

CELEBRATING THE UNSEEN

A public interface to Hartebeespoort Dam water infrastructure.

A re-appropriation of the infrastructure through an architectural interface that fulfils cultural, social and economic functions to create a positive recreational space that celebrates water and its importance in our heritage. The intention is to create a productive infrastructure that facilitates exchanges between site, infrastructure and the user.

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Submitted in fulfilment of part of the requirements for the degree of Master in Architecture (Professional)

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I further state that no part of my thesis has already been, or is currently being, submitted for any such degree, diploma or any other qualification.

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

Ryan Taylor

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I would like to thank my parents and brother for the amazing support throughout my life in order for me to reach this point. Could not have done it without you by my side.

Special thanks to Prof Arthur Barker for the time and effort that you put into each and every one of your students. An amazing mentor and friend.

Steph, thank you for always being there with me, through the good and difficult times.

PROJECT SUMMARY

Programme:	Integrated Natural Resource Facility
Site description:	The infrastructure of Hartbeespoort Dam wall
Site Location:	Hartbeespoort Dam, North West Province
Address:	Scott Street, Hartbeespoort Dam, 0216
Coordinates:	25 °43'31.95" S; 27° °50'54.20" E, elev. 1167m
Research Field:	Environmental Potential, Heritage and Cultural Landscapes
Client(s):	The Department of Water Affairs (DWA) The Rand Water Foundation
Keywords:	public infrastructure, regeneration, vermiculture, Hartbeespoort Dam
Theoretical Premise:	Regenerative theory with the water Infrastructure to rehabilitate the scarred landscape of Hartbeespoort Dam
Architectural Approach:	The exploration of regenerative architecture as a means of re-imagining the potential energy locked into Hartbeespoort Dam to creating a new relationship between site, infrastructure and the user.

ABSTRACT

A public interface for the infrastructure of Hartbeespoort Dam

Water sustains all living things on this earth and has a huge impact on the natural environment. Water is the most valuable natural resource on this earth. It is vital to humans' existence. It is why we have evolved to the point that we are now and if we do not appreciate it, it will be our demise. Water has the ability to adapt and change as different natural systems interact with it, it allows a constant balance to remain. Humans have broken the delicate balance of water supply and demand, detrimentally affecting the natural systems that support us.

Since the start of the industrial era our cities have grown at an exponential rate. The development of cities has impacted negatively on natural systems. This has led to a concomitant disconnection between man and nature and has divorced humans from an understanding of the role and importance of natural water systems. We have forgotten the positive effects that we experience when directly engaging with water as we live in environments often far from nature; rarely experiencing it fully. Our physical control of natural resources has led to a physical disconnection and under appreciation of these precious resources.

This project aims to reconnect man and nature to create a new paradigm where humans value our natural resources and, in particular, water.

A re-appropriation of water infrastructure through an architectural interface that fulfils cultural, social and economic functions to create a positive recreational space that celebrates water and its importance in our heritage. The intention is to create a productive infrastructure that facilitates exchanges between site, existing infrastructure and the user.

USHWANKATHELO

Isinxulumanisi sezi bonelelo sika wonke wonke kwi dama lase Hartebeespoort.

Amanzi iyona nto ibalulekileyo emhlabeni ebangela abantu baphile. Ukuba asiwongi amanzi sizokufa. Abantu bawasebenzise kakubi amanzi, lonto icaphazele indalo yethu kakubi.

Oko kwaqala ezoshishini izixeko zethu zakhula ngokukawuleza ngendlela engumangaliso. Uphuhliso bezixeko zethu bumoshe inkqubo yendalo. Lonto yenze abantu bangayikathaleli indalo; bahoye ukuphuhlisa izixeko. Lento yabantu behlala kude kune ndalo yenze abantu baphethe bengaxabisi oovimba bendalo.

Leprojekthi ijonge ukwenza uqhagamshelwano phakathi kwabantu kunye nolawulo loovimba bendalo, ingakumbi amanzi.

Leprojekthi ijonge nakhona ukwakha izinxulumanisi ezizokutshintsha indlela abantu bawasebenzinsa ngayo. Umnqweno ngowokuba abantu bazakuxabisa amanzi, bawasebenzise ngokufanelekileyo.

