

RESURGENCE:

Recycling hub for marginalised waste reclaimers in soweto, South Africa.

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PREFACE

Having lived in Johannesburg's Central Business District for the past five years, I have been constantly confronted with an unsettling reality: despite the presence of a waste management company, the inner city's streets are often littered with rubbish. My curiosity was further piqued by the presence of a group of individuals who, almost ritualistically, would be seen pushing trolleys laden with waste across the city, primarily from the north to the south. These individuals, though performing an essential yet unglamorous role, seemed to be marginalized and undervalued by society.

As I delved deeper into this issue, it became clear that the problem extends far beyond the urban landscape and into the landfills that serve Johannesburg. Reports have indicated that the city is nearing a critical shortage of airspace for waste disposal. This realization sparked a vision of a different reality one where these informal waste reclaimers could work in concert with the government in a more structured and formalized capacity, collaboratively addressing the waste crisis while fostering public awareness and education.

This research emerged from a desire to explore the feasibility of this vision. Through architecture, I seek to investigate how we might bridge the gap between informal waste reclaimers and formal waste management systems, leveraging design as a tool to address the waste management challenges facing Johannesburg.

RESURGENCE:

Recycling hub for marginalized informal waste reclaimers in Soweto south Africa.

A thesis for the school of the built environment
University of the Witwatersrand
Johannesburg, South Africa

Written by: **Matsebe Lloyd Tshehla**

Year:2024

Course: Master of Architecture (professional)

Declarations

I am aware that plagiarism (the use of someone else's work without their permission and/or without acknowledging the original source) is wrong. I confirm that ALL the work submitted for assessment for the above course is my own unaided work except where I have explicitly indicated otherwise. I have followed the required conventions in referencing the thoughts and ideas of others. I understand that the University of the Witwatersrand may take disciplinary action against me if there is a belief that this is not my own unaided work or that I have failed to acknowledge the source of the ideas or words in my writing.



23/02/2025

ACKNOWLEDGEMENTS

First and foremost, I want to express my deepest gratitude to God for granting me the strength and perseverance needed to carry out this research. His guidance has been my source of resilience and inspiration throughout this journey.

I am profoundly thankful to my family for their unwavering support and encouragement. Your belief in me, both academically and personally, has been the cornerstone of my achievements. The dedication you've shown in nurturing my education and instilling in me the values that guide me has profoundly shaped who I am today.

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To all my colleagues and friends at the School of Architecture, your camaraderie and contributions have enriched my academic experience. A special thank you to Nakedi Phefadu & Tamara Maposa for their steadfast support and friendship, which have been a source of strength and motivation throughout this endeavor.

I am also deeply grateful to the experts and participants who generously contributed their time and knowledge to this research. Your valuable insights and perspectives have been crucial to the success of this project, and I sincerely appreciate your willingness to be a part of this study.

Thank you all for being a vital part of this journey and for helping me bring this research to fruition.



ABSTRACT

Johannesburg, a dynamic and rapidly expanding city, it has been one of the most remarkable urban centers in the world since the discovery of gold in 1886. As a relatively young major city, Johannesburg has continually attracted a growing population, which has significantly increased demand for essential resources such as food, water, energy, housing, and other necessities.

This unprecedented urban growth has placed immense pressure on the environment, particularly with regard to waste generation and management. As the city has urbanized, the volume of waste produced has surged, while the capacity and availability of space for waste disposal have diminished, leading to severe environmental and public health issues.

The inner-city streets of Johannesburg are increasingly marred by visible waste, a direct result of the city's landfills reaching their maximum capacity and significant amounts of waste not making it to landfills due to inefficiencies in the waste management system. This situation has exacerbated the challenge of maintaining clean and healthy urban spaces, as the

existing waste management infrastructure struggles to cope with the rapid increase in waste production.

This research aims to explore the relationship between formal and informal waste management systems, with a focus on empowering informal waste reclaimers, focusing how architecture can bring about a positive social and economic impact whilst tackling waste management problems faced by the city of Johannesburg.

The study emphasizes the role of waste management techniques that prioritize the empowerment of informal waste recyclers, a marginalized group of individuals who play a crucial yet often undervalued role in the city's waste management ecosystem. These informal recyclers, who operate throughout Johannesburg, are integral to the recycling process but frequently face challenges due to their informal status and lack of support.

The site for proposed research in Soweto, South Africa, a prominent area within Johannesburg, selected for its relevance to the informal recycling community and

the potential for impactful architectural intervention.

The creative component of this research involves translating the collected data into a defensible architectural proposal.

This proposal aims to integrate waste management solutions with community empowerment strategies, offering a practical and innovative approach to addressing the waste management crisis in Johannesburg. By bridging the gap between informal and formal recycling systems, the proposed design seeks to enhance the efficiency of waste management while improving the working conditions and status of informal recyclers.

Fig 02: Waste pickers pulling trolleys loaded with recyclable materials (Sibeko, S. 2020)

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01

CHAPTER

Problem statement : *Introduction*
: *Methodology*

INTRODUCTION

The concept of recycling is not a novel invention; it has been a part of human civilization since ancient times. From the Roman civilization, which repurposed bronze statues into new sculptures, to the present day, where recycling has permeated societal consciousness more in theory than in practice, the ebb and flow of recycling practices have responded to the environmental challenges of each era.

The 18th century Industrial Revolution marked a significant shift in society, necessitating a rapid adaptation to a new, fast-paced lifestyle driven by capitalism. The relentless pursuit of efficiency and mass production led to a consumerist culture, demanding extensive extraction of natural resources. This insatiable appetite for consumption resulted in severe environmental degradation, primarily through massive carbon emissions.

In August 1995, LIFE magazine published an article with the now-vaguely-sinister, then-celebratory title, "Throwaway Living." The idea, it seems, was that humans had entered a kind of wanton Golden Age, when cleaning up after ourselves was just one more quaint waste of time, and tossing more and more of our used-once items into the trash was another sign of modernity's relentless ascendancy over the drudgery of the past. (Cosgrove, B:2014) This mentality of disposability has significantly

contributed to the environmental crises we face today.

In recent decades, the rise of environmental movements in response to global warming has popularized the 3R's waste management strategy: Reduce, Reuse, Recycle. The hierarchy of the 3R's emphasizes that recycling should be a last resort, following reduction and reuse. Despite some skepticism regarding the efficacy of recycling, especially claims of it being a diversion tactic by big oil companies, it remains an essential practice in addressing today's environmental challenges.

While the waste crisis may not seem like a direct architectural problem, it is a global dilemma that can be mitigated through policy and design. Implementing policies that penalize companies for producing non-recyclable materials and rewarding environmentally conscious practices is crucial. Architecture also plays a vital role in this effort. By incorporating the principles of reduce, reuse, and recycle into building design, architecture can contribute to a more sustainable world and educate society about responsible waste management.

The pervasive "throwaway living" mentality reflects a broader issue in human behavior, where items of perceived lesser value are discarded without consideration. This attitude extends to the marginalized individuals in the

recycling industry, known as waste pickers, reclaimers, and trolley pushers. Often uneducated, unskilled, and driven by unemployment, these individuals play a crucial role in the recycling process yet remain unrecognized by authorities and formal industries.

This research aim's to design a recycling facility focused on the empowerment of informal waste reclaimers in Soweto, south Africa in order to bring about a positive social and economic impact whilst tackling waste management problems faced by the city of Johannesburg.

Theoretical Lense through which to view this research work will be constructed through a set of principles and ideas used by a contemporary Ghanaian artist named El Anatsui. These principles will be supplemented by the theory of circular economies, and Placemaking theory. All this is meant to aid in the development and conceptualization of the physical architectural makeup of this kind of place or building we're trying to reimagine.



Throwaway Living

DISPOSABLE ITEMS CUT DOWN HOUSEHOLD CHORE

Fig 03: A man, woman and child toss "disposable" items into the air (Stackpole.P .1955)



*Fig 04: A waste reclaimer in Johannesburg
(Sibeko, S. 2020)*

METHODOLOGY

1 Research Design

The research design for this study is both qualitative and quantitative, incorporating a mixed-methods approach to provide a comprehensive understanding of the waste management challenges faced by informal waste reclaimers and the potential architectural solutions. The qualitative aspect involves in-depth interviews, observations, and case studies to gather rich, detailed data on the experiences and perspectives of informal waste reclaimers, and stakeholders. The quantitative aspect includes structured questionnaires, surveys, and statistical analysis. Municipal data on waste issues to quantify the extent of waste management issues and the impact of potential interventions.

1.1 Data Collection Methods

Interviews and Questionnaires

Structured questionnaires will be distributed and In-depth interviews will be conducted with various stakeholders, including: Professionals in the waste management industry, NGOs and organizations working in waste management and recycling. These interviews aim to gather detailed insights into the challenges faced by informal waste reclaimers, the effectiveness of existing waste management systems, & the potential for architectural interventions.

Photographs

Photographic documentation will be utilized to capture the current state of the chosen project site and its surrounding buildings, providing a comprehensive understanding of the context. The data gathered through this method will inform relevant design decisions for the potential recycling hub in Soweto.

Literature Reviews

A comprehensive review of existing literature on waste management, informal recycling, and sustainable architecture will be conducted. This includes academic papers, policy documents, reports, and case studies. The literature review will help to contextualize the research within the broader body of knowledge and identify best practices and theoretical frameworks.

Case Studies

Several case studies of successful recycling hubs and waste management systems from around the world will be analyzed. These case studies will provide practical examples of how similar challenges have been addressed in other contexts and inform the design of the proposed recycling hub in Soweto.

1.2 Data Analysis Techniques

Qualitative Data Analysis

Qualitative data from interviews, and observations will be analyzed using thematic analysis.

Quantitative Data Analysis

Quantitative data from the city of Joburg statistic will be analyzed to inform decision making patterning to the project.

Mapping and Site Analysis

Geospatial analysis tools such as GIS (Geographic Information Systems) will be used to map waste generation and disposal patterns in Soweto. This includes identifying hotspots of waste accumulation and mapping the locations of informal recycling activities. Site analysis will involve assessing the physical and social characteristics of potential sites for the recycling hub, including accessibility, proximity to waste sources, and community needs.

1.3 Mapping and Site Analysis

GIS Mapping

GIS technology will be employed to create detailed maps of the site, including: Analyzing the accessibility of waste collection points and recycling facilities. Identifying local recycling facilities with the area. These maps will provide a spatial understanding of waste management challenges and inform the site selection for the recycling hub.

Site Analysis

Potential sites for the recycling hub will be as-

sessed based on various criteria, including:

Proximity to waste generation sources
Accessibility for informal waste reclaimers
Availability of space for recycling activities
Potential economic and tourist attraction of the site
Site visits and will be conducted to gather detailed information about each potential site, including physical conditions, infrastructure, and dynamics.

3.5 Ethical Considerations

Ethical considerations are paramount in conducting this research, the following ethical principles will be adhered to:

Informed Consent

All participants will be provided with detailed information about the research, including its purpose, methods, potential risks, and benefits. Informed consent will be obtained from all participants before data collection begins.

Confidentiality

The confidentiality of participants will be strictly maintained. Personal information will be anonymized, and data will be stored securely to prevent unauthorized access for the duration of the research and deleted afterwards.

Respect for Participants

02

CHAPTER

Reaserch Theory : *El Anatsui and Contemporary art*
: *Circular Economy*
: *Place making*

Theoretical outline

This research project is grounded in a hierarchy of interconnected theoretical frameworks that inform the design of a recycling facility aimed at bridging the gap between informal and formal waste management systems in South Africa. At the core of this investigation is the theory of circular economies, which serves as the primary lens through which the architectural intervention is conceived. Supplementing this are the works of El Anatsui and contemporary African art, which offer a unique perspective on the transformation of discarded materials into valuable resources. Finally, the theory of placemaking is employed to ensure that the design fosters inclusivity and community engagement, countering the exclusionary tendencies of hostile architecture.

By progressing through these three theories—from the broad systems thinking of the circular economy to the artistic and cultural lens of El Anatsui’s work, and finally to the socially-focused approach of placemaking—this research develops a comprehensive framework for addressing both the environmental and social challenges of waste management in South Africa through architectural intervention.

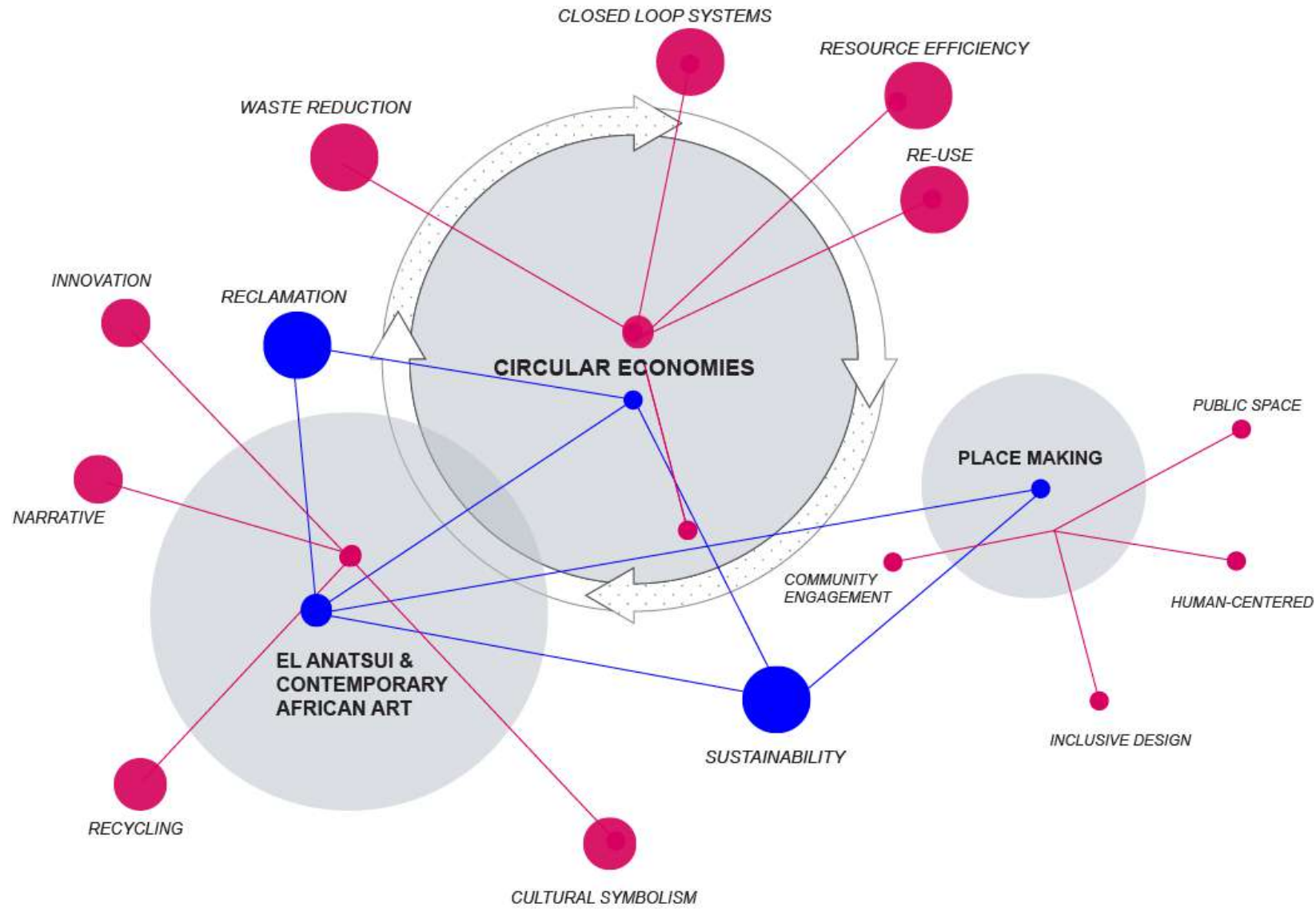
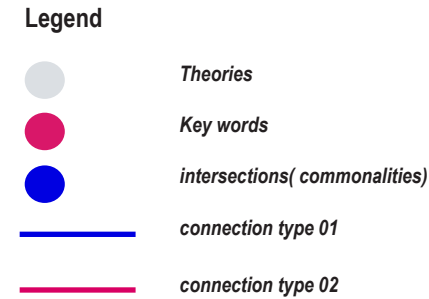


Fig 05: Nexus: Visual showing connections & hierarchy of theories(Author,2024))

CIRCULAR ECONOMIES

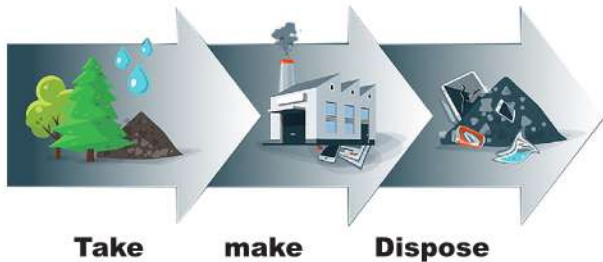


Fig 06: Linear Economy (Sphera.2020)

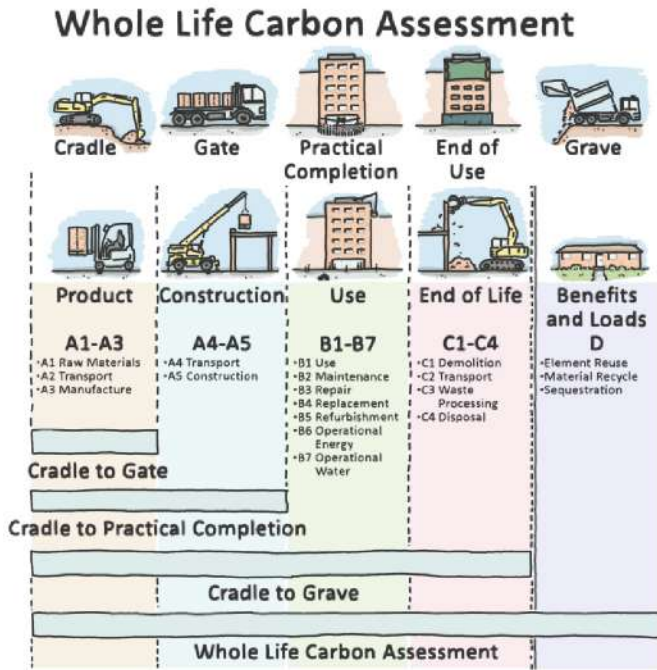


Fig 07:whole Life Carbon Assessment (Malik C.2020)

In the broader context of sustainability, waste management and recycling are essential components. However, the theory of the circular economy offers a more comprehensive framework. The built environment is largely shaped by a linear economy, where materials are extracted, used in construction, and ultimately discarded at the end of a building's life cycle. This approach treats buildings and materials as inseparable, with both often ending up in landfills once their functional purpose is fulfilled. This cycle of consumption and disposal contributes significantly to environmental degradation, as valuable resources are wasted. In contrast, the circular economy offers a solution, reimagining how materials can be repurposed and reintegrated into future building's life cycles.

For a recycling facility, this approach is vital, transforming waste into a resource and promoting sustainability in construction. This framework investigates how circular economy concepts might be implemented in architecture and construction, with a particular emphasis on developing a recycling facility and to provide a holistic approach to creating sustainable and resilient built environment

The theory of circular economy marks a significant shift away from the traditional linear model of **"take-make-dispose"** and toward a regenerative approach that emphasizes resource efficiency, waste minimization, and closed-loop

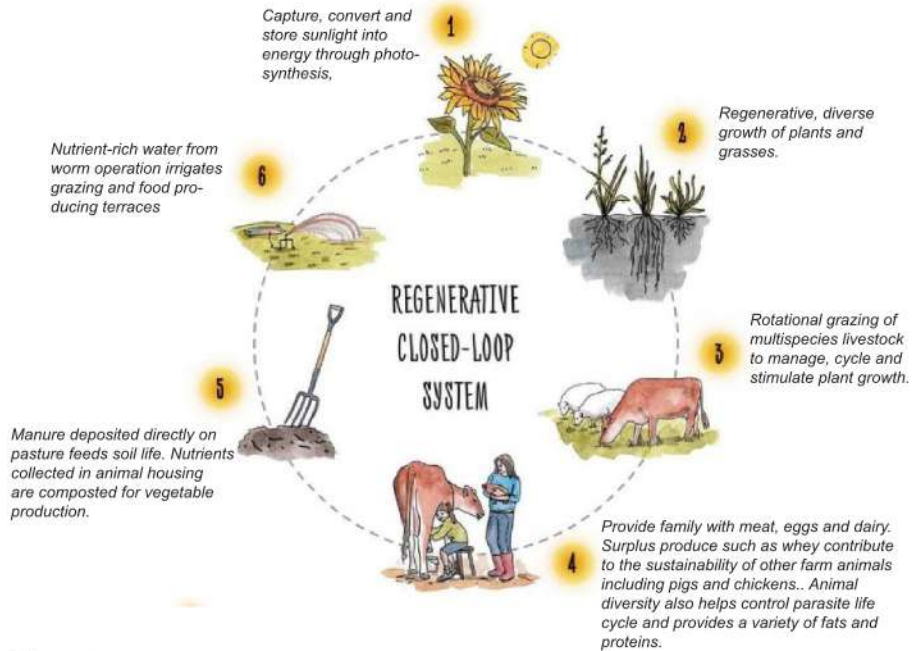


Fig 08: Closed loop systems source (Quinlan B. 2020)

systems. This approach is inspired by natural processes that transform waste into resources, & has significant implications for both architecture and the construction industry. The design and construction of buildings, including recycling facilities, can be made more sustainable, resilient, and resource-efficient by applying circular economy principles.

The theoretical underpinning behind the circular economy is deeply rooted in observations of natural systems. In nature, the concept of waste is virtually nonexistent; instead, waste from one organism becomes a resource for another. This natural process of resource regeneration has inspired human systems to adopt similar principles.

The theory of circular economy is influenced by various philosophical and economic ideas. One of the most notable contributions is the concept of “**Cradle to Cradle**,” introduced by William McDonough and Michael Braungart in their 2002 book of the same name. McDonough and Braungart advocate for a design philosophy where products are created with the end of their lifecycle in mind, ensuring that materials can be endlessly recycled or safely returned to the environment.

They argue that “waste is food,” emphasizing the idea that industrial processes should mimic natural cycles of regeneration.

“The laws of nature are the same whether they apply to living things or to the objects we make”_ Linus Pauling

The formal adoption and promotion of circular economy principles gained momentum with the establishment of the Ellen MacArthur Foundation in 2010. The foundation has played a crucial role in advancing circular economy thinking through research, case studies, and collaborative projects.

The European Union has also incorporated circular economy principles into its policies, with the Circular Economy Action Plan adopted in 2015. This plan outlines strategies for transitioning to a circular economy, including measures to promote recycling, waste reduction, and sustainable product design. The European Commission asserts that “implementing circu-

lar economy principles could reduce the EU’s greenhouse gas emissions by up to 56 percent by 2050”. This policy framework underscores the growing recognition of circular economy principles in addressing environmental challenges.

The theoretical framework of the circular economy is informed by three main key concepts which are:

- 01: designing out waste, and pollution.
- 02: keeping products and materials in use.
- 03: lastly regenerative natural systems.

Recycling facilities are a critical application area for circular economy principles due

Cradle to Gate Embodied Carbon A1 - A3

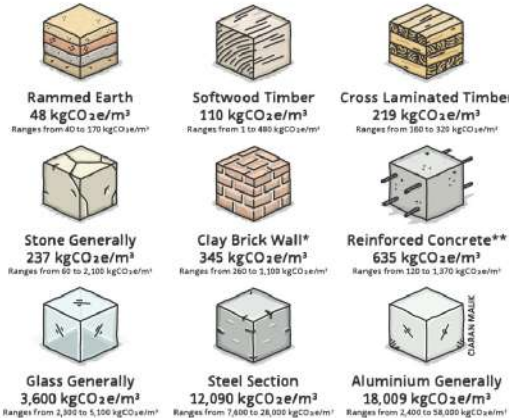


Fig 09: Cradle to Gate embodied carbon (Malik C. 2020)

to their role in managing waste and promoting resource recovery.

Designing such facilities with circular economy principles in mind can enhance their effectiveness and sustainability:

Principle 01: Designing Out Waste and Pollution:

The primary concept of the circular economy is to eliminate waste and pollution through well thought out design and creative methods. This requires a fundamental rethinking of how products are designed, produced, and circulated. Waste may be considerably minimized by creating items and systems that are durable, repairable, and recyclable.

Furthermore, using non-toxic and renewable materials helps reduce pollution and improve environmental health. According to the Ellen MacArthur Foundation, “80 percent of environmental impacts are determined at the design stage,” underscoring the importance of incorporating sustainability from the outset. This principle is very much relevant and applicable in architecture & construction in many ways including.

-Sustainable Design and Planning:
Architects can incorporate sustainable design ideas as early as the planning stage. This includes utilizing digital tools such as Building In-

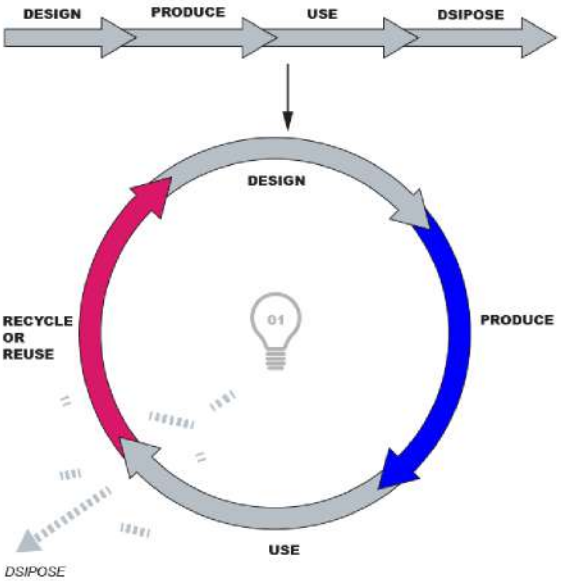


Fig 10: Principle 01: designing out waste (Author, 2024)

formation Modeling (BIM) to optimize material usage and reduce waste. BIM enables exact material estimation and efficient construction operations, minimizing excess and offcuts. Recycling facilities should be designed to maximize the recovery and processing of materials. This involves creating efficient sorting and processing systems that minimize contamination and waste.

- **Material Selection:** Using environmentally friendly and non-toxic materials helps to prevent pollution. Low-VOC paints, adhesives, and finishes, for example, can improve indoor air quality while lowering dangerous emissions. Furthermore, using products that are sustainably sourced or repurposed might help to reduce the environmental impact.

- **Construction Techniques:** Innovative construction methods, such as prefabrication and modular construction, can significantly reduce waste. These techniques allow for components to be manufactured in controlled environments, where waste can be better managed and minimized.

Prefabricated elements can be designed to fit together precisely, reducing material waste on-site. Recycling facilities can benefit from modular and adaptive designs that allow for future expansion and reconfiguration. This flexibility ensures that facilities can adapt to changing

waste streams and technological advancements, aligning with the circular economy's focus on long-term utility and adaptability.

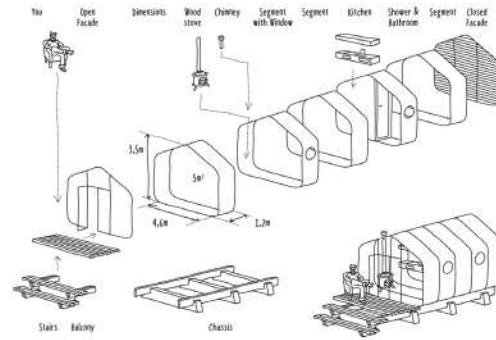


Fig 11: Principle 02: Modular design, that easy to dismantle for relocation or material repurposing .(Fiction factory,2018)

Principle 02:

Keeping Products and Materials in Use:

This principle focuses on extending the life-cycle of products and materials through reuse, repair, and refurbishment. In the built environment, it can be applied in various ways:

- Design for Disassembly:** this means that a building's components can be simply sepa-

rated and reused when they reach the end of their useful life. This technique ensures that materials and elements are reused for as long as possible rather than being disposed of. For example, utilizing mechanical fasteners rather than glue can facilitate easier disassembly.

- Adaptive Reuse:** Repurposing existing buildings for new uses is a key strategy for keeping materials in use. Instead of demolishing old structures, they can be renovated and adapted to serve new functions. This not only preserves the embodied energy of the original construction but also reduces the demand for new materials. Adaptive reuse projects, such as converting old factories into residential lofts or office spaces, exemplify this approach

- Material Passports:** Implementing material passports, which document the materials used in a building and their potential for reuse, can support circularity. These digital records help track the lifecycle of materials, making it easier to recover and reuse them in future projects. Material passports facilitate the identification and extraction of valuable materials during renovations or demolitions.

Building Life Strategies

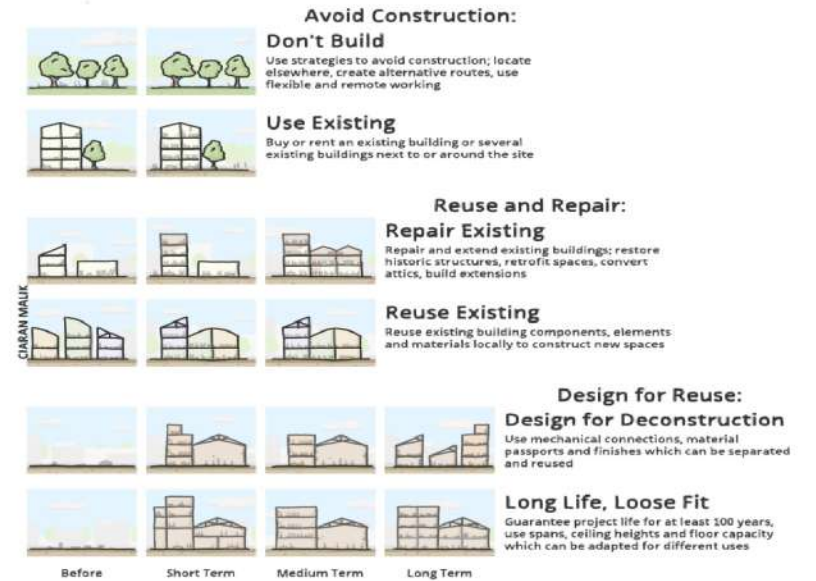


Fig 12: Building Life Cycle Strategies (Malik C.2020)

Construction Cycle and Waste

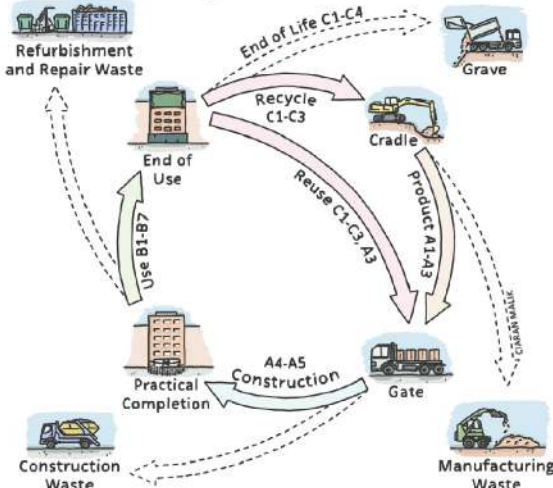


Fig 13: Construction Cycle & waste
(Malik C.2020)

Principle 03:

Regenerating Natural Systems:

Regenerating natural systems involves restoring and enhancing the environment through the built environment. This principle can be implemented through the following methods

-Green Building Practices: Green building approaches, such as green roofs, living walls, and rainwater collection systems, can assist restore natural systems. These characteristics not only enhance the building's environmental performance, but also benefit biodiversity and the local ecosystem.

Green roofs, for example, provide habitat for wildlife while also reducing urban heat island effects and improving air quality.

-Biophilic Design: Integrating biophilic design elements that connect building occupants to nature can improve well-being and raise environmental awareness. Natural lighting, indoor plants, and water features can all help to create healthier indoor settings while also fostering a stronger connection to nature. Biophilic design has been found to increase mental health and productivity while instilling a feeling of environmental responsibility.

-Net Positive Impact: Designing buildings with a net positive environmental impact entails more than just preventing harm; it also includes actively enhancing the ecosystem. This can include measures like regenerative landscapes, which rehabilitate degraded land while also

supporting biodiversity, and energy-positive buildings, which generate more energy than they consume. For example, the Bullitt Center in Seattle is meant to be energy-positive, producing more electricity from solar panels than it consumes each year. Incorporating renewable energy sources into the building systems that minimize contamination and waste.

