Applicant: Aquarius Platinum (South Africa) (Pty) Ltd

DMR Reference Number: MP30/5/1/2/3/2/1(127) MR

DEDET Reference Number: 17/2/2/2 E-15

ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT FOR THE PROPOSED HOOGLAND OPENCAST PROJECT AT EVEREST PLATINUM MINE

SUBMITTED IN TERMS OF SECTION 39 AND OF REGULATIONS 50 AND 51 OF THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, 2002 (ACT NO. 28 OF 2002) (the Act)

AND

AS REQUIRED IN TERMS OF REGULATION 385 OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT (ACT NO. 107 OF 1998)

Compiled by

Metago
(part of the SLR Group)

Johannesburg office: PO Box 1596, Cramerview, 2060
Fourways Manor Office Park, Cnr Roos and Macbeth Str, Fourways
Tel: +27 (11) 467-0945, Fax: +27 (11) 467-0978

Pretoria Office: PO Box 40161, Faerie Glen, 0043
Pentagon House, 669 Plettenburg Rd, Faerie Glen
Tel: +27 (12) 991-8881, Fax: +27 (12) 991-1907

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Project Manager	Hylton Allison
Author	Alex Pheiffer
Reviewer	A Pheiffer PrSciNat
Client	Aquarius Platinum (South Africa) (Pty) Ltd
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METAGO-SLR OFFICES	
Johannesburg, South Africa Physical Address: Metago House Fourways Manor Office Park Corner Roos and Macbeth Streets Fourways Johannesburg South Africa Postal Address: P O Box 1596 Cramerview 2060 Tel: +27 (011) 467-0945 Fax: +27 (011) 467-0978 Web: www.metago.co.za	Pretoria, South Africa Physical Address: Pentagon House 669 Plettenberg Rd Faerie Glen Pretoria South Africa Postal Address: P O Box 40161 Faerie Glen 0043 Tel: +27 (012) 991-8881 Fax: +27 (012) 991-1907 Web: www.metago.co.za

IDENTIFICATION OF THE REPORT

Herewith I, the person whose name and identity number is stated below, confirm that I am the person authorised to act as representative of the applicant in terms of the resolution submitted with the application, and confirm that the above report comprises EIA and EMP compiled in accordance with the guideline on the Departments official website and directive in terms of Sections 29 and 39(5) in that regard.

Full names and surname:	**Abraham van Ghent**
Company:	**Aquarius Platinum (South Africa) (Pty) Ltd**
Identity number:	**6605035011089**

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ACCRONYMS AND ABBREVIATIONS

Below a list of acronyms and abbreviations used in this report.

Acronyms / Abbreviations	Definition
%	Percentage
Al	Aluminium
AQP	Aquarius Platinum Limited
AQPSA	Aquarius Platinum Mines South Africa
ASAPA	Association for Southern African Professional Archeaologist
BID	Background information document
BIF	Banded Iron Formation
Ca	Calcium
Cd	Cadmium
CEC	Cation exchange capacity
Cl	Chloride
CO	Carbon monoxide
dBA	A-weighted decibel
DDF	Depth-Duration Frequency
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
DFS	Definite feasibility study
DLA	Department of Land Affairs
DMR	Department of Mineral Resources
DRDLR	Department of Rural Development and Land Reform
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWEA	Department of Water and Environment Affairs
EAP	Environmental Assessment Practitioners
EAPSA	Environmental assessment practitioner of Southern Africa
EC	Electrical conductivity (EC)
EIA	Environmental impact assessment
EMP	Environmental management programme
ESS	Earth Science Solutions
ESIA	Environmental Social Impact Assessment
Fe	Iron (Fe)
GCS	Ground Water Consuling Services
GDP	Gross domestic profit
HDPE	High density polyethylene
HIA	Heritage Impact Assessment
HPGR	High pressure grinding roll
IAPs	Interested and/or affected parties
IBA	Important Bird Area
IDP	Integrated Development Plan
IRS	Impala Refining Services
K	Potassium
km^2	Square kilometres
LEDET	Limpopo Department of Economic Development, Environment and Tourism
LIMS	Low intensity magnetic strip
LOM	Life of mine
m	Meters

Acronyms / Abbreviations	Definition
mamsl	meters above mean sea level
m/s	meters per second
m^2	Square meter
m^3	Cubic meter
MAR	Mean annual runoff
mbgl	Metres below ground level
MDEDET	Mpumalanga Department of Economic Development, Environment and Tourism
MTPA	Mpumalanga Tourism and Parks Agency
Mg	Magnesium
mm	millimetres
Mn	Manganese
MPRDA	Mineral and Petroleum Resources Development Act
MWG	Metago Water Geosciences
MVA	Megavolt ampere
MW	Megawatts
N	Nitrogen
NAAQS	National Ambient Air Quality Standards
Na	Sodium (Na)
NB	Nominal Bore
NEMA	National Environmental Management Act
Ni	Nickel
NLA	Newton Landscape Architects
NO_2	Nitrous oxide
^OC	Degrees celcius
PGMs	Platinum Group Metals
PH	Professional Hunter
PM10	Particulate matter with a fraction smaller than 10µm (microns)
PM_{10}	Particulate matter
PrSciNat	Registered professional in natural science
RLS	Rusternburg Layer Suite
RMF	Regional Maximum Flood
ROM	Run-of-mine
RWD	Return water dam
SACNSP	South African Council for Natural Scientific Professionals
SAHRA	South African Heritage Resources Agency
SANBI	South African National Botanical institute
SAS	Scientific Aquatic Services
Se	Selenium
SDF	Standard Design Flood
SO_2	Sulphur dioxide
SO_4	Sulphate (SO_4)
TDS	Total dissolved solids
Ti	Titanium
TSF	Tailings storage facility
TSP	Total suspended particles
UMD	Unified model
WHIMS	Wet high intensity magnetic separator
WMA	Water Management Area

EXECUTIVE SUMMARY

Project Proponent and the affected area

Aquarius Platinum (South Africa) (Pty) Ltd (Aquarius) owns and operates Everest Platinum Mine (Everest) near Lydenburg in the Mpumalanga Province (Figure 1). The mine is located on the farms De Kafferskraal 53-JT, Sterkfontein 52-JT and Sterkfontein 749-JT, in the Thaba Chewu Local Municipality within the Ehlanzeni District Municipality (Figure 2). The current operations comprise rehabilitated open pit mining areas, an underground mine, mineral processing operations, a tailings dam, water management infrastructure and various support services and networks.

Aquarius is planning to extend its current operations at Everest to include additional open cast mining areas with associated support infrastructure on portions of the farms Hoogland 38-JT, Sterkfontein 52-JT and De Kafferskraal 53-JT. The proposed project area lies approximately 2km south of the existing mine infrastructure (Figure 2).

In broad terms, the proposed Hoogland opencast project will comprise two open pit mining areas (referred to as the North and South pits, respectively), a waste (overburden) stockpile, soil stockpiles, water management facilities, a haul road/services corridor (between the mine and project site) and support infrastructure and services. The activities/ facilities will be temporary for the duration of the opencast operations. No permanent infrastructure will be established at the Hoogland project site.
The key project location facts are tabulated below.

Project location	
Province	Mpumalanga
District	Ehlanzeni District
Municipality	Thaba Chweu Local Municipality
Farms on which project is located	Hoogland 38JT, De Kafferskraal 53JT, Sterkfontein 52JT
Nearest towns	Lydenburg (Mashishing) thirty (30) kilometres to the east, Roossenekal, approximately forty (40) kilometres to the west, Dullstroom approximately forty (40) kilometres to the south
Nearest settlements	Private farmsteads and farm labourer residences (within 1.5km from the Hoogland project site), Kiwi community (approximately 4km north)
Catchment	Quaternary catchment B41G

Overview of the project

In broad terms, the proposed Hoogland mining operation will comprise two open pit mining areas (referred to as the north and south pit respectively), an overburden waste stockpile, storm water management facilities, a service corridor and various support infrastructure and services. The activities/ facilities will be temporary for the duration of the mines operations (approximately 6 years - this could increase to 8 years depending on the viability of the south pit). No permanent infrastructure will be established in the Hoogland area.

Legal framework and process

Aquarius operates under a converted mining right (Original Mining License No.: ML14/18/2/5071) for portions of the farms Sterkfontein 52-JT, Sterkfontein 749-JT and De Kafferskraal 53-JT and holds a converted prospecting right (DMR Reference No.: MP 30/5/1/1/2/1051 PR, Prospecting Right No.: 132/2007 CPR) for the farm Hoogland 38-JT and the remaining extent of portion 1 of the farm de Kafferskraal 53-JT. There is an approved environmental impact assessment (EIA) and environmental management programme (EMP) report for the current mine site (approved July 2003) and two amendments (approved in December 2009 and May 2010 respectively) catering for changes in mine infrastructure. This document is the EIA and EMP report for the Hoogland project as it relates to the existing mining operations

Given that the project will be a mine and that it incorporates several listed environmental activities the environmental assessment process and report was done and compiled in accordance with the requirements of the Mineral and Petroleum Resources Development Act, 28 of 2002 (MPRDA) and the National Environmental Management Act, 107 of 1998 (NEMA) and the regulations there under. Other approvals/permits needed for the project, include amending the mine's integrated water use license, permits for protected flora and permits for heritage sites, will be applied for at the required time.

Independent environmental impact assessment practitioner

Metago Environmental Engineers (Pty) Ltd (Metago) is the independent firm of consultants that has been appointed by Aquarius to undertake the EIA and related processes. The EIA and EMP report is the product of the EIA process and provides a detailed description of the project, presents the results of specialist investigations, identifies and assesses potential impacts and mitigation measures should the project be approved.

As part of the EIA process, a stakeholder engagement process was conducted comprising:

- newsletters;
- newspaper advertisements;
- site notices;
- a background information document;
- various focussed and general stakeholder meetings; and

- distribution of reports and report summaries for review.

All issues, concerns and comments raised by IAPs have been addressed in the EIA and EMP report.

Summary of environmental impacts

Potential environmental impacts were identified by Metago in consultation with IAPs, regulatory authorities, specialist consultants and the Aquarius technical team. All identified impacts are considered in a cumulative manner such that the impacts of the current baseline conditions on and surrounding the site and those potentially associated with the project are discussed and assessed together. A summary of the potential impacts is presented in the table below.

TABULATED SUMMARY OF POTENTIAL CUMULATIVE IMPACTS

Section	Potential impact	Significance of the impact (the ratings are negative unless otherwise specified)							
		Construction		Operation		Decommissioning		Closure	
		Unmitigated	Mitigated	Unmitigated	Mitigated	Unmitigated	Mitigated	Unmitigated	Mitigated
Topography	Hazardous structures and excavations posing risk to third parties	H	M-L	H	M-L	H	M-L	H	M-L
Soils and land capabilities	Loss of soil resources (from physical disturbance, erosion, contamination) and associated natural land capabilities	H	M-L	H	M-L	H	M-L	H	M-L
Biodiversity	Physical destruction of biodiversity (including aquatic environments)	H	H	H	H	H	H	H	H
	General disturbance of biodiversity	H	M	H	M	H	M	H	M
Surface water	Pollution of surface water resources	H	M-L	H	M-L	H	M-L	H	M
Groundwater	Dewatering impacts affecting third party users	No impacts expected							
	Dewatering impacts affecting base flow	No impacts expected		M	M	M	M	M	M
	Contamination of groundwater	M	L	-	M	-	M	-	M
Air quality	Increase in air pollution	H	M	H	M	H	M	H	L
Noise	Increase in disturbing noise levels	M-H	M-H	M-H	M-H	M-H	M-H	No impacts expected.	
Visual impacts	Negative landscape and visual impact	H	H	H	H	H	H	H	M-L
Land use	Loss of current land uses	H	M-H	H	M-H	H	M-H	H	L
	Blasting hazards	No impacts expected.		H	L	No impacts expected.		No impacts expected.	
	Project-related road use and traffic	M	L	M	L	M	L	No impacts expected.	

Section	Potential impact	Significance of the impact (the ratings are negative unless otherwise specified)							
		Construction		**Operation**		**Decommissioning**		**Closure**	
		Unmitigated	**Mitigated**	**Unmitigated**	**Mitigated**	**Unmitigated**	**Mitigated**	**Unmitigated**	**Mitigated**
Heritage (and cultural)	Destruction and disturbance (indirect) of heritage resources	H	L	H	L	M	L	No impacts expected.	
	Loss of palaeontological resources	No impacts expected.							
Socio-economic impacts	Loss of mineral resources through sterilisation	No impacts expected.							
	Economic impact (positive and negative)	H+	H+	H+	H+	H+	H+	M+	H+
	Informal settlements, safety, security and services and associated social ills	H	M-L	H	M-L	H	M-L	H	M-L
	Change in land values	H	M-L	H	M-L	H	M-L	H	M-L

Conclusion

This document presents the project plan as defined by Everest, presents findings of specialist studies, identifies and assesses potential impacts on the receiving environment in both the unmitigated and mitigated scenarios, including cumulative impacts, and identifies measures together with monitoring programmes to monitor and mitigate potential impacts.

A summary of the potential impacts (as per Section 7 of the EIA and EMP report), associated with the chosen alternatives (as per Section 2 and Appendix A of the EIA and EMP report), in the unmitigated and mitigated scenarios for all project phases is included in Table above. The assessment of the proposed project presents the potential for significant negative and positive impacts to occur on the bio-physical, cultural and socio-economic environments both on the site and in the surrounding area.

The economic impact assessment concluded that the development of the Hoogland project is the preferred economic land use alternative and that the economic benefits of the project are significantly positive. A key related issue that has been raised by AQPSA is that the continuation of Everest mine is necessarily linked to the implementation of the Hoogland project. From a cumulative perspective, it follows, given current market and operational conditions, that if the Hoogland project does not proceed then the mine may close and be placed in an indefinite period of care and maintenance. This will mean a loss of approximately R699 million GGP per annum and a loss of 1685 jobs. Even when this is period adjusted to take account of the relatively short 6 year life of the Hoogland project, the number of potential lost jobs is significant at 337 jobs. In comparison, the potential negative impact on the agricultural sector (without land use mitigation) will be less at approximately R9 million GGP per annum and a loss of between 35 jobs if current farming practices continue and 103 jobs if current farming productivity is improved.