UITTREKSEL

'n Publieke skeidingsvlak vir die infrastruktuur van die Hartebeespoort Dam omgewing.

Water onderhou alle lewe op aarde en het 'n groot impak op die natuurlike omgewing. Water is die belangrikste natuurlike hulpbron op die aarde en is van die uiterste belang vir die mens se voortbestaan. Dit is hoekom ons die punt bereik het waar ons nou is. Dit sal ons ondergang beteken as ons dit nie bewaar en waardeer nie. Die mens het die delikate balans van aanvraag en watervoorsiening versteur tot nadeel van die natuurlike sisteme wat ons onderhou.

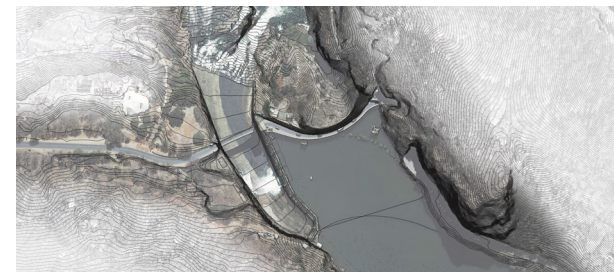
Sedert die begin van die industriële tydperk het ons stede eksponensieël vergroot. Die ontwikkeling van stede het 'n negatiewe impak gehad op ons natuurlike omgewing. Dit het gelei na 'n gepaardgaande diskonneksie tussen mens en natuur en het die mens se begrip van die rol en belang van natuurlike waterbronne negatief beïnvloed. Omdat ons in omgewings woon vër verwyder van water en dikwels van die natuur kom ons nie direk met water as lewensmiddel in ons omgewing in kontak nie. Ons fisiese beheer van natuurlike bronne het gelei tot die skeiding en onderwaardeering van hierdie kosbare bronne.

Die doel van die projek is om mens en die natuur bymekaar te bring en 'n nuwe paradigma te skep waar die mens sy natuurlike bronne, en in die besonder water, waardeer.

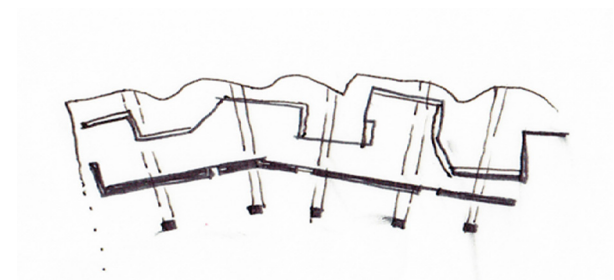
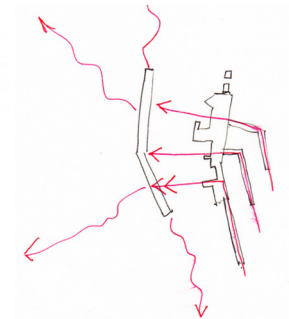
'n Nuwe benadering tot waterinfrastruktuur deur 'n argitektoniese wisselwerking wat kulturele, sosiale en ekonomiese funksies bymekaar bring om 'n positiewe onspanne ruimte te skep waar die belang van water as 'n erfenis vier, is nodig. Die doel is om 'n produktiewe infrastruktuur te skep wat uitruiling tussen die terrein, die huidige infrastruktuur en die gebruiker bymekaar bring.

