Ritualizing secular space

A waste management facility on Bloemfontein's northern landfill.

By Joubert Steyn

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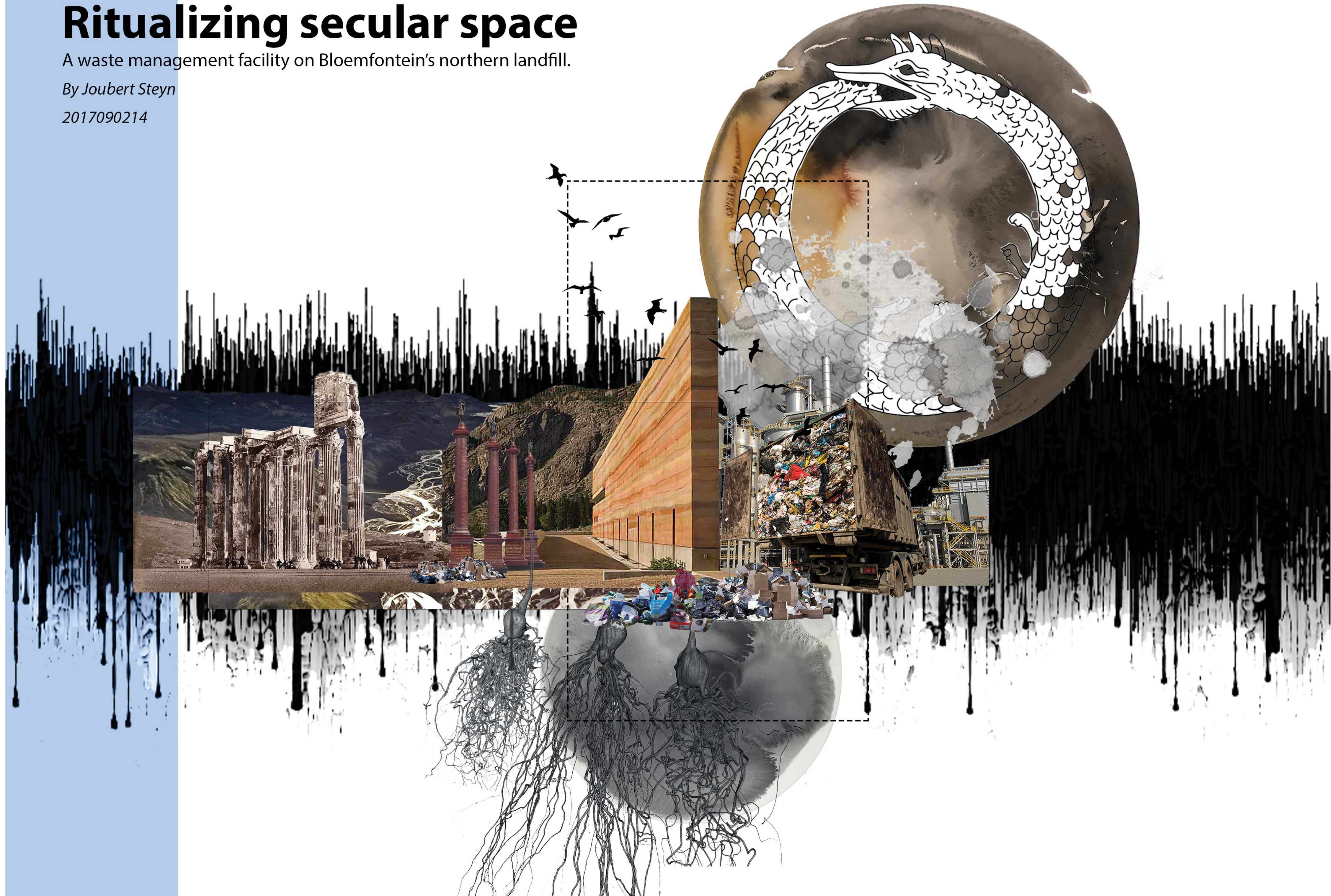

Declaration:

This dissertation is submitted in partial fulfilment of the requirements for the degree M. Arch (Prof) at the University of the Free State, Bloemfontein, South Africa.

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The work contained in this document has not been previously submitted at this or any other institution of higher education for the requirements of any degree. To the best of my knowledge all work contained within this document are my own unless where due credit is given.

I hereby declare that 'Ritualising Secular space' is my own work unless otherwise indicated

Abstract

0

Pyrolysis Facility

An architectural response to neglected space

This thesis explores an architectural solution to the complex issue of landfilling in the urban environment. However, the aim is to transcend functionalistic recycling and offer more than mere site rehabilitation. How can an architectural intervention mitigate ruination and empower the marginalized as a form of social justice in response to neglected spaces? Traditional recycling methods are often too costly or cumbersome for degraded and contaminated plastic samples from landfills. Plastic refuse can be more efficiently recycled through a waste management technique called pyrolysis, which can turn plastic into fuel sources, stimulating economic growth and addressing fuel shortages. Good architecture is much more than a programmatic accommodation list; it has a layeredness that adds depth and presents rich opportunities for design intervention. How can a waste management facility become more than just a piece of infrastructure? The hopes and aspirations for this thesis, captured in this document, are to perform architectural alchemy on the urban environment, to transform a failing landfill in the northern suburbs of Bloemfontein into an urban node that can actively contribute to the local community and become worth its weight in gold.

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CHAPTER 1

[Macro]- Analysis

Contextual Insight
Looking at the bigger picture

This chapter examines the rational behind the inception of this problem by critically evaluating broad based forces exerting themselves on a global scale in terms of the environmental and socio economic challenges faced by developed and developing countries alike.

CHAPTER 01

Environmental Crisis........1.1

Climate change refers to long-term changes in average weather patterns, whether globally or locally *(Pappas, 2022: online)*. This has happened quite a few times in earth's history, but over a significantly extended period. We experience this today due to the rapid growth and expansion experienced during the industrial age beginning in the early 1800s. According to the National Oceanic and Atmospheric Administration, carbon emissions have skyrocketed to the highest concentration in over 4.5 million years, at 417 parts per million, according to the National Oceanic and Atmospheric Administration.

Today we face a severe problem regarding the future of our planet and the world we plan to leave behind for our children. Temperature records from as far back as 1850, show that the globe has on average warmed by 0.8° C; if this trend continues in its current trajectory, the IPCC estimates that the global average temperature will be 2.5-4.7° C , higher in 2100 when compared to pre-industrial levels. The ambition of humankind and the exertion of our rapid expansion over the earth has seen a 48% rise in carbon concentration within the atmosphere, which would take approximately 20 000 years as a natural phenomenon. This sudden rise in atmospheric temperatures has devastating effects on climate and biodiversity, clearly visible today. Forest fires and flash flooding are at an all-time high as seasonal changes are delayed and average daily temperatures are on the rise. The effects of our consumerism-based society stretch far and wide and between 2009 and 2018, coral cover has progressively declined by a staggering 14%.

While they only consist of 0.5% of the ocean surface area, they are the primary producer of oxygen on the planet *(Creary, 2021: online)*.

While a growing number of countries have aspired to reach net zero emissions by 2050, about half of emissions cuts must already be in effect by 2030, to keep warming below 1.5°C. Fossil fuel production must decline by roughly as much as 6 per cent per year between 2020 and 2030 (UN, 2022: online). The contemporary model of society is quite dependent on carbon emissions; our economies and industries were built around the burning of fossil fuels, it's not just as simple as abandoning carbon, cold turkey.

Though every nation on earth has a part to play in global carbon emissions, some countries produce much more than others. The 100 least-emitting countries contribute 3 per cent of total emissions while the ten countries with the most significant emissions contribute 68 per cent. Alas, the political dilemma associated with carbon emissions poses far-reaching complications towards finding an agreeable solution to scaling back. Wealthy developed countries have profited from the burning of fossil fuels in the past to kick-start their economic growth.

They have benefited for centuries from this low-cost, low-effort approach to building their infrastructure and accumulating generational wealth. This can be seen as a double standard for them to expect carbon-neutral pledges from developing countries without offering financial aid to drive down the immense cost of renewable energies while consuming almost 6-10 times the amount of carbon than some sub-Saharan African countries.*(Purkayastha, 2021: online)*

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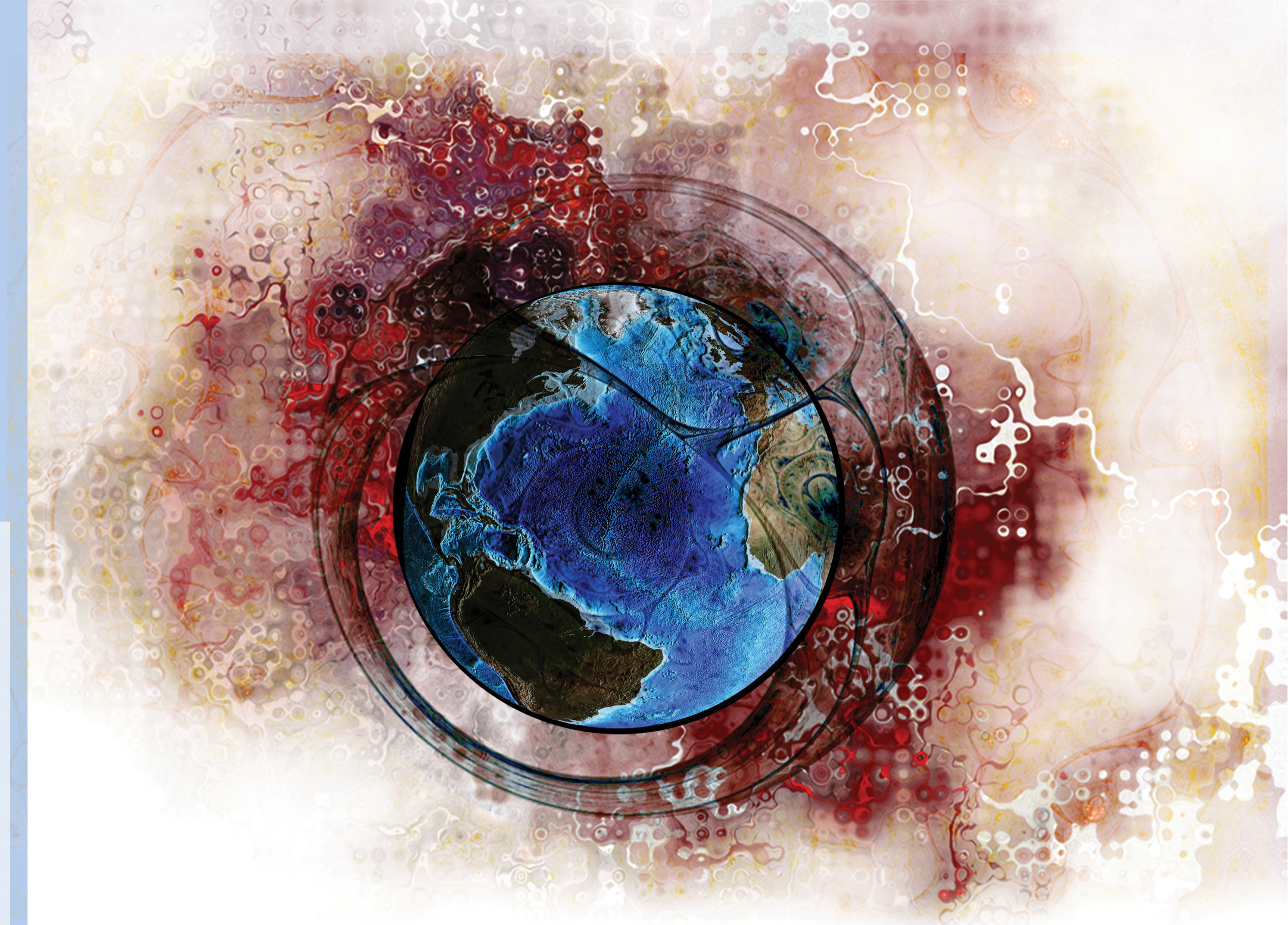

Figure 01 : Looming crisis (Author,2022)

CHAPTER 01

SA'S Energy Crisis..............1.2

South Africa's national energy enterprise, Eskom, proclaimed numerous times this year that it would implement its rolling blackouts, plunging the country into pitch darkness for sometimes more than six or even nine hours a day, leaving the economy gasping for breath, with a broader unemployment and inflation crisis looming large. Eskom, the state-owned entity at the helm of supervising all stages of electricity generation and distribution, was established in 1923 during the apartheid era and followed a grid system designed to accommodate the country's white minority. The grid largely bypassed Black areas and as a result, currently struggles to meet the country's ever-growing demands for energy. *(Rathi, 2022: online)*

A 1998 government report forewarned about the country's poor energy planning and hypothesized that if South Africa did not commission any new power facilities, it would cause dire shortages by 2007. The report was quite auspicious in its factual accuracy. Often when electricity demand exceeds supply, energy distributors utilize load-shedding to mitigate the pressure and prevent the total collapse of the entire power grid.

Eskom started implementing load-shedding in late 2007. Instead of erecting a new generation of energy facilities when it should have, in 2007 and 2008, Eskom commissioned the construction of two large-scale coal-fired power stations in Medupi and Kusile, respectively, as these facilities would have expanded the power grid's generation abilities. *(Rathi, 2022: online)*

Unfortunately, it was already too late at that stage. The Medupi and Kusile power plants, hindered by design flaws and delayed construction, became entangled in time and cost overruns. By that time, older power plants were starting to reach the end of their shelf life and were decommissioned.

"The old plants kept getting older, and the new plants were performing like the old ones." (Rathi, 2022: online)
Dire as they are, South Africa's power problems are not purely domestic. Nearly 86 per cent of the entire continent's coal-fired generation capacity can be found in South Africa. The country exports electricity to Botswana and Namibia and is part of the *Southern African Power Pool*, which provides electricity to countries in southern Africa. Despite the support of IPPs (Independent Power Producers) and renewable energy being endorsed to produce up to 100MW, Eskom is also facing competition for its client base. *(Rathi, 2022: online)*

The company faces many adversities and significant costs in reducing its emissions as it is responsible for around 40% of South Africa's greenhouse gases. The South African economy has slowly atrophied over recent years, of which Eskom's continual load shedding and unreliable power supply have played no small part.

Adopting IPPs and renewable forms of energy is a surefire way to amplify electricity generation in the near foreseeable future. Over 90% of South Africa's present model of electricity generation capabilities have been produced by fossil fuels, which is expected to continue in the foreseeable future, with more renewable energy sources only being introduced by 2030.

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South Africa is blessed with abundant sunshine and strong winds, especially in the Northern Cape and Karoo. Therefore, South Africa is undoubtedly disposed towards renewable energy resources, which must be urgently utilized. Renewable energy sources could pave the way for new power purchase agreements (PPAs), whilst clean energy generation will allow South Africa to reduce its energy shortcomings and bolster the economy. *(Majola, 2022: online)*

Eskom's performance remains inexcusable. The country is routinely undermined by crippling rolling blackouts, yet South Africans are expected to pay more than ever for electricity. Immediately after Eskom made its case for a tariff increase of 20.5% in January 2022 to the National Energy Regulator of South Africa, it tried to warrant the request on the grounds that the toll of procuring energy from Independent Power Producers (IPP's) and the carbon tax were driving the tariff increase. These two facets encompassed 13.8% of the proposed increase.

The government cannot attain an effective resolution on its own, meaning a partnership of private and the public sector is required to absolve SA of its energy crisis. Moreover, if the government relinquished the renewable energy market to private and community-based energy procurers to participate without government interference, this would help alleviate the power crisis and be a catalyst for job creation.

However, the country requires a just transition , and currently, the model proposed that the government envisioned does not match up to what was outlined by the International Labour Organization as a just transition from fossil fuels to renewable energy.

The ILO encourages a 'human-centered approach, one where the livelihoods of workers and communities in the fossil fuel industry are not negatively affected. Where every job lost in the fossil fuel industry is replaced, or workers are up-skilled. The best way to achieve that is if these companies are owned and controlled by workers and communities. Alternatively would be the promotion of facilities that accommodate a just transition, where change is implemented at a rate a developing country can afford and in a manner that does not cause any more suffering to the working class.

CHAPTER 2

[Meso] Analysis

02

Waste management

A problem .. Or The solution ?

This chapter examines an unlikely solution to the energy crisis that has been in use in developed countries for centuries and is abundant in developing countries. Waste management is a serious issue at a national level, if approached correctly ,could be the solution to all the energy problems we face as a nation, in the form of Pyrolysis.

CHAPTER 02

Waste management.....2.1

According to the 2012 departmental report on the environmental condition, South Africa generates approximately 42 million square meters of ordinary typical waste and 5 million square meters of hazardous waste every year. If the local government continues to defy the national regulations of landfill sites, serious ramifications such as the pollution of water sources, soil, and breathable air, could become a crippling problem. This is a serious concern as it directly affects the health and safety of every South African Citizen. *(Afriforum, 2021: online)*

The administration of household refuse in South Africa faces multiple hurdles, including law enforcement, administration and institutional coordination. The South African waste management approach is derived from numerous laws to reduce and mitigate environmental harm. The most relevant of these laws are:

"The hazardous Substances Act 15 of 1973"
"The Environment Conservation Act 73 of 1989"
"The National Environmental Management Act 107 of 1998"
"The National Environmental Management; Waste Act 59 of 2008"

Landfill sites.......................2.2

A landfill site is where common waste is dumped, leveled, immersed in sand and left to decompose. These sites should be situated where waste can be processed without posing a risk to people's health or the adjacent environment.

In terms of section 9(1) of the National Environmental Management: Waste Act 59 of 2008, a municipality must utilize its executive powers to provide waste management services, including refuse removal and storage as well as the leveling of waste, in such a way that it does not contradict the national or provincial standards. *(Afriforum, 2021: online)*

General Waste 2.3

This is also known as household waste and is sourced primarily from urban areas, such as homes, businesses and construction sites. This encompasses building rubble, garden waste and refuse from people's homes, towns and cities. The municipality is accountable for the collection, transportation and administration of refuse in populated areas. General waste is dumped at general landfill sites, identified in official documents by the symbol G.

Hazardous waste...........2.4

This kind of waste can cause significantly more harm to the environment as well as people's health. It originates in factories, mines and hospitals and includes toxic substances, biohazardous waste and explosive or easily combustible materials. Hazardous refuse is ranked from 1, which is extremely hazardous, to 10, slightly less hazardous. This type of refuse may only be dumped at specialized sites that are furnished to process this kind of waste. These sites are classified by the symbol H in official documents. *(Afriforum, 2021: online)*

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The Problem.....................2.5

Refuse from urban communities not only cause an aesthetic complication, but can also have severe health implications, if it is not adequately managed. These threats are exponentially amplified if the refuse consists out of hazardous substances. Municipalities can and should be made to answer for acts of carelessness that affect people's well being or give rise to environmental harm. Local municipalities can also be civilly prosecuted for associated financial implications, specifically the closing or rehabilitating of landfill sites and rehabilitating polluted soil or land that has been zoned for urban development. These sites can become detrimental to the health of nearby communities and harm the environment should :

- The landfill sites be positioned in close proximity to residential areas
- The landfill sites are incompetently designed and developed where leached or toxic water penetrates into the groundwater reservoirs and rivers
- The landfill sites are ineffectively administered; for instance, if access to the site is barely controlled, fires occur regularly, or refuse is not concealed with soil and compacted at regular intervals
- The waste is not transported to adequately administered landfill terrains, but illegally deposited onto open ground.

Health Implications.........2.6

People who reside or work in proximity to landfill terrains are susceptible to several complications and perils. Landfill sites can be extremely noisy, unsafe, and odorous. Spontaneous combustion and fires on these terrains are commonplace and can befoul the atmosphere, not to mention that the gas buildup on landfill sites could very easily cause massive detonations. Pollution on the site can infiltrate the nearby natural water sources and soil, and people can fall gravely ill if they unknowingly inhale the polluted air, consume tainted water or consume food grown in toxic soil. *(Afriforum, 2021: online)*

Serious health implications have been documented in people living in close proximity to landfill sites, such as the development of cancer or asthma and other lung and chest ailments. Congenital disabilities could occur, and children raised in proximity to landfill sites can exhibit stunted growth and be sickly. In addition, landfill sites lure rodents and insects that may carry plague and diseases, such as rats and flies, which can transfer these pathogens to people who come into direct contact with the site.

The solution.....................2.7

At the start of January 2020, South Africa enlisted in the Plastics Pact, establishing South Africa as the first African country to enlist in the organization. The Plastics Pact Network is a conglomerate of national and local initiatives aiming toward "a circular economy for plastics" to drastically decrease waste worldwide.

Johann Conradie, the chairperson of the South African Plastics Recyclers Organisation (*Sapro*), noted that it is imperative to distinguish South Africa from the other

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nations advocating for more efficient plastic management. He argues that South Africa is more inclined towards financial motivations than European nations, which are often more environmentally concerned, and the key to an optimal solution lies in understanding this facet.

In a report compiled by Sapro, it was noted that *"plastic recycling created 7,892 formal jobs in recycling centres in 2018."* Moreover, over 58,470 people benefited in other ways, *"including informal waste pickers and small or family-owned businesses."* Informal waste pickers are people that scavenge for recyclables abandoned in landfills and sell their finds to recycling facilities. The pickers are often compensated for their yields, which can mean an income for some who would otherwise be unemployed to sustain a livelihood. In European countries designated services gather household recyclables and transports these items to recycling centers. However, waste-pickers are a necessity, because landfills account for at least 70% of recyclables in South Africa. Unlike other countries, South Africa needs this waste-picking niche to mitigate harm to the environment and reduce plastic pollution.

Speaking to ESI Africa, Kate Stubbs, Director of Business Development and Marketing at Interwaste, asserted that 1.144 million metric tonnes of recyclable plastic entered the South African waste stream in 2017. *"While this figure shows a significant growth in the increased awareness from South Africans around plastic recycling – which has for long, been a contentious topic – there is still more to be done in managing perceptions around waste recycling in general." (Theron, 2018: online)*

Stubbs said, *"This is critical if we are to make strides in achieving a zero-waste-to-landfill status, and all stakeholders can play a role in finding and supporting solutions – as the responsibility does not lie with government alone." (Theron, 2018: online)*

According to Stubbs, waste–to–energy facilities are an excellent solution to this conundrum as these plants facilitate a nuanced means of disposal for plastic and other forms of refuse.
"Locally, waste-to-energy plants are also on the uptake, and while this is the case, we need to consider that there are different waste-to-energy plants that re-purpose other sources of waste not necessarily relating to plastics, and therefore, it is not a one-size-fits-all approach." (Theron, 2018: online)

She elaborated that the company Interwaste recently launched a *Refuse Derived Fuel (RDR)* plant intending to mitigate waste-to-landfill and actively support the government's attempts to mitigate the country's carbon emissions.
"The plant pioneers some forms of general, industrial and municipal waste into alternative fuels – while ensuring less reliance on fossil fuels that are carbon intensive, such as coal. Taking on average 100 tonnes of particular general, industrial and municipal waste per month, the RDF plant converts this waste into an alternative fuel – used in the cement industry and developed according to European standards." (Theron, 2018: online)

If these alternative technologies and processes operate as envisioned in South Africa, other African states could realize the potential advantages and incorporate them as well. South Africa could serve as a pioneer to usher a new era of waste management in developing countries.

CHAPTER 3

Scrutinizing perceptions

03

Plastic

Friend or Foe ?

This chapter takes a closer look at the chemical feedstock of pyrolysis and the primary material of concern on a landfill. It explores the chemical composition and applications of plastic to better understand how this environmental villain could in fact be the solution to the energy, waste and fuel crisis in South Africa.

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Plastics 3.1

The word "plastic" can be etymologically traced to the Greek word plastikos, which signifies that it can be sculpted or molded. The term plastic alludes to any synthetic or semisynthetic organic polymer. For instance, while various compounds might be present, plastics always contain carbon and hydrogen. Although plastics can be manufactured from any organic polymer, most commercial plastic is manufactured from petrochemicals.

Thermoplastics and thermosetting polymers are two distinct classes of plastic. The term "plastic" alludes to the unique quality of its plasticity, the potential to stertch without breaking easily; plastics are incredibly malleable polymers which can flex and bend to an impressive degree. Plastics have found a wide variety of applications in all sorts of industries. They are most used in piping, plumbing and vinyl siding applications. They have also been used in automobiles, furniture and toy industries, as well as the field of medical equipment, which have pioneered various lifesaving applications for plastics. *(Helmenstine, 2020: online)*

The polymer used to manufacture plastic is often mixed with additives, including colorants, plasticizers, stabilizers, fillers, and reinforcements. These additives change plastic's chemical composition, chemical properties, mechanical properties and cost. Thermosetting polymers, also go by the name thermo-sets, solidify into a rigid and constant form. Thermoplastics, however, can be heated and remoulded as frequently as desired. Some thermoplastics are molecularly vague and unstructured, while others have a crystalline structure. The unique attributes of certain kinds of plastics, rely on the chemical composition of the subunits, the formation of these subunits and the fabrication technique. All plastics are polymers, but not all polymers can be classified as plastic. Plastic polymers consist of a series of chains through linked subunits called monomers. If twin monomers are combined, it creates a homopolymer. Opposite monomers combine to create copolymers. Homopolymers and copolymers may be either linear chains or branched chains.

Types of Plastics 1.1

Plastics are complex compounds; each one is different from the next. Some are reusable, while others produce toxic substances after several uses. Some are effortlessly recyclable, and others need more advanced and expensive processes to recycle successfully. In 1988, the Global conglomerate of the Plastics Industry introduced the Resin Identification Code (RIC) system, which classified plastic resins into several distinct groups. The intent of this system was to: *"provide a consistent national system to facilitate recycling of post-consumer plastics."* Since then, after experiencing some slight variations, the RIC has been established as the worldwide standard plastic classification. If you assess your nearest plastic product, perhaps a water bottle, you'll notice a number at its back or bottom, allocating it to one of the seven categories. The numeral designates the class of plastic used to manufacture the product you are observing right now, and each has a unique name and set of characteristics. *(Helmenstine, 2020: online)*

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1 . Polyethylene Terephthalate Plastic Type (PET or PETE or Polyester)

Polyethylene Terephthalate or PET, otherwise known as a wrinkle-free fiber, has different qualities from the plastic bag we typically see at the supermarket. This type of plastic polymer has a broad-based application in the food and drink packaging industry due to its advantageous ability to prevent oxygen from entering the container and spoiling the product inside. It is also quite effective at keeping the carbon dioxide in carbonated drinks from escaping.*(Bahraini, 2018: online)*

PET is one of the most likely types of plastic to end up in recycling facilities, although it should be noted that this type of plastic contains antimony trioxide. This substance is classified as a carcinogen capable of causing prolonged damage to cells in the form of cancer. The longer a liquid spends in a PET container, the greater the risk for the release of the antimony. High temperatures inside cars, garages and enclosed spaces could also increase the release of toxic compounds.*(Bahraini, 2018: online)*

2 . High-Density Polyethylene Plastic Type (HDPE)

This class is unique compared to the other types of plastic, High-Density Polyethylene or HDPE has elongated virtually unbranched polymer chains, making them really dense. This, in turn, makes them significantly more robust and thicker than PET. HDPE is a plastic-type commonly used in grocery bags, opaque milk, juice containers, shampoo bottles, and medicine bottles. This plastic is recyclable and comparatively more stable than PET. *(Bahraini, 2018: online)*

3 – Polyvinyl Chloride Plastic Type (PVC)

PVC is commonly used in toys, blister wrap, cling wrap, detergent bottles, loose-leaf binders, blood bags, and medical tubing. This plastic used to be the second most widely manufactured plastic resin in the world (after polyethylene), before it was discovered that the manufacture and disposal process of PVC has been linked to severe health risks and environmental pollution risks.*(Bahraini, 2018: online)*

In terms of toxicity, PVC is undoubtedly the most hazardous plastic. PVC could leach a variety of toxic substances such as bisphenol A (BPA), phthalates, lead, dioxins, mercury, and cadmium. Several of the compounds listed may cause cancer; they could also cause allergic symptoms in young children and disrupt the body's endocrine system. In addition , PVS is rarely accepted by recycling programs.

4 – Low-Density Polyethylene Plastic Type (LDPE)

Polyethylenes are the most widely used type of plastic in the world. This plastic has the most basic polymer chemical structure, making it relatively easy and cheap to manufacture. LDPE polymers have excellent chain branching, including long side chains making them less hardened and less crystalline (structurally ordered) and thus a typically thinner, more flexible form of polyethylene is commonly used for bags (grocery, dry cleaning, bread, frozen food bags, newspapers, garbage), plastic wraps; and coatings for milk as well as hot & cold beverage cups; some squeezable bottles , food storage containers, container lids.

