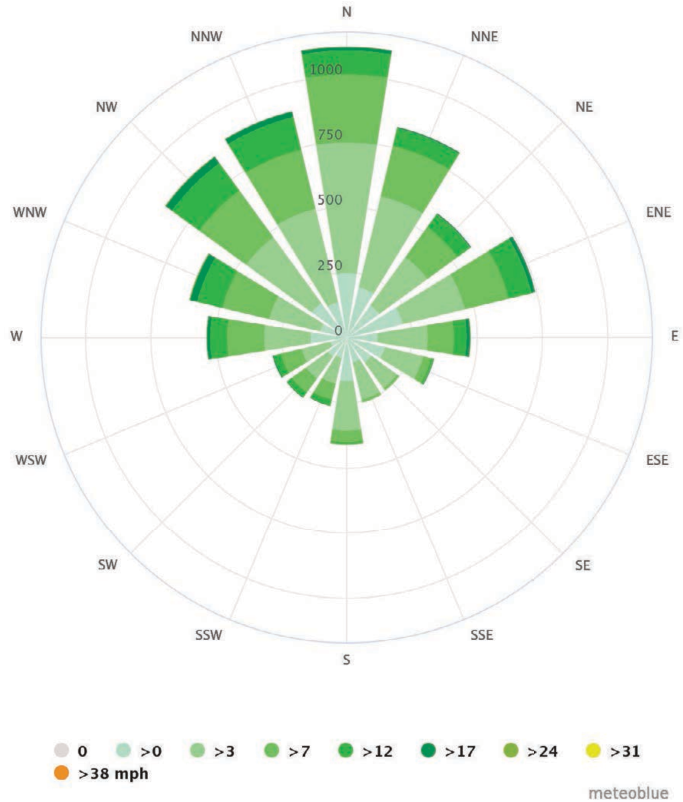


Figure 3.54: Braamfontein windrose (Meteoblue 2017)

Johannesburg climate

Johannesburg has a mild, mostly warm and temperate climate. It receives most of its rainfall during the summer months, with an average of 790 mm per year and has an annual temperature of around 16°C (Climate-data.org [sa]).

Change in landscape

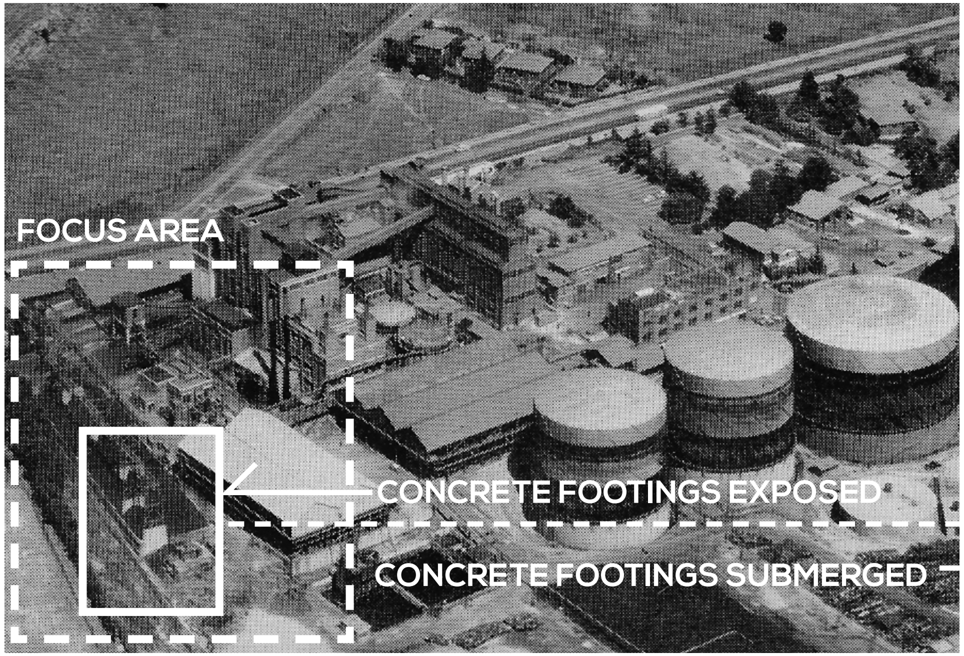


Figure 3.55: Aerial photograph of the Johannesburg Gasworks (City of Johannesburg Gas Department 1959)

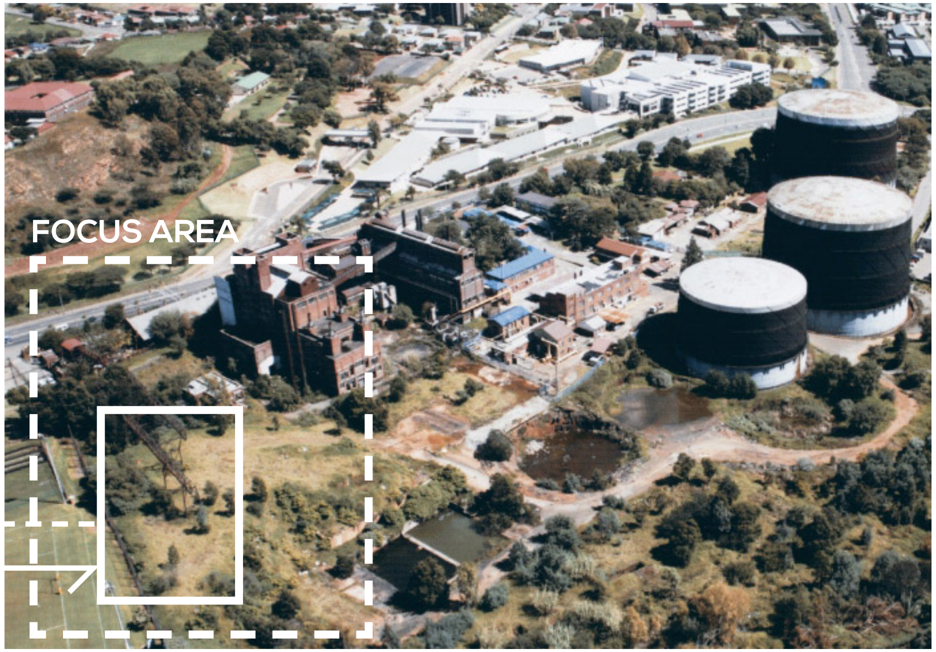


Figure 3.56: Aerial photograph of the old Johannesburg Gasworks in 2009 (Egoli Gas 2009, edited by Author)

Figure 3.57: 1992 Partial demolition (Peter Finsen 1992, edited by Author)

Figure 3.58 Footings (Läuferts Le Roux 2010, edited by Author)

How the change in landscape informs the design approach

Although no record was kept of the change in landscape, it can be assumed that soil was used to cover the southern edge of the old Johannesburg Gasworks that possibly contained rubble from the partial demolition in 1992.

As the contours of the site have been altered from the original topography, it can be assumed that the site does not contain virgin soil. This allows for the adoption of a less sensitive architectural response towards the landscape and opens up the possibility to cut and fill.

Chapter 4

Programme

04 | Programme

Johannesburg as incubator for a textile revival

Johannesburg's inner city has established itself as a manufacturing hub, dominating in mostly light industries such as food processing, printing, jewellery, furniture and clothing manufacturing for the last century.

An estimated eighty percent of formal clothing production takes place in Johannesburg's inner city, making it the third most important clothing manufacturing area in South Africa, after the Western Cape and Durban (Kesper 2003:88).

The formal manufacturing economy is dominated by the clothing production industry which is mostly led by small, medium and micro-enterprises (SMMEs). The advantage of SMMEs is its '*high labour absorptive capacity*' (Kesper 2003:98) and although SMMEs don't necessarily have the capacity to drive the entire revival of Johannesburg's inner city, its contribution to the creation of wealth and employment opportunities is promising. Due to its dominance in the formal and informal manufacturing industry, clothing production has been recognised as a key target in achieving this goal (Kesper 2003:97).

Unfortunately the South African textile industry has undergone rapid decline since the late 1990s as a result of cheap mass Chinese imports. This is an issue that has been recognised by the South African government and amidst support and investment to initiate revival, the industry is barely able to survive, let alone expand (Ndalana 2016).

In order for the industry to expand to a point where it is able to export, the supply chain, destroyed by China's cheap imports, first needs to be mended.

Figure 4.1. Left: Retort 2 interior (Author 2017)

Since the early 2000s the majority of resources such as dye houses and laundry services that formed part of the supply chain in South Africa have disappeared, resulting in a broken value chain (Ndalana 2016).

The potent vision of the South African textile and clothing industry is to use human, technological and natural resources in order to establish South Africa as the favoured supplier of manufactured clothing and textiles not only on a domestic scale but also an international scale (Brand South Africa 2002).

Figure 4.2: Textile Manufacturing (Brand South Africa 2017, edited by Author)

Figure 4.3: Furniture Manufacturing (Hospitality Designs 2017, edited by Author)

Figure 4.4: Jewellery Manufacturing (Rand Refinery 2017, edited by Author)

Figure 4.5: Food processing (Kirchhoff 2016, edited by Author)

Built environment theory's focus on the ability of living systems to regenerate and renew themselves amidst disturbances and pressures in order to avoid environmental collapse, has ignited the possibility of architecture becoming the catalyst for urban renewal through the understanding and integration of living systems (Peres, Barker & Du Plessis 2015:1)

Through the application of regenerative design, the possibility arises for architecture to become entirely comprehensive, inclusive of nature and respectful towards every part of a site's biosphere and ecosystem. The natural and living systems that exist on site become the driving force behind the architecture and utilizing these systems and responding to them appropriately, is a vital part of this type of thinking (Littman 2009:1).

An understanding of the theory as well as the context has led to the proposal of an eco-textile emporium as programme for the southern edge of the site.

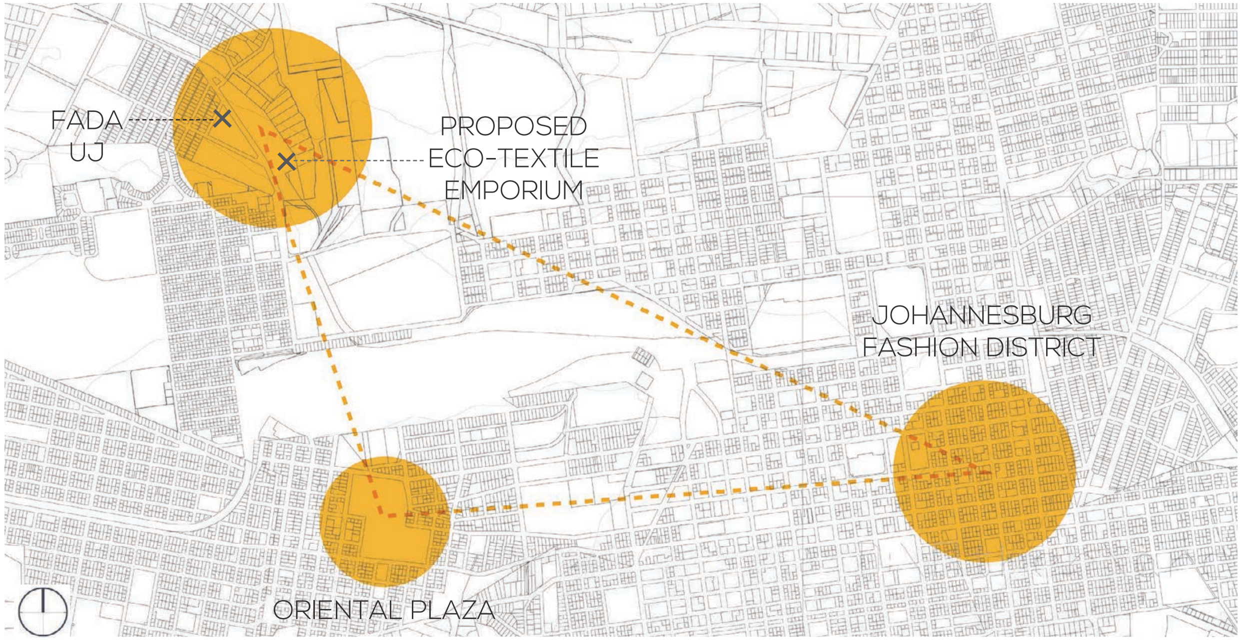


Figure 4.6: Fashion and textile hubs in Johannesburg (Author 2017)

This includes a textile mill where hemp, flax and stinging nettle, grown on the site, are used for the manufacturing of textiles. This provides the opportunity for living system regeneration on site, as the introduction of the plants could lead to the reintroduction of bio-diversity onto the site. A market space where the textiles are sold will contribute to the socio-economic activities on site. Workshops where the FADA fashion design students can transfer their sewing skills to the local community, as well as small rentable workshops for entrepreneurs to start up their businesses and eventually form part of the larger Fashion District in Johannesburg are also envisaged. Sub-programmes include a micro-brewery with tasting room as well as a tea house. Beer and tea are made from the leaves that are separated from the fibres after they have been harvested. The sub-programmes not only contribute to the socio-economic regeneration of the site, but also aid in the reduction of waste in the textile production process, contributing to the overall industrial ecology.

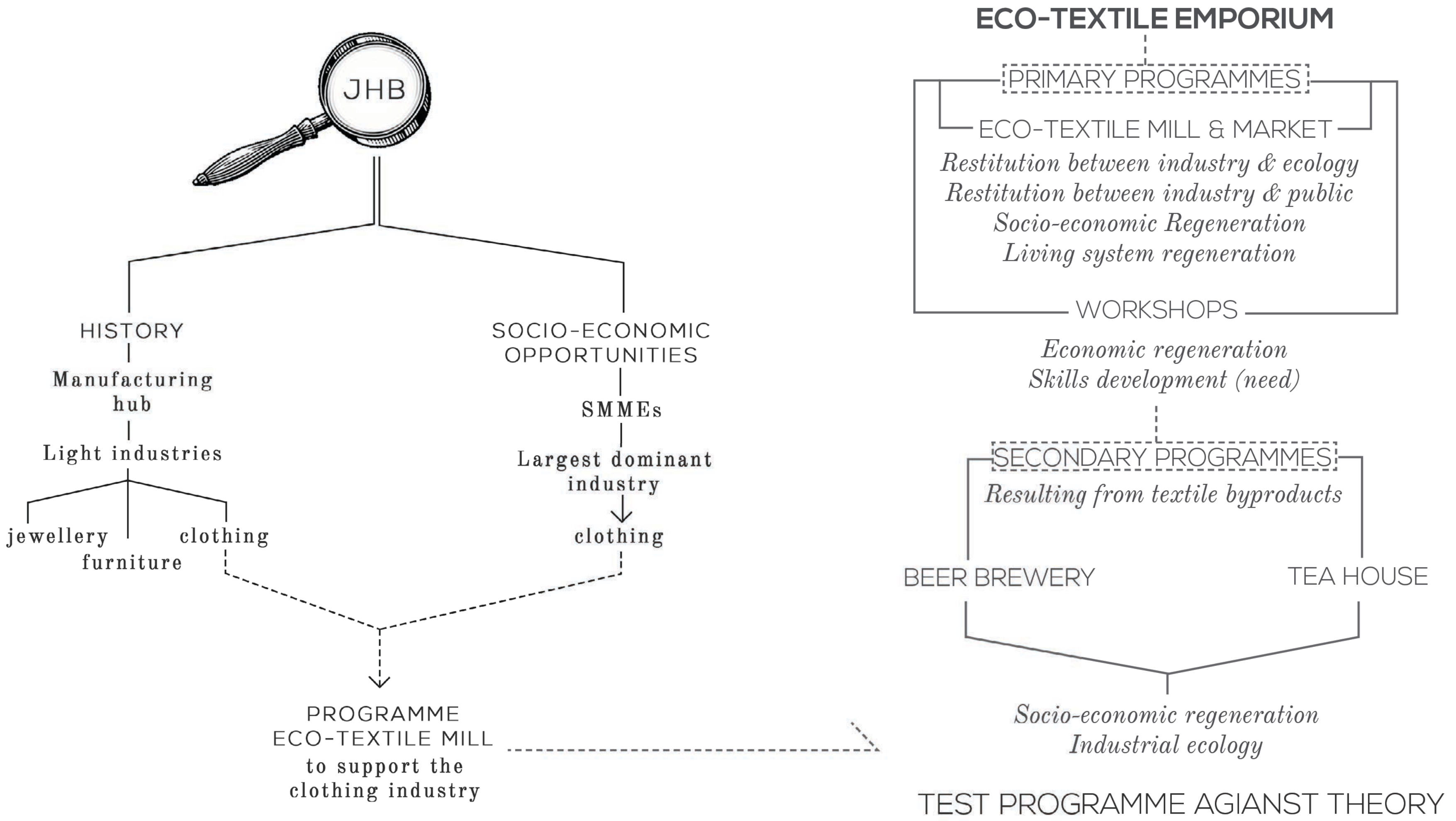


Figure 4.7: Programme outline (Author 2017)

How programme contributes to theory

The introduction of plants needed in the eco-textile market and natural dye house brings back the diversity of species to the site, allowing for the regeneration of living systems. Introducing labour intensive programmes like a textile mill and dye house and the sub programmes of a tea house, textile market, micro-brewery and skill transferring workshops, contribute to the socio-economic regeneration of the site.

Fibre choice justification

Natural fibres as source for textiles

Hemp [Cannabis Sativa]

Hemp was chosen as a fibre due to its rapid growth in the absence of agro-chemicals (Camira 2012:4). Hemp, like flax and nettles, is classified as a bast fibre plant, making it ideal for the manufacturing of textiles (Camira 2012:2). Hemp is also classified as a 'mop crop' as it has the ability to remove heavy metals or other harmful pollutants from the soil (The Hill 2016) and in so doing restoring nutrients to the soil (Delaney & Madigan 2014:161). Although the crop cannot be harvested for consumable purposes after it has been used as a 'mop crop', it can be mixed with lime to produce a building material known as 'hempcrete'.

Due to the current pollution on site, the introduction of hemp as a means of phytoremediation is proposed. The hemp will therefore be planted in the soil before any construction can commence and after the soil has been replenished and phytoremediated, the hemp can then be used to make 'hempcrete' which can be used in the construction of the new proposed dye house. It is proposed that the hemp seeds be given to the essential oils factory for use there in order to contribute to industrial ecology and the minimisation of industrial waste.

Flax [Linum Usitatissimum]

Flax is believed to have been the first crop to be domesticated by humans (Textile learner 2011). Flax has 'superior high textile qualities' (Kozłowski & Mackiewicz-talarczyk 2012:100) and is used in the manufacturing of linen fabric.

According to the Republic of South Africa's Department of Agriculture, Forestry and Fisheries, (2012:1) flax has a variety of uses. Fibre flax and linseed are just some of the products derived from the same plant namely, Linum usitatissimum.

Flax fibre is used for textiles and makes use of the bast fibres of the linseed plant. Linseed oil is a wonderful source of Omega-3 fatty acids and is obtained from the brown seed of the same plant. It is proposed that the seeds be given to the essential oils factory for use there, in order to contribute to the industrial ecology on site.

Stinging Nettle [Urtica Dioica]

Nettles were chosen as one of the natural fibres to produce the eco-textiles due to their perennial nature, rapid growth rate and their ability to grow on brownfield sites (Camira n.d.:3). Nettles are extremely strong and elastic bast fibres, with natural fire retardant properties, which make them ideal for textile manufacturing (Camira n.d.:4). Nettles need no pesticides or herbicides as the plants have a powerful sting which protects them whilst at the same time creating their own unique ecosystem by attracting various birds, butterflies, frogs and even rabbits (Camira n.d.:3). Nettles also have medicinal properties and can be used to flavour tea, beer or soup (Camira n.d.:1).

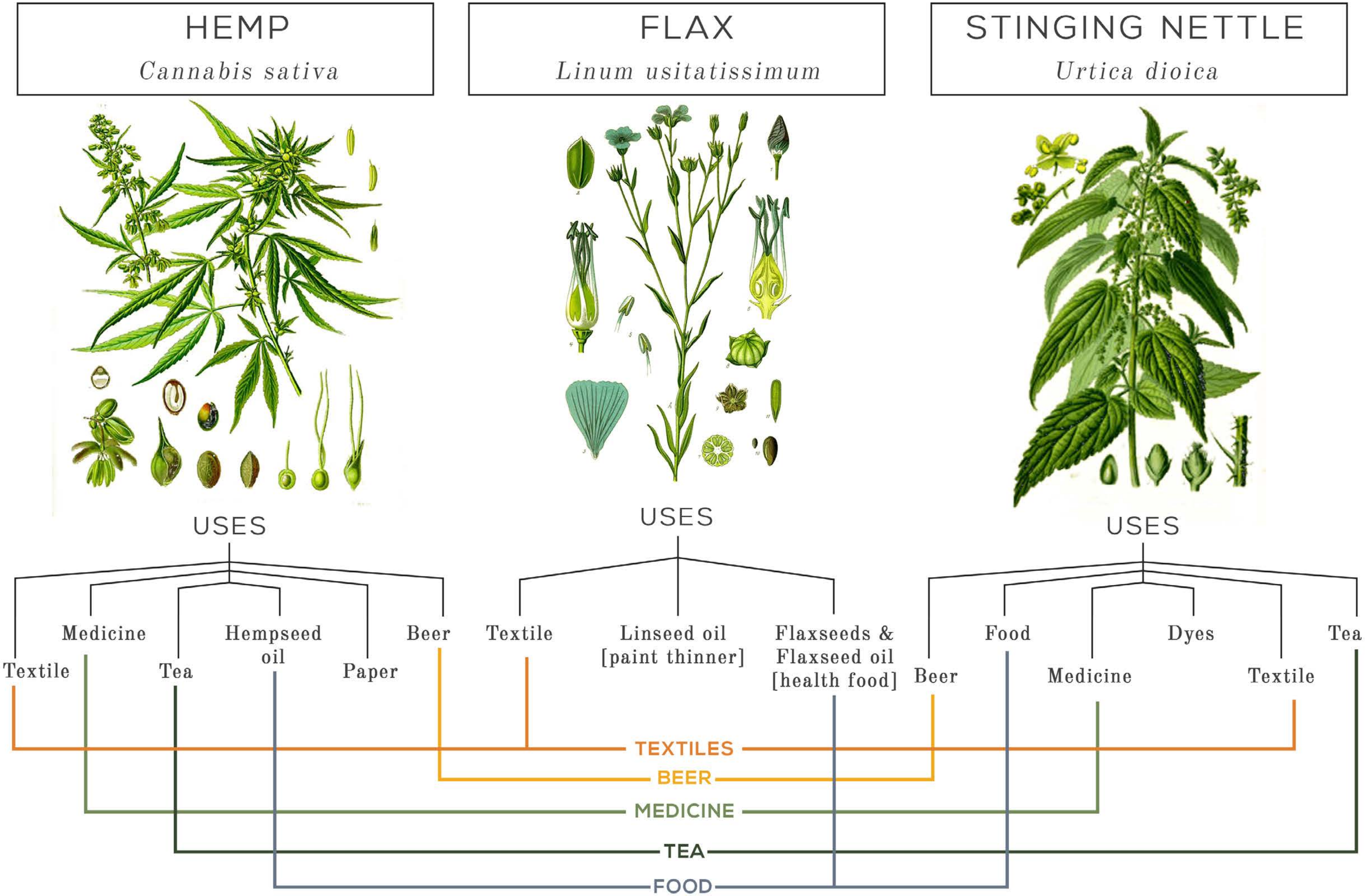


Figure 4.8: Fibres and their uses (Author 2017)

The textile making process

Retting

This process involves the breaking down of the 'gummy substances' (Horne 2012:125) that bind the fibres together. This helps to separate the fibres from the woody part of the hemp's stem more easily (Horne 2012:126). Water retting is just one of the numerous methods of retting hemp fibres. According to Horne (2012:27) this method of retting produces the finest hemp fibres in the shortest amount of time.

Scutching

After the retted fibres have been dried they reach the first stage of the mechanical process. This process involves the breaking down of straw in order to loosen the fibre from its woody core. This is achieved through the use of a machine comprising a series of rollers, which crushes the straw along its length (Horne 2012:131).

After the straw has been crushed it is ready for the scutching stage of the process. The primary purpose of this stage in the process is to remove the remaining hurd that has been loosened by the retting and mechanical breaking processes, but is still attached to the plant fibres. The scutching process ensures softer fibres and this is achieved by sending the fibres through a machine with turbine blades that beat the fibres (Horne 2012:132).

Hackling

This process is used particularly in flax fibre preparation. This process involves the separation of the long fibres from the shorter fibres. This is achieved by combing the fibres over a hackle, a structure with pins or nails embedded in it (All Fibre Arts 2015) or a hackling frame. This process aids in removing any remaining hurd or short fibres and helps in the disentangling and straightening of the fibres (Horne 2012:138).

Spinning

Spinning – Hemp fibre can be spun using either wet spinning or dry spinning. Dry spinning is more commonly used as wet spinning can be a costly process. The fibres are spun into yarn which can be woven to produce textiles (Horne 2012:139).

Weaving

Weaving – Is the process that involves the interlacing of yarn on a loom in order to form fabric (Merriam-Webster 2017).

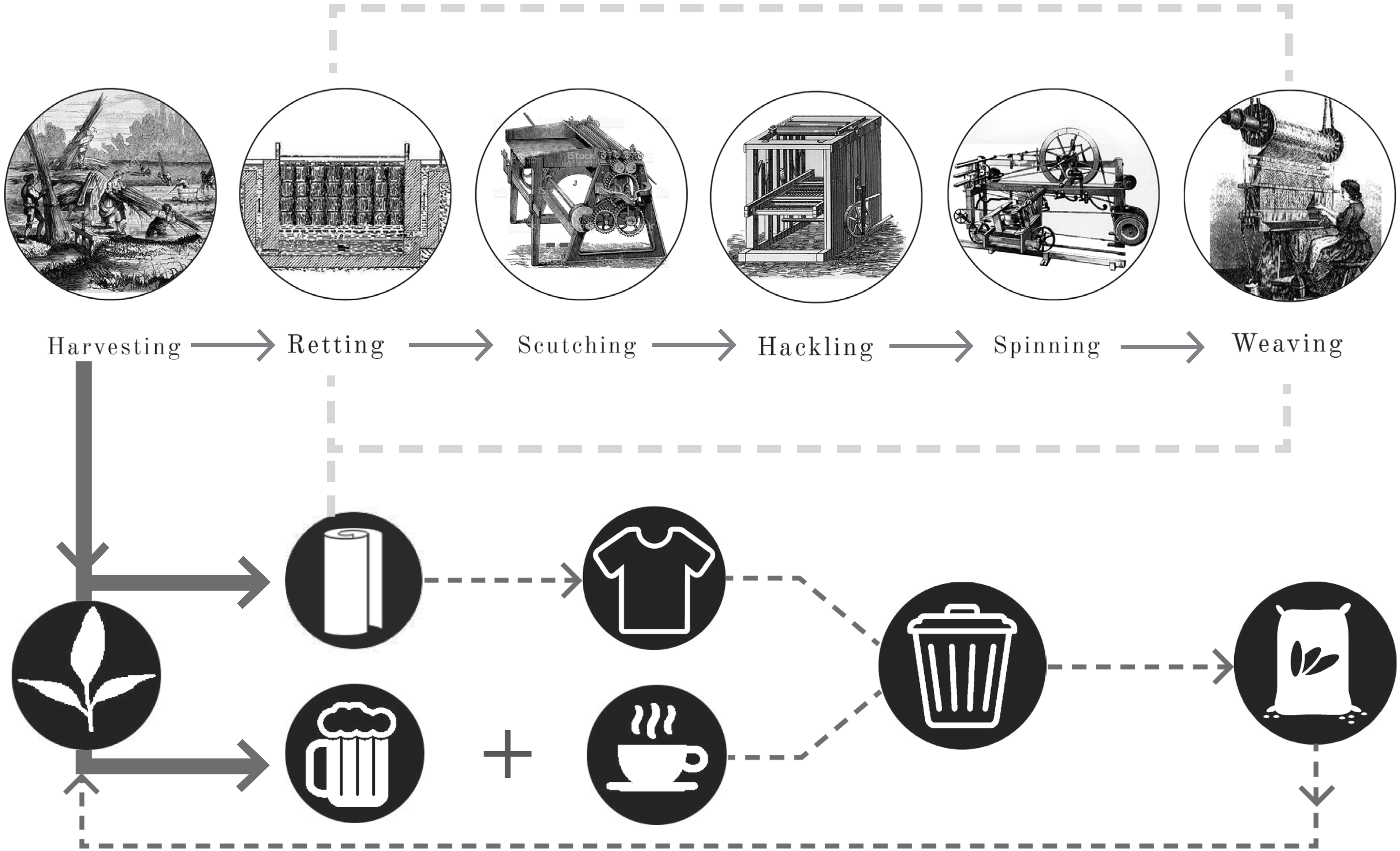


Figure 4.9: Textile manufacturing process as a closed loop system (Author 2017)

Vegetable dye colour chart

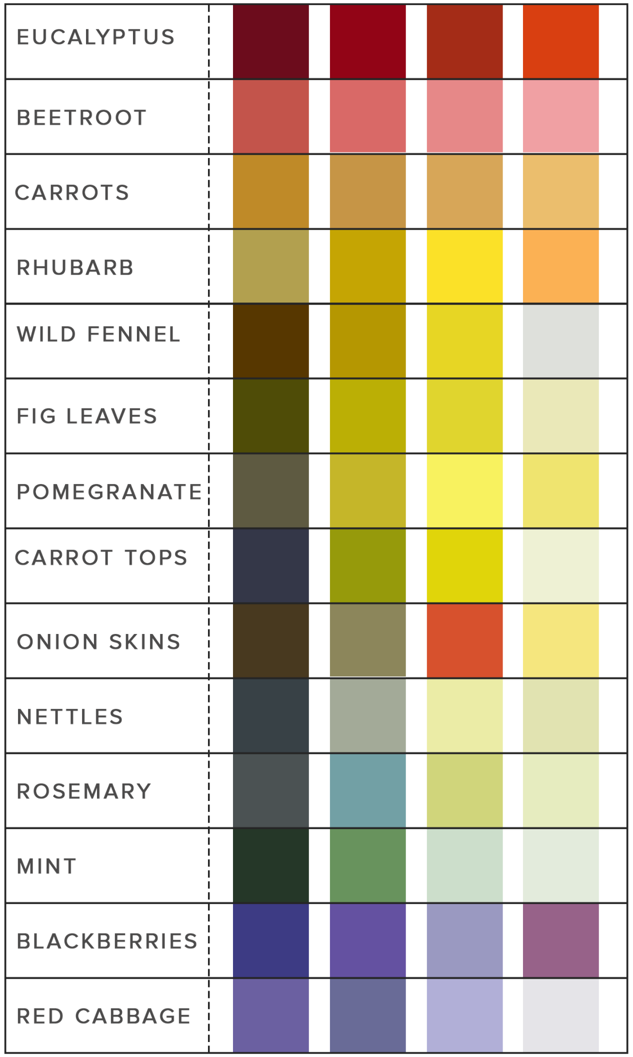


Figure 4.10: Vegetable dye colour chart (Compiled by Author based on Sasha Duerr's Seasonal Color Wheel 2013)

Natural Dyeing

A new but old approach

As the demand for textiles increases, so does the amount of wastewater produced by textile mills and inadvertently the amount of environmental pollution (Khan & Malik 2013:55). Most textile mills make use of harmful chemicals that cause not only environmental problems but health issues as well. Among these harmful chemicals excreted by textile mills, artificial dyes are considered to be the most worrisome.

Most environmental problems, caused by the textile industry, are as a result of untreated dye effluent being discharged into water sources. The effluent containing toxic chemicals causes havoc in the water ecosystems, as these chemicals decrease the oxygen in the water and prevent light from penetrating. Textile effluent is renowned for causing environmental degradation and illness in humans. Many heavy metals can be found in the effluent from textile mills, which is a major concern as these metals are not biodegradable and if ingested can accumulate in the body's major organs causing numerous diseases. It is evident that if this textile effluent is left untreated it will continue to cause harm to terrestrial and aquatic life due to the effects of these toxins, polluting natural ecosystems and inducing health issues.

The answer to these pressing issues lies in the traditional methods of dyeing textiles. Various plants and vegetables, even vegetable skins and offcuts, can be used in the dyeing process. The proposed dye house will make use of plant materials as dye pigment in order to break the pollutive cycle of conventional textile dye houses. Due to the natural composition of the dyes, the water can easily be purified and re-used after a dye cycle has occurred.

