7.4.1.9 Noise

INTRODUCTION AND LINK TO ANTICIPATED IMPACT

Activities associated with a project have the potential to cause an increase in ambient noise levels in and around the site. This may cause a disturbance to nearby receptors. Potential receptor sites include the surrounding land owners/land users such as Bakubung Bush Lodge and Sun City, settlements including Phatsima, Ledig and Chaneng and schools/creches in the Lekwadi, Letlhabile and Serosecha sectors of Ledig. As a baseline, this section provides an understanding of existing conditions in the area from which to measure changes as a result of project-related noise.

DATA SOURCES

The information for this section was sourced from the approved EIA and BAR and the updated noise impact assessment (NIA) conducted for the project (Jongens Keet Associates (JKA), 2016; Appendix N).

RESULTS

Noise surveys

The measured noise levels (LAIeq equivalent noise level – 'average') around the mine area are in Table 7.26 and the noise climate adjacent to the main roads (Ldn Day-night equivalent) is in Table 7.27. The location of the sampling points is illustrated in Figure 7-24

TABLE 7.26: MEASURED NOISE LEVELS IN THE BPM STUDY AREA (JKA, 2016)

Site No	Location Description	Measured Sound Pressure Level (dBA) LAIeq	
		Daytime Period	Evening Period
1	At the Bakubung Mine entrance.	52.8	45.3
2	On the central southern portion of the Bakubung Mine property just north of the Elands River at borehole WF18	50.0	-
3	In the south eastern sector of Ledig Village (Kagiso Ext 2 sector)	49.7	-
4	In the north eastern sector of Ledig Village (Kagiso Ext 2 sector)	50.7	54.0
5	Eastern boundary of the Bakubung Mine property approximately 1.2 km south of R556	44.8	-
6	In the north western sector of Chaneng Village	45.7	50.4
7	In the north western sector of Ledig Village (Lekwadi sector) at a school in the south eastern quadrant of the R565 and R556 intersection	61.2	-
8	In the south eastern sector of Ledig Village (Lekwadi sector)	47.5	-
9	In the north western sector of Reagile informal settlement	55.3	-
10	In the south eastern sector of Phatsima Village	46.8	47.4
11	Along the southern boundary of Melani Game Ranch on access road and approximately 1.8 km west of R565	51.7	44.1
12	At the Sundown Ranch Hotel, east of the parking lot.	52.9	54.1

Site No	Location Description	Measured Sound Pressure Level (dBA) LAIeq	
		Daytime Period	Evening Period
	Approximately 90 m west of R565		
13	North of Elands River, 1.6 km south east of Phatsima Village, 5 km west of R565	48.8	-

TABLE 7.27: EXISTING NOISE CLIMATE ADJACENT TO THE MAIN ROADS NEAR THE BAKUBUNG MINE (JKA, 2016)

Offset (m)	Ldn at 25	Ldn at 50	Ldn at 100	Ldn at 250	Ldn at 500	Ldn at 1000	Ldn at 1500	Ldn at 2000	Ldn at 2500	Ldn at 3000	Ldn at 4000
R565N	61.7	58.7	55.5	51.1	47.3	42.8	39.7	37.5	35.6	34.2	31.7
R565S	66.1	63.1	59.9	55.5	51.7	47.2	44.1	41.9	40	38.6	36.1
R556	65	62	58.8	54.4	50.6	46.1	43	40.8	38.9	37.5	35
Phatsima	57.9	54.9	51.7	47.3	43.5	39	35.9	33.7	31.8	30.4	27.9

Following from the noise sampling, the main sources of noise in the area are from:

- Traffic on the R565, the R556 and Phatsima Road;
- The Pilanesberg Airport;
- Construction work at the Bakubung Mine; and
- Styldrift and Maseve Mines.

The existing noise climate alongside the main roads is degraded with regard to suburban residential living. Residences in some areas are negatively impacted from traffic noise (particularly at night) for up to the following distances from these roads:

- The R565 (North of R556) - 300 metres.
- The R565 (South of R556) - 550 metres.
- The R556 (East of R565) - 550 metres.
- Phatsima Road - 140 metres.

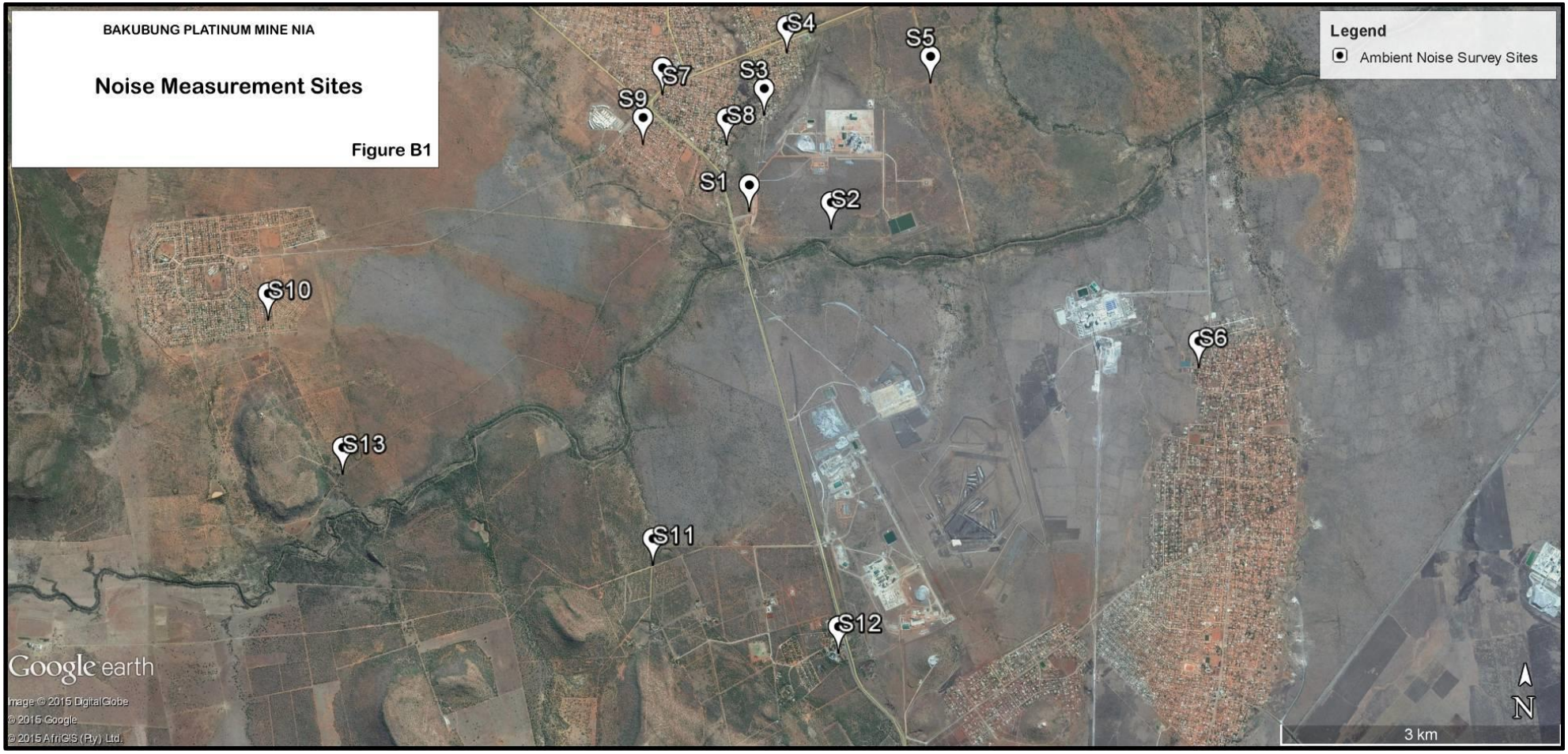
SANS 10103 indicates ambient noise level should not exceed 50 dBA for daytime periods and 40 dBA for night-time periods. The residual (existing background) noise levels are relatively low (quiet) in the areas of Ledig Village that are not close to and are relatively shielded from the main roads. Daytime ambient conditions range from about 45dBA to 62dBA. Evening conditions range from about 44dBA to 54dBA. Similar conditions occur in Phatsima Village and in the Reagile informal settlement.

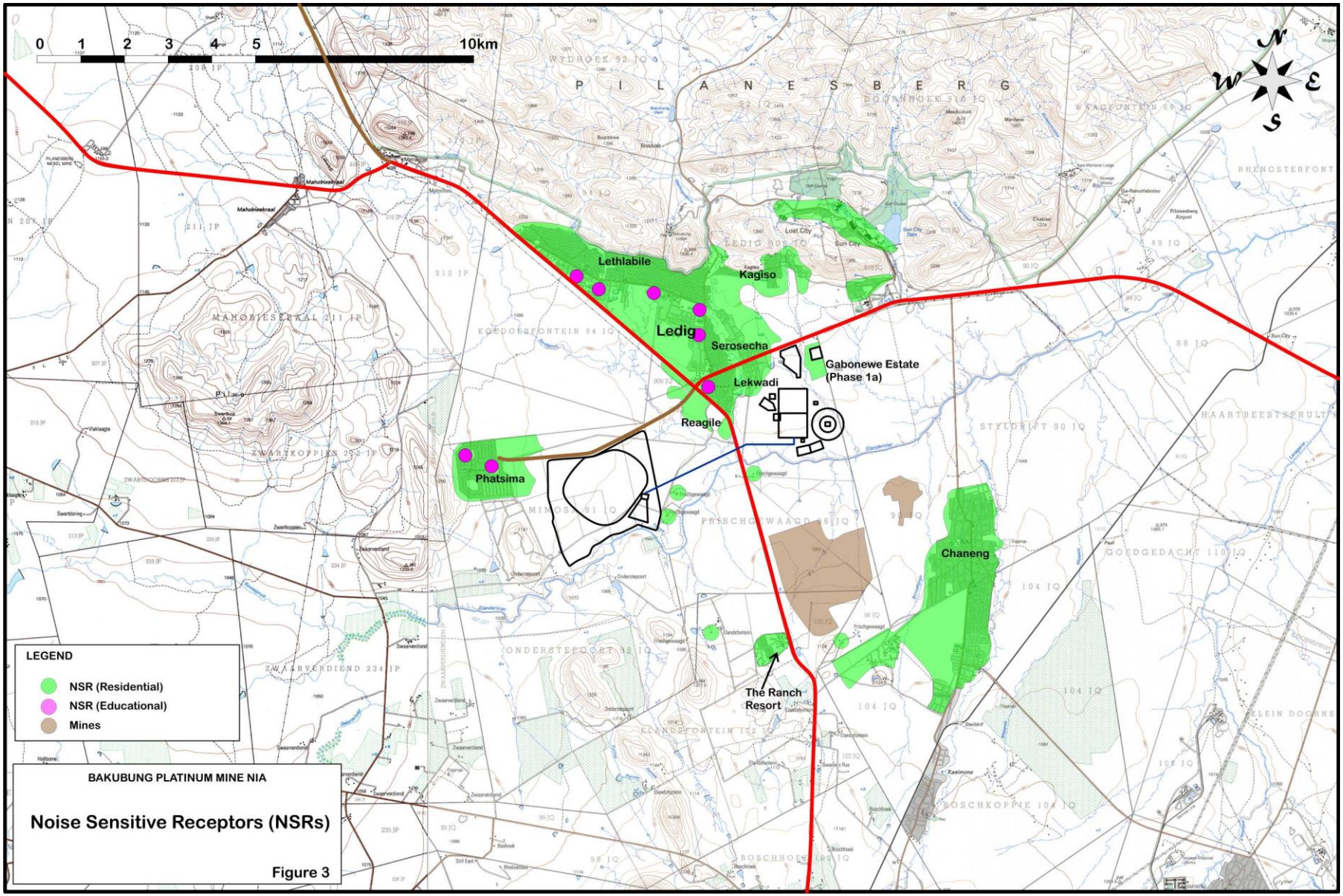
In general the residual noise levels in the undeveloped areas south and south-east of Lekwadi and Kagiso (east of Road R565) and areas to the south of Phatsima and Reagile (west of Road R565) are low (very quiet). The noise levels are typically representative of a rural farming area, namely where the average daytime noise levels do not exceed 45dBA and the night-time levels do not exceed 35dBA. Actual night-time noise levels fall to 30dBA and less. The noise levels at the school in the

south-eastern quadrant of the intersection of Roads R556 and R565 are significantly higher than those desirable for educational facilities which should not exceed 50dBA (outdoor) and 40 dB (indoor) and which were measured at an average of 61.2dB.

Potential noise sensitive receptors

The noise sensitive receptors around the project area are shown in Figure 7-25.


BAKUBUNG PLATINUM MINE NIA
Noise Measurement Sites
Figure B1
Legend
Ambient Noise Survey Sites
S1
S2
S3
S4
S5
S6
S7
S8
S9
S10
S11
S12
S13
Google earth
Image © 2015 DigitalGlobe
© 2015 Google
© 2015 AfriGIS (Pty) Ltd.
N
3 km


0 1 2 3 4 5 10km
N
W
E
S
Lethlabile
Kagiso
Ledig
Serosecha
Lekwadi
Reagile
Phatsima
Gabonewe Estate
(Phase 1a)
Chaneng
The Ranch
Resort
LEGEND
NSR (Residential)
NSR (Educational)
Mines
BAKUBUNG PLATINUM MINE NIA
Noise Sensitive Receptors (NSRs)
Figure 3

CONCLUSION

The proposed project has the potential to contribute to disturbing noise levels within and surrounding the project area. It is however important to note that activities associated with surrounding land uses (Maseve and Styldrift mines and the Pilanesberg airport) including traffic along the R565, R556 and Phatsima Road contribute to the existing noise climate. Construction activities at BPM are also indicated by the specialist to contribute to ambient noise levels. Any further increase in ambient noise levels may influence nearby potential noise receptors. Careful planning should therefore be taken into consideration for the proposed project in order to minimise increasing disturbing noise levels.

7.4.1.10 Visual aspects

INTRODUCTION AND LINK TO ANTICIPATED IMPACT

Mining related activities have the potential to alter the landscape character of a site and surrounding area through the establishment of both temporary and permanent infrastructure. As a baseline, this section provides an understanding of the visual aspects (such as landscape character, sense of place, scenic quality, and sensitive views) of the area against which to measure potential change as a result of project infrastructure and activities.

DATA SOURCES

For the approved mine EIA, a specialist study was conducted by MetroGIS (Pty) Ltd (2007). This information has been updated by SLR for the purposes of this study.

RESULTS

Landscape character

The topography of the Frischgewaagd and Mimosa areas is generally flat with moderate slopes leading down to the Elands River in the southern parts. The area is characterised by semi-industrial mining-related activities, agriculture and conservation.

The natural environment within and around the mining right area has been extensively disturbed by past and current mining and agricultural activities. As such, mining activities and specifically residue facilities have become an integral part of the landscape's topographical features and character.

The landscape around the project area (within 5 km of the project area was assessed) includes mountains and ridges, river channels and undulating slopes. The major topographical feature is the Pilanesberg Mountain Range. The foothills lie approximately 1.3 km north of the plant area. The Elands River which flows south of the project area is approximately 50 m from the Frischgewaagd property border and an unnamed tributary of the Elands River flows on the eastern edge of the plant and between the Phase 1 and Phase 1a housing areas. There are various ephemeral drainage lines and channels and wetlands around the project area.

The area is characterised by transformed secondary vegetation and natural vegetation. Prior to the commencement of mining operations and fencing of the future TSF area, the areas where there is secondary vegetation experienced heavy grazing and browsing by domestic livestock and were frequently burnt which impacted the landscape characteristics. Heavy grazing and cultivation has also taken place within the ephemeral drainage line catchments (De Castro and Brits, 2016a)

Sense of place

The BPM is located within a 'mining belt' with various mines being located south east of the project area, east of the R565. To the north, the Pilanesberg Mountain Range dominates the skyline at an approximate height of 160 m from base to top. Isolated ridges between 80 m and 100 m occur to the south and to the east. There are also residential features in the landscape.

The fact that the project components will take place within the current BPM operations and the existence of the immediately surrounding mining activities, gives the area where project-related infrastructure is located a relatively weak sense of place (when the viewer is within the 'mining belt'). The TSF area is further west than the 'mining belt' with it being west of the R565. However, seen in context with the site contained by distant hills and ridges and the Pilanesberg Mountain Range which 'soften' the harsh nature of the mining activities (when the viewer views the area from outside the 'mining belt'), the larger area has a stronger sense of place.

Scenic quality / Visual resource value

The scenic quality is linked to the type of landscapes that occur within an area. The landscape quality of the study area can be divided into the following distinct categories in the local context:

- The mountains and ridges have a very high visual quality due to the steep slopes and isolated ridges that dominate the skyline.
- The river channels were rated have a high visual quality due to moderate steep slopes and trees.
- The visual quality of the undulating slopes has a medium visual quality.
- The vegetation, although mostly degraded and overgrazed, provides a visual buffer for the current landscape and is has a medium visual quality.
- The surrounding communities and industrial developments are progressively expanding and their presence decreases the overall visual quality of the area.
- Apart from the human activities, the remainder of the area is mainly covered by vegetation. These areas have moderate to steep slopes and are covered with trees in varying densities therefore giving them a visual quality rating of high
- The visual quality of the area varies between low to very high due to the diversity of land use activities. Although the visual quality of the surrounding communities is low, the views of mountains and surrounding open space creates a sense of peace. Views of site to the south and east were noted. The visual quality of the mining and associated industries on the periphery of

the project area was rated as low due to the distance from the site and the screening effects of buildings and trees. The specialist gave an average rating of medium for visual quality of the area.

Visual receptors

When viewed from the perspective of tourists and farmers within the area, mining activities could be associated with a sense of disenchantment. People who benefit from the mine and proposed project (employees, contractors, service providers etc.) may not experience this disenchantment but rather see the mine with a sense of excitement and anticipation. While some residents may see the benefit of the mine, the specialist allocated a high sensitivity as the possibility of high visual receptors within the community needed to be taken into account. Phatsima, Chaneng and Ledig were considered to be receptors with high sensitivity. The R565 and R556 are the main access roads to Sun City and are frequently travelled by tourists; these roads and Sun City are considered to have very high sensitivity. The sensitive viewers are a combination of tourists and land owners / land users on surrounding farms.

CONCLUSION

The landscape character and quality of the visual resource has been altered by various land uses including mining operations at and around BPM. Views from residential areas as well as tourism areas have been altered since the establishment of the approved mine in 2010 and will alter as the approved infrastructure development progresses. Further disturbance by the addition of the project components needs to be minimised through appropriate design and implementation of mitigation measures.

7.4.1.11 Heritage/cultural and paleontological resources

INTRODUCTION AND LINK TO ANTICIPATED IMPACT

Various natural and cultural assets collectively form the heritage. Heritage resources (cultural resources) include all human-made phenomena and intangible products that are the result of the human mind. Natural, technological or industrial features may also be part of heritage resources, as places that have made an outstanding contribution to the cultures, traditions and lifestyles of the people or groups of people of South Africa.

Mining related activities have the potential to disturb both the ground surface (through establishment of infrastructure) as well as soils and rock layers below the surface (through excavations for foundations). In this regard, heritage and palaeontological resources could be disturbed or destroyed. As a baseline, this section identifies the presence of heritage and palaeontological resources and their conservation significance.

DATA SOURCES

Information in this section was sourced from the heritage study conducted by PGS (2016; Appendix Q). A paleontological desktop study was conducted by PGS. A desktop assessment was considered adequate for this study.

RESULTS - HERITAGE

Heritage resources identified in the study area, including approved mine areas, are summarised in Table 7.28. The most important heritage resources discovered in the area were cemeteries, graves and stone cairns which might be graves according to the specialist.

Of relevance to the project components are MHC003, MHC005, MHC018, MHC019, MHC020, MHC021, MHC025, MHC026 and MHC027. Their location in relation to project components is provided in Table 7.28.

Of the identified sites, the identified graves, possible graves and cemeteries have a high significance level as graves and burial grounds have high levels of emotional, religious and historical significance. Graves and burial grounds fall under various legislative protections, depending on factors such as where the graves are located as well as their age. These sites will require careful consideration and particular mitigation to ensure the dignity of the remains are kept intact.

As part of the approved project, permits were received for the destruction/mitigation of two sites. These sites have been included below for completeness (MHC002 and MHC004).

TABLE 7.28: HERITAGE RESOURCES IDENTIFIED AT BAKUBUNG MINE (PGS, 2016)

Site	Disturbed by approved activities	Disturbed by new project components	Study footprint location	Description	Significance Level
Iron /Middle Iron Age /Early Stone Age					
MHC001	No	No	-	Iron Age site comprising an open scatter of slag and undecorated ceramics.	Low/Medium
MHC003	Yes	No	Explosives magazine	Iron Age site comprising lower grinders, hut dagga (with pole impressions) as well as ceramics.	Medium
MHC005	Yes	No	Security office	Iron Age site comprising a low concentration of undecorated ceramics.	Low
MHC012	No	No	-	Iron Age site comprising upper grinding stones as well as decorated and undecorated ceramics.	Medium
MHC013	No	No	-	Iron Age site comprising decorated and undecorated ceramics as well as upper grinding stones and hut dagga.	Medium

Site	Disturbed by approved activities	Disturbed by new project components	Study footprint location	Description	Significance Level
MHC015	No	No	-	Iron Age site comprising five circular hut structures with verandas associated with a grain bin foundation and two cooking huts. All structures from the site are marked by a single row of upright stones. Associated cultural material includes hut dagga remains and undecorated ceramics.	Medium
MHC019	No	Yes	Phase 1a housing	Iron Age site comprising a low concentration of undecorated ceramics.	Low
MHC020	No	Yes	Phase 1a housing	Iron Age site comprising decorated and undecorated ceramics, upper and lower grinding stones and hut dagga.	Medium
MHC022	No	No	-	Iron Age site comprising undecorated ceramics and a broken lower grinding stone.	Low
MHC023	No	No	-	Iron Age site comprising undecorated ceramics and a broken lower grinding stone.	Low
MHC010	No	No	-	Possible Iron Age site comprising a circular hut foundation structure associated with what appears to be a grain bin structure. Undecorated ceramics were also identified.	Medium
MHC002	Yes	No	Explosives magazine	Middle Iron Age site comprising lower grinders, hut dagga (with pole impressions), Madikwe type pottery and Early Stone Age lithics.	Medium
MHC004	Yes	Yes (changes within an approved footprint)	Concentrator area	Possible Middle Iron Age site comprising two possible grain bin stands and a low concentration of undecorated ceramics.	Low
MHC006	No	No	-	Middle Iron Age site comprising lower grinders, hut dagga (with pole impressions) as well as decorated (Madikwe) and undecorated ceramics.	Medium
MHC008	No	No	-	Middle Iron Age site comprising lower grinders, slag, a possible midden as well as decorated (Madikwe) and undecorated ceramics.	Medium
MHC018	No	Yes	Eskom/Ledig Substation	Middle Iron Age site comprising decorated (Madikwe) and undecorated ceramics, lower grinding stones and hut dagga.	Medium
MHC011	No	No	-	Possible Late Iron Age site comprising a low concentration of undecorated ceramics as well as several disturbed stone circles.	Low

Site	Disturbed by approved activities	Disturbed by new project components	Study footprint location	Description	Significance Level
Historic/recent site					
MHC009	No	No	-	Historic to Recent site comprising four rectangular stone foundation structures and one circular hut. A lower grinding stone and undecorated ceramics were also identified.	Medium
MHC027(B)	No	Yes	Return water dam	Rectangular structure which may have been a reservoir.	Low
Graves and cemeteries					
MHC007	No	No	-	Three stone cairns are located here which may be graves.	High
MHC014	No	No	-	The site comprises a single stone cairn, which might be a grave.	High
MHC016	No	No	-	The site comprises three stone cairns, which might be a grave.	High
MHC017	No	No	-	Modern cemetery consisting of approximately 90 graves was identified here.	High
MHC021	Yes	No	Phase 1 housing	The site comprises a single stone cairn, which might be a grave (this has been fenced off).	Medium
MHC024	No	No	-	An extensive modern cemetery was identified here.	High
MHC025	No	Yes	TSF pipeline route	Two possible graves, with no cultural material or formal headstones present.	Medium/High
MHC026	No	Yes	Return water dam	Three possible graves, with no cultural material or formal headstones present. However, a broken lower grinding stone was observed on the eastern end of one of the possible graves.	Medium/High
MHC027(A)	No	Yes	Return water dam	Two rectangular foundation structures of stone and brick were identified here. An associated glass bottle dates the site to the recent past (possibly the 1960s). The possibility exists for stillborn babies to be buried in unmarked graves in association with the structures.	Medium/High
MHC027(C)	No	Yes	Return water dam	A rectangular structure was identified here. Several glass fragments associated with the structure dates it to the recent past. The possibility exists for stillborn babies to be buried in unmarked graves in association with the structure.	Medium/High

Site	Disturbed by approved activities	Disturbed by new project components	Study footprint location	Description	Significance Level
MHC027(D)	No	Yes	Return water dam	A rectangular stone foundation structure was identified here. Several glass fragments associated with the structure dates it to the recent past. The possibility exists for stillborn babies to be buried in unmarked graves in association with the structure.	Medium/High
MHC027(E)	No	Yes	Return water dam	Three possible graves, with no cultural material or formal headstones present.	Medium/High
MHC027(F)	No	Yes	Return water dam	A rectangular stone foundation structure was identified here. The possibility exists for stillborn babies to be buried in unmarked graves in association with the structure.	Medium/High
MHC027(G)	No	Yes	Return water dam	A rectangular stone foundation structure was identified here. The possibility exists for stillborn babies to be buried in unmarked graves in association with the structure.	Medium/High

RESULTS – PALAEONTOLOGICAL RESOURCES

The study area was found to be within a grey area on the Palaeontological Sensitivity Map of South Africa indicating that the area has no significant/zero palaeontological significance. Therefore, no desktop study was required.