CHAPTER 03

They are widely applied in wire and cable covering. However, some studies have shown that LDPE could also cause unhealthy hormonal effects in the body. LDPE is considered a safer plastic choice for storing food and drink. Although this type of plastic is challenging and expensive to recycle. *(Bahraini, 2018: online)*

5 – Polypropylene Plastic Type (PP)

Rigid and more resistant to high temperatures, PP is commonly used for hot food containers. Its robust strength quality is somewhere between LDPE and HDPE. Besides thermal vests and car parts, PP is also included in disposable diapers and sanitary pad liners. Like LDPE, PP is a safer plastic option for food and drink use. It's a good material for baby milk bottles, as long as its made of food-grade plastic and identified as *"BPA-free"*. Although it bears all those exceptional qualities, PP isn't entirely recyclable and could also cause asthma and hormone disruption in the human body.(Bahraini, 2018: online)

6 – Polystyrene Plastic Type (PS)

Polystyrene (PS) is more commonly known as Styrofoam, a packaging medium typically used for food containers, egg cartons, disposable cups, bowls, packaging, and bike helmet. When exposed to searing hot and oily foods, PS could leach styrene, which is highly toxic to the brain and nervous system. It can also cause damage to RNA, lungs, liver and the immune system. PS has a meager yield regarding its recycling rate and can be considered a single-use plastic.

7 – Other

Category 7 is for all plastics other than those identified throughout numbers 1-6 and also plastics that may be layered or combined with other plastics, such as the exciting field of bioplastics. Polycarbonate (PC) is the most popular type of plastic in this category but hasn't been used as much in recent years because it is associated with bisphenol A (BPA). PC is known by various names: Lexan, Makrolon, and Makroclear.

Quite shockingly, PC is commonly used for baby bottles, sippy cups, water bottles, water gallons, metal food can liners, ketchup containers and dental sealants. Due to its high toxicity, numerous countries have banned using PC for baby bottles and infant formula packaging. The BPA contained inside PC has been linked to many health defects, including chromosome damage in female ovaries, sperm production atrophy in males, early onset of puberty and various physiological and behavioral alterations.

It has also been linked to impaired immune function, sex reversal in frogs, altered brain and neurological functions, cardiovascular system damage, adult-onset (Type II) diabetes, obesity, resistance to chemotherapy, increased risk of breast cancer, prostate cancer, infertility and metabolic disorders. *(Bahraini, 2018: online)*

CHAPTER 4

Tradversing Mediums

04

Traditional Plastic Recycling

Why its not enough ...

This chapter gives insight into the recycling process and critically examines the recycling technique of plastic as it is most widely used in order to understand the advantages as well as the disadvantages of this particular method.

CHAPTER 4

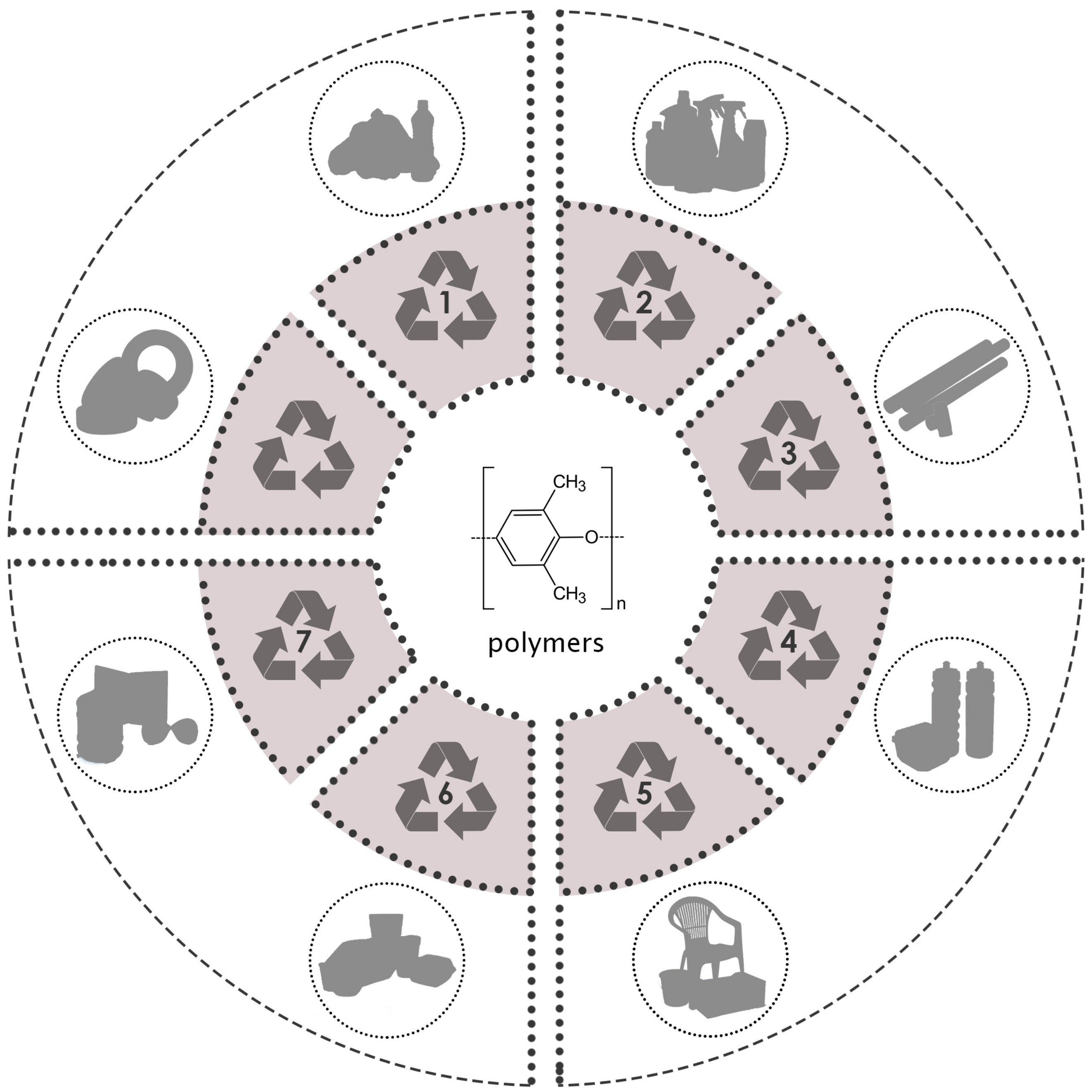


Figure 02 : Plastics Classifications (Author,2022)

C H A P T E R 04

Plastic Recycling.............4.1

One promising avenue to diminish the production of virgin plastic is recycling the plastic that has already been manufactured and using it to produce new items. Plastic recycling has become more prevalent in recent years and is continually evolving. Providentially, many plastics can be re-purposed to give this wonder material a second life. (Slavikova, 2018: online)
Plastic waste recycling limits fossil fuel consumption and saves energy, landfill space, carbon dioxide emissions and other greenhouse gases. Plastic recycling can be divided into a couple of consecutive steps. Generally, these processes remain constant for most recycling plants, but specific actions can be combined or omitted depending on the desired outcome.

Step 1: Collection

First, plastic waste has to be gathered by a recycling facility. This can be done when recycling collection drivers pick up the plastic recycling bin in front of our homes, if one has a subscription or when people bring their recyclable refuse to a nearby recycling collection point. This step relies entirely upon businesses, restaurants and the general public to dispose of their plastic waste responsibly. If plastic waste is thrown away in standard trash bins, it will most likely not be recycled, so it is essential to segregate ordinary and plastic refuse. Furthermore, it would be advantageous for governmental municipalities to employ a recycling collection initiative that goes to people's homes or businesses to collect plastic waste. *(Slavikova, 2018: online)*

Making the process simple and practical for people to responsibly dispose of plastic refuse is essential in ensuring widespread recycling success.

Step 2: Sorting

After plastics are accumulated and delivered to a recycling plant, should the recycling facility rely on a single-stream recycling system, by which all refuse is mixed together, these materials must first undergo a sorting process to distinguish different materials, such as glass and paper or metals.
In wealthy developed countries, machines automatically do most of this sorting process. Still, at least one manual sort is usually included to eject as much contamination of the materials as possible.
Sophisticated Machinery separates plastics into different compartments based on many physical characteristics and properties that are often influenced by the budget of the recycling facility, or what final outcome will be produced.

Plastics are typically sorted in a few standard ways, such as the type of plastic, what compounds the material is made of, the color of the plastic and its weight or buoyancy. This is crucial because different types of plastics have to be processed in different ways and some recycling facilities are only equip to recycle one kind of plastic. If an inappropriate type of plastic is processed at the wrong facility, it can sabotage the whole process and require that the entire batch be sent back again for resorting.
Since many types of plastics are in use today, all of the plastic materials in a recycling facility must be segregated by type. *(Slavikova, 2018: online)*

C H A P T E R 04

Regrettably, certain kinds of plastics are not as efficiently recycled as others and various recycling plants do not have the necessary amenities to accommodate every kind of plastic, so these items may be sold to another facility that can recycle them, or they may end up in a landfill as most plastics do. Thus it is crucial to esquire beforehand about your plastic recycling company and what they do with items that cannot processed. *(Slavikova, 2018: online)*

Step 3: Washing

Just like with any other raw material, plastics must be cleansed before they can be further processed. The objective is to eliminate contamination and everything that is not made from petrochemicals. Most containers and packages have labels, adhesives, or even food leftovers that have to be seperated. This non-plastic waste might influence the chemical composition and could influence the final product's structural integrity. *(Slavikova, 2018: online)*

Step 4: Resizing

Resizing includes, but is not limited to shredding or granulating the plastic waste into smaller particles. This optimizes the surface area of the plastic, making it more efficient to handle, remoulds, and relocate if required. Furthermore, it offers recycling facilities a final chance to eject any non-plastic waste that has made it through the first three processing operations. This is often executed with metal detectors or magnetic rollers that help remove any residue metal in the batch. *(Slavikova, 2018: online)*

Step 5: Separation

The identification and separation of plastics are when the processed small plastic particles are run through mechanical testing to ascertain their purity and classification.
The first quality tested is buoyancy. This is done by floating the plastic in a large tank of water. Particles less dense than water will float, and more dense particles will sink.
Next, their mass classification is established. Air classification is the official test for how thick or thin a particle is. This is done by dropping the particles into a small wind tunnel. The smaller pieces will fly higher up the tunnel and the bigger ones will remain lower. Two other characteristics that plastics are typically evaluated on are their melting point and color. These are determined by collecting and analyzing samples from each batch of plastic particles.
(Slavikova, 2018: online)

Step 6: Compounding

The final step in the recycling process is when the plastic granules are transformed into recycled raw materials used for future production. Compounding is when the small particles are grounded and melted into plastic pellets. The pellets can then be used to produce other plastic products. These recycled plastic pellets can then be sold to factories and used to manufacture all kinds of different products. Some products made from recycled plastic particles include synthetic fleece, engineered wood products, carpeting, floor mats, tiles, furniture, motor oil, detergent bottles, pipes and pails. Throughout this entire process, the plastic may be transferred to different facilities that specialize in additional steps of the process. *(Slavikova, 2018: online)*

CHAPTER 5

Assuaging Conviction

05

Pyrolysis Process

An Alternative Solution

This chapter introduces the concept of Pyrolysis and delves deeper into all the complex steps involved in turning plastic waste into crude oil. This material can be further processed to produce all manor of useful combustible compounds , amongst the most precious , diesel and petrol.

CHAPTER 05

Pyrolysis.............................5.1

The disposal of plastic waste is a big problem; landfilling or burning plastics are the most popular methods, but this route is very detrimental to the environment; recycling waste material is the only way to make a difference, but it is often too costly. More often than not, the plastic refuse that ends up in landfills are contaminated, debased and mixed to such a degree that it becomes too cumbersome or expensive to recycle. However, pyrolysis is an efficient way one can economically recycle plastic material. The Definition and meaning of 'pyrolysis' can be understood by breaking the word into its two roots: Pyro, meaning heat and Lysis to break down. *(Baranski, 2021 : Online)*

Pyrolysis involves the thermal deconstruction of materials at high temperatures in a contained and regulated atmosphere. What this means is that the Pyrolysis reaction comprises out of the molecular degradation of larger plastic molecules into smaller molecules of oil gas and carbon by applying heat. Plastic is manufactured from gas and oil, the molecules of which are put end to end to form long-chain polymers. By heating plastic to over 450 ° C, deprived of oxygen, pyrolysis breaks these molecular chains to transform plastic waste back into a liquid and gaseous hydrocarbon. Pyrolysis is also known as thermal cracking, thermolysis, and depolymerisation. This method has many industrial applications. Plastic pyrolysis is one of the most profitable methods or techniques to convert waste into energy from solid, liquid, or gaseous fuels. Subsequently, it is an energy recovery method and a more nuanced type of waste-to-energy conversion. *(Baranski, 2021 : Online)*

Pyrolysis is not a new process, it has been around for decades, but its implementation remains scarce due to the low expense of extracting virgin oil from fossil fuels and the intricacy of this large-scale technology. Small-scale and modular pyrolysis systems are an excellent way of handling local plastic waste and accessing energy. Pyrolysis can refine dirty and mixed plastics that would be very cumbersome to recycle. It makes it feasible to give a second life to waste in contexts such as landfills in developing countries where energy is limited and recycling economically inviable.

Pyrolysis is especially potent when it comes to processing mixed, degraded and soiled plastics to distill quality fuel and operate without risk; the ideal plastics for the reaction are Polypropylene (PP), Low-Density Polyethylene (LDPE) and High-Density Polyethylene (HDPE). In small proportions, pyrolysis accepts PET, PS and PC. Specific types of plastic, such as polyethene and polypropylene plastics, can be processed to extract fuels more quickly because they are made from petrochemicals and other hydrocarbon compounds. Specific types of fuels can be extracted through the pyrolysis of plastics, namely:

• Hydrogen: The recycled hydrogen can be utilized for aircraft propulsion and fuel cell vehicles.

• Diesel: The thermal breakdown of plastic waste can also produce liquid oil. The high temperature and high pressure break down the plastics and convert them into oils. The extracted liquid oil can be processed further through an oil refinery distillation. Distillation converts the liquid oil into diesel. *(Baranski, 2021 : Online)*

CHAPTER 5

Disadvantages of Traditional Recycling

01

Highly Fragile

Despite the efficiency of most advanced recycling facilities, there can still be some unanticipated complications involved with the sorting process of recycling plastic waste. Compounds such as dyes, heavy metals, pharmaceuticals, and occasionally pieces of biodegradable plastic could pose a serious risk of contaminating an entire batch of petroleum-based plastics, which must all be thrown away.

02

High Maintenance

The first step in the recycling process is perhaps the most crucial. If the user doesn't correctly discard the plastic, it will never be recycled. When one recycles plastic materials, washing or shaking them out is essential to reduce the amount of organic residue sent to the recycling centre. Moreover, it is custom to remove the screw caps from any bottles you recycle. The caps are manufactured from a different kind of plastic than the bottle. If the user does not remove them, they must be removed by employees at the recycling centre before they can be processed.

03

Low impact

Since the mass production of plastics began in the 1950s, the world has produced over 8.3 billion metric tons of plastic. Out of all of this plastic, we have only recycled around 9 % of it. Out of the remaining 91 %, around 12 % has been incinerated and 79 % is currently in landfills. This plastic will remain in landfills for the next few hundreds of years before it degrades, if it even will; during that time, even more plastic will accumulate.

04

Environmental impact

Plastic recycling can harm the environment; when the material is melted down, VOCs are released into the atmosphere and are detrimental to surrounding plant and animal life.VOCs (volatile organic compounds) released during the plastic recycling process present health risks to the people who use recycled plastic. Plastic recycling can create more environmental problems; if not done right, recycling companies might abandon dump sites and leave the harmful chemicals contaminating the ground water and the environment.

CHAPTER 5

Advantages of Pyrolysis

01

Waste Management

The recycling of plastic, through the process of pyrolysis, can be made into a valuable source of energy such as chemical feedstock. This makes the time consuming process of recycling waste significantly more profitable for waste management companies. Pyrolysis entirely encompasses the amount and types of plastics that can be recycled. Currently most plastic waste is shipped abroad and or land filled which, through a defective system of subsidies, is economically more viable than sorting waste and recycling it.

02

Environmental impact

Pyrolysis has the potential to significantly reduce land-filling .In doing so, it will prevent toxic waste from contaminating the soil and polluting the environment. Pyrolysis can reduce the emissions of greenhouse gasses through mitigating land-filling and the need to extract new fossil fuels from the earth. The process of drilling oil out from the ground is a big contributor to global warming in itself, roughly 1.7 gigatons of carbon dioxide. As long as we are burning fuel and creating emissions we might as well put our plastic waste to good use.

03

Economic Activity

The operation of pyrolysis facilities, as well as the activities built around energy recovery from waste plastics through pyrolysis, can have huge economic and social implications. These facilities can generate jobs, become a source of livelihoods in communities, and become a primary industry for entire regions.

Apart from the architectural implications of constructing and operating pyrolysis plants, community members can participate in enterprises involved in collecting and sorting solid waste materials. A fact-sheet published by the American Chemistry Council mentioned that the United States could employ 39,000 individuals and produce nearly USD 9 billion in economic output.

04

Source of Energy

The thermal reaction of waste plastics ultimately produces fuel by-products. Pyrolysis, particularly when applied in plastics, is an energy recovery method. The technology can supplement the energy generation while reducing the need to extract, transport, and burn fossil fuels to maintain energy security for the greater whole.

Energy recovery via plastic pyrolysis has also many advantages over fossil fuels. The Pyrolysis technique can reduce greenhouse gas emissions by up to 14 percent, water usage by 58 percent, and fossil fuel-derived energy usage by 96 percent.

CHAPTER

Cultivating Sustainability

06

Biofuel

With an eye on the future

This chapter investigates a possible, future interpretation to the pyrolysis facility when the current iteration has achieved its purpose with plastic and the transmutation process can take place again. This approach embodies the circular economy principles as the transition to sustainability is concluded , from a wasteland to green space.

CHAPTER

06

BioFuels............................6.1

Apart from alternative sustainable energy sources, biomass can be transformed directly into liquid fuels, known as "biofuels," to mitigate transportation fuel demands. The two most popular biofuels currently in use are ethanol and biodiesel, affirming the first generation of biofuel technology.

The biomass is transformed through hydrotreating and hydrocracking to refashion biomass into usable transportation fuels. Through hydrotreating, hydrogen reacts with the biomass to remove sulfur and oxygen from the compound. With hydrocracking, the hydrotreated biomass reacts with hydrogen to create smaller chains of hydrocarbons to reach the desired specifications of gasoline and diesel fuels. *(Imran, Bramer, Seshan and Brem, 2018: online)*

Petroleum-derived fuels, such as gasoline, diesel, and jet fuel, encompass a composite assortment of hydrocarbons that are burned to produce energy. Hydrocarbons can also be derived from biomass sources through various biological and thermochemical processes. Biomass-based renewable hydrocarbon fuels are just about indistinguishable from the petroleum-based ones they are intended to substitute—these mixtures are compatible with modern diesel engines, pumps, and other industrial infrastructure.

Ethanol (CH3CH2OH) is a sustainable source of fuel that can be produced from a diverse range of plant matter, conjointly called "biomass." Ethanol is an alcohol used as a blending medium with gasoline to optimize octane content and reduce carbon monoxide and other smog-causing emissions.

The process of manufacturing complex-biofuels routinely entails a multistep process. First, the rugged, rigid structure of the plant cell wall—which includes the biological molecules cellulose, hemicellulose, and lignin bound together—must be broken down. This can be achieved in two ways: high-temperature deconstruction or low-temperature deconstruction.

High-Temperature Deconstruction
High-temperature deconstruction uses extreme heat and pressure to break rigid biomass particles into liquid or gaseous states such as the case with Pyrolysis.

In the course of pyrolysis, biomass is warmed up swiftly at extreme temperatures (500°C–700°C) in an oxygen-starved vacuum. The heat decontructs the biomass into pyrolysis vapor, gas, and char. Once the char has been separated from the gas, the vapours are cooled and condensed into a liquid "bio-crude" oil.

Low-Temperature Deconstruction
This method commonly utilizes biological catalysts called enzymes or chemicals to break down feedstock into intermediates. The process used to convert biomass into ethanol is known as fermentation. In the course of fermentation, microorganisms consume plant glucose to make ethanol. Similar to petroleum-based diesel, biodiesel is used to fuel compression-ignition engines. Biodiesel can be amalgamated with petroleum-based diesel in any percentage, including B100 (pure biodiesel) and the most conventional blend, B20 (a blend containing 20% biodiesel and 80% petroleum diesel). *(Imran, Bramer, Seshan and Brem, 2018; online)*

CHAPTER

Precedent Study

07

Incineration Line in Roskilde

Waste to energy facility in Denmark

This chapter examines a similar typology to what I am proposing , a facility that makes use of pyrolysis to turn waste into chemical feedstock for a power plant. This precedent is quite applicable in the way it responds to the natural landscape while preserving its industrial character and functionality.

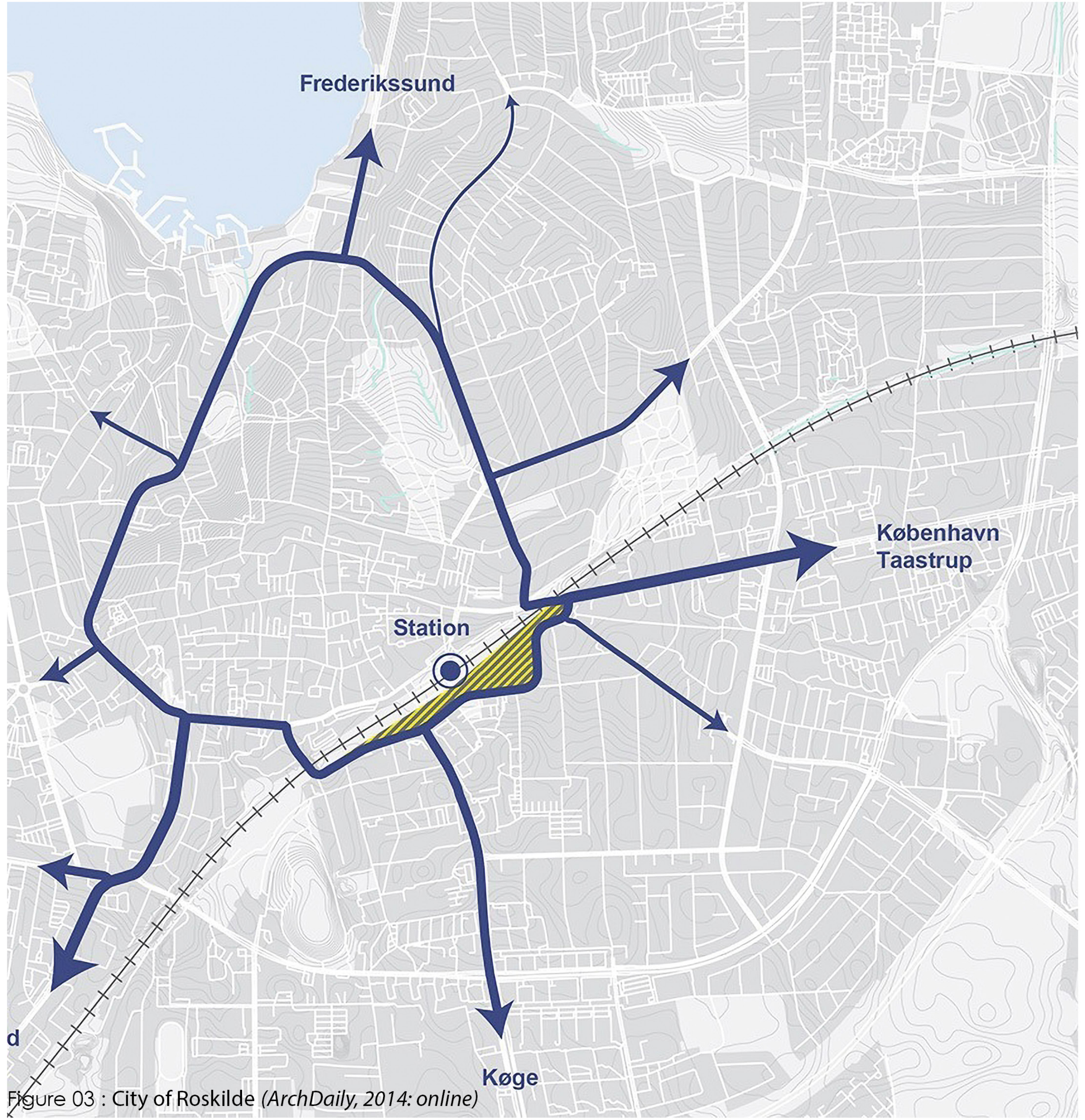


Figure 03 : City of Roskilde *(ArchDaily, 2014: online)*

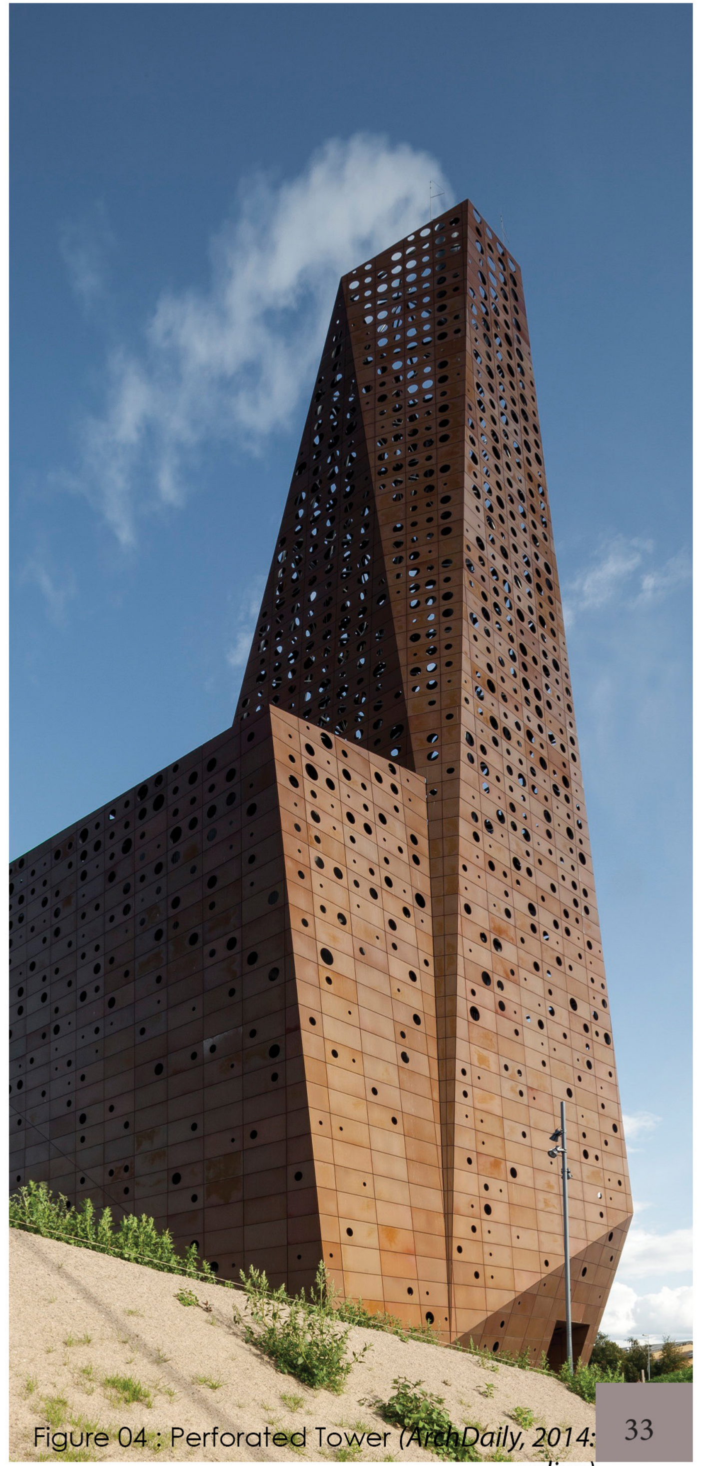


Figure 04 : Perforated Tower *(ArchDaily, 2014: online)*

CHAPTER 07

Program.............................7.1

The new energy tower designed by architect Erick van Egeraat in the city of Roskilde in Denmark, a waste-to-energy Incineration Line inaugurated by his royal Highness Crowned Prince Frederik on September 2, 2014. The facility will incinerate domestic refuge from nine neighbouring municipalities and import waste from many other countries to produce electricity and heat for the whole region of Roskilde.

An international design competition was organised to design the enormous new incinerator line, situated in a relatively level landscape, next to the small city of Roskilde, with an industrial yet appropriate appearance to compliment the natural beauty of the Danish landscape. In 2008 the committee unanimously selected the design proposed by Erick van Egeraat. The facility will utilise state-of-the-art technology and the most efficient systems to sort 260,000 to 350,000 tons of waste annually. In turn, this will generate enough electricity for 60,000 households each year. When commenting on his design approach, Erick van Egeraat said, *"It is a contemporary cathedral; close to the ground, we shaped the building to reflect the angular factory roofs of the immediate surroundings. We then let the building culminate in a 100-meter tall spire, an articulation of a fascinating and sustainable process in creating energy."*

The brief for the new incinerator in Roskilde is explicitly created to contribute architecturally to an otherwise exclusively industrial complex. Complementing the skyline of this small Danish city, once the Danish Capital, the silhouette of the incinerator also delivers a powerful historical commentary.