Closed loop system

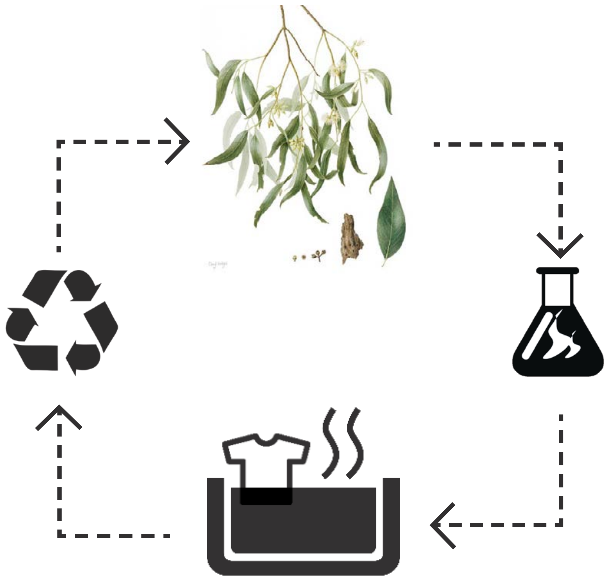


Figure 4.11: Natural deying closed loop system (Author 2017)

Herbal dye colour chart

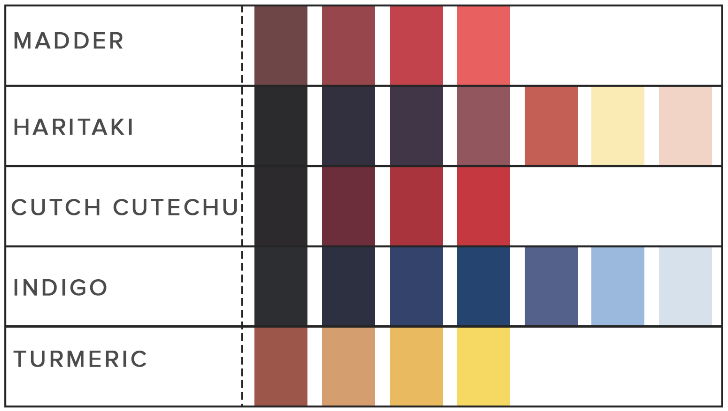


Figure 4.12: Herb dye colour chart (Compiled by Author based on Photoganic herbal dye info 2015)

The natural dye process

Desizing is the first step in the natural dyeing process (Photoganic 2015). This involves soaking the fabric in sea salt water to remove any of the oils or gums applied to the fabric during the weaving process.

After the fabric has been desized, it is **bleached** through the application of a natural bleaching mixture of grass and manure. The fabric is then placed in direct sunlight to complete the bleaching process.

The next step in the process involves the treatment of the fabric with a natural **mordant** such as salt or lemon juice. This ensures that the dye is fixed to the fabric.

Natural **dye is prepared** by boiling the natural plant material in water and letting it cool overnight. It is proposed that all dye mixtures be prepared in the dye laboratory with source materials grown on the site.

After the mordanting process, the fabric is **dyed** with the natural or plant dye by immersing it in a dye pit. Once the fabric has been dyed, it is rinsed and then **finished** off by sprinkling it with water while stretching it on hand rolls.

Graphic representation of natural dyeing process

1. Harvesting plants for dye

2. Preparing and sorting plants for dyes

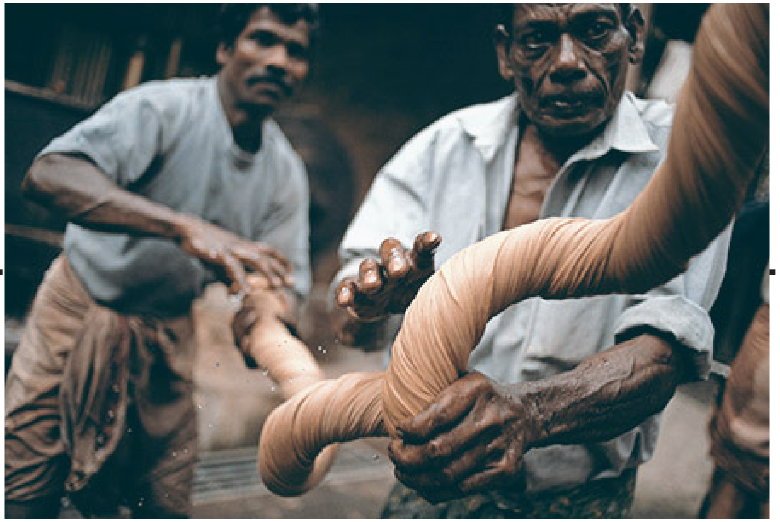
5. Dyeing fabric

6. Fabric soaking in dye

Figure 4.13: Natural Dyeing Process (Five Elements Eco Designs 2012, edited by Author)

3. Mordanting fabric with natural mordants

4. Preparing dye mix



7. Finishing process

8. Drying fabric outdoors

Figure 4.14: (Colouricious 2014)

Spatial requirements

SPACE	FUNCTIONAL REQUIREMENTS	USER EXPERIENCE	USERS	AREA (M^2)
		ECO-TEXTILE MILL		
THRESHING ROOM				120
STORAGE ROOM	HEMP STORAGE ROOM FLAX STORAGE ROOM NETTLE STORAGE ROOM			35
DRYING ROOM				30
SCUTCHING & HACKLING ROOM				30
SPINNING ROOM				375
SORTING & STORAGE OF TEXTILES				375
STAFF CHANGING ROOM	FEMALE [20] - 4 WCs; 5 WHBs; 2 SHWRS; - 20 x LOCKERS MALE [45] - 6 WCs; 6 URINALS; 7 WHBs; 3 SHWRS - 45 x LOCKERS			375
		DYE HOUSE & ADMINISTRATION		
RESTROOMS (SHARED WITH STUDIOS)	FEMALE: - 4 WCs; 4 WHBs, - 1 UNISEX DISABLED WC MALE: - 2 WCs; 3 URINALS, 5 WHBs			16 16
STAFF KITCHEN	BASIN			20
STAFF RELAXATION [TERRARIUM]	SEATING			130
DYE HOUSE	2 x DESIZING TANKS 2 x DYEING PITS 2 x OUTSIDE DRYING RACKS			276
DYE LABRATORY	STORAGE BASINS GAS SOURCE FOR HEATING			85

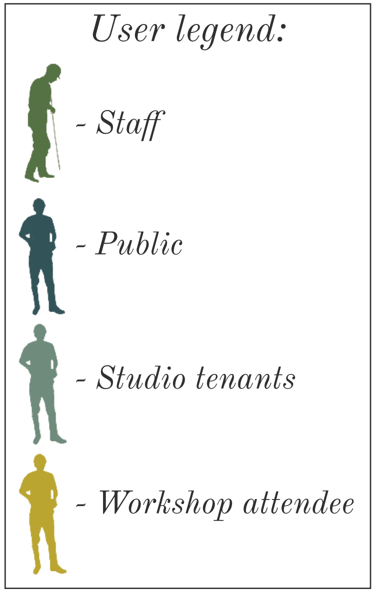


Figure 4.15: Spatial requirements table A (Author 2017)

User experience:
(connection to nature or industry)

- *Smell*
- *Taste*
- *Touch*
- *Hearing*
- *Sight*

SPACE	FUNCTIONAL REQUIREMENTS	USER EXPERIENCE	USERS	AREA (M^2)
SKILLS TRAINING & RENTABLE SPACE				
WORKSHOPS	WORKSHOP 1 WORKSHOP 2 WORKSHOP 3			70 70 70
RESTROOMS	FEMALE; - 3 WCs; 4 WHBs; - 1 DISABLED WC MALE: - 3 WCs; 4 WHBs; - 1 DISABLED WC			20 20
RENTABLE STUDIOS	STUDIO 1 STUDIO 2 STUDIO 3 STUDIO 4			25 25 25 25
SOCIAL SPACES				
MICRO BREWERY [70 SEATS]	BREWERY TASTING ROOM KITCHEN			55 95 15
TEA HOUSE	KITCHEN TASTING ROOM RESTROOMS FEMALE: - 2 WCs; 2 WHBs - 1 UNISEX DISABLED WC MALE: - 2 WCs; 2 WHBs REFUSE YARD			30 145 10 10 15
ECO-TEXTILE MARKET				
MARKET	INDOOR OUTDOOR RESTROOMS FEMALE: - 4 WCs; 4 WHBs; 1 DISABLED WC MALE: - 2 WCs; 4 URINALS; 3 WHBs - 1 DISABLED WC			410 190 20 20

Figure 4.16: Spatial requirements table B (Author 2017)

Chapter 5

Concept

05 | Concept

Hierarchy of summarised informants

RESULT OF CONVENTIONAL INDUSTRIAL PRACTICES

Conventional industrial practices have often abused natural systems. The pollution left on the old Johannesburg Gas Works' site as a result of the coal to gas process is one such an example. The exploitation of natural resources is also reaching a critical level and a drastic new approach is needed in order to prevent further degradation of our planet.

The abuse of nature by industries is a result of the disconnection between nature and the built environment caused by the Industrial revolution. In order to change the way in which industries are run, this relationship between industry and nature needs to be mended and architecture should become more responsive to its surrounding context.

INDUSTRIAL HERITAGE

The remnants of our industrial heritage, play an important part in understanding the development of cities. Preserving this part of our heritage is important and the re-use of these sites may be the key to reintegrating them back into the surrounding urban fabric and mitigating environmental and social issues that arose as a result of the hazardous industrial processes. The insertion of new functions into abandoned industrial buildings and sites opens up the possibility of these sites thereby catalysing regeneration.

It is important to use lessons from the past as tools to improve the way in which industries are approached in the future. It becomes important to change linear systems to closed loop systems to restrict waste production and energy consumption. The emerging concept of industrial ecology provides a means of dealing with unwanted waste and utilizing renewable resources to power some of these processes.

Figure 5.1. Left: Retort 2 interior (Author 2017)

THEORETICAL PREMISE

Regenerative theory

Regenerative theory aspires to mend the broken relationship between man and nature as a result of industrialization. In order for this to be achieved a radically different approach needs to be taken. Instead of man dominating nature through the exploitation of natural resources and the environmental degradation caused by this one-way throughput approach, man should assume his role as part of nature. This reverts back to the idea of systems thinking.

Philological restoration

As described in the theory chapter, philological restoration perceives a building as a document conveying a specific meaning and should therefore not be falsified and any additions made should be minimal and respect the epoch of the building. Due to the intentions of this dissertation to mediate the dichotomy between industry and nature and to adopt a regenerative approach to architecture, the existing retort house will be tested in terms of its environmental performance and any additions or changes made to the building will purely be to improve any inadequacies in terms of its environmental performance or to allow for the new programme to function effectively inside the old retort.

THE CURRENT CONDITIONS ON SITE

The current dilapidated conditions on site have prompted the need for an intervention in order to regenerate this dead node in Johannesburg. This begins by understanding the importance of preserving this part of our country's industrial heritage but at the same time endowing these ghosts of industries as instigators of change in the field of industrial architecture and more broadly, in the field of regenerative architecture.

The conceptual approach was strongly influenced by the polluted and dilapidated conditions on site and the need for remediation in order to regenerate the site's latent productive potential in an attempt to not only preserve this important industrial heritage but also to act as a pioneer in the way industrial architecture is approached in future.

PROGRAMMATIC DRIVERS

The proposed programme for the old Johannesburg Gas Works aims to introduce production back onto site. This opens up the possibility of setting the tone for the way in which future industries can be approached.

The textile dyeing industry is synonymous with pollution, but the key to sustainable processes lies in ancient methods of textile dyeing. The proposed dye house will make use of purely natural dyes in the form of plant materials that will be grown on site.

Figure 5.2: Pollution of the River Bandi by Textile industry (Zimbardo 2009)

THE SITE AND ITS LOCATIONAL DRIVERS

Addressing the need for the revitalisation of the South African textile industry will be through the introduction of a new textile mill that is able to promote mutualism between industry and nature through the utilization of fibres that require less pesticides and water (an alternative to cotton) and the implementation of cyclical processes and natural materials that are less harmful to the environment and promote living system regeneration on site.

The site's location relative to the universities allows for skill transfer between the fashion students at the University of Johannesburg and the members of the surrounding Vrededorp community, as a part of the students' community service. This strengthens the urban vision strategy of restituting the relationship between city dweller and the site. Exposing man to the process and making the city dweller more aware of the process also allows for the restitution of the relationship between industry and city dweller as well.

MEMORY

The concept of memory is important in preserving old buildings. However, industrial heritage is often tasked with integrating its multi-layered memory whilst enabling new development (Chilingaryan 2014:4).

According to Bangstad (2014:95), industrial heritage can often be classified as a form of hybrid, as it has the capacity to preserve the local industrial past while at the same time catalysing community renewal. The slightly opposing roles industrial heritage has to assume, ultimately involves celebrating the industrial past, while finding ways in which preservation can be used to overcome this same industrial past. Numerous scholars have concluded "that the function of cultural memory and heritage is not antithetica to forgetting but rather accompanied by it" (Bangstad 2014:95).

CONCEPT DIAGRAMS

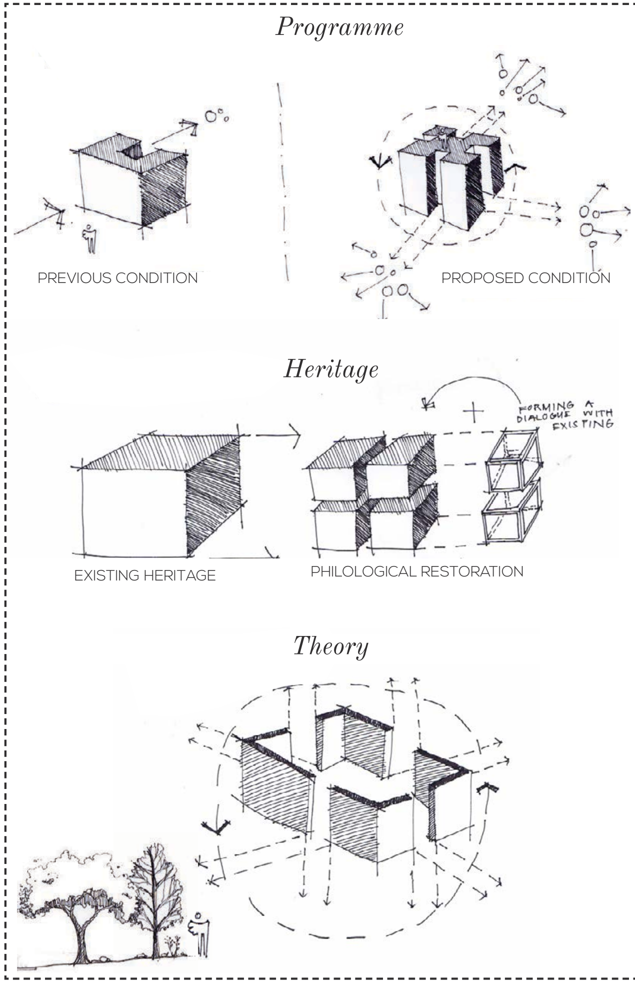


Figure 5.3: Concept diagrams of informants (Author 2017)

DESIGN CONCEPT
Architecture as [Re]mediator

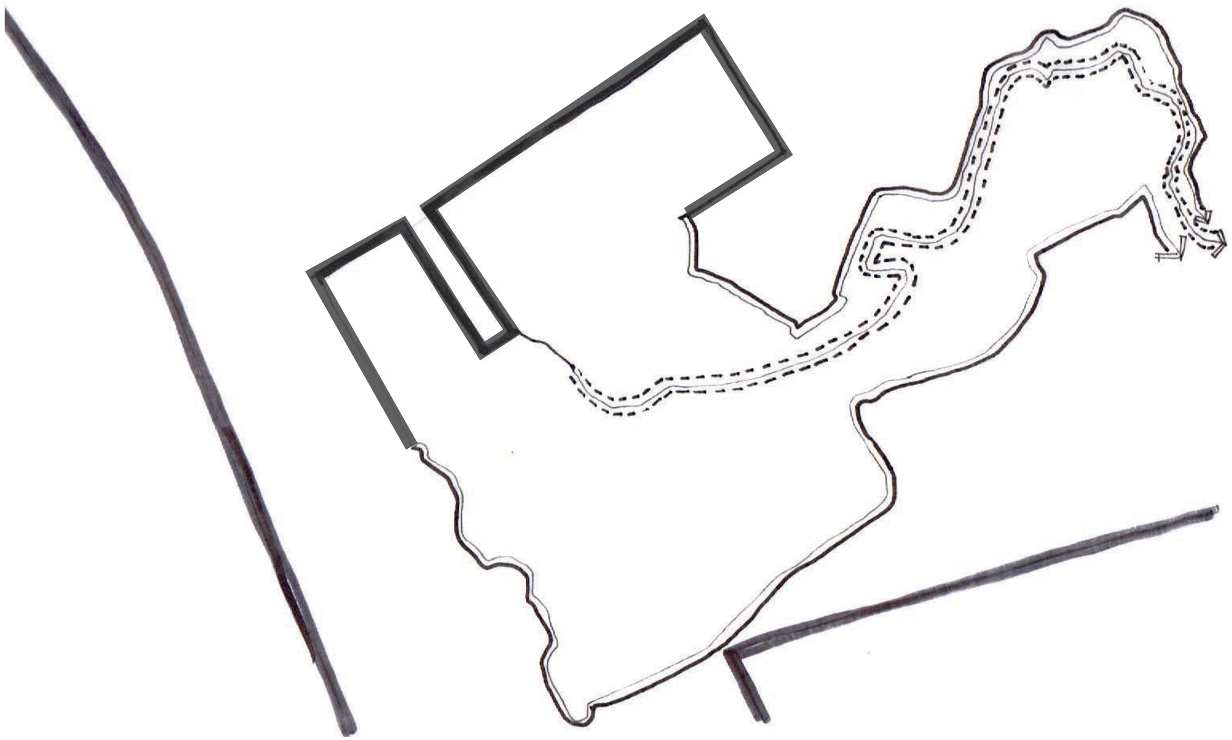


Figure 5.4: Conceptual diagram of industry and nature merging (Author 2017)

A synthesis of the previously mentioned informants led to the development of the concept of architecture as [re]mediator.

The concept is based on two ideas. The first being the idea of architecture as a remediator.

The Oxford Living Dictionary (2017) defines remediator as, "*A person who or thing which remediates something; an agent or provider of remediation*" and the act of remediation as fixing or solving something often referring to that of environmental damage.

The second part of the concept refers to the idea of a mediator. The Merriam-Webster dictionary (2017) defines mediation as an act of intervening between two conflicting parties in order to encourage reconciliation or compromise.

The underlying issue identified throughout the preceding chapters is the need for resolution of the dichotomy between industry and nature, resulting from the

Renaissance ideals of man being above nature and nature merely being a service to be exploited by the Industrial Revolution. Regenerative and other environmental theories have prompted the need for design that responds to nature and instead of exploiting nature, working together with nature in order to promote prosperity of living systems as well as socio-economic systems.

The architecture should therefore act as mediator between industry and nature and at the same time as remediator, promoting ecological health and remedying the current environmental damaged caused by previous industrial processes.

The architecture could possibly allow for nature and industry to work together in a more mutually beneficial relationship and also act as a facilitator in order for interaction between these two entities to occur. This means that all interfaces become important tools in achieving and experiencing this new mediated relationship.

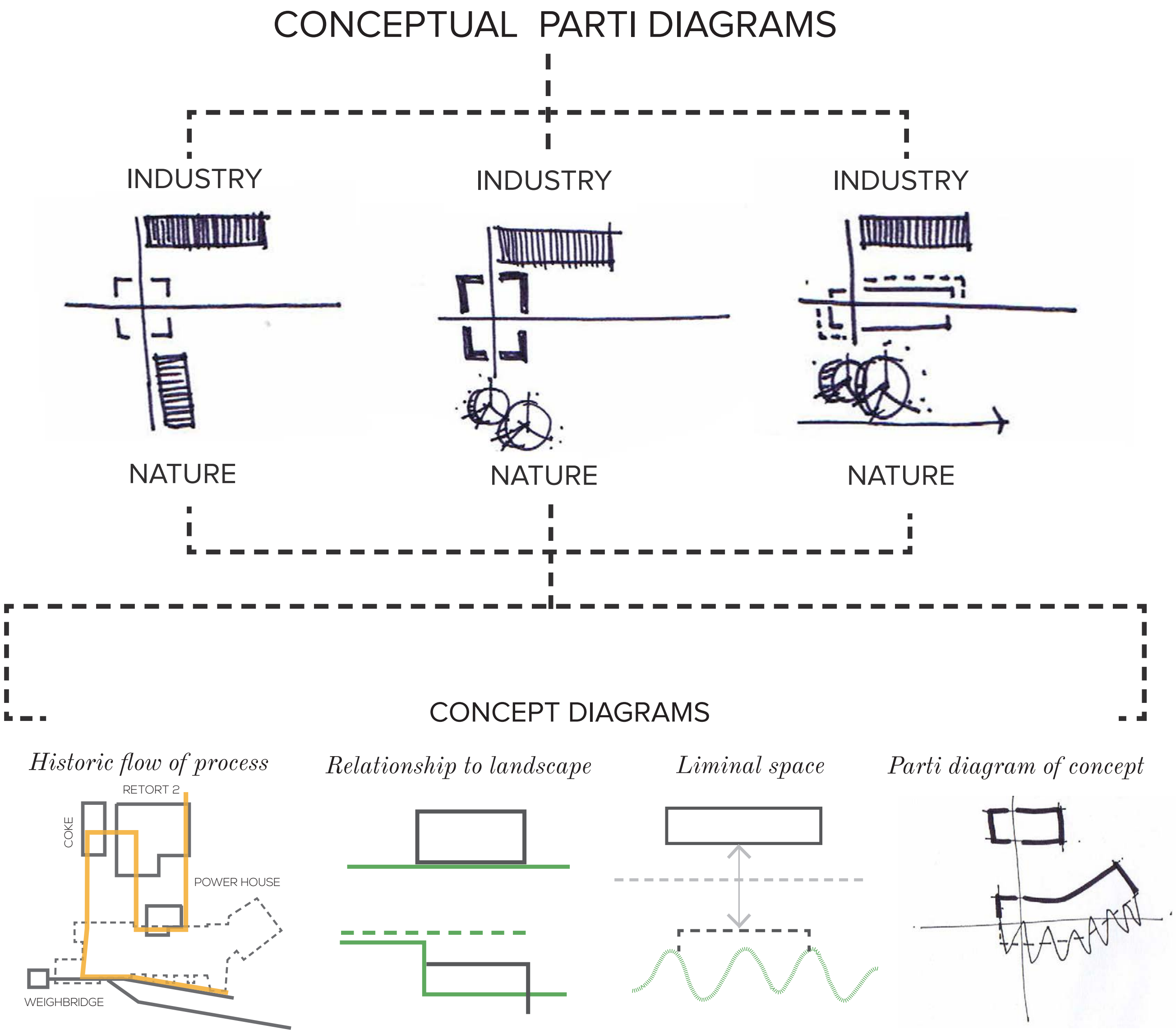


Figure 5.5: Conceptual diagram development - Architecture as [Re]mediator (Author 2017)

BUILDING AS [RE]MEDIATOR

Remediator defined

A thing which remediates something;
an agent or provider of remediation (English Oxford Living Dictionary 2017)

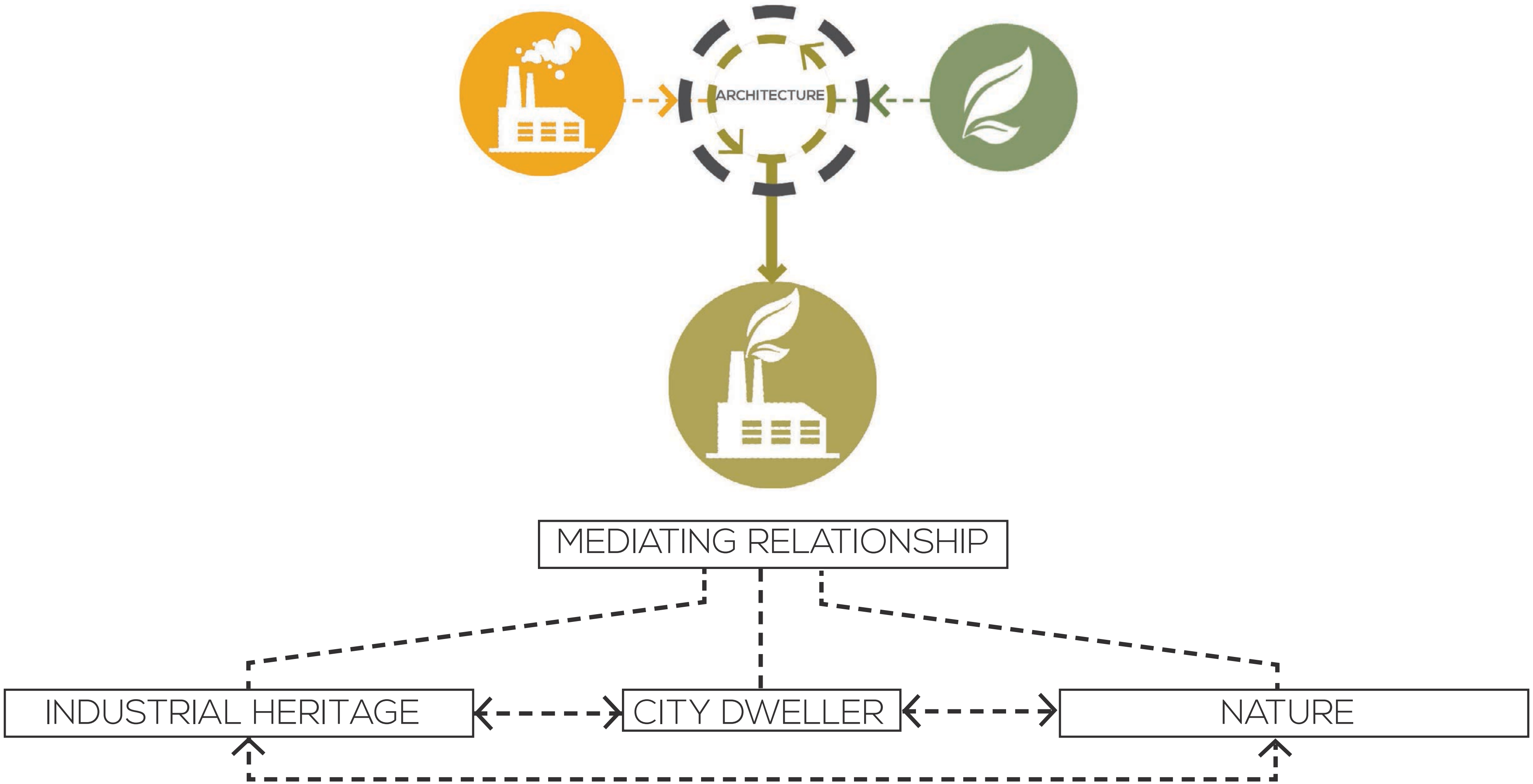


Figure 5.6: [Re]mediator diagram (Author 2017)

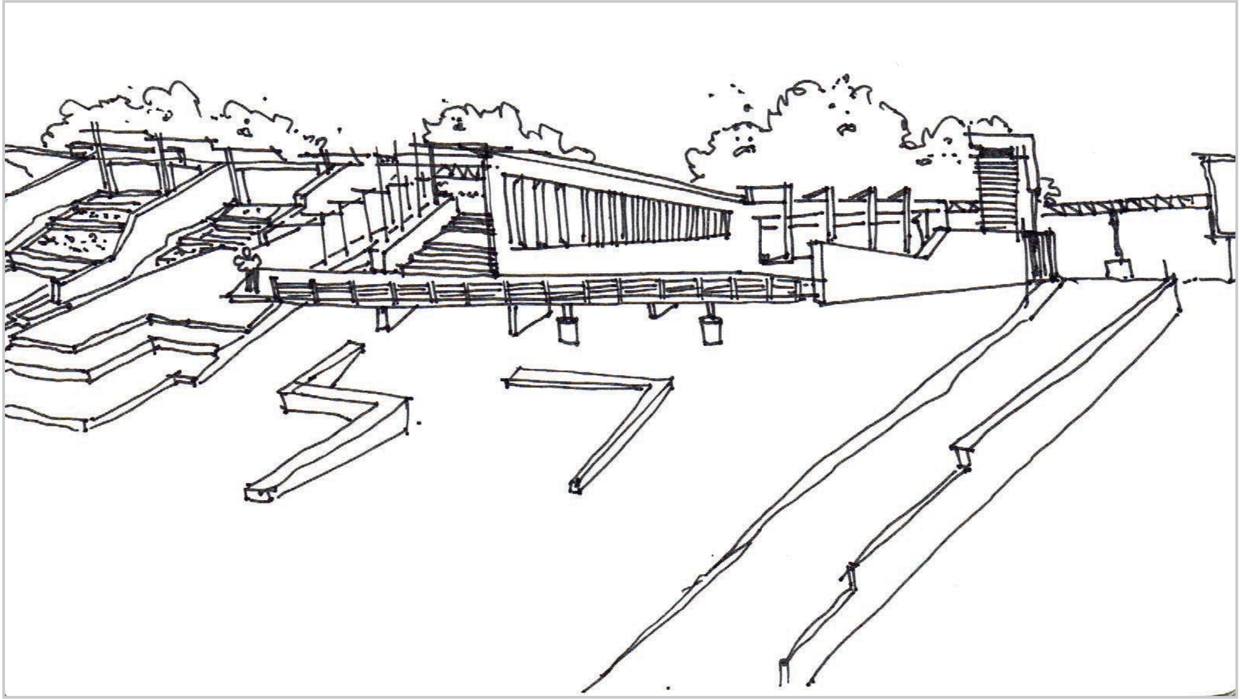


Figure 5.7: Conceptual perspective A (Author, June 2017)

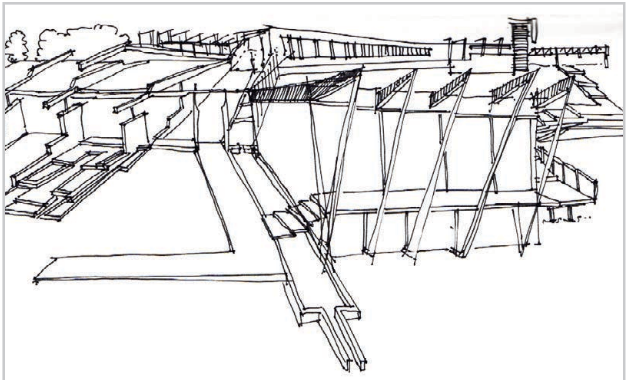


Figure 5.8: Conceptual perspective B (Author, June 2017)

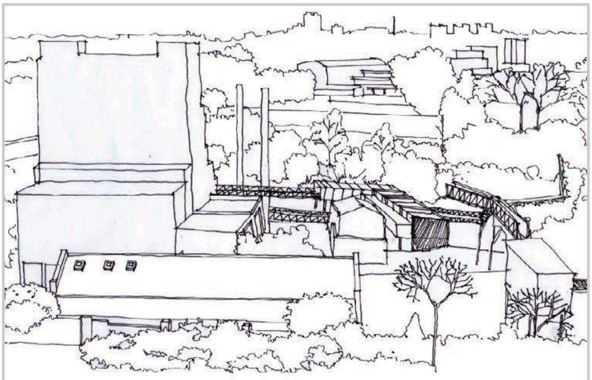


Figure 5.9: Conceptual perspective C (Author, June 2017)

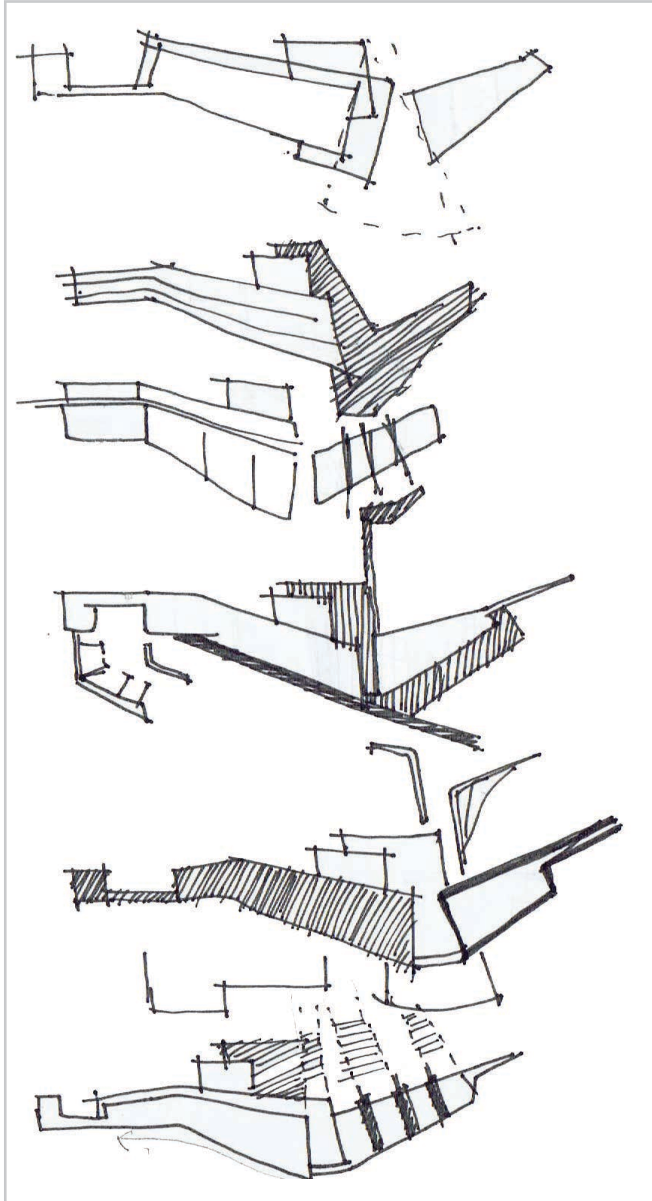


Figure 5.10: Plan vignettes (Author, June 2017)

Chapter 6

Design Development

06 Design Development

Application of design informants

The coal to gas process played an important part in the value of this part of South Africa's industrial heritage, therefore the new programme responds to this by adhering to the same directional flow as the original programme (see Fig. 6.2). The new structure is also positioned to the south of the existing retort in order to create the critical dialogue between the old structure, which was designed to be unresponsive to and dominating over the landscape surrounding it, and the new structure. The new structure in the form of a dye house and workshops is in stark contrast to the old retort house. The new dye house assumes its position as part of the landscape and starts to distort the line between industry and nature.

