D Mining overview

Mining overview

Mining in general

South Africa is one of the world's and Africa's most important mining countries in terms of the variety and quantity of minerals produced. It has the world's largest reserves of chrome, gold, vanadium, manganese and Precious Group Metals (hereinafter referred to as PGM's). South Africa is the leading producer of nearly all of Africa's metal and mineral production apart from diamonds (Botswana and the Democratic Republic of Congo), uranium (Niger), copper and cobalt (Zambia and the Democratic Republic of Congo) and phosphates (Morocco).

D. 1 Structure of the mining industry

The mining industry in South Africa has seen significant restructuring and changes since the early 90's with the traditional "big six" mining houses - Anglo American / De Beers, Gencor / Billiton, Goldfields, JCI, Anglovaal and Rand Mines - being restructured and extending their global presence. These companies traditionally controlled gold, platinum, chrome, coal and base metal production in South Africa. The advent of a new democratic constitution and rising costs from gold mining activities resulted in several changes in the industry.

As the South African mining industry is still predominantly white controlled, emphasis is being placed on stimulating black empowerment in the industry. As a result, several black or union owned firms are now beginning to play an important role in the industry. This is particularly the case following the impending legislation of the Minerals Bill that favors involvement of previously disadvantaged communities in South Africa's mineral resources.
This process, coupled with the anticipated change in mineral rights legislation in the country, should see South Africa developing its mineral resources to the benefit of all South Africans.

D. 2 Minerals Legislation

The long awaited White Paper on Minerals and Mining Policy has been released in 1998. The underlying objective of the White Paper was the proposed change in ownership of mineral rights. Currently, two thirds of South Africa's mineral rights are privately owned, with the remainder vested in the Goverment.
In late 2000, the draft Minerals Development Bill was released for public comment. The Bill (based on the White Paper on Minerals and Mining Policy) will usher in a new era of mineral and mining law in South Africa. The core objectives of this Bill are to:

- Recognize that mineral resources are the common heritage of all South Africans and collectively belong to all the peoples of South Africa;
- Ensue that a proactive social plan is implemented by all mining companies;
- Attract foreign direct investment;
- Ensure a vigorous beneficiation drive in the mining industry;
- Contribute to rural development and the support of communities surrounding mining operations;
- Redress the results of past racial discrimination and ensure that historically disadvantaged persons participate meaningfully in the mining industry;
- Guarantee security of tenure to existing prospecting and mining operations.

D. 3 Mining Process

D. 3.1 Status Quo

The site as it currently stands taking cognizance of the disturbance and impacts regimes operating.

D. 3.2 Pre construction phase

This includes all activities on site up to the start of construction, including the initial site preparations (surveying etc.), environmental assessments, scoping reports and authoritative decision-making. (S.E.F. 2001:34)

D. 3.3 Construction Phase

This entails all the construction and construction related activities on site, until the contractor leaves and developments are commissioned.
Typical mining infrastructure on site includes:

- Open pit/decline shaft systems depending on the geological setting
- Temporary and permanent access roads
- Access control
- Offices, change houses and training facilities
- Power and water supply with the necessary servitudes
- Crushing, milling and screening facilities
- Conveyor belts transporting ore
- Flotation facilities with tailings and concentrate thickeners
- Nominal concentrator capacity of 100 000 tpm
- Waste water purification plants; and
- A Tailings dam in close proximity of the concentrator.

(S.E.F. 2001:12)

D. 3.4 Operational phase

All activities, including the operation and maintenance of the proposed mining development.
The Concentrator plant is designed to treat a total of 60 000 tonnes per month of Merensky and UG2 ore. The tails from the concentrator is pumped to a tailings disposal facility with a return water reticulation system. To achieve this availability the plant is fully automated, incorporating a high level of instrumentation, automatic pump changeover stations and dedicated pipelines.