The lower part of the building's angular rooves is sloped to accommodate the form of surrounding factories. Still, the impressive 97-meter spire and its materialisation is a contemporary interpretation of the city's most beloved historical monument, Roskilde Cathedral. *(ArchDaily, 2014: online)*

Structure.........................7.2

The façade consists of two separate skins: the inner layer is the barrier which provides the most climatic insulation and protection, liberating the secondary skin to be utilised as an aesthetical element. Raw umber-coloured aluminium plates with an irregular pattern of laser-cut circular holes slowly dematerialise the structure as the Cathedral of industry ascends towards the heavens. The aluminium plates are chemically altered to give them the desired colour and patina during the daytime.

The automated lighting elements installed between the two facades give the building a different ambience at night. (ArchDaily, 2014: online) The design is based on basic construction details combined with cutting-edge manufacturing technology for producing the aluminium façade panels and clever processing and repetition. Due to its enormous size, the incinerator is destined to become a unique structural landmark in the vast and open landscape of the Roskilde area. It represents a hypermodern and sustainable energy plant where the waste will be turned into power.

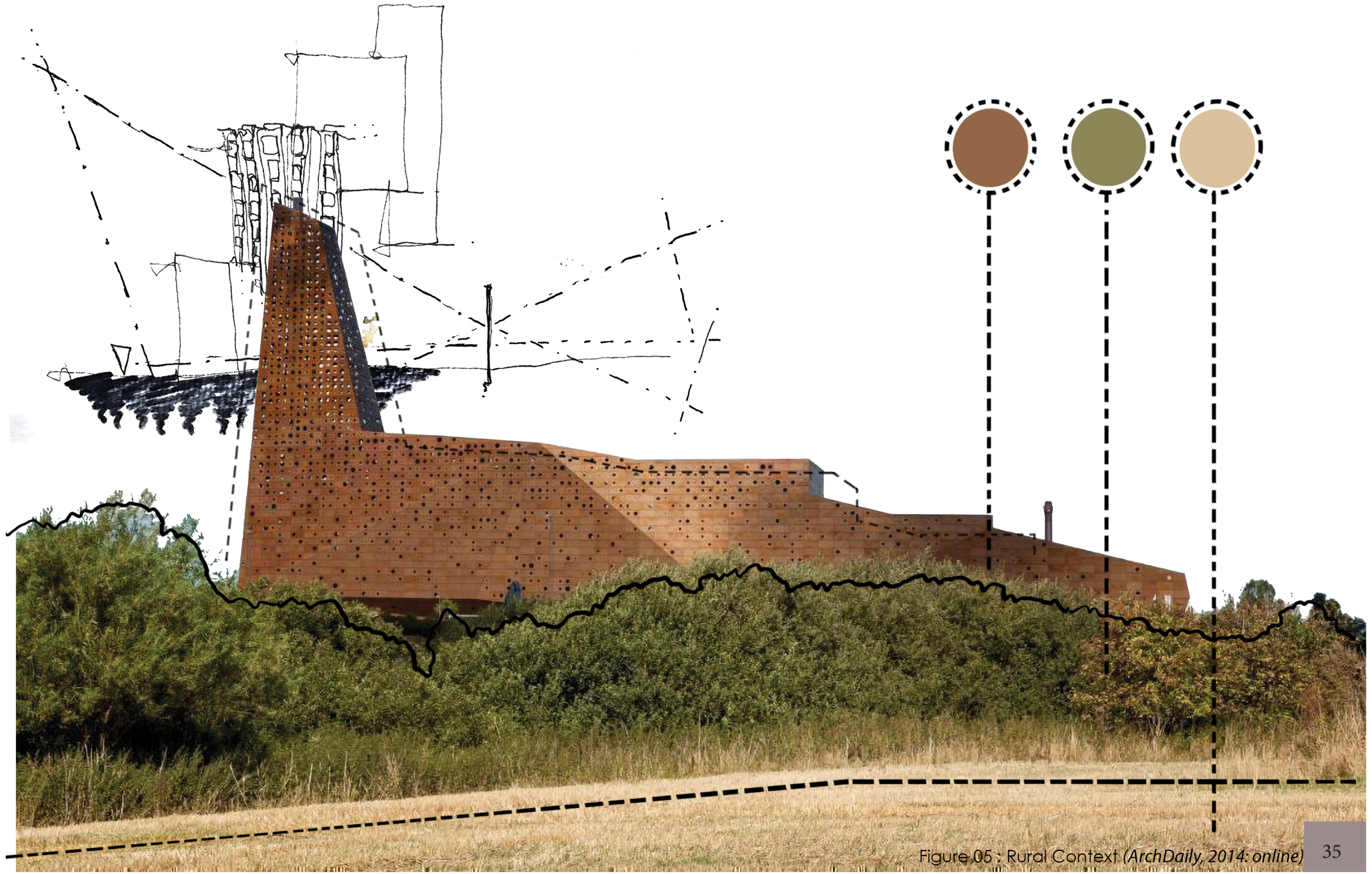


Figure 05 : Rural Context *(ArchDaily, 2014: online)*

CHAPTER 07

Materiality........................7.3

Erick van Egeraat commented on his design: *"At night, the back-lit perforated facade transforms the incinerator into a gently glowing beacon – a symbol of the plant's energy production. Several times an hour, a spark of light will gradually grow into a burning flame that lights up the entire building. When the metaphorical fire ceases, the building falls back into a state of burning embers.' Although almost 1000 years apart, the Cathedral's twin towers made of warmly colored stone and brick and the new iconic glowing incinerator have become the novel guardians of the city's otherwise modest presence in the Skagerrag landscape. Of course, I am proud of that." (ArchDaily, 2014: online)*

For the illumination of the façade, only the light and not the light sources themselves needed to be visible. This has been achieved by reflecting the light on the inner façade, which allowed the ambient light to flow through the perforated skin like a lantern. All light fixtures can be programmed independently and in different colours. The play with light is not a superficial tactic but a symbolic cultural reference to the aurora borealis; nevertheless, the light show is not intended to brighten the sky or dominate the surroundings; instead, it serves to underline the buildings' industrial character and, above all, to give it poetic meaning and experience at night.
(ArchDaily, 2014: online)

This perforation is not just decorative, as ventilation in a waste-to-energy incineration plant is a crucial functional element; additionally, the perforated skins allow the multi-story chimney structure to offer minimal wind resistance.

Sustainability..................7.4

Most waste-to-energy plants burn solid waste from the municipality, and some burn industrial or toxic waste. These plants burn 80 to 90% of waste in terms of volume. Sometimes ash residues are used for specific products as a raw material for manufacturing cylindrical bricks or road construction. In addition, minerals that cannot be integrated are collected from the bottom of the furnace and sold to foundries.

Globally, waste generation rates are rising due to rapid population growth and urbanisation. Inadequate waste management negatively impacts the entire planet. Waste-to-energy (WTE) plants offer a profitable and environmentally friendly way of adequately managing waste.

Utilising a steam reheat system in a WTE plant is one of the best ways to increase overall plant performance. In a steam reheat turbine package, live steam is fed through a high-pressure (HP) turbine, returned to the steam generator to increase the steam temperature, and then routed through a low-pressure (LP) turbine. Raising the temperature of the steam passing from the HP turbine section to the LP section generates greater output using the same amount of fuel.

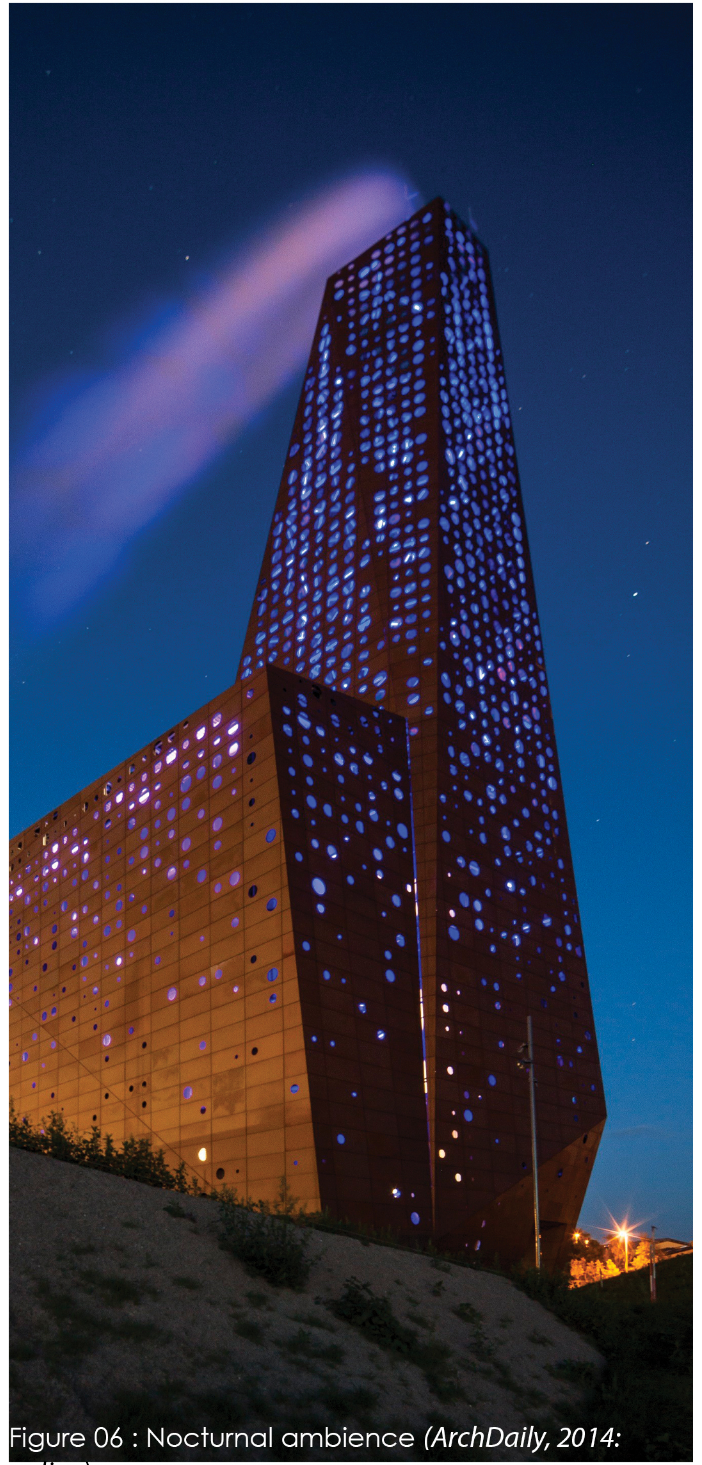


Figure 06 : Nocturnal ambience *(ArchDaily, 2014: online)*

Figure 07 : Peforated facade *(ArchDaily, 2014: online)*

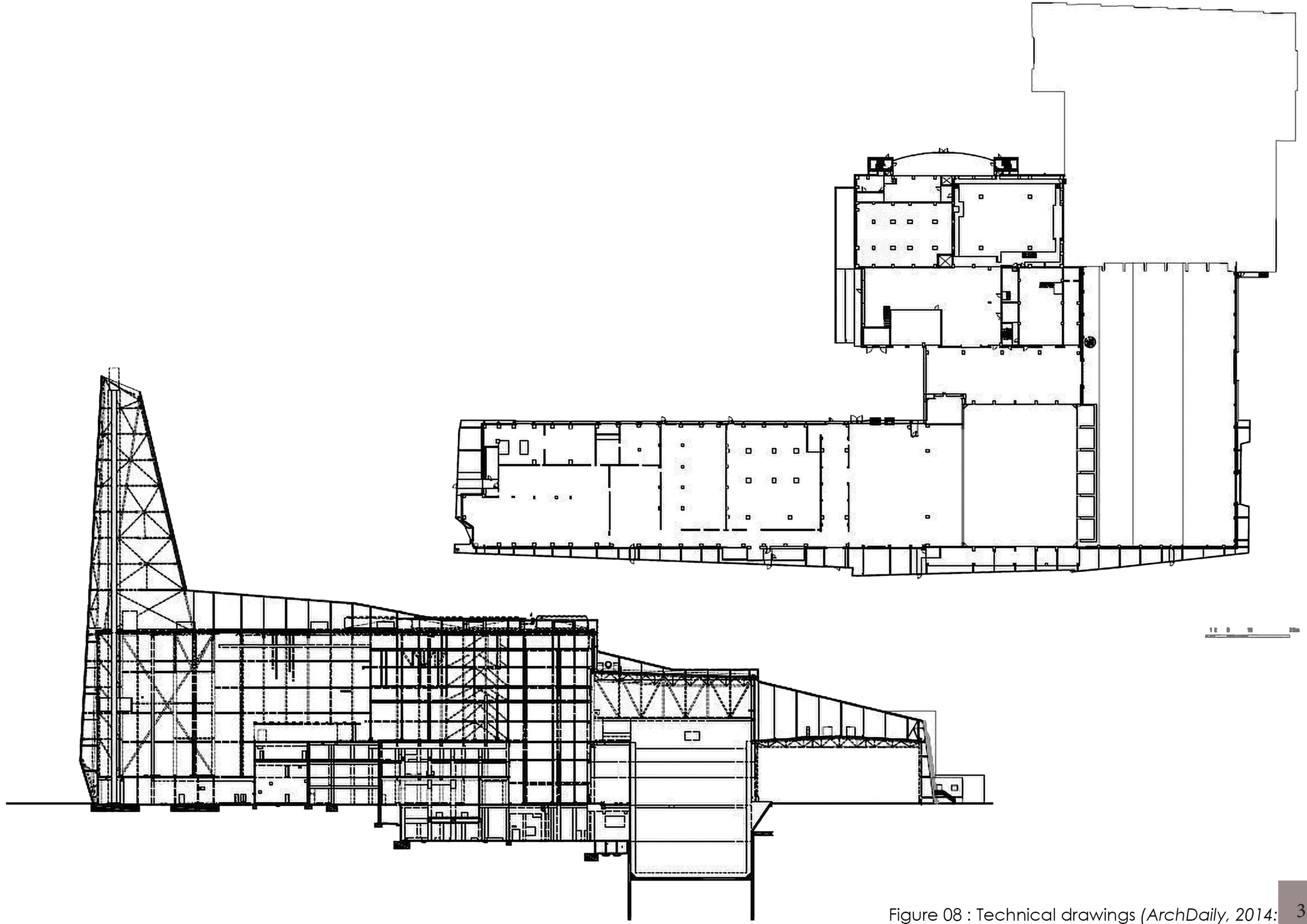


Figure 08 : Technical drawings *(ArchDaily, 2014: online)*

CHAPTER 8

[Micro] Analysis

08

Bloemfontein northern landfill
A wasted opportunity ?

This chapter examines the immediate context and the present situation on-site with all the complex social and environmental forces exerting themselves on this terrain to formulate a coherent argument of multiple confluence as to why this specific site is ideal for an architectural intervention.

CHAPTER 8

Climate Summary

01

Avergage Rainfall

The Maximum: 111mm
The Minimum : 8mm

02

Average Temperatures

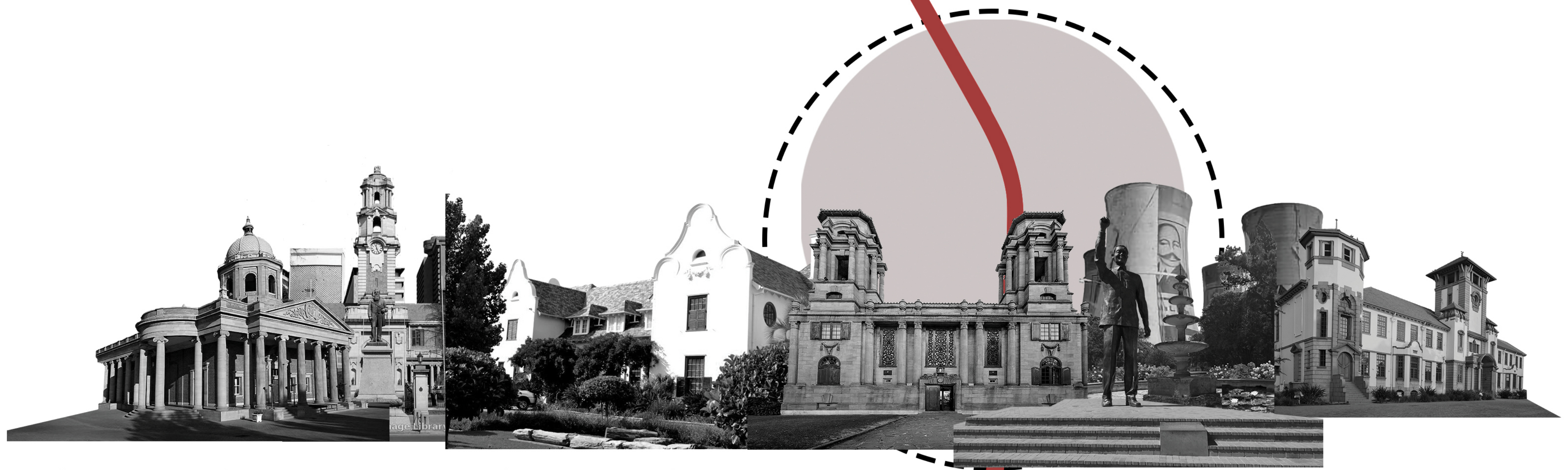
The Maximum: 30.8°C
The Minimum : -0.5°C

03

Meteorology

Prevelent wind direction : NNW
Maximum speed : 35 to 40 km/h

Bloemfontein is located in central South Africa, with a dry and dusty climate. This region receives plenty of sunshine with excellent light quality and little rain. The average temperature fluctuates but is not extreme or intolerable. Dry grassy landscapes cover the surrounding areas with isolated hillsides scattered across the plain as far as the eye can see. The summers are warm and dry while the winters are cold and frosty, though snow is scarce. The soil has a high clay content with a dolerite ridge running beneath the surface. Considering the climate of the context is of paramount importance in synthesizing an appropriate design response toward the site. The site is stretched almost 13km longitudinally, facing north. Using passive design strategies such as orientation, gravity pump systems, thick insulting walls and natural ventilation, the functionality of the building can be increased and the environmental impact minimized.



Founding Bloemfontein

The city was Founded in 1846 by Major Henry Douglas Warden on the British farm, 'Mangaung'; the place of the leopard. Four primary topographical elements influenced the city's development: Naval Hill, Signal Hill, Fort Hill in the south, and the dolerite ridge extending between Signal Hill and Fort Hill. This dolerite ridge created a natural barrier from water draining to the west, and the pressure built fed the aquifer flowing eastward as Bloemspruit. The Street orientation was laid out following the Bloemspruit creating an east-west axis, and Naval Hill & Fort Hill forming the north-south axis. (Auret, 201 6: online).

Early Days

One of the most significant developments was the setting out of Hoffman Square to intersect with the new axis of Church Street & the first Dutch Reformed Church, which extended only as far as the military camp at Fort Hill. A more defined space where church & market square forms the north-south 'institutional axis' & waterway forming a residential east-west axis.
In 1854 the British abandoned the Free State, a now independent Boer republic. (Auret, 2016: online).

Republican years

The three squares, Warden, Market & Baumann Square, began to define a spatial order strengthened by the Tweetoring Church steeples and the Government Building tower. Between the north-south axis of the Tweetoring Church & Basotho War Memorial, the first indication of Waaihoek native settlement took form. The stark contrast between President Brand St. & Waaihoek alludes to the city's racial segregation development. Moreover, the solid institutional axis was already taking shape as the Government Building was joined by the Presidency & the Fourth Raadzaal (Auret, 201 6: online).

Birth of Union

Bloemfontein undergoes explosive population and infrastructure growth. The central district of the judicial capital of the Union of South Africa is surrounded by extensive and varied land-Uses. These developments catalyzed residential expansion: Tempe, Grey College, the horse racing course, King's Park, the asylum, the agricultural showgrounds, the National Women's Memorial site, Queen's Fort & railway grounds, to name a few. (Auret, 2016: online).

WaaiHoek destruction

The formation of formal rigour gardens, from King's Park to various institutional & private gardens, interposed with an array of geometric botanicals.In line with the general principle of racial segregation, the town council allocated the South-East as a "hygienic Native township", the beginning of Batho location, appropriate housing of 'labourers'. Waaihoek residents were displaced to accommodate a new power station, ushering in the systematic destruction of Waaihoek. No other buildings or additions were allowed. When owners died, their homes were sold to the municipality and demolished. In 1941 the last inhabitants were relocated to Batho. (Auret, 201 6: online).

Rescripting Heritage

The systematic failing & termination of the historic urban fabric. Green spaces like Victoria Park, a portion of Victoria Square, the space between Springbok Park & King's Park, the northern corner of King's Park & the southern part of King's Park was demolished for "progress". They were making way for suburbs, like Langenhovenpark, Mandela View, Woodland Hills and developments around Northridge Mall. (Auret, 2016: online).

CHAPTER 08

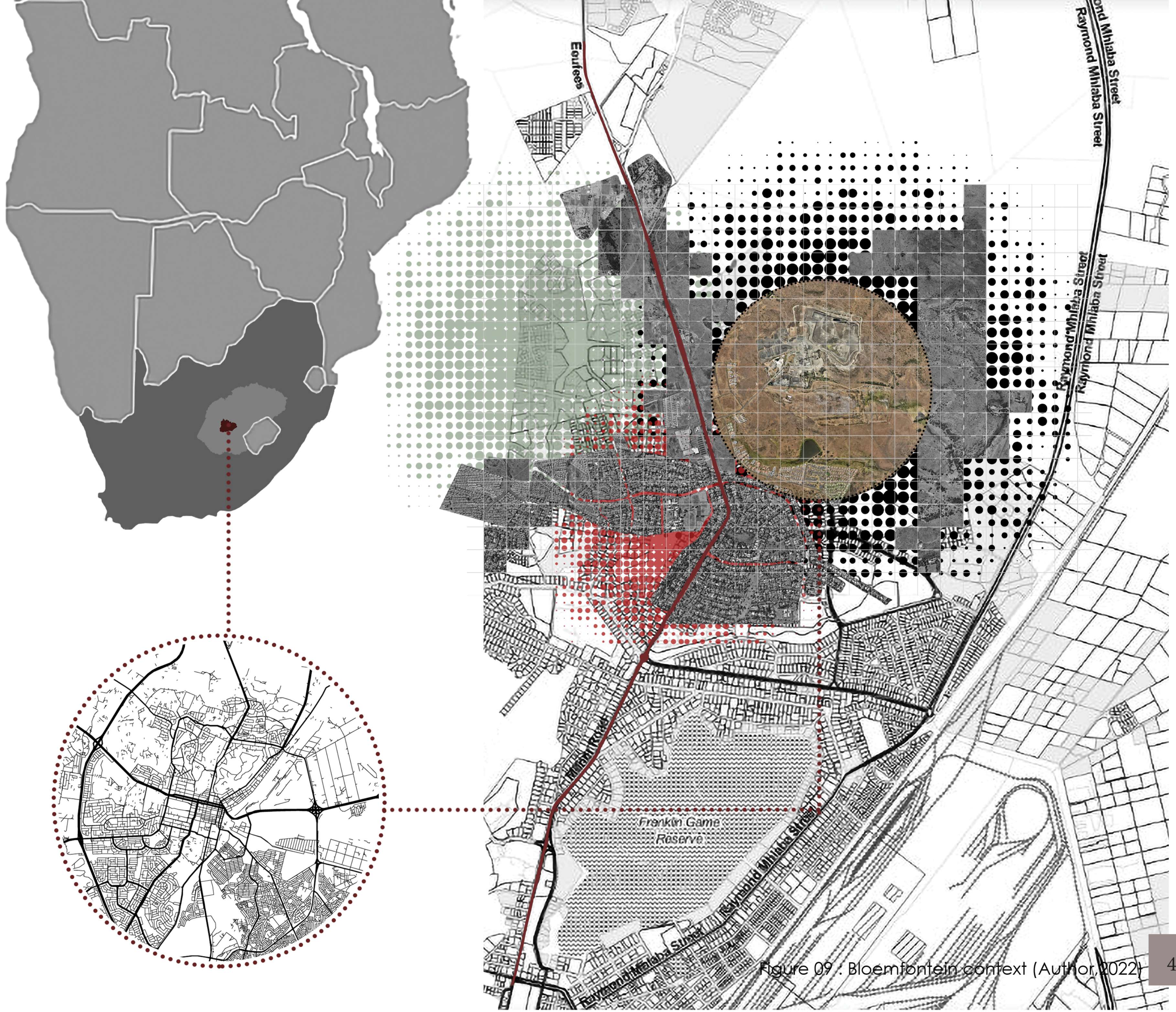


Figure 09 : Bloemfontein context (Author 2022)

CHAPTER 08

The site............................8.1

The chosen site for this prototype facility is the northernmost landfill on the outskirts of the Bloemfontein metro. This site is unique in its positioning and controversial regarding environmental impacts and community sentiment. Located on the periphery of the city edge, nestled between the rural, urban and natural landscape, it lends itself towards an interesting state of in-between-ness. This is also evident in an analysis on the contextual level, with the two clashing typologies of industrialization and sprawling suburbia competing with one another for the main typological character of the place.

The Bloemfontein municipality has a very irregular pattern of refuse collection; as a result, some residents have decided to take their refuse to dump sites themselves. The peril of crime in and around these refuse terrains have caused an increase in illegal dumping just outside the borders of the landfill. Residents are scared to enter dumping sites, and police spokesperson, Lieutenant-Colonel Thabo Covane, says he comprehends their reservations. The vacant land near the dumping sites has become focal areas for criminals and the homeless to take root. Furthermore, the vacant land close to the northern dumping site has become a hub for illegal activity. *(Hartzenberg, 2018: online)*

"There are two groups of people we find in these areas. Firstly, parolees who do not have accommodation and choose to bunk in these open areas. And secondly, people who come to the city looking for a better life and find themselves homeless due to lack of employment. Both groups are rummaging through the dumping site, hoping to find old mattresses, pots or any material they can use to make small shelters. They start settling on these hills where three to five families are settling there. The people who are involved in criminal activities use these areas as a launch base and for hide-outs. During the day some go out and rummage through the garbage, if they don't find anything, they then opt to commit crime, such as stealing items from cars and breaking into houses. And it's challenging for us to trace them because they don't have a permanent place where they stay."(Semenokane, 2018: online)

The landfill site, which shares a bordered fence with the nearby Petra quarry, has also become a haven for several dozen waste pickers who survive by selling recyclable material they collect. This includes South African and foreign nationals staying with their families. These waste pickers have erected makeshift dwellings on the landfill.
This landfill site has been making headlines as residents have voiced their frustrations about the continuous fires. Residents are concerned not only about their health but also about their newly built properties. After much deliberation and many years of opposition, the municipality had finally taken action by issuing a tender for the restoration of the northern landfill site.

CONTEXT SITE SPILL EXPANSE

Figure 10 : Site aerial view (Adapted by author,2022)

CHAPTER 8

Tender No: MMM/BID 602: 2020/2021

Three (03) Year Refurbishment Contract for Mangaung Metropolitan Municipality Northern Landfill Site Sw1004 A.

Architecture vs Engineering

Can architecture uncover richer layers of opportunity ?

The northern most landfill is set to be closed due to community and health concerns as well as failing infrastructure. The municipality has issued a Tender for the renovation of this site , as expected , it is to be a civil engineering project, but how would an architectural response do it differently ?

Research Question :

How can an architectural intervention mitigate ruination and empower the marginalized as a form of social justice in response to neglected space?

