TOPOGRAPHY AND VISUAL IMPACT ASSESSMENT FOR THE PROPOSED PLATREEF UNDERGROUND MINE

PLATREEF RESOURCES (PTY) LTD

OCTOBER 2013

Digby Wells & Associates (Pty) Ltd. Co. Reg. No. 1999/05985/07. Fern Isle, Section 10, 359 Pretoria Ave Randburg Private Bag X10046, Randburg, 2125, South Africa
Tel: +27 11 789 9495, Fax: +27 11 789 9498, info@digbywells.com, www.digbywells.com

This document has been prepared by **Digby Wells Environmental**.

Report Title: **Topography and Visual Impact Assessment for the proposed Platreef Underground Mine**

Project Number: **PLA1677**

Name	Responsibility	Signature	Date
Stephanie Crone	Report Writer	[signature]	03/10/2013
Bradly Thornton	Reviewer	[signature]	03/10/2013

EXECUTIVE SUMMARY

The proposed Platreef Project involves the development of an underground platinum mine situated in the Mokgalakwena Local Municipality and the Waterberg District of the Limpopo Province, South Africa. The environmental considerations for the Environmental and Social Impact Assessment (ESIA) phase of the proposed Platreef Project included a Topography and Visual Impact Assessment (T&VIA) for the study area.

The proposed Platreef Project is situated on the northern lobe of the Bushveld Igneous Complex. The predominant platinum reef in this area is known as the Plat Reef. The study area and surrounds are characterised by traditional authorities consisting of numerous rural settlements and associated agricultural land used for agricultural activities. The nearest town is Mokopane (formerly known as Potgietersrus), situated approximately 8.8 km south-east of the study area.

The proposed Platreef Project will have negative topographic and visual impacts on the receiving environment, but these impacts can be reduced by implementing various mitigation measures. The most important of these is rehabilitation with the emphasis being on re-contouring the site and reconstructing the surface water and drainage lines. Soil erosion is visible in the study area and surrounds due to the degraded nature of the natural vegetation. Particular attention must be paid to the management of the activities that affect the topography so as to prevent further soil erosion. The proposed Platreef Project can proceed based on the results of the T&VIA provided that the recommended mitigation measures are implemented.

The theoretical viewshed of the project covers an area of approximately 663 km². The villages of Ga-Kgubudi, Ga-Madiba, Ga-Magonwa, Mzumbani and Tshamahansi are closest to the proposed development and are therefore expected to experience the highest visual impact. The theoretical viewshed model indicates that the proposed Platreef Project will potentially be visible from the N1 and N11 national routes, and the R101 and R5168 regional routes as well as other smaller roads within the study area. The southern part of the Witvinger Nature Reserve will potentially be visually affected by the proposed Platreef Project. The proposed Platreef Project is expected to have a minimal visual impact on the buffer and no visual impact on the core area of the Makapan Valley World Heritage Site (WHS).

The mitigated viewshed model for the proposed Platreef Project illustrates the potential mitigation effect of vegetation screening. This model assumed that the existing noise berm would be vegetated to form a vegetation screen and takes into account the resultant screening effect of the vegetated berm. The mitigated viewshed covers an area of approximately 631 km². There is a difference of 32 km² between the theoretical and mitigated viewshed models. The screening effect of the vegetated noise berm will not decrease the visual impact of the proposed Platreef Project on the villages closest to the proposed infrastructure area but will reduce the visual impact further away. Based on the theoretical viewshed, the village of Ga-Masenya would potentially be visually impacted on by the proposed Platreef Project but with the implementation of the vegetated noise berm, this village will no longer be affected.

TABLE OF CONTENTS

1 INTRODUCTION 1
2 TERMS OF REFERENCE 1
3 RELEVANT LEGISLATION 2
3.1 International Conventions 2
3.2 National Legislation and Policy 2
4 STUDY AREA 3
4.1 Alternative Site 5
5 EXPERTISE OF THE SPECIALIST 5
6 AIMS AND OBJECTIVES 6
7 KNOWLEDGE GAPS 6
8 METHODOLOGY 6
8.1 Characterisation of Visual Impacts 7
8.2 Visual / Aesthetic Character and Topography 8
8.3 Viewshed Analysis 8
9 FINDINGS 10
9.1 Visual / Aesthetic Character and Topography 10
9.2 Viewshed Model 15
9.3 Sensitive Receptors 16
10 DISCUSSION 17
10.1 Topography 17
10.2 Visual 17
11 IMPACT ASSESSMENT 19
11.1 Assessment Methodology 19
11.2 Identification of Project Activities 21
11.3 Topography Impact Assessment 22
11.4 Visual Impact Assessment 30
12 CUMULATIVE IMPACTS 38
13 MITIGATION MEASURES AND MANAGEMENT PLAN 38
13.1 General Mitigation 47
14 MONITORING PROGRAMME 48
15 RECOMMENDATIONS 48

16 CONCLUSION 49
17 REFERENCES 50

LIST OF FIGURES

Figure 1: Theoretical background of viewshed modelling 10
Figure 2: Relatively flat study area with mountainous regions to the east and west 11
Figure 3: Agricultural activities 11
Figure 4: Grazing of livestock 12
Figure 5: Sparse degraded bush on the western side of the study area 13
Figure 6: Denser natural bush on the eastern side of the study area 13
Figure 7: Drill rigs visible in the distance (circled in red) 14
Figure 8: Vegetation of the alternative site 15
Figure 9: N11 national route running through the study area 17
Figure 10: Vegetation screening (Source: Golder & Associates) 47
Figure 11: Vegetation positioning (Source: Golder & Associates) 47

LIST OF TABLES

Table 1: Closest towns and settlements 4
Table 2: Categorisation of expected visual impact (adapted from Oberholzer, 2005) 7
Table 3: Key to Categorisation of development (adapted from Oberholzer, 2005) 8
Table 4: Infrastructure height for viewshed modelling 9
Table 5: Severity, spatial scale, duration and probability categories 19
Table 6: Significance scores based on consequence and probability 21
Table 7: Impact categories based on significance scores 21
Table 8: Project activities 22
Table 9: Mitigation and management plan 39

LIST OF PLANS

Plan 1: Regional Setting

Plan 2: Local Setting

Plan 3: Study Area & Alternative Site

Plan 4: Infrastructure

Plan 5: Topography

Plan 6: Slope Model

Plan 7: Aspect Model

Plan 8: Theoretical Viewshed Model

Plan 9: Mitigated Viewshed Model

Plan 10: Makapan Valley WHS Viewshed Model

LIST OF APPENDICES

Appendix A: Plans

Appendix B: CV and Declaration of Independence

ACRONYMS

CD: NGI	Chief Directorate: National Geospatial Information
CV	Curriculum Vitae
ELC	European Landscape Convention
ESIA	Environmental and Social Impact Assessment
GIS	Geographic Information System
IFC	International Finance Corporation
km	kilometres
m	metres
mamsl	metres above mean sea level
MPRDA	Mineral and Petroleum Resources Development Act 28 of 2002
NEMA	National Environmental Management Act 107 of 1998
NEMPPA	National Environment Management: Protected Areas Act 57 of 2003
NHRA	National Heritage Resources Act 25 of 1999
PCD	Pollution Control Dam
PGM	Platinum Group Metal
SAHRA	South African Heritage Resources Agency
T&VIA	Topography and Visual Impact Assessment
TSF	Tailings Storage Facility
VAC	Visual Absorption Capacity
VIA	Visual Impact Assessment
WHS	World Heritage Site

1 INTRODUCTION

Topography is the study of the earth's surface. It includes both natural and man-made features. The Collins English Dictionary (2003) describes topography as:

- The study or detailed description of the surface features of a region (Earth Sciences / Physical Geography);
- The detailed mapping of the configuration of a region (Earth Sciences / Physical Geography);
- The landforms or surface configuration of a region (Earth Sciences / Physical Geography);
- The surveying of a region's surface features (Mathematics & Measurements / Surveying); and
- The study or description of any object.

For the purpose of this study, the topography will be conceptualised as the landforms and surface configuration of the landscape.

"Visual, scenic and cultural components of the environment can be seen as a resource, much like any other resource, which has a value to individuals, to society and to the economy of the region" (Oberholzer, 2005). A Topography and Visual Impact Assessment (T&VIA) is a combined specialist study performed to identify the topographical and visual impacts of a proposed project on the surrounding environment.

This report describes the current topography and visual / aesthetic character of the receiving environment and the expected topographical and visual impacts of the proposed Platreef Project. The impacts are described and rated and mitigation measures to reduce the negative impacts and enhance the benefits of the proposed project are also discussed in this T&VIA.

A study was conducted to identify and evaluate the surface features using ArcGIS 3D Analyst Extension to create a topographical model, and the resultant slope intensity and slope aspect and viewshed models.

2 TERMS OF REFERENCE

Digby Wells Environmental (Digby Wells) was appointed by Platreef Resources (Pty) Ltd as independent environmental consultants to investigate the social and environmental aspects required for the Environmental and Social Impact Assessment (ESIA) phase of the proposed Platreef Project in the Mogalakwena Local Municipality and Waterberg District Municipality of the Limpopo Province, South Africa. This ESIA phase was conducted according to the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and the Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA). The environmental considerations for this study included a T&VIA for the study area.

3 RELEVANT LEGISLATION

The following international, national and regional documents form part of the legislative and policy framework of the T&VIA.

3.1 International Conventions

The European Landscape Convention (ELC) created by the Council of Europe, was the first international convention to focus exclusively on landscapes. The purpose of this convention is to promote effective management and planning of landscapes. It was signed by the United Kingdom government in 2006 and became binding from 2007. Public documents that explore the impacts of large scale developments, as defined in the ELC, on any landscape should take into account the effects of these developments. A landscape means "and area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors" i.e. the natural, visual and subjectively perceived landscape, (Contesse, 2011; European Landscape Convention, 2007).

There is no regional or local scale legislation pertaining to mining activities and VIAs exclusively but, VIAs are relevant to the International Finance Corporation's (IFC) Performance Standards.

The Environmental, Health and Safety Guidelines for Mining therefore need to be considered (World Bank, 2007):

"Mining operations, and in particular surface mining activities, may result in negative visual impacts to resources associated with other landscape uses such as recreation or tourism. Potential contributors to visual impacts include high walls, erosion, discoloured water, haul roads, waste dumps, slurry ponds, abandoned mining equipment and structures, garbage and refuse dumps, open pits, and deforestation. Mining operations should prevent and minimise negative visual impacts through consultation with local communities about potential post-closure land-use, incorporating visual impact assessment into the mine reclamation process. Reclaimed lands should, to the extent feasible, conform to the visual aspects of the surrounding landscape. The reclamation design and procedures should take into consideration the proximity to public viewpoints and the visual impact within the context of the viewing distance. Mitigation measures may include strategic placement of screening materials including trees and use of appropriate plant species in the reclamation phase as well as modification of the placement of ancillary and access roads."

