CHAPTER 6: DESIGN DEVELOPMENT
INTEGRATING MAN AND THE NATURAL ENVIRONMENT

HYPOTHESIS

Integrating the public realm of the urban environment with areas of void or wasted landscape, through the use of rehabilitation systems and processes of the Moreleta Spruit as a design generator and informant for the site, will connect man on various levels to the natural and urban environments.

Through the incorporation of social, ecological and economic aspects, informed by the natural environment, the wasted landscape is transformed through the integration of the natural environment, into a public space centred on the interaction, education and awareness of the complexity and significance of urban river ecosystems.

DESIGN QUESTION

Can the rehabilitation of a polluted resource and the associated surrounding environment become a connecting feature with an impact on the surrounding environment?

Through enhancing the spatial quality of the rehabilitation process and incorporation of these processes into economic and social aspects of the intervention, will the public realm be drawn into the previously wasted landscape connecting man and the environment through common participation and experience?
CONTOUR MANIPULATION
EXISTING CONTOURS BEFORE MANIPULATION FOR RIVER DIVERSION

Figure 2.6.3: Manipulated contours model investigation
The main contour manipulation which was required related to the diversion of the Moreleta Spruit into the purification system designed in the Era Brick Works Quarry. The presence of a ridge as well as the change in levels from the river to the proposed purification was resolved by removing the ridge through the excavation and creation of a narrow channel through which water would be able to flow from the dam. The dam was a result of contour manipulation and alterations of water levels in the existing river system, the dam allowed for the raising of the water level for the free flow water system in to the purification channels and wetlands.
This diagram captures the essence of the main elevated walkway which is the main elements creating the physical connection between the separated communities of Eersterust and Jan Niemand Park. The walkway is designed with the intention increasing public space along the purification system in the quarry, promoting the connection between man and his surrounding natural environment.
Figure 2.6.6: Overall approach to systems and strategies. (Author, 2015)
The physical connection created by the walkway, a solid constructed element within the landscape directly connecting separated societies.

The choice of event space and main lawn area is central to the design with easy movement and accessibility between both industrial, commercial and natural environments. A connection node between all three.

The points of connection between the higher levels (industrial and commercial area) are guided through the systems and processes of water, connecting to the lower levels or natural environment. The process of immersion in nature.

The main connection is the visual connection between the separated societies created through the merging of two river systems in to the purification system in the quarry. This visual connection gives the impression of the merging and convergence of societies and communities.

Figure 2.6.8: Evaluation and development of masterplan intention. (Author, 2015)
DESIGN DEVELOPMENT

The design development clearly demonstrates the hierarchy of connectivity, initially starting with the diversion of river systems and the integration of the purification system into the quarry. Slowly progressing to the design and development of the industrial and commercial sector of the design. Integration of previously proposed interventions with the vision and intention of the idea of connectivity between social, environmental and economic aspects. The bridge or main walkway through the site developed as a prominent connection within the design and from there activities and public space was created linking to and from the walkway.

Figure 2.6.9: Master plan development and iteration
(Author, 2015)
Figure 2.6.10: Final Master plan proposal. (Author, 2015)
Evaluation and critique of initial sketch plan. Taking into consideration the design decisions made and how the design can develop and change through further iteration.

Interaction with the dam was considered however the implications of human interaction with the water quality and standard has led to the decision of the dam remaining a natural element which does not cater for swimming and interaction with people. The dam will serve solely as a purification element and water storage element.

Integration of public space and dam edge needs to be refined. The use of the space, design and transition into natural environment needs to be taken into consideration.

Aquaponic systems are too rigid and not integrated into the layout of the quarry or the natural environment. Softening of design and the creation of public space and public incorporation into the systems and processes of the system is required.

Biopools are not practical, the design needs to be refined in terms of movement in and around the pools and the interaction between pool edges and surrounding spaces. The planting strategy and placement needs to be taken more carefully into consideration as well as the design implications of the use of highly organic shapes and curves.