Instead of the new dye house adhering to the patterns of conventional industries by polluting the surrounding water sources and landscapes, the new dye house exposes the purification process of the water used in the dye process and also exposes its dependency on nature to feed the process. This is achieved through the new building forming a type of infrastructure for the plants needed in the natural dye process to grow on. The old powerhouse is also transformed into a terrarium where plants are grown to be used in the dye process.

The linearity of the new plan responds to the opposing linear form of the existing retort house. However, the new building breaks away from its linear nature as it reaches the tea house. This is to indicate a new approach in industrial architecture, where the structure directs itself parallel to the contours and becomes completely enveloped in the landscape.

The design is developed in such a way that the users experience a form of progression as they move from the entrance, which is more technological and rectilinear in form, to the outside

Figure 6.1. Left: CWG Plant (Author 2017)

Historic flow of process

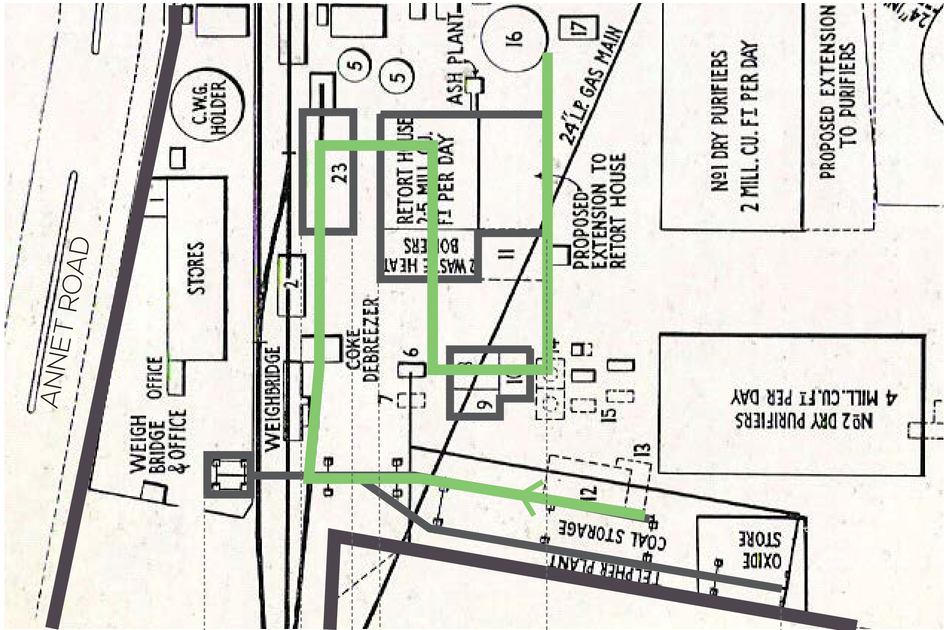
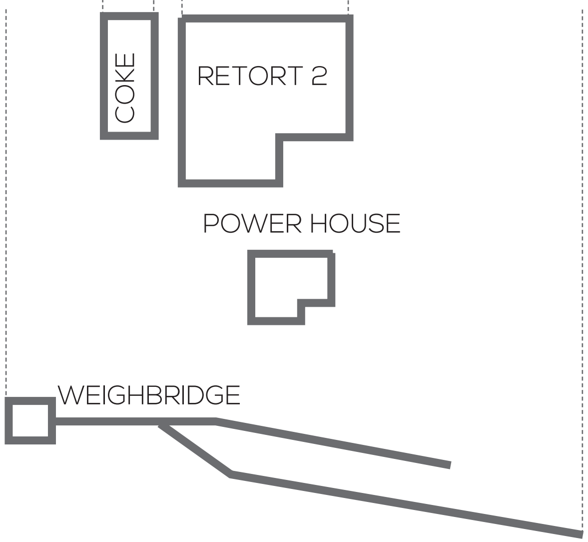


Figure 6.2: Historic flow of process (City of Johannesburg Gas Department 1954, edited by Author)



Dialectical relationship between old & new

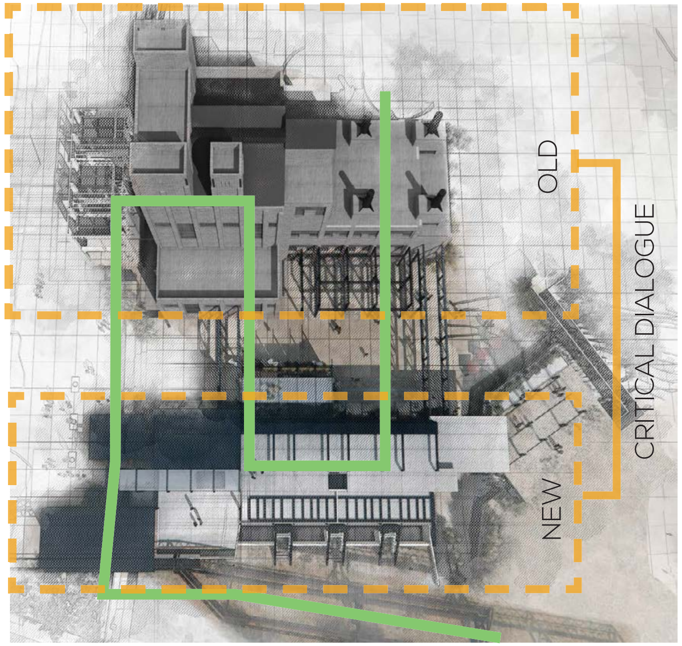
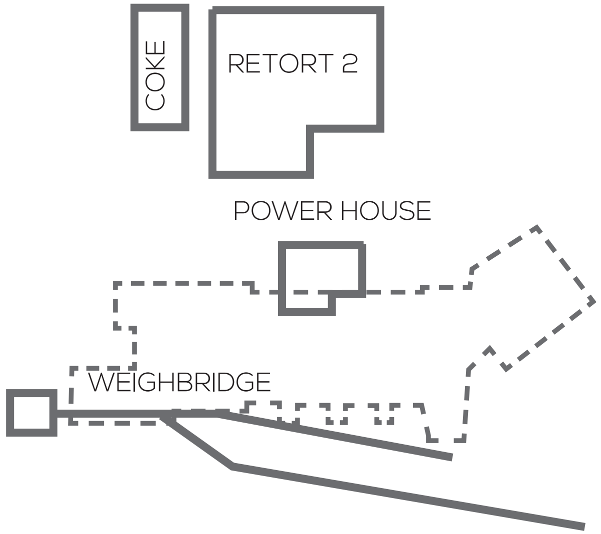


Figure 6.3: New intervention responding to heritage flow of process (Author 2017)



market space between the retort house and the new dye house, which becomes more phenomenological as the processes of weaving and dyeing are metaphorically presented in the structures and landscape.

The goal is to design a place where the culmination of the whole process can be experienced and the new relationship between industry and nature can be observed and appreciated. This also creates a stronger connection between the process and the final product as the dye house is placed directly opposite the market space where the finished textiles are sold.

How memory and heritage is approached in the design

Unfortunately all machinery used in the coal to gas process was stripped from Retort 2 during the 1992 partial demolition of the Gasworks. The only remnants of the industrial process can now be found in historical photographs, a few industrial artefacts still present in the landscape and ambiguous records. In an attempt to retain and expose the memory of the industrial heritage, the new process of intervention will adhere to the same directional flow as the original process. The entrance where coal was brought to the site by rail, will remain the main entrance serving the new intervention. Visitors to the market will enter the retort house on the same edge where coal entered the retort. The new proposed walkways connecting the heritage building to the new intervention signify a material manifestation of the industrial memory.

How philological restoration is approached in design

Apart from the adopted heritage approach, the reasoning behind minimal alteration to the existing retort house is to preserve the epoch of the building in order to create a dialectical relationship between the existing retort house, representing past industrial approaches, and the new juxta-positioned building representing a different approach to industrial architecture which allows for interaction between nature and industry to occur in a mutually beneficial manner.

Simitch and Warke (2014:130) suggest in their book *The Language of Architecture* that systems of movement have the ability to mediate between past and present conditions. Modes of movement often guide humans into the liminal space that exists between these two opposing conditions "*establishing a critical dialogue that allows one to be understood from the lens of the other*" (Simitch and Warke 2014:130).

Design precedent

Artspark Performing Arts Pavilion by Morphosis

Morphosis [sa] describes the conceptual design of the 1989 Artspark Performing Arts Pavilion as an architectural expression, blurring the boundaries between architecture and the landscape.

The focus of the project was to insert man-made objects within a suburban park. The motivation behind the submerged nature of the building (see Fig. 6.5) was to achieve compatibility with the context.

Morphosis exposed articulated structural (see Fig. 6.7-6.8) elements to entice passersby to explore the building further. Inspiration was drawn from the subliminal nature of the arts by focusing on the rituals that take place in the spaces and that which occurs at a deeper level. Elements assumed the role of "*kinetic sculptural pieces emerging from the earth to begin to reveal what lies below*" (Morphosis [sa]).

The landscape was seen as an overlay to exert the character of the architecture rather than the form throughout the remaining part of the site. This created the opportunity to design small objects which obscures the boundaries between architecture and the landscape.

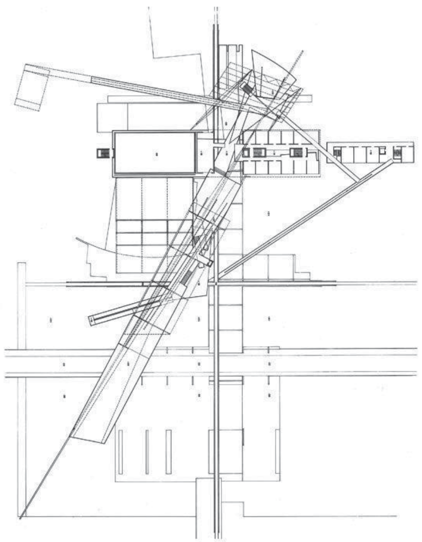


Figure 6.4: Artspark Plan (Morphosis 1989, edited by Author)

Figure 6.5: Artspark section illustrating submerged nature of building (Morphosis 1989)

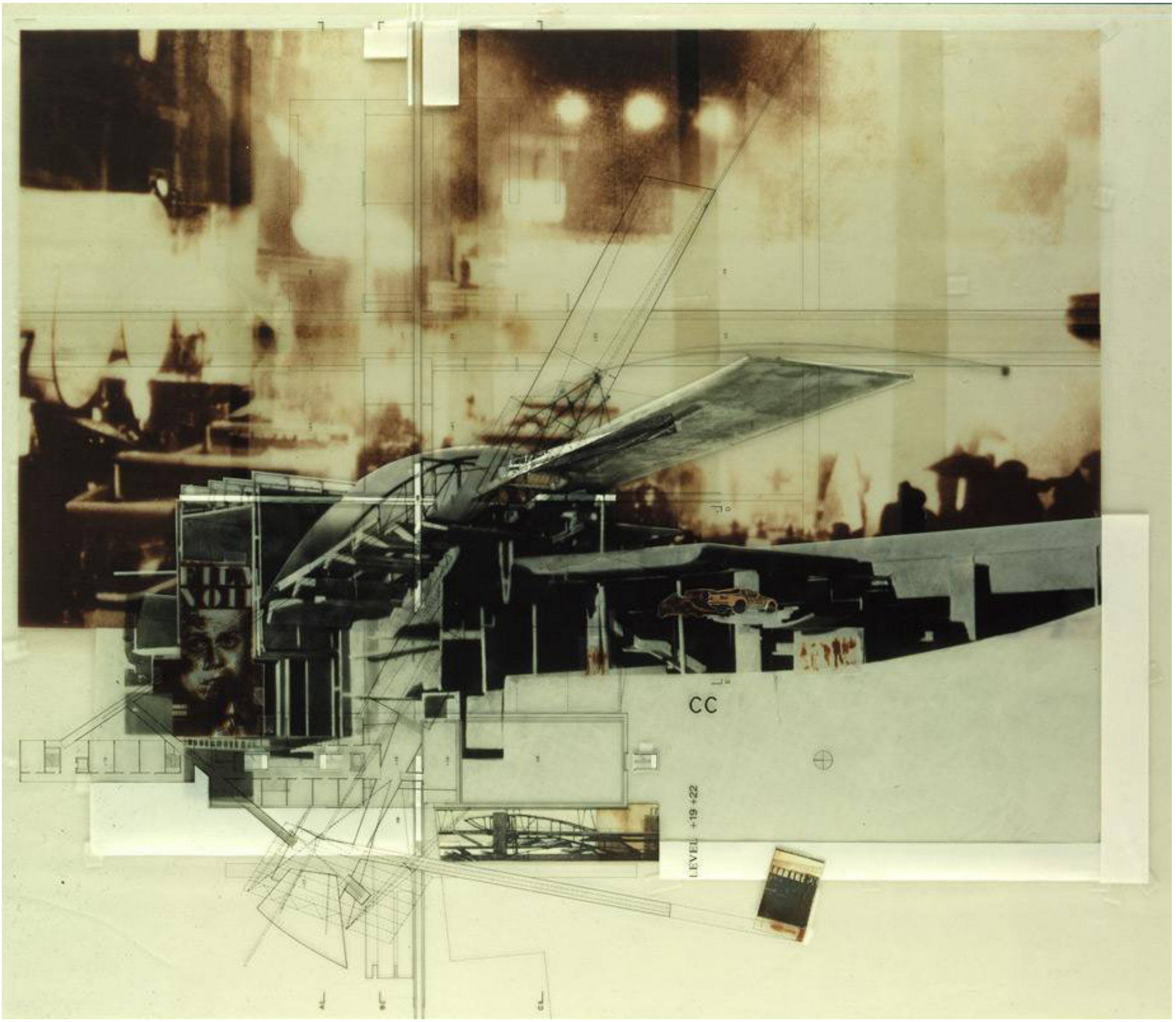


Figure 6.6: Artspark conceptual representation (Morphosis 1989)

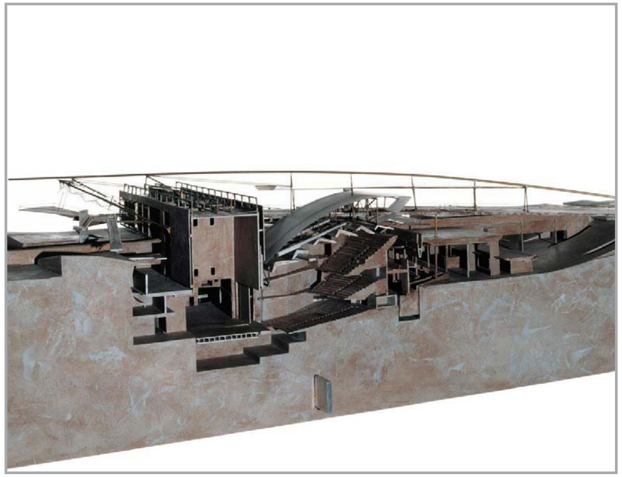


Figure 6.7: Artspark section illustrating sculptural elements protruding from landscape (Morphosis 1989)

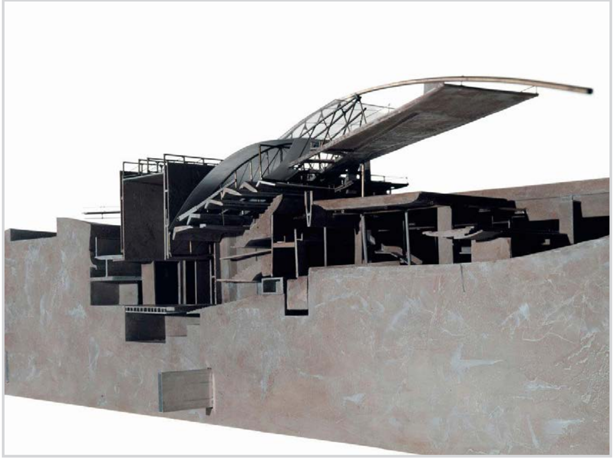


Figure 6.8: Artspark Sculptural elements (Morphosis 1989)

Design Iterations

Maquette - Iteration 1

Iteration 1 explored the development of a new tectonic architectural language to oppose the stereotomic nature of the existing retort.

Critique: The New addition's response was too tectonic in nature, very linear and did not create a strong enough relationship with the surrounding landscape in order to strengthen the concept of mediation between the landscape and industry.

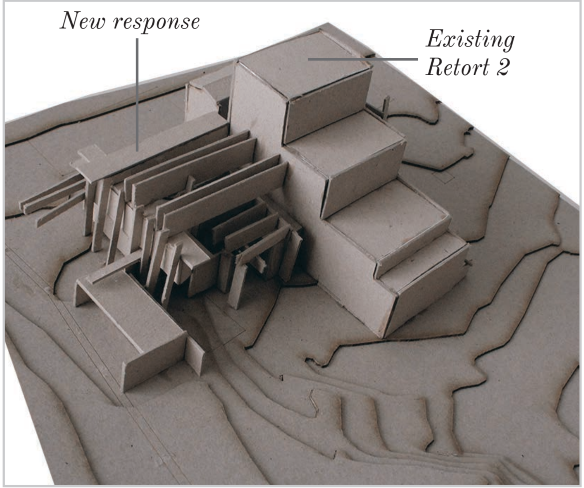


Figure 6.9: Iteration 1 Maquette view A (Author, April 2017)

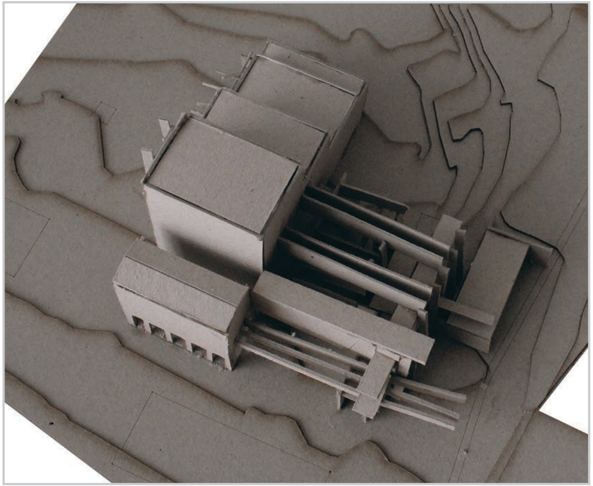


Figure 6.10: Iteration 1 Maquette view B (Author, April 2017)

Maquette - Iteration 2

Iteration 2 explored the notion of directing the new building away from the existing one by following the direction of the existing contours to signify the establishment of a new industrial typology that is completely different from the historic industry.

Critique: This iteration lacked the necessary response to the existing structure as well as a relationship with the landscape. The new structure was too ornate, creating a confused architectural language.

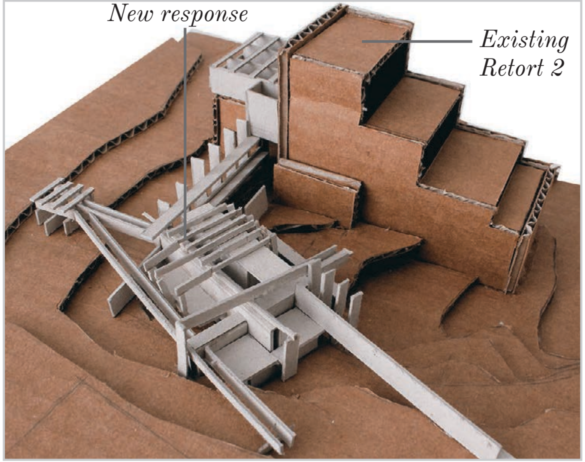


Figure 6.11: Iteration 2 Maquette view A (Author, May 2017)

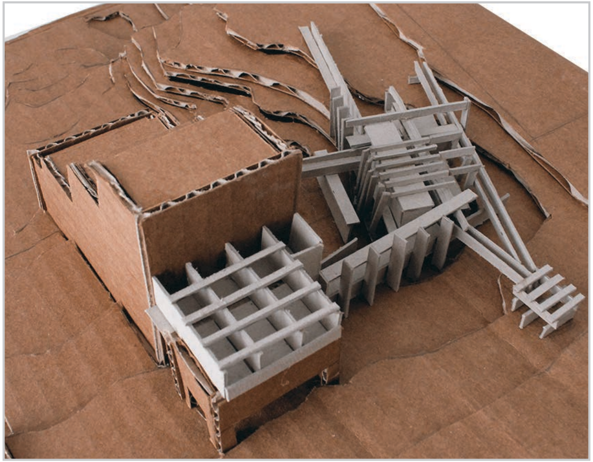


Figure 6.12: Iteration 2 Maquette view B (Author, May 2017)

Maquette - Iteration 3

Iteration 3 focused on strengthening the connection to the existing retort through the insertion of a very strong, linear connection in the form of a walkway. The structure was simplified and lifted from the ground, in order to create a sensitive architectural approach.

Critique: The architectural language of the new structure was too stereotomic in nature, not providing enough opportunities for the mediation of industry and nature as the structure spoke a very similar language as the existing retort. Elevating the structure from the ground also created a detached relationship between the building and the landscape, making interaction between the two difficult.

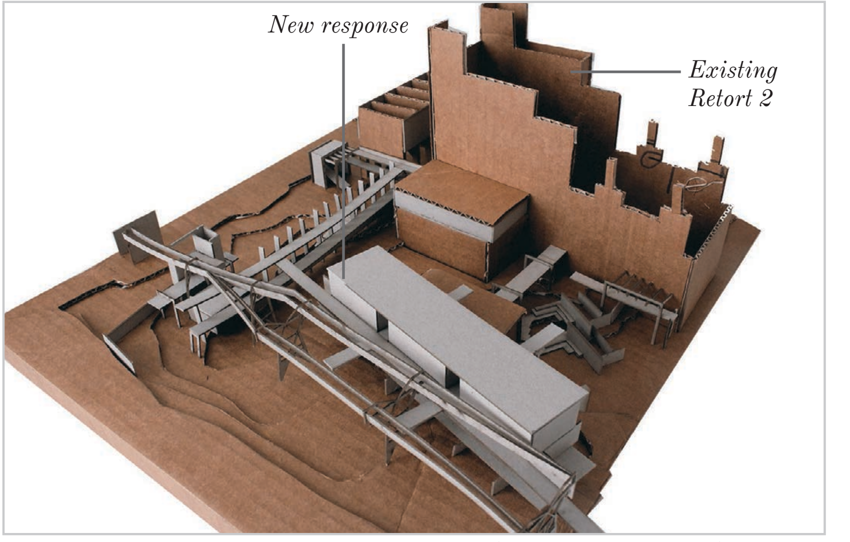


Figure 6.13: Iteration 3 Maquette view A (Author, May 2017)

Maquette - Iteration 4

Iteration 4 focused on creating a stronger connection between building and landscape, by embedding the structure within the landscape and making use of strong structural elements to anchor the roof of the new building to the landscape. This provided many more opportunities for mediation between the building and nature, as well as between industry and nature to occur.

Critique: Although iteration 4 created a much stronger relationship between the new building and the landscape, it did not form any relationship with the existing heritage fabric.

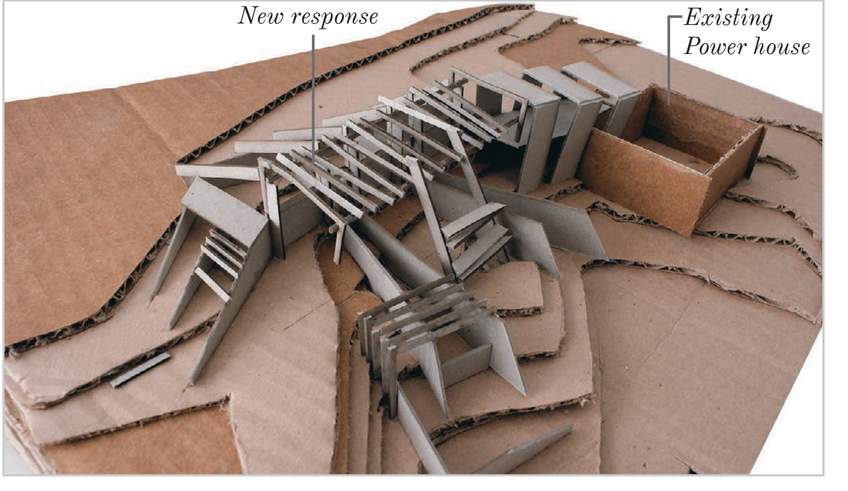


Figure 6.14: Iteration 4 Maquette view A (Author, June 2017)

Iteration 5

Iteration 5 explored the spatial implications of the programme on plan as well as the conceptual approach on section. The rentable studio spaces were placed along the eastern edge of the site, with the dye house and dye laboratory assuming the central position on the ground floor plan. The first floor plan consisted of the workshops and an office.

Section A-A expresses the connection between the studios and the landscape, almost embedding the studios in the landscape and allowing for the building to break away from the landscape as it moves towards the existing retort. Section B-B illustrates the connection between the proposed new building and the existing retort. The two buildings are connected by walkways that form part of the memory of the old process, while providing process routes for the new programme.

Critique: The studios were too detached from the rest of the design and the tea house was too small. Spaces were purely functional and lacked experiential quality. The outdoor market space remained unresolved as well as the interior space of the retort.

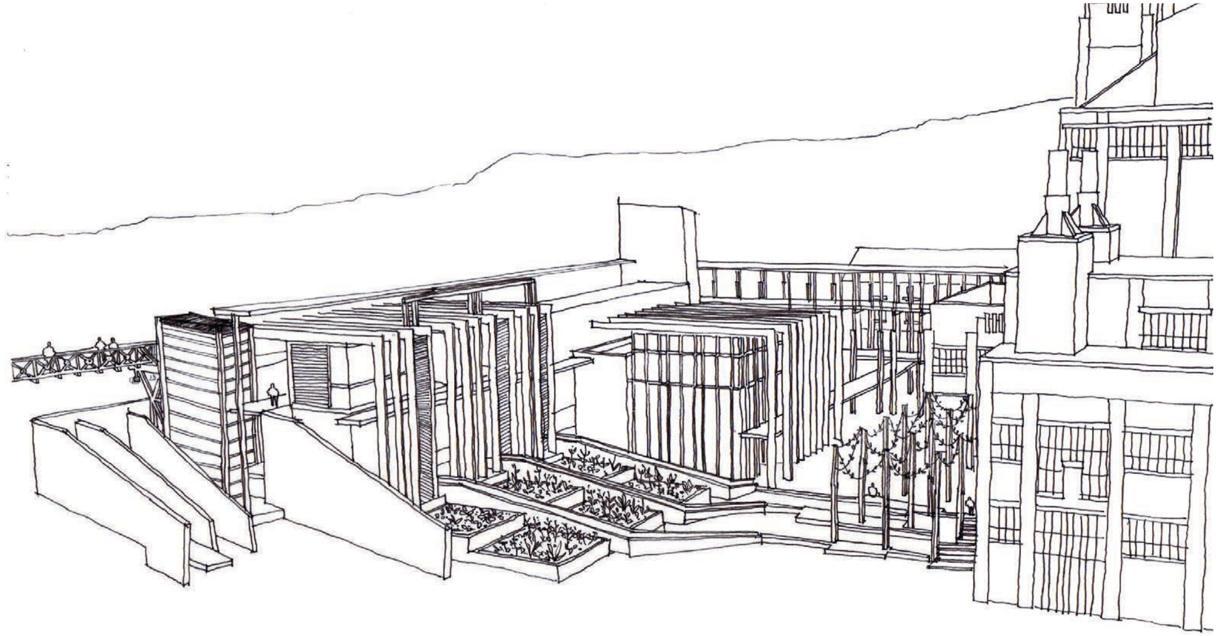


Figure 6.15: Perspective 1 (Author, July 2017)

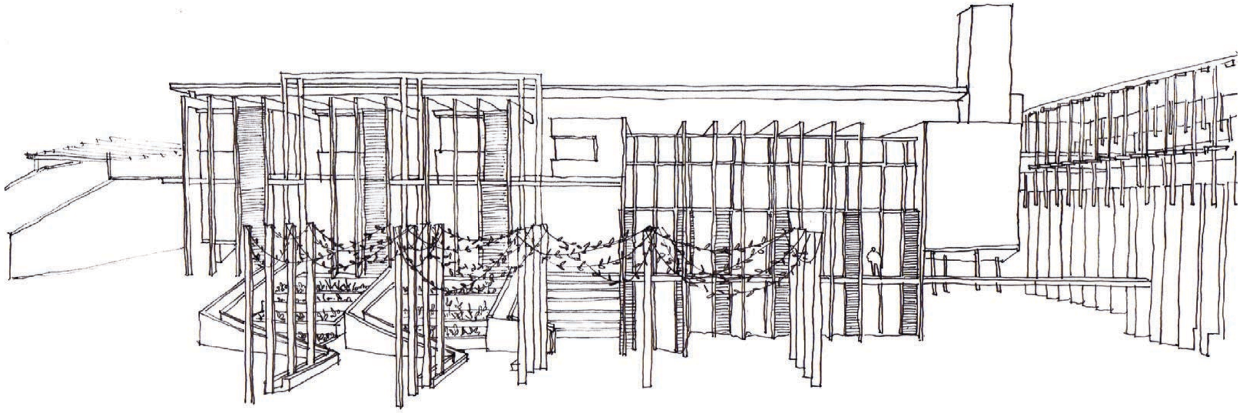


Figure 6.16: Perspective 2 (Author, July 2017)

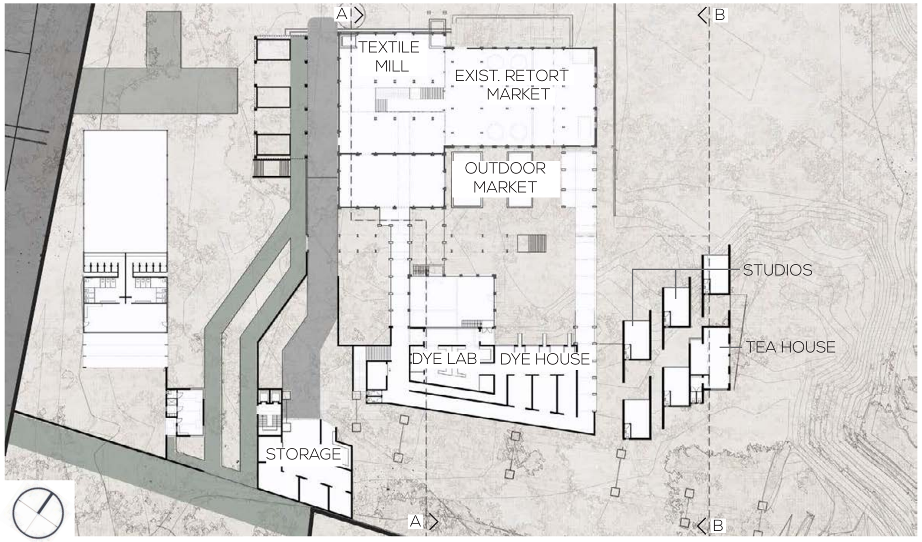


Figure 6.17: Iteration 5 Ground Floor Plan - June crit (Author 2017)

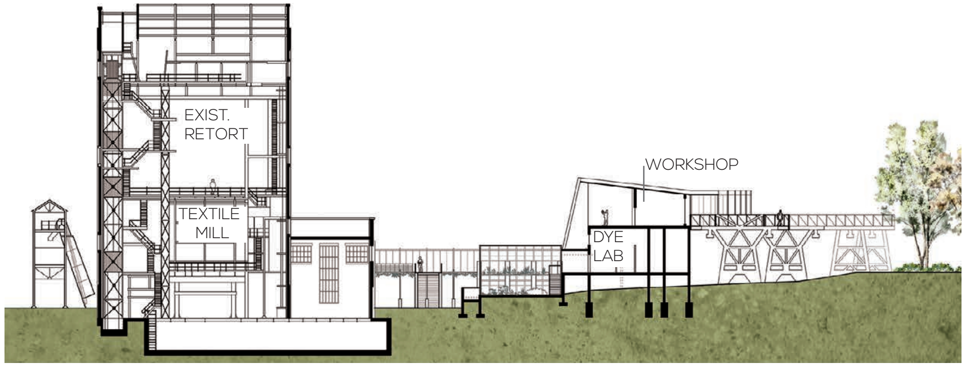


Figure 6.19: Iteration 5 Section A-A - June crit (Author 2017)

