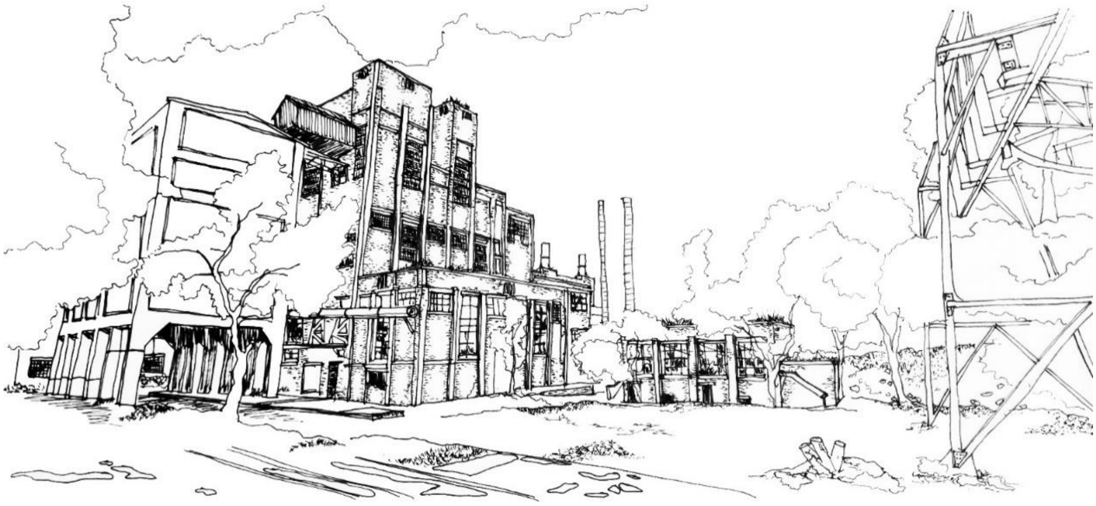
Seva: being in service to a larger whole



By

Tayla Ashleigh Summerton

16027338

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Main supervisor: Paul Devenish

Co-supervisor: Tariq Toffa

Discipline coordinator: Jan Hugo

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2.0 Abstract

Due to expanding cities and rapid urbanization, many urban spaces are scarred with brownfield sites from the industrial era. These sites are often abandoned, polluted and act as idle zones in the urban context preventing urban connectivity, recognition of industrial heritage, effective land use and healthy ecosystems. It is critical to bridge the divide between urban and natural systems to ensure the prosperity of future cities and generations. Therefore, this project looks at how architecture can act as a regenerative device between a brownfield site and the natural environment to inaugurate socioeconomic value on a macro, meso and micro scale. The site explores a dialogue between the surrounding urban systems and the sites natural systems through an eco-learning urban environment. The site vision builds onto the adjacent university's spatial development frameworks and local architect's proposed urban frameworks by connecting the adjacent universities, surrounding student residences and Empire Road movement through pedestrian corridors. This is a proposed research site between the University of Johannesburg, the University of Witwatersrand and the Council of Industrial Research (CSIR) in which students, researchers and lecturers involved in environmental restoration can use the site to conduct research on Phytoremediation processes. This is to not only restore the site itself but to create a space for Phytoremediation research for the Johannesburg mining belt as well, as this is a new, natural, on-site cleaning process being explored in South Africa to restore polluted industrial land. The site's ground floor is an interactive eco-learning environment for the public and upper floors house the semi-private laboratory spaces. When a user passes through the site, they come into contact with and are educated about the natural onsite cleaning processes (constructed wetlands and mixes of planting). Through the use of the sites recycled materials, existing buildings, incorporation of the natural environment and circular green economy thinking, a regenerative design where man and nature coexist mutually is achieved through recognising living system potential of existing components of the built environment.

3.0 Introduction

As a result of rapid urbanization and expanding cities, many places like Johannesburg are scarred with brownfield sites from the industrial era (Kirovova & Sigmundova, 2014). These sites are often abandoned, polluted and act as idle zones in the urban context.

3.1 General Issue

It is currently evident in our urban contexts that there is a disconnection between the built and natural environment and the health and well-being of its users (du Plessis, 2023). Scientific projections indicate that if urbanization continues as it is now (separate from the natural environment), future generations will not be sustained by natural ecosystems due to vast pressures on its natural systems. It is therefore critical to understand and establish a balance between urban and natural systems and people, and to recognize our cities and human settlements as part of the systemic operations of natural systems.

3.2 Urban Issue

Brownfield sites that act as idle zones in the urban fabric prevent urban connectivity and effective land use and fail to recognize the value of industrial heritage (Goosen & Fitchett, 2020). To prevent further urban decay, make efficient use of existing infrastructure and discourage urban sprawl, the redevelopment of urban brownfield sites is critical to explore. Part of recognizing urban forms and human settlements as part of nature is to consider urban systems and forms from a regenerative perspective to recognize living system potential of existing components of our built environments.

3.3 Architectural Issue

A common worldview of the design of the built environment in the past has been ego-centered (du Plessis, 2023), in which people and the natural environment have been detached from each other. This resulted in the degradation and exploitation of the natural environment. This ideology is especially emphasized during the industrial era. The aim of this project is to investigate a possible solution to the disconnection between natural and manmade; interior and exterior; ruin and regenerate.

3.4 Project question

How can architecture act as a regenerative device between a brownfield site and the natural environment to inaugurate socio-economic value?

4.0 Context

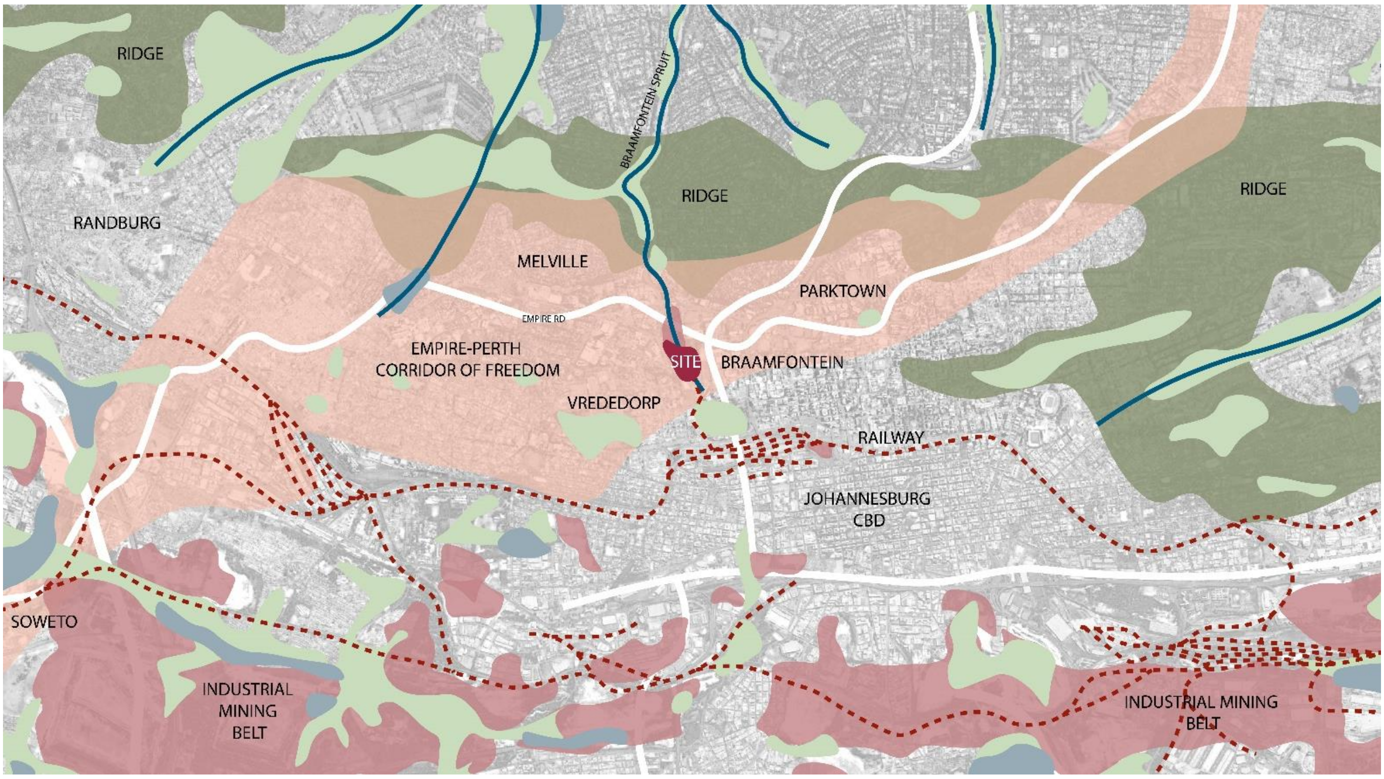


Figure 1: The site sits within the Empire-Perth corridor of Freedom, north of the Johannesburg mining belt and the Braamfontein Spruit runs through it.

4.1 Macro scale: The Johannesburg Gasworks, Braamfontein Gauteng

On a macro scale the site sits within a number of urban systems. The site falls within the Empire-Perth Corridor of Freedom which is envisioned as a major movement route connecting people to socio-economic opportunities. The site sits between the University of Johannesburg's main campus to the west and the University of Witwatersrand's main campus to the east. Both universities expansion and development frameworks emphasize reimaging campus systems that are contextually sustainable, creating new knowledge and diverse learning environments. Both universities also emphasize a focus on research activities relating to environmental sustainability, greener building designs and the importance of institutional links. The location of the abandoned gas works site offers an opportunity to explore these shared sustainable development values and goals as a link between the institutions and the public. Numerous development frameworks have been proposed for the site and it is clear that the site is envisioned for educational use.

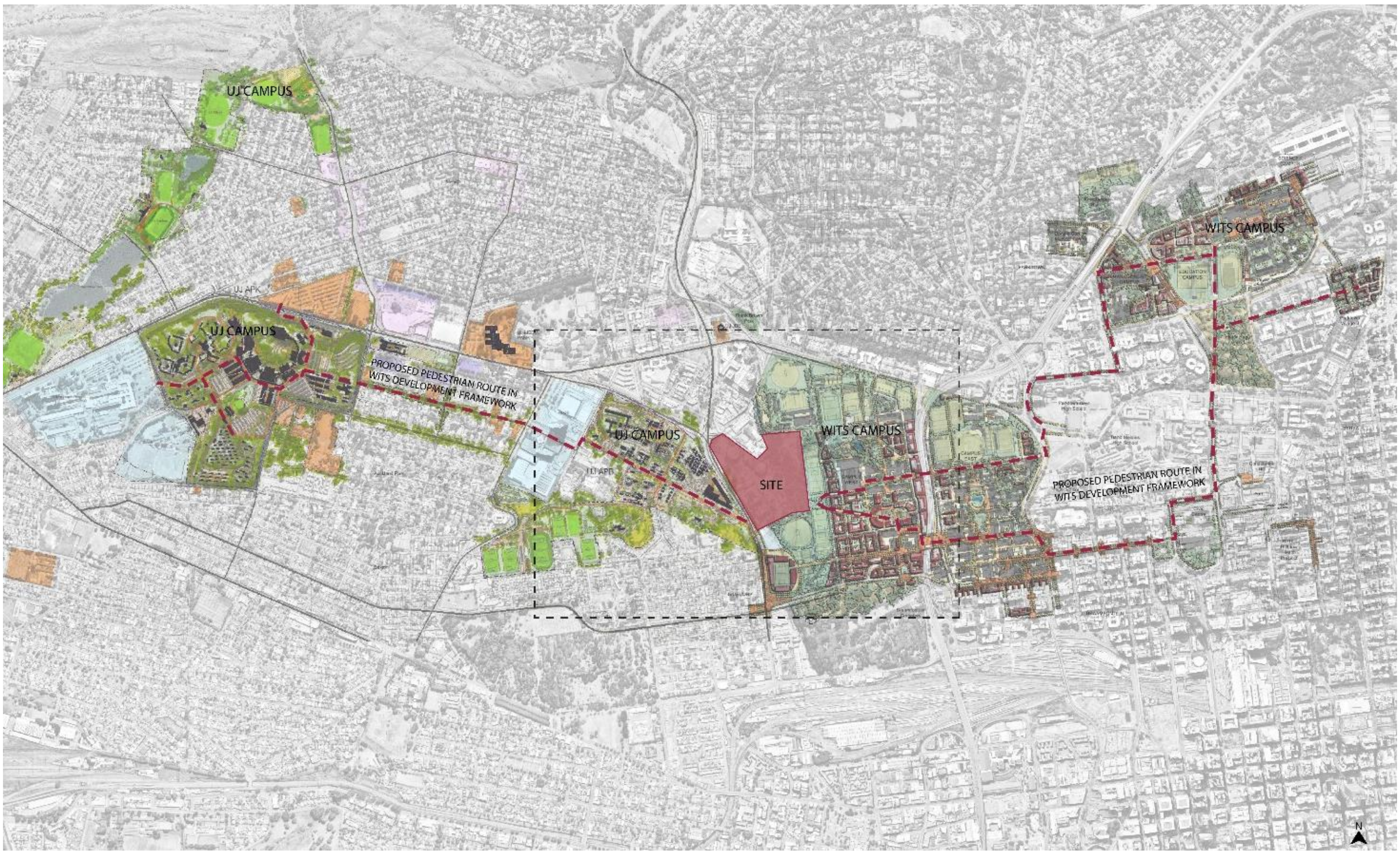


Figure 2: The University of Johannesburg and the University of Witwatersrand Spatial Development Frameworks demonstrating predominant pedestrian corridors connecting the universities campuses (University of Johannesburg, 2021; Hansen, 2011). The site sits between these two frameworks.

