The settlements of these early Tswana chiefdoms are characterised by an impressive and elaborate stone-built tradition. Hundreds and perhaps thousands of sites were built along the bases of the norite hills. The most formidable of these chiefdoms were the Kwena Môgôpa, Kwena Môgale (Bapô), Bakgatla and Fokeng. Further to the west, closer to Rustenburg was the Fôkeng chiefdom while several Kgatla spheres of influence emerged further to the west near Brits. The Kgatla were subjugated by Mzilikazi and were used as labourers to built one of the Ndebele's villages, probably known as emHlalandlela.

The Bapô, a people whose earliest ancestors were descended from the Amambô Nguni from Kwa Zulu/Natal, arrived in the Magaliesberg during the 16th or 17th centuries. One of their capitals was Tlhôgôkgôlô (Wolhuterskop). Several of the chiefs of this clan where known by the name of Môgale. The name of the Magalies Mountains (Magaliesberg) was derived from the name Môgale.

Numerous *difaqane* wars were fought during the last quarter of the 18th century and during the first quarter of the 19th century in the Central Bankeveld. These wars led to the displacement of large numbers of Tswana in the Bankeveld. The *difaqane* wars were caused by the Ndebele (Matabele) of Mzilikazi who arrived from the Vaal River region to occupy the Bankeveld in August 1827. The Ndebele destroyed the Kwena Môgôpa, the Kgatla and what had remained of the Bapô after an earlier defeat by the Pedi of Thulare. These wars exacerbated the havoc started earlier in the Bankeveld and gradually became a characteristic feature of historical events in this region during the early 19th century.

The Ndebele established several settlement complexes in the Central Bankeveld from whence they maintained their grip on the indigenous population. Four of these Zulu/Nguni residences (*imisi*) and military kraals (*amakhanda*) have been discovered during the course of earlier archaeological surveys.

Internal strife between the various Tswana chiefdoms also seems to have been on the increase from the latter half of the 18th century onwards. Paternal relatives fought against each other to attain the chieftaincy of the various Tswana chiefdoms.

Succession disputes also led to the splintering of the existing chiefdoms into a growing number of independent spheres of influence in the Bankeveld.

During the early 19th century travellers, traders and missionaries visited the Central Bankeveld where they encountered the devastated Tswana chiefdoms. They also mentioned that numerous Tswana tribes were displaced. These travellers included the traders Robert Schoon and William McLuckie in August 1829. They were soon followed by the missionary Robert Moffat who visited Mzilikazi in an *umuzi* near what is today Pretoria. In June 1835 Charles Bell and other members of Andrew Smith's expedition visited a Ndebele village near Rustenburg which Bell subsequently painted. One year later, in December 1836, Cornwallis Harris also visited the Central Bankeveld where he painted emHlalandlela near Brits.

The Bankeveld was rich in fauna which attracted the Griqua and the first white hunters to the region. Ivory was plentiful, with herds of elephants roaming the area. Ivory and the skins of the wide variety of fauna were sought after as precious trade commodities. Although the Tswana hunted the fauna of the Bankeveld, they were more renowned as agriculturists and cattle herders than as hunters.

Complex causes led to the unfolding of the numerous Tswana chiefdoms and their spheres of influence throughout the Bankeveld during the last decades of the 18th century and during the first decades of the 19th century. These causes were multidimensional and included the ecological potential of the region, the social and political formation and expansion of different spheres of influence, the establishment of short and long distance trade relations and local and regional wars. These causes and historical events were complex and are not fully recorded in oral traditions or in any other records.

5.3 Brief history of the Fokeng

The Thaba-ea-Nape (also known as the Thaba-ea-Maralla) range of mountains in which the Ga-Nape Heritage Park and Wilderness Area is located was home to numerous ancestral rulers of the Fokeng people. According to oral tradition different branches (clans) of the Fokeng settled from the north to the south along this range of

mountains from as early as the 17th century. The places of settlement were: Serutube, Marekana, Tsitsing (Kanana), Thekoane (Thekwana) and Photsaneng (Bleskop).

It is not necessary to describe the origins and the history of the Fokeng here in great detail. Only a broad outline of the genealogy of Fokeng rulers, from Nape (AD1700) to Môkgatle (AD1835) is outlined. Settlements that were associated with some of these rulers, although only a few are mentioned in oral tradition, are also indicated.

The oldest legends state that the Fokeng entered the Transvaal through Tweedepoort, under the leadership of Nape, the earliest known Fokeng chief. This was before AD1700 AD. The group moved south-eastwards and settled on the banks of the Elands River (Kgetleng). Three Fokeng groups detached themselves from the main branch and moved southwards on different occasions. The Fokeng are therefore spread over the Orange Free State, Lesotho and even the former homeland of Transkei. The Fokeng are, next to the San people, the oldest inhabitants of the Orange Free State.

The domain under Fokeng control during the last two centuries was the following: the northern border was the Kgetleng River (and the Tlôkwa and Kgatla Kgafêla chiefdoms); the western boundary was the Kwena Modimosana chiefdoms and the southern boundary the Magaliesberg. The eastern boundary was determined by the presence of the Kwena Môgôpa and the Kwena Mogale chiefdoms.

The history of the Fokeng begins with Sekete III (Maleriba) who probably ruled in AD1700. He had three sons Kgantsi, Pitswe and Diale. (The last two had the same mother). Kgantsi was born from a Hurutshe father after the Hurutshe had abducted his mother. (Controversy surrounded Sekete's III position until his death, although he was the oldest son).

Diale succeeded Sekete III and his reign probably began in AD1720. His sons were Mokuru, Mogotsi, Ramarwa, Ramogase, Tlase and Ntê. (The first two died young). Diale's sons freed the Fokeng from the Hurutshe's custom to castrate the Fokeng's bulls, an act that was considered offensive by the Fokeng as it indicated the Huruthse's seniority above the Fokeng. This particular incident put an end to the Huruthse's domination of the Fokeng.

With the exception of Ramorwa all the known sons of Diale became leaders of *dikgoro*, Ntê, the progenitor of the *kgoro* Seloko, Tlase, of Mathebetswaane and Ramogware of Metlapeng.

Ramorwa succeeded Diale as chief and had fours sons: Mmutle, Sekete, Katane and Mpie.

Sekete succeeded Ramorwa in about AD1790. He was a formidable warrior and is remembered as one of the greatest Fokeng chiefs. The following individuals were sons of Sekete: Thete, Nameng, Nôge, Mogotsi, Molefe, Pitswe, Ramarue, Mohue, Manaana, Rantsogwana and Marahtsane (more can be added). Important individuals were Thete, Nameng and Nôge.

Katane, or Raikane acted as regent for Thethe (also known as Mmakgongwana) who became the next chief. He had the following sons: Diale, Mokgatle, Molotlegi, Molefe, Liphatse and Pogwe. (The first, third and fifth died young). Môkgatle, Molefe and Pogwe played important parts in the next phase of Fokeng history.

Thethe was very fond of his two younger brothers, Namemg and Nôge. The two brothers, however, turned against him. (The main concentration point in Thethe's time was at Makotshaneng [Makojaneng], east of Rustenburg near the Hex River). Thethe fled with his followers and took refuge with the Modimosana Mmatau. The Fokeng accepted Nameng as chief.

Nameng reigned for only eight months after the enforced departure of Thethe as he was killed by the doings of Nôge, who now became chief.

Nôge's rule commenced in about 1820 and ended when he was ousted in 1829 to 1830. Nôge's reign represents a stormy period in Fokeng history. Thethe invited the Pedi to attack the Fokeng whereupon Malekutu destroyed the Fokeng in 1823 to 1824. The devastation caused by the Pedi accounts for the fact that Mzilikazi amassed very little from the Fokeng's territory in 1826 to 1829.

Nôge killed Ndebele visitors to his village. He occupied the summit of Ntlhane, a 'hillock near Malejane', with his followers and bolstered the foot and slopes with wooden stockades. The Fokeng pounded the Ndebele with stones forcing them to retreat.

Nôge became unpopular and fled to Moshoeshoe in the Orange Free State.

Môkgatle's accession was somewhere between 1834 and 1836. His reign had hardly begun when the Voortrekkers drove the Ndebele out of the Transvaal. He remained in office until his death in 1891 when he was about eighty years old. His principal village was named Mmakgongwana (after Thethe), today located in Rustenburg and partly on Paardekraal. Dirêpotsana Hill, where Phokeng now stands, was also re-occupied as residential area in Mokgatle's time.

5.4 Historical context

Some of the earliest Voortrekkers who moved across the Magaliesberg in the early 19th century established themselves on the farms Kafferskraal and Witpensfontein (today Rustenburg) and Schaapkraal, to the east of the study area. Since the second half of the 19th century, farmers and workers have occupied the Rustenburg District (including the Mooinooi, Marikana, Hartebeespoort and Brits areas). Tobacco and citrus farming, together with cattle herding, became a subsistence pattern that has lasted to this day. Old farm homesteads, agricultural implements and other infrastructure such as tobacco drying sheds may still exist on farms adjacent to the study area.

During the Anglo Transvaal Boer War (1899-1902) British blockhouses were built along the ridge of the Magaliesburg, from Pretoria in the east to Rustenburg in the west. Several of these structures are located in Kommandonek, Pampoennek and in Olifantsnek in the Magaliesberg, to the south of the Impala Shaft 17 project area.

After the discovery of the Merensky Reef in 1929, the economy of the area was gradually changed from farming into platinum and chrome mining. What started as small scale mining activities north of the Magaliesberg during the 20th century was soon eclipsed by the rise of the platinum mining complex near Rustenburg. The discovery of

the Merensky Reef and the accompanying platinum boom was soon followed by the establishment of numerous chrome and norite mines in the North-West Province.

6 THE PHASE I HERITAGE IMPACT ASSESSMENT

6.1 Types and ranges of heritage resources

The Phase I HIA study for the proposed new Tailings Dam (No.5) and the proposed opencast expansion areas (Pit 14 and Pit 9U_B) is briefly discussed and illuminated with photographs below.

6.1.1 The proposed Tailings Dam

The proposed Tailings Dam stretches across a level piece of land situated adjacent to Impala's current Tailings Dam. The affected area is marked by outstretched agricultural fields as well as patches with pristine grassveld.

A few norite protrusions are located close to the north-eastern boundary of the proposed new Tailings Dam (No.5) project site.

Figure 1- Outstretched agricultural fields occupy large tracks of land where the proposed new Tailings Dam will be established (above).

Figures 3 & 4- Patches of grassveldt with *acacia* trees occupy part of the proposed new Tailings Dam area. Note the historical Ga-Nape mountain range in the far background (above). Norite protrusions occur near the north-eastern perimeter of the proposed new Tailings Dam (below)

6.1.2 The proposed Open Cast mining areas

The opencast expansion included in this Impala Project, are:

- An open cast pit next to the Kutlwanong School and old age home (Pit 14).
- A second Open Cast pit located on opposite sides of the main road leading to Impala (Pit 9U_B).

6.1.2.1 The proposed Pit 14 Open Cast expansion project

The proposed Pit 14 opencast expansion project is located adjacent to the Kutlwanong School and old age home on the farm Kookfontein 265 JQ, on a relatively level piece of land. A prominent mountain is located to the north-west of the proposed project area. The base of this mountain is covered with stone walled sites dating from the Late Iron Age (LIA). A large LIA site may also be located opposite the mountain on a slight rise. Both these archaeological sites are located outside theProject Area of Pit 14.

Figure 5- The proposed Open Cast mine (Pit 14) is located on a level stretch of land parts of which may have been ploughed in the past (above).

Infrastructure such as Eskom's power lines and barbed wire fences run through the Project Area. Part of the Pit 14 project area may have been ploughed in the past. It is therefore not a pristine piece of land any longer.

Figure 6- The proposed Open Cast mine (Pit 14) is located next to the Kutlwanong School on a piece of land which cannot be described as pristine any longer (above).

6.1.2.2 The proposed Pit 19U_B Open Cast mine

The proposed Pit 19U_B opencast expansion project is located on the farm Kookfontein 265JQ on either side (west and east) of the main access road towards main Impala offices.

The proposed Pit 9U_B project area, particularly to the west of the tar road will be located on a piece of land which has been intensely disturbed in the past. A rail way line as well as dirt roads, one leading to a magazine, used to criss-cross this piece of land. The piece of land to the east of the tar road used to be covered with natural

vegetation and used to be in a pristine condition. However, mining related activities on this piece of land has scarred its former condition so that it cannot be described as a pristine piece of land any longer.

It is highly likely that a Late Iron Age site may exist on the low rise to the south of the proposed Open Cast mine. However, this site, which is thickly covered with *Euphorbia* and other trees, is not located within the footprint area of the proposed Pit 9U_B project area.

Figure 7- A part of the land to be used for the proposed Open Cast mine (Pit 9U_B 14) is located to the west of the main road running to the headquarters of Impala. This piece of land is currently covered with open cast mining activities which will be extended into the proposed Pit 9U_B (above).

6.2 Summary

The Phase I HIA study for the proposed Tailings Dam and Open Cast mining areas revealed none of the types and ranges of heritage resources as outlined in Section 3 of the National Heritage Resources Act (No 25 of 1999).

7 CONCLUSION AND RECOMMENDATION

The Phase I HIA study for the development of a proposed new Tailings Dam (No. 5) and the proposed Pit 14 and Pit 9U_B opencast expansion areas revealed none of the types and ranges of heritage resources as outlined in Section 3 of the National Heritage Resources Act (No 25 of 1999).

There is consequently no reason from a heritage point of view why the proposed Impala Project should not continue.

DR JULIUS CC PISTORIUS
Archaeologist & Heritage Consultant
Member ASAPA

8 SELECT BIBLIOGRAPHY

Breutz, P.L. 1953. *The tribes of Rustenburg and the Pilanesberg districts*. Pretoria: Government Printer.

Bergh, J.S. 1992. Die vestiging van die Voortrekkers noord van die Vaalrivier tot 1840. *Historia*, 37(2); 38-42.

Coertze, R.D. 1987. *Bafokeng family law and law of succession*. Revised edition. Pretoria: Sabra.

Mason, R.J. 1968. Iron Age settlement in the Transvaal and Natal revealed by aerial photography and excavation. *African Studies*, 27(4)

Pistorius, J.C.C. 1995. Rathateng and Mabyanamatshwaana: cradles of the Kwena and Kgatla. *South African Journal of Ethnology,* 18(2):49-62.

Pistorius, J.C.C. 2000. New Late Iron Age spatial identities in the Bankeveld. *South African Journal of Ethnology*, 23(4):150-163.

Pistorius, J.C.C. 2001. Late Iron Age sites of Mmatshetshele Mountain in the Central Bankeveld of the North-West Province, South Africa. *South African Archaeological Bulletin*. 56 (173&174), 45-56.

Pistorius, J.C.C. 2004. A Heritage Impact Assessment (HIA) study for Impala Platinum's proposed new No 16 Shaft Complex on the farm Reinkoyalskraal 278JQ in the Bojkone-Bothlaba District Municipality of the North-West Province. Unpublished report prepared for Ground Water Consulting Services CC.