The final tails are thickened in a high rate thickener before being pumped to the tailings facility. A return

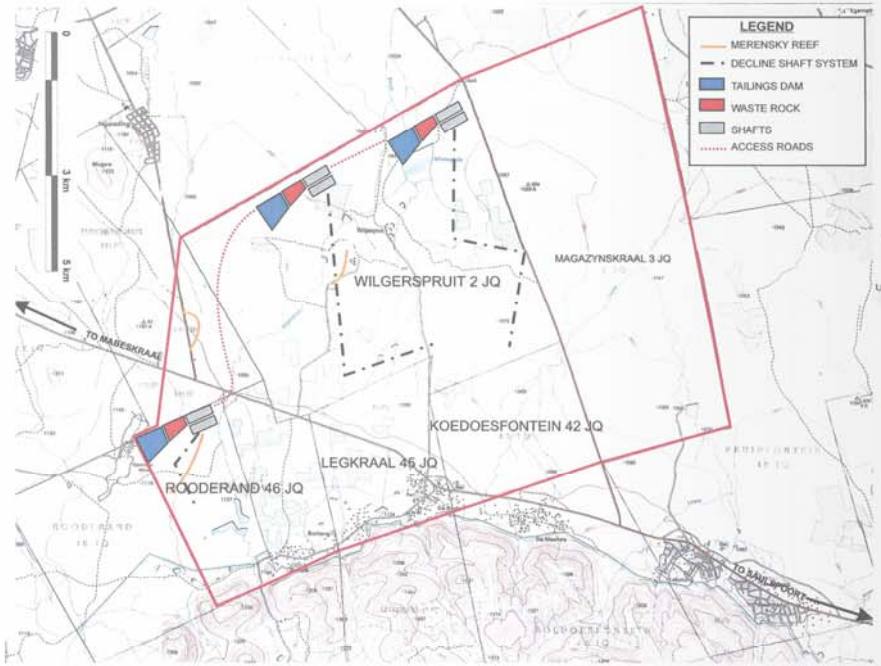


Figure D.1 Proposed zones and footprint areas for surface infrastructure

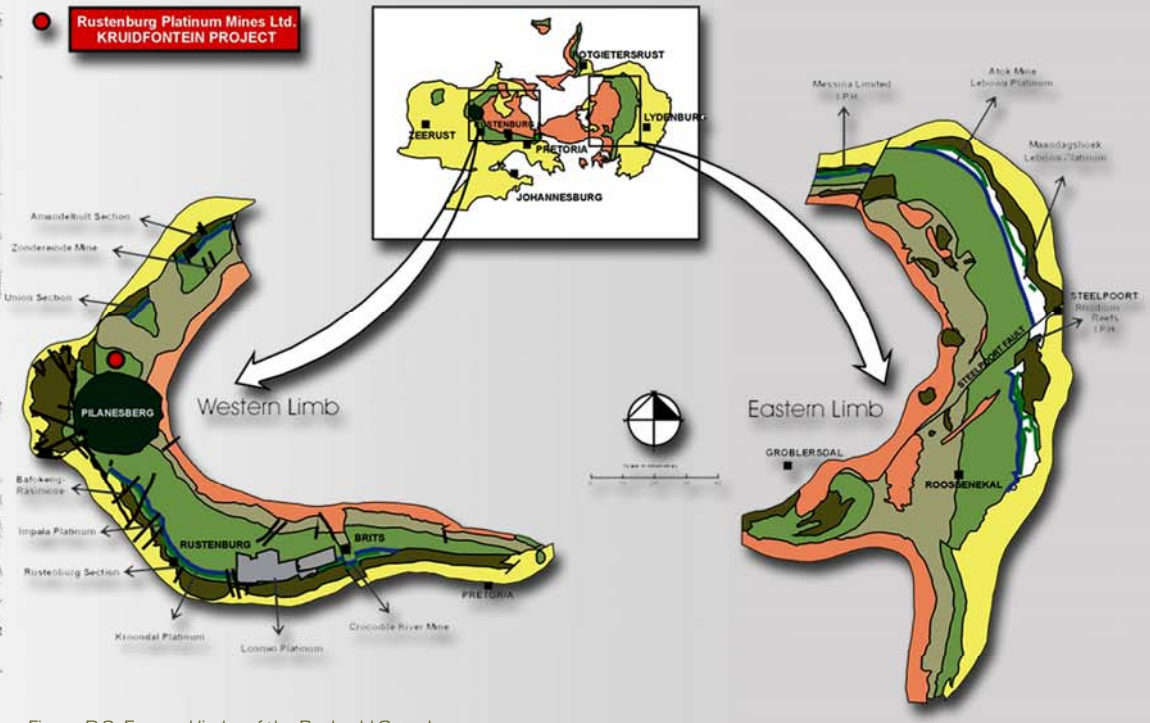


Figure D.2 Exposed limbs of the Bushveld Complex

water pump station returns decant water to the plant for recycling. The final concentrates are thickened in a high rate thickener and then dispatched as slurry via road transport to the Rustenburg/Union Section smelter. (S.E.F. 2001:15)

D. 3.5 Closure/Decommissioning

The goal upon decommissioning and closing of any mining project will include the removal of all buildings, structures and equipment, and the rehabilitation of the site to ensure a stable and self-sustaining environment. This will further include the mitigation of all significant impacts, and no alterations to the environment that are apparent as far as it is practically possible. All land should be rehabilitated to a state that facilitates compliance with current national environmental quality objectives.