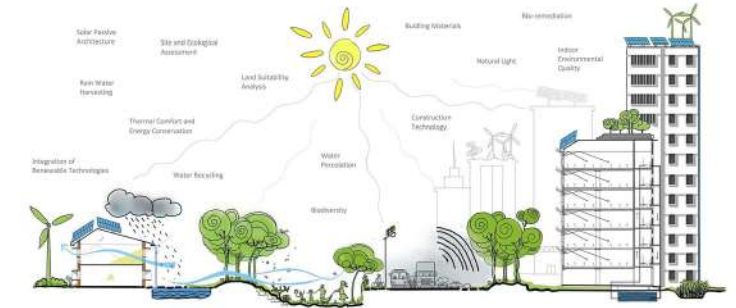


Fig 14: Regenerative design: Building that harnesses natural systems while adding a positive impact to environment
(Malik C.2020)



Fig 15: Art Installation made out of recycled materials titled " Stress world) (El Anatsui,2012)

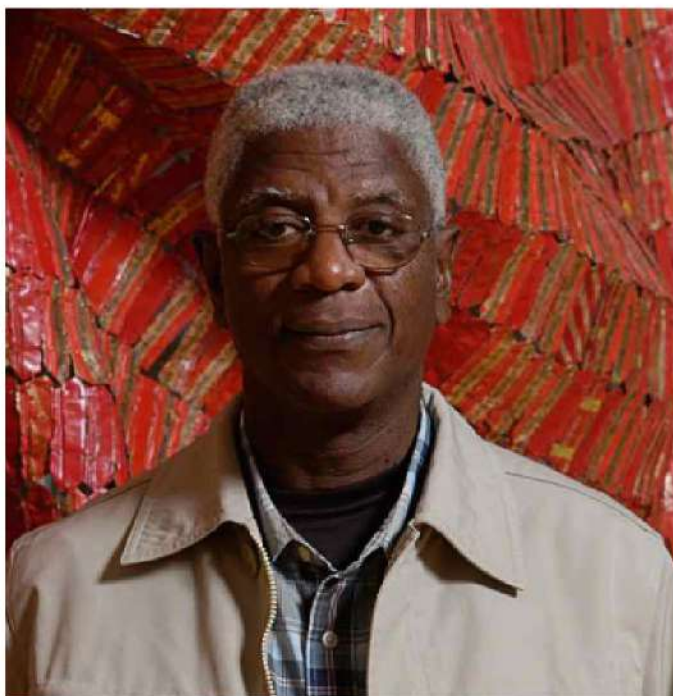


Fig 16: El Anatsui
(Gyre Magazine, 2012)

This theoretical framework investigates the innovative and sustainable ways that El Anatsui's art-making ideas and techniques could be incorporated into architectural design. In a way that benefits the architectural profession and is in line with environmental stewardship principles, we can learn from his techniques as well as those of other contemporary African artists.

EL ANATSUI & CONTEMPORARY ART

Who is El Anatsui?

Born on February 4th, 1944 in the Ewe town of Anyako, Ghana as the youngest of the thirty-two children in his family. El Anatsui is a world renowned artist known for his material innovation and processes in the making of his art. He is a prominent figure in contemporary African art, his work goes beyond cultural and artistic boundaries. Anatsui's practice and philosophy is deeply rooted in African traditions and his awareness of the global environment. His work often explores history, memory and time, he believes art can tell complex stories and evoke deep emotions.

Anatsui's early education in Ghana and his academic and professional career in Nigeria gave him a rich cultural foundation. He studied at the University of Science and Technology in Kumasi, Ghana under a British educational model which continued following Ghana's independence in 1957. After receiving his bachelor's degree in 1968, Anatsui pursued a post-graduate diploma in arts education and shortly after graduation got his first teaching position. A pivotal moment in his career occurred after he was appointed as a professor at the University of Nigeria, Nsukka.

During this time, he started experimenting with

incorporating writing, other languages, and Ghanaian art techniques into his works. Since he did not have the same access to wood and carvers as he did in Ghana, He started working with clay, a material that was readily available and held cultural meaning for him. His teaching and practice are one and the same, both are about exploring African aesthetics and philosophies demonstrating how discarded objects can be reimagined and given new life.

Throughout his career Anatsui has received many awards and his work has been shown in major international institutions including the Venice Biennale and the Metropolitan Museum of Art. His ability to merge traditional African art forms with contemporary art practices has made him a celebrated artist and a voice in the global art world.

Principles and Philosophy

"As a sculpture I first decided that whatever I do, I have to work with the medium found in my immediate environment" _El Anatsui

In his work the artist argues for context specific use of materials. "Art grows out of each particular situation, and I believe artists are better off working with whatever their environment throws up. I think that's what has been



Fig 16: El Anatsui sculpting
(Taylor L, no date)

happening in Africa for a long time, in fact not only in Africa but the whole world, except that maybe in the west they might have developed these 'professional' materials. But I don't think that working with such prescribed materials would be very interesting to me-industrially produced colors for painting. I believe that color is inherent in everything, and it's possible to get color from around you, and that you're better off picking something which relates to your circumstances and your environment than going to buy a ready-made color. It's like someone, a stranger is trying to tell you what to do,

rather than you decide what to do with what circumstances have made available to you.” El Anatsui. (Fortin, Sueli:2012)

Architecture and Art

Similar to vernacular architecture, the idea that the buildings should evolve and arise completely out of their immediate geographic and cultural context. Anatsui has the same belief and approach to the making of his art, the difference is that he stretches the approach a step further by questioning and reading deep into the properties and qualities of the materials in order to represent abstract ideas and to give meaning and new life forms to the materials.

This philosophy can inform architectural practices, encouraging the use of recycled materials in construction. By understanding the properties and histories of discarded materials, architects can create buildings that are not only environmentally sustainable but also culturally meaningful. El Anatsui’s inventive use of repurposed materials has fundamentally changed the conversation about modernity, value, and cultural identity. His expansive works, which are made from leftover aluminum scraps and bottle caps, subvert preconceived ideas about success and beauty while providing a singular viewpoint on how African art interacts with mo-

ernity.

Anatsui’s work transforms what is often considered waste into striking, intricate compositions. By repurposing materials that are typically overlooked, he redefines their value and aesthetic potential. His installations, such as those exhibited at the Royal Ontario Museum, feature thousands of recycled bottle caps meticulously assembled into shimmering, fluid forms that evoke both beauty and complexity. This transformation of discarded objects into high art challenges the prevailing belief that only pristine or high-tech materials can achieve artistic and cultural significance. Anatsui’s approach illustrates that worth can be found in materials that society might otherwise deem insignificant or discarded.

Although Anatsui’s work is transformational, some critics would contend that by using recycled materials, he perpetuates the idea that African art is intrinsically poor rather than adhering to Western definitions of modernity, which include high-tech or opulent materials. According to this criticism, Anatsui’s emphasis on recycled materials could be interpreted as a sign of underdevelopment or financial hardship. This viewpoint, however, ignores the inventive and elevating facets of Anatsui’s work. His work investigates and enhances the aesthetic and cultural potential of recycled materials rather than using them solely to make a state-

ment about their scarcity. In doing so, Anatsui rewrites the story about recycled materials and shows how they may become emblems of originality and rich cultural heritage.

Expanding on this point, the same could be said that building with recycled materials can be controversial, particularly in communities where there is a stigma attached to such materials considered as waste. Some people might be resistant to the use of recycled materials in construction, perceiving it to be inferior or even demeaning to think of building facilities for marginalized communities out of garbage.

They may see such practices as perpetuating a form of symbolic or actual neglect, where the aesthetic and functional quality of the built environment reflects the socio-economic status of its inhabitants. This critique can be particularly poignant in places like Soweto, where historical injustices have already contributed to disparities in living conditions. Addressing these perceptions requires a nuanced approach that emphasizes the value and potential of recycled materials. The use of recycled materials in construction is an innovative and sustainable practice. According to the U.S. Environmental Protection Agency (EPA), recycling construction and demolition debris can significantly reduce environmental impacts by conserving natural resources and reducing landfill waste. This approach reflects a commitment to sus-



Fig 17: El Anatsui sculpture “untitled-broken pot series (Anatsui E, 1980)

tainable development and should be seen as a positive advancement rather than something demeaning (EPA 2021).

Looking at Anatsui's work, the quality of his finished products is exponentially greater in value than that of the discarded materials when he first found them. Similarly, building out of recycled materials should not automatically translate to poor- or low-quality architecture. The quality and value lie in how the materials are transformed. It is also important to emphasize that recycled materials can be of high quality and aesthetic value when used thoughtfully.

This principle can be applied to architecture, where buildings made from recycled materials can serve as symbols of innovation, sustainability and demonstrate the ability of marginalized communities to adapt. The use of recycling materials in construction has been a well-documented global trend. Architect Shigeru Ban has become well-known for his work creating disaster relief shelters and decent homes using recycled materials. This method is part of a larger movement in sustainable building that crosses regional boundaries. The narrative around recycled materials should focus on their transformative potential. According to design critic Alice Rawsthorn, the creative use of recycled materials can challenge traditional notions of aesthetics and utility, demonstrating their value as symbols of progress and creativ-

ity. By highlighting these aspects, recycled materials can be redefined as emblems of innovation and cultural evolution (Rawsthorn 2013).

Anatsui's approach also serves as a commentary on broader issues of consumption, waste, and environmental sustainability. His work addresses the impact of materialism and waste on the environment, offering a critique of contemporary consumer culture. By integrating discarded materials into his art, Anatsui highlights the environmental consequences of material excess and encourages a more sustainable perspective. This environmental consciousness adds another layer of value to his work, aligning with global discussions about sustainability and reinforcing the relevance of his art in contemporary debates.

Moreover, Anatsui's global recognition and success challenge the notion that recycled materials are inherently less prestigious. His participation in major international exhibitions, such as the Venice Biennale, and his work in prominent collections, including the Museum of Modern Art, underscore the fact that innovative use of materials can achieve high artistic standards and be celebrated on the global stage. Anatsui's acclaim demonstrates that contemporary African art, even when utilizing materials associated with waste, can redefine global standards of achievement and modernity. His success highlights the ability of African

artists to challenge and expand the boundaries of artistic practice and recognition.

In one Interview, when Anatsui was asked why he often times makes use of previously used materials in his art and the importance of this history? he replied "When something has been used, there is a certain charge, a certain energy, that has to do with the people who have touched it and used it and sometimes abused it. This helps to direct what one is doing, and also to root what one is doing in the environment and the culture." (Buck, Louisa:2023). In the realm of art, the use of reclaimed materials serves as a powerful statement on both creativity and sustainability.

Artists who work with discarded objects often do so to highlight themes of transformation, resilience, and the interconnectedness of human experience. By repurposing materials, they create works that tell stories of past lives and histories, thus imbuing the artwork with layers of meaning.

Anatsui's mental model when it comes to working with materials and producing impactful objects (art or architecture). The choice of materials used in the making of the object is very imperative. An already established connection between the familiar material and the

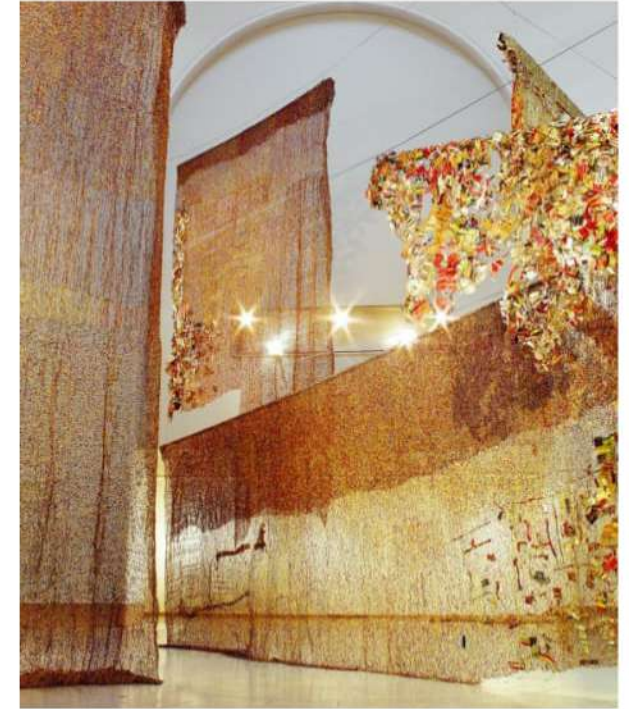


Fig 19: Gli (Wall), Aluminum and copper wire, installation (Brooklyn Museum, 2010)

viewer helps creates a significant impact when material is transformed and used creatively beyond their normal everyday use. The idea of re-use in art involves transforming existing materials into something new and valuable. This concept is particularly relevant in architecture, where buildings can be designed with sustainability in mind. Anatsui's work demonstrates how discarded objects can be reimagined and given new life, a principle that can be applied to architectural design.

For the purpose of this research, in our case this framework can help us draw a parallel between our subject (user: in this case trolley pushers) and the object (recyclable materials). We can try to look for similarities between our user, "trolley pusher" and the materials they often times collect for recycling purposes. So little is known about the life of the trolley pushers, they are often times found living on the outskirts of the city, sometime in the landfills away from society. Just like discarded materials

in landfills they are concealed away from the eyes of society because no one sees value or use in them due to them being uneducated and most likely unemployable in the formal sector. This idea can inform the physical expression of this proposed architecture intervention, perhaps it could embody the energy of these materials that has passed through the hands of the trolley pushers on a daily basis to create meaning and impact due to the inherent connection they already have with these materials. In a broader sense, this proposed architectural intervention could be thought of as a place of transformation, that embodies the idea of rebirth and renewal. Both the man (trolley pusher) and the materials (recyclables) are being renewed and given a new life.



Fig 20: Close-up view of Art installations showing the intertwining of bottle caps recycled (jakobvongunten , 2007)



Fig 21: Unti-homeless staircase
(COMPLETEANARCHY,2018)

PLACE MAKING

How can architecture create a sense of community & belonging in the public realm?

"Architecture must be in the service of dignity and always in defense of human rights. Human rights and dignity, on the other hand, need architecture to make themselves present in life. But this equation doesn't always work like this." _ (Father Júlio Lancellotti)

There's a place for aesthetics and ornamentation in architecture, it's only quite problematic when architecture becomes all about the image and nothing else beyond. This leaves the architecture as an object in the landscape that alienates its users from it. The role of architecture is to shape society and foster a sense of community. This cannot be achieved when architecture (the built form) is viewed in isolation as the supreme maker of society. It can only be achieved by enhancing the public realm that it sits in. Therefore the public aspect of architecture becomes very essential for place making. It's quite unfortunate that these ideas and principles are often forgotten and put aside by architects in favor of the Authorities/developers due to capitalistic agendas.

A new trend has been emerging in the more recent years due to urbanization and growth of cities across the globe, as authorities and stakeholders try to control the different spaces and manage their own properties. A new form of

architecture was born, "Hostile- architecture".

Hostile – Architecture refers to design elements intentionally incorporated into public space to control or restrict certain activities, often times targeting marginalized populations like the homeless. This is another form of thinking that gave birth to apartheid in the context of south Africa. In both scenarios design is used as a tool of destruction than in services of the society at large.

Apartheid manifests spatially by uprooting of marginalized group of individuals from any desired spaces and separating them spatially from those spaces as well as from other groups of people in society. On the other hand, hostile architecture manifests itself as an active aggressor in the public realm, creating uncountable spaces to control the behavior/ prevent any form of appropriation of these spaces by the targeted group of individuals.

Hostile architecture creates uncomfortable spaces that one has to overcome to get to where they want to be, This deteriorates the quality of our public spaces because they end up not being appealing nor welcoming to either the general public or the targeted group.

According to projects for public space "placemaking refers to a collaborative process by

which we can shape our public realm in order to maximize shared value. More than just promoting better urban design, placemaking facilitates creative patterns of use, paying particular attention to the physical, cultural, and social identities that define a place and support its ongoing evolution". The term emerged in the 1960s and 1970s from the fields of urban planning and community development, emphasizing the transformation of public spaces to strengthen connections between people and places, fostering community engagement, well-being, and social cohesion. A significant distinction between hostile architecture and placemaking lies in their approach to inclusion and social/community-centeredness.



Fig 22: Design against humanity
(National Coalition for the HomelessY,no date)

Placemaking prioritizes inclusivity and does not favor one group over another."Placemaking is guided by several core principles

Community Engagement:

Effective placemaking involves the community in the design and planning process to ensure the spaces meet their needs and desires. This fosters a sense of ownership and pride among residents. According to PPS, "Placemaking begins at the smallest scale. Placemaking is not a new profession or discipline. It is a collaborative approach to the planning, design, and management of public spaces" (PPS 2023).

Human-Centered Design:

Placemaking prioritizes the human experience, focusing on creating spaces that are accessible, comfortable, and enjoyable for people of all ages and backgrounds. This concept is echoed in Whyte's work, where he emphasizes, "The street is the river of life of the city. The place where we come together, the pathway to the center" (Whyte 1980, 23).

Sociability:

Successful public spaces encourage social interactions and activities, helping to build a sense of community and belonging. Jacobs notes, "The trust of a city street is formed over

time from many, many little public sidewalk contacts" (Jacobs 1961, 56).

Multi-Use Spaces:

Placemaking promotes the creation of spaces that can serve multiple purposes and be used by a diverse range of people throughout the day and year. PPS states, "The more activities that are going on and that people have an opportunity to participate in, the more successful a public space will be" (PPS 2023).

Local Identity:

Placemaking respects and reflects the unique cultural, historical, and social characteristics of the community, fostering a sense of place and identity. As Jacobs put it, "A city's vitality

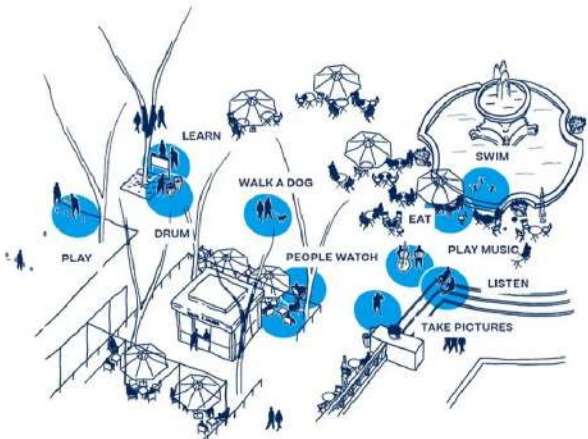


Fig 24: Diagram showing layers of thing to do at a place (Projects for public space ,2022)

What Makes a Great Place?

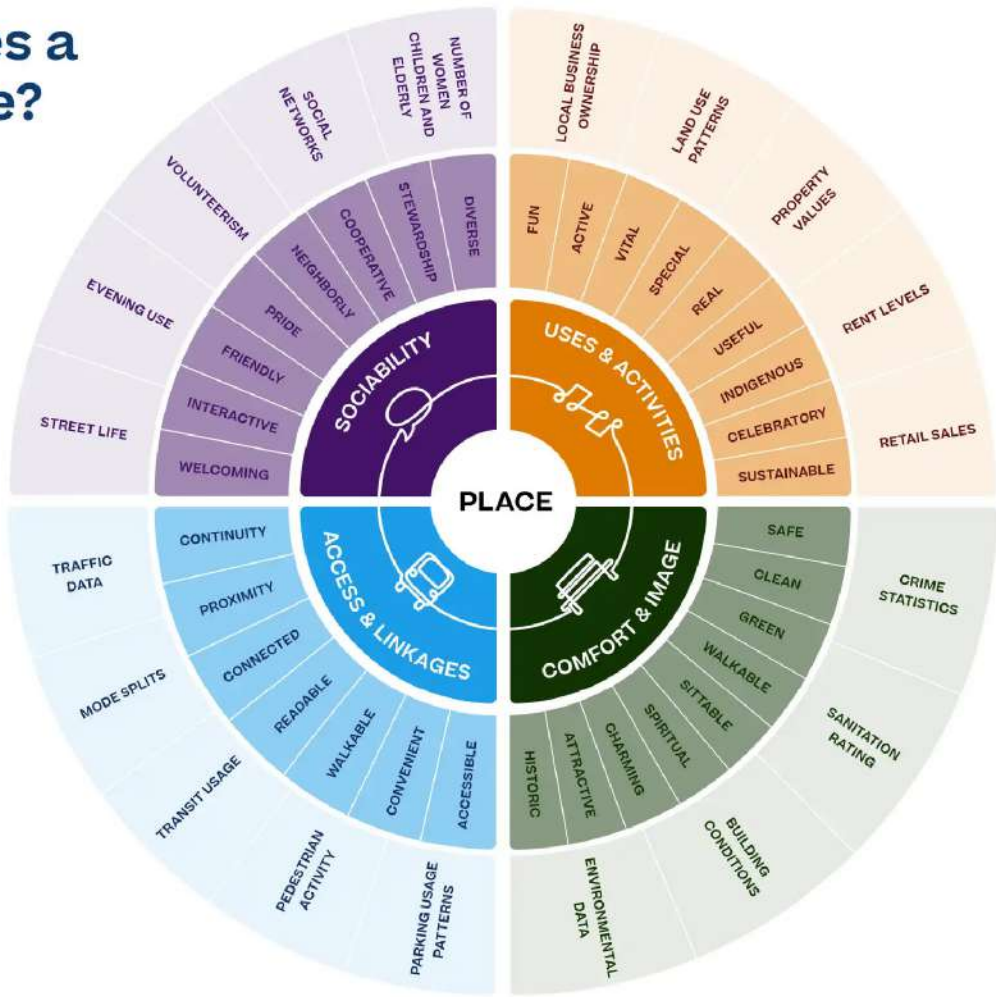


Fig 24: Diagram showing key attributes to provide a comprehensive assessment of a place (Projects for public space ,2022)



Fig 25: Waste scattered at the Robinsons landfill (Mgwenya A ,2023)

03

CHAPTER

Research : *Waste management*
 : *History of waste management*
 : *Waste economy*
 : *Waste reclaimers*



Fig 26: Wate Reclaimers in a Land fill
(Otieno,B. 2022)



Fig 27: landfill Truck (Elliot C,2023)

WASTE MANAGEMENT

CITY OF JOHANNESBURG

The City of Johannesburg (CoJ), where socioeconomic level profiles are changing, it's South Africa's economic hub with the greatest industrial and population density. The steady increase of population In Johannesburg can be attributed to various factors, including urbanization and the migration of people from nearby provinces. Johannesburg generates tons of waste, both municipal (general) & hazardous wastes.

According to research conducted by the Association of Water and rural development in 2019. They found that, "every single person (in South Africa) generates up to 2,5 kilograms of waste per day, depending on his or her level of income." The CoJ collects approximately 6000 tons of waste every single day. (Ngwenya, 2023).

Landfills are a common waste management strategy that the city of Johannesburg relies on. The City of Johannesburg had six landfills until recently; two of them have already surpassed capacity, leaving just four in operation. Based on the city's current Municipal waste generation, each landfill has a maximum lifespan of two to three years remaining. In January 2001, the city of Johannesburg founded Pikitup (pty) to provide waste management services on behalf of the City of Johannesburg.

Informal sector & waste reclaimers

An important part of South Africa's waste management environment is the informal waste management sector. Although it's not officially recognized, it makes an enormous difference in recycling and environmental sustainability. This section investigates the history, roles, difficulties, and contributions of South Africa's informal waste industry.

The contributions of the informal sector extend beyond material recovery. By diverting waste from landfills, waste pickers help reduce the environmental impact of waste disposal. Their activities also provide economic benefits to many low-income households. As noted by Dlamini and Nkosi (2020), "The informal waste sector provides crucial livelihoods for thousands of South Africans who might otherwise face severe economic hardship.

Over several decades, South Africa's informal waste management industry has changed, reflecting broader socioeconomic shifts. In the past, local municipalities in South Africa were mostly in charge of Waste management, with an emphasis on waste collection and disposal. However, during the post-apartheid era, with increasing urbanization and socio-economic disparities, an informal sector emerged to fill

the void left by the formal waste management systems.

Informal waste pickers, often referred to as "waste reclaimers," began to operate independently of municipal systems, scavenging recyclable materials from waste streams and landfills. Despite this sector being uncontrolled, it grew to be a vital part of South Africa's waste management system. "

HISTORY OF WASTE MANAGEMENT

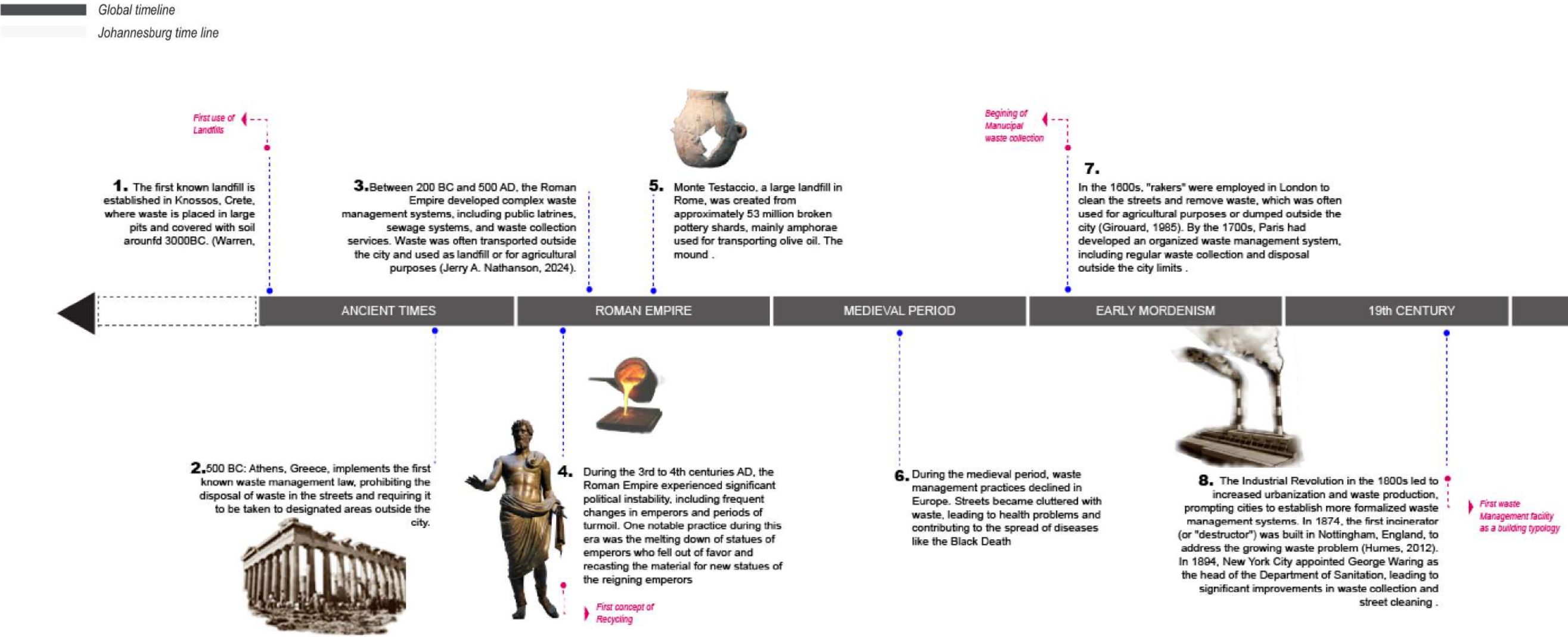


Fig 28: Waste Management history (Author,2024)

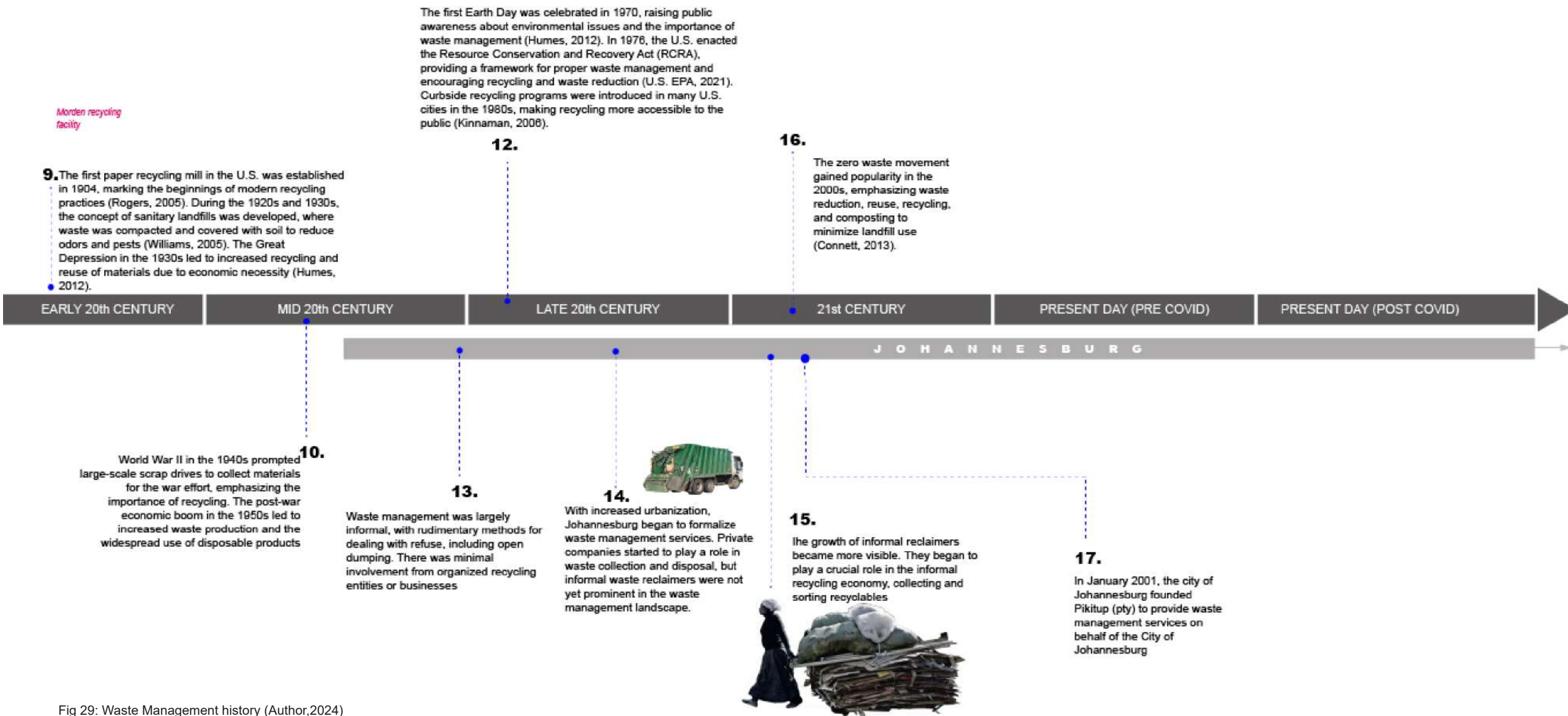


Fig 29: Waste Management history (Author,2024)

WASTE MANAGEMENT VALUE CHAIN

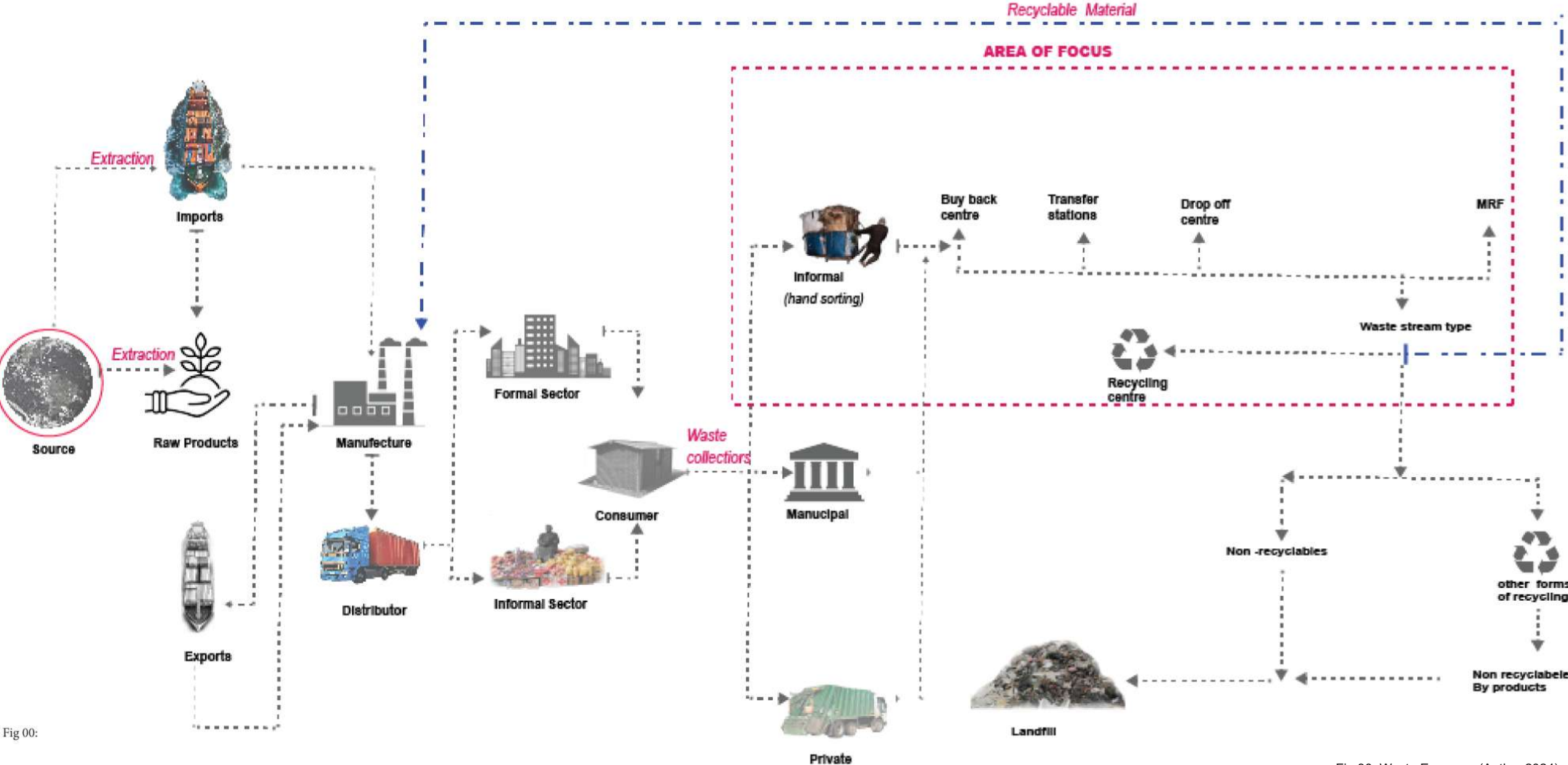


Fig 00:

Fig 30: Waste Economy (Author,2024)

WHO ARE INFORMAL WASTE RECLAIMERS?

