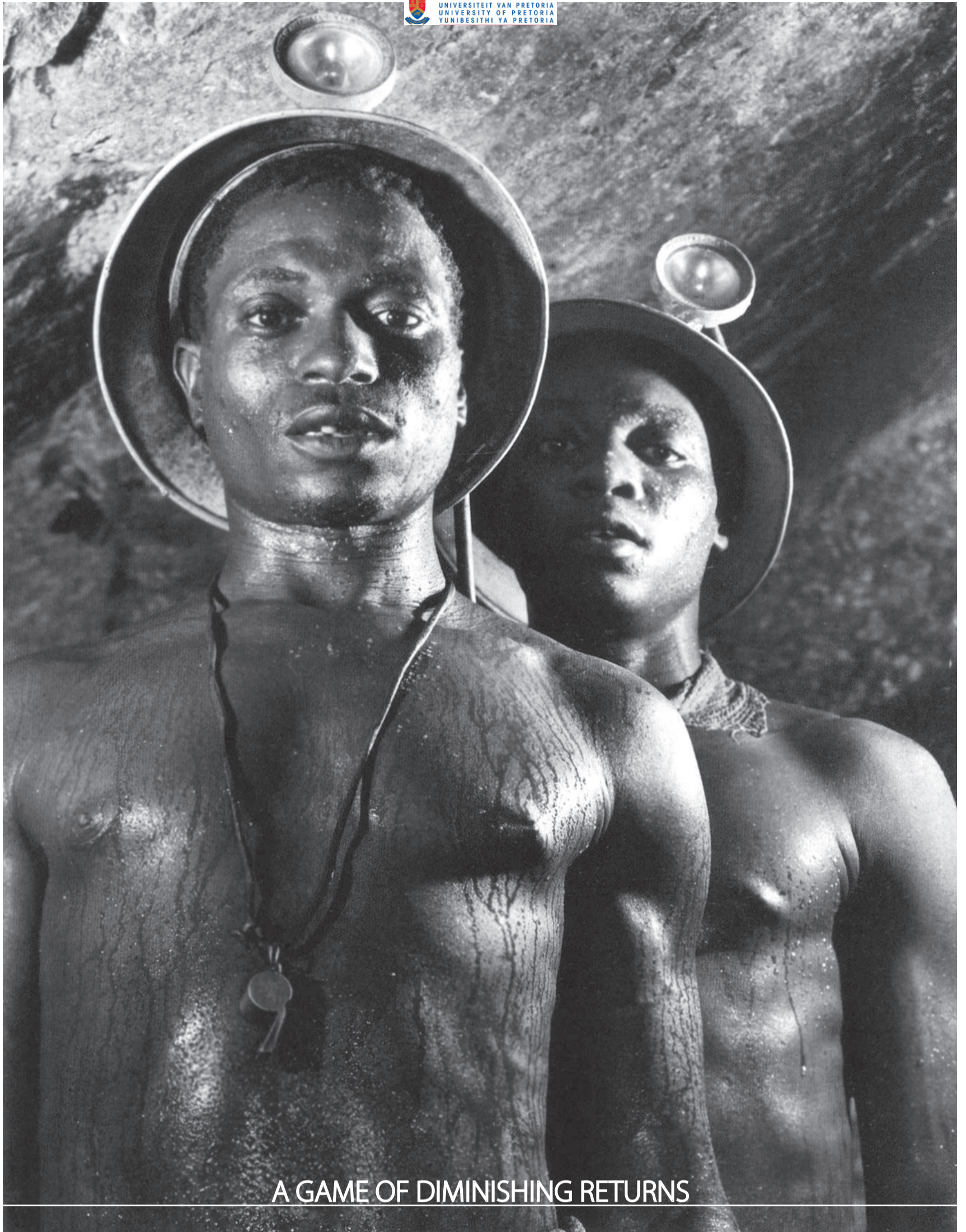# CHAPTER 01
## INTRODUCTION

A GAME OF DIMINISHING RETURNS

↑ 004 - Gold miners, Johannesburg, South Africa. (Bourke-White, 1950)

## 1.1// INTRODUCTION

If one was to define the origin of major South African cities, one could do so with single descriptors.