Mine closure is anticipated to occur after 20 to 50 years, except for the areas occupied by the tailings dam, rock dumps, buildings and infrastructure, which can be commercially employed or converted for any other purpose. Otherwise, it should be returned to its original agricultural capability.

After closure the tailings disposal facility and waste rock dumps will remain on site.

D. 3.6 Post closure phase

The main closure objective for any mining site is the return of land to its pre-mining state where possible. This includes the resale/removal of the entire infrastructure and building materials other than the waste rock dumps and tailings dam, covering all disturbed and exposed surfaces with new vegetation, and the removal of rubble and waste. Engineering works (re-shaping, earthworks etc.) and rehabilitation of areas (especially during operational phase) is very important during post closure. Whereas the mine itself is concerned, the decline shafts will be sealed, fenced off and shaped to prevent runoff from drainage inwards. No rehabilitation will be done inside the mine. (S.E.F. 2001:146)

Kruidfontein project

D. 4.1 Location

Anglo Platinum proposes the establishment of new mining operations north of the Pilanesberg National Park and south west of the Rustenburg Platinum Mines Ltd. Union Section operations, in the North West Province. The proposed infrastructure will be established to exploit the UG2 Reef in and upon portions of the farms Rooderand 46JQ, Tuschenkomst 135JP, Wilgerspruit 2JQ, Koedoesfontein 42JQ, Legkraal 45JQ and Magazynskraal 3JQ. (S.E.F. 2001:i)

D. 4.2 Mineral deposit

The proposed Kruidfontein Project is situated in the middle of the Bushveld Complex's Western Limb – a layered igneous complex consisting of alternating layers of chromitite, pyroxenite, norite and a variety of anorthosites. The Kruidfontein Project will access the UG2 and Merensky Reef. (S.E.F. 2001:v)

D. 4.3 The need and the benefits of the project

Market research of PGMs and the close involvement with the global market's needs and future requirement plans lead the PGM mining industry to believe, with a fair deal of confidence, that the Kruidfontein Project is compatible with future demand. (S.E.F. 2001:19)

The project will mine the six platinum group metals (PGM's), including Platinum, Palladium, Rhodium, Ruthenium and Iridium. All six of the PGM's share many of the same physical and chemical properties:

- Rarity;
- Outstanding catalytic properties;
- Resistance to oxidation;
- Resistance to high temperature corrosion;
- Stable electrical properties.

D. 5 Life of Mine

A 20 year life of operation is anticipated. Note however, that annual rate of production is contingent on prevailing market forces and ruling metal prices.

D. 6 Job opportunities

There will be an increase in the workforce related to the project, with estimated 1800-2000 new mine-related jobs.

D. 7 Hours of operation

Expected operations will take place 24 hours a day. Undue noise disturbances will be restricted to the hours of 06H00 to 18H00 or otherwise as agreed with the Department of Minerals and Energy. (S.E.F. 2001:14)

D. 8 Pre construction phase

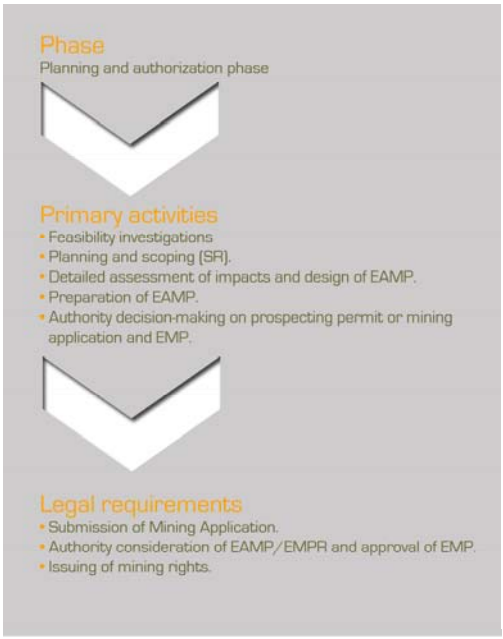


Figure D.3 Pre-construction components

D. 9 Construction phase

The proposed Kruidfontein Project will require the following infrastructure:

D. 9.1 Wilgespruit 2JQ & Magazynskraal 3JQ:

- Two decline shaft systems on the farm Wilgerspruit 2JQ, owing to the geological faulting which has displaced the mineralised reefs subsequent to the formation. The eastern shaft system on Wilgerspruit 2JQ will also provide access to shallow ore underlying the farm Magazynskraal 3JQ;
- Roads; workshops; explosive sheds;
- Tailings dam;
- Waste rock dumps.