Informal waste reclaimers"—are individuals who collect and sort recyclable materials from waste streams, landfills, and public spaces. These workers operate outside of the formal waste management system and are crucial in managing and recycling a significant portion of the city's waste. Here's a detailed look at who they are and their role in Johannesburg:

Profile of Informal Waste Pickers

- **Demographics:** Informal waste pickers in Johannesburg come from a variety of socio-economic backgrounds, often representing marginalized communities. Many are low-income individuals who rely on waste picking as their primary source of income. While most are adults, some children may also be involved, although child labor laws and physical demands limit this group (Meyer, 2021).

- **Occupation:** Waste pickers operate independently or in small groups, collecting recyclables such as paper, plastic, glass, and metal from waste streams and landfills. They sort and clean these materials to prepare them for sale, significantly contributing to the recycling process (Smith, 2020).

- **Economic Role:** The informal sector's recycling efforts help reduce municipal waste management costs and support environmental sustainability. Informal waste pickers also

contribute to the local economy by providing affordable recyclables to businesses and recycling centers (Ngcobo, 2019).

- **Social Dynamics:** Despite their vital role, informal waste pickers face harsh working conditions, including exposure to hazardous materials and a lack of social protections. They often work without legal recognition or support from municipal authorities (Dlamini, 2021).

Challenges Faced by Informal Waste Pickers

- **Health and Safety:** Informal waste pickers face significant health risks, including exposure to toxic substances and injuries from sharp objects. Limited access to medical care exacerbates these risks (Human Sciences Research Council, 2021).

- **Legal and Social Recognition:** Waste pickers often lack formal recognition, leading to a lack of legal protections and benefits. This informal status means they do not receive the same support as formal workers (Nkwanyana, 2019).

- **Economic Instability:** Income from waste picking is unstable, varying with the quantity and quality of recyclables collected. This economic uncertainty affects the livelihoods of waste pickers (Meyer, 2021).

- **Integration with Formal Systems:** The relationship between informal waste pickers and municipal waste management systems can be

tense. Issues include competition over waste and lack of coordination, leading to inefficiencies (Ngcobo, 2019).

Several efforts have been made by the government and different organizations to provide support for informal waste reclaimers. These includes:

- **Waste Picker Integration Programs:** The Johannesburg Waste Pickers Integration Program (JWIP) aims to integrate informal waste pickers into the formal waste management system. This program provides training, resources, and improved working conditions (City of Johannesburg, 2021).

- **Advocacy and Support Organizations:** Organizations such as the South African Waste Pickers Association (SAWPA) advocate for the rights and recognition of waste pickers. They work to improve working conditions and facilitate better integration with formal systems (SAWPA, 2022).

- **Municipal Initiatives:** The City of Johannesburg has initiated pilot projects to engage with informal waste pickers, focusing on formalizing their roles and improving their working conditions. However, the success of these initiatives varies (City of Johannesburg, 2021).



Fig 31: Female waste reclaimer pushing trolley (Moeti K, 2021)

WASTE RECLAIMER (STORY TIME)



Box 3 – A typical day of a male street waste picker

My name is Tshepo and I work as a reclaimer in the City of Johannesburg. I am 34 years old and have been doing this work for the last six years. I used to work in mines as a casual worker, but I lost my job when the mine started retrenching. I have a 5 year old daughter who I need to support and there are no jobs out there, so I decided to become a reclaimer after I saw others doing this.

I usually start work at three am in the morning. I pull my trolley from Booyens and work in a different wealthy northern suburb each day of the week. On Thursdays and Fridays I work in Sunninghill, which is more than 29 km away. It takes me two and a half to three hours to get there. It is very dark when we start and we usually travel as a group to where we need to work in order to protect ourselves from criminals. I pull the trolley and at times run so that I can get there in time. Some residents put their bins out the night before, so we start working on those. However, usually we wait for domestic workers to arrive at different homes and start when they take out the bins. We also have to look out for private security because in some streets they do not allow us to collect materials. We are often threatened with arrest and some of us have been assaulted. We sometimes pay security guards to allow us to collect from a few bins before residents report us.

I go through bins to collect clean materials for a few hours until the Pikitup waste collection truck arrives at around 10h00 or when we are chased away by security guards. I usually take a break and buy something to eat and then start the long journey home. On a good day I can collect up to 200 kg of material that I have to haul back. The return journey is longer than the one to Sunninghill because of the routes I take to avoid traffic and the challenge of climbing hills with such a heavy load. At times I can save time and preserve my energy by surfing down hills on my trolley. It takes me around five hours to get back to the area where I sort and store my materials together with other reclaimers. Once I get back around 5pm, I start sorting through what I collected by separating the various grades of materials. I usually finish work by 6pm, wash, cook my supper and then I am asleep by 7pm.

Challenges Faced

Long, exhausting commutes: Commutes up to three hours to work and five hours to return while hauling heavy materials.

Long working hours: Starts work at 3 AM and finishes sorting materials around 6 PM.

Physical strain: Pulls a heavy trolley over long distances, sometimes up to 29 km, and works for several hours collecting materials.

Safety concerns: threats from criminals and travels in groups for protection.

Harassment: Often threatened by private security and sometimes assaulted; pays bribes to avoid being chased away.

Difficult working conditions: Works in darkness, avoids heavy traffic, and deals with exhaustion from pulling a 200 kg load.

33: Dpiction of tshepo and his friends (Author,2024)



Fig 32: Tshepo' s story from the Waste picker integration guideline for South Africa:
(Department of Environment, Forestry and Fisheries and Department of Science and Innovation,2024)

WASTE RECLAIMER (STORY TIME)



Box 4 – A typical day of a female landfill waste picker

My name is Thabisile and I work at a landfill site in KwaZulu Natal. I am 60 years old with three children and have been doing this work since 1992. At first it was very hard to work at the dump – it stank and I didn't want to touch the garbage. But I needed the work so I got used to it. Two of my children are in tertiary colleges and this work has sustained my family all this time. I also support my granddaughter who lives with me.

I take taxis like everyone else who is going to work. I leave my house at 06h30 in the morning and arrive at the landfill by 07h00. I arrive at the place where I store my materials, change into my work clothes and carefully store away my street clothes to change into at the end of the day. Trucks start arriving at the landfill from 07h30. Trucks are directed to tip at a certain area and once a few have done so, we go over to that area and start working. I move as quickly as I can to sift through the waste to find good quality materials. The young men always get the more valuable materials first, so I usually take white paper, cardboard, PET bottles, and milk containers. I put all the materials I collected into a sack and then go back to search for more.

I usually stop at noon to buy a freshly cooked meal from one of the eating places opened by some of my fellow workers and community members. After a 20 minute break I get back to work. When I have collected enough material or the time is getting late, I take my materials to my sorting space at the bottom of the hill and divide them into categories based on what buyers will purchase together. We mostly sell our materials on Fridays to buyers who have stalls at the landfill.

My day finishes at 16h00 when I change back to my regular clothes. I clean up the best that I can before I take a taxi home and start caring for my granddaughter, helping her with homework, cooking a meal, putting her to bed, cleaning the house, and finally go to sleep.



Photo Credit: Melanie Samson

Challenges Faced

01) *Unpleasant Working Conditions: Initially struggled with the smell and handling of garbage.*

02) *Competition for Valuable Materials: Younger reclaimers often take the more valuable items first, leaving her with lower-value materials.*

03) *Physical Strain: Sifts through waste and manages heavy sacks of recyclables.*

04) *Modest Earnings: Relies on selling collected materials to buyers at the landfill.*

05) *Limited Facilities: Minimal time to clean up after work. Balancing Responsibilities: Manages work and caregiving duties for her granddaughter and household.*

Fig 34: Thabisile's story from the Waste picker integration guideline for South Africa: (Department of Environment, Forestry and Fisheries and Department of Science and Innovation, 2024)

Conclusion

The lives of waste reclaimers like Tshepo and Thabisile highlight the immense challenges they face in their daily work. Tshepo, who works in urban residential areas, must endure long, dangerous journeys while pulling a heavy trolley, often facing harassment and threats from security guards. On the other hand, Thabisile, who works at a landfill, contends with competition from younger reclaimers and must navigate the physical strain of sorting through large amounts of waste materials. Both reclaimers, despite the differences in their working environments, share common struggles—financial instability, physically demanding labor, and inconsistent access to valuable materials.

These challenges underscore the urgent need for an architectural intervention that addresses the specific needs of both types of reclaimers. A centralized sorting and storage facility would reduce Tshepo’s burden of hauling heavy loads over long distances and provide secure spaces for reclaimers to store and sort materials. Sheltered rest areas with basic amenities would offer reclaimers a place to rest and recover from the physically taxing nature of their work. Equal access to high-value materials could be ensured through a fair distribution system, reducing competition and ensuring more consistent earnings for individuals like Thabisile.

Additionally, transportation solutions such as improved trolleys or public transport designed to accommodate heavy loads would make Tshepo’s long commutes more manageable. Secure working environments, with proper lighting and safety measures, would protect reclaimers from harassment and crime, while material processing and selling hubs would streamline their operations, allowing them to process and sell materials on-site without lengthy trips to buyers.

Integrating educational and training spaces into the design would empower reclaimers by offering them opportunities to upskill, enhancing their income potential and contributing to a more sustainable and dignified livelihood. By focusing on these architectural solutions, the intervention could significantly improve the daily lives of waste reclaimers, providing them with safer, more efficient working conditions while addressing their financial and material needs.

-Finally given that plastic and paper are the largest contributors to municipal waste, the project will focus on recycling these materials from the overall waste stream

TABLE 1
AVERAGE COMPOSITION OF JOHANNESBURG MSW

MSW COMPONENT	JOHANNESBURG AVERAGE MSW	UK NATIONAL AVERAGE MSW
Paper	25% w/w	35% w/w
Plastics	16	13
Glass	5	8
Metals	5	5
Textiles	6	3
Food waste & Organics	30	30
Miscellaneous	13	6
TOTAL	100%	100%

Ref. PIKITUP Johannesburg, SA 2005 and updated 2015 : Private communication in UK (2005)

Fig 35: Average composition of Johannesburg Municipal waste (Rickshaw trade and investment, 2023)

TYPES OF PLASTICS

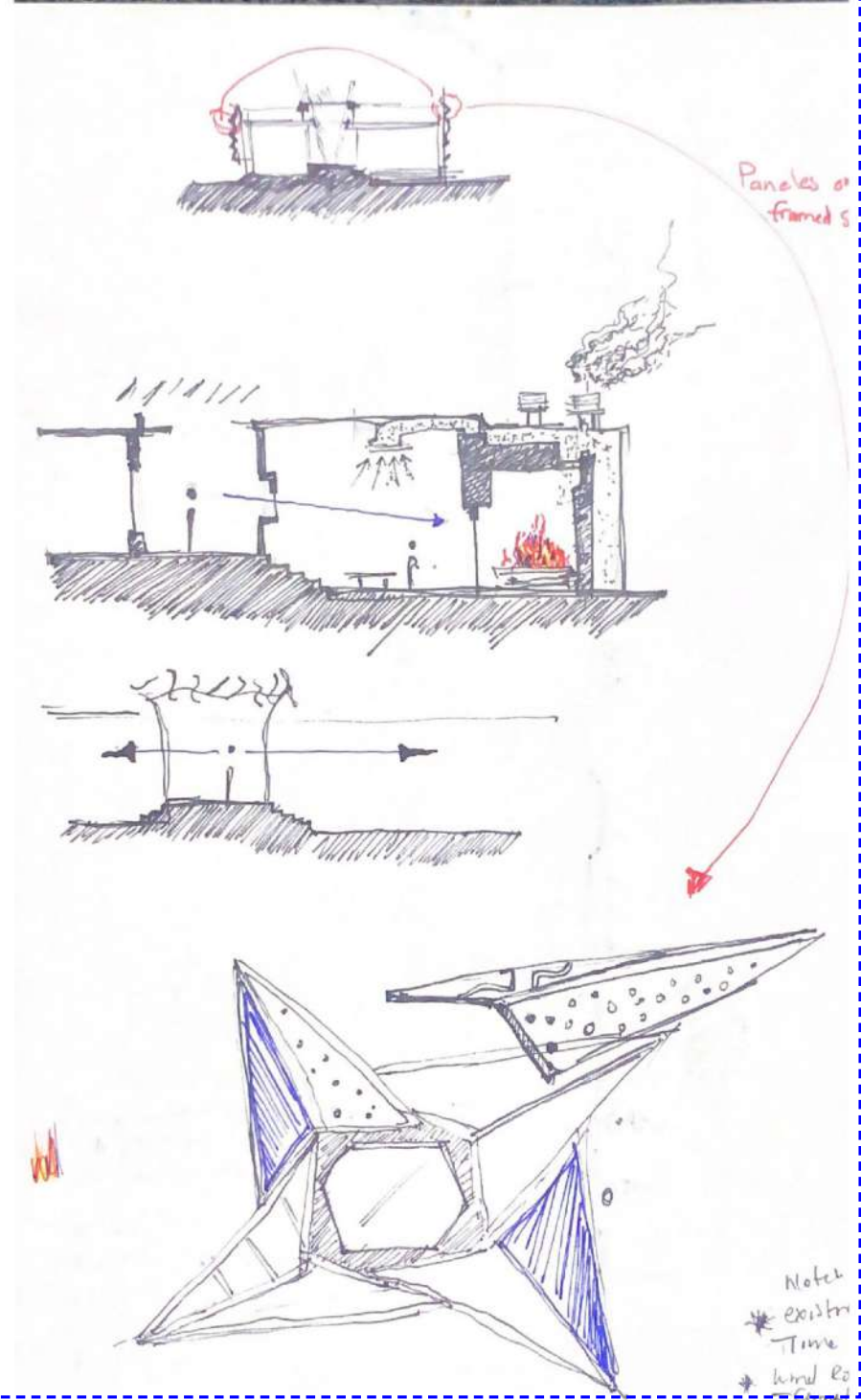


Fig 36: Mountain of plastic waste (Snowden S.2020)

Table 1. Types of plastics, their properties and common uses.

Symbols	Types of Plastics	Common Uses	Properties	Negative Health Effect	Recycled Into
 PETE	Polyethylene terephthalates	Water bottles, soft drinks, salad dressing and domes, containers and biscuit trays	Tough, clear, solvent resistant, a barrier to moisture and gas softens at 80 °C	Causes carcinogens, vomiting, diarrhoea [19]	Sleeping bag and pillow filling, carpeting, clothing, soft drink bottles, building insulation
 HDPE	High-density polyethylene (HDPE)	Freezer and shopping bags, buckets, shampoo, ice cream and milk containers, juice bottles, chemical and detergent bottles, rigid agricultural pipe, crates	Hard to semi-flexible, resistant to chemicals and moisture, waxy surface, opaque, softens at 75 °C, easily coloured, processed and formed	Stomach ulcers [20]	Recycling bins, compost bins,
 V	i. Polyvinyl chloride (PVC) ii. Plasticized polyvinyl chloride PVC-P	Cosmetic containers, plumbing pipes and fittings, electrical conduct, blister packs, wall cladding, roof sheeting, bottles, garden hose, shoe soles, cable sheathing, blood bags and tubing	i. Strong, tough, softens at 80 °C, can be solvent welded and clear. ii. Flexible, clear, elastic, can be solvent welded	Interferes with hormonal development [21]	Compost bins
 LDPE	Low-density polyethylene (LDPE)	Refuse bags, irrigation tubings, mulch film, cling wrap, garbage bags, squeeze bottles	Soft flexible, waxy surface, translucent, softens at 70 °C, scratches easily	Not recyclable [22]	Bin liners, pallet sheets
 PP	Polypropylene (PP)	Lunch boxes, microwave dishes, garden furniture, kettles, bottles and ice cream tubs, potato chip bags, straws and packaging tape	Hard and translucent, softens at 140 °C, withstands solvents, versatile	No known effects [23]	Pegs, bins, pipes, pallet sheets
 PS	i. Polysterene (PS) ii. Expanded polysterene (PS)	CD cases, plastic cutlery, imitation glassware, low-cost brittle toys, video cases/foamed polystyrene cups, protective packaging, building and food insulation	i. Semi-tough glassy rigid clear or opaque, material, it softens at 95 °C, affected by fat, acids and solvents, but resistant to salt solutions and alkalis, low water absorption, when not pigmented it is clear, odour- and taste-free. ii. Special types PS are available for special applications	Takes a thousand years to degrade [24]	Recycle bins
 OTHER	Polycarbonate and others	Automotive and appliance components, computers, electronics, cooler bottles, packaging	Includes all resins and multi-materials (e.g., laminates) properties dependent on plastic or combination of plastics	Obesity, cancer, endocrine problems in foetuses and children [25]	Recycle bins

Fig 37: The Health Environmental impact of plastic waste disposal in south african townships composition of joburg Manucipal waste (Adeniran,A,2023)



CASE STUDIES

All case studies are Critiqued and filtered through the lense of our frameworks,programe, materiality and their inovativeness

Fig 38: Initial design conceptual sketch showing the relationship between the market and the recycling facility
(Author,2024)

PROGRAMME
(LARGE SCALE FACILITY)



Fig 39:The Sunset Park Material Recovery Facility (Nikolas k,2014)

Name : The Sunset Park Material Recovery Facility
Typology : MRF (waste management + education)
Operators : Sims Municipal Recycling (SMR)
Location : Sunset Park, Brooklyn, New York
Architect : Selldorf Architects
Capacity : Approximately 1,000 tons of recyclables per day
Year :2013

The Sunset Park Material Recovery Facility (MRF) is a state-of-the-art recycling center,It serves as a key component in New York City's recycling system, handling the majority of the city's metal, glass, and plastic recyclables. The facility uses advanced sorting technologies, including optical sorters, magnets, and eddy current separators, to efficiently

- Materials**
- steel
 - plastered brickwork
 - Glass
 - Corrugated wall cladding

Programme

- 01: Barge
- 02: Mooring pier
- 03: Barge loading/offloading
- 04:Tipping building (sorting)
- 05: Processing building
- 06: Truck loading / offloading
- 07: Pedestrian bridge
- 08: Truck Scale
- 09: Bale storage building
- 10: Education & Administration
- 11: Substation
- 12: Cover walkway
- 13: Greenspace
- 14: Bus drop-off
- 15: Stuff & Loading area
- 16: Gate house

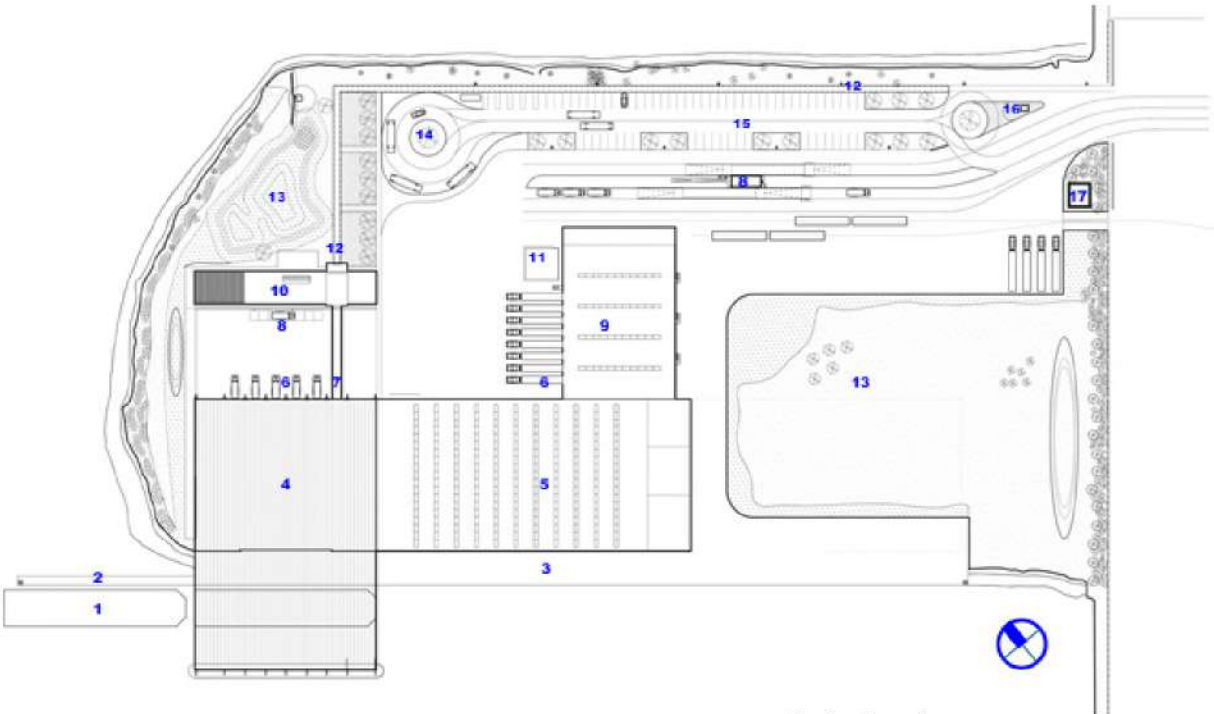


Fig 40:Site plan (Author ,2024)



Fig 41: Recycling facility (Author ,2024).
base image by (Nikolas k,2014)

- Legend**
- Pedestrian movement
 - Vehicular movement (staff & visitors)
 - Recycling operations circulation

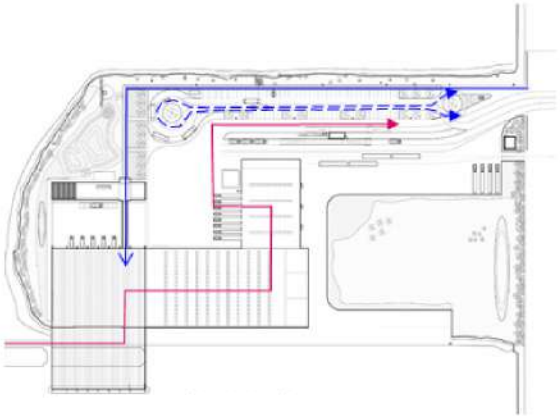
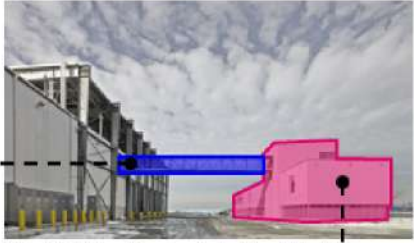


Fig 42:Circulation flow (Author ,2024)
base image by (Nikolas k,2014)



43: Education & admin block(Author,2024)
 ,base image by (Nikolas k,2014)



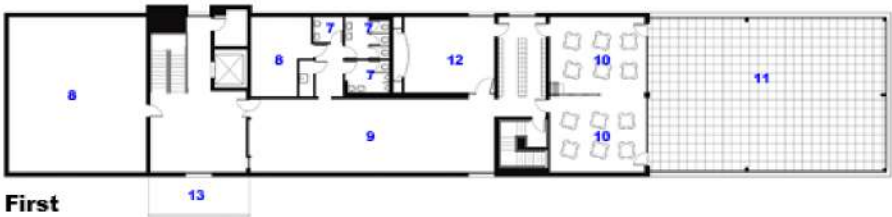
44:Ground floor plan, Education & admin block(Author,2024)
 ,base image by (Nikolas k,2014)

Programme

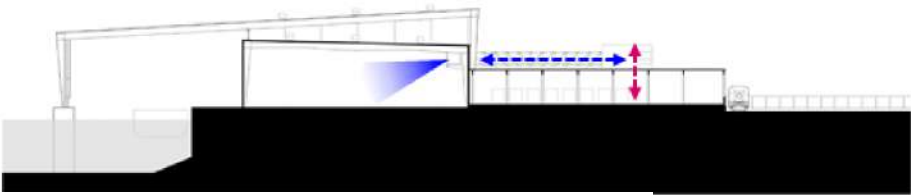
- 01: Lobby
- 02: Cafeteria
- 03: Open office
- 04:Conference room
- 05: Private Office
- 06: Locker room
- 07: Restroom
- 08: Mechanical
- 09: Exhibition
- 10: Classroom
- 11: Terrace
- 12: Theater
- 13: Pedestrian Bridge

Legend

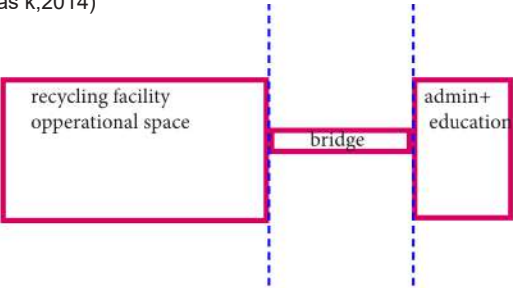
-  Viewing platform
-  Vertical circulation
-  Horizontal circulation



45:First floor plan, Education & admin block(Author ,2024)
 ,base image by (Nikolas k,2014)



46: Section (Author ,2024) ,
 base image by (Nikolas k,2014)



47: digram showing public and private interface via a bridge that connects the admin block and the recycling facility (Author ,2024)

PROGRAMME
(LARGE SCALE FACILITY)



48: Fig 45:copen hill_outside view
(Ghinitoiu L , no date)

Name : Copenhill power plant
Typology : Industrial, Factory
Operators : Amager Resource Center (ARC)
Location : Copenhagen, Denmark
Architect : Bjarke Ingels Group
Year :2019

CopenHill exemplifies effective placemaking by merging its primary function as a waste-to-energy plant with multifunctional public spaces. Its design transforms a utilitarian facility into a landmark that fosters community engagement and recreational use. The facility features a green rooftop that includes a ski slope, climbing wall, and hiking trails, making it accessible and inclusive. This innovative approach not only addresses Copenhagen’s waste management needs but also contributes to environmental sustainability and reflects local values. By providing a unique blend of functionality, public interaction, and educational opportunities, CopenHill enhances the urban landscape and strengthens community connections.

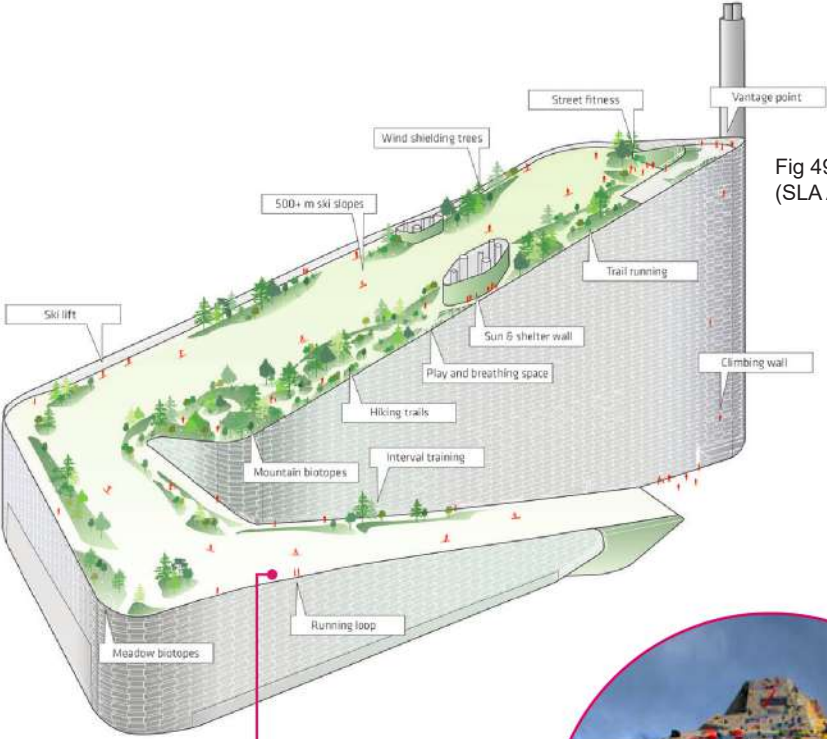


Fig 49:Park diagram_ Aerial View.
(SLA Architects , no date)

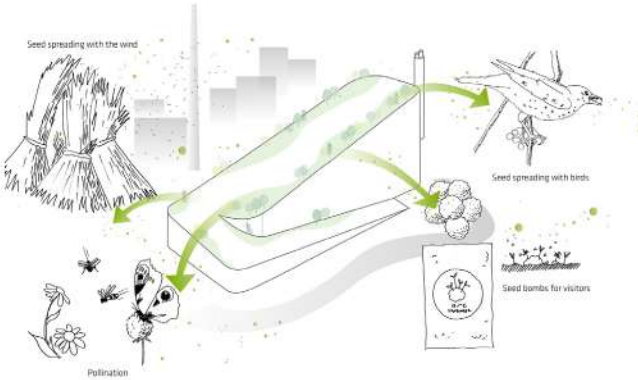


Fig 50:Seed dispersal_ illustration
(SLA Architects , no date)



Fig 51: Running loop, rendering.
(SLA Architects ,2016)



Fig 52.Climbing wall
(Hjorth, M,no date)

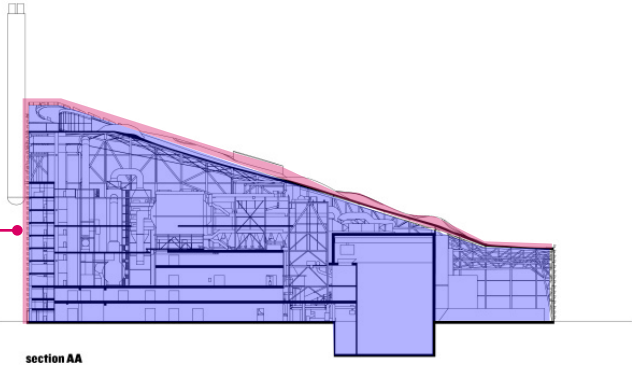


Fig 53. section (Author,2024)
base imageby(Unknown,no date)

The building is enveloped by a recreational program designed to foster community engagement and interaction

INNOVATION

(MATERIALITY)



Fig 54-55. EcoArk, street view (Wang L, 2017)

Name : ECOARK
Typology : :Exhibition Hall
Operators : Taipei Expo Park
Location : Taipei, Taiwan
Architect : Miniwiz
Year :2010

The Eco-park designed by Miniwiz is a strong embodiment of circular economy principles while also drawing inspiration from El Anatsui's approach to reimagining waste. The façade, crafted from discarded plastic, transforms waste into a valuable and high-performing architectural feature, filtering light and providing thermal regulation. The materials maintain high value and structural integrity, ensuring both aesthetic appeal and long-term durability.