**Cape Town – Trade
Pretoria – Safety
Johannesburg – Mining**

Definitively, the same is true for Cullinan – Diamonds.Johannesburg's success stands out as an improbability. Mine closure frequently results in utter social decay, leaving behind bereaved social conditions with no stabilizing economic or community factors. One must question what factors could allow for community survival when the main source of equilibrium is removed.

REFILWE

SITE

SLIME DAM

CULLINAN
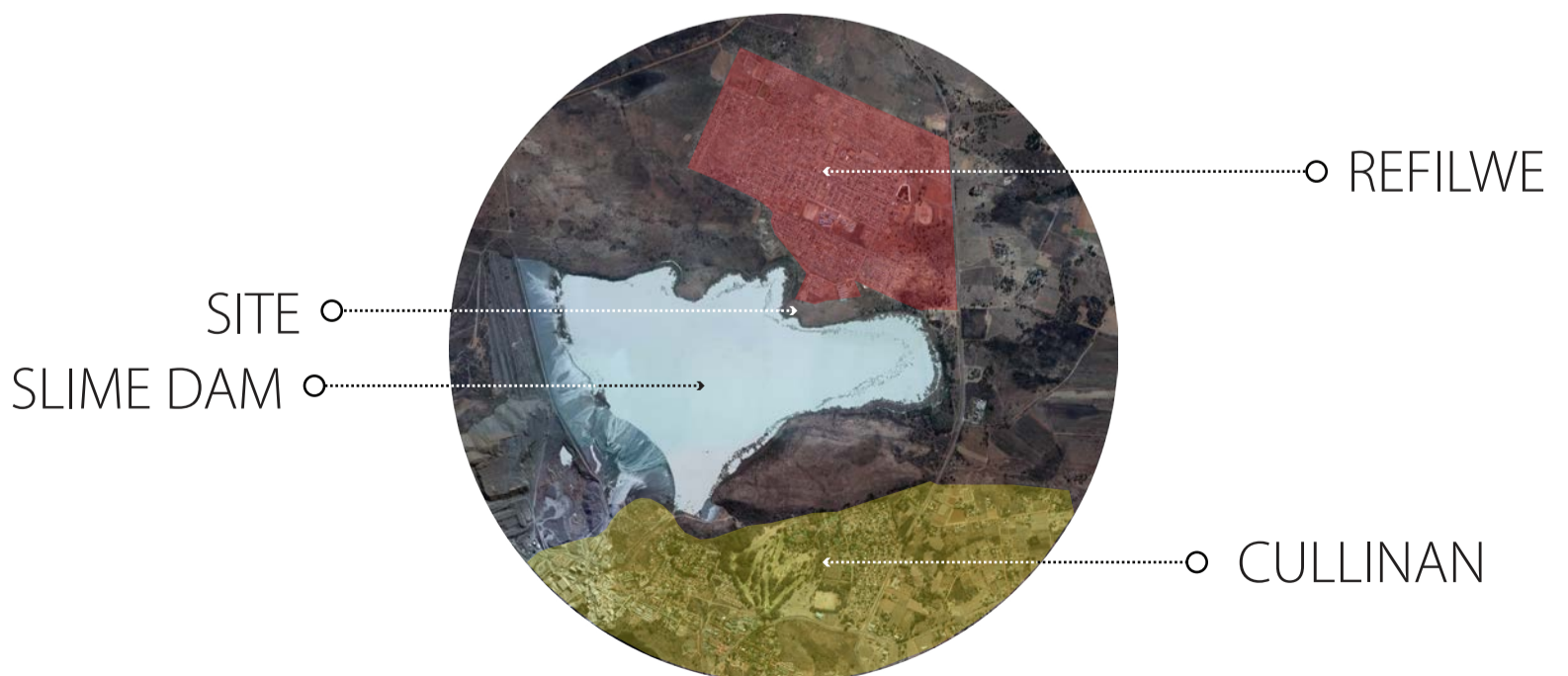
↑   005 - Site Location

↑   006 Crop Growth

The negative effects of ill-prepared mine closures are an international problem, especially in developing countries. Ultimately, mine closure is inevitable for any mine. Due to this inevitability, it has become increasingly important to predict and structure the process for mine closures from as early on in the process as the mine design stage (World Bank and International Finance Corporation, 2002). The process of mine closure is an increasingly complex process, encompassing much more than technical solutions. Today mine closure involves not only mining companies but also includes governments, specialists and communities connected to mines.It is imperative that local communities are proactively involved in eventual mine closure to ensure there are benefits reaped from the all processes. These processes include secondary programmes that ensure sustainability for future generations. For the process of mine closure to be successful and completed governments must provide strict and up-to-date legal frameworks to ensure no large-scale environmental or social problems are left solely up to them.