(S.E.F. 2001:151)

D. 9.2 Rooderand 46 JQ:

- Access road from the Saulspoort / Mabeskraal provincial road;
- A decline shaft system with associated waste rock dump;
- concentrating plant;
- offices, ablutions, change houses and workshops;
- Tailings- and return water dam;
- Training facility;
- Storage silos;
- Explosive sheds.

(S.E.F. 2001:150)

D. 9.2.1 Shaft systems required

The decline shaft system will consist of 2 declines developed parallel to one another on an apparent dip of 10°. The declines will be sunk 25 m below the reef horizon and 20 m apart.

A conveyor belt system will be installed in one decline and during sinking broken waste from both shafts will be loaded and tipped directly onto the conveyor belt. The second decline will be reserved for men and materials. (S.E.F. 2001:5)

D. 9.2.2 Roads, railways and power lines

The Rooderand 46JQ Project is linked with a tarred road to the provincial road between Saulspoort and Mabeskraal. The tarred internal roads connects the main office complex, the shaft; the training facility, workshops and change houses. Approximately three trucks will use the roads per day.No railway lines will be used for the Rooderand 46JQ project. (S.E.F. 2003:4.1)

It is envisaged that Eskom Transmission and Distribution will supply power to a substation on the mine from Spitzkop. The overhead line will run adjacent to the main access road to the mine complex.

D. 9.2.3 Workshops, administration and other buildings

Workshops and administration buildings will be in the centralised surface complex where mining and other services require them.

D. 9.2.4 Housing, recreation and other employee facilities

It is the intention of Anglo Platinum to source the majority of employees from the local surrounds; therefore it will not be necessary to provide any housing or recreational facilities.

D. 9.2.5 Proposed river diversions

No river diversions will be constructed or necessary during the Rooderand 46JQ Project.

D. 9.2.6 Immediate adjacent land use

The Pilanesberg National Park is located directly south of the study area. Subsistence crop and cattle farming dominate additional adjacent land use.
It should be noted that all mine infrastructure would be located in the far northwestern part of the farm in order to mitigate against any potential impacts that might occur.

D. 9.2.7 Tailings facility

The proposed site of the tailings facility on the eastern periphery of the farm Rooderand 46JQ is considered to have the following environmental advantages:

- The underlying geo-hydrological conditions are considered favourable;
- It is located outside the proposed Heritage Park;
- The site is in a slight depression thereby minimising the visual impacts from the west.

In addition to the above the proposed rehabilitation of the tailings dam is likely to result in a significant decrease in fugitive dust emissions as well as the visual impact that the facility may have on the surrounding area. (S.E.F. 2003:3.10)