Conclusion

Heritage resources of high significance have been identified within the study area and will be affected by approved and new infrastructure.

Resources of medium/high significance (graves and cemeteries) occur within the return dam area, the TSF pipeline route and the Phase 1 housing area (fenced off). These sites are important in terms of emotional, religious and historical significance and are protected by national legislation. Any disturbance of these sites requires the necessary permits and further assessment work.

Although no paleontological resources are expected within the study area, these resources are protected by national legislation and must be reported to the South African Heritage Resources Agency (SAHRA) should they be identified on-site.

7.4.1.12 Road and Traffic Conditions

INTRODUCTION AND LINK TO ANTICIPATED IMPACT

Traffic from mining developments has the potential to affect the capacity of existing road networks as well as result in noise, air quality and public road safety issues. This section provides an overview of the current road network, conditions and road use. Understanding the layout, use and conditions of transport systems relevant to the proposed project site provides a basis for understanding a change as a result of project contributions.

DATA SOURCES

The information for this section was sourced from the traffic impact assessment conducted by WSP Group Africa (Pty) Ltd (WSP 2016; Appendix O). A separate traffic impact assessment (TIA) was conducted for the Gabonewe Estate housing (Mott MacDonald, 2014 and 2015 (2015 was an addendum to 2014)). The WSP assessment took this assessment into consideration as part of their reporting.

The study comprised sourcing relevant data from a site inspection of the existing road network, traffic counts, calculations and reference to relevant traffic impact assessment guideline documents.

RESULTS

The Bakubung Mine is located south of the R556 on both sides of the R565. Access to the mine is and will remain approximately 1.5km south of the intersection of the R565 and R556. Currently access to the TSF is approximately 1.5km south of the mine access to the west of the R565 (Figure 7-26)

The access to the mine has already been constructed as a T-junction with priority stop control on the access road. Short turning lanes have been provided for both left and right turn movements into the mine. A short acceleration lane has also been provided for vehicles exiting the mine in the southbound direction.

A schematic diagram of the existing intersection and number of lanes for each road is shown below in Figure 7-27. The Gabonewe TIA suggested that the road be upgraded to add an additional approach lane to the north-eastern approach, separating the through and right turning movements (shown in red in Figure 7-28). The speed limit of the R556 varies between 60km/h and 120km/h along the section east of its intersection with the R565. The speed limit at the intersection is indicated as 60km/h.

The average traffic volumes conducted along the R565 are shown in Table 7.29. Peak-hour traffic counts (AM – 06:00-07:00 and PM – 17:00-18:00), between Ledig and the mine access are shown in

Table 7.30. The peak-hour traffic flow at the relevant intersections shows a general increase in traffic volumes during the evening (PM) peak period. An annual growth rate of 3% was assumed for background traffic.

TABLE 7.29: AVERAGE TRAFFIC VOLUMES ALONG THE R565 (WSP, 2016)

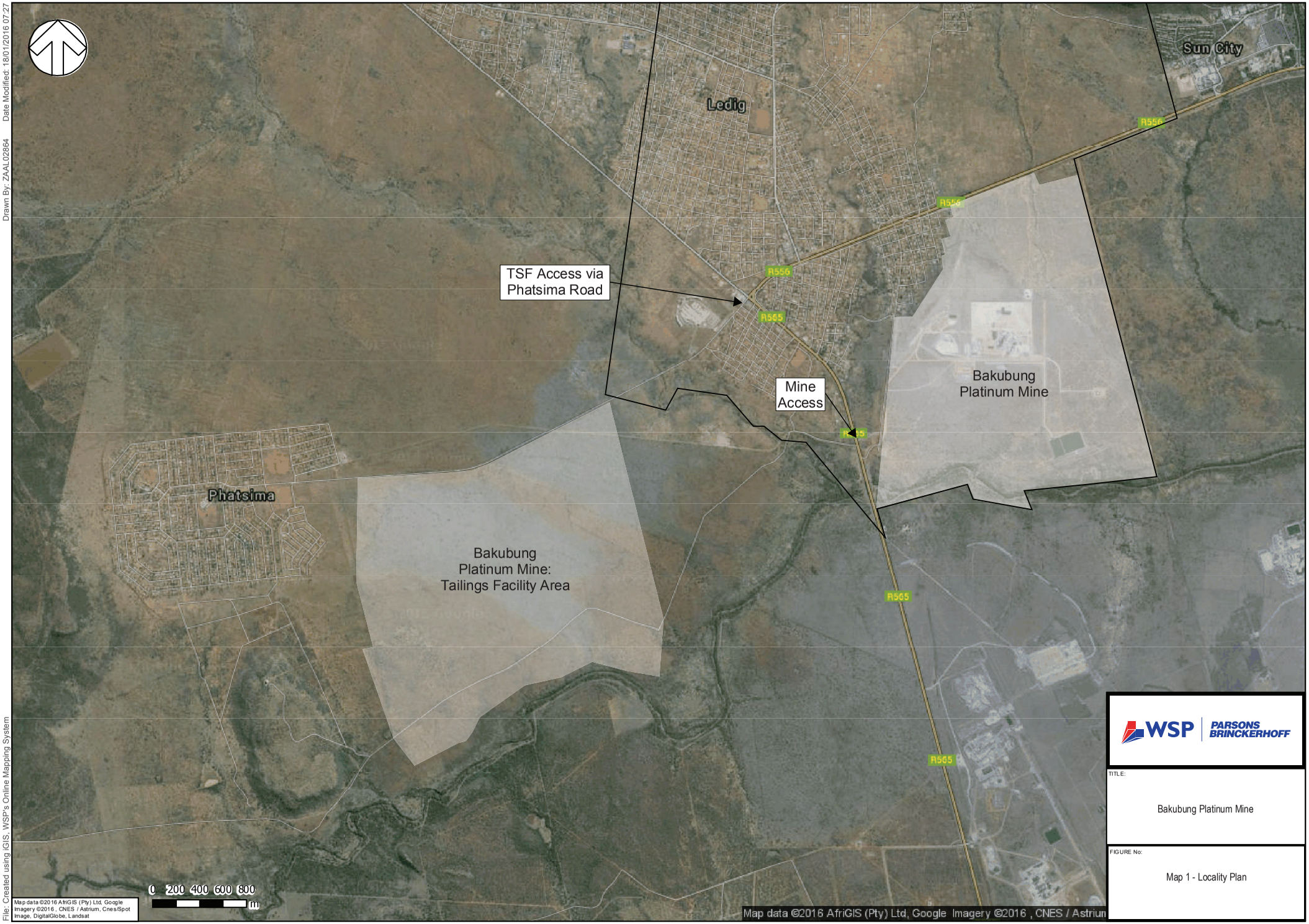
Vehicle Classification	Northbound	South Bound	Both Direction
Light	3521	3349	6870
Heavy	319	469	785
All	3837	3718	7654

TABLE 7.30: PEAK TRAFFIC VOLUMES FOR THE 565 AND ACCESS INTERSECTION AND THE R565 AND R556 INTERSECTION (WSP, 2016)

Intersection	AM peak		PM peak	
	Time interval	Number of vehicles	Time interval	Number of vehicles
R565 and Access	06:00 – 07:00	569	17:00 – 18:00	714
R565 and R556	06:00 – 07:00	680	17:00 – 18:00	896

The TIA indicated that the level of service (LOS) of the existing road network for AM peak hours ranged between reasonably free flow (LOS B) and approaching unstable flow (LOS D). For the PM peak hours the level of service ranged between reasonably free flow to unstable flow (LOS E) (LOS E was for two of the turning lanes). LOS A represents the best operating conditions and LOS F represents the worst. With the proposed project, the LOS levels for the two turning lanes that are currently LOS E, become LOS F which is forced/breakdown of flow. The LOS during peak hours can be decreased with the introduction of a roundabout improving the LOS to LOS A and LOS B.
It should be noted that the LOS of the roads will be LOS F even without the mine, though the mine will contribute to the lowered LOS.

In terms of road condition, both the R556 and the R565 appear to be generally in a good condition and evidence of maintenance measures were observed, especially along the R556.



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File: Created using iGIS, WSP's Online Mapping System

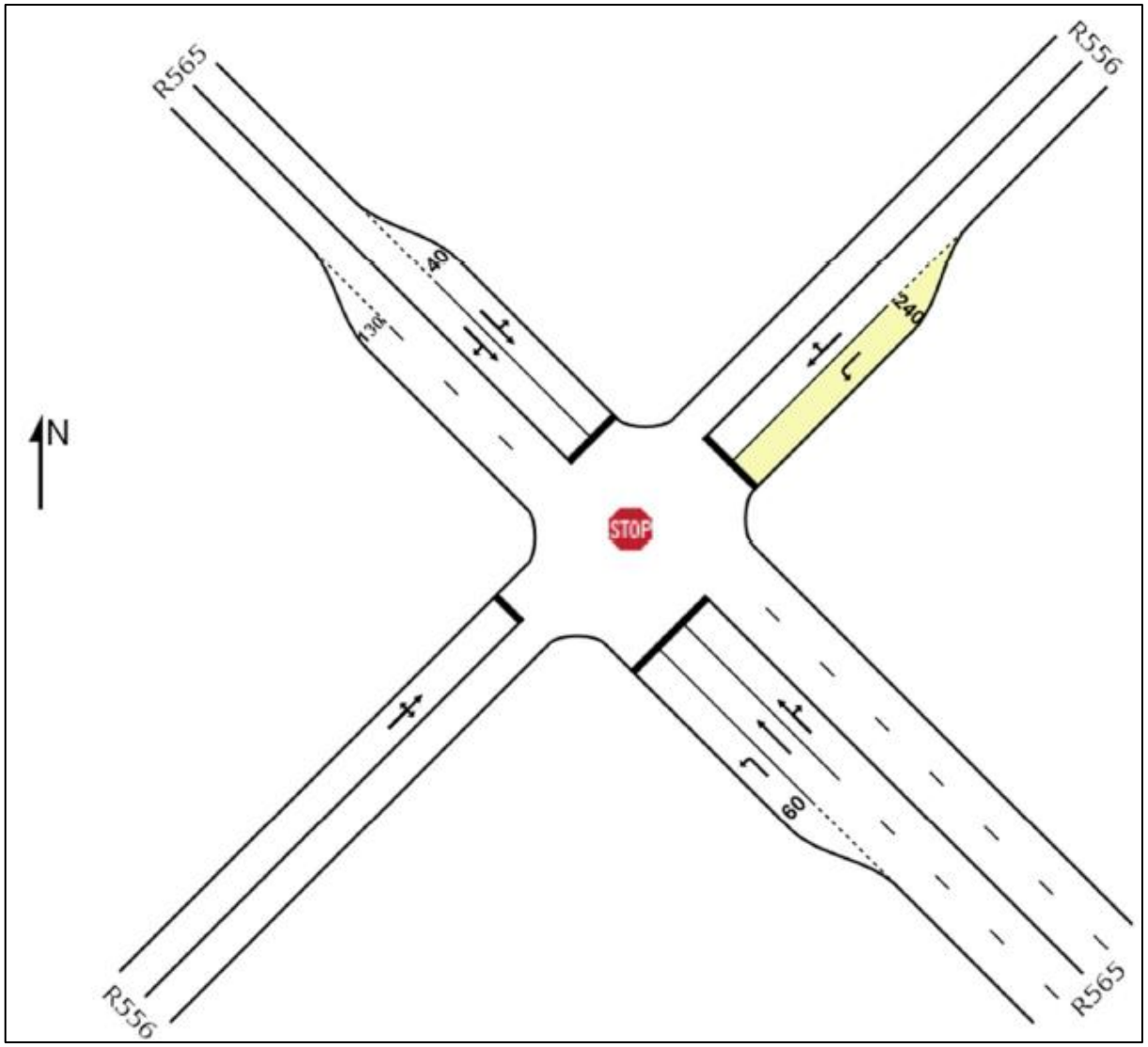
WSP | PARSONS BRINCKERHOFF

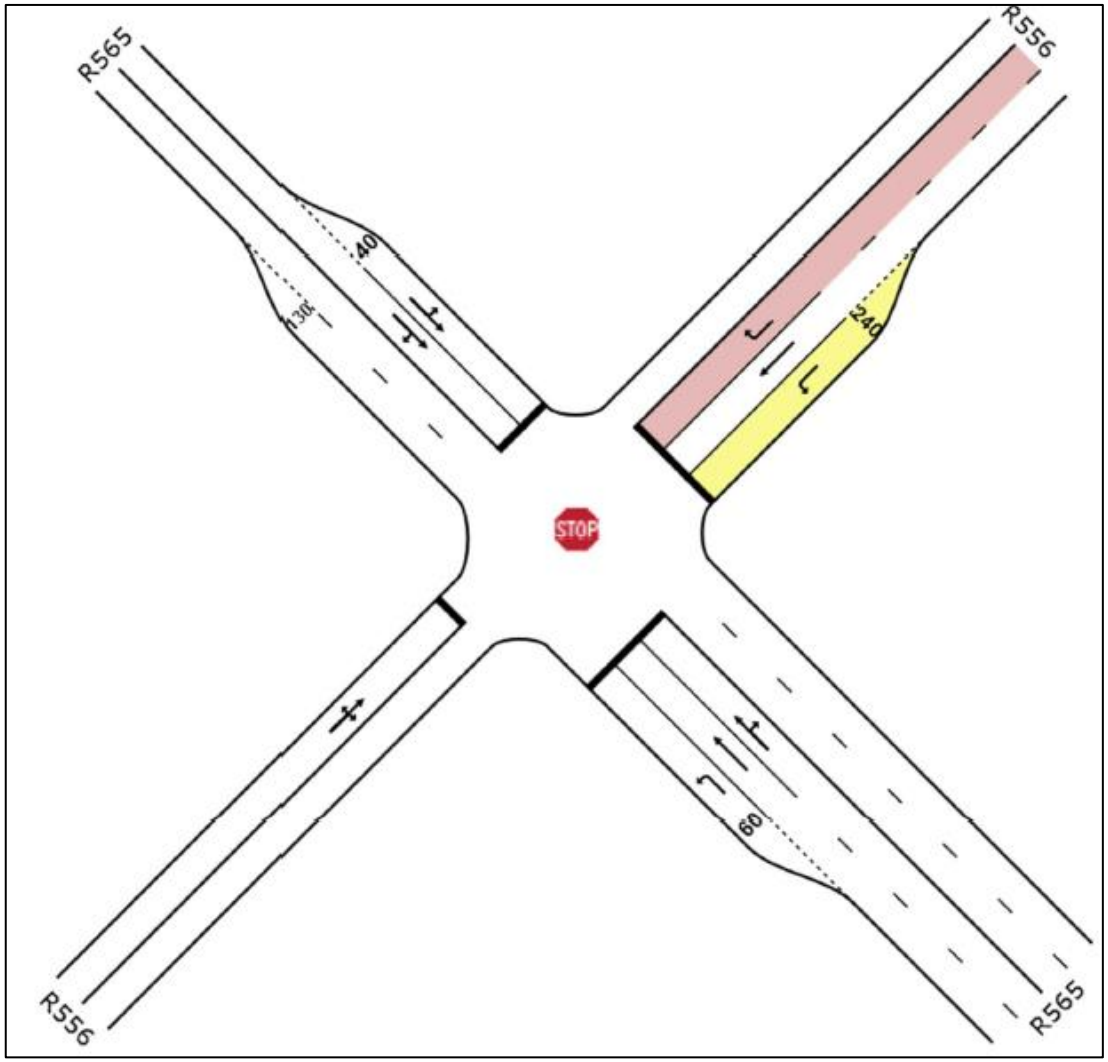
TITLE:

Bakubung Platinum Mine

FIGURE No:

Map 1 - Locality Plan


R565
R556
40
130'
240
N
STOP
R556
60
R565


R565
R556
40
130
240
STOP
60
R556
R565

CONCLUSION

With the current traffic volumes and level of service, improvements to the road network need to be considered for the proposed project. The Gabonewe TIA recommended that the intersection be upgraded to add an additional approach lane to the north-eastern approach, separating the through and right turning movements. There is a further recommendation to convert the intersection into a roundabout improving the LOS of the intersection.

7.4.1.13 Socio-economic

INTRODUCTION AND LINK TO ANTICIPATED IMPACT

Mines have the potential to result in both positive and negative socio-economic impacts. The positive impacts are usually economic in nature with mines contributing directly towards employment, procurement, skills development and taxes on a local, regional and national scale. In addition, mines indirectly contribute to economic growth in the local and regional economies because the increase in the number of income earning people has a multiplying effect on the trade of other goods and services in other sectors.

The negative impacts can be both social and economic in nature. In this regard, mines can cause:
Influx of people seeking job opportunities which can lead to increased pressure on basic infrastructure and services (housing, health, sanitation and education), informal settlement development, increased crime, introduction of diseases and disruption to the existing social structures within communities
A change to not only pre-existing land uses, but also the associated social structure and meaning associated with these land uses and way of life. This is particularly relevant in the closure phase when the economic support provided by mines ends, the natural resources that were available to the pre-mining society are reduced, and the social structure that has been transformed to deal with the threats and opportunities associated with mining finds it difficult to readapt.

DATA SOURCES

The information for this section was sourced from the socio-economic impact assessment that was conducted for this project by Kerryn Desai (2016; Appendix P) and the approved EIA and BAR.

RESULTS

<u>Governance</u>

There is a dual system of governance in the Province, the political and traditional structure of governance. The project area falls within the jurisdiction of the Rustenburg and Moses Kotane local municipalities (RLM and MKLM respectively) of the Bojanala District Municipality (BDM). The TSF area falls within the RLM and the Plant area falls within the MKLM. The people living in the project area, most specifically Ledig, are the Bakubung-Ba-Ratheo. The leadership structure of the Bakubung-Ba-Ratheo consists of the Royal Family, Heads of Clans and the Traditional Council.

Population

In 2011 the population of the BDM was 1 507 505 with a growth rate of ~2.4% per annum. The RLM has the largest population in the district with approximately 46% of the district's population, with the MKLM having approximately 21%.

The population density is highest in RLM with 161 persons/km^2, with MKLM having only 42 persons/km^2. The lower density in MKLM can be attributed to the area being predominantly rural in nature with land primarily being managed via communal land tenure, with 92% of the settlements being located on tribal/ traditional land. In RLM only 30% are located on tribal land with 68% of settlements being located in urban areas.

The Project area has a young population, with RLM having the higher working-age population between 15 and 64 (Table 7.31).

TABLE 7.31: AGE COMPOSITION OF THE PROJECT AREA

Age	BDM	MKLM	RLM
0-14	26%	29%	24%
15-64	68%	63%	73%
65+	5%	8%	3%

The dominant language in the MKLM is Setswana followed by isiZulu, isiXhosa and English. In the RLM the dominant language is Setswana followed by Afrikaans, isiXhosa and Tsonga.

Basic services

Health

Health care services are available at a community level as well as in the local municipality centres i.e. Madikwe and Rustenburg. The Provincial hospital is located in the capital, Mahikeng. There are local clinics also available located in Ledig and Phatsima and despite the low standards and lack of adequate resources, approximately 70% (of respondents of a 2007 survey) make use of the local clinics with only 6% going to the provincial hospital.

Infrastructure and services

Households in the BDM seem to lack access to most basic infrastructure, most notably water and flush toilets. Table 7.32 below shows household access to basic infrastructure and services for the BDM, MKLM and RLM.

TABLE 7.32: HOUSEHOLD ACCESS TO BASIC INFRASTRUCTURE AND SERVICES

Services / Infrastructure	BDM	MKLM	RLM
Formal housing	69%	78%	69%
Water inside dwelling and < 200m from house	79%	81%	84%
No access to piped water	8%	7%	6%
Electricity for lighting	84%	83%	91%
Flush toilets	33%	12%	53%
Weekly refuse removal	49%	81%	70%

The 2008 SIA indicated that in the local communities, nearly 6% of households in Phatsima have access to water inside their homes and the remaining 94% had access to water in their yards. In Ledig, nearly 6% of the households have no access to water, approximately 58% have water available in their yards, approximately 23% have taps in their homes and approximately 10% have both hot and cold taps in their homes. In Ledig, half the households reported that water supply is unreliable and generally problematic, while nearly 85% reported that the quality is good.

In the local areas, 11% of respondents had flush toilets; the majority of households have pit latrines. In Ledig, 87% of households use pit latrines.

Electricity is used for cooking, lighting and heating. Paraffin, gas, wood and candles are used as alternate fuel sources. In Ledig, nearly all households (approximately 96%) make use of electricity for cooking. Electricity supply is considered to be poor by over 50% of the population.

Education

Between 2006 and 2010 the level of education and literacy increased in the BDM with the functional literacy rate being approximately 74% in 2010. Approximately half of the adult population in the BDM have completed some secondary schooling, including grade 12. The RLM has the highest functional literacy in the DBM (78%) and generally has higher levels of education than the MKLM. In RLM, approximately 67% of the population have some secondary education and/ or have completed Grade 12, compared to 62% in MKLM. Only 9% and 5% of the population have completed a higher education in the RLM and MKLM respectively. The differences in literacy rates of the two Local Municipalities may be attributed to their respective levels of urbanisation and employment opportunities.

Economic profile

Sector services

In 2013 the regional gross domestic product (GDP) of the North West Province (NWP) equated to over 5% of the national economy. The GDP growth rate for the province was lower at 1.6% when compared to the national growth rate of 1.9%.