3.2 National Legislation and Policy

At a national level, the following legislative documents potentially apply to the T&VIA:

- Regulations in Chapter 5 (Integrated Environmental Management) of the NEMA and the act in its entirety. The Act states that "the State must respect, protect, promote and fulfil the social, economic and environmental right of everyone…" landscape is both moulded by, and moulds, social and environmental features;
- Section 23(1)(d) of the MPRDA, where it is mentioned that a mining right will be granted if "the mining will not result in unacceptable pollution, ecological degradation or damage to the environment". Visual pollution is a form of environmental pollution

and therefore needs to be considered under this section. Further, section 38(1)(a) states that "the holder of a reconnaissance permission, prospecting right, mining right, mining permit or retention permit must at all times give effect to the general objectives of integrated environmental management laid down in Chapter 5 of the National Environmental Management Act, 1998 (Act 107 of 1998)". Lastly, section 39(3)(b)(i) mentions that "…an environmental management plan must investigate, assess and evaluate the impact of his or her proposed prospecting or mining operations on the environment…".

- The National Heritage Resources Act, 1999 (Act 25 of 1999) (NHRA) in terms of the related provincial regulations – in some instances there are policies or legislative documents that give rise to the protection of listed sites. The NHRA states that it aims to promote "good management of the national estate, and to enable and encourage communities to nurture and conserve their legacy so that it may be bequeathed for future generations". A holistic landscape whose character is a result of the action and interaction and/or human factors has strong cultural associations as societies and the landscape in which they live are affected by one another in many ways; and
- Section 17 of the Protected Areas Act, 2003 (Act 57 of 2033) (NEMPPA) sets out the purposes of the declaration of areas as protected areas which includes the protection of natural landscapes. Landscapes are defined by the natural, visual and subjectively perceived landscape; these aspects of a landscape are intertwined to form a holistic landscape context.

4 STUDY AREA

The proposed Platreef Project is situated on the northern lobe of the Bushveld Igneous Complex. The predominant platinum reef in this area is known as the Plat Reef. The study area and surrounds are characterised by traditional authorities consisting of numerous rural settlements and associated agricultural land used for agricultural activities. Plan 1 illustrates the regional setting of the study area.

The proposed Platreef Project is situated within the Mogalakwena Local Municipality and the Mokerong Magisterial District. The nearest town is Mokopane (formerly known as Potgietersrus), situated approximately 8.8 km south-east of the study area. The settlements Ga-Madiba, Masodi, Ga-Kgubudi, Ga-Magonwa, Tshamahansi, Mzumbani and Mahwelereng are situated within the study area. There are a number of other small settlements in the surrounding area.

The closest towns and settlements, as well as their direct distance, distance by road and direction from the study area are summarised in Table 1. All distances are straight line distances measured from the centre of the study area and the centre of the settlements unless otherwise stated.

Table 1: Closest towns and settlements

Name	Type	Direct Distance	Road Distance	Direction
Drummondlea	Settlement	22.1 km	27.5 km	S
Gilead	Settlement	52.2 km	53.6 km	N
Groesbeek	Settlement	42.5 km	51.2 km	NW
Haakdoring	Settlement	36 km	49.4 km	SW
Immerpan	Settlement	46.9 km	51.5 km	SE
Limburg	Settlement	35.2 km	36.2 km	N
Mapela	Settlement	11.8 km	17.1 km	NW
Mashashane	Settlement	23.9 km	29.2 km	NE
Matlala	Settlement	34.2 km	50.8 km	N
Mogalakwenastroom	Settlement	51.1 km	66.3 km	NW
Mokamole	Settlement	38.7 km	44.7 km	NW
Mokopane (Potgietersrus)	Secondary Town	8.8 km	10.7 km	SE
Mookgophong (Naboomspruit)	Other Town	52.3 km	61.7 km	SW
Nuwe Smitsdorp	Settlement	37.1 km	59.5 km	E
Palala	Settlement	50 km	72.5 km	SW
Polokwane (Pietersburg)	City	53.4 km	67.6 km	NE
Rietkolk	Settlement	52.5 km	73.9 km	NE
Roedtan	Other Town	55.5 km	60.2 km	S
Seshego	Settlement	51.5 km	78.2 km	NE
Sterkwater	Settlement	15.4 km	18.9 km	W
Vanalphensvlei	Settlement	48.8 km	61.2 km	SE
Zebediela	Other Town	35 km	48.9 km	SW

The N1 national route runs approximately 12.8 km south-east of the study area while the N11 national route runs in a north-south direction through Mokopane and the study area. These national routes are both used by tourists travelling through Limpopo and to Botswana and Zimbabwe. The R101 regional route is an alternative route to the tolled N1 and runs in an east-west direction through Mokopane and the study area while the R518 regional route runs in an east-west direction through Mokopane and the study area. The nearest railway line runs through Mokopane and could be used to transport material for the proposed project. There is some mining activity in the surrounding area with the nearest mine being the Mogalakwena Platinum Mine situated approximately 6 km north-west of the study area. Plan 2 illustrates the local setting of the study area.

The study area consists of numerous semi-rural settlements and agricultural land used for agricultural activities. A few areas of natural bush still exist within the study area and are typically used for grazing. These bush areas have become degraded by over-grazing and the dumping of waste. The Witvinger Nature Reserve borders the north-eastern boundary of the study area.

The study area for this T&VIA covers an area of approximately 10,686 hectares (Plan 3). The coordinates for the centre of the study area are 24° 06' 35.344" S and 28° 58' 27.467" E. The study area is situated on the farms Rietfontein 2 KS, Turfspruit 241 KR and Macalacaskop 243 KR.

The study area falls within the Limpopo River Catchment Area. The perennial Mogalakwena River and flows along the western boundary of the study area. Floodplains occur along the Mogalakwena River on the south-western boundary of the study area. Several non-perennial streams flow in a westerly direction through the study area. These include the Klein-Sandsloot, Dithokeng, Rooisloot, Dorps and Ngwaditse Rivers, all of which are tributaries of the Mogalakwena River. Soil erosion is evident along these drainage lines and attention must be paid to the management of the activities that affect the topography so as to prevent further soil erosion.

The Makapan Valley World Heritage Site (WHS) is situated approximately 20 km east of the study area and is an "extension to the Fossil Hominid sites of South Africa" (Government of the Republic of South Africa, 2007). The Makapan Valley WHS caves and other sites of archaeological and paleontological interest are situated on the farm Makapansgat 39 KS. The South African Heritage Resources Agency (SAHRA) requested that the possible impact (including the potential visual impact) of the proposed Platreef Project on the WHS be assessed.

4.1 Alternative Site

An alternative site is being considered for TSF Site 3. This alternative site is situated directly north of the study area described above (Plan 1). The alternative site is the farm Bultongfontein 239 KR which covers an area of approximately 2,354 hectares. The coordinates for the centre of the alternative site are 24° 00' 28.584" S and 28° 59' 18.340" E.

The nearest settlements are Machikiri situated on the south-western boundary of the alternative site and Ga-Molekana situated approximately 1 km north-west of the alternative site. The N11 national route and a secondary road run through the alternative site. The eastern part of the alternative site falls within the Witvinger Nature Reserve. Several non-perennial streams and small dams occur within the alternative site. There is also evidence of soil erosion along these drainage lines (Plan 2 and Plan 3).

5 EXPERTISE OF THE SPECIALIST

A Curriculum Vitae (CV) and declaration of independence is attached in Appendix B.

6 AIMS AND OBJECTIVES

The aim of this T&VIA is to determine the nature of the study area and the impact of the proposed Platreef Project on the topography and the visual / aesthetic character of the surrounding landscape. The following objectives have been identified to achieve this aim:

- Examine aerial photography available for the study area (CD: NGI 2008 and Platreef 2011);
- Create and examine topographical, slope intensity, slope aspect and viewshed models in ArcGIS;
- Describe the topography and visual / aesthetic character of the receiving environment;
- Determine the size of the viewshed area; identify potential receptors within the viewshed area;
- Determine the potential topographical and visual impacts; and
- Recommend measures to mitigate negative impacts and enhance benefits.

7 KNOWLEDGE GAPS

A VIA is open to subjectivity. This subjectivity is due to the different opinions receptors have of a proposed project. A receptor may be partial to the fact that the proposed project is occurring in an area, which becomes a source of economic upliftment for a community, whereas another receptor may view a proposed project as a negative factor which could hamper tourism or recreational activities.

Many factors can enhance or reduce the visual impact of the proposed project. Vegetation near a receptor's viewpoint can greatly reduce that receptor's view of the proposed project. Other factors such as weather / climatic conditions and seasonal change can also affect a receptor's view of the proposed project. It is, therefore, difficult to determine the visual impact of the proposed project from the viewpoint of each individual receptor. Consequently, this report focuses on the size of the viewshed area which is the most objective measure of a project's visibility in an area.

Detailed contour relief data (1 metre contour intervals) is only available for the study area. The surrounding area has been modelled using the available 5 and 20 metre contour relief and spot height data. Heights were not available for all of the proposed infrastructure and assumptions have been made. These assumptions are based on the heights of infrastructure from similar projects. Due to time constraints, the viewshed models created for this study could not be verified / ground-truthed in detail via fieldwork; however extensive field work for this project has been done, especially during the scoping phase.

8 METHODOLOGY

The T&VIA was performed using surveyed geographically referenced information and aerial photography, together with the professional opinion of an experienced topography and visual impact assessor.

8.1 Characterisation of Visual Impacts

The expected visual impact of the proposed Platreef Project was categorised based on the type of receiving environment and the type of development as detailed in Table 2 (Oberholzer, 2005). This table provides an indication of the visual impacts that can typically be expected for different types of developments in relation to the nature of the receiving environment. According to Oberholzer (2005), the proposed Platreef Project is classified as a **Category 5 development** (Table 3). The receiving environment can be described as having **high** scenic, cultural or historical significance due to the proximity of the Makapan Valley WHS to the proposed project. It is therefore expected that the proposed Platreef Project will have a **very high visual impact** on the environment. This will be verified in the investigation to follow.

Table 2: Categorisation of expected visual impact (adapted from Oberholzer, 2005)

Type of Environment	Type of Development (Low to High Intensity)				
	Category 1 Development	**Category 2 Development**	**Category 3 Development**	**Category 4 Development**	**Category 5 Development**
Protected / wild areas of international, national or regional significance	Moderate visual impact expected	High visual impact expected	High visual impact expected	Very high visual impact expected	Very high visual impact expected
Areas or routes of high scenic, cultural or historical significance	Minimal visual impact expected	Moderate visual impact expected	High visual impact expected	High visual impact expected	**Very high visual impact expected**
Areas or routes of medium scenic, cultural or historical significance	Little or no visual impact expected	Minimal visual impact expected	Moderate visual impact expected	High visual impact expected	High visual impact expected
Areas or routes of low scenic, cultural or historical significance	Little or no visual impact expected. Possible benefits	Little or no visual impact expected	Minimal visual impact expected	Moderate visual impact expected	High visual impact expected
Disturbed or degraded sites / run-down urban areas / wasteland	Little or no visual impact expected. Possible benefits	Little or no visual impact expected. Possible benefits	Little or no visual impact expected	Minimal visual impact expected	Moderate visual impact expected

Table 3: Key to Categorisation of development (adapted from Oberholzer, 2005)

Type of Development	Examples of Development
Category 1	Nature reserves, nature related recreation, camping, picnicking, trails and minimal visitor facilities
Category 2	Low-key recreation / resort / residential type development, small-scale agriculture / nurseries, narrow roads and small-scale infrastructure
Category 3	Low density resort / residential types development, golf or polo estates, low to medium-scale infrastructure
Category 4	Medium density residential development, sports facilities, small-scale commercial facilities / office parks, one-stop petrol stations, light industry, medium-scale infrastructure
Category 5	High density township / residential development, retail and office complexes, industrial facilities, refineries, treatment plants, power stations, wind energy farms, power lines, freeways, toll roads, large-scale infrastructure generally. Large-scale development of agricultural land and commercial tree plantations. **Quarrying and mining activities with related processing plants**

8.2 Visual / Aesthetic Character and Topography

The visual / aesthetic character of the receiving environment was described in terms of the topography and vegetation. A desktop study was conducted to evaluate the topography of the receiving environment. Chief Directorate: National Geospatial Information (CD: NGI) aerial photography (flown in 2008) and Platreef aerial photography (flown in 2011) of the study area was examined to determine the surface features. The available vector data was used to determine the relative location of the features surrounding the study area.