Figure 11 : Locality plan (Adapted by Author,2022)

CHAPTER 8

Research Question - De-constructed

Functional

01 How can an Architectural intervention mitigate ruination ?

Theory : Alchemy – Spatial Transformation
Purpose : Functional aspect
How : Pyrolysis facility – Removes Plastic waste
Aim : Site rehabilitation

Social

02 Empower the marginalized people as a form of social justice ?

Theory : Phenomenology - Critical Noticing
Purpose : Inclusive Design
How : Emphasize employability of marginalised on site
Aim: Community Service

Formalistic

03 Respond towards neglected space ?

Theory : Urban Acupuncture
Purpose : Targeted intervention – Economic Stimulation
How : Ritualised space
Aim : Design Synthesis

CHAPTER 09

Extracting a formula

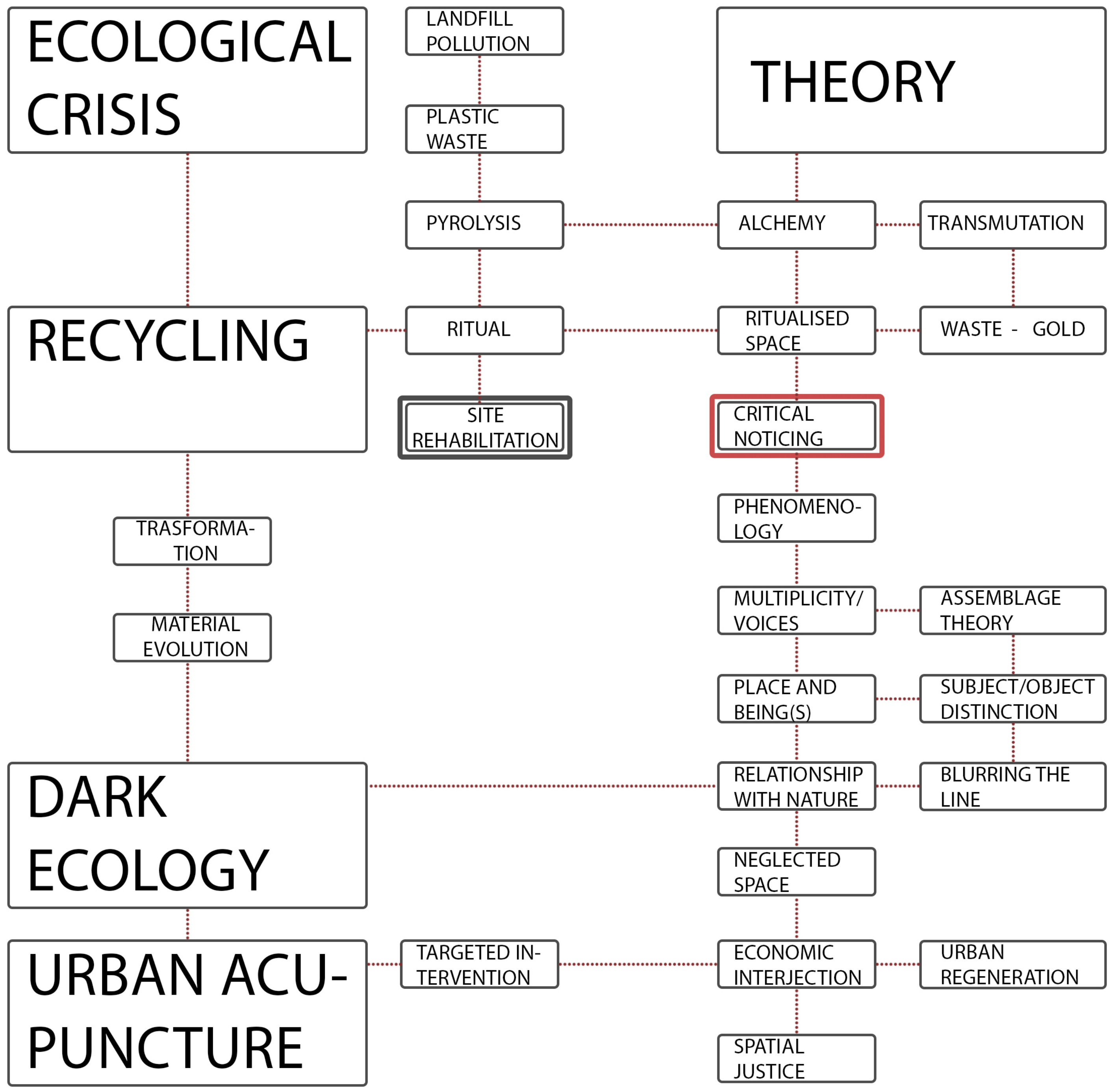
09

Theoretical discourse

Introduction

This chapter traces the thought process that led to the final design synthesis. It is a chronological and systematic exploration of philosophical notions related to architecture and place that helped me conceptualize the site and also the complex factors related to it, in a more abstract and nuanced manner. Through this alternative process of ideation, specific thought processes can be stimulated to arrive at a more inclusive and encompassing design resolution.

CHAPTER 09



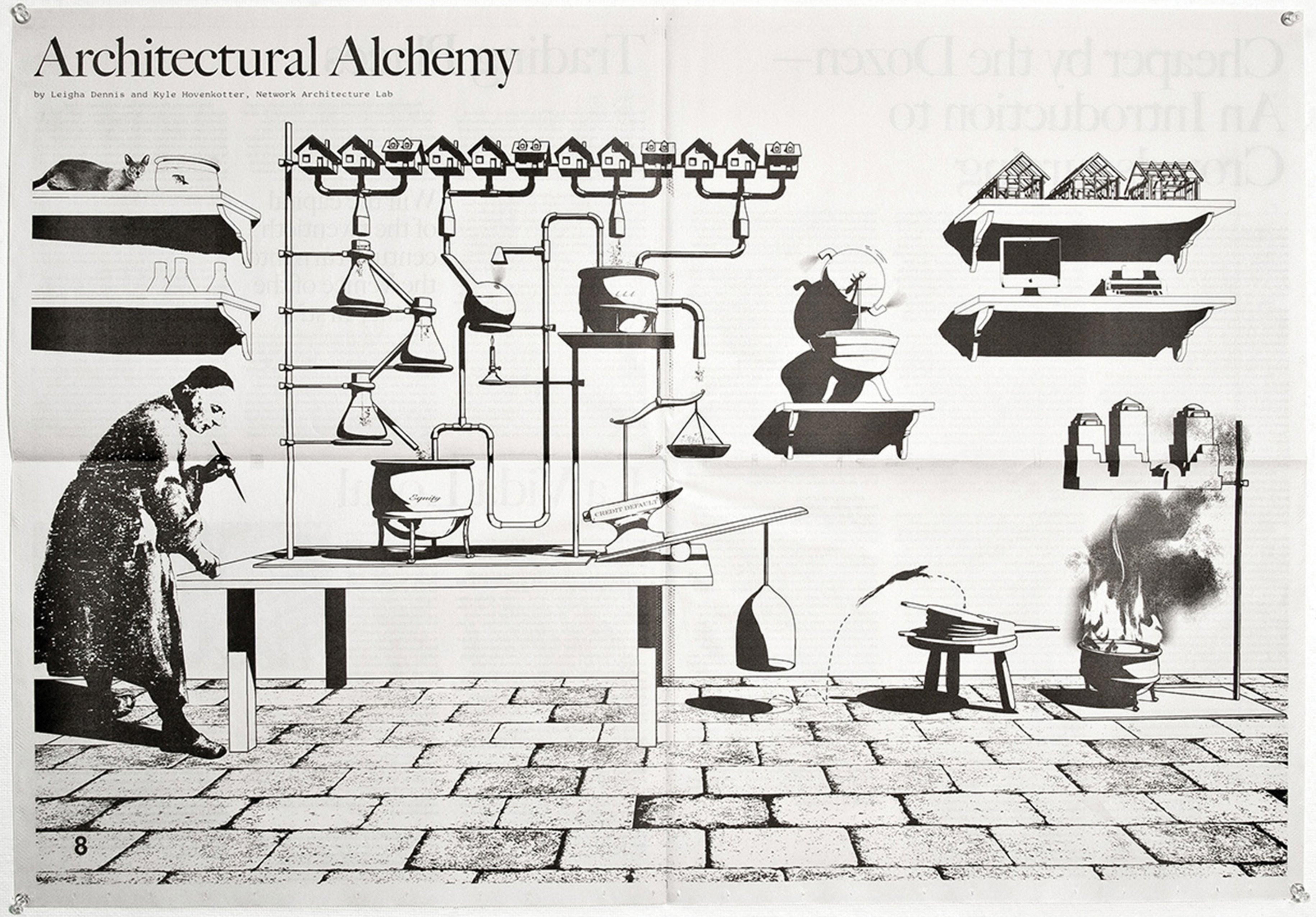


Figure 12 : Architectural Alchemy (Dennis,2016: online)

CHAPTER 09

Architectural alchemy...9.1

During the enlightenment period, humanity's quest for lost knowledge and the deeply rooted desire to understand the physical world through critical evaluation and careful experimentation led to the development of the predecessor to modern science, the arcane practice of alchemy. One of the more, if not the most, famous pursuits of alchemy was the transmutation of the elements, the quest to turn lead into gold. To take something of lesser value and ample abundance and transform it into a noble element that does not decay and has many times the value. The ability to awaken the potential for greatness in base elements and whisper a spell that begins a truly magical transformation. *(Dennis, 2016: online)*

Much like in the architectural profession, where we distinguish between theory and practice, the holy duality encompasses all the magnum opus of our mortal toils. Conversely, exploring the duality of alchemy, the laboratory and the library present us with two sides of the same coin, the opus alchemical: the practical and theoretical. While the practical side of alchemy consists of a series of experiments with chemical substances' enacted in the workshop, where we sit at our tables and sketch till the break of dawn, build models, and trace the site's contours. The theoretical side is speculative and comprises creating an individual set of hypotheses. These can then be developed into fully-fledged concepts that guide a project down a particular trajectory, turning thought into tangible substance.

The architect Louis Kahn, famous for his transcendental notions about space, remarked that good architects are "form-givers", denoting that architects can access the livingness of the materials, geometry and order to give architectural life to a building. Winston Churchill also said, "*We shape our buildings, and our buildings shape us,"* implying a reciprocal relationship between the state of society and the spaces we choose to create. The transmutation of lead to gold can also be interpreted figuratively, where it is a symbolic analogy for a global transformation or a shift of focus– the evolution of individual centered humanity into that of societal care. *(Bank, 2017 : online)*

The application of Alchemy with regard to this thesis and global transformation lies in the transmutation of substances or places and their transition from a lower to a higher state. Global transformation can be seen as transitioning from a materialistic human species into something new, a more consciously awakened, spiritualised society. According to schools of an esoteric narrative, spirituality is any way of life that contributes to the improvement and good of humanity, our living conditions, human understanding, and relationships, even though no religious beliefs may be involved. This is where the architectural theory of ritual comes into play, the art of turning mundane habits into spiritualised pleasure.

Ritualising space............9.2

When many people hear the word ritual, they immediately think of the temple or rites of passage, some sacred transition from adolescence to an exalted member of their community. An event horizon that demarcates a pivotal moment in an individual life, a moment of change. *(Swaminathan, 2021: online)*

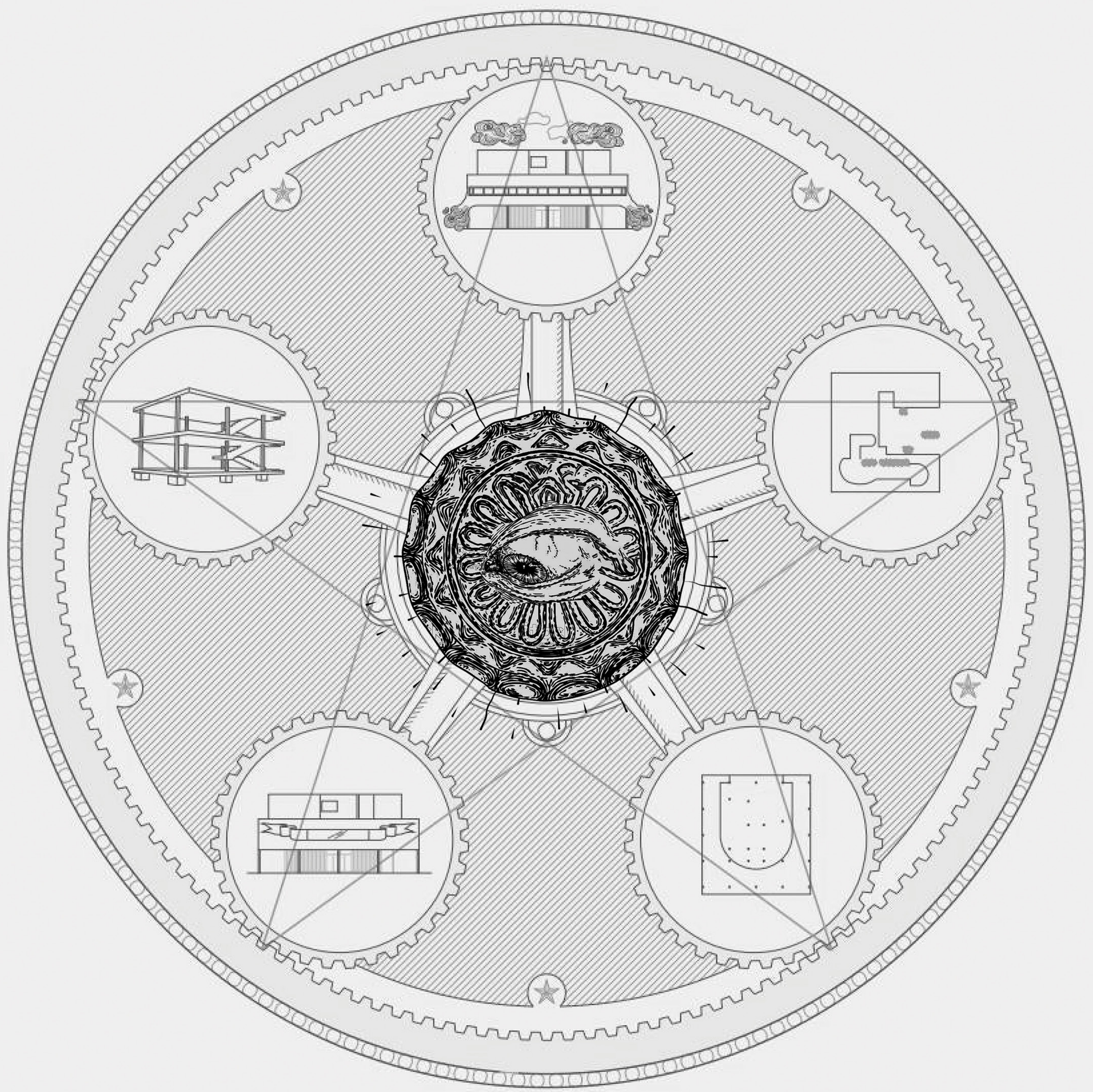


Figure 13 : Peculiar practice (Dennis,2016: online)

CHAPTER 09

However, rituals are often a group activity; the whole community binds together to celebrate a significant aspect of their life. Still, rituals are not just about evoking sacred rights carried through generations; they focus more on ordering and cementing the character of civilization.

Rituals deeply ingrained in the daily life of people perform a pivotal role in giving rise to the essence of that society. As we usher in a new age of rapid modernization and change, our psychological need for rituals are by no means diminished. These rituals can be as trivial as an evening jog or as extravagant as attending an annual music festival in the vast cosmic expanses of the desert. Every ritual can have meaning and an impact on the participants. Furthermore, every ritual is chosen and performed because of the experiences it offers. Can these attributes encompass the spatial features of structure? Can the ritualisation of space enhance the communal experience of the user? *(Swaminathan, 2021: online)*

Analyzing the pertinence and foundation of some sacred rites imparts a more delicate comprehension of the culture and traditions that underpin society. Regardless of its implication, every ritual has symbolic underpinnings guided by the aspects of the cultural climate. Rituals practiced in groups or communities evoke the phenomenon known as *collective effervescence*. It is a sociological concept coined by Emile Durkheim. It can be described as a sudden excitement and kinship when people gather to enact extremely arousing events. A reoccurring pattern tends to emerge if one analyses rituals, where at least three ensuing facets are always present: sequential, symbolisms, ordering, goal orientated, and re-enactment. Rituals can be divided into two - classifications, religious and secular. When we consider rituals, our minds tend to drift towards religious ceremonies and in many ways, rituals and their enactment embodies religion and vice versa.

Conversely, what is meant by secular rituals? Those which have no sacred or religious-related rationale. The thing we do on a day-to-day basis out of our own volition. Rituals are typically part of our cultural heritage and an integral part of the behavioral attributes of our species; people have a universal ritual grammar that is inhibited by specific characteristics yet is flexible enough to sustain the burgeoning of staggering variety. Practicing rituals intensify collaboration and community cohesion throughout all facets of society. But what does the ritual do to the mind and the body that makes it so impactful to us as people?

Anthropologist Dimitris Xygalatas at the University of Connecticut theorizes that rituals are powerful mental instruments. Rituals furnish us with a sense of identity, predominantly in conjunction with culture. They are complex networks that affirm a community and increase social cohesion when in place. These repetitive and ordered activities reduce stress and boost confidence as it relaxes the mind. *(Swaminathan, 2021:online)* Can these benefits be experienced in spaces with no underlying ritualistic value? Can rituals guide architects when designing spaces that stand to benefit the users through ritual-inspired spatial cues? How do rituals influence architecture? Can the ritualisation of the activity be amplified by spacial, material choice, or morphology?

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Phenomenology.............9.3

Phenomenology stems from the Greek word phainómenon, *"that which appears"* and lógos *"study"* alludes to the philosophical study of the manifestation of experience and sentience. As we have come to understand, the phrase, Phenomenology was coined by the German philosopher Edmund Husserl in the two volumes of *Logische Untersuchungen* Husserl's intent was to study the ethos of human consciousness through the idiosyncratic encounters of phenomena. As clearly stated in his Inaugural Lecture at Freiburg im Breisgau in 1917:

"A new fundamental science, pure phenomenology, has developed within philosophy: This is a science of a thoroughly new type and endless scope. It is inferior in methodological rigour to none of the modern sciences. All philosophical disciplines are rooted in pure phenomenology, through whose development, and through it alone, they obtain their proper force. Philosophy is possible as a rigorous science at all only through pure phenomenology." (ABIBOO, 2014: online)

In Being and Time, Martín Heidegger elaborated on the extent of phenomenology by incorporating semiconscious and even unconscious cognitive ventures allied to practical and internalized activities, such as speaking, composing a poem or dwelling. His perspective is more elaborate than Husserl's, as he called into question the capacity of technology and scientific postulations to ascertain infallible truth. He was partial to a unique investigation into experience utilizing psychoanalysis as a way to reach a more profound comprehension of being. By imposing these concepts on structure, Heidegger denoted a connection between phenomenology and architecture that impacted numerous architects and theorists for decades.

This theory began to gain traction sometime after World War 2 as a critical reflection on the validity of sentience in terms of so-called archetypal human experiences, such as the bodily orientation of backward or forward, the perceptions of light and shadow, or the palpable sensations of dryness and wetness. Architectural theorists became more concerned with examining architecture through the lens of perception and its effect on people, in contrast with the analytic practice of analyzing architecture in terms of the stylistic custom of the structure's composition itself. It is worth mentioning that this movement was born as a contrarian's voice in callous opposition to the clinical modernist movement. Architectural phenomenology, amongst many other movements of the time, resulted from attempts to reconstruct the lost unity of the personal experience in architecture. Still, it was also distinct as it positioned authentic experience as a phenomenon timeless and essentially external to modernity, innate to the place of being.

Architectural phenomenology, the discourse woven into the sensory experience and architectural history, achieved coherence by interlacing three thematic strands. Woven together, these three strands defined architectural phenomenology and its legacy.

Experience: the senses were not historically determined - buildings are designed with the human body in mind - bodily experience became the point of entry for spiritualist and religious interpretations of architecture

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History: - a modernist doctrine that historical buildings were expressions of a deeper structuring reality, which was thought to remain uniform across time.
Theory: - originated as an early occurrence of interdisciplinary - supports the assumption that experience was the 'essence' of architecture - architects examined other disciplines for evidence , in particular phenomenological philosophy - an ambivalent but esoteric realm, at the intersection of the professional architect's and the historian's practice - transformed the tradition of architectural historiography - producing pivotal new theories and styles of writing architectural history, that included the visual and experiential sensitivity of architectural synthesis. Perhaps most notably, Juhani Pallasmaa wrote:

"In our time, architecture is threatened by two opposite processes: instrumentalisation and aestheticisation. On the one hand, our secular, materialist, and quasi-rational culture is turning buildings into mere instrumental structures. devoid of mental meaning, for the purposes of utility and economy. On the other hand, in order to draw attention and facilitate instant seduction, architecture is increasingly turning into the fabrication of seductively aestheticised images without roots in our existential experience and devoid of authentic desire of life. Instead of being a lived and embodied existential metaphor, today's architecture tends to project purely retinal images, architectural pictures as it were, for the seduction of the eye." (Indian Architect & Builder, 2015: online)

His commentary alludes to the premise that we confront architecture with all our senses and that this experience is continuous, robust and contextually derived.

The aptitude to create buildings by reverse engineering experiences or to obtain through innate intuition the elementary requirements of future structures are the precepts of phenomenology in architecture. Different cultural backgrounds significantly affect experiences of architectural space, yet is it possible to decern if an architect is genuinely capable of reversing the process to design circumstantially appropriate experiences for other people, or are they simply the extrapolation of his own convictions onto everyone else? Is it idealistic for architects to apply their lived experiences and observations of a specific culture and context to design, in an attempt to replicate those spatial sensations in others?

Although advocates of phenomenology favor an individual analysis of subconscious understanding and specific context throughout history to ascertain certain timeless truths, it is also true that modern architects need to conform and engage with the rapid pace, cultural and physical adaptations of the world otherwise known as the zeitgeist. Design with zeitgeist is to notice the moment, being prompt and dynamic, while to follow genius loci is to undertake a slow and sincere contemplation of intrinsic knowledge. *(ABIBOO, 2014: online)*

Pondering and designing architecture through the lens of phenomenology compels the architect to embrace the fact that creating a building is a process too intricate to be reduced to or made only from rationalization and functionalism; however, not so complicated that the designer can not encapsulate the spirit through intuition and the study of unconscious collective understanding.

CHAPTER 0.9

This process of transmutation from a lower to a higher state is less about changing, but simply revealing what is already there. We seek to unlock the latent voice of the place that will make for a truly authentic and poetic place to dwell, in a phenomenological way. This requires critically noticing the micro factors and macro trends exerting influence and forces on the site.
An architectural response must foremost consider the implications to human life and their lived experience on-site, not ignoring the multiplicity of voices but incorporating as many of them into the final synthesis as possible.

Assemblage Theory........9.4

Many thought-provoking theories deal with the definition of place and temporality from various sources. The most common and established are that of Martin Heidegger and architectural theorist Christian Norberg-Schulz. However, an interesting yet relatively recent philosophy has entered the fray that could have an immense impact on the theoretical field of architecture and how we interpret place.

The urban fabric can be regarded as an assemblage of multiplicities, not necessarily a complete being, but always in a dynamic state of becoming. No single distilled essence but many essences in a continual process of plotting a narrative onto the flesh of the urban fabric. This architectural response seeks to illustrate the rich layeredness of the site as well as contextual amalgamations. The architecture of memory and place is the amalgamation of the physical and metaphysical essences that make up the lived experiences of all people. In the Heideggerian interpretation of place, it is defined as a phenomenon and can exist only once it has been or is being experienced; a being in the space is crucial to its existence.

However, the being does not merely experience the space; they appropriate and interact with it. Architecture is an interactive medium where people can create places and fulfill their need for a meaningful existence. The counter or rather supplementary argument to the Heideggerian interpretation by French philosopher Gilles Deleuze suggests that spaces and beings do not jump in and out of existence. They are in the process of becoming rather than already being *(Muminovic, 2019: online)*; the space shapes the being just as much as the being shapes the space and other beings in their proximity. This approach broadens the horizons of one's perception of space and people in a liminal way; the world is not concrete nor imaginary but, something in between.

This way of thinking can be extended to the very essences of beings; the conventional school of thought with regards to the voice or character of a place employs Christian Norberg-Schulz's interpretation of the eternal essence, in which he argues that everything has a specific, discernible essence that will accompany them from birth into death. This theorized eternal essence is quite a static concept with little room for change or evolution, while Deleuze's proposed theory is much more adaptable and multifaceted. His theoretical interpretation of multiplicities, as opposed to essences, comprise many individuals or characteristics shaping the collective identity of a place, something that is not inherent but externally influenced, mobile and fleeting almost. Unlike essence, which is distilled and finite, multiplicities are an amalgamation of infinite

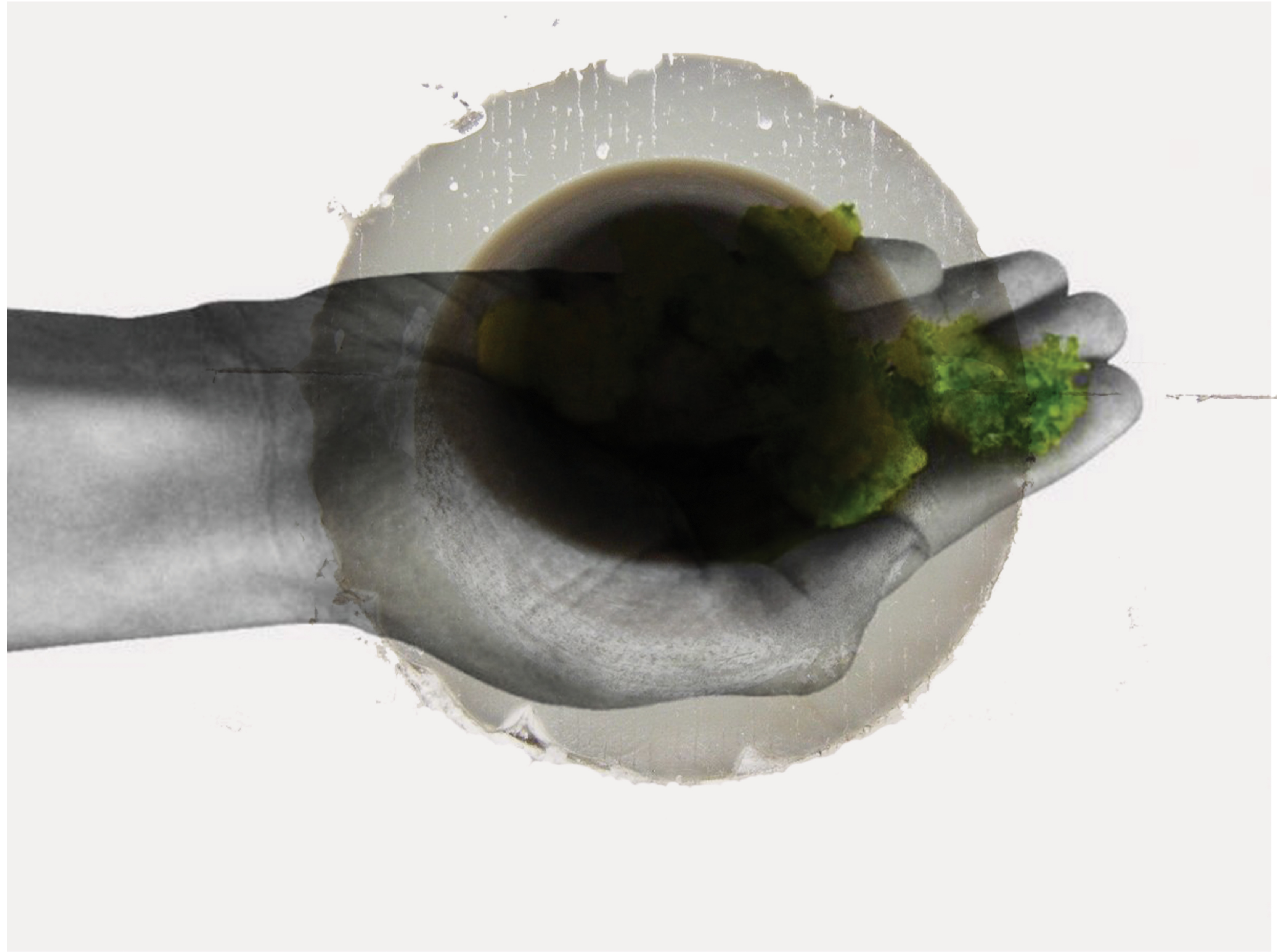

Figure 13 : Blind ecology (Price, 2016: online)

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possibilities that are much more coherent with the nature of urbanity and humanity.

Dark Ecology 9.5

The Origins of dark ecology lie in the literary work of British philosopher Timothy Morton, author of the books Ecology Without Nature (2007) and 'The Ecological Thought' (2010). He positions how we perceive nature and the 'natural' as problematic to the survival of our species. Historically nature is something beyond us that is classically romanticized, removed from civilization. This is an outdated idea; according to Timothy Morton, nature is civilization, and civilization is natural. Morton's ideas are associated with speculative realism. American philosopher Graham Harman, one of the key figures in object-oriented ontology, has many similarities with Morton's postulations. *(Blasdel, 2017: online)*

To illustrate his premise in 'The Ecological Thought,' Morton introduces the concept of dark ecology as an artistic way to show the irony, unsightliness, and trepidations of ecology. At Nickel, the Russian city above the Arctic Circle, one of the biggest nickel-producing facilities in the world can be found. The metal nickel is extracted via the deepest bore hole anywhere on the globe. The extraction process has had an enormous impact on the ecology of this territory. The habitat of this area shows that human intervention and nature are inseparably connected and can no longer be seen independently of one another *(Ploeg, 2016 : online)*. Our effect on Ecology has become an integral part of the ecosystems and the so-called natural world. The barrier that forms the distinction between artificial and natural is steadily starting to blur regardless of the ecological consequences. The word "Oecologie", initially introduced in 1866 by the German zoologist Ernst Haeckel in his book Generelle Morphologie der Organismen, stems from the Greek words "οικοσ" ("oikos"), which means "house" or "dwelling place" and the word "λογοσ" ("logos") which translates to "word" or "language". The phrase evolved until it was later expressed as "ecology", which refers to studying the relationships between living organisms and their environment. Living organisms that interact within an ecological system create networks, and the shape and structure of these networks are known as "topology".Within materials and materiality, when one considers Greek philosopher Aristotle's hypothesis that everything is an amalgamation of matter (Typology) and form (morphology), which is brought together in its genesis. The creation begins with a form in mind and a formless conglomerate of raw matter and it ends when form and materials are unified in the finalized object. The structure is actively imposed on, whereas matter is that which was imposed upon to bring forth its potential.