Everest will go a long way to mitigating the potential negative environmental and social impacts by committing to apply the findings of the cumulative assessment and related mitigation objectives and actions to its project. However, potential negative impacts on the biodiversity will remain as high negative residual impacts even with mitigation. In this regard the specialist is of the view that some of the proposed project development zones are fatally flawed from a biodiversity perspective. For the following impacts the significance with mitigation would reduce to somewhere between high and medium depending on the success of implemented mitigation measures: impacts from the general disturbance of biodiversity, impacts from pollution of surface water (at closure only), impacts on noise levels, impacts on visual aspects, and loss/change of current land uses as it relates to the above issues.

It follows that there will be people that oppose the project development on the grounds of the negative environmental and social impacts, but there will also be people that support the project on the grounds of the positive economic impacts. Ultimately, the decision makers will be required to prioritise either the positive economic impacts or the negative environmental and social impacts.

ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT FOR THE PROPOSED HOOGLAND OPENCAST PROJECT AT EVEREST PLATINUM MINE

INTRODUCTION AND LEGAL FRAMEWORK

Introduction to the proposed project and this document

Aquarius Platinum (South Africa) (Pty) Ltd (AQPSA) owns and operates Everest Platinum Mine (Everest) near Lydenburg in the Mpumalanga Province (Figure 1). The mine is located on the farms De Kafferskraal 53-JT, Sterkfontein 52-JT and Sterkfontein 749-JT, in the Thaba Chewu Local Municipality within the Ehlanzeni District Municipality (Figure 2). The operations comprise rehabilitated open pit mining areas, an underground mine, mineral processing operations, a tailings dam, water management infrastructure and various support services and networks.

Aquarius is planning to extend its current operations at Everest to include additional open cast mining areas with associated support infrastructure on portions of the farms Hoogland 38-JT, Sterkfontein 52-JT and De Kafferskraal 53-JT. The proposed project area lies approximately 2km south of the existing mine infrastructure (Figure 2).

In broad terms, the proposed Hoogland opencast project will comprise two open pit mining areas (referred to as the North and South pits, respectively), a waste (overburden) and soil stockpile area, stormwater controls and in pit water management facilities, a haul road (between the mine and project site) and facilities for parking, offices, waste collection and ablutions. The activities/ facilities will be temporary for the duration of the opencast operations. No permanent infrastructure will be established at the Hoogland project site.

Aquarius operates under a converted mining right (Original Mining License No.: ML14/18/2/5071) for portions of the farms Sterkfontein 52-JT, Sterkfontein 749-JT and De Kafferskraal 53-JT and holds a converted prospecting right (DMR Reference No.: MP 30/5/1/1/2/1051 PR, Prospecting Right No.: 132/2007 CPR) for the farm Hoogland 38-JT and the remaining extent of portion 1 of the farm de Kafferskraal 53-JT. There is an approved environmental impact assessment (EIA) and environmental management programme (EMP) report for the current mine site (approved July 2003) and two amendments (approved in December 2009 and May 2010 respectively) catering for changes in mine infrastructure. This document is the consolidated EIA and EMP report for the mine incorporating the Hoogland project.

FIGURE 1 : REGIONAL SETTING OF THE PROPOSED HOOGLAND PROJECT

FIGURE 2: LOCAL SETTING OF THE PROPOSED HOOGLAND PROJECT

Project Motivation (Need and Desirability)

Based on the exploration work conducted at the Hoogland site, Aquarius believes there is a feasible ore body worth developing using open cast methods. The proposed ore body has an expected life of mine (LoM) of approximately six years. This could extend to eight years depending on the metal prices. The mining of these ore reserves will contribute to current run of mine (ROM) ore being fed into the underutilised plant. The current and anticipated market prices in the medium and long-term favour the establishment of the proposed open cast pits to access and extract the platinum ore. Direct economic benefits will be derived from on-going wages, taxes and profits. The mine's wage bill is in the order of R35 million per annum. Indirect economic benefits will be derived from the continued procurement of goods and services and on-going spending power of employees. Moreover, AQPSA has stated that the continuation of the Everest Mine is necessarily linked to the implementation of the Hoogland project to the extent that the mine will close of the Hoogland project does not proceed.

Decisions required and legal framework

Prior to the commencement of the Hoogland project, environmental authorisations are required.

- An environmental decision from the Mpumalanga Department of Mineral Resources (DMR) in terms of the Mineral and Petroleum Resources Development Act (MPRDA), 28 of 2002 for the proposed project. A Section 102 application was submitted to the DMR by Aquarius in May 2010 to amend the mine's approved EMP and to incorporate its prospecting right area into its mining right. Initially the application was being handled by the Limpopo DMR. The file has subsequently been transferred back to Mpumalanga DMR as it was erroneously transferred to Limpopo for processing.
- Environmental authorisation from the Mpumalanga Department of Economic Development, Environment and Tourism (DEDET) in terms of the National Environmental Management Act, 107 of 1998 (NEMA). The project incorporates several listed activities (see Section 2.5). An application was submitted by Metago to DEDET in March 2010 and accepted by the department (Appendix B). The EIA regulation being followed for this project is Regulation 385 (2006 EIA Regulations) (see acceptance letter attached in Appendix B). Cognisance of the more recent Regulation 543 (2010 EIA regulations) was taken in the compilation of this document.

This report is the consolidated environmental impact assessment (EIA) (Section 1) and environmental management programme (EMP) (Section 2) for the mine catering for the existing operations including the Hoogland project.

Given the legal framework above, this report has been compiled to meet the requirements of the 2006 EIA Regulations and MPRDA Regulations. In this regard, the new DMR report structure template has been used. To assist with cross-referencing in the report, the chapter numbering in the EMP section continues on from the chapter numbering in the EIA section.

In terms of Regulation 385 of the 2006 EIA Regulations, Table 1 provides a guide to the relevant sections where the information is contained.

TABLE 1: NEMA REQUIREMENTS FOR EIA/EMP REPORTS

Environmental Regulation 385	Section in report
Environmental impact assessment (EIA)	
Description of the property and location of the activity on the property	1.3.1 and 1.4
Details of the person who compiled the EIA, and his/her expertise	Introduction
Details on the public involvement process including –compliance with the PSS, IAP database, issues table, additional comments/objections	10, Appendix C, Appendix D, Appendix E and Appendix F
Comment on the need and desirability of the proposed activity(ies) in the context of alternatives	Introduction
Description and comparative assessment of alternatives identified during the EIA	8 and Appendix B
Description of proposed activity(ies)	2
A description of the environment that may be affected by the activity	1
Methodology used to determine impact significance	7.3
Summary of findings and recommendations of specialist reports	Throughout document
Description of environmental issues, assessment of significance, and extent to which these can be mitigated	7
Assessment to include: cumulative impacts, nature, extent, duration, probability, reversibility of resource loss, mitigation	7
Assumptions, uncertainties and knowledge gaps	11
Provide an authorisation opinion – with possible conditions	27
Environmental impact statement – summary of key findings and comparative assessment of the positive and negative implications of the activity and alternatives	27
Specialist reports as appendices	See appendices
Environmental management programme/plan (EMP)	
Details of the person who compiled the EMP, and his/her expertise	Introduction
Detailed description of the activity aspects covered in the EMP	2
Details on the management/mitigation measures from planning and design stages through to closure (where relevant)	18 and 19
Time frames for implementation where appropriate	19
Identification of responsible persons for implementation	19

Secondary approvals / permits

Secondary approvals/permits needed for the project are listed below. In this regard, there are other approvals that are required prior to construction and/or commissioning of project-related activities. This list does not cover occupational health and safety legislation requirements.

- Everest operates with a water use license (License No. 24073173) issued by the Department of Water Affairs (DWA) in 2006. For the Hoogland project, prior to conducting any water uses as defined in Section 21 of the National Water Act, 36 of 1998, Aquarius will submit a new application to the DWA for water uses associated with the project. This will include any exemptions from Regulation 704 of 4 June 1999. The water uses and exemptions include taking water from a

resource (dewatered water from the open pits will be re-used in the process), storing water in stormwater facilities, impeding or diverting the flow of water in a watercourse (destruction of headwaters, clean stormwater controls), disposing of waste in a manner that may detrimentally impact on a water resource (overburden will be temporarily stockpiled on site) , altering the bed, banks, course or characteristics of a watercourse (haul road crossings, destruction of headwaters, encroachment on watercourses), removing/discharging/disposing of water found in the open pit, placement of infrastructure/activities within floodlines and the use of waste rock in road building.

- Prior to damaging or removing heritage resources including graves, permissions are required in terms of the National Heritage Act, 25 of 1999, the Ordinance on Exhumations, 12 of 1980, and the Human Tissues Act, 65 of 1983.
- Prior to removing or damaging any protected plant species, the necessary permits will be obtained from DWA in terms of the National Forests Act, 84 of 1998 and National Environmental Management: Biodiversity Act (Act 10 of 2004).

No waste-related activities are triggered and therefore no waste license application in terms of the NEM: Waste Act, 59 of 2008, is required.

EIA approach and process

A summary of the approach and key steps in the combined EIA process and corresponding activities are outlined in Table 2.

TABLE 2: EIA PROCESS

Objectives	Corresponding activities
Project initiation and application phase (January to May 2010)	
• Notify the decision making authorities of the proposed project. • Initiate the environmental impact assessment process.	• A meeting was held with DMR on 28 January 2010 in which Aquarius indicated its intent to submit an EMP amendment. • NEMA application for listed activities submitted to DEDET by Metago on 02 March 2010. Application accepted. • MPRDA Section 102 application submitted to DMR by Aquarius in May 2010. DMR file transferred to Limpopo by Mpumalanga DMR.
Scoping phase (May 2010 to June 2011)	
• Identify interested and/or affected parties (IAPs) and involve them in the scoping process through information sharing. • Identify potential environmental issues associated with the proposed project. • Consider alternatives. • Identify any fatal flaws. • Determine the terms of	• Notify IAPs of the project and environmental assessment process (social scans, distribution of background information document s (BIDs), newspaper advertisements, telephone calls and site notices) (May 2010) • Regulatory authorities site meeting (July 2010) • Focussed meetings with stakeholder groups (July 2010). • Distribute scoping report to IAPs and other regulatory authorities for review (April – June 2011). • Submission of scoping report to DMR (May 2011) • Record comments (May 2011). • Forward scoping report including IAP comments to DEDET for

Objectives	Corresponding activities
reference for additional assessment work.	review (June 2011).
Detailed specialist investigations (November 2010 to August 2011)	
• Describe the affected environment. • Define potential impacts. • Provide management and monitoring recommendations.	• Investigations by technical project team and appointed specialists (see Table 3) of issues identified during the scoping stage.
EIA/EMP phase (June 2011 to September 2012)	
• Assess potential impacts with assistance from appointed specialists where required. • Design requirements and management and mitigation measures. • Receive feedback on application.	• Compilation of draft EIA and EMP report. • Distribute draft EIA and EMP report to IAPs, DMR and other regulatory authorities for review (August 2011). • Feedback meetings with IAPs (September 2011). • Record comments (September 2011). • Forward final EIA and EMP report to DEDET for review (October 2011). • Forward IAP comments to DMR (October 2011). • EIA process placed on hold (January 2012). • EIA and EMP report revised to accommodate infrastructure changes and provide improved mitigation measures. • Draft revised report distributed for public review (March 2012). • Record comments and feedback meetings (May 2012). • Forward final EIA and EMP report, including IAP comments, to DMR and DEDET for review (May 2012). • Circulate record of decisions to all registered IAPs registered.

EIA team

Metago Environmental Engineers (Pty) Ltd (Metago) is the independent firm of consultants that has been appointed by the applicant company to undertake the environmental assessment. The project team is outlined in Table 3. Hylton Allison has approximately eight years of relevant experience. Alex Pheiffer has approximately ten years of relevant experience and is registered with the South African Council for Natural Scientific Professions (SACNSP) as a professional natural scientist (PrSciNat) (Environmental Management).

Neither Alex Pheiffer, Hylton Allison, nor Metago has any interest in the project other than fair payment for consulting services rendered as part of the environmental assessment process.

TABLE 3: PROJECT TEAM

Name	Designation	Tasks and roles	Company
Environmental impact assessment and public involvement team			
Hylton Allison and Alex Pheiffer	Project manager	Management of the assessment process, stakeholder engagement and report compilation.	Metago Environmental Engineers (Pty) Ltd
Charlene Mureverwi	Project administrators		
Stella Moeketse			
Natasha Daly			

Name	Designation	Tasks and roles	Company
Victoria Tucker			
Alex Pheiffer and Brandon Stobart	Project reviewer	Report and process review	
Specialist environmental assessment consultant team			
Garry Patterson	Soil scientist	Soil and land capability study	Agricultural Research Council - Institute of Soil Climate and Water
Duncan McKenzie	Vegetation study	Biodiversity study	Ecorex
Anthony Emery	Habitat mapping		
Dr Robert Palmer	Aquatic fauna		
Warren McCleland	Terrestrial vertebrate fauna		
Peter Hawkes	Terrestrial invertebrate fauna		
Luke Wiles and Mark Bollaert	Hydrologist	Hydrology study and conceptual stormwater management plan	Metago Environmental Engineers (Pty) Ltd
Alkie Marais and Johannes van der Walt	Groundwater specialists	Groundwater study	Groundwater Consulting Services
Pieter Labuschagne	Geohydrologist	Water balance study	
Reneé von Gruenewaldt	Air quality specialist	Air quality study	Airshed Planning Professionals
Derek Cosijn	Noise specialist	Noise study	Jongens Keet Associates/Calyx Environmental
Ben van Zyl	Noise specialist	Updated noise baseline	Acusolv
Graham Young and Mitta Theron	Visual specialists	Visual study	Newtown Landscape Architects
Dr Julius Pistorius	Heritage consultant	Heritage impact assessment	Julius Pistorius CC
Dr Bruce Rubidge	Palaeonotologist	Palaeontology study	BPI for Palaeontological Research
Gerrie Muller	Economist	Economic study	Strategy4Good

Contact details for responsible parties

The contact details for the project team/mine are included below.