A notable aspect of the design is the use of modular interlocking panels made from recycled plastic bottles. Modular design, a fundamental principle of the circular economy, is prominent here. It allows for flexible assembly,

reconfiguration, and future reuse, reducing the need for new materials and extending the lifecycle of the components. This modularity, combined with the reuse of waste materials, reinforces the circularity of the building, creating a sustainable structure that aligns with the ethos of minimizing waste and maximizing the value of resources. The design echoes El Anatsui's practice of transforming discarded objects into something valuable, both functionally and artistically

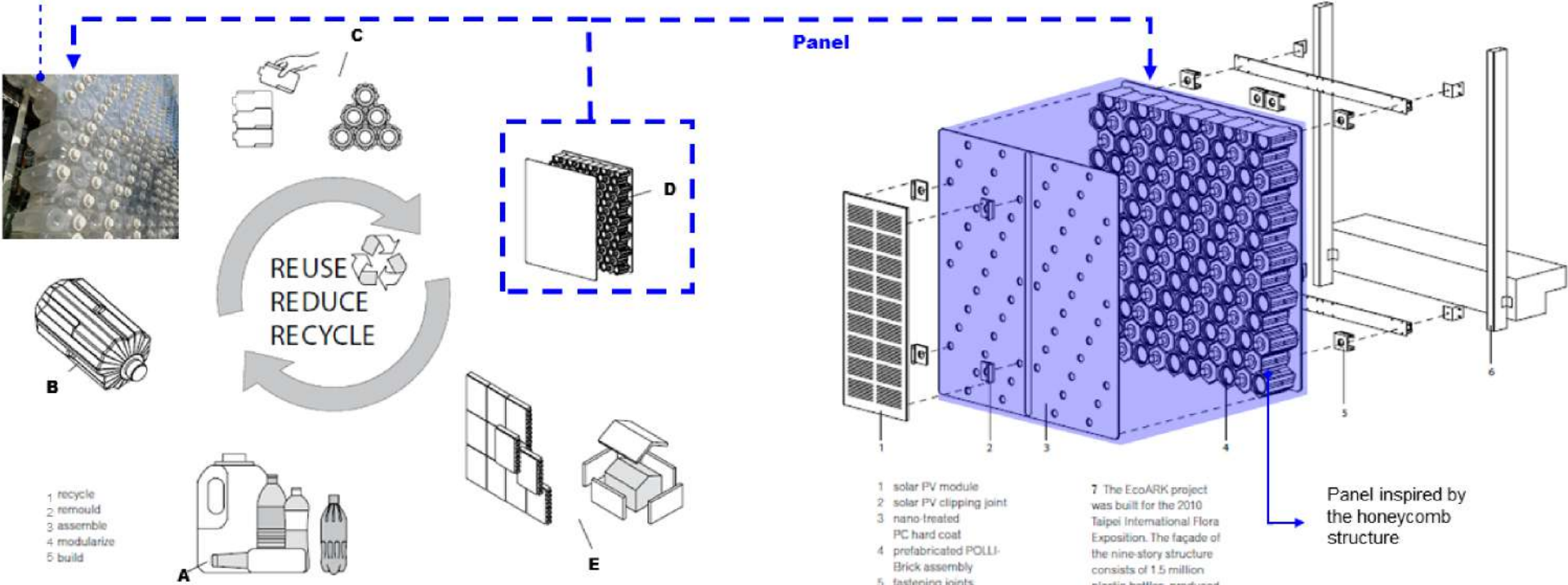
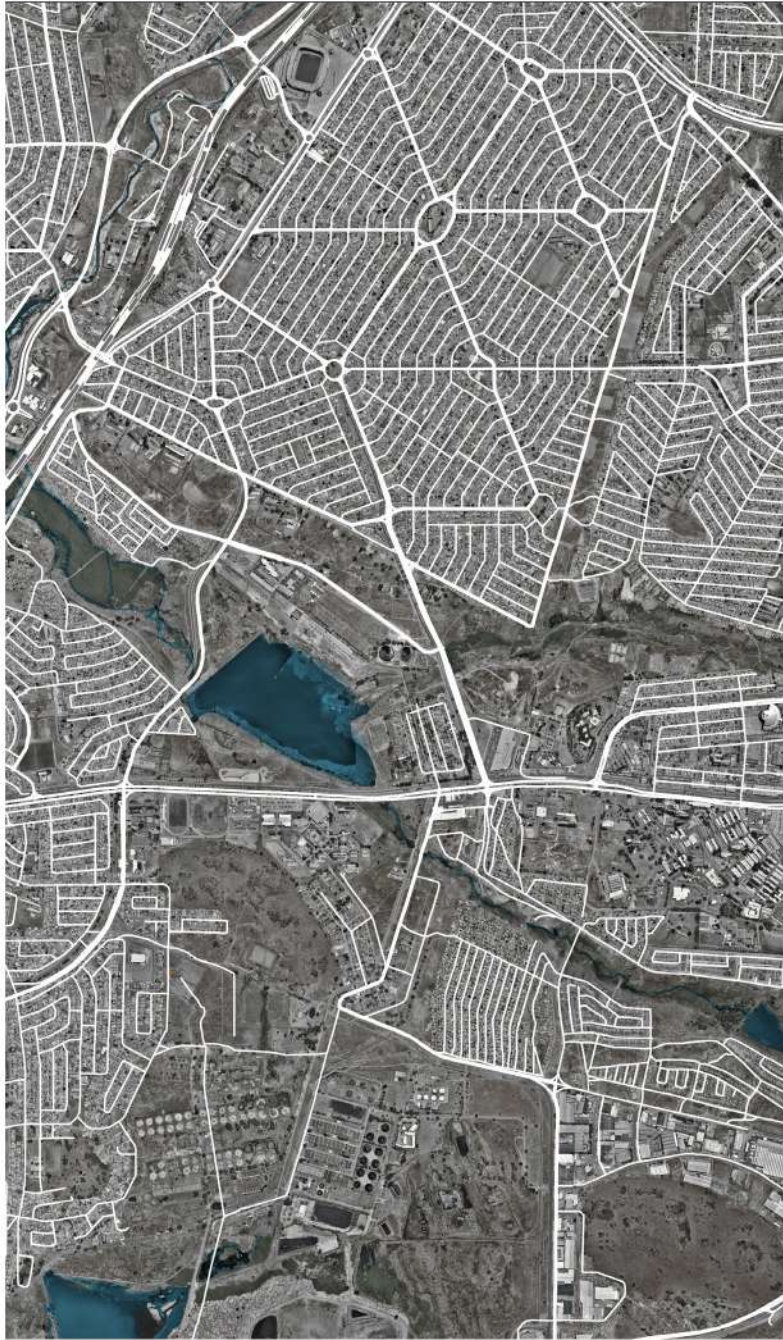


Fig 56. Polibrick Pannel Construction (Author, 2017), base drawing by (Miniwiz, 2017)



Fig 57. Image Showing building materialy, (Miniwiz, 2017)



SITE ANALYSIS

Site selection
Site history
Climate
Micro site analysis
Viability report

Fig 58. Map of Orlando, soweto (Author, 2024)
base map from (google earth,2024)

SITE SELECTION



Fig 59.Global Map (author,2024)
(base map from ArcGis)

To kick off the search for my project site, I decided to start with a more intuitive approach by examining the nearest landfill: Goudkoppies Landfill. This choice allows me to explore the potential for establishing a recycling facility in the area, aiming to make a significant impact on the broader community.

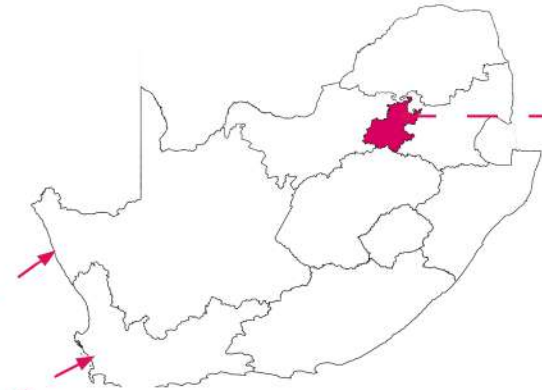


Fig 60. Map of South Africal (author, 2024) (base map from ArcGis)

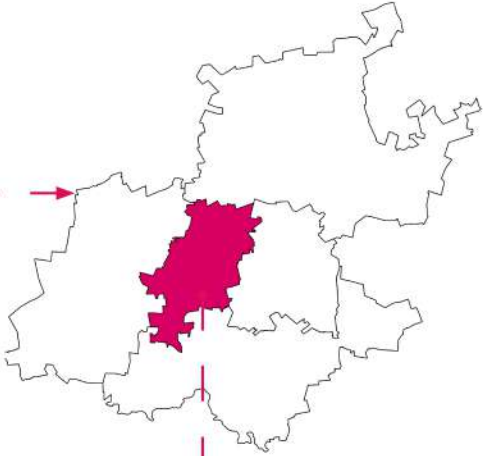


Fig 61. Gauteng Map (author,2024)
(base map from ArcGis)

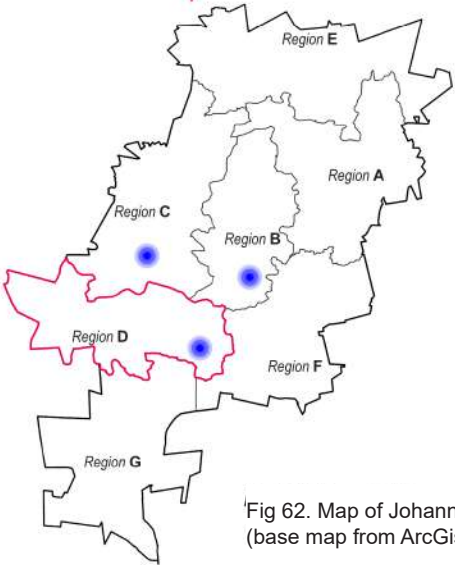


Fig 62. Map of Johannesburg (author,2024)
(base map from ArcGis)

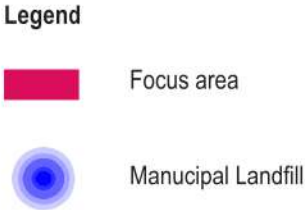




Fig 63. Map of Johannesburg, showing Landmarks
(author,2024), base map from (google earth,2024)



Fig 64.FNB stadium
(Unknown, no date)



Fig 65.Hector Pieterse Memorial.
(Unknown, no date)



Fig 66.Nelson Mandela' s house
(Mason H, no date)



Fig 67.Orlando Stadium
(Unknown, no date)



Fig 68.Soweto Towers
(Unknown, no date)

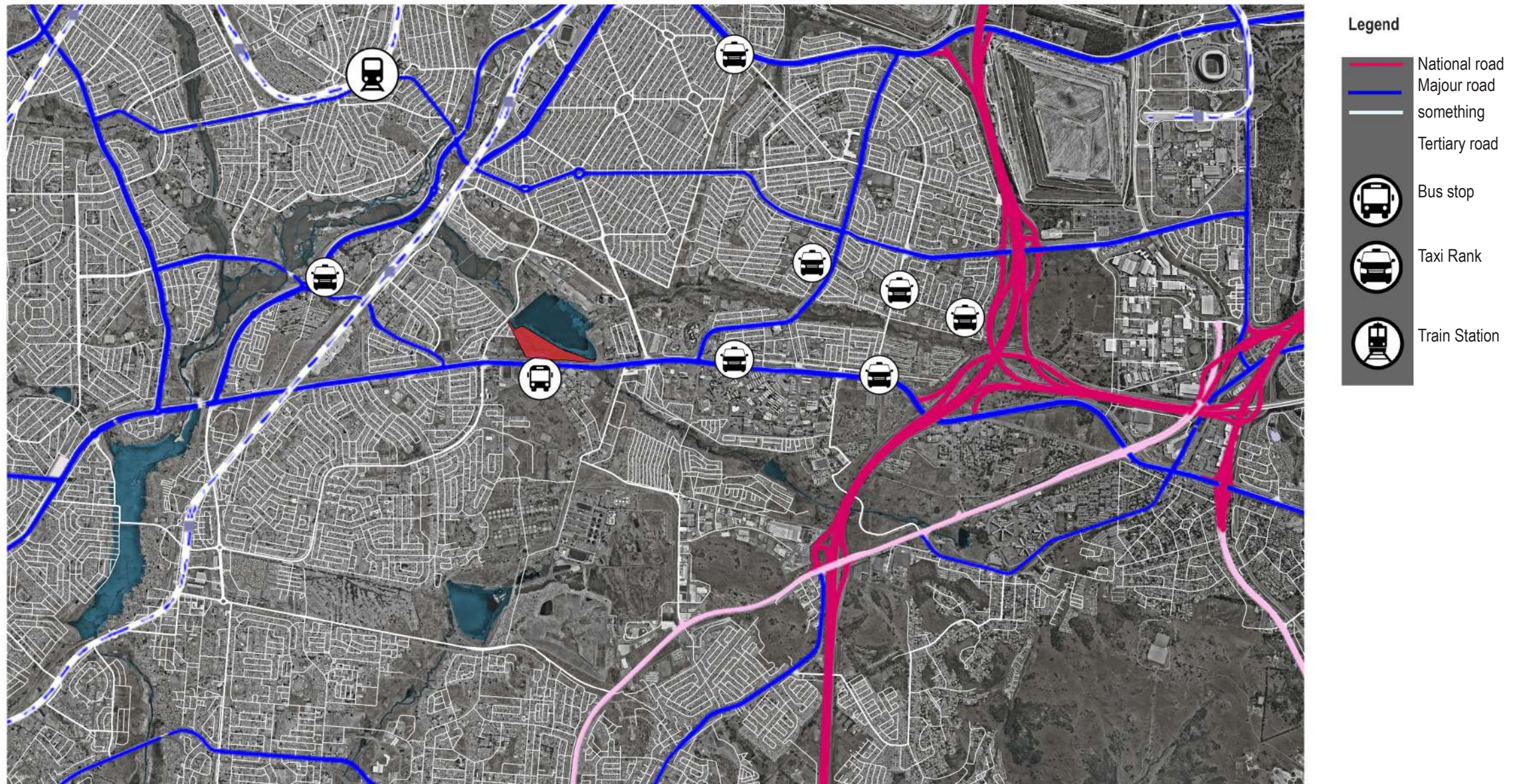


Fig 69: Roadnetworks (Author,2024)

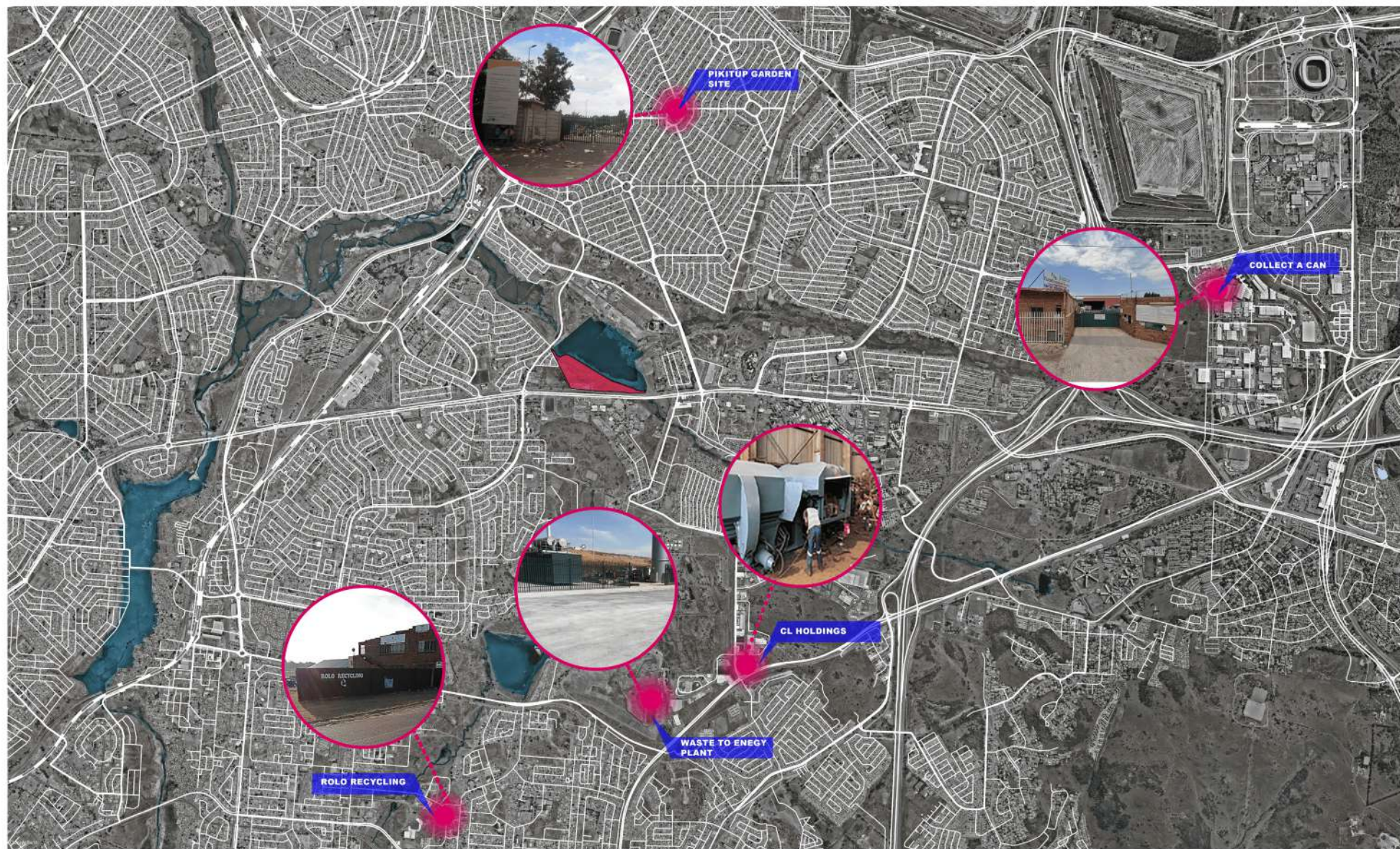


Fig 70.Recycling facilities (Author,2024)

Map showing all recycling facilities around site.

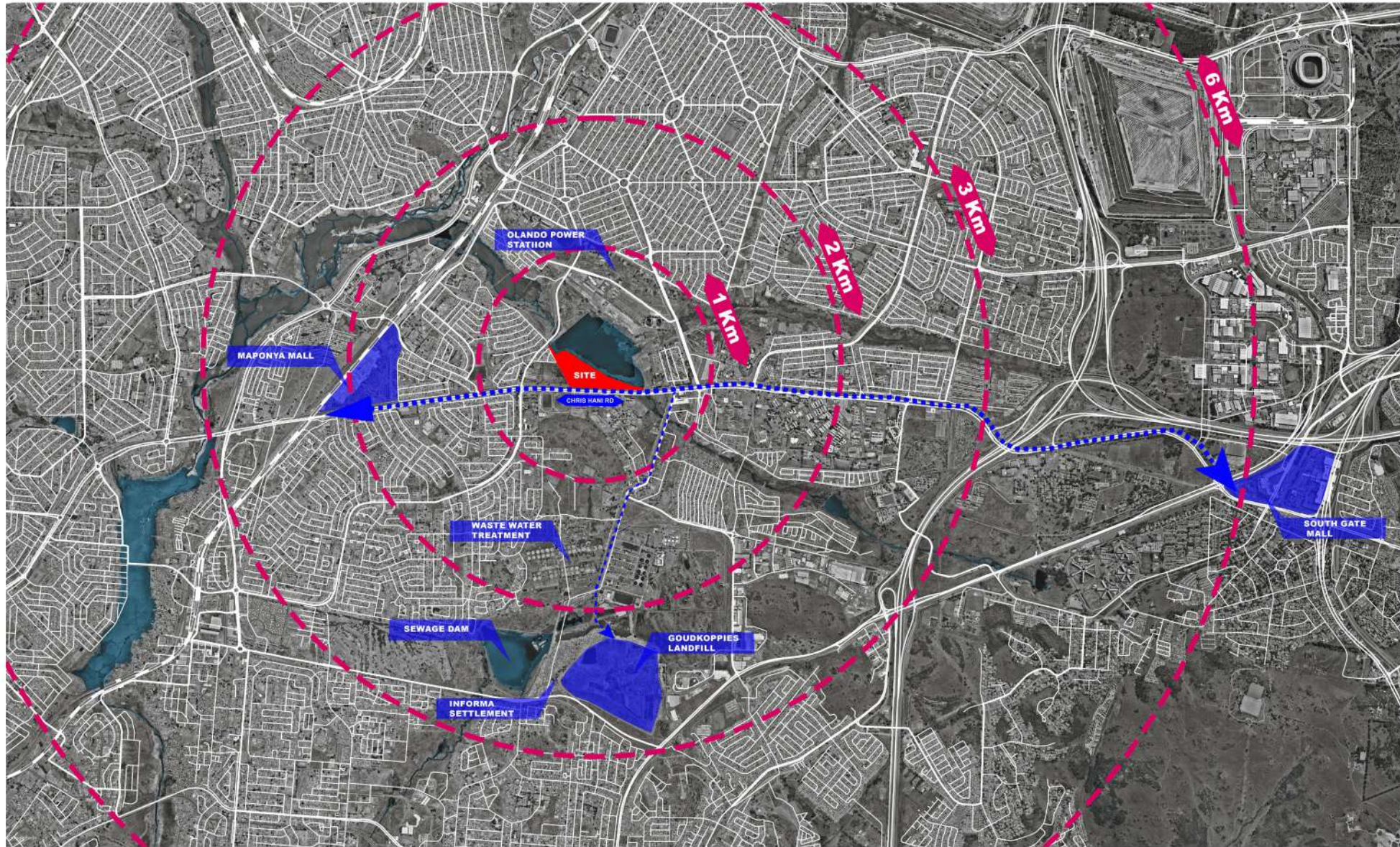


Fig 71.Site connectivity and buffers
(Author,2024)

“Utilizing the theory of placemaking, which focuses on creating vibrant, functional, and human-centered environments, justifies our decision to avoid the landfill site for construction. The landfill’s unstable soil conditions pose significant risks to the integrity and safety of any development, while its current state is not conducive to productive or pleasant human activity.

Placemaking emphasizes the importance of designing spaces that enhance quality of life, support community interaction, and provide a conducive environment for work and social engagement. The landfill site, given its environmental and operational challenges, does not align with these principles.

In contrast, our alternative site is strategically located within walking distance from the landfill and centrally situated along a major route. This location is not only more stable and accessible for construction but also enhances connectivity for waste reclaimers working both at the landfill and in the surrounding suburbs. By choosing this site, we ensure better accessibility and integration for all stakeholders, supporting a more inclusive and functional environment that aligns with the values of placemaking and improves overall community engagement

SITE HISTORICAL CONTEXT

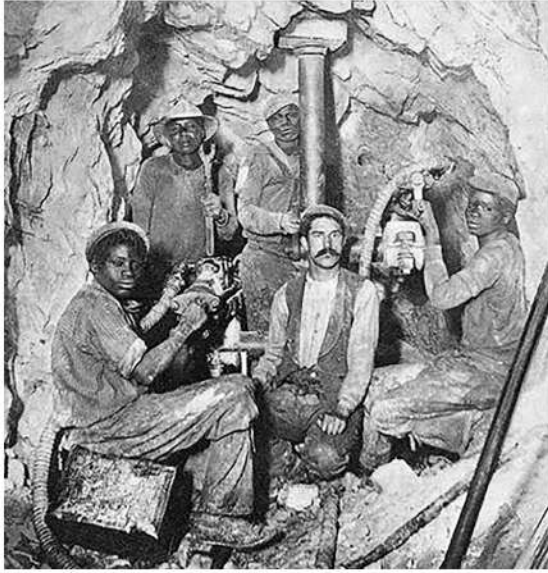


Fig 72. Joburg Miners
(Author, 2024)

ORLANDO , SOWETO

The City of Johannesburg (CoJ), where so following the discovery of gold in Johannesburg in 1886, many black men migrated to the city, leaving their families behind. They lived in single-sex barracks on mining properties and worked under short-term contracts. At this time, Johannesburg was still a racially mixed city. In 1904, a plague spread among the black residents of Vrededorp, a suburb west of Johannesburg's produce market and abattoir.

The Johannesburg Town Council exploited this situation to clear out the slums, forcibly relocating the ill to a sewage farm over 10 kilometers southwest of Johannesburg. They lived in corrugated iron sewage tanks that had been cut in half, and 43 years later, many were still residing in these tanks. This area, named Klipspruit, was the precursor to Soweto, eventually becoming the site of Pimville (Magubane, 1998).

The 1913 Land Act dispossessed many black people of their land, increasing migration to Johannesburg. Despite efforts to prevent black people from living in the city center, the council lacked the financial resources to establish alternative housing for evicted black residents, a legal obligation they were supposed to fulfill. A legislative change and a rise in the gold price in 1931 facilitated the creation of low-cost housing for black people near Johannesburg. This new area, named Orlando after Councilor Edwin Orlando Leake, was close to Pimville, with both areas later forming the heart of Soweto (Lodge, 1983).

Orlando, established in the 1930s, became a key suburb in Soweto, Johannesburg, South Africa, & holds a significant place in the country's history. This township, developed as part of a broader policy of racial segregation under apartheid, was designed to accommodate Black South Africans who were forcibly relocated from other areas of Johannesburg

and the so-called "white" zones. The segregation policies enforced by the South African government during this period aimed to create distinct residential areas for different racial groups, with Orlando being one of the designated areas for Black residents.

The rise of Soweto, including Orlando, was marked by its role in the resistance against apartheid. Throughout the 1950s and 1960s, the township became a center of political activism. The residents of Orlando, along with other parts of Soweto, actively protested against the oppressive regime, contributing significantly to the anti-apartheid movement.

SITE MOVEMENT PATHS



Fig 73.Site Pedestrian foot paths
(Author,2024)

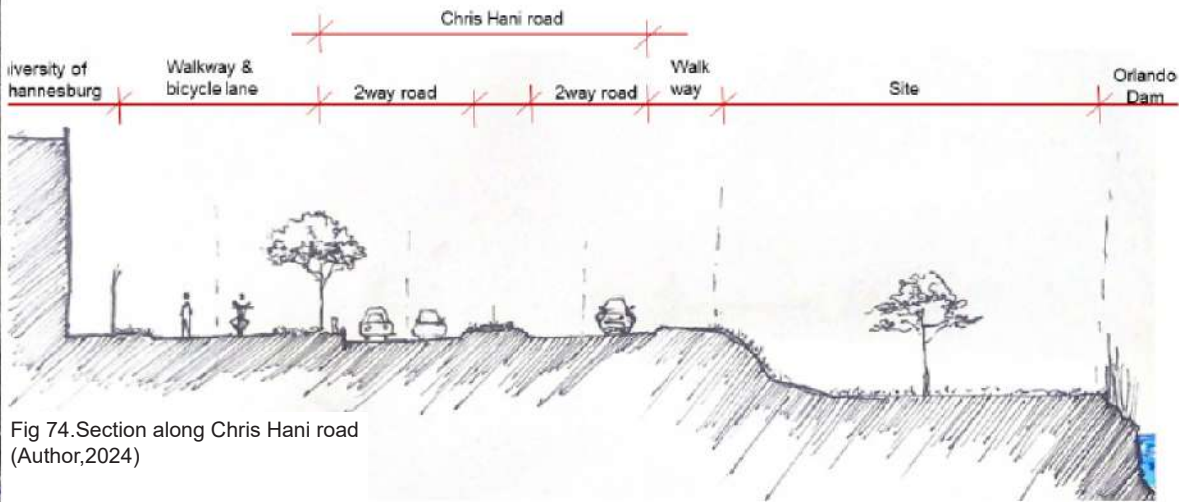


Fig 74.Section along Chris Hani road
(Author,2024)

Currently, the site is utilized by the Klip-spruit community as a shortcut, facilitating access to educational and commercial activities along Chris Hani Road

CLIMATE

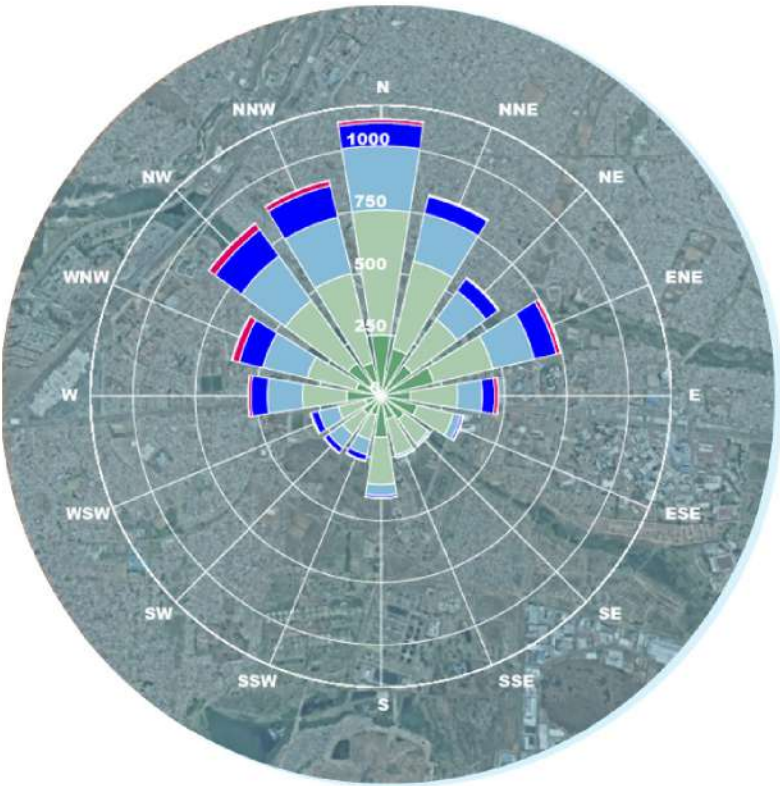


Fig 75.Wind directions
(Author,2024)

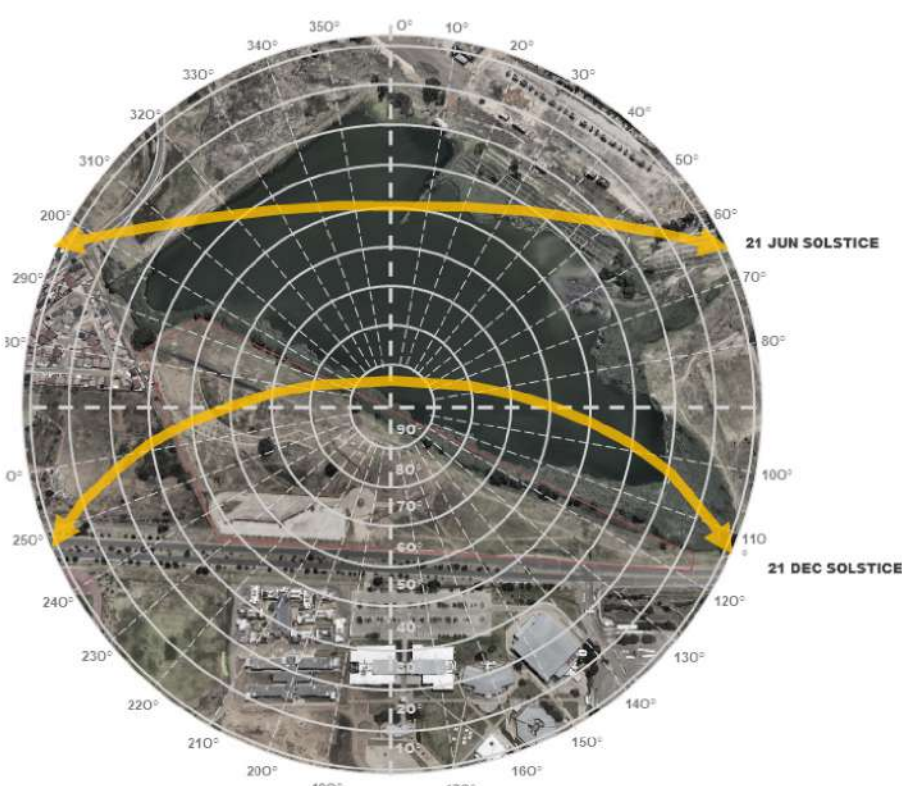


Fig 76.Solar paths
(Author,2024)

Johannesburg features a subtropical highland climate, marked by summer rains with annual precipitation averaging between 800 and 900 mm, predominantly falling from November to March. The prevailing winds typically come from the south and southwest, though they may shift to the east in summer. The city benefits from ample sunshine throughout the year, with extended sunny days in summer and shorter, yet bright, winter days. These climatic elements impact outdoor activities and architectural

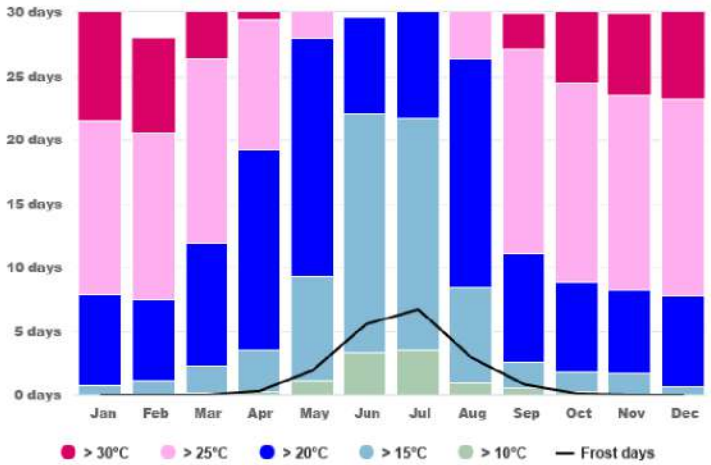


Fig 77.Precipitation levels
(Author,2024)

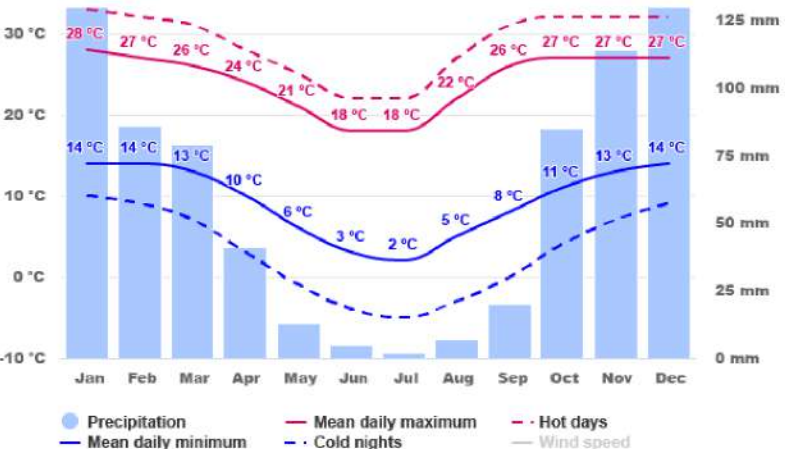


Fig 78.Rainfall
(Author,2024)



Fig 79. Site Flood Lines
(Author,2024)

LEGEND

- 50 Year flood line
- 100 Year flood line

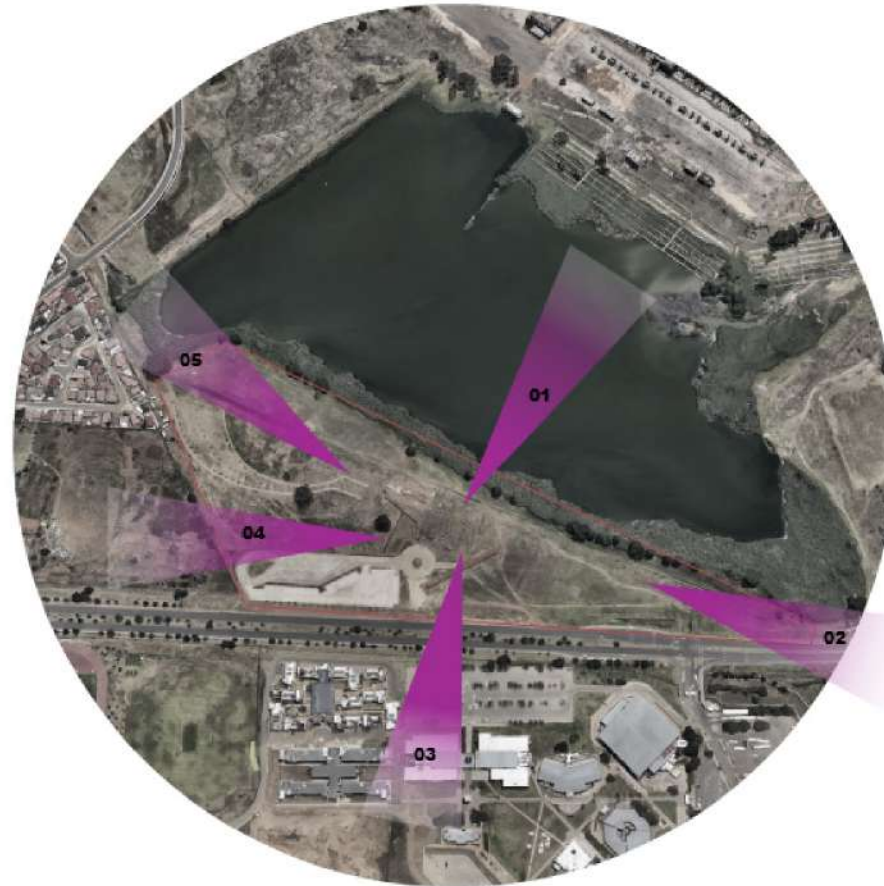


Fig 80.Highrachy of views
(Author,2024)



01



02



04



05

Fig 81-84.Site Images
(Author,2024)

ORLANDO POWER STATION (HISTORY)



Fig 85. Old Orlando station
(Unknown, no date)



Fig 86. Old Orlando station
(Unknown, no date)



Fig 87. Old Orlando station
(Unknown, no date)

The Orlando Power Station, situated in Soweto, Johannesburg, is a significant historical and industrial site in South Africa. Built in 1955, it was among the largest coal-fired power plants in the country, crucial for meeting the electricity demands of Johannesburg and its neighboring areas. Its development was part of the broader industrial expansion during the apartheid era, underscoring the focus on infrastructure growth. The station's distinctive twin cooling towers, known as the "Orlando Towers," have become iconic landmarks of Soweto. Although the power station was decommissioned in 2004, the cooling towers have been repurposed for bungee jumping and other adventure activities, turning them into a well-known tourist destination and a symbol of the area's resilience and change.