A topographical model was created using ArcGIS 3D Analyst Extension. The model was created using site specific one metre contour relief data. This provided a detailed model of the study area. Another topographical model was created to include the surrounding area. This model was created using available five and 20 metre contour relief data with spot height data to increase the accuracy of the topographical model.

The resultant topographical model was then used to create slope and aspect models using the Slope and Aspect Tools of the ArcGIS 3 D Analyst Extension. The slope model indicates the slope degree and was classified using the Jenks Natural Breaks method.

8.3 Viewshed Analysis

The resultant topographical model was used to create a viewshed model using the Viewshed Tool of the ArcGIS 3D Analyst Extension. This viewshed model illustrates the areas from which the proposed project will potentially be visible taking into account the estimated height of the proposed infrastructure (Table 4). Plan 4 illustrates the proposed infrastructure.

Table 4: Infrastructure height for viewshed modelling

Infrastructure	Height	Source
TSF Site 2	77 m	Provided
Main Shaft Headgear	45 m	Provided
Plant Wet Area	25 m	Provided
Plant – Front End	10 m	Provided
Waste Rock Dumps	15 m and 17 m	Provided
Noise Berm	10 m	Provided
Ore Stockpile	8 m	Provided
General Mine Offices	Double Storey (10 m)	Provided
Buildings	Single Storey (5 m)	Provided
Vent Shafts	5 m	Assumed
Vehicle Washbay	10 m	Assumed
Mining Area	5 m	Assumed
General Waste and Salvage Area	5 m	Assumed
Covered Parking	3 m	Assumed
Raw Water Dam	2 m	Assumed
Mine Service Water Storage	2 m	Assumed
Pollution Control Dams	2 m	Assumed
Conveyor Servitudes	1 m	Assumed
Tailings Servitude	1 m	Assumed

The concept of viewshed modelling is depicted in Figure 1. The topography denotes whether or not a development will be visible from a receptor. In Figure 1 below the development is only visible from the receptors within the valley and on the slopes of the hills facing it. The development will be hidden from all receptors beyond the first hills.

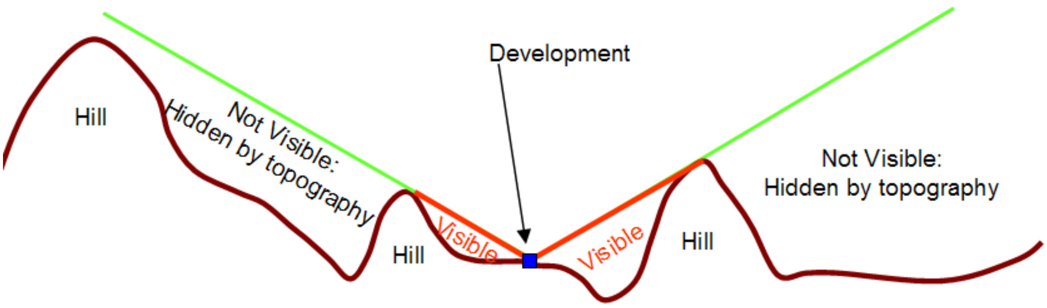

Figure 1: Theoretical background of viewshed modelling

A theoretical viewshed model was created. The theoretical viewshed model is based on the topography only and does not take the screening effect of vegetation into account. There are limited areas of natural bush within the study area. These areas have become degraded by over-grazing and the dumping of waste. This existing vegetation is not expected to provide noticeable screening of the proposed development.

A second viewshed model was created to show the effect of mitigation in the form of vegetation screening. For this model, it was assumed that the existing noise berm would be vegetated thereby forming a vegetation screen. A model of this vegetation screen was added to the topographical model to simulate the screening effect of a vegetation screen. The resultant topographical model was used to create a viewshed model taking into account this vegetation screen.

At the request of SAHRA, a third viewshed model was created for a larger surrounding area to determine if the core area and buffer of the Makapan Valley WHS would be visually affected by the proposed Platreef Project. This is a theoretical viewshed model based on the topography only.

9 FINDINGS

9.1 Visual / Aesthetic Character and Topography

This section provides the results obtained from the analysis of the topographical, slope and aspect models created in ArcGIS.

The study area is situated in the Mogalakwena River valley. Mountainous areas run to the east and west of the study area (Figure 2). The study area is relatively flat except for the mountainous area in the north-eastern corner and several isolated ridges. The land within the study area is mainly used for agricultural activities and livestock grazing (Figure 3 and Figure 4).

Figure 2: Relatively flat study area with mountainous regions to the east and west

Figure 3: Agricultural activities

Figure 4: Grazing of livestock

The topographical model indicates that the elevation of the study area increases from 1,030.5 metres above mean sea level (mamsl) in the Mogalakwena River floodplain in the south-western corner of the study area to 1,759 mamsl on the ridges in the north-eastern corner of the study area. Plan 5 illustrates the topographical model and features of the study area.

The majority of the study area has gentle slopes of between 0° and 3°. Moderate slopes of between 4° and 8° occur in some areas. Isolated steeper slopes of between 9° and 16° occur along the banks of the Rooisloot and Klein-Sandsloot Rivers. The steepest slopes occur on the ridges and range between 17° and 45°. Plan 6 illustrates the slope model of the study area.

The slope aspect/direction of the study area is generally in a south-westerly direction towards the Mogalakwena River. Slopes of various other directions occur in isolated areas along the river valleys/channels and on the ridges. Plan 7 illustrates the aspect model of the study area.

The relatively flat topography of the study area will only provide minimal screening of the proposed project. The mountainous areas to the east and west of the study area will provide screening of the proposed project to those areas on the opposite sides of the mountains.

The vegetation of the study area is a mixture of agriculture with isolated large trees and areas of degraded natural bush. The natural bush consists of grass and scattered small bushes and aloes. The average vegetation height in these areas is 1 metre. The natural bush on the western side of the study area is very sparse (Figure 5) while the bush on the eastern side of the study area tends to be denser (Figure 6). Both the agricultural areas and natural bush will only provide minimal screening of the proposed project. This minimal screening is illustrated in Figure 7 where the drill rigs currently being used for exploration (circled in red) are visible from a distance away.

Figure 5: Sparse degraded bush on the western side of the study area

Figure 6: Denser natural bush on the eastern side of the study area

Figure 7: Drill rigs visible in the distance (circled in red)

9.1.1 Alternative Site

A mountainous area runs along the eastern side of the alternative site. The topographical model indicates that the elevation of the alternative site ranges from 1,162.5 metres above mean sea level (mamsl) to 1,807 mamsl on the ridges in the eastern part of the alternative site (Plan 5).

The majority of the alternative site has gentle slopes of between 0° and 3°. Moderate slopes of between 4° and 8° occur in some areas. Isolated steeper slopes of between 9° and 16° occur along the ridges with the steepest slopes of between 17° and 48° (Plan 6). The slope aspect/direction of the alternative site is generally in either a north to north-westerly or a west to south-westerly direction (Plan 7).

The relatively flat topography of the alternative site will only provide minimal screening of the proposed TSF. The mountainous area on the eastern side of the alternative site will provide screening of the proposed TSF to those areas on the opposite side of the mountain.

The vegetation on the alternative site consists mainly of natural bush and there is only a small area of agriculture near the village of Machikiri. The natural bush on the alternative site is slightly denser and taller than the vegetation of the study area described above. Figure 8 illustrates the vegetation of the alternative site with the mountainous area in the background. The natural bush will provide moderate screening of the proposed TSF.

Figure 8: Vegetation of the alternative site

9.2 Viewshed Model

The theoretical viewshed model for the proposed Platreef Project is illustrated in Plan 8. This model depicts the area from which the proposed Platreef Project will potentially be visible. The theoretical viewshed covers an area of approximately 663 km^2.

The second viewshed model for the proposed Platreef Project illustrates the potential mitigation effect of vegetation screening (Plan 9). This model assumed that the existing noise berm would be vegetated to form a vegetation screen and takes into account the resultant screening effect of the vegetated berm. The mitigated viewshed model depicts the area from which the proposed Platreef Project would potentially be visible if the existing noise berm was used as a vegetation screen. This viewshed covers an area of approximately 631 km^2.

The difference between the theoretical and mitigated viewshed models is highlighted in yellow (Plan 9). These are areas which will be potentially visually affected by the theoretical viewshed model but will benefit from the implementation of the vegetation screen, i.e. areas that will no longer be visually affected if the noise berm is vegetated. Although there is a difference of 32 km^2 between the theoretical and mitigated viewshed models, the screening effect of the vegetated noise berm will not decrease the visual impact of the proposed Platreef Project on the villages closest to the proposed infrastructure area. This is because the villages are directly adjacent to the infrastructure area and there is infrastructure (main shaft, plant and waste rock dumps) that is taller than the 10 m noise berm. The vegetated noise berm will reduce the visual impact further away from the infrastructure area near the Mogalakwena Platinum Mine. Based on the theoretical viewshed, the village of Ga-Masenya would potentially be visually impacted on by the proposed Platreef Project but with the implementation of the vegetated noise berm, this village will no longer be affected.

The third viewshed model illustrates the potential visual impact of the proposed Platreef Project on the Makapan Valley WHS (Plan 10). This viewshed model indicates that the core area of the Makapan Valley WHS will not be visually affected by the proposed Platreef Project. The western side of the buffer of the Makapan Valley WHS near the town of Mokopane will potentially be visually affected by the proposed Platreef Project. This visual impact is expected to be minimal as the buffer is at least 10 km from the proposed infrastructure. There is also likely to be an existing visual impact from the industrial area of Mokopane that already affects this part of the buffer. The proposed Platreef Project is, therefore, expected to have a minimal visual impact on the buffer and no visual impact on the core area of the Makapan Valley WHS.

9.3 Sensitive Receptors

The receptors identified within the theoretical viewshed area include residents of the town of Mokopane as well the following villages as illustrated in Plan 8:

- Ga-Kgubudi;
- Ga-Madiba;
- Ga-Magonwa;
- Ga-Mapela;
- Ga- Masenya;
- Ga- Molekana;
- Mahwelereng;
- Masodi;
- Mosate;
- Mzumbani;
- Phola Park;
- Sekgakgapeng; and
- Tshamahansi.