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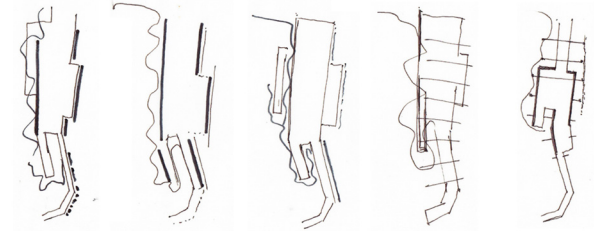
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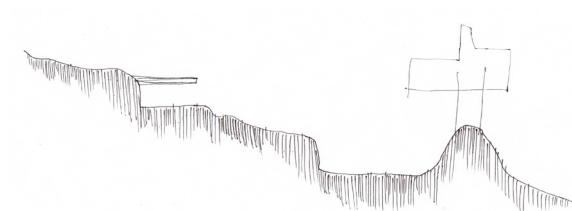
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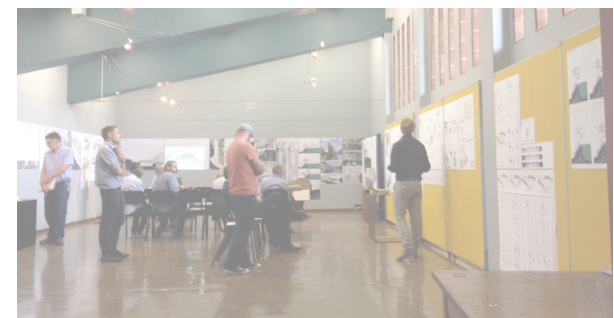
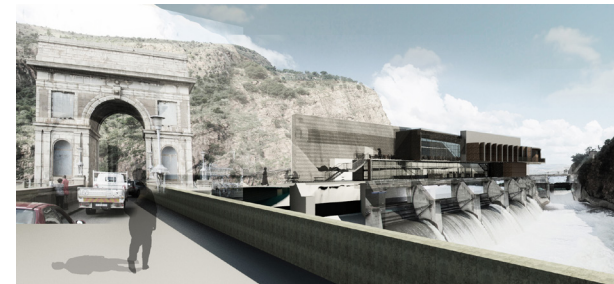
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Chapter 1:
Resources and their
consequences

INTRODUCTION



1.1 Resources and their consequences

1.1.1 The Cities of today

Before the modern era, human settlements such as Machu Picchu, either integrated or coexisted peacefully with nature. Here the city was sculptured into the site and man made elements such as the stonework are woven between and formed from nature.



Fig 1.1. Machu Picchu (Thousandwonders, 2016).

urtynsky (2006) remarked that “Like all animals, human beings have always taken what they want from nature. But we are the rogue species. We are unique in our ability to use resources on a scale and at a speed that our fellow species can’t” (Manufactured Landscapes, 2006).

During the industrial era infrastructure was implemented into cities to deal with the influx of people. With the use of fossil fuels, people were able to live outside of the city and commute every day. This led to the infrastructure sprawling across our natural landscape. Infrastructure was used to control our rivers and retain our water in dams. This caused a disconnection between man and nature.



Fig 1.2 Machu Picchu (Thousandwonders, 2016).

Further urbanism changed cities, the modern movement a call for a home, a high rise habitat that replaced gardens.

Grant (2012: 53) states that “urban dwellers became increasingly disconnected from nature, so that nowadays many of us no longer understand the connection of a healthy ecosystem and healthy cities. Landscapes on and around our buildings and infrastructure can be more than an optional ornamental extra but a multi-functional layer of soil and vegetation that controls surface water, provides food and wildlife habitat and keeps us cool, fit and sane. To make this transformation from grey to green will require panoramic, trans disciplinary thinking and coordinated action“ (The nature of cities, 2013).

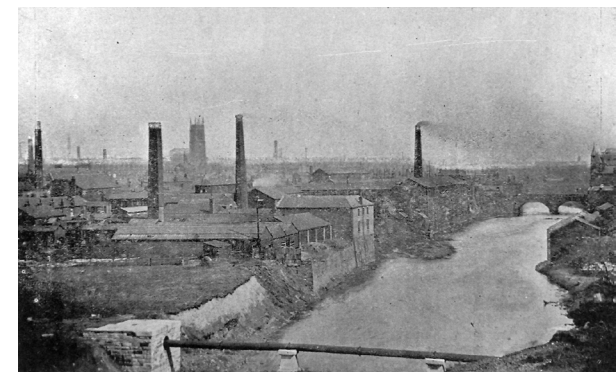


Fig 1.3 the Industrial Revolution on the River Irwell (Wikimedia, 2014).

1.1.2 The City of Pretoria

Man and nature have always been connected. We have relied on nature to provide us with resources in order for us to grow and become the civilisation that we have. But over time we have become disconnected from nature and separated ourselves from that which sustains us. Now we tend to view nature as a form of escapism; to break away from urban life. Our cities have become so disconnected from nature and there are only remnants of it left (The nature of cities, 2013).