D. 10 Operational phase

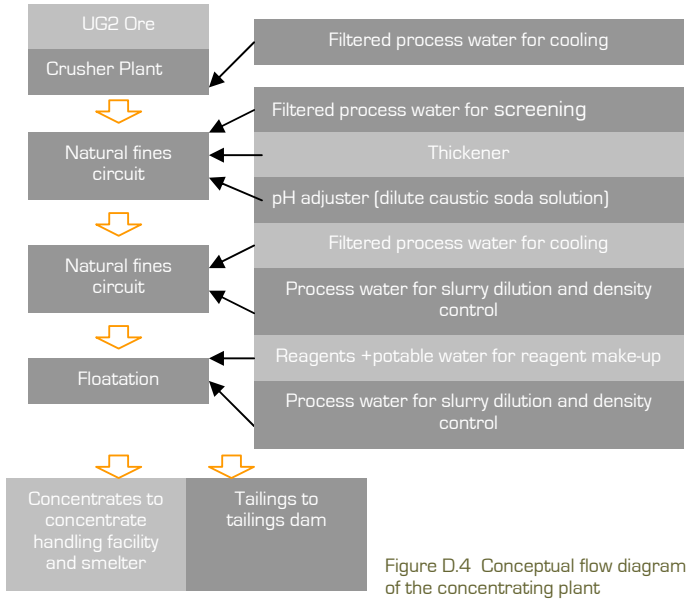


Figure D.4 Conceptual flow diagram of the concentrating plant

Figure D.5 Mining infrastructure

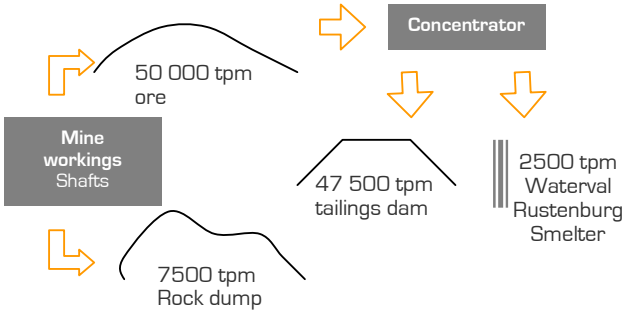


Figure D.6 Materials balance diagram

D. 11 Closure/decommissioning

To date, no post-closure plans for the Kruidfontein project has been identified other than the overall decommissioning objectives for any Anglo Platinum mining operation.

Environmental Impacts

D. 12.1 Water pollution

Contaminated surface run-off from construction and operational areas has the potential of polluting natural water resources. The main source of pollution will be the tailings dam with drainage and seepage into underground water resources. (S.E.F. 2001:ix-xi)

D. 12.2 Dust fallout

Ore transfer points at the shafts, waste rock dumps, mills, spills from tailing pipelines, tailings dams and disturbed land may be the primary source of dust. The dust from these sources is relatively inert and is more likely to be a nuisance than a health hazard. (S.E.F. 2001:ix-xi)

D. 12.3 Soil disturbances

The loss of soil as a non-renewable resource will take place. Soil erosion, degradation of soils and subsequent pollution and contamination has to be considered and mitigated. (S.E.F. 2001:ix-xi)

D. 12.4 Land Use and Land Capability

The mine related activities will cause a loss to medium potential arable and grazing land during operation. The tailings dam surface area will cause a permanent loss to land. (S.E.F. 2001:ix-xi)

D. 12.5 Fauna and Floral displacement

Mining activities will cause loss of natural habitats within the proposed site. It can however be envisaged that this will be limited because of previous agricultural activities on large parts of the site. (S.E.F. 2001:ix-xi)

D. 12.6 Traffic Impact

There will be an increase in mine-related traffic on the site, on privately owned internal mine roads as well as on public roads in the surrounding area. (S.E.F. 2001:ix-xi)

D. 12.7 Noise and Visual Impacts

Noisy mine activities are expected. The relatively flat terrain aggravates the level of visual intrusion caused by mining operations when viewed from elevated positions. (S.E.F. 2001:ix-xi)

D. 12.8 Socio-Economic Impacts

Mining will impact positively on local, national and international economies. There will be an increase in the workforce related to the project, with an estimated 1800-2000 new mine-related jobs.
Some of the effects include:

- Relocation of individuals and families;
- Influx and efflux of temporary workers;
- Population changes;
- Introduction of new social classes;
- Disruption of social networks and the alteration of family structures;
- Disruption of daily movement patterns;
- Change in community infrastructure;
- Impact on local government;
- Perceptions of public health and safety;
- Change in tourism and leisure opportunities.

(S.E.F. 2001:130)

D. 12.9 Sensitive landscapes

The mining activities may possibly be in conflict with tourism related initiatives in the surrounding area. The farm Rooderand overlaps with a portion of the Proposed Heritage Park, a green corridor initiative that will link Madikwe Lodge in the North with the Pilanesberg National Park. (S.E.F. 2001:135)


1.1: Processing Plant main building


1.2: Storage sheds


1.3: Transport interchange


2: Rock dump


3: Main shaft

Location

The Bafokeng Rasimone Platinum Mine (BRPM), one of Anglo Platinum's steady state operations, is located 30 km north west of Rustenburg, in the North West Province.