Project applicant:	Aquarius Platinum (South Africa) (Proprietary) Limited (AQPSA)	
Contact person:	Mine	Head office
	Mr Abraham van Ghent	Mr Neels Hoek
Postal address:	PO Box 1093, Mashishing (Lydenburg), 1120	PO Box 1282, Bedfordview, 2008
Telephone No:	(013) 235 8400	(011) 455-2050
Fax No:	(013) 235 8401	(011) 455-2095
E-mail Address:	Abraham.van Ghent @aquariussa.co.za	Neels.Hoek@aquariussa.co.za

Brief history of the mine

Given that this report is a consolidation of the current operations and the proposed Hoogland project, a brief history of the mine's operations are included below.

Aquarius Platinum (South Africa) (Pty) Ltd (AQPSA) is the South African operating subsidiary of Aquarius Platinum Limited (AQP). AQP is currently listed on the Australian, London and Johannesburg stock

exchanges. The South African subsidiary has a number of mining and exploration-related interests in the Mpumalanga Province with Everest Platinum Mine (Everest) being one of its mining operations

Everest operates with an approved environmental management programme (EMP) report (approved June 2003) and was granted a mining license in terms of the old Minerals Act, 50 of 1991, in July 2003. The mining license was converted to a new order mining right in terms of the Mineral and Petroleum Resources Development Act (MPRDA), 28 of 2002, in October 2006.

In early December 2008, the mine suspended all operations after instability was detected in the upper areas of the underground mine. This instability affected the existing decline into the mine workings and resulted in the issuing of a Section 54 instruction in terms of the Mine Health and Safety Act, 29 of 1996. A small area above the existing decline collapsed resulting in surface subsidence of approximately 20 cm. No persons were harmed during the event as mine management took preventative action and removed all personnel from underground. This suspension coupled with the economic crunch resulted in the retrenchment of the majority of the workforce. Only a small component of the management staff was retained. On-going investigations were carried out by the mine to identify means of re-gaining access to the ore reserves and bringing the mine and plant back into full production. In April 2009, an EMP amendment to cater for changes to the surface mine layout (to replace the original decline) was submitted to the DMR (approved December 2009). In July 2009, a second EMP amendment, in terms of the MPRDA, for the extension of mining activities into the valley area was submitted to the DMR (approved May 2010). In addition to this a basic assessment for listed activities under NEMA was submitted to the DEDET (then known as Department of Agriculture and Land Administration) for the valley project in December 2009 (approved May 2010). The mine recommenced operation in 2010.

SECTION 1 – ENVIRONMENTAL IMPACT ASSESSMENT

1 DESCRIPTION OF THE BASELINE ENVIRONMENT

The proposed Hoogland project site is located approximately 2km south of the existing Everest operations. Given that this doducment is a consolidated EIA and EMP report, this section provides a description of the current baseline conditions of the project site and provides a situational analysis of the conditions of the existing Everest mine site. Each discussion provides a link to anticipated impacts and highlights the relevance of the information provided, identifies how data was collected (either by the specialist and/or Metago) to inform the baseline description, provides the results/outcomes of research and/or studies undertaken for the Hoogland project and concludes with the main findings as relevant to the impact assessment and management plan.

The environmental aspects are discussed as follows:

- baseline description of bio-physical environment (Section 1.1)
- baseline description of land uses, socio-economic conditions, heritage and cultural aspects (Section 1.3).

Key environmental aspects requiring protection or remediation are identified in Section 1.2. Maps showing environmental features on and off site are included in Section 1.4 and cross-referenced in the relevant baseline descriptions. A list of supporting specialist information used in the baseline description is included in Section 1.5. Assumptions and uncertainties identified by the specialist studies are outlined in Section 11.

1.1 ON-SITE ENVIRONMENT (BIO-PHYSICAL) RELATIVE TO SURROUNDING ENVIRONMENT (BIO-PHYSICAL)

1.1.1 GEOLOGY BASELINE

The geology, geological processes and associated structural features and stratigraphy in and surrounding the area influence soil forms (discussed further in Section 1.1.3), groundwater resources (discussed further in Section 1.1.6), palaeontological resources (discussed further in Section 1.3.3) and the presence of economical reserves (discussed further in Section 1.3.1). The potential for acid rock drainage and groundwater pollution is discussed in Section 3.3.

1.1.2 TOPOGRAPHY BASELINE

Information in this section was sourced from the approved EMP reports for the current mine infrastructure (approved July 2003, December 2009 and May 2010), the Hoogland hydrology study (Metago 2011) (Appendix H), and site visits undertaken by the Metago EIA team and should be read with reference to Figure 5 (topography) (Section 1.4).

Introduction and link to anticipated impact

The topography of an area influences surface water behaviour, safety of third parties, the location of soils and the visual character of a landscape. Mine-related activities have altered the topography through the establishment of both temporary (such as processing infrastructure and support facilities) and permanent infrastructure (such as the tailings storage facility). This in turn has resulted in changes to drainage patterns, presented landforms which could prove hazardous to people and animals (if unmanaged), as well as changes to the visual character. Project-related activities have the potential to alter the topography of an additional area located approximately 2km south of the current mine operations. As a baseline, this section provides an understanding of the topographical features relevant to the mine, project site and surrounding area from which to measure potential change.

Data Collection

Data on topography for the project site was sourced through the studying of topographical and GIS data, aerial surveys of the area and observations made by specialist consultants and the Metago team during site visits.

Results

The Hoogland project site is located south of the existing mining operations, at the foothills of the De Berg peak and on a ridge above the Groot Dwars River valley. There is a great change in altitude in the Groot Dwars River valley (Figure 5). The De Berg peak is the highest point in the Steenkampsberge which rises to 2 331 m above mean sea level (amsl). The confluence of the Dwars River with the Steelpoort River is 1 500 m lower, at 770 mamsl. At the Hoogland project site, the average elevation is approximately 1750m above mean sea level (amsl), with a variation in elevation of approximately 200m from the lowest (1600m amsl) to highest (1800m amsl) points. The area is characterised by steep slopes averaging around 16% and more gentle slopes averaging around 5%.

Conclusion

The steep topography of the Hoogland project site poses a challenge to the design, operation and management of project facilities and activities. The topographical data has been used to determine the behaviour of surface water and floods which in turn has been used to inform the Hoogland stormwater management plan. The design of project landforms and infrastructure should be such that any changes to topography result in stable topographic features which do not pose significant risk to third parties and limit impacts on the visual character of the area.

1.1.3 SOIL AND LAND CAPABILITY

Information in this section was sourced from the approved EMP reports for the current mine infrastructure (approved July 2003, December 2009 and May 2010) and the Hoogland soils and land capability survey

(ISCW 2010) (Appendix F) and should be read with reference to Figure 6 (soil forms and land capability) (Section 1.4).

Introduction and link to anticipated impact

Soil supports a variety of life forms and plants that in turn create new soil by breaking down rocks and sand. Furthermore, soil characteristics determine the natural capability of land. Soil resources have the potential to be lost through physical disturbance, erosion of exposed soils by wind and water, and contamination. A range of soil types (ranging from deeper arable soils to shallow soils in rocky areas) and land capabilities (ranging from arable and grazing to wilderness and wetland capabilities) have been disturbed by the mine's current operations. The Hoogland project has the potential to impact additional soil resources, if unmanaged. As a baseline, this information identifies sensitive soil types, guides the preservation of soil and rehabilitation of disturbed land and aids in informing an end land use for the project site.

Data Collection

Data collection was done through review of published reports and maps and verification of site specific data through field work and collection of soil samples for analysis work. Further detail on the methodologies used is provided in the specialist report (Appendix F).

The Chamber of Mines Guideline document (Chamber of Mines 1991) and classification from the Soil Classification Working Group (1991), was used to identify and classify the soil units identified during the survey. The land capability of the study area was classified into four classes (wetland, arable land, grazing land and wilderness). The Hoogland survey investigated and mapped an area of approximately 157ha.

Results

Soil forms

The vast majority of the project area comprises rock outcrops with very little shallow soil (similar to those found in the valley), which have a low potential for agriculture (map units **R/Ms** and **Ms/R**) (Table 4). These areas are, at best, suitable only for grazing. The small zone of red, moderately structured Hutton soils, with varying depths from shallow to moderately deep (map unit **mdHu**) and a moderate to low potential for agriculture, occur only at the edge of the north-eastern portion. The haul road is expected to host similar soil types given the similarity in the terrain.

According to the soil specialist there is little difference in terms of soil composition between soils found along drainage lines and those that have been identified in the study area. No large floodplain or river terrace areas as they relate to soil resources occur.

TABLE 4: SOILS OCCURING AT THE HOOGLAND PROJECT SITE

Map unit	Land capability	Dominant soil form and family	Depth (mm)	Description	% of study area
mdHu	Arable	Hutton, occasionally Bainsvlei or Clovelly	500-900	Brown to reddish-brown, structureless to weakly structured, sandy clay loam topsoil on reddish-brown (occasionally yellowish-brown), structureless to weakly structured, sandy clay loam subsoil on hard to weathering rock (occasionally soft plinthite).	26% (40ha)
R/Ms	Wilderness	Rock, Mispah	0-50	Rock outcrops. Very little soil.	59% (93ha)
Ms/R	Grazing / wilderness	Mispah, Rock, occasionally Hutton	50-150	Brown to reddish-brown, weakly structured to structureless, sandy clay loam topsoil on rock. Many rock outcrops also occur.	15% (24ha)

Soil characteristics

The properties of the soil units identified at the project site are summarised in the table below (Table 5). Soils have high clay contents in both the topsoil and subsoil and are acidic, with a high degree of leaching, due predominately to the high rainfall in the area. The soils reflect a lack of any recent fertilisation from anthropogenic activities.

TABLE 5: PROPERTIES OF SOILS AT THE HOOGLAND PROJECT SITE

Map unit	Dominant soil form and family	Natural fertility	Erodibility	Dry land crop production potential	Soil potential for irrigation
mdHu	Hutton, occasionally Bainsvlei or Clovelly	High	Low	Moderate	Moderate
R/Ms	Rock, Mispah	Low	Very low	Very low	Very low
Ms/R	Mispah, Rock, occasionally Hutton	Low	Very low	Very low	Very low

Land Capability

The land capability of soils at the project site range from arable (26%) to wilderness and/or grazing (74%) (Table 4).

Conclusion

A range of soils with varying land capabilities have been disturbed by the current mine activities. A soil conservation procedure was developed with specialist input and implemented by the mine during the construction and operation phases. This procedure was key to the effective stripping, stockpiling and re-use of soil resources in the rehabilitation of the previously mined out open pits.

The vast majority (117ha, 74%) of soils at the project site comprise shallow soils with rock, which have a low potential for agriculture. These areas are, at best, suitable only for grazing. A relatively small area (40ha, 26%) comprises slightly deeper soils with arable capability and moderate to low potential for agriculture. Soils located along drainage lines are the same as soils found in the larger study area. This baseline has been used to update the soil (conservation and use) management plan for the mine to cater

for the site-specific conditions. Given the current natural land capabilities, the post closure land capability should be a combination of grazing and wilderness. This is similar to the current land uses on site.

1.1.4 BIODIVERSITY BASELINE

Information in this section was sourced from the approved EMP reports for the current mine infrastructure (approved July 2003, December 2009 and May 2010) and the Hoogland biodiversity study (Ecorex 2011) (Appendix G) and should be read with reference to Figure 7 (vegetation types) and Figure 8 (Hoogland vegetation communities) (Section 1.4).

Introduction and link to anticipated impacts

The biodiversity value and conservation importance of any area requires an understanding of the vegetation communities together with the occurrence of fauna species. The presence and extent of fauna is directly linked to the natural vegetation. Although the establishment of existing mine infrastructure was done with careful consideration of the existing ecological resources of the area (that is, areas of sensitive biodiversity were avoided and most infrastructure was placed in areas already disturbed by pre-mining land uses such as forestation), some disturbance has taken place. The establishment of project infrastructure as well as project related activities have the potential to result in additional loss of habitat through the destruction and/or general disturbance of vegetation and/or contamination of soil and/or water resources thereby reducing the occurrence of fauna on site and in the surrounding areas. As a baseline, this section provides an outline of the vegetation communities occurring on site, highlights the occurrence of sensitive ecological environments including sensitive/ endangered species (if present) that require protection and/or additional mitigation should they be disturbed, and outlines the conservation importance of the vegetation communities and associated vertebrate and invertebrate species. It is expected that the biodiversity in the surrounding area would be similar to that found on site given the similarity in land uses.

Data Collection

Prior to the fieldwork, data collection was done through desktop assessments of most current aerial images, available published reports, plant and animal lists and maps. The timing of the fieldwork was aimed at coinciding with the flowering times of most plants expected to occur in the study area. Field investigations covered day- and night-time activities. Caught faunal specimens were identified through reference to literature and input from expert specialists. The floristic importance of each vegetation community identified was determined using a flora index. The invertebrate and vertebrate importance of each vegetation community was then also determined. Field investigations for the project were undertaken in April 2009 (invertebrates), November 2009 (flora, vertebrates), February 2010 (flora, vertebrates, aquatics) and June 2010 (flora, vertebrates). Further detail on the methodologies used is provided in the specialist report (Appendix G).

The specialist studies covered flora and terrestrial fauna, both vertebrate and invertebrate, as well as aquatic fauna. The vertebrate fauna included mammals, birds, reptiles and frogs. The invertebrate fauna included scorpions, spiders, dragonflies and damselflies, leafhoppers, cicada, ground beetles, butterflies, and ants.

Results – Flora

National vegetation types

Regionally the mine and project site are situated at a junction of three national vegetation types, namely the Sekhukhune Montane Grassland, the Lydenburg Montane Grassland and the Sekhukhune Montain Bushveld (Mucina & Rutherford, 2006 as cited in Ecorex, 2010). The Mucina and Rutherford classification is a more recent classification than the one used for the mine's approved EMP report. A summary of these national vegetation types is provided below with further detail included in the specialist report (Appendix G).