The major provincial export products are gold, diamonds, platinum and other metals and minerals, machinery and equipment. Mining is a primary sector driving the economy contributing over 30% to the economy in 2010. NWP's mining contributed approximately 16% to the mining GDP in South Africa. The Province contributes 50% of the world's platinum, as well as gold, diamonds, chrome, vanadium, granite, slate, limestone, dimension stone, nickel, silica, manganese, fluorspar, zinc and andulasite. Therefore, the economic, social and physical characteristics of the greater project area, which includes the BDM, are largely determined by the dominant mining sector.

The project area is located in the Bushveld Complex which is one of the most heavily mineralised areas in the world, with the largest platinum producing mines in the world. In 2011, the 95 mines in the NWP

accounted for 25% of the provincial employment. Following mining, community services, trade, finance and transport were the next most economically dominant sectors, which were boosted by mining sector activities. While not necessarily being the highest revenue contributors, agriculture, manufacturing, tourism, services and green economy also play an important role in the local economy.

Employment levels

The unemployment rate in the NWP in 2013 was 26% with the national rate being 25.5%.

There are high levels of unemployment in the areas surrounding the project site. In the BDM the unemployment rate is approximately 31%, 38% in MKLM, and 26% in RLM. Youth unemployment is higher at 39% in BDM and 47% and 35% in MKLM and RLM, respectively. At community level, the communities of Ledig and Phatsima offer few employment opportunities. A skills audit conducted by BPM in 2006 found that 42% of Ledig's economically active population are unemployed.

Sector employment

The 2012-2017 IDP (2006) indicated that at district level the largest employer is the mining sector accounting for 43% followed by trade at 15.4%, community services at 13.6% and manufacturing at 6.1%. Of the employed population, males are the most dominant with 97% and only 3% being females, with the exception of people employed in private households and community sector jobs.

At a community level, in Ledig and Phatsima, the tourism and hospitality industry is the primary employer (approximately 43%); Sun City provides approximately 80% of all hospitality industry and tourism jobs in the communities. Construction and mining are the next largest sources of employment at 9% and 8%, respectively.

CONCLUSION

When considering the socio-economic environment the statistical data reflects a community where there is unemployment, pressure on basic infrastructure and services and pressure on delivery of basic services. The project has the potential to impact on these either positively or negatively although the amended activities will not be as significant as the approved mine. The aim of any project should be to enhance these positives and minimise the potential negatives.

7.4.1.14 Current land uses

INTRODUCTION AND LINK TO ANTICIPATED IMPACT

Mining projects have the potential to influence current land uses both on the site (through loss) and in the surrounding areas (through direct or secondary positive and/or negative impacts). As a baseline, this section outlines pre-mining land uses, land tenure including surface and prospecting/mining rights (both on the site and in the surrounding area), describes the land uses on site and in the surrounding area, and identifies third party service infrastructure. This section provides the context within which potential impacts on land uses and existing economic activity will be felt.

DATA SOURCES

The information for this section was sourced from approved EIA and EMP as well as specialist studies including the social impact assessment (Desai, 2016) and the heritage impact assessment (PGS, 2016).

RESULTS – SURFACE RIGHTS

Properties within the mining rights area are owned by the mine and a number of individuals/entities (Table 7.33). The project components will be located within the existing mining rights area. For project areas where there will be project infrastructure, the property is owned by either Wesizwe (TSF area) or the *Bakubung-Ba-Ratheo Tribe* (Plant and pipeline area). BPM has a lease for the plant area owned by the *Bakubung-Ba-Ratheo* Tribe and has permission to utilise the area where the pipeline is to be located.

TABLE 7.33: SURFACE RIGHTS OF PROPERTIES AFFECTED BY THE PROPOSED PROJECT

Note: This table does not represent all interested and/or affected parties (IAPs) registered on the IAP database but gives an indication of land ownership within the mining rights area.

Farm Name	Farm Portion Number	Owner	Title Deed Number
Frischgewaagd 96 JQ	R/E Portion 1	Jacobus Paulus Voessee	D/T4996/1906
	Portion 3	RSA President in Trust for Bakubung Tribe	D/T36887/64
	Portion 4	RSA President in Trust for Bakubung Tribe	D/T362/84
	Portion 11	RSA President in Trust for Bakubung Tribe	D/T362/84
Ledig 909 JQ	Consolidated farm Ledig (Comprising the former Portions 1, 2, 3, 4, 5, & 6)	RSA President in Trust for Bakubung Tribe	D/T94/1981
	Portion 3	RSA National Government	D/T41635/04
	Portion 4	RSA National Government	D/T41635/04
	Portion 6	Provincial Government of North West Province	D/T41636/04
	Portion 7	RSA National Government	D/T41637/04
Mimosa 81 JQ	Portion of the Remainder	Wesizwe Platinum Limited	D/T161187/03

RESULTS - RIGHT TO MINE

Bakubung Minerals (Pty) Ltd hold the mineral rights. In terms of the mineral right, two reefs will be mined for Platinum Group Elements - platinum, palladium, rhodium and gold, with copper and nickel as by-products. The current project caters to also include waste rock as aggregate into the mineral right as it may potentially be crushed and sold.

RESULTS – LAND USES

Prior to BPM, land use in the area was a mixture of predominantly grazing (non-commercial cattle farming), industrial/commercial (hydroponics farming and a glass recycling plant), residential, cemeteries and sporting grounds. Communal grazing land is a scarcity in this area already, due to the surrounding land owners using their farms for other activities like township development, mining, game farming, etc. (TWP, 2008). The surrounding area also included mining, tourism, horticulture (on private property for private consumption),

livestock (on private property or communal lands for personal consumption), and limited commercial and industrial developments (TWP, 2008). Similar land uses still take place adjacent to the mine infrastructure and activity areas. These are discussed further below.

Residential, agricultural and tourism

Residential land use i.e. formal, informal and farmsteads is one of the main land uses near the mine. Communities and community structures include:

- Private land owners/residents
- Ledig Village
- Phatsima Village
- Chaneng Village
- Reagile informal settlement
- Surrounding grazing areas (including Mimosa where BPM is allowing grazing on their property until such time that the TSF is constructed).

Areas of tourism interest include:

- Sun City
- The Pilanesberg National Park

Mining/Industry

Locally there are several mining and mining related activities occurring in the surrounding areas, these include, but are not limited to:

- Platinum Group Metals' and Wesizwe's Maseve Mine, 1.7 km south of BPM
- Royal Bafokeng Platinum's and Anglo Platinum's Styldrift Mine, 1.6 km south east of BPM
- Glencore Xstrata/Merafe Boshoek Smelter, 10 km south of BPM
- Royal Bafokeng Platinum's and Anglo Platinum's Bafokeng Rasimone Platinum Mine, 7.3 km south of BPM
- Impala's Platinum's Shafts
    - Shaft 6, 12.9 south east of BPM
    - Shaft 8, 11.4 km south east of BPM
    - Shaft 12N, 9.9 km south east of BPM
    - Shaft 20, 7.5 south east

Secondary support services/facilities

Infrastructure present in the area is directly linked to the type of land uses occurring in the area as described above. Support infrastructure and facilities identified in the area include:

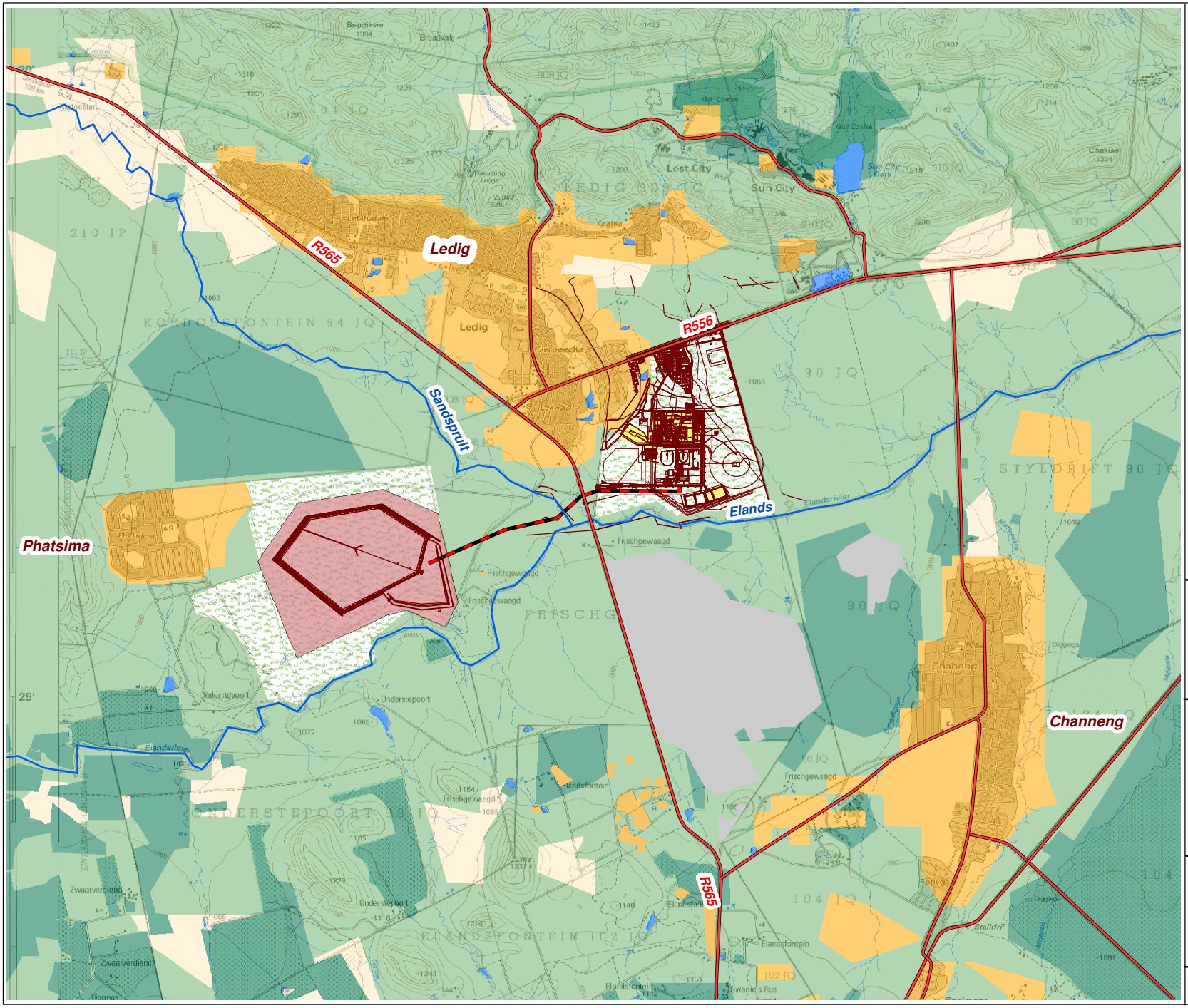
- Road network: A network of roads exists in and around BPM, these include:
- R556 – the road linking Ledig to Sun City linking to the N4 at Moddersprui t
- R565 – the road linking Ledig to Rustenburg

- Railway: There is a railway network passing near Chaneng running in a north east – south west direction
- Villages: Within the towns and villages, there are varying degrees of infrastructure and service provision e.g. schools, clinics, businesses.
- Airport: The Pilanesberg airport is 8.9 km north east of the BPM.
- Power supply and communication: Two 88kV power lines and associated ESKOM servitude supply the mine. Powerlines also cross over the south western corner of the plant area crossing over the R565 running south east / north west towards Ledig. Powerline and telephone lines service the residential and tourism areas in the surrounding area.
- Cemeteries: Two modern cemeteries are located around the project area. One is located west of the existing soil noise berm on Frischgewaagd and the other is located on Mimosa north west of the proposed TSF, neither of these fall within project footprints. Additional possible cemeteries may also exist around the project area (PGS, 2016; refer to the Heritage baseline in Section 7.4.1.11)

CONCLUSION

Through the development of the approved mine, land within the mining footprint has started to change from being predominantly grazing, to mining. The TSF area is still being used for grazing until such time that the TSF is constructed. While much of the plant area still needs to be developed that area is no longer available for grazing or alternative land uses.

Land surrounding BPM is mostly used for mining operations, residential, grazing and tourism. Land within the project footprints ranges from developed, to agricultural which has a combination of secondary or transformed vegetation and natural vegetation. The residential areas surrounding the mine include villages of varying scales including clinics and schools. There is the potential for these land uses to be impacted to varying degrees by changes to the mine's approved infrastructure and operations. As some of these land uses contribute to the economy of the region together with mineral-related activities, care should be taken when planning the project to limit impacts on these land uses. Third party service infrastructure does exist and care needs to be taken to avoid and/or manage these appropriately.



Legend

- Roads
- Rivers
- Mine Layout
- Proposed Pipeline

Land Use

- Already Developed Mining Infrastructure
- Mining/Industry
- Grazing Earmarked for Mining Purposes
- Built-Up /Residential Areas
- Cultivation
- Grazing Land
- Natural and Secondary Vegetation
- Waterbodies
- Degraded Land

Data Source:
South African National Biodiversity Institute (SANBI) 2012, Specialist Input and Satellite Imagery

Kilometers
0 2 4

Scale: 1:60 000 @ A4

SA Grid WGS84

BAKUBUNG PLATINUM MINE (PTY) LTD

Figure 7.29

Land Use

SLR Consulting (Africa) (Pty) Ltd
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7.5 ENVIRONMENTAL IMPACTS AND RISKS OF THE ALTERNATIVES

This section provides a list of potential impacts on environmental and socio-economic aspects that have been identified in respect of each of the main project actions / activities and processes as described in the initial site layout. A discussion of the negative and positive impacts of the project alternatives is provided in Section 7-1 and Section 7.7. The ratings for consequence, probability and significance of each of the impacts in the **unmitigated scenario** (which assumes that no consideration is given to the prevention or reduction of environmental and social impacts) are also provided in the table below in accordance with the new DMR report template.

TABLE 7.34: LIST OF IMPACTS IDENTIFIED FOR THE PROPOSED PROJECT INCLUDING ALTERNATIVES

The assessment ratings provided in this table are for the unmitigated scenario only which assumes that no consideration is given to the prevention or reduction of environmental and social impacts. Alternative 2 is the re-aligning infrastructure, however this represents a mitigation scenario and thus ratings are kept the same for both Alternative 1 and 2 for the unmitigated scenario.

Potential impact	Activity	Alternative	Project phases	Consequence			Probability	Significance	Degree to which impact		
				Severity	Duration	Spatial scale			Can be reversed	Causes irreplaceable loss of resources	Can be avoided/ Managed/ Mitigated
Additional mineral resource	Waste rock management	1 & 2	Construction Operation Decommissioning Closure	L	M	H	M	M	Fully	Possible	Can be fully managed/mitigated
Hazardous excavations, surface subsidence and infrastructure that can be harmful to people and animals	Site preparation Civil works Earthworks Waste rock management Mining and mining related activities Tailings management Demolition Rehabilitation Maintenance and aftercare	1 & 2	Construction Operation Decommissioning Closure	H	H	M	H	H	Fully (plant and pipeline areas) No (TSF)	Possible	Can be managed/mitigated to acceptable levels
Loss of soil resources and land capability through contamination	Site preparation Earthworks Waste rock management Transport systems Tailings management Housing Process and storm water management Sewage sludge management Demolition Rehabilitation Maintenance and aftercare	1 & 2	Construction Operation Decommissioning Closure	H	H	H	H	H	No	Definite	Can be avoided and managed/mitigated to acceptable levels

Potential impact	Activity	Alternative	Project phases	Consequence			Probability	Significance	Degree to which impact		
				Severity	Duration	Spatial scale			Can be reversed	Causes irreplaceable loss of resources	Can be avoided/ Managed/ Mitigated
Loss of soil resources and land capability through physical disturbance	Site preparation Earthworks Waste rock management Transport systems Tailings management Housing Demolition Rehabilitation Maintenance and aftercare	1 & 2	Construction Operation Decommissioning Closure	H	H	M	H	H	Partially	Unlikely	Can be managed/mitigated to acceptable levels
Physical destruction of biodiversity	Site preparation Civil works Earthworks Tailings management Waste rock management Transport systems Housing Process and storm water management Sewage sludge management Site/contract management Demolition Rehabilitation Maintenance and aftercare	1 & 2	Construction Operation Decommissioning Closure	H	H	M	H	H	Partially	Definite (vegetation/ habitat type) Potential (other aspects)	Can be managed/mitigated to acceptable levels
General disturbance of biodiversity	Site preparation Civil works Earthworks Tailings management Waste rock management Transport systems Housing Process and storm water management	1 & 2	Construction Operation Decommissioning Closure	H	H	M	H	H	Partially	Unlikely	Can be managed/mitigated to acceptable levels

Potential impact	Activity	Alternative	Project phases	Consequence			Probability	Significance	Degree to which impact		
				Severity	Duration	Spatial scale			Can be reversed	Causes irreplaceable loss of resources	Can be avoided/ Managed/ Mitigated
	Sewage sludge management Site/contract management Demolition Rehabilitation Maintenance and aftercare										
Contamination of surface water resources	Site preparation Civil works Earthworks Transport systems Mining and mining related activities Waste rock management Tailings management Process and storm water management Site support services General and hazardous waste management Sewage sludge management Site support services Demolition Rehabilitation Maintenance and aftercare	1 & 2	Construction Operation Decommissioning Closure	H	H	M	H	H	No	Possible	Can be managed/mitigated to acceptable levels
Alteration of surface water drainage patterns	Site preparation Civil works Earthworks Transport systems Waste rock management Tailings management Process and storm water management Demolition	1 & 2	Construction Operation Decommissioning Closure	H	H	M	H	H	No (TSF) Partially (plant and pipeline areas)	Possible	Can be managed/mitigated to acceptable levels

Potential impact	Activity	Alternative	Project phases	Consequence			Probability	Significance	Degree to which impact		
				Severity	Duration	Spatial scale			Can be reversed	Causes irreplaceable loss of resources	Can be avoided/ Managed/ Mitigated
	Rehabilitation Maintenance and aftercare										
Contamination of groundwater resources	Site preparation Civil works Earthworks Transport systems Waste rock management Tailings management General and hazardous waste management Site support services Process and storm water management Demolition Rehabilitation Maintenance and aftercare	1 & 2	Construction Operation Decommissioning Closure	H	H	M	H	H	No	Possible	Can be managed/mitigated to acceptable levels
Air pollution	Site preparation Civil works Earthworks Mining and mining related activities Waste rock management Mineral processing operations Tailings management Power Supply and Use Site support services Transport systems Housing Demolition Rehabilitation Maintenance and aftercare	1 & 2	Construction Operations Decommissioning Closure	H	H	M	M	H	No	Possible	Can be managed/mitigated to acceptable levels

Potential impact	Activity	Alternative	Project phases	Consequence			Probability	Significance	Degree to which impact		
				Severity	Duration	Spatial scale			Can be reversed	Causes irreplaceable loss of resources	Can be avoided/ Managed/ Mitigated
Noise pollution	Site preparation Earthworks Civil works Tailings management Waste rock management Transport systems Mineral processing operations Mining and mining related activities Demolition Rehabilitation	1 & 2	Construction Operation Decommissioning	M	M	M	H	M	Fully	Unlikely	Can be managed/mitigated to acceptable levels
Road disturbance and traffic safety	Transport system	1 & 2	Construction Operation Decommissioning Closure	M	M	M	H	M	Fully	Unlikely	Can be mitigated to improve the service level
Negative visual impacts	Site preparation Civil works Earthworks Mining and mining related activities Waste rock management Mineral processing operations Tailings management Housing Demolition Maintenance and aftercare of final land forms and rehabilitated areas	1 & 2	Construction Operation Decommissioning Closure	H	H	M	H	H	Partially (TSF) Fully (plant and pipeline areas)	Unlikely	Can be managed/mitigated to acceptable levels
Loss of heritage, cultural and paleontological resources	Site preparation Earthworks Transport systems Housing	1 & 2	Construction Operation Decommissioning	H	H	M	H	H	No	Possible	Can be managed/mitigated to acceptable levels

Potential impact	Activity	Alternative	Project phases	Consequence			Probability	Significance	Degree to which impact		
				Severity	Duration	Spatial scale			Can be reversed	Causes irreplaceable loss of resources	Can be avoided/ Managed/ Mitigated
	Site/contract management Tailings management Demolition Rehabilitation										
Economic impact	Site preparation Civil works Earthworks Mining and mining related activities Waste rock management Mineral processing operations Tailings management Power Supply and Use Water supply and use Process and storm water management Transport systems General and hazardous waste management Sewage sludge management Site support services Housing Site/contract management Demolition Rehabilitation Maintenance and aftercare	1 & 2	Construction Operations Decommissioning Closure	M - H+	M	H	H+	H+	Fully	Possible	Can be managed/mitigated to acceptable levels
Inward migration impacts	Site preparation Civil works Earthworks Mining and mining related activities Waste rock management	1 & 2	Construction Operations Decommissioning Closure	H	H	H	M	H	Fully	Possible	Can be managed/mitigated to acceptable levels

Potential impact	Activity	Alternative	Project phases	Consequence			Probability	Significance	Degree to which impact		
				Severity	Duration	Spatial scale			Can be reversed	Causes irreplaceable loss of resources	Can be avoided/ Managed/ Mitigated
	Mineral processing operations Tailings management Power Supply and Use Water supply and use Process and storm water management Transport systems General and hazardous waste management Sewage sludge management Site support services Housing Site/contract management										
Change in land use	Construction of project components Operation of the mine Decommissioning of project components Final land forms	1 & 2	Construction Operations Decommissioning Closure	H	H	M	H	H	Partially	Possible	Can be managed/mitigated to acceptable levels

7.6 METHODOLOGY USED IN DETERMINING THE SIGNIFICANCE OF ENVIRONMENTAL IMPACTS

The method for the assessment of environmental issues is set out in the Table 7.35 below. Part A in Table 7.35 below provides a list of criteria that can be selected in order to rank the severity, duration and spatial scale of an impact. The consequence of the impact is determined by combining the selected criteria ratings allocated for severity, spatial scale and duration in part B of Table 7.35. The significance of the impact is determined in Part C of Table 7.35 whereby the consequence determined in part B is combined with the probability of the impact occurring. The interpretation of the impact significance is given in Part D.

This assessment methodology enables the assessment of environmental issues including: cumulative impacts, the severity of impacts (including the nature of impacts and the degree to which impacts may cause irreplaceable loss of resources), the extent of the impacts, the duration and reversibility of impacts, the probability of the impact occurring, and the degree to which the impacts can be mitigated. This assessment method was used to assess impacts associated with all project alternatives.