A complete object is formed when a form is imposed on raw material. Any additional alterations to this object after it has been completed are either because of consumption or further exertions, which makes it a new object. If this is seen as a sample of material, it has the potential for further growth and transfigurations. Hence, nothing is ever 'completed in a world of materials.' This fundamentally questions what belongs in the natural landscape and what can be considered a foreign object. From an object-centered perspective, recycling can be seen as simply the next phase of a material's transformation journey.

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Urban acupuncture........9.6

Acupuncture is a well-known traditional Chinese medicinal technique that aims to restore energy and general well-being by inserting precise needles in strategic points, causing the rejuvenation and stability of the being. However, what does acupuncture have to do with architecture?

Among many developing countries, the global South faces a plethora of glaring difficulties borne from a legacy of colonialism and poor infrastructure. Often, ineffective governance and institutional frameworks inhibit local economies' change and regeneration. One of the most widely affected areas of concern is essential service delivery and the congestion of basic commerce due to widespread corruption. This monumental task does not necessarily require billions in private investments and large-scale gentrifications. Still, it can be as simple as relieving the pressure from a concentrated point of urban congestion through a targeted architectural intervention to promote the circulation of people and commerce.

Andreea Cutieru, a Bucharest-based architect, devised a clever strategy that can be widely implemented to begin the work of regeneration, re-imagining, and renewal within the urban and communal landscapes. Cutieru frames this under the banner of Urban Acupuncture as *"A design tactic promoting urban regeneration at a local level, supporting the idea that interventions in public space do not need to be ample and expensive to have a transformative impact. . An alternative to conventional development processes, urban acupuncture represents an adaptable framework for urban renewal, where highly focused and targeted initiatives help regenerate neglected spaces, incrementally deploy urban strategies, or consolidate the social infrastructure of a city."*

Urban acupuncture combines a theoretical and practical approach that seeks to integrate socio-environmental theory, contemporary urban design, and critical thinking around cities and communities. Traditional acupuncture results in an urban design tool that utilizes small-scale or targeted interventions to transform the sizable urban context within appropriate typological framing and structuring. The typological structuring and amalgamation of various theoretical and design tactics emphasize the immense benefit of introducing vigorous, pragmatic, and tactical interventions across different pressure points. *(Gasnolar, 2020: online)*

Urban acupuncture is an architectural design principle of regeneration. The aim is that improving an urban space helps enhance the quality of all the connections that converge and diverge from that location, such as squares, streets, or parks. Urban acupuncture arises from the necessity to adapt the conventional city approach to a new model of an industrial typology. The segregation of spaces characterizes the industrial city according to the different uses that citizens are going to assign to it: residential, commercial, leisure, etc. (MCH, 2021: online)

The rapid growth of metropolitan areas in the last few decades through a trend in the developed world utilizing large and expensive infrastructure interventions has left obsolete spaces in some strategic or, more frankly, neglected parts of the cities with great potential for activation

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could only benefit the marginalized inhabitants. These spaces are not used because they are not cared for. This situation creates the need for new urbanist planning solutions, and the lack of resources is no longer a valid or acceptable excuse for neglect.

The manifesto of the Urban acupuncture movement is to critically investigate those spaces that have become outdated and abandoned within the urban structure of cities. Eventually, the goal is to reuse and reintroduce these spaces into their context to make the city more compact and user-friendly. Consequently, using public space as a merging point for work and leisure reduces the distances between the two typologies and thus creates a more efficient and sustainable city.

This approach can be as versatile as the current need demands; reorganization of spaces is done at many different scales. It can range from something as concentrated as the reorganization of a street corner, vacant plots of land, or empty buildings to implementing a pyrolysis waste management facility.
The apparent absence of green spaces in cities is an obvious starting point. The construction of new parks represents a practical hurdle due to the scarce space and lack of financial resources to carry out a project of such magnitude. However, rehabilitating small or neglected urban spaces to build gardens and green spaces is feasible and possible.

Conclusion.....................9.10

Alchemy and architecture can be regarded as a theoretical touchstone, a catalyst to begin the process of conceptualizing and exploring possibilities within this site. Noticing the potential that lies within and uncovering the formula through experimentation could lead to this site's transmutation from its lower to a higher state of being.

Utilizing a phenomenological lens allows the designer to empathetically scrutinize the site for cues and signs of human lived experience embedded into the effects an architectural intervention will have on the lives of local communities and the people that dwell there. Will it benefit them or disrupt their way of life? That being said, can these benefits be experienced in spaces with no underlying ritualistic value? Can rituals guide architects when designing spaces that stand to benefit the users through ritual-inspired spatial cues? Can the ritualisation of the activity be amplified by spacial, material choice, or morphology? Essentially culminating in a cathedral of industry, a secular space where the recycling ritual can still have a life and environmentally changing effect on participants and local inhabitants. A medium that delivers salvation from circumstantial toil employing a targeted architectural intervention that alleviates urban congestion and stimulates economic growth to mitigate unemployment while attempting to address a facet of the energy crisis.

All these thought-provoking notions culminate in the principle of spatial justice, which is about the equal allocation of the responsibilities and privileges of urban expansion, primarily focusing on how these rights are managed and distributed amongst the people. Architects can play a significant role in the fight for change and spatial justice for all members of society regarding how our cities and communities are zoned, arranged, designed and managed.

CHAPTER 10

Translating Enigma

10

Design Development
Revealing the process

This Chapter explores the design conglomeration and sheds a little more light on the ideation process that led to the final synthesis.

CHAPTER 10

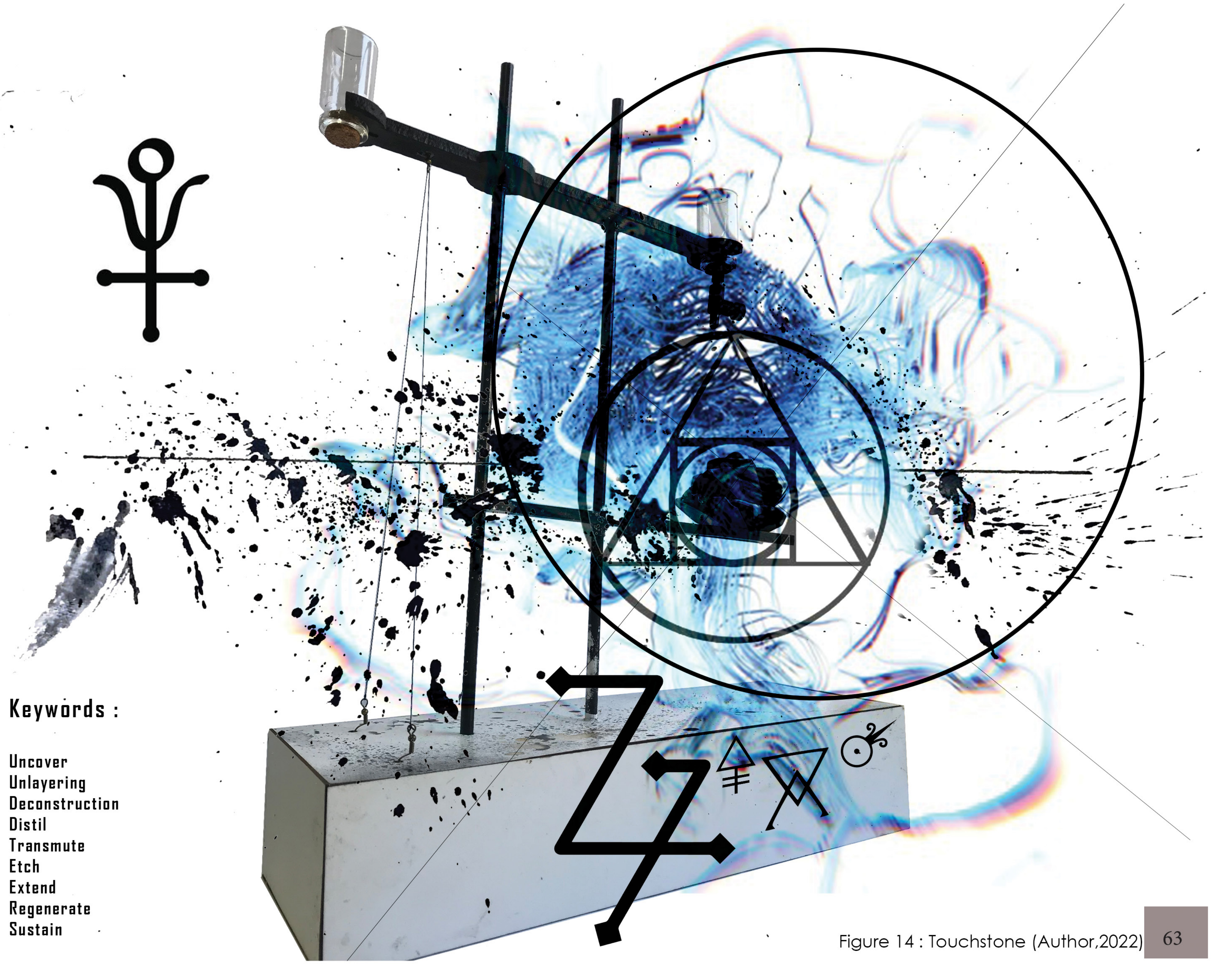
Touchstone

10

Architecture and Alchemy
Transcending circumstance

This touchstone explores the essence of my research project during the March(prof) thesis, my aim is to delve deeper and broaden my understanding of architectural expression through an abstract medium. A thesis is much more than a programmatic accommodation list ,it has a layeredness that adds depth and present rich opportunities for design intervention. How can a waste management facility become more than just a piece of infrastructure , my hopes and aspirations with this thesis , captured in the touchstone is to perform architectural alchemy on the urban environment , to transform a failing landfill into an urban node that can actively contribute to the community and become worth its weight in gold.

CHAPTER 10



Keywords :

Uncover
Unlayering
Deconstruction
Distil
Transmute
Etch
Extend
Regenerate
Sustain

Figure 14 : Touchstone (Author,2022)

CHAPTER 01

Concept

01

Assimilation

The quest for equilibrium

This concept explores the notion of assimilation derived from one of the well known methodologies of Recycling. By construing reuse in an architectural lens one can arrive at thought provoking notions that ultimately leads to an architectural response. The idea behind assimilation deals with taking in or consuming what is around oneself to ultimately reach a higher state of being. This ties in loosely with the theme of my research project , alchemy with regards to the intent of the alchemical doctrine that suggest that opposite forces seek to find harmony by balancing each other as hot migrates to cold, day becomes night the perpetual strive for equilibrium.

CHAPTER 01

Keywords :

Uncover
Unlayering
Deconstruction
Distil
Transmute
Etch
Extend
Regenerate
Sustain

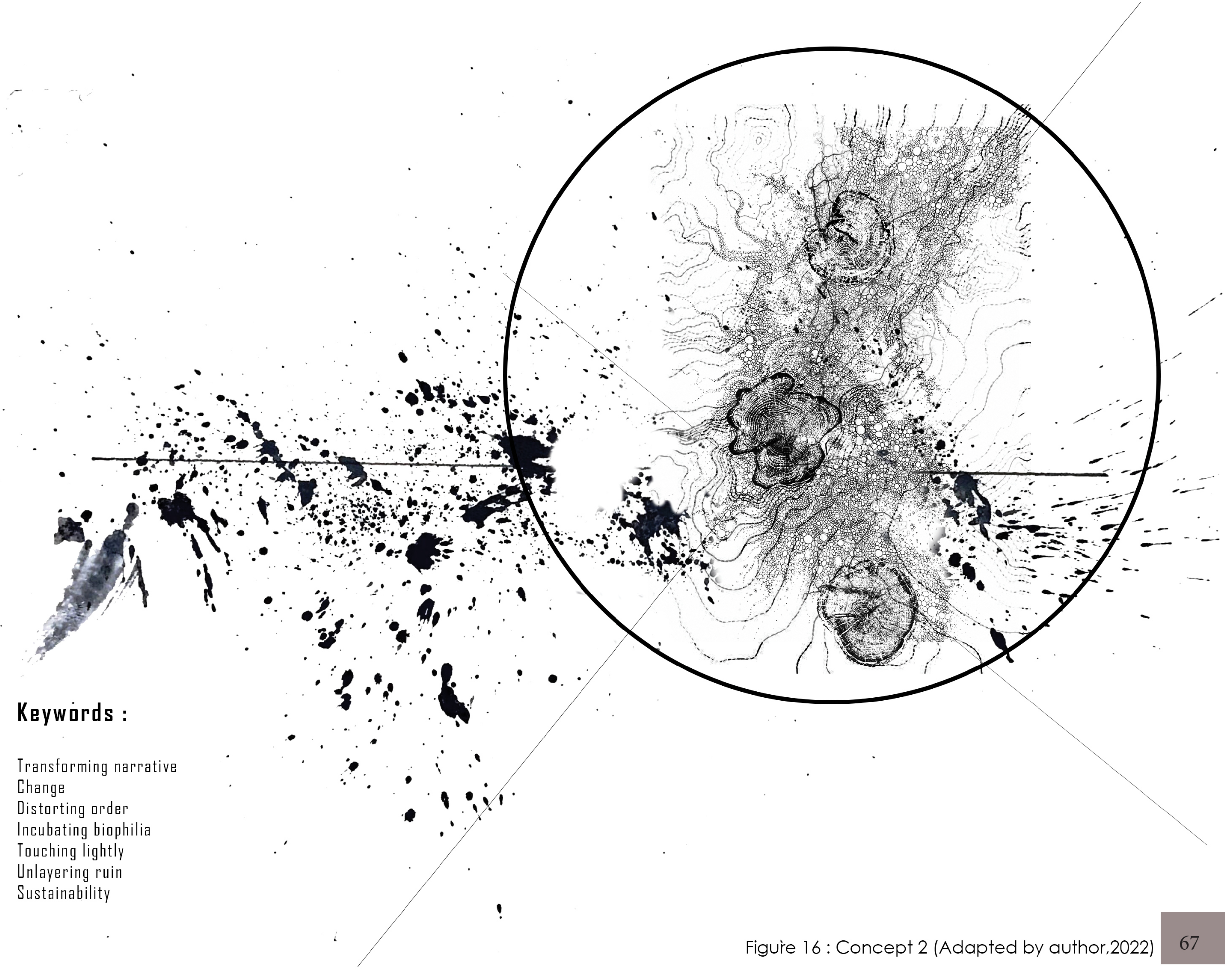
Figure 15 : Concept 1 (Adapted by author,2022)

Concept

02

Scar
Inspiring sympathy

This concept explores the notion of the Scar on the landscape and man's adverse effects on nature. By delving into the practices of destruction , witnessing the charring and the disintegration of something that was once pristine one starts to conceptualize imposition. This creates a great sense of apathy and in turn inspires a great sense of responsibly as a designer to be as careful and resource-full as possible , to not perpetuate the scar even further , but to contribute to a dire situation in a sensitive manor. Exploring this concept with my experiment of ruination made me cautious of mass imposition and etching troughs in the landscape just for the sake of an impact full design.



Keywords :

Transforming narrative
Change
Distorting order
Incubating biophilia
Touching lightly
Unlayering ruin
Sustainability

Figure 16 : Concept 2 (Adapted by author,2022)

CHAPTER

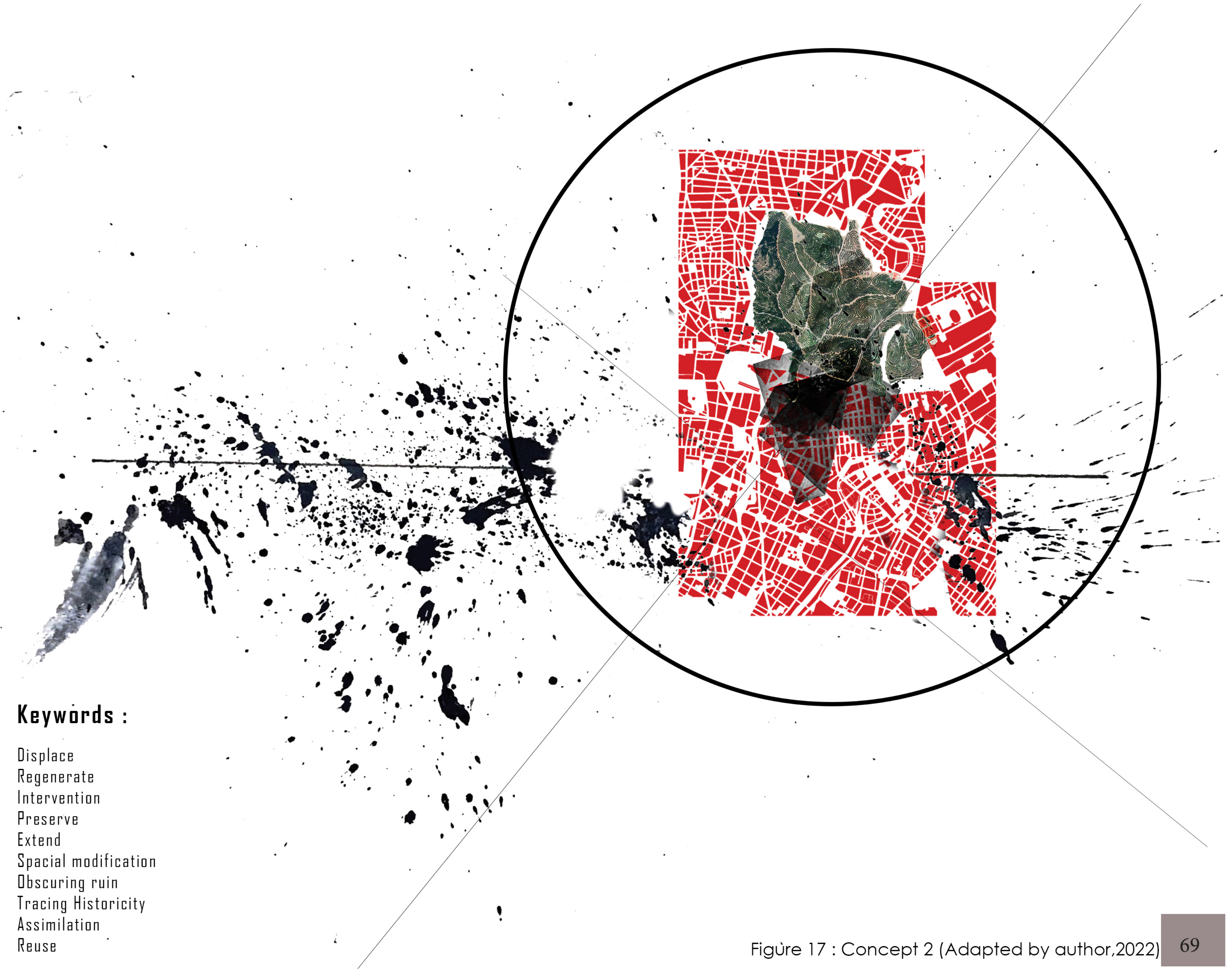
Concept

03

Oasis
Liminal sanctuary

This concept explores the notion of an oasis within the tumultuous barren landscape as a temporary safe haven from harsh reality. These spaces serve as a tranquil reflection space where the body can unwind and replenish itself before embarking on its next journey.

CHAPTER



Keywords :

Displace
Regenerate
Intervention
Preserve
Extend
Spacial modification
Obscuring ruin
Tracing Historicity
Assimilation
Reuse

Figure 17 : Concept 2 (Adapted by author,2022)

The machine aesthetic

04

Concept model
Assimilation

This concept model explores the notion of assimilation, a mechanised structure that wonders the land scavenging for scrap and raw materials to feed its insatiable hunger. The aim of assimilation is not the preservation of the two respective entities, but the total integration of one by the other. as the more substantial essence dissolves, the weaker essence, in the process, becomes even more potent.

CHAPTER

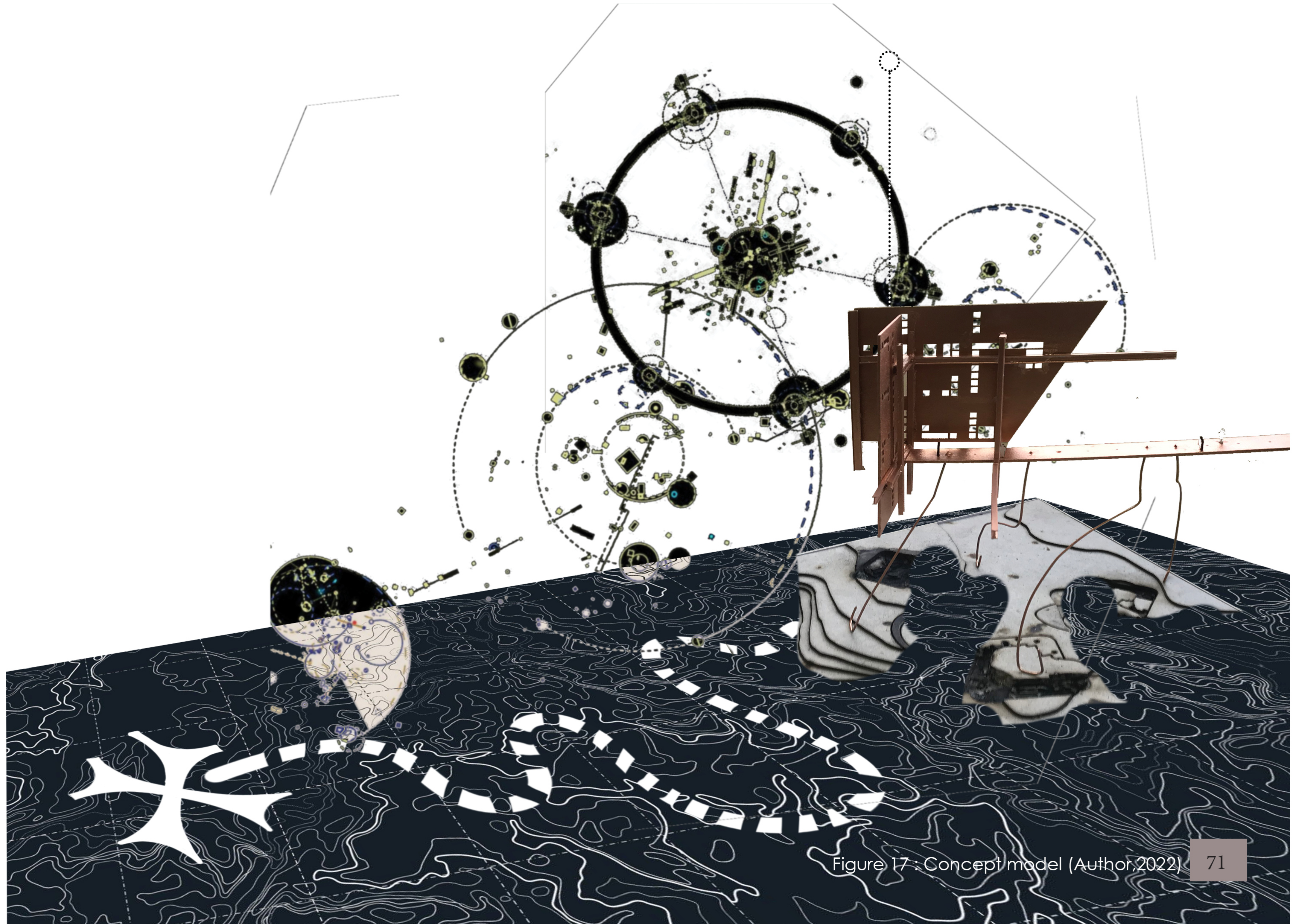


Figure 17 : Concept model (Author 2022)

Brief Development

The northern most landfill site is a bustling and frequented place, many people come in and out of this facility from all walks of life , thus is it imperative to explore the different types of users.

Present | **Future**

01

Public

1.1 Waste Pickers

1.2 Waste collectors

1.3 Independent Suppliers

1.4 Homeless

02

Institutional

1.1 Municipal Staff

1.2 Pyro-Facility Staff

1.3 Deliveries

1.5 Fuel collection

03

Recreational

1.1 Festivals and events

1.2 Exercise Enthusiast

1.3 Families and Community

1.4 Flaneurs

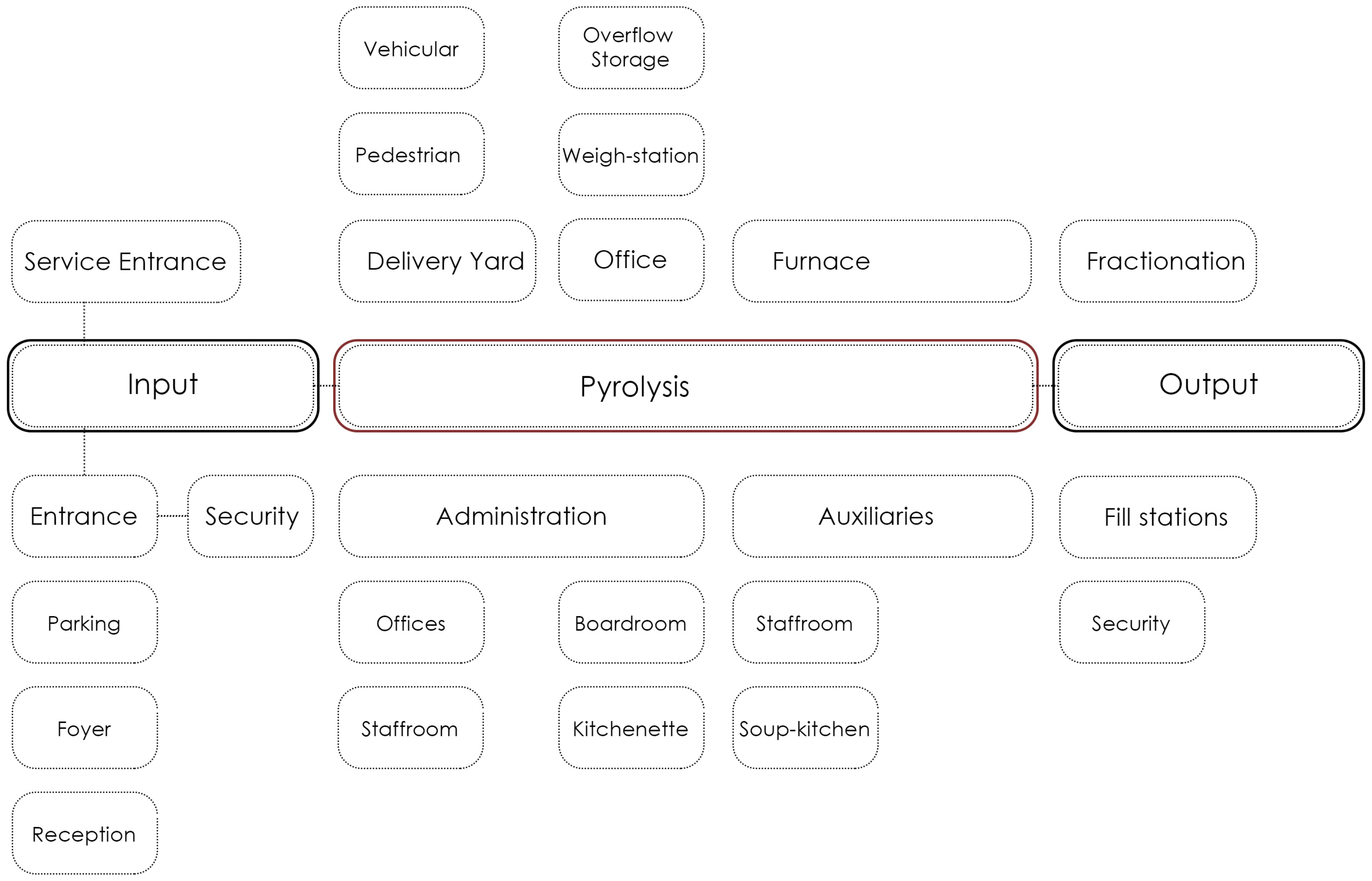
Program
Site
- High Risk Location
- Sprawling suburbia

Program
Approach
- Security
  - Access Control
  - Gaurd stations
  - Landscape terrace
- Visitors Parking
- Entrance Foyer
  - Thresholds
  - Liminal Space
  - {Courtyards}
- Reception

Program
Admin
- Mangerial Office
  - Private Ablution
  - Private Courtyards
- Boardroom
  - Kitchenette
- Storage
  - Utility closet
- Laboratory
  - Wet lab
  - Dry storage
  - Office

Program
Auxiliary
- Staff Ablution
  - Male showers
  - Female showers
  - Lockers
- Staff room
- Soup Kitchen
  - Seating
  - Food prepartion
  - Pantry
  - Refuse
  - Scullery

Program
Function
- Delivery yard
  - Pedestrain
  - Vehicular
- Weiging station
- Overflow Storage
- Sorting Yard
- Conveyor Belts
  - Delivery mechanism
  - Visual inspection
- Primary Furnace
- Vapour condesation
- Secondary Furnace
  - Pump station
  - Truss-hosted HVAC
- Fractionation Columns
  - Tripple distillation
- Fuel Storage Tanks
- Fuel Dispensary

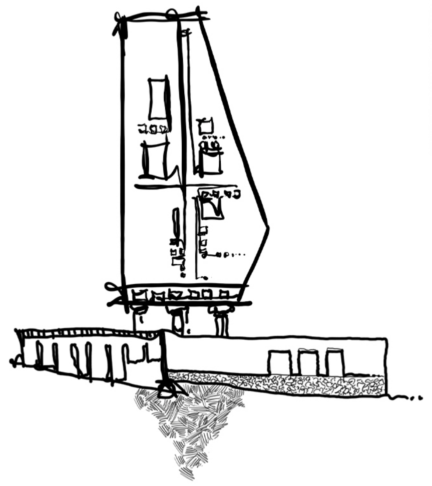


CHAPTER

Spatial cues

01

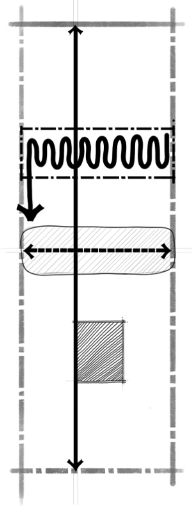
Focal Point



A point of Hierarchy that attracts and orients pilgrims in the space.