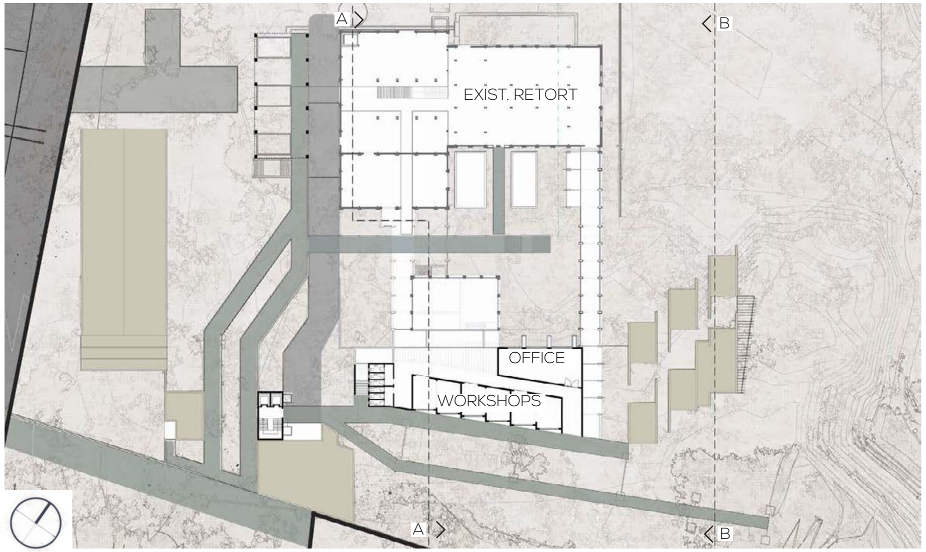


Figure 6.18: Iteration 5 First Floor Plan - June crit (Author 2017)

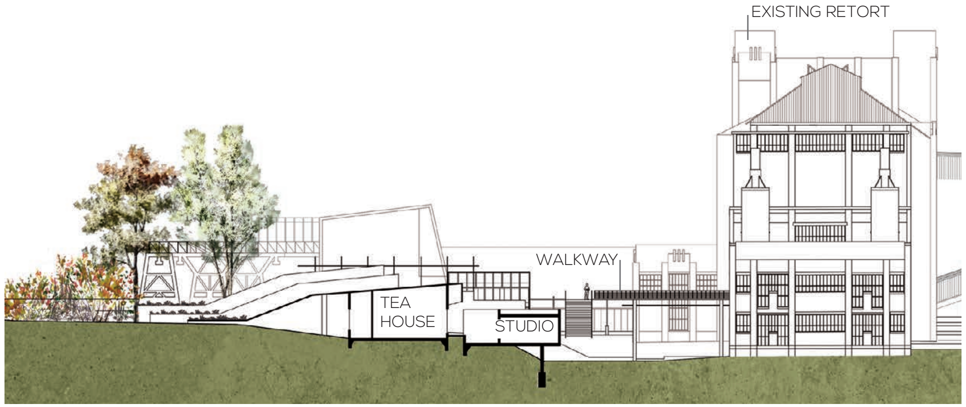


Figure 6.20: Iteration 5 Section B-B - June crit (Author 2017)

Iteration 6

Figure 6.21: Iteration 6 Ground Floor Plan - August (Author 2017)

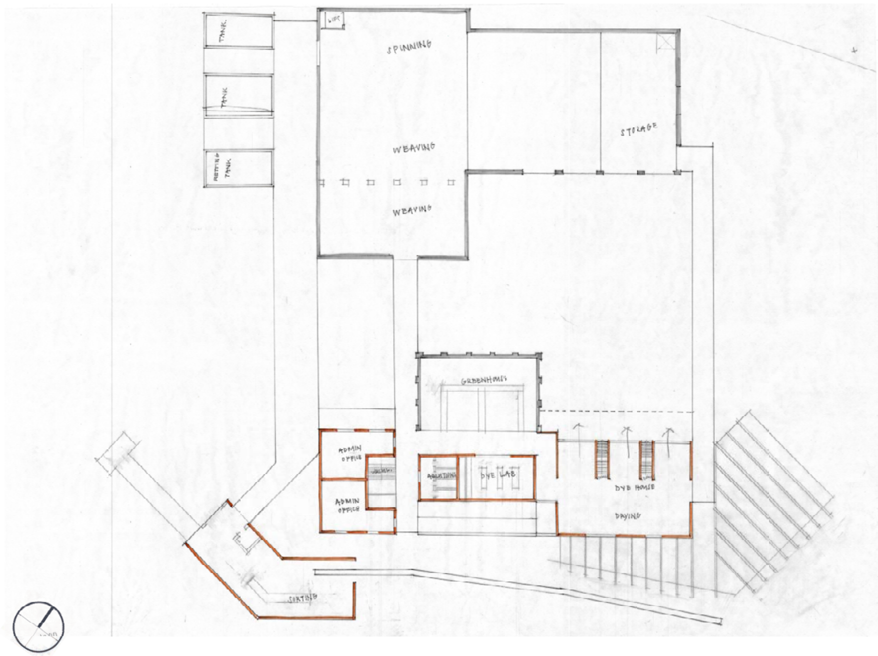


Figure 6.22: Iteration 6 First Floor Plan - August (Author 2017)

Iteration 6 attempted to create a more coherent design by moving the studios to the southern and northern edge on the ground floor of the new building and transforming the eastern edge of the building into the tea house. In order to create a stronger connection between landscape and building and to allow for interactions between industry and nature to occur, the tea house was sunk into the landscape. The dye house was placed on the first floor with drying to the south, workshops to the west and a ramp on the southern edge.

Critique: The position of the ramp on the southern edge of the building resulted in the studios and workshops not utilising the much needed southern light for ideal working conditions. The service connection of the tea house was placed on the northern edge of the building, exposing it to the public courtyard. The tea house design was still very disjointed from the rest of the design.

Iteration 7

Iteration 7 attempted to create more coherent connections between the interior spaces and their functions as well as a better connection between the dye house and the tea house. Moving the dyeing and drying section of the design to the northern façade, allowed for better interaction between industry and the public, as the dye house faces the outdoor market. On section, iteration 7 started to explore environmental systems in the form of ventilation.

Critique: Although better spatial connections were established, the position of the tea house was still slightly disjointed from the rest of the building. On section the ventilation system was unnecessarily complicated and did not contribute to the overall spatial quality of the spaces it was serving.

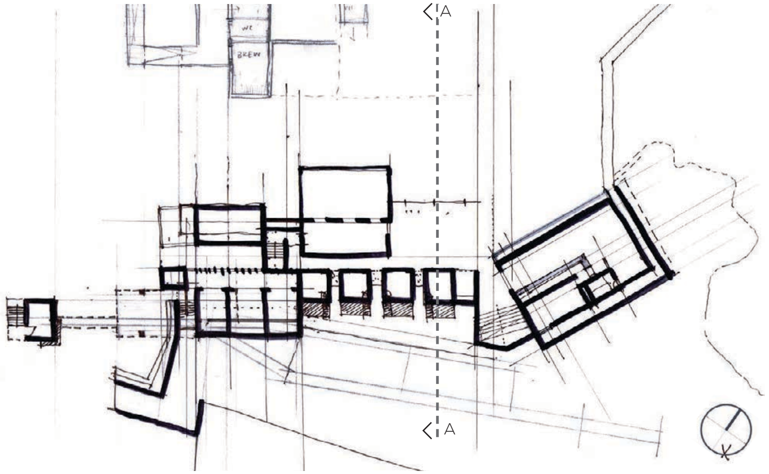


Figure 6.23: Iteration 7 ground floor plan (Author 2017)

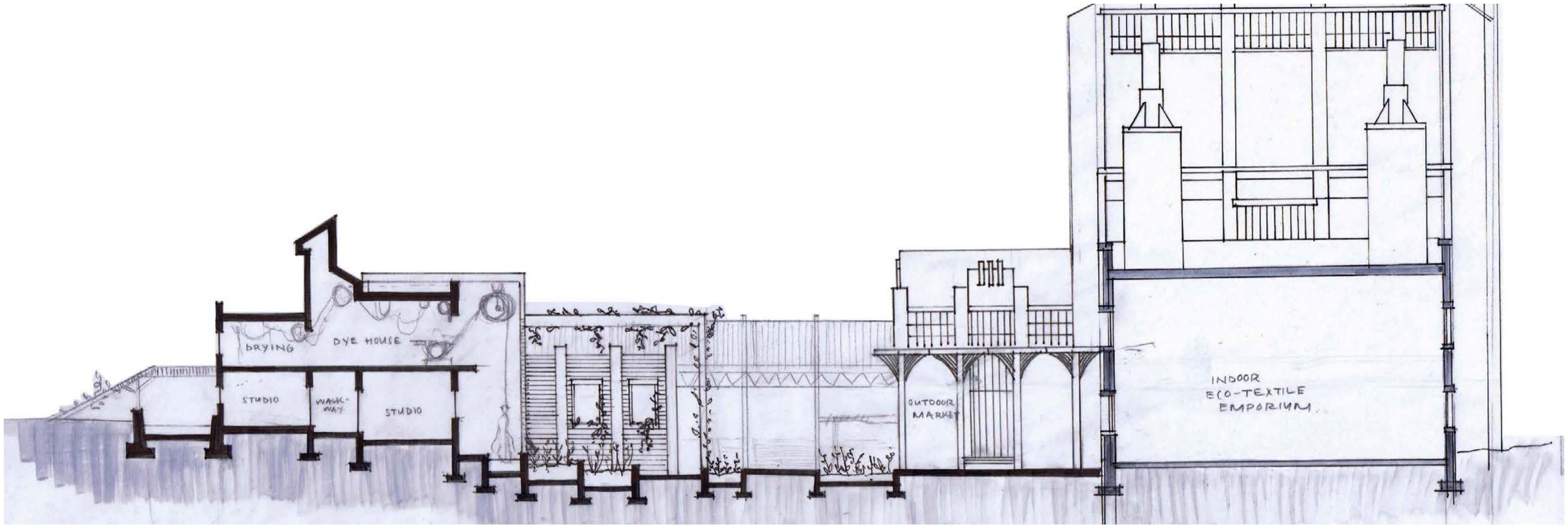


Figure 6.24: Iteration 7 Section A-A (Author 2017)

Iteration 8

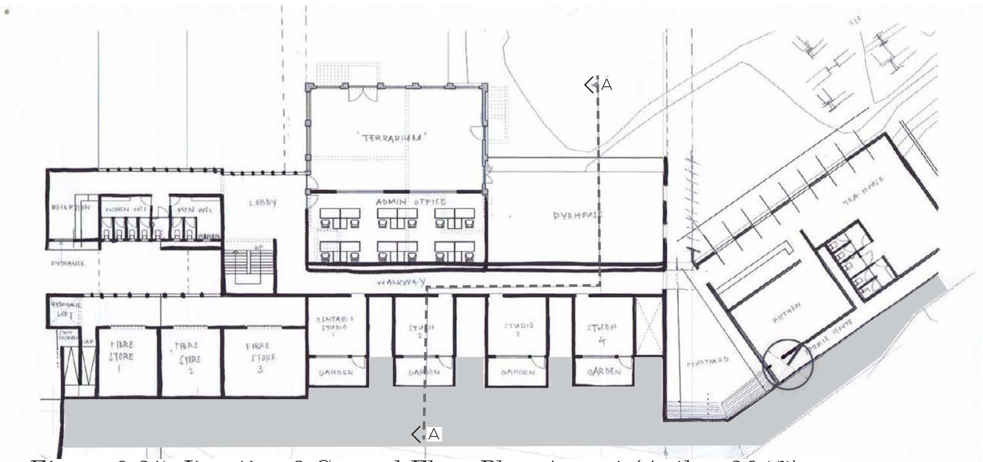


Figure 6.25: Iteration 8 Ground Floor Plan August (Author 2017)

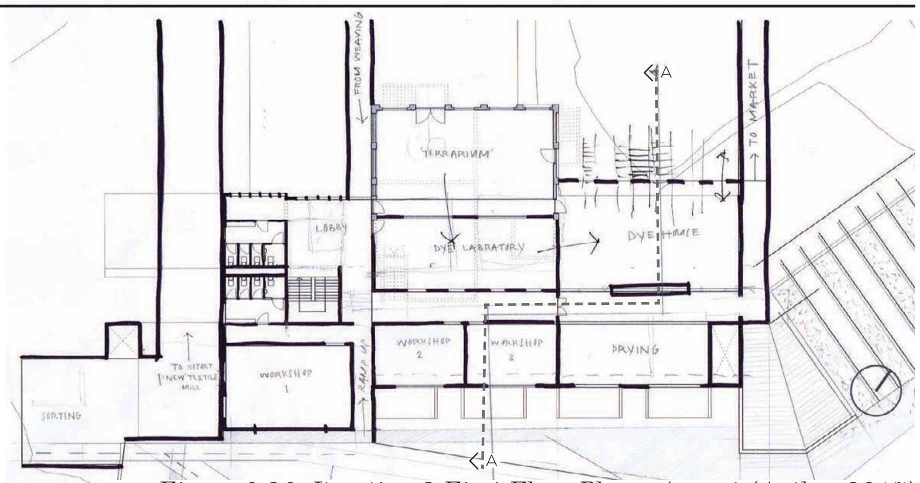


Figure 6.26: Iteration 8 First Floor Plan - August (Author 2017)

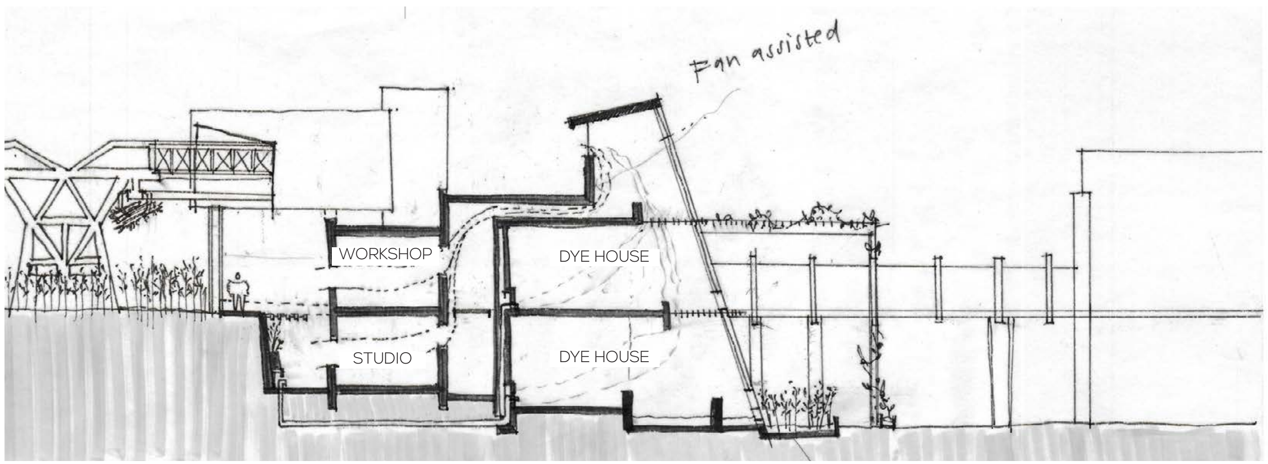


Figure 6.27: Iteration 8 Section A-A - August (Author 2017)

Iteration 8 & 9 started to address the proposed systems in a more simplistic manner by utilizing the northern solar heat gain to aid in the stack ventilation of the new building. Attention was given to defining the studio spaces more and in providing them with a small relaxation space which is engulfed by nature due to the structure being submerged into the landscape. In iteration 8 the drying area for the textiles was moved to the northern façade in order to expose the process to the public square instead of concealing it and also to allow the heat from the north to dry the textiles quicker.

Critique: The section needed further resolution as the use of two roof slabs to channel the hot air was identified as wasteful and unnecessary.

Iteration 9

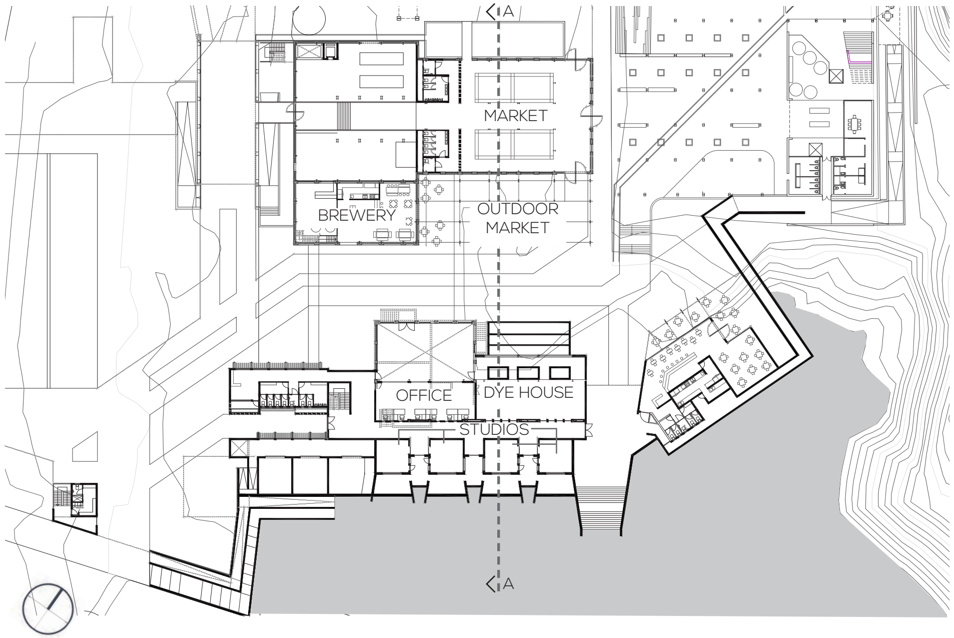


Figure 6.28: Iteration 9 Ground Floor Plan - August (Author 2017)

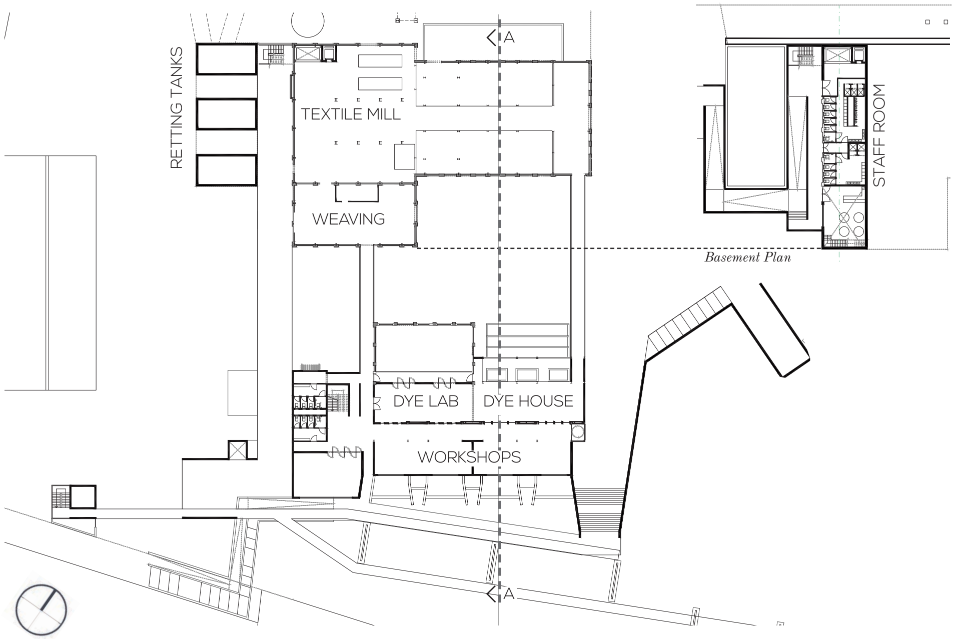


Figure 6.29: Iteration 9 First Floor Plan - August (Author 2017)

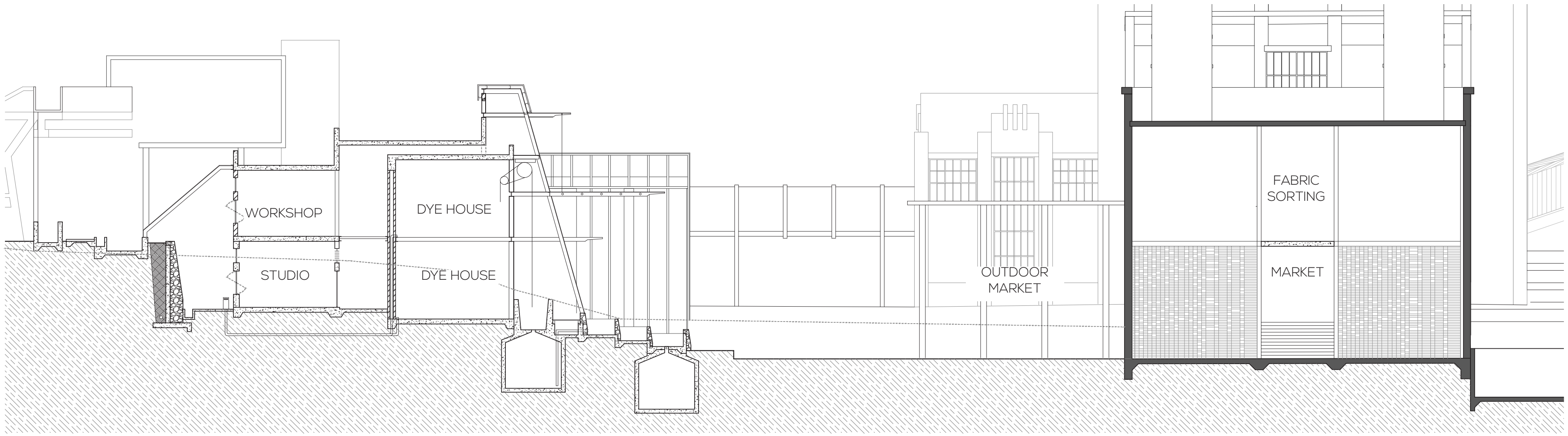


Figure 6.30: Iteration 9 Section A-A - August (Author 2017)

Iteration 10

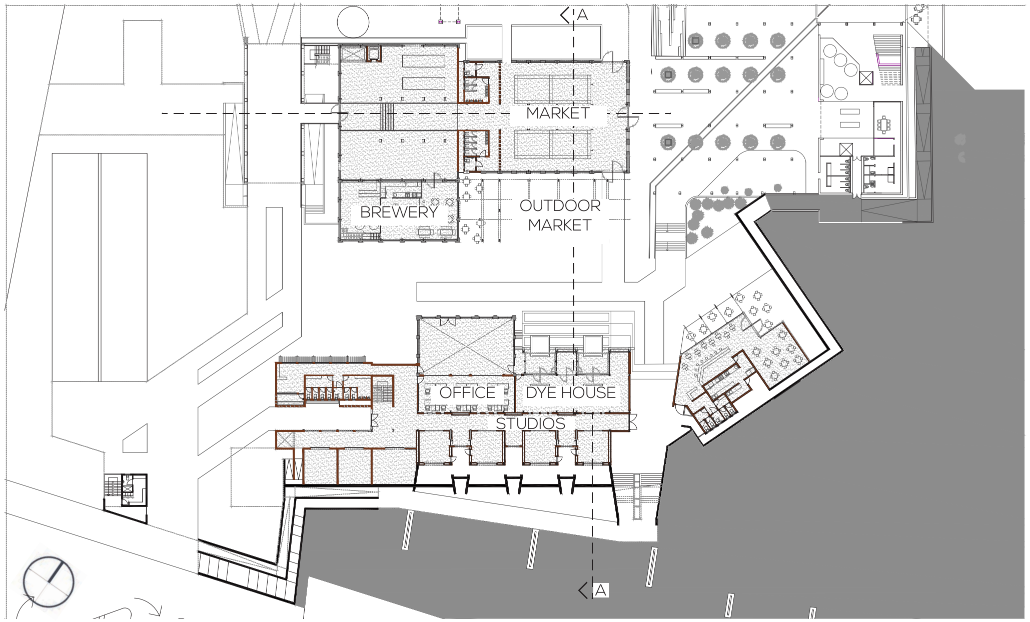


Figure 6.31: Iteration 10 Ground Floor Plan - September (Author 2017)

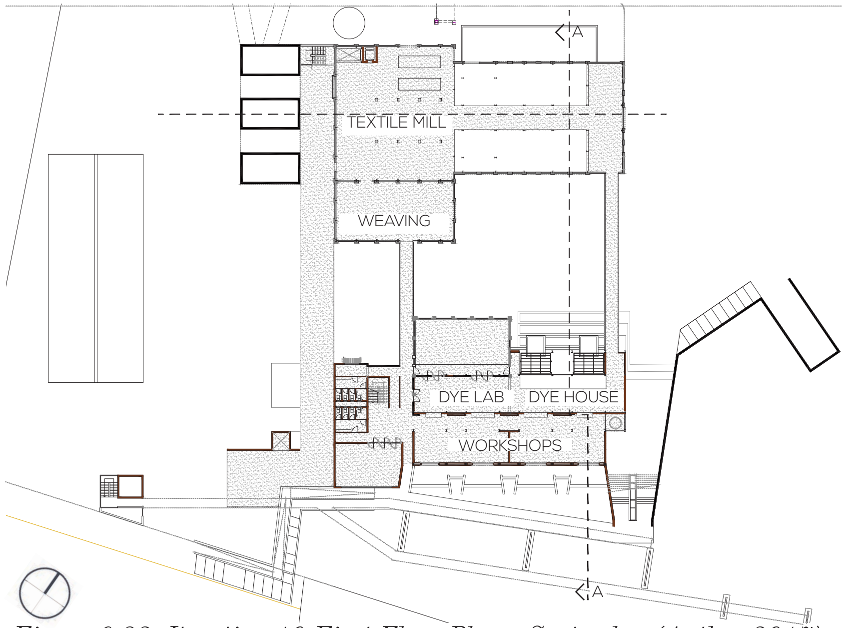


Figure 6.32: Iteration 10 First Floor Plan - September (Author 2017)

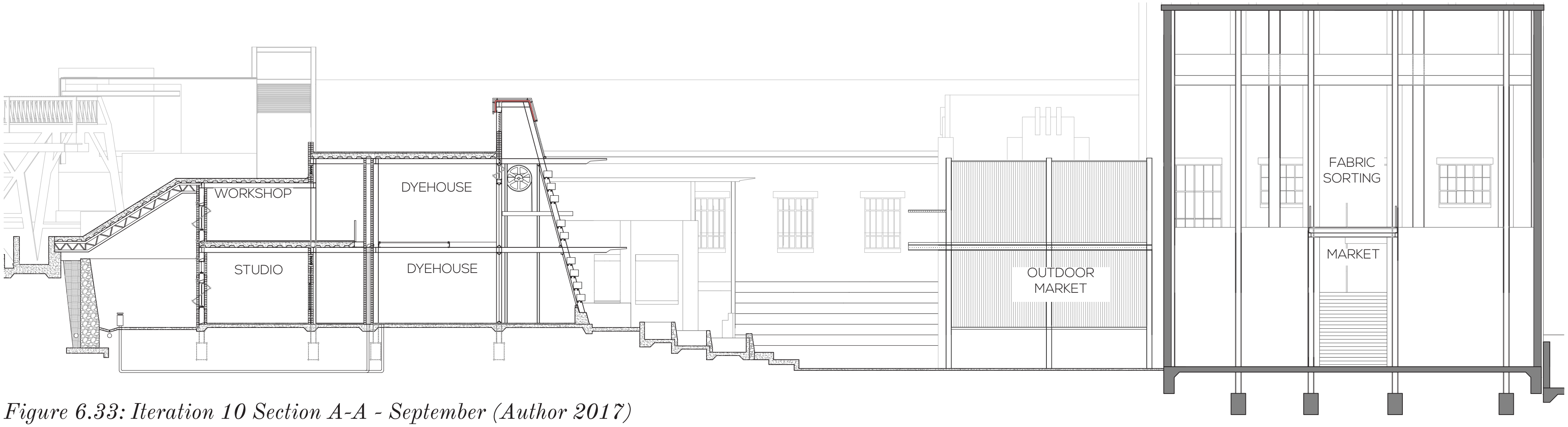


Figure 6.33: Iteration 10 Section A-A - September (Author 2017)

Final design maquette

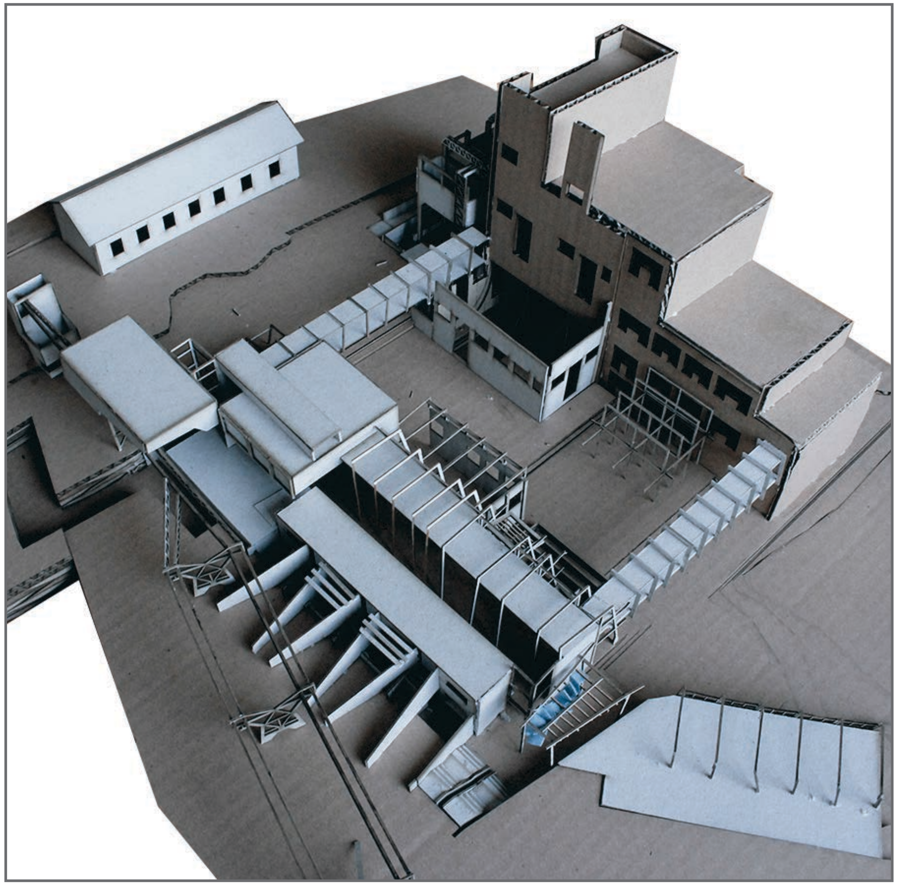


Figure 6.34: Final design maquette view 1 - September (Author 2017)

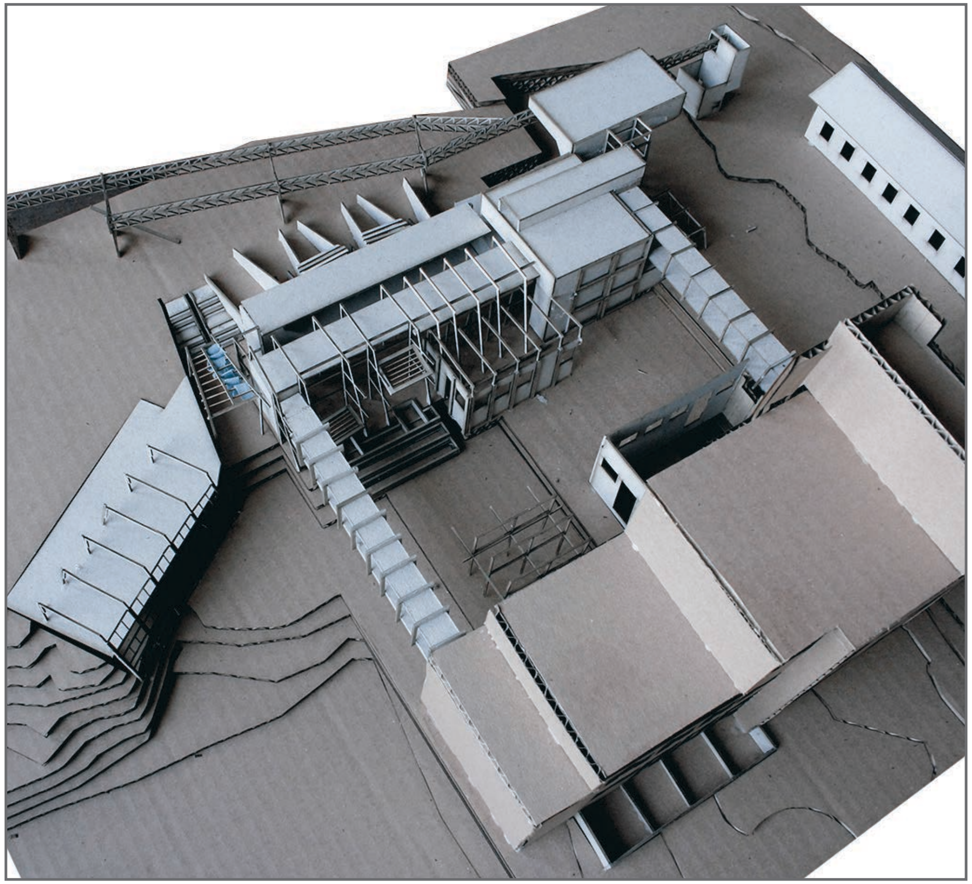


Figure 6.35: Final design maquette view 2 - September (Author 2017)