TABLE 7.35: CRITERIA FOR ASSESSING IMPACTS

PART A: DEFINITION AND CRITERIA*		
Definition of SIGNIFICANCE		**Significance = consequence x probability**
Definition of CONSEQUENCE		**Consequence is a function of severity, spatial extent and duration**
Criteria for ranking of the SEVERITY of environmental impacts	**H**	Substantial deterioration (death, illness or injury). Recommended level will often be violated. Vigorous community action.
	M	Moderate/ measurable deterioration (discomfort). Recommended level will occasionally be violated. Widespread complaints.
	L	Minor deterioration (nuisance or minor deterioration). Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	L+	Minor improvement. Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	M+	Moderate improvement. Will be within or better than the recommended level. No observed reaction.
	H+	Substantial improvement. Will be within or better than the recommended level. Favourable publicity.
Criteria for ranking the DURATION of impacts	**L**	Quickly reversible. Less than the project life. Short term
	M	Reversible over time. Life of the project. Medium term
	H	Permanent. Beyond closure. Long term.
Criteria for ranking the SPATIAL SCALE of impacts	**L**	Localised - Within the site boundary.
	M	Fairly widespread – Beyond the site boundary. Local
	H	Widespread – Far beyond site boundary. Regional/ national

PART B: DETERMINING CONSEQUENCE

SEVERITY = L

DURATION	Long term	**H**	**Medium**	**Medium**	**Medium**
	Medium term	**M**	**Low**	**Low**	**Medium**
	Short term	**L**	**Low**	**Low**	**Medium**

SEVERITY = M					
DURATION	Long term	**H**	**Medium**	**High**	**High**
	Medium term	**M**	**Medium**	**Medium**	**High**
	Short term	**L**	**Low**	**Medium**	**Medium**
SEVERITY = H					
DURATION	Long term	**H**	**High**	**High**	**High**
	Medium term	**M**	**Medium**	**Medium**	**High**
	Short term	**L**	**Medium**	**Medium**	**High**
			L	**M**	**H**
			Localised Within site boundary Site	Fairly widespread Beyond site boundary Local	Widespread Far beyond site boundary Regional/ national
			SPATIAL SCALE		
PART C: DETERMINING SIGNIFICANCE					
PROBABILITY (of exposure to impacts)	Definite/ Continuous	**H**	**Medium**	**Medium**	**High**
	Possible/ frequent	**M**	**Medium**	**Medium**	**High**
	Unlikely/ seldom	**L**	**Low**	**Low**	**Medium**
			L	**M**	**H**
			CONSEQUENCE		

PART D: INTERPRETATION OF SIGNIFICANCE	
Significance	**Decision guideline**
High	It would influence the decision regardless of any possible mitigation.
Medium	It should have an influence on the decision unless it is mitigated.
Low	It will not have an influence on the decision.

***H = high, M= medium and L= low and + denotes a positive impact.**

7.7 POSITIVE AND NEGATIVE IMPACTS IN TERMS OF SITE LAYOUT ALTERNATIVES

Following the assessment of the original site layout, alternative site layouts were suggested by the biodiversity specialists. This includes:

- Modify TSF footprint so as to maximise the surface area comprising Secondary vegetation and minimise the extent of Marikana Thornveld within the footprint.
    - The final layout of the TSF has a footprint that covers less Marikana Thornveld and more secondary vegetation than the footprint assessed by the specialist. This recommendation from the specialist is thus already catered for with the final TSF layout. Therefore, this aspect does not need to be assessed further as the recommendation is met.
- Re-aligning the Frischgewaagd section of the tailings and return water pipeline alignment along the recently constructed access road and reduce the width of the construction servitude in untransformed habitats.
- Shifting the product stockpiles – this was referring to the Concentrator Complex area.

  - The area where the watercourses and the Concentrator Complex overlap is the approved Concentrator Complex footprint which is not changing. The product stockpiles will be placed in the northern section of the Concentrator Complex and not overlapping with the ephemeral drainage line. This recommendation from the specialist is thus already catered for with the final positioning of the product stockpiles. Therefore this aspect does not need to be assessed further as the recommendation is met.
- Modify the return water dam footprint by shifting it to the north and west so that it is situated outside of the recommended buffer zone for the biological corridor along the Elands River and so as to avoid overlap between watercourses, as well as the 32 m and 100 m buffers as far as possible.
- Modify PCD footprint by shifting it approximately 50 m to the north-west so as avoid a small patch of 'Stony grassland' and situate it outside of the recommended buffer zone for the biological corridor along the Elands River.
- Modify Phase 1 Mine housing footprint to so as to avoid overlap between watercourses, as well as the 32 m and 100 m buffers as far as possible.
  - The final layout of the Phase 1 Mine housing is slightly further north than the layout in the wetland specialist's assessment. The Phase 1 Mine housing is thus not overlapping with the watercourse. Therefore, this aspect does not need to be assessed further as the recommendation is met.
- Modify Phase 1a Mine housing footprint to so as to avoid overlap between watercourses, as well as the 32 m and 100 m buffers as far as possible.
- Modify the solar plant layout to reduce the extent of infrastructure in the high biodiversity conservation value and status areas: Mixed Woodland/Thicket and *Acacia mellifera* Bushland/ Thicket.

PCD and return water dam alternative consideration

- Shifting the return water dam is not feasible as the position of the dam is located at the lowest topographical point to ensure appropriate collection of potential seepage from the TSF and has been optimised for engineering purposes. The applicant has indicated that the TSF location has also already been shifted as far as possible to the west to be further away from the Phatsima community to decrease the noise and air pollution impacts. Therefore, Option 1 is the only feasible option. This alternative has therefore not been considered further.
- The PCD layout is within a footprint that was already approved for a dirty water containment area and thus there is no new impact. The PCD is located at the lowest topographical point to ensure appropriate collection of dirty water from the shaft and concentrator complex areas and has been optimised for engineering purposes. In addition, there are existing powerlines north and west of the approved location of the PCD restricting any significant movement. This alternative has therefore not been considered further.

A basic alternative selection matrix was compiled in order to provide a discussion in terms of the advantages and disadvantages of the site layout options. Table 7.36 presents the results of the related high level selection matrix process. The ranking system is a simple two score relative ranking system. For each criterion, a score of one is allocated to the best option and a score of two to the worst. The option with the lowest total score is the preferred option. Option 1 is the original layout and Option 2 is the suggested alternatives as provided by the biodiversity specialists. The tailings and return water pipeline, the Phase 1a housing and the solar plant have been assessed separately.

TABLE 7.36: POSITIVE AND NEGATIVE IMPACTS ASSOCIATED WITH SITE LAYOUT ALTERNATIVES

Criteria	Relative ranking		Advantages and disadvantages
	Option 1	Option 2	
Biodiversity (terrestrial and aquatic fauna, flora)	2	1	**Pipeline:** The pipeline route in Option 1 is located in Marikana Thornveld and crosses over rocky outcrop vegetation. The pipeline route in Option 2 also falls within Marikana Thornveld but does not cross over rocky outcrop vegetation. The vegetation specialist highlighted that this option will be along a recently constructed access route and will thus decrease the width of the construction servitude in untransformed habitats. The rocky outcrop is entirely restricted to a single outcrop and is considered to have high botanical diversity. The pipeline route in Option 1 is also located within the 32 m buffer of an ephemeral channel and an ephemeral drainage line thus the associated habitat. Neither route option avoids the ephemeral drainage line but Option 2 moves the pipeline outside of this buffer area of the ephemeral channel. Based on the above, Option 2 is preferred.
Heritage resources	1	2	**Pipeline:** When considering Option 2 for the pipeline route, a heritage site of low significance was identified near the access road route in 2007 but during the 2015 site assessment, there was no evidence of the site observed. The reason for this is unknown. The original extent of this site was no possible to judge in 2007.The site included dense scatter of undecorated ceramics, a lack of visible archaeological deposit and little evidence for Iron Age settlement. The heritage specialist indicated that this site is of low heritage significance and following mitigation it can be destroyed. No additional identified heritage resources are expected to be affected by the proposed pipeline route alternative. Since the extent of the heritage resource identified in 2007 was not known, it would be conservative to assume there could be a larger extent than observed; the Option 1 for the pipeline route is therefore preferred. However, since this site can be destroyed Option 2 is not considered undesirable.
Soils and land capability	2	1	**Pipeline:** Along the pipeline route in Option 1, Sepane soil was identified. The Sepane soil covering less than 0.1 ha was within a wetland system and is not suitable for crop production, but is considered to have high sensitivity. Option 2 for the pipeline, shifts the pipeline away from the Sepane soil. Route option 2 is therefore the preferred option. Based on the above, Option 2 is preferred.
Ground water regime and impacts on downstream users	1	1	**Pipeline:** Both site layout options are underlain by two aquifers, an upper weathered aquifer and a lower fractured aquifer. The proposed minor shifts of Option 2 are unlikely to change groundwater regimes. It follows that there are no disadvantages or advantages with either site option when compared together.
Proximity to surface water resources	2	1	**Pipeline**: The pipeline route in Option 1 is also located within the 32 m buffer of an ephemeral channel and an ephemeral drainage line. Neither route option avoids the ephemeral drainage line but Option 2 moves the pipeline outside of this buffer area of the ephemeral channel.

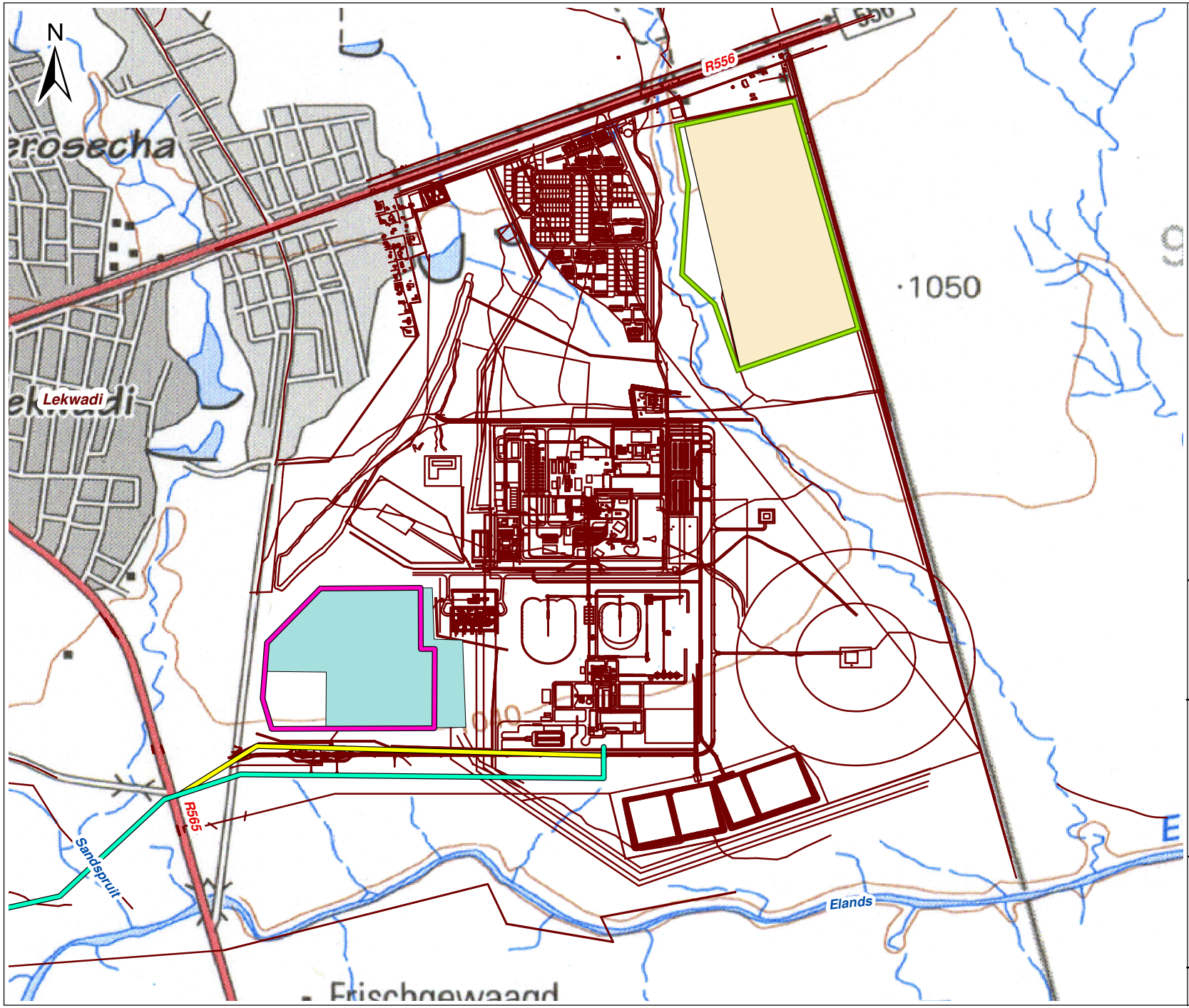
Criteria	Relative ranking		Advantages and disadvantages
	Option 1	Option 2	
			Based on the above, Option 2 is preferred.
Visual impact	1	1	**Pipeline:** For both site layout options, the proposed footprints are surrounded by existing mining operations and are within approved project footprints. In addition, Option 2 layouts are within 100 m of Option 1 layouts and thus are not expected to have differing visual impact. It follows that in the context of existing surrounding mining operations both site layout options are not expected to materially influence existing negative visual impacts. It follows that there are no disadvantages or advantages with either site option when compared together.
Proximity to residential areas	1	1	**Pipeline:** For both options, the external sensitive receptors are the same. There are no disadvantages or advantages with either site option when compared together.
Change in land use	1	1	**Pipeline:** For both site layout options, land use will be changed from agricultural to mining. In addition to this, the land uses surrounding the proposed project area are the same for both site layout options. There are no disadvantages or advantages with either site option when compared together.
Economic impact	1	1	**Pipeline:** The proposed project will contribute towards local, regional and national economies through wages, taxes and profits regardless of the site layout options. No disadvantages or advantages with either site option when compared together
Inward migration	1	1	**Pipeline:** The proposed project can lead to an influx of job seekers that will place pressure on existing services regardless of the site layout options, as this is the nature of mining. No disadvantages or advantages with either site option when compared together.
Total pipeline	**13**	**11**	**Infrastructure layout option 2 is preferred**

Criteria	Relative ranking		Advantages and disadvantages
	Option 1	Option 2	
Biodiversity (terrestrial and aquatic fauna, flora)	2	1	**Phase 1a housing:** The Phase 1a footprint in Option 1 overlaps with watercourse buffer zones, and thus the associated riparian biodiversity. The housing footprint Option 2 will shift the footprint out of these buffer zones and thus reducing overlap with associated watercourse habitats. Based on the above, Option 2 is preferred.
Heritage resources	1	1	**Phase 1a housing:** Modifications to the housing footprint (Phase 1a) will not change the impact the current layout is having on the identified heritage resources present and these resources will still be impacted. There are no disadvantages or advantages with either site option when compared together.
Soils and land capability	2	1	**Phase 1a housing:**

Criteria	Relative ranking		Advantages and disadvantages
	Option 1	Option 2	
			Option 2 will shift infrastructure outside of watercourse buffer areas and thus outside of areas that the 2007 soil report indicated to be eroded which was considered as sensitive according to the specialist. Shifting the infrastructure can decrease the chance of further degradation. Based on the above, Option 2 is preferred
Ground water regime and impacts on downstream users	1	1	**Phase 1a housing:** Both site layout options are underlain by two aquifers, an upper weathered aquifer and a lower fractured aquifer. The proposed minor shifts of Option 2 are unlikely to change groundwater regimes. It follows that there are no disadvantages or advantages with either site option when compared together.
Proximity to surface water resources	2	1	**Phase 1a housing:** The Phase 1a footprint in Option 1 overlaps with watercourse buffer zones. The housing footprint Option 2 will shift the footprint out of these buffer zones and thus reducing overlap with watercourse habitats. Based on the above, Option 2 is preferred.
Visual impact	1	1	**Phase 1a housing:** For both site layout options, the proposed footprints are surrounded by existing mining operations and are within approved project footprints. In addition, Option 2 layouts are within 100 m of Option 1 layouts and thus are not expected to have differing visual impact. It follows that in the context of existing surrounding mining operations both site layout options are not expected to materially influence existing negative visual impacts. It follows that there are no disadvantages or advantages with either site option when compared together.
Proximity to residential areas	1	1	**Phase 1a housing:** For both options, the external sensitive receptors are the same. It follows that there are no disadvantages or advantages with either site option when compared together.
Change in land use	1	1	**Phase 1a housing:** For both site layout options, land use will be changed from agricultural to mining. In addition to this, the land uses surrounding the proposed project area are the same for both site layout options. There are no disadvantages or advantages with either site option when compared together.
Economic impact	1	1	**Phase 1a housing:** The proposed project will contribute towards local, regional and national economies through wages, taxes and profits regardless of the site layout options. No disadvantages or advantages with either site option when compared together
Inward migration	1	1	**Phase 1a housing:** The proposed project can lead to an influx of job seekers that will place pressure on existing services regardless of the site layout options, as this is the nature of mining. No disadvantages or advantages with either site option when compared together.
Total Phase 1a housing	**13**	**10**	**Infrastructure layout option 2 is preferred**

Criteria	Relative ranking		Advantages and disadvantages
	Option 1	Option 2	

Criteria	Relative ranking		Advantages and disadvantages
	Option 1	Option 2	
Biodiversity (terrestrial and aquatic fauna, flora)	2	1	**Solar Plant:** Option 1 will cover approximately 12 ha of secondary vegetation and 9.5 ha of vegetation units that have high biodiversity conservation value and sensitivity. Option 2 will cover 14.7 ha of secondary vegetation and 6.8 ha of vegetation units that have high biodiversity conservation value and sensitivity. Based on the above, Option 2 is preferred.
Heritage resources	1	1	**Solar Plant:** No additional identified heritage sites will be impacted by the solar plant positioning. It follows that there are no disadvantages or advantages with either site option when compared together.
Soils and land capability	1	1	**Solar Plant:** The same soils will be impacted by the Option 1 and Option 2 of the solar plant and neither of these soils were indicated to have high sensitivity. It follows that there are no disadvantages or advantages with either site option when compared together.
Ground water regime and impacts on downstream users	1	1	**Solar Plant:** Both site layout options are underlain by two aquifers, an upper weathered aquifer and a lower fractured aquifer. The proposed changes are unlikely to change groundwater regimes. It follows that there are no disadvantages or advantages with either site option when compared together.
Proximity to surface water resources	1	1	**Solar Plant:** There are no delineated watercourses within the solar plant footprint. It follows that there are no disadvantages or advantages with either site option when compared together.
Visual impact	1	1	**Solar Plant:** For both site layout options, the proposed footprints are surrounded by existing mining operations and are within approved project footprints. It follows that there are no disadvantages or advantages with either site option when compared together.
Proximity to residential areas	1	1	**Solar Plant:** For both options, the external sensitive receptors are the same. It follows that there are no disadvantages or advantages with either site option when compared together.
Change in land use	1	1	**Solar Plant:** For both site layout options, land use will be changed from agricultural to mining. The land uses surrounding the proposed project area are the same for both site layout options. It follows that there are no disadvantages or advantages with either site option when compared together.
Economic impact	1	1	**Solar Plant:** The proposed project will contribute towards local, regional and national economies through wages, taxes and profits regardless of the site layout options. No disadvantages or advantages with either site option when compared together.
Inward migration	1	1	**Solar Plant:** The proposed project can lead to an influx of job seekers that will place pressure on existing services regardless of the site layout options, as this is the nature of mining. No disadvantages or advantages with either site option when compared together.
Total Phase 1a housing	**11**	**10**	**Infrastructure layout option 2 is preferred**



Legend

Mine Layout

Alternatives

- Pipeline - Option 1
- Pipeline - Option 2 (Preferred Option)
- Mine Housing - Option 1
- Mine Housing - Option 2 (preferred Option)
- Solar Plant - Option 1
- Solar Plant Option 2 (preferred Option)

Data Source: Rehab Green CC (2007)

Kilometers

0 0.4 0.8

Scale: 1:18 000 @ A4

SA Grid WGS84

BAKUBUNG PLATINUM MINE (PTY) LTD

Figure 7.30

Site Layout Alternatives

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7.8 POSSIBLE MITIGATION MEASURES THAT COULD BE APPLIED AND THE LEVEL OF RESIDUAL RISK

Section 7.3, provides a summary of issues and concerns raised by IAPs as part of the proposed project. This section outlines possible mitigation measures or alternatives that are available to accommodate or address issues and concerns raised by IAPs where relevant. In addition to this, this section will also provide an assessment of the impact or risks associated with the identified possible mitigation measures or alternatives. The full comments are contained in Appendix E and this table only highlights the issue raised in the comments received.

TABLE 7.37: POSSIBLE MITIGATION MEASURES AND ANTICIPATED LEVEL OF RESIDUAL RISK

Issue and concern raised	Possible mitigation measure or alternative to address issue	Impact significance of the possible mitigation measure or alternative before and after mitigation (Section 9)	
		Unmitigated	Mitigated
Concerned about proximity of the proposed infrastructure to the Elands River and proposed mitigation. Interested in information on understanding monitoring plans for surface and groundwater. Concerned about project polluting water. Youth must not be affected by pollution Water must not be polluted by mining activities. Concerned about the TSF being constructed close to their location as it will contain acid water.	The studies found that the tailings material is considered to be non-acid forming. There could be other water pollution impacts which will be mitigated through: • Continuing the surface and groundwater monitoring programme on site including additional groundwater monitoring around the TSF site • Through management of dirty water by containing it in polluted water facilities. • Through the effective implementation of a liner below the TSF, return water dam and PCDs. • Clean and dirty storm water are to be kept separated through implementation of a storm water management plan. • Spills are to be cleaned timeously • Regular inspections of infrastructure • Hazardous substances, chemicals, fuels, oil and grease are to be stored and handled on impermeable surfaces	High	Medium
Concerned about additional noise from the crusher moved above ground.	The incremental noise of the project components was assessed to not significantly increase form what was previously assessed.	Medium	Medium

Issue and concern raised	Possible mitigation measure or alternative to address issue	Impact significance of the possible mitigation measure or alternative before and after mitigation (Section 9)	
	Mitigation to minimise noise impacts include: • Keeping noisy activities to reasonable working hours during the day and early evening • Keeping equipment and vehicles in good repair • Incorporating acoustic designs to minimise noise levels • Monitor noise	(The mitigated significance is unchanged from the approved project)	
Concerned about the TSF being constructed close to their location and the sand drying up and causing dust which has health impacts. Concerned about dust at the mine affecting the community and plants. Concerned about the cumulative impacts of air quality in the area. The TSF is susceptible to wind entrainment and can lead to environmental impacts especially for sensitive receptors downwind. Dust during construction must be controlled effectively. Animals in the game reserve must not be affected by dust. Youth must not be affected by pollution	• Continuation of the existing monitoring programme • Erosion control measures to be implemented on the TSF to minimise • Dust suppression to be implemented on exposed areas, roads, material handling and drilling points • Concurrent rehabilitation of the TSF • Soil stockpiles are to be wetted • Vehicle speeds are to be controlled to reduce dust entrainment • Trees to be planted around the TSF to break laminar wind flow • Site inspections are to take place to monitor areas where dust can be problematic	High	Medium (TSP and PM10) Low- High (PM2.5)
Employment should be given as far as possible to local skilled, semi-skilled and unskilled labour force. Wondering how the community will benefit from the project. Hoping there will be employment and improvement of the local economy. Employment opportunities in Phatsima. How will we know about project happening/ What kind of jobs will be available? Looking for work. Will preference be given to Phatsima since the project is located near Phatsima inhabitants? Want the community members to be included	• Local products and services to be maximised and used where possible. • Create a database of employable community members. • Fair and equitable recruitment opportunities to all with equivalent qualification. • Contracts to specify the preferential use of local labour from Phatsima and Ledig as far as possible • Identify candidates from the local communities for apprenticeships and on the job training programs. • Implementing SLP project which include projects identified in IDPs relating to infrastructure, road improvements • Periodic communication and feedback to be undertaken to the community in respect of the progress of the Project and the implementation. • Focus on employing local labour as far as possible	High Positive	High Positive

Issue and concern raised	Possible mitigation measure or alternative to address issue	Impact significance of the possible mitigation measure or alternative before and after mitigation (Section 9)	
to mitigate socio-economic impacts.			
Hoping for change in the community by providing employment and reducing crime and poverty.			
Query on internships and learnerships			
Improvement of local economy, schools being built, improvement to roads			
Concerned about lives being endangered by the project Concerned about community health and safety.	Projects of this nature can bring about an influx of people looking for employment, this brings within it associated social ills. Management of some of the issues linked to safety and health will include: • Through the *Bakubung-Ba-Ratheo* Non-Mining Economic Development Trust and the *Bakubung-Ba-Ratheo* Economic Development Unit and BPM's corporate social investment program investigate opportunities to improve local health care. • Work closely with the *Bakubung-Ba-Ratheo* to minimise establishment of informal settlements • Educate employees and contractor employees about promoting good health practices, and inform them about other communicable diseases, and the prevention of the spread thereof. • Identify opportunities to improve the health of the community. • Link with relevant forums/organisations on issues of community safety and provision of emergency response services.	High	Medium
Concerned about graves being destroyed.	A heritage study was conducted to identify graves present on site that might be impacted by the project. Impacted graves identified will be relocated and not destroyed. A procedure will be followed for the relocation of graves which includes: • A detailed social consultation process, at least 60 days in length, comprising the attempted identification of the next-of-kin so as to obtain their consent for the relocation of the graves. • Bilingual site notices indicating the intent of the relocation. • Bilingual newspaper notices indicating the intent of the relocation. • Permit applications to the legally required authorities, including (but certainly not restricted to) the South African Heritage Resources Agency. • An exhumation process that keeps the dignity of the remains and family intact. • An exhumation process that will safeguard the legal rights of the families as well as that of the development company. • The process must be done by a reputable company well versed in the mitigation of graves.	High	Medium

Issue and concern raised	Possible mitigation measure or alternative to address issue	Impact significance of the possible mitigation measure or alternative before and after mitigation (Section 9)	
Concerned about blasting impacts.	There will be no blasting activities as part of this project for the additional/changed infrastructure on site.	Not applicable to this project's components	Not applicable to this project's components
The land has been degraded and does not know what the final state of the environment will be and the physical extent of the impact. No negative impacts must be experienced The environment needs to be protected as the current state of the environment is not good.	• Minimisation of degradation to the environment during the life of the project will be through managing hazardous excavations and structures, disturbance of biodiversity, surface and groundwater quality and quantity, dust generation, increase in traffic, noise pollution, visual and negative socio-economic impacts. Following the cessation of the project, infrastructure that is not to be retained is to be demolished and the area is to be rehabilitated. The final land form is to be returned to its pre-mining state as far as possible of grazing and wilderness where appropriate.	High	Medium to Low (during operations) Low (Closure)

7.9 MOTIVATION WHERE NO ALTERNATIVE SITES WERE CONSIDERED

Not applicable.