Pistorius, J.C.C. 2004. A Heritage Impact Assessment (HIA) study for Impala Platinum's proposed new No 16 Shaft Complex on the farm Reinkoyalskraal 278JQ in

the Bojkone-Bothlaba District Municipality of the North-West Province. *Unpublished report prepared for Ground Water Consulting Services CC.*

Pistorius, J.C.C. 2006. A Phase I Heritage Impact Assessment (HIA) study for the Impala Platinum Shaft 17 Complex on the farm Vlakfontein 276JQ near Rustenburg in the North-West Province of South Africa. *Unpublished report for Golder Associates and for Impala Platinum.*

Pistorius, J.C.C. 2006. A Phase I Heritage Impact Assessment (HIA) study for Impala Platinum's exploration activities near Rustenburg in the North-West Province of South Africa. *Unpublished report for Golder Associates and for Impala Platinum.*

Pistorius, J.C.C. 2007. *Prelimanary report on a heritage survey for the Ga-Nape Late Iron Age Complex on Welbekend 117 in the Rustenburg (Bafokeng) District in the North-West Province of South Africa. Unpublished report prepared for Royal Bafokeng Resources.*

Pretorius, Z.L. 1967. *Die Geskiedenis van Rustenburg*, 1851-1918. MA verhandeling. Potchefstroom: PU vir CHO.

9 SPOKESPERSONS CONSULTED

Bruce Beagley (082 679 9711). Land surveyor employed by Impala. Involved with the development of the Tailings Dam.

George Kallin (083 647 0808). Land surveyor employed by Impala. Involved with the development of the Open Cast mines.

APPENDIX M: PALAEONTOLOGICAL DESKTOP SURVEY

BPI for Palaeontological Research

Private Bag 3, WITS 2050, South Africa • Telephone +27 11 717-6682 • Fax +27 11 717-6694

Email: bruce.rubidge@wits.ac.za

12 April 2011

Ms Natasha Daly
Metago
Fourways,
2055

E-Mail Natasha.Daly@metago.co.za

Dear Ms Daly

Impala Proposed Tailings Dam Projects and expansion of Open Pit – Palaeontological Impact Assessment

As requested, I have undertaken a desktop EIA to assess the possible affect on palaeontological heritage which will result from the expansion of mining activities of Impala Platinum in three different areas on the farms Vlakfontein 276 JQ, Goedgedacht 114 JQ, Welbekend 117JQ, Doornspruit 106 JQ, Vaalkop 275 JQ, and Kookfontein 265 JQ in the Rustenberg district (Figure 1).

The entire area on which these farms are situated is underlain by igneous rocks of the Precambrian Rustenberg Layered Suite of the Bushveld Igneous Complex. This Complex is an intrusive igneous body comprising a series of ultramafic-mafic layers and a suite of associated granitoid rocks. As these rocks are Precambrian in age and are of igneous origin it is unlikely that fossils will be affected by the proposed subsurface mining development.

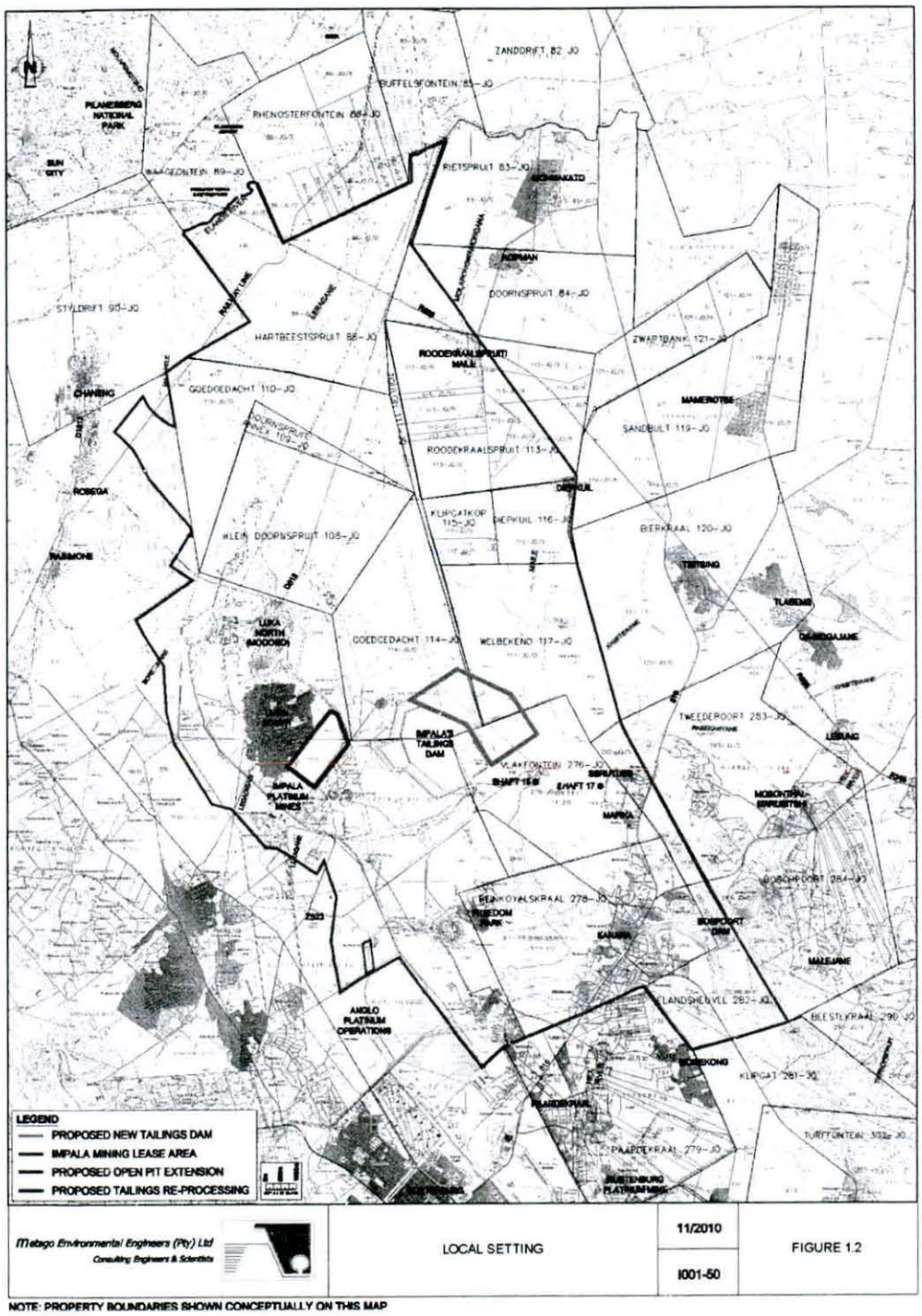


Figure 1: Map of the Rustenberg area showing the three areas of proposed new mining developments of Impala Platinum

In my opinion this development will not negatively affect palaeontological heritage and I suggest that, from a paleontological perspective, this development should proceed.

Yours sincerely

Professor Bruce Rubidge PhD, Pr Sci Nat

Bibiliography:

Cawthorn RG, Eales HV, Walraven F, Uken R, and Watkeys MK. 2006. The Busveld Complex. *In*: Johnson MR, Anhaeusser and Thomas RJ (Eds). *The Geology of South Africa*. Geological Society of South Africa, Johannesburg/Council for Geoscience, Pretoria. pp 261-281.

Mc Carthy, T.S. and Rubidge, B.S. 2005. *The story of Earth and Life – a southern African perspective on the 4.6 billion year journey*. Struik Publishers, Cape Town. pp 333.

APPENDIX N: SOCIO-ECONOMIC STUDY

Impala Platinum socio-economic baseline analysis

Socio-economic Improvements on many levels in labour areas

23 May 2011

Authored: Gerrie Muller, Strategy4Good

Contents

1 Executive Summary

This socio-economic baseline assessment has been undertaken in the context of a mine, Impala Platinum, wanting to increase its production and production rate at their current mine site in Bafokeng, Rustenburg. In this regard, it is important to note that the increased production will take place on an existing mining footprint. At present the exact mine plan and number of new employees have not been finalised and hence this baseline is very generic in nature.

The salient socio-economic aspects relevant to Impala Platinum are the following:

- The mine is situated in a relatively densely populated area, namely Bafokeng, which is a sub municipal area of the Rustenburg Municipality. The relevance to Impala Platinum is that the potential exist for significant sustainable development impacts on human settlements, both positive and negative.
- There is an undoubted influx of job seekers into the Rustenburg area due to the growth in the mining industry, and with the planned increase in production, it is likely that more in-migration to the municipality may take place. This has impacts on the provision of social facilities and services.
- Although there have been major increases in education facilities and performance throughout the country and in the Bojanala District Municipality, compared to OECD countries, the country still has major educational gaps that needs to be closed.
- SA's health status quo remains very precarious. It has a significant HIV/AIDS pandemic and its average life expectancy is one of the worst in the world (for peaceful countries). The same deficient health conditions that exist nationally also exist locally in Impala Platinum's labour areas.
- The status of the environment in the Rustenburg area is often questioned by many NGO's on suspicion that mines pollute the area significantly. This aspect, however, is the domain for the Environmental Impact Assessment.
- Bojanala District Municipality, Rustenburg and Bafokeng Municipal Place have relatively high employment rates compared to the rest of South Africa due to strong growth in mining jobs in the area over the last decade.
- Bafokeng Municipal Place itself has a relatively less developed profile than the average Rustenburg household, but this is not significant. Given that Bafokeng was part of the old homeland system, it has relatively well developed infrastructure and the trends are that facilities are continually improving.

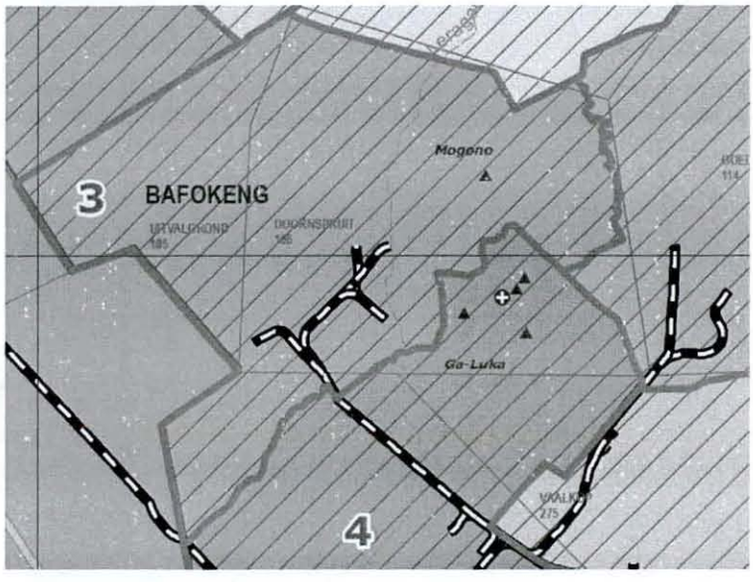
In essence, the mine development will take place on an existing mine site, in an existing mine area, which is relatively better off than peer areas in the rest of the country. The impacts over the life of mine should be mainly positive – if the life of mine is severely compromised, then mine closure impacts would be a very important consideration.

2 Socio-economic baseline information

2.1 Location

Impala Platinum is situated in the Rustenburg Municipality and specifically in the municipal area called Bafokeng, which is one of the official Municipal Places. Rustenburg is furthermore part of the Bojanala District Municipality, in the North West Province. The Bafokeng Municipal Place has 49 Wards[1], all of which can be regarded as immediate stakeholders to Impala Platinum. The closest settlement to the mine border is Ga-Luka, Ward 12 according to the 2001 population census.

Figure 1: Snapshot of Bafokeng

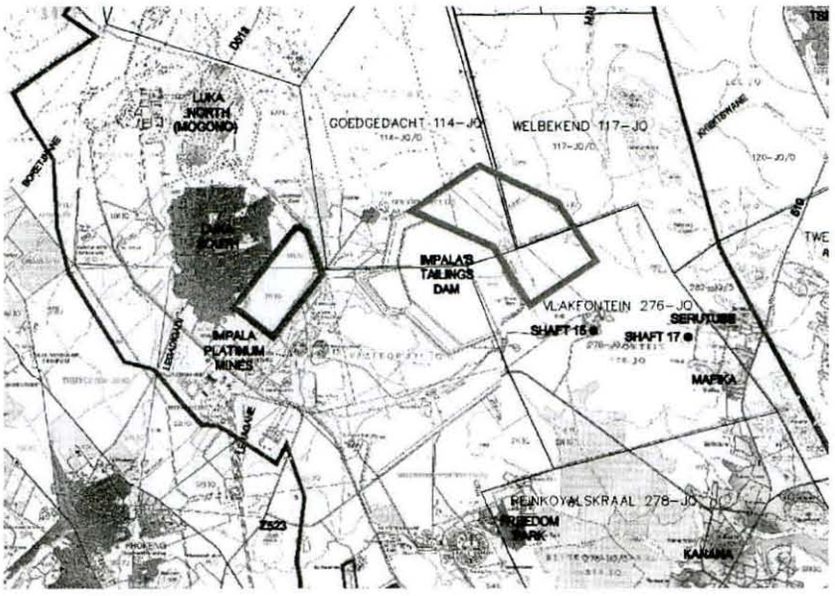


Impala Platinum's footprint is approximately 300 sq km and the site is a modern mining and industrial complex. It has significant facilities, inclusive of shafts, conveyor belts, pipelines, roads, offices, railway lines, smelting facilities, tailings dams and others.

[1] Bafokeng North Mines, Bafokeng South Mines, Beestekraal, Bleskop Mines, Chachalaza, Chaneng, Diepkuil, Dithabane, eNtabeni, Freedom Park, Frischgewaagd, Ga-Luka, Ga-Mogajane, Kanana, Kgale, Kopman, Lefaragatlha, Lekgalong, Lemenong, Lesung, Mabitse, Mafika, Magokgwane, Maile, Malejane, Mamerotse, Masosobane, Mfidikoe, Mmatshetshele, Mogokgwane, Mogono, Mosonthal-Marubitshi, Nkaneng, NONE, Phokeng, Photshaneng, Pudunong, Rasimone, Robega, Saron, Seritube, Tantanana, Thekwane, Tlapa, Tlaseng, Tshwara, Tsitsing, Wildebeesfontein and Windsor.

The nature of the project is one of increasing production within the already licensed mine site in Bafokeng. Three new activities are envisaged, 1) the reprocessing of a tailings dam, 2) an increase in the current tailings dam facility, and 3) the creation of an open cast mine.

Figure 2: Envisages Increase in production within existing mining site



The most significant impact will be the relocation of a handful of new houses where the open cast mine will be situated. There are no significant social impacts expected as a result of the reprocessing of an existing tailings dam and expansion of a further tailings dam.