When mine closure happens incorrectly or abruptly, due to unforeseen and sometimes uncontrollable circumstances, it can cause significant liabilities for both mining companies and governments. More often for governments than for mining companies, as ultimately, a mining site is the responsibility of a government if a mining company were, for instance, to dissolve.
The liabilities imparted on a government due to improper closure plans can include significant costs, which are often unpayable for developing countries' governments. Unfortunately the reality is that, even with a successful mine closure, the severe reduction in incomes within a community can cause great socio-economic strain. With an improper mine closure, the effects can be devastating in both social and environmental spheres. This is confirmed by the World Bank and International Finance Corporation (2002) and International Finance Corporation (2002), who state that "for mining communities, mine closure can cause severe distress because of the threat of economic and social collapse – possibly of an entire region." The aforementioned information does not even begin to consider the impact of mine-related pollution on the environment and community health.

In the past, mines were often merely abandoned after they became economically unviable. This historic trait, unfortunately, still occurs today in some developing countries where governments do not have sufficient policies or frameworks in place. Often the benefits of a monetary influx, associated with mining, is considered of more importance than the negative consequences due to environmental or social health damage.

It has become abundantly clear that it is of the utmost importance that the socio-economic and long lasting environmental damage of mine closure; and the impact this has on employees, their families and the general mining community; must be mitigated .

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

**COMMUNITY**
Xenophobic Attacks
Refilwe Community

**2014**

*MINE RENAMING*
*Mine renamed 'Cullinan' as*
*part of centenary celebrations*

**2003**

**OWNERSHIP CHANGE**
De Beers acquires full
ownership

**1977**

*REFILWE TOWNSHIP*
*The Mine Compound*
*First formal housing for miners*

**MINE REOPENS**
Dewatered for drilling of
underground mine

**1976**

**1945**

*MINE CLOSURE*
*The Great Depression*

**MINE REOPENS**
De Beers acquired
a majority stake

**1932**

JOBLESS MEN
KEEP GOING
WE CANT TAKE CARE OF OUR OWN

**1916**

*MINE CLOSURE*
*Start of World War One*

**THE CULLINAN DIAMOND**
Sir Thomas Cullinan
McHardy, Fred Wells (right),
(left)

**1914**

**1905**

*CULLINAN MINE*
*Began full operation*

*REFILWE*
*Informal Living by Miners*

**1903**

**FOUNDER**
Thomas Cullinan
Discovers Kimberlite pipe

**1902**

↑  007 - Timeline

Cullinan is a small mining town located 30km from the Eastern border of Pretoria, and 44km from the Pretoria CBD. Cullinan relies primarily on mine-related tourism and mining related industry as its main economic stabilizing agents. The town offers a wide variety of tourist activities, focusing around the mine itself and including the offshoot businesses that target visitors and tourists.

The town is named after the diamond industrialist Sir Thomas Cullinan. Cullinan first discovered the kimberlite pipe in the area in 1902 (Petra Diamonds, 2008). Before the discovery of the kimberlite pipe, the Cullinan area, originally known as the Elandsfontein farm, played host to a significant heritage of agriculture. Cullinan mine utilizes a mining method known as mechanized panel retreat block caving. This process requires the development of an open drilling level, where the ore body is undercut by drilling and blasting (Bester, 2005). This method has resulted in a large open incision in the landscape better known as the "The Cullinan Big Hole". The Cullinan mine is still largely active and stands as the world's second largest indicated diamond resource and is the only significant source of the extremely rare blue diamonds (Petra Diamonds, 2008).