7.10 STATEMENT MOTIVATING THE PREFERRED ALTERNATIVE

With reference to Section 7.1 and Section 10, site layout alternatives were considered as part of the proposed project. A motivation describing the preferred alternatives is provided below.

7.10.1 SITE LAYOUT ALTERNATIVES

With reference to Section 10, layout alternatives were proposed by specialists to avoid sensitive areas including vegetation units and watercourses. The alternative layouts represent a part of the mitigated scenarios for the biodiversity and soil impact assessments contained in Appendix F. Following a site selection assessment, alternative layouts were preferred for some infrastructure, whereas shifting other infrastructure was not feasible. For the site alternatives the following was concluded:

- Modify TSF footprint so as to maximise the surface area comprising Secondary vegetation and minimise the extent of Marikana Thornveld within the footprint.
    - The final layout of the TSF has a footprint that covers less Marikana Thornveld and more secondary vegetation than the footprint assessed by the specialist. This recommendation from the specialist is thus already catered for with the final TSF layout. Therefore, this aspect does not need to be assessed further as the recommendation is met.
- Shifting the product stockpiles – this was referring to the Concentrator Complex area.
    - The area where the watercourses and the Concentrator Complex overlap is the approved Concentrator Complex footprint which is not changing. The product stockpiles will be placed in the northern section of the Concentrator Complex and not overlapping with the ephemeral drainage line. This recommendation from the specialist is thus already catered for with the final positioning of the product stockpiles. Therefore this aspect does not need to be assessed further as the recommendation is met.
- Modify Phase 1 Mine housing footprint to so as to avoid overlap between watercourses, as well as the 32m and 100m buffers as far as possible.
    - The final layout of the Phase 1 Mine housing is slightly further north than the layout in the wetland specialist's assessment. The Phase 1 Mine housing is thus not overlapping with the watercourse. Therefore this aspect does not need to be assessed further as the recommendation is met.
- Re-aligning the Frischgewaagd section of the tailings and return water pipeline alignment along the recently constructed access road.

- Modifying Phase 1a Mine housing footprint to avoid overlap between watercourses, as well as the 32 m and 100 m buffers as far as possible.
- Modify the solar plant layout to reduce the extent of infrastructure areas of high biodiversity conservation value and status: Mixed Woodland/Thicket and *Acacia mellifera* Bushland/ Thicket.
- Shifting the return water dam: This is not feasible as the position of the dam is located at the lowest topographical point to ensure appropriate collection of potential seepage from the TSF and has been optimised for engineering purposes. The applicant has indicated that the TSF location has also already been shifted as far as possible to the west to be further away from the Phatsima community to decrease the noise and air pollution impacts. Therefore, Option 1 is the only feasible option. This alternative has therefore not been considered further
- Shifting the PCD layout: The PCD layout is within a footprint that was already approved for a dirty water containment area and thus there is no new impact. The PCD is located at the lowest topographical point to ensure appropriate collection of dirty water from the shaft and concentrator complex areas and has been optimised for engineering purposes. In addition, there are existing powerlines north and west of the approved location of the PCD restricting any significant movement. This alternative has therefore not been considered further.

It should be noted that the preferred site alternative came about from the impact assessment conducted for this project; therefore the impact assessment contained below is based on Layout Option 1 with Layout Option 2 representing a part of the mitigated scenario.

8 FULL DESCRIPTION OF THE PROCESS UNDERTAKEN TO IDENTIFY, ASSESS AND RANK THE IMPACTS AND RISKS THE ACTIVITY WILL IMPOSE ON THE PREFERRED SITE THROUGH THE LIFE OF THE ACTIVITY

8.1 DESCRIPTION OF THE PROCESS UNDERTAKEN TO IDENTIFY IMPACTS

Environmental and socio-economic impacts associated with the proposed project were identified through site visits, undertaken by SLR and specialists (where relevant), the social scan, consideration of the project description, site layout and specialist studies.

Potential environmental and socio-economic impacts identified were outlined in the background information document that was distributed to IAPs and regulatory authorities (Section 7.2.1) for consideration. In addition to this, potential identified environmental and socio-economic impacts were discussed at the public and regulatory authorities meetings (Section 7.2.4). The feedback received from IAPs and regulatory authorities also provided input into the identification of environmental and socio-economic impacts.

8.2 DESCRIPTION OF THE PROCESS UNDERTAKEN TO ASSESS AND RANK THE IMPACTS AND RISKS

A description of the assessment methodology used to assess the severity of identified impacts including the nature of impacts and the degree to which impacts may cause irreplaceable loss of resources is provided in Section 7.6. In addition to this, the assessment methodology also assesses the extent of the impacts, the duration and reversibility of impacts, the probability of the impact occurring, and the degree to which the impacts can be mitigated.

8.3 A DESCRIPTION OF THE ENVIRONMENTAL IMPACTS AND RISKS IDENTIFIED DURING THE ENVIRONMENTAL ASSESSMENT PROCESS

This section below (Table 8.1) provides a description of the impacts on environmental and socio-economic aspects in respect of each of the main project actions / activities and processes that will be assessed in Appendix F and summarised in Section 9.

TABLE 8.1: LIST OF POTENTIAL IMPACTS AS THEY RELATE TO PROJECT ACTIONS / ACTIVITIES / PROCESSES

Main activity/process	Impacts (unmitigated)
Site preparation	Hazardous excavations, surface subsidence and infrastructure that can be harmful to people and animals Loss of soil resources and land capability through contamination Loss of soil resources and land capability through physical disturbance Physical destruction of biodiversity

Main activity/process	Impacts (unmitigated)
	General disturbance of biodiversity Contamination of surface water resources Alteration of surface water drainage patterns Contamination of groundwater resources Air pollution Noise Pollution Negative visual impacts Loss of heritage, cultural and paleontological resources Economic impact Inward migration impacts Change in land use
Civil works	Hazardous excavations, surface subsidence and infrastructure that can be harmful to people and animals Physical destruction of biodiversity General disturbance of biodiversity Contamination of surface water resources Alteration of surface water drainage patterns Contamination of groundwater resources Air pollution Noise Pollution Road disturbance and traffic safety Negative visual impacts Loss of heritage, cultural and paleontological resources Economic impact Inward migration impacts Change in land use
Earthworks	Hazardous excavations, surface subsidence and infrastructure that can be harmful to people and animals Loss of soil resources and land capability through contamination Loss of soil resources and land capability through physical disturbance Physical destruction of biodiversity General disturbance of biodiversity Contamination of surface water resources Alteration of surface water drainage patterns Contamination of groundwater resources Air pollution Noise pollution Negative visual impacts Loss of heritage, cultural and paleontological resources Economic impact Inward migration impacts Change in land use
Mining and mining related activities	Hazardous excavations, surface subsidence and infrastructure that can be harmful to people and animals Contamination of surface water resources Air pollution Noise pollution Negative visual impacts Economic impact Inward migration impacts Change in land use
Waste rock management	Additional mineral resource Hazardous excavations, surface subsidence and infrastructure that can be harmful to people and animals Loss of soil resources and land capability through contamination Loss of soil resources and land capability through physical disturbance Physical destruction of biodiversity

Main activity/process	Impacts (unmitigated)
	General disturbance of biodiversity Contamination of surface water resources Alteration of surface water drainage patterns Contamination of groundwater resources Air pollution Noise pollution Negative visual impacts Economic impact Inward migration impacts Change in land use
Mineral processing operations	Air pollution Noise pollution Negative visual impacts Economic impact Inward migration impacts Change in land use
Tailings management	Hazardous excavations, surface subsidence and infrastructure that can be harmful to people and animals Loss of soil resources and land capability through contamination Loss of soil resources and land capability through physical disturbance Physical destruction of biodiversity General disturbance of biodiversity Contamination of surface water resources Alteration of surface water drainage patterns Contamination of groundwater resources Air pollution Noise pollution Negative visual impacts Loss of heritage, cultural and paleontological resources Economic impact Inward migration impacts Change in land use
Power Supply and Use	Air pollution Economic impact Inward migration impacts Change in land use
Water supply and use	Economic impact Inward migration impacts Change in land use
Process and storm water management	Loss of soil resources and land capability through contamination Physical destruction of biodiversity General disturbance of biodiversity Contamination of surface water resources Alteration of surface water drainage patterns Contamination of groundwater resources Economic impact Inward migration impacts Change in land use
Transport systems	Road disturbance and traffic safety Change in land use
General and hazardous waste management	Contamination of surface water resources Contamination of groundwater resources Inward migration impacts Economic impact Change in land use
Sewage sludge management	Loss of soil resources and land capability through contamination

Main activity/process	Impacts (unmitigated)
	Physical destruction of biodiversity General disturbance of biodiversity Contamination of surface water resources Economic impact Inward migration impacts Change in land use
Site support services	Contamination of surface water resources Contamination of groundwater resources Economic impact Inward migration impacts Change in land use
Housing	Loss of soil resources and land capability through contamination Loss of soil resources and land capability through physical disturbance Physical destruction of biodiversity General disturbance of biodiversity Air pollution Negative visual impacts Loss of heritage, cultural and paleontological resources Economic impact Inward migration impacts Change in land use
Site/contract management	Physical destruction of biodiversity General disturbance of biodiversity Loss of heritage, cultural and paleontological resources Economic impact Inward migration impacts Change in land use
Demolition	Hazardous excavations, surface subsidence and infrastructure that can be harmful to people and animals Loss of soil resources and land capability through contamination Loss of soil resources and land capability through physical disturbance Physical destruction of biodiversity General disturbance of biodiversity Contamination of surface water resources Alteration of surface water drainage patterns Contamination of groundwater resources Air pollution Noise pollution Negative visual impacts Loss of heritage, cultural and paleontological resources Economic impact Inward migration impacts Change in land use
Rehabilitation	Hazardous excavations, surface subsidence and infrastructure that can be harmful to people and animals Loss of soil resources and land capability through contamination Loss of soil resources and land capability through physical disturbance Physical destruction of biodiversity General disturbance of biodiversity Contamination of surface water resources Alteration of surface water drainage patterns Contamination of groundwater resources Air pollution Noise pollution Negative visual impacts Loss of heritage, cultural and paleontological resources Economic impact

Main activity/process	Impacts (unmitigated)
	Inward migration impacts Change in land use
Maintenance and aftercare	Hazardous excavations, surface subsidence and infrastructure that can be harmful to people and animals Loss of soil resources and land capability through contamination Loss of soil resources and land capability through physical disturbance Physical destruction of biodiversity General disturbance of biodiversity Contamination of surface water resources Alteration of surface water drainage patterns Contamination of groundwater resources Air pollution Noise pollution Negative visual impacts Loss of heritage, cultural and paleontological resources Economic impact Inward migration impacts Change in land use

8.4 ASSESSMENT OF THE SIGNIFICANCE OF EACH IMPACT AND RISK AND AN INDICATION OF THE EXTENT OF TO WHICH THE ISSUE AND RISK CAN BE AVOIDED OR ADDRESSED BY THE ADOPTION OF MITIGATION MEASURES

The assessment of the significance of the impacts identified for the proposed project area are included in Appendix F and summarised in Section 9. The extent to which the identified impacts can be avoided or addressed by the adoption of mitigation measures is included in Section 9.

9 ASSESSMENT OF EACH IDENTIFIED POTENTIALLY SIGNIFICANT IMPACT AND RISK

As stipulated by the DMR template a summary of the assessment of the environmental and socio-economic impacts associated with the proposed project is provided in Table 9.1 below. A full description of the assessment is included in Appendix F. All identified impacts are considered in a cumulative manner such that the current baseline conditions on site and in the surrounding area are discussed and assessed together.

TABLE 9.1: ASSESSMENT OF SIGNIFICANT IMPACTS AND RISKS

L = Low, M= Medium, H = High, + = positive impact

Activity	Potential impact	Aspects affected	Phase	Significance (unmitigated)	Mitigation type	Significance (mitigated)	Extent to which the impact can be avoided or addressed through the implementation of management measures
Waste rock management	Inclusion of additional mineral resources	Geology	Construction Operation Decommissioning Closure	M	• Manage through sale of all available aggregate waste rock	H+	Can be fully managed/mitigated
Site preparation Civil works Earthworks Waste rock management Mining and mining related activities Tailings management Demolition Rehabilitation Maintenance and aftercare	Hazardous excavations infrastructure and surface subsidence	Topography	Construction Operation Decommissioning Closure	H	• Control through access control • Control through management and monitoring • Control through rehabilitation • Remedy through emergency response procedure (Section 31.2.2) • Control and remedy through training	M (Plant area) M-H (TSF area)	Can be managed/mitigated to acceptable levels
Site preparation Earthworks Waste rock management Transport systems Housing Tailings management Demolition Rehabilitation Maintenance and aftercare	Loss of soil resources and land capability through physical disturbance	Soils and land capability	Construction Operation Decommissioning Closure	H	• Manage through the implementation of soil conservation management plan and waste management plan • Control through rehabilitation • Control through limiting project footprint • Control through erosion control measures	M-H	Can be managed/mitigated to acceptable levels
Site preparation Earthworks Waste rock management Transport systems Tailings management Housing	Loss of soil resources and land capability through pollution	Soils and land capability	Construction Operation Decommissioning Closure	H	• Manage through the implementation of soil conservation management plan and waste management plan • Control through rehabilitation • Remedy through emergency response procedure (Section 31.2.2)	L M-H (pipeline)	Can be managed/mitigated to acceptable levels

Activity	Potential impact	Aspects affected	Phase	Significance (unmitigated)	Mitigation type	Significance (mitigated)	Extent to which the impact can be avoided or addressed through the implementation of management measures
Process and storm water management Sewage sludge management Demolition Rehabilitation Maintenance and aftercare					• Control and remedy through training		
Site preparation Civil works Earthworks Tailings management Waste rock management Transport systems Housing Process and storm water management Sewage sludge management Site/contract management Demolition Rehabilitation Maintenance and aftercare	Physical destruction of biodiversity	Biodiversity	Construction Operation Decommissioning Closure	H	• Modify through placement of infrastructure • Control through species relocation and an invasive species management plan • Remedy through conservation and rehabilitation measures • Control through monitoring and inspections • Control through limiting disturbance	M- H (habitat / vegetation type) M (other biodiversity aspects)	Can be managed/mitigated to acceptable levels
Site preparation Civil works Earthworks Tailings management Waste rock management Transport systems Housing Process and storm water management Sewage sludge	General disturbance of biodiversity	Biodiversity	Construction Operation Decommissioning Closure	H	• Can be controlled through pollution management • Can be controlled through implementation of procedures, management plans and personnel training • Can be managed through an invasive species management plan	M	Can be managed/mitigated to acceptable levels

Activity	Potential impact	Aspects affected	Phase	Significance (unmitigated)	Mitigation type	Significance (mitigated)	Extent to which the impact can be avoided or addressed through the implementation of management measures
management Site/contract management Demolition Rehabilitation Maintenance and aftercare							
Site preparation Civil works Earthworks Transport systems Mining and mining related activities Waste rock management Tailings management Process and storm water management General and hazardous waste management Sewage sludge management Site support services Demolition Rehabilitation Maintenance and aftercare	Contamination of surface water resources	Surface water	Construction Operation Decommissioning Closure	H	• Control through storm water management and design • Remedy through emergency response procedure (Section 31.2.2)	L	Can be managed/mitigated to acceptable levels
Site preparation Civil works Earthworks Transport systems Waste rock management Tailings management Process and storm water management Demolition	Alteration of natural drainage patterns		Construction Operation Decommissioning Closure	H	• Control through appropriate design / re-alignment • Control through the separation of dirty and clean water	M	Can be managed/mitigated to acceptable levels

Activity	Potential impact	Aspects affected	Phase	Significance (unmitigated)	Mitigation type	Significance (mitigated)	Extent to which the impact can be avoided or addressed through the implementation of management measures
Rehabilitation Maintenance and aftercare							
Site preparation Civil works Earthworks Transport systems Mining and mining related activities Waste rock management Tailings management Process and storm water management General and hazardous waste management Sewage sludge management Site support services Demolition Rehabilitation Maintenance and aftercare	Contamination of groundwater resources	Groundwater	Construction Operation Decommissioning Closure	H	• Control through monitoring • Remedy through emergency response procedure (Section 31.2.2)	L	Can be managed/mitigated to acceptable levels
Site preparation Civil works Earthworks Mining and mining related activities Waste rock management Mineral processing operations Tailings management Power Supply and Use Transport systems Housing	Air pollution	Air	Construction Operation Decommissioning Closure	H	• Control through implementation of dust control measures • Monitor through the continuation of the monitoring programme	M (PM10 & Dustfall) L-H (PM2.5)	Can be managed/mitigated to acceptable levels

Activity	Potential impact	Aspects affected	Phase	Significance (unmitigated)	Mitigation type	Significance (mitigated)	Extent to which the impact can be avoided or addressed through the implementation of management measures
Demolition Rehabilitation Maintenance and aftercare							
Site preparation Earthworks Civil works Waste rock management Tailings Management Transport systems Demolition Rehabilitation Waste rock management Mineral processing operations Mining and mining related activities	Noise pollution	Noise	Construction Operation Decommissioning	M	• Control through noise control measures and monitoring (if required)	M	Can be managed/mitigated to acceptable levels
Transport systems	Road disturbance and traffic safety	Traffic	Construction Operation Decommissioning Closure	M	• Modify through the introduction of a roundabout and converting a lane into turning lane only. • Control through appropriate design • Management through the implementation of traffic safety programme • Remedy through emergency response procedure (Section 31.2.2)	H+	Can be mitigated to improve the service level
Site preparation Civil works Earthworks Mining and mining related activities Waste rock management Mineral processing operations	Negative visual views	Visual	Construction Operation Decommissioning Closure	H	• Control through visual controls and concurrent rehabilitation	M	Can be managed/mitigated to acceptable levels

Activity	Potential impact	Aspects affected	Phase	Significance (unmitigated)	Mitigation type	Significance (mitigated)	Extent to which the impact can be avoided or addressed through the implementation of management measures
Tailings management Housing Demolition Maintenance and aftercare of final land forms and rehabilitated areas							
Site preparation Earthworks Transport systems Housing Site/contract management Tailings management Demolition Rehabilitation	Loss of heritage, cultural and palaeontological resources	Heritage/ cultural and palaeontological resources	Construction Operation Decommissioning	H	• Control through relocation of graves • Avoid through data collection • Control through additional site assessments prior to development • Remedy through emergency response procedure (Section 31.2.2)	L-M	Can be managed/mitigated to acceptable levels
Site preparation Civil works Earthworks Mining and mining related activities Waste rock management Mineral processing operations Tailings management Power Supply and Use Water supply and use Process and storm water management Transport systems General and hazardous waste management Sewage sludge management Site support services	Economic impact	Socio-economic	Construction Operation Decommissioning Closure	H+	• Control through procurement programme and bursary and skills development programme	H+	Can be managed/mitigated to acceptable levels

Activity	Potential impact	Aspects affected	Phase	Significance (unmitigated)	Mitigation type	Significance (mitigated)	Extent to which the impact can be avoided or addressed through the implementation of management measures
Housing Site/contract management Demolition Rehabilitation Maintenance and aftercare							
Site preparation Civil works Earthworks Mining and mining related activities Waste rock management Mineral processing operations Tailings management Power Supply and Use Water supply and use Process and storm water management Transport systems General and hazardous waste management Sewage sludge management Site support services Housing Site/contract management Demolition Rehabilitation Maintenance and aftercare	Inward migration and associated social ills		Construction Operation Decommissioning Closure	H	• Control through health policy, monitoring the development of informal settlements • Remedy through emergency response procedure (Section 31.2.2)	M	Can be managed/mitigated to acceptable levels
Construction of project components Operation of the mine Decommissioning of project	Loss or changes to existing land use	Land use	Construction Operation Decommissioning	H	Control through closure planning Manage through implementation of mitigation measures for environmental and social impacts	M-L L (at closure)	Can be managed/mitigated to acceptable levels

Activity	Potential impact	Aspects affected	Phase	Significance (unmitigated)	Mitigation type	Significance (mitigated)	Extent to which the impact can be avoided or addressed through the implementation of management measures
components Final land forms			Closure				

10 SUMMARY OF SPECIALIST REPORT FINDINGS

The relevant specialist studies that were undertaken as part of the proposed project including the recommendations made by the specialist are summarised in Table 10.1 below. The relevant specialist reports have been attached in the appendices to this EIA and EMP report.