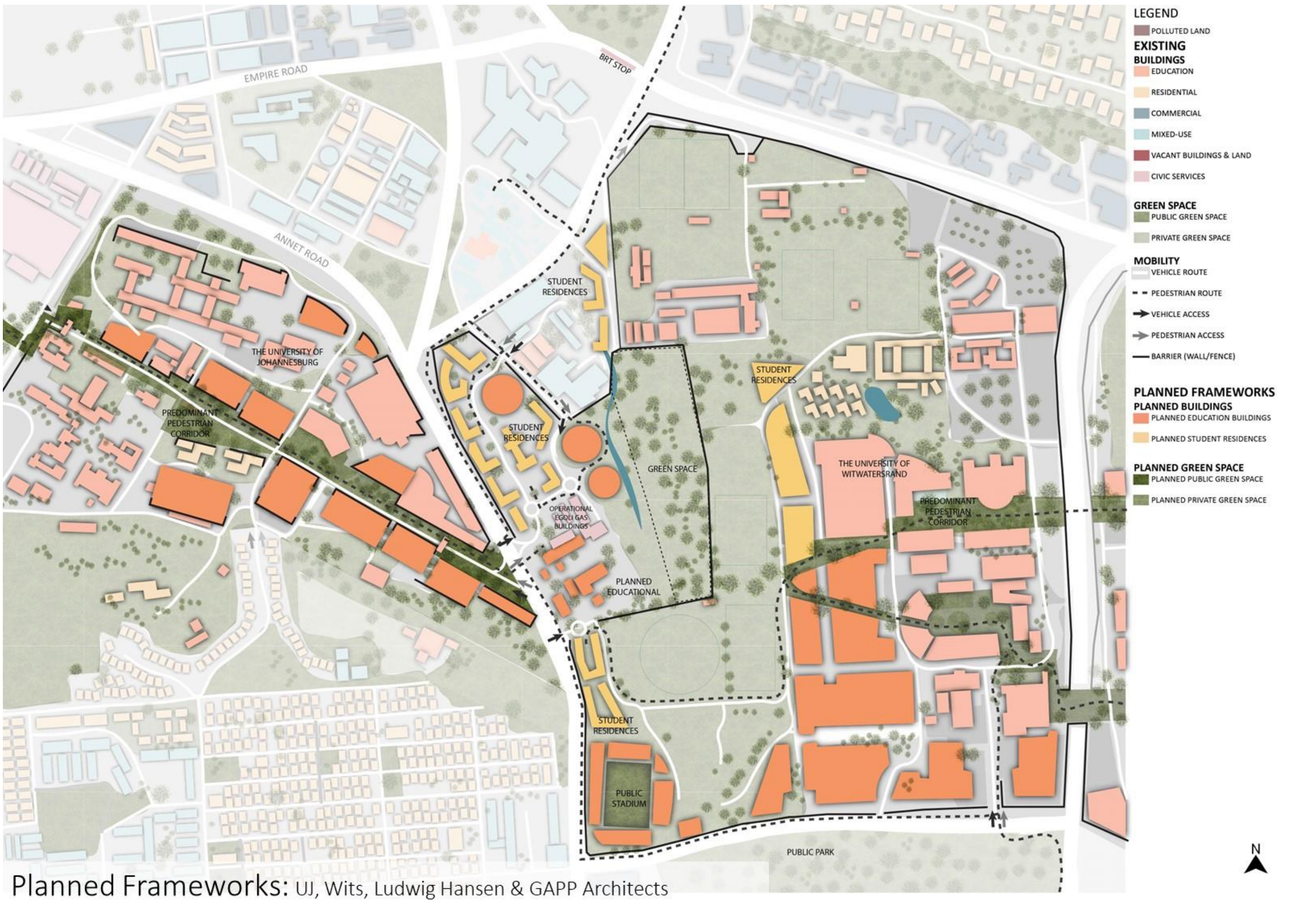


Figure 3: A combination of planned frameworks for the site and surrounding context.

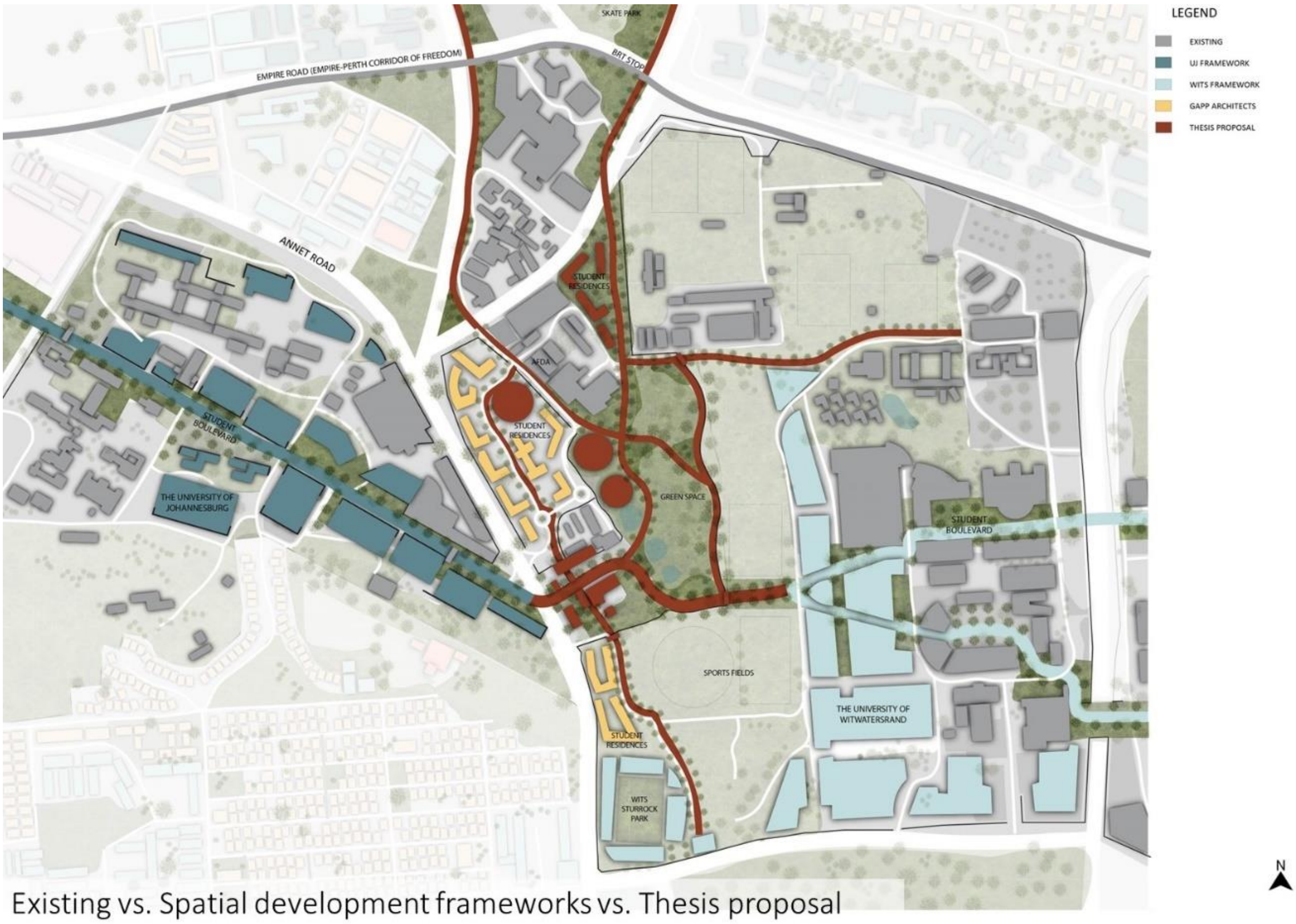


Figure 4: Indication of specific frameworks.

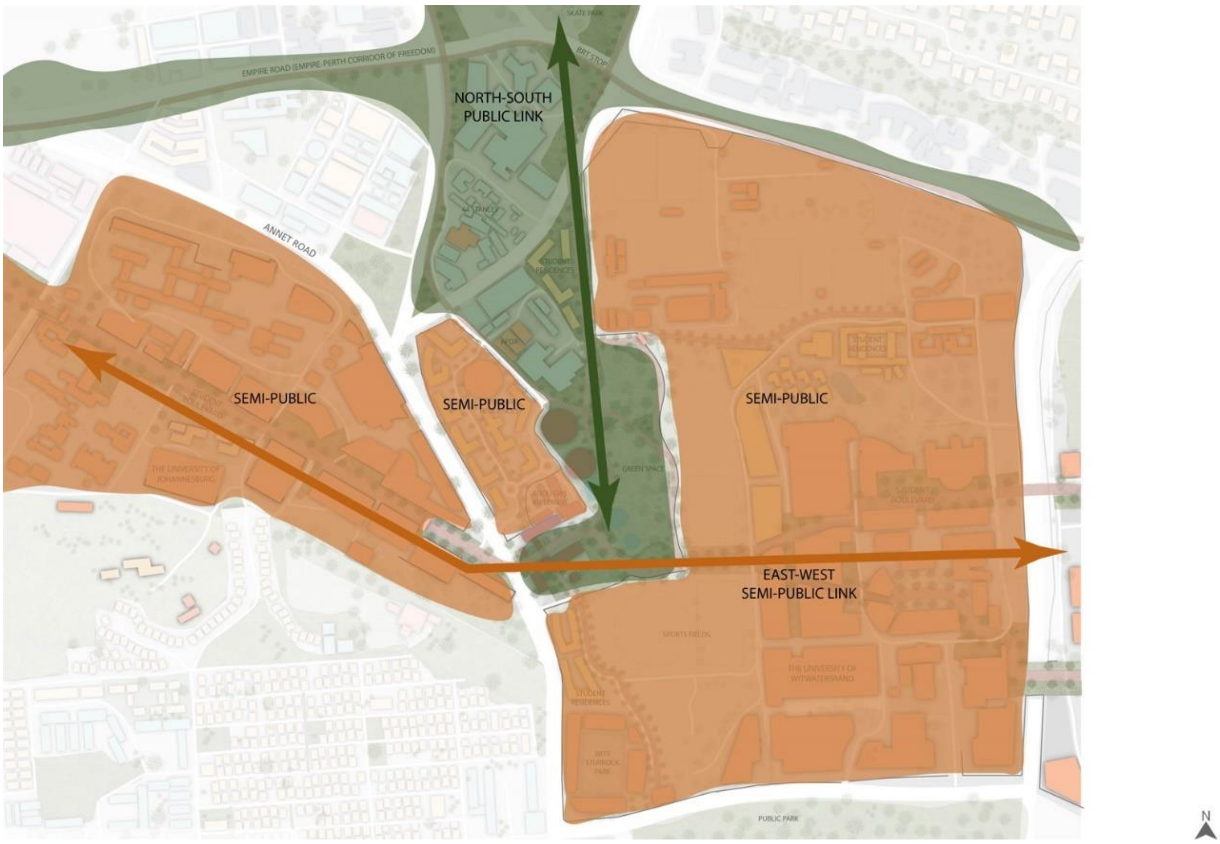


Figure 5: The site vision explores a north-south public link to Empire road and an east-west semi-public link between the two major universities.