1 Processing Plant

2 3 Shaft & Rock dump

4 Informal settlement

5

6

North


4: Informal settlement next to main roads


5.1: Royal Bafokeng Sports Palace


5.2: Royal Bafokeng Sports Palace


6: Smaller satellite shaft

Case study: Bafokeng Rasimone Platinum Mine

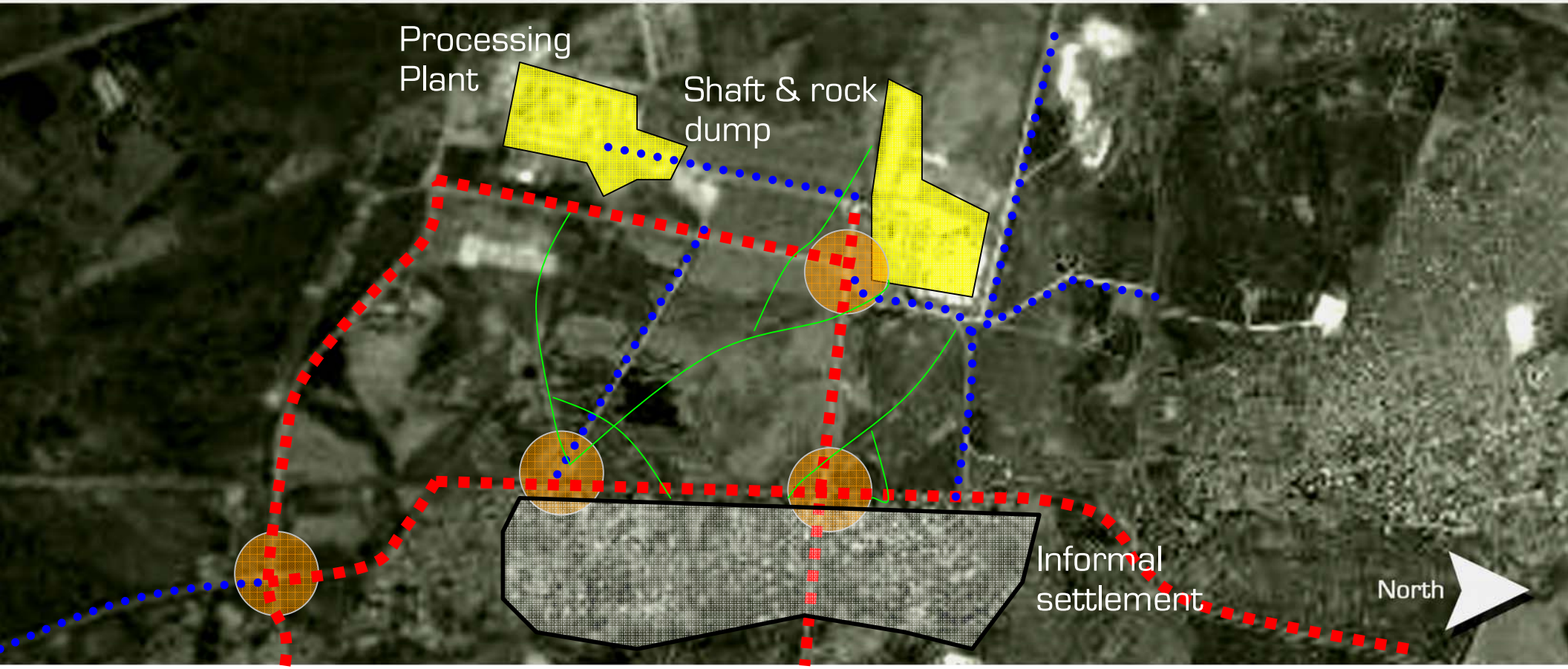
Figure D.7 BRPM regional layout

Precis

BRPM, which involves the Royal Bafokeng Nation as a 50% joint venture partner, is said to be the 'most sustainable' mining operation in the western Bushveld limb. Some of these sustainable approaches include cleaner, more environmentally friendly methods of ore-extraction and processing, rehabilitation of open pit excavations and other disturbed areas on site during operational phase, and small gestures such as painting the buildings green to minimize the visual impact of the infrastructure. Mining activities on the farm Rooderand 46JQ and in Saulspoort will probably resemble the scale, infrastructural layout and operations of BRPM.

Infrastructural Layout

Overall, BRPM resembles a fragmented layout, with the four site-specific shaft compounds situated between 3 and 10 kilometers from the plant complex. The tailings dam and series of rock dumps are also in close proximity to the mining activities and the suburban areas next to the main road.