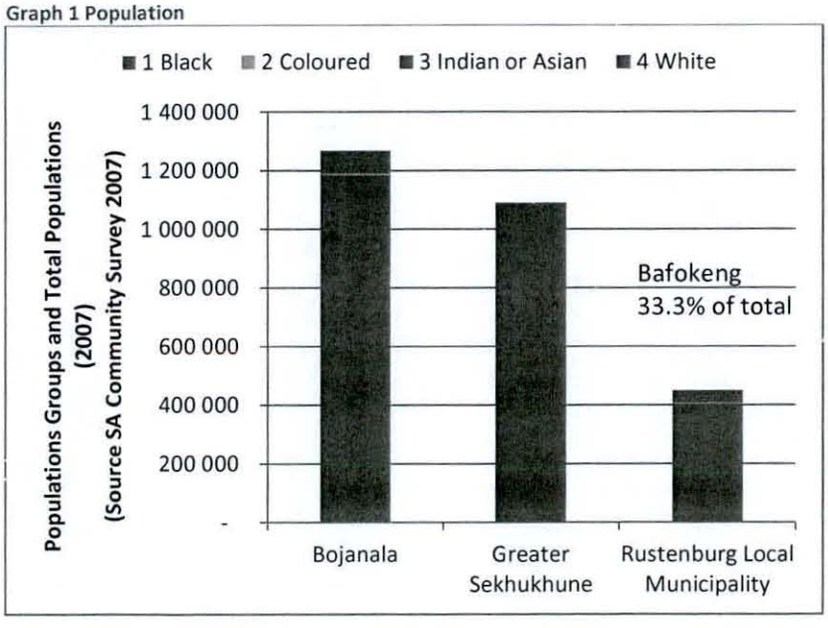
As the purpose of a baseline study is to form a basis to evaluate impacts, this baseline information will serve to provide "steers" to the mine when it eventually undertakes a full Social Impact Assessment.

2.2 Population

The key issue is that Bafokeng Municipal Place is a relatively densely populated area with the Bafokeng Soccer Stadium its most known landmark. The main road through it leads to Sun City and hence this area is likely to be well-known to most of Rustenburg's inhabitants. The area is relatively urbanised and built-up with modern infrastructure to support what appears to be a bustling and thriving community. Much of the urbanisation and development is most probably spawned by the mining industry, of which platinum and chromium are the most predominant commodities.

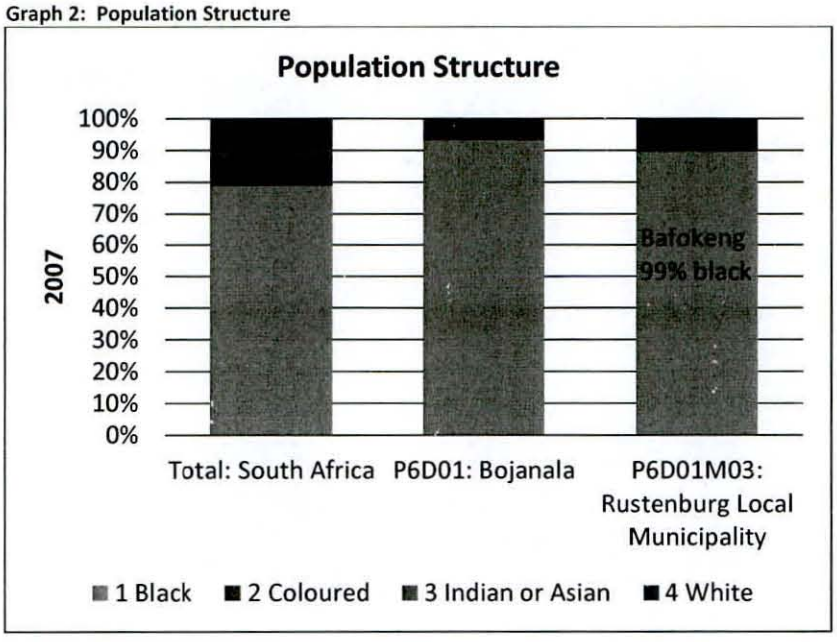
Bojanala District Municipality is large with just under 1.3 million inhabitants, with the vast majority of them being black and Setswana speaking. The Bafokeng area is very populous, at an estimated 150 000 people in 2011. This is a third of the Rustenburg population.

Graph 1 Population



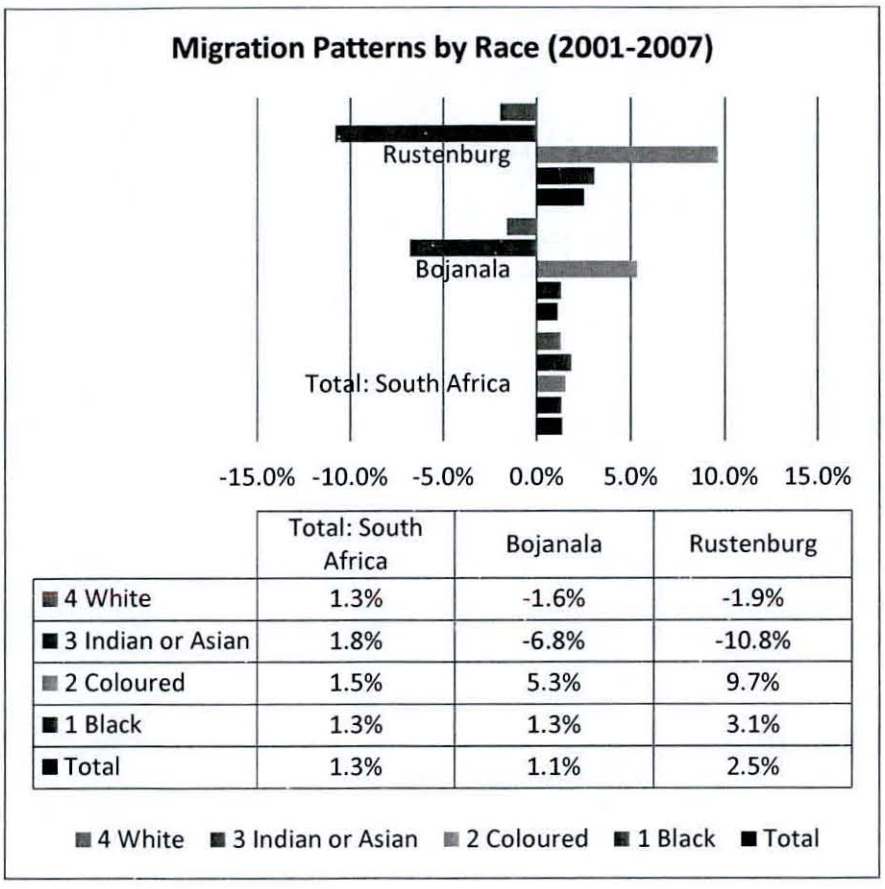
The graph below clearly shows that there are relatively more black people in Bojanala and Rustenburg.

Graph 2: Population Structure



2.3 Migration patterns

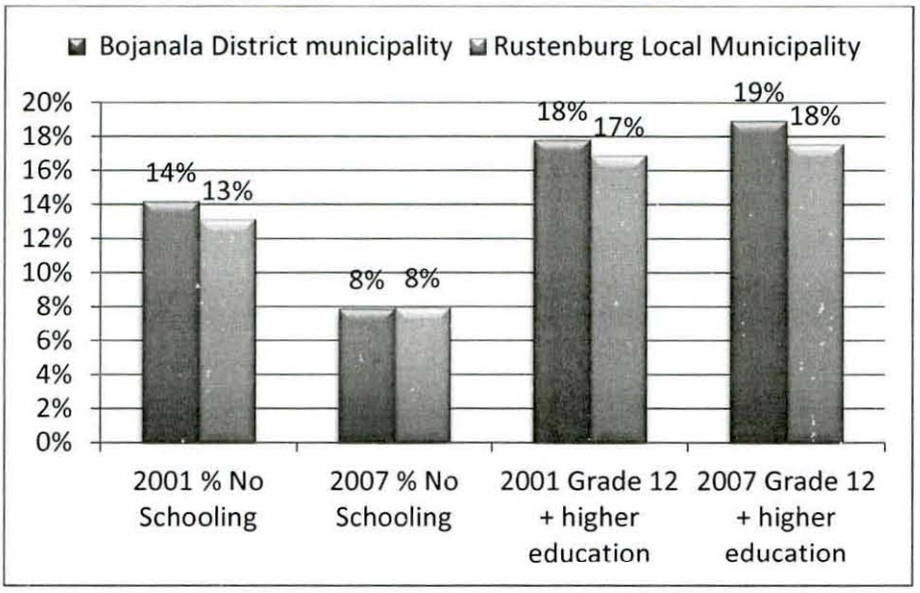
In terms of migration patterns, Indians and Whites are emigrating out of the Rustenburg area and Coloureds and Blacks are migrating in. One suspects that this is in pursuit of the many new jobs being filled by these race groups in terms of employment equity targets in the mining industry.



	Total: South Africa	Bojanala	Rustenburg
4 White	1.3%	-1.6%	-1.9%
3 Indian or Asian	1.8%	-6.8%	-10.8%
2 Coloured	1.5%	5.3%	9.7%
1 Black	1.3%	1.3%	3.1%
Total	1.3%	1.1%	2.5%

2.4 Educational Improvements

A very encouraging sign is the improvement in educational outcomes in the area. The portion of the population with no education in Bojanala and Rustenburg had decreased substantially. In addition, the % of the population with a matric has also improved marginally.

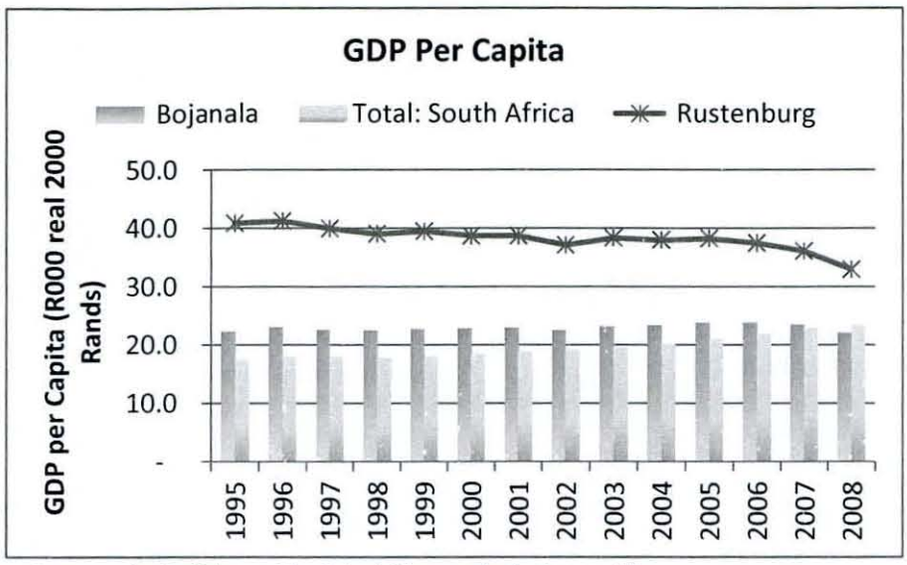


Regardless of the improvement, it needs to be understood that SA 's educational gaps are very large compared to OECD countries, and hence despite pleasing improvements in the last decade, there is still a significant gap to fill.

Table 1: SA compared to OECD education indicators

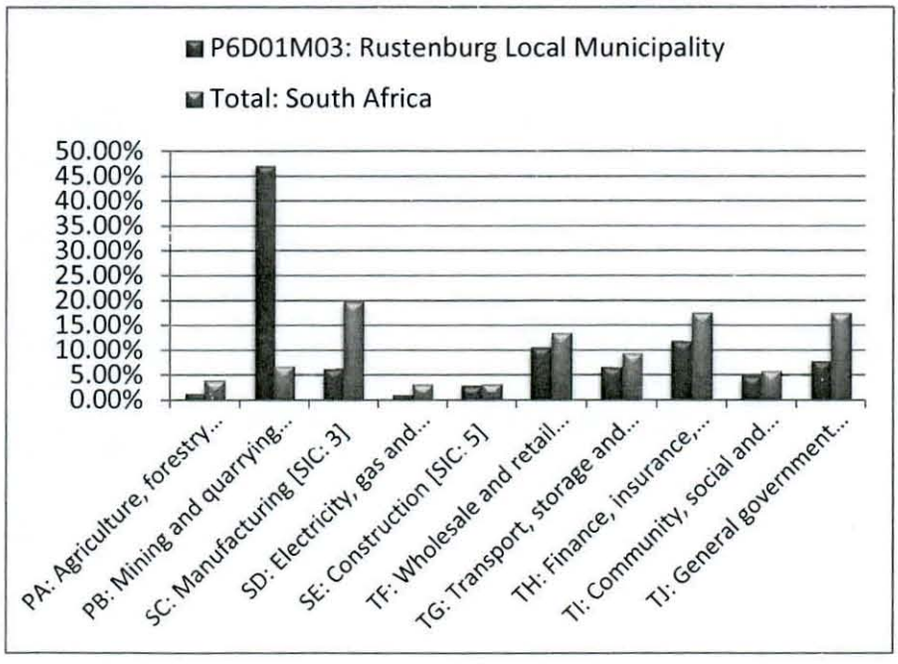
Indicators	OECD countries	South Africa	% Gap	Gap Ranking
School enrolment, primary, private (% of total primary)	10.37	2.06	-405 %	1
Pupil-teacher ratio, secondary	13.64	29.67	-54%	2
Pupil-teacher ratio, primary	16.16	33.18	-51%	3
Expenditure per student, primary (% of GDP per capita)	18.92	13.99	-35%	4
Primary education, duration (years)	6.00	7.00	-14%	5
Literacy rate, adult total (% of people ages 15 and above)	98.19	88.72	-11%	6
School enrolment, secondary (% gross)	99.52	90.23	-10%	7
Primary completion rate, total (% of relevant age group)	98.27	90.03	-9%	8
School enrolment, primary (% gross)	100.28	106.53	6%	9

2.5 GDP per capita



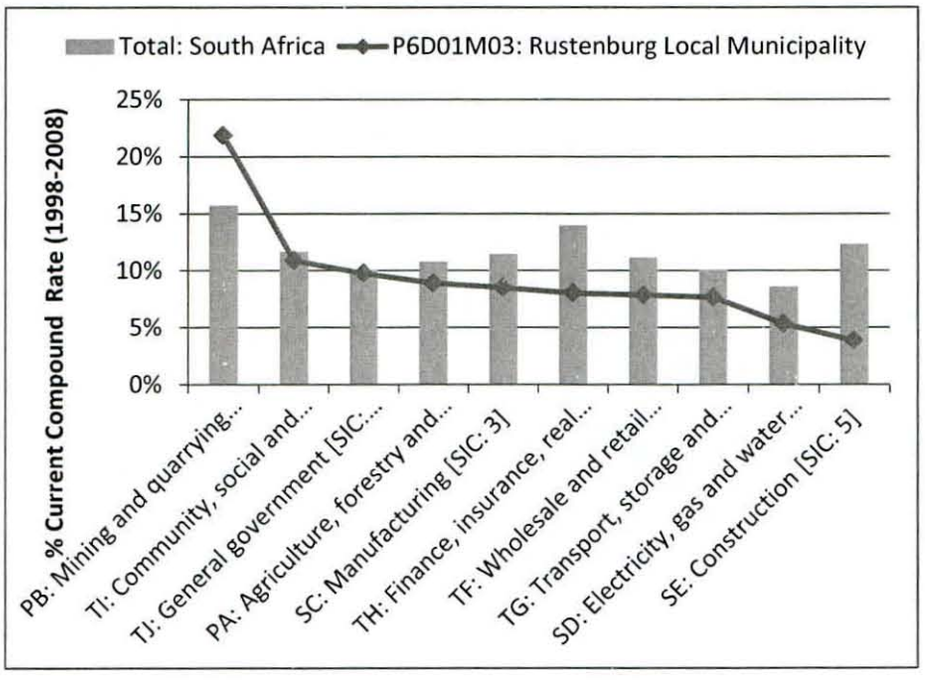
GDP per capita is a measure of wealth and denotes how much GDP is created per individual in an economy. Bojanala and Rustenburg are much higher than that of the average for South Africa, and can be explained by the high output per employee in the mining industry. In essence the wealth or resources in the district make Bojanala, Rustenburg and we can impute the Bafokeng Municipal Place, relatively wealthy.