Figure 6: The proposed urban vision for the site on a macro scale.

4.2 Meso scale: Site vision

4.2.1 Natural systems present on site

The natural systems present includes a naturally sloping topography to the center of the site where water collects and runs to the north to join the Braamfontein Spruit. However, this landscape and water is polluted with Benzopyrene, a by-product from the production of gas in earlier years. Johannesburg also sits between two catchment areas on a major watershed divide (known as Witwatersrand) which results in no major water sources in close proximity to sustain the local population. Egoli Gas also still distributes gas as an alternative energy source in a few operational buildings adjacent to the abandoned buildings. These informants prompted the proposed learning zones of the site (figure 9).

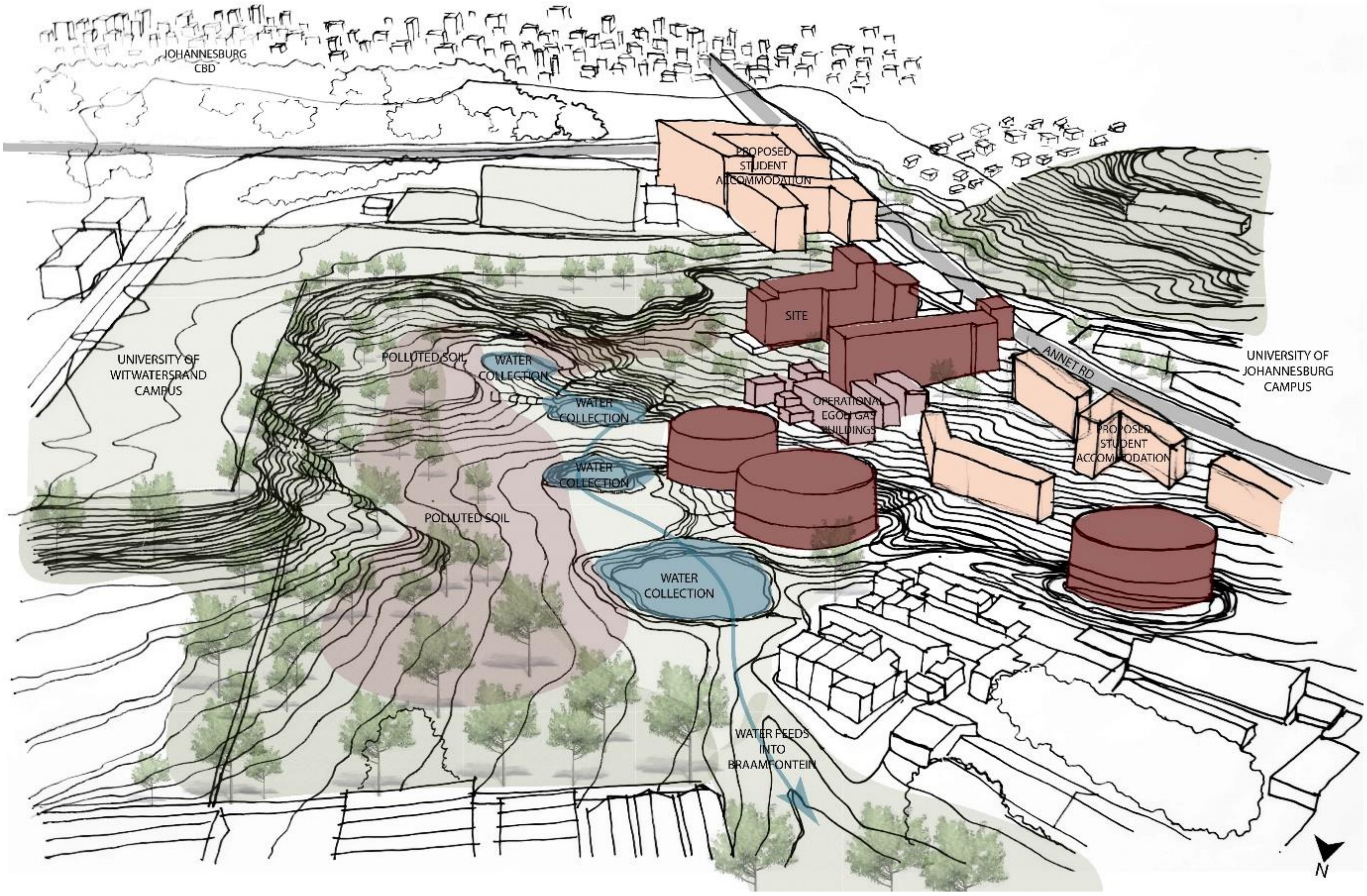


Figure 7: The natural systems present on the site.

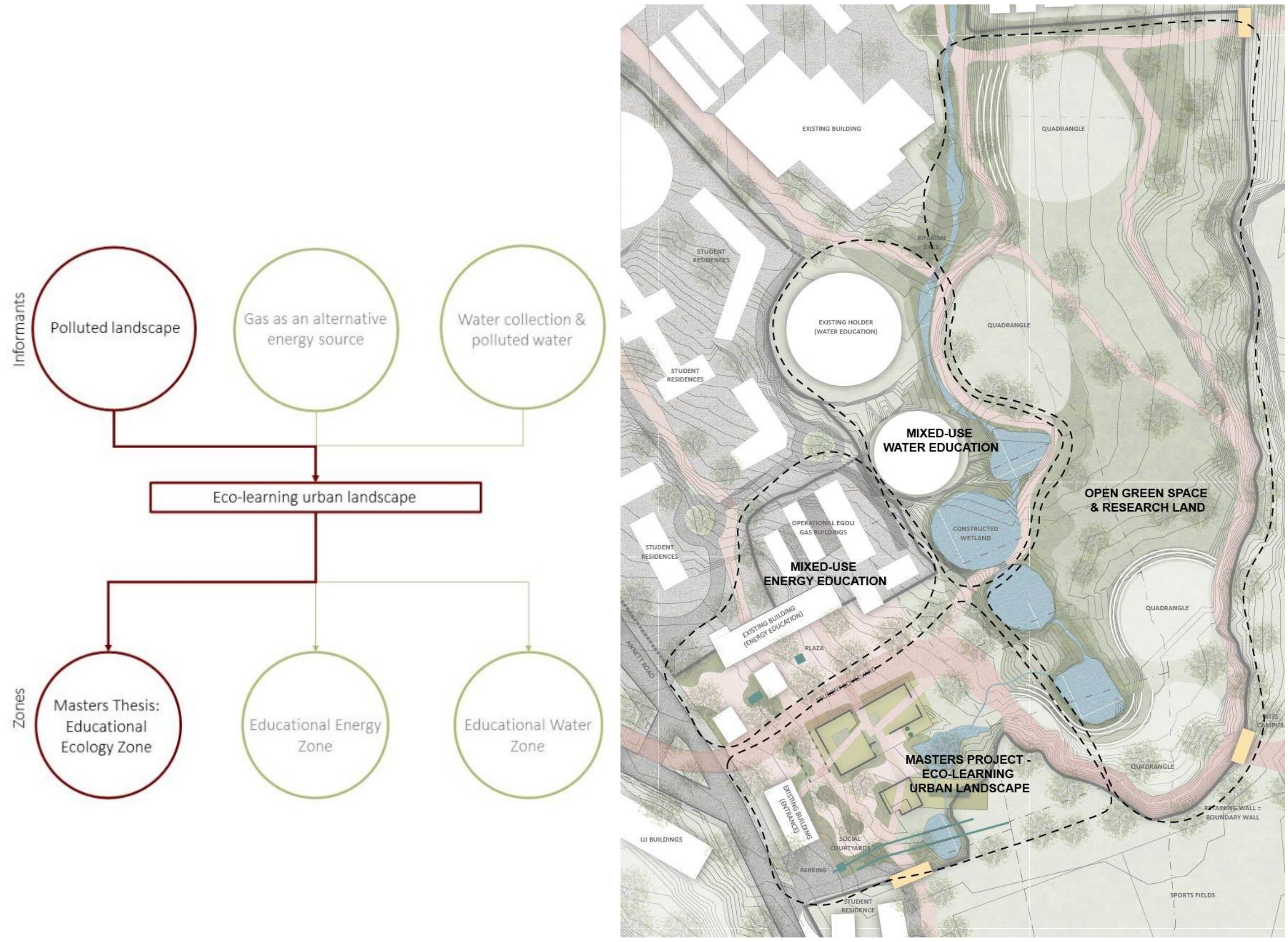


Figure 8: The site is zoned in terms of water, energy and ecology educative landscapes. The master's thesis focuses on the Ecology zone.

4.2.2 Site vision

The vision for the site on a meso scale is an extended public campus and eco-learning urban environment where users are educated about environmental restoration as they pass through and engage with the site.

Figure 9: The site vision demonstrates the site as an extended public campus and eco-learning urban environment.

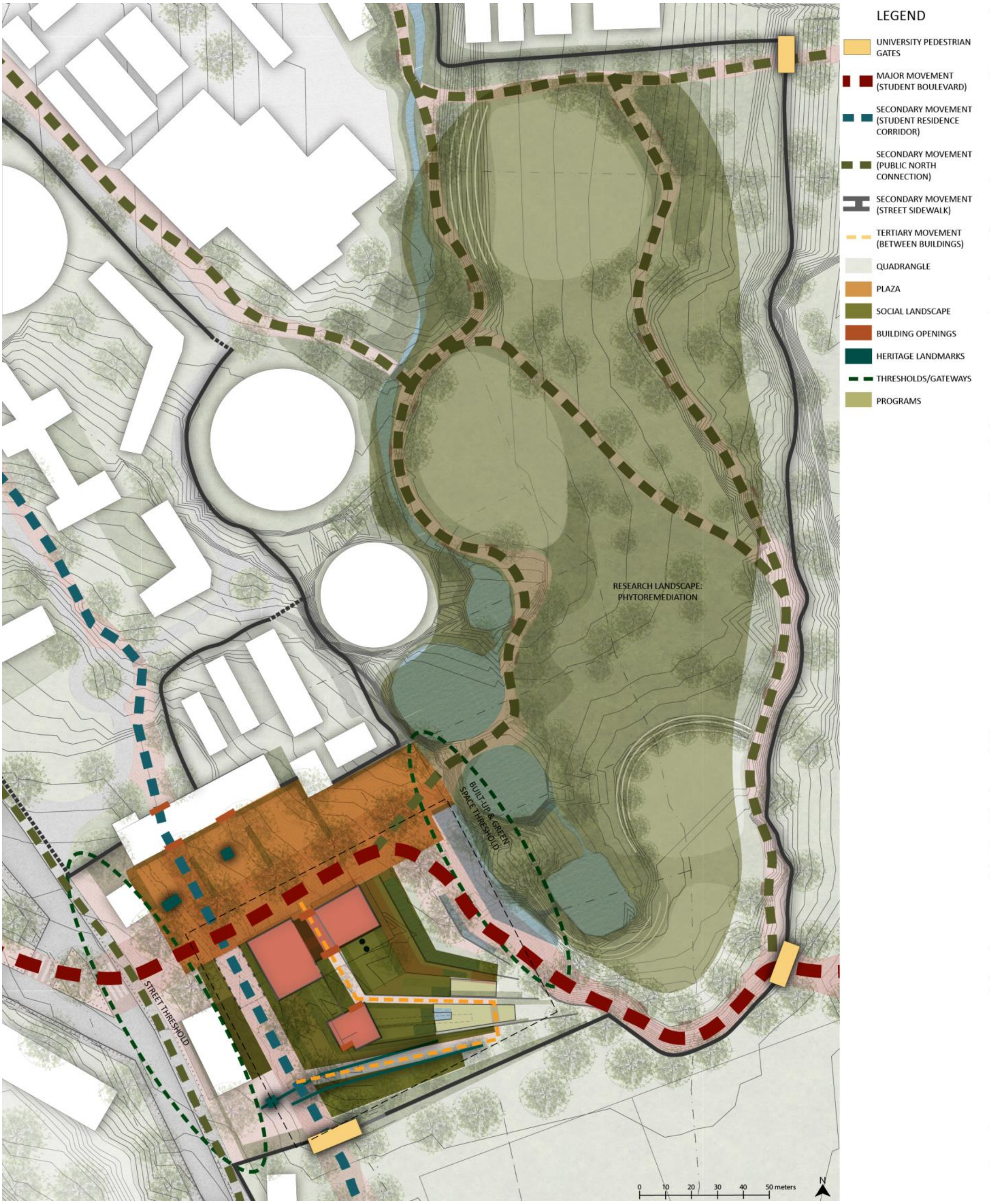


Figure 9.1: A diagrammatic representation of the site vision.