TABLE 10.1: SUMMARY OF SPECIALIST REPORTS

Studies undertaken	Recommendations of specialists	Specialist recommendations that have been included in the EIA report (mark with an x)	Reference to applicable section in this report
Soil, land use and land capability	• Place pipeline in areas already transformed or where transformation will occur owing to road construction etc. • Avoid vehicle slippage and rutting. • Place pipeline away from the drainage lines on the farm Frischgewaagd, especially where the Sepane soil form occurs. • Construct in dry season. • If soil erosion has occurred, an erosion control plan entailing hard (i.e. gabion construction) and/or soft (i.e. breaking surface water flow velocities) should be designed by a competent person. • Soil horizons to be stripped separately. • Soil horizons to be stockpiled separately. • C-horizon material to be backfilled first followed by B- and A-horizon material. • Maintain pipeline in order to avoid spillage. • If spillage occurs, the spill must be contained with swales and berms, after the leakage has been repaired the spilled material should be removed and pollution plume should be determined by a soil chemist and hydrologist and geohydrologist. • A remediation plan must be compiled by the soil chemist and hydrologist following a spill event.	X	Section 28 and Section 31
Heritage/ cultural and palaeontological resources	**Possible Graves:** • A detailed social consultation process, at least 60 days in length, comprising the attempted identification of the next-of-kin so as to obtain their consent for the relocation of the graves. • Bilingual site notices (in the most appropriate languages) indicating the intent of the relocation. • Bilingual newspaper notices indicating the intent of the relocation. • Identified graves and cemeteries (including those confirmed to be graves from the procedure followed for possible graves): • Permit applications to the legally required authorities, including (but certainly not restricted to) the South African Heritage Resources Agency. • An exhumation process that keeps the dignity of the remains and family intact. • An exhumation process that will safeguard the legal rights of the families as well as that of the development company. • The process must be done by a reputable company well versed in the mitigation of graves. **Iron Age sites** *For MCH002, MCH003, MCH004, MHC018, MCH020*: • Shovel pit test to determine depth and integrity of archaeological deposit of site and for	X	Section 28

Studies undertaken	Recommendations of specialists	Specialist recommendations that have been included in the EIA report (mark with an x)	Reference to applicable section in this report
	sites with ceramics also to collect more diagnostic ceramics (MHC018 and MHC020) to positively establish group identity. • Test pit excavations will be aimed at identifying structures. • Based on the findings further assessment of the site might be required. • Before destruction of the site, a destruction permit must be applied for (for sites that require destruction permits) and received from the South African Heritage Resources Agency. • This work can only be undertaken by a suitably qualified and experienced archaeologist. • This work may only be undertaken after permits had been received from the South African Heritage Resources Agency allowing such mitigation measures to be undertaken. *For MHC005:* • If the site is impacted upon, an archaeologist must monitor the site during construction to mitigate accidental finds. • Before destruction of the site, a destruction permit must be applied for and received from the South African Heritage Resources Agency. • This work can only be undertaken by a suitably qualified and experienced archaeologist. *MHC019:* • An archaeologist must monitor the site during construction to mitigate accidental finds. This work can only be undertaken by a suitably qualified and experienced archaeologist. **Early Stone Age:** • An Early Stone Age specialist must assess the study area in particular the pebble layers that contain artefacts. New dating techniques could be used here.		
Traffic	• The intersection of the R556 & R565 should be converted to a 2-lane roundabout as already recommended in the 2008 traffic study. • The roundabout should have a minimum island diameter of 15m and two circulating lanes. The geometric details of the roundabout are however subject to detail design; the limitations of the design vehicle; and restrictions on site.* • Further investigation should be undertaken to determine the remaining pavement capacity of the transport route and to establish the upgrading and maintenance requirements if any. These further investigations should not be a requirement for receiving authorisation but can be included as part of the construction phase.	X *The recommendation for the construction of a traffic roundabout at the intersection ~1.6 km from the mine access road is one that cannot be fulfilled by BPM exclusively as the road does not fall within BPM's jurisdiction. The commitment provided in the EMP incorporates consideration of this.	Section 28
Groundwater Modelling	**Construction Phase**	X	Section 28

Studies undertaken	Recommendations of specialists	Specialist recommendations that have been included in the EIA report (mark with an x)	Reference to applicable section in this report
	• Excess water that accumulates during the construction phase will be dealt with as part of the construction phase water balance; • All unwanted water accumulating in the excavations will be used or discharged into pollution control dams; and • Clean runoff will be diverted around the total TSF complex. • **Operational Phase** • All excess water must be managed as part of operational phase water balance. Return water from the TSF must be used as much as possible; • All water coming to the TSF must be treated as polluted. Where water is not returned to the plant area, disposal must take place in the correct polluted water facility; • As the TSF will be lined, seepage of potential contaminants to the groundwater system will be significantly reduced • The sustainability of the lining must be continuously checked through continuous monitoring of groundwater quality and levels for any type of impact; • Groundwater quality and levels should be continuously monitored for any type of impact; and • If required, a groundwater abstraction scheme should be implemented around the TSF to capture polluted ground water, and to prevent the migration of polluted water away from the site. **Decommissioning Phase** • During the decommissioning phase, final rehabilitation of the TSF will take place. All measures put in place during the operational phase will be extended through the decommissioning phase to closure. The long term groundwater closure objective is to prevent any migration of polluted water from the TSF. **Monitoring** • Groundwater monitoring has to continue during all phases of the TSF operation to identify the impact on the groundwater resources over time, so effective measures can be taken at an early stage before serious damage to the environment occurs. • In total nine monitoring points are recommended for the proposed groundwater monitoring program (four shallow, four deep and one by the Elands River).		
Aquatic Ecology Assessment	• Any damage to the drainage lines necessary to complete the work must be limited in extent; • Tie-in points at riverbanks (i.e. where infrastructure is placed into the ground) must be suitably safeguarded with gabion cut-off walls to prevent erosion. • Permit only essential construction personnel within 32m of the riparian habitat, if	X	

Studies undertaken	Recommendations of specialists	Specialist recommendations that have been included in the EIA report (mark with an x)	Reference to applicable section in this report
	absolutely necessary that they enter the buffer zone; • All areas should be monitored for erosion and incision. Specific mention is made of sedimentation of riparian areas; • To prevent the erosion of topsoils, management measures to minimise erosion should include installation of berms, silt traps, hessian curtains at erodible areas and storm water diversion away from areas susceptible to erosion; • Sheet runoff from access roads should be slowed down by the strategic placement of berms; • All soils compacted as a result of activities falling outside of project footprint areas should be ripped and profiled; • Rehabilitate all drainage line and riparian habitat areas if required, in order to ensure that the ecology of these areas is re-instated during all phases; • Edge effects of activities including erosion and alien/weed control need to be strictly managed in these areas; • Alien and invasive vegetation control should take place throughout all phases of the development; • All reseeding activities must be undertaken at the end of the dry season to ensure optimal conditions for germination and rapid vegetation establishment; • Implement effective waste management in order to prevent construction related waste from entering the drainage line and riparian environments; • It must be ensured that all hazardous storage containers and storage areas comply with the relevant SABS standards to prevent leakage; • No camp fires should be permitted in or near the riparian area; • During the operational phase of the tailings pipeline, ensure that operational and maintenance related activities are kept strictly within the development footprint; • Regular monitoring of the tailings pipeline is recommended during the operational phase to prevent potential spills/leakages; • All spills/leakages by the tailings pipeline should be immediately cleaned up and treated accordingly; • All development footprint areas and areas affected by closure and decommissioning of the tailings pipeline should remain as small as possible and should not encroach onto surrounding riparian areas and their associated buffer zones; • Upon closure and decommissioning, reseeding with indigenous grasses should be implemented in all affected areas; • On-going aquatic ecological monitoring must take place on a 6 monthly basis by an SA RHP Accredited assessor during both the construction and operational phases; • Post closure aquatic ecological monitoring is recommended to ensure that no impact on the aquatic resources in the area takes place after decommissioning and closure has taken place;		

Studies undertaken	Recommendations of specialists	Specialist recommendations that have been included in the EIA report (mark with an x)	Reference to applicable section in this report
	• Since the downstream sites in both the Sandspruit and unnamed tributary of the Elands River displayed higher SASS scores this spatial trend should not show a deterioration in the future once the proposed development takes place and this trend should be considered a Key Performance Indicator for the project throughout the life of the infrastructure.		
Faunal Assessment	• Additional surveys to be performed if expansion of infrastructure is planned in the future. • Apply sound veld management principles to ensure maximum biodiversity. This would include sound fire management and grazing techniques. Refer to mitigation measures in the Flora and Vegetation Report; • Construction teams to be housed off-site to reduce human presence on site; • Fence off surrounding untransformed vegetation (applicable to all footprints except the pipeline); • Limit damage and access to riparian vegetation during bridge construction; • Limit transformation only to development footprints; • Maintain untransformed vegetation in a natural state; • Mine infrastructure to be adequately rehabilitated after mining ceases. This includes stockpiles, tailings, rock dumps etc.; • Monthly perimeter inspections to assess state of fence and determine if it is being breached by poachers; • Report and monitor species of conservation-concern and implementing a monitoring programme.		
Floral Assessment	• Avoid placement of any infrastructure footprints within the buffer zones for the biological corridors recommended in the vegetation report (Appendix 12 of Appendix K). • Botanical research and conservation institutions (e.g. SANBI and universities), should also be afforded an opportunity to search the footprint for species that are of research or horticultural interest, prior to commencement of development. • Conduct additional, brief floristic surveys, focused on searching for Drimia sanguinea, Stentonstelma umbelluliferum, *Boophone disticha* and *Hypoxis hemerocallidea* within the final development footprints prior to construction. Surveys should be conducted in late October to early November and in January. The brief floristic surveys should focus on searching those parts of the proposed infrastructure footprints containing potentially suitable habitat for Drimia sanguinea. These surveys will also contribute towards confirming the absence of other 'species of conservation concern' within the study area. • Develop and implement a rehabilitation plant for the tailings pipeline construction servitude. The principal objectives of the plan should be the optimal reintroduction of stripped topsoil and the establishment of indigenous seral plant communities through the natural process of secondary succession. • Develop and implement a veld management plan for the study area, which emphasises the use of sustainable grazing and controlled fires to ensure optimal vegetation condition	X	Section 28

Studies undertaken	Recommendations of specialists	Specialist recommendations that have been included in the EIA report (mark with an x)	Reference to applicable section in this report
	and biodiversity levels in areas of Marikana Thornveld and spatially restricted untransformed vegetation units not destroyed by the project. • Develop and implement an alien plant control programme for the study area, with emphasis on areas surrounding infrastructure footprints. • If herbaceous Protected plant species that are readily transplantable are found (e.g. many geophytes), viable populations of such species can also be translocated to transformed (including rehabilitation areas) or untransformed areas within the study area which provide potentially suitable habitats, but such translocations will have to be carried out in a manner that ensures that no ecological degradation of the host habitat occurs, and will have to be evaluated by a botanist for each species and each potential translocation area. Alternatively such species should be rescued and placed in a nursery or donated to a research institute (e.g. SANBI and universities), rather than simply being destroyed upon receipt of a permit. • Illegal medicinal plant harvesting should be discouraged through control of access to untransformed habitats and vegetation within the study area. • Implement pollution control measures recommended in the soil, geotechnical and hydrological specialist reports for the project. • In the event of any Declining (sensu Raimondo et al., 2009) plant species being recorded within approved development footprints in future, permission for their removal or destruction should be obtained from the provincial Directorate of Biodiversity Management. Where feasible, viable populations of such species should be translocated to degraded or untransformed areas within the study area which provide potentially suitable habitats, but such translocations will have to be carried out in a way that ensures no ecological degradation of the host habitat occurs, and will have to be evaluated by a botanist for each species and each potential translocation area. • In the event of any threatened (i.e. Critically Endangered, Endangered and Vulnerable) or Near Threatened plant species being recorded within the study area or proposed development footprints in future, appropriate in situ and/or ex situ conservation measures should be developed in consultation with the North-West Province Directorate of Biodiversity Management. • Limit transformation only to development footprints. • Modify infrastructure footprints so as to reduce the area of spatially restricted vegetation units and Marikana Thornveld within the footprints wherever possible. Realigned footprints should be placed within the 'Secondary vegetation' unit in as far as possible. • Modify PCD footprint by shifting it approximately 50m to the north-west so as avoid a small patch of 'Stony grassland' and situate it outside of the recommended buffer zone for the biological corridor along the Elands River.* • Modify the return water dam footprint by shifting it to the north and west so that it is situated outside of the recommended buffer zone for the biological corridor along the		

Studies undertaken	Recommendations of specialists	Specialist recommendations that have been included in the EIA report (mark with an x)	Reference to applicable section in this report
	Elands River.* • Modify TSF footprint so as to maximise the surface area comprising Secondary vegetation and minimise the extent of Marikana Thornveld within the footprint. • Realign the Frischgewaagd section of the 'final tailings pipeline alignment' along the recently constructed access road and reduce the width of the construction servitude in untransformed habitats. • The 'final' Tailings Pipeline alignment was not surveyed in the field during the current study and was assessed only at a desktop level. The final Tailings Pipeline alignment should be searched for Protected plant species prior to the commencement of construction. • The damaging or destruction of any plant species Protected in terms of the National Forest Act or the Biodiversity Act should be avoided wherever possible, and a permit for the destruction of any such protected plant must be obtained from the provincial Directorate of Biodiversity Management prior to development. • A thorough survey for plant 'species of conservation concern' and Protected plant species within the proposed Solar Plant footprint should be conducted prior to any development of the footprint. This survey should focus on searching for Drimia sanguinea, Stentonstelma umbelluliferum, Boophone disticha and Hypoxis hemerocallidea within the final development footprints prior to construction, and should be conducted in late October to early November and in January. • The proposed Solar plant footprint should be modified so as reduce the extent of vegetation units with High biodiversity conservation value and sensitivity (Units 1.1 and 1.2) contained within the footprint. The attached mapping indicates the recommended realignment of the proposed footprint, which would result in the new footprint alignment including only 6.8ha of Unit 1.1, no area of Unit 1.2 and 14.7ha of Unit 6. Transformed habitats would therefore comprise 68.4% of the recommended footprint and the percentage of transformed habitat included within the final footprint could be further increased by shifting the eastern boundary of the footprint further to the east	*The recommendation to shift the PCDs and the return water dam is not feasible. Further details are contained in Section 7.7 for further details.	
Wetland Assessment	• A remediation plan must be compiled by a soil chemist and hydrologist after a spill event. • A watercourse rehabilitation plan should be developed during the latter part of the construction process to help address remnant impacts that were not successfully mitigated. Note that rehabilitation works in a watercourse will require a Water Use License. It is therefore recommended that rehabilitation needs and flexibility are considered as part of the WULA. • A well designed and implemented storm water management system will be required to attenuate flood peak events within the property and thereby prevent erosion and sediment impacts in watercourses. • Buffer zones are not walk away solutions and need to be maintained during the operational phase of the project in order to be effective. This includes the maintenance of	X	

Studies undertaken	Recommendations of specialists	Specialist recommendations that have been included in the EIA report (mark with an x)	Reference to applicable section in this report
	a well vegetated grass cover that is free of aliens and erosion features. Any aliens and/or erosion features observed within the buffer zone need to be addressed in order to ensure buffer functioning. • Delineated watercourses and buffers should be treated as sensitive no-go areas as far as possible. No unauthorized access is allowed in these features. • Develop and implement a site specific alien control plan during the latter half of the construction phase based on the evaluation of weed species present within watercourses located within or in close proximity to infrastructure features. Alien species in remaining areas of the properties should also be addressed as part of the alien control plan. • The proposed alien control plan should include a monitoring phase to evaluate successes achieved. Timing of treatments are essential, as control for most alien plant species can only be done during the growing season. • Dewatering that may be required during excavation activities should not be released directly into watercourses. • Discharged storm water must be released in a controlled manner in a diffuse flow pattern across a buffered vegetation strip and be accompanied by energy dissipating interventions to prevent erosion damage. • Storm water release impacts can be addressed in two main ways: The first is to make use of preventative construction techniques (source controls), such as to limit the amount of impervious material near watercourses as far as possible, and to demarcate setbacks from watercourses in the form of a buffer zone with a natural vegetation cover. • Structural control measures such as treatment techniques or naturally vegetated detention basins could be used to improve storm water quality. • Other structural control measures include grass swales, infiltration trenches and basins, wet ponds, and constructed wetlands to intercept and partially treat storm water before it is released. A combination of source controls and structural controls can result in an integrated solution, which is likely to provide the best benefits. • Ensure that geotechnical and geohydrological mitigation measures are in place around the proposed tailings storage facility to prevent seepage into nearby watercourses. • Ensure that the return water dam, tailings storage facility and product stockpiles are constructed and operated according to specifications, in order to help reduce the likelihood of structure failure, which can result in disastrous water quality impacts in downstream watercourses over a short space of time. • If spillage occurs, the spill must be contained with swales and berms after the leakage has been repaired, the spilled material should be removed and pollution plume should be determined a soil chemist and hydrologist. • Implement sediment control structures upslope of watercourses, in between stockpiles and construction activities that may act as sources of sediment. • A portion of the tailings pipeline will have to be moved north to avoid overlap with the		

Studies undertaken	Recommendations of specialists	Specialist recommendations that have been included in the EIA report (mark with an x)	Reference to applicable section in this report
	100m buffer. • Maintain the pipeline in a good working order with regular checks and inspections to help reduce the risk of spillage events. • Maintain sediment control structures in a functional manner during the entire construction phase. • Modify infrastructure footprints so as to avoid overlap between watercourses, as well as the 32m and 100m buffers as far as possible. This pertains specifically to changes to the two Mine housings phases (Phases 1a and 1), the product stockpiles, and return water* dam. • No new access roads may be created through watercourses along the pipeline alignment. All new tracks and roads that intersect delineated watercourses and the 32m buffer will have to receive environmental approval before they can be constructed. • No refueling of heavy motorised vehicles (HMVs) or other vehicles, stockpiling of material or the positioning of portable toilets should be allowed within any of the watercourses or their associated buffer zones. • Overlap between the tailings pipeline and the Sandspruit River is unavoidable, but a restricted servitude width should be used, while no construction activities should occur within the instream and riparian habitat along the macro channel. Plinths can be located within the 32m buffer, but not within delineated riparian habitat. • Repair erosion damage within watercourse through the use of either soft or hard rehabilitation interventions. Hard interventions, such as gabion drop inlets and other features, will require design by an engineer with rehabilitation experience. Soft rehabilitation interventions include rehabilitation interventions that do not consists of rock and concrete, examples include earth berms, revegetation with indigenous species and biojute fabrics. Note also that rehabilitation works in watercourses require a WUL. • Stockpiles should be protected from erosion during the wet season to prevent sedimentation in watercourses. • Storm water outflows should not be allowed to enter directly into watercourses, but need to be attenuated before they are released into watercourses. • Interventions and mechanisms in the storm water management system can include measures to facilitate a higher percentage of infiltration and reduce runoff volumes and velocities, without concentrating their outflows as far as practically possible. • The alignment of the tailings pipeline along the new access road can also serve as a maintenance road for the pipeline, which will remove the need for a new access road along the pipeline alignment. • The damaging or destruction of any plant species Protected in terms of the National Forest Act or the Biodiversity Act should be avoided wherever possible, and a permit for the destruction of any such protected plant must be obtained from the provincial Directorate of Biodiversity Management prior to development.	*The recommendation to shift the return water dam is not feasible. Further details are contained in Section 7.7 for further details.	

Studies undertaken	Recommendations of specialists	Specialist recommendations that have been included in the EIA report (mark with an x)	Reference to applicable section in this report
	• The proposed bridge can remain at its current location as an access road through Ephemeral channel 2 that connects the two housing phases appears to be unavoidable. The bridge will have to be modified to prevent further habitat loss due to expected anthropogenic erosion damage. • The proposed bridge crossing through Ephemeral channel 2 should contain culverts across the length of the crossing and armouring on the downstream channel banks and bed to avoid further channel incision and channel bank scour during high flow events. Pipes are not recommended as they can become easily blocked with alluvial material, which can lead to further scour damage in the watercourse. • The proposed tailings pipeline should move further to the north along the new access road in order to avoid overlap with Ephemeral channels 9 and 10, as well as Ephemeral drainage line 8. Overlap with Ephemeral drainage line 7 appears to be unavoidable, but the servitude width should be minimised as far as practical during the construction process. The pipeline should be spanned across the watercourse with plinths, which will need to be located outside of Ephemeral drainage line 7. • The storm water management plan needs to give special consideration to buffer zones in order to prevent erosion impacts and the creation of channelised flows at discharge points, which would largely negate the benefits of any buffers present. • Environmental control officers should ensure that signage to identify watercourses and their buffers are kept in place and remain well visible during the construction process and that no unauthorised access occurs. Toolbox talks should address the importance and sensitivity of wetlands and other watercourses.		
Air Quality	**Construction** • Land clearing activities such as bulldozing and scraping of road and blasting • Water sprays at area to be cleared. • Moist topsoil will reduce the potential for dust generation when tipped onto stockpiles. • Ensure travel distance between clearing area and topsoil piles to be at a minimum. **Road construction activities such as road grading** • Water sprays at area to be graded. • Freshly graded areas to be kept to a minimum. • During construction operations monthly dustfall rates should not exceed 600 mg/m²/day at residential dustfall bucket locations and 1 200 mg/m²/day at non-residential dustfall bucket locations. *Wind erosion from exposed areas* • Ensure exposed areas remain moist through regular water spraying during dry, windy periods.	X	Section 28

Studies undertaken	Recommendations of specialists	Specialist recommendations that have been included in the EIA report (mark with an x)	Reference to applicable section in this report
	• Monthly dustfall rates should not exceed 600 mg/m²/day at residential dustfall bucket locations and 1 200 mg/m²/day at non-residential dustfall bucket locations. *Operations* • Ventilation shafts (underground mining emissions) • It is recommended that a mitigation measure of water sprays on underground roads resulting in 75% CE. • Shorter haul routes would reduce emissions. • It is recommended that a mitigation measure of water sprays at underground materials handling points resulting in 50% CE. • It is recommended that a mitigation measure of water sprays at underground drilling resulting in 70% CE. • Vehicle exhausts – vehicle inspection and maintenance programs. • Monthly dustfall rates should not exceed 600 mg/m²/day(a) at residential dustfall bucket locations and 1 200 mg/m²/day(b) at non-residential dustfall bucket locations. *Vehicle activity on unpaved roads* • A minimum mitigation measure of water sprays resulting in 75% CE. • Shorter haul routes would reduce emissions. • Speed limits on all the BM roads. • Vehicle exhausts – vehicle inspection and maintenance programs. • Monthly dustfall rates should not exceed 600 mg/m²/day(a) at residential dustfall bucket locations and 1 200 mg/m²/day(b) at non-residential dustfall bucket locations. *Vehicle activity on paved roads* • Shorter haul routes would reduce emissions. • Speed limits on all the BM roads. • Vehicle exhausts – vehicle inspection and maintenance programs. • Monthly dustfall rates should not exceed 600 mg/m²/day(a) at residential dustfall bucket locations and 1 200 mg/m²/day(b) at non-residential dustfall bucket locations. *Materials handling* • A minimum mitigation measure of water sprays resulting in 50% CE. • Monthly dustfall rates should not exceed 600 mg/m²/day(a) at residential dustfall bucket locations and 1 200 mg/m²/day(b) at non-residential dustfall bucket locations. *Crushing and screening*		

Studies undertaken	Recommendations of specialists	Specialist recommendations that have been included in the EIA report (mark with an x)	Reference to applicable section in this report
	• A minimum mitigation measure of enclosure with fabric filters resulting in 83% CE. • Monthly dustfall rates should not exceed 600 mg/m²/day(a) at residential dustfall bucket locations and 1 200 mg/m²/day(b) at non-residential dustfall bucket locations. *Wind erosion* • Keep active TSF and WRD surfaces to a minimum. • Monthly dustfall rates should not exceed 600 mg/m²/day(a) at residential dustfall bucket locations and 1 200 mg/m²/day(b) at non-residential dustfall bucket locations. **G*eneral*** • Monthly dustfall rates should not exceed 600 mg/m²/day(a) at residential dustfall bucket locations and 1 200 mg/m²/day(b) at non-residential dustfall bucket locations. • PM2.5 and PM10 ambient samplers with no exceedances of the selected criteria. • SO2 and NO2 ambient samplers with no exceedances of the selected criteria. **Closure** *Wind erosion from exposed areas* • Demolition of infrastructure to have water sprays where a lot of vehicle activity is required. • Ensure site is restored to pre-mining conditions. **Record keeping and reporting** • Site inspections and progress reporting be undertaken at regular intervals (at least quarterly) during operations, with annual environmental audits being conducted. • Results from site inspections and off-site monitoring efforts should be combined to determine progress against source- and receptor-based performance indicators. Progress should be reported to all interested and affected parties, including authorities and persons affected by pollution. • Corrective action or the implementation of contingency measures must be proposed to the stakeholder forum in the event that progress towards targets is indicated by the quarterly/annual reviews to be unsatisfactory. • Stakeholder forums at specific intervals should be held for information dissemination and consultation		
Noise	**Pre-construction**: • Local residents are to be notified of any potentially noisy field survey works or other works during the planning and design phase and these activities are to be undertaken at reasonable times of the day. These works should not take place at night or on weekends. • During this phase, consideration must be given to the noise mitigation measures required	X	Section 28

Studies undertaken	Recommendations of specialists	Specialist recommendations that have been included in the EIA report (mark with an x)	Reference to applicable section in this report
	during the construction phase that should be included in the tender document specifications and the design. **Construction:** • Construction site yards, concrete batching plants, asphalt batching plants, construction worker camps (accommodation) and other noisy fixed facilities should be located well away from noise sensitive areas adjacent to the development site. • All construction vehicles and equipment are to be kept in good repair. • Noisy construction activities are to be contained to reasonable hours during the day and early evening. • The temporary ventilation system for the shaft construction should incorporate all the applicable noise mitigation measures. • With regard to unavoidable very noisy construction activities in the vicinity of noise sensitive areas, the contractor should liaise with local residents on how best to minimise impact. • In general operations should meet the noise standard requirements of the Occupational Health and Safety Act (Act No 85 of 1993). • Construction staff working in areas where the 8-hour ambient noise levels exceed 75dBA should wear ear protection equipment. **Operational:** • The following noise mitigation measures, which will need to be considered where appropriate, are indicators of what needs to be done to reduce or control the noise generated by the proposed operations: • The designs of the proposed plant are to incorporate all the necessary acoustic design aspects required in order that the overall generated noise level from the new installation does not exceed a maximum equivalent continuous day/night rating level (LRdn), namely a noise level of 70dBA (just inside the property projection plane, namely the property boundary) as specified for industrial districts in SANS 10103. • Notwithstanding this provision, the design is also to take into account the maximum allowable equivalent continuous day and night rating levels of the potentially impacted sites outside the mine property. Where the noise level at such an external site is presently lower than the maximum allowed, the maximum for that land use zoning shall not be exceeded. Where the noise level at the external site is presently at or exceeds the maximum, the existing level shall not be increased by more than indicated as acceptable in SANS 10103. Note that the induced ambient noise levels in the residential areas of Ledig Village should ideally not exceed 50dBA during the day and 40dBA at night. • The latest technology incorporating maximum noise mitigation measures for the shaft complex and concentrator plant components should be designed into the system.		