Samiei's (2012) opinion is that "nature has been seen as a superficial embellishment, as a luxury encountered only in parks and gardens, rather than a meaningful essential force that permeates the city" (The nature of cities, 2013).

This is no different to Pretoria's public spaces while they were viewed as an escape from the city, a natural area contained in an urban sprawl, but over time parks and recreation spaces have become derelict and forgotten and now are places of crime. These spaces have quotidian activities in them now which create further pollution.

Water is one of the main reasons why Pretoria was able to develop into the town that it is today. Fortunately there was an abundance of natural groundwater in the form of dolomite aquifers. There are two dolomite aquifers in the Groenkloof nature reserve which flow into the Apies River. Other dolomite aquifers are located to the south of Groenkloof, namely Grootfontein and Sterkfontein. This water has been retained in large dams such as Rietvlei and Hartbeespoort. They are a vital part of Pretoria's heritage and still supply drinking and irrigation water to the city. But yet there is little understanding of their significance and the role they have played in the development of Pretoria.

To gain a greater understanding of Pretoria's water systems, all water bodies have been mapped by the framework group. More detailed research has been delimited to the section of the Apies River and Hartbeespoort Dam. Through research on the urban development of Pretoria it is evident that there has been a growing disconnection between man and nature. We no longer understand nature's importance and its role in our life.

In order to reconnect man and nature there is a need to install a new identity of water, an identity that looks at a symbiotic relationship between man and nature, rather than the current parasitic relationship. This identity allows a critique of our current infrastructure and a celebration of water.



Fig 1.4 Pretoria growing (Adapted from N, Clarke. 2010).



Fig 1.5 Pretoria growing (Adapted from N, Clarke. 2010).



Fig 1.6 Pretoria growing (Adapted from N, Clarke. 2010).

1.2 Problem Statement

1.2.1 Destruction of natural systems

The natural world consists of complex and integrated systems that all work in unison. Natural systems are made up of many closed loops that maintain their existence and balance. As humans we often disrupt these closed loop systems and sometimes even destroy them (DeKay and O'brien, 2001).

The impact of human activities on the world has grown significantly since the Industrial age. We see ourselves as being above nature and its systems. We have taken advantage of it. These ideas are slowly shifting to viewing ourselves as being a part of the natural balance of life. As can be seen in fig. 1.8-1.9 below that reflects these ideas.

The built environment is a major factor in the destruction of closed loop systems. With these shifting ideas of viewing ourselves as part of nature we have tried to become more sustainable and to think "Green" in the built environment. This only stops further damage to the environment but does not deal with the existing damage that has already been created. Now we need to think of regenerative architecture, where these natural systems can be integrated into our buildings to create closed loops, but also regenerate the environment and context around buildings (Grant, 2012).

"Water, like many other resources, is harvested, transported and used throughout all aspects of society. Unlike other resources, water is critical to the survival of all forms of life. The underlying question that sits at the core of my exploration is to what degree we can shape water before it begins to shape us" (Manufactured Landscapes, 2006).



Fig 1.7 Web of life (Quotelotus, 2016).



Fig 1.8 Apies River (Author, 2016).

1.2.2 Disconnection between man and water

Physical

In most cities there is a division between humans and water. We simply open our taps and the water comes out. There is no understanding of where it came from or where it goes after we have used it.

Visual

Often rain water is not only taken away by open storm water channels but also enclosed in pipes; as is evident in Pretoria with the Apies River as it was a natural river which has been mostly channelized.

Natural

A natural river from a natural spring is contained and dammed to hold the water. A natural element is now a man made controlled element.

The Hartbeespoort Dam contains much of Pretoria's water. It is very polluted and has disrupted closed loop natural systems. This is a problem for our water supply because as it becomes more polluted, it destroys more systems.

Privatisation

The land around our water features has been privatised with limited public spaces or access to the water. This means that there is only a connection for a select few.

Public Space

Public spaces which used to be our one connection back to nature have now become dead zones in our city surrounded by mono-functional buildings (see fig 1.4-1.6). Pretoria's public spaces are no different. Spaces that could create a connection back to nature, such as the Apies river, have not been designed appropriately and end up being negative spaces.

Through this disconnection between humans and water we have become irresponsible with this natural resource and have forgotten its historical importance. It is hypothesised that a similar disconnection has occurred at the Hartbeespoort Dam, where space has been privatised and therefore it is thought that there is little or no connection to the water besides limited visual connection.