4.2.3 Site phasing

A phased approach to the site development is used to enable public access and movement through the site sooner while the soil and water is restored. (This will be graphically presented in the final exam)

Stage:	What happens:	Time:
1	Restoration of existing buildings and new buildings. Construction of walkways through landscape using rubble on site for retaining walls. The public will be restricted to these hardscaped pathways.	Year 1
2:	Introduce phytoremediation research spaces and restore site soil and water. Public spaces of the existing buildings open to the public.	Year 2 - 5
3.	As the landscape becomes restored, the public may start interacting with social green spaces in the landscape	Year 2 - 6
4.	Once the soil and water is restored, the landscape will continue to act as a public pedestrian urban space and be used to for further phytoremediation research on the Johannesburg industrial mining belt	Year 7 onwards

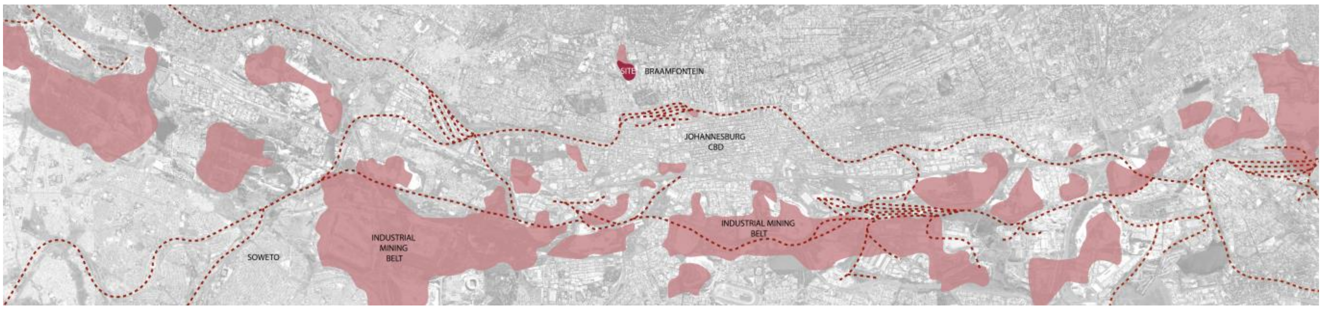


Figure 10: A diagram illustrating the industrial mining belt through Gauteng that the site's research facilities will start looking to restore through Phytoremediation processes when the site itself is restored.

4.2.4 Stakeholder model

The project is a proposed collaboration between the University of Johannesburg, University of Witwatersrand and Council for Scientific and Industrial Research (CSIR) in which students, researchers and lecturers from either institution or the greater public involved in environmental restoration can use the site to conduct research on Phytoremediation processes. The predominant users are students and lecturers from the surrounding educational institutions, users that commute through the site or use the open green space from surrounding land uses like AFDA and the public that are interested in visiting the industrial heritage site.

4.3 Micro scale: Architecture

4.3.1 Concept

The conceptual approach to the project is the duality between natural and manmade; interior and exterior; ruin and regenerate (demonstrated in figure X). This concept is explored through the dialogue of urban and natural systems on site.

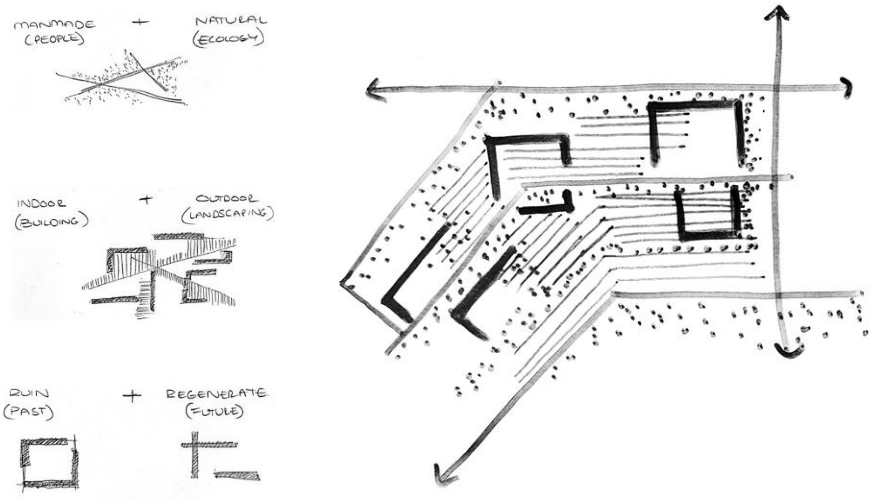


Figure 11: Conceptual parti diagram.

4.3.2 Program: Phytoremediation research facilities

Phytoremediation is a relatively new, natural, on-site process of restoring polluted soil and water from industrial use. It is recently being researched on the Johannesburg industrial mining belt. It is the process where certain plants or mixture of plants and constructed wetlands are used to draw pollutants out of soil and water through the plants roots and either break them down or absorb them. This can take many years of testing and research to achieve. Different types of planting and wetland spaces are needed to accommodate the cleaning process (a diagram of where the specific types of spaces will be presented in the final exam). The program and spaces needed to restore the site's water and landscape systems are housed in the buildings.

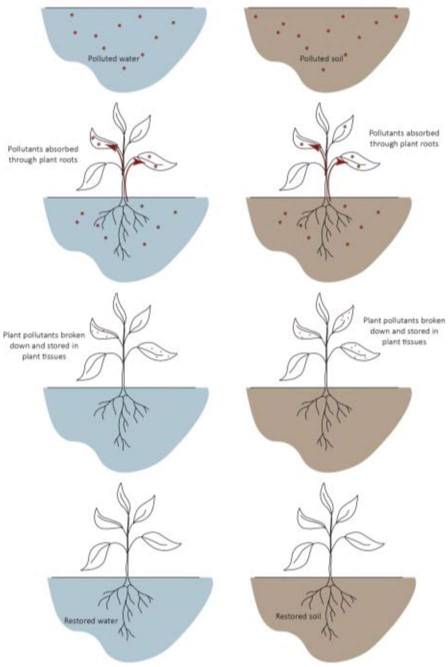


Figure 12: A diagram of the Phytoremediation program process.

4.3.3 Design informants

Site heritage

Name	Egoli Gas Buildings
Dates built	1950 - 1957
Erf numbers	South portion of RE/552, RE/53, 4, 5
Architectural Style	Industrial
Occupancy	Abandoned
Address	1952 Annet Road, Cottesloe, Braamfontein, Johannesburg
Name of existing buildings being used	Retort House 2, Coke House and Powerhouse
Land Zoning	Industrial – will need rezoning to education.
Architect	Unknown, there are only structural engineers signing off the buildings existing plans.
Associated organization	Egoli Gas pty.
Structural status	Structural steel can be reclaimed. Existing brick walls are not sound and need restoration in areas.
NHRA protection	The buildings are older than 60 years and have heritage significance and are protected by the National Heritage Resources Act 25.
History	The site produced gas from coal as an alternative energy source in its past use. The Retort House 2 included machinery that was used in the process. The coke house was used for storing coal and the powerhouse also obtained machinery for the processes. Due to a lack of demand the buildings became redundant. The buildings on the site have been abandoned for approximately 30 years. The current operational Egoli gas buildings import gas from Mozambique and distribute it to areas in Johannesburg directly.
Architectural details	Three projecting vertical brick dentils on each major elevation acknowledge the civic importance of the towers. Red face brick in English bond and tonal variations and mineral tints from the local veld landscape, horizontal shadow line corbel courses, structural piers and brick copings where there are projections. Verticality – inspires a sense of awe. Structural steel members that are visible on the interior of the structure but hidden from the exterior. High level differences (approximately 4 meters).
Materiality	Structural steelwork skeleton that is concealed by an envelope of red brickwork. Red clay brick – various local sources. All the steel construction and production know-how was imported from Britain. However, from 1946 South African steel was used from Germiston. Therefore, the site acts as an accurate barometer of major economic change in SA.
Social significance	The abandoned Johannesburg Gasworks is known and held with high regard by many people in the Gauteng context. This includes architects, historians, developers, local residents and tourists. The scale and architectural style of the

	buildings have turned the site into an iconic and well renowned landmark in Johannesburg.
Heritage value	Due to the uniqueness of the gasworks buildings, the buildings shells are deemed as high heritage significance. The interior walls and some sections of the building shell on ground floor are of lower heritage significance and have therefore been altered and the buildings reprogrammed on the interior.

The three abandoned buildings that the project interrogates are indicated in figure 12 within the dotted line.

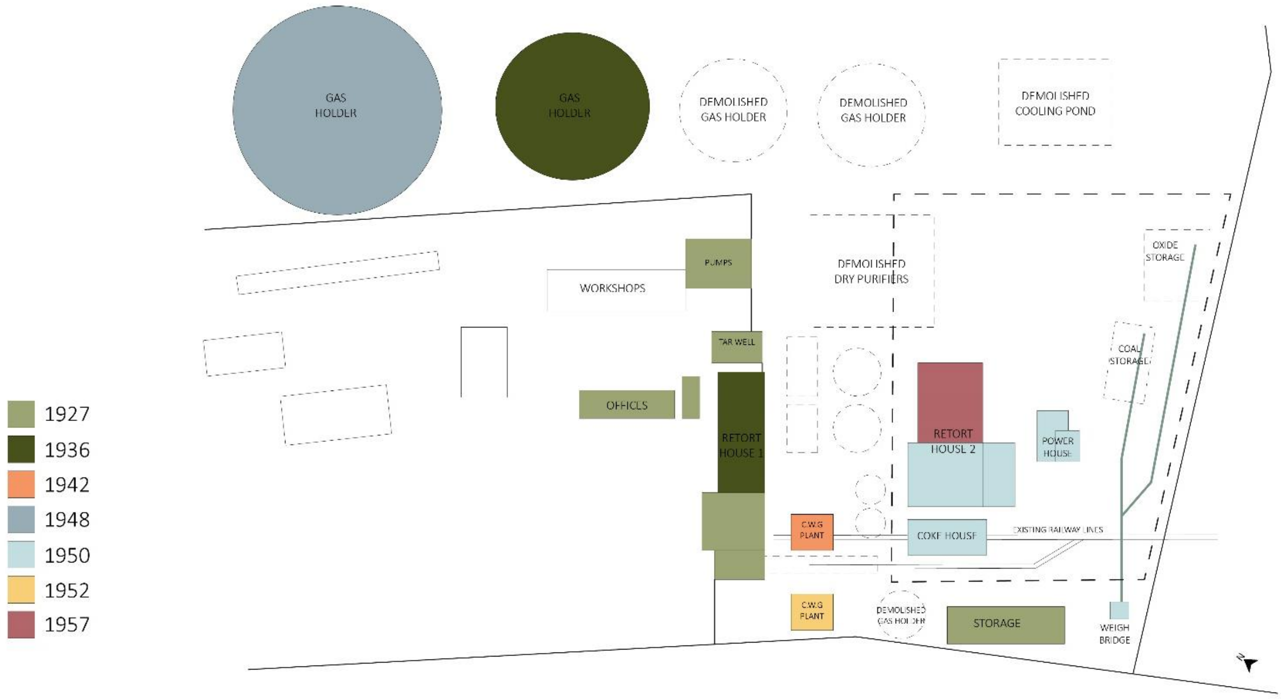


Figure 13: A diagram illustrating the existing buildings use before abandonment.

The heritage response is to restore the existing shell of the buildings to its original state and any new construction on the site will use the existing material palette for heritage integrity and to keep the character of the site. The new building will use the reclaimed site materials in new sustainable ways which will result in a collage of old and new that is softened by the natural systems. The separation of the new building is to build onto the existing site character of separate buildings linked by overhead bridges. Any addition to the existing structures will be treated as an extension of the existing to build onto and enrichen the exiting site character. The existing, demolished and new will be graphically presented in the exam.