The villages of Ga-Kgubudi, Ga-Madiba, Ga-Magonwa, Mzumbani and Tshamahansi are closest to the proposed development and are therefore expected to experience the highest visual impact. The theoretical viewshed model indicates that the proposed Platreef Project will potentially be visible from the N1 and N11 national routes (Figure 9), and the R101 and R518 regional routes as well as other smaller roads within the study area. The southern part of the Witvinger Nature Reserve will potentially be visually affected by the proposed Platreef Project.

Figure 9: N11 national route running through the study area

The mitigated viewshed model indicates that the screening effect of the vegetated noise berm will result in the village of Ga-Masenya no longer being visually impacted on by the proposed Platreef Project.

10 DISCUSSION

10.1 Topography

A change in the land use from agricultural activities and natural bushveld to mining will change the topography. Mining involves changing the natural features and adding man-made features to the topography and will therefore have a negative impact on the topography of the study area. Changing the topography of an area will cause negative impacts on the other environmental, social and cultural aspects of the receiving environment. The removal of topsoil and vegetation will change the topography/surface. This will affect surface water flow and if not managed correctly could result in soil erosion. Vegetation removal will result in biodiversity and habitat loss. The greatest impact on the topography will be from the waste rock dumps and TSF which have large footprint areas and will dramatically change the slope of the topography. This will affect surface and groundwater flows. The construction of other surface infrastructure will have a lesser impact on the topography as it only covers a small footprint area. Topography change as a result of mining will degrade the visual aesthetic of the area and could affect tourism.

10.2 Visual

The proposed Platreef Project will have a negative visual impact on the receiving environment. The greatest visual impact will be from the main shaft headgear, plant area, waste rock dumps and tailings storage facility (TSF) as these are the tallest components of the infrastructure and in the case of the waste rock dumps and TSF, cover a large area. The construction of the other smaller surface infrastructure will have a lesser visual impact.

10.2.1 Visibility of the Project

The visibility of the project refers to the viewshed area. Oberholzer (2005) describes this as "the geographic area from which the project will be visible". The visibility of the project is also related to the number of receptors affected. The proposed Platreef Project has a **high visibility** as it is visible form a large area (theoretical viewshed of approximately 633 km^2) with numerous visual receptors.

10.2.2 Visual Exposure

Visual exposure is "based on the distance from the project to selected viewpoints" and "tends to diminish with distance" (Oberholzer, 2005). The proposed Platreef Project has a **high exposure** as it will be clearly noticeable. This is due to the large area covered by the project and the height of the dumps and stockpiles.

10.2.3 Visual Sensitivity of the Area

The visual sensitivity of the area refers to "the inherent visibility of the landscape, usually determined by a combination of topography, landform, vegetation cover and settlement pattern" (Oberholzer, 2005). The receiving environment of the proposed Platreef Project has a **high visual sensitivity** as there are highly visible and potentially sensitive areas in the landscape. This is due to the proximity of the Makapan Valley WHS to the proposed Platreef Project.

10.2.4 Visual Sensitivity of Receptors

The visual sensitivity of receptors is dependent on the nature of the receptors. Receptors in residential areas or nature reserves have a high sensitivity while receptors in industrial or mining areas have a low sensitivity. The identified receptors (roads, farm residences and game lodges) of the proposed Platreef Project have a **high sensitivity** as they are situated in scenic areas.

10.2.5 Visual Absorption Capacity (VAC)

The visual absorption capacity (VAC) refers to "the potential of the landscape to conceal the proposed project" (Oberholzer, 2005). The receiving environment of the proposed Platreef Project has a **low VAC** because although there is partial screening provided by the vegetation, this is not sufficient to conceal the project effectively.

10.2.6 Visual Intrusion

The visual intrusion of the project refers to "the level of compatibility or congruence of the project with the particular qualities of the area, or its sense of place". Visual intrusion is "related to the idea of context and maintaining the integrity of the landscape or townscape" (Oberholzer, 2005). The proposed Platreef Project has a **medium visual intrusion** as it partially fits into the surroundings due to the proximity of the Mokgalakwena Platinum Mine, but will still be clearly noticeable.

11 IMPACT ASSESSMENT

11.1 Assessment Methodology

The impact rating process is designed to provide a numerical rating of the various environmental impacts identified for various project activities. The significance rating process follows the established impact/risk assessment formula:

Significance = Consequence x Probability

Where

Consequence = Severity + Spatial Scale + Duration

And

Probability = Likelihood of an impact occurring

The severity, spatial scale and duration of the potential impacts were rated using Table 5 below. The significance of each impact was then measured based on their scores of consequence and probability (Table 6). Once a score was assigned to each of the impacts, they could be categorised as either a Major, Moderate, Minor or Negligible impact, based on the classification in Table 7.

Table 5: Severity, spatial scale, duration and probability categories

Rating	Severity	Spatial Scale	Duration	Probability
7	Very significant impact on the environment. Irreparable damage to highly valued species, habitat or eco system. Persistent severe damage.	International The effect will occur across international borders	Permanent: No Mitigation No mitigation measures of natural process will reduce the impact after implementation.	Certain / Definite The impact will occur regardless of the implementation of any preventative or corrective actions.

Rating	Severity	Spatial Scale	Duration	Probability
6	Significant impact on highly valued species, habitat or ecosystem.	National Will affect the entire country	Permanent: Mitigation Mitigation measures of natural process will reduce the impact.	Almost Certain / Highly Probable It is most likely that the impact will occur.
5	Very serious, long-term environmental impairment of ecosystem function that may take several years to rehabilitate.	Province/ Region Will affect the entire province or region	Project Life The impact will cease after the operational life span of the project.	Likely The impact may occur.
4	Serious medium term environmental effects. Environmental damage can be reversed in less than a year.	Municipal Area Will affect the whole municipal area	Long term 6-15 years	Probable Has occurred here or elsewhere and could therefore occur.
3	Moderate, short-term effects but not affecting ecosystem functions. Rehabilitation requires intervention of external specialists and can be done in less than a month.	Local Local extending only as far as the development site area	Medium term 1-5 years	Unlikely Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur.
2	Minor effects on biological or physical environment. Environmental damage can be rehabilitated internally with/ without help of external consultants.	Limited Limited to the site and its immediate surroundings	Short term Less than 1 year	Rare / Improbable Conceivable, but only in extreme circumstances and/ or has not happened during lifetime of the project but has happened elsewhere. The possibility of the impact materialising is very low as a result of design, historic experience or implementation of adequate mitigation measures

Rating	Severity	Spatial Scale	Duration	Probability
1	Limited damage to minimal area of low significance, (e.g. ad hoc spills within plant area). Will have no impact on the environment.	Very limited Limited to specific isolated parts of the site.	Immediate Less than 1 month	Highly Unlikely / None Expected never to happen.

Table 6: Significance scores based on consequence and probability

Significance										
		Consequence (severity + scale + duration)								
		1	3	5	7	9	11	15	18	21
Probability / Likelihood	1	1	3	5	7	9	11	15	18	21
	2	2	6	10	14	18	22	30	36	42
	3	3	9	15	21	27	33	45	54	63
	4	4	12	20	28	36	44	60	72	84
	5	5	15	25	35	45	55	75	90	105
	6	6	18	30	42	54	66	90	108	126
	7	7	21	35	49	63	77	105	126	147

Table 7: Impact categories based on significance scores

Significance		
High (Major)	108 – 147	
Medium-High (Moderate)	73 – 107	
Medium-Low (Minor)	36 – 72	
Low (Negligible)	0 – 35	

11.2 Identification of Project Activities

The project activities are listed in Table 8 below. The activities highlighted in red are applicable to this T&VIA.

Table 8: Project activities

Activity	Description
Construction Phase	
Activity 1	Site clearing: Removal of topsoil and vegetation.
Activity 2	Construction of surface infrastructure e.g. access roads, pipes, storm water diversion berms, change houses, admin blocks etc.
Activity 3	Transportation of materials and workers on site.
Activity 4	Drilling, blasting and development of infrastructure and adits for mining.
Activity 5	Temporary storage of hazardous chemicals and fuels.
Operational Phase	
Activity 6	Removal of PGM's (underground mining process).
Activity 7	Operation of surface infrastructure such as the operation of the mining shaft, crusher, pipelines, the TSF and processing plant (includes water use and storage on site, including pollution control dams).
Activity 8	Transportation of mineral off site using trucks/conveyor.
Activity 9	Storage, handling and treatment of hazardous products (fuel, explosives, oil) and waste activities (waste, sewage, discards, PCD).
Decommissioning Phase	
Activity 10	Demolition and removal of all infrastructure (including transportation off site).
Activity 11	Rehabilitation (spreading of soil, re-vegetation and profiling/contouring) (includes sealing of adit and ventilation shaft entrances).
Activity 12	Storage, handling and treatment of hazardous products (fuel, explosives, oil) and waste activities (waste, sewage).
Post-closure Phase	
Activity 13	Post-closure monitoring and rehabilitation.

11.3 Topography Impact Assessment

The project activities listed in Table 8 will be rated according to the impact they will have on the receiving environment, i.e. the environment before development. Negative impacts change the topography from the pre-development topography to the post-development topography. Neutral impacts assist to minimise the long term effects of the negative impacts on the topography. Positive impacts do not occur as the topography cannot be returned to a state better than the pre-development topography.

11.3.1 Construction Phase

The construction phase is characterised by site development and infrastructure construction. This includes site clearing, topsoil removal and stockpiling, construction of surface infrastructure (access roads, pipes, storm water diversion berms, change houses, admin blocks, etc.), and drilling, blasting and development of infrastructure and adits for mining. The construction phase will have negative impacts on the topography. The surface infrastructure is medium-scale and will therefore have a moderate impact on the topography.

Activity 1: Site clearing: Removal of topsoil and vegetation.

Impacted Environment: Topography

Description: The removal of vegetation and topsoil will change the surface of the study area and will therefore change the topography. The areas to be cleared include the infrastructure area, TSF Site 2 and the tailings pipeline servitude. The study area is susceptible to soil erosion due to the degraded nature of the natural vegetation. This is evident from the eroded drainage lines running through TSF Site 2. It is essential that vegetation and topsoil are only removed when and where necessary to prevent the occurrence of unnecessary soil erosion.

Impact Assessment:

Parameter	Pre-Mitigation		Post-Mitigation	
Duration	Project Life	5	Project Life	5
Spatial Scale / Extent	Local	3	Local	3
Severity	Serious	4	Moderate	3
Probability / Likelihood	Certain / Definite	7	Likely	5
Significance	Moderate	84	Minor	55

Mitigation:

Objectives:

- To minimise topography change and disruption of surface water flow; and
- To minimise soil erosion and topsoil loss.

Mitigation Measures:

- Only clear vegetation when and where necessary;
- Only remove topsoil when and where necessary;
- Ensure topsoil is stored away from surface water and drainage lines; and
- Ensure topsoil stockpiles are contoured and not too steep.

Activity 2: Construction of surface infrastructure e.g. access roads, pipes, storm water diversion berms, change houses, admin blocks etc.