The Cullinan mine relies primarily on unsustainable methods of extraction of non-renewable resources. Although The Petra Diamond Group states their adherence to South African environmental laws, regulations and requirements, including the following acts: Mineral Resources and Petroleum Development Act (MPRDA) of 2002, the National Environmental Management Act (NEMA) of 1998, the reality of the matter is that these documents are outdated and do not provide adequate enforcement in protecting the direct mine area and surrounding areas (Petra Diamonds, 2008). In recent years numerous research papers have delineated the adverse effects of waterborne pollution on the environment and communities situated in close proximity. The deleterious effects of the pollution are both a present-day problem and future problem. The viability of Cullinan's survival, as a town, depends both on the sustained ability to attract visitors and the health of the community which serves it. It is estimated that the viability to mine the Cullinan kimberlite ore pipe will become economically unviable by 2059. Thereafter interest in rehabilitation efforts of the mine site by Petra Diamonds will reduce significantly due to costs and reduced involvement with the area (Reynecke, 2011). This dissertation questions methods of reversing these deleterious effects of mine-related waterborne pollution, both on the environment and local communities. My research report describes alternative perspectives on societal and environmental rehabilitation, through architectural means.

019

ENVIRONMENTAL

MINING
AIR POLLUTION - WASTE REMOVAL

DENSITY
INFRASTRUCTURE - IMPOVERISHED HOUSING

25.6400° S 28.5297° E

COMMUNITY
XENOPHOBIA - ISOLATION - ESCAPE

SOCIETAL

MINING
WATER POLLUTION - ARTIFICIAL LANDSCAPE

ENVIRONMENTAL

Refilwe exemplifies the racial segregation in South Africa which existed prior to, during and even up to the present day. Even though the laws of Apartheid did not come into being until 1948, numerous laws which benefited only white racial groups were passed preceding this date, benefiting colonial white settlers over indigenous Southern Africans and other people of colour residing in South Africa . The founding of the Refilwe community, comes directly from two laws which were passed pre-Apartheid (Meisel, 1994): In 1911, the Mines and Workers act which reserved any high paying jobs for whites only, leaving black racial groups with low-paying, labour-intensive work. Secondly; in 1913 the Natives Land Act was passed which only allowed the black labour class to buy land within predefined areas called reserves (Ibid., 1994). Refilwe was just one such reserve. In a document written by West (2017), it states that the initial influx of residents into the area, now known as Refilwe, were black residents which were "forcefully removed from their settlement in the then Ditloung, Kgapamadi and Matolokwane areas to make way for white farmers" (West, 2017).

Refilwe inarguably originated due to the success of the Cullinan mine, thus even with a delimitation of site to Refilwe, it is superfluous to look at the one without considering the other. Cullinan's primary source of financial stability comes from the mine, but it doesn't only come from the physical, mined product but also from tourist industries, visitor interests and other general community support systems. Trying to separate Refilwe's existing identity from Cullinan is impossible. Cullinan and Refilwe are an intertwined entity.

In the modern paradigm, media can heavily influence the self-evaluation of a community's identity. This can result in either positive or negative growth. Refilwe's only media coverage in the last five years relates to xenophobic unrest and government service protests. Refilwe's overriding identity is one of segregation. A problem stemming from historically formal racial segregation and the continued resultant economic imbalance in privileges.

Much of Refilwe's instability stems from a lack of community identity or cultural cohesion. Over the course of Cullinan's history, Refilwe has always been an evicted and displaced community. However, Refilwe's history of segregation could, in itself, be seen as a form of identity. This interpretation could lead to an understanding of the recent acts of xenophobia. A community formed through segregation, forms a collective identity. An identity which is then, in certain terms, disrupted by the more recent influx of foreign nationals, which threatens to deprive an already unstable community of their only binding sense of identity. Refilwe is under constant threat of having its only social binding agents unravel completely. With the constant levels of tumult in social, political and economic dynamics in Refilwe, it is now more than ever that a strong community identity must be formed. One hypothesis would postulate that community strength, in the form of identity, could be the salvation for an area which is soon to be abandoned. Architecture, is often seen as a social catalyst, yet what is often forgotten is that a catalyst only works if it is added to an existing reaction. Two questions arise from this line of inquiry:

What factors can give a community a passive identity and in turn allow for stability?

Can architecture provide an environment and linked programme which is conducive to the formation of a community with a well-defined identity?