Understanding the design

Existing & New

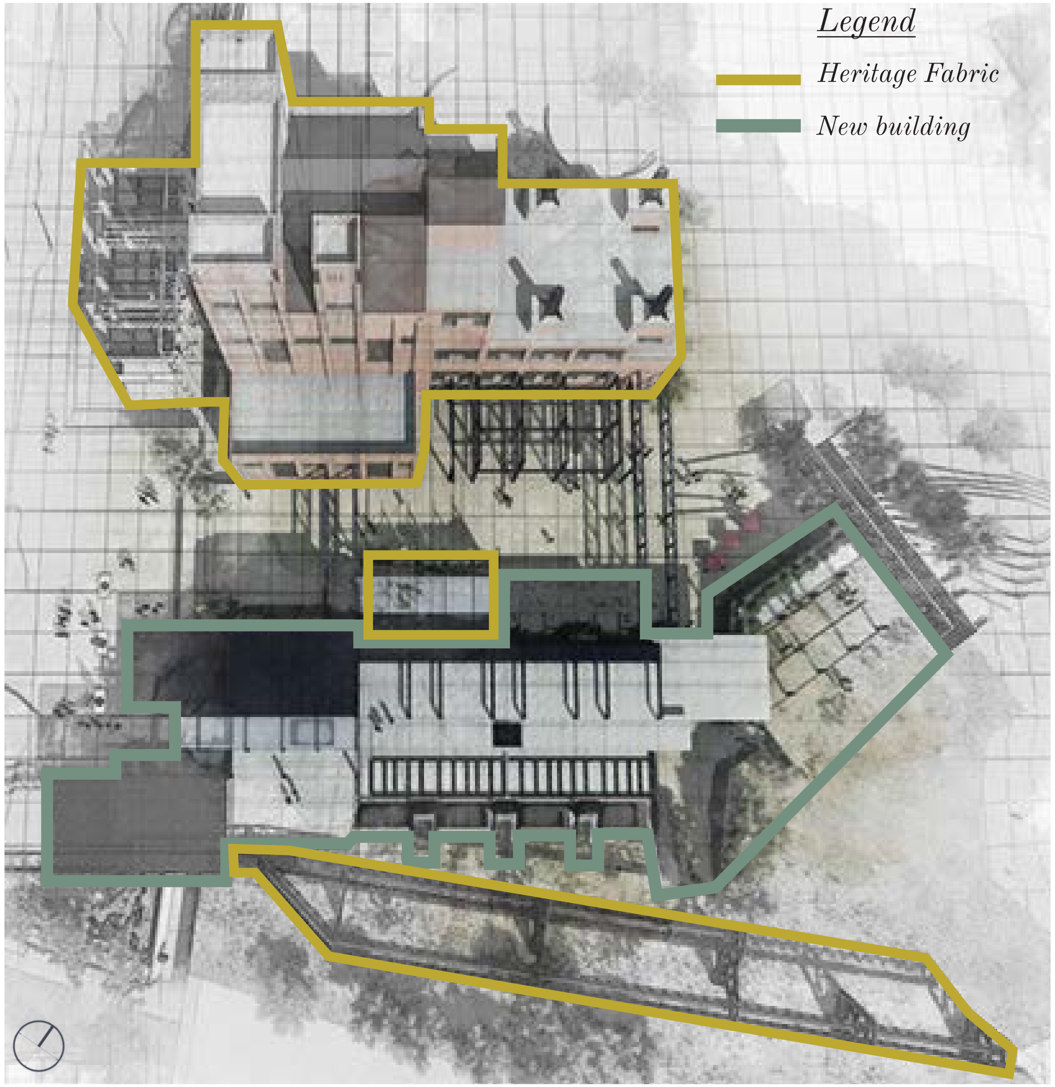


Figure 6.36: Site plan illustrating old vs. new - September (Author 2017)

Circulation / Movement

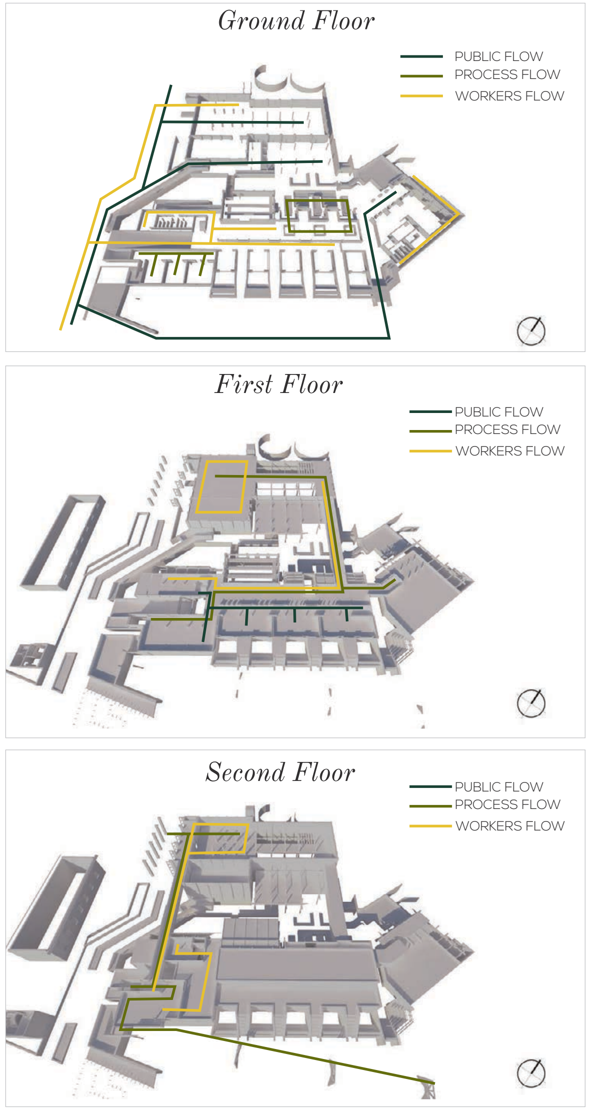
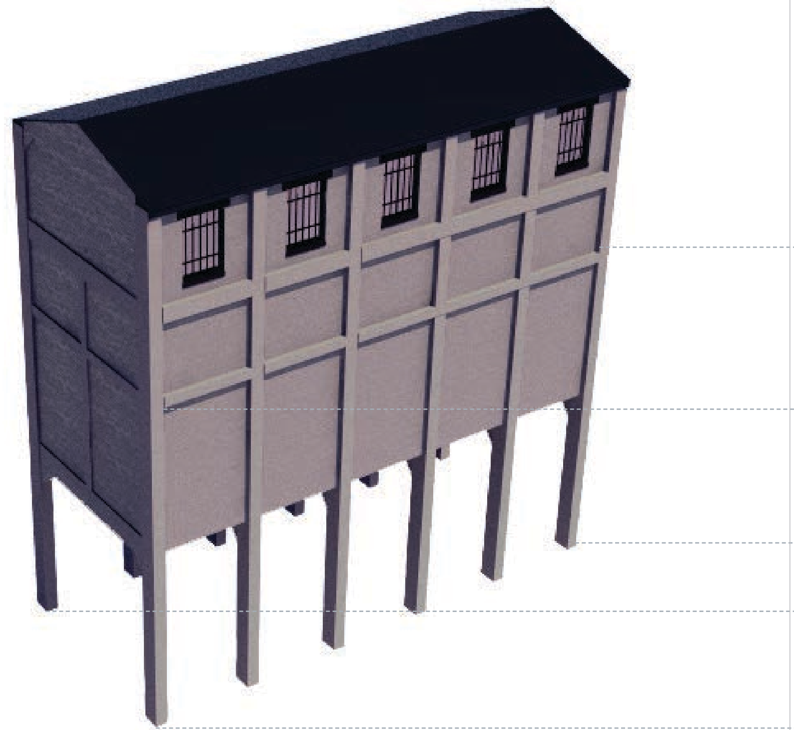


Figure 6.37: Flow of movement (Author 2017)

Changes to heritage fabric

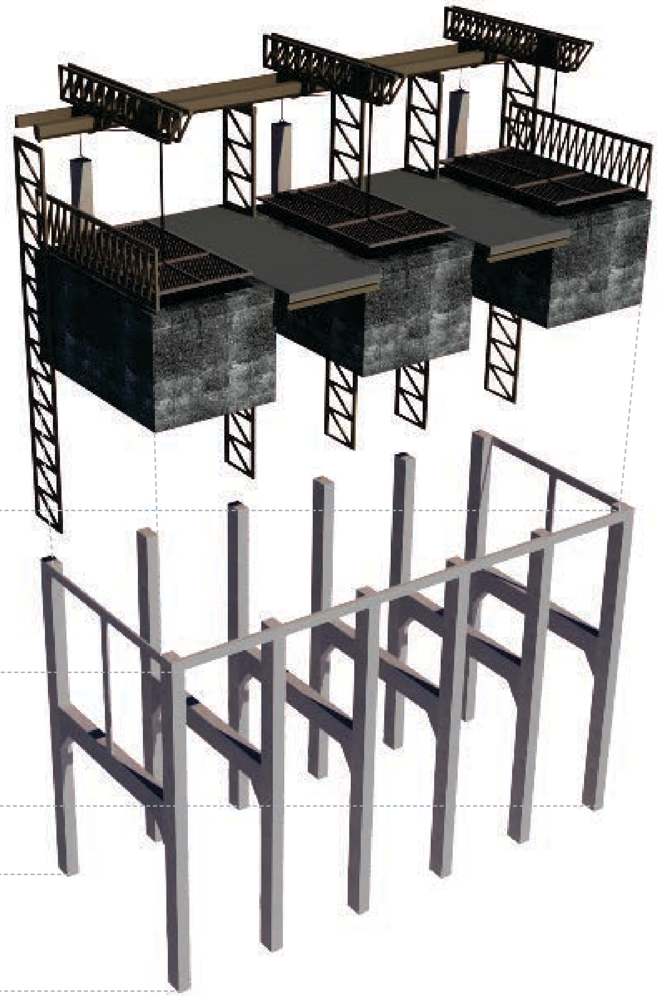
Coke storage bunker



Before

Previous use: Coke storage

Figure 6.38: Coke storage before intervention (Author 2017)



After

New proposed use: Retting tanks for textile mill

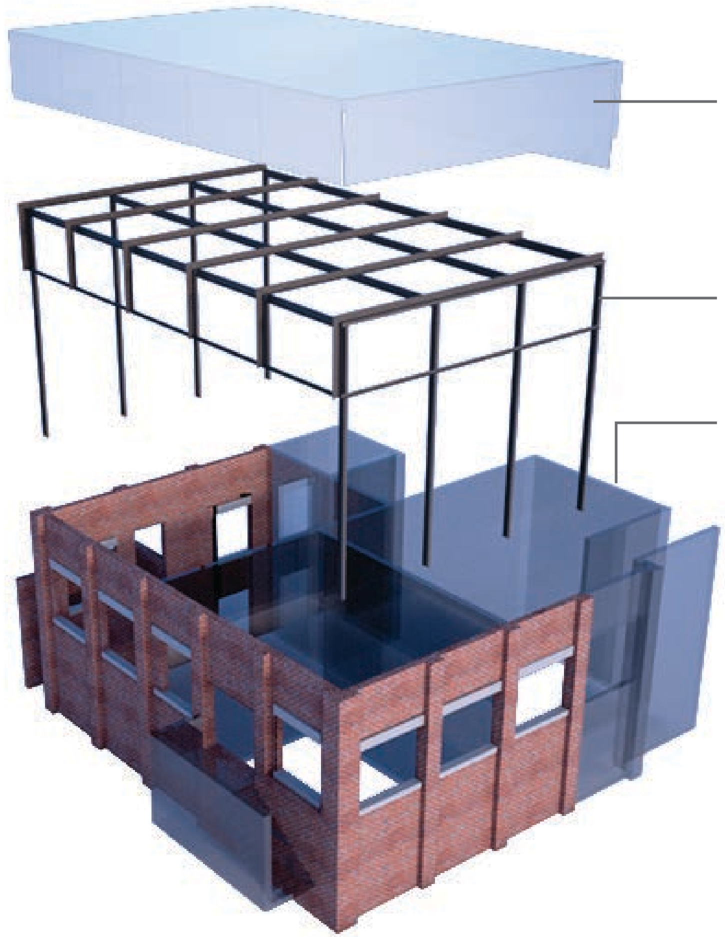
Figure 6.39: Coke storage after intervention (Author 2017)

Power house

Before

Previous use: Housed machinery

Figure 6.40: Power house before intervention (Author 2017)



After

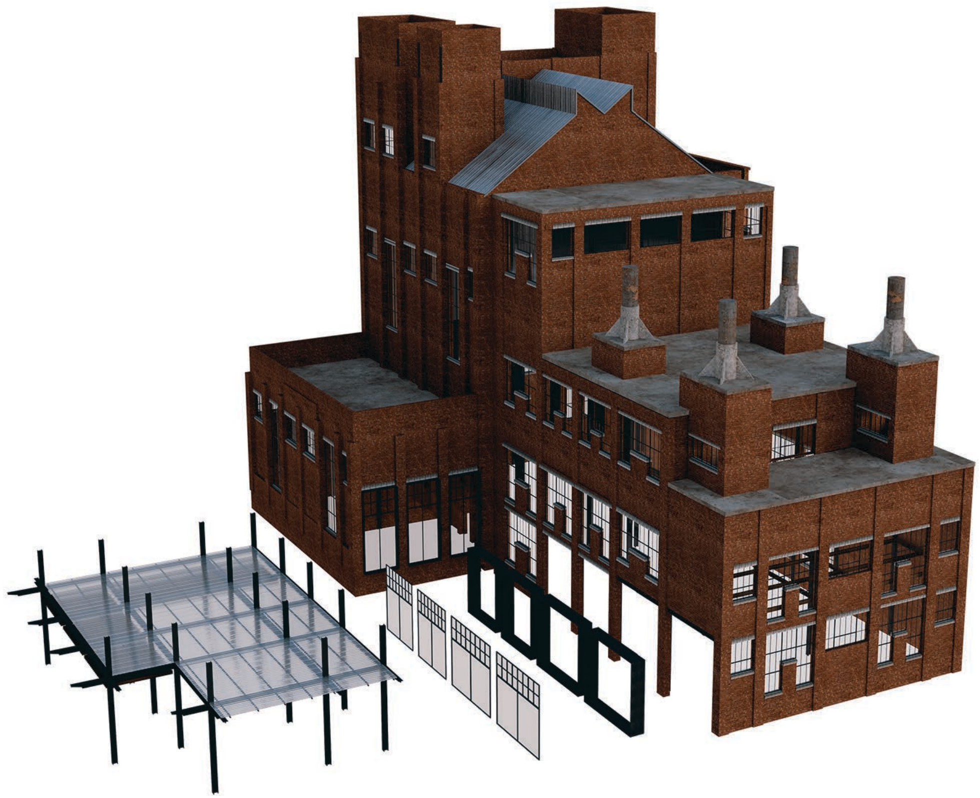
New proposed use: Terrarium for growing of plants for dyes

Figure 6.41: Power house after intervention (Author 2017)

Before

Previous use: Coal to Gas production

Figure 6.42: Coke storage before intervention (Author 2017)



After

New proposed use: Eco-textile Mill & Textile Market

Figure 6.43: Coke storage after intervention (Author 2017)

Final design

Site plan

Figure 6.44: Final Design Site Plan (Author 2017)

Ground Floor Plan

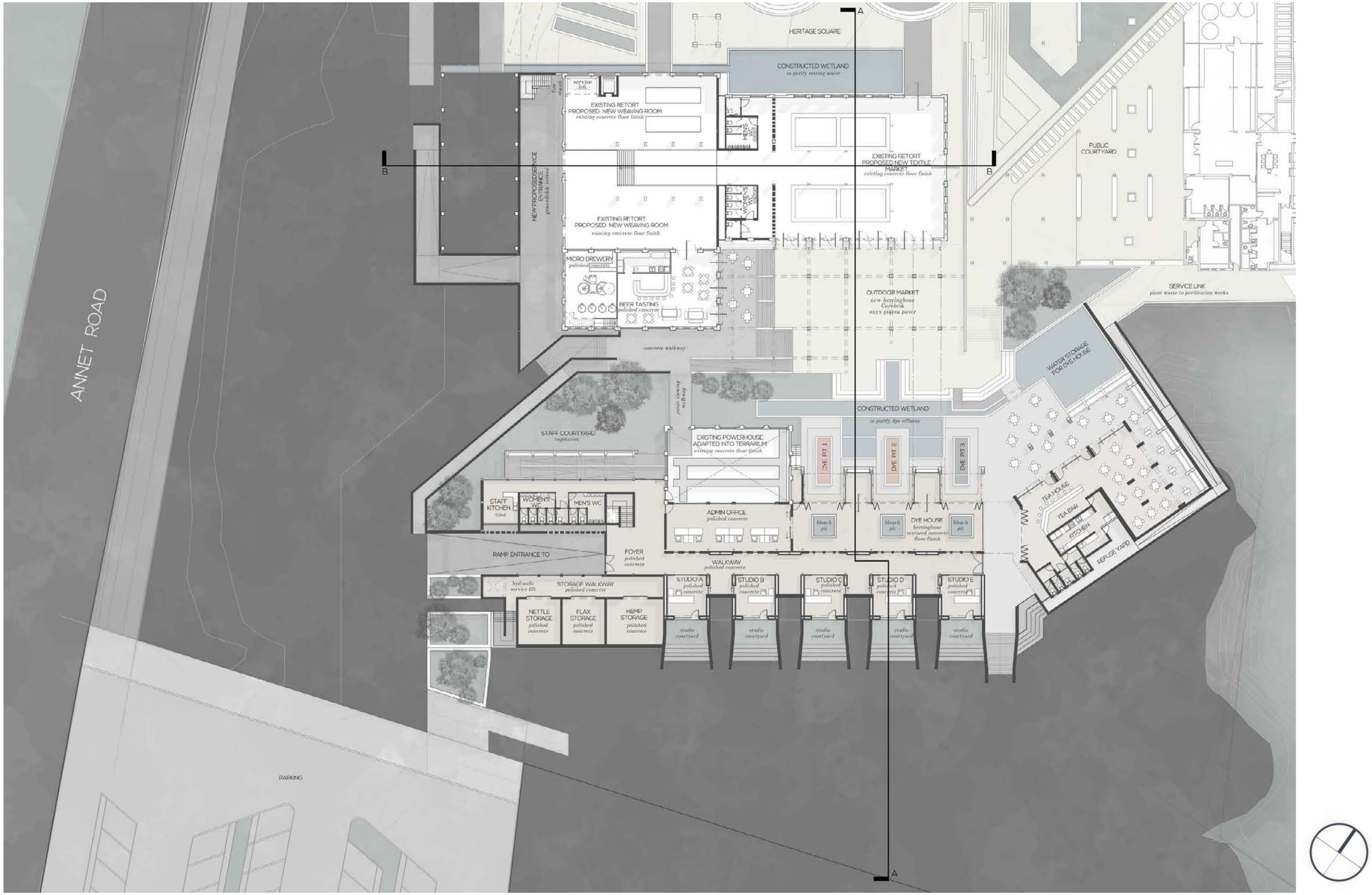


Figure 6.45: Final design Ground Floor Plan (Author 2017)

First Floor Plan

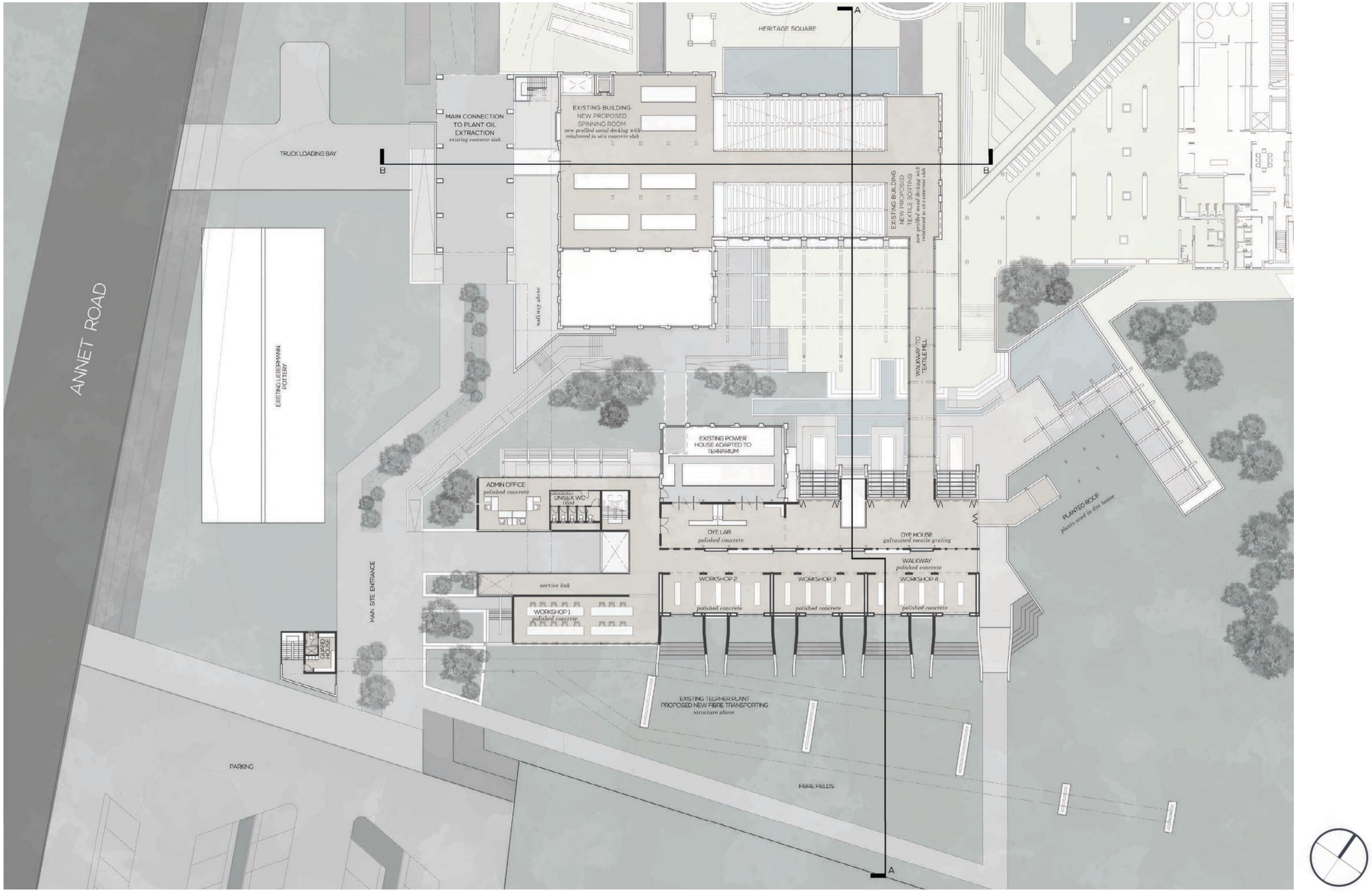
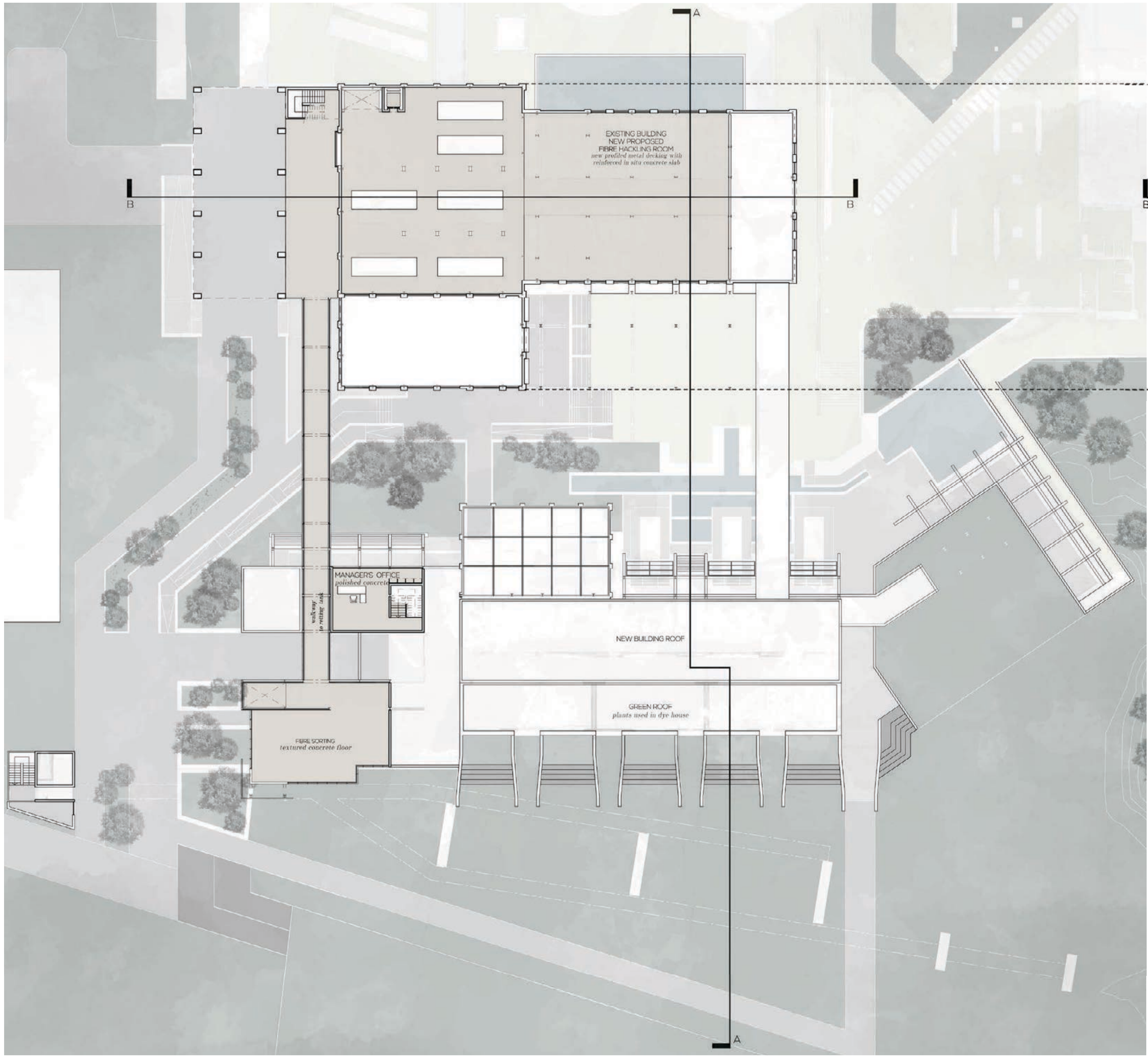


Figure 6.46: Final design First Floor Plan (Author 2017)

Second Floor Plan



Basement Floor Plan

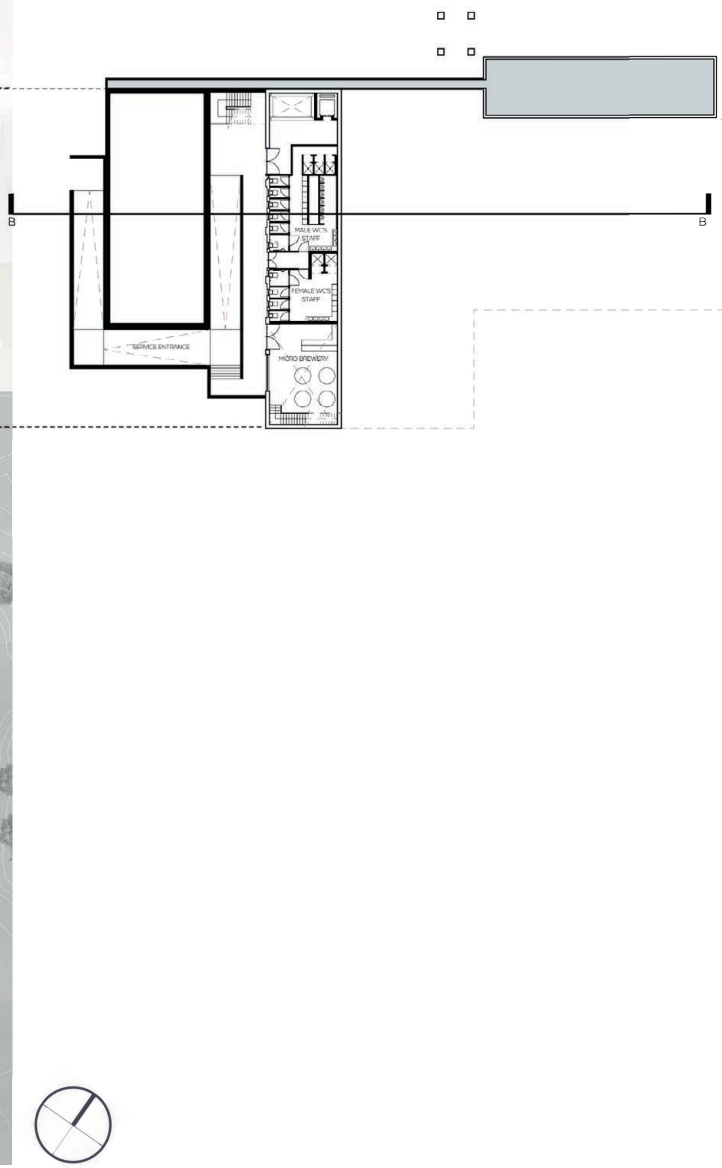


Figure 6.47: Final design Second & Basement Floor Plan (Author 2017)

Section A-A

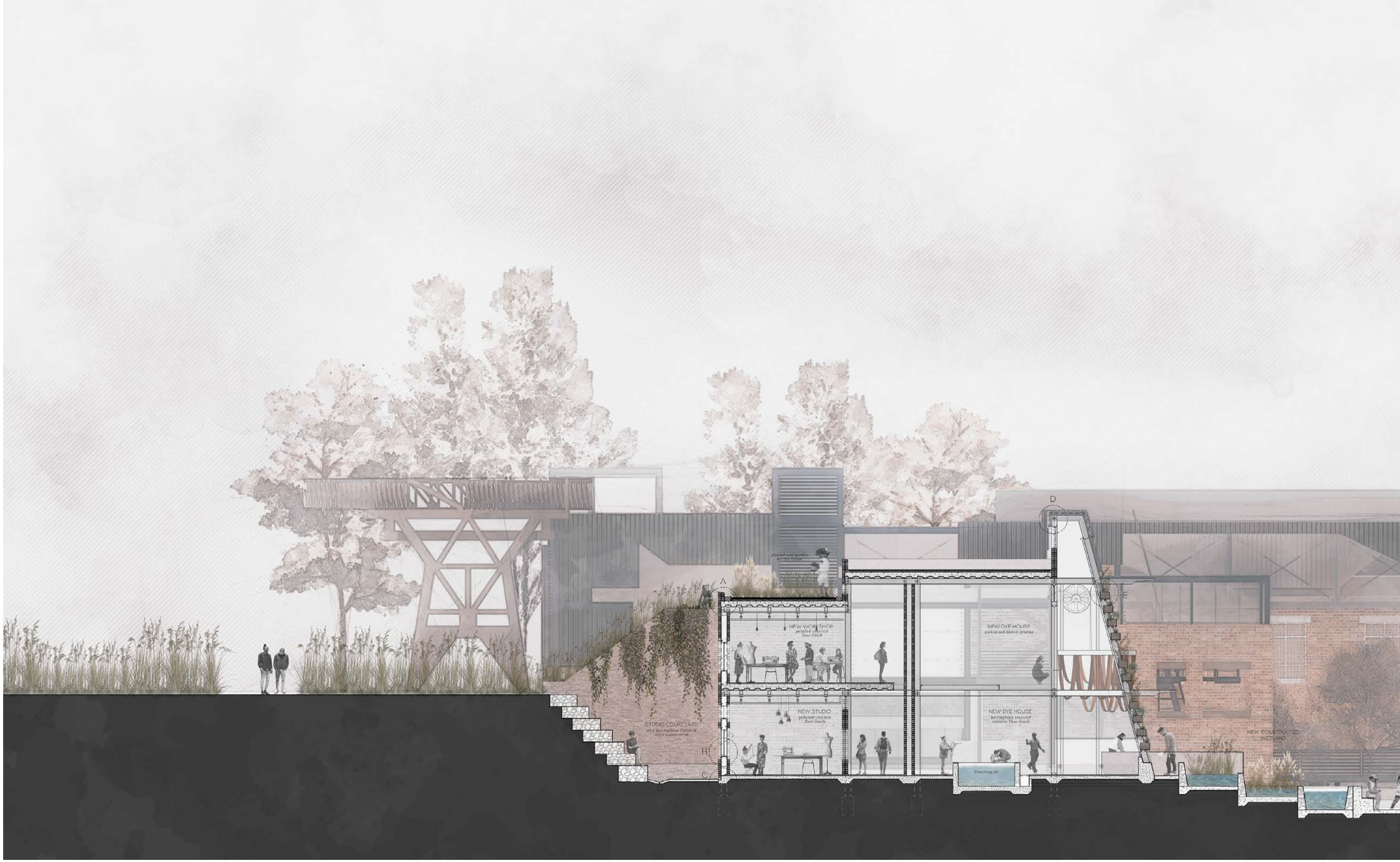


Figure 6.48: Final design section A-A (Author 2017)