02

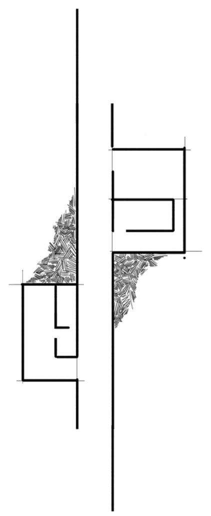
Journey



Spatial choreography of the body, an architectural narrative that is not conveyed but experienced.

03

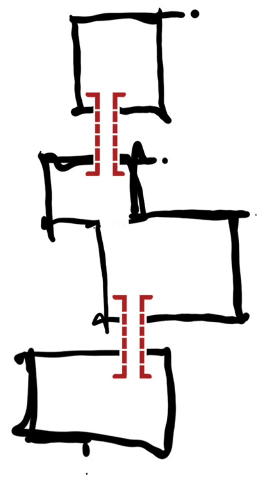
Undulating space



Stimulates the mind as well as the bodily experience from vast to enclosed spaces. Transitioning from public to private.

04

Threshold



A liminal space that prepares and ushers the body into a new expiernce of place.

CHAPTER

Structural pellucidity

11

Technical synthesis
Introduction

This chapter investigates the design synthesis from a functional and practical point of view. Examining material and structural choices that informed passive design strategies and integrated health and safety protocols into the final design. Since the essence of this project is an industrial facility , program and function determined the majority of the structural and antithetical decisions that led to the culmination of this project.

CHAPTER

Climate report..............11.1

Bloemfontein is the largest city situated in the Free State province of South Africa with an exponentially growing population due to people migrating from rural areas, drastically increasing waste generation. Currently, there are two landfills in the city, one situated north and the other south of the city, and these sites are the primary recipients of all the waste produced in the city.

According to the Mangaung Metropolitan Municipality, the two landfill sites are currently permitted to be used, but neither meets the minimum requirements as they lack some basic facilities in a well-designed landfill. These facilities include an underlying barrier and leachate collection systems, as well as proper controls concerning the health and safety of the reclaimers. Both landfill sites are positioned in two different geological terrains; although they are both underlain by Karoo sediments, slight differences exist in the underlying geology. *(Ololade, Mavimbela, Oke and Makhadi, 2019: online)*

The regions climate is classified as a cold, semi-arid zone, with a lowland climate associated with dry winters and mean annual temperatures below 18 degrees Celsius. The median yearly precipitation in Bloemfontein is 514 mm, with an evaporation rate of 1676mm. The summer season is typically from October to February and winter from May to August, with a median yearly maximum temperature fluctuating from 26 degrees Celsius in summer and an average annual mean minimum temperature of 8c in winter. The terrain soil type is categorized as duplex soil, with a significant portion being clay.

Geology report............11.2

The Bloemfontein northern landfill site is located on the northern margin of the city and is about 35 hectares in extent. The landfill terrain is zoned as a general waste site. The landfill terrain is made up of two geological groups of the Karoo Supergroup, namely, the Ecca and the Beaufort groups. The Beaufort group consists of vast sedimentary rocks, such as sandstone, shale and mudstone, which are intruded by dolerite dykes and sills.

Two aquifer classes are common to the Bloemfontein area, namely, fractured and inter-granular aquifers. Inter-granular aquifers comprise sedimentary rocks that have a series of dolerite intrusions. The landfill has a steep inclination to the north and is situated on a slight rise. Waste rock piles from a dolerite mine, located on the north-western boundary and steep inclination of the landfill site may affect the chemistry of the ground and surface water, as a large part of the runoff from the mine drains through a portion of the landfill.

Groundwater report....11.2

A dolerite sill entirely underlies the landfill site with depths of up to 35m. Derived from the topography of the terrain, the predominant flow of groundwater is in a south-easterly direction. Regrettably, groundwater resources are commonly vulnerable to pollution, especially in the present day wherein extreme contamination occurs on the surface and eventually reaches the groundwater system. *(Ololade, Mavimbela, Oke and Makhadi, 2019: online)*

CHAPTER 11

Some of the significant regulations regarding water quality gathered from groundwater samples were non-complient with the South African National Standard (SANS241:2015) and World Health Organization permissible limits for drinking water. Most boreholes had total dissolved solids and electrical conductivity values exceeding the SANS 241:2015.

Based on the analyzed physiochemical parameters, the study concluded that the northern landfill site had a poorer water quality than the southern landfill site. The high porosity of the weathered dolerites in the northern landfill site could have caused the infiltration of contaminants into the groundwater resulting in poorer water quality. *(Ololade, Mavimbela, Oke and Makhadi, 2019: online)*

Over the years, the disposal of waste by landfilling has established itself as one of the principal malefactors behind the contamination of groundwater resources. Municipal solid waste landfills create a lot of pollution due to the leakage of landfill leachate that affects the nearby habitat, especially surface and groundwater bodies.
If this problem is not addressed, the groundwater supply could contaminate surrounding neighbourhoods and adversely affect the health of the nearby community. The anaerobic leachate that originates in landfills comprises a high amount of dissolved organic carbon, salts, ammonium and organic compounds, and metals.

Landfill Requirements....11.3

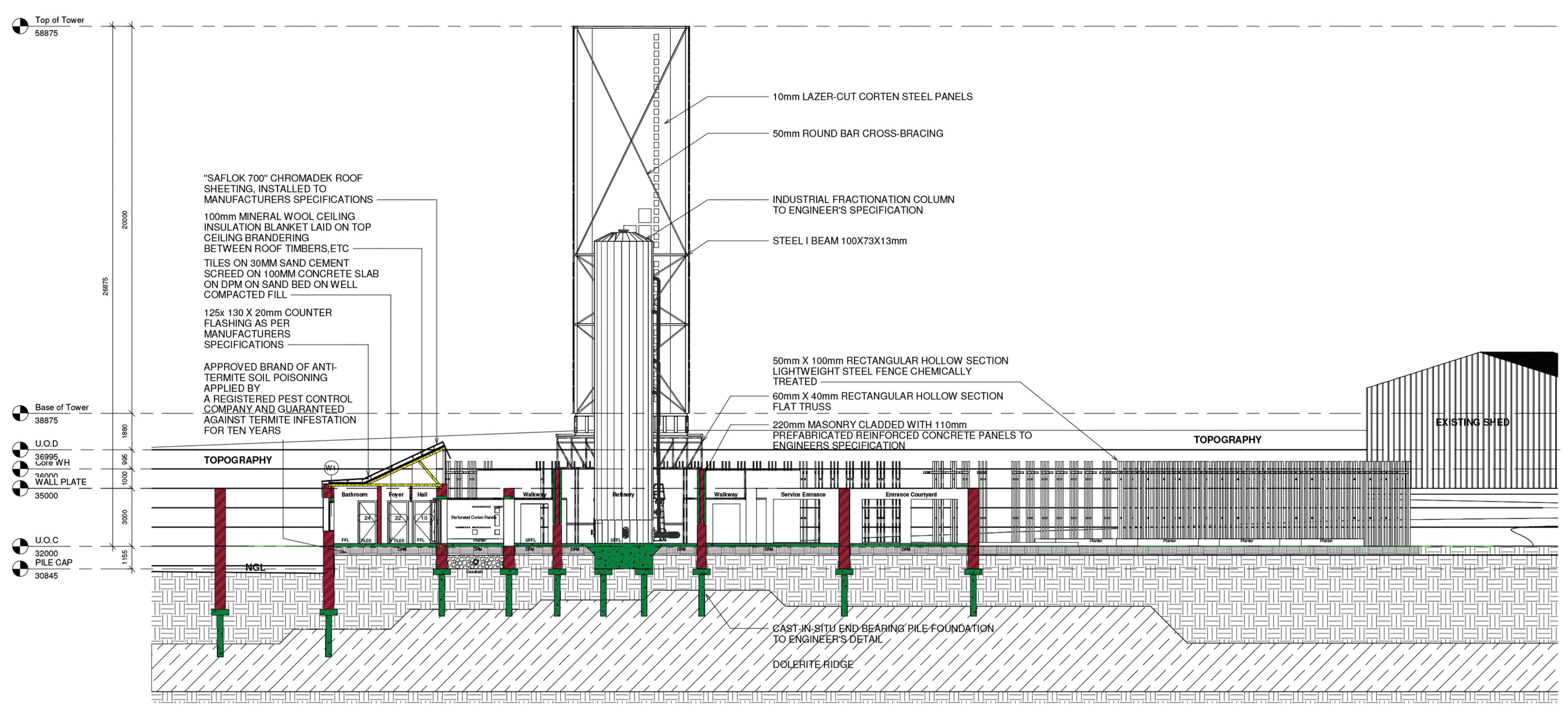
A plethora of factors need to be considered when selecting a site that will be suitable for locating a landfill site, and over time, these factors that might have been appropriate at the inception might no longer be suitable. The geological structure of an area with an emphasis on the underlying bedrock and geological structures is one of the most critical facets that must be examined when determining the suitability of a site for landfill construction. Hydrogeological, topographical, ecological and economic, as well as the social environment, are some of the main factors influencing waste disposal site sustainability. *(Ololade, Mavimbela, Oke and Makhadi, 2019: online)*

Pile Foundations..........11.4

Pile foundations are deep sub-structures consisting of long, slender, column elements commonly made from steel or reinforced concrete, or even timber. A foundation is described as 'piled' when its depth is more than three times its breadth and is used to support the structure and transfer the load at the desired depth. Pile foundations are typically used for massive structures, and in circumstances where the soil at shallow depth is not adequate to resist exorbitant settlement. These foundations are also preferable when the groundwater table is high. *(Singh, 2022: online)*

Type : End Bearing Piles

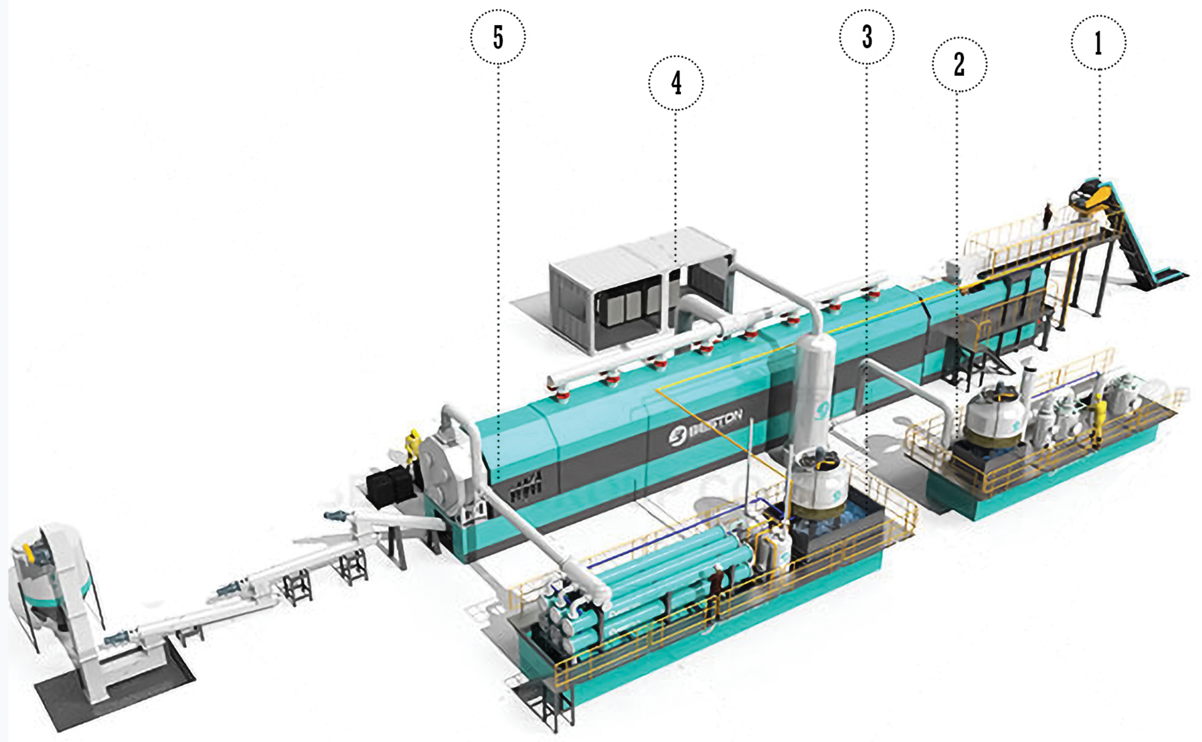
In this type of pile foundation, the loads pass through the lower tip of the pile. The bottom end of the end-bearing pile rests on a solid layer of soil or rock. Usually, the pile rests at a transition layer from weak soil conditions to a more robust layer. As a result, the pile acts as a column and safely transfers the load to the strong layer.



CHAPTER 11

BLL-16 Semi-continuous Plastic Pyrolysis

Model	BLL-16	
Capacity	12-16t/d	
Working Process	Semi-continuous	
Reactor Size	φ2800*7100mm	
Reactor Material	Q245R	
Drive System	500 reducer+7.5kw drive motor	
Land (L*W*H)	33m*13m*8m	
Power	55.6kw	
Burner	2*400,000 kcal	
Total Weight of Shipped Materials	About 34.5t	
Number of Containers	1*40FR+2*40HQ	
Noise (dB)	≤60	
Heating Materials		
Condensing System	Vertical Condenser	φ820*3600 Single piece condensing area 35.6m2
	3-in-1 Condenser	8000*2260*2500 Condensing area 49.5m2



1. Feeder system
2. Multipoint monitoring system
3. Oil gas recycling system
4. Hot air circulation heating system
5. Moving horizontal pyrolysis reactor

Figure 17 : Pyrolysis system (BESTON,2022)

CHAPTER 11

Material : Cast-in-Place Concrete Piles

This pile footing is constructed by boring soil up to the desired depth, depositing mixed concrete in that place and letting it cure there. Cast in situ concrete pile foundation is constructed either by driving a metallic shell into the ground, filling it with concrete, and leaving the shell with the concrete or pulling it out while concrete is poured. Usually, round piles are used in cast-in-situ piling. *(Singh, 2022: online)*

Health and Safety 11.5

Architects, by definition, need to be concerned with health and safety. After all, any new or renovated building has to be designed with health and safety in mind. Whether it is ventilation, fire escape routes or materials, health and safety always need to be considered. However, it is not only about the building's safety standards but also about the process. *(Emma,2019 : online)*

When it comes to risks on site, there are some principles which should be adhered to. This can help to eliminate risks at their root and prevent any hazards from escalating. Eliminate the hazard - the best way to avoid accidents is to eliminate the hazard. This is where ethical and responsible design comes into play; by adequately studying and understanding the intricate processes and machinery used in this facility. *(Emma,2019 : online)*

One can identify possible risks associated with a particular facet of the facility such as oil spills or machine malfunction and design accordingly. It is imperative to take note of these possible perils and to reduce people's contact with the potential hazard. Because of these-chemicals, oil refineries are tightly regulated places to work. Fortuitously the pyrolysis machinery specified for this project is a prefabricated, automated and closed system with added engineering controls to reduce the risk to human life. It is quite modern in that the equipment can simply be placed in the space designed for it without additional supporting systems such as custom cooling mechanisms or structural support as it is already built-in.

A petroleum refinery's primary function is to separate crude oil into its various components, these are then reprocessed into valuable compounds. The type, number, and size of process units required at a particular refinery depend on numerous variables, including the type of crude oil and the final outcome required. The interconnected units making up a refinery are a maze of tanks, furnaces, and distillation towers, otherwise known as fractionating columns, reactors, heat exchangers, pumps, pipes, fittings, and valves.

The plant and equipment of refineries are generally modern, and the processes are mainly automatic and enclosed. Routine operations of the refining processes generally present a low risk of exposure when adequate maintenance is carried out, and proper industry standards for design, construction, and operation have been followed. However, the potential for hazardous exposures always exists. Hazards include fire, explosion, toxicity, corrosiveness, and asphyxiation. One of the most effective ways to mitigate these hazards is by avoiding enclosed spaces where pressure and toxicity can build up; keeping the spaces ventilated is crucial to ensure the safety of all who work in them.

C H A P T E R 11

The plant and equipment of refineries are generally modern, and the processes are mainly automatic and enclosed. Routine operations of the refining processes generally present a low risk of exposure when adequate maintenance is carried out, and proper industry standards for design, construction, and operation have been followed. However, the potential for hazardous exposures always exists. Hazards include fire, explosion, toxicity, corrosiveness, and asphyxiation.

One of the most effective ways to mitigate these hazards is by avoiding enclosed spaces where pressure and toxicity can build up; keeping the spaces ventilated is crucial to ensure the safety of all who work in them. Other precautions can be taken, such as sloping the floors where the petrochemicals are being processed to drain at the specific point that does not connect to the main municipal sewer line, but a separate tank is crucial to mitigating possible environmental harm in the case of a spillage.

Gravity pump.................11.6

It is expected to find extravagant water management systems at industrial facilities, such as mines and refineries, based on costly and complex high-pressure pumped systems when a more economical gravity flow system would be sufficient in most cases. While many mines and refineries rely upon delivering high-pressure water ,requiring powerful pumps and heavy-duty pipework, elements of an efficient pump system can often operate successfully without the need for pumps *(Wood, 2015: online)*

These processes can sometimes be configured to use "cost-free" gravity flow and drainage management as non-pressurised systems. Although, it is common to see pumped-pipe systems specified for such applications, leading to unnecessary expenses on pumps and high-specification pipes and ongoing equipment maintenance. Fully certified, high-quality, high-density polyethene (HDPE) pipes designed for gravity-application pressure grade would provide all the corrosion and abrasion resistance required of an industrial application without the added expense of more complex systems. *(Wood, 2015: online)*

Pump manufacturers estimate that up to 90% of a pump's running cost is due to energy usage, wear and parts, making them one of the most expensive components on industrial sites and even more costly if specified when not required. They can be supplied in longer lengths than more expensive concrete or ductile iron alternatives, meaning fewer joints are needed, reducing the possibility of leakage. *(Wood, 2015: online)*

By suspending the gravity pump system in the flat trusses, less energy will be required to transport the fuel in its various stages while making maintenance more accessible than subterranean alternatives.

C H A P T E R 11

Passive Design Strategies

01

North-orientation

The length of the site is orientated almost perfectly north, and this crucial factor informed the spatial planning as well as the morphology of a prospective structure on this terrain. Making use of northern sunlight to illuminate and regulate the interior spaces reduces the need for air conditioning and enhances the climatic atmosphere of these spaces. All windows and clerestory windows are either north or south, with the roof structure sloping to open up to the north.

02

Natural-ventilation

When working with fumes and industrial processes, ventilation is crucial regarding health and safety regulations. The design employs an open-air truss system covered with louvres to provide shading and UV protection since the machinery is robust and weather resistant. This system allows for plenty of natural ventilation while not putting the nearby community at risk since the prevailing wind direction is NNW blowing away from Bloemfontein.

03

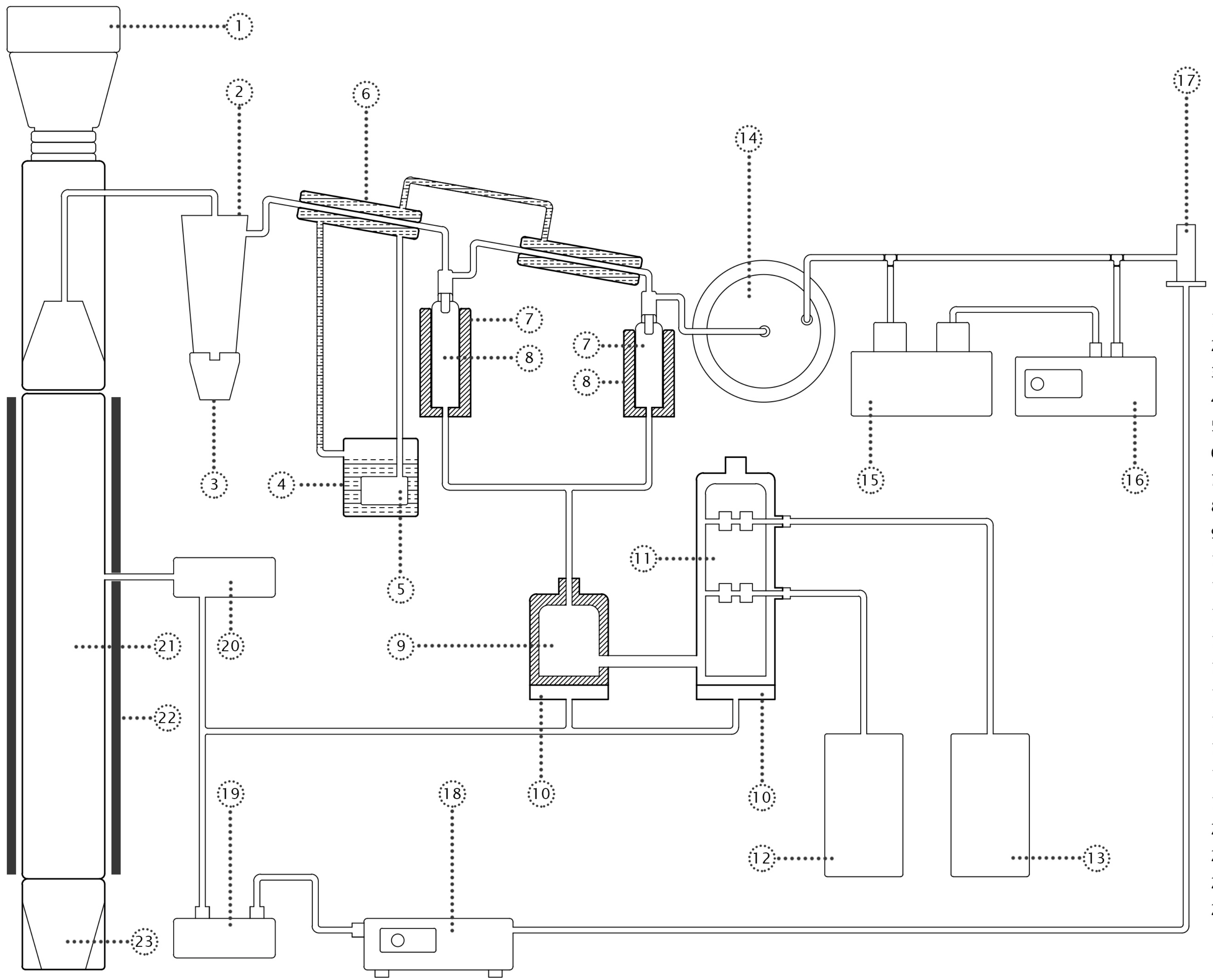
Climatic insulation

The Free state climate is arid; temperatures can fluctuate between the extremities. For this reason, I have decided to use thick masonry walls to insulate the interior spaces keeping the atmosphere constant and shielding it from fluctuating temperatures. The thick walls are also for security and safety purposes since the site can be classified as a high-risk area. The innermost section that accommodates the pyrolysis machinery and fuel tanks is made of a different material, reinforced concrete, to mitigate danger from a potential explosion.

04

Gravity pump system

The transportation of the fuel in its various stages, refined and unrefined, vapour and liquid states are done through a pipe system hosted within the flat truss system pitched at an angle to utilize gravity as means of mitigating energy consumption, similar to plumbing systems, but with added pressure and temperature regulation.



1.............. Feeder
2.............. Cyclone
3.............. Ash Cabinet
4.............. Chilled Water
5.............. Water pump
6.............. Condenser
7.............. Membrane
8.............. Collector
9.............. Boiler
10............. Heating element
11............. Distillation Chamber
12............. Diesel Collection
13............. Petrol Collection
14............. Gas chamber
15............. Gas Flow Totaliser
16............. Gas conditioning unit
17............. Gas Burner
18............. Air compressor
19............. Gas Flow Meter
20............. Pre Heating system
21............. Plastic Gasifier
22............. Heating element
23............. Waste collection

Figure 18 : Pyrolysis diagram (Author,2022)

CHAPTER 11

Pyrolysis Process.............11.6

The pyrolysis process is quite technical, but not necessarily that complicated. To simplify, the first and foremost step is collecting raw plastic waste material. Then, it is pre-treated to remove any foreign material from the conversion process of plastic to fuel. In a nutshell, impurities are washed and removed from the raw material to ensure a homogeneous reaction.

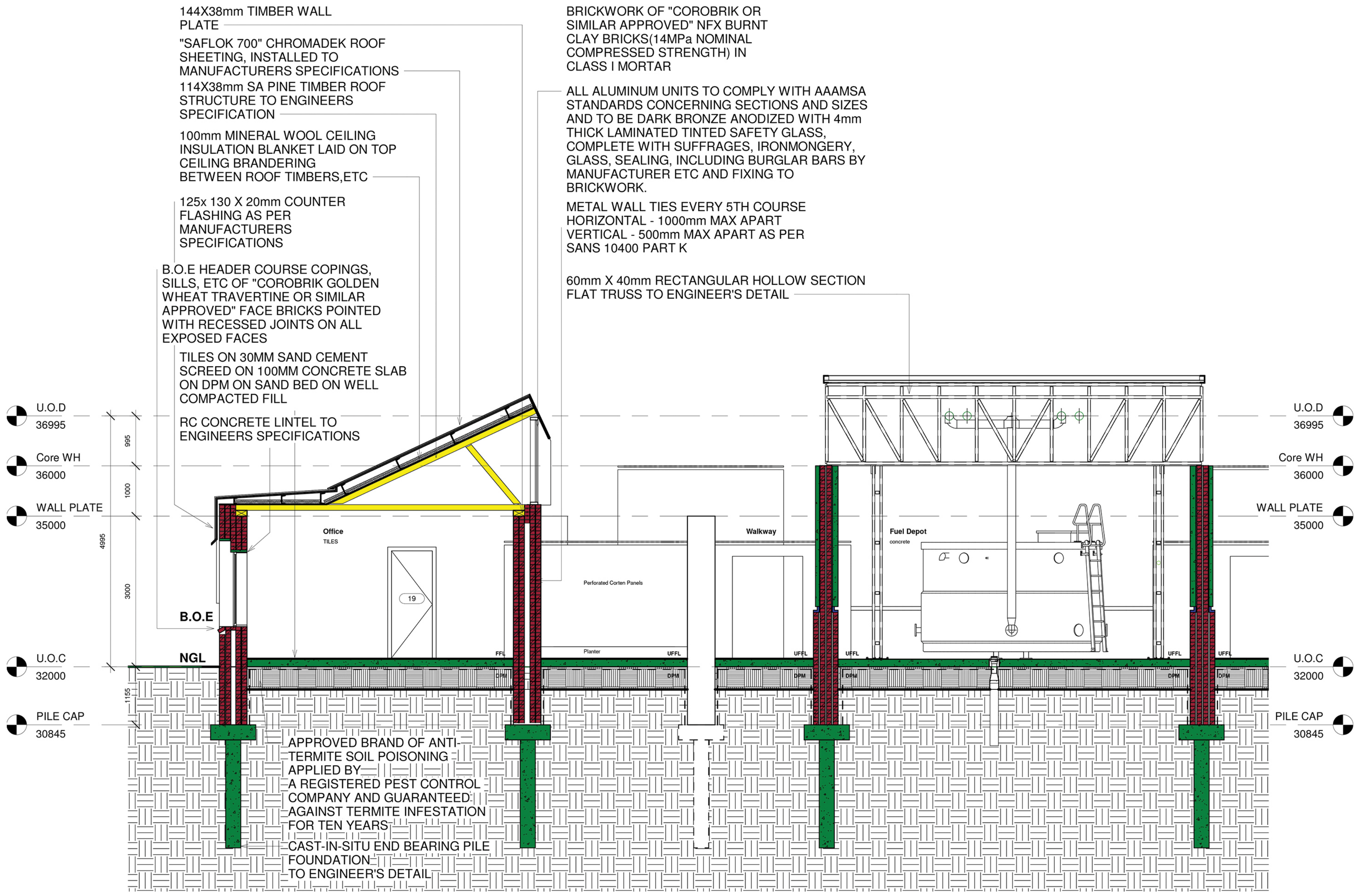
Then the pre-treated raw material is ground to the desired size before loading the ground plastic particles into the reactor, the pyrolysis chamber. The size should be appropriate to ensure the reaction can occur smoothly and efficiently.
The pyrolysis chamber is loaded with ground plastic and a suitable catalyst to promote specific types of chemical reactions. The reaction temperature can range from 200-900 C based on the quality of the liquid oil desired further down the line as a product. The ground raw material first gets melted, and then it gets vaporised.