As can be seen in fig 1.11, Roma's water infrastructure is still displayed to this day in Italian cities, even though it may not be used. For example the aqueducts no longer have water flowing in them they but they are still highlighting their importance and heritage value. A good example is the image on the bottom right hand side, Trevi fountain that creates a public space to this day.

This is not the same in Pretoria where water infrastructure is concealed or removed from sight. For example the Fountain in Church Square (see fig 1.10) has been removed to the zoo and the furrows, where water used to run, have now been covered up. This attitude towards our water history shows the disconnection that we have created.

1.2.3 Mono-functional infrastructure

Through this disconnection we have changed our perspective of water from a natural element to a natural resource. A resource that can be used and exploited and which is used irresponsibly.

Our infrastructural buildings are the only interaction with our natural resources that remain. This infrastructure is something that we rely on every day, it provides us with power and water but yet these buildings remain inaccessible to us. They often create divisions in our city, because of their physical size and singular use.

Infrastructure is constantly used without us seeing or experiencing the processes. Our infrastructure buildings are essentially mono-functional. The engineering design is as efficient as possible with no public access or connection to the city (Davids, R, 2016: 5).

Often these areas are restricted because there are safety issues. These spaces are engineered to be as effective as possible and this does not consider safety as a priority. This being said there are ways of making these space safer in order to be publicly accessible.

Pretoria - water infrastructure covered and forgotten



Fig 1.10 Pretoria's water fountain (Wikipedia, 2016).

Rome - water infrastructure celebrated and remains a part of the city



Fig 1.11 Romes Trevi water fountain (Wikipedia, 2016).

1.3 Intention of this dissertation

This dissertation will attempt to look at infrastructure in three ways:

- To celebrate our water heritage and its importance.
- To redesign the single use spaces as multifunctional spaces.
- To re-acquaint man and nature by adapting primarily inaccessible buildings, with secondary functions to be better publicly connected.

This calls for a re-appropriation of infrastructure through an architectural interface that fulfils cultural, social and economic functions. This will create a positive recreational space that celebrates water and its part in our heritage, reminding us of its importance - a productive infrastructure that creates a better connection between man and nature that heals scarred landscapes.

The fig. 1.13 shows a building that creates a public space as well as being a dam wall, producing a better public connection to water through contact and sight.

Summary of issues

Through the development of our cities we have controlled natural water to become a natural resource. The only place that we now have connection with water is in water infrastructure buildings and, as they are right now, these structural buildings are mono-functional and closed off to public. This has led to us being less engaged with water and a new architectural paradigm needs to be created.