EXISTING BUILDING
NEW PROPOSED TEXTILE MILL
EXISTING BUILDING
NEW PROPOSED INDOOR
NEW OUTDOOR
TEXTILE MARKET
F

Section B-B

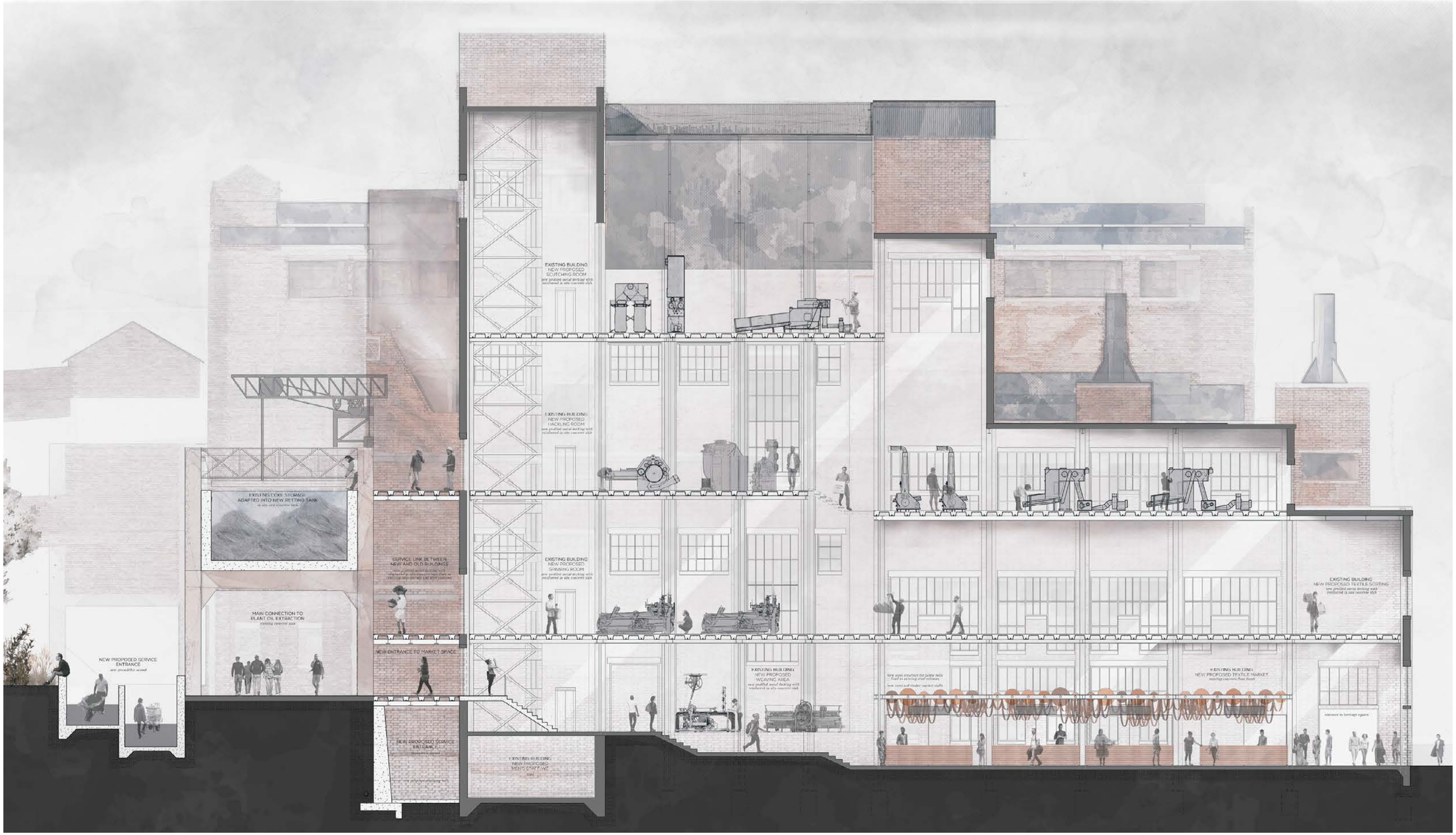
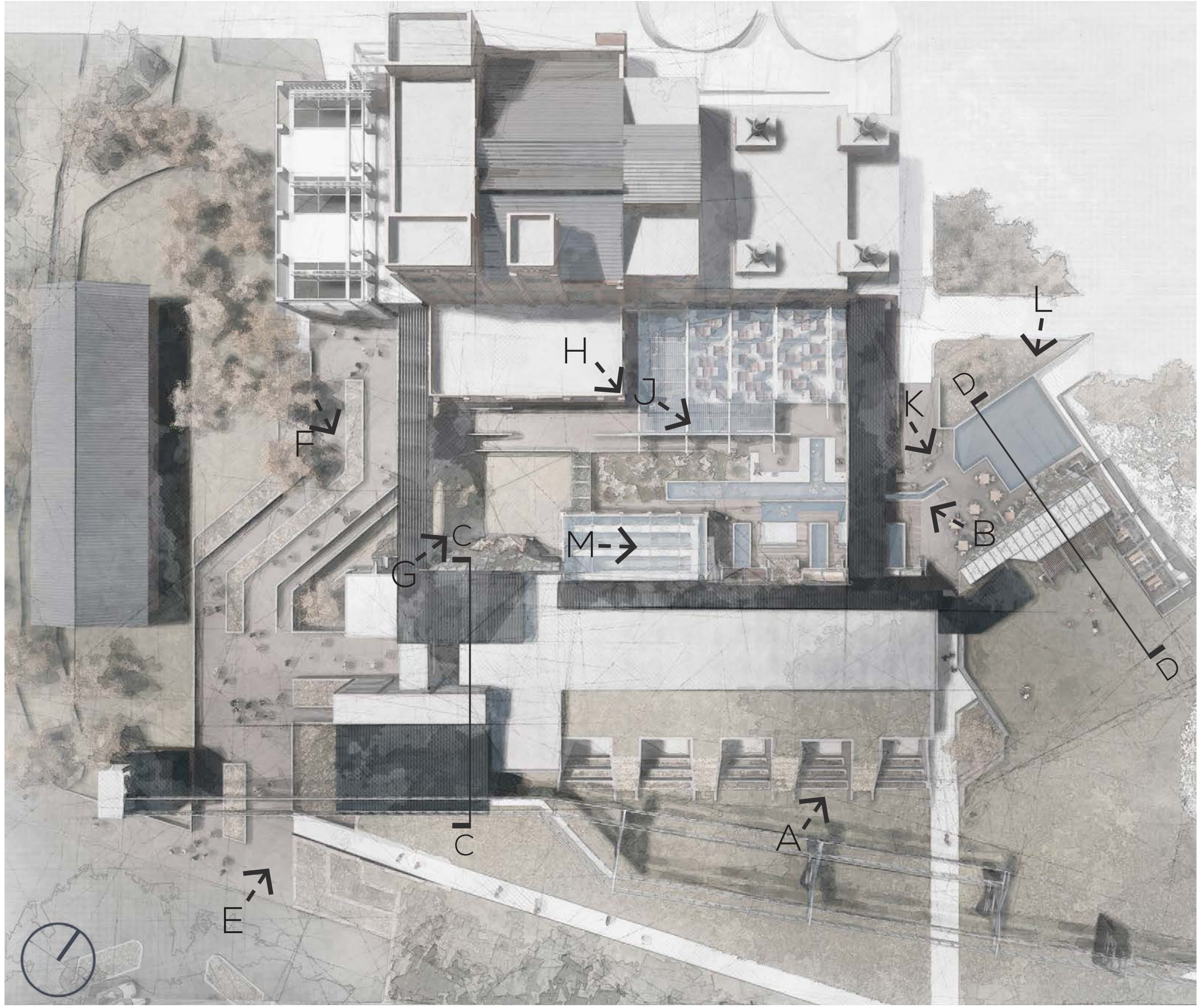


Figure 6.49: Final design section B-B (Author 2017)

Views on site



Key site plan

Figure 6.50: Key site plan (Author 2017)

View A towards studios

Figure 6.51: View A (Author 2017)

View B from tea house towards market space

Figure 6.52: View B (Author 2017)

Sectional perspective C-C through sorting & offices

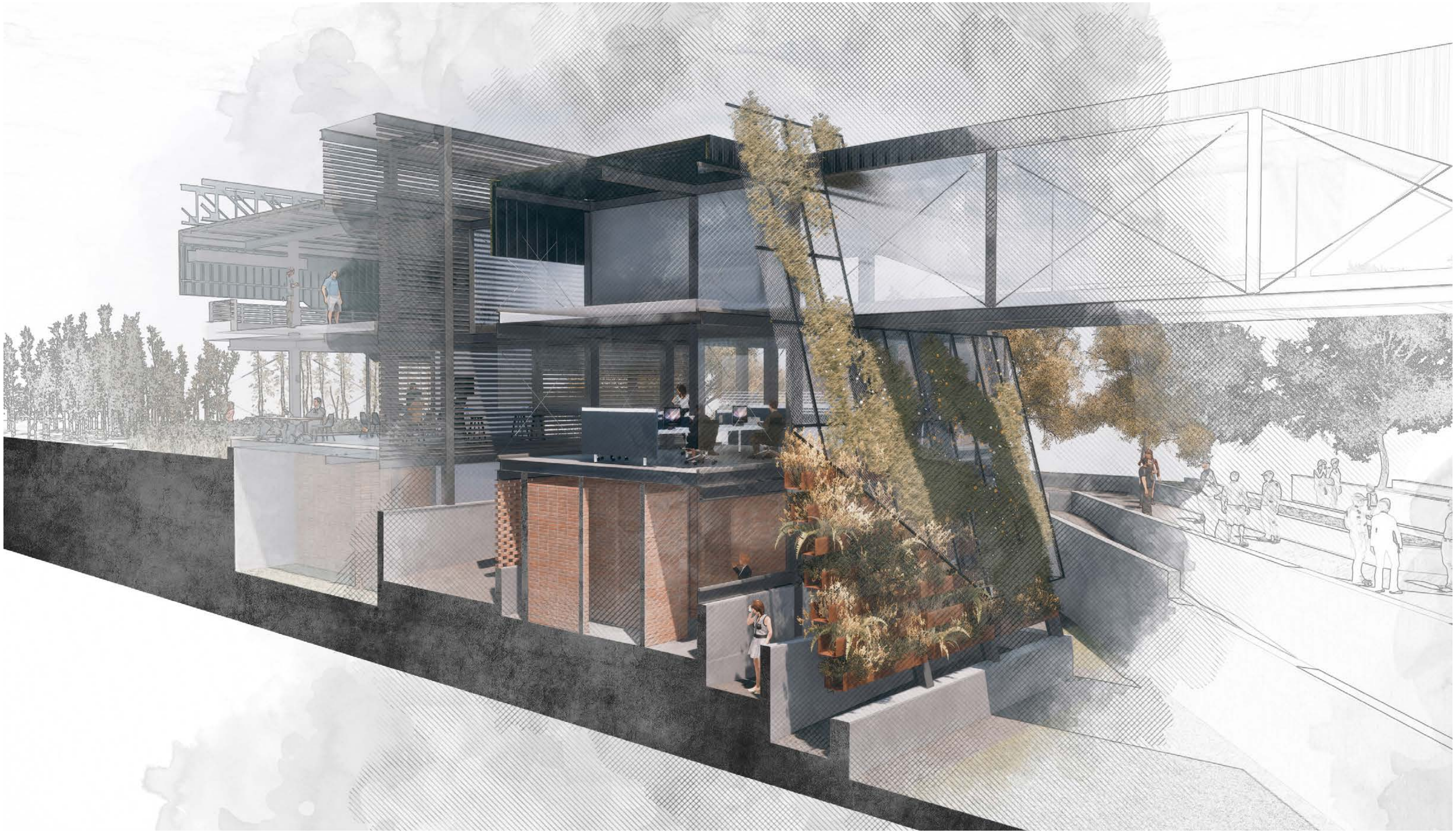


Figure 6.53: Sectional perspective C-C (Author 2017)

Sectional perspective D-D through tea house

Figure 6.54: Sectional perspective D-D (Author 2017)

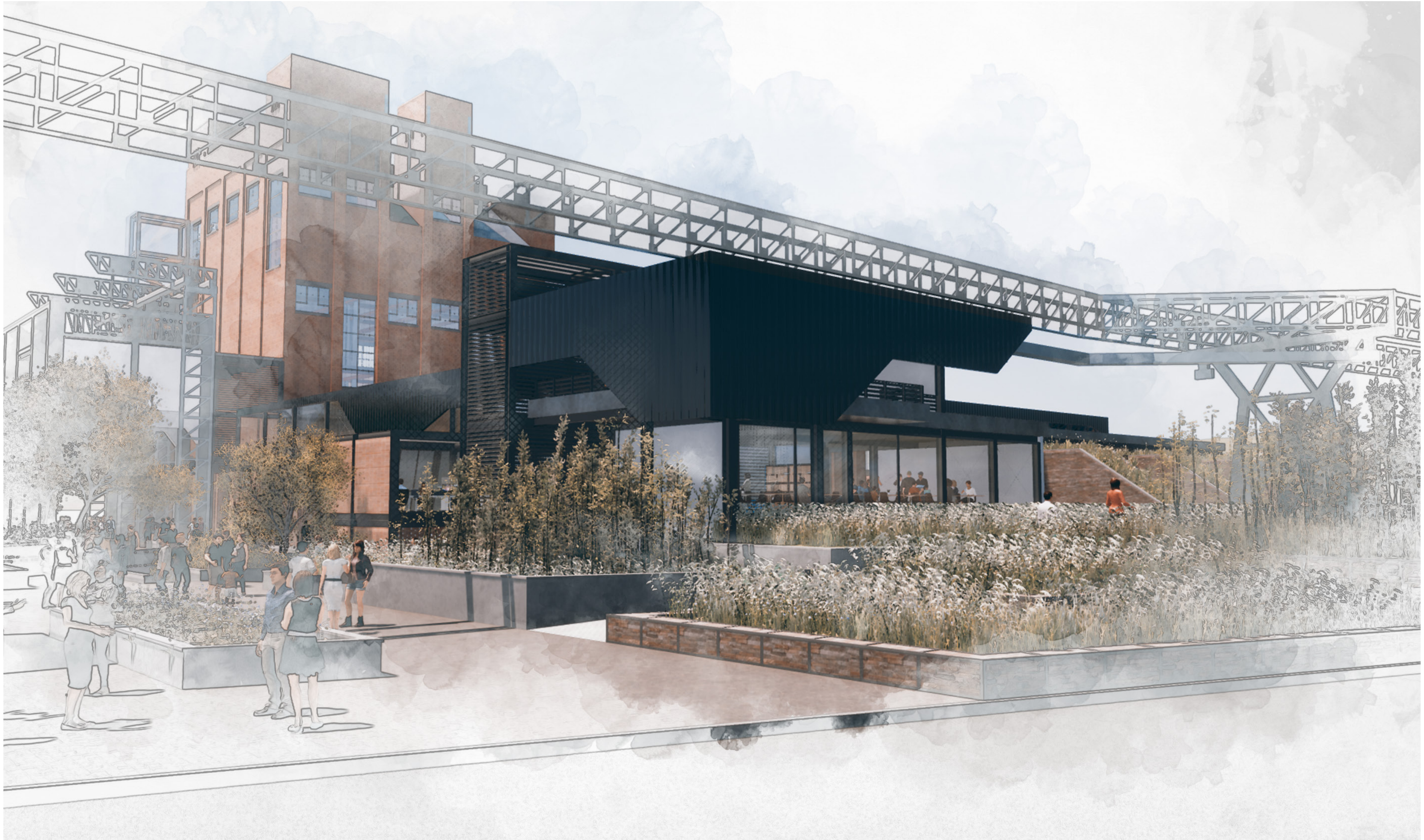


Figure 6.55: View E (Author 2017)

View E

Entrance to site

View F - View of sorting facilities

Figure 6.56: View F (Author 2017)

View G - View towards market

Figure 6.57: View G (Author 2017)

View J - View from market towards dyehouse

Figure 6.58: View J (Author 2017)

View K - View from market towards tea house

Figure 6.59: View K (Author 2017)

Figure 6.60: View H (Author 2017)

View H

View from retort 2 towards dyehouse

Figure 6.61: View L (Author 2017)

View L

View towards tea house

Figure 6.62: View M (Author 2017)

View M

View inside terrarium

Figure 6.63: Bird's eye view of site (Author 2017)

Bird's eye view of site

Looking towards new intervention

Chapter 7

Techné

07 Technical concept

Inversion as concept

Figure 7.1. Left: Retort 2 Interior (Author 2017)

The technical concept developed as a result of a comprehensive understanding of the current conditions at the Old Johannesburg Gasworks and the reasons for its demise and inability to be resilient in terms of its industrial processes.

The need for a drastic different approach to the way in which industries are operated and designed became evident.

The existing structures on site lend little interaction between the interior spaces and the landscape. The structures consist of elaborate tectonic steel cores enveloped in brick skins.

The concept of 'inversion' could be explored on various levels pertaining to the design and implementation of a new kind of industry. Figure 7.2 illustrate the current conditions as well as how the inversion thereof could provide solutions to the issues raised by this dissertation.

Accessibility

Restitution of the severed relationships is at the forefront of the site's urban vision. Inverting the previously inaccessible site to become accessible for city dwellers to utilize as educational and recreational spaces could be conducive to restoring the severed relationship caused by orthodox hazardous industries.

Process & approach

In order to allow interaction between industry and humans, the industrial processes need to be inverted from a previously degenerative status to a more regenerative one. For this to occur, a radically different approach is needed to transform industrial practices from linear to closed loop systems. Closed loop systems allow for minimum waste and also attempts to eradicate pollution of the natural environment.

TECHNICAL CONCEPT IN VERSION

: a reversal of position, order, form, or relationship
: the condition of being turned inward or inside out
(Merriam-Webster 2017)

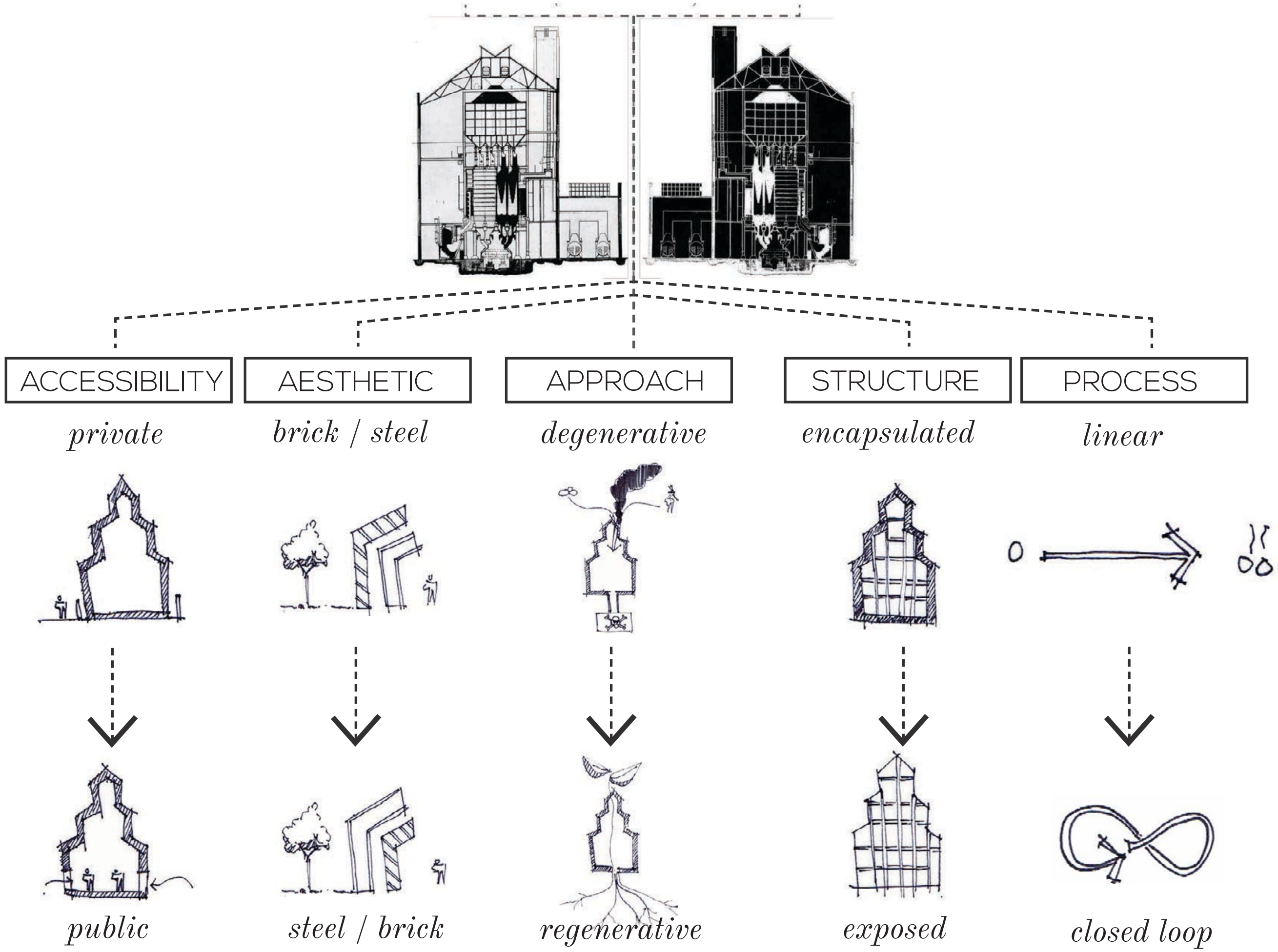


Figure 7.2: Technical concept diagram (Author 2017)

Regenerative projects have a close relationship with the natural environment. The natural environment can often be utilised to achieve favourable climatic conditions within a building. This has often been replaced by mechanical strategies. The new dye house, studios, offices and workshops will be ventilated passively through the use of stack ventilation and earth tubing.

As mentioned in the programme chapter, the textile industry is synonymous with dramatic consumption of water sources and the pollution thereof. Making use of all natural plant and herbal dyes along with natural mordants[5], allows for the possibility of water to be purified and re-used. This is exposed by placing it on the northern edge of the building, to solidify the new established relationship between industry and nature. Although the industry makes use of the natural elements similar to conventional industries, the difference lies in the sources that are used as well as in the manner in which they are used. Where conventional industries often make use of depletable resources like coal, the new industry proposed in this dissertation, makes use of renewable resources and ensures that the natural resources used in the process such as water, is purified after use through natural methods of purification. Implementing this type of industry also allows for the remediation of the site scarred by previous parasitic and polluting industrial practices.

Aesthetic & structure

In terms of conventional, industrial buildings' aesthetic, more often than not, the buildings have an encapsulated structure. In the case of the old Johannesburg Gas Works the buildings are comprised of steel structures enveloped by a brick skin. This allows for little or no interaction between the process and the landscape. In the quest to establish a new relationship between industry and nature, the manner in which the building interacts with the landscape becomes critical. In cases where industries are dependent on the natural environment to function and vice versa, the aesthetics of industrial buildings need to change in order to allow for this interaction to occur.

In the case of the natural dye house, the inversion of a building's structure could allow for it to become infrastructure for the growing of plants needed for the natural dyes. In cases where the soil is polluted, the structure becomes a catalyst for living system regeneration on a site that would otherwise be unable to catalyse prosperity for the natural environment.

The concept of inversion is explored in the new building in terms of the relationship of the steelwork to the brick work. Figures 7.3-7.5 explore the conceptual application of 'inversion' in terms of structure.

The new building is cut into the landscape on the southern edge. It is at this point that the illusion of a heavy mass is created through enveloping the steelwork in between two single brick skins (see Fig. 7.3). As one moves closer to the existing structure, the steelwork emerges from the brick (Fig.7.4) to where it is finally completely released from the brickwork (see Fig. 7.5) and at this point allows for the steelwork to become the infrastructure for the plants in the form of planter boxes.

Structural concept diagrams

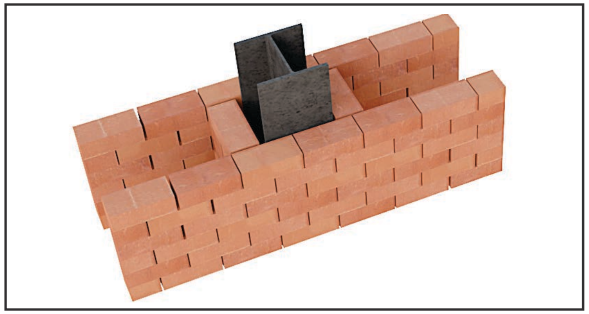


Figure 7.3: Steel enveloped in wall (Author 2017)

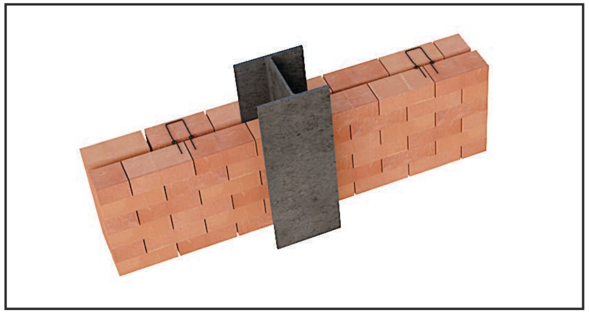


Figure 7.4: Steel emerging from wall (Author 2017)

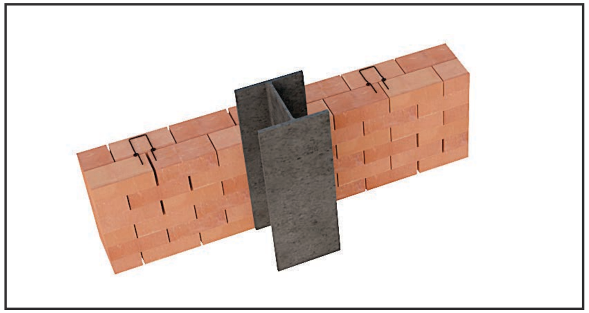


Figure 7.5: Steel emerged from wall (Author 2017)

How inversion aids mediation

The reasoning behind the inversion of structure is to enable the use of the structure as infrastructure for the growing of plants needed in the dye process. This enables the architecture to facilitate mediation between industry and nature. By inverting the structure for the growing of plants, the dye house (industry) now has a direct connection to nature which is responsible for feeding the dye process. Inversion allows for better interaction between the building programme (industry) and the landscape that surrounds it.

Inverting previously degenerative industrial processes, allows for a new, more mutually beneficial relationship between industry and nature, one in which industry inspires environmental prosperity.

Structural concept diagram on plan

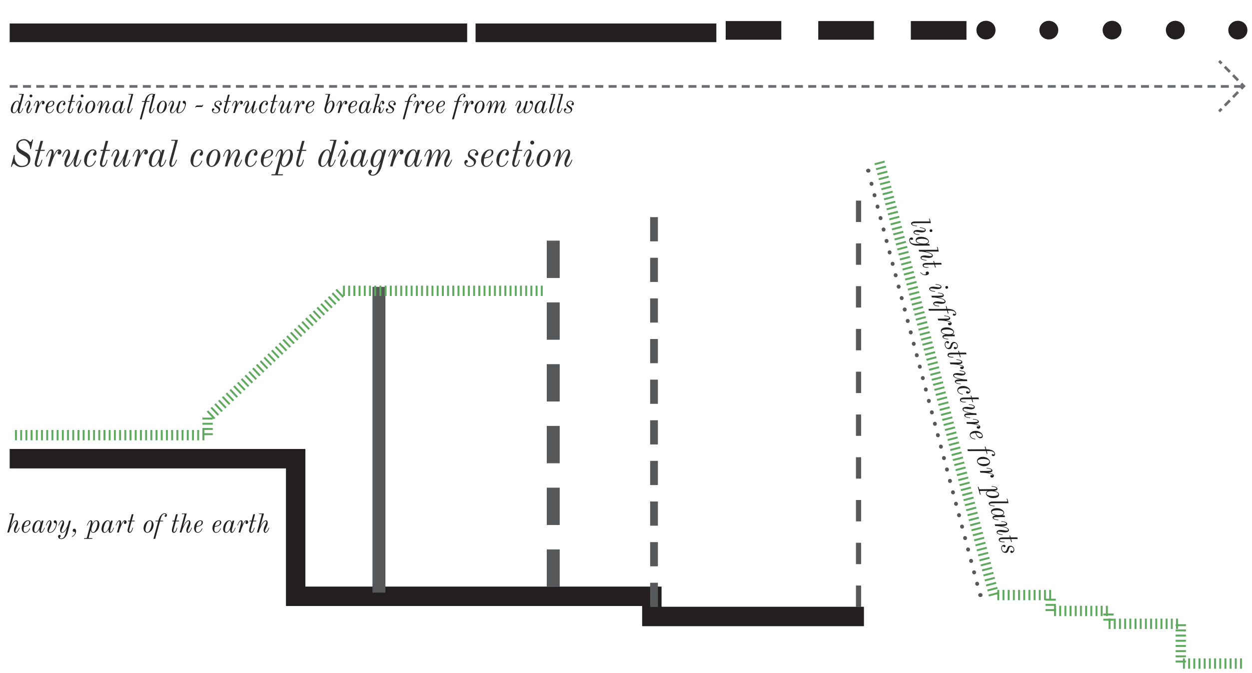


Figure 7.6: Structural concept diagrams (Author 2017)

Material palette

Existing materials on site

Weathered timber doors

Clay bricks

White washed clay bricks

Weathered steel

Rusted steel

Corrugated steel roller shutter doors

Rusted painted steel

Rusted painted steel

Weathered steel

Weathered clay bricks

Clay bricks

Weathered painted steel

Figure 7.7: Existing material palette on site (Author 2017)

Proposed material palette

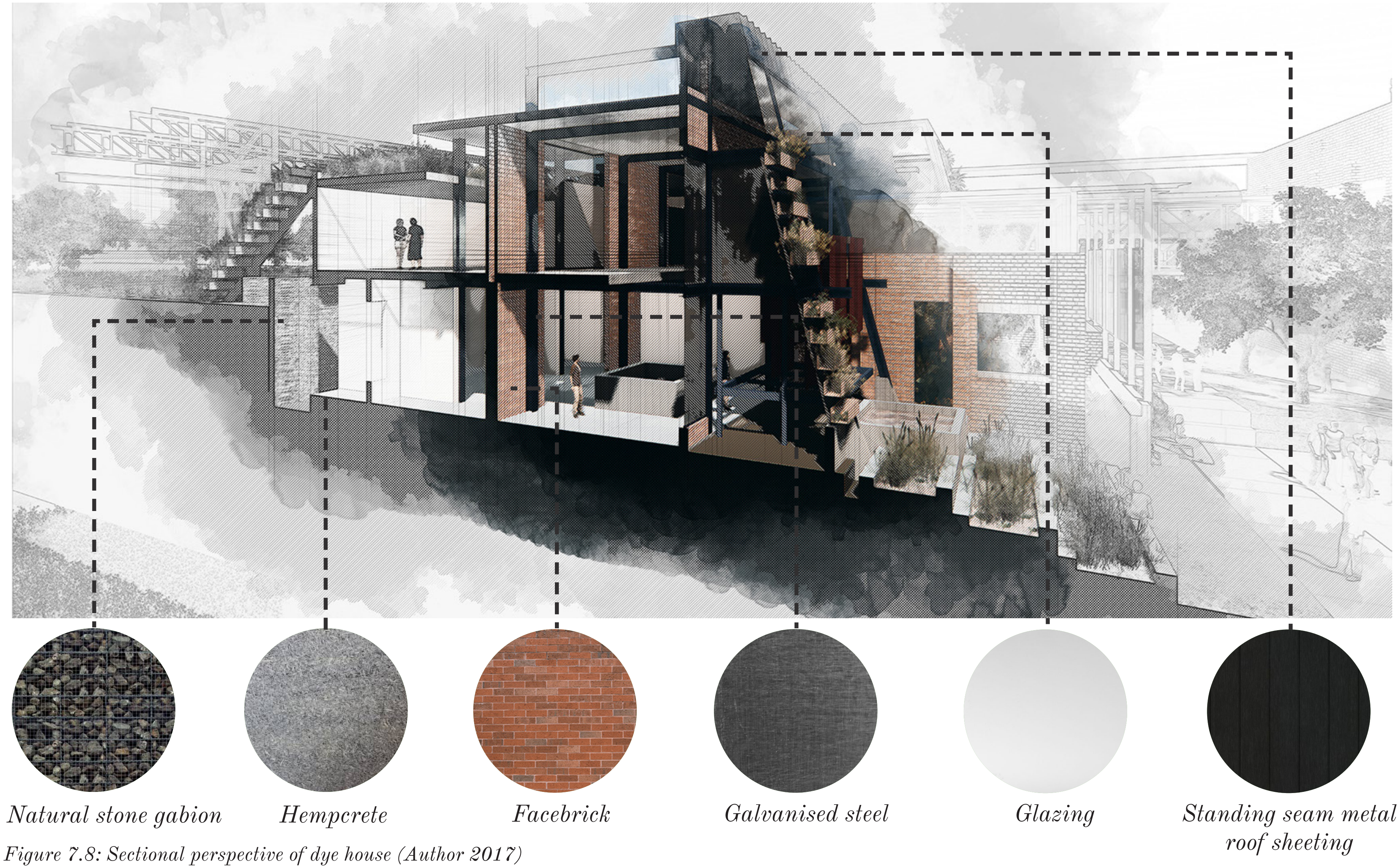


Figure 7.8: Sectional perspective of dye house (Author 2017)

Material choice motivation

There are numerous advantages to using hempcrete as a building material. These include energy efficiency, the ability to maintain a steady temperature, its breathable and hygroscopic qualities, its ability to increase in strength over time and its versatility as it can be used in the construction of floors, walls and roofs, to name but a few (Cowell 2015). According to Flahiff (2009), hempcrete can also be classified as a carbon negative building material as the growing and harvesting process of hemp, locks in more CO2 than that which the process of producing the lime binder releases.