## 1.5// PROBLEM STATEMENT

This dissertation is guided by the constant and conclusive negative influences of mining, on social and environmental factors and how these harms can inform an architecture of remediation; both programmatically and physically.
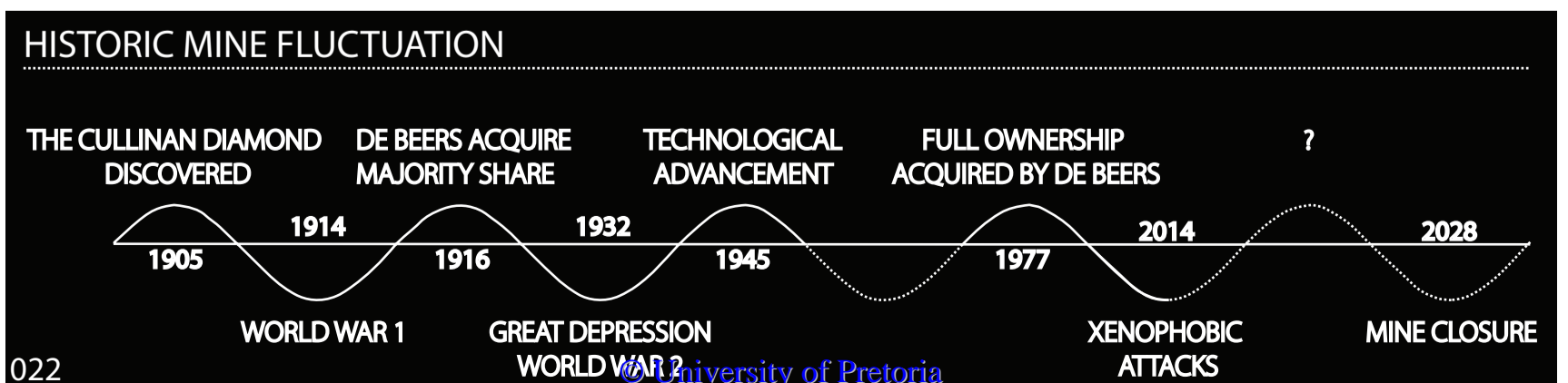


RAISING THE ISSUE

↑    009 - Sheltering behind his shovel from a stinging gale of grit. (Goldblatt, 2012)

## 1.5.1// MAIN ISSUE

The abandonment of mining sites is a well-known societal and environmental problem internationally. The towns and cities which form around mining areas often have no strategy for survival after mine closure.  Various social groups are affected through mine closure, but none more so than the low-income bracket. Low-income communities often struggle to survive with a functional mine, with mine closure resulting in a complete unraveling of social and economic structures. Refilwe's existence is the direct result of pre-apartheid and apartheid laws. Even with political shifts and revoking of racially seg-regating laws, the demographic divide is still abundantly clear. Refilwe is rife with societal problems, stemming from lack of basic services and community identity. The question of whether architecture can serve as a catalyst to augment a community, which can survive mine closure, is a difficult one.

Societal imbalances is hardly the only problem faced by mining communities. Environmental pollution can have long-lasting negative effects of community health, both tangibly and intangibly. Communities such as Refilwe often have severely limited means to managing the influx of pollution into direct areas of livelihood and treating the associated health problems. The proximity of Petra Diamond's slime dam to the Refilwe community creates great concerns of polluted water seepage and spillage.

↓    010 - Historic Mine Fluctuation

### HISTORIC MINE FLUCTUATION

| THE CULLINAN DIAMOND DISCOVERED | DE BEERS ACQUIRE MAJORITY SHARE | TECHNOLOGICAL ADVANCEMENT | FULL OWNERSHIP ACQUIRED BY DE BEERS | ? |
|---|---|---|---|---|
| 1914 | 1932 | | 2014 | 2028 |
| 1905 | 1916 | 1945 | 1977 | |
| WORLD WAR 1 | GREAT DEPRESSION WORLD WAR 2 | | XENOPHOBIC ATTACKS | MINE CLOSURE |

↑ 011 - Home lands. (Goldblatt, 2012)

Urban areas exemplifying segregation of racial groups is omnipresent in South Africa. Refilwe's urban fabric stems as a direct result of racial and political segregation. The lack of services and urban strategies in Refilwe demonstrates how Refilwe should truly have formed part of Cullinan, and not have been established as separate entity. An urban vision will be developed from a detailed site analysis. The urban vision will strive to mitigate conditions of segregation, identity, density and services fulfilment. The site analysis and urban vision will allow for the formation of a relevant architectural response to the current urban problems. These analyzes will be used to establish a framework which will aid Refilwe in surviving the eventual closure of the Cullinan mine.