Movement from higher level of quarry in to lower areas needs activation and ease of accessibility. The experience of immersion into the natural environment needs to be emphasized as well as the importance and use of water as a guide for movement through the space.
SYSTEM DESIGN DEVELOPMENT: AQUAPONICS
Understanding the systems and processes of the aquaponics system allowed for the redesign and development of such a system for the integration into the site for both form and function. The main intention with the incorporation of the aquaponics system, in addition to the economical benefits through the use of natural water systems, was the creation of public space and the promotion of human interaction with the productive landscape.

The development of a spatial system with which people would feel connected to and immersed in the natural environment would require the exposure of the hidden elements and systems of the aquaponics system. The initial design investigation drew inspiration from the surrounding proposed natural industries, in particular, the apiary. The hexagonal approach opened up the system through the creation of modular units which fit into and create spaces between one another.

The design did not respond well to the nature of the site in terms of the industrial feel and atmosphere of the quarry. The design required more integration with the slopes and drastic change in level which it was not as flexible to as the final design.
Hydroponic beds on edges of walkways

Aquaculture tanks

Open water channel for transport of water

Seating on edge of aquaculture tanks

Figure 2.6.14: 3D development of Aquaponics elements (Author, 2015)
The aquaponics system requires certain systems and processes for the maintenance and purification of the water within the system. These services include two clarifiers, four filters and a degassing tank. These have been incorporated into the design in a manner which has covered the services up and serves as a seating space without prohibiting or influencing the flow of water from the aquaculture tanks to the hydroponic beds.

LAVATORY AND EVENT SPACE. THIS AREA WILL CATER FOR THE HOSTING OF EVENTS SUCH AS MARKETS, FESTIVALS, LIVE MUSIC, ETC.

ACCESSIBLE GREEN ROOF. THE ROOFS ARE RESPONSIBLE FOR THE PROVISION OF SHADE FOR SEATING SPACES BELOW AS WELL AS WIDENING THE ADJACENT WALKWAYS. CREATED PUBLIC SPACE FOR BOTH MOVEMENT AND INERTING.

HYDROPONIC BEDS ARE TERRACED INTO THE QUARRY EDGE, AIDING IN THE TRANSPORTATION OF WATER THROUGH GRAVITY FLOW. THE TERRACED BEDS PROVIDE FOR SEATING SPACES AS WELL, ALLOWING FOR PUBLIC INTERACTION AND EXPOSURE TO THE SYSTEMS AND MEANS OF PRODUCTION.

AQUACULTURE TANKS OR FISH HARVESTING TANKS. THE TANKS HAVE BEEN CONSTRUCTED INTO THE SIDE OF THE MOUNTAIN AT THE HIGHEST POINT OF THE SYSTEM. THE FISH REQUIRE SPARING TANKS FOR TRANSPORT FROM THE TANKS TO THE EXISTING DAM. THE WATER IS GRAVITY FED FROM THE AQUACULTURE TANKS THROUGH THE FILTRATION SYSTEM AND INTO THE HYDROPONIC BEDS. IF ADDITIONS WATER IS REQUIRED, DUE TO EVAPORATION LOSS OR USE IN THE SYSTEM, WATER IS TAKEN FROM THE EXISTING DAM.

The water path travels from the aquaculture tanks through 30 millimeter PVC pipes into the clarifiers, filters and degassing tank. The water is then gravity fed into the hydroponic beds where it is responsible for the growth of various agricultural crops. Through further gravity flow the water is transported to a sump and base addition tank from where it is recirculated and pumped back to the aquaculture tanks.

Figure 2.6.15: Aquaponics system explanation (Author, 2015)
<table>
<thead>
<tr>
<th>ACCESSIBLE GREEN ROOF</th>
<th>HYDROPONIC BEDS</th>
<th>FISH REARING TANKS</th>
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SYSTEM DESIGN DEVELOPMENT: BIOPOOLS
The movement paths that allow for pedestrian traffic moving from the higher levels to the lower levels are emphasized and directed by the presence of water systems and processes. The incorporation of terraced biopools allows for a public interface between the industrial and natural environments. Making use of the purified water from the purification system in the quarry, the recirculating systems are focused on the process of immersion of the user in the natural environment and they move down into the quarry.