Main vehicular route

Secondary vehicular routes

Main pedestrian routes

Main intersections

Informal settlement along main route

Processing plant, offices, warehouses and storage

Shafts, rock dump, and storage yards

Case study: Bafokeng Rasimone Platinum Mine

Figure D.8 BRPM mine component layout

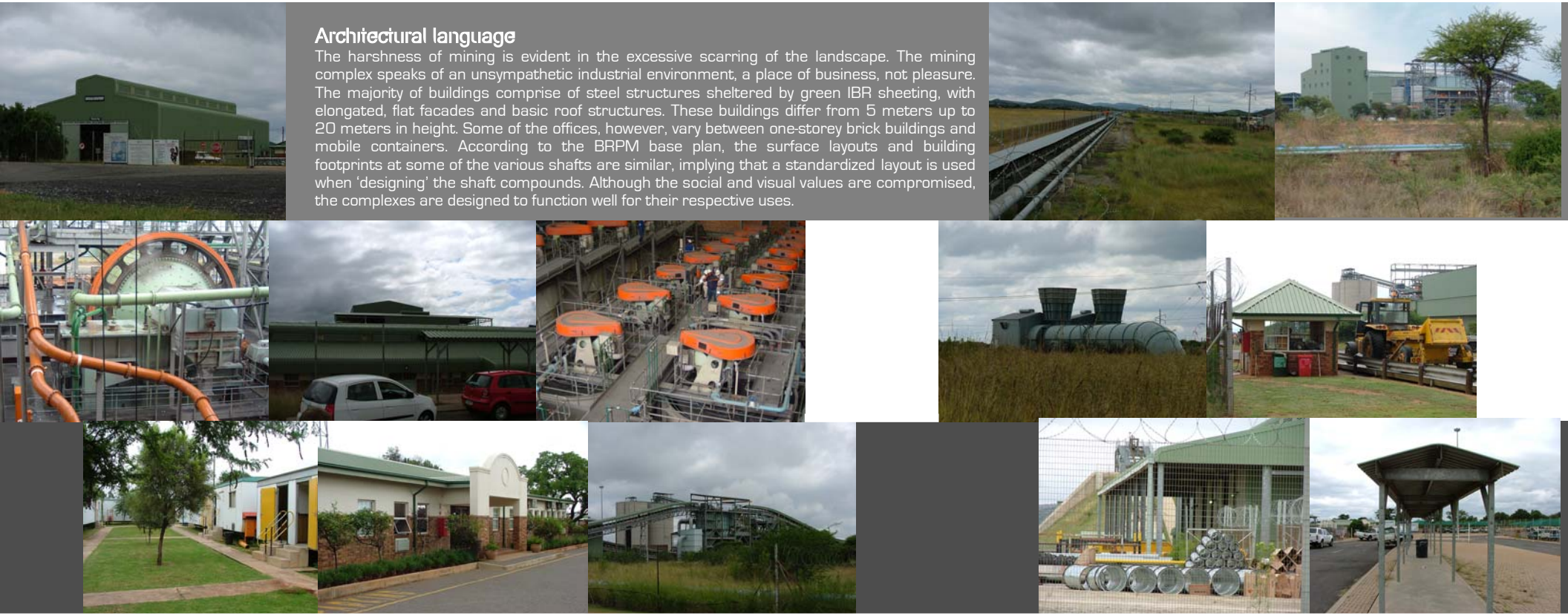
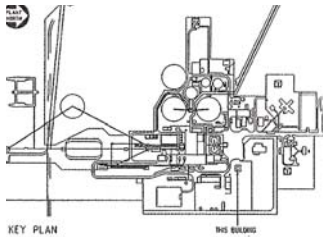
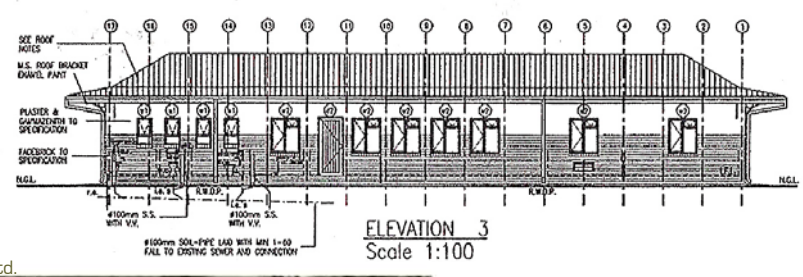
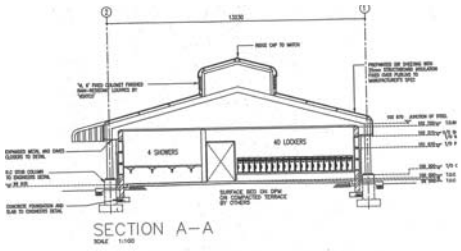