- The Sekhukhune Montane Grassland is endemic to Mpumalanga, stretching across the escarpment mountains from Stoffberg in the south-west to Schurinksberg in the north-east. This is the most prominent vegetation type represented within the study area, covering almost 90% of the area. Vegetation structure is dense grassland on rocky slopes and boulder fields, with scattered dense thickets on sheltered rocky outcrops. Project-related infrastructure is located within this vegetation type.
- The Lydenburg Montane Grassland is also endemic to Mpumalanga, occurring from Pilgrim's Rest south-west to Dullstroom and then south and east to Belfast and Machadodorp. It includes the highest mountain ranges in northern South Africa, namely the Steenkampsberg and Mauchesburg. This vegetation type is represented to the south east of the project site. Vegetation structure is dense grassland characterised by high species richness of forbs.
- The Sekhukhune Mountain Bushveld is mostly represented in Limpopo Province, occurring marginally in Mpumalanga. It is the dominant vegetation type of much of the Dwars River valley downstream of the project site. Vegetation structure is open to closed microphyllous and broad-leaved savannah, often with a well-developed herb layer.
- The Sekhukhune Montane Grassland and Lydenburg Montane Grassland both have a conservation status of Vulnerable. For the Sekhukhune Montane Grassland this is due to the high level of transformation (30%), significant threat posed by mining, and because no areas within this vegetation type are formally protected (Mucina & Rutherford, 2006 as cited in Ecorex, 2010). For the Lydenburg Montane Grassland this is due to the high level of transformation (23%), mostly because of commercial afforestation, and because only 2.4% of vegetation type is formally protected within reserves (Mucina & Rutherford, 2006 as cited in Ecorex, 2010).
- Sekhukhune Mountain Bushveld has a conservation status of Least Threatened because of the moderate level of transformation (15%), although this vegetation type is coming under increasing

pressure from mining developments, particularly in the Dwars River Valley; only 0.4% of this vegetation type is formally protected within reserves (Mucina & Rutherford, 2006).

The study area is also positioned at the boundary of two threatened terrestrial ecosystems as listed in Notice 1477 of Government Gazette No. 32689 (6 November 2009) (SANBI & DEAT, 2009 as cited in Ecorex 2010). These two threatened ecosystems are:

- The Sekhukhune Mountainlands (MP9), which is situated in the high-lying norite mountains between Roossenekal, De Berg and Steelpoort. It is characterised by a high level of plant endemism and is known to have 29 threatened and / or endemic plant and animal species. The ecosystem has been assessed as Endangered.
- The Dullstroom Plateau Grasslands (MP4), which is confined to Mpumalanga and comprises high-altitude plateau grasslands between De Berg in the north and Belfast in the south. Key biodiversity features include breeding and feeding habitat for two critically endangered bird species (Wattled Crane and Rudd's Lark), a Vulnerable vegetation type, and habitat for 33 threatened and / or endemic plant and animal species. The ecosystem has been assessed as Endangered.

In terms of centres of plant endemism, the study area is situated at the boundary of two centres (Van Wyk & Smith, 2001; Lötter *et al*., 2002 as cited in Ecorex, 2010):

- The Sekhukhuneland Centre of Plant Endemism (SCPE) is shared between Limpopo and Mpumalanga Provinces and is bordered by the Highveld to the south, the Strydpoort Mountains to the north, the Steenkampsberg Mountains to the east and the Springbok Flats to the west. It is home to an estimated 2 200 plant species, of which over 100 (4.5%) are endemic to the centre. The flora is poorly known and many species await description. There is only one provincial nature reserve in the SCPE and it is considered poorly protected and vulnerable to disturbance through mining developments. The Sekhukhune Montane Grassland and Sekhukhune Mountain Bushveld have a high proportion of species endemic to the SCPE and four species that are endemic to the specific vegetation types (*Aloe reitzii* var. *reitzii*, *Delosperma deilanthoides*, *Resnova megaphylla* and *Zantedeschia pentlandii*).
- The Lydenburg Centre of Plant Endemism *(*LCPE) is confined to Mpumalanga, occurring between the SCPE in the west and the Wolkberg Centre of Plant Endemism in the east. Two high mountain ranges characterise this centre, namely the Steenkampsberg and the Mauchesberg. The LCPE is home to an estimated 2 266 plant species, of which 51 (2.5%) are endemic to the centre. Two sub-centres have been identified, of which one (Steenkampsberg Sub-centre) occurs within the study area. This sub-centre has 15 taxa that are strictly endemic to it. Only 2% of the LCPE is protected in provincial nature reserves. The Lydenburg Montane Grassland has a high proportion of species endemic to the LCPE and 25 species that are endemic to the specific vegetation type.

Vegetation communities

Seven vegetation communities were identified within the broader study area on the basis of distinctive vegetation structure (grassland, woodland, thicket, etc), floristic composition (dominant and diagnostic species) and position in the landscape (midslopes, terrace, crest, etc) (see Figure 8 for the location of the vegetation communities in relation to the project footprint). A summary of the key aspects of the vegetation communities is provided below with further detail included in the specialist report.

- **Vegetation community 1: *Tristachya* - *Themeda* Grassland on rocky hillslopes**

  This vegetation community occurs on footslopes and hillslopes throughout the study area and covers 322ha which equates to 47% of the area surveyed. Rock cover is moderate to high, with many scattered norite boulders present. The Thicket and Sheetrock communities are nested within this vegetation community wherever boulder clumps or areas of sheetrock provide fire protection.

  Vegetation structure is Low to Short Closed Grassland (*sensu* Edwards, 1983) with certain areas along steep slopes becoming Low Sparse Woodland. This vegetation community is characterised by low diversity of trees and a high diversity of grasses, forbs and geophytes. The dominant grasses are *Tristachya biseriata, Themeda triandra, Brachiaria serrata* and *Diheteropogon amplectens*, while other common species are *Heteropogon contortus, Eulalia villosa, Cymbopogon pospischilii* and *Cymbopogon nardus*. Numerous forbs and geophytes are dominated by *Hypoxis rigidula, Hypoxis obtusa, Melhania randii, Merwilla plumbea* (around boulder clusters), *Chlorophytum fasciculatum, Raphionacme galpinii, Berkheya insignis* (Sekhukhune form), *Callilepis laureola, Dimorphotheca jucunda, Gerbera ambigua, Helichrysum nudifolium* var. *nudifolium, Senecio bupleuroides, Vernonia natalensis, Ipomoea oblongata* and *Pentanisia angustifolia*. Dwarf shrubs are quite prominent in parts, particularly on terraces and adjacent areas of sheetrock. Dominant species are *Lopholaena coriifolia, Senecio microglossus, Rhoicissus tridentata, Rhynchosia spectabilis, Rabdosiella calycina* and *Tetraselago nelsonii*. *Protea caffra* can dominate in parts, particularly on steeper slopes, changing vegetation community structure to Low Sparse Woodland. Other scattered trees are *Vitex obovatum* subsp. *wilmsii, Ozoroa paniculosa, Searsia tumulicola* var. *tumulicola* and *Cussonia transvaalensis*.

  A total of 180 species (40% of the entire list) was recorded from *Tristachya-Themeda* Grassland with 33 species having conservation significance. Four threatened species were confirmed to occur within this vegetation community. The most significant of these is a new species of *Asclepias,* which is allied to *Asclepias schlechteri* (Pieter Bester, SANBI, *pers.comm*.). A single plant was located within the proposed north pit area. While this taxon has not been formally assessed yet, it would qualify for a status of Critically Endangered because it is only known from one locality and detailed surveying only resulted in one plant being located (Lize von Staden, Threatened Plant Programme, SANBI, *pers.comm*.). Further study of this new species is needed within its type locality. The other three species are classed as Vulnerable (*Eucomis vandermerwei, Resnova megaphylla* and *Zantedeschia pentlandii*). Four other species are considered to be species of conservation concern although not immediately threatened. One of these is classed as Rare (*Watsonia occulta*), while one is Near

Threatened (*Merwilla plumbea*) and two are Declining (*Aloe cooperi, Eucomis montana*). Twelve species occurring in this vegetation community are endemic to the SCPE, the LCPE or to the province and 24 are protected under the Mpumalanga Nature Conservation Act (No.10 of 1998) or the National Forest Act (No.84 of 1998).

This vegetation community is representative of Sekhukhune Montane Grassland and is interpreted as being part of the *Themeda triandra – Senecio microglossus* Cool Moist Grassland classification of Siebert *et al*. (2002a), particularly the *Brachiario serratae – Melhanietum randii* association.

- **Vegetation community 2: *Themeda – Brachiaria* Grassland on plains and terraces**

  This vegetation community occurs on plains and terraces throughout the study area and covers 217ha which equates to 31.6% of the entire area. Rock cover is moderate with scattered norite boulders and sheetrock areas present. The Sheetrock community is nested within this vegetation community.

  Vegetation structure is Low to Short Closed Grassland (*sensu* Edwards, 1983). This vegetation community is characterised by low diversity of trees and a high diversity of grasses, forbs and geophytes. The dominant grasses are *Themeda triandra* and *Brachiaria serrata*, while other common species are *Heteropogon contortus, Eragrostis superba, Melinis nerviglumis* and *Tristachya leucothrix*. Forbs and geophytes are common, particularly *Hypoxis obtusa, Gerbera ambigua, Melhania randii, Cyperus sphaerocephalus*, *Chlorophytum fasciculatum, Justicia anagalloides, Rhynchosia monophylla, Acalypha peduncularis, Eriosema kraussianum, Lotononis eriantha, Pachycarpus scaber, Pachycarpus transvaalensis, Haplocarpha scaposa*, *Hibiscus aethiopicus, Helichrysum nudifolium* var. *pilosellum, Vernonia natalensis, Ipomoea oblongata* and *Pentanisia angustifolia*. Dwarf shrubs are quite prominent in parts, with the most common species being *Senecio microglossus, Rhoicissus tridentata, Aeschynomene nodulosa, Elephantorrhiza elephantina* and *Protea welwitschii*. Scattered trees are *Cussonia paniculata, Gymnosporia buxifolia, Searsia tumulicola* var. *tumulicola* and *Protea gaguedi*.

  A total of 125 species (28% of the entire list) was recorded from *Themeda - Brachiaria* Grassland with 19 species having conservation significance. One threatened species was confirmed to occur within this vegetation community, namely *Zantedeschia pentlandii*, which has a conservation status of Vulnerable. Three other species are considered to be species of conservation concern although not immediately threatened. One of these is classed as Near Threatened (*Habenaria barbertoni*) and two are Declining (*Aloe cooperi, Eucomis autumnalis* subsp*. clavata*). The *Habenaria* is only known from three localities within Mpumalanga and several in Gauteng, so this represents a significant find. Five species occurring in this vegetation community are endemic to the SCPE or the LCPE and 14 are protected under the Mpumalanga Nature Conservation Act (No.10 of 1998).

  Themeda – Brachiaria Grassland is representative of Sekhukhune Montane Grassland (Mucina & Rutherford, 2006) and is interpreted as being part of the *Themeda triandra – Senecio microglossus* Cool Moist Grassland classification of Siebert *et al*. (2002a), particularly the *Brachiario serratae – Melhanietum randii* association.

- **Vegetation community 3: *Tristachya – Monocymbium* Grassland on upper slopes and crests**

  This vegetation community is confined to the highest altitudes within the study area, on crests and upper slopes and covers 20.17 ha which equates to 3% of the area surveyed. Rock cover is high to very high, comprising scattered rocks throughout with intermittent low ridges. This vegetation community is threatened by invasion by alien *Acacia mearnsii* trees.

  Vegetation structure is Low to Short Closed Grassland (*sensu* Edwards, 1983). This vegetation community is characterised by a lack of trees and a high diversity of grasses, forbs and geophytes. The dominant grasses are *Tristachya leucothrix, Monocymbium ceresiiforme*, *Themeda triandra* and *Loudetia simplex,* while other common species are *Heteropogon contortus, Melinis nerviglumis, Diheteropogon amplectens, Trachypogon spicatus, Aristida transvaalensis* and *Harpochloa falx.* Grass species composition is noticeably different to that of the previous two grassland vegetation communities and can be attributed to altitude and geology differences. Forb diversity is high with common species being *Helichrysum nudifolium* var. *nudifolium, Vernonia natalensis, Vernonia oligocephala, Acalypha peduncularis, Eriosema kraussianum, Haplocarpha scaposa*, *Rhynchosia monophylla, Raphionacme hirsuta, Lotononis eriantha*, *Pearsonia aristata, Clutia monticola, Becium obovatum, Senecio bupleuroides, Ipomoea oblongata* and *Pentanisia angustifolia*. Dwarf shrubs are prominent around rocky ridges, particularly *Erica drakensbergensis* and *Rabdosiella calycina,* while *Phymaspermum acerosum* can be common in wet seeps. *Protea roupelliae* can dominate in parts, changing vegetation community structure to Low Closed Woodland.

  A total of 107 species (24% of the entire list) was recorded from *Tristachya-Monocymbium* Grassland with 18 species having conservation significance. Two threatened species were confirmed to occur within this vegetation community, namely *Crassula setulosa* var. *deminuta* and *Eucomis vandermerwei*, both of which are classified as Vulnerable. One other species is considered to be a species of conservation concern although not immediately threatened, namely *Callilepis leptophylla* which is classified as Declining. Four species occurring in this vegetation community are endemic to the SCPE, the LCPE or to the province and 15 are protected under the Mpumalanga Nature Conservation Act (No.10 of 1998).

  Tristachya – Monocymbium Grassland is representative of Lydenburg Montane Grassland (Mucina & Rutherford, 2006).

- **Vegetation community 4: *Aloe - Myrothamnus* Shrubland on norite sheetrock**

  This vegetation community is scattered throughout the study area, with the largest sheetrock fields being found in the vicinity of the proposed north pit and in the southern third of the study area. This community covers 50.9 ha which equates to 7.4% of the area surveyed. Rock cover is very high to continuous, comprising areas of flat to gently sloping open rock of up to 150m² in area; the sheetrock fields vary in size from 0.13 to 12.4 ha in size.

  Vegetation structure is Short Sparse Shrubland (*sensu* Edwards, 1983). This vegetation community is characterised by dominance of succulent and xerophytic species, the dominant species being *Aloe castanea, Myrothamnus flabellifolius, Craterostigma wilmsii, Tulbaghia leucantha, Xerophyta viscosa*

and *Xerophyta retinervis*. Growing conditions are harsh within this community and vary from wet and waterlogged for brief periods of time to extremely hot and dry for extended periods of time. Xerophytic ferns are a typical feature of this community, particularly *Mohria vestita, Selaginella dregei* and *Pellaea calomelanos*. Other common succulents are *Crassula* species, *Cotyledon orbiculata, Aeollanthus buchnerianus, Senecio oxyriifolius, Kleinia longiflora* and *Huernia zebrina* subsp. *insigniflora*. Grasses and sedges are limited to shallow areas of soil trapped on the sheetrock and include *Melinis nerviglumis, Cyperus rupestris, Coleochloa setifera, Sporobolus pectinatus* and *Eragrostis pseudosclerantha*.