Theory: Regenerative design

The project is exploring regenerative theory to restore the site. Regenerative design explores how the built environment can be designed to minimize environmental impact and improve the health of ecosystems. This looks at not only achieving a net-zero design, but achieving a design that impacts the context, users and ecosystem positively.

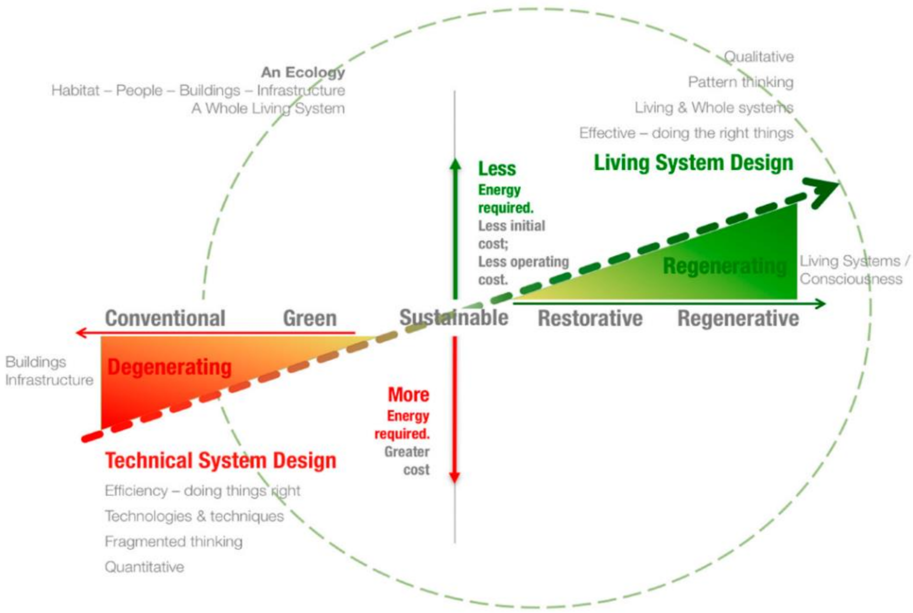


Figure 14: A diagram illustrating the intention of regenerative theory (Koti, 2018).

Urban vs natural site systems

The site feeds into two large educational campuses, an active Empire road movement route and other surrounding public, mixed-use and educational spaces. The project interrogates a dialogue between these urban systems and the sites natural systems. These natural systems include a sloping topography towards a central open green space and water collection point which feeds into a larger water system (Braamfontein Spruit). The proposed program of phytoremediation research facilities creates a dialogue between the educational campuses spatial frameworks, polluted natural site systems, surrounding public as well as the greater Johannesburg mining belt restoration. The architecture interrogated these systems by incorporating natural systems within the built form and terraced topography. The sites storm water is harvested, cleaned and stored within the constructed wetland system and mitigates the sites water demand, resulting in a net zero-water design. The merged program, buildings and landscape create an educative public environment and balance between the natural and built environment.

5.0 Integrated design and technical investigation

5.1 Material systems

The new addition and reprogramming of the interior existing buildings used the existing material palette of the industrial site for heritage integrity: steel, red brick and glazing. However, the new building will contrast the verticality of the existing architecture in a horizontal form. The site currently contains a large amount of existing materials which includes rubble, rebar, bricks, structural steel and corrugated sheeting. The new addition will reclaim the existing site materials before any new materials are introduced. Lidar scanning of the existing site materials would indicate if additional materials were needed in the design and the amount.

Figure 15: Existing site materials currently present on site.

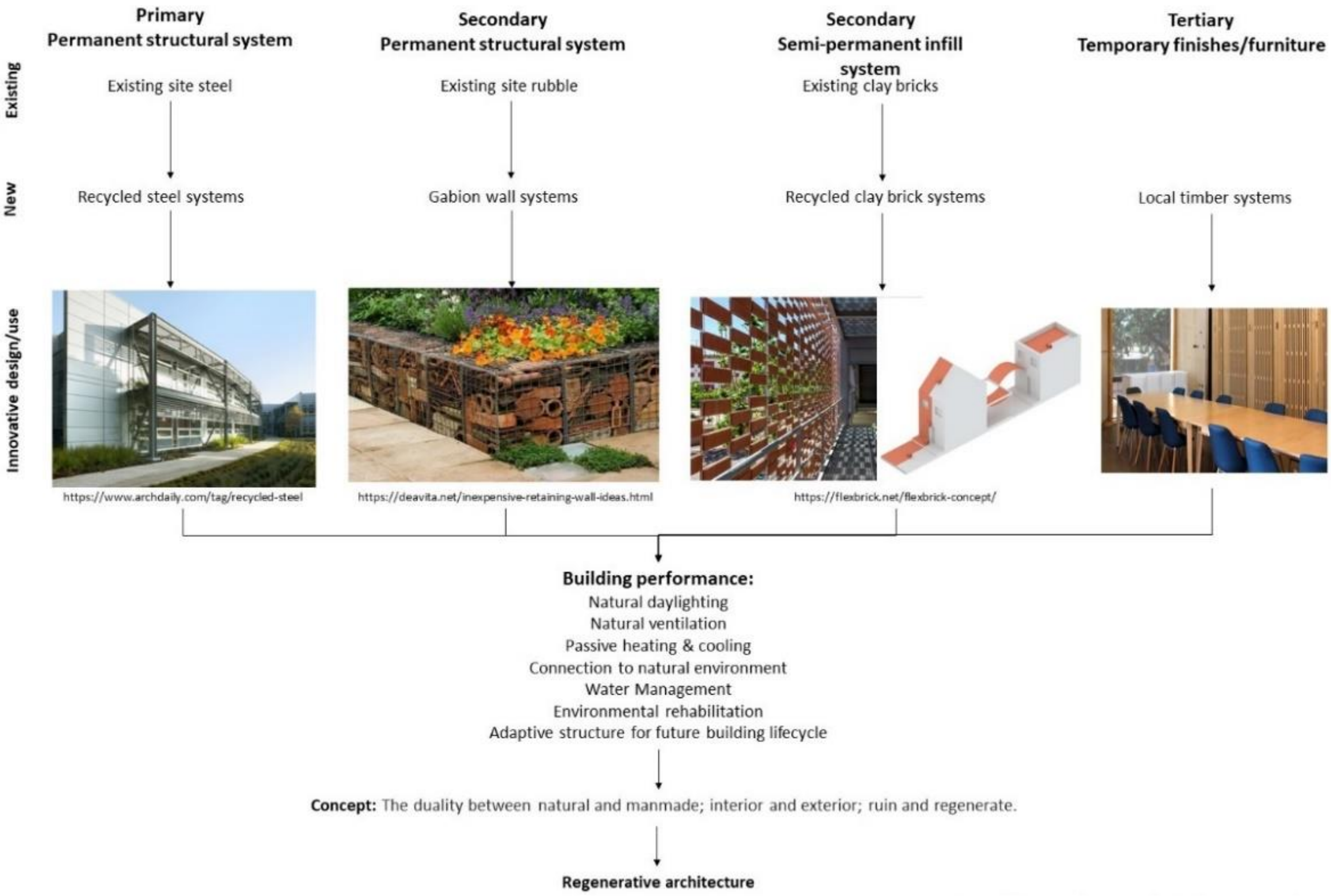


Figure 16: The primary, secondary and tertiary material systems that focus on reclaiming existing site materials.

5.2 Tectonic approach

The tectonic approach to the architecture is in response to the existing. The existing buildings comprise of an industrial aesthetic, degenerative, closed off to the public, hidden structural system, vertical form and no connection to the natural environment. The tectonic approach of the project included an industrial aesthetic by using the existing material palette, an approach that is regenerative, public access, structural systems that are visible, a form that was horizontal/linear and included an interactive interface with the natural environment.

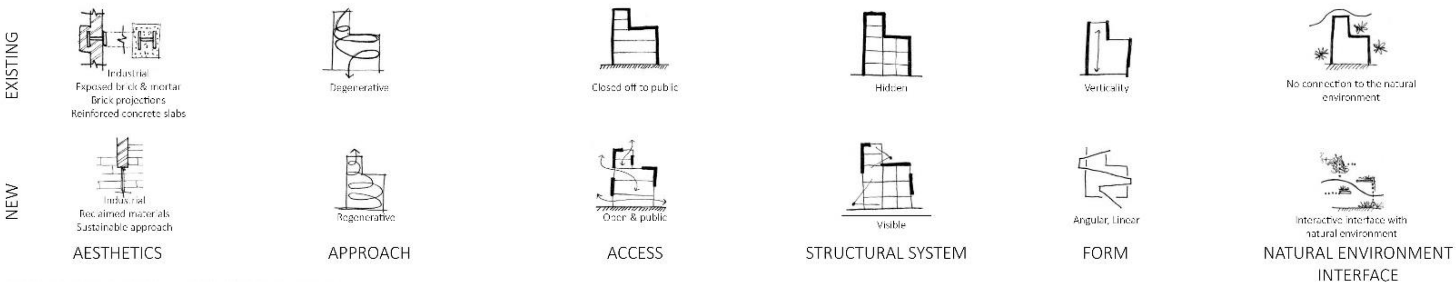


Figure 17: The tectonic approach to the architecture of the new building.

5.3 Structural systems

The primary permanent structural system is structural steel, hempcrete floor slabs and gabion retaining walls, the secondary semi-permanent systems are clay brick infill walls, and the temporary systems are timber furniture and finishes. This will be demonstrated visually in the exam.

5.4 Iterative design documentation

Site vision iterations

The site vision was iterated numerous times to understand major and minor movement routes and the relation to the existing buildings. The hierarchy of movement routes evolved, and thresholds became more defined between the natural and urban environment/systems.

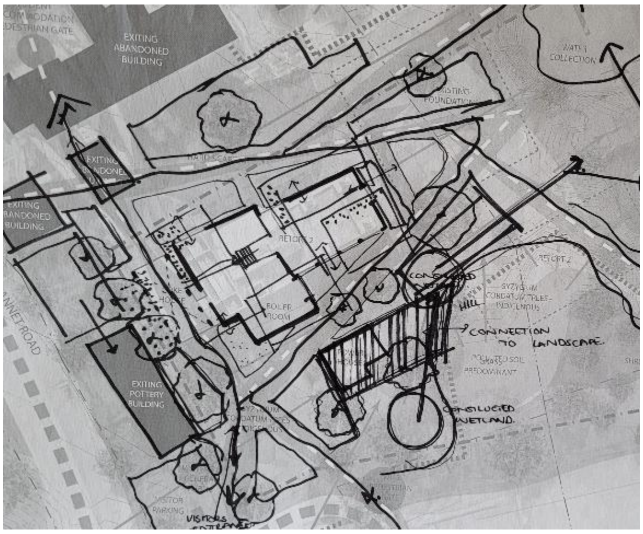


Figure 18: Movement paths around the buildings contained the same hierarchy and didn’t interact with the buildings.

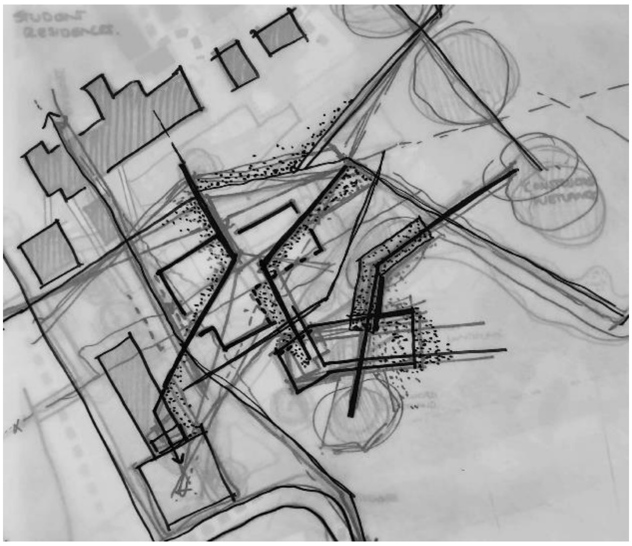


Figure 19: Movement paths reflected the concept parti diagram and connected the buildings to the surrounding environment.

Figure 20: The movement paths connected the surrounding landscape and buildings sufficiently.