Impacted Environment: Topography

Description: The construction of surface infrastructure will add features to the topography thereby changing it. This surface infrastructure includes the access roads, water and tailings pipelines, storm water diversion berms, change houses, admin blocks, crusher, processing plant, pollution control dams (PCD's), water storage dams, waste rock dumps and the TSF. Piles of construction material will temporarily change the topography of the study area.

Impact Assessment:

Parameter	Pre-Mitigation		Post-Mitigation	
Duration	Project Life	5	Project Life	5
Spatial Scale / Extent	Local	3	Local	3
Severity	Serious	4	Moderate	3
Probability / Likelihood	Certain / Definite	7	Likely	5
Significance	Moderate	84	Minor	55

Mitigation:

Objectives:

- To minimise topography change and disruption of surface water flow.

Mitigation Measures:

- Limit the surface area of infrastructure where possible;
- Store construction materials away from surface water and drainage lines; and
- Don't create numerous haul roads alongside each other.

Activity 3: Transportation of material and workers on site.

Impacted Environment: Topography

Description: Vehicular activity to transport construction material and workers on site could damage the surface of roads and impact on the topography.

Impact Assessment:

Parameter	Pre-Mitigation		Post-Mitigation	
Duration	Project Life	5	Project Life	5
Spatial Scale / Extent	Limited	2	Limited	2
Severity	Moderate	3	Minor	2
Probability / Likelihood	Likely	5	Probable	4
Significance	Minor	50	Minor	36

Mitigation:

Objectives:

- To minimise topography change and disruption of surface water flow; and
- To minimise soil erosion and topsoil loss.

Mitigation Measures:

- Don't create numerous haul roads alongside each other; and
- Ensure that drainage off haul roads does not result in soil erosion.

Activity 4: Drilling, blasting and development of infrastructure and adits for mining.

Impacted Environment: Topography

Description: The drilling, blasting and development of infrastructure and adits for mining will change the topography. The development of surface infrastructure will add features to the topography while drilling and blasting for the adits will create voids.

Impact Assessment:

Parameter	Pre-Mitigation		Post-Mitigation	
Duration	Project Life	5	Project Life	5
Spatial Scale / Extent	Local	3	Local	3
Severity	Very Serious	5	Serious	4
Probability / Likelihood	Certain / Definite	7	Likely	5
Significance	Moderate	91	Minor	60

Mitigation:

Objectives:

- To minimise topography change and disruption of surface water flow.

Mitigation Measures:

- Only remove overburden when and where necessary to create the voids for the adits; and
- Limit the surface area of infrastructure where possible.

11.3.2 Operational Phase

The operational phase is characterised by the removal of PGM's (underground mining process), the operation of surface infrastructure and the transportation of mineral off site. The operational phase will have negative impacts on the topography. The underground mining process will have a negligible impact on the topography unless subsidence occurs. The operation of surface infrastructure will have a moderate impact on the topography. This is mainly due to the waste rock dumps and TSF which will significantly change the topography of the study area. The water management activities will change the drainage lines and affect surface water flow resulting in a moderate impact on the topography.

Activity 6: Removal of PGM's (underground mining process).

Impacted Environment: Topography

Description: Underground mining techniques will be utilised and therefore the removal of PGM's (underground mining process) is unlikely to impact on the topography. If underground mining occurs close to the surface and insufficient pillars are left to support the surface then subsidence could result. This subsidence would have an impact on the topography.

Impact Assessment:

Parameter	Pre-Mitigation		Post-Mitigation	
Duration	Project Life	5	Project Life	5
Spatial Scale / Extent	Limited	2	Limited	2
Severity	Serious	4	Minor	2
Probability / Likelihood	Probable	4	Unlikely	3
Significance	Minor	44	Negligible	27

Mitigation:.

Objectives:

- To minimise subsidence resulting in topography change and disruption of surface water flow.

Mitigation Measures:

- Ensure that sufficient pillars are left to support underground mining areas.

Activity 7: Operation of surface infrastructure such as the operation of the mining shaft, crusher, pipelines, the TSF and processing plant (includes water use and storage on site, including pollution control dams).

Impacted Environment: Topography

Description: Operation of the stockpiles, waste rock dumps and TSF will add to the surface and thereby change the topography of the study area. The increasing height of the TSF will continuously change the topography. The TSF will remain beyond the closure phase of the proposed Platreef Project and will therefore have a permanent impact on the topography. Water use and storage on site (including pollution control dams) will change the surface water flow of the study area. This change in surface water will impact on the topography.

Impact Assessment:

Parameter	Pre-Mitigation		Post-Mitigation	
Duration	Project Life	5	Project Life	5
Spatial Scale / Extent	Local	3	Local	3
Severity	Significant	6	Very Serious	5
Probability / Likelihood	Certain / Definite	7	Almost Certain / Highly Probable	6
Significance	Moderate	98	Moderate	78

Mitigation:

Objectives:

- To minimise topography change, disruption of surface water flow and pollution of clean water.

Mitigation Measures:

- Store waste rock, tailings and stockpiled ore away from surface water and drainage lines;
- Limit the footprint area of the waste rock dumps, TSF and ore stockpile if possible;
- Limit the quantity and time of ore stockpiled on site;
- Ensure ore stockpiles, waste rock dumps and the TSF are contoured and not too steep;
- Ensure all dirty water is channelled towards pollution control dams;
- Ensure water diversion berms are well maintained, contoured and not too steep.

Activity 8: Transportation of mineral off site using trucks/conveyor.

Impacted Environment: Topography

Description: Vehicular activity to transport the mineral off site could damage the surface of roads and impact on the topography. Transporting the mineral by conveyor belt will not impact on the topography.

Impact Assessment:

Parameter	Pre-Mitigation		Post-Mitigation	
Duration	Project Life	5	Project Life	5
Spatial Scale / Extent	Local	3	Local	3
Severity	Moderate	3	Minor	2
Probability / Likelihood	Likely	5	Probable	4
Significance	Minor	55	Minor	40

Mitigation:

Objectives:

- To minimise topography change.

Mitigation Measures:

- Liaise with local authorities to ensure that roads are well maintained.

11.3.3 Decommissioning Phase

The decommissioning phase is characterised by rehabilitation activities including the demolition and removal of all infrastructure, spreading of soil, re-vegetation and profiling/contouring. This phase will have neutral impacts on the topography. The surface infrastructure is medium-scale and its removal will have a minor neutral impact on the topography. The spreading of soil and re-vegetation will assist in the prevention of soil erosion. Profiling/contouring will assist to recreate the natural drainage lines and surface water flow. These will have a moderate neutral impact on the topography.

Activity 10: Demolition and removal of all infrastructure (including transportation off site).

Impacted Environment: Topography

Description: The demolition and removal of all infrastructure will remove features from the surface and thereby change the topography. This is a neutral change that will help to reverse some of the negative changes that occurred when the infrastructure was constructed.

Impact Assessment:

Parameter	Pre-Mitigation		Post-Mitigation (Neutral Impact)	
Duration	Project Life	5	Medium-Term	3
Spatial Scale / Extent	Local	3	Limited	2
Severity	Serious	4	Minor	2
Probability / Likelihood	Certain / Definite	7	Likely	5
Significance	Moderate	84	Negligible	35

Mitigation:

Objectives:

- To rehabilitate the topography.

Mitigation Measures:

- Ensure all unnecessary infrastructure is removed.

Activity 11: Rehabilitation (spreading of soil, re-vegetation and profiling/contouring) (includes sealing of adit and ventilation shaft entrances).

Impacted Environment: Topography

Description: Rehabilitation (spreading of soil, re-vegetation and profiling/contouring) will change the topography of the study area. This is a neutral change as the aim of rehabilitation is to return the topography to a state similar to the pre-development topography. After the surface infrastructure has been removed, the study area should be profiled and contoured to restore drainage lines. Soil should then be spread and the project area should be re-vegetated. Re-vegetation will help to prevent soil erosion.

Impact Assessment:

Parameter	Pre-Mitigation		Post-Mitigation (Neutral Impact)	
Duration	Project Life	5	Medium-Term	3
Spatial Scale / Extent	Local	3	Limited	2
Severity	Serious	4	Minor	2
Probability / Likelihood	Certain / Definite	7	Likely	5
Significance	Moderate	84	Negligible	35

Mitigation:

Objectives:

- To rehabilitate the topography;
- To recreate natural drainage lines and surface water flow; and
- To minimise soil erosion.

Mitigation Measures:

- Fill the shaft voids with waste rock;
- Ensure that the rehabilitated area is re-contoured and profiled to a topography similar to the pre-development topography;
- Spread soil over the rehabilitated area;
- Ensure that surface water and drainage lines are rehabilitated to pre-development condition; and
- Re-vegetate rehabilitated areas.

11.3.4 Post-Closure Phase

The post-closure phase is characterised by continuous monitoring and rehabilitation. The topography needs to be returned to a state similar to the pre-development topography. Soil erosion is visible in the study area and surrounds due to the degraded nature of the natural vegetation. Particular attention must be paid to the management of the activities that affect the topography so as to prevent the occurrence of soil erosion.

Activity 13: Post-closure monitoring and rehabilitation.

Impacted Environment: Topography

Description: The post-development topography will never be the same as the pre-development topography. There will therefore be a permanent and irreversible change to the topography of the study area. Post-closure monitoring and rehabilitation is essential to limit the impact of the proposed Platreef Project on the topography. This is a neutral impact that will help to reverse some of the negative impacts. The topography, surface water flow and drainage lines need to be returned to a state similar to their pre-development state. Continuous monitoring and rehabilitation is essential to manage the risk of soil erosion.

Impact Assessment:

Parameter	Pre-Mitigation		Post-Mitigation (Neutral Impact)	
Duration	Permanent: No mitigation	7	Permanent: Mitigation	6
Spatial Scale / Extent	Local	3	Local	3
Severity	Very Serious	5	Minor	2
Probability / Likelihood	Certain / Definite	7	Likely	5
Significance	Moderate	105	Minor	55

Mitigation:

Objectives:

- To rehabilitate the topography; and
- To minimise soil erosion.

Mitigation Measures:

- Ensure that the post-development topography is as close as possible to the pre-development topography by re-contouring and profiling the study area;
- Ensure that surface water and drainage lines are rehabilitated to pre-development condition; and
- Carefully monitor rehabilitated areas to ensure that soil erosion is prevented.

11.4 Visual Impact Assessment

The project activities listed in Table 8 will be rated according to the impact they will have on the receiving environment, i.e. the environment before development. Negative visual impacts decrease the visual character of the pre-development environment. Positive visual impacts increase the visual character of the pre-development environment. Neutral visual impacts assist to minimise the negative visual impacts of a development but don't result in a positive visual impact. A positive visual impact only occurs when an area is rehabilitated to a state that is better than the state of the pre-development environment, e.g. a mining area on previously agricultural land is rehabilitated to an area of natural vegetation and all visible signs of agriculture and mining are removed. Positive visual impacts rarely occur.