Architectural language
The harshness of mining is evident in the excessive scarring of the landscape. The mining complex speaks of an unsympathetic industrial environment, a place of business, not pleasure. The majority of buildings comprise of steel structures sheltered by green IBR sheeting, with elongated, flat facades and basic roof structures. These buildings differ from 5 meters up to 20 meters in height. Some of the offices, however, vary between one-storey brick buildings and mobile containers. According to the BRPM base plan, the surface layouts and building footprints at some of the various shafts are similar, implying that a standardized layout is used when 'designing' the shaft compounds. Although the social and visual values are compromised, the complexes are designed to function well for their respective uses.

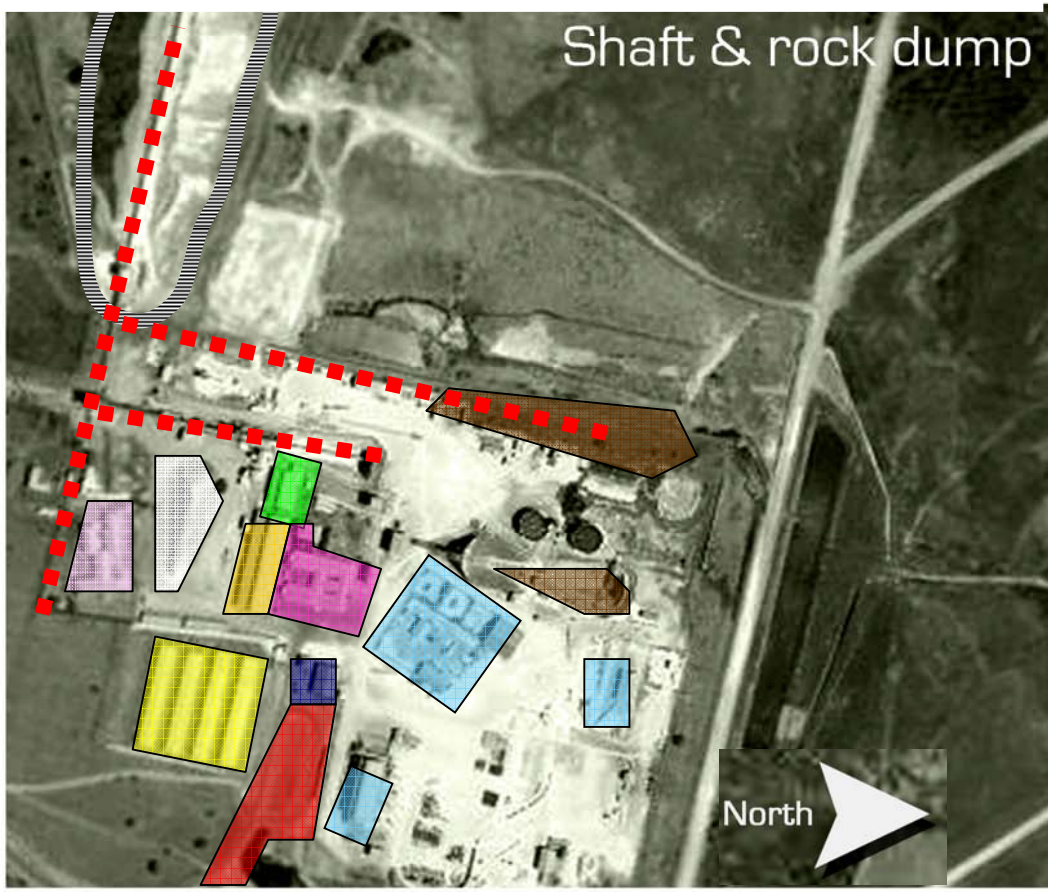
Figure D.9







Sections and elevations courtesy of Anglo Platinum Ltd.



Parking

Taxi and bus terminal

Access control

Change house

Lamp room

Main office complex and safety offices

Training belt

Work and repair shops

Shaft for men and equipment

Shaft for ore extraction

Rock dump

Conveyor belt

Training center

Case study: Bafokeng Rasimone Platinum Mine

Figure D.10 Shaft complex layout