A total of 75 species (16.7% of the entire list) was recorded from *Aloe - Myrothamnus* Shrubland with 9 species having conservation significance. One threatened species was confirmed to occur within this vegetation community, namely *Zantedeschia pentlandii*, which has a conservation status of Vulnerable. Two other species are considered to be a species of conservation concern although not immediately threatened. These are *Merwilla plumbea* (Near Threatened) and *Aloe cooperi* (Declining). Five species occurring in this vegetation community are endemic to the SCPE, the LCPE or to the province and eight are protected under the Mpumalanga Nature Conservation Act (No.10 of 1998).

Aloe – Myrothamnus Shrubland is representative of the *Ursinio nanae – Myrothamnion flabellifoli* alliance of Siebert *et al.* (2003) which falls within Sekhukhune Montane Grassland (Mucina & Rutherford, 2006).

- **Vegetation Community 5: Wetlands**

  Within the study area wetlands occur in midslope and valley bottom landscape settings (as described by Kotze *et al*., 1994 and cited in Ecorex, 2010):

  - *Fuirena – Pycreus* Sedge Meadow (midslope wetland)

    The sedge meadows are situated in the upper reaches of the streams that drain from the steep slopes in the southern part of the study area, and on the large terrace in the south-west. Dominant species are the sedges *Fuirena pubescens* and *Pycreus cooperi* and the grasses *Setaria incrassata* and *Digitaria tricholaenoides*. Species richness among sedges is high and includes *Ascolepis capensis, Cyperus schlechteri, Schoenoplectus corymbosus, Kyllinga erecta* and *Scirpus ficinioides*. The most common geophytes are *Ledebouria cooperi, Eucomis autumnalis* subsp*. clavata* and *Kniphofia fluviatilis*. Common forbs include *Senecio erubescens, Senecio inornatus, Monopsis decipiens* and *Chironia palustris*.

  - *Tulbaghia – Helichrysum* Sheetrock Wetland (midslope)

    These are seasonal wetlands with very shallow soils that are recharged by groundwater flow over sheetrock terraces. Most of the sheetrock wetlands are concentrated on the large exposed sheetrock terraces in the proposed north pit area. While species diversity is low, floristic composition is diagnostic, making this an easily recognised vegetation association. *Tulbaghia leucantha* and *Helichrysum aureonitens* are noticeably dominant, while other common species

are short sedges such as *Kyllinga erecta* and *Eleocharis dregeana*, the dwarf geophytes *Ledebouria cooperi* and *Eriospermum cooperi*, *Eriocaulon* cf. *dregei* and *Xyris* species.

- *Miscanthus - Hyparrhenia* Channelled Valley-bottom Wetland

  These wetlands are generally linear in shape and are confined to channelled drainage lines in the central and north-eastern parts of the study area. Grasses are dominant, particularly *Miscanthus junceus, Hyparrhenia tamba, Paspalum dilatatum* and *Arundinella nipalensis*. Forbs and small shrubs include *Nidorella auriculata, Nidorella hottentota, Senecio inornatus, Dissotis canescens, Cliffortia nitidula* and *Verbena bonariense*.

- **Vegetation Community 6: *Pterocelastrus – Olea* Thicket on rock outcrops**

  This vegetation community is scattered throughout the study area wherever boulder clusters have provided sufficient protection from fire and an improved moisture regime, which allows forest / thicket to develop. Thickets vary in size from 10m^2 to just over 1ha in open grassland, whereas the forest-like thicket below the cliffs at the proposed north pit is almost 10ha in size. *Pterocelastrus – Olea* Thicket covers 17.6ha which equates to 2.6% of the area surveyed. Rock cover is moderate to high, comprising clusters of large boulders.

  Vegetation structure is Short Thicket around boulder clusters to Tall Thicket below the cliffs around the proposed north pit (*sensu* Edwards, 1983). This vegetation community is characterised by dominance of woody shrubs and trees. *Pterocelastrus echinatus* and *Olea capensis* subsp. *enervis* are noticeably dominant in the outcrop thickets in the grassland, with other co-dominant trees and shrubs including *Diospyros whyteana, Euclea crispa, Hippobromus pauciflorus* and *Halleria lucida*. Other common woody species include *Olinia rochetiana, Acokanthera oppositifolia, Maytenus albata* and *Myrsine africana*. Forbs are scarce and are mostly represented by *Achyranthes aspera, Rubia petiolaris, Pelargonium* species, *Gerbera jamesonii, Hypoestes aristata* and *Zaluzianskya* species. Creepers and climbers are more common and include *Secamone alpinii, Rhynchosia caribaea, Sarcostemma viminale* and *Clematis brachiata*.

  The forest-like thicket that has developed below the large cliffs has greater diversity of trees and shrubs, including true forest species such as *Curtisia dentata, Scolopia oreophila, Scolopia mundii, Robsonodendron eucleiforme, Rothmannia capensis, Canthium ciliatum* and *Maytenus acuminata*.

  A total of 119 species (26.5% of the entire list) was recorded from *Pterocelastrus - Olea* Thicket with 14 species having conservation significance. One threatened species was confirmed to occur within this vegetation community, namely *Resnova megaphylla*, which has a provincial conservation status of Vulnerable. Two other species are considered to be a species of conservation concern although not immediately threatened. These are *Merwilla plumbea* (Near Threatened) and *Curtisia dentata* (Near Threatened). One species occurring in this vegetation community is endemic to the SCPE (*Resnova megaphylla*) and one is endemic to Mpumalanga Province (*Agapanthus inapertus*), while 14 species are protected under the Mpumalanga Nature Conservation Act (No.10 of 1998) or the National Forest Act (No.84 of 1998) (Appendix A4).

Pterocelastrus - Olea Thicket is representative of the *Hippobromus pauciflorus – Rhoicissus tridentata* Rock Outcrop Vegetation of Siebert *et al.* (2002b) which occurs within Sekhukhune Montane Grassland and Sekhukhune Mountain Bushveld (Mucina & Rutherford, 2006).

- **Vegetation Community 7: *Pittosporum – Ilex* Riparian Thicket**

  This vegetation community occurs as two discontinuous linear strips along north-flowing tributaries of the main drainage line in the study area. *Pittosporum – Ilex* Thicket covers 1.36 ha which equates to 0.2% of the area surveyed. Rock cover is moderate to high, comprising clusters of large boulders as well as bedrock along the drainage lines.

  Vegetation structure is Short to Tall Thicket (*sensu* Edwards, 1983), with vegetation structure increasing in height lower down the slopes. This vegetation community is characterised by dominance of woody shrubs and trees. *Pittosporum viridiflorum* is noticeably dominant throughout, while *Ilex mitis* is prominent higher upstream. Other common woody species include *Searsia lucida, Diospyros whyteana, Cliffortia nitidula, Nuxia congesta, Mimusops zeyheri, Buddleja auriculata, Buddleja saligna, Otholobium wilmsii* and *Myrsine africana*. Forbs are scarce and are mostly represented by *Achyranthes aspera, Rubia petiolaris, Phymaspermum acerosum*, *Hypoestes aristata* and *Stachys natalensis*.

  A total of 49 species (10.9% of the entire list) was recorded from *Pittosporum - Ilex* Riparian Thicket with 5 species having conservation significance. No threatened species were confirmed to occur within this vegetation community, while two species are considered to be a species of conservation concern although not immediately threatened. These are *Merwilla plumbea* (Near Threatened) and *Ilex mitis* (Declining). No species occurring in this vegetation community are endemic to any centres of plant endemism, while four species are protected under the Mpumalanga Nature Conservation Act (No.10 of 1998) or the National Forest Act (No.84 of 1998).

A total of 449 plant species was recorded within the study area during fieldwork. This is remarkably high considering that a much larger area further north within the Dwars River valley only produced 400 species, even after repeated visits by a number of botanists (McCleland, 2007b). Of the 449 species, 67 (15%) are considered species of conservation concern, are endemic to centres of plant endemism, and / or are protected by legislation.

Fourteen species are listed in the latest Red List publication as having conservation concern. Five of these are considered threatened: *Asclepias* sp.nov. (a new species of *Asclepias* likely to be assessed as Critically Endangered), Yellow Arum Lily *Zantedeschia pentlandii* (endemic to the Roossenekal Sub-centre of the SCPE, with a conservation status of Vulnerable), Dwarf Pineapple-flower *Eucomis vandermerwei* (almost confined to the Steenkampsberg Sub-centre of the LCPE, with an isolated sub-population near Middelburg and assessed as Vulnerable), *Resnova megaphylla* (allocated a provincial status of Vulnerable), *Crassula setulosa* var. *deminuta* (endemic to the Steenkampsberg Sub-centre of the LCPE, allocated a conservation status of Vulnerable).

Of the 14 plants of conservation concern occurring in the study area, nine are not considered threatened, but are nonetheless of some concern. One of these, *Watsonia occulta*, has been allocated a status of Rare, while three are Near Threatened (*Curtisia dentata, Merwilla plumbea* and *Habenaria barbertoni*) and five are Declining (*Ilex mitis, Callilepis leptophylla, Aloe cooperi, Eucomis autumnalis* subsp. *clavata* and *Eucomis montana*.

Eight plants confirmed during fieldwork are endemic to the Sekhukhuneland Centre of Plant Endemism, six are endemic to the Lydenburg Centre, and two are endemic to Mpumalanga Province. Fifty-three species are protected by legislation, in terms of the Mpumalanga Nature Conservation Act (No.10 of 1998) and the National Forests Act (No.38 of 1998). Fourteen of these are orchids, with the genera *Habenaria* (4 species), *Disa* (3 species) and *Eulophia* (3 species) being well represented.

Sixteen threatened plant species have been confirmed within the quarter-degree grids 2530AA and 2530AC, one of which is Endangered and 15 are Vulnerable. One Vulnerable species, *Brownleea graminicola*, has a High chance of occurring, since it was collected in grassland just over 1km from the study area in similar habitat. This is a small terrestrial orchid that could easily have been overlooked during fieldwork.

Results – Vertebrate fauna

Through field observations and discussions with landowners:

- Twenty mammal species, 107 bird species, four reptiles species and nine frog species were confirmed to occur within the study area.
- A number of these species are of conservation concern:
    - Four mammals have a national Red Data status of Near Threatened: Serval (seen well at night in a seepage wetland at the proposed office footprint), Brown Hyaena (anecdotal report from landowners), Honey Badger (anecdotal report from landowners), Geoffroy's Horseshoe Bat (specimen collected by MTPA below the high cliffs in the proposed north pit footprint).
    - Three mammal species have been allocated provincial Red Data status of Near Threatened (African Clawless Otter, Aardvark and Leopard). Evidence of the otter and Aardvark were located during fieldwork, while landowners report the confirmed presence of Leopard.
    - Three other mammals are not considered threatened nationally, but have been assessed provincially as Data Deficient (Black-backed Jackal, Caracal and Slender Mongoose). These are likely to be fairly common in the area.
    - Two bird species have a national Red Data status of Vulnerable: Cape Vulture (several birds seen soaring over the study area), Short-tailed Pipit (this rare and highly localised species was seen displaying and then a breeding pair was found incubating three eggs in a well-concealed nest in the vicinity of the proposed south pit).

  - One reptile species, Southern African Python, has a national Red Data status of Vulnerable, and was confirmed to be resident at one of the farm dams (Mr A. Nel, pers.comm.).
  - Another species which has a provincial Red Data status of Near Threatened was confirmed, namely Sekhukhune Flat Lizard. A species that has a provincial status of Near Threatened, Montane Dwarf Burrowing Skink, was confirmed to occur on an adjacent property (Boycott, 2002 and cited in Ecorex 2010) and has a high likelihood of occurring in the study area.
  - None of the confirmed frog species has threatened status.
- Data supplied by MTPA and data accessed from the South African Bird Atlas Project (SABAP2) website (http://sabap2.adu.org.za) were used to compile a list of potentially occurring species of conservation concern (Appendix B2). Nine birds in addition to those above are listed as having been recorded on nearby properties. Two have a low likelihood of occurrence because of incorrect altitude and / or limited to no available habitat; these are Wattled Crane (Critically Endangered) and Yellow-breasted Pipit (Vulnerable). Four of the remaining species have a status of Vulnerable, but three are of these (Blue Crane, Grey Crowned Crane and African Grass Owl) only have a moderate likelihood of occurrence and then only as irregular visitors. However, Southern Bald Ibis has been recorded on an adjacent property and has a high likelihood of occurring, particularly after grassland has been burnt. Three Near Threatened species have been recorded on adjacent properties and have a high likelihood of occurring in the study area, namely African Crowned Eagle, Secretarybird and Lanner Falcon.

Results – Invertebrate fauna

Through field observations:

- Scorpion: Twelve species of scorpion are predicted as potentially occurring at the project site. Four of these species (*Hadogenes bicolor, H. polytrichobothrius, Opistophthalmus glabrifrons* and *Opistacanthus validus*) are of conservation concern and are included on the published list of threatened and protected species (Biodiversity Act) due to potential threats from the pet trade. Only three species of scorpions were found during the field surveys; these included one non-protected species, *Cheloctenus intermedius*, and two species protected under the Biodiversity Act, *Hadogenes polytrichobothrius* and *Opistacanthus validus*. Both *H. polytrichobothrius* and *C. intermedius* occurred in all areas surveyed within the study area. Although *O. validus* was only found in the south pit site, the survey was not intensive and it is very probable that it is also widely distributed on the site, especially in the more wooded parts. *Hadogenes polytrichobothrius* was the most commonly encountered species, indicating that the site represents highly suitable habitat for this species.
- Trapdoor and Baboon Spiders: Only 19 species of Mygalomorph spider have been confirmed from Mpumalanga Province but it is likely that this low diversity is largely due to under-collecting. Very few mygalomorph spiders were encountered during the transect searches and in pitfall trap samples collected during the survey, and none were sufficiently mature for identification. Diversity and

abundance of this group thus appears to be fairly low at the project site, and insufficient data was obtained for any meaningful statistical analysis or diversity estimation.