Each pool has been designed to provide a various level of immersion, a further interaction with both water systems as well as the planting and natural environments. The use of the river as a resource for the interaction and public use by users has added significant value to the river from a purely interactive and recreational point of view while the aquaponics systems add value to the river system from a productive and economic point of view. The biopools are largely responsible for the social aspect of the design.
The sections explain and indicate the intention behind the incorporation of the biopools and their integration of and connection to the social and natural environments. The response of the biopool design to the existing quarry landscape allows for the user to feel immersed in and experience the landscape. Varying degrees of immersion and experience of the natural environment reconnects man to the river and its surrounding habitats in a socially comfortable and stimulating manner.
EXISTING DAM FOR THE STORAGE AND PURIFICATION OF WATER WHICH IS USED AND PUMPED INTO THE BIOPOOLS. WHEN THESE WATER LEVELS DROP, THE DAM AND PURIFICATION SYSTEM IS RESPONSIBLE FOR THE REMOVAL OF ALL FORMS OF POLLUTION EXCEPT PATHOGENS.

NATURAL PUBLIC BIOPOOL. THIRD LEVEL OF IMMERSION IN THE NATURAL ENVIRONMENT FOR THE USER.

COMPLETELY INTEGRATED PURIFICATION PLANTING WITH THE SWIMMING AREA OF THE POOL.

SECOND LEVEL OF IMMERSION CONSTRUCTED BIOPOOL. PURIFICATION PLANTING IS PARTIALLY INTEGRATED INTO THE SWIMMING AREA. PEOPLE ARE ABLE TO INTERACT AND MOVE IN THE PLANTING AREA.

PURIFICATION PLANTING. MORE NATURAL AND INTERACTIVE THAN THE FIRST BIOPOOL. STILL REQUIRED 30 PERCENT OF AREA IS COVERED BY PLANTING FOR THE APPROPRIATE PURIFICATION.

SHADEN LAWN AREA

INTEGRATED PURIFICATION PLANTING

SEPARATED SWIMMING AREA OF BIOPOOL. NO PLANTING IS INTEGRATED IN TO THE AREA. A MORE CONSTRUCTED AND UNNATURAL FEEL TO THE POOL.

30 PERCENT OF AREA OF WATER THAT REQUIRES PURIFICATION IS THE REQUIRED PLANTING AREA. THE PLANTING AREA IS COMPLETELY SEPARATED FROM THE SWIMMING AREA, PREVENTING INTERACTION BETWEEN USER AND NATURAL ENVIRONMENT. NO IMMERSION IN THE NATURAL ENVIRONMENT YET STILL USES NATURAL SYSTEMS FOR FUNCTION.

PUBLIC ABUTMENTS

SECURITY: RESTRICTED ACCESS TO PUBLIC BIOPOOLS. FENCING HAS BEEN INCORPORATED AROUND EACH OF THE CONSTRUCTED POOLS.
FIRST CONSTRUCTED BIOPOOL: NO IMMERSION

SECOND CONSTRUCTED BIOPOOL: PARTIAL IMMERSION IN THE NATURAL ENVIRONMENT

Figure 2.6.19: Explanation of various Biopool construction approaches (Author, 2015)
Figure 2.6.12: Section through Biopools

(Author, 2015)

**First Level of Interaction:**
Constructed biopool, planting and biopool separated from one another; no human interaction with planting. Man and natural relationship is minimal.

**Second Level of Interaction:**
Constructed biopool, planting and biopool are integrated with one another; promotion of human and natural interaction through people moving through planted vegetation in order to get to open swimming area. Some human and natural interaction, partial immersion in the natural environment.

**Third Level of Interaction:**
Natural biopool construction. The last public pool is designed in the same way as a weir or natural dam. The pool is fully integrated with nature and allows for full immersion of people into the natural habitat.

**Section Through Biopool**
(NOT TO SCALE)