New building and program iterations

Iteration 1: The new addition as a solid extension of the existing building.
From the site analysis, the positioning of the new addition was established as this area was at the start of a water system, it didn't fall within the existing buildings shadows and the topography provided an opportunity to integrate the new building with the landscape owing to a 4 meter level change. This iteration created an awkward junction between the two and the new building ended abruptly in the landscape.

Figure 21: Iteration 1.

Iteration 2: The new addition separated from the existing building and connected with bridges.
In iteration 2, the new building extended into the landscape to try to mitigate the abrupt connection between the two. The ground floor consisted of small scaled public program spaces which does not suit the character of the existing buildings scale. The surrounding landscaping was also organic to create more intimate learning spaces, however this also did not suit the architectural language of the architecture.

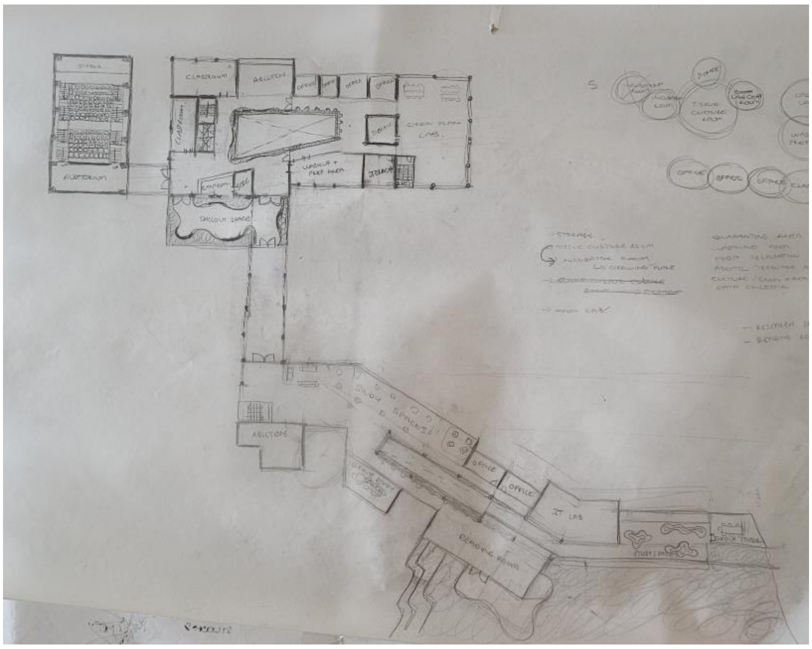
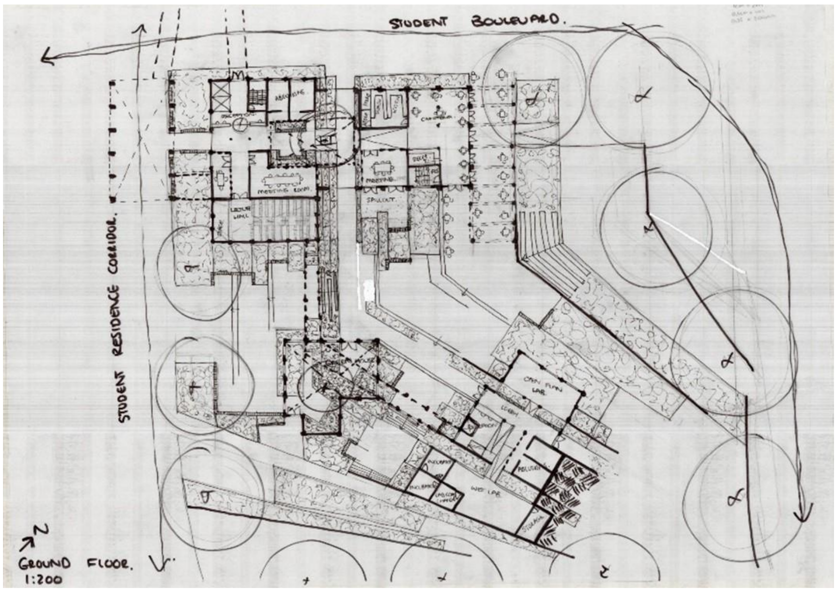


Figure 22: Iteration 2.

Iteration 3: The program and topography informing the stepped terracing of the design.
In iteration 3, the angled movement through the existing building and atrium shape was altered to run perpendicular to the existing building shell. This created a improve flow through the building and connection to the surrounding

landscape. Terracing of the topography was created to enhance the dialogue between the landscape, existing buildings and movement between the two. This also created a better transition between the natural and urban system. Constructed wetlands and planting followed this terracing to create an educative outdoor environment.



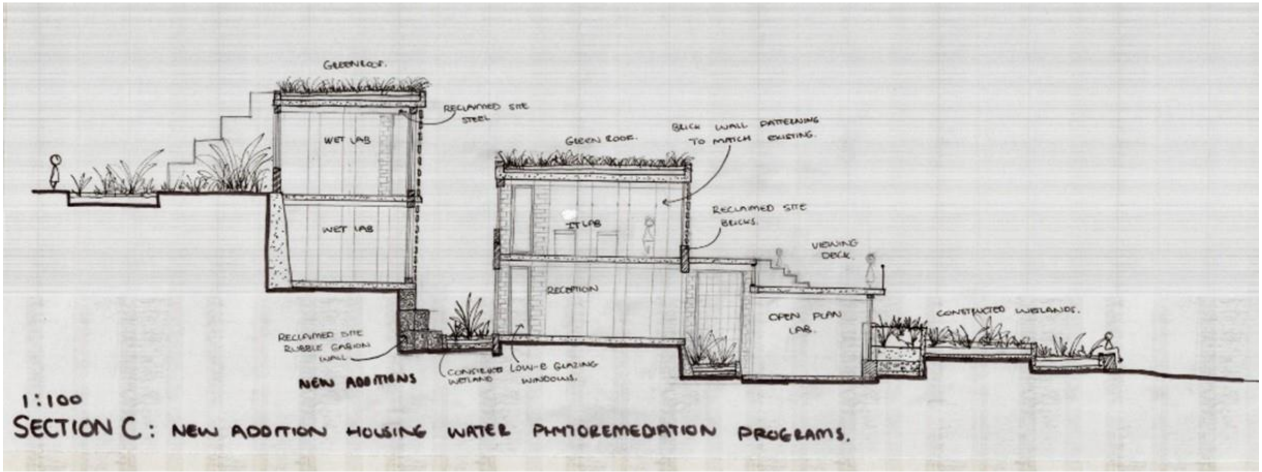


Figure 23 & 24: Iteration 3.

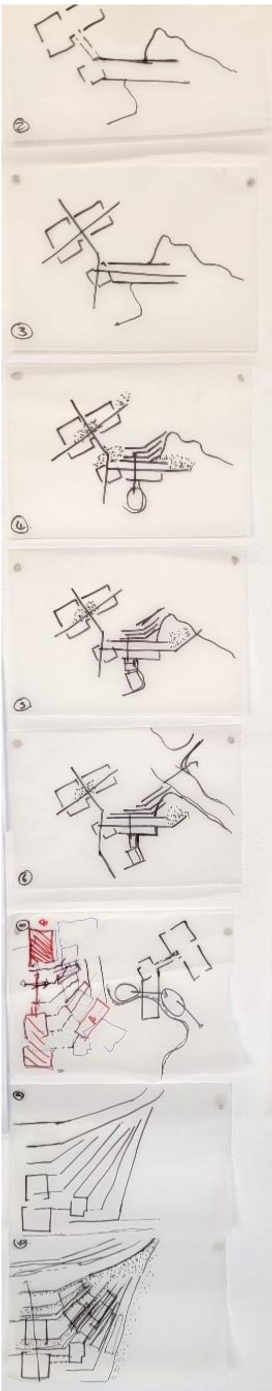


Figure 25: Parti sketches of the development of the new addition placement.

6.0 Critical reflection: Mini project

The mini project in quarter 1 explored the duality of hard manmade incisions into softer organic forms. The interest of exploring the relationship (or lack of) between the natural and built environment was realized. This informed the decision of site choice and urban problem to address in the major project. The Johannesburg Gas Works site presented opportunities of exploring both natural and manmade/urban systems, and problems associated with industrial brownfield sites such as a disconnection between people and the natural environment, degradation and exploitation of the natural environment and prevention of urban connectivity and effective land use.

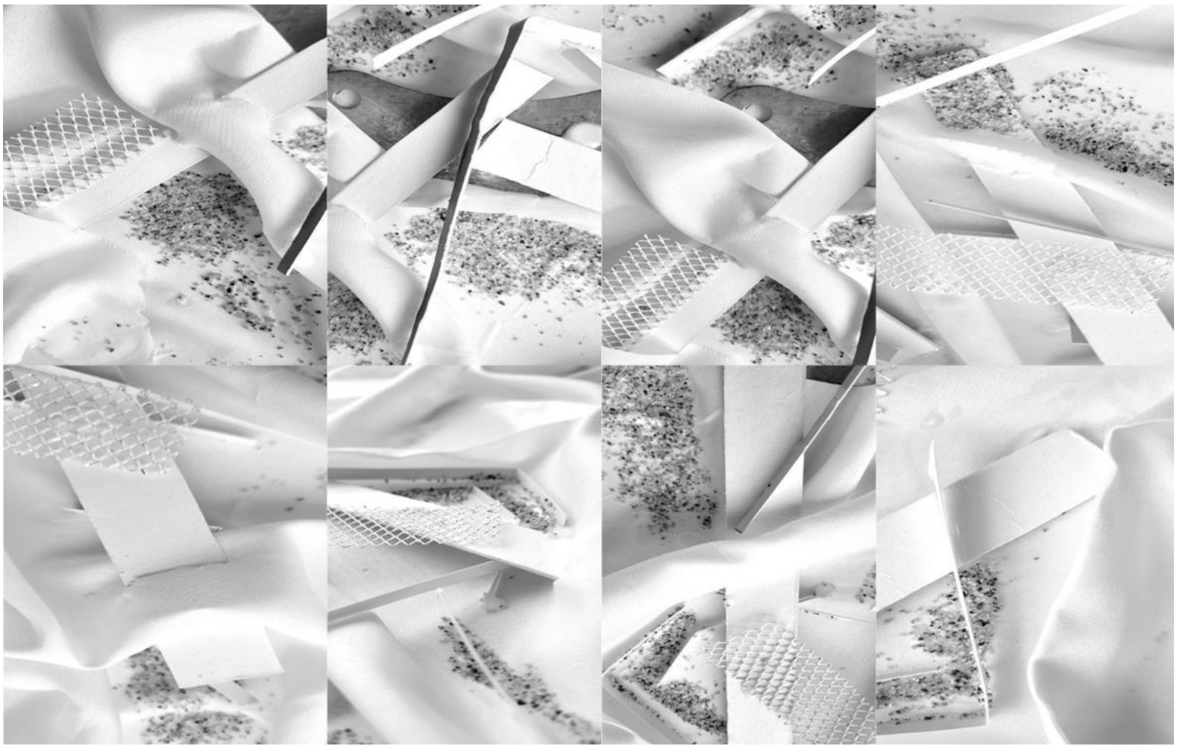


Figure 26: Images of the mini project model.