11.4.1 Construction Phase

The construction phase is characterised by site development and infrastructure construction. This includes site clearing, topsoil removal and stockpiling, construction of surface infrastructure (access roads, pipes, storm water diversion berms, change houses, admin blocks, etc.), and drilling, blasting and development of infrastructure and adits for mining. The establishment of infrastructure and related construction activities will draw attention to the infrastructure area and TSF site making receptors aware of the development. This phase will have negative visual impacts on the receiving environment. The surface infrastructure is medium-scale and will have a moderate visual impact.

Activity 1: Site clearing: Removal of topsoil and vegetation.

Impacted Environment: Visual

Description: The removal of topsoil and vegetation will have a negative visual impact on the receiving environment. The infrastructure area and TSF site will become noticeable to the nearby receptors as it will contrast the surrounding areas.

Impact Assessment:

Parameter	Pre-Mitigation		Post-Mitigation	
Duration	Project Life	5	Project Life	5
Spatial Scale / Extent	Local	3	Local	3
Severity	Serious	4	Moderate	3
Probability / Likelihood	Certain / Definite	7	Almost Certain / Highly Probable	6
Significance	Moderate	84	Minor	66

Mitigation:

Objectives:

- To minimise the negative visual impact caused by topsoil and vegetation removal.

Mitigation Measures:

- Topsoil and vegetation should only be removed when and where necessary; and
- Topsoil stockpiles should be vegetated and positioned to reduce visual disturbance where possible.

Activity 2: Construction of surface infrastructure e.g. access roads, pipes, storm water diversion berms, change houses, admin blocks etc.

Impacted Environment: Visual

Description: The construction of surface infrastructure will have a negative visual impact on the receiving environment. This surface infrastructure includes the access roads, water and tailings pipelines, storm water diversion berms, change houses, admin blocks, crusher, processing plant, pollution control dams (PCD's), water storage dams, waste rock dumps and the TSF. Infrastructure lighting will be visible at night and will have a negative visual impact on the receiving environment. These visual impacts will occur for the life of the project.

Impact Assessment:

Parameter	Pre-Mitigation		Post-Mitigation	
Duration	Project Life	5	Project Life	5
Spatial Scale / Extent	Local	3	Local	3
Severity	Serious	4	Moderate	3
Probability / Likelihood	Certain / Definite	7	Almost Certain / Highly Probable	6
Significance	Moderate	84	Minor	66

Mitigation:

Objectives:

- To minimise the negative visual impact caused by the construction of surface infrastructure.

Mitigation Measures:

- The area of the surface infrastructure should be limited where possible;
- Surface infrastructure should be painted with natural hues so as to blend into the surrounding landscape where possible;
- Down lighting should be implemented to minimise light pollution at night;
- Pylons and metal structures should be galvanised so as to weather to a matt grey finish rather than be painted silver. If pylons and metal structures are to be painted it is recommended that a neutral matt finish be used;
- Construction of vegetation berms should be implemented close to infrastructure so that vegetation can be established;
- Numerous haul roads should not be created alongside each other; and
- Roads should be wetted frequently by means of a water bowser to suppress dust.

Activity 3: Transportation of material and workers on site.

Impacted Environment: Visual

Description: Vehicular activity to transport construction material and workers on site and the resulting dust will draw attention to the study area.

Impact Assessment:

Parameter	Pre-Mitigation		Post-Mitigation	
Duration	Project Life	5	Project Life	5
Spatial Scale / Extent	Local	3	Local	3
Severity	Moderate	3	Minor	2
Probability / Likelihood	Almost Certain / Highly Probable	6	Probable	4
Significance	Minor	66	Minor	40

Mitigation:

Objectives:

- To minimise the negative visual impact caused by vehicular activity to transport construction material and workers on site.

Mitigation Measures:

- Numerous haul roads should not be created alongside each other;

- Vehicles must be roadworthy and obey the recommended speed limits at all times; and
- Roads should be wetted frequently by means of a water bowser to suppress dust.

Activity 4: Drilling, blasting and development of infrastructure and adits for mining.

Impacted Environment: Visual

Description: The drilling, blasting and development of infrastructure and adits for mining will have a negative visual impact on the receiving environment. Dust from blasting will have a negative visual impact on the receiving environment. The impact of the construction will occur for the life of the project while the impact of the dust from blasting will occur during the construction phase.

Impact Assessment:

Parameter	Pre-Mitigation		Post-Mitigation	
Duration	Project Life	5	Project Life	5
Spatial Scale / Extent	Local	3	Local	3
Severity	Very Serious	5	Serious	4
Probability / Likelihood	Certain / Definite	7	Almost Certain / Highly Probable	6
Significance	Moderate	91	Minor	72

Mitigation:

Objectives:

- To mitigate the negative visual impact caused by the drilling, blasting and development of infrastructure and adits for mining.

Mitigation Measures:

- The area of the surface infrastructure should be limited where possible;
- Surface infrastructure should be painted with natural hues so as to blend into the surrounding landscape where possible;
- Down lighting should be implemented to minimise light pollution at night;
- Pylons and metal structures should be galvanised so as to weather to a matt grey finish rather than be painted silver. If pylons and metal structures are to be painted it is recommended that a neutral matt finish be used; and
- Construction of vegetation berms should be implemented close to infrastructure so that vegetation can be established.

11.4.2 Operational Phase

The operational phase is characterised by the removal of PGM's (underground mining process), the operation of surface infrastructure and the transportation of mineral off site. The operational phase will have negative visual impacts on the receiving environment. The underground mining process will have a moderate visual impact. The operation of surface infrastructure will have a moderate visual impact. This is due to the size and height of the waste rock dumps and TSF. The transportation of mineral off site using trucks/conveyor will have a minor visual impact.

Activity 6: Removal of PGM's (underground mining process).

Impacted Environment: Visual

Description: Underground mining techniques will be utilised and therefore the visual impact of the underground mining process will be moderate. The reason for this activity receiving a moderate rating is due to the proximity of the villages to the mining area. The movement of the main shaft headgear will draw attention to the mining area. Infrastructure lighting will be visible at night and will have a negative visual impact on the receiving environment. These impacts will occur for the life of the project.

Impact Assessment:

Parameter	Pre-Mitigation		Post-Mitigation	
Duration	Project Life	5	Project Life	5
Spatial Scale / Extent	Local	3	Local	3
Severity	Moderate	3	Minor	2
Probability / Likelihood	Almost Certain / Highly Probable	6	Likely	5
Significance	Minor	66	Minor	50

Mitigation:

Objectives:

- To reduce the negative visual impact caused by the removal of PGM's (underground mining process).

Mitigation Measures:

- Down lighting should be implemented to minimise light pollution at night.

Activity 7: Operation of surface infrastructure such as the operation of the mining shaft, crusher, pipelines, the TSF and processing plant (includes water use and storage on site, including pollution control dams).

Impacted Environment: Visual

Description: Operation of the ore stockpile, waste rock dumps and TSF will have a negative visual impact on the receiving environment. This impact will occur while material is being added to the dumps and stockpiles. The increasing height of the TSF will continue to draw attention to the area throughout the life of the project. The TSF will remain beyond the closure phase of the proposed Platreef Project. This will result in a permanent and irreversible negative visual impact. Operation of the crusher will result in dust and draw attention to the mining area.

Impact Assessment:

Parameter	Pre-Mitigation		Post-Mitigation	
Duration	Project Life	5	Project Life	5
Spatial Scale / Extent	Local	3	Local	3
Severity	Very Serious	5	Serious	4
Probability / Likelihood	Certain / Definite	7	Almost Certain / Highly Probable	6
Significance	Moderate	91	Minor	72

Mitigation:

Objectives:

- To minimise the negative visual impact caused by the operation of the ore stockpile, waste rock dumps and TSF; and
- To minimise the negative visual impact caused by the dust from operation of the crusher.

Mitigation Measures:

- The ore stockpile, waste rock dumps and TSF should be positioned to reduce visual disturbance where possible;
- The quantity and time of ore stored on site should be limited where possible;
- The height of the waste rock dumps and TSF should be limited where possible;
- The waste rock dumps and TSF should be top soiled and vegetated where possible; and
- Dust suppression should be used during operation of the crusher.

Activity 8: Transportation of mineral off site using trucks/conveyor.

Impacted Environment: Visual

Description: The transportation of mineral off site using trucks will have a negative visual impact on the receiving environment. Vehicular activity and the resultant dust will draw attention to the infrastructure area. The transportation of mineral off site using a conveyor will have a smaller negative visual impact. The conveyor is fixed infrastructure and the movement inside to transport the mineral is not visible.

Impact Assessment:

Parameter	Pre-Mitigation		Post-Mitigation	
Duration	Project Life	5	Project Life	5
Spatial Scale / Extent	Local	3	Local	3
Severity	Moderate	3	Minor	2
Probability / Likelihood	Likely	5	Probable	4
Significance	Minor	55	Minor	40

Mitigation:

Objectives:

- To minimise the negative visual impact caused by vehicular activity to transport the mineral off site.

Mitigation Measures:

- Vehicles must be roadworthy and obey the recommended speed limits at all times;
- Haul roads should be wetted frequently by means of a water bowser to suppress dust; and
- Liaise with local authorities to ensure that roads are well maintained.

11.4.3 Decommissioning Phase

The decommissioning phase is characterised by rehabilitation activities including the demolition and removal of all infrastructure, spreading of soil, re-vegetation and profiling/contouring. This phase will have mainly neutral visual impacts on the receiving environment. The demolition and removal of all infrastructure will have a minor neutral visual impact. The spreading of soil and re-vegetation, profiling/contouring will have a moderate neutral visual impact. Rehabilitation will assist to reduce the negative visual impact of the proposed Platreef Project on the receiving environment.

Activity 10: Demolition and removal of all infrastructure (including transportation off site).

Impacted Environment: Visual

Description: The demolition and removal of all infrastructure will have a neutral visual impact on the receiving environment. Vehicular activity to transport the demolished infrastructure off site will have a minor negative visual impact. This will, however, be far outweighed by the neutral impact of the demolition and removal of all infrastructure.

Impact Assessment:

Parameter	Pre-Mitigation		Post-Mitigation (Neutral Impact)	
Duration	Project Life	5	Medium-Term	3
Spatial Scale / Extent	Local	3	Limited	2
Severity	Serious	4	Minor	2
Probability / Likelihood	Certain / Definite	7	Likely	5
Significance	Moderate	84	Negligible	35

Mitigation:

Objectives:

- To increase the neutral visual impact caused by the removal of all infrastructure.

Mitigation Measures:

- Ensure all unnecessary infrastructure is removed; and
- Ensure all concrete foundations are removed.

Activity 11: Rehabilitation (spreading of soil, re-vegetation and profiling/contouring) (includes sealing of adit and ventilation shaft entrances).

Impacted Environment: Visual

Description: Rehabilitation (spreading of soil, re-vegetation and profiling/contouring) will have a neutral visual impact on the receiving environment. The aim of rehabilitation is to return the study area to a state similar to the pre-development state. The spreading of soil, re-vegetation and profiling/contouring will have neutral visual impacts. Rehabilitation will assist to reduce the negative visual impact of the proposed Platreef Project on the receiving environment.