- Dragonflies and damselflies: One dragonfly and three damselfly species of conservation concern in South Africa may potentially occur on the site. However, of these only the highly endangered Balinsky's Sprite (*Pseudagrion inopinatum*) is globally significant, as the other three are all widespread in Africa and have only marginal distributions in South Africa. Odonata were abundant around dams, along streams and in wetland areas surveyed, but diversity was low and all specimens collected belonged to the widespread and common species.
- Leafhoppers: Sixty-three species of cicadellid leafhopper were collected, this represents about 20% of the number of leafhopper species known from South Africa. The estimated total diversity of cicadellid leafhoppers was 87. At nearly 30% of the total number of species known from South Africa this is indicative of a diverse and healthy leafhopper community.
- Cicadas: the habitat at the project site appears generally suitable for *Pynca sylvia* with areas of high suitability in both open pits. Their presence or absence could not be confirmed during the site visit.
- Ground beetles: Seven described carabid species of conservation concern (three *Graphipterus* and four *Dromica* species) have been identified as potentially occurring in the study area. No ground beetles of conservation significance were found during the field survey, but this was not unexpected as most of these species are largely active in early to mid-summer.
- Butterflies: Two species of conservation concern have been confirmed close to the study site; these are *Aloeides rossouwi* (recorded from De Berg, part of which overlaps the southern portion of the study area) and *Lepidochrysops rossouwi* (recorded from near Lydenberg and Dullstroom) and the potential for these species to occur must be considered. No Red Data butterfly species were found on the site.
- Ants: In total 85 species of ground-dwelling ants were collected. Estimated total diversity for each pit site was approximately 80 species, and for both sites combined about 112 species, which is indicative of a very diverse and undisturbed bushveld ant community. Ant diversity is surprisingly high considering the altitude, as numbers of ant species generally fall off at higher elevations. *Anoplolepis custodiens*, an aggressive species that is characteristically dominant in open or disturbed habitats, was not present in any of the samples collected, and the relative abundances of ant species suggest an undisturbed community. Undescribed ant species were confirmed from samples collected during the site surveys.

There is a low to moderate probability that other invertebrate species of conservation concern could occur on site but none were located during the fieldwork.

Results - Aquatic systems

Aquatic ecosystems that occur in the study area include:

- The Groot Dwars River, a perennial river that flows past the project site. In the vicinity of the project area, the valley slopes are fairly steep on both banks of the river. The project area is on the eastern bank, just over 1km from the river.
- There are a number of ephemeral tributaries in the study area. During the field sampling flow conditions were moderate and stable and highly suitable for sampling aquatic fauna.
- Midslope wetlands occur on sheetrock and are fed by groundwater. These are situated higher up in the catchment and do not have stream channels within or entering them.
- Channelled valley bottom/riparian wetlands have steep gradients and a discernible stream channel. These are located within and downstream of the project footprint.

Three sample sites were assessed. A summary of the findings is provided below with further detail provided in the specialist report (Appendix G):

- The ecological classification for water quality at the three sites ranged from good (for Sites T1 and T2) to high quality (for Site T3). The species composition reflects unimpacted waters close to reference condition with minimal to no anthropogenic influences. There is no evidence of major pollution related impacts.
- The in-stream habitat integrity was classified as Natural (for Sites T2 and T3) to Largely Natural and Moderately Modified (for Site T1). The main impact at Site T2 was associated with elevated sedimentation caused by stormwater runoff from a farm road crossing. This site was also impacted by the constriction of flows caused by an undersized culvert and potential effects from a small farm dam upstream of the site (affecting low flows and altering water temperatures).
- The riparian habitat integrity is classed as Natural at all three sites.
- The Present Ecological State of aquatic invertebrates was rated as Moderately Modified (at Site T1) to Natural and Near-Natural (at Site T3). Site T2 was unrated due to the limited availability of suitable habitats. A previous survey conducted in the Groot Dwars River rated the River in the vicinity of the Hoogland project site as Natural.
- The presence of several highly sensitive taxa indicated that water quality was excellent. Low overall diversity was attributed mainly to excessive siltation caused by runoff of sediments from the gravel road crossing. The presence of at least two undescribed species of baetid mayflies, and several species of invertebrates that are restricted to clear, mountain streams with excellent quality water, is considered to be of conservation importance.
- Neither exotic aquatic invertebrate taxa nor pest species were recorded during this and previous surveys in the area.
- In terms of fish species, two species of indigenous fish were recorded. Populations were low, with only 19 individuals caught at Site T1, eight individuals caught at Site T2, and 11 individuals caught at Site T3. No exotic species of fish were recorded. However, trout may be expected to occur in the farm dams. None of the fish species sampled, or expected to occur in the study area, is Red Data listed (IUCN Red List). However, two species (Barred Minnow - *Opsaridium peringueyi* and the

Marico Barb - *Barbus motebensis*) are of conservation concern for the Groot-Dwars Catchment as a whole.

The Department of Water Affairs and Forestry's Desktop Ecological Classification considers quaternary catchment B41G to be of High Ecological Importance and Sensitivity (Class B: Small risk allowed). The high status is attributed to the presence of rare and endangered aquatic species, high diversity of aquatic habitats, and its importance as a refuge area, migration corridor and conservation area. The assessment was based on conditions at the lower border of the quaternary. The specialist study undertaken for Hoogland, which was at a much finer spatial resolution than the Desktop Assessment, generally supports the results of the Desktop Assessment.

Conclusion

The four vegetation communities for conservation-important flora and fauna are *Tristachya* - *Themeda* Grassland on norite hillslopes, *Themeda* - *Brachiaria* Grassland on norite plains, *Tristachya* - *Monocymbium* Grassland on quartzite crests and slopes, and *Aloe-Myrothamnus* Shrubland on norite sheetrock. While the riparian and wetland communities do not have high value for conservation-important flora and fauna, they do have considerable functional value for the ecosystem as a whole (Table 6, Figure 9).

All aquatic ecosystems within the study area are ecologically highly sensitive. The composition of diatoms, aquatic invertebrates and fish indicate that the water quality is excellent. The sites are minimally impacted by anthropogenic activities and are representative of reference conditions. Existing impacts are limited to sedimentation, which was localised to stormwater runoff from a farm road crossing. Other impacts are likely to be associated with the farm dams, and include altered low-flows and altered stream temperatures downstream of the dams. Runoff from the area is an important contributor to stream flows in the Groot Dwars River, both in terms of quality and quantity of water.

TABLE 6: INTEGRATED CONSERVATION IMPORTANCE

	Grassland					**Thicket**	
	***Tristachya-Themeda* Grassland**	***Themeda-Brachiaria* Grassland**	***Tristachya-Monocymbium* Grassland**	***Aloe-Myrothamnus* Sheetrock Shrubland**	**Wetland**	***Pterocelastrus-Olea* Thicket**	***Pittosporum-Ilex* Riparian Thicket**
Flora	Very high	Very high	Very high	High	Medium-high	High	Medium-Low
Vertebrate Fauna	Very high	Very high	Very high	Very high	High-Medium	High	High
Invertebrate Fauna	Very high	Very high	Very high	High	Low	Medium	Medium
Integrated Conservation Importance	Very high	Very high	Very high	Very high	High	High	High

The specialist is of the view that the development of the site is fatally flawed from a biodiversity perspective as a result of the following:

- Destruction of habitat of type specimen of *Asclepias* sp.nov.
- Destruction of Short-tailed Pipit breeding site
- Deterioration of habitat quality of type locality for new mayfly species
- Mining development would be in a Highly Significant area according to the MBCP; MBCP guidelines do not allow open-cast mining in Highly Singificant areas
- Mining development would be within a listed Threatened Ecosystem
- Mining development would be within a the one kilometre buffer zone of no-developments around a declared protected area; MTPA have stated that they would not support an application for mining within this buffer zone.

With the revised layout, the proposed project will avoid as far as possible, a sensitive seep wetland habitat along the eastern side of the project site.

1.1.5 HYDROLOGY BASELINE

Information in this section was sourced from the approved EMP reports for the current mine infrastructure (approved July 2003, December 2009 and May 2010), the Hoogland hydrology study (Metago 2011) (Appendix H) and the Hoogland biodiversity study (Ecorex 2010) (Appendix G) and should be read with reference to Figure 5 (hydrology) (Section 1.4).

Introduction and Link to Impacts

Surface water resources include watercourses (with associated wetlands) and paths of preferential flow of stormwater runoff. Project-related activities have the potential to alter the drainage of surface water through the establishment of temporary infrastructure (such as the open pits and waste stockpile areas) and/or result in the contamination of the surface water resources through sedimentation and seepage and/or spillage of general and industrial hazardous waste (negligible) and stockpiled overburden/waste. Key to understanding the hydrology of the site is the climatic conditions of the site. As a baseline, this section provides an understanding of the climatic (rainfall, temperature and evaporation) conditions of the area, hydrological catchments that could be affected by the project and the status of surface water features in the area.

Data Collection

No on-site weather station is present. A number of weather stations within 22km of the mine and project site were reviewed by the hydrology specialist as part of this study. Based on this review, relevant climatic data was sourced as follows (further detail is provided in the hydrology report):

- monthly rainfall was sourced from the mine and Roosenekal (DWAF No. B4E004; SAWS No. 553762 W) weather station
- monthly evaporation was sourced from Roosenekal weather station
- rainfall depths were sourced from the Design Rainfall Estimation Software for South Africa (Smithers and Schulze technique) (using the 90% Upper Confidence limit) (further detail is provided in the hydrology report)
- temperature data was sourced from Lydenburg.

Data used in determining the surface water characteristics of the study area included topographical data, climatic data (as discussed above), a survey done by Aquarius (defining the 10m contours), and field observations by the specialists. Project-specific surface water sampling was undertaken as part of the hydrology study. Four samples were collected and sent to a laboratory for analysis.

In terms of hydrological calculations:

- The mean annual runoff (MAR) for the catchments associated with the project was estimated using rainfall-runoff response parameters from WR2005. The rainfall-runoff response of the catchment was assumed to be the same as the regional rainfall-runoff response as determined for the quaternary catchment in which the project site falls (B41G).
- Flood peaks for the catchments associated with the project site were calculated using the Rational Method (further detail is provided in the hydrology report).
- Floodlines were modelled using HEC-RAS 4.0.

Results

Climatic data

The mine is located on the eastern escarpment on the border of the Highveld and Northern Transvaal climatic zones (Schulze, 1974). Shadow effects are likely to affect microclimate, especially in winter, by reducing temperature and increasing moisture holding capacity on southern slopes. In summer, elevated areas are frequently exposed to mist that accompanies the inflow of moist air from the Indian Ocean. Rain falls in the area in the form of showers and thunderstorms and mostly between October and March.

WR2005 (2009) indicates that the mean annual rainfall (MAP) for the site is approximately 640 mm/annum with a range in annual evaporation for the site of between 1800 – 2000mm (A-Pan estimate) and between 1400 – 1500mm (S-Pan estimate).

Rainfall data records that were obtained from the mine for the 2008/2009 hydrological year indicate a total rainfall of 1067 mm for this period with the highest rainfall recorded during the month of November 2008 and February 2009, when 298 and 286 mm were recorded respectively.

The average monthly rainfall record at Roossenekal ranges between 1mm (in July) and 85mm (in January) per annum with an annual record of 419mm (Table 7). Evaporation ranges from 3.1mm (in July) to 123.8mm (in November) with an annual A-Pan evaporation of 1 634mm. The more significant rains occur in summer. Temperatures tend to be warm to mild (Table 7), ranging from 18.3 to 25.9 ^{o}C (maximum) and 2.7 to 14.7 ^{o}C (minimum), with average temperatures between 9.5 ^{o}C and 22.9 ^{o}C.

TABLE 7: RAINFALL, EVAPORATION AND TEMPERATURE DATA

Month	Rainfall*	Evaporation (A-Pan)*	Temperature#		
	Mean monthly (mm)	Mean monthly (mm)	Average maximum (^{o}C)	Average minimum (^{o}C)	Average (^{o}C)
January	120.9	171.7	25.9	14.7	20.3
February	93.4	153.1	25.5	14.2	19.8
March	74	143.2	24.8	12.9	18.8
April	34.6	116.7	22.6	10.0	16.3
May	13.4	101.5	20.8	6.0	13.4
June	7.3	83.9	18.3	2.8	10.6
July	3.1	91.5	18.8	2.7	10.7
August	7.4	119.5	20.9	4.8	12.8
September	17.4	151.1	23.6	8.1	15.9
October	68.8	169.9	24.0	10.8	17.4
November	123.8	166	24.2	12.7	18.4
December	117	174.7	25.2	14.1	19.6
Annual	**683.0**	**1634.0**	**-**	**-**	**-**

** Data sourced from Roossenekal weather station*
 # Data sourced from Lydenburg weather station

Maximum 24-hour rainfall depths for various recurrence intervals were used for all hydrological calculations (Table 8).

TABLE 8: 24-HOUR STORM DEPTHS

Return period (yrs)	Average 24-hour rainfall depth (mm)
2	29.8
5	39.6
10	46.6
20	53.9
50	63.9
100	72.4
200	81.3

Surface drainage

The mine and project site falls within quaternary catchment B41G, which is situated in the Olifants River Water Management Area. The Groot Dwars River is a major tributary of the Klein Dwars River. After its confluence with the Klein Dwars River, the river feeds into the Steelpoort River approximately 2km downstream of the De Hoop dam. The Steelpoort River ultimately flows into the Olifants River Basin.

The terrace where current mine infrastructure is located downstream of the Hoogland project site and is drained by two perennial streams, namely the East and West streams. On the terrace there are currently three dams, namely the TKO dams located on the East stream downstream of the mine's current infrastructure. Both the West and East streams feed into a second TKO dam from where the East stream flows in a northerly direction before flowing steeply towards the Groot Dwars River. The East stream feeds into the Groot Dwars River upstream of Der Brochen Dam.

In the valley area, there are several ephemeral tributaries draining the side of the valley towards the Groot Dwars River. The service road leading to the valley decline from the terrace crosses a number of these tributaries. The valley decline is located approximately 1km west of the Groot Dwars River.