7.0 Critical reflection: Major project outcome

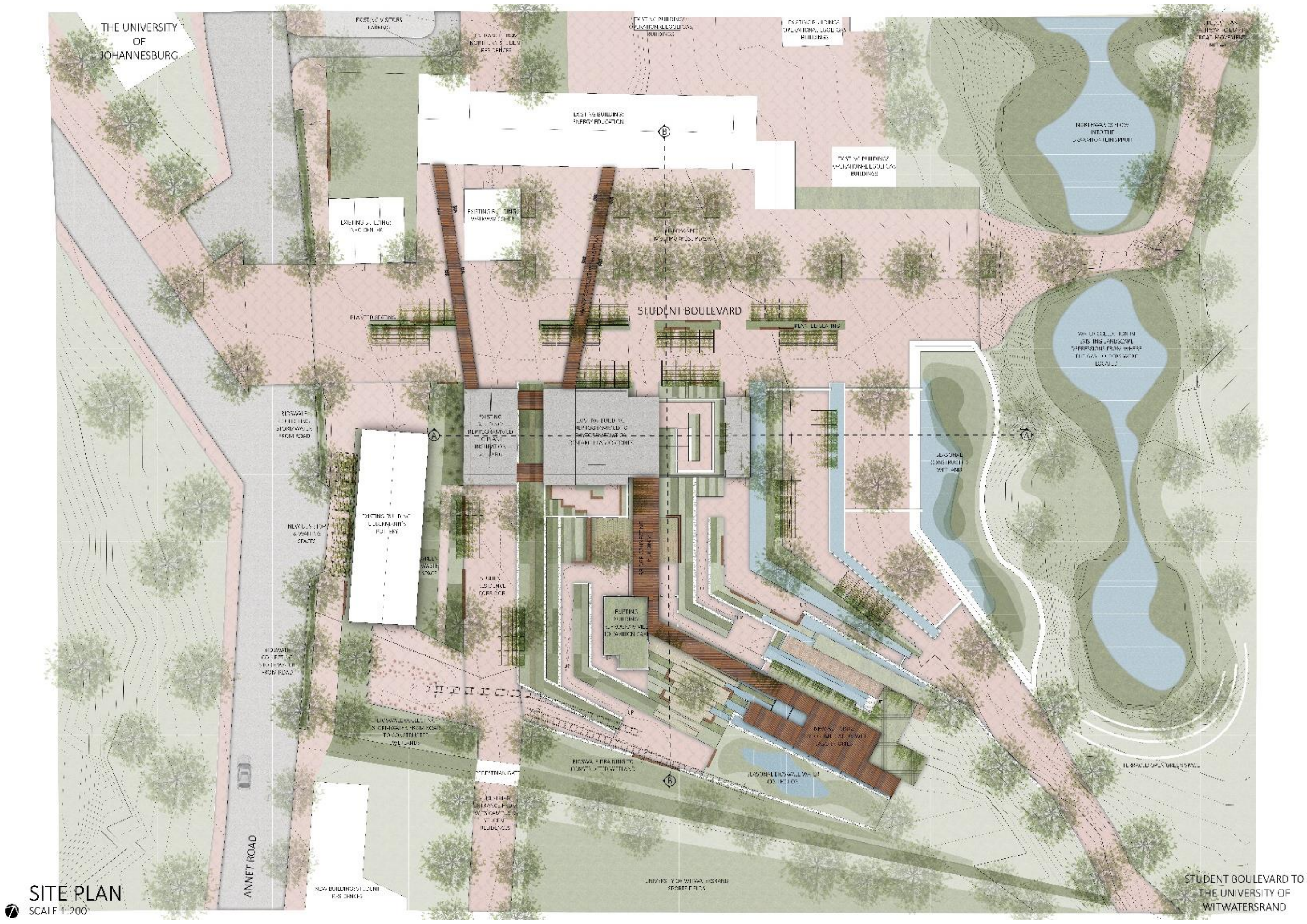


Figure 27: Site plan (incomplete).

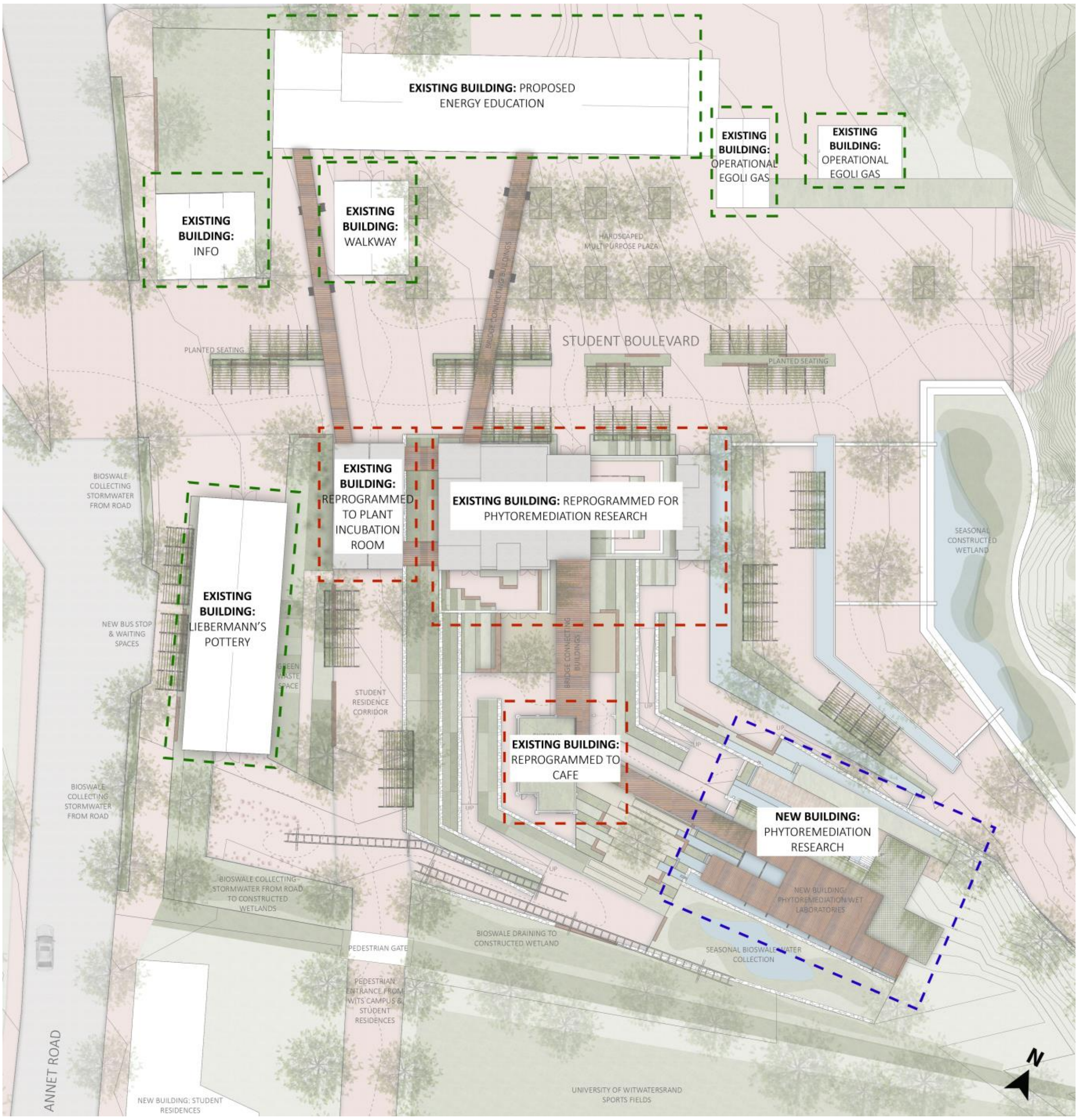


Figure 28: A summary of the site buildings. The buildings outlined in red, and blue were interrogated for the master's project.

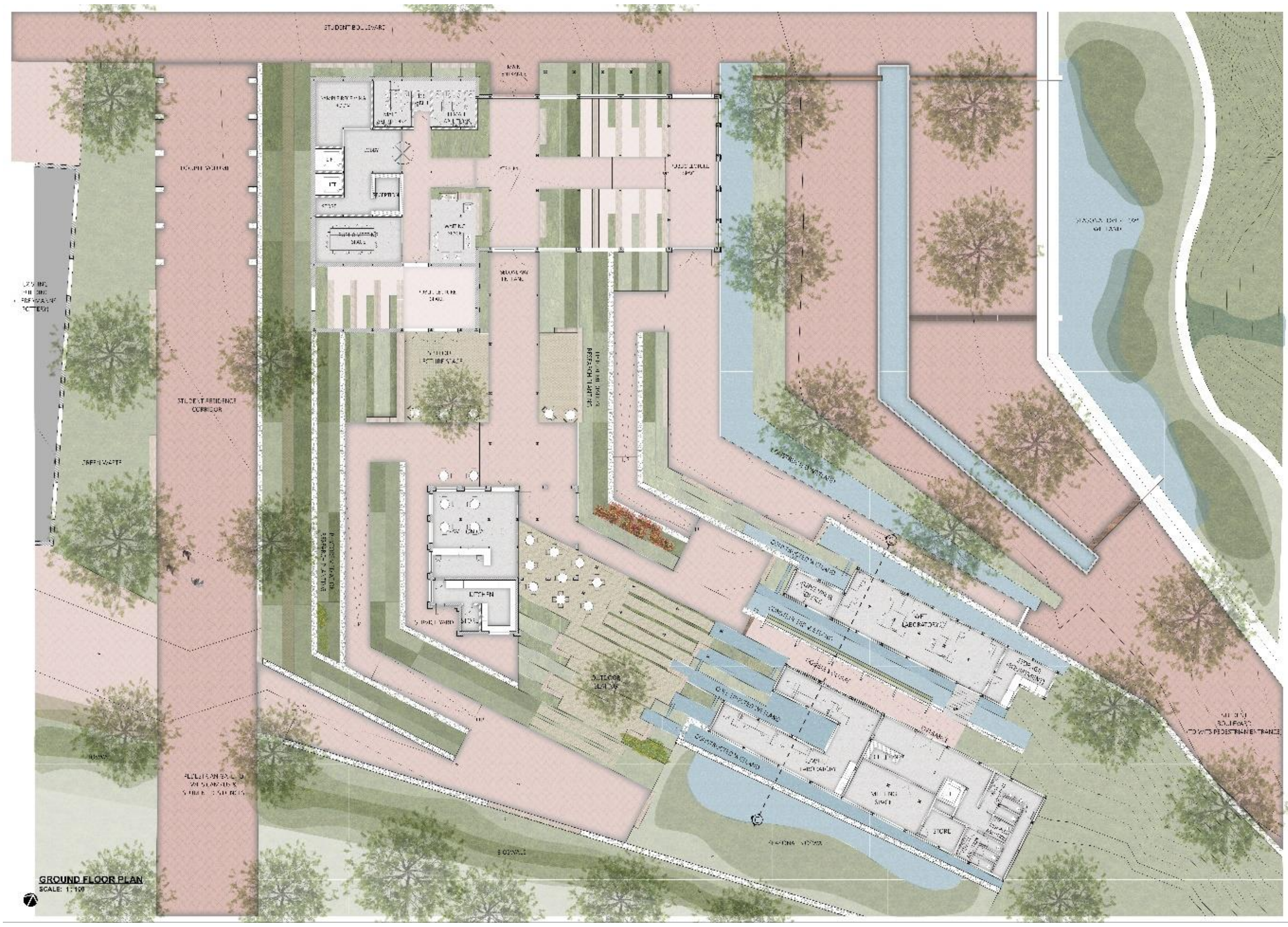


Figure 29: The ground floor plan (incomplete) demonstrating how the terraced topography connects the buildings and Phytoremediation spaces (constructed wetlands and mixed planting spaces).

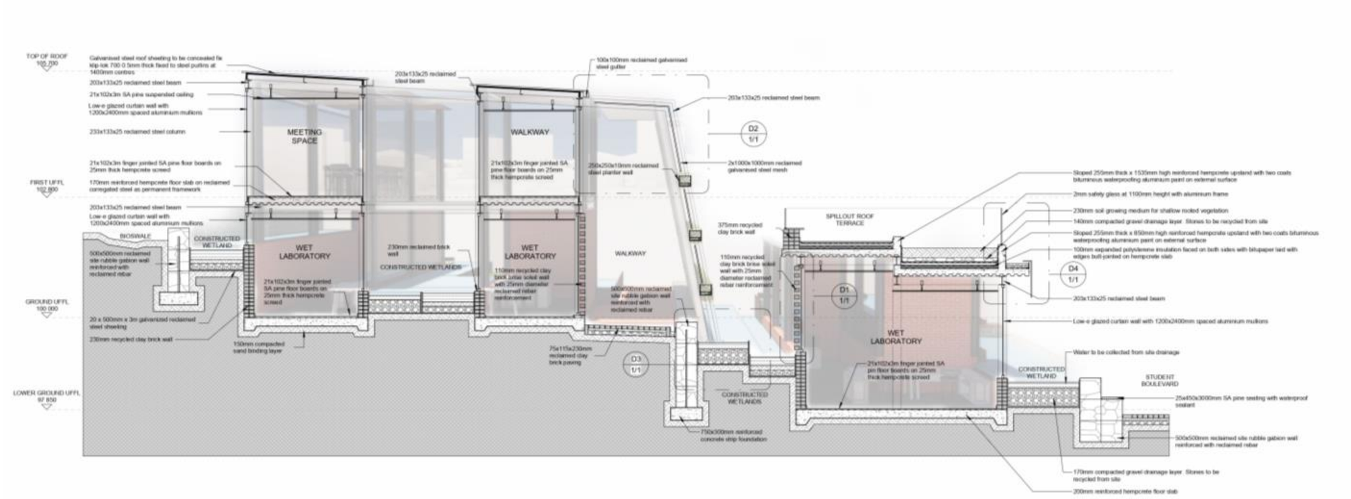


Figure 30: Section C demonstrates how the new building fits into the terraced landscape and relation to the constructed wetlands, as wells as the innovative use of reclaimed materials and the relation to the natural environment (incomplete).