Impact Assessment:

Parameter	Pre-Mitigation		Post-Mitigation (Neutral Impact)	
Duration	Project Life	5	Medium-Term	3
Spatial Scale / Extent	Local	3	Local	3
Severity	Serious	4	Minor	2
Probability / Likelihood	Certain / Definite	7	Likely	5
Significance	Moderate	84	Minor	40

Mitigation:

Objectives:

- To increase the neutral visual impact caused by rehabilitation (spreading of soil, re-vegetation and profiling/contouring).

Mitigation Measures:

- Fill the shaft voids with waste rock;
- Topsoil and vegetate the TSF;
- Rehabilitate all disturbed areas;
- Ensure all rehabilitated area are re-contoured and profiled to a topography similar to the pre-development topography;
- Spread soil over the rehabilitated areas; and
- Re-vegetate all rehabilitated areas.

11.4.4 Post-Closure Phase

The post-closure phase is characterised by continuous monitoring and rehabilitation. The study area needs to be returned to a state similar to the pre-development state. Soil erosion occurs within the study area and surrounds due to the degraded nature of the natural vegetation. Particular attention must be paid to the management of the activities that could result in soil erosion so as to prevent this negative visual impact from occurring.

Activity 13: Post-closure monitoring and rehabilitation.

Impacted Environment: Visual

Description: Post-closure monitoring and rehabilitation will have a neutral visual impact on the receiving environment. Rehabilitation will assist to reduce the negative visual impact of the proposed Platreef Project on the receiving environment.

Impact Assessment:

Parameter	Pre-Mitigation		Post-Mitigation (Neutral Impact)	
Duration	Project Life	5	Medium-Term	3
Spatial Scale / Extent	Local	3	Local	3
Severity	Serious	4	Minor	2
Probability / Likelihood	Certain / Definite	7	Likely	5
Significance	Moderate	84	Minor	40

Mitigation:

Objectives:

- To increase the neutral visual impacts of post-closure rehabilitation.

Mitigation Measures:

- Ensure that all disturbed areas are rehabilitated to a state as close as possible to the pre-development state.

12 CUMULATIVE IMPACTS

The nearest mine is the Mogalakwena Platinum Mine situated approximately 6 km north-west of the study area. This existing mine has impacts on the topography and visual character of the receiving environment. There a several companies holding prospecting rights in the Mokopane area. These include (but are not limited to) Sylvania Platinum and Bushveld Minerals. The possible development of these mines as well as the development of the proposed Platreef Project and will add to these existing topographic and visual impacts.

13 MITIGATION MEASURES AND MANAGEMENT PLAN

The Environmental Management Plan (EMP) has been described according to the project activities in order to provide an understanding of what objectives and recommended management measures are required to minimise the environmental impacts arising from these activities. The management measures are described in Table 9.

Table 9: Mitigation and management plan

Activity	Impacted Environment	Objectives	Mitigation / Management Measure	Frequency of Mitigation	Legal Requirements	Recommended Action Plans	Timing of Implementation	Responsible Person	Significance Before Mitigation	Significance After Mitigation
Activity 1: Site clearing: Removal of topsoil and vegetation.	Topography	■ To minimise topography change and disruption of surface water flow; and ■ To minimise soil erosion and topsoil loss.	■ Only clear vegetation when and where necessary; ■ Only remove topsoil when and where necessary; ■ Ensure topsoil is stored away from surface water and drainage lines; and ■ Ensure topsoil stockpiles are contoured and not too steep.	Weekly	N/A	Mining Plan	Construction	Mining Contractor	Moderate	Minor
	Visual	■ To minimise the negative visual impact caused by topsoil and vegetation removal.	■ Topsoil and vegetation should only be removed when and where necessary; and ■ Topsoil stockpiles should be vegetated and positioned to reduce visual disturbance where possible.	Weekly	N/A	Mining Plan	Construction	Mining Contractor	Moderate	Minor
Activity 2: Construction of surface infrastructure e.g. access roads, pipes, storm water diversion berms, change houses, admin blocks etc.	Topography	■ To minimise topography change and disruption of surface water flow.	■ Limit the surface area of infrastructure where possible; ■ Store construction materials away from surface water and drainage lines; and ■ Don't create numerous haul roads alongside each other.	Weekly	N/A	Mining Plan	Construction	Mining Contractor	Moderate	Minor

Activity	Impacted Environment	Objectives	Mitigation / Management Measure	Frequency of Mitigation	Legal Requirements	Recommended Action Plans	Timing of Implementation	Responsible Person	Significance Before Mitigation	Significance After Mitigation
	Visual	■ To minimise the negative visual impact caused by the construction of surface infrastructure.	■ The area of the surface infrastructure should be limited where possible; ■ Surface infrastructure should be painted with natural hues so as to blend into the surrounding landscape where possible; ■ Down lighting should be implemented to minimise light pollution at night; ■ Pylons and metal structures should be galvanised so as to weather to a matt grey finish rather than be painted silver. If pylons and metal structures are to be painted it is recommended that a neutral matt finish be used; ■ Construction of vegetation berms should be implemented close to infrastructure so that vegetation can be established; ■ Numerous haul roads should not be created alongside each other; and ■ Roads should be wetted frequently by means of a water bowser to suppress dust.	Weekly	N/A	Mining Plan	Construction	Mining Contractor	Moderate	Minor

Activity	Impacted Environment	Objectives	Mitigation / Management Measure	Frequency of Mitigation	Legal Requirements	Recommended Action Plans	Timing of Implementation	Responsible Person	Significance Before Mitigation	Significance After Mitigation
Activity 3: Transportation of materials and workers on site.	Topography	■ To minimise topography change and disruption of surface water flow; and ■ To minimise soil erosion and topsoil loss.	■ Don't create numerous haul roads alongside each other; and ■ Ensure that drainage off haul roads does not result in soil erosion.	Weekly	N/A	Mining Plan	Construction	Mining Contractor	Minor	Minor
	Visual	■ To minimise the negative visual impact caused by vehicular activity to transport construction material and workers on site.	■ Numerous haul roads should not be created alongside each other; ■ Vehicles must be roadworthy and obey the recommended speed limits at all times; and ■ Roads should be wetted frequently by means of a water bowser to suppress dust.	Weekly	N/A	Mining Plan Air Quality Plan	Construction	Mining Contractor	Minor	Minor
Activity 4: Drilling, blasting and development of infrastructure and adits for mining.	Topography	■ To minimise topography change and disruption of surface water flow.	■ Only remove overburden when and where necessary to create the voids for the adits; and ■ Limit the surface area of infrastructure where possible.	Weekly	N/A	Mining Plan	Construction	Mining Contractor	Moderate	Minor

Activity	Impacted Environment	Objectives	Mitigation / Management Measure	Frequency of Mitigation	Legal Requirements	Recommended Action Plans	Timing of Implementation	Responsible Person	Significance Before Mitigation	Significance After Mitigation
	Visual	■ To mitigate the negative visual impact caused by the drilling, blasting and development of infrastructure and adits for mining.	■ The area of the surface infrastructure should be limited where possible; ■ Surface infrastructure should be painted with natural hues so as to blend into the surrounding landscape where possible; ■ Down lighting should be implemented to minimise light pollution at night; ■ Pylons and metal structures should be galvanised so as to weather to a matt grey finish rather than be painted silver. If pylons and metal structures are to be painted it is recommended that a neutral matt finish be used; and ■ Construction of vegetation berms should be implemented close to infrastructure so that vegetation can be established.	Weekly	N/A	Mining Plan Air Quality Plan	Construction	Mining Contractor	Moderate	Minor
Activity 6: Removal of PGM's (underground mining process).	Topography	■ To minimise subsidence resulting in topography change and disruption of surface water flow.	■ Ensure that sufficient pillars are left to support underground mining areas.	Weekly	N/A	Mining Plan	Operation	Mining Contractor	Minor	Negligible
	Visual	■ To reduce the negative visual impact caused by the removal of PGM's (underground mining process).	■ Down lighting should be implemented to minimise light pollution at night.	Weekly	N/A	Mining Plan	Operation	Mining Contractor	Minor	Minor

Activity	Impacted Environment	Objectives	Mitigation / Management Measure	Frequency of Mitigation	Legal Requirements	Recommended Action Plans	Timing of Implementation	Responsible Person	Significance Before Mitigation	Significance After Mitigation
Activity 7: Operation of surface infrastructure such as the operation of the mining shaft, crusher, pipelines, the TSF and processing plant (includes water use and storage on site, including pollution control dams).	Topography	■ To minimise topography change, disruption of surface water flow and pollution of clean water.	■ Store waste rock, tailings and stockpiled ore away from surface water and drainage lines; ■ Limit the footprint area of the waste rock dumps, TSF and ore stockpile if possible; ■ Limit the quantity and time of ore stockpiled on site; ■ Ensure ore stockpiles, waste rock dumps and the TSF are contoured and not too steep; ■ Ensure all dirty water is channelled towards pollution control dams; ■ Ensure water diversion berms are well maintained, contoured and not too steep.	Weekly	N/A	Mining Plan	Operation	Mining Contractor	Moderate	Moderate

Activity	Impacted Environment	Objectives	Mitigation / Management Measure	Frequency of Mitigation	Legal Requirements	Recommended Action Plans	Timing of Implementation	Responsible Person	Significance Before Mitigation	Significance After Mitigation
	Visual	■ To minimise the negative visual impact caused by the operation of the ore stockpile, waste rock dumps and TSF; and ■ To minimise the negative visual impact caused by the dust from operation of the crusher.	■ The ore stockpile, waste rock dumps and TSF should be positioned to reduce visual disturbance where possible; ■ The quantity and time of ore stored on site should be limited where possible; ■ The height of the waste rock dumps and TSF should be limited where possible; ■ The waste rock dumps and TSF should be top soiled and vegetated where possible; and ■ Dust suppression should be used during operation of the crusher.	Weekly	N/A	Mining Plan	Operation	Mining Contractor	Moderate	Minor
Activity 8: Transportation of mineral off site using trucks/conveyors.	Topography	■ To minimise topography change.	■ Liaise with local authorities to ensure that roads are well maintained.	Weekly	N/A	Mining Plan	Operation	Mining Contractor	Minor	Minor
	Visual	■ To minimise the negative visual impact caused by vehicular activity to transport the mineral off site.	■ Vehicles must be roadworthy and obey the recommended speed limits at all times; ■ Haul roads should be wetted frequently by means of a water bowser to suppress dust; and ■ Liaise with local authorities to ensure that roads are well maintained.	Weekly	N/A	Mining Plan Air Quality Plan	Operation	Mining Contractor	Minor	Minor
Activity 10: Demolition and removal of all infrastructure	Topography	■ To rehabilitate the topography.	■ Ensure all unnecessary infrastructure is removed.	Monthly	N/A	Rehabilitation Plan	Decommissioning	Environmental Officer	Moderate	Negligible