## 1.5.3// ARCHITECTURAL ISSUE

An architectural response to the delineated issues will investigate architecture as a rehabilitation agent. Rehabilitation of Man and the Natural Environment. The proposed architecture will provide the much needed aforementioned sense of identity to the community of Refilwe. This will be achieved partly through the addition of a rehabilitation-based research laboratory, and partly through supporting programmes. The architectural programme will test the ability of architecture in providing a stable platform for the development of a defensible mining community identity.

While the ability of architecture to be a catalyst for identity is relatively unknown, its ability as an environmental rehabilitation agent is well defined. The architectural difficulty will come from the design and construction of structures directly informed by environmental remedial elements and not merely architecture clad with them.
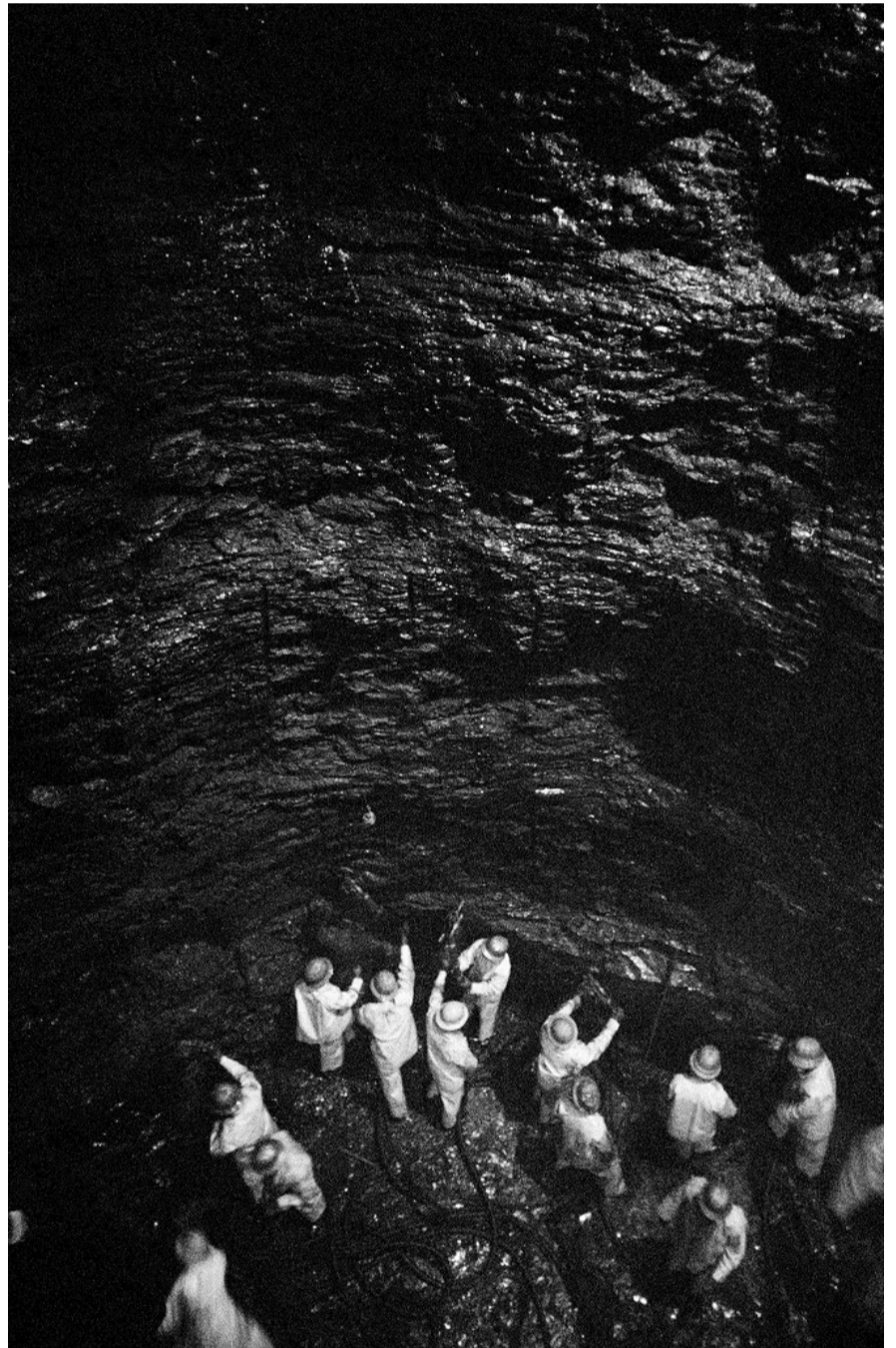