SITE EVOLUTION



2000: Empty site



2004: No changes



2007: No changes



2015: Demolition of the power station commenced.



2015: Construction at UJ Commenced. Parking bays on site. Complete Demolition of power station



2018: New building erected on site with parking bays



2022: Construction UJ at complete



2024: Current state of the site

Fig 88-95.Site Images (Author,2024)
base map from (Goggle Maps)

Orlando Powerstation
(walk through)

Fig 97-100.Old Orlando power staton, site images
(Author,2024)



Fig 96.Olando dam,Site plan (Author,2024)
base map from (Goggle Maps)



A_Restricted powerlines and transformers



B_Abandoned building



C_Abandoned building



D_Abandoned building



E_Abandoned building



F_Abandoned building



F_Brick wall



G_Concrete wall Fence



H_Abandoned Building



I_Abandoned building



J_Abandoned building



K_Abandoned building



L_Abandoned building

Soweto towers in
the background

Fig:101-109.Old Orlando
power staton, site images
(Author,2024)



M_Abandoned Building



N_Abandoned Building



O_Abandoned Building



P_Abandoned Building

Fig:110-116.Old Orlando power staton, site images (Author,2024)



Q_Dimolished building rubble





Fig:117.Soweto canoing club (Unknown, no date)



Fig:118..Soweto canoing club (Unknown,



Fig:119..Soweto towers(Unknown, no date)



Fig:120.Soweto canoing club (Unknown,no date)



Fig:121.Orlando Dam (Unknown, no date)



Fig: 122.Soweto canoing club (Unknown, no date)

The Soweto Canoe Club (SCC) is a prominent organization based at Orlando Dam, contributing to the site's dynamic activity profile. Founded in 1998, the SCC has transformed the dam into a hub for canoeing and kayaking, fostering a vibrant community engagement with the water body. The Soweto Canoe Club has played a transformative role at Orlando Dam, turning it into a center for water sports and community engagement. Through its activities, the club has enhanced the site's social, environmental, and economic value, contributing significantly to the vibrancy and development of Soweto

VIABILITY REPORT

01: Project Overview

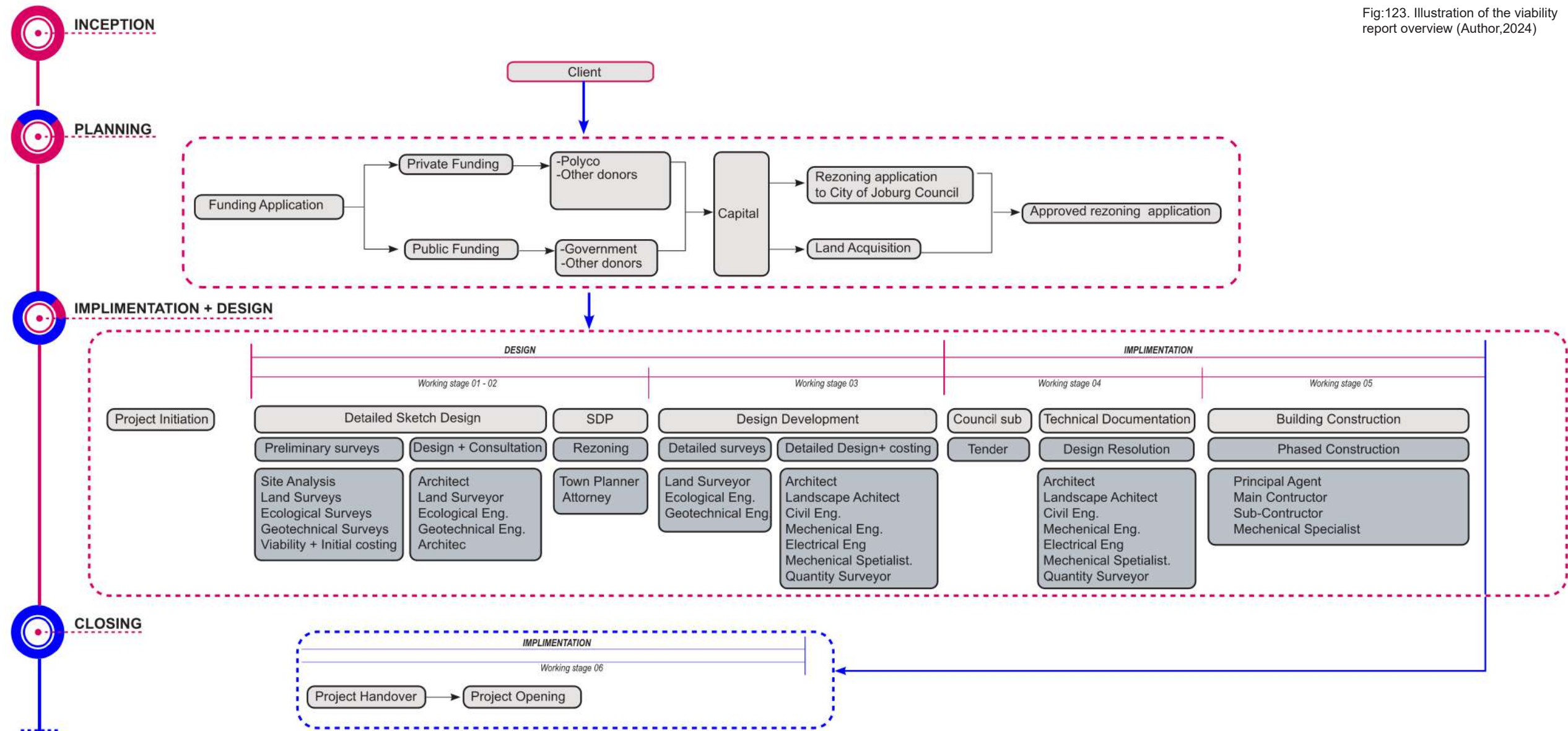


Fig:123. Illustration of the viability report overview (Author,2024)

VIABILITY REPORT

00: Project Conception

Design Intent

The design intent is to create a transformative recycling hub in Soweto next to Orlando dam, with a primary focus on empowering informal waste reclaimers. This facility will act as a catalyst for urban renewal by integrating and enhancing the diverse site activities and spaces around it. Embracing circular economy and placemaking principles, the design will repurpose materials from the demolished Orlando PowerStation and incorporate other recycled materials into the building. The facility will cater to informal waste reclaimers and provide a welcoming space for university students to hang out and access workshops. Additionally, the design will feature markets where recycled products can be sold, and stalls can be rented by individuals or businesses working with recycled materials. These markets will provide economic opportunities and attract tourists, showcasing the facility's sustainability efforts and fostering community engagement. The project aims to unify the site's various uses—including the rowing, and sports—into a cohesive, vibrant urban space with reclaimers at its core, making it a dynamic destination for both locals and visitors.

Design Brief

To create an innovative recycling facility that goes beyond traditional recycling functions by integrating community-focused recreational and educational spaces. The facility will not

only address the operational needs of waste management but also serve as a vibrant hub for the local community, providing areas for sports, rowing activities, technical workshops, and exhibitions.

Key Objectives:

Community Integration: Create spaces that cater to the recreational needs of Soweto's diverse population, including parks, sports facilities, and areas for rowing.

Educational and Exhibition Spaces: Incorporate workshops and exhibition areas to provide educational opportunities and showcase recycling processes and innovations.

Controlled Interface: Design an architecture that carefully manages the interaction between public recreational spaces and private recycling processing areas, allowing for exposure and educational experiences while maintaining operational efficiency.

Design Requirements:

Functional Areas:

Recycling Processing: Efficient, scalable spaces for waste sorting, processing, and management.

Reclaimers' Support Spaces: Dedicated areas for waste reclaimers, including facilities for sorting and storing collected materials, rest areas, and spaces for skills development and training

Recreational Spaces: Park, sports fields, and facilities for rowing activities that integrate seamlessly with the recycling facility.

Workshops and Exhibitions: Areas dedicated to technical workshops and exhibitions related to recycling and sustainability.

Public and Private Interface:

Controlled Interaction: Design solutions that separate yet connect public recreational areas with private processing areas to facilitate educational exposure while maintaining operational integrity.

Visibility and Access: Incorporate features that allow the public to view and learn about recycling processes without disrupting operations.

- Architectural Design:

PROJECT SITE



Fig:124. Orlando dam site plan (Author,2024)
Retrieved from google maps.

The site along Chris Hani Road was chosen for its prime location in a densely populated residential zone, providing accessibility and visibility due to its position along a major route. This strategic placement not only ensures ease of access for informal waste reclaimers and other users but also maximizes the site's potential as a central, transformative community hub in Soweto. The underutilized park adjacent to Orlando Dam emerged as the ideal project site, offering ample space for the proposed development.

Site owner:	City of Johannesburg
Suburb, City:	Orlando, Johannesburg
Address	38 Chris Hani Road
Zoning Designation:	Public Open Space
Stand No. :	1598
Site Area:	103 024 sqm
Building Lines:	N/A

01: INCEPTION



The city of Johannesburg founded pickup in 2001 as a major waste management plan for the city waste. Currently the City of Johannesburg(COJ) is running out of air space to dispose waste in their landfills. As a response to this crisis, Mpack Group Limited , decides to Partner with Coj to take a community-oriented approach in order to reinforce the city waste management strategy, Partnering with both the local waste management companies and informal waste reclaimers in Soweto with the aim to raise awareness and collectively deal with the waste crisis.

MPACT Group Limited is a leading South African firm that specialises in paper and plastic packaging solutions. MPACT Recycling, a fundamental component of their business, focuses on the sustainable handling of recyclable materials. This division is responsible for collecting, classifying, and processing used paper and plastic, with the goal of reducing waste and lowering environmental impact. MPACT Recycling promotes a circular economy and strengthens its commitment to environmental sustainability by incorporating recycled materials back into its manufacturing processes

Fig:124. Diagram illustrating the inception stage(Author,2024)

02: PLANNING

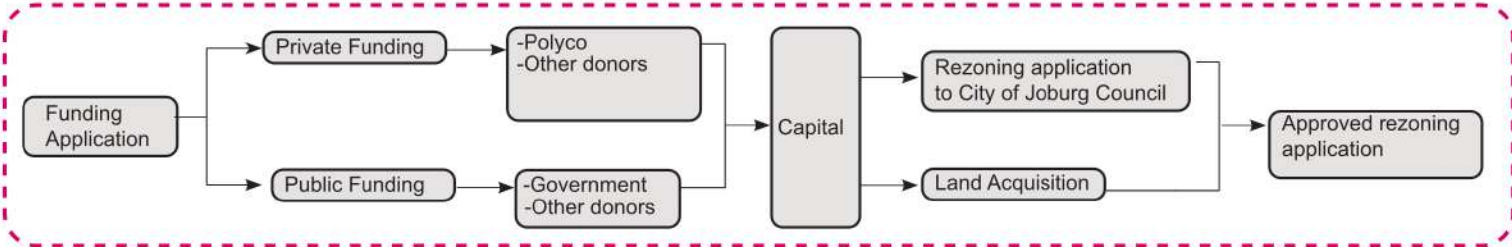


Fig:125. Diagram illustrating the planning stage (Author,2024)

The recycling facility project will proceed through a number of preparatory stages, each of which is essential. The project essentially stops during the period of review by the appropriate authorities. Due to the interconnectedness of all project parts, input on each is expected to be received in close succession, however the exact timing of approvals may vary.

01Funding.

Mpack Group Limited will reach out to various stakeholders and investors in order to source funding for this initiative. At this stage initial costing and businesses plan would be very necessary to convince our public and private investors to buy into the idea to ensure that we have funds both land acquisition and rezoning of the land

-Government : Departent of Environmental Affairs.

The Department of Environmental Affairs (DEA) of the South African government established the Green Fund to facilitate the shift to a low-carbon, resource-efficient, and climate resilient development path that yields significant benefits to the economy, environment, and society.

The initial resources made available for distribution by the Green Fund are represented by the allocation of R800 million. The Development Bank of Southern Africa (DBSA) has been designated by the DEA as the Green Fund's implementing agent.

Given that the green fund's objectives are to promote initiatives that will assist with poverty reduction, job creation, innovation and environmental stewardship. Our project aligns with those objectives and makes this a best funding source to apply to.



-Polyco.

Polyco is a business that specializes in personal protective equipment (PPE) and protective gloves. They provide a large selection of goods for use in the food processing, healthcare, and industrial sectors, among others.

They invest in recycling innovation to create new end-use markets, recycling infrastructure to increase efficiency and capacity, and recycling education and awareness in South Africa. To date, Polyco has invested over R120 million into the

plastics recycling industry Public Private. Based off their dedication to see this industry thriving this makes them another great funding source.

02.Land Acquisition.

Given that the land is owned by the city of Johannesburg, The first stage for the land acquisition will begin with a lease application to the city of Johannesburg by the client in order to acquire the site. Including the rezoning application at this stage ensures that the City of Johannesburg (CoJ) fully understands the implications of the development from the outset. Given that the nature of the project is an industrial activity might raise concerns on using a public land for such an activity. The following documents may be necessary to help motivate for and address concerns by the city of Johannesburg:

-Ecological Survey: it's important to assess the ecological value of the site's natural features, such as the trees. If the survey finds any trees older than 60 years, we might also need a Heritage Report, especially since the site has no existing buildings. This survey won't be as detailed as a full Environmental Impact Assessment , but sufficient enough to convince Coj in terms of how we're going to keep the natural feature of the site.

Based on personal observations from site visits and Google Earth images, there is evidence of a demolished building on the site, with no subsequent construction before or after. As a result, geotechnical assessments are needed to confirm the site's suitability and constructability for future development.

-Utility Survey: to be carried out in order to confirm the location of utilities on the site and the best way to connect to them To effectively sell the project and show its benefits for the site and surrounding communities, site development plans and a presentation prepared by the architect would be needed.

These materials will address concerns and clearly showcase the project's scope and impact.

03. Rezoning Application

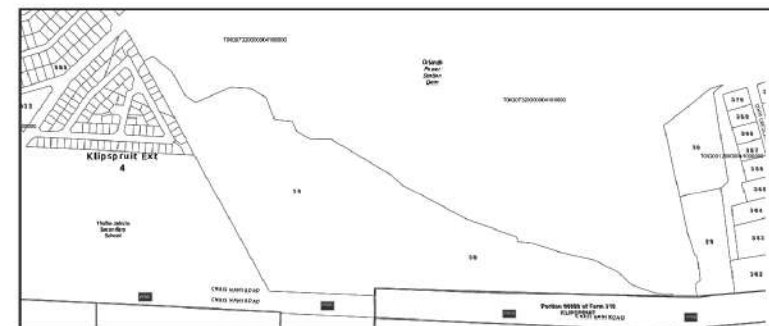


Fig:126. Site zoning diagram (Author,2024)

	permitted	Proposed	Compliance
FAR	N/A	0.5	No
Coverage	N/A	10%	No
Use Zone	Private open space	Industrial + buisness + education	No
Hight	N/A	9 m	No
Building lines	N/A	6 m	Yes

According to the City of Joburg's town planning schemes, the proposed intervention doesn't comply with the primary right/ land use schemes for the site. To carry out the project, an application for amendments of rights would be filed to the city of Johannesburg

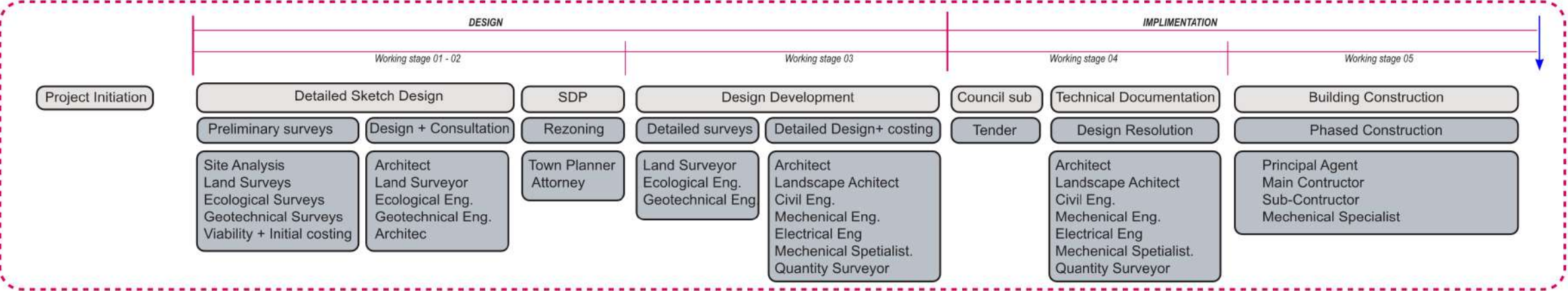


Fig:127. Diagram illustrating the implementation stage (Author,2024)

The project will be implemented in accordance to the JBCC Building agreement & will professional team consist of the client, design and construction team. The design professional team will create documentation to aid with the applications in working stage 1 and 2, Their contracts will be extended once enough funding has been acquired for working stage 3 and beyond. The construction team will be appointed during the construction phase by the client. In this project the architect will be appointed by the client to be the principal agent.

01 Professional Team

Architect:

The architect will be appointed for the initial sketch design phase, which will allow him to generate an initial cost estimate and business strategy for the funding application process

PROGRAM + Projet Value (Based on estimates made before the final design is completed)

Program	no. of spaces	Area per sinle room (sqm)	Total Area
ADMIN BLOCK			
1)Entrance Foyer	01	50	50
2)Reception	01	20	20
3)Security Control Room	01	10	10
4)Store room	01	10	10
5)Cafeteria	01	80	80
6)Open Office	02	50	100
7)Private Office	04	30	120
9) Boardroom	02	40	80
10)Locker room	01	60	60
			530
Estimated cost per sqm in R:			8600
Total Estimated cost per sqm in R:			4 558 000

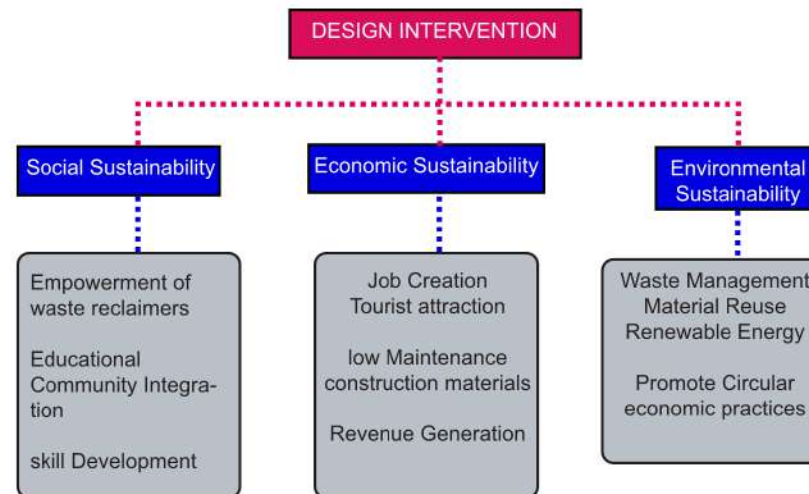
Program	no. of spaces	Area per sinle room (sqm)	Total Area
MATERIAL RECOVERY			
1) Informal sorting area (for waster recaimers)	01	240	240
2) Trolley drop off & Weigh Station	01	210	210
3) Heavy Load Weighing Station (trucks)	01	150	150
4) truck drop off and parking	01	610	610
5) Sorting area	01	680	680
6) Bailing stations	01	300	300
7) bail storage	01	500	500
8) Operational manager's office	01	10	10
			2 700
Estimated cost per sqm in R:			4600
Total Estimated cost per sqm in R:			12 420 000

PROGRAM + CONSTRUCTION COSTS (Based on estimates made before the final design is completed)

Program	no. of spaces	Area per sinle room (sqm)	Total Area
RECYCLING FACILITY			
1)Receiving and Unloading Area	01	80	80
2)Shredding Area (for both plastic & paper)	01	500	500
3)Washing & Cleaning (for both plastic & paper)	01	380	380
4)Processing and Recycling Area	01	400	400
5)Product sorage	01	100	100
6)Non recyclables storage (by products)	01	50	50
7)Loading/Dispatch Area	01	80	80
			1 240
Estimated cost per sqm in R:			4600
Total Estimated cost per sqm in R:			5 704 000
MAKERS' SPACE			
1)Reception	01	20	20
2)Seminar room	01	60	60
3)Workshops	02	50	100
4)Exhibition	01	100	100
5)Multi-purpose space	01	60	60
6) Artist studio	05	50	250
			590
Estimated cost per sqm in R:			16000
Total Estimated cost per sqm in R:			9 440 000
COMMERCIAL SPACES			
1)Market (recycled products and rentals to businesses)	06	100	600
2) Resturant	01	120	120
			2 220
Estimated cost per sqm in R:			9100
Total Estimated cost per sqm in R:			20 202 000
COMMERCIAL SPACES			
1) Accomodation rentals (for informal waste reclaimers)	30	50	1500
			1 500
Estimated cost per sqm in R:			3 500
Total Estimated cost per sqm in R:			5 250 000

Program	no. of spaces	Area per sinle room (sqm)	Total Area
RECREATIONAL SPACES			
1)Soccer Equipment & Ablutions Facility	01	80	80
2) Canoe Pavilion	01	150	150
			230
Estimated cost per sqm in R:			4600
Total Estimated cost per sqm in R:			5 704 000
OUTDOOR			
1) Parking	01	4000	4000
2) Soccer field	01	3600	3600
			7600
Estimated cost per sqm in R:			650
Total Estimated cost per sqm in R:			4 940 000
Total Estimated construction cost per sqm in R:			4600

sustainable considerations.



Professional team

Town Planner:

Assist in the assessment of the current site and in gaining permission for the site the development rights of this intervention

Land Surveyor:

Determine site boundaries and datum levels, Provide site contoursLand surveying reports

Quantity Surveyor

Advice and manage the project costs and finances
Mechanical engineer

Mechanical engineer

Coordinate with the design team to ensure seamless integration of mechanical equipment's

Civil engineer:

Design & do calculations for all structural elements to ensure they meet the building regulations & as well as to ensure that the structure can withstand all loads in its lifespan

Mechanical Specialist

Installation of the recycling mechanical equipment's

Landscape architect

Coordinated the design , planning and oversee the making of external outdoor recreational spaces

Electrical engineer

Design ,installing and maintenances of the electrical systems and equipment's of the building

Main contractor

carries out the project works within the contractual terms and conditions

Subcontractor

Carries out works by main contractor

Project implementation

02. Procurement

Due to the nature of the project being a partnership between city of Johannesburg (government) and Mpact group. The project will therefore the contracting method will be based of the government tenders

02. Site Technicalities and Access

Technicality	Good	Neutral	Bad
1) Access	The site is situated along a major regional route, providing convenient access for deliveries.		Empty plot. Temporary structures would be constructed first to store construction material
2) Material storage			
3) Water supply	Abundant water supply is available from the nearby dam, facilitating construction needs		
4) Recycled building components			phased construction. recycled finishes, furniture and shading screens to installed after the construction of the recycling facility

03. Technology & Materiality

The architecture of this project is thoughtfully designed to respond to the unique context of Soweto, incorporating a sensitive approach to the local environment. The material selection is carefully considered to minimize embodied carbon footprints and adhere to circular economic principles. This commitment is exemplified by the reuse of construction materials sourced from the nearby demolished Orlando Power Station

04. Structure

Simple structural systems and construction technology

Foundation: Pad foundations

Walls : Gabion walls (out of rubble), masonry walls (reusedbricks), Glazing; glass windows(reused glass), polycarbonate, custom plastic recycled shading system.

Structure: Concrete columns, steel beams & roof trusses

Roof sheeting: corrugated sheeting, polycarbonate.

Flooring Finishes: Recycled plastic & rubber tile,

05. Material availability

Most of the materials to be bought for this construction are accessible with the metropolitan area of the site, at warehouses and builders supplies.

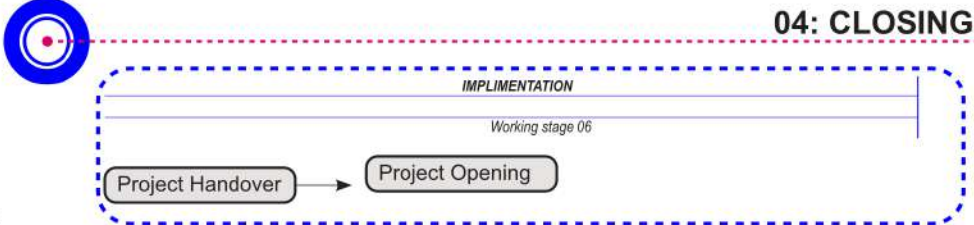
The reused bricks, rubble, glass windows are accessible adjacent the site from the old Orland power station. Concrete rubble will be crushed and reused as aggregate in the production of new concrete.