Steel was chosen as building material due to the abundance of steel in the existing retort house. In order to allow for the new programme to be inserted into the existing retort house, some of the steel work will need to be stripped down. It is proposed that this steel then be re-used in the structure of the new building.

Brick was chosen as a building material to respond to the existing architectural language present on site. The use of a darker brick will be explored in order to create a distinction between the existing and the new and to assert the principles of philological restoration by creating a distinguishable architectural language from the existing heritage fabric.

Aluminium frame glazing is proposed for the new building. This is to allow a more transparent approach to industry, allowing interaction between the public and industry, reinforcing the intention of the urban vision while allowing for the new and old buildings to have a stronger connection to nature in the form of visual connections as well as daylighting.

Sheet metal is proposed as a building material in order to resonate with the existing materials on site. However, the colour proposed is a dark grey in order to create a distinction between the old and the new.

Natural stone is proposed for the southern edge of the building in order to reinforce the relationship of the new building to the landscape while providing the necessary strength to retain the soil that will be cut back. Gabions will also be used in the constructed wetland as a means of purifying the water. This reinforces nature's role in purifying the dye house effluent and establishes a new counter dependant relationship between industry and nature.

All materials proposed in the construction of the new building can be sourced within a 37km radius from the old Johannesburg Gasworks site, contributing to lower embodied energy.

Structure

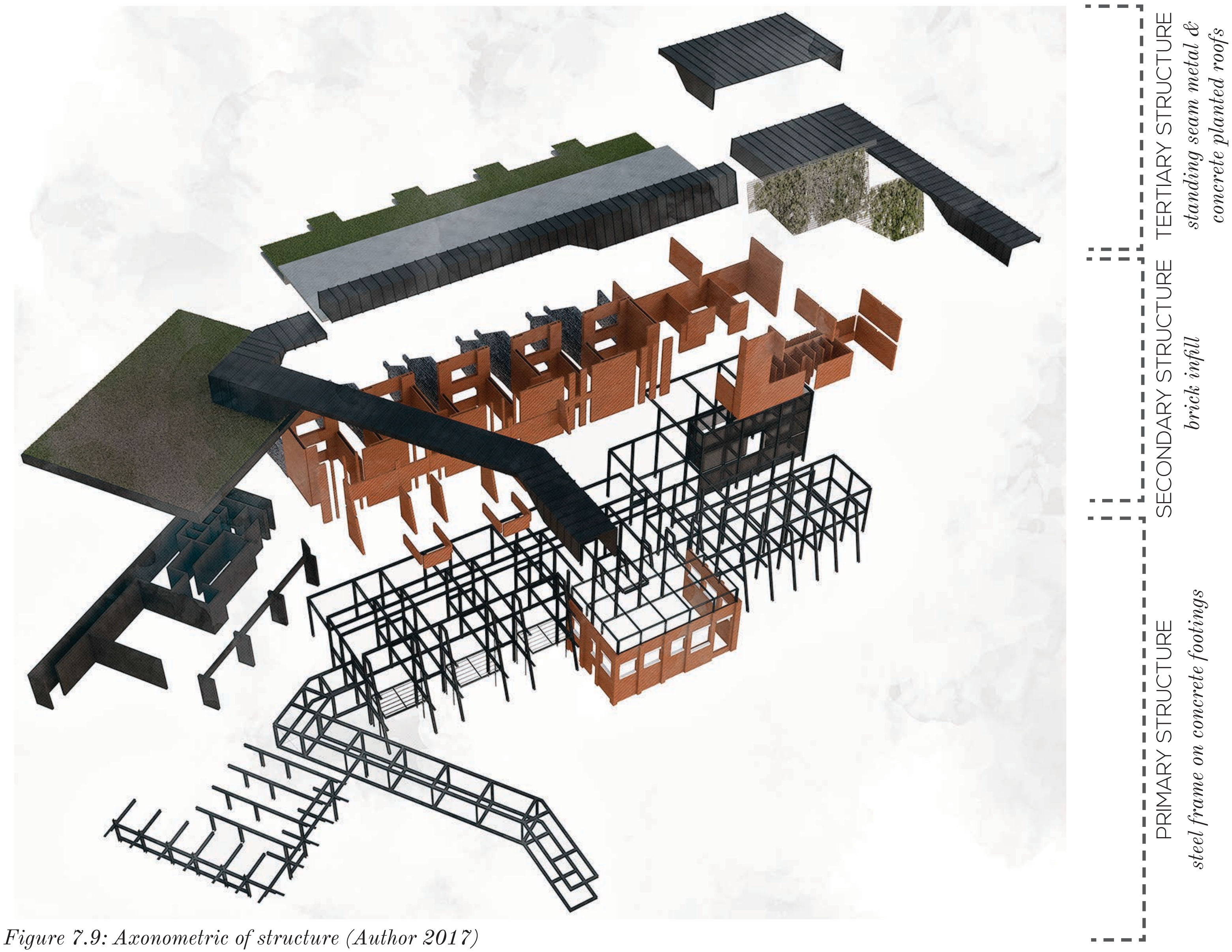


Figure 7.9: Axonometric of structure (Author 2017)

Structure concept details

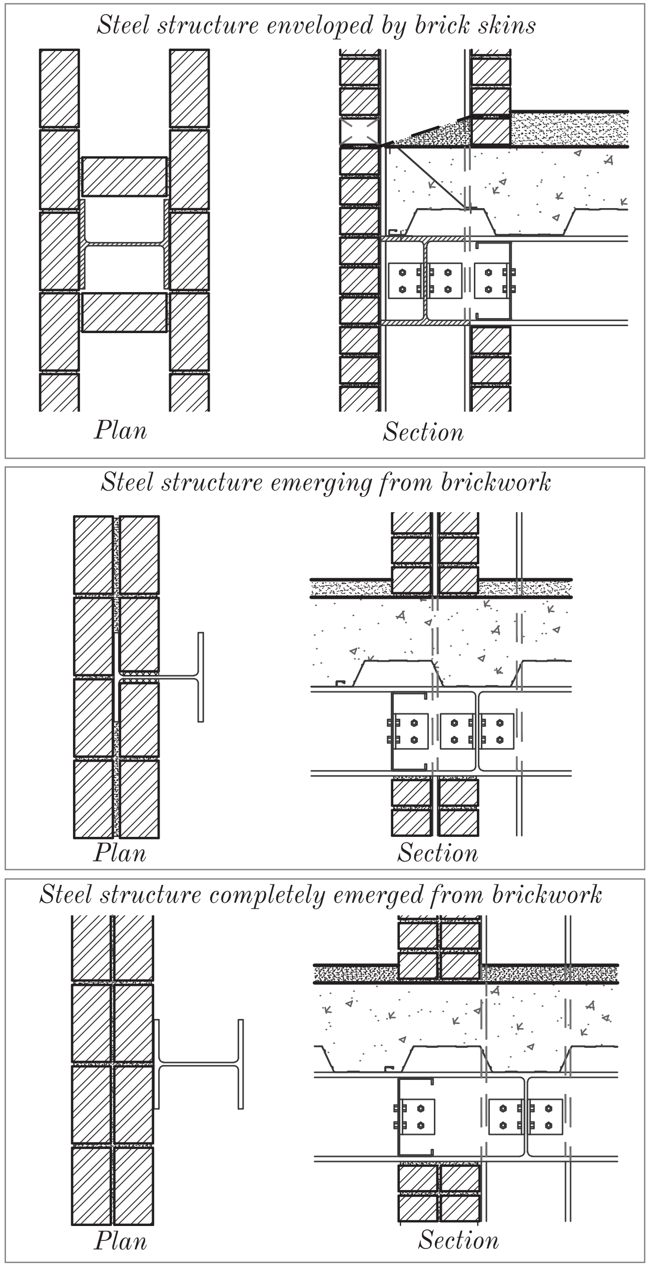


Figure 7.10: Structural concept details (Author 2017)

Sectional perspective

Figure 7.11: Sectional perspective (Author 2017)

Services - Water purification systems

The storm and grey water treatment strategy involves the collection of site runoff into underground storage tanks where it will be purified and used for the watering of vegetation used in the dye process as well as for use in the water closets. The first step in the process is to ensure that large debris is prevented from entering the storm water channel. This is achieved by covering the channel with a mentis grid. From the channel the water is directed to and underground grease trap. All water from basins and showers are also piped to this tank. The grease trap prevents all grease or oil from entering the weir. From here the water is pumped to another tank for use in water closets and for irrigation purposes.

The rainwater collection strategy involves collecting water from all roof surfaces of the old retort as well as the new proposed design. Before water enters the storage tanks, it goes through a first flush diverter that ensures that the initial water, which may be contaminated, is flushed away in order to collect the cleaner rainwater that follows. The rainwater is then used in the natural dyeing process. Some of the rainwater will be purified by sending it through a bio-filter, comprising a sand, plant, gravel and stone filter. Water that has been sent through the filter can then be stored underground from where it can be pumped through a UV filter to kill all pathogens still present in the water so that it can finally be used as drinking water, water for wash hand basins, and again to feed the dye house.

Dye water purification

The dye runoff water purification strategy involves similar steps to the rainwater purification strategy. The purification system is placed directly adjacent to the dye house in order to strengthen the conceptual approach of a new mutually beneficial relationship between industry and nature, as nature aids in the purification of the water.

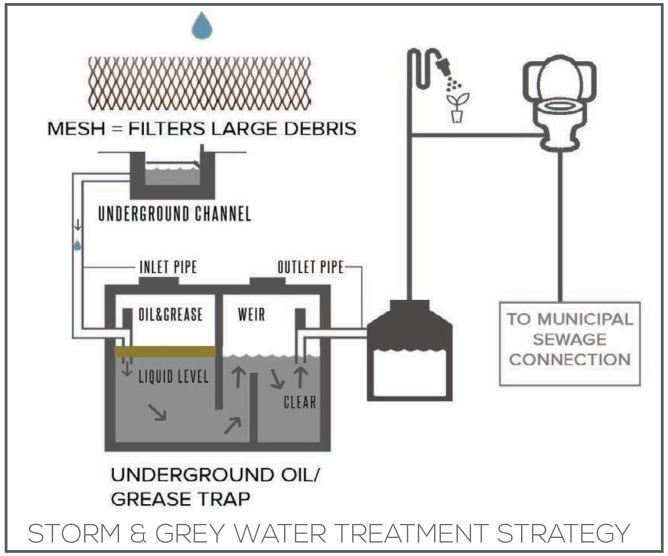


Figure 7.12: Stormwater purification (Author 2017)

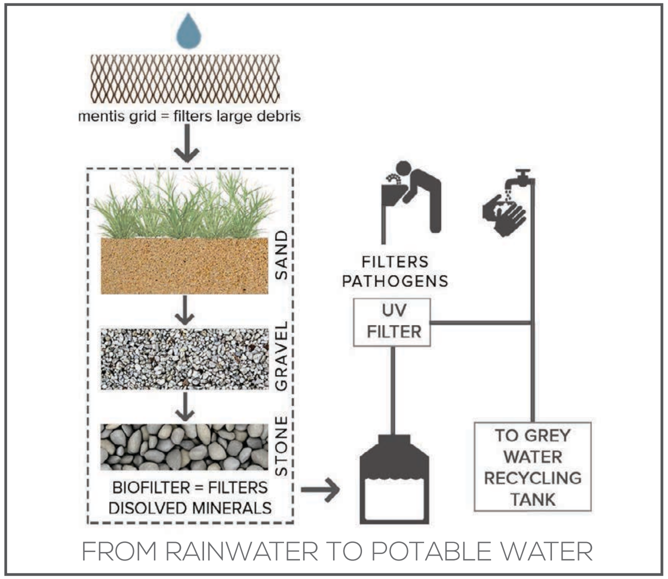


Figure 7.13: Rainwater purification (Author 2017)

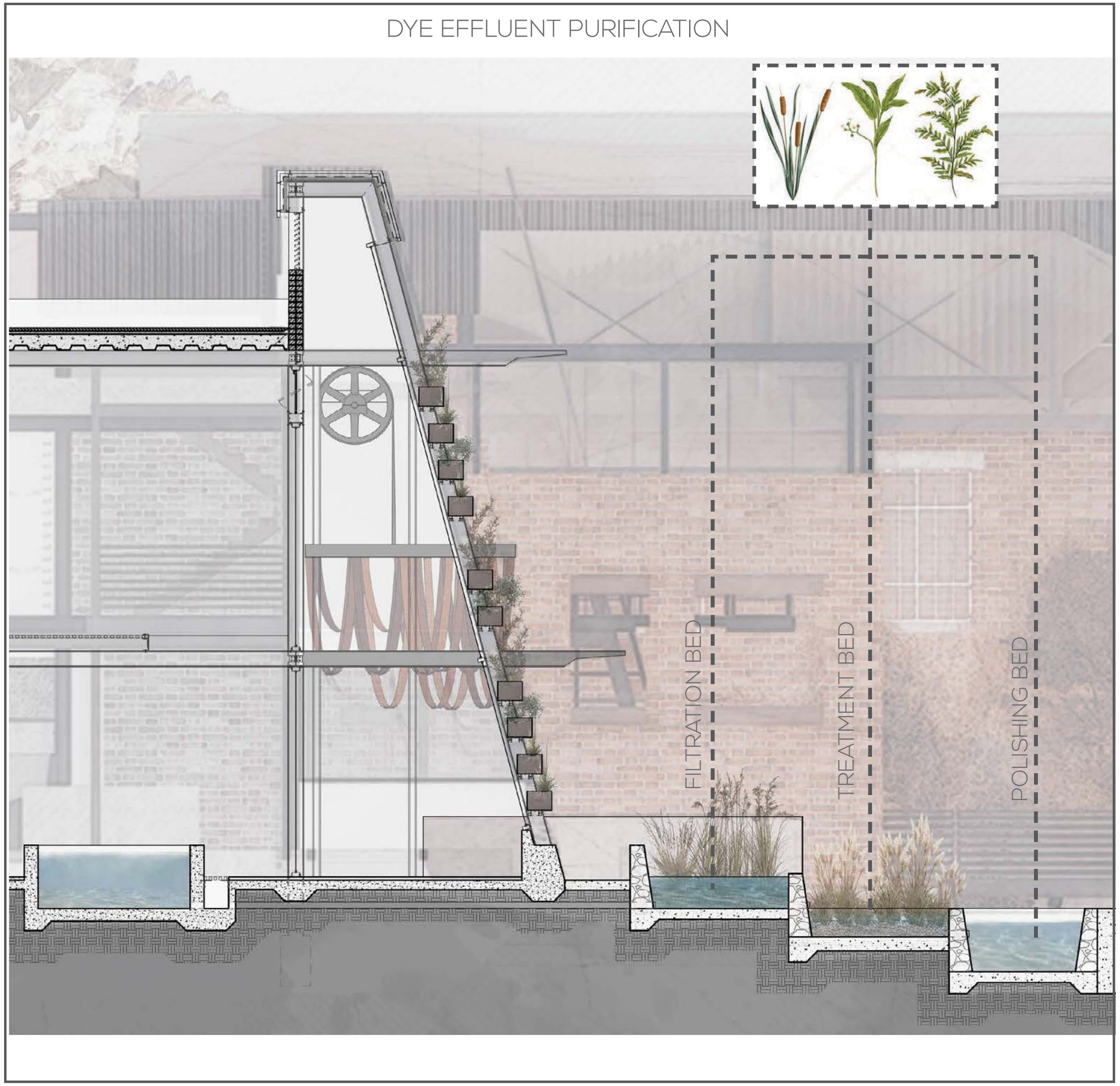


Figure 7.14: New structure water system section (Author 2017)

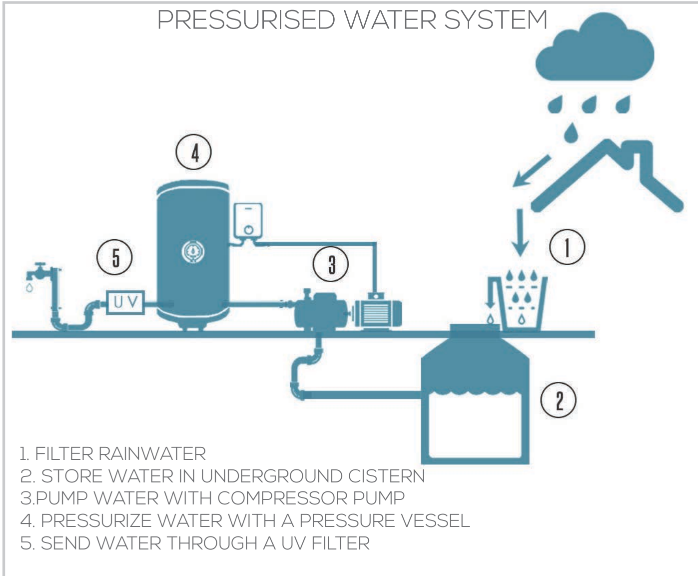


Figure 7.15: Pressurized water system diagram (Author 2016)

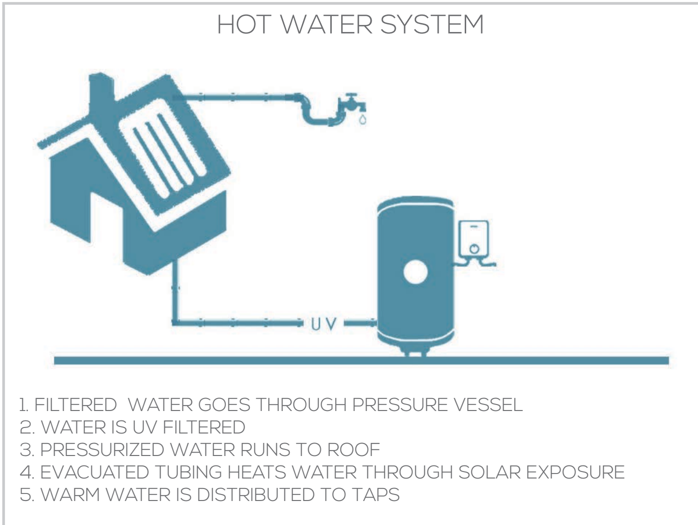


Figure 7.16: Hot water system diagram (Author 2016)

WATER CATCHMENT STRATEGY

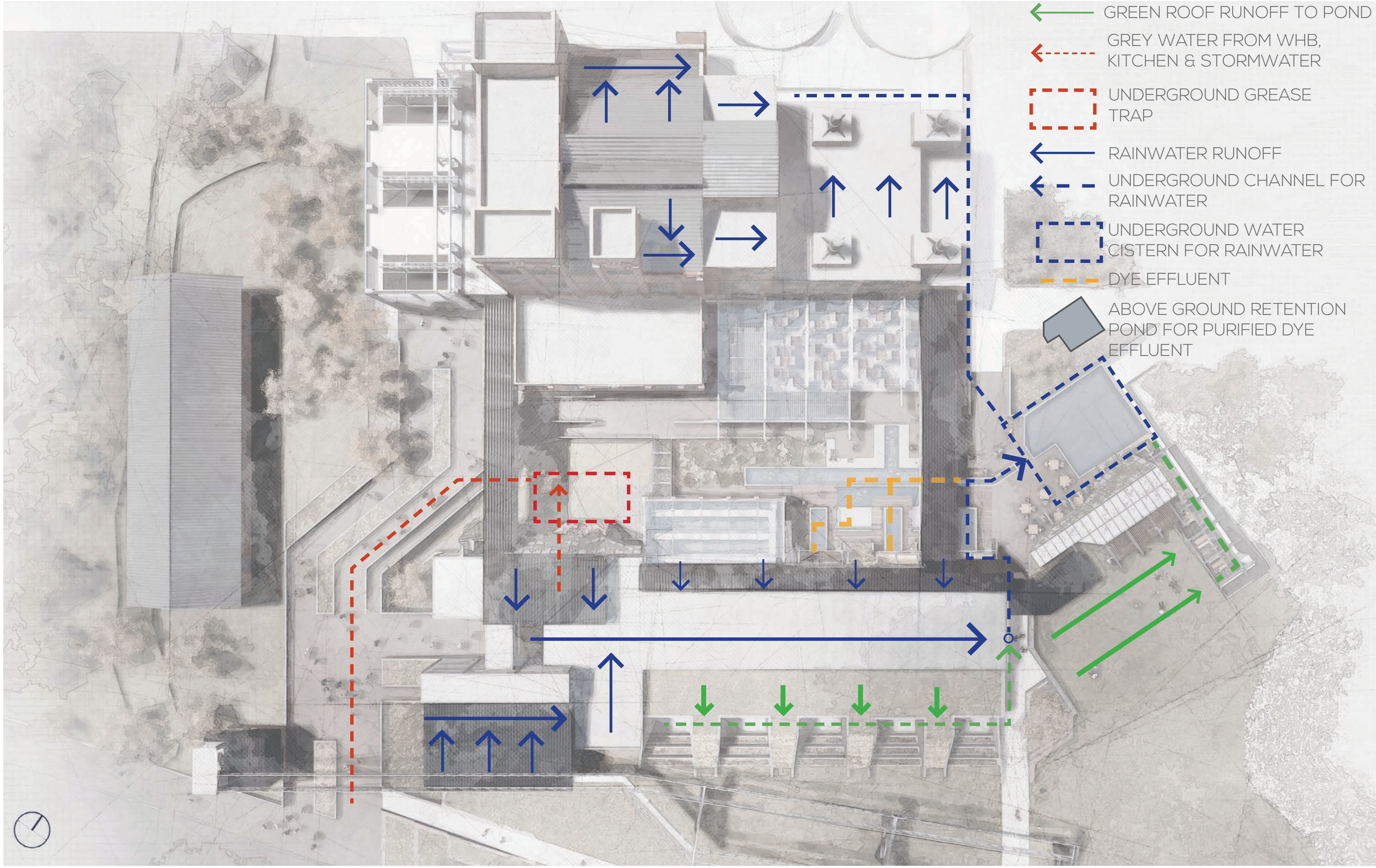


Figure 7.17: Water catchment strategy (Author 2017)

IRRIGATION & DOMESTIC DEMAND

IRRIGATION DEMAND

	Planting Area (m²)	Irrigation Depth per week (m)	Irrigation Depth per month (m)	IRRIGATION DEMAND (m³)
January	591 m²	0,040 m	0,177 m	105 m³
February	591 m²	0,040 m	0,160 m	95 m³
March	591 m²	0,040 m	0,177 m	105 m³
April	591 m²	0,030 m	0,129 m	76 m³
May	591 m²	0,020 m	0,089 m	52 m³
June	591 m²	0,020 m	0,086 m	51 m³
July	591 m²	0,020 m	0,086 m	51 m³
August	591 m²	0,020 m	0,089 m	52 m³
September	591 m²	0,030 m	0,129 m	76 m³
October	591 m²	0,040 m	0,177 m	105 m³
November	591 m²	0,040 m	0,171 m	101 m³
December	591 m²	0,040 m	0,177 m	105 m³
YEAR	**591 m² (Average)**	**0,032 m (Average)**	**1,646 m (Total)**	**973 m³ (Total)**

DOMESTIC DEMAND

	Number of Individuals	Water / capita / day (Litres)	Total Water / month (Liters)	DOMESTIC DEMAND (m³)
January	115	25 l	89 125 l	89 m³
February	115	25 l	80 500 l	81 m³
March	115	25 l	89 125 l	89 m³
April	115	25 l	86 250 l	86 m³
May	115	25 l	89 125 l	89 m³
June	115	25 l	86 250 l	86 m³
July	115	25 l	86 250 l	86 m³
August	115	25 l	89 125 l	89 m³
September	115	25 l	86 250 l	86 m³
October	115	25 l	89 125 l	89 m³
November	115	25 l	86 250 l	86 m³
December	115	25 l	89 125 l	89 m³
YEAR	**115 (Average)**	**25 l (Average)**	**87 208 l (Total)**	**1 047 m³ (Total)**

Figure 7.18: Workers water demand (Author 2017)

TOTAL DEMAND

	IRRIGATION DEMAND (m³)	DOMESTIC DEMAND (m³)	**TOTAL WATER DEMAND**
January	105 m³	89 m³	**194 m³**
February	95 m³	81 m³	**175 m³**
March	105 m³	89 m³	**194 m³**
April	76 m³	86 m³	**162 m³**
May	52 m³	89 m³	**141 m³**
June	51 m³	86 m³	**137 m³**
July	51 m³	86 m³	**137 m³**
August	52 m³	89 m³	**141 m³**
September	76 m³	86 m³	**162 m³**
October	105 m³	89 m³	**194 m³**
November	101 m³	86 m³	**188 m³**
December	105 m³	89 m³	**194 m³**
YEAR	973 m³ (Total)	1 047 m³ (Total)	**2 019 m³ (TOTAL)**

Figure 7.19: Total water demand (Author 2017)

YIELD (m³) = P x A x C

P = precipitation (m), A = area (m²), C = run-off coefficient

Per surface (Per surface)	Area (m²)	Run-off Coefficient
Roofing	1 834,00 m²	0,9
Paving	12 331,00 m²	0,8
Veldgrass & Planting	3 595,00 m²	0,4
TOTAL:	**17 760,00 m²**	0,73

Month	Precipitation Average Monthly (mm)	Area	Run-off Coefficient	YIELD P(m) x A(m²) x C
January	125 mm	17 760 m²	0,73	1 619 m³
February	90 mm	17 760 m²	0,73	1 166 m³
March	91 mm	17 760 m²	0,73	1 179 m³
April	54 mm	17 760 m²	0,73	699 m³
May	13 mm	17 760 m²	0,73	168 m³
June	9 mm	17 760 m²	0,73	117 m³
July	4 mm	17 760 m²	0,73	52 m³
August	6 mm	17 760 m²	0,73	78 m³
September	27 mm	17 760 m²	0,73	350 m³
October	72 mm	17 760 m²	0,73	933 m³
November	117 mm	17 760 m²	0,73	1 516 m³
December	105 mm	17 760 m²	0,73	1 360 m³
YEAR	**713 mm**	**17 760 m²**	0,73	**9 236 m³**

Figure 7.20: Total water yield (Author 2017)

WATER BUDGET

	YIELD from onsite runoff (m³)	DEMAND total onsite water demand (m³)	Monthly Balance	Water in Tank/Reservoir (m³)
January	1 619 m³	194 m³	1 425 m³	**3 920 m³**
February	1 166 m³	175 m³	991 m³	**4 910 m³**
March	1 179 m³	194 m³	985 m³	**5 895 m³**
April	699 m³	162 m³	537 m³	**6 433 m³**
May	168 m³	141 m³	27 m³	**6 459 m³**
June	117 m³	137 m³	- 20 m³	**6 439 m³**
July	52 m³	137 m³	- 85 m³	**6 354 m³**
August	78 m³	141 m³	- 64 m³	**6 290 m³**
September	350 m³	162 m³	188 m³	**6 478 m³**
October	933 m³	194 m³	739 m³	**0 m³**
November	1 516 m³	188 m³	1 328 m³	**1 328 m³**
December	1 360 m³	194 m³	1 166 m³	**2 494 m³**
YEAR	**11 255 m³ (Total)**	**2 019 m³ (TOTAL)**		

Greatest volume of water in tank/reservoir at any time is the minimum capacity of the tank	**6 478 m³**

Safety Factor:	**1,5**	**Final Tank/Reservoir Size:**	**9 717 m³**

Figure 7.21: Water budget (Author 2017)

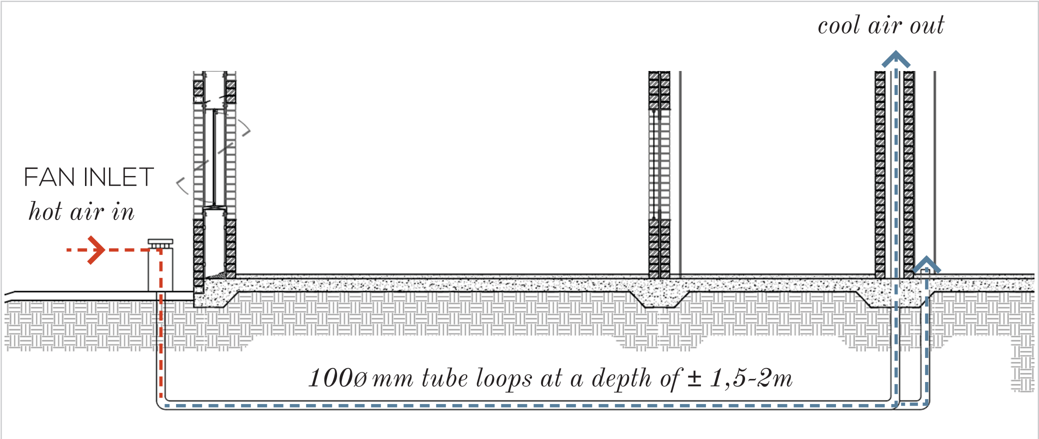
Ventilation system - Stack Ventilation

Stack ventilation is proposed as a means of ventilating the new building. Stack ventilation makes use of the differences in air temperatures to move air (Autodesk Sustainability Workshop 2013). It is proposed that geo-thermal pipes be used to introduce cool air at low inlets in the dye house and that outlets be placed at the highest point in the structure because of hot air's low pressure which causes it to rise and to escape. It is at this point that a form of solar chimney will be used to incite the process. The solar chimney comprises a north-west facing glazed facade and thermal mass in the form of a brick wall.

As the solar radiation penetrates the glazed façade, it heats up the thermal mass which stores the heat to allow the chimney to work even after the sun has set. By optimising solar radiation at a high level in the building, the temperature increases at this point, and this in turn increases the rate of the acceleration in air movement.