↑ 012 - The sidewall. (Goldblatt, 2012)

This disconnection results in a disregard for the natural environment. The ultimate goal for this dissertation is to investigate and isolate a method for making technological systems an architectural approach, instead of mere post-design addition.

Architecture has been somewhat slow to adopt technology, when compared to other industries and fields of research. Too often the addition of technology in structures is based on affluence and not universal human and environmental benefit. Technology can affect both the tangible and intangible connections to users within the built environment. The integration of technology could benefit both users and the environment alike. Technology should be symbiotic with nature (natural materials, viewpoints and rehabilitation) and the built environment and not merely addition without mutualism.

*"Modernist design at large has housed the intellect and the eye, but it has left the body and the other senses, as well as our memories, imagination and dreams, homeless."* (Pallasmaa, 2012).

*"The hands want to see, the eyes want to caress"* (Goethe, 1870).

## Architectural Issue Summary

**What factors can give a community an identity and in turn stability?**

- Programmatic solutions
- Apply the philosophy of Rabbi Moses ben Maimon: "Give a man a fish and you feed him for a day; teach a man to fish and you feed him for a lifetime."

**Can architecture provide an environment which is conducive to the formation of a community with a well-defined identity?**

- Prevention of graph bottoming out
- Identity through stability

## 1.6// DISSERTATION INTENTIONS

This dissertation's main goal is to investigate the potential of a mine slime dam as a water source for agriculture and community use. This investigation will dually provide possible solutions to how architecture can act as a remedial agent in ensuring the safety of a community, with regards to usage of the slime dam water. Scientific research principles of Bioremediation, Active and Passive filtration systems and chemical extraction will be integrated into an architectural programme, allowing for architecture to act as a remediation system. As the choice of site is so closely linked to the Refilwe community, it will be of paramount importance for the overarching architectural intentions to integrate community members into its programme. Integration of users from Refilwe will both be in the form of active and passive roles. Where active members will perform roles on the architectural programme and passive users will benefit from the various programmatic outputs. A successful remedial programme must be present and active before the eventual closure of the mine, to ensure the security of both the community's future and the protection of the adjacent natural environment.

## 1.7// RESEARCH QUESTIONS

**How can architecture act as a catalyst in the formation of a sustainable community identity, to prevent social decay associated with mine closure?**

**How can architecture rehabilitate both man and the natural environment?**

**How can technology and botanical-based systems inform architectural form?**

**Can architecture offer a viable solution to mine-related water-body pollution?**

**Can an architectural project act as an international awareness catalyst with regards to mine-related environmental and population health threats?**

## 1.8// RESEARCH METHODOLOGY

As an initial research tool, literature studies were conducted to identify relevant theories, historic information and programme related requirements. Theories pertaining to: The role of architecture and materiality: in reconnecting man and the natural environment, Architecture as catalyst for community identity and Architecture's role as rehabilitation agent: Man and Environment. These readings were used to establish codes and guidelines which had the possibility for architectural interpretation. The use of case studies, research documents and architectural precedents provided informants for further research directions and allowed for an understanding of current site closeout requirements. Architectural precedent studies, which pertain to the mentioned theoretical studies, were conducted to establish a baseline for architectural undertakings and act as informants on how other projects addressed similar programmatic requirements. A detailed site analysis allowed for the development of an urban vision which fulfilled both quantitative and qualitative research aspects. This in turn allowed for initial testing of the outlined design questions and the formation of a relevant architectural response. Various methods were utilized to further develop and scrutinize of the architectural design. These methods included the help of peers, study leaders, graphic interpretations, computer modeling, physical architectural modeling and on-site testing.