The vapors are then passed through condensers in series to condense them into a liquid. This liquid oil is then further sent through the process of refining, fracturing and distillation. This refined liquid is the desired oil which is used as a multipurpose fuel. The combustible substance is an excellent fuel source and has many industrial applications, such as diesel electrical generators, diesel burners/stoves, boilers, heaters, geysers and diesel pumps. The distillate can be further fractionated into fuels such as petrol, commercial diesel and kerosene for automobiles.

Research suggests that pyrolysis is probably the best way to recycle plastic waste. Those in the commercial sphere of recycling can see record profits through their waste plastic recycling plants when they choose to utilise this process. Through the pyrolysis process's thermal degradation of plastic feedstock, a facility can extract up to 40-45% oil, 30-35% carbon black, 10% combustible gas, and 15% steel wire.

The Plastic pyrolysis process can astonishingly turn waste into wealth. With as little wastage as possible, gasses produced during the thermal degradation reaction can be repurposed as a fuel source for the burners. The remaining carbon black residue has a wide range of industrial applications. The carbon black can be used for constructing clay bricks or as fly ash in concrete production. At the same time, the fuel oil can be utilized as industrial fuel materials for burning or further refined to diesel or petroleum.

CHAPTER 1



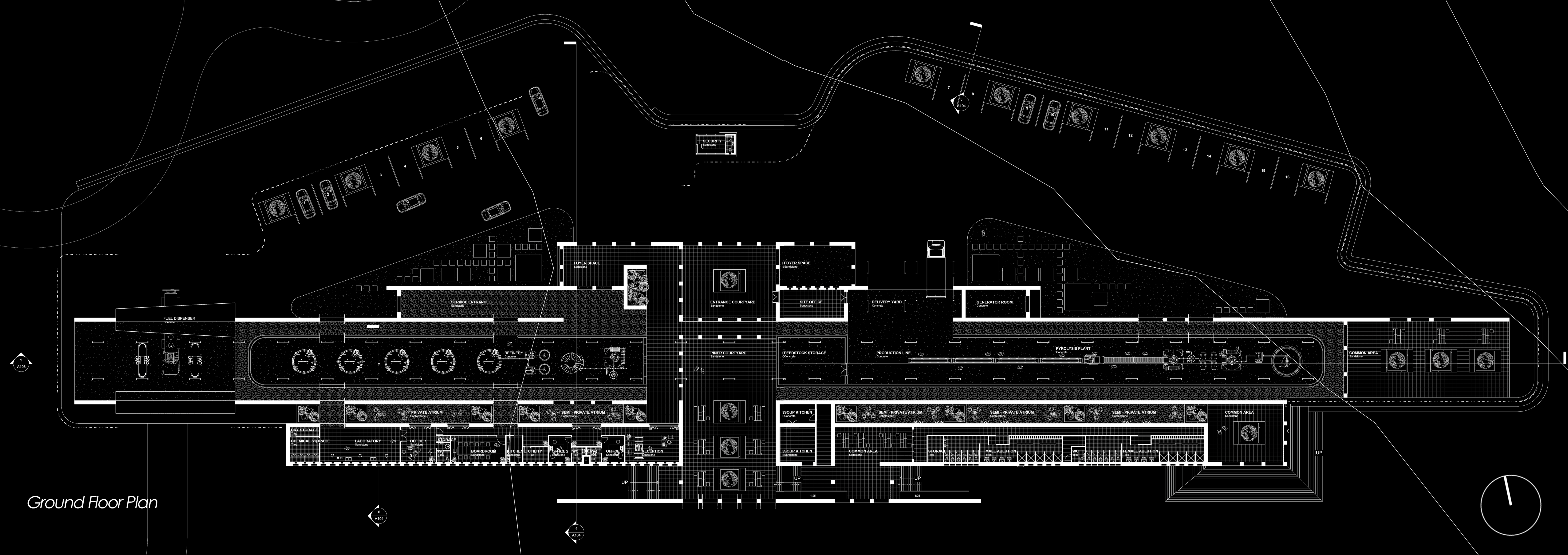
CHAPTER 2

Design Analysis

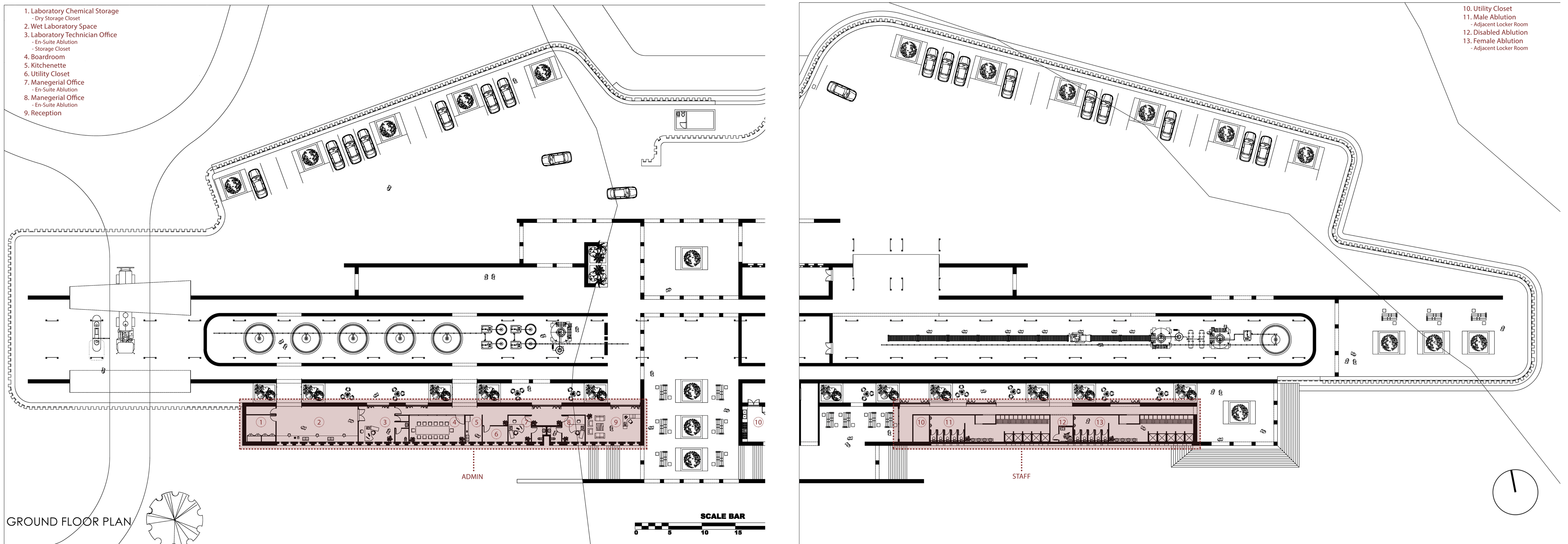
Plan function

Exploration

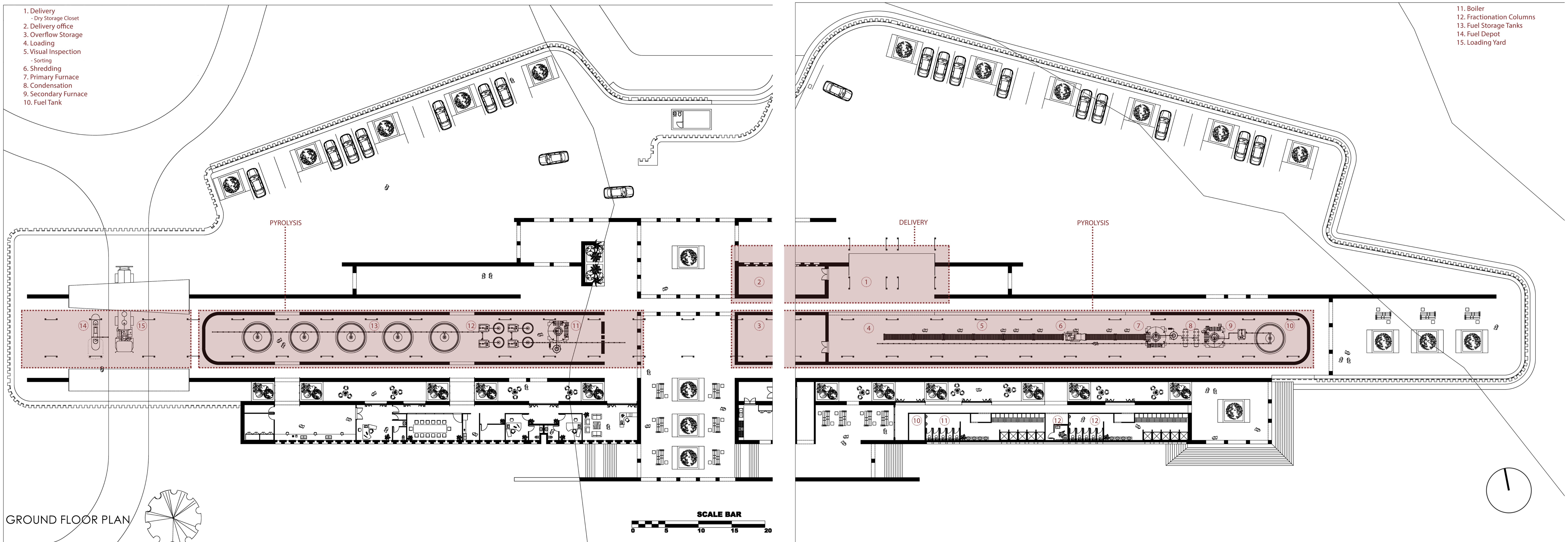
This chapter breaks the complex plan into smaller components , illustrating how the various spaces function in relation to one another , as well as an user-analysis that speculates as to how a certain type of individual would circulate through the building.



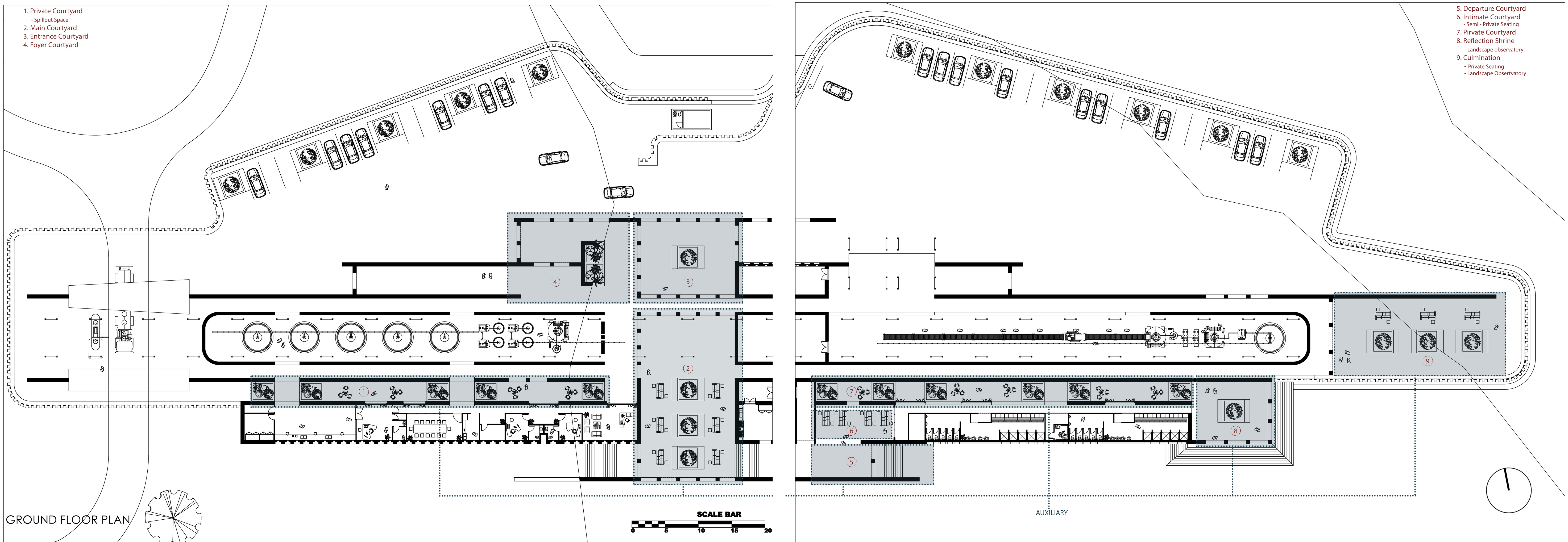
Ground Floor Plan



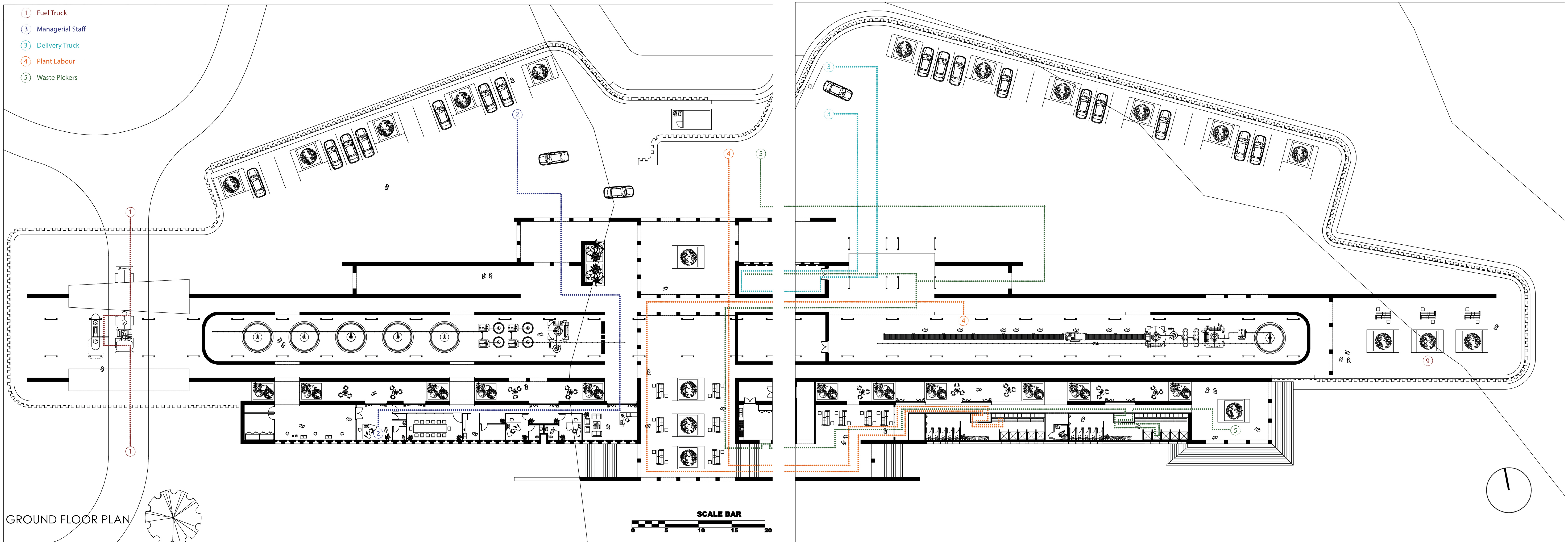
1. Laboratory Chemical Storage
- Dry Storage Closet
2. Wet Laboratory Space
3. Laboratory Technician Office
- En-Suite Ablution
- Storage Closet
4. Boardroom
5. Kitchenette
6. Utility Closet
7. Manegerial Office
- En-Suite Ablution
8. Manegerial Office
- En-Suite Ablution
9. Reception
ADMIN
GROUND FLOOR PLAN
SCALE BAR
0 5 10 15
10. Utility Closet
11. Male Ablution
- Adjacent Locker Room
12. Disabled Ablution
13. Female Ablution
- Adjacent Locker Room
STAFF



1. Delivery
- Dry Storage Closet
2. Delivery office
3. Overflow Storage
4. Loading
5. Visual Inspection
- Sorting
6. Shredding
7. Primary Furnace
8. Condensation
9. Secondary Furnace
10. Fuel Tank
11. Boiler
12. Fractionation Columns
13. Fuel Storage Tanks
14. Fuel Depot
15. Loading Yard
PYROLYSIS
DELIVERY
PYROLYSIS
SCALE BAR
0
5
10
15
20
GROUND FLOOR PLAN



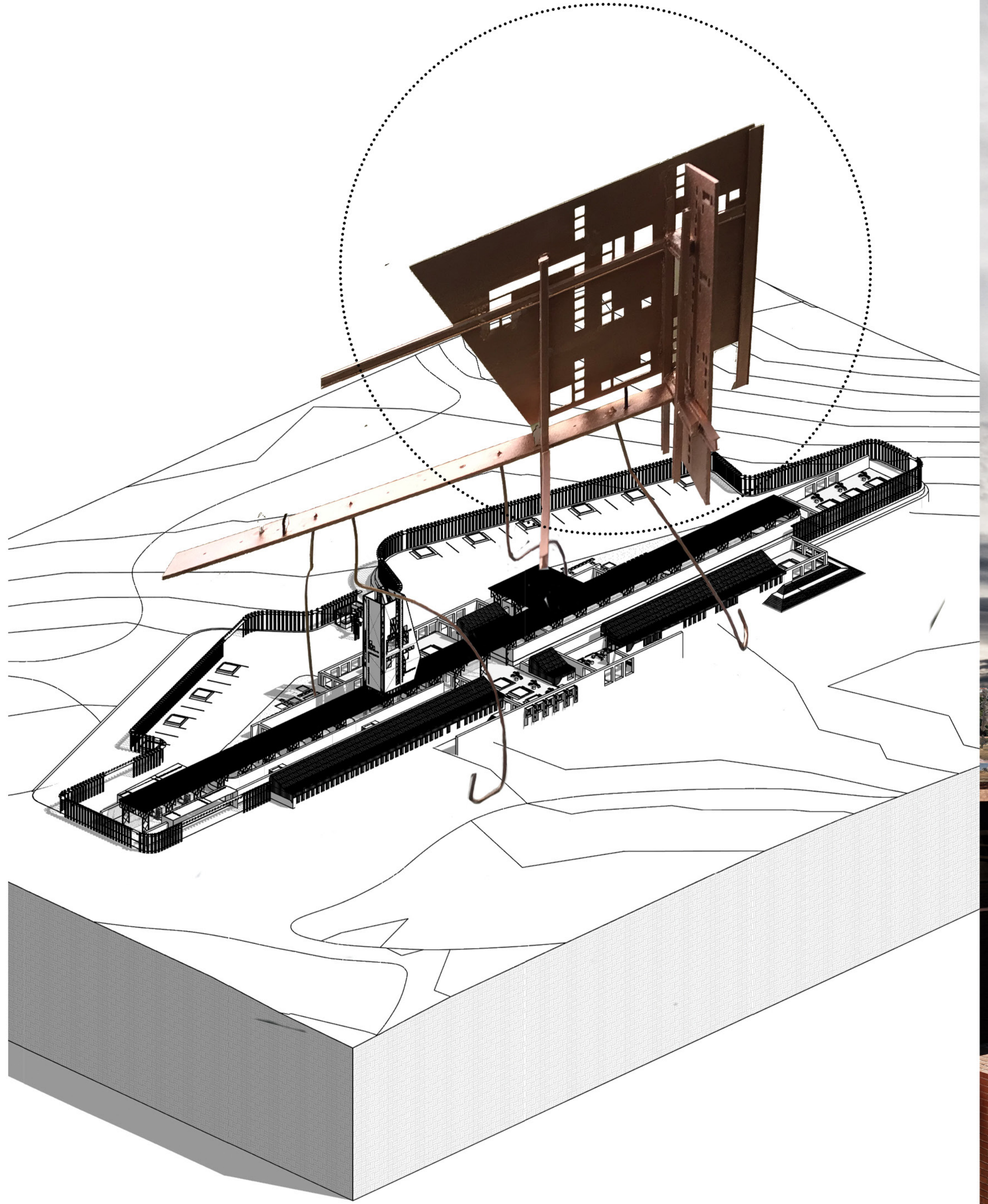
GROUND FLOOR PLAN

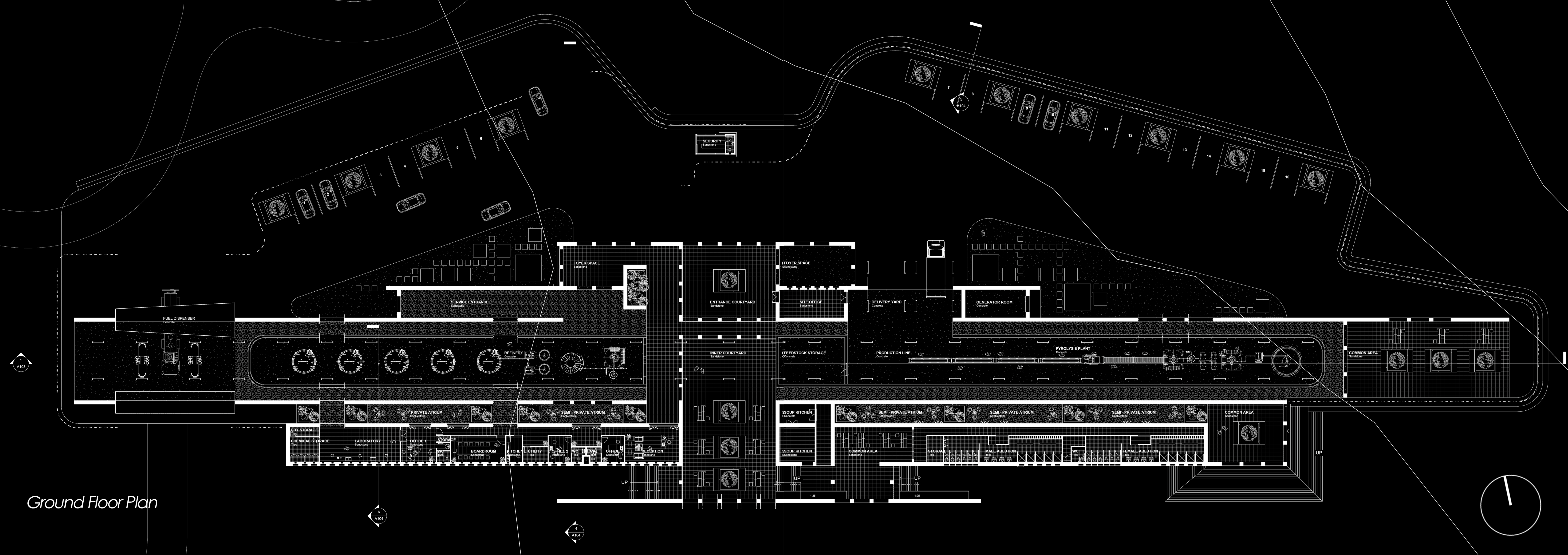

1 Fuel Truck
3 Managerial Staff
3 Delivery Truck
4 Plant Labour
5 Waste Pickers
GROUND FLOOR PLAN
SCALE BAR
0
5
10
15
20

13

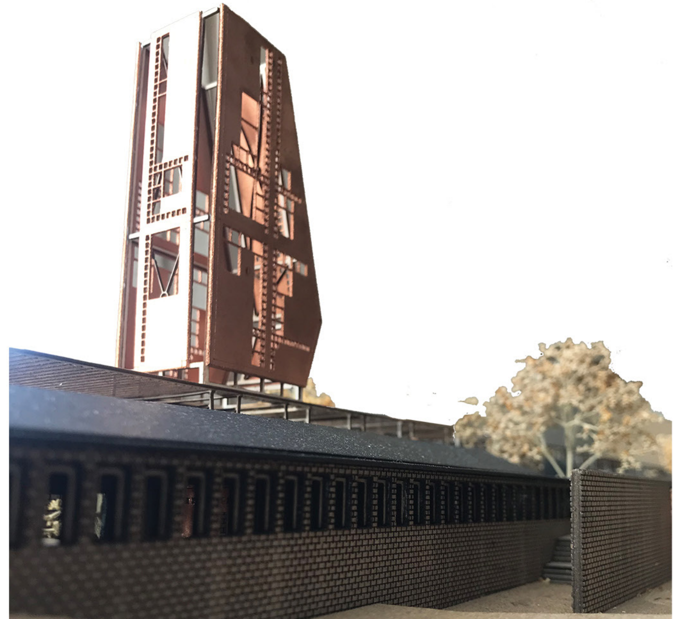
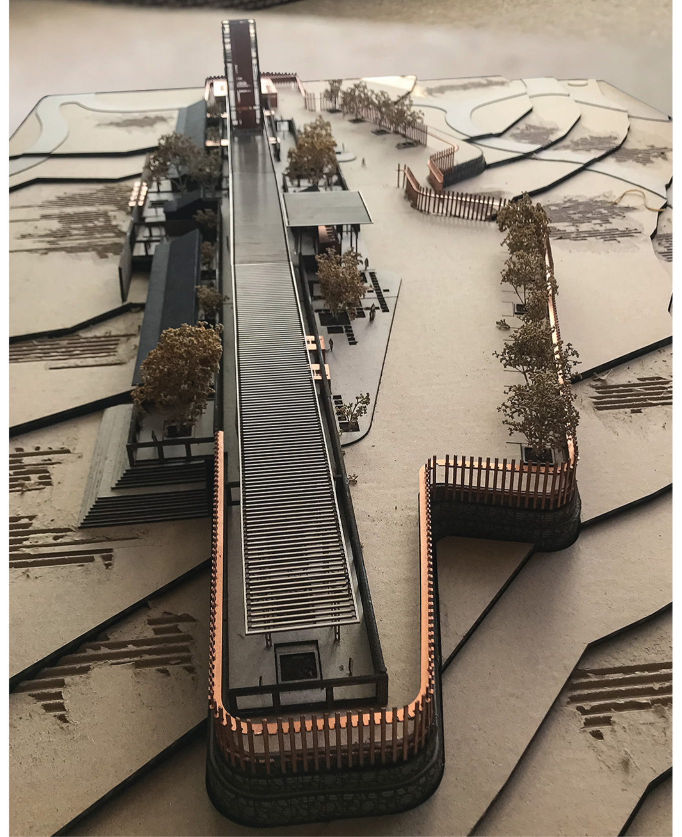
Pyrolysis Facility
Free State
Bloemfontein

Brief Project description
A Waste management facility on the northernmost landfill that transforms discarded plastic into crude oil which can be processed into diesel or petrol. This design emphasizes community utilization and economic stimulation.
Together all can prosper.