06. skill

The building makes use of non-complex systems that don't require specialized skills except for the custom recycled plastic shading system

04: CLOSING



CASH FLOW

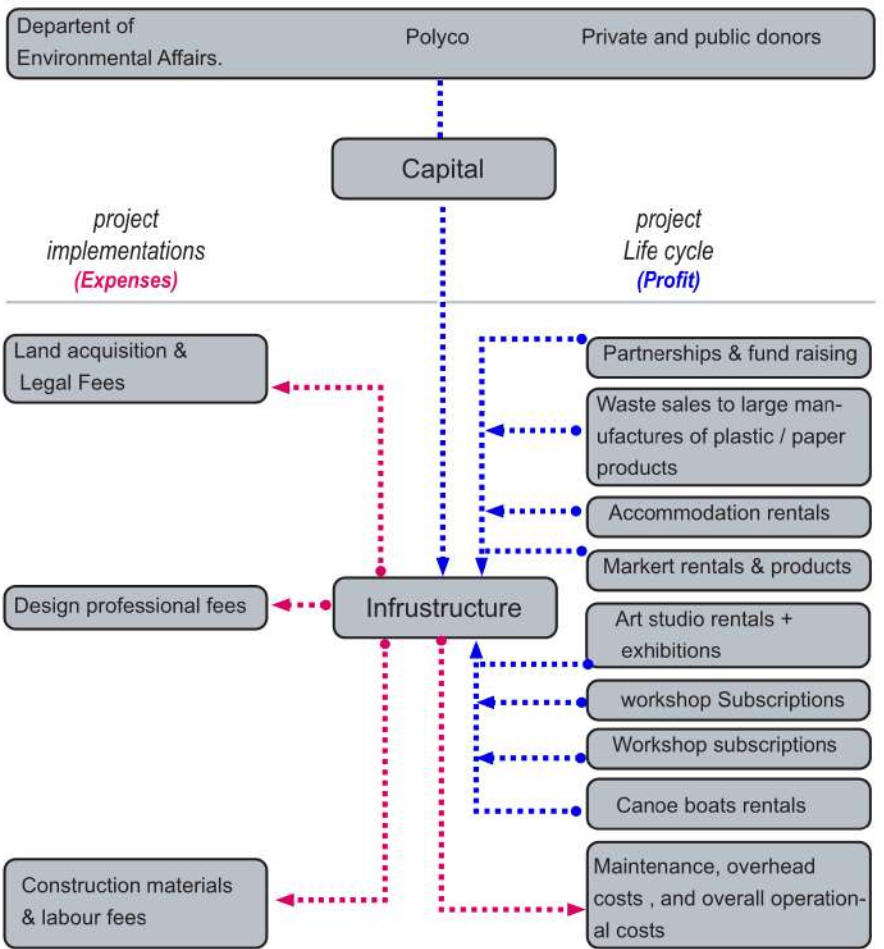


Fig:128. Diagram illustrating the project cashflow (Author,2024)

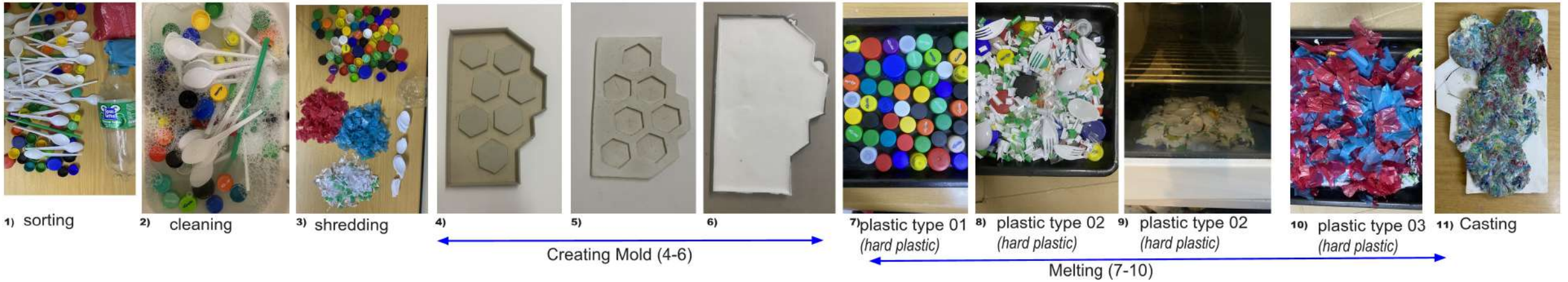
04

CHAPTER

Design : *Initial concept*
: *Design Development*
: *Final design*

RECYCLING

(PROCESS EXPERIMENTS)



This section, we explore the outcomes of a plastic recycling experiment conducted in a home setting, aimed at understanding the potential applications of recycled plastics in architectural and spatial design. By examining the properties and performance of recycled materials, we delve into how these insights can ultimately influence both tectonic elements and spatial configurations. This exploration seeks to bridge the gap between experimental findings and practical design solutions



Fig:130-142. Plastic recycling process
(Author,2024)

CHARRET

(PAPER RECYCLING EXPERIMENT)



1) Create mould



2) Paper sorting



3) Paper shredding



4) Paper pulp



5) Refined paper pulp with blender



6) Paper Moulding



7) Removed mould onto a dry cloth



8) Final recycled paper product



Fig:143-151. Paper recycling process
(Author,2024)

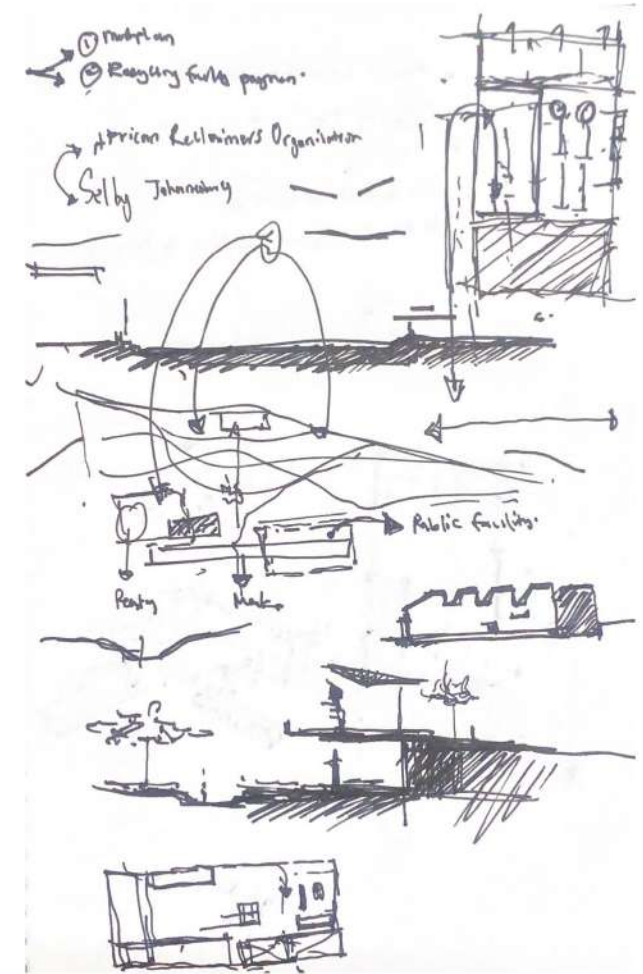
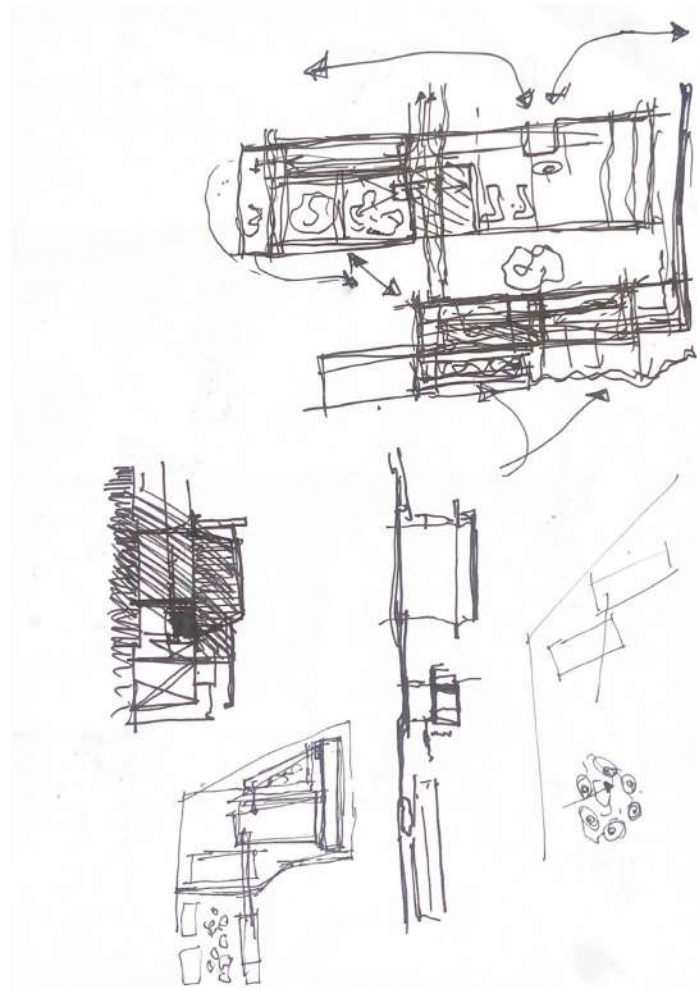
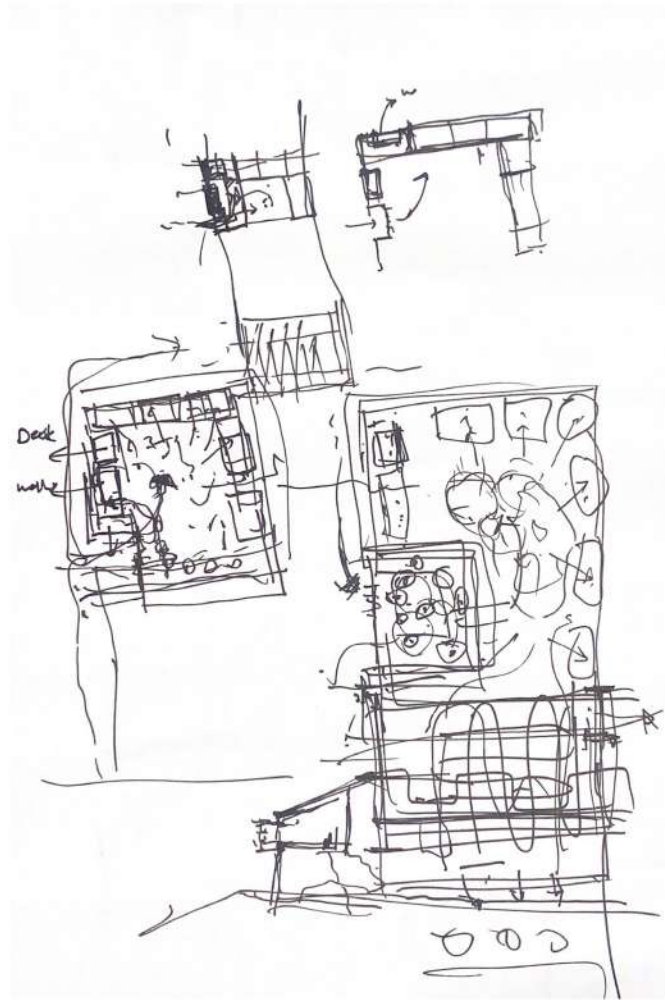
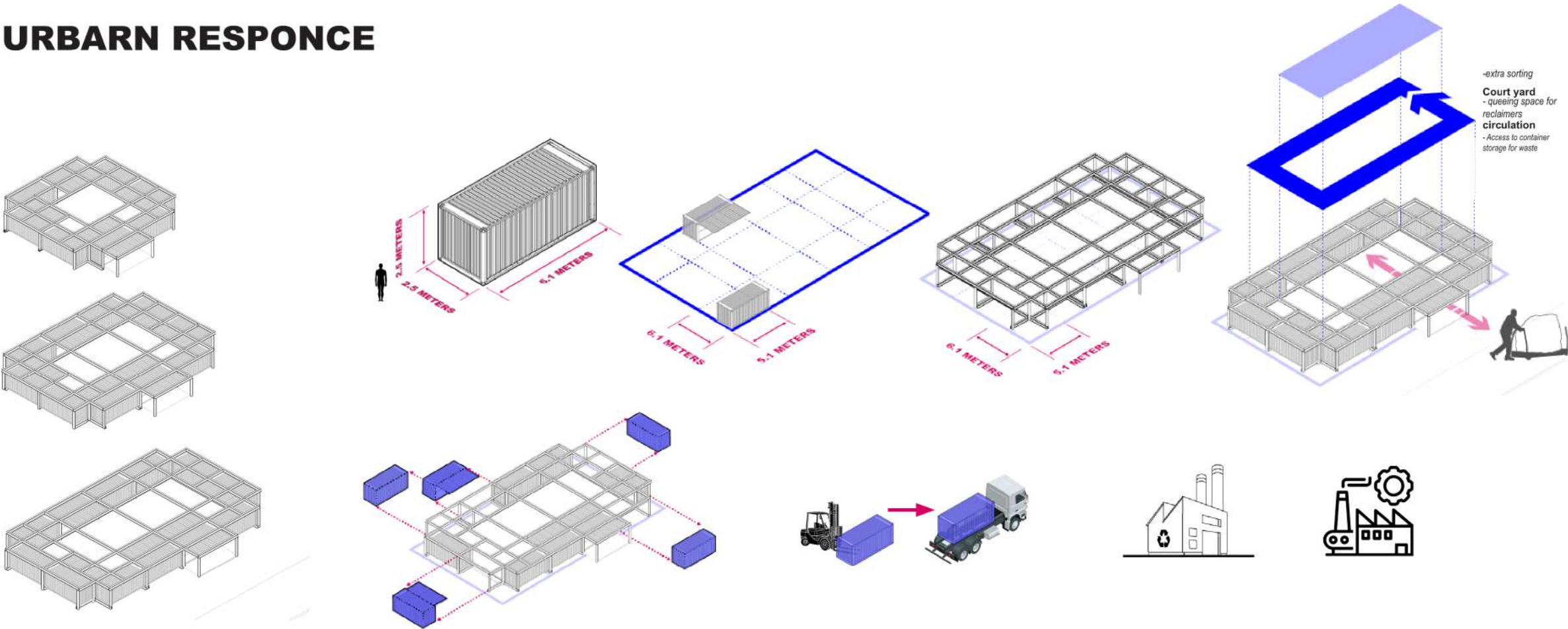


Fig:152. Initial Conceptual sketches
(Author,2024)

URBARN RESPONSE



The urban design strategy for the facility includes establishing waste reclaimer lanes along major routes to facilitate smooth transport from waste collection points to our facility. We propose a modular steel structure that can be deployed throughout the city as the facility expands. These modular units will serve as local waste collection points where reclaimers can sell their recyclables without the need to travel long distances with their loads.

The modular design is highly adaptable, allowing the structure to expand or contract based on the volume of waste brought in by reclaimers from specific areas. This flexibility ensures that the infrastructure can effectively handle varying amounts of waste, optimizing space and resources. From these collection points, our facility will gather the pre-sorted materials, enhancing the efficiency of waste collection. By reducing travel distances and adjusting capacity as needed, this approach not only increases the earnings for reclaimers but also streamlines the recycling process.

Fig:153. Conceptual diagram_ showing the illustrating the project's urban response strategy (Author,2024)

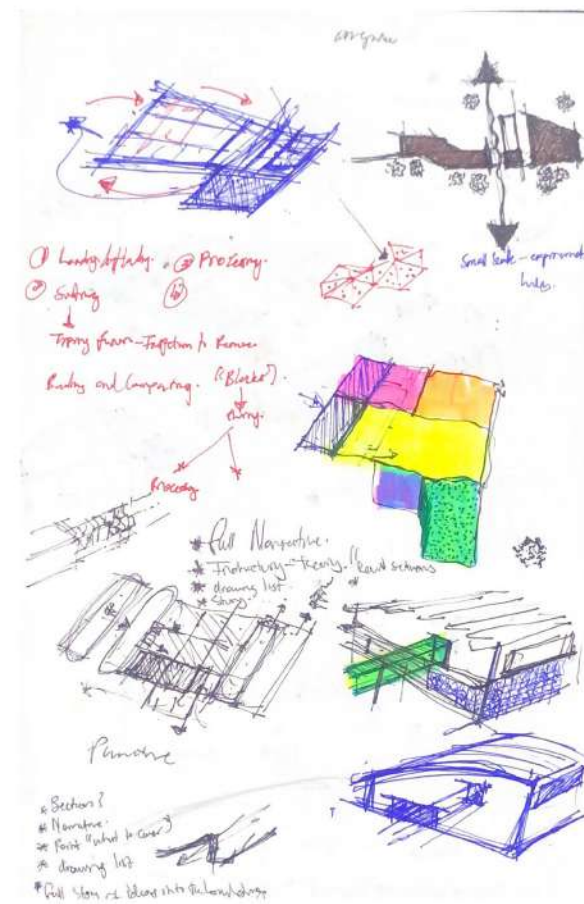
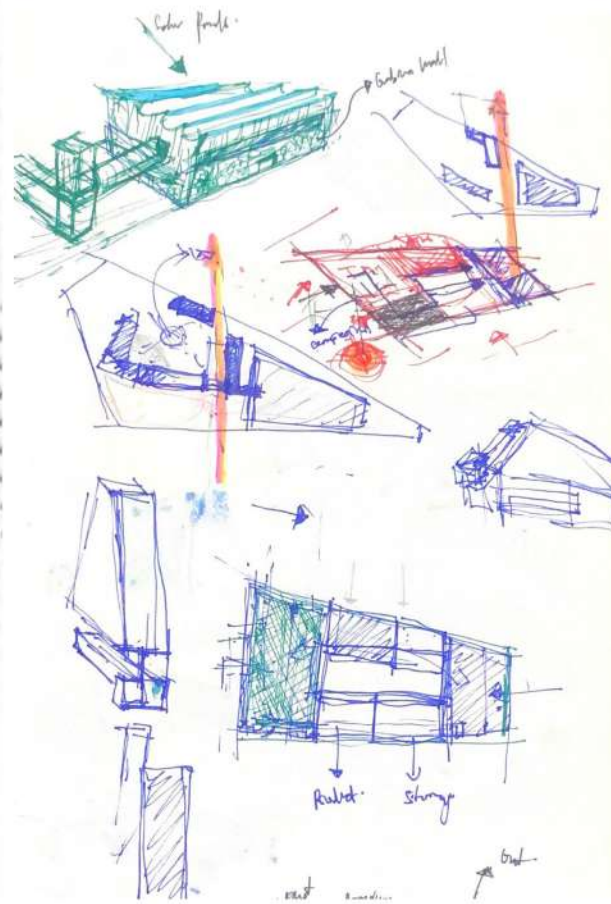
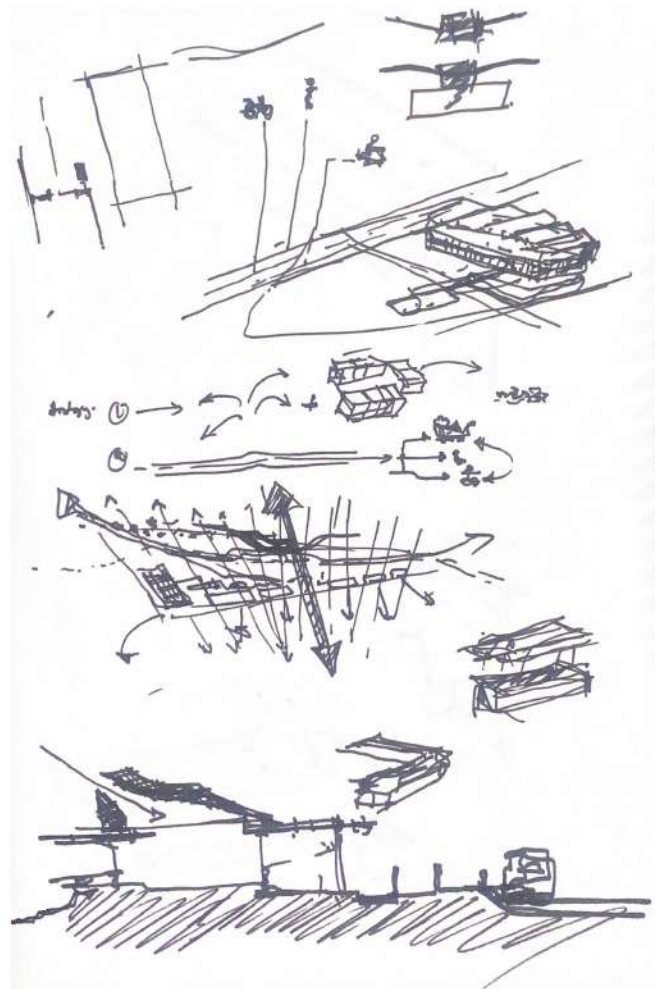


Fig:154.Initial Conceptual sketches
(Author,2024)

MASTER PLAN DEVELOPMENT

(ITERATIONS)

Fig:155-157.design iteration plans.
(Author,2024)



ITERATION 01

Design Iteration One began with an analysis of the site's footpaths, focusing on aligning everything along an axis leading towards the dam as a central destination point. The initial concept aimed to center the design around this focal point, enhancing accessibility and visibility. However, the placement of the recycling facility—a large structure—proved problematic. It lacked adequate access control and was positioned too far from other key buildings, leading to issues with connectivity and convenience. The design needed to address these concerns to improve overall functionality and integration within the site.



ITERATION 02

Design Iteration Two continued to utilize the axis concept but adjusted the strategy by anchoring the buildings at the site corners. This new layout successfully improved access control to the recycling facility, effectively managing site entry and security. However, the iteration revealed a need to better address the scale and proportion of the buildings relative to their surroundings. While access control was enhanced, the design must refine the balance between building size and site context to ensure a cohesive and functional integration with the environment.



ITERATION 03 (Chosen layout)

The final iteration synthesizes all previous design concepts by reinforcing the overall layout with a central courtyard. This design integrates the various elements effectively, positioning the administrative block in close proximity to the recycling facility. This arrangement facilitates a greater interface between the recycling operations and public activities, enhancing interaction while ensuring that recycling efficiency is maintained during visits. The courtyard serves as a focal point, harmonizing the spatial relationships and optimizing both functionality and user experience.



SITE PLAN

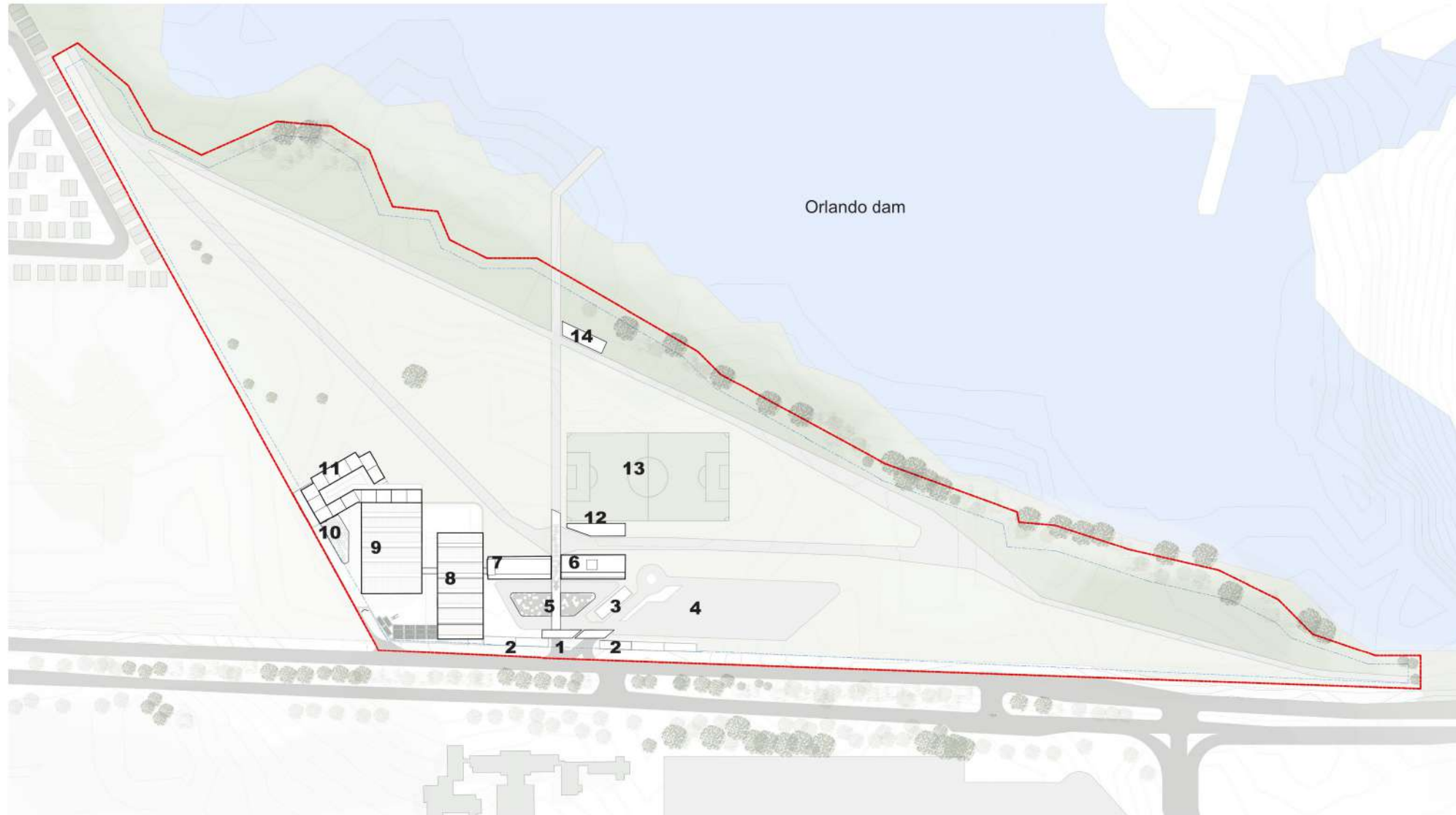


Fig:158. site plan
(Author,2024)

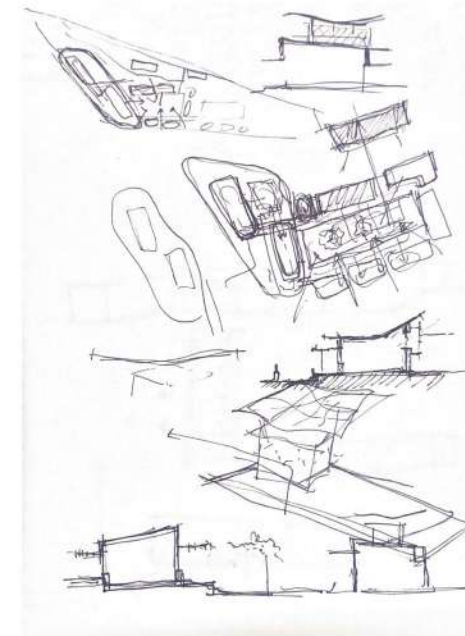


Fig:159.Initial Conceptual sketches
(Author,2024)

1. Entrance
2. Markets
3. Restaurant
4. Parking
5. Courtyard
6. Maker's space
7. Admin block
8. Recycling Facility
9. Material Recovery
10. Informal sorting Area
11. Accommodation
12. Sports & Public ablutions
13. Soccer field
14. Canoeing shelter

PROGRAM

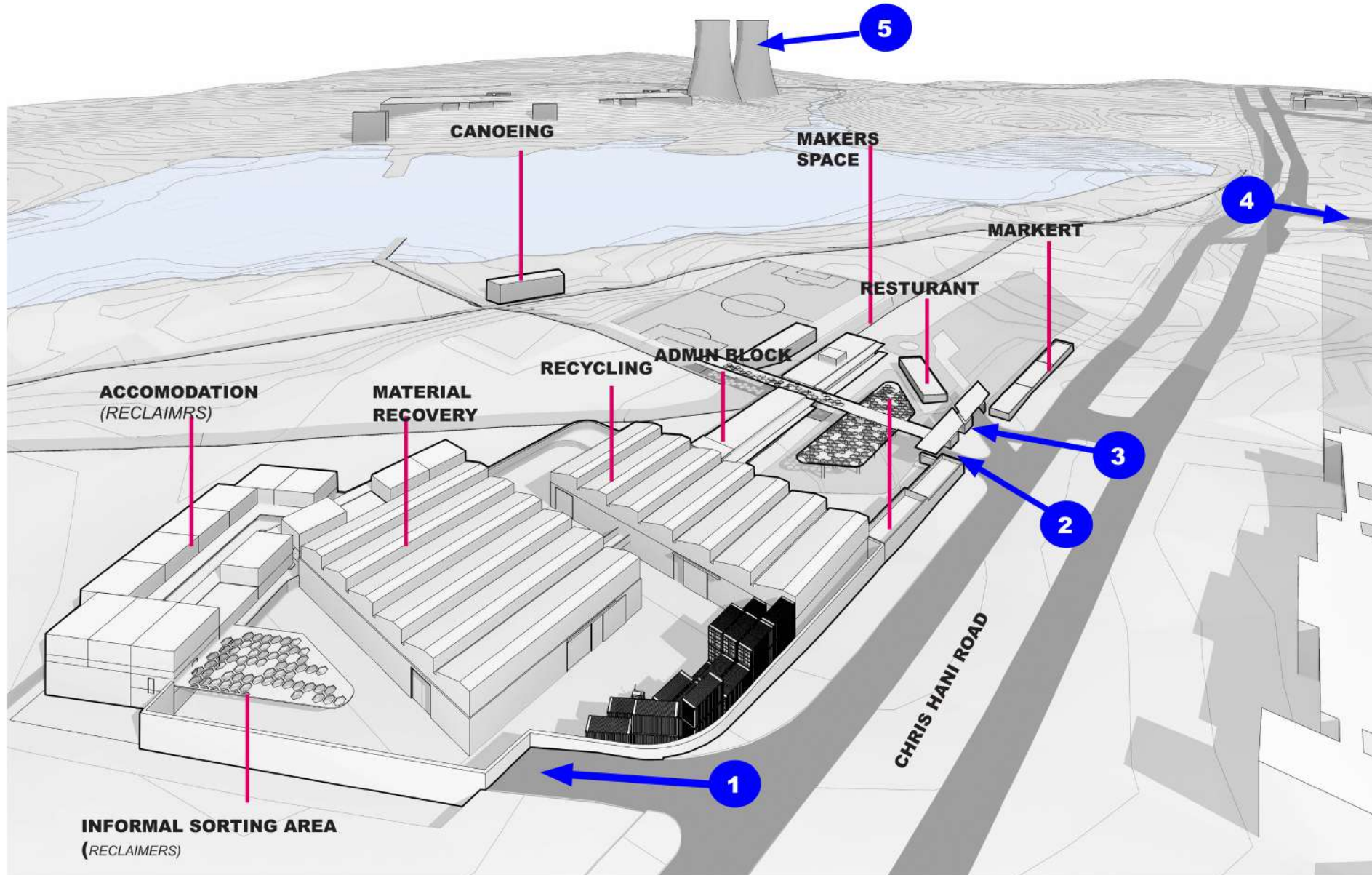


Fig:160.Site Axo_ showing project program and contex
(Author,2024)

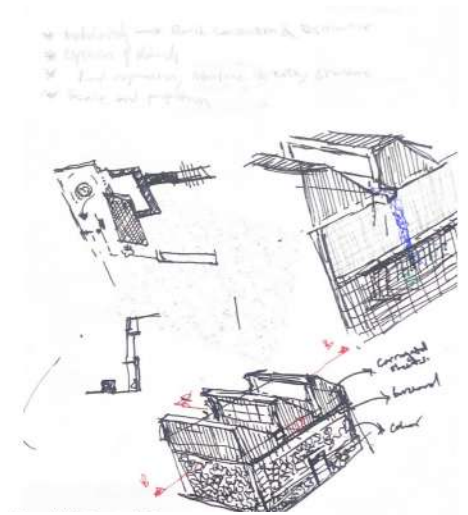


Fig:161.Initial Conceptual sketches
(Author,2024)

1. Recycling operations Entrance
2. Pedestrian Entrance
3. Vehicular Entrance
4. University of Johannesburg Entrance
5. Soweto Towers
7. Admin block
8. Recycling Facility

The Markets, located along Chris Hani Road, are designed as rentable spaces for businesses that sell products made from recyclable materials. These businesses will use these spaces solely for selling their products. Our facility, however, will handle the production of recyclable materials on-site and sell these products directly at the Markets. Additionally, the Makers Space will feature art studios available for rent to artists who work with recycled materials, along with workshops, training spaces, and exhibition areas to support their creative activities.

CIRCULATION

DAIGRAM showing movement of waste reclaimers (in blue) and the formal faacility opperation(in pink) along with the vistors shown in yeallow

- Infomal waste reclaimer movement
- Stuff movement
- Visitor Movement
- Off site Collection points (Waste source)
- Land fill and other collection points for re-claimers

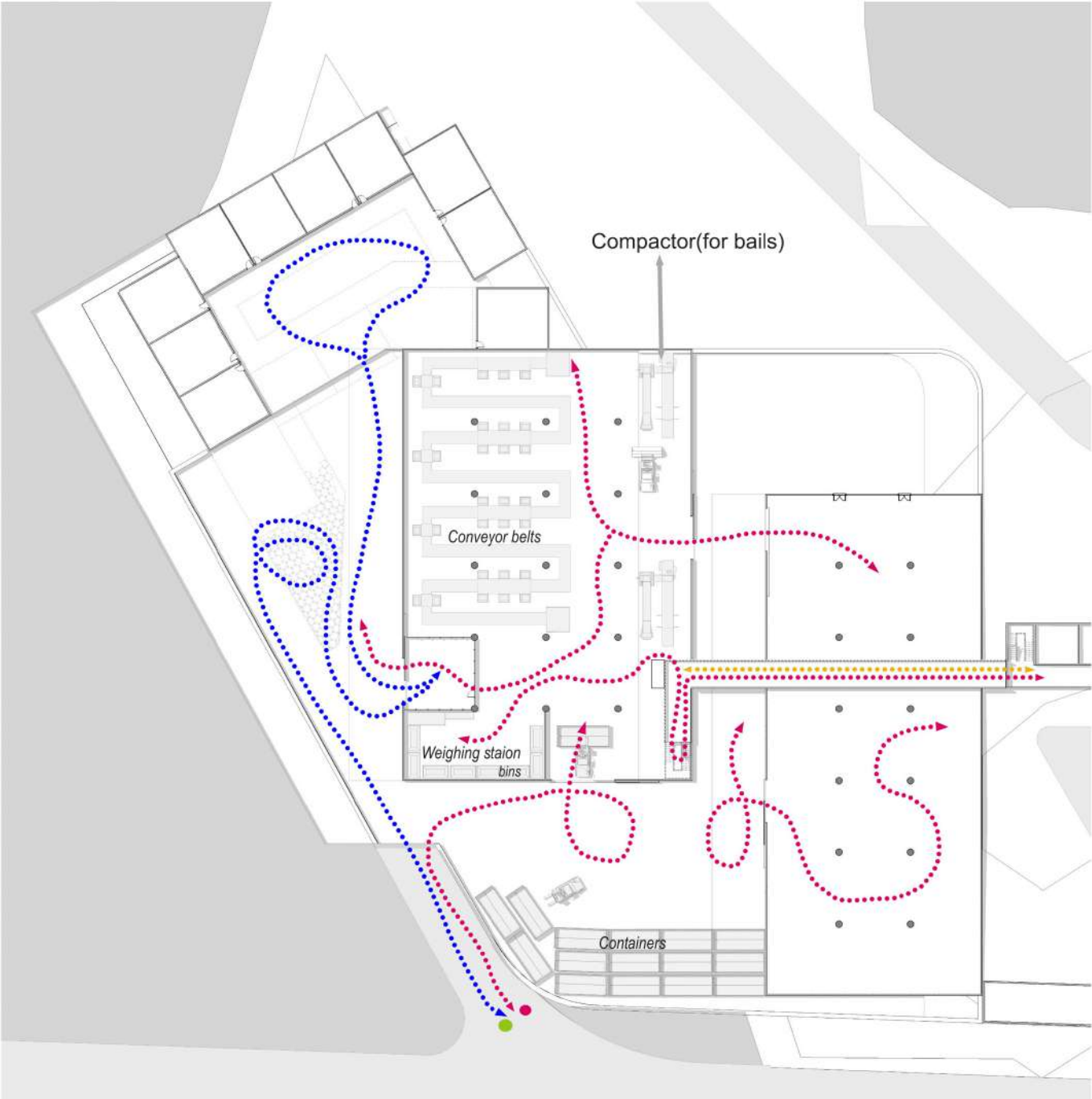


Fig:162.Recycling facility Ciculation diagram (Author,2024)