2.6 Economic structure



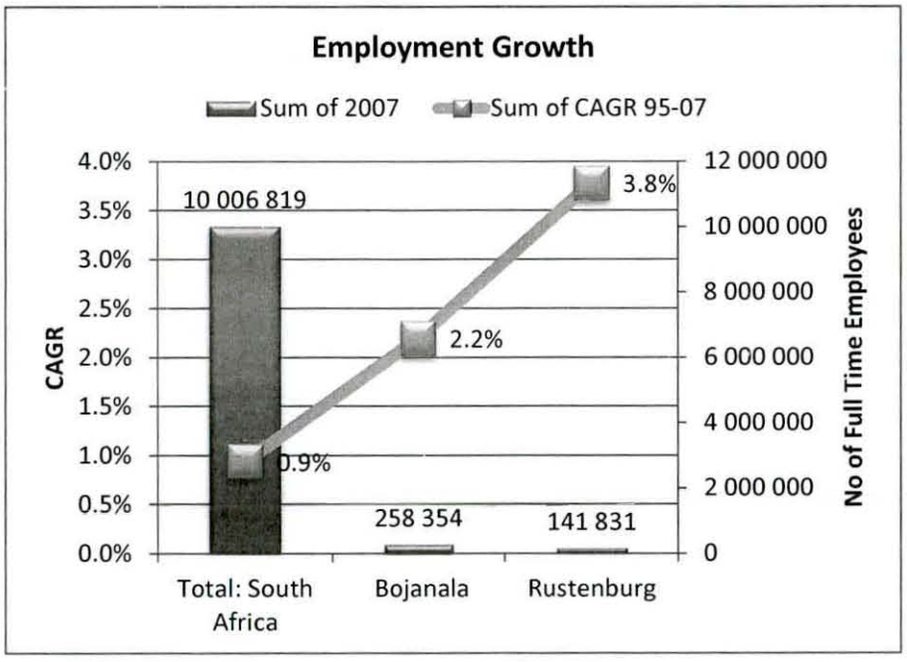
This graph shows clearly how dominant the mining sector is in the Rustenburg area and as mentioned, this drives wealth in the region. Over 45# of Rustenburg's output comes from mining.

2.7 Economic Growth per sector



This graph shows clearly how strong the growth in the mining industry had been from 1998 to 2008. It also shows the growth in community services (which is essentially local government services) and the general government sector.

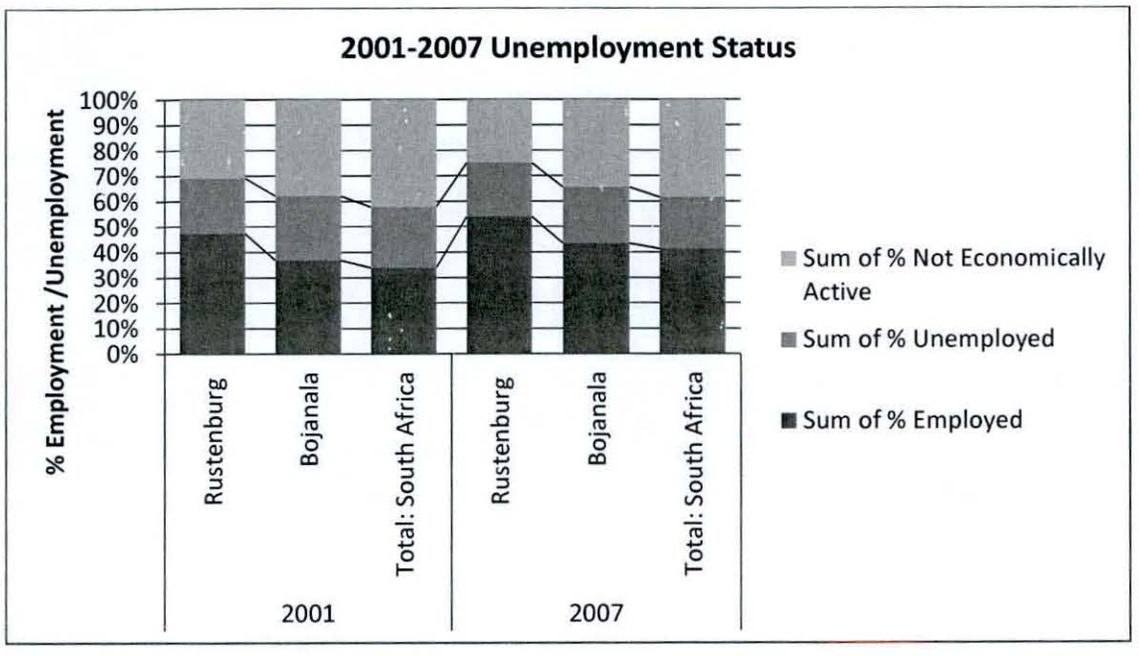
2.8 Employment structure and growth



Employment growth in the Rustenburg and Bojanala areas has been exceptionally good compared to most other regions in SA. It demonstrates how effective a job creator mining can be.

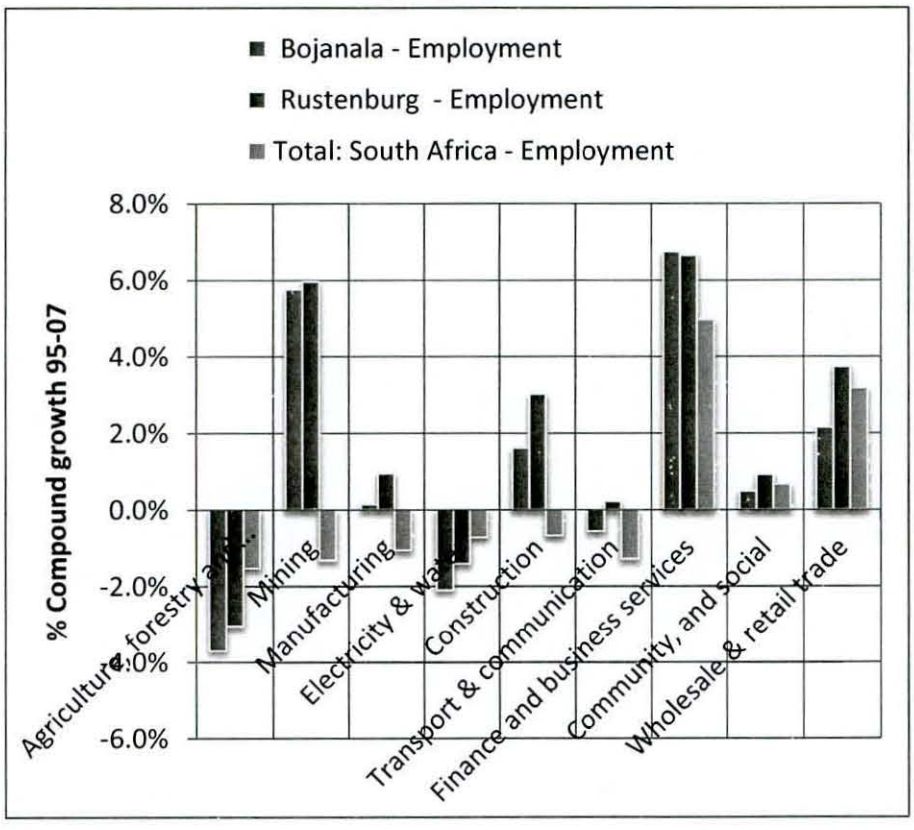
2.9 Employment Structure

The graph below shows that employment in in Rustenburg and Bojanala District Municipality is much better than that of the average of South Africa. As is to be expected, Bafokeng Municipal Place has relatively a high employment rate – in 2001 it was 43% and with the strong employment growth in the mining industry, this is likely to be higher in 2007 – as a minimum it compares well with South Africa.



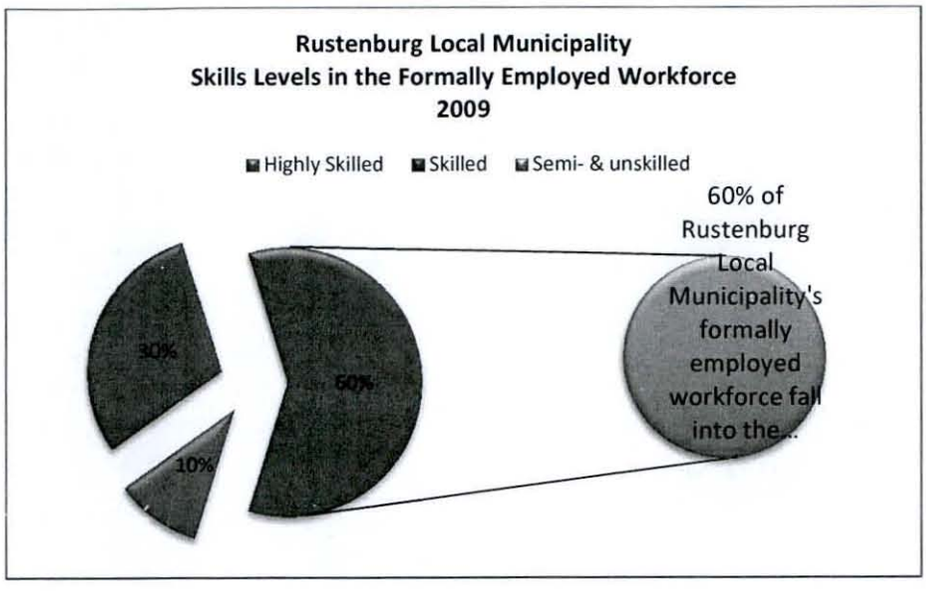
Bafokeng	*2001*
Sum of Employed	43%
Sum of Unemployed	26%
Sum of Not Economically Active	31%

2.10 Employment growth by industry and region

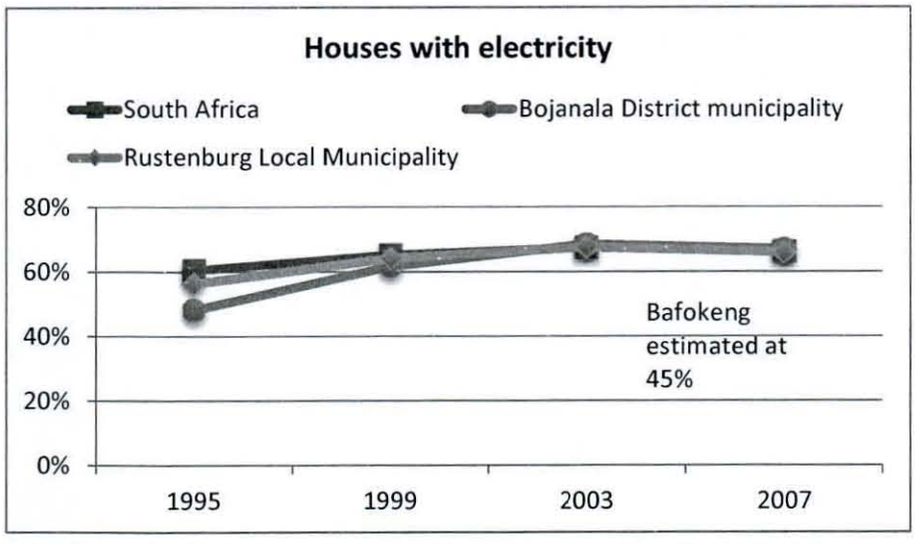


This growth in employment in ther region clearly came from the mining industry. This graph also shows the incredible decline in agricultural employment and growth in the services industries, private and public.

2.11 Skills levels

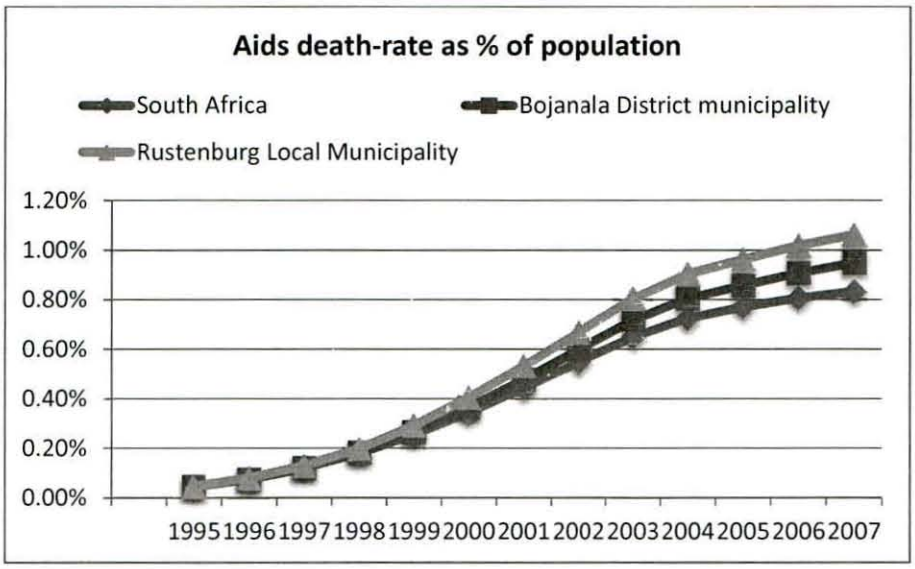


2.12 Houses with electricity



The electrification of houses has improved dramatically in the Bojanala District Municipality – from below 50% in 1995 and today it is well over 60%. The Bafokeng Municipal Place is more rural in nature and had much bigger backlogs – based on the population census of 2001 and considering the improvement throughout the district, we estimate that this area has 45% of all dwellings electrified. In the very immediate vicinity of Impala Platinum, thus the wards closest to it, our observation is that all the houses have been electrified.

2.13 Aids deaths



The aids death rate in SA and the district is very high and from this we can impute that the rate in Bafokeng Municipal Place will equally be high.