Studies undertaken	Recommendations of specialists	Specialist recommendations that have been included in the EIA report (mark with an x)	Reference to applicable section in this report
	• The design process is to consider, inter alia, the following aspects: • The position and orientation of buildings on the site. • The design of the buildings to minimise the transmission of noise from the inside to the outdoors. • The insulation of particularly noisy plant. • Specifically measures need to be taken for the two types of equipment, which are responsible for the highest noise levels from the shaft complex, namely the compressor house and the mine ventilation system (upcast vent fans): • The compressors should be fitted with effective silencers and the walls and roof of the compressor house should be constructed of a sufficiently dense material so as to achieve at least a 20dBA reduction (insertion loss) between the indoor noise and that transmitted to the outside of the building. Ventilation openings, if required, should be placed on the side of the building facing away from the noise sensitive areas. • The mine ventilation system should preferably use centrifugal fans rather than radial fans. The upcast vent fan outlets should be oriented slightly upwards and to the south-east away from Ledig Village, and if possible the enclosure of the surface infrastructure in an insulated building should also be considered. • Irrespective of the aforementioned mitigation measures that need to be taken at the sources of the noise, earth berms (noise attenuation barriers) should also be constructed: • Along the eastern perimeter of Ledig Village. • North of mine along the southern perimeter of the planned Gabonewe Estate (mine housing). • The design of the pump stations at the planned tailings dam is to incorporate all the necessary acoustic design aspects required in order that the induced ambient noise levels in the residential areas of Phatsima Village and Reagile informal settlement shall not exceed 50dBA during the day and 40dBA at night. • It should be noted that any mitigation measures taken at the development site will limit the impacts in the specific areas designed for, and will not necessarily contribute to improving the degraded noise climates in adjacent areas where there is already a problem from another source(s). **General recommendations** • The National Noise Control Regulations and SANS 10103 should be used as the main guidelines for addressing the potential noise impact on this project. • Various measures to reduce the potential noise impact from the planned mine are possible, and the mitigation measures indicated need to be considered. • The noise mitigation measures will need to be designed and/or checked by an acoustical engineer in order to optimise the design parameters and ensure that the cost/benefit of the measure is optimised.		

Studies undertaken	Recommendations of specialists	Specialist recommendations that have been included in the EIA report (mark with an x)	Reference to applicable section in this report
	• At commissioning of the mine, the noise footprint of the new shaft complex, the concentrator plant and the tailings dam area should be established by measurement in accordance with the relevant standards, namely SANS ISO 8297:1994 and SANS 10103. The character of the noise (qualitative aspect) should also be checked to ascertain whether there is any nuisance factor associated with the operation.		
Socio-economic	• Implement all Planning/ Design Phase and Construction Phase mitigation measures as outlined in the April 2008 EMP, Section 13.14.1. • A grievance/ complaints register should be compiled and implemented in which all community and Interested and Affected Parties (IAP) complaints are recorded and addressed. • Periodic communication (annual at a minimum) and feedback should be undertaken to the community and IAPs in respect of the progress of the Project and the implementation of the EIA management plans. • Implement all mitigation measures as outlined in the April 2008 EMP, Section 13.14.2. • Review all commitments outlined in the SLP and EMP, update to ensure that there is an increased benefit directed towards Phatsima. This should include meaningful interventions that promote long-term investment and expenditure in the community. • All directly affected communities will be considered for corporate social investment initiatives. BPM to clearly define beneficiaries (notably Ledig and Phatsima). Specific initiative should be defined for these communities. • BPM will continue to support the Bakubung-Ba-Ratheo Non-Mining Economic Development Trust and Bakubung-Ba-Ratheo Economic Development Unit (EDU) sustainable development initiatives and monitor their effectiveness. • All IAPs should be informed of the commencement of the decommissioning phase and the date of mine closure on a regular basis. • BPM must ensure that rehabilitation has taken place correctly, as stated in Section 13.17 of the SLP and according to legislation and the final end land users' requirements. • In order to ensure that no additional pressure is added to the existing infrastructure and services, BPM must continue to implement all mitigation measures as outlined in the April 2008 EMP, Sections 13.14.2, and 13.14.4. • Worker accommodation (construction and operation phases) must comply with the standards of international best practice; i.e. Workers Accommodation Processes and Standards: A Guidance Note by IFC and EBRD (2009). • Implement all mitigation measures as specified in the relevant 2016 specialist inputs, namely: o noise impact assessment; o air quality impact assessment; o traffic impact assessment; and o visual impact assessment in the EIA.	X	Section 28

Studies undertaken	Recommendations of specialists	Specialist recommendations that have been included in the EIA report (mark with an x)	Reference to applicable section in this report
	• A grievance/complaints register should be compiled and implemented in which all community and IAP complaints are recorded and addressed. • Periodic communication (annual at a minimum) and feedback should be undertaken to the affected communities and stakeholders in respect of the activities that will generate nuisance factors. **Construction staff, plant and equipment:** • All construction staff will agree to a Code of Conduct (CoC) that outlines protocols and standards for working on the affected land. The CoC should address the following: o respect for local residents; o respect for existing livelihood activities and the environment; o no hunting, snaring or unauthorised taking of any property belonging to someone else; o compliance with the Traffic Management Plan and all associated regulations; o unambiguous disciplinary measures for not adhering to the Code of Conduct. • Community members / affected land users will be able to lodge grievances with BPM using the existing grievance procedure. In the event that the grievance is not addressed or closed out properly, there should be an avenue through which the matter is escalated to a higher level of authority within BPM. • BPM and the Bakubung-Ba-Ratheo Traditional Authority will discuss appropriate mitigation measures including methods and procedures to minimise the disruption to land use patterns and livelihood activities. This will include, fencing off the construction site to ensure that community members and livestock do not get injured due to construction activities and providing access points (both during construction and during operations and maintenance) across, over or under the pipeline to ensure unhindered movement for pedestrian and livestock as well as a clear and simple claim mechanism in the event of proven damage to property by the contractor. • Compliance with relevant mitigation measures as outlined in the noise, air quality, and heritage assessments. **Pipeline crossings:** • Identify and confirm all affected land uses and land user groups with input from the Bakubung-Ba-Ratheo Traditional Authority. • Consider all possible measures to enable convenient and safe pedestrian and livestock crossing of the construction site and the pipeline, post construction. These may include providing overpasses and underpasses at regular intervals or in designated locations along the pipeline route. • Together with the Bakubung-Ba-Ratheo Traditional Authority and affected land user groups identify practical and cost-effective engineering solution to cross the construction site and the pipelines.		

Studies undertaken	Recommendations of specialists	Specialist recommendations that have been included in the EIA report (mark with an x)	Reference to applicable section in this report
	• The pipelines should not be fenced during operations as this will completely prevent all pedestrian and livestock from crossing. **If required:** • Hold discussions with the Traditional Authority to confirm that they are in agreement that all livelihoods activities can proceed unhindered. Should they raise concerns, these should be defined and investigated, suitable mitigation should be agreed. • Update BPM's "Grazing Compensation Assessment Procedure". Implement as and when required. • A practical and cost effective yet fair agreement should be reached between all parties. Possible mitigation measures may therefore include the construction of overpasses and underpasses at designated locations along the pipeline route or pursuing other options as detailed in the procedure[1]. • Mitigation measures should be approached in accordance with the principles of the International Finance Corporation's Performance Standard 5 on Land Acquisition and Involuntary Resettlement (IFC PS5, 2012), namely to achieve fair compensation that will not leave affected parties worse off than their position pre-project intervention. • implement all mitigation measures as outlined in the Environmental Impact Assessment and Environmental Management Program for BPM and Associated Infrastructure, April 2008. [1]Should the pipeline prohibit livestock movement to the extent that livelihoods are compromised, BPM should enhance/ extend the Bakubung-Ba-Ratheo Farming Project to provide opportunities for the affected people.		

11 ENVIRONMENTAL IMPACT STATEMENT

11.1.1 SUMMARY OF KEY FINDINGS OF THE EIA

This section provides a summary of the findings of identified and assessed potential impacts on the receiving environment in both the unmitigated and mitigated scenarios, including cumulative impacts. A summary of the potential impacts (as per Section 9), associated with the original layout (as per Section 7), in the unmitigated and mitigated scenarios for all project phases is included in Table 11.1 below. The alternatives suggested by the specialists would partly be represented by the mitigated scenario.

TABLE 11.1: SUMMARY OF POTENTIAL IMPACTS

Section	Potential impact	Significance of the impact (the ratings are negative unless otherwise specified)	
		Unmitigated	Mitigated
Geology	Additional mineral resource and sterilization of mineral resources	M	H+
Topography	Hazardous excavations and infrastructure	H	M (Plant area) M-H (TSF area)
Soils and land capability	Loss of soil resources and land capability through contamination	H	L M-H (pipeline)
	Loss of soil resources and land capability through physical disturbance	H	M-H
Biodiversity	Physical destruction of biodiversity	H	M- H (habitat / vegetation type) M (other biodiversity aspects)
	General disturbance of biodiversity	H	M
Surface water	Contamination of surface water resources	H	L M (pipeline)
	Alteration of drainage patterns	H	M
Groundwater	Contamination of groundwater resources	H	L M (pipeline)
Air quality	Air pollution	H	L-H
Noise	Noise pollution	M	M
Traffic	Road disturbance and traffic safety	M	H+
Visual	Visual impacts	H	M
Heritage, palaeontological and cultural resources	Loss of heritage, palaeontological and cultural resources	H	L-M
Socio-economic	Economic impact	H+	H+
	Inward migration	H	M

Section	Potential impact	Significance of the impact (the ratings are negative unless otherwise specified)	
		Unmitigated	Mitigated
Land use	Land use impact	H	M-L L (at closure)

The assessment of the proposed project presents the potential for significant negative impacts to occur (in the unmitigated scenario in particular) on the bio-physical, cultural and socio-economic environments both on the project sites and in the surrounding area. With mitigation these potential impacts can be prevented or reduced to acceptable levels.

It follows that provided the EMP is effectively implemented there is no environmental, social or economic reason why the project should not proceed.

11.1.2 Final Site Map

The final preferred site layout plan is included in Appendix G.

11.1.3 Summary of the Positive and negative implications and risks of the proposed activity and identified alternatives

A detailed discussion of the positive and negative implications and risks of the proposed activity are discussed in Section 7.5 and a high level assessment of identified alternatives is provided in Section 7.7. As discussed, site layout alternatives were suggested as a result of the impact assessment and thus are a management measure to the proposed project.

In three cases, the recommendations for shifting infrastructure layouts has already been met through the final layout as provided by the applicant (Figure 0.1); Phase 1 housing and the product stockpiles which are not overlapping the watercourse buffer areas as well as the TSF which overlaps with less Marikana Thornveld and more secondary vegetation (Section 7.7).

For the other layouts alternatives the following was concluded:

- For the pipeline route alternative, there are no expected differences for impacts to groundwater, visual, proximity to residential areas, change in land use, economic and inward migration. For Option 2 for the pipeline, there will be less disturbance to sensitive biodiversity areas, there could be an impact to a heritage resource of low significance, the sensitive Sepane soils will be avoided and the route will be located outside of the 32 m of an ephemeral channel.

- For the Phase 1a housing, there are no expected differences for impacts to heritage, groundwater, visual, change in land use, economic impact and inward migration impacts. For Option 2, the housing will be outside of the 32m buffer areas, will avoid additional degradation of eroded soils and will reduce overlap with watercourse habitats.
- For the solar plant, there are no expected differences for impacts to heritage, soils, groundwater, surface water, proximity to residential areas, land use or economic or inward migration impacts. For Option 2 there will be a lower disturbance of areas with high biodiversity conservation value and sensitivity and a slightly lower visual impact.

In conclusion:

- The final site layout as provided by the applicant already meets the recommendations for the TSF, Phase 1 mine housing and the product stockpiles.
- The Option 2 layout is the preferred alternative for the tailings and return water pipelines, Phase 1a mine housing, and the solar plant.
- The Option 1 layout is the only feasible alternative for the return water dam and the TSF.

Appendix G shows a representation of these changes.

12 IMPACT MANAGEMENT OBJECTIVES AND OUTCOMES FOR INCLUSION IN THE EMPR

Based on the outcome of the impact assessment and where applicable the recommendations from specialists the proposed management objectives and outcomes for inclusion into the environmental management programme are detailed in this section.

12.1 PROPOSED MANAGEMENT OBJECTIVES AND OUTCOMES FOR ENVIRONMENTAL AND SOCIO-ECONOMIC IMPACTS

Specific environmental objectives to control, remedy or stop potential impacts emanating from the proposed project is provided in Table 12.1 below.

TABLE 12.1: ENVIRONMENTAL OBJECTIVES AND OUTCOMES

Aspect	Environmental objective	Outcome
Geology	To maximise use of mineral resources and minimise residual deposits	To maximise sale of waste rock
Topography	To prevent physical harm to third parties and animals from potentially hazardous excavations and infrastructure	To ensure the safety of people and animals
Soil and land capability	To prevent soil pollution and to minimise the loss of soil resources and related land capability through physical disturbance, erosion and compaction	To handle, manage and conserve soil resources to be used as part of rehabilitation and re-establishment of the pre-mining land capability
Biodiversity	To prevent the unacceptable disturbance and loss of biodiversity and related ecosystem functionality through physical destruction and disturbance	To limit the area of disturbance as far as practically possible
Surface water	To prevent pollution of surface water resources and related harm to surface water users (if any) and to prevent unacceptable alteration of drainage patterns and related reduction of downstream surface water flow	To ensure surface water quality remains within acceptable limits for both domestic and agricultural purposes. To ensure that the reduction of the volume of run-off into the downstream catchment is limited to what is necessary and that natural drainage patterns are re-established as part of rehabilitation.
Groundwater	To prevent pollution of groundwater resources and related harm to water users and to prevent losses to third party water users.	To ensure groundwater quality remains within acceptable limits for both domestic and agricultural purposes. To ensure that groundwater continues to be available to current users.
Air	To prevent air pollution health impacts	To ensure that any pollutants emitted as a result of the proposed project remains with acceptable limits
Noise	To prevent unacceptable noise impacts	To ensure that any noise generated as a result of the proposed project remain within acceptable limits
Visual	To limit negative visual impacts	To ensure visual views that complement the surrounding environment
Traffic	To reduce the potential for safety and vehicle related impacts on road users	To ensure the mine's use of public roads is done in a responsible manner
Heritage and cultural	To prevent unacceptable loss of heritage resources and related information	To protect heritage resources where possible If disturbance is unavoidable, then mitigate impact in consultation with a specialist and the SAHRA and in line with regulatory requirements
Socio-economic	To enhance the positive economic impacts and limit the negative economic impacts	To work together with existing structures and organisations
Inward migration and	To limit the impacts associated with inward	To establish and maintain a good working

Aspect	Environmental objective	Outcome
social ills	migration	relationship with surrounding communities, local authorities and land owners
Land uses	To prevent unacceptable impacts on surrounding land uses and their economic activity	To co-exist with existing land uses To negatively impact existing land uses as little as possible

12.1.1 IMPACTS THAT REQUIRE MONITORING PROGRAMMES

Outcomes of the environmental objectives are the implementation of monitoring programmes. Impacts that require monitoring include:

- Hazardous excavations and structures
- Physical destruction and general disturbance of biodiversity (this includes a protected tree monitoring programme).
- Pollution of surface water resources
- Contamination of groundwater
- Depletion of groundwater resources (due to the approved operations)
- Increase in air pollution
- Increase in noise levels
- Blasting damage (due to the approved operations)
- Traffic increase and road use

12.1.2 ACTIVITIES AND INFRASTRUCTURE

The source activities of potential impacts which require management are detailed in Section 4.2 and listed below.

- Site preparation
- Civil works
- Earthworks
- Mining and mining related activities
- Waste rock management
- Mineral processing operations
- Tailings management
- Power Supply and Use
- Water supply and use
- Process and storm water management
- Transport systems
- General and hazardous waste management
- Sewage sludge management
- Site support services
- Housing
- Site/contract management
- Demolition
- Rehabilitation
- Maintenance and aftercare

12.1.3 MANAGEMENT ACTIONS

Management actions which will be conducted to control the project activities or processes which have the potential to pollute or result in environmental degradation are detailed in Section 28.

12.1.4 ROLES AND RESPONSIBILITIES

The key personnel to ensure compliance to this EMP report will be the operations executive, the environmental department manager and the stakeholder engagement manager/sustainability manager. As a minimum, these roles as they relate to the implementation of monitoring programmes and management activities will include:

- Senior Operational Manager and Environmental Department Manager
  - Ensure that the monitoring programmes and audits are scoped and included in the annual mine budget
  - Identify and appoint appropriately qualified specialists/engineers to undertake the programmes
  - Appoint specialists in a timeously manner to ensure work can be carried out to acceptable standards
- Stakeholder engagement department/ sustainability department:
  - Liaise with the relevant structures in terms of the commitments in the SLP
  - Ensure that commitments in the SLP are developed and implemented timeously
  - Establish and maintain good working relations with surrounding communities and landowners
  - Facilitate stakeholder communication, information sharing and grievance mechanism

13 FINAL PROPOSED ALTERNATIVES

The preferred alternatives for the project include the following:

- Site Layout Option 1B (Central Route) for the tailings and return water pipelines route with modification based on specialist recommendations – Site layout Option 2.
- For the Phase 1 housing, the housing footprint will be outside of the 32 m buffer.
- For the Concentrator Complex the product stockpiles will be outside of the 32 m buffer.
- For the Phase 1a housing, the preferred alternative is Site Layout Option 2 of shifting the layout to be outside of the 32 m buffer of the unnamed tributary of the Elands River.
- The final TSF layout covers less Marikana Thornveld and more secondary vegetation that the originally assessed layout.
- For the return water dam, the only feasible layout is Site Layout Option 1 (the original layout) as its location is based on the final TSF design which has been located in its final position to be as far away from Phatsima as possible. The approved return water dam footprint would have impacted the ephemeral drainage line as well and thus there is no new impact as a result of the updated design. Site Layout Option 1 is the only feasible option.
- For the PCD, the layout is within a footprint that was already approved for a dirty water containment area and thus there is no new impact. Shifting the approved location will also not be possible as there are roads, the sewage treatment plant and powerlines north and west of the approved location of the PCD. Therefore there is no space for shifting the PCD. Site Layout Option 1 is the only feasible option.

14 ASPECTS FOR INCLUSION AS CONDITIONS OF THE AUTHORISATION

Management measures including monitoring requirements as outlined in Sections 28 and 30 need to form part of the conditions of the environmental authorisation. With reference to Section 26 of GN 982 of NEMA, additional conditions that need to form part of the environmental authorisation that are not specifically included in the EIA and EMP report include the following:

- BPM must comply with all applicable environmental legislation whether specifically mentioned in this document or not and which may be amended from time to time.

15 ASSUMPTIONS, UNCERTAINTIES AND GAPS IN KNOWLEDGE

Assumptions, uncertainties and limitations associated with the proposed project are included below.

15.1 ENVIRONMENTAL ASSESSMENT LIMIT

The EIA and EMP focused on third parties only and did not assess health and safety impacts on workers because the assumption was made that these aspects are separately regulated by health and safety legislation, policies and standards, and that BPM will adhere to these.

15.2 PREDICTIVE MODELS IN GENERAL

All predictive models are only as accurate as the input data provided to the modellers. If any of the input data is found to be inaccurate or is not applicable because of project design changes that occur over time, then the model predictions will be less accurate.

15.3 CLOSURE COST ESTIMATE

The closure cost estimate was provided to SLR by the applicant and was deemed to be correct at the time of this study. No verification was done by SLR.

15.4 FAUNA

- The fieldwork component of the current survey was conducted in summer on the 18th and 19th November 2015. The single-season survey is deemed adequate for this survey as faunal activity levels are highest during spring / summer and due to the disturbance levels on site eliminating most of the potentially occurring Red Data species..
- After the completion of the fieldwork, a final pipeline alignment was provided in December 2015 and an updated Tailings Storage Facility (TSF) layout was provided in February 2016. As the November 2015 site visit entailed an assessment within a corridor surrounding the original design and much of the December 2015 pipeline layout falls within this corridor or its immediate surrounds, the findings of the November 2015 site visit are still deemed relevant. The changes in the TSF layout do not impact the findings of this report either and thus the mapping has been kept with the previous TSF layout.
- Emphasis was placed on searching for threatened species and compiling species lists at each of the proposed development sites so as to best compare the sensitivity of each site.
- Surveys occurred during daylight hours and no nocturnal surveys took place.
- No trapping of species was performed for sampling.