Activity	Impacted Environment	Objectives	Mitigation / Management Measure	Frequency of Mitigation	Legal Requirements	Recommended Action Plans	Timing of Implementation	Responsible Person	Significance Before Mitigation	Significance After Mitigation
(including transportation off site).	Visual	■ To increase the neutral visual impact caused by the removal of all infrastructure.	■ Ensure all unnecessary infrastructure is removed; and ■ Ensure all concrete foundations are removed.	Monthly	N/A	Rehabilitation Plan	Decommissioning	Environmental Officer	Moderate	Negligible
Activity 11: Rehabilitation (spreading soil, re-vegetation and profiling/contouring) (includes sealing of adit and ventilation shaft entrances).	Topography	■ To rehabilitate the topography; ■ To recreate natural drainage lines and surface water flow; and ■ To minimise soil erosion.	■ Fill the shaft voids with waste rock; ■ Ensure that the rehabilitated area is re-contoured and profiled to a topography similar to the pre-development topography; ■ Spread soil over the rehabilitated area; ■ Ensure that surface water and drainage lines are rehabilitated to pre-development condition; and ■ Re-vegetate rehabilitated areas.	Monthly	N/A	Rehabilitation Plan	Decommissioning	Environmental Officer	Moderate	Negligible
	Visual	■ To increase the neutral visual impact caused by rehabilitation (spreading of soil, re-vegetation and profiling/contouring).	■ Fill the shaft voids with waste rock; ■ Topsoil and vegetate the TSF; ■ Rehabilitate all disturbed areas; ■ Ensure all rehabilitated area are re-contoured and profiled to a topography similar to the pre-development topography; ■ Spread soil over the rehabilitated areas; and ■ Re-vegetate all rehabilitated areas.	Monthly	N/A	Rehabilitation Plan	Decommissioning	Environmental Officer	Moderate	Minor

Activity	Impacted Environment	Objectives	Mitigation / Management Measure	Frequency of Mitigation	Legal Requirements	Recommended Action Plans	Timing of Implementation	Responsible Person	Significance Before Mitigation	Significance After Mitigation
Activity 13: Post-closure monitoring and rehabilitation.	Topography	■ To rehabilitate the topography; and ■ To minimise soil erosion.	■ Ensure that the post-development topography is as close as possible to the pre-development topography by re-contouring and profiling the study area; ■ Ensure that surface water and drainage lines are rehabilitated to pre-development condition; and ■ Carefully monitor rehabilitated areas to ensure that soil erosion is prevented.	Monthly	N/A	Rehabilitation Plan	Post-closure	Environmental Officer	Moderate	Minor
	Visual	■ To increase the neutral visual impacts of post-closure rehabilitation.	■ Ensure that all disturbed areas are rehabilitated to a state as close as possible to the pre-development state.	Monthly	N/A	Rehabilitation Plan	Post-closure	Environmental Officer	Moderate	Minor

13.1 General Mitigation

According to Brush *et al* (1979), vegetation screening is the best mitigation measure to conceal a development. Figure 10 illustrates the effect of a vegetation screen strategically located on a berm. Vegetation screens are most effective when planted close to the receptor but this is not always possible. A vegetation screen planted close to a development will still reduce the visual impact of the development. Vegetation screens should include both fast growing trees and dense shrubs arranged as illustrated in Figure 11, with a tree planted next to a shrub and vice versa. Alien vegetation should not be used for vegetation screens.

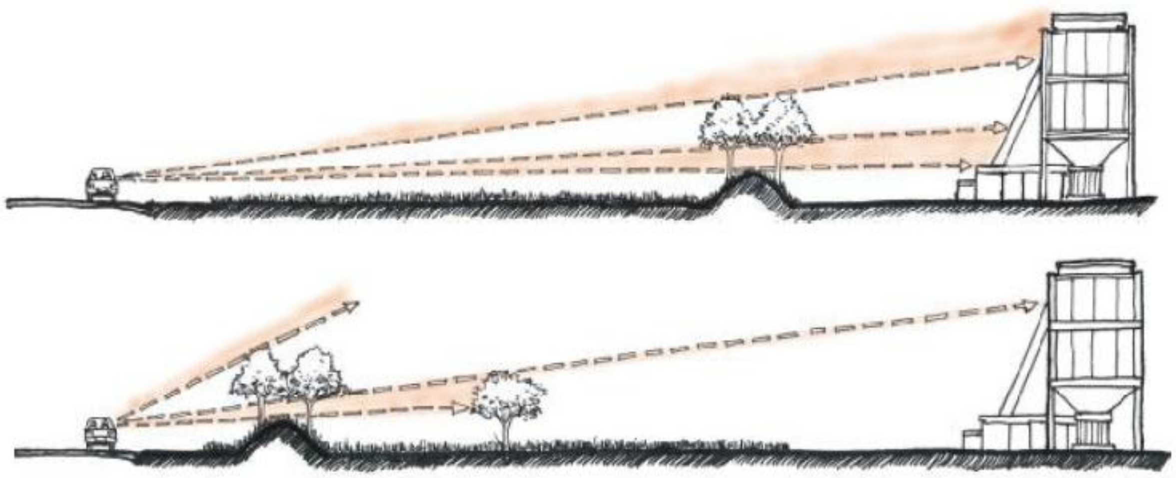

Figure 10: Vegetation screening (Source: Golder & Associates)

Figure 11: Vegetation positioning (Source: Golder & Associates)

Other general mitigation measures that should be implemented where possible include:

- As much existing vegetation as possible should be retained, specifically bushes and trees if present. This will assist to conceal the development;
- Areas susceptible to dust should be frequently wetted by means of a water bowser. It is extremely important to suppress the visual aspects of dust to avoid creating the impression of a polluting industry;
- Vehicles should keep to the recommended speed limit, so as to reduce the creation of dust and attention;
- Down lighting should be implemented to minimise light pollution at night; and
- Grievances from receptors relating to topographical and visual aspects should be monitored and addressed.

14 MONITORING PROGRAMME

The following monitoring activities should be undertaken on a monthly basis for the life of the project:

- Dust monitoring as per the Air Quality Monitoring Plan;
- Vegetation screens need to be maintained and protected against fire and utilisation of the vegetation for fire wood, etc.; and
- Grievances from receptors must be monitored and addressed through a Grievance Mechanism.

15 RECOMMENDATIONS

It is recommended that the mitigation measures detailed in Table 9 above are implemented in order to reduce the impact that the proposed Platreef Project will have on the topography and visual character of the receiving environment. Vegetation and topsoil removal should only be done when and where necessary to avoid exposing larger areas for longer periods of time which could result in soil erosion and increase the visual disturbance. Infrastructure and operations should be kept out of surface water and drainage lines as far as possible and it is essential to implement berms and pollution control dams to separate clean and dirty water on site.

The most important mitigation aspect is the rehabilitation of the site. The success of this rehabilitation will influence the overall long term impacts of the project. The shaft voids should be filled with waste rock. It is of utmost importance that the topography of the site be re-contoured to resemble the pre-development topography as closely as possible. It is also essential to reconstruct all pre-development surface water and drainage lines to ensure that the surface water flow returns to its original state. After re-contouring the site, it should be covered with soil and re-vegetated to complete the rehabilitation process.

16 CONCLUSION

The proposed Platreef Project will have negative topographic and visual impacts on the receiving environment, but these impacts can be reduced by implementing various mitigation measures. The most important of these is rehabilitation with the emphasis being on re-contouring the site and reconstructing the surface water and drainage lines. The receiving environment is prone to soil erosion along the drainage lines and special attention must be paid to managing the activities that affect the topography. The proposed Platreef Project can proceed based on the results of the T&VIA provided that the recommended mitigation measures are implemented.

The receiving environment of the proposed Platreef Project has a high visual sensitivity as the relatively flat topography will only provide minimal screening of the proposed project and there are numerous residential areas within the study area. The mountainous areas to the east and west of the study area will provide screening of the proposed project to those areas on the opposite sides of the mountains. The vegetation of the study area is a mixture of agriculture with isolated large trees and areas of degraded natural bush. The natural bush consists of grass and scattered small bushes and aloes. The average vegetation height in these areas is 1 metre. Both the agricultural areas and natural bush will only provide minimal screening of the proposed project.

The theoretical viewshed covers an area of approximately 663 km². The villages of Ga-Kgubudi, Ga-Madiba, Ga-Magonwa, Mzumbani and Tshamahansi are closest to the proposed development and are therefore expected to experience the highest visual impact. The theoretical viewshed model indicates that the proposed Platreef Project will potentially be visible from the N1 and N11 national routes, and the R101 and R5168 regional routes as well as other smaller roads within the study area. The southern part of the Witvinger Nature Reserve will potentially be visually affected by the proposed Platreef Project. The proposed Platreef Project is expected to have a minimal visual impact on the buffer and no visual impact on the core area of the Makapan Valley WHS.

The mitigated viewshed model for the proposed Platreef Project illustrates the potential mitigation effect of vegetation screening. This model assumed that the existing noise berm would be vegetated to form a vegetation screen and takes into account the resultant screening effect of the vegetated berm. The mitigated viewshed covers an area of approximately 631 km². There is a difference of 32 km² between the theoretical and mitigated viewshed models. The screening effect of the vegetated noise berm will not decrease the visual impact of the proposed Platreef Project on the villages closest to the proposed infrastructure area but will reduce the visual impact further away from the infrastructure area near the Mogalakwena Platinum Mine. Based on the theoretical viewshed, the village of Ga-Masenya would potentially be visually impacted on by the proposed Platreef Project but with the implementation of the vegetated noise berm, this village will no longer be affected.

17 REFERENCES

Brush, R.O., Williamson, D. and Fabos, J., 1979: Visual screening potential of forest vegetation, USDA Forest Service, Mass. U.S.A.

Collins English Dictionary (Complete and Unabridged) 6th Edition, (2003) HarperCollins Publishers.

Contesse, E., 2011: Landscape and wind turbines. Report presented at the 6th Council of Europe Conference of the European Landscape Convention. Available online: http://www.coe.int/t/dg4/cultureheritage/heritage/landscape/reuniunconf/6econference/CEP-CDPATEP(2011)11_en.pdf (19/09/2013).

European Landscape Convention, 2007: A framework for implementation. Available online: http://www.naturalengland.org.uk/Images/elcframework_tcm6-8169.pdf (19/09/2013).

Golder & Associates, 2010: Land development division. Visual impact assessment.

Government of the Republic of South Africa, 2007: Proclamation of the Fossil Hominid Sites of South Africa (Consisting of Fossil Hominid Sites of Sterkfontein, Swartkrans, Kromdraai and the Environs, Taung Skull Fossil Site and Makapan Valley) as a World Heritage Site in Terms of the World Heritage Convention Act, 1999 (Act No. 57 of 1999).Government Gazette No. 1197. Government Gazette.

Oberholzer, B. 2005: guideline for involving visual & aesthetic specialists in EIA processes: Edition 1. CSIR Report No ENV-S-C 2005 053 F. Republic of South Africa, Provincial Government of the Western Cape, Department of Environmental Affairs & Development Planning, Cape Town.

World Bank Group, 1997: Environmental, health and safety guidelines for mining. Document prepared by the International Finance Corporation, Washington, DC, U.S.A.

Appendix A: Plans

Plan 1: Regional Setting

Plan 2: Local Setting

Plan 3: Study Area & Alternative Site

Plan 4: Infrastructure

Plan 5: Topography

Plan 6: Slope Model

Plan 7: Aspect Model

Plan 8: Theoretical Viewshed Model

Plan 9: Mitigated Viewshed Model

Plan 10: Makapan Valley WHS Viewshed Model

Appendix B: CV and Declaration of Independence