The Hoogland project site lies approximately 2km upstream of the existing mine and within the headwaters of three main tributaries of the Groot Dwars River. These tributaries flow in a northerly and then westerly direction to their confluence with the Groot Dwars River. These three tributaries are shown as non-perennial on the 1:50 000 topographical map although each was flowing in mid May and have the potential to flow all yearLimited activities (an inadequate farm road crossing and some man-made dams) occur on and upstream of the Hoogland project site. These have altered the natural drainage of the area to a certain extent.

Catchment characteristics

Five sub-catchments have been identified in the study area, where project infrastructure will be located, for the purposes of defining flood risk to the site (labelled 1 to 5 on Figure 5). The peak flow rate calculations are summarised in Table 9. The proposed north and south open pits sit on sub-catchment divides. The mean annual runoff (MAR) for the catchment associated with the project site was estimated using rainfall-runoff response parameters from WR2005. The rainfall-runoff response of the catchment was assumed to be the same as the regional rainfall-runoff response as determined for the quaternary catchment in which the mine and project site falls. Using WR2005 quaternary catchments dataset, and an estimated 1.2km^2 of the sites runoff being contained, it expected that approximately 0.15 million m^3 of the quaternary catchments 55.4 million m^3 MAR, will be held back. This accounts for 0.27% of the MAR for quaternary catchment B41G.

TABLE 9: DESIGN PEAK FLOWS FOR CATCHMENTS IN THE STUDY AREA

Catchment	Area (km^2)	Peak Flow (m^3/s) associated with return periods	
		1 in 50	1 in 100
1	4.182	28.78	36.14
2	1.4	12.17	15.27
3	1.82	16.70	20.96
4	0.3	3.03	3.80

Catchment	Area (km^2)	Peak Flow (m^3/s) associated with return periods	
		1 in 50	1 in 100
5	0.17	1.34	1.68

Floodlines

Floodline modelling was undertaken. At the project site the 100m offset from the centre of the drainage line (as set out in GN704) is greater than the 1:100 year floodline and therefore this buffer has been used for planning purposes.

Surface water quality

As part of the mine's approved EMP report (July 2003), surface water was sampled at two points within the Groot Dwars River (Figure 5). Both these points are downstream of the Hoogland project site. The results showed that aluminium, copper and lead concentrations in the Groot Dwars River exceeded DWAF's guidelines for aquatic ecosystems. The reasons for the exceedances are expected to be linked to mineralogical occurrences. When comparing monitored data to DWAF's domestic, irrigation and livestock watering guidelines, iron (all locations) and to a lesser extent manganese (one location) exceeded DWAF's domestic use guideline and total dissolved solids (TDS) (all locations) exceeded DWAF's irrigation guideline. The concentration of iron however, falls within the range of unpolluted surface waters as stated by DWAF (0.001 mg/l to 0.5 mg/l). Iron is the fourth most abundant element and found in many minerals. Manganese is also a relatively abundant element with DWAF stating a natural range of 0.00002 mg/l to 0.13 mg/l in fresh water. There is no significant health risk posed by the concentrations of these two elements. The TDS concentrations, although they exceed the irrigation guideline, are all considered low. The elevated baseline concentrations are expected to be linked to natural variations in geology and hydrogeology and were evident prior to mining activities taking place on the terrace.

The mine monitors water quality in the Groot Dwars River as part of its routine monitoring programme (GD3: downstream of mine infrastructure) (Figure 5). Results from the mine's monitoring programme indicate excellent water quality with slightly elevated levels of calcium at times.

For the Hoogland project, four surface water points (H1 to H4) were selected for sampling (see Figure 5). Water quality data was compared to the SANS domestic use standards for Class 1 and 2 (SANS 241:2006) as well as the as well as the evaluation criteria for aquatic ecosystems The surface water quality results compared to the SANS standards indicate that the baseline water quality class is Class 2 for all four samples (Table 10). For samples H1 and H4, arsenic (As) is marginally elevated above the Class 1 range and for samples H2 and H3, iron (Fe) is marginally elevated above the Class 1 range. When compared to the DWAF classification system, all four samples have been classified as Class 1 which indicates good water quality which is suitable for human consumption. Once again, it is the Arsenic

in samples H1 and H4 as well as the Iron in samples H2 and H3 which prevent this water from being classified as Class 0 according to the DWAF system. The elevated iron and arsenic levels are assumed to be a function of the underlying geology. Iron does not pose a health threat but does have aesthetic implications. Arsenic on the other hand, although not a concern at this stage, has significant health implications over time (depending on exposure) and levels should be closely monitored. Overall the current surface water is of excellent condition, fit for human consumption.

TABLE 10: SURFACE WATER CHEMISTRY RESULTS AND COMPARISON TO SANS DRINKING WATER STANDARD AND WATER CLASSES (ALL VALUES IN MG/L)

	SANS drinking water standard		SAWQG aquatic ecosystems	H1	H2	H3	H4
	Class 1	Class 2	TWQR				
pH	5.0 – 9.0	4.0-10.0	>0.5 pH unit / 5% change from background	8.3	7.9	7.5	7.0
CONDUCTIVITY in mS/m	<150	150-370 (7 yrs)	N/A	16.5	7.6	3.5	9.5
TOTAL DISSOLVED SOLIDS	<1000	1000-2400 (7 yrs)	Not more than a 15% change from background	114	54	34	84
ALKALINITY AS $CaCO_3$	N/A	N/A	N/A	76	32	12	40
NITRATE as N	<10	10-20 (7 yrs)	N/A	0.3	0.3	0.4	0.3
CHLORIDE as Cl	<200	200-600 (7 yrs)	<0.0002	6	<5	<5	<5
SULPHATE as SO_4	<400	400-600 (7 yrs)	N/A	<5	<5	<5	<5
FLUORIDE as F	<1.0	1-105 (1 yr)	<0.75	<0.2	<0.2	<0.2	<0.2
SODIUM as Na	<200	200-400 (7 yrs)	N/A	4	2	<2	3
POTASSIUM as K	<50	50-100 (7 yrs)	N/A	<1.0	<1.0	<1.0	<1.0
CALCIUM as Ca	<150	150-300 (7 yrs)	N/A	17	7	3	9
MAGNESIUM as Mg	<70	70-100 (7 yrs)	N/A	11	5	2	6
ICP scan results							
Aluminium as Al	<0.3	0.3-0.5 (1 yr)	<0.005	<0.100	<0.100	<0.100	<0.100
Vanadium as V	N/A	N/A	N/A	<0.025	<0.025	<0.025	<0.025
Chromium as Cr	<0.1	0.1-0.5 (3 months)	<0.012 #	<0.025	<0.025	<0.025	<0.025
Manganese as Mn	<0.1	0.1 – 1.0 (1 yr)	0.18	<0.025	<0.025	0.064	<0.025
Iron as Fe	<0.2	0.2-2.0 (7 yrs)	Not more than 10% variation from background in dissolved state	0.078	0.210	0.735	<0.025
Copper as Cu	<1.0	1-2 (1 yr)	<0.0008*	<0.025	<0.025	<0.025	<0.025
Zinc as Zn	<5.0	5-10 (1 yr)	<0.002	<0.025	<0.025	<0.025	<0.025
Arsenic as As	<0.01	0.01-0.05 (1 yr)	<0.01	0.015	<0.010	<0.010	0.013
Selenium as Se	<0.02	0.02-0.05 (1 yr)	<0.002	<0.020	<0.020	<0.020	<0.020
Cadmium as Cd	<0.005	0.005-0.01 (6 mnths)	<0.00025*	<0.005	<0.005	<0.005	<0.005
Lead as Pb	<0.02	0.02-0.05 (3 mnths)	<0.0005*	<0.020	<0.020	<0.020	<0.020
Class of water (parameter in brackets are those responsible for the class of the water)				2 (As)	2 (Fe)	2 (Fe)	2 (As)

For Chrome III
* For medium water hardness

Notes: Class 1 - values in orange exceed the SANS Class 1 standard;

The aquatic guidelines have been included for comparative purposes, however the analysis detection limit was not low enough in most cases so the water quality values have not been compared to the aquatic guideline

Surface water use

Most people living on the terrace obtain water from springs, streams and boreholes (see the hydrocensus data in Section 1.1.6). Surface water is also used by the aquatic ecosystems present along the streams. Surface water within the Hoogland study area is used by the aquatic ecosystems (upstream, within and downstream of the project site) and for man-made dams (upstream of the site) (Figure 5).

The Der Brochen Dam is located downstream of the mine on the Groot Dwars River, over 10km north of the mine. About 97% of the water in the dam is allocated to various mining houses. The remaining allocation is used by a farmer and Didingwe Lodge downstream of the mine for irrigation and livestock watering.

Wetlands

The project site hosts both midslope and valley bottom wetlands (Section 1.1.4) (Figure 8).

Conclusion

Surface water features on the site include ephemeral tributaries (although some are thought, by the hydrologist, to potentially retain flow all year round), wetlands (both midslope and valley-bottom wetlands) and a man-made dam (located near to the proposed offices). The nearest known perennial river is the Groot Dwars River located approximately 1km west of the project site. These surface water resources are in excellent condition and special care is needed to ensure that these conditions are not significantly altered through a decrease in water quality and/or quantity. Project-related activities are also located either on or in close proximity of the proposed 100m buffer of tributaries. This is however unavoidable due to the location of the ore body on and adjacent to these resources. The project design should therefore include provision for appropriately designed measures for controlling flood waters, dirty water runoff and erosion control.

1.1.6 GROUNDWATER BASELINE

Information in this section was sourced from the approved EMP reports for the current mine infrastructure (approved July 2003, December 2009 and May 2010), geological information supplied by the mine (Rock & Stock 2009) and the Hoogland groundwater study (GCS 2011) (Appendix I) and should be read with reference to Figure 4 (geology and structures), Figure 10 (boreholes and springs), Figure 11 (groundwater zones) and Figure 12 (groundwater flows and levels) (Section 1.4).

Introduction and link to Impacts

Groundwater, in general, is a valuable resource and is defined as water which is located beneath the ground surface in rock pore spaces and in the fractures of lithologic formations. Understanding the

geology of the area provides a basis from which to understand the occurrence of groundwater resources. Groundwater conditions at the project site are expected to be similar to those found at the existing mine. Project-related activities such as dewatering from the open pits and the temporary disposal of waste/overburden have the potential to result in the loss of groundwater resources, both to the environment and third party users, through loss in supply and pollution. Activities that will take place for the project have either been undertaken at the mine previously (such as the open pit operations) or are currently being carried out by the mine (such as the support activities). As a baseline, this section provides an understanding of the current groundwater conditions (quality, quantity and use) at the project site and the potential for dewatering cones of depression and pollution plumes to occur as a result of project-related activities.

Data Collection

The Hoogland groundwater study included (further detail on the methodologies used is provided in the specialist report):

- A desktop review of previous groundwater studies undertaken for Aquarius in 2002 and 2007.
- A hydrocensus investigation was undertaken within a 2km radius of the project site. The purpose of the hydrocensus was to identify groundwater use, borehole yields, measure groundwater levels and sample water for analysis. The hydrocensus also included exploration boreholes, mine and community water supply boreholes and fountains/springs relative to the the mine and project site. Approximately 35 boreholes were identified and visited and of these 20 samples (15 boreholes and 5 springs) were selected for sampling to provide a representation of current water qualities.
- A three-dimensional geological model was developed which revealed a major NE-SW running faults zone, bordering the proposed open cast area directly to the east
- Four new monitoring boreholes were drilled into the hanging wall of the fault zone to a depth of 50m and these boreholes were pump tested to characterise the aquifer conditions on the site.
- Aquifer parameters were used to simulate the watering bearing capabilities of the fault zone making use of a three-dimensional numerical groundwater flow model.

Results

Regional geology and structural features

The mine is currently exploiting a UG2 reef resource that forms part of the Rustenburg Layered Suite of the eastern lobe of the Bushveld Complex (Figure 3). Outside of the current mine property, the UG2 reef outcrops along the western side of the Groot Dwars River valley for over 20 km. In the vicinity of the mine, the ore body forms an elongated erosional remnant that projects eastwards under the Groot Dwars River and is preserved within a basin-like structure on the eastern side of the valley (Figure 4). The reef outcrops and subcrops around almost the entire perimeter of the basin with the exception of the western part of the southern flank, where the UG2 reef is downthrown along a fault, and the western side of the ore body, where the reef passes under the Groot Dwars River and merges with the rest of the UG2 reef

that underlies the entire western side of the river valley. The mine's ore body dips towards the Groot Dwars valley.

The targeted ore body for the Hoogland project is the same UG2 chromitite seam that occurs at Everest. It is also located on the eastern side of the Groot Dwars River valley and occurs as two separate outliers, namely the north-eastern and south-western ore bodies. For the purposes of this report, these areas are referred to as the North and South pit (Figure 4). Drilling and surface mapping outlined a tabular UG2 chromitite seam interlayered with norite, anorthosite and pyroxenite, in certain areas occurring approximately 155m above the UG1 (Rock & Stock 2009).

The UG2 in the Hoogland area is divided into two geozones, two distinct modes of emplacement. Geozone 1 occurs essentially in the north-eastern ore body and here the UG2 occurs essentially as a well-developed upper chromitite layer, with minor interlayering towards the top and bottom contacts. The total average thickness of the UG2 in Geozone 1 is 1,55m. To the south and south-west of this occurrence, interlayering between chromitite and silicate rock assemblages in the footwall becomes more pronounced. In this area referred to as Geozone 2 the UG2 package thickens due to the development of the lower unit, consisting of a parting as well as a lower chromitite layer. The lower unit has a total average thickness of 5,07m. The upper chromitite in this area has an average thickness of 1.51m. The UG2 is overlain by pyroxenite, norite and anorthosite and it attains its deepest position in the northeast where it was intersected at 76m below the surface (Rock & Stock 2009).

Major structures delineated by surface mapping and interpreted from borehole intersections and geophysical data are a north-east striking fault transecting the area and a north south bifurcating dyke system transecting the south-western ore body. The maximum projected displacement on the fault is approximately 55m and the UG2 terminates against it for the largest part of the eastern limit of the north-eastern orebody (Rock & Stock 2009). It is expected that this fault zone will act as a groundwater conduit, potentially feeding water into the proposed North pit. Dykes are likely to act as barriers of groundwater flow from the east towards the Groot Dwars River. However, their extent within the Hoogland project area is not fully known (GCS 2010).