- An invertebrate study was not considered necessary for this study. Invertebrate studies are of such a nature that unless something specific needs to be looked for on site, conducting sampling of general invertebrates on site will not provide valuable information. By conserving habitat the invertebrates associated with that habitat will be conserved (*Pers. Comm.* Tony De Castro, 2016)

15.5 AIR QUALITY

- Emissions were based on the process description and layout plan as provided by BPM through SLR.
- This study only considered atmospheric emissions and impacts associated with the underground mining, concentrator plant, waste rock dump and TSF at BPM.
- Site specific particle size fraction, moisture or silt content data were not available for all sources and use was made of US EPA default values and values from similar operations in South Africa.
- Only routine emissions from operations were simulated.
- Dispersion models do not contain all the features of a real environmental system but contain the feature of interest for the management issue or scientific problem to be solved (MFE, 2001). Gaussian plume models are generally regarded to have an uncertainty range between -50% to 200%. It has generally been found that the accuracy of off-the-shelf dispersion models improve with increased averaging periods. The accurate prediction of instantaneous peaks are the most difficult and are normally performed with more complicated dispersion models specifically fine-tuned and validated for the location.
- The selected dispersion model, AERMOD, cannot compute real time processes; average process throughputs were therefore used, though the nature of operations may change over the life of operations.
- Gaseous emissions would result from vehicle exhaust and blasting. Emissions from blasting underground is expected to be intermittent and minimal. Emission rates for combustion sources are dependent on the amount of fuel used, type and size of vehicles used. The fuel use amount for plant vehicles was supplied and the main underground vehicles' type and size were available. Only vehicle exhaust emissions at the plant and underground were estimated and modelled.
- NO is rapidly converted in the atmosphere into the much more toxic NO_2. The rate of this conversion process is determined by the rate of the physical processes of dispersion and mixing of the plume and the chemical reaction rates as well as the local atmospheric ozone (O_3) concentration. 20% of NO_x emissions from vehicle exhaust were assumed to be to NO_2 (Howard, 1988).
- The construction, decommissioning and closure phases of the proposed additions to BPM are assessed qualitatively. It was assumed that all processing operations will have ceased by the closure phase. The potential for impacts during this phase will depend on the extent of demolition and rehabilitation efforts during decommissioning and on features which will remain. Information

regarding the extent of demolition and/or rehabilitation procedures were limited and therefore not included in the emissions inventory or the dispersion modelling.

15.6 GROUNDWATER NUMERICAL MODEL

- The aquifer systems at the proposed TSF area can be subdivided into hydrostratigraphic units to represent naturally occurring aquifers;
- Groundwater movement in the hydrostratigraphic units follows Darcy"s law and hence can be modelled using the equivalent porous medium" approach. i.e. the use of effective (or bulk) hydraulic properties to approximate conditions in the aquifer;
- Net recharge to the area is limited and weathered aquifer is mostly dry except in areas close to the Elands River; and
- The Sandspruit can be adequately represented by drain nodes set below ground surface to receive flows from the aquifers.
- The transport simulation was run for 100 years was assumed.
- A recharge source term was used at 100 % of the contaminant concentration.
- Groundwater flow at the proposed TSF was simulated with a finite difference model MODFLOW-NWT.
- Layer Property Flow (LPF) flow package and the Newton solver were used to solve the flow matrix. The Elands River was modelled using the river (RIV) package. As well as the recharge (RCH), drain package (DRN).
- The groundwater model was simulated only for the updated TSF. The contamination plume for the waste rock dump area at the plant was not remodelled and the assessment in Appendix F is based on the assumption is that the previous modelling is still applicable as the waste rock dump is not increasing in size.
- For the impact assessment included in the Appendix F of the EIA report, the predicted pollution plume of sulphate was based on the source concentration of sulphate of approximately 2830 mg/l (as per the supernatant concentration included in the TSF report).

15.7 AQUATIC ECOLOGY

- Reference conditions are unknown: The composition of aquatic biota in the study area prior to regional disturbance is unknown. For this reason, reference conditions are hypothetical, and are based on professional judgement and/or inferred from the baseline environmental data collected as part of the Environmental Impact Assessment process for the BPM.
- Lack of suitable habitat: Limited SASS5 biotopes present at the various sites which is likely to limit the diversity and sensitivity of the macro-invertebrate community.

- Lack of strong flowing water: The diatom samples for Sites Bak1 and Bak2 were taken within stagnant waters which may be subject to strong fluctuations in their condition, specifically salinity, organic and nutrient levels. Any attempt to use existing diatom indices suitable for freshwater ecosystems to determine the biological integrity of such systems will likely result in misleading conclusions.
- The 2015 survey focused on macro-invertebrates and diatoms as indicators of river health and thus did not update the database of fish assemblages.

15.8 FLORA

- A total of five days of field work and seven days of data analysis, mapping and reporting were available for the completion of this study which included the revision of the available vegetation maps for the Frischgewaagd and Mimosa sections of the study area, the compilation of a new vegetation map for the pipeline corridor and mapping of vegetation and searches for threatened plant species within the proposed infrastructure footprints.
- Vegetation mapping was based on the existing vegetation and land-cover type maps compiled by De Castro and Brits CC (May, 2015). The current survey focussed on verifying, and where necessary modifying, the vegetation mapping within the existing infrastructure footprints.
- Most of the study area is mapped as Zeerust Thornveld, with a significant area of Western Sandy Bushveld in the western parts of the farm Mimosa 81 JQ and very small areas of Moot Plains Bushveld and Marikana Thornveld along the southern boundaries of the farms Mimosa 81 JQ and Frischgewaagd 96 JQ respectively. However, the vegetation specialist indicated that the NWBSP vegetation map was compiled at a provincial scale and relied strongly on land type mapping which is inaccurate for much of the study area. It was also indicated that while the vegetation of the project area shows some physiognomic, and to a lesser extent floristic, elements of Zeerust Thornveld, it does not show any significant similarities to Western Sandy Bushveld, and conforms far more closely to the Mucina and Rutherford (2006) description of Marikana Thornveld in terms of species composition and dominance.
- The species list provided in the specialist report is based on field surveys conducted in November 2014 and March and April 2015 for the purposes of a baseline botanical biodiversity assessment (De Castro & Brits cc, May 2015) as well as five days of field work conducted for the current study in November 2015. All surveys where therefore conducted during the growing season and reasonable seasonal coverage has been incorporated. The timing of the field surveys used to compile this study is therefore not seen as a significant limitation, though additional brief surveys aimed at searching for potentially occurring ‘species of conservation concern’ are recommended in the specialist report. Based on the authors experience the 414 plant species provided in Appendix 1 includes approximately 80% or more of the species actually present in the study area.

- The entire length of the proposed ca. 3.83 km pipeline alignment, as proposed by the client in November 2015, was subjected to a 'walkover' survey by the botanist. In December 2015, after the completion of the fieldwork, a final pipeline alignment was provided. After the completion of the fieldwork, a final pipeline alignment was provided in December 2015 and an updated Tailings Storage Facility (TSF) layout, which falls entirely within the larger original layout, was provided in February 2016. The final pipeline alignment closely follows the originally proposed alignment for most of its length, and was not subjected to a walkover survey, but was assessed at a desktop level and included in the mapping corridor for the tailings pipeline. As the November 2015 site visit entailed an assessment within a corridor surrounding the original design and much of the December 2015 pipeline layout falls within this corridor or its immediate surrounds, the findings of the November 2015 site visit are still deemed relevant. The changes in the TSF layout do not impact the findings of this report either and thus the mapping has been kept as per the previous TSF layout.
- Due to project scheduling constraints, the footprints of the proposed infrastructure were not subjected to seasonal surveys. Furthermore, the study area was experiencing a severe drought at the time of the field surveys (November) and the Mimosa section and pipeline mapping corridor were severely overgrazed. The species lists provided in the specialist report can therefore not be regarded as comprehensive. Based on the authors experience the plant species lists provided in Appendix 1 of the specialist report probably include no more than approximately 80% of the species present within the study area.

15.9 HERITAGE

- Not detracting in any way from the comprehensiveness of the fieldwork undertaken, it is necessary to realise that the heritage resources located during the fieldwork do not necessarily represent all the possible heritage resources present within the area. Various factors account for this, including the subterranean nature of some archaeological sites and the current dense vegetation cover.
- Not all the development footprints assessed as part of this study were known at the time of the fieldwork. Such omitted footprints include the Mine Housing Phase 1A area as well as the Waste Rock Dump. As these development footprint areas fall within the study area of a previous heritage impact assessment (Matakoma-ARM, 2007), additional fieldwork was not deemed necessary. However, this meant that sites which had been identified during the previous study and which now fall within some of these proposed development footprints were not visited in the field. The findings and information in this study are still considered relevant for the project.
- The study area of the heritage impact assessment undertaken by ARM-Matakoma (2007) included significant components of the proposed development footprint areas assessed for this report. As a result, the findings, significance assessments and mitigation measures outlined in the 2007 are integrated within this report.

- Following the completion of the site visit, the layout of the TSF was updated. The footprints of the old and new layout of the TSF are in the same area, with minor differences. The findings of this study are still relevant for the updated layout and no additional identified heritage sites are affected by the new layout.
- It is the understanding of the author of this report that a destruction permit was issued by SAHRA in terms of two Iron Age sites falling within the present study area, namely MHC002 and MHC004. This followed on mitigation work carried out by Matakoma-ARM in 2008. However, no copy of this destruction permit was available at the time that this current report was released. Furthermore, the author of this report was informed that these two sites were destroyed in terms of the permission provided by this destruction permit.

15.10 SURFACE WATER

- It is assumed for the unmitigated scenario that for the project area each hectare has an equal contribution to the reduction of mean annual runoff.

15.11 NOISE

- Noise is variable and can be influenced by climatic conditions so the findings of the noise study should not be taken as absolute/definitive.
- The tailings facility design and the pipeline alignment changed during the course of the compilation of this report. These changes do not impact on the findings of this study and thus mapping with the previous layout has been retained.
- Sound power level of some of the new equipment is not yet available. Data from similar type equipment was used in the calculations.

15.12 SOCIO-ECONOMIC

- It was assumed that information provided by BPM and SLR is accurate and that the technical specifications of the Project and site selection are in accordance with the relevant requirements.
- This report and assessment are dependent on the accuracy of the publicly available secondary information; such as Statistics South Africa (StatsSA, 2011), and the 2008 SIA. The data from these sources was considered sufficient for the purposes of this study.
- The economic information used in this SIA is the most recent that could be obtained.
- No further detailed community level survey was performed as part of this SIA; the 2008 SIA provided a detailed overview of the neighbouring communities of Ledig and Phatsima.
- The assessment is based on project information provided at the time of the study.

- At the time this SIA was submitted, none of the associated specialist studies were available for review and incorporation; namely the water, noise, air quality, traffic and visual assessments. No water related impacts have been identified or assessed. Cursory links have been made to the noise, air quality, traffic and visual impacts as nuisance factors.
- Selected key informant interviews were performed. Community concerns were identified using the public participation records (i.e. the comments and response register in the Final Scoping Report, 2015).
- The 2008 SIA has been used as a basis for impact identification, assessment and formulation of mitigation measures. This is to ensure that the findings are aligned with BPM's current management approach. Most impacts fall away completely and others are being managed through the existing management plan; the assumption is that BPM is in full compliance with all commitments in their existing Management Plan.

15.13 SOIL, LAND CAPABILITY AND LAND USE

- The site visit for this study was conducted in summer in November 2015. During December 2015 the layout for the pipeline changed. As the November 2015 site visit entailed an assessment of the soils within a corridor surrounding the original design and the December 2015 pipeline layout falls mostly within this corridor, the findings of the November 2015 site visit are still deemed relevant.

15.14 ROAD AND TRAFFIC DISTURBANCE

- The traffic study considered 910 housing units. Following the analysis the applicant indicated that there would be 400 houses. From the above it was concluded that the impact of fewer houses will decrease private vehicle/car trips from Gabonewe Estate and increase public transport trips from external housing developments. This will reduce the overall number of vehicle trips, i.e. have a lesser traffic impact during the peak hours and the proposed mitigation measures will still be adequate.
- It was assumed that none of the office staff, consisting mostly of managerial positions, would be allocated housing in Gabonewe Estate and would make use primarily of private transport.
- For the purposes of the report, it was assumed that Phase 1A would be the only mine housing provided for the time being, in order to analyse a worst-case scenario.
- During the decommissioning and closure phases it can be expected that the traffic impact of the mine will reduce and eventually discontinue.
- The 910 housing units are 70% of the total development for which the TIA was done. Only 70% of the trip generation for the housing were therefore included in the 2016 TIA as latent rights and the same distribution for these trips were also assumed.
- For the purpose of trip distribution, office employees were assumed to use private vehicles/cars, while the shift employees were assumed to make use of public transport (minibus taxis).

- An annual growth rate of 3% was assumed for background traffic.
- The peak hours considered for the analysis of the intersections was based on the shift change times and the existing peak hours observed during the traffic counts. In the mornings it was assumed that the shift ending at 06:00 would leave the mine between 06:00 and 07:00, this will coincide with the arrival of the office employees who start work at 07:00. This overlap in arrivals and departures was considered to be the worst case scenario.
- For the study, the upgraded layout suggested by the 2014 housing TIA conducted was assumed to be the intersection layout for the analysis of both the base and horizon years.
- It was assumed that the average heavy vehicle (HV) currently on the R565 is equivalent to 3.0 E80's. E80's defined by the Guidelines for Provision of Engineering Services and Amenities in Residential Township Development.
- For the additional heavy vehicle loading, it was assumed that all heavy vehicles, except slurry trucks, will be distributed equally to the north (via R565 and R556) and south (via R565 to/from Rustenburg) of the access.
- The 2008 TIA assumed two access points to the mine site: 1 from the R565 and another from the R556. It is now proposed only to have 1 access from the R565.
- The housing development was not considered as part of the 2008 TIA. A TIA was conducted for the Gabonewe housing development by Mott MacDonald PDNA in 2014, which recommended certain road upgrades and which were considered in the WSP study.
- The details contained in the 2008 TIA were very limited in terms of trip generation and distribution characteristics; mode of employee transport (private/public); and heavy vehicle trip generation and impact.
- The horizon year of the 2008 TIA was 2011. Typically traffic impact studies only stay relevant for a maximum period of 5 years and none of the road upgrades recommended in the 2008 TIA have yet been implemented.
- The TIA considered the trip generation of the full mine and not only the proposed changes, this was done based on the following reasons:
    - The TIA conducted by Trafftrans in 2008 for the approved project assumed two access points to the mine site: 1 from the R565 and another from the R556. It is now proposed only to have 1 access from the R565;
    - The housing development was not considered as part of the 2008 TIA. A TIA was conducted for the Gabonewe housing development by Mott MacDonald in 2014, which recommended certain road upgrades and which were considered in the 2016 study;
    - The details contained in the 2008 TIA were very limited in terms of trip generation and distribution characteristics; mode of employee transport (private/public); and heavy vehicle trip generation and impact;

- The horizon year of the 2008 TIA was 2011. Typically traffic impact studies only stay relevant for a maximum period of 5 years and none of the road upgrades recommended in the 2008 TIA have yet been implemented.

Considering the above, together with the fact that currently available staff volume estimations and information regarding mine operations and production are based on the full mine development, the 2016 TIA considered the trip generation of the full mine and then compared the mitigation measures with those recommended by Trafftrans (2008).

15.15 WATERCOURSE DELINEATION

- Wetland areas within transformed landscapes, such as urban, agricultural settings, or mining areas with existing infrastructure, are often affected by disturbances that restrict the use of available wetland indicators, such as hydrophytic vegetation or soil indicators (e.g. as a result of the dominance of alien vegetation, stock piling, sedimentation, hard surfaces, and infilling). Hence, a wide range of available indicators are considered, to help determine wetland boundaries more accurately.
- Wetland assessments are based on a selection of available techniques that have been developed through the Department of Water and Sanitation. These methods are, however, largely qualitative in nature with associated limitations due to the range of interdisciplinary aspects that have to be taken into consideration.

15.16 GENERAL

- Layouts included in the EIA and EMP are as per information and layouts provided by the applicant. For the solar plant and Phase 1a mine housing, only indicative positions have been included based on information provided by the applicant. Should these differ from the final layout, these areas would need to be re-assessed.
- The final preferred layouts based on changes suggested by the specialists (the tailings and return water pipelines and Phase 1a housing) have been shown on the final layout map as a representation of what the final layout will look like. This does not represent the final designed layouts and it is assumed the applicant will ensure designs and implementation of these meets the requirements of the specialist recommendations.
- The EIA and EMP have been compiled with the assumption the specialists and the applicant have provided the best available information and the information is true and correct.
- Information sourced from the approved mine EIA and EMP and the approved housing BAR and EMP is assumed to be true and correct.

16 REASONED OPINION AS TO WHETHER THE PROPOSED ACTIVITY SHOULD OR SHOULD NOT BE AUTHORISED

16.1.1 REASONS WHY THE ACTIVITY SHOULD BE AUTHORIZED OR NOT

The assessment of the proposed project presents the potential for significant negative impacts to occur (in the unmitigated scenario in particular) on the bio-physical, cultural and socio-economic environments both on the project sites and in the surrounding area. With mitigation these potential impacts can be prevented or reduced to acceptable levels. None of the specialist provided any objections to the implementation of the study based on their specific field of study. It follows that provided the EMP is effectively implemented there is no environmental, social or economic reason why the project should not proceed.

16.1.2 CONDITIONS THAT MUST BE INCLUDED IN THE AUTHORISATION

16.1.2.1 Specific conditions for inclusion in the EMPR

Refer to Section 14.

16.1.2.2 Rehabilitation Requirements

Refer to Section 29.1.1.

17 PERIOD FOR WHICH AUTHORISATION IS REQUIRED

The life of mine is expected to be approximately 28 years.

18 UNDERTAKING

I, Chiara D'Egidio Kotze, the Environmental Assessment Practitioner responsible for compiling this report, undertake that:

- the information provided herein is correct;
- the comments and inputs from stakeholders and IAPs has been included;
- inputs and recommendations from the specialist reports have been included where relevant.
- Any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties are included where relevant

Kotze

Signature of EAP

01/04/2016

Date

Signature of commissioner of oath

01/04/2016

Date

BRANDON IAN STOBART
EX OFFICIO
COMMISSIONER OF OATHS
NON-PRACTISING ATTORNEY
REPUBLIC OF SOUTH AFRICA
UNIT 7, FOURWAYS MANOR OFFICE PARK
FOURWAYS

19 FINANCIAL PROVISION

19.1.1 METHOD TO DERIVE THE AMOUNT TO MANAGE AND REHABILITATE THE ENVIRONMENT

Estimated costs for implementing the technical and management actions identified in Section 28 are included in the table below (Table 19.1). Please note that the costs included in the table are based on conceptual estimates only (using experience in similar projects) and input by the applicant.

TABLE 19.1: ESTIMATED COSTS FOR IMPLEMENTING TECHNICAL AND MANAGEMENT OPTIONS

Potential impact	Technical and management options	Estimated costs
Resources	• All options need to be implemented with input from a dedicated environmental management resource at the mine.	• R700 000.00
Auditing and annual review	• Biannual EMP performance assessment (external) • Annual review of closure cost estimate • Water Use Licence Audit (external)	• R60 000.00 (EMP performance assessment) • R92 000.00 (Closure cost update) • R45 000.00 (WULA audit)
Hazardous structures	• Establish and maintain site security measures • Control site and facility access • Appropriate design of stockpiles, TSF, PCD with the potential to fail (and by qualified person) • Establish and maintain infrastructure security measures • Undertake third party awareness training	• Approximately 2 million to cover all aspects
Loss of soil resources	• Implement a site-specific soil management plan • Implement a non-mineralised waste management procedure (provide skips for waste sorting and waste removal contractor) • Rehabilitation of contaminated soils (as soon as possible)	• Approximately 1 million to cover all aspects
Biodiversity	• Survey for protected trees • Apply for permit to disturb protected trees • Implement a monitoring programme to remove alien and invasive species	• R35 000 (per survey) • R30 000.00 (Tree removal permit - as and when required) • R30 000 (Alien invasive species programme) •
Alternation of drainage patterns	• Construction of storm water controls (and by qualified person) •	• R20 000 000.00 (storm water controls – once off) •
Surface water pollution	• Maintain storm water controls and inspections • Update water balance on an annual basis • Surface water monitoring	• R30 000.00 (water balance) • R60 000.00 (maintain storm water controls and inspections) • R400 000.00 (monitoring)
Groundwater quality and quantity	• Groundwater monitoring. • Installation of liners in recycled water dams	• R400 000.00 (monitoring) • R 210 000 000.00 (liners – once off)
Air pollution	• Continue monitoring on site and install PM2.5 monitor	• R400 000.00 (monitoring). • R400 000 ($PM_{2.5}$ sampler – once off)
Disturbing noise	• Short term noise monitoring if required • Maintenance of equipment	• R60 000.00 (Noise sampling) • R 500 000.00 (maintenance)
Landscape and visual	• Retain natural vegetation as screens • Paint buildings and structures in colours that reflect landscape • Careful use of night lights • Prevent litter	• Approximately R500 000.00
Blast hazards	• Design and implement blast to meet threshold criteria • Monitor blasts and installation of seismographs	• R200 000.00 (blast design and monitoring)
Traffic	• On-going training of staff • Maintenance of vehicles and of roads	• R150 000.00 (training) • R2 000 000 (maintenance)
Heritage	• Phase 2 assessments for destruction of heritage resources.	• R200 000.00 (specialist assessment)

Potential impact	Technical and management options	Estimated costs
Socio-economic	• Quarterly meetings	• R100 000.00

The estimated total amount to manage and rehabilitate the environment amount to approximately R239 392 000. It is however important to note that some of these costs are once-off and will only be required during the construction phase as part of implementing facilities. The once off costs are approximately R230 400 000.

19.1.2 CONFIRM THAT THE AMOUNT CAN BE PROVIDED FOR FROM OPERATING EXPENDITURE

The amount required in order to manage and rehabilitate the environmental is provided for in the operating costs.

20 DEVIATIONS FROM SCOPING REPORT AND APPROVED PLAN OF STUDY

20.1.1 DEVIATION FROM THE METHODOLOGY USED IN DETERMINING THE SIGNIFICANCE OF POTENTIAL ENVIRONMENTAL IMPACTS AND RISKS

No deviations in terms of the methodology used to determine the significance of potential environmental impacts and risks were made as per the approved plan of study in the scoping report.

20.1.2 MOTIVATIONS FOR DEVIATION

Not applicable.

21 SPECIFIC INFORMATION REQUIRED BY THE COMPETENT AUTHORITY

21.1.1 IMPACT ON THE SOCIO-ECONOMIC CONDITIONS OF ANY DIRECTLY AFFECTED PERSON

The impacts associated with socio-economic conditions are discussed in Appendix F. Management and mitigation measures identified to address any socio-economic impacts are included in Section 28. It is however important to note that no person will be directly affected by the proposed project given that no IAPs currently reside within the proposed project footprint area.

21.1.2 IMPACT ON ANY NATIONAL ESTATE REFERRED TO IN SECTION 3(2) OF THE NATIONAL HERITAGE RESOURCES ACT

Some heritage sites of low significance will need to be destroyed as part of this project. Some heritage sites of medium/high significance will need to be relocated (e.g. graves); refer to Appendix F for further details. For the relocation of graves, the process as provided by the heritage specialist will need to be followed which includes:

- A detailed social consultation process, at least 60 days in length, comprising the attempted identification of the next-of-kin so as to obtain their consent for the relocation of the graves.
- Bilingual site notices (in the most appropriate languages) indicating the intent of the relocation.
- Bilingual newspaper notices indicating the intent of the relocation.
- Permit applications to the legally required authorities, including (but certainly not restricted to) the South African Heritage Resources Agency.
- An exhumation process that keeps the dignity of the remains and family intact.
- An exhumation process that will safeguard the legal rights of the families as well as that of the development company.
- The process must be done by a reputable company well versed in the mitigation of graves.

22 OTHER MATTERS REQUIRED IN TERMS OF SECTIONS 24(4)(A) AND (B) OF THE ACT

No other matters are required in terms of Section 24(4)(A) and (B) of the act.