2.14 Health Indicators

This table shows without any shadow of doubt that SA has a massive HIV/AIDS pandemic. It is remarkable how low HIV infection in developed countries really is. SA 's life expectancy of just under 53 years as opposed to 79 years in developed countries, is a phenomenal indictment of the poor status of its health. It therefore has to be imputed that the Bafokeng Municipal Place will be equally afflicted with health challenges.

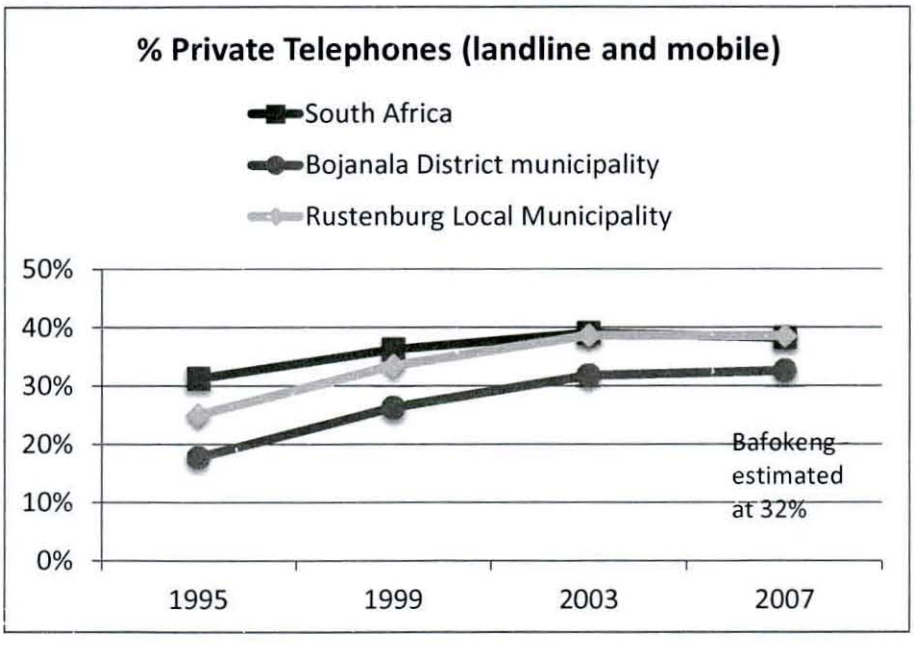
Table 2: Health Indicators - SA relative to OECD[2] countries

Indicator Name	High income: OECD	South Africa	Absolute Gap	Ranking Gap
Prevalence of HIV, total (% of population ages 15-49)	0.30	17.69	-5881%	1
Incidence of tuberculosis (per 100,000 people)	15.40	853.30	-5441%	2
Mortality rate, under-5 (per 1,000)	6.09	71.18	-1068%	3
Mortality rate, infant (per 1,000 live births)	5.22	48.38	--826%	4
Adolescent fertility rate (births per 1,000 women ages 15-19)	20.51	66.04	-222%	5
Health expenditure per capita, PPP (constant 2005 international $)	3,606	715	-80%	6
Fertility rate, total (births per woman)	1.65	2.69	-63%	7
Survival to age 65, male (% of cohort)	82.75	33.98	-59%	8
Survival to age 65, female (% of cohort)	90.75	45.46	-50%	9

[2] Organisation for Economic Cooperation and Development

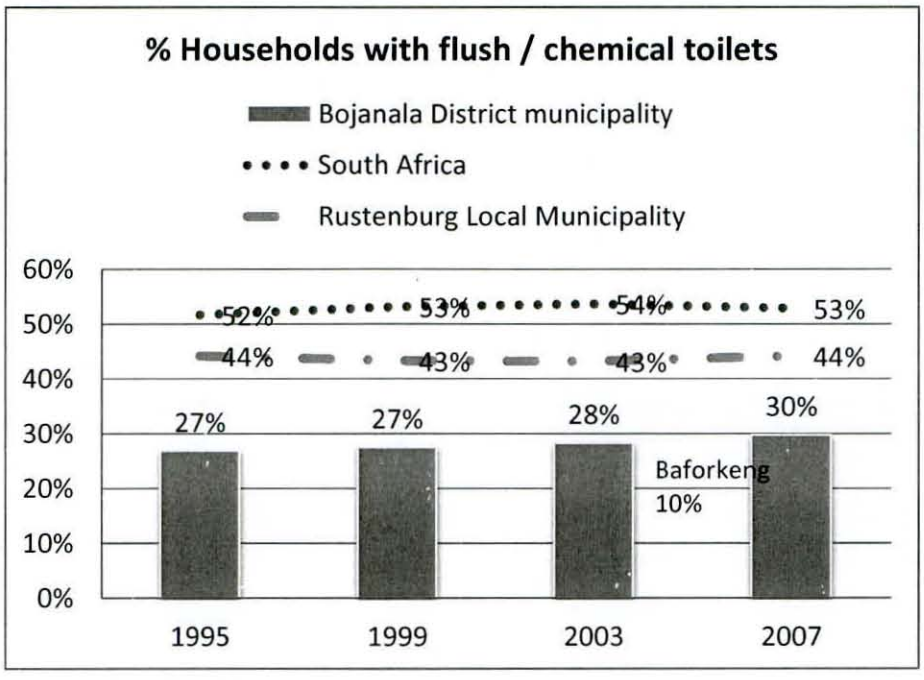
Indicator Name	High income: OECD	South Africa	Absolute Gap	Ranking Gap
Health expenditure, public (% of GDP)	6.71	3.39	-49%	10
Health expenditure, public (% of total health expenditure)	60.40	39.34	-35%	11
Life expectancy at birth, total (years)	78.96	52.71	-33%	12
Immunization, measles (% of children ages 12-23 months)	92.25	64.00	-31%	13
Out-of-pocket health expenditure (% of private expenditure on health)	37.63	27.25	-28%	14
Tuberculosis case detection rate (%, all forms)	86.60	62.80	-27%	15
Immunization, DPT (% of children ages 12-23 months)	94.93	69.70	-27%	16
Health expenditure, total (% of GDP)	11.11	8.63	-22%	17

2.15 Telephone lines



The Bojanala District Municipality has relatively less access to landlines and cell phones than the average of South Africa, and Bafokeng Municipal Place itself has a very similar % score as that of the District.

2.16 Flush toilets



Bafokeng Municipal Place has much less developed sewerage and toilet facilities than that of the **average** for Rustenburg and Bojanala District Municipality. The lack of ablution facilities can result in poorer environmental conditions for the municipal place.

2.17 Environmental indicators in SA

The Bafokeng Municipal Place is in a area that often has news items on environmental degradation. In total, when we compare SA to OECD countries, we find a significant gap between SA 's environmental performance and these countries. Of relevance to Impala Platinum in the below table would be SA 's low water productivity, its high CO2 emissions per economic unit of output, and its high dependence on coal.

Indicator Name	High income: OECD	South Africa	Absolute difference
Electricity production from hydroelectric sources (% of total)	12.6	0.6	1888%
Renewable internal freshwater resources per capita (cubic meters)	8,956.8	956.1	837%
Alternative and nuclear energy (% of total energy use)	14.3	2.8	409%
Marine protected areas (% of total surface area)	13.6	4.4	207%
Water productivity, total (constant 2000 US$ GDP per cubic meter of total freshwater withdrawal)	32.1	10.6	202%
Rural population growth (annual %)	(0.3)	0.4	172%
Nitrous oxide emissions in industrial and energy processes (% of total nitrous oxide emissions)	29.4	12.3	138%
Electric power consumption (kWh per capita)	9,228.9	4,602.6	101%
Terrestrial protected areas (% of total surface area)	11.6	6.9	69%
Urban population growth (annual %)	0.9	2.4	63%
CO2 emissions (kg per 2005 PPP $ of GDP)	0.4	1.0	62%
Electricity production from coal sources (% of total)	38.5	93.8	59%
CO2 emissions (metric tons per capita)	12.3	8.5	46%
Rural population (% of total population)	24.2	41.4	42%
Urban population (% of total)	75.8	58.6	29%
Energy related methane emissions (% of total)	34.1	45.3	25%
Annual freshwater withdrawals, agriculture (% of total freshwater withdrawal)	50.9	62.7	19%
Population density (people per sq. km of land area)	32.2	38.0	15%

3 Conclusion

In essence, the mine development will take place on an existing mine site, in an existing mine area, which is relatively better off than peer areas in the rest of the country. The impacts over the life of mine should be mainly positive – if the life of mine is severely compromised, then mine closure impacts would be a very important consideration.

APPENDIX O: ECONOMIC STUDY

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Strategy4Good
Strategy and Sustainability

MEMORANDUM 1

To: Natasha Daly, SLR Environmental Engineers

From: Gerrie Muller, Strategy4Good Partners

Date: 21 March 2012

Re: **Economic and sustainable development cost and benefits analysis of alternative land-use for Impala mine expansion projects**

For ease of reference we outline this memorandum as follows:

ABBREVIATIONS

AHP
Analytical Hierarchical Process, 10

GDP
Gross Domestic Product, 6

GGP
Gross Geographic Product, 6, 7, 15

GTM
Greater Tubatse Municipality, 8, 15

MWP
Mine Works Program, 4, 6

SA
South Africa, 6

SLR
SLR Consulting, 3, 4, 10, 11, 12, 13, 15 (SLR and SLR used interchangeably

TCM
Thaba Chweu Municipality, 7, 8, 15

1 Impala Open-cast mining, Tailings and Reclamation Dams Alternative Land-use Economic Analysis

1.1 Background and objectives

Impala Platinum Limited (Impala) is proposing four projects (the project). The project includes:

- The development of a new tailings dam (No. 5);
- Re-processing and rehabilitating the footprint of the old tailings dam (No. 1&2) and associated waste disposal facility;
- Establishment and expansion of Pit 9_UB; and
- Establishment and expansion of Pit 14.

The projects are located within Impala's mining lease area at its Rustenburg operations. This lease area falls within the Rustenburg Local Municipality and the Bojanala Platinum District Municipality in the North West Province. The regional and local settings are presented in **Error! Reference source not found.** and **Error! Reference source not found.** respectively.

Regulation 50[1] has two distinct components, the first being a straight analysis of the economic value of land between a mining project and the predominant alternative land-use, and the second being an opinion on the sustainable development quality of the project relative to the alternative land-use. The latter requires the integration of all the social, environmental and economic impacts on a cost-benefit basis. The wording of this requirement is ambiguous and we interpret this as an assessment of the better land-use alternative for this generation without compromising the needs of the next generation.[2]

Based on Regulation 50, the first task required in terms of this analysis is to report on the property values that would potentially be lost and gained in the continuation of the mining project. We assume the logical reason for this (not stated in Regulation 50) is that at any given time a country has capital stock with which it produces income and a reduction of one type of asset (for example, farming land), needs to be replaced by another (in this case, mining land assets). This calculation is incorporated in the findings below.

The second task with respect to the alternative land use valuation is the calculation of the Net Present Value of future income streams to determine which alternative land-use yields the most positive economic results for this generation. Our approach in this regard was to obtain the budgeted economic value added from the mine for the duration of its life (which is its Investments,

[1] Guideline For The Compilation Of An Environmental Impact Assessment And An Environmental Management Programme To Be Submitted With Applications For A Mining Right In Terms Of The Mineral And Petroleum Resources Development Act, 2002, (Act No. 28 Of 2002) (The Act)". Regulation 50.

[2] The most common definition of Sustainable Development is: 'Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

EBITDA[3], Salaries and Wages less its mine closure costs). The economic value opportunity cost is the economic value lost in agricultural produce of impacted farms. The land use with the highest value is then rated as the better economic alternative land-use.

Although not stated in Regulation 50 as a requirement to analyse, we deem the net employment gained and lost as an important factor and have considered this analysis as well.

1.2 Assumptions and limitation

a) We assume that the mining projects being evaluated is economically viable
b) We assume that all the financial information provided to us (in its unsigned format) is correct
c) We assume that the agricultural land in hectares that could potentially be lost to this industry is correct (the hectares), as provided by SLR
d) This study is limited in its scope as we worked mainly with "inferred economic data", thus we limited ourselves to desktop research, telephonic interviews and relied on independent information from SLR

1.3 Approach

The approach undertaken in this evaluation is aligned to the stipulations of Regulation 50. In this regard, we firstly compare the new mining investment with the potential loss of agricultural property values. We secondly sum the present value of the net economic value added of the mining project relative to directly and indirectly impacted farmland yields and employment. Standard present value formulae have been used as are found in a Microsoft Excel Spreadsheet. Values for the mining industry were obtained from the project developer and values in the agricultural industry were imputed based on our own macro-economic databases (using hectares as a base).

1.4 Key Findings

1.4.1 Key Results

In the tables below we show that the economic benefits of the mining developments far exceeds the opportunity costs associated with the current agriculture use.

[3] Earnings before Interests, Taxes, Depreciation and Amortisation

1.4.1.1 Pit 14 economic land use

Table 1: Pit 14 (See main report for project descriptions)

Pit 14 (Rand Million)	Mining	Agriculture	Net-Difference
i. Discount Rate	20%	8%	
ii. Economic Period (years)	5	40	
iii. Impacted Agricultural Hectare		25	
iv. Annual Estimated GDP ph (R'm)		0.003	
v. PV Investment/Divestment (R'm)	33	(2.30)	30.68
vi. PV of Future GDP Contributions/losses (R'm)	200	(0.86)	198.78
vii. PV Mine closure costs (R'm)	-30	-	-30
viii. Net Present Value (sum of v-vii) (R'm)	208	-3.2	204.5
ix. Employment creation/retention/losses	45	-1.6	43.4
x. NPV after GDP multiplier (R'm)	385.6	-6	379
xi. Gross Employment after multiplier	370	-1.8	367.8
xii. Period adjusted employment (xi*[5/40])	**46**	**(1.8)**	**44.4**

The above table outlines the following:

1. On average, the GDP for agriculture is R3 000 per hectare per annum and the total value of farming property lost is estimated at R2.3 million. This is based on an average asking price of R93 000 per hectare, which is extraordinary high for agricultural land, but in line with market demand and supply in that area for such small parcels of land.
2. The net effect of land use is that the mine will employ 370 people over five years (46 when adjusted for the short mining life cycle), and a total of just under 2 jobs will be lost, which is immaterial.
3. Likewise, in present value terms the mine will add R385 million to the economy and a total of R6million would potentially be lost. The net benefit of the mine to the economy is thus undoubted.

The same holds true for Pit 9U and the Tailings 1 and 2 projects below.

1.4.1.2 Pit 9U_B

The same findings as those expanded on in the previous paragraph holds true for this Pit; as can be seen very little hectares are being impacted and hence Mining is far more beneficial, economically, than Agriculture.