Geo-thermal system

WARM MONTHS



COLD MONTHS

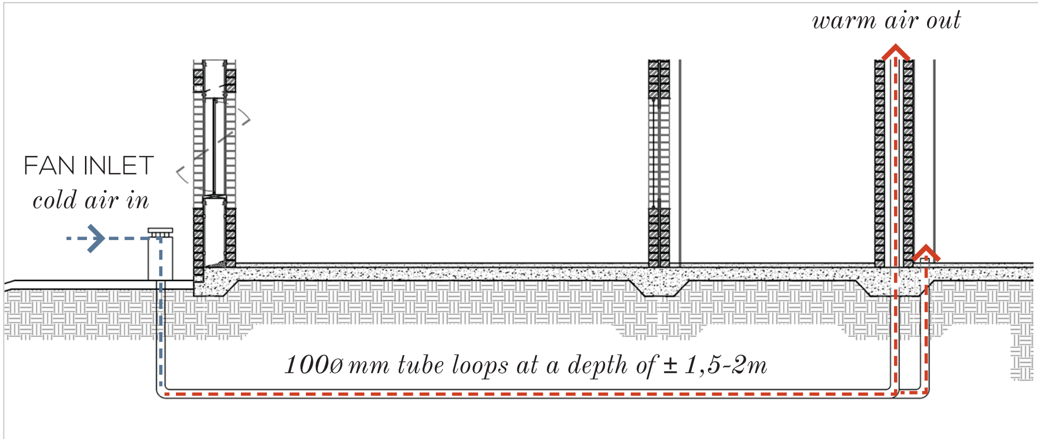


Figure 7.22: Geo-thermal system diagrams (Author 2017)

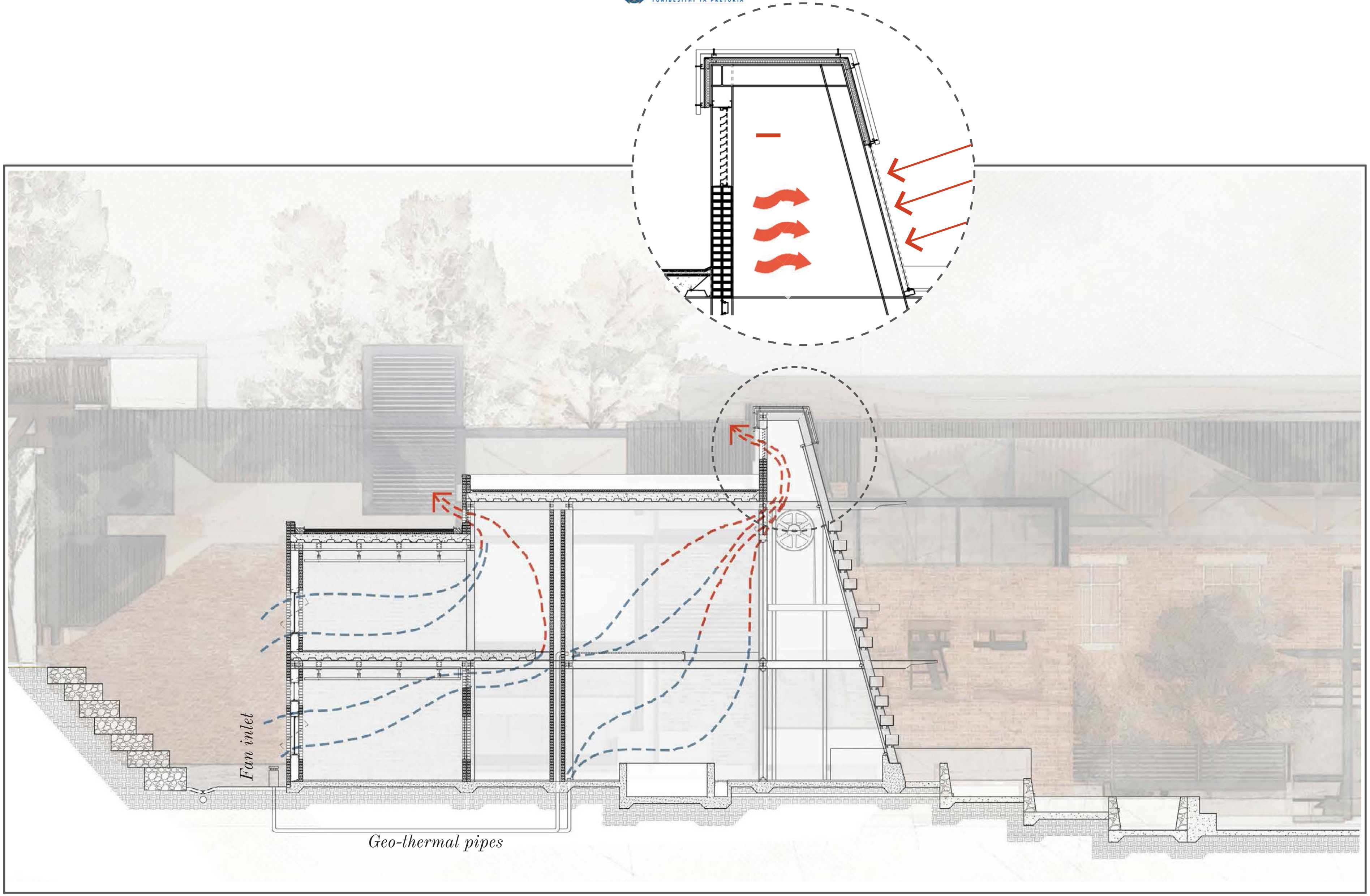


Figure 7.23: Section through proposed ventilation system in new structure (Author 2017)

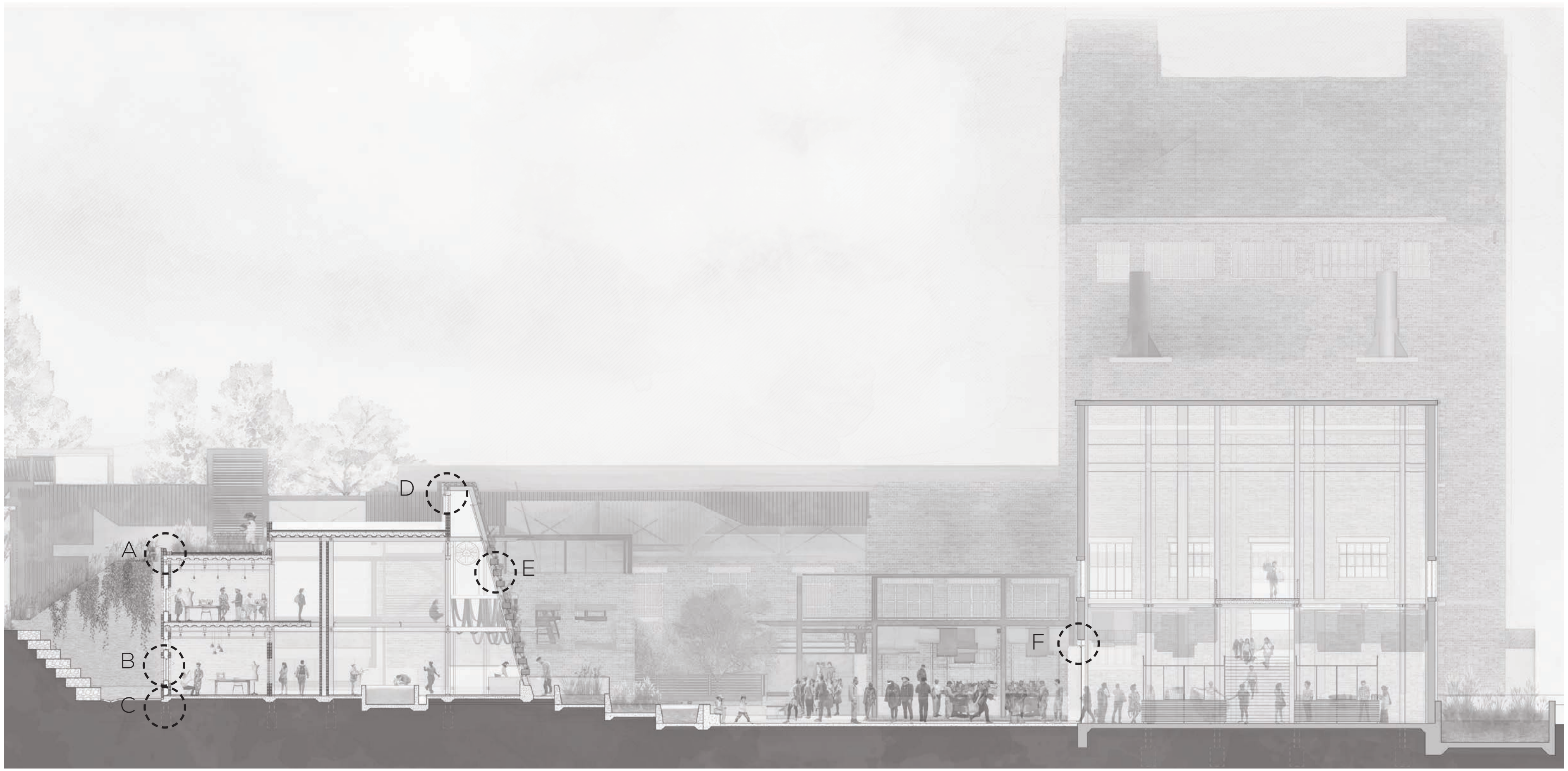
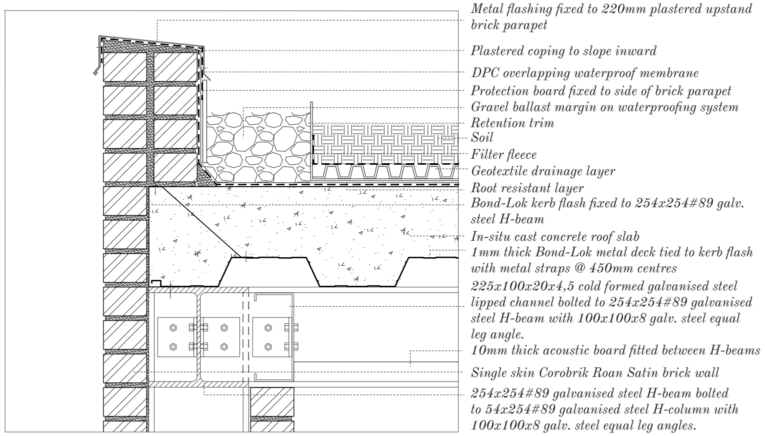
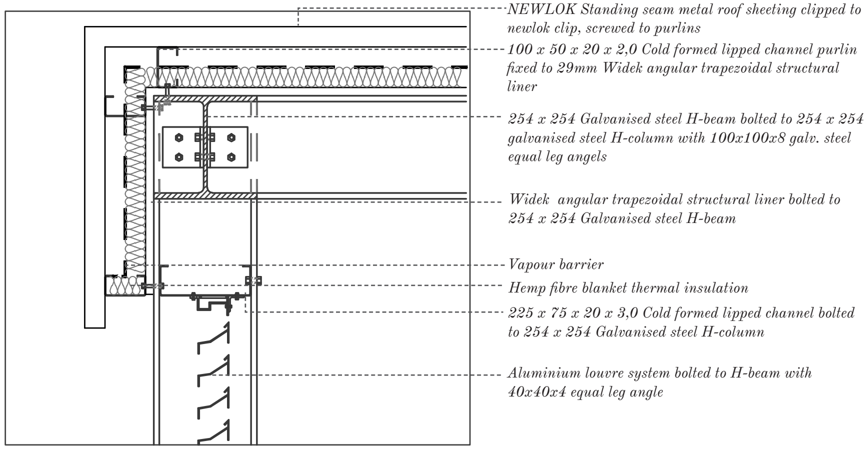


Figure 7.24: Section A-A (Author 2017)

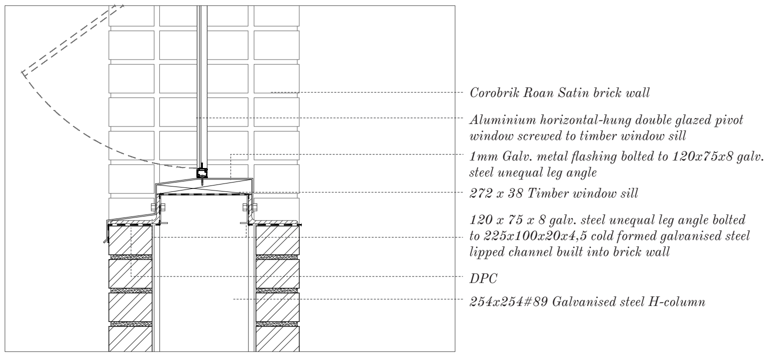
Detailing



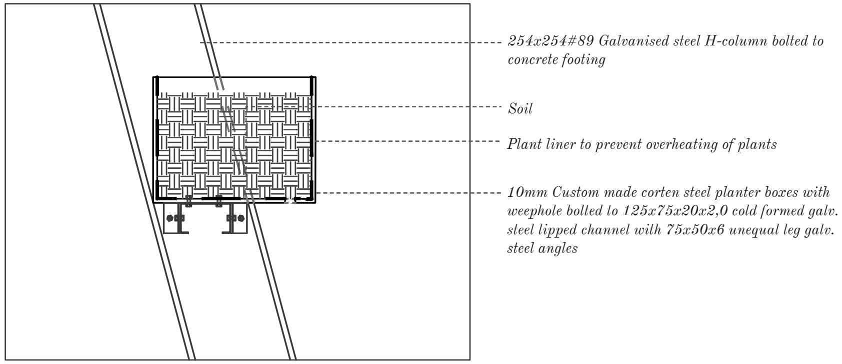
Detail A: Green roof detail



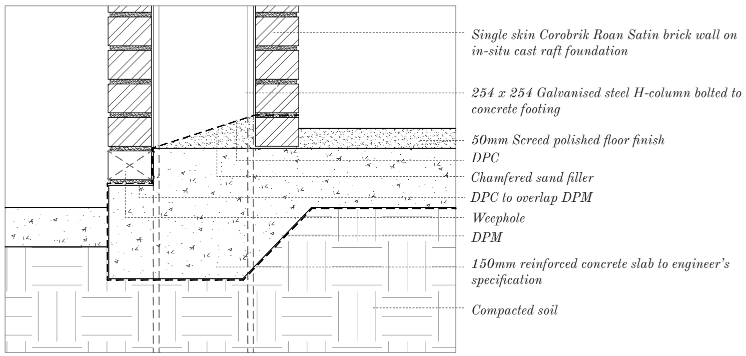
Detail D: Roof detail



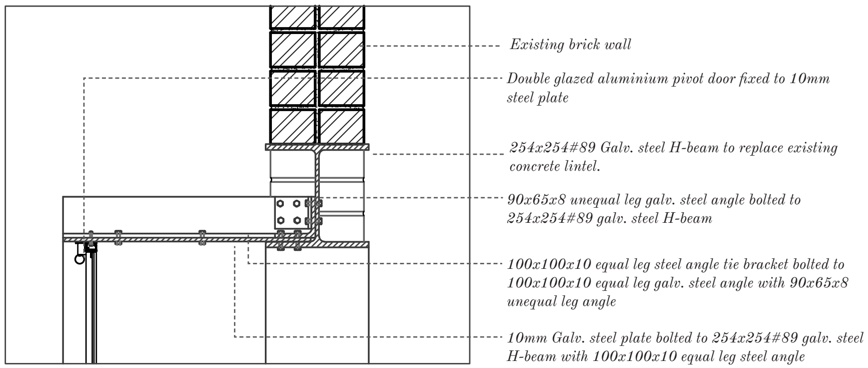
Detail B: Window sill detail



Detail E: Planter detail



Detail C: Floor detail



Detail F: Heritage connection detail (Retort 2)

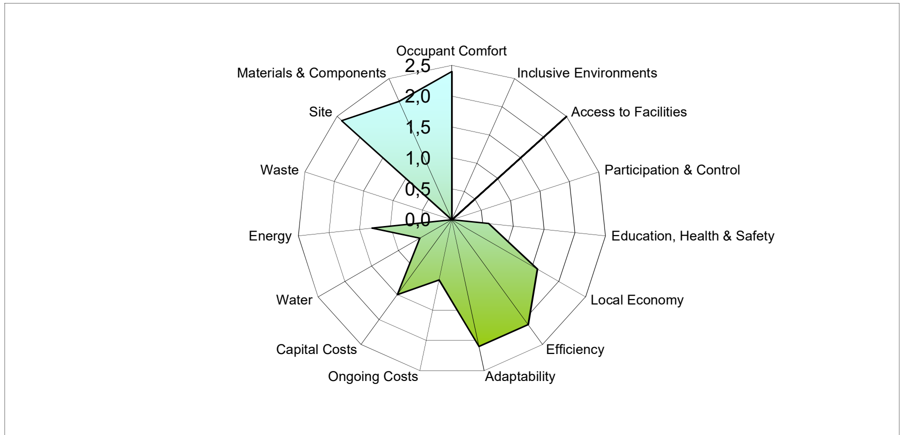
Figure 7.25: Detail A-F (Author 2017)

SBAT rating

Before intervention

SUSTAINABLE BUILDING ASSESSMENT TOOL (SBAT- P) V1

PROJECT		ASSESSMENT	
Project title:	Eco-textile Emporium	Date:	15 -Oct-17
Location:	Braamfontein, Johannesburg	Undertaken	Renée Minnaar
Building type (specify):	Textile Mill & Dye house	Company:	Student
Internal area (m2):		Telephone:	Fax:
Number of users:	50-70	Email:	
Building life cycle stage (specify):	Design		



Social	1,1	Economic	1,7	Environmental	1,3
		Overall	1,3		

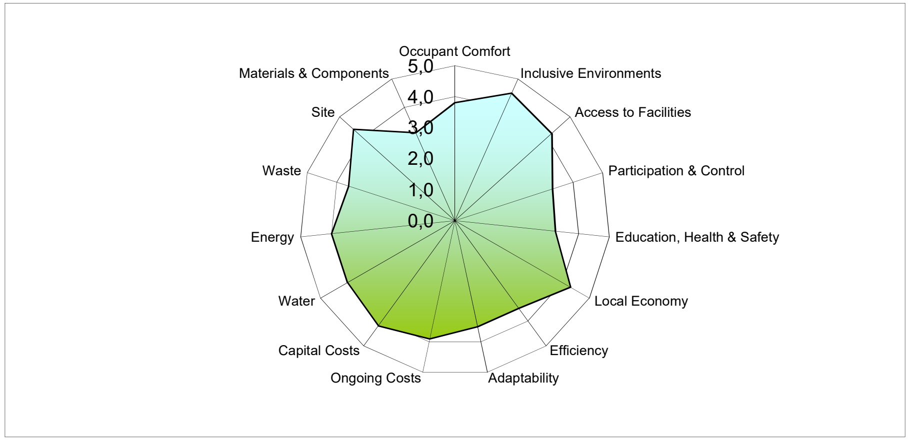
Figure 7.26: SBAT analysis before intervention (Author 2017)

From the SBAT analysis it is clear that before intervention, the site and existing buildings were lacking in terms of their social, economic and environmental contribution to society. The site was further lacking in terms of inclusive design, health and safety and in terms of its waste, water and energy management.

After intervention

SUSTAINABLE BUILDING ASSESSMENT TOOL (SBAT- P) V1

PROJECT		ASSESSMENT	
Project title:	Eco-textile Emporium	Date:	15-Oct-17
Location:	Braamfontein, Johannesburg	Undertaken	Renée Minnaar
Building type (specify):	Textile Mill & Dye house	Company / organisation	Student
Internal area (m2):		Telephone:	Fax:
Number of users:	50-70	Email:	
Building life cycle stage (specify):	Design		



Social	3,8	Economic	3,9	Environmental	3,8
		Overall	3,8		

Figure 7.27: SBAT analysis after intervention (Author 2017)

The SBAT analysis after the intervention, illustrates a great improvement in terms of the site's social, economic and environmental contribution. As well as creating an inclusive environment; waste, energy and water management have also shown a great improvement.

Sefaira testing

Daylighting

Terminology

Spatial daylight autonomy [sDA]:
Is a factor used to measure the amount of usable daylight a space receives throughout a year (Schoen 2015).

Annual Sun Exposure [ASE]:
This factor helps to identify whether a space is overlit (Schoen 2015), which might lead to glare and visual discomfort.

Benchmark

The Leadership in energy and environmental design (LEED) and the Green Building Council of South Africa benchmarks were used to assess the daylight performance of the existing retort house.

	Benchmark Value
sDA	> 75%
ASE	< 10%

Figure 7.38: Benchmark table (Author 2017, adapted from LEED 2017)

Results

The sDA underperformed 11% under the desired benchmark of 75% and the ASE exceeded the maximum 10% benchmark by 30%.

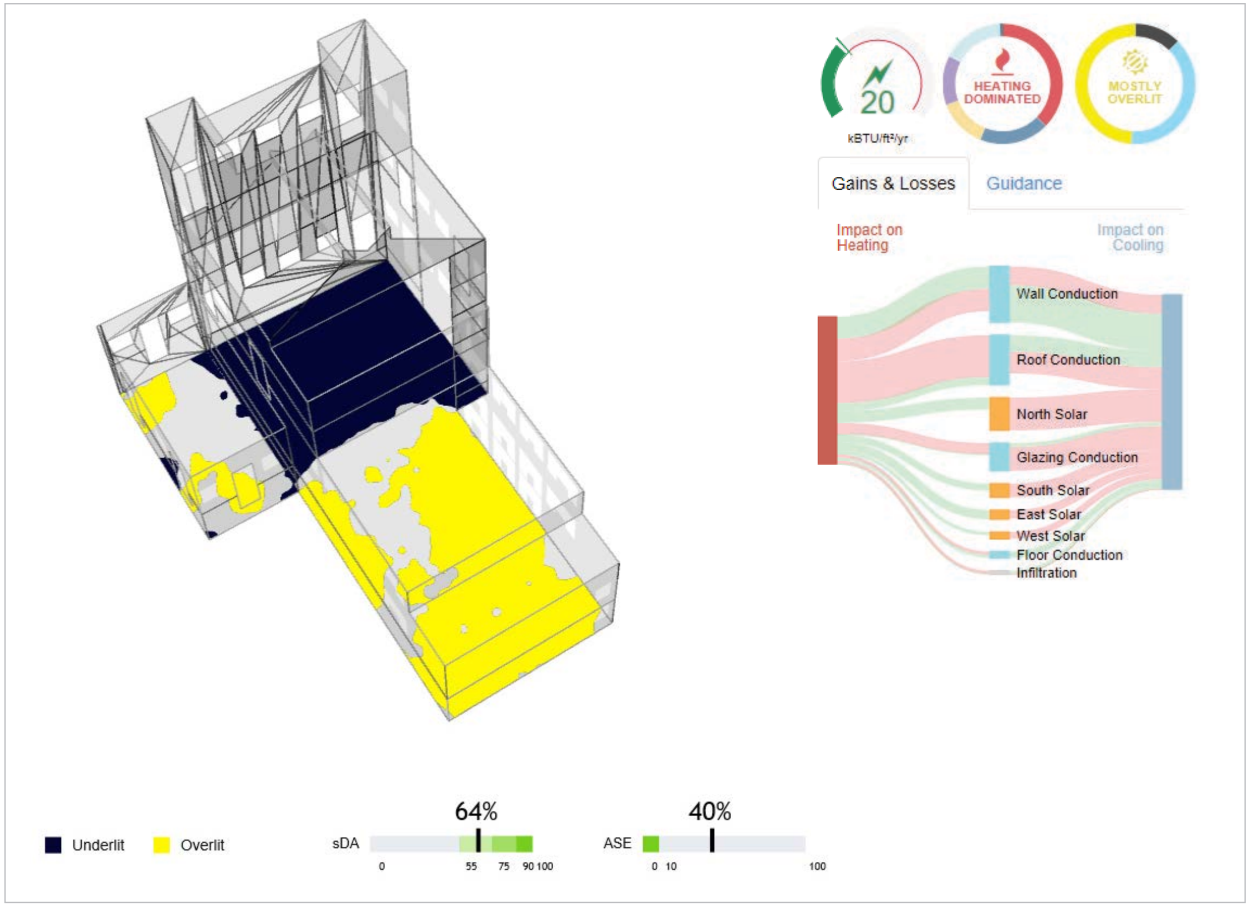


Figure 7.28: Sefaira daylight analysis (Sefaira 2017)

	Benchmark Value	Existing building performance	Strategy
sDA	> 75%	64%	Increase
ASE	< 10%	40%	Decrease

Final model

Figure 7.29: Final model view 1 (Minnaar 2017)

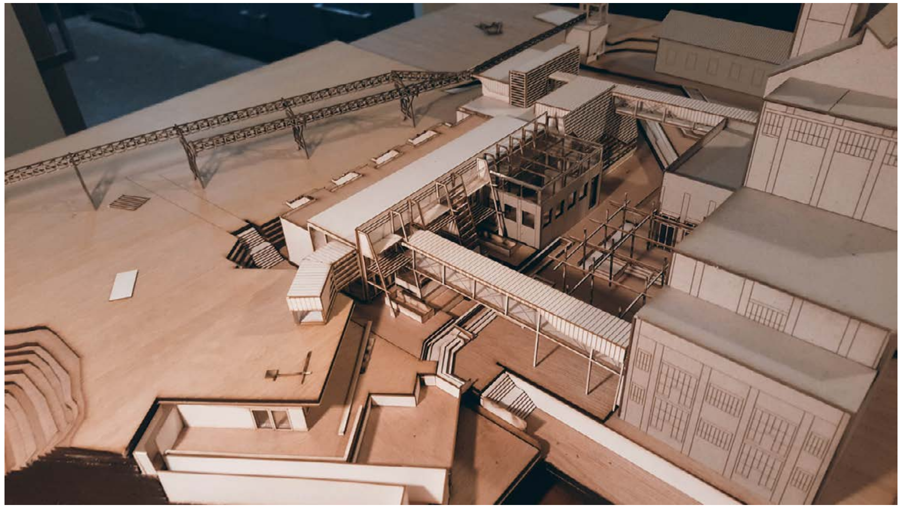


Figure 7.30: Final model view 2 (Minnaar 2017)

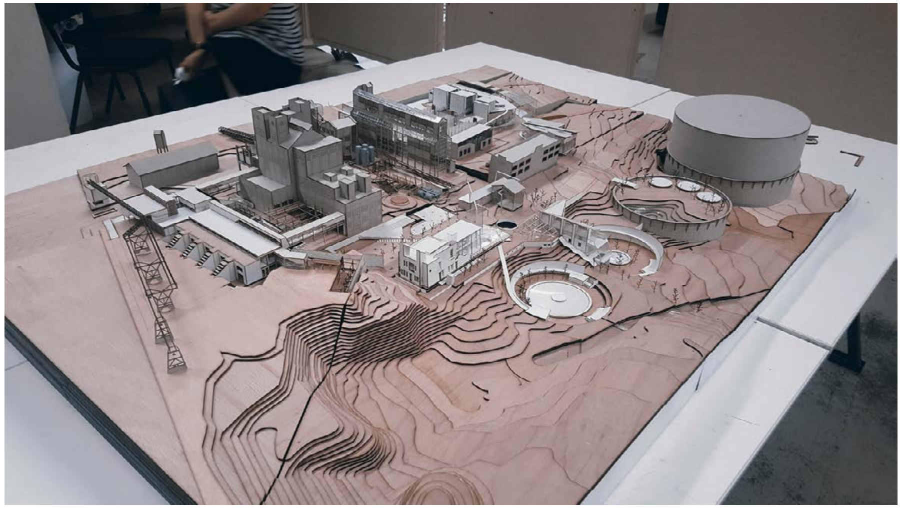


Figure 7.31: Final group model (Minnaar 2017)

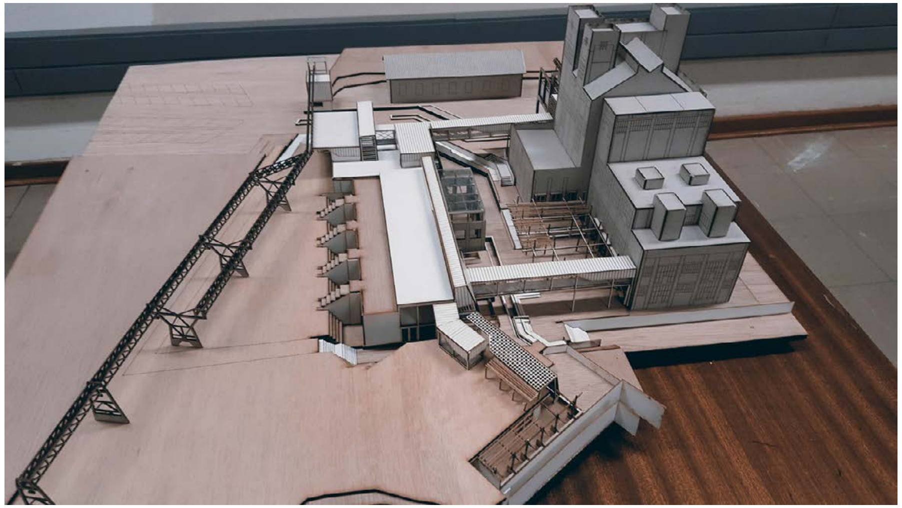


Figure 7.32: Final model view 3 (Minnaar 2017)

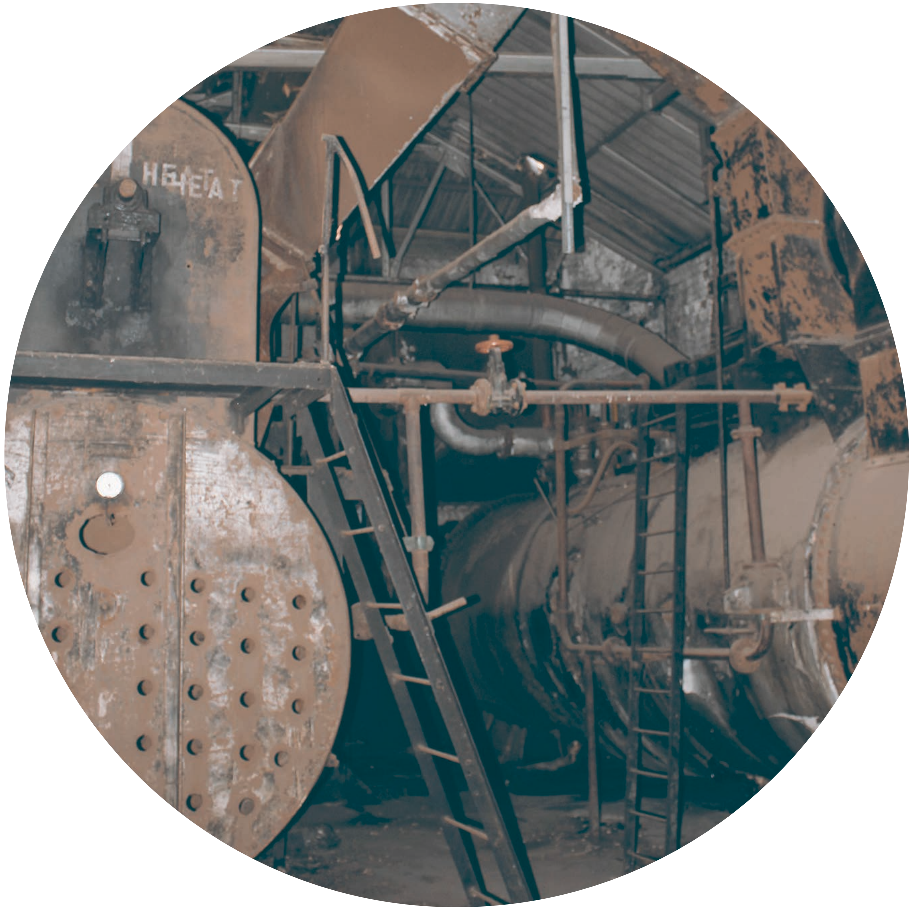
Final presentation - 22 November

Figure 7.33: Verbal presentation (Minnaar 2017)

Figure 7.34: Visiual presentation (Minnaar 2017)

Figure 7.35: Final model & presentation (Minnaar 2017)

Figure 7.36: Gasworks Group - exhibition night (Minnaar 2017)



Chapter 8

Conclusion

08 | Conclusion

Response to the original intentions

The intention of this dissertation was to catalyse the urban regeneration of the old Johannesburg Gasworks through the insertion of an architectural intervention, as well as to challenge the ideas of conservation in an attempt to create a strong dialogue between the existing industrial heritage of the past and the envisioned contemporary architecture of the future.

The issue regarding the disconnection between the natural and built environment inspired a theoretical approach rooted in regenerative design. Through literature studies it became evident that the disconnection between the natural and built environment was as a result of Renaissance and Industrial thinking. This severed relationship between man and nature led to the exploitation of natural systems without considering the long-term effects on the vitality of these systems resulting in the dichotomy between industry and nature.

The repercussions of this dichotomous relationship, in the form of pollution, caused the old Johannesburg Gasworks to become secluded from the rest of the urban fabric and this redundancy endangered the industrial heritage fabric on site.

An understanding of the existing retort house and its dominating relationship with nature inspired the adoption of a new approach to industrial architecture. Through the technical concept of inversion, an approach towards industries and the way in which they interact with the surrounding context was produced. In order to address the dichotomy between industry and nature, the new building makes use of an inverted structure, which provides infrastructure for the growing of plants needed in the dye process thus connecting industry and nature on a physical level, as opposed to the existing retort's structure. The new building also embeds itself in the landscape on the southern edge of the site,

Figure 8.1. Left: Machinery (Author 2017)

which Littman (2009:16) believes creates the opportunity for a building to contribute to the natural balance that exists on site by connecting the users of the space to the land on a more spiritual level. It is this spiritual connection that has the ability to restore the great divide between humans and nature by re-establishing humanity's place as equal shareholders in the well-being of the earth's biosphere.

The heritage was approached from the perspective of preservation through transformation in the form of a philological approach. Through the insertion of a new function, the latent potential of the building was reactivated. Due to the lack of machinery describing the old process, the new systems of movement were inserted between the old and new buildings, which act as spatial manifestations of the industrial memory.

The juxta-positioning of the new and old buildings in stark contrast to one another, provided the opportunity for a strong dialectical relationship to be established and for the old to be understood through the lens of the new building.

The optimisation of the industrial waste in the form of the leaves from the hemp and stinging nettle inspired the development of new social spaces, namely the tea house and a micro-brewery. This, along with the introduction of an urban textile market, re-establishes the city dwellers' place on the old Johannesburg Gasworks site and provides a platform for the restitution of the relationship between man and industry, reconnecting the site to the vibrant socio-economic spaces of the surrounding context.

In conclusion, through the application of the regenerative and transformative resilience theory in conjunction with philological restoration, post-industrial sites like the old Johannesburg Gasworks have the potential to provide a platform for the development of new industrial archetypes capable of remediating the severed relationship between industry and nature instigated by Industrialization. The way in which architecture manifests the mediated relationship between industry and nature provides architects with a myriad of exciting architectural possibilities to be further explored.

Our biggest challenge with post-industrial sites lies in creating architecture that is entirely comprehensive and architecture that is able to deviate from its destructive path and instead inspire remediation of issues arising from the past in order to provide prosperity for the future.

“We stand now where two roads diverge. But unlike the roads in Robert Frost’s familiar poem,
they are not equally fair.
The road we have long been traveling is deceptively easy,
a smooth superhighway on which we progress with great speed,
but at its end lies disaster.
The other fork of the road
— the one less traveled by —
offers our last, our only chance to reach a destination that assures
the preservation of the earth.”

- Rachel Carson, Silent Spring -
(Quaratiello 2004:101)

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