Figure 31: Section A through the existing building connecting to the surrounding public landscape and Phytoremediation research spaces (incomplete). The greyed out walls/floors demonstrate the existing structure.

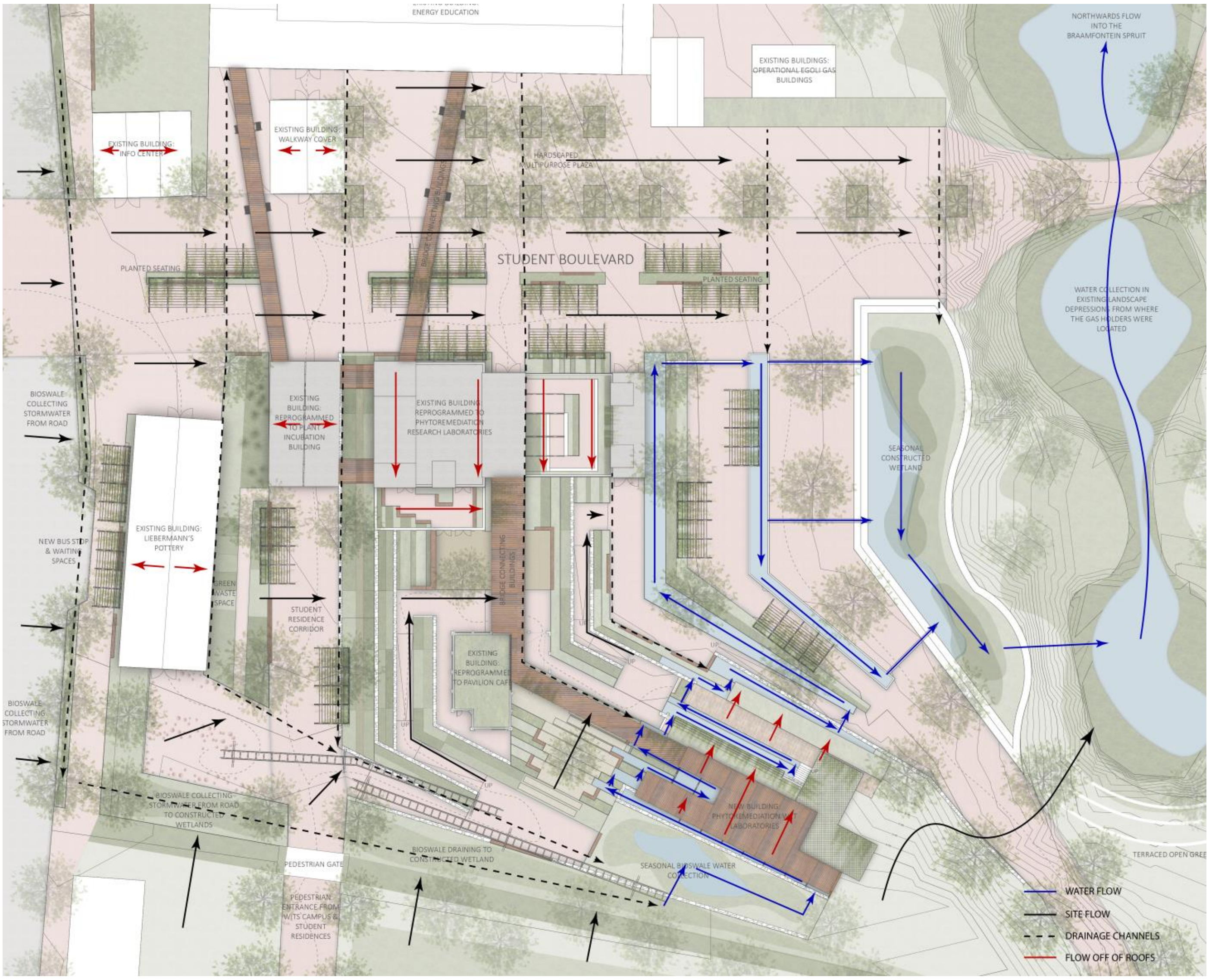


Figure 32: The water management strategy demonstrating how water is collected, cleaned and stored in the constructed wetlands. Water harvesting calculations influenced the size of the constructed wetlands, the site surface materials (runoff coefficient) and site drainage to create a design that is net-zero water. The sites water demand includes water for irrigating the planted research spaces, ablutions and laboratory taps. The sites drainage lines follow the contours into the constructed wetlands.

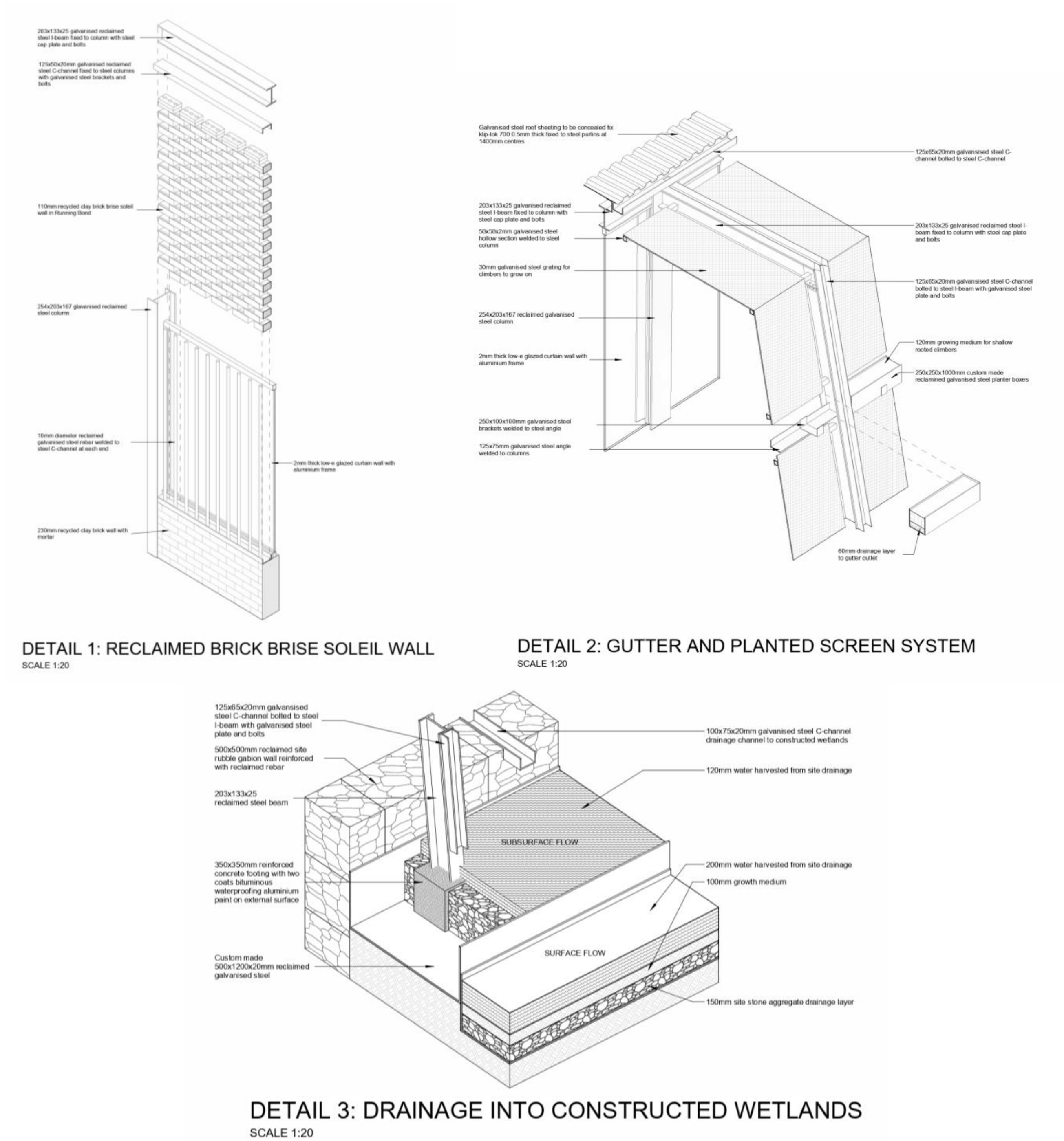


Figure 33: The details explore the usage of existing materials in the new building, how they are integrated with the new design and how they are integrated with natural systems of rainwater collection and planted screens (incomplete).

Figure 34: A birds eye view perspective of the final site design (incomplete render).

This project looked at how architecture can act as a regenerative device between a brownfield site and the natural environment to inaugurate socio-economic value. This was achieved by integrating the abandoned site and buildings with the surrounding context and restoring the polluted soil and water through the programs research spaces (constructed wetlands and various planting spaces). The architecture combined natural systems with the built environment and built form to achieve a regenerative design that is not only net-zero water, but positively affects the surrounding context. This was achieved by creating natural cleaning process spaces that users come into contact with when moving through the site. People benefit from being in close proximity to the natural environment which includes improved health and wellbeing, healthier air quality (both indoors and outdoors). Nature also provides natural shading and shelter, stormwater management, temperature regulation of buildings and comfortable outdoor spaces. Environmental restoration creates healthier ecosystems that attract wildlife into urban spaces. The combined natural and built systems created a coevolving environment and ecosystem where man and nature mutually benefit.

8.0 Conclusion

Developing brownfield sites that create urban connectivity and effective land use through regenerative theory tap into circular thinking and greener economies. This is critical to explore in terms of the current climate crisis, expanding cities, limited resource, population growth and destruction of the natural environment. By reusing existing materials and buildings, less embodied energy is used for creating new spaces to inhabit. By restoring and incorporating natural systems within the built environment and built forms, a healthier ecosystem can be achieved where man and nature coevolve mutually and benefit from each other. This also includes natural strategies for urban problems such as storm water management, cleaning and usage.

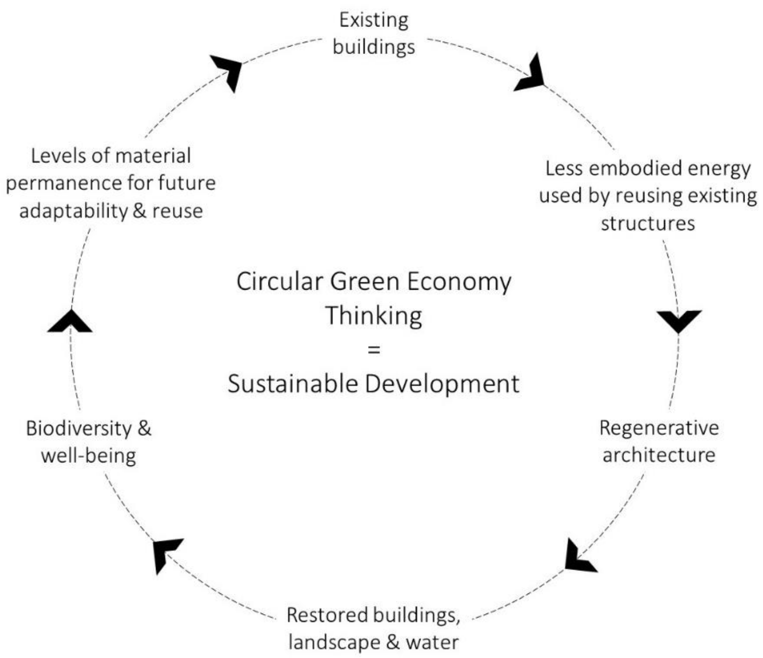


Figure 35: The project outcome was aimed at achieving a regenerative project that taps into circular green economy thinking to not only restore existing urban environments but positively impact future ecosystems.

9.0 References

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