Table 2: Pit 9U_B (See main report for project descriptions)

Pit 9U_B (Rand Million)	Mining	Agriculture	Net-Difference
i. Discount Rate	20%	8%	
ii. Economic Period (years)	1	40	
iii. Impacted Agricultural Hectare		7	
iv. Annual Estimated GDP ph (R'm)		0.003	
v. PV Investment/Divestment (R'm)		(0.65)	(0.65)
vi. PV of Future GDP Contributions/losses (R'm)	29	(0.24)	28.73
vii. PV Mine closure costs (R'm)	-5	-	-5
viii. Net Present Value (sum of v-vii) (R'm)	25	-0.9	24.1
ix. Employment creation/retention/losses	50	-0.4	49.6
x. NPV after GDP multiplier (R'm)	46	-2	45
xi. Gross Employment after multiplier	411	-0.5	410.1
xii. Period adjusted employment (xi*[1/40])	**10.3**	**(0.5)**	**9.8**

1.4.1.3 The tailings dam expansion and reclamation projects

Note: The tailings dam expansion and reclamation projects are dealt with as one calculation given that the reclamation is in fact a restoration of mining land back to normal use.

Table 3: Tailings Dam 1 & 2 Reclamation Project (See main report for detailed project descriptions)

Tailings Dam 1 & 2 Reclamation Project	Mining	Agriculture	Net-Difference
i. Discount Rate	20%	8%	
ii. Economic Period (years)	31	40	
iii. Impacted Agricultural Hectare		550	
iv. Annual Estimated GDP ph (R'm)		0.003	
v. PV Investment/Divestment (R'm)	200	(51.15)	148.85
vi. PV of Future GDP Contributions/losses (R'm)	169	(19.05)	150.00
vii. PV Mine closure costs (R'm)		-	-
viii. Net Present Value (sum of v-vii) (R'm)	400	-70.2	329.9
ix. Employment creation/retention/losses	37	-35.1	1.9
x. NPV after GDP multiplier (R'm)	743	-141	602
xi. Gross Employment after multiplier	304	-39.1	264.7
xii. Period adjusted employment (xi*[31/40])	**235.5**	**(39.1)**	**196.3**

The economic benefit of the Tailings Dam also outweighs the opportunity costs of losses to Agriculture.

Table 4: Summary Total

Summary Total	Mining	Agriculture	Net-Difference
v. PV Investment/Divestment (R'm)	233	(54.10)	178.88
vi. PV of Future GDP Contributions/losses (R'm)	398	(20.15)	377.51
vii. PV Mine closure costs (R'm)	-35	-	-35
viii. Net Present Value (sum of v-vii) (R'm)	633	(74.26)	558.4
ix. Employment creation/retention/losses	132	(37.10)	94.9
x. NPV after GDP multiplier (R'm)	1,175	(149.35)	1026
xi. Gross Employment after multiplier	1084	(41.40)	1,042.6
xii. Period adjusted employment	**291.9**	**(41.4)**	**250.5**

The total investment emanating from the mining expansions/new projects far exceed the potential losses in agricultural property values. In summary, mining investments of R233 million could be made compared to the loss of farming land to the value of an estimated R54.1 million.

Secondly, the net economic value added from mining exceeds agriculture by tenfold (after multipliers are considered) – Effectively +R1.2 billion in mining versus -R150 million in agriculture.

Thirdly, the period adjusted employment for mining also exceeds that of the potential loss in agriculture by seven times. For ease of understanding, we outline our methodology below at first, followed by our estimated results.

We did not add the positive economic land-use at the end of the rehabilitation of the old tailings dam (No.1&2) and associated waste disposal facility, for the simple reason that it is likely to be used by the community for recreational purposes. Although this is likely to contribute to a healthier lifestyle, the actual economic value is not material for the purposes of this analysis.

Table 5 Explanatory notes to approach

Mining project	
i. Discount Rate	The rate at which future GGP streams are discounted to the present to accommodate for risk and the inflation rate. For mining this was set at 20% due to the higher risk nature of projects and for agriculture at the risk-free rate of 8% in South Africa.
ii. Economic Period (years)	The estimated life of mine for the mining project and 40 years for agriculture. The 40 years is estimated to be the economic life of one worker.
iii. Impacted Agricultural Hectare	The hectares that would potentially be impacted as advised by the Environmental Consultants.

Mining project		
iv.	Annual Estimated GDP per hectare	The GGP per hectare is based on: [[The total income to farms in the relevant area/number of farms that area]/average hectares per farm]*a GGP factor[4]
v.	PV Investment/Divestment	The present value (PV) of the mining investment compared to the potential losses in farm land values. Investment refers to mining investment and Divestment refers to potential property values lost. Property values are calculated at [the average asking price for land in the area less 15%]* number of hectares.
vi.	PV of Future GDP Contribution	Total GGP in the mining industry is calculated as the total of salaries and wages plus EBITDA, discounted at the discount rate over the life of mine. The agricultural PV of GGP is the sum of the imputed GGP per hectare, over 40 years, discounted back to today.
vii.	PV Mine closure costs	Anticipated mining closure costs. Treated as a negative to GGP as it reduces the economic value added.
viii.	Net Present Value (NPV)	Net present value is the sum of *v to vii* above.
ix.	Employment creation/retention	Number of direct jobs created/retained. The mining employment is taken from the mine plan and that of agriculture imputed based on Stats SA averages for that region.
x.	NPV after GDP multiplier	Standard multipliers for South Africa as supplied by Quantec[5].
xi.	Gross Employment after multiplier	Same as above.
xii.	Period adjusted employment	We reduced the employment numbers for mining on the following basis: we take a factor of [Life of Mine /40 years for agriculture] * estimated jobs to be created or retained in mining. This gives a comparable life time equivalent jobs to Agriculture.

1.5 Conclusion

In terms of the better alternative land-use we conclude that the proposed mining developments far outstrips any economic opportunity costs associated with the current land-use of the above projects.

[4] Derived as Agriculture EVA/Total Output as per Quantec analyses
[5] Quantec is a reputable economics data provider

2 Integrated sustainable development analysis for the four Projects

2.1 Background and objectives

As we pointed out in the previous section, Regulation 50 has two distinct components, the first being a straight comparison of the value of land between a proposed mining project and the existing land-use, and the second being an opinion on the sustainable development quality of the project relative to the existing land-use. The latter, ***which is covered in this section,*** requires the integration of all the social, environmental and economic impacts on a cost-benefit basis. The wording of this requirement is ambiguous and we interpret this as an assessment of the better land-use alternative for this generation without compromising the needs of the next generation[6].

2.2 Assumptions and limitation

e) We assume that the mining project being evaluated is economically viable. If not so, this analysis is null and void;

f) We base our findings on the environmental impact ratings complied by SLR.

g) We use post-mitigated ratings on the assumption that the mine will manage environmental risks responsibly and as prescribed.

2.2.1 Approach

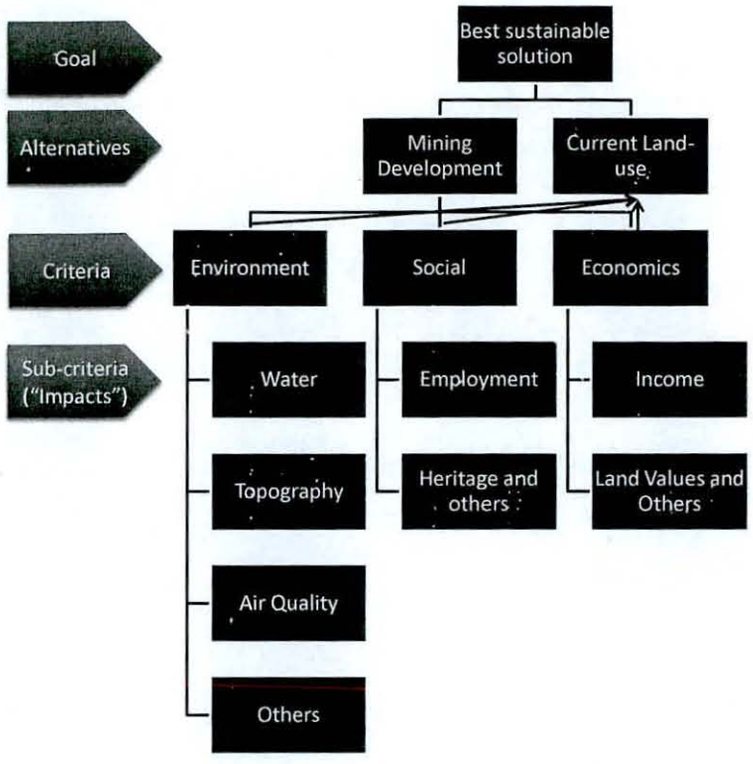
Our approach to Regulation 50 (d) 9 is to evaluate all the sustainable development impacts (social, economic and environmental) to determine the best land-use for this and the next generation.

In arriving at the better sustainability option of land-use, we use the Analytical Hierarchical Process, which is a structured technique for organizing and analysing complex decisions. Based on mathematics and psychology, it was developed by Thomas L. Saaty in the 1970s and has been extensively studied and refined since then. It has particular application in group decision making and is used around the world in a wide variety of decision situations, in fields such as government, business, industry, healthcare, and education.

[6] The most common definition of Sustainable Development is: 'Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

The figure below outlines this methodology.

Figure 1: AHP Decision Making Process



The first issue to establish in the Analytical Hierarchical Process is to define the decision-making goal. In this case, it is to decide the better land-use for this and the next generation between the mine development and existing land-use. The criteria used are the generally accepted sustainability categories, namely Environment, Social and Economics with each having their own sub-criteria (being the impacts as identified by SLR.)

2.2.2 Execution of the Analytical Hierarchical Process in this analysis

The Analytical Hierarchical Process was designed and executed by us in the following manner:

a. We used the SLR socio-economic and environment impact assessment as a basis for the severity of risks. These impacts have been described in the main Environmental Impact Assessment document as undertaken by SLR Consulting.

b. ***We only work with the mitigated impacts as it is assumed that mitigation will take place. In this regard, the role of monitoring by the regulator is critical for the sustainable development success of this application.***

c. We converted these impacts into numerical scales (+90% for very positive, e.g. income generation and -90% for severely negative (e.g. the physical destruction of biodiversity).

Figure 2: Post mitigated impact assessment

Indicator	Aspect	Category	Construction	Operations	Decomissioning	Closure
Loss and sterilisation of mineral resources	Geology	Envlronment	(L)	(L)	(L)	(L)
Hazardous structures and excavations posing risk to third parties	Topography	Envlronment	(M)	(M)	(M)	(M)
Loss of soil resources and land capability through pollution	Soils and land capabiliti	Envlronment	(L)	(L)	(L)	(L)
Loss os soil resourses and land capability through physical disturbance	Soils and land capabiliti	Envlronment	(L)	(L)	(L)	(L)
Physical destruction of biodiversity	Biodiversity	Envlronment	(M)	(M)	(M)	(L)
General disturbance of biodiversity	Biodiversity	Envlronment	(M)	(M)	(M)	(M)
Pollution of surface water resources	Surface water	Envlronment	(M)	(M)	(M)	(M)
Alteration of natural drainage patterns	Surface water	Envlronment	(M)	(M)	(M)	(L)
Contamination of groundwater	Groundwater	Envlronment	(M-L)	(M-L)	(M-L)	(M-L)
Dewatering	Groundwater	Envlronment	(L)	(L)	(L)	(L)
Air pollution	Air quality	Envlronment	(M)	(M)	(M)	(L)
Noise pollution	Noise	Envlronment	(M)	(M)	(M)	(M)
Blasting impact	Blasting impacts	Envlronment	(H-M)	(H-M)	(H-M)	(H-M)
Road distrubance and traffic safety	Traffic	Envlronment	(M)	(M)	(M)	(M)
Visual impacts	Visual	Envlronment	(M)	(M)	(M)	(L)
Loss of heritage, palaeontological and cultural resources	Heritage, palaeontologi	Social	0	0	0	0
Employment	Employment	Social	H	H	M	L
Income generation	Income generation	Economic	H	H	M	L
Inward migration	Inward migration	Social	(H-M)	(H-M)	(H-M)	(H-M)
Land use impact	Land use	Social	(M)	(M)	(M)	(L)

The conversion is then done on the basis outlined below.

Figure 3: Conversion of impact rating to Percentage Scale

Rating	%	Direction
H	90%	Positive
H-M	66%	Positive
M-H	66%	Positive
M	50%	Positive
M-L	22%	Positive
L	10%	Positive
0	0%	Neutral
(L)	-10%	Negative
(M-L)	-22%	Negative
(M)	-50%	Negative
(H-M)	-66%	Negative
(M-H)	-66%	Negative
(H)	-90%	Negative
(FF) (Fatal Flaw)	-100%	Negative

a. We then used the Analytical Hierarchical Process pair wise analysis to determine weighted averages for each environmental impact.

Figure 4: Pairwise example

Aspect	Air quality	Biodiversity	Blasting impacts	Geology	Groundwater	Noise	Soils and land capabilities	Surface water	Topography	Traffic	Visual	Total
Air quality	1	9	3	9	6	6	9	9	9	9	9	79.00
Biodiversity	1/9	1	1/6	3	1	1/9	3	3	3	3	3	20.39
Blasting impacts	1/3	6	1	6	6	1/6	6	9	6	6	6	52.50
Geology	1/9	1/3	1/6	1	1/3	1/6	1/6	1/3	1/9	1/6	1/6	3.06
Groundwater	1/6	1	1/6	3	1	1/6	3	6	3	3	3	23.50
Noise	1/6	9	6	6	6	1	9	9	9	9	9	73.17
Soils and land capabilitie	1/9	1/3	1/6	6	1/3	1/9	1	3	3	1	3	18.06
Surface water	1/9	1/3	1/9	3	1/6	1/9	1/3	1	1/3	3	1	9.50
Topography	1/9	1/3	1/6	9	1/3	1/9	1/3	3	1	1	1	16.39
Traffic	1/9	1/3	1/6	6	1/3	1/9	1	1/3	1	1	3	13.39
Visual	1/9	1/3	1/6	6	1/3	1/9	1/3	1	1	1/3	1	10.72

SLR viewed the relative importance of each aspect for this project as follows:

Figure 5: SLR relative weighting of impacts

Row Labels	Sum of Relative Importance
Economic	**100%**
Income generation	100%
Environment	**100%**
Air quality	20%
Noise	19%
Blasting impacts	13%
Groundwater	12%
Biodiversity	10%
Soils and land capabilities	9%
Surface water	5%
Topography	4%
Traffic	3%
Visual	3%
Geology	1%
Social	**100%**
Employment	70%
Inward migration	25%
Land use	5%
Heritage, palaeontological and cultural resources	0%

b. We then summed all the weighted impacts by category (environment, economic and social) to determine the % extent of positive or negative.

c. In the final ranking environment, social and economics are rated as equal in importance.

2.3 Findings

2.3.1 Pit 14

This section describes our findings with respect to the sustainable development quality of the Pit 14 project.