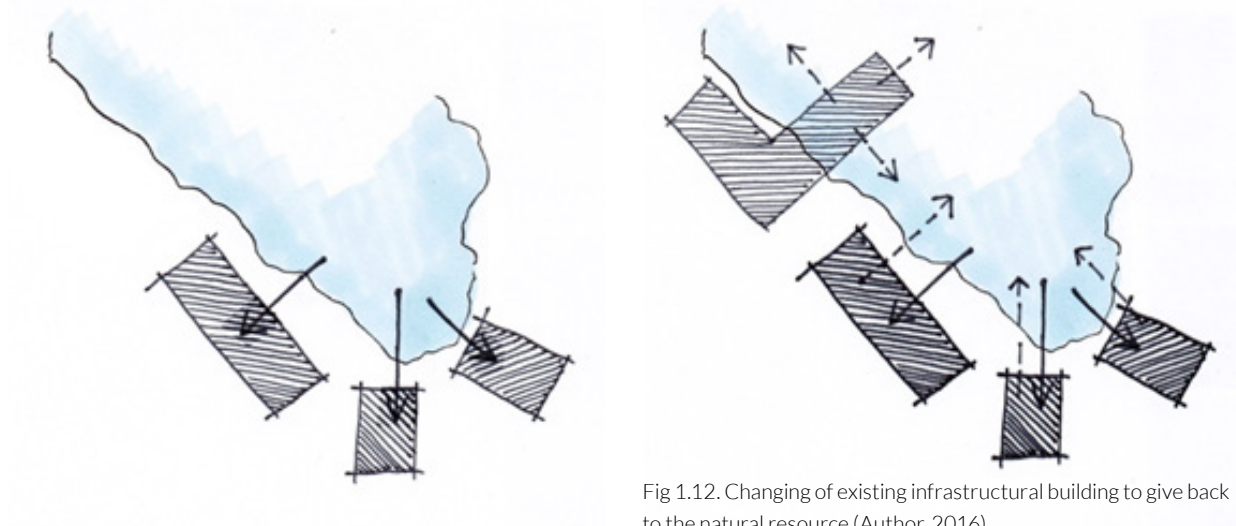


Fig 1.12. Changing of existing infrastructural building to give back to the natural resource (Author, 2016).



Fig 1.13 Landscape Architecture student (Asla. 2016).

1.4 Regenerative and Resilient Theories

As the existing site has been scarred by the creation of the dam and the eutrophication of the water has created an imbalance in nature that cannot be self corrected. Regenerative theories could be used to create an architecture that starts to bring equilibrium back to the site. The building does not only need to cater for the new user but also to rehabilitate the site in order for other uses to be sustained in the future.

The theories of Regenerative Architecture do not mean that the building is 'regenerated', in the way of self-healing, like a living system. Rather it means that a regenerative building is a catalyst for positive change within a unique place in which it is situated. This looks at a specific situation or site that has declined to a point where it is right for renewal (Cole, 2012: 54).

Using regenerative architecture to explore how ecosystem services available in Hartbeespoort Dam could be utilized through a public interface to the existing dam wall (Cole, 2012:54).

This dissertation will use regenerative theories as a departure point for the design. The architectural intervention will be tested against Steven Moore's eight points for regenerative regionalism. He contextualises these eight points in a non-modern regionalism refuting modernity and post-modernity. The eight points will have to be given a hierarchy of importance relative to the needs of the site in order to proceed with design (Canizaro, 2007:433-442).

The diagrams in figure 1.15 show how a system can be made stronger through regenerative theories. The top diagram shows a one-way flow of materials into a system that will eventually use up all the resources and collapse. The lower diagram shows a networks of different systems that feed into one another creating closed loop systems and insuring a continues system.

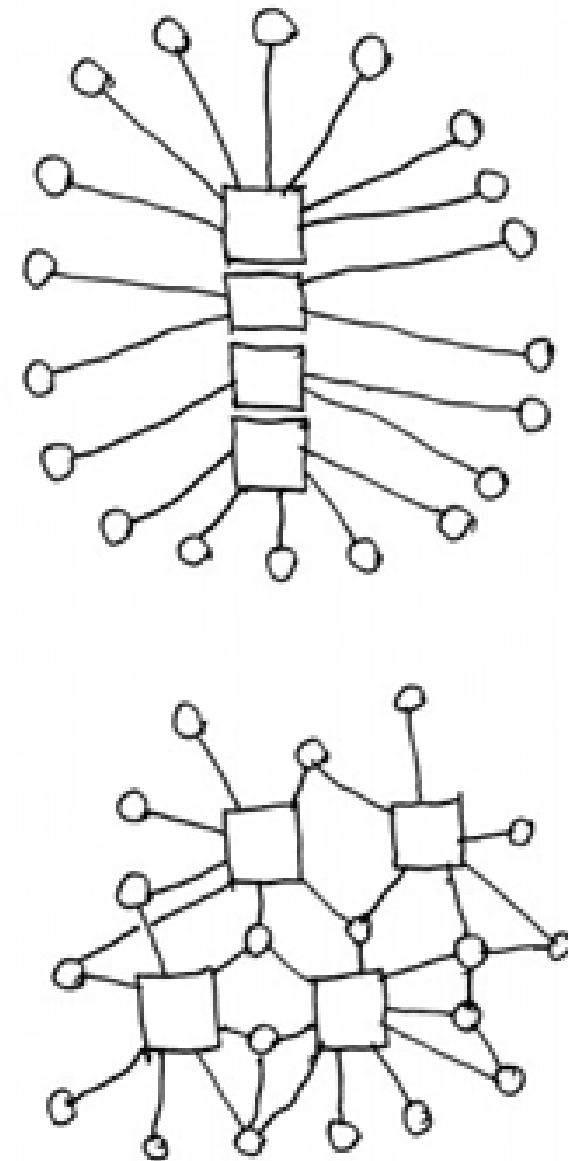


Fig 1.15 Resilient diagram (metropolismag, 2016).