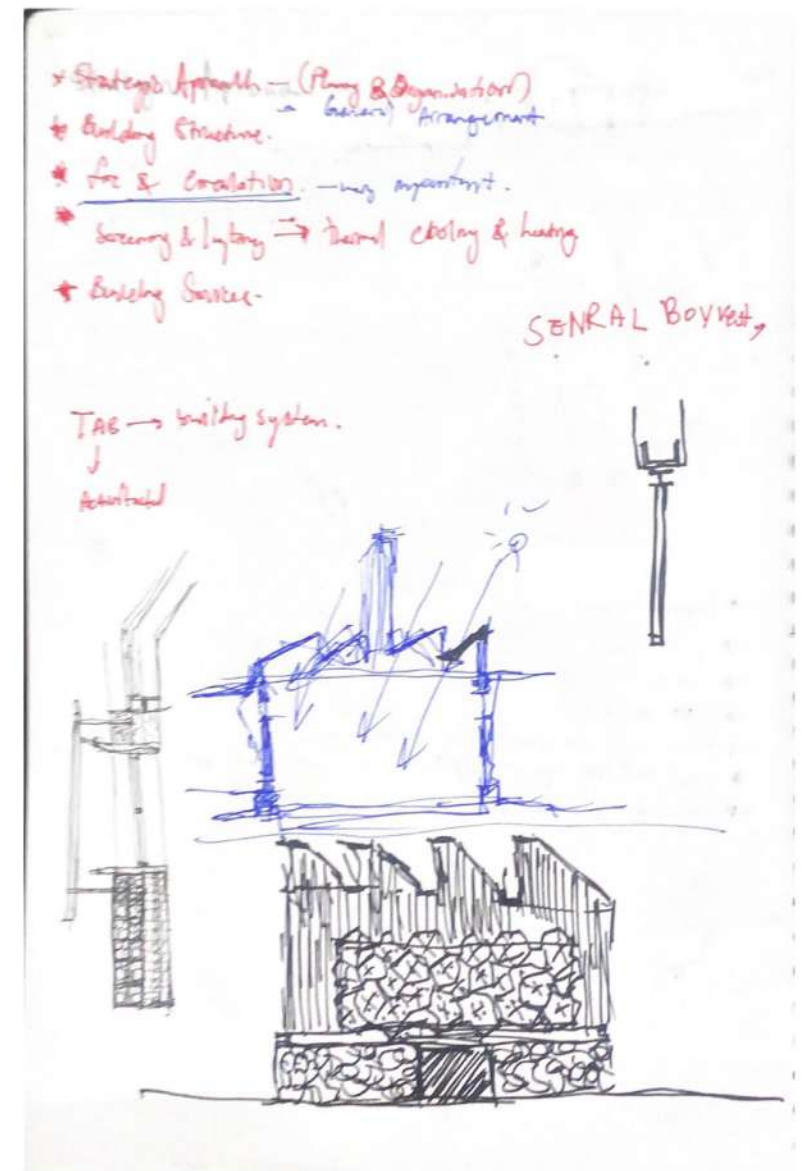
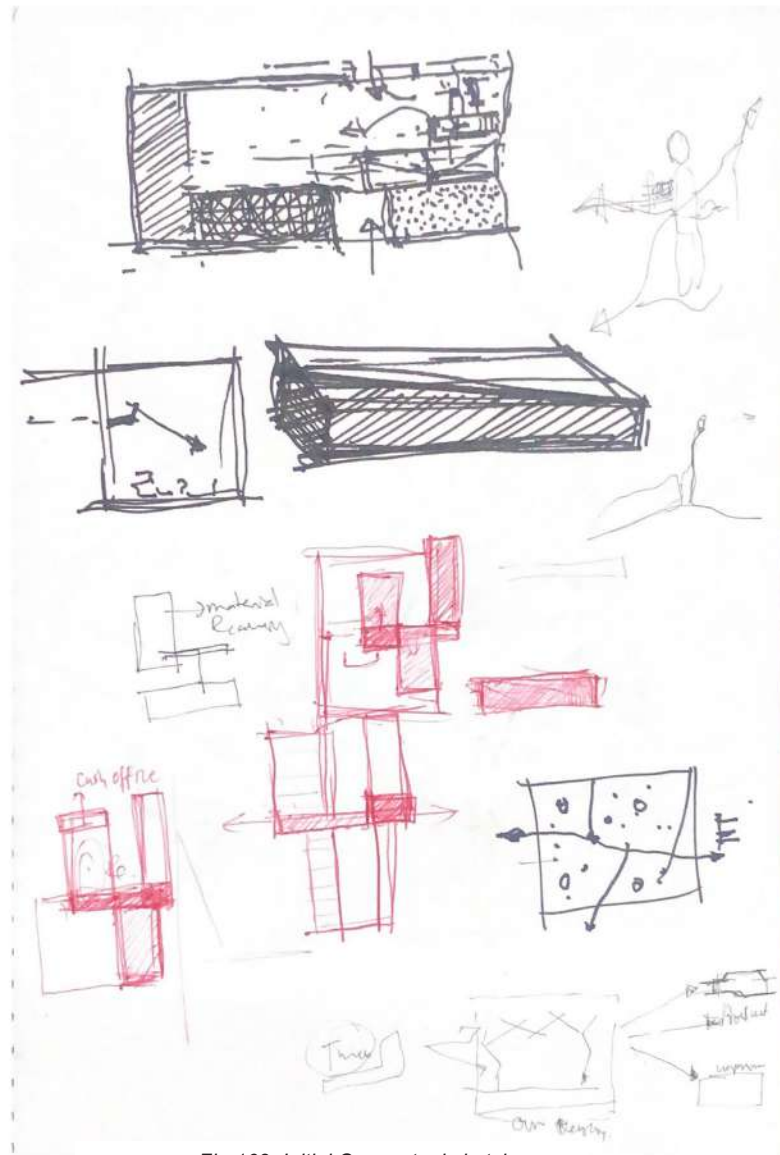
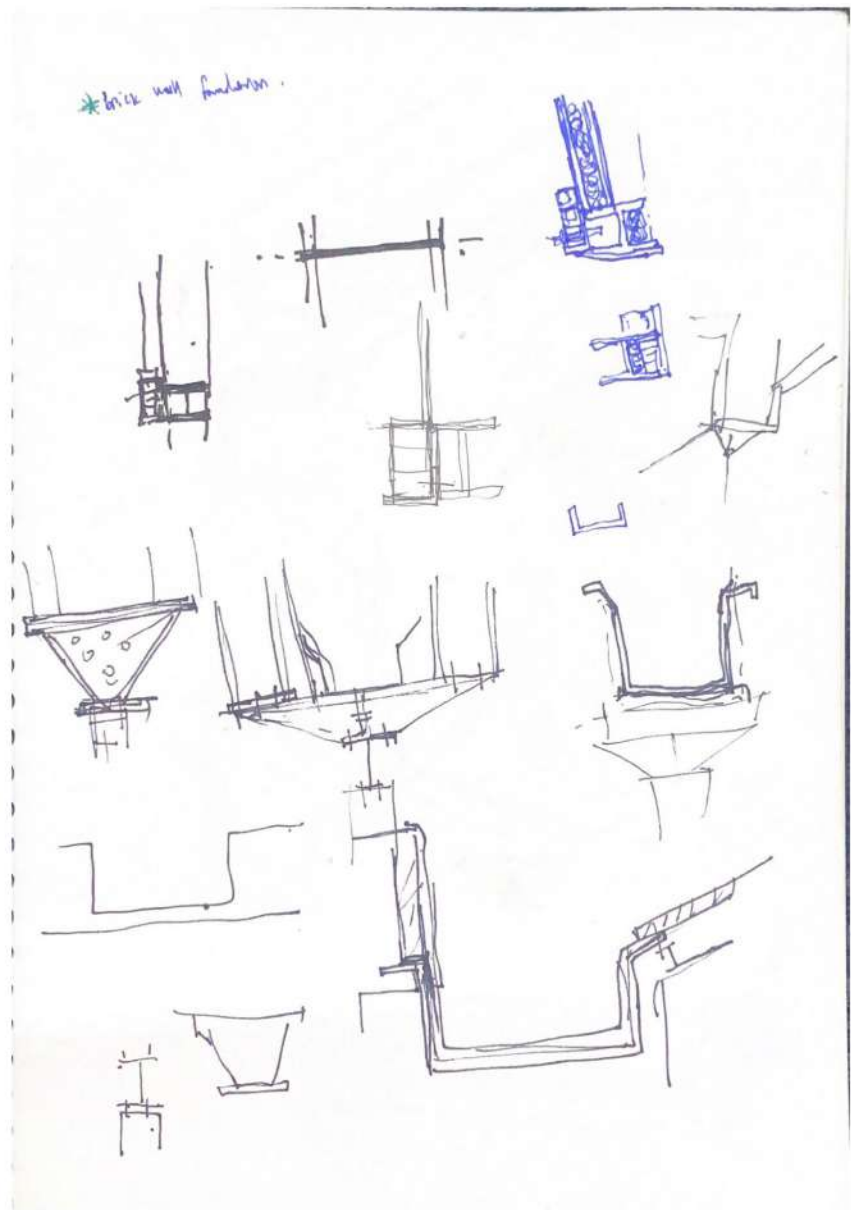


*Fig:163. Initial Conceptual sketches
(Author,2024)*

TECHNICAL DESIGN

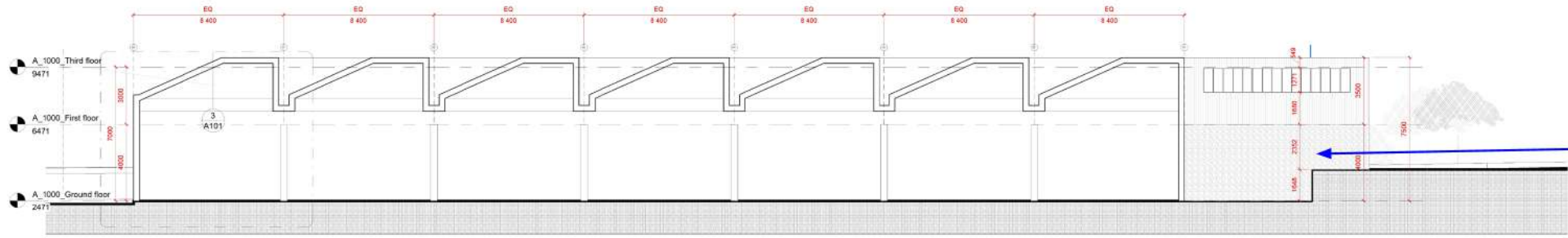
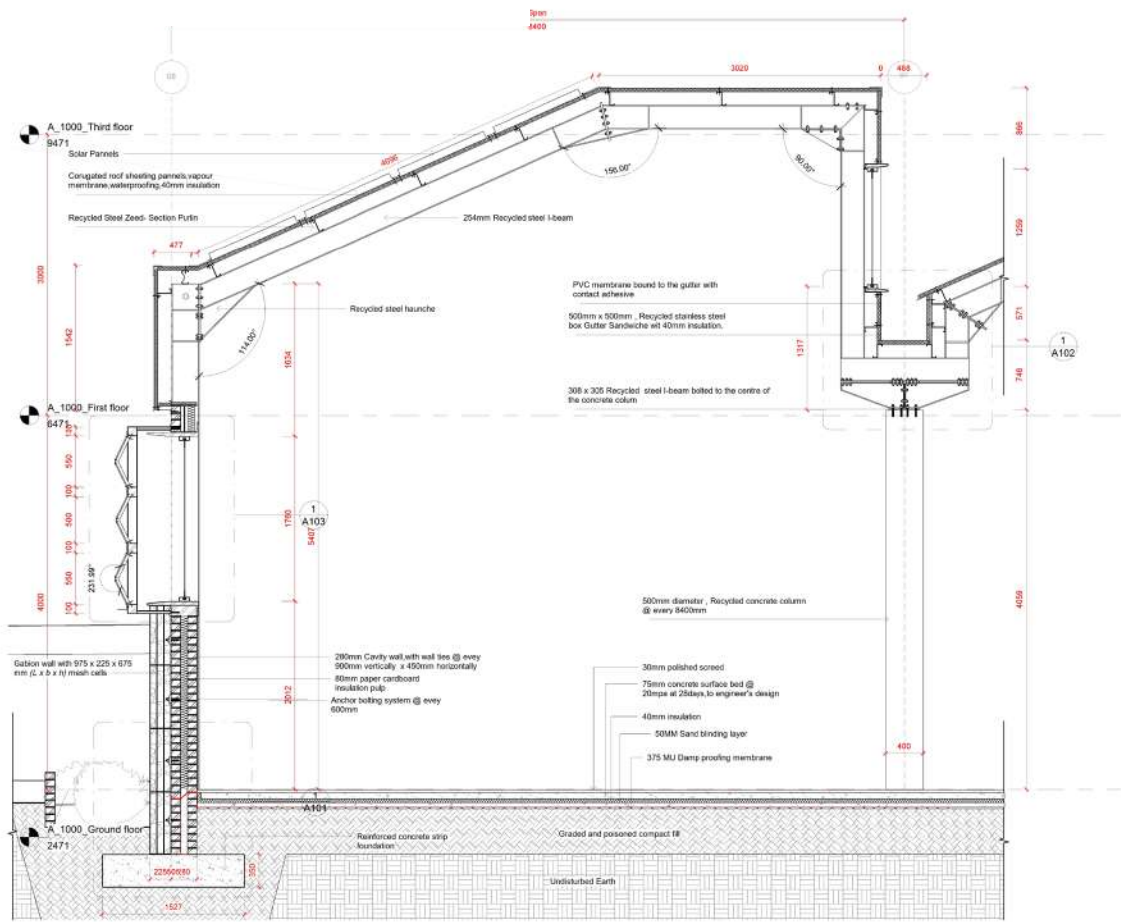


Fig:164. Recycling Facility section
(Author,2024)



SECTION 1 - Callout 1
1 : 25

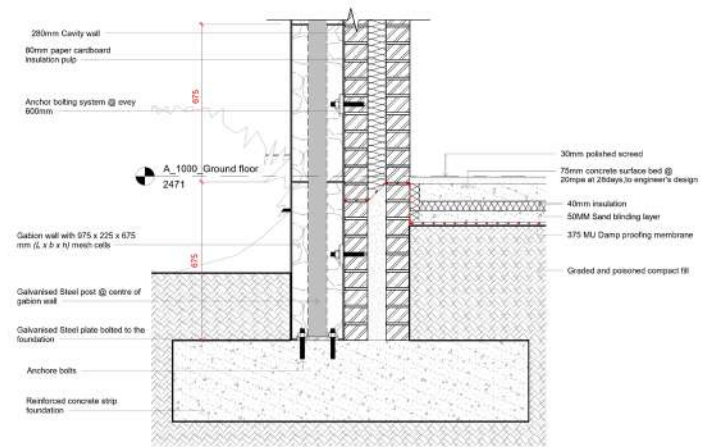


Fig:166. Gabion wall detail_Section
(Author,2024)

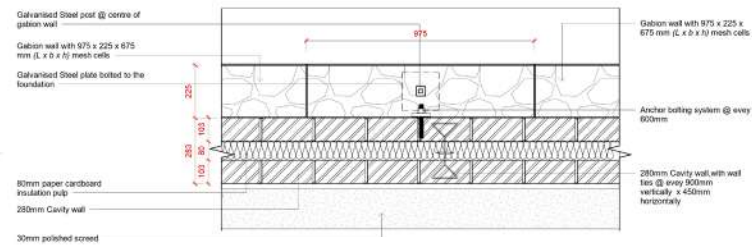


Fig:167. Gabion wall detail_plan
(Author,2024)



Fig:169. Gabion wall reference image
(Unknown,no date)



Fig:168. Gabion wall supports,reference image
(Unknown,no date)

Given that we are repurposing materials from demolished buildings, the compressive strength of the recycled brickwork is likely to be compromised. Therefore, we will use recycled steel as the primary structural support to ensure stability and safety.

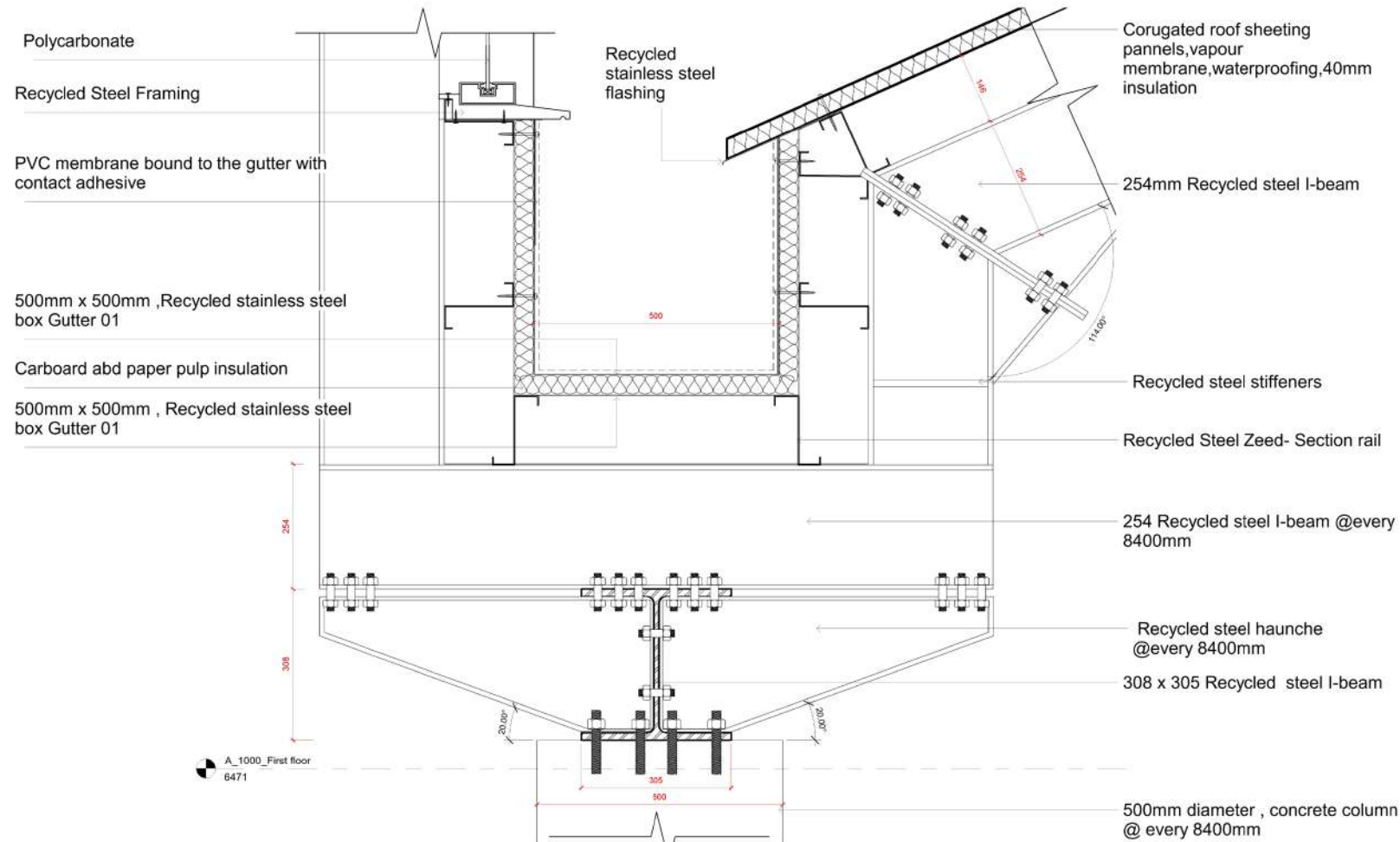


Fig:170. BOX Gutter detail
(Author,2024)

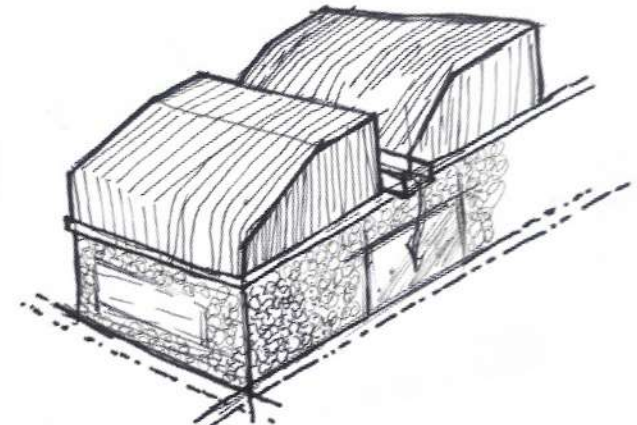


Fig:171. Initial Conceptual sketche, box gutter
(Author,2024)

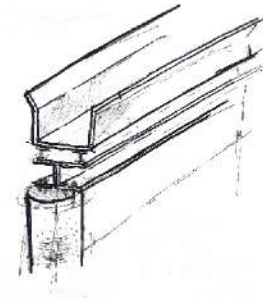


Fig:172. Initial Conceptual sketche, box gutter
(Author,2024)

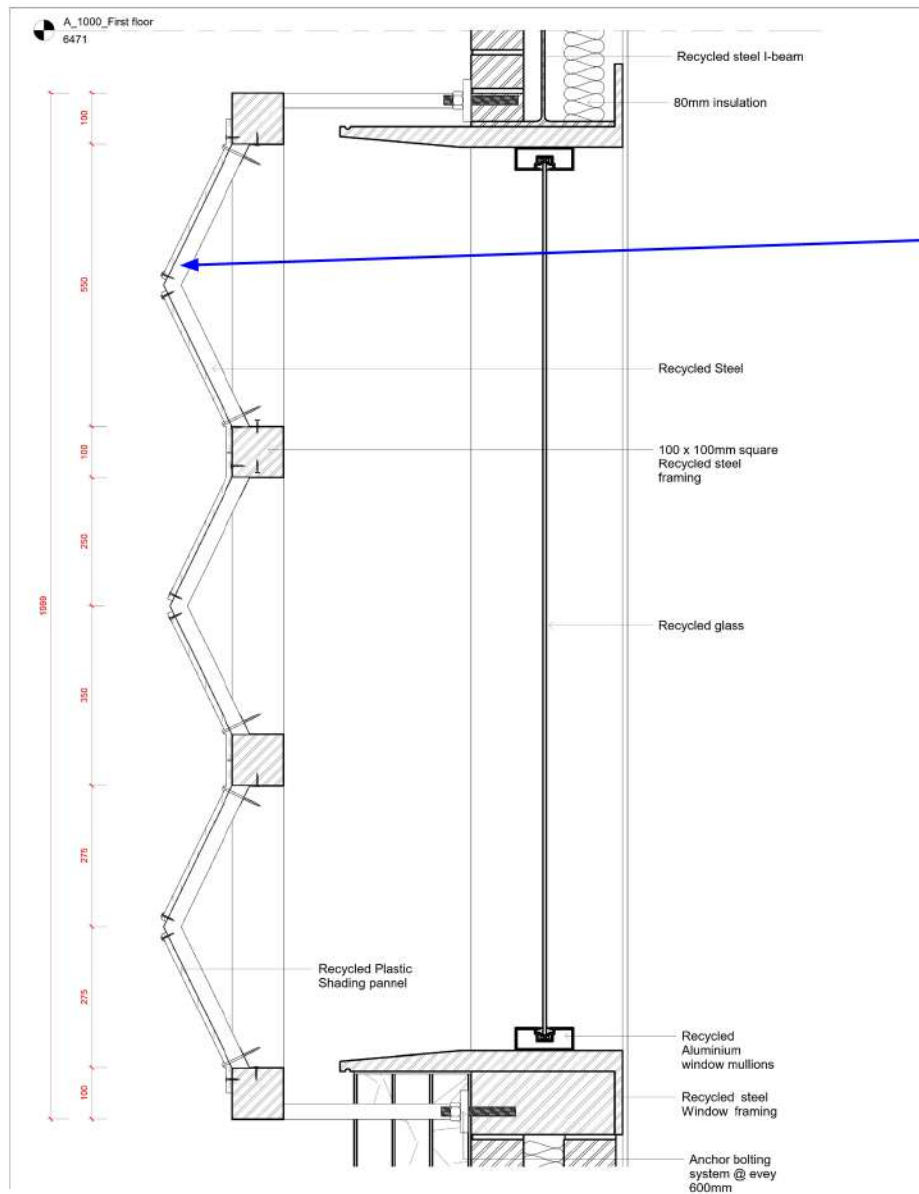


Fig:173. Recycle plastic,Shading system detail
(Author,2024)

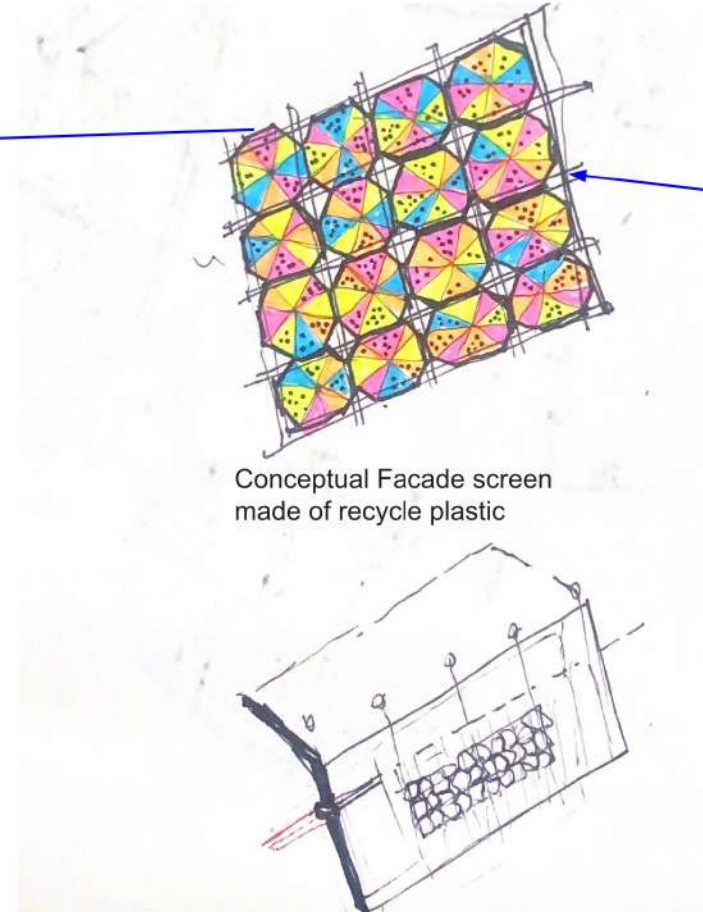


Fig:174. Concetual Recycled plastic,Shading system
(Author,2024)



Fig:175. Shading panel reference
(Unknown,no date)

Recycled plastic panels will be used on the facades for shading, serving as a unifying design element that defines the building's architectural language. Both vertical and horizontal shading screens will be incorporated, embodying the concept of resurgence—rebirth and renewal. This approach reflects the idea of transforming waste into treasure, aligning with Elanastui's vision

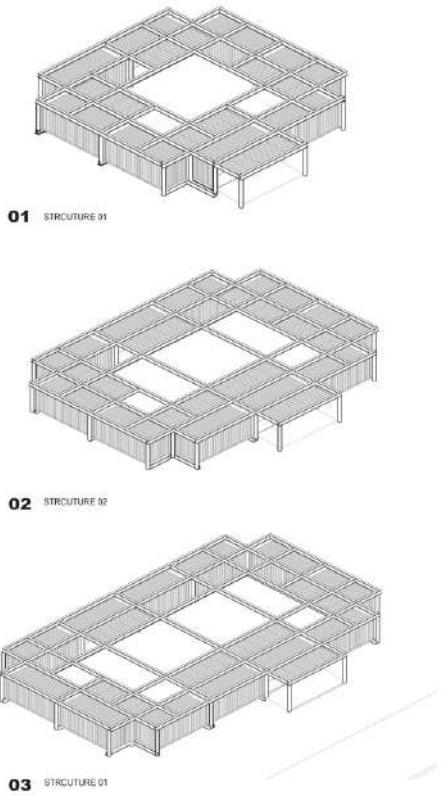


FINAL DESIGN

Fig 176. Project 3d render_Arial view (Author, 2024)



Fig 177. Render showing courtyard of the waste collection satellite structures (Author, 2024)



01 STRUCTURE 01

02 STRUCTURE 02

03 STRUCTURE 03

Fig 178. Design options for the Modular addapeble satilite waste collection structure:(Author, 2024)

CONCEPT

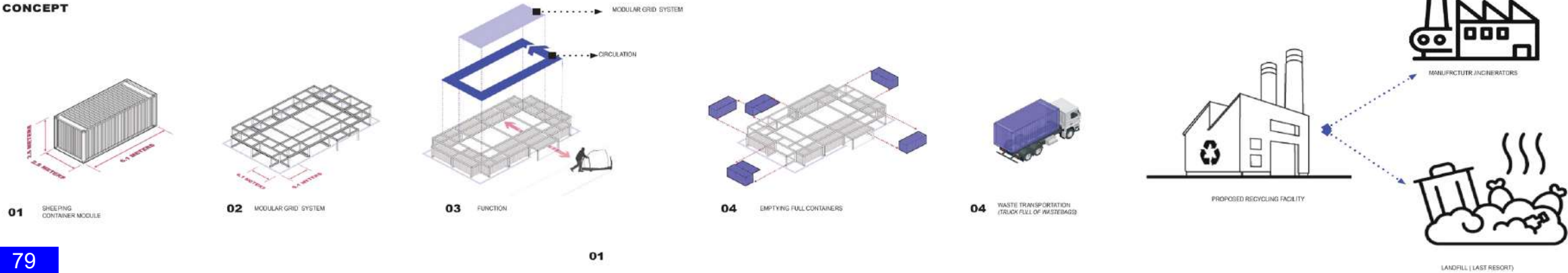


Fig 179. Diagram showing project's urban response strategy (Author, 2024)



Fig 180. Aerial view of the project in context (Author, 2024)

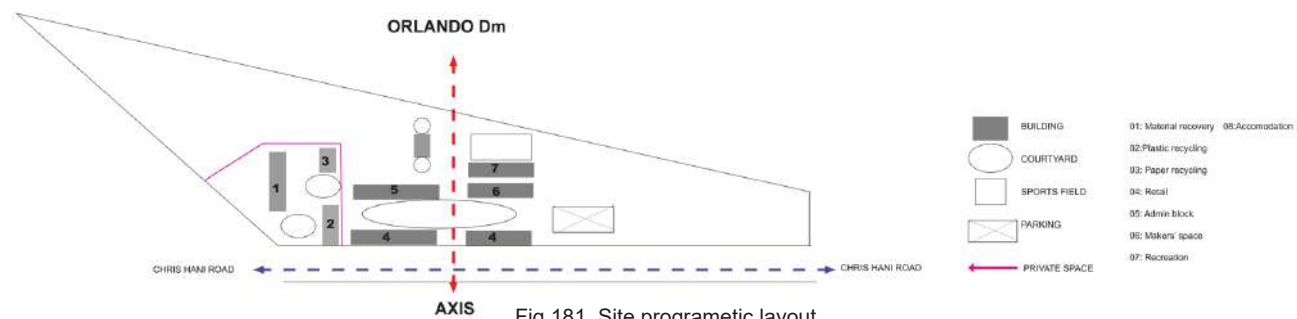
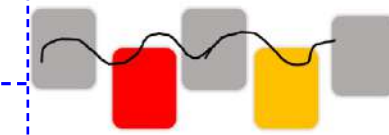


Fig 182. Shading system concept (Author, 2024)

The shading screens are inspired by El Anatsui's recycled bottle cap tapestries. The vibrant colours symbolizes this idea of rebirth and renewal (resurgence), with the recycled materials being given a new life and the waste reclaimers along side the immediate community being given opportunities to learn, earn and create.