Figure 6: Un-weighted and Weighted Results (Post mitigated)

Row Labels	UNW-Construction	UNW-Operation	UNW-Decommissioning	UNW-Closure	UNW-Total	W-Construction	W-Operation	W-Decommissioning	W-Closure	W-Total
Economic	90%	90%	50%	10%	60%	90%	90%	50%	10%	60%
Environment	-39%	-39%	-39%	-28%	-36%	-44%	-44%	-44%	-32%	-41%
Social	-7%	-7%	-17%	-17%	-12%	44%	44%	16%	-10%	24%
Average	15%	15%	-2%	-11%	4%	30%	30%	7%	-11%	14%

Row Labels	UNW-Construction	UNW-Operation	UNW-Decommissioning	UNW-Closure	UNW-Total	W-Construction	W-Operation	W-Decommissioning	W-Closure	W-Total
Economic	H	H	M	L	M	H	H	M	L	M
Environment	(M)	(M)	(M)	(M)	(M)	(M)	(M)	(M)	(M)	(M)
Social	(L)	(L)	(M-L)	(M-L)	(M-L)	M-L	M-L	L	(L)	M-L
Average	L	L	(L)	(M-L)	L	M-L	M-L	L	(L)	L

Note 1: () = NEGATIVE VALUES / NTR = NEUTRAL (BETWEEN -3% AND +3%)

The above table shows our findings as follows:

2.3.1.1 Un-weighted:

1. Overall, in an un-weighted scenario, the development is Low Positive, which means the alternative land-use is more suitable for mining development.
2. Note, in the un-weighted scenario, every indicator has an equal chance of influencing the overall ratings per category. For example, in social, employment is similar to inward migration; or in the environmental category, ground-water contamination has the same probability of impacting the final results as e.g. visual impacts.
3. In the un-weighted scenario the straight averages for economic benefits is Medium with high economic benefits in the beginning and operational phases, which then reduces in the decommissioning and closure phases.

4. Based on straight averages, the environmental impacts are merely the average ratings as essentially assessed by SLR. As can be seen, this is in the negative medium category.

2.3.1.2 Weighted

The findings with respect to the weighted scenarios are as follows:

1. The aggregate sustainable development score is Low positive which gives it a potential Low positive net benefit to society from a sustainable development perspective.
2. The economic benefits are again High Positive in the initial life cycle of the Mine and averages out to Medium positive over the life of mine. This lowering of the scores is due to the negative impacts of decommissioning and closure.
3. In the weighted scenario the negative environmental impacts remain the same being in the M negative territory. Not much has essentially changed and this simply indicates that the critical impacts and the overall impacts are largely the same. Intuitively, one would expect this. ***This also indicates that if only the environment was a criterion, the project ought not to be recommended.***
4. The economic rating does not change as only one variable is used, being income generation. The scores thus remain the same.
5. The social ratings improved in this scenario due to the high priority placed on employment. As employment has a high positive impact, the overall weighted average improves accordingly.

2.3.2 Tailings dam expansion

The results for the tailings dam expansion is outlined below.

Figure 7: Un-weighted and Weighted Results (Post mitigated) (UNW = unweighted and W = Weighted

	A	B	C	D	E	F	G	H	I	J	K	L
1	Row Labels	UNW-Construction	UNW-Operation	UNW-Decommissioning	Average of UNW-Closure	UNW-Total	W-Construction	W-Operation	Decommissioning	W-Closure	W-Total	
2	Economic	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	
3	Environment	-40%	-41%	-41%	-29%	-38%	-45%	-45%	-45%	-32%	-42%	
4	Social	-7%	-7%	-7%	4%	-4%	19%	19%	19%	31%	22%	
5	**Average**	**14%**	**14%**	**14%**	**22%**	**16%**	**22%**	**22%**	**22%**	**29%**	**24%**	

Row Labels	UNW-Construction	UNW-Operation	UNW-Decommissioning	UNW-Closure	UNW-Total	W-Construction	W-Operation	W-Decommissioning	W-Closure	W-Total
Economic	H	H	H	H	H	H	H	H	H	H
Environment	(M)	(M)	(M)	(M)	(M)	(M)	(M)	(M)	(M)	(M)
Social	(L)	(L)	(L)	NTR	(L)	L	L	L	M-L	M-L
Average	L	L	L	L	L	L	L	L	M-L	M-L

We outline the results from the above table as follows:

1. Looking a cell F5, which is the total un-weighted rating for the project and this amounts to +16%, the development is Low Positive, which means one would continue with this project on this basis.
2. Note, in the un-weighted scenario, every indicator has an equal chance of influencing the overall ratings per category, for example, in economics, income generation is similar to loss of land-use values, or in the environmental category, ground-water contamination has the same probability of impacting the final results as e.g. visual impacts.
3. Turning to cell K5, the +16% improves to +24% in the weighted average scenario which is the average of the three categories and shows that this development is in the overall medium positive territory.

4. Row 3 above shows all the environmental ratings for the project which places it in the medium negative bracket, on an un-weighted and weighted basis. This indicates that if there is no socio-economic benefit, one will not recommend this project. In the weighted scenario, the environmental impacts deteriorate slightly due to the fact that the higher weighted impacts are also some of the worst. For example, the contamination and pollution of water resources have a high weight and also has high negative impacts.
5. The overall scores improved in the weighted scenario because income generation and employment creation essentially dominate the weightings for the socio-economic categories.
6. The economic benefits are high due to the large amount of income to be generated from this project.
7. The negative percentage for social in the un-weighted scenario is due to the consequences of the influx of people and deterioration in land-use. However, this was balanced by employment creation, and since it is weighted the highest in the social category it changed the negatives to positives in the weighted scenario.

2.3.3 Impala Tailings Dam Reclamation

The change in land-use for the Tailings Reclamation Project is a change away from mining activities to a bare dominium, thus a site for any land-use. Thus this is the opposite of mining development on new land as it is being transferred to other industries. Therefore, it is also superfluous to undertake an integrated cost-benefit analysis.

2.3.4 Impala Pit9U_B

The land-use regarding the Pit 9U_B project is only suitable for mining development given that it is surrounded by existing mining activities and its small size and location. As it is, it is mainly useful for mining. For this reason, it is superfluous to undertake an integrated cost-benefit analysis for this project.

2.4 Integrated Sustainable Development Conclusion

Given this project's strong socio-economic benefits, we conclude that it is acceptable. The fact that relatively little land is impacted and that the Impala footprint is well-established also assists in making it acceptable from a sustainable development viewpoint. Hence one would recommend this project from a sustainable development perspective.

Thus based on Regulation 90[7] the better alternative land use is the mining related developments (the new tailings dam, the open pits and the reprocessing and rehabilitation of the old tailings dam

[7] Guideline for the Compilation of an Environmental Impact Assessment and an Environmental Management Programme to be Submitted with Applications for a Mining Right in terms of the Mineral and Petroleum Resources Development Act, 2002, (Act no. 28 of 2002) (the Act)". Regulation 50

and associated waste facility) compared to the current land-uses. In the first place, the socio-economic valued added by these projects significantly outstrips the opportunity costs of the current land-use. In the second place, the socio-economic benefits outweigh the potential environmental risks and for this reason the project is also acceptable on an integrated development basis.

APPENDIX P: FINANCIAL PROVISION

August 2011

IMPALA PLATINUM

Closure Costs for Impala Platinum's Proposed New Tailings and Open Pit Projects, as at June 2011

Submitted to:
Metago
P.O. Box 1596
Cramerview
Fourways
2060

REPORT

Report Number. 10612628-10742-4

Distribution:

1 x Metago
1 x Golder Associates Library
1 x Golder Associates Project File

Golder Associates

Executive Summary

Golder Associates (Golder) in association with E-TEK Consulting was requested by Metago to assist with determination of the preliminary closure costing of the following new proposed projects for Impala Platinum at their Rustenburg Operations:

- Proposed new No. 5 tailings dam;
- Re-processing of the old tailings dam (No. 1 and 2);
- Proposed rehabilitation of the footprint of the old tailings dam (No. 1 and 2) and associated historical waste disposal facility; and
- Expansion of open pit mining operations.

These closure costs are determined to form part of an authorisation process with the Department of Mineral Resources (DMR) for Impala's proposed new projects and are aligned to the DMR guideline document for new EIA/EMP applications. Closure costs were estimated for the scheduled (planned - life-of-mine) closure situation as well as a forecast for the first ten years of operation.

The closure cost estimate was structured in the format that is routinely used for the presentation of the closure costs for large infrastructural sites by reflecting the costs in terms of the following categories:

- Infrastructural areas;
- Mining areas and residue deposits;
- General surface reclamation;
- Water management;
- Post-closure aspects; and
- Additional allowances.

The closure cost estimates quantities were taken from available plans, maps and information provided by Metago and/or Impala. Aligned to the updated closure costing completed by Golder and E-TEK for Impala's current Rustenburg operations, as at May 2011, unit rates for the planned tailings and opencast project were assumed to be similar to that of the bigger Impala project. These unit rates were obtained from Golder's data base and/or in consultation with demolition and rehabilitation practitioners.

The estimated scheduled closure costs for the above proposed new projects, as determined at the end of June 2011, amount to approximately R107 million, allowing for 6 percent P&Gs and 10 percent contingencies, as summarised below:

	Closure component	Scheduled closure
	INFRASTRUCTURAL ASPECTS	
1	Infrastructural aspects	R 7,261,710.50
2	Mining aspects	R 30,782,200.00
3	General surface reclamation	R 553,800.00
4	Water management	R 39,750,000.00
	SUB-TOTAL 1 (for infrastructure and related aspects)	**R 78,347,710.50**
5	Post-closure aspects	R 14,385,000.00
	SUB-TOTAL 2 (for post-closure aspects)	**R 15,823,500.00**
6	**ADDITIONAL ALLOWANCES**	
6.1	Preliminary and generals	R 4,700,862.63
6.2	Contingencies	R 7,834,771.05
	SUB-TOTAL 3 (for additional allowances)	**R 12,535,633.68**
	Grand total (for sub-total 1+2+3)	**R 106,706,844.18**

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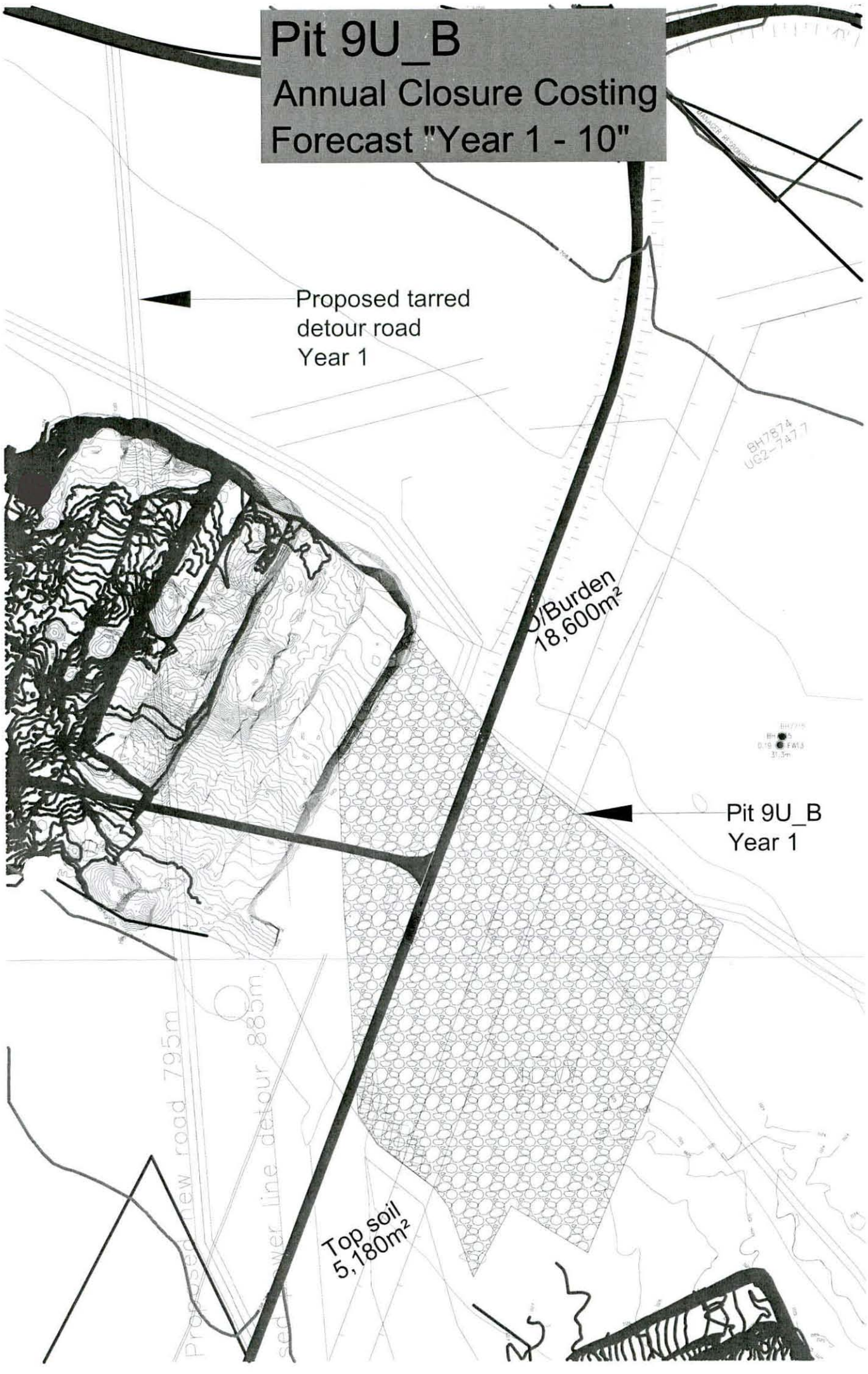
Pit 9U_B
Annual Closure Costing
Forecast "Year 1 - 10"
Proposed tarred
detour road
Year 1
O/Burden
18,600m²
Pit 9U_B
Year 1
Top soil
5,180m²

LIST OF TERMS AND ABBREVIATIONS USED

Reclamation	The re-instatement of a disturbed area into a usable state (not necessarily its pre-mining state) as defined by broad land use and related performance objectives.
Remediation	To assist in the reclamation process by enhancing the quality of an area through specific actions to improve especially bio-physical site conditions.
Rehabilitation	The return of a disturbed area to its original state, or as close as possible to this state.
Scheduled closure	Closure that happens at the planned date and/or time horizon.
Unscheduled closure	Immediate closure of a site, representing decommissioning and reclamation of the site in its present state.
Decommissioning	This relates to the situation after cessation of operations involving the deconstruction/removal and/or transfer of surface infrastructure and the initiation of general site reclamation.
Care and maintenance	This involves the maintaining and corrective action as requires as well as conducting the required inspection and monitoring to demonstrate achievement of success of the implemented measures.
Closure	This involves the application for closure certificate and initiation of transfer of on-going care and maintenance to third parties.
Site relinquishment	Receipt of closure certificate and handover to third parties for on-going care and maintenance, if required.
Post-closure	The period of on-going care and maintenance, as per arrangement with third parties.
Preliminary and Generals (P&Gs)	This is a key cost item which is directly related to whether third party contractors are applied for site reclamation or not. This cost item comprises both fixed and time-related charges. The former makes allowance for establishment (and de-establishment) of contractors on site, as well as covering their operational requirements for their offices (electricity/water/communications), latrines, etc. Time-related items make allowance for the running costs of the fixed charged items for the contract period.
Contingencies	This allows for making reasonable allowance for possible oversights/omissions and possible work not foreseen at the time of compilation of the closure costs. Allowance of between 10 percent and 20 percent would usually be made based on the accuracy of the estimations. The South African Department of Minerals and Energy Guideline (January 2005) requires an allowance of at least 10 percent.