1.5 Site

1.5.1 Study area

Through research of Pretoria a greater understanding of water bodies was gained and a delimitation was made to focus on the Apies river that flows through the CBD and the Hartbeespoort Dam. Through research on the urban development of Pretoria a new identity was envisioned between man and nature. This identity was applied to the Hartbeespoort Dam which became the new focus area for this dissertation.

1.5.2 Context focus

The Hartbeespoort Dam is located to the west of Pretoria and was constructed to create a constant water flow to the agricultural lands to the north. It has become a recreational space for Johannesburg and Pretoria. Many natural systems and ecological potentials have been disrupted by humans resulting in a polluted water system. This has resulted in the eutrophication of the water, through an increase of phosphates and nitrates. This abundance of nutrients leads to a boom in algae growth which, in turn, blocks out the sun and uses the oxygen in the water, killing other marine life. This increase in nutrients is due to sewer water and fertiliser polluting the water system in the Crocodile River (Harties, 2016).

Through a greater investigation of the dam it became possible to hypothesise that the dam wall was a key point to create a better connection between man and the natural resource, water.

1.6 Program

Celebration of water

The aim of this dissertation is to explore the creation of a public interface along the Hartbeespoort Dam wall infrastructure by creating a space that celebrates one of our natural resources, water. Secondary functions will be to create closed loops systems to rehabilitate the dam, mainly a vermiculture system that removes Hyacinth from the dam and creates compost.

This dissertation will reintroduce urban communities to natural processes by integrating people and natural productive systems within the context of Hartbeespoort Dam's infrastructure.

The products of this system can be used to rehabilitate the dam by creating wetlands that filter out the causes of eutrophication before entering into the dam. The systems can be heightened and displayed to create awareness and therefore create public participation in correcting the dam's state (Harties, 2016).

Products of the systems will be sold to the public in a retail and restaurant space which will draw people back to the space as well as recreation boardwalks and picnic areas.

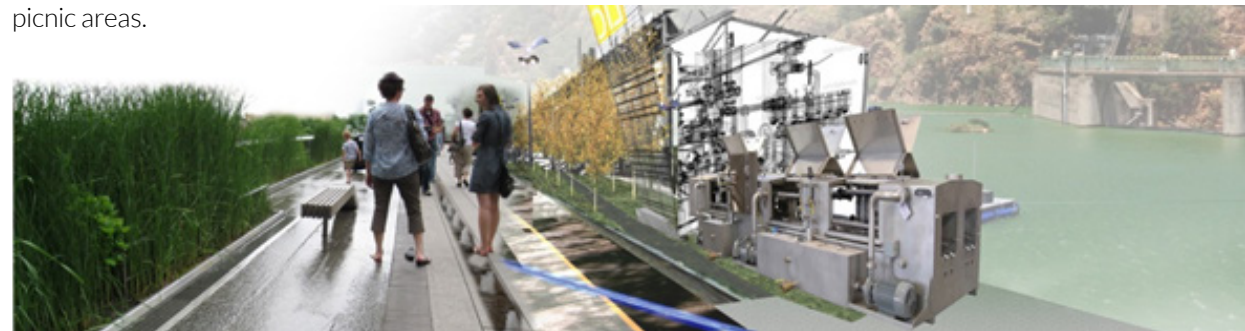


Fig 1.16 Vision perspective (Author, 2016).

1.7 Research Questions

The focus of this dissertation is to test whether architecture can create a public interface to Hartbeespoort Dam water infrastructure that facilitates exchanges between site, infrastructure and the user.

The dissertation aims to answer the following research questions:

- Can architecture construct integrated cultural and ecological processes to create social activity?
- How can architecture as a productive infrastructure rejuvenate and regenerate the Hartbeespoort Dam in order to create a sustainable recreational space and re connect humans with their environment?
- Can architecture facilitate closed loop systems?
- How can architecture create economic opportunities for sustainable food production to reinforce the rehabilitation of the Hartbeespoort and reconnect Pretoria and surrounding areas to the dam?