WOVEN MODULAR COMPONENTS



- 01: UNIVERSITY OF JOHANNESBURG
- 02: THABA_JABULA SECONDARY SCHOOL
- 03: ORLANDO DAM.
- 04: OLD ORLANDO POWER STATION
- 05: SOWETO TOWERS

Fig 183. Site plan
(Author, 2024)



10 0 10 20 30 40 50
SCALE 1: 1000
m

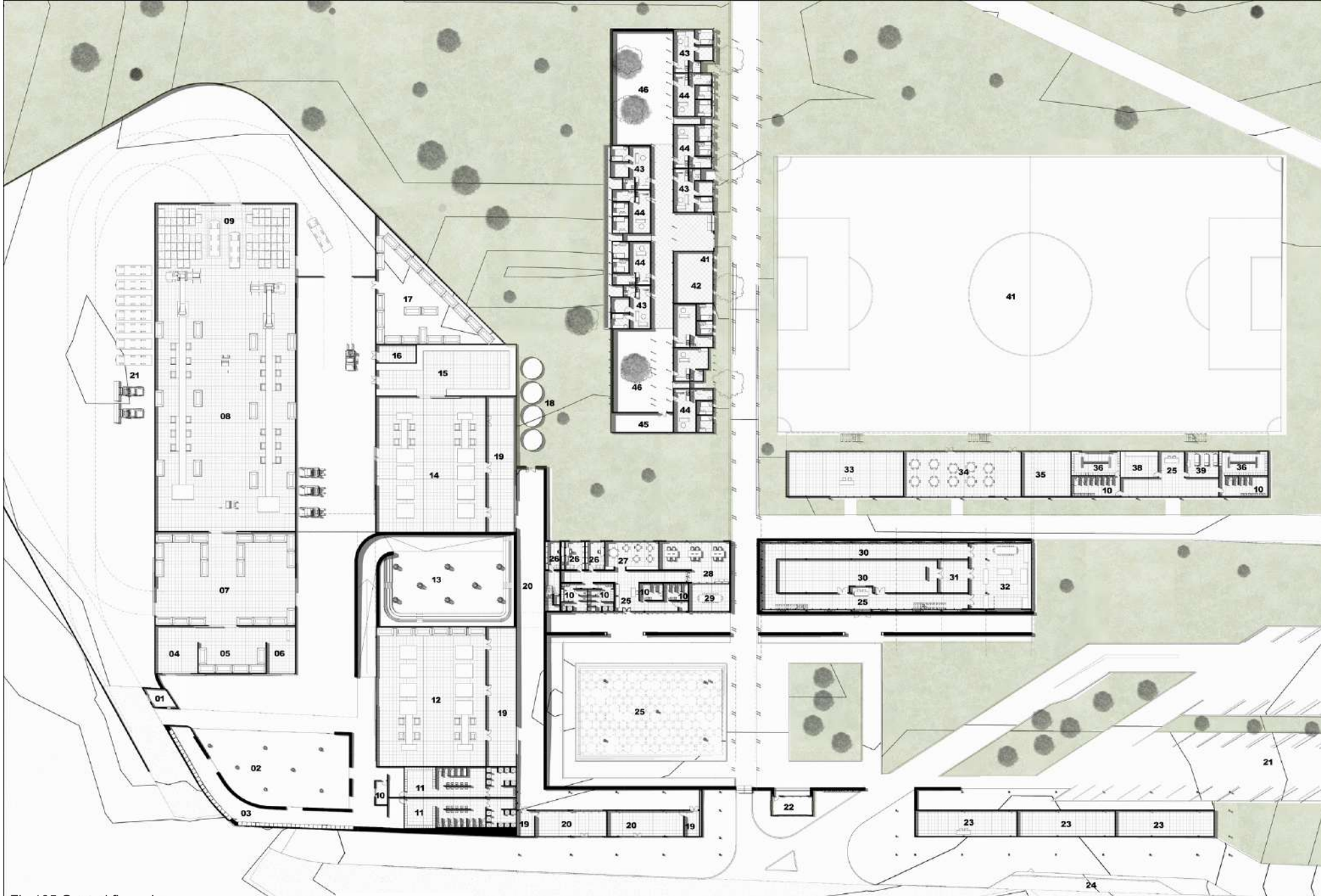


Fig 185.Ground floor plan
(Author, 2024)



Fig 184.key plan
(Author, 2024)

RECYCLING

- 01: Security
- 02: Sorting Area
- 03: lockers
- 04: Weighing station
- 05: Waste bag storage
- 06: Cashier
- 07: Vehicular dropoff
- 08: Formal sorting area
- 09: Ball storage
- 10: Control room
- 11: Rest rooms
- 12: Plastic Recycling
- 13: Private Courtyard
- 14: Paper recycling
- 15: Paper drying area
- 16: HT & LT room
- 17: Non recyclables' storage
- 18: Waste water treatment tanks
- 19: product storage
- 20: Product corridor
- 21: Parking

MARKERT

- 22: Facility retail block
- 23: Rentable retail blocks
- 24: Drop of zone

ADMIN BLOCK

- 25: Public courtyard
- 26: Reception
- 27: Small Office
- 28: Cafeteria
- 29: Open plan office
- 30: Boardroom

MAKERS' SPACE

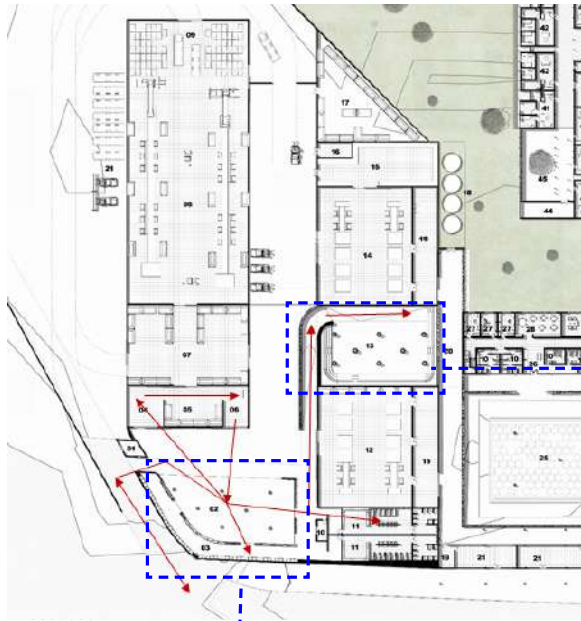
- 31: Exhibition space
- 32: Storage
- 33: Workshop

RECREATION

- 34: Canoe shop
- 35: Resturant
- 36: Resturant Kitchen
- 37: Changing rooms
- 38: Sports equipment storage
- 39: First aid room

RECREATION

- 40: Trolley storage
- 41: Unit type 01
- 42: Unit type 02
- 43: Unit type 03
- 44: Laundr room
- 45: Kids Play area



RECYCLING

- 01: Security
- 02: Sorting Area
- 03: lockers
- 04: Weighing station
- 05: Waste bag storage
- 06: Cashier
- 07: Vehicular dropoff
- 08: Formal sorting area
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- 20: Product corridor
- 21: Parking

MARKET

- 22: Facility retail block
- 23: Rentable retail blocks
- 24: Drop of zone

ADMIN BLOCK

- 25: Public courtyard
- 26: Reception
- 27: Small Office
- 28: Cafeteria

The movement of the waste reclaimer divided between two saces which are the production spaces (sorting area, weighing station & cashier zone) and rest areas (ablutions and the private courtyard). The producon spaces are the spaces that are aligned with assiting the waste reclaimer to earn money and are spaces foer them to refres and socialize .

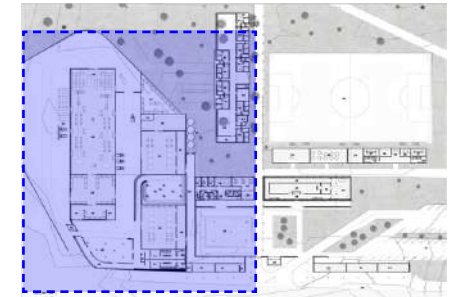


Fig 186.key plan
(Author, 2024)



Fig 187.Floor plan
showing waste reclaimer
movement in the facility
(Author, 2024)

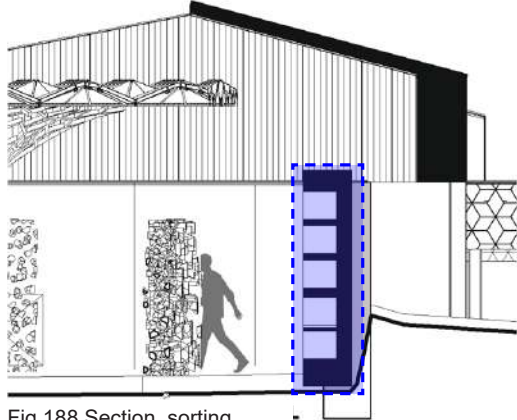


Fig 188.Section_sorting
area boundary wall detail(
storages)
(Author, 2024)



Fig 189.Waste reclaimer rest area
(Author, 2024)

Recycled
plastic

Bridge

steel

Gabion wall

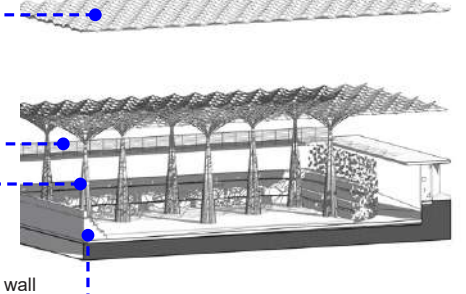


Fig 190.Waste reclaimer Rest area, 3d Axo
(Author, 2024)

The waste reclaimer rest area is centralzed within the layout, to celebrate their contributions within the waste management industry. The bridge connects the public/visitors to the recycling facility (formal waste management system) for educational purposes. This is the only access point that allows visiors to see the entire process without interrupting the daily production activities in the recycling plant



Fig 192.Recycling Facility Perspective view
(Author, 2024)

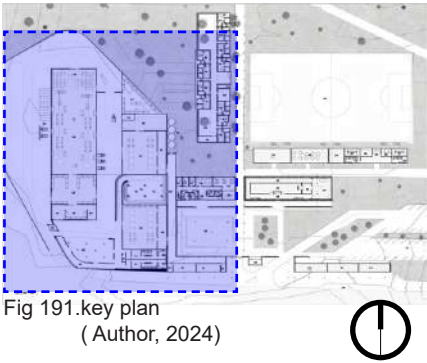


Fig 191.key plan
(Author, 2024)

- RECYCLING**
- 01: Security
 - 02: Sorting Area
 - 03: lockers
 - 04: Weighing station
 - 05: Waste bag storage
 - 06: Cashier
 - 07: Vehicular dropoff
 - 08: Formal sorting area
 - 09: Bail storage
 - 10: Control room
 - 11: Rest rooms
 - 12: Plastic Recycling
 - 13: Private Courtyard
 - 14: Paper recycling
 - 15: Paper drying area
 - 16: HT & LT room
 - 17: Non recyclables' storage
 - 18: Waste water treatment tanks
 - 19: product storage
 - 20: Product corridor
 - 21: Parking
- MARKERT**
- 22: Facility retail block
 - 23: Rentable retail blocks
 - 24: Drop of zone
- ADMIN BLOCK**
- 25: Public courtyard
 - 26: Reception
 - 27: Small Office
 - 28: Cafeteria
 - 29: Open plan office
 - 30: Boardroom

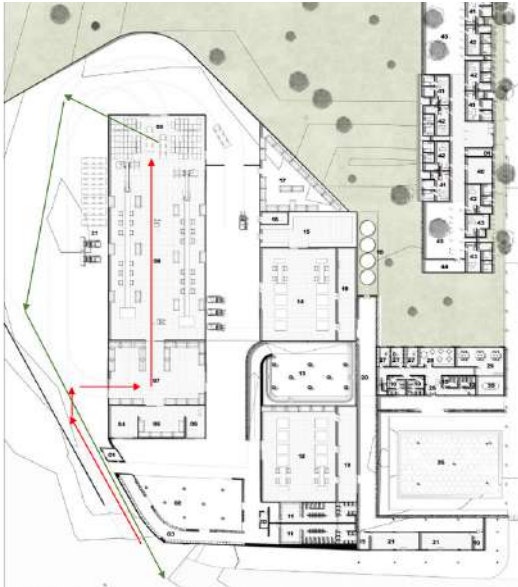


Fig 193.Floor plan showing waste movement from our satalite collection points(Author, 2024)

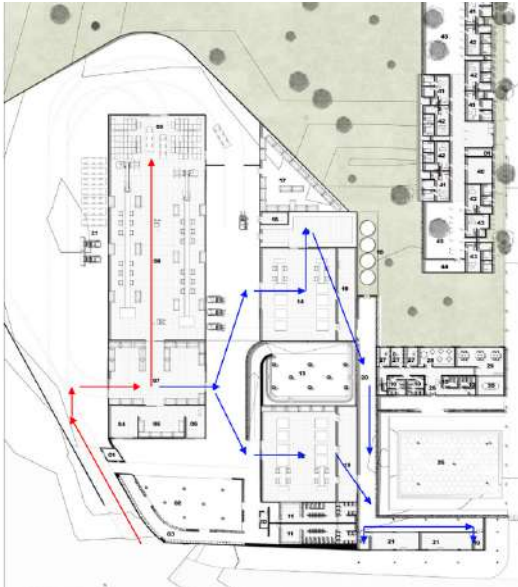


Fig 194.Floor plan showing waste movement into recyclables & final retail products(Author, 2024)

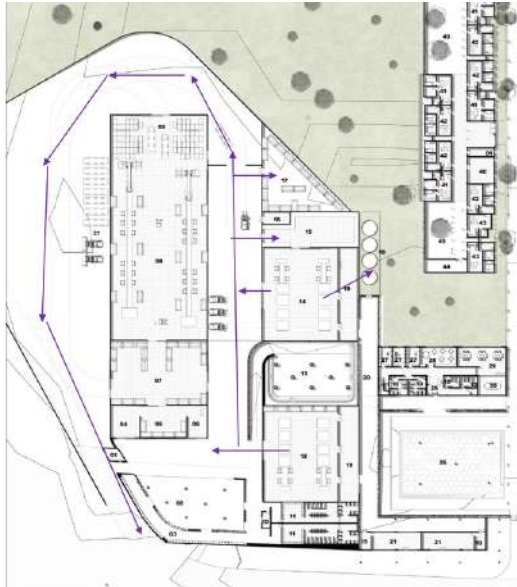


Fig 195.Floor plan showing waste movement of non-recyclables and byproducts out of the facility
(Author, 2024)

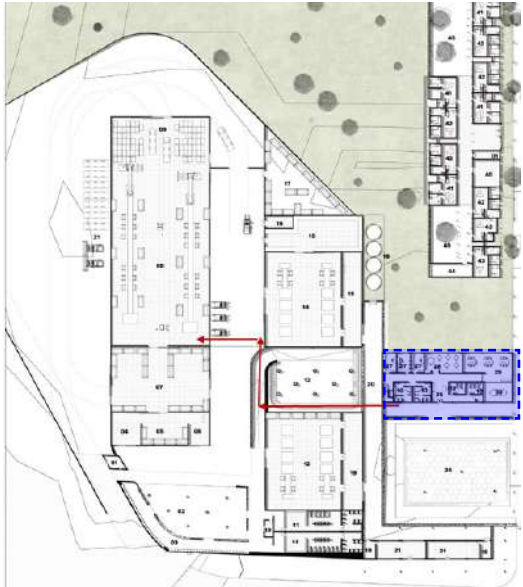


Fig 196.Floor plan showing waste movement of Visitors, through an acces bridge between admin block and recycling facility
(Author, 2024)

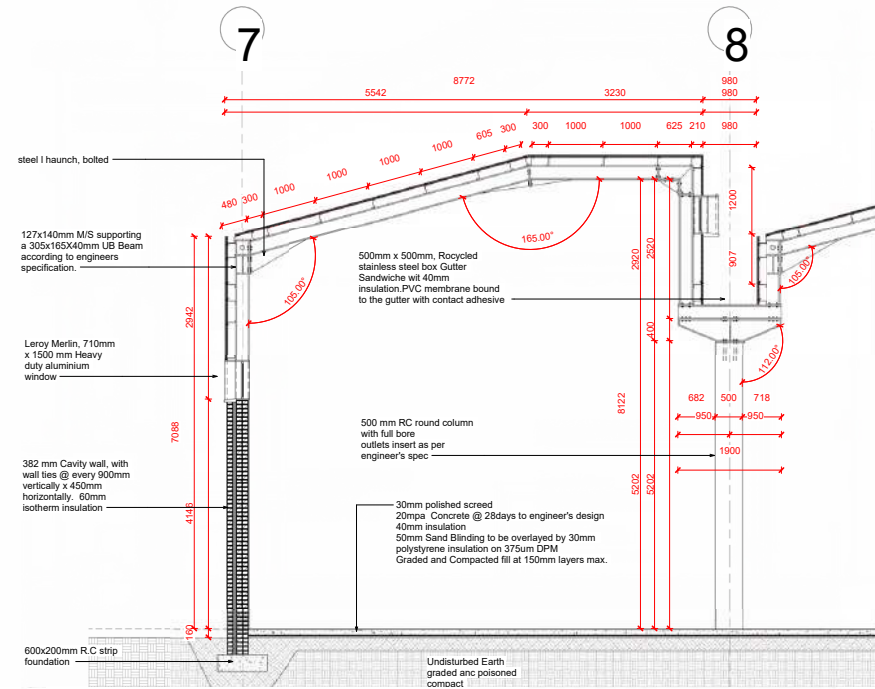


Fig 198.Call out detail A
(Author, 2024)

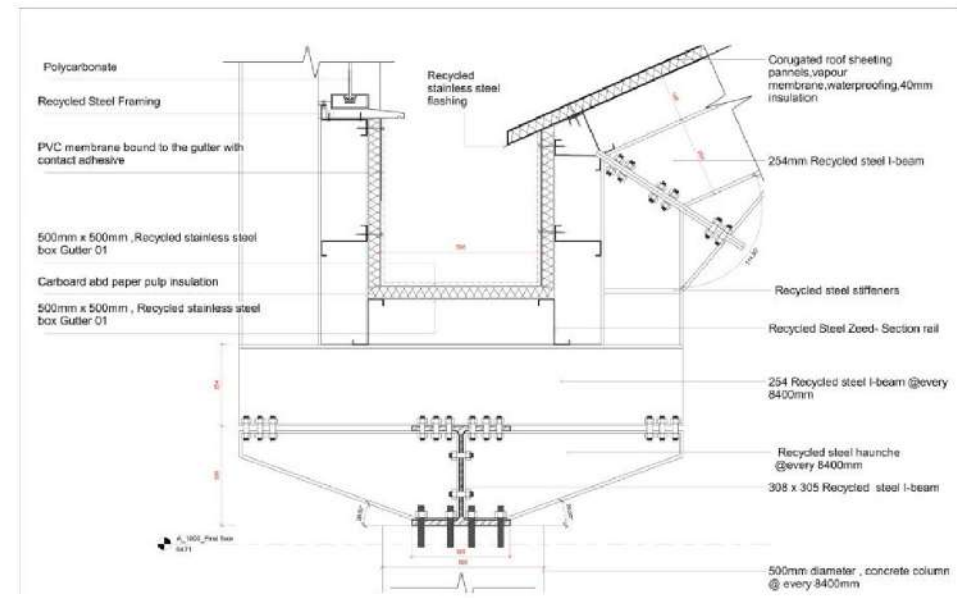


Fig 199.Call out detail B_Box gutter
(Author, 2024)

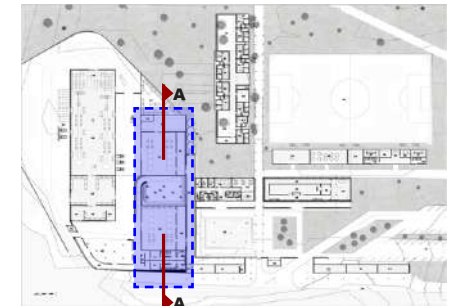


Fig 197.key plan
(Author, 2024)

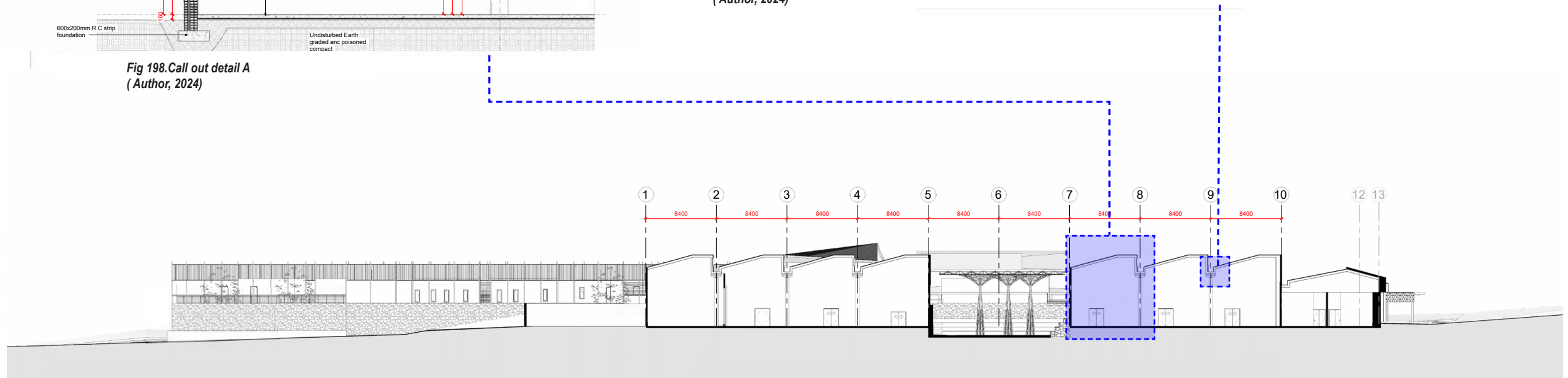


Fig 200.Section AA
(Author, 2024)



Fig 202.South elevation (chris hani road)
(Author, 2024)

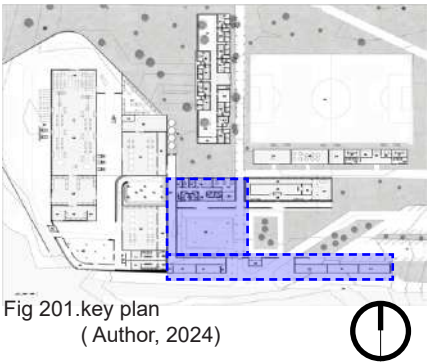


Fig 201.key plan
(Author, 2024)

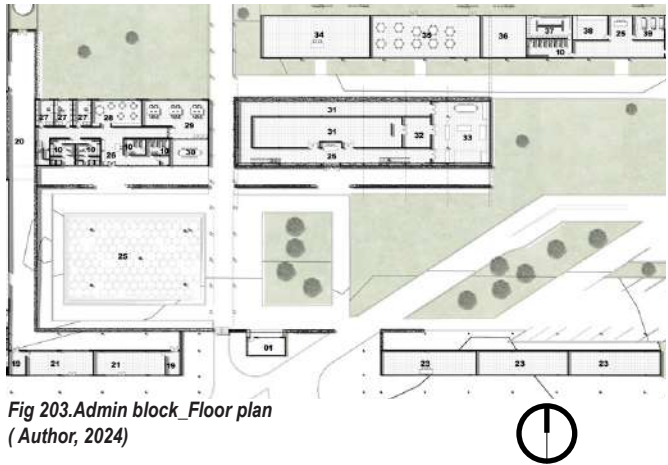


Fig 203.Admin block_Floor plan
(Author, 2024)



Fig 204.Shaded walk way_perspective
(Author, 2024)



Fig 205.Courtyard_perspective
(Author, 2024)



Fig 206.Courtyard_perspective
(Author, 2024)

ADMIN BLOCK

- 25: Public courtyard
- 26: Reception
- 27: Small Office
- 28: Cafeteria
- 29: Open plan office
- 30: Boardroom

MAKERS' SPACE

- 31: Exhibition space
- 32: Storage
- 33: Workshop

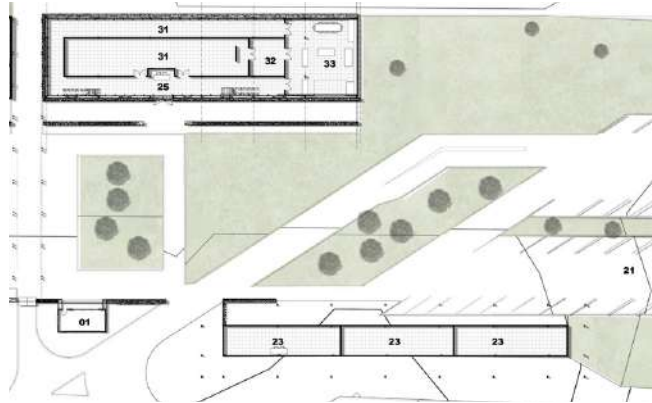


Fig 208. Maker's space_Floor plan
(Author, 2024)

MAKERS' SPACE
31: Exhibition space
32: Storage
33: Workshop

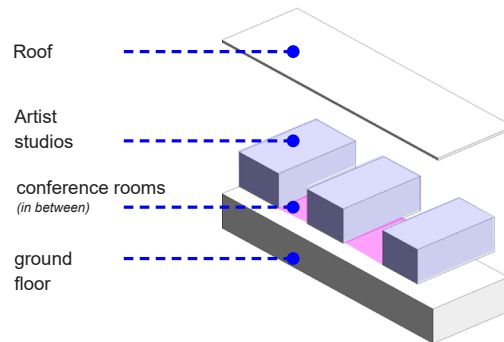


Fig 209. Makers space, program diagram
(Author, 2024)



Fig 210. Maker's space_Courtyard
(Author, 2024)



Fig 211. Maker's space_Courtyard
(Author, 2024)



Fig 207. key plan
(Author, 2024)

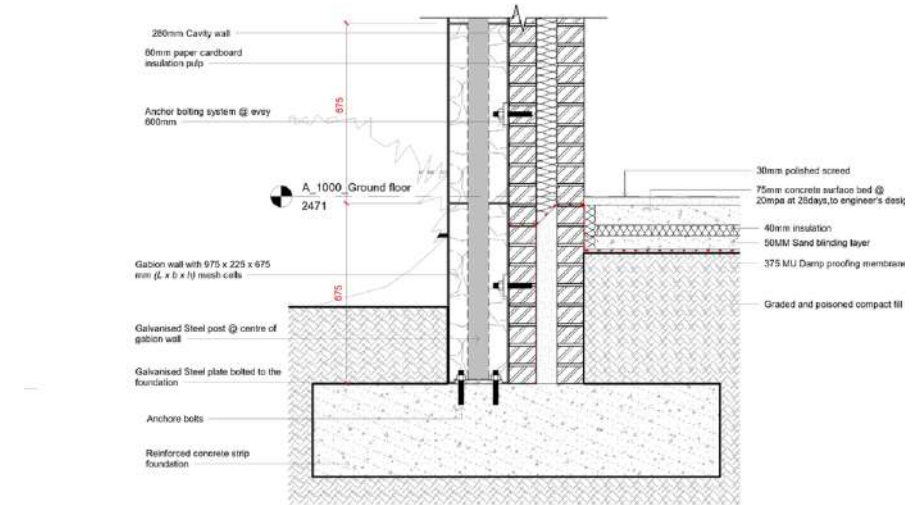


Fig 212. Gabion wall detail_Section
(Author, 2024)

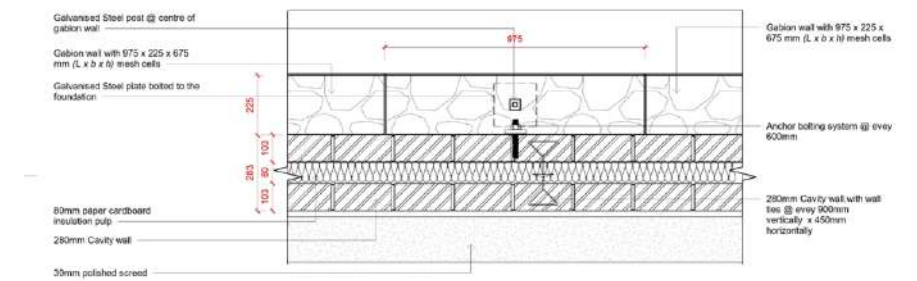


Fig 213. Gabion wall detail_plan
(Author, 2024)



Fig 215.Recreation zone and Accomodation_plan
(Author, 2024)

- | | |
|------------------------------|---------------------|
| RECREATION | Accomodation |
| 34: Canoe shop | 40: Trolley storage |
| 35: Resturant | 41: Unit type 01 |
| 36: Resturant Kitchen | 42: Unit type 02 |
| 37: Changing rooms | 43: Unit type 03 |
| 38: Sports equipment storage | 44: Laundr room |
| 39: First aid room | 45: Kids Play area |



Fig 216.Recreation zone perspective
(Author, 2024)



Fig 217..Recreation zone perspective
(Author, 2024)



Fig 218.Recreation zone perspective
(Author, 2024)

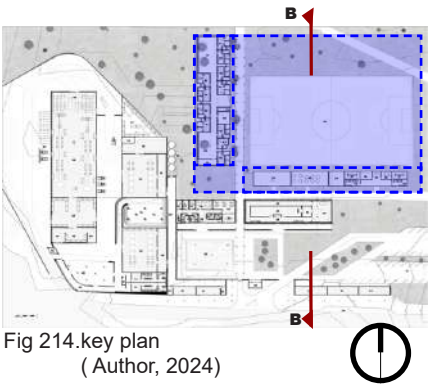


Fig 214.key plan
(Author, 2024)

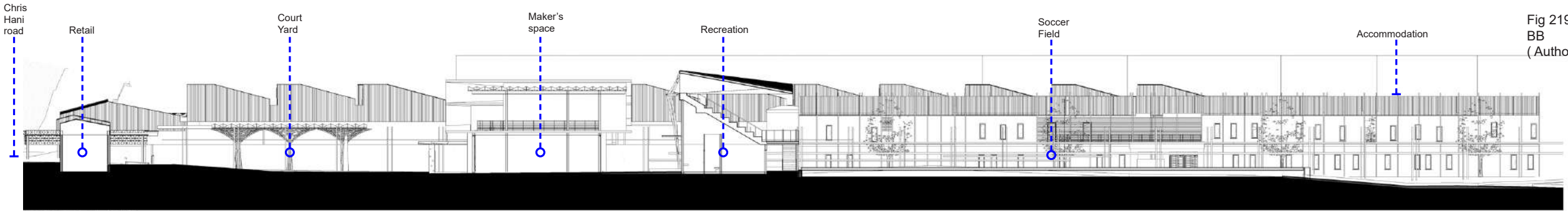


Fig 219.Section
BB
(Author, 2024)



Bale size=1.5m x1.1m = **1.65 m²**

Volume=1.5m×1.1m×0.8m= **1.32m³**

Machine Area = 8,5 x 4 = **34 m²**

Capacity = 9 ton/h x 8hours = **72 ton/day**
 = 72 tons × 907.185 kg/ton = 65,317.32 kg

for 2 machines = **72 tons x2 = 144 tons**

Storage :

Weight of One Bale=Density × Volume= 500kg/m³× 1.32m³= **660kg**

Number of Bales in 72tons = 65,317.32kg / 660 kg
 = 98.87 bales = **99 bales / machine**

Therefore area = Area of One Bale × Number of Bales
 =1.65m²×99 =**163.35m²**

Total Volume= Volume of One Bale×Number of Bales
 =1.32m³×99 = **130.68m³**

Hight of storage= 5m

Maximum bail Layers= Height of Storage/ Height of One Bale = 5m/ 0.8m
 =6.25 layers = **6 layers**

Bales per Layer = Total Number of Bales / Maximum Layers = 99/ 6
 = 16.5 bales per layer = **17 bales**

Total Area (per machine) =Area of One Bale × Bales per Layer =1.65m² × 17
 =**28.05m²**

Thefore minimum area per day = 28.05 x2 (machines) = **56.1 m²**

Model	XTY-1000W11080-60	XTY-1000W11080L-60	XTY-1000W110110-60	XTY-1000W110110L-60
Pressure	100tons	100tons	100tons	100tons
Main Motor Power	45kw	45kw	45kw	45kw
Feed Opening Size (L*W)	1780*1050mm	1980*1050mm	1780*1050mm	1980*1050mm
Bale Size (L*W*H, L is adjustable)	L*1100*800mm	L*1100*800mm	L*1100*1100mm	L*1100*1100mm
Bale Density(OCC)	400-500kgs/m ³	400-500kgs/m ³	400-500kgs/m ³	400-500kgs/m ³
Throughput (30-60kgs/m ³)	5-9tons/h	5-10tons/h	6-11tons/h	6-12tons/h
Machine Weight	15tons	16tons	17tons	18tons
Machine Overall Dimension	8500*4000*4200mm	9100*4000*4200mm	8700*4000*4200mm	9300*4000*4200mm



80% to 90% of plastic and paper waste recycled in South Africa, is recycled by informal reclaimers.



Each informal reclaimer diverts up to 24 tons of recyclable waste a year from our country's landfills.

There are **approximately 8000** reclaimers in Johannesburg. Some have been collecting recyclables for more than 30 years and there are families with several generations of reclaimers. 05 May 2021



Wits University
<https://www.wits.ac.za/news/latest-news/opinion>

Johannesburg is threatening to sideline informal waste ...

$$\text{Daily diversion} = \frac{24 \text{ tons}}{365 \text{ days}} = 0.0658 \text{ tons/day}$$

Each informal reclaimer diverts approximately 0.0658 tons (or about **65.8 kilograms**) of recyclable waste from landfills each day.

$$\text{Average percentage} = \frac{80\% + 90\%}{2} = 85\%$$

$$\text{Total plastic and paper waste} = 24 \text{ tons} \times 0.85 = 20.4 \text{ tons}$$

$$\text{Daily diversion} = \frac{20.4 \text{ tons}}{365 \text{ days}} = 0.056 \text{ tons/day}$$

$$= \underline{\underline{56 \text{ kg/day}}}$$

$$\text{Therefore : Plastic waste} = \frac{56 \text{ kg}}{2} = \underline{\underline{28 \text{ Kg/day}}}$$

$$\text{Plastic waste} = \frac{56 \text{ kg}}{2} = \underline{\underline{28 \text{ kg/day}}}$$

$$144 \text{ tons} \times 907.185 \text{ kg/ton} = 130,816.32 \text{ kg}$$

$$\begin{aligned} \text{Minimum number of reclaimers} &= \text{Total Waste} / \text{Waste per Reclaimer} \\ &= 130,816.32 \text{ kg} / 56 \text{ kg} = 2,335.29 = \underline{\underline{2,336}} \end{aligned}$$

For the facility to process 144 tons of waste a day, 2,336 waste reclaimers would be require

If 10% of the are able to access the site then :

$$10\% \text{ of } 2,336 = 2,336 \times 0.10 = 233.6 = \underline{\underline{234}} \text{ reclaimers in a day}$$

If 10% is accommodated then:

$$12\% \text{ of } 234 = 234 \times 0.12 = \underline{\underline{28}} \text{ reclaimers}$$



Fig 220-222.
Final exhibition
models
(Author, 2024)

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