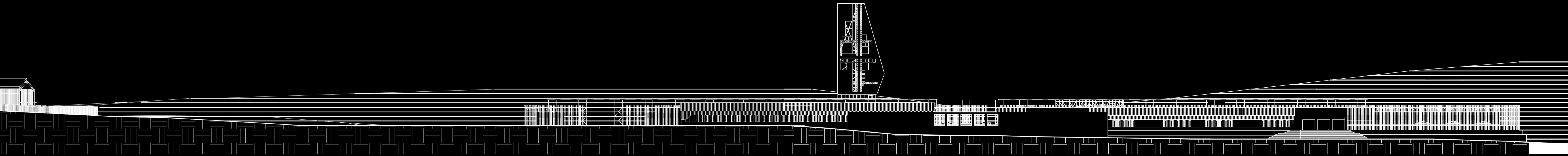




Ground Floor Plan

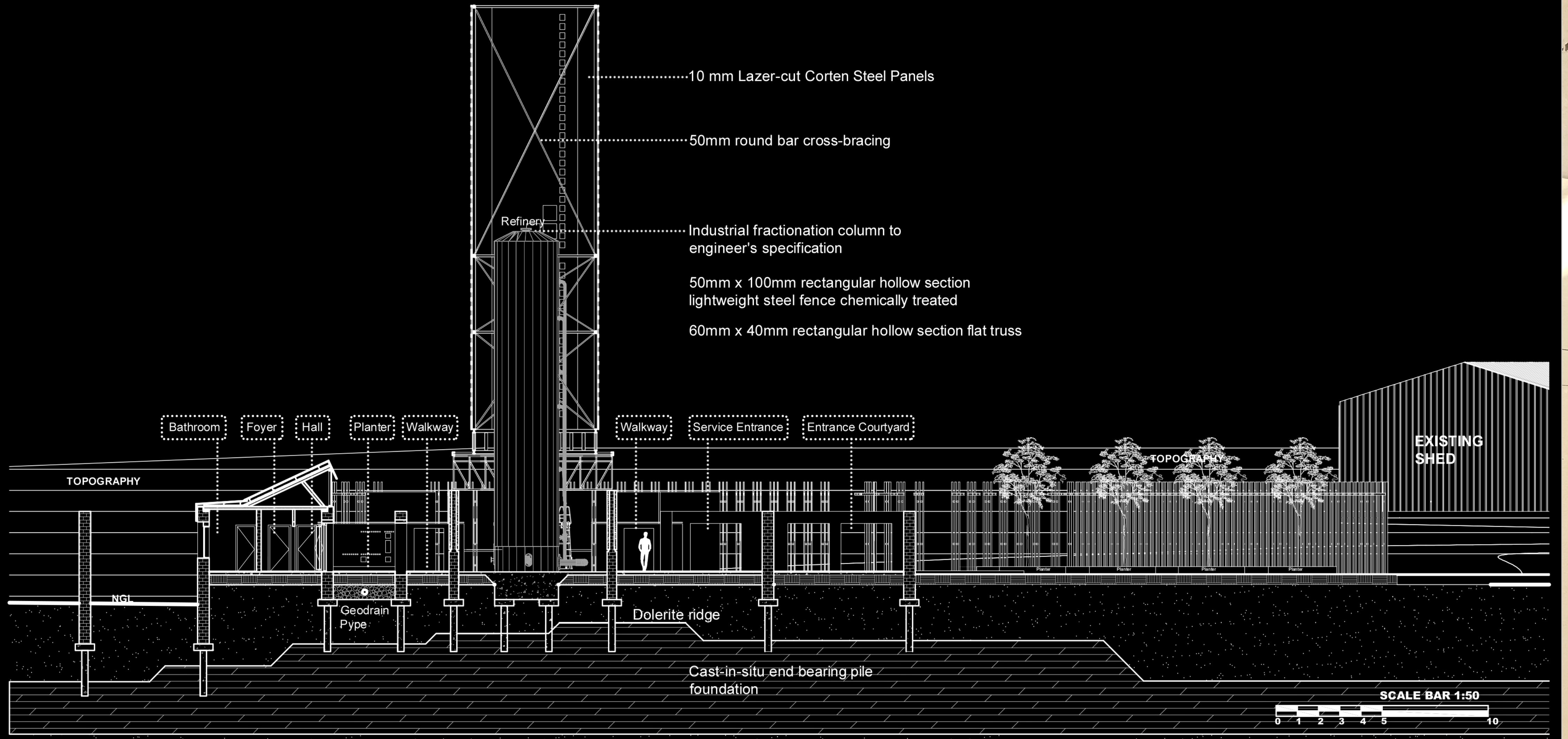




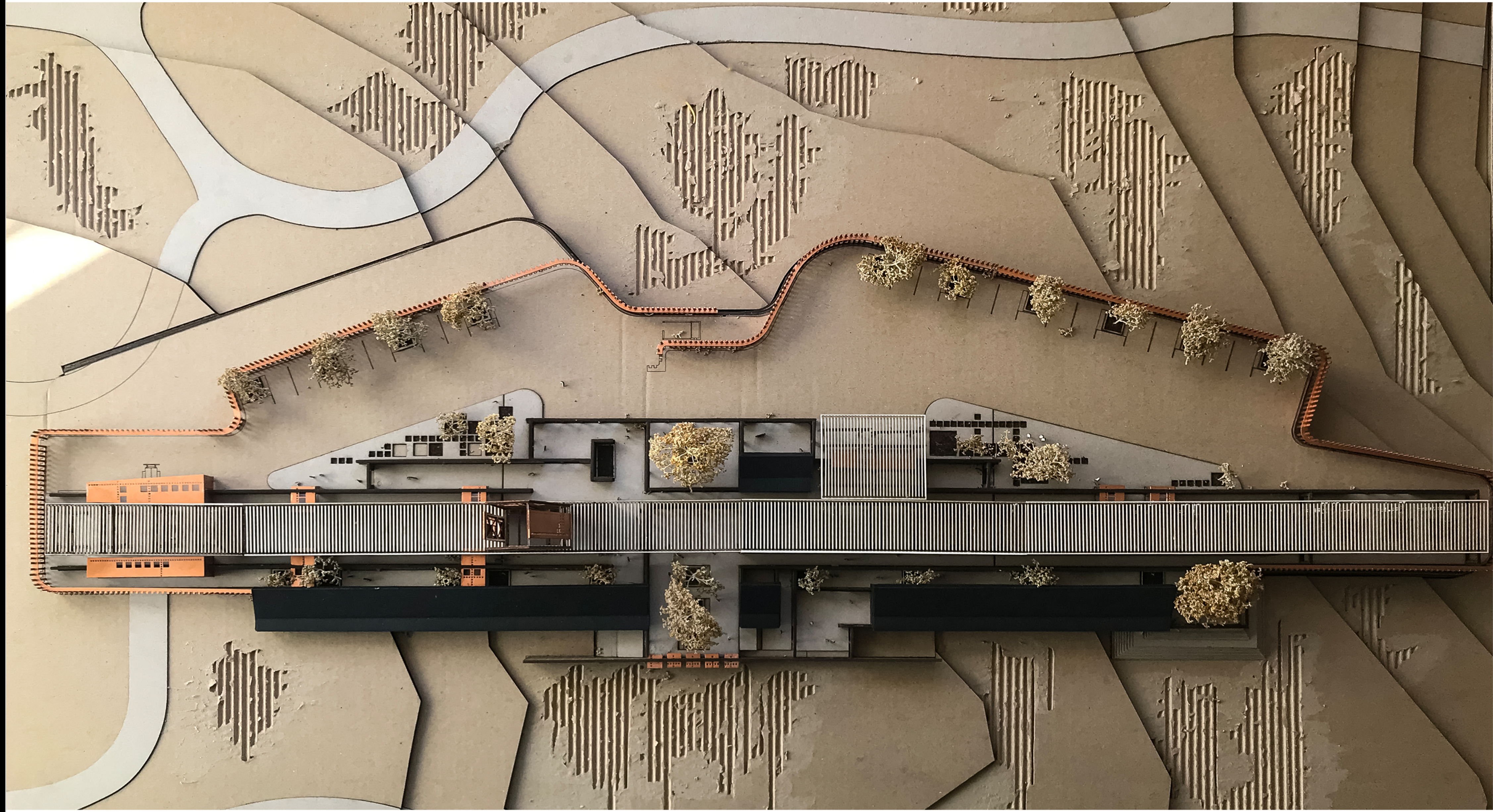
South Elevation






10 mm Lazer-cut Corten Steel Panels
50mm round bar cross-bracing
Refinery
Industrial fractionation column to engineer's specification
50mm x 100mm rectangular hollow section lightweight steel fence chemically treated
60mm x 40mm rectangular hollow section flat truss
Bathroom
Foyer
Hall
Planter
Walkway
Walkway
Service Entrance
Entrance Courtyard
EXISTING SHED
TOPOGRAPHY
TOPOGRAPHY
NGL
Geodrain Pype
Dolerite ridge
Cast-in-situ end bearing pile foundation
SCALE BAR 1:50
0 1 2 3 4 5 10

Section A-A



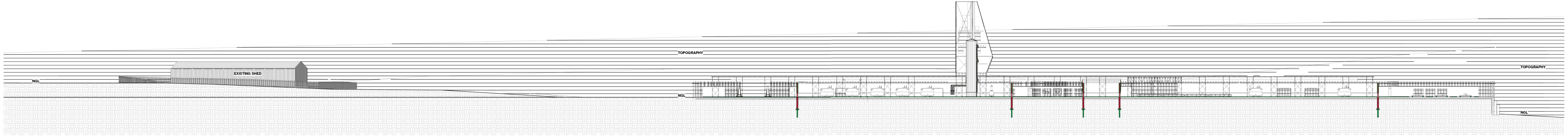
Re-scripting Narrative

Prospective SDP
This Site Development Plan is a conceptual approach to what could happen to the landfill once it has been rehabilitated. This neglected space could become a green park where all members of the community can feel included and at peace in nature.

Conclusion

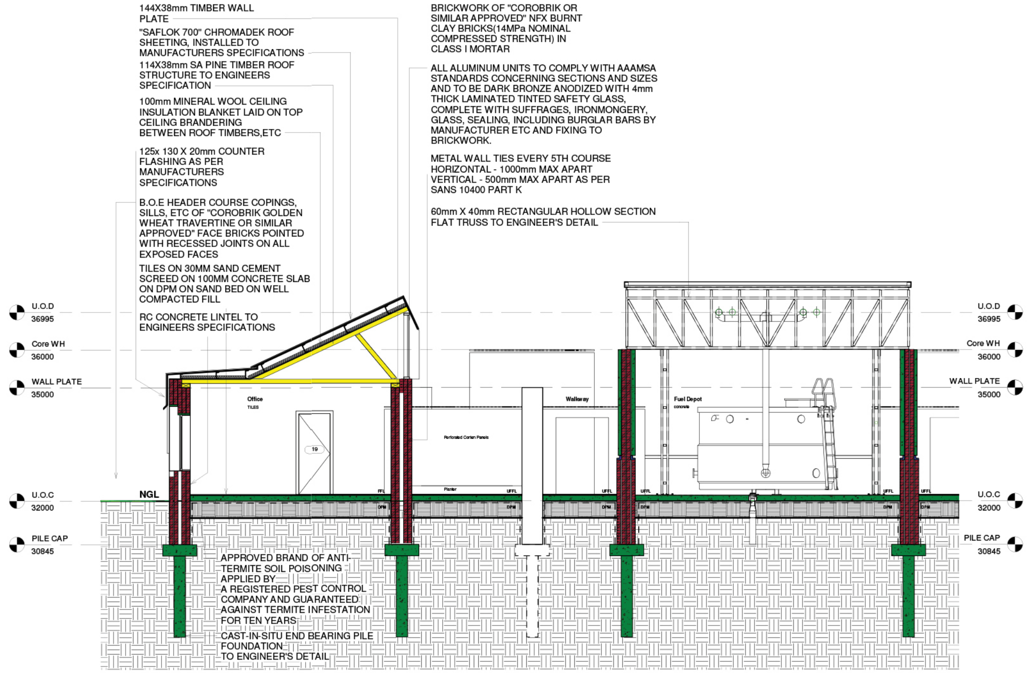
01

In conclusion, this thesis investigates how an architectural solution can mitigate the ruination of neglected spaces and transcend mere functional infrastructure when dealing with a complex issue of landfilling in the urban environment. These spaces are a treasure trove of wasted opportunities to create jobs and stimulate economic growth while critically noticing an opportunity to celebrate the downtrodden as a crucial contributor in addressing the nation's waste management hurdles. Exploring possibilities within this site, noticing the potential that lies within and uncovering the formula through experimentation could lead to this site's transmutation from its lower to a higher state of being. Adding depth to secular function by stimulating bodily experiences in an attempt to ritualize and celebrate a mundane process. Sometimes, a nuanced perspective can open new possibilities that have not yet been considered. Plastic refuse can be recycled more efficiently using pyrolysis, turning plastic into fuel sources, and transforming the issue into a grand resolution. A functional complex can become a cathedral of industry, a secular space where the recycling ritual can impact the environment and all the pilgrims who venture there.

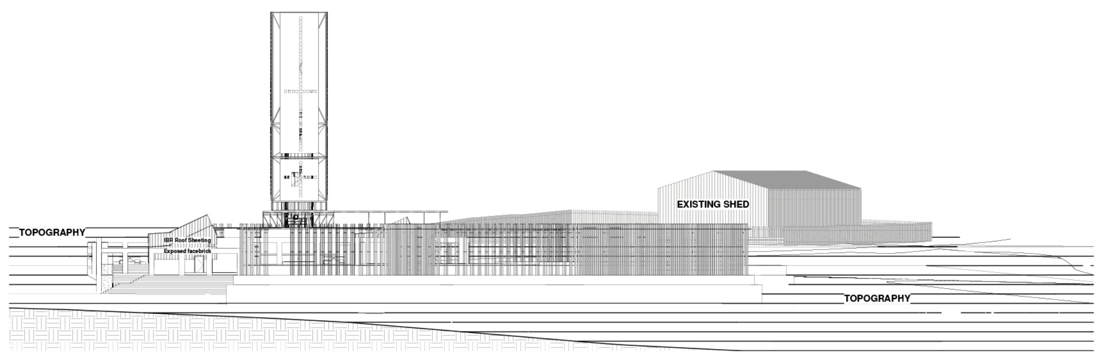


1 Section 1
1 : 200

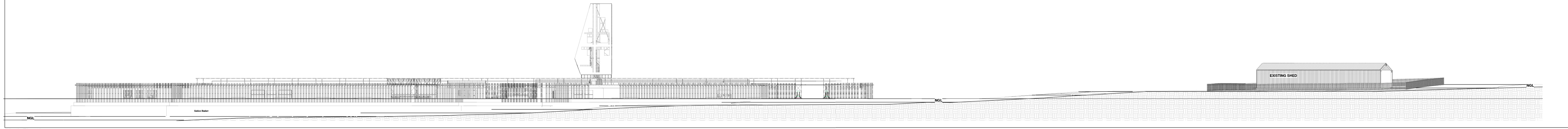
3 AREA PLAN
1 : 300



4 Section 6
1 : 50



2 West Elevation
1 : 200



5 North Elevation
1 : 200

NOTES:

General Notes:
-Work to figured dimensions only.
-Do not scale from drawing unless otherwise instructed.
-All dimensions to be checked on site.
-Any discrepancies to be reported to the architect prior to construction.
-Information on large scale drawings/details will typically supersede general arrangement drawings.
-Drawing to be read in conjunction with the relevant consultants drawings and any discrepancies to be reported.

Foundations
Mass concrete footings, 25mpa concrete to sizes indicated on drawings, laid in trenches free of any vegetable matter, with a minimum of 300mm ground cover above the top of the footings.

Walls
To be built true and level to sizes indicated on the drawing with brickforce every 4 vertical courses for the full length of the wall.
Cavity Walls to have Exact permaties built in 6 per m2 with regular weepholes at ground level.
Continuous strip dpc to be built into brickwork at slab level, stepped down at cavity walls and window cills, as shown on drawings.
No.2 coats smooth sand/cement plaster to walls and painted.

Floor Slabs
Floor finishes as indicated on plan on 30 mm sand/cement screed on 100 mm 25 mpa concrete slab on 250 micron sheet dampproofing membrane with 200 mm overlapping and bonded, joints and turned up at slab edges on 100 mm well watered, sandbed on compacted fill free of any vegetable matter.

Cills
Internal cills to be plastered, external to be sloped as part of the plaster mould to all windows, with strip dpc to be built in under all windows

Ceilings
6mm skimmed rhinoboard fixed to 38 x 38 brandering fixed to roof structure to all areas.

Lintels
Prestressed precast concrete lintels to be built in over all door and window openings to bear minimum 110 mm on brickwork

Roof design by specialists and as specified on the drawing PVC gutters and downpipes.

Windows and Doors
Plastered molded cills and heads to windows

Rainwater
Half round PVC gutters and Round PVC Downpipes

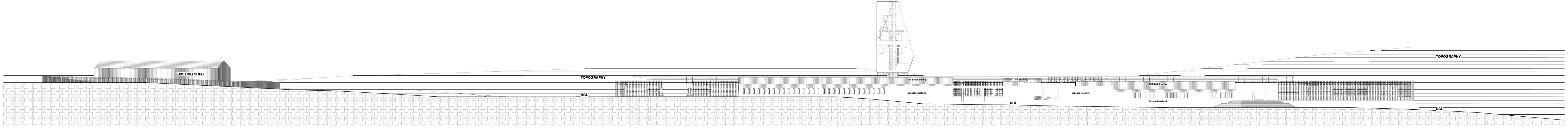
Plumbing and Drainage:
40mm waste pipes to waste sanitary fittings with traps and cleaning eyes at all bends and junctions to fall and discharge over gullies.
110mm PVC soil pipes with 110mm stub stack vents and rodding eyes at the highest point which is to be laid to fall 1:60 gradient to municipal connections with .IE's where indicated

Electrical
All electrical work is to be undertaken by licensed electricians only who must provide an electrical COC proving compliance at completion of his work

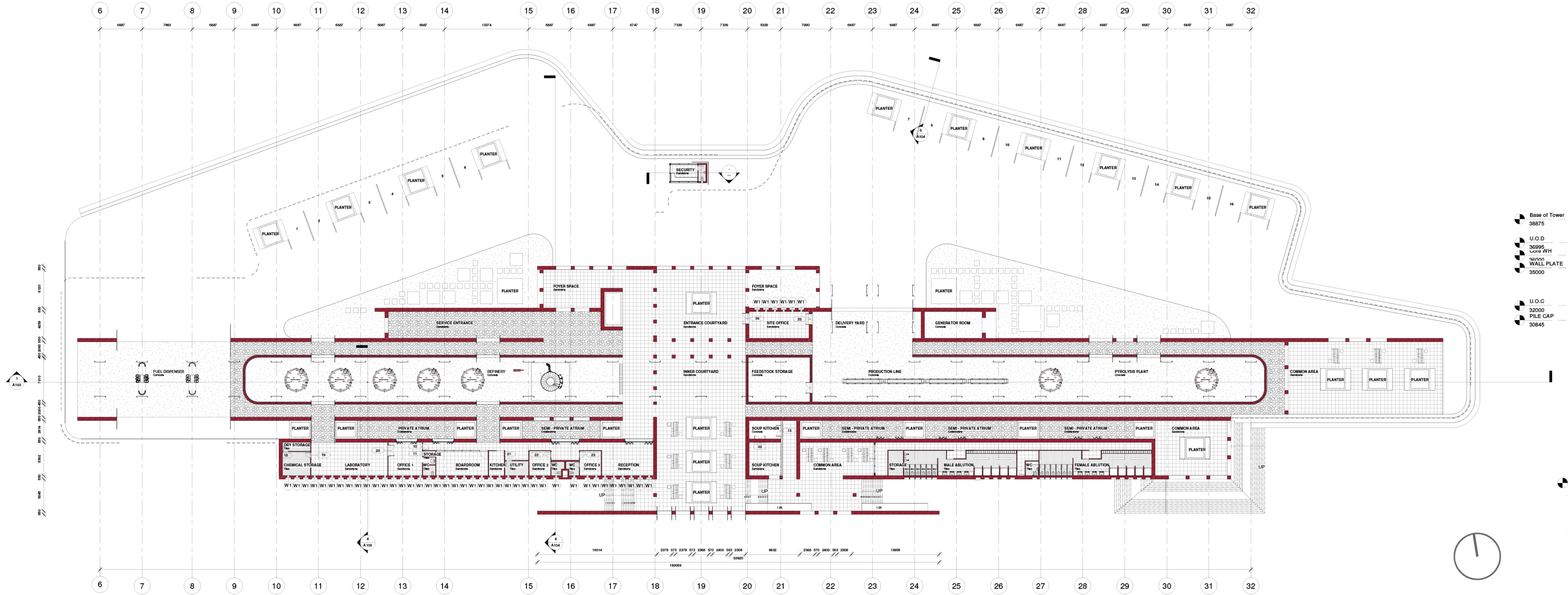
Fire Protection
All work to comply with SABS 0400 -1990, occupancy classification
Installation of fire equipment to be done According to SABS 0105 for Extinguishers, SABS 543 for fire hose reels and SABS 1128 part 1 for Hydrants
Structural elements and components to comply with requirements as specified in the National fire report and SANS 10400-T 4.7 and to have fire rating of at least 120 minutes.
Portable fire extinguishers to be hung on dedicated boards and fixed in secure positions as indicated on the plan at a height of no more than 750mm
Fire hydrants to include 75mm pillar with double headed booster connection, pressure gauge and non-return valve to engineers specification
Smoke control and detection devices installed according to engineers specification
Emergency lighting to be installed according to engineers specification
Symbolic safety signs to be installed in accordance with SABS code 1186 and positioned as required by the fire department.
Fire doors to be fitted with emergency exit locksets.
Class B fire doors to comply with SABS code 1253 and to be fitted with approved self-closing or automatic closing mechanism.

Movement joints
All movement joints according to engineers specification.
No structural, floor or wall finish to be taken over expansion joints.

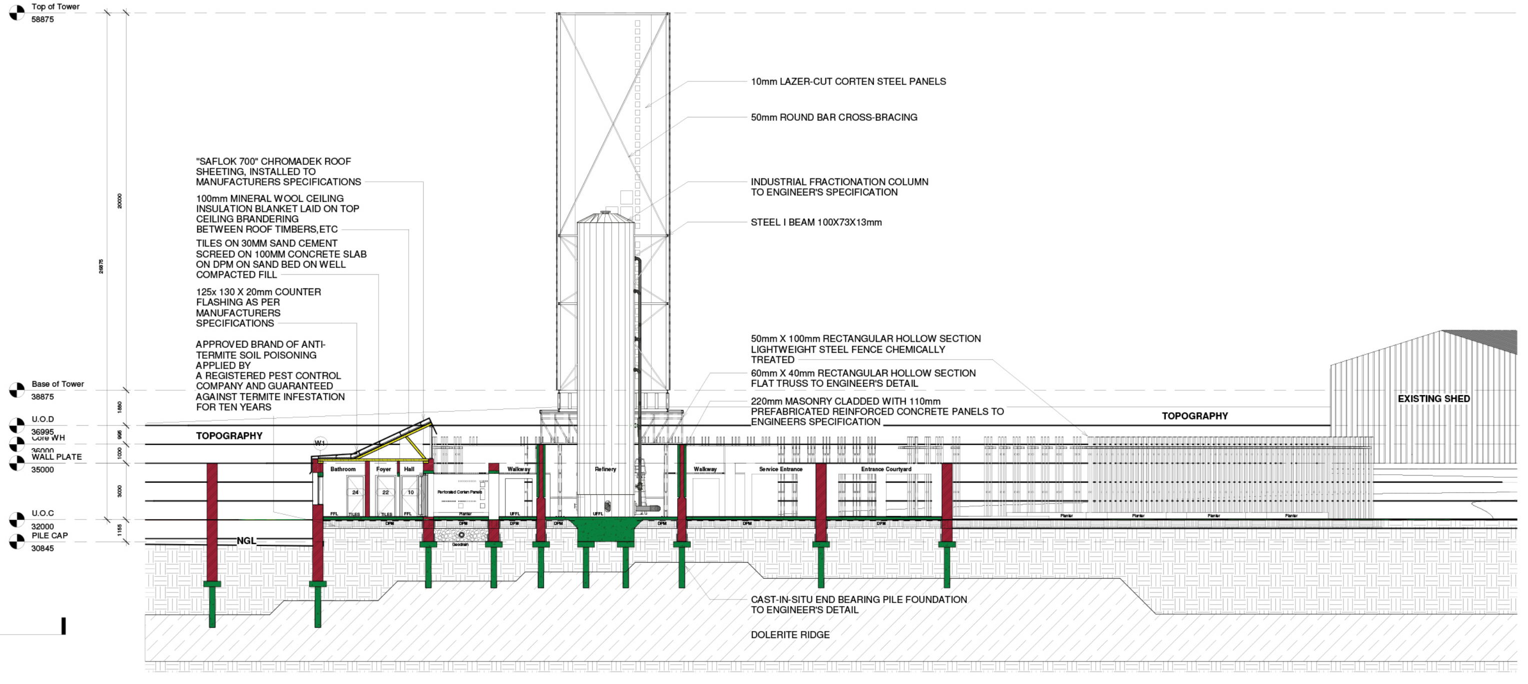
Project Title: Pyrolysis Facility	
Waste Management Plant	
Project Name: Pyrolysis	**Scale:** As indicated
Drawn By: Joubert Steyn 2017090214	**Date:** 2022/11/14 11:50:20
Client: BigOil	**Drawing NR:** A-101
Contact: Tel: 0712 555 5555	



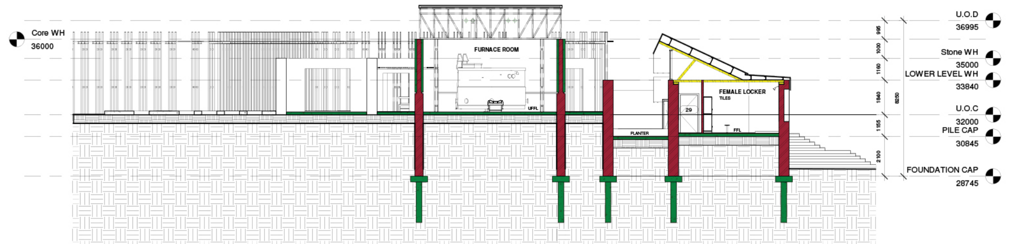
1 South Elevation
1 : 200



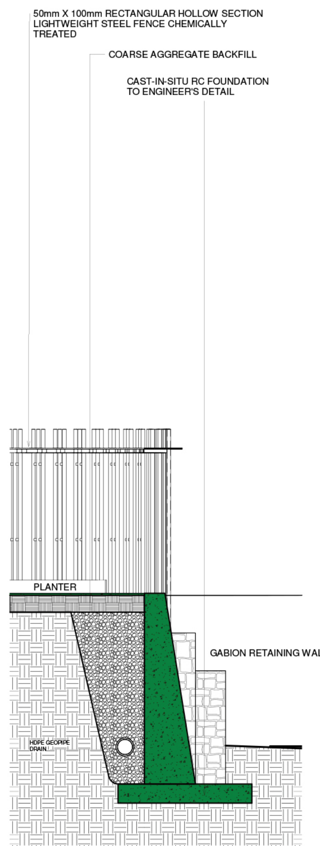
2 GROUND FLOOR PLAN
1 : 200



4 Section 4
1 : 100



3 Section 10
1 : 100



5 Section 5
1 : 50

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No.2 coats smooth sand/cement plaster to walls and painted.

Floor Slabs
Floor finishes as indicated on plan on 30 mm sand/cement screed on 100 mm 25 mpa concrete slab on 250 micron sheet dampproofing membrane with 200 mm overlapping and bonded, joints and turned up at slab edges on 100 mm well watered, sandbed on compacted fill free of any vegetable matter.

Cills
Internal cills to be plastered, external to be sloped as part of the plaster mould to all windows, with strip dpc to be built in under all windows

Ceilings
6mm skimmed rhinoboard fixed to 38 x 38 brandering fixed to roof structure to all areas.

Lintels
Prestressed precast concrete lintels to be built in over all door and window openings to bear minimum 110 mm on brickwork

Roof design by specialists and as specified on the drawing PVC gutters and downpipes.

Windows and Doors
Plastered molded cills and heads to windows

Rainwater
Half round PVC gutters and Round PVC Downpipes

Plumbing and Drainage:
40mm waste pipes to waste sanitary fittings with traps and cleaning eyes at all bends and junctions to fall and discharge over gullies.
110mm PVC soil pipes with 110mm stub stack vents and rodding eyes at the highest point which is to be laid to fall 1:60 gradient to municipal connections with .IE's where indicated

Electrical
All electrical work is to be undertaken by licensed electricians only who must provide an electrical COC proving compliance at completion of his work

Fire Protection
All work to comply with SABS 0400 -1990, occupancy classification
Installation of fire equipment to be done According to SABS 0105 for Extinguishers, SABS 543 for fire hose reels and SABS 1128 part 1 for Hydrants
Structural elements and components to comply with requirements as specified in the National fire report and SANS 10400-T 4.7 and to have fire rating of at least 120 minutes.
Portable fire extinguishers to be hung on dedicated boards and fixed in secure positions as indicated on the plan at a height of no more than 750mm
Fire hydrants to include 75mm pillar with double headed booster connection, pressure gauge and non-return valve to engineers specification
Smoke control and detection devices installed according to engineers specification
Emergency lighting to be installed according to engineers specification
Symbolic safety signs to be installed in accordance with SABS code 1186 and positioned as required by the fire department.
Fire doors to be fitted with emergency exit locksets.
Class B fire doors to comply with SABS code 1253 and to be fitted with approved self-closing or automatic closing mechanism.

Movement joints
All movement joints according to engineers specification.
No structural, floor or wall finish to be taken over expansion joints.

Project Title: Pyrolysis Facility	
Waste Management Plant	
Project Name: Pyrolysis	**Scale:** As indicated
Drawn By: Joubert Steyn 2017090214	**Date:** 2022/11/14 13:26:17
Client: BigOil	**Drawing NR:** A-101
Contact: Tel: 0712 555 5555	

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