1.0 INTRODUCTION

Golder Associates (Golder) in association with E-TEK Consulting (E-TEK) was requested by Metago to assist with the preliminary closure costing of various new proposed development projects for Impala Platinum (Impala) at their Rustenburg Operations. These closure costs were determined to form part of an authorisation process with the Department of Mineral Resources (DMR) for Impala's proposed new projects and are aligned to the DMR guideline document for new EIA/EMP applications. The closure costs were estimated for the scheduled (planned - life-of-mine) closure situation as well as a forecast for the first ten years of operation.

The Rustenburg operations' mining rights area covers approximately 330 km^2 comprising, but not limited to, the following:

- Approximately 20 vertical shafts, with associated infrastructure including processing plants, refrigeration plants, administration and staff buildings, workshops, etc.;
- Ventilation shafts;
- Waste rock dumps (WRDs), as well as WRD footprint areas;
- Two tailings dams;
- Opencast mining areas; and
- Return water dams, storm water dams, process water dams, settling ponds, etc.

However, in addition to the abovementioned infrastructure and mining aspects, Impala is now also considering the following new projects:

- Proposed new No. 5 tailings dam;
- Re-processing of the old tailings dam (No. 1 and 2);
- Proposed rehabilitation of the footprint of the old tailings dam (No. 1 and 2) and associated historical waste disposal facility; and
- Expansion of open pit mining operations.

Golder, in association with E-TEK, recently updated the financial provision for the entire Impala Platinum Rustenburg Operations, as at May, 2011 (report no. 12628/9888/2, dated June 2011). Aligned to these operations-wide costs, it was requested that the closure cost assessment for these proposed new projects be undertaken, taking cognisance of the new DMR guideline document for new EIA/EMPs.

Hence, this report provides the scheduled (LOM) closure cost along with the first ten year forecast for the operation of the new proposed activities, as calculated at the end of June 2011.

2.0 APPROACH TO COST DETERMINATION

The approach followed with the determination of the closure costs could be summarised as follows:

- Sourcing and review of project information from Metago to determine the nature and extent of the proposed new projects;
- Agreement that no site visit was required as construction of the two shafts has not yet commenced. Furthermore, the project team has a good understanding of the general site conditions and nature of operations at Impala due to involvement in the closure costing for the whole of Impala's current Rustenburg Operations;

- Based on the review of available information, identification of infrastructure and mining-related activities that would need to be decommissioned at closure;
- Determination of the various components of demolition or rehabilitation related to each structure and/or area;
- Compilation of a Bill of Quantities capturing the quantities and actions relating to closure of the complexes;
- Determination/verification of unit rates for plant dismantling and demolition as well as associated reclamation as per recent tenders available to Golder, as well as consultation with demolition and rehabilitation practitioners;
- Application of the above unit rates and associated quantities in pre-determined spreadsheets to determine the latest closure cost estimates;
- Forecasting the first ten operational years of the increase/fluctuation in closure costs for the proposed shaft complexes; and
- Compilation of a closure cost report to reflect the assumptions made in the closure costing as well as the matters requiring attention to ensure that future closure costing is gradually improved.

3.0 AVAILABLE INFORMATION

The sources of information used for the closure cost estimate were as follows:

- Project overview – extract from the BID, from Metago;
- Pre-feasibility Design Report for the New Tailings Disposal Facility at Impala Platinum, Rustenburg (SRK Report No. 414226/2) and Appendices;
- General Arrangement drawings for the new tailings disposal facility from Metago;
- Detailed site plan for the opencast expansion from Metago;
- Final Landfill Closure Report – The Closure of Waste Sites at Impala Platinum Limited (Metago Report 105/003 No 1), dated August 1998;
- Tailings Re-Processing Plant Phase 2 description from Metago; and
- Technical Memo by Sentinel Water Services dated 14 April 2011 summarising the various pipeline routes and details.

4.0 BATTERY LIMITS

The new proposed projects covers a total of four projects with battery limits as indicated below:

- No. 5 tailings dam project, including:
  - The new No. 5 tailings dam consisting of Phases 1-3 of the development of the facility;
  - The Phase 1 and 2 return water dams (RWD);
  - Two silt traps;
  - Return water pumpstation;
  - Tailings supply pipelines from the existing facilities to the new No. 5 tailings dam;
  - Return water pipelines; and

- Booster pump station.

- Re-processing of the old tailings dam (No. 1 and 2) project, including:
  - The slurry sump and pumpstation at the No 1&2 tailings dam;
  - Slurry pipelines to the new processing plant;
  - Return water pipelines to the No. 1 and 2 tailings dam; and
  - New tailings reprocessing plant within the existing overall Minpro footprint area.
- Rehabilitation of the footprint of the old tailings dam (No. 1 and 2) and associated historical waste disposal facility project, including:
  - The footprint of the No. 1 and 2 tailings dam; and
  - Historical Luka general waste disposal site.
- Expansion of opencast mining, including:
  - Pit 14M; and
  - Pit 15M.

5.0 ASSUMPTIONS AND QUALIFICATIONS

The assumptions and qualifications listed below were made with respect to the closure cost estimates.

5.1 General

- The closure cost estimate is aligned to the principles reflected in the Department of Mineral Resources' (DMR) Guideline Document for the Evaluation of the Quantum of Closure Related Financial Provision Provided by a Mine (January, 2005);
- The closure costs for the plant site could comprise a number of cost components. This report only addresses the decommissioning and rehabilitation costs, equating to an outside (third party) contractor establishing on-site and conducting the decommissioning and reclamation-related work. Other components such as staffing of the plant site after decommissioning, the infrastructure and support services (e.g. power supply, etc.) for this staff as well as workforce matters such as separation packages, re-training/re-skilling, etc., are outside the scope of this report. However, the on-going treatment of the contaminated groundwater from the scavenger boreholes is included;
- Based on the above, dedicated contractors would be commissioned to conduct the demolition and work over the plant site. This would *inter alia* require establishment costs for the demolition and rehabilitation contractors and hence, the allowance of preliminary and general (P&Gs) in the cost estimate. Allowance has also been made for third party contractors and consultants to conduct post closure care and maintenance work, as well as compliance monitoring;
- Although the existing plant and related surface infrastructure could have a salvage or resale value at closure, this could not be determined and hence no cost off-sets due to possible salvage values were considered as part of this costing;
- Concrete footings and bases would be demolished to a maximum of 1 000 mm below the final surface topography;
- Fixed ratios for P&Gs (12 percent) and contingencies (10 percent) have been applied; and

- It is foreseen that demolition waste, such as concrete and building rubble, would be largely inert and can be disposed of at a local permitted landfill site. Steel and related material from the plant demolition which has salvage value will remain on-site for sale to third parties.

5.2 Site-specific

- As these are proposed new projects, it was assumed that no development and/or site disturbance has taken place; and
- It was assumed that all of the projects will start with development mid-2012.

6.0 UNIT RATES

Unit rates were obtained from the Golder's existing database and in consultation with demolition and earthworks contractors and rehabilitation practitioners. These key rates are included in Appendix C.

6.1 General surface shaping

It has been assumed that general surface shaping would be required over most of the areas where surface infrastructure has been removed as part of the overall surface rehabilitation. This includes the stockpiling of rubble to be removed and the final profiling of the surface afterwards to backfill small voids and allows free drainage of the site. For this purpose it has been assumed that shaping would involve the movement of material to an average thickness of about 500 to 750 mm. With an adopted dozing rate of R10.00/m^3, this equates to about R 50 000 to R75 000/ha.

6.2 Compaction alleviation

Allowance was made for a mid-sized dozer, equipped with 3 ripper tines, ripping to a depth of approximately 500 mm. A rate of R8 500/ha was estimated, based on the dozer ripping at a wet rate of R1 000/h.

6.3 Establishment of vegetation (general)

The unit rate for the establishment of vegetation on un-compacted growth medium/topsoil includes the amelioration of the soil by applying fertiliser and organic material, such as well cured cattle manure. It also includes cultivation and seeding, but excludes ripping to alleviate compaction. The vegetation would be grass species type/mix as specified by ecological specialist. A rate of R 12 500/ha was used.

6.4 Vegetation establishment on tailings dams

As per the current closure plan, it has been assumed that the vegetation on the tailings dam will be established directly in the tailings. This rate includes amelioration of the tailings by applying fertiliser and a high application of organic material such as well-cured cattle manure. The ameliorants is then worked into the tailings and the area is then seeded with the recommended seed mixture. A rate of R17 500/ha was adopted.

6.5 Surface water monitoring

It has been assumed that surface water quality monitoring has to continue at a quarterly frequency for at least five years post-closure.

If it is assumed that the above monitoring has to be conducted at least six (6) monitoring points and that it would take one (1) man-day to conduct the sampling at these points, this would equate to about R 4 800 per sampling event for professional fees. If an additional allowance is made for sample analysis for of R 1 500 per sample, this equates to an additional amount of R9 000. Allowing for disbursements, the amount could be rounded to R 15 000 per event or R60 000 per year.

6.6 Groundwater monitoring

It has been assumed that at least 6 groundwater monitoring boreholes would be required to reflect post-closure groundwater quality.

If it is assumed that one man-days would be required to conduct a monitoring event, this would equate to about R 15 000. Allowance has also been made for chemical sample analysis at a rate of R 1 500/sample, amounting to R 9 000 per sampling event. If approximately R 1 200 is added for travelling the cost will amount to R 15 000 per event. If sampling has to be conducted at least four times a year (quarterly), the annual cost would be R 60 000.

It has been assumed that groundwater monitoring around the tailings dam will have to continue for the period as long as the boundary control measures are maintained. Assuming that this is 30 years, the groundwater monitoring will have to continue around the tailings dam for 30 years post closure.

7.0 CLOSURE COST ASSESSMENT

The various sub-sections that follow are aligned to and should be read in conjunction with the closure cost schedules included in Appendix D. Assuming that no development has taken place for these new projects, the current or unscheduled closure costs for April 2011 was omitted as this will be zero (R0.00). Based on the available information, scheduled closure costs as well as a predicted ten (10) year forecast of the unscheduled closure during the first ten years after project approval has been granted, was calculated.

7.1 Infrastructural aspects

7.1.1 No 5 Tailings dam

Closure component	Closure cost assessment
General	■ Tailings dam No. 5 will be developed in three phases over a period of approximately 30 years. ■ Construction will start mid-2012. ■ All infrastructure for Phase 1 (excluding the tailings dam itself) will be constructed within the first year after construction started. ■ Based on the preliminary development schedule, it was assumed that only Phase 1 of the new No. 5 tailings dam will be developed within the first 10 years after development started. ■ Construction of Phase 2 will only commence mid-2022, or in the 11th year after Phase 1 construction started.
Dismantling of processing plant and related structures	■ Not applicable
Demolition of re-inforced concrete buildings and structures	■ All infrastructural components are included under the concrete buildings and structures item in the costing spreadsheets to ensure that the various components (brickwork, concrete and steel) of an individual structure are grouped together. ■ Infrastructure considered here includes pump stations, sumps and silt traps. ■ All infrastructure will be dismantled/ demolished.

Closure component	Closure cost assessment
	■ Concrete and foundations will be removed to depth of 1 m below ground level. ■ All metal and steel waste will be salvaged. ■ Allowance was made to plug two penstocks and the outfall pipeline at closure. ■ Allowance was made for the disposal of demolition waste. ■ General surface rehabilitation will be implemented on footprint areas.
Demolition of steel buildings and structures	■ All steel components are included under the concrete buildings and structures item in the costing spreadsheets to ensure that the various components (brickwork, concrete and steel) of an individual structure are grouped together. ■ Allowance is made only for the dismantling of steel structures but not for the disposal of the steel as it was assumed that all steel and metal waste will be salvaged. However the scrap value of the steel was not used as an offset for closure costs.
Demolition of offices, workshops and residential buildings	■ Not applicable.
Demolition and rehabilitation of railway lines	■ Not applicable.
Rehabilitation of access and haul roads	■ All access roads will remain to support post closure monitoring and maintenance.
River diversions	■ Not applicable.
Pipelines	■ Provision was made to remove all additional tailings delivery pipelines that link the existing infrastructure with the new No 5 tailings dam. ■ For the first 10 year forecast it was assumed that only the delivery lines for Phase 1 will have to be removed as the rest will only be constructed during years 11-12. ■ Provision was made to remove the return water pipelines from the Phase 1 return water dam up to the existing return water

Closure component	Closure cost assessment
	facilities. ■ The cost for the removal and disposal of the concrete plinths are included in the rate for the removing of the pipelines.
Fencing	■ The perimeter fence will remain post closure to support the end land use and management of the facility post closure.
Waste disposal	■ All demolition waste is inert and could be disposed of at a local permitted general waste site. ■ A nominal allowance was made for a haul distance of 50km.

7.1.2 Re-processing of the No. 1 and 2 tailings dam

Closure component	Closure cost assessment
General	■ Construction of infrastructure required for the re-processing project will start mid-2012. ■ The new processing plant and all related infrastructure will be constructed within one year after the project started part of phase 1 and if trial period is successful the equipment will be re-established to new position as part of phase 2.
Dismantling of processing plant and related structures	■ Assume that the new tailings processing plant will be located within the existing Minpro complex. ■ All aspects of the new processing plant are included under this item in the costing spreadsheets to ensure that the various components (steelwork, concrete and sheeting etc.) of an individual structure are grouped together. ■ The plant will be completely dismantled. ■ All metal and steel waste will be salvaged. ■ Provision was made to bring in a crane to assist with the dismantling process. ■ Eskom sub-stations were excluded from these calculations.

Closure component	Closure cost assessment
	■ Allowance was made for the disposal of demolition waste.
Demolition of re-inforced concrete buildings and structures	■ Infrastructure considered here includes the slurry sump and pump station at the tailings dam that is used to pump the slurry from the tailings dam site to the reprocessing plant. ■ All infrastructure will be dismantled/demolished. ■ Concrete and foundations will be removed to depth of 1 m below ground level. ■ All metal and steel waste will be salvaged. ■ Allowance was made to demolish the old penstock. ■ Allowance was made for the disposal of demolition waste.
Demolition of steel buildings and structures	■ All steel components are included under the concrete buildings and structures or processing plant items in the costing spreadsheets to ensure that the various components (brickwork, concrete and steel) of an individual structure are grouped together. ■ Allowance is made only for the dismantling of steel structures but not for the disposal of the steel as it was assumed that all steel and metal waste will be salvaged. However the scrap value of the steel was not used as an offset for closure costs.
Demolition of offices, workshops and residential buildings	■ Not applicable.
Demolition and rehabilitation of railway lines	■ Not applicable.
Rehabilitation of access and haul roads	■ Not applicable.
River diversions	■ Not applicable.