1.8 Research methodology

1.8.1 Understanding of site

Context analysis and secondary data analysis of Hartbeespoort Dam will be collected to gain a greater understanding of the issues at hand. Comparative analysis and historical studies will be used in a thorough investigation of the dam wall and the Hartbeespoort context to understand its historical meaning. Photography was the primary medium used to capture qualitative data to understand the development of the wall and the context that preceded it.

Evaluative research/appraisals will give hierarchy of the existing value of the current development proposal. This will be used to understand which has potential to become integrated into the project and which are of lesser importance. The current remediation proposal for the site and its surroundings will be analysed to find whether such proposals are appropriate, and where alternatives or improvements can be considered.

Literature research of past analyses of this site and its context to gain an understanding of gaps in the research that will need to be carried out as well as gain a greater understanding of site.

1.8.2 Understanding of theory

The investigation of critical theories through literature reviews will be carried out. Relevant literature related to resilience and regenerative design was researched (desktop study) to develop an appropriate architectural design response to conditions on the site. Steven Moore's eight points for regenerative regionalism are specifically used as a departure point.

1.8.3 Understanding the condition of water

An understanding of the disconnection between man and water is to be gained through the subcategories of history, physicality and naturalness. These subcategories were interpreted to provide architectural potential for the project.

Further desktop research will be done to understand the state of the water as well as the activities that influence this and what the possibilities are of using this water 'pollutants' for alternative activities and therefore the potential energy contained in the water.

Research of what the current processes are to alleviate the eutrophication of the water and their effectiveness in doing so. If any spin off activities are required or could be utilized.

1.9 Delimitations

This dissertation looks at a specific site in its context and will not postulate a set of rules to apply to any infrastructural building/object. This dissertation will reintroduce urban communities to natural processes by integrating people and natural production systems only within the context of Hartbeespoort Dam's infrastructure.

This dissertation will look specifically at the water around the dam wall and not try and solve the entire situation of Hartbeespoort Dam. It is simply an example of catalytic intervention that could be integrated throughout the dam.

1.10 Limitations

It is important to note that the author is not an expert on the production aspect, but is simply researching the possibilities of cross programming of these production systems.

The extent of this understanding is limited by the time available for this dissertation. This may lead to further investigation of these possibilities that are being researched in this dissertation as they are not finite and can be broadened.

There is a limitation on the information about the construction of the dam wall. Due to the limitations of time, the dam wall will be drawn to the best of my knowledge and this information will be taken forward in this dissertation.

1.11 Assumptions

The assumption that the existing wall is strong and stable enough to support the proposed interventions was confirmed by the departmental engineer.

The existing water control system can be manipulated to allow for the proposed program exchanges.

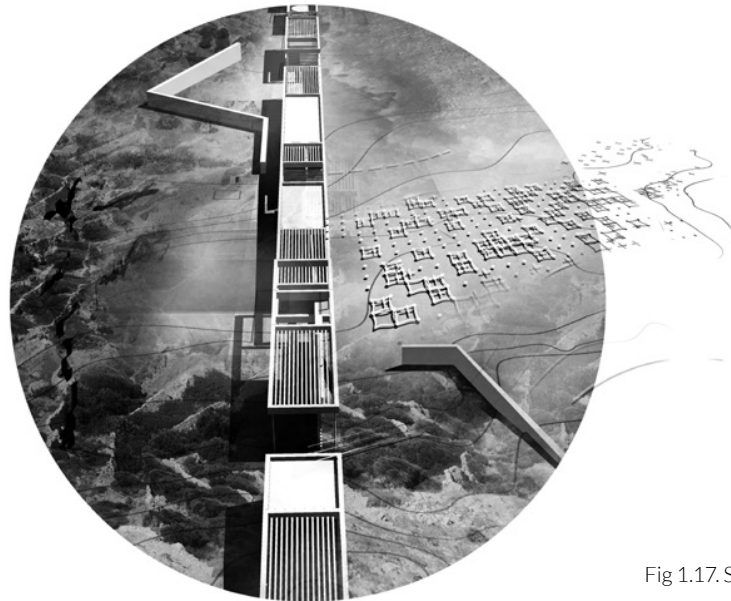


Fig 1.17. System Bridge (Alexandra Vougia, a et al., 2014).