<u>Groundwater zones (aquifers) on site</u>

Two main aquifers occur in the study area (refer to Figure 11 for a graphical representation):

- Upper weathered zone: This aquifer is formed by vertical infiltration of recharging rainfall through the weathered material which is retarded by an underlying material of lower permeability. Groundwater collecting above the contact migrates down gradient along the contact to lower lying areas, either to appear as fountains along the steep slopes of the mountainous study area, or recharge the lower lying streams and rivers as base flow. The aquifer is expected to be seasonably variable with increased groundwater levels and groundwater availability during the raining season, when there is

active recharge from rainfall. The average thickness of the weathered zone is approximately 6.7 m, with a maximum thickness of 22 m.

- Deep underlying fractured rock aquifer: Groundwater flows in this aquifer are associated with the secondary fracturing in the competent rock and as such, will be along discrete pathways associated with these fractures.

Aquifers in the area have been classified according to the Aquifer Classification Guideline (WRC, 1995) as a minor aquifer. The aquifers yield between 0.1 l/s to 5 l/s of potable quality water. Some people in the area rely on both surface and groundwater resources because the springs that supply water to the streams, furrows and farm dams are hydrolically connected to the underlying groundwater resources.. The nature of the rock, in terms of fractured or potentially fractured characteristics with relative low permeability or variable permeability is the main reason for the identified classification.

Groundwater levels, use and flow

According to GCS (2010), the depth to the groundwater level is topographically determined. This means that it is shallower in lower lying areas such as along streams, and deeper in higher lying areas such as hills. Fountains or springs are, however, either structurally or topographically controlled. The depth of the groundwater table at the project site varies between 0 and 45 meters below surface, with an average of 16m (Figure 12). Springs are indicative of area's where the groundwater daylights. These are abundant in the area (Figure 10). The shallow depth to the groundwater along the surface streams implies that the largest component of base flow in the streams can most probably be attributed to groundwater. It is unlikely that large variations in depth to groundwater level will occur during the course of a normal rainfall year. However, variations in the volumes of spring flow and stream base flow will probably be linked to fluctuations in rainfall. Significant variations in spring and stream flow volumes could, therefore, occur in response to natural phenomena such as droughts (GCS, 2010).

Groundwater flow directions generally tend to be from topographically higher areas towards lower lying areas. Groundwater flow in the project area is westwards towards the Groot Dwars River (Figure 12).

Groundwater, including springs, in the vicinity of the mine and project site is used by the mine (boreholes for drinking potable water), local community and private landowners. The Bakone Ba Phetla Community, also referred to as the Kiwi community, relies largely on groundwater for potable use from two existing production boreholes located to the north east of the existing mine, over 4km from the Hoogland project site (Bh1 and Bh2 on Figure 10). Approximately 260 approximate people rely on these two boreholes for potable water use. In addition private landowners, the nearest of which is located 750m north east of the Hoogland project site, also rely on boreholes and fountains/springs (S1 to 6 on Figure 10) for domestic and agricultural water supply. Everest currently has four production boreholes that are pumped for the

provision of potable water use, and for water use within the change house (Bh 3 to 6 on Figure 10) (GCS, 2010).

Groundwater quality

For the Hoogland project, 20 groundwater samples (15 boreholes and five springs) were collected (Table 11, Figure 10). The water quality results were compared to the SABS 241 Target Range Water Quality Objectives. The constituents that exceeded the compliance objectives are shaded in grey in the table, for which health and/or aesthetic effects are associated with the water with long-term use. The results are summarised below.

- All water samples that were taken indicate baseline conditions.
- Exploration boreholes DH 34 and ED 102, including the water sample for the supply source of Mr. Nel on Portion 1 of Farm 53 JT (S1), indicated elevated iron concentrations, which are considered a function of the geology.
- Two of the newly drilled monitoring boreholes (GCS 1 and 3) also indicated some elevated metal concentrations (aluminium, iron and lead), which is also considered a function of the geology.
- There are no health effects associated with these slightly elevated iron concentrations.
- All the water samples, with the exception of S1, show a bicarbonate-calcium and magnesium dominance, which implies a recently recharged aquifer. S1 has a relatively higher chloride concentration.

TABLE 11: PRE-PROJECT GROUNDWATER QUALITY

Constituent (mg/l)	SABS 241	TWQR	Exploration Boreholes									Privately owned Supply Sources						New GCS Monitoring Boreholes				
			HD 40	DH 34	HD 38	HD 10	ED 95	BH 5556	HD 16	HD 19	ED 102	ED 96A	Bh1	S1	S2	S3	S4	S5	GCS 1	GCS 2	GCS 3	GCS 4
pH Value @ 24°C	5.0 - 9.5	>0.5 pH unit / 5% change from background	7.5	7.2	6.6	7.1	6.9	7	6.8	6.7	6.8	7.4	5.1	7.3	9	6.2	6.6	6.4	7.8	8.2	7.6	7.7
Conductivity mS/m @ 25°C	< 150	N/A	27.3	18.5	16	19.9	19.2	9.45	22.3	17.4	90.8	56.6	2.02	13.1	2.43	2.26	9.38	4.72	24.9	21.0	20.0	26.1
Total Dissolved Solids	<1000	Not more than a 15% change from background	196	174	146	154	200	78	178	170	532	386	36	96	36	42	74	50	158	132	135	162
Calcium, Ca	<150	N/A	19	18.6	19.3	17.6	18.2	9	15	12.5	38	52	0.8	12	1.4	1.3	4.8	2.9	21	21	15.4	25
Calcium Hardness as $CaCO_3$	N/S	N/A	47	46	48	44	45	22	37	31	95	130	2	30	3	3	12	7	52	52	38	62
Magnesium, Mg	<70	N/A	13.5	8	4.1	6.9	5.8	0.6	7.3	8.1	14.4	26	0.3	5.6	0.9	1.1	5.2	2.2	14.6	7.9	10.1	14.3
Magnesium Hardness as $CaCO_3$	N/S	N/A	56	33	17	28	24	2	30	33	59	107	1	23	4	5	21	9	60	33	42	59
Total Hardness as $CaCO_3$	N/S	N/A	103	79	65	72	69	25	68	65	154	237	3	53	7	8	33	16	113	85	80	121
Sodium,Na	<200	N/A	4.7	4.6	7.2	7.9	12.4	6.6	9.6	7.6	19.5	15.7	5.5	3.8	4.8	4.6	6.1	6.2	6.0	6.1	4.1	4.7
Potassium,K	<50	N/A	0.5	0.4	0.3	2	0.4	1	0.4	0.8	13.2	0.5	0.1	0.9	0.1	0.1	0.2	0.2	0.5	0.3	1.3	0.2
Total Alkalinity as $CaCO_3$	N/S	N/A	120	92	67	100	94	34	69	76	382	273	3	69	16	12	46	22	104	91	73	90
P Alk as $CaCO_3$	N/S	N/A	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	13	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Bicarbonate,HCO_3	N/S	N/A	146	112	82	122	115	41	84	93	466	333	4	84	Nil	15	56	27	127	111	89	110
Carbonate, CO_3	N/S	N/A	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	4	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Chloride,Cl	<200	<0.0002	10	2.3	6.9	2.8	4.1	1.8	3.2	8.1	10.3	4.7	2.4	6.2	8.3	4.1	1.4	6.2	3.2	2.8	9.3	13.3
Sulphate,SO_4	<400	N/A	<0.2	3.8	<0.2	0.8	4.3	7.2	6.7	0.5	13.9	7.7	<0.2	<0.2	2.7	2.7	1.5	2.4	4.2	2.4	3.6	4.8
Nitrate,NO_3	N/S	N/A	4.5	0.8	0.9	0.8	0.3	0.4	12.5	0.5	0.2	0.2	1.9	1.3	1.8	0.7	0.9	0.8	<0.1	0.1	0.4	8.6
Nitrate as N	<10	N/A	1	0.2	0.2	0.2	0.1	0.1	2.8	0.1	<0.1	<0.1	0.4	0.3	0.4	0.2	0.2	0.2	<0.1	<0.1	0.1	1.9
Fluoride,F	<1.0	<0.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0	0	0	0
Total Suspended Solids	N/S	Not more than 10% change from background	160	120	196	52	20	384	1140	270	675	60	13	<1	5	<1	3	<1	195	24	18	22
Aluminium, Al	<0.3	<0.005	0.022	<0.009	<0.009	0.05	<0.009	0.025	<0.009	<0.009	0.012	<0.009	<0.009	<0.009	0.073	<0.009	<0.009	0.04	0.87	<0.009	0.026	0.015
Nickel, Ni	<0.150	N/A	<0.003	<0.003	<0.003	<0.003	<0.003	0.011	<0.003	<0.003	<0.003	<0.003	0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Manganese, Mn	<0.1	0.18	<0.001	<0.001	<0.001	0.001	0.013	0.004	0.001	<0.001	1.1	0.14	0.02	<0.001	0.001	<0.001	<0.001	<0.001	0.003	0.019	0.006	0.001
Iron, Fe	<0.2	Not more than 10% variation from background in dissolved state	0.039	0.54	0.002	0.14	0.004	0.005	0.002	0.003	3.8	0.052	<0.001	0.003	0.41	0.006	0.19	0.073	0.31	<0.001	0.033	<0.001
Vanadium, V	<0.2	N/A	0.002	0.003	<0.002	<0.002	0.002	0.003	<0.002	0.002	<0.002	0.006	<0.002	0.002	<0.002	<0.002	<0.002	<0.002	0.005	0.005	0.005	0.003
Zinc, Zn	< 5.0	<0.002	<0.005	<0.005	0.018	<0.005	0.006	<0.005	<0.005	0.007	0.029	0.017	<0.005	<0.005	0.11	<0.005	<0.005	<0.005	<0.005	0.008	<0.005	<0.005
Lead, Pb	< 0.02	<0.0005*	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	0.03	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	0.082	<0.01
Cobalt, Co	< 0.5	N/A	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.011	<0.001	0.018	<0.004
Copper, Cu	<1.0	<0.0008*	<0.002	<0.002	0.003	0.005	<0.002	0.002	0.002	0.002	<0.003	<0.002	0.002	<0.002	0.005	<0.002	<0.002	<0.002	0.002	<0.002	0.007	<0.002
Total Chromium, Cr	< 0.1	<0.012 [#]	<0.003	<0.003	<00.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.005	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Phosphorus, P	N/S	Not more than 15% variation from background	<0.04	<0.04	<0.04	0.1	<0.04	0.07	<0.04	<0.04	6.2	<0.04	<0.04	<0.04	<0.04	<0.04	0.06	<0.04	<0.04	<0.04	<0.04	<0.04

[#] For Chrome III
* For medium water hardness

Note: The aquatic guidelines have been included for comparative purposes, however the analysis detection limit was not low enough in most cases so the water quality values have not been compared to the aquatic guideline.

Conclusion

Private landowners in the immediate vicinity of the project site rely on groundwater for domestic and agricultural use (in the absence of an alternative municipal water supply). The nearest of these is 750m north east of the project siteAny significant changes to groundwater availability and water quality could lead to significant impacts on these groundwater users. The boreholes drilled into the hanging wall of the fault zone for the Hoogland site were found to be low yielding. The groundwater quality was noted to be generally good, however some of the samples indicated elevated metals, which is considered a result of natural water/rock interactions. The parameters, status and classification of groundwater resources on site has provided input into the design requirements of the waste/overburden facility and dewatering modelling of the open pits.

1.1.7 AIR QUALITY BASELINE

Information in this section was sourced from the approved EMP reports for the current mine infrastructure (approved July 2003, December 2009 and May 2010) and the Hoogland air quality study (Airshed 2011) (Appendix J) and should be read with reference to Figure 15 (land uses) (Section 1.4).

Introduction and link to anticipated impact

Identification of existing sources of emissions in the area and the characterisation of existing ambient pollution concentrations is fundamental to the assessment of cumulative air impacts. In this regard there are facilities and activities at the existing mine that have the potential to impact on ambient air quality, if unmanaged. A change in ambient air quality can result in a range of impacts which in turn may cause a disturbance to nearby receptors. Potential receptor sites in the vicinity of the Hoogland project site include private landowners (the nearest of which is 750m north east of the project site) and the natural environment. As a baseline, this section provides a description of the climatic environment as it relates to air dispersion and aims to identify existing ambient air concentrations that may be impacted by project emissions.

Data collection

No on-site weather station (with wind data) exists, so meteorological data for the period 2010 (specific to the mine site) was extracted from the calculated MM5 data for the site. No ambient dust fallout or PM_{10} monitoring is available for the project site. Dust fallout is however measured at the mine. Given this the air study focused first on identifying sources and pollution types in the region and at the project site that may be important from a cumulative impacts perspective and provided an overview of available monitoring data from the mine. Further detail on the methodologies used is included in the specialist report (Appendix J).

Results

Wind data and atmospheric stability indices

Meteorological characteristics of a site govern the dispersion, transformation and eventual removal of pollutants from the atmosphere.

The predominant wind direction in the project area is south-easterly. The slope of the terrain accounts for the increased frequency of occurrence of northerly to north-westerly wind during the day-time and increased southerly to easterly winds during the night-time. The differential heating and cooling of air along a slope typically results in down-slope flow at night with low level up-slope airflow occurring during the day.

The atmospheric boundary layer constitutes the first few hundred metres of the atmosphere. This layer is directly affected by the earth's surface, either through the retardation of flow due to the frictional drag of the earth's surface, or as result of the heat and moisture exchanges that take place at the surface. During the daytime, the atmospheric boundary layer is characterised by thermal turbulence due to the heating of the earth's surface and the extension of the mixing layer to the lowest elevated inversion. The radiative flux divergence during the night usually results in the establishment of ground-based inversions and the erosion of the mixing layer. The night times are characterised by weak vertical mixing and the predominance of a stable layer. These conditions are normally associated with low wind speeds, hence less dilution potential.

The mixed layer ranges in depth from a few metres (i.e. stable or neutral layers) during night times to the base of the lowest-level elevated inversion during unstable, daytime conditions. Elevated inversions may occur for a variety of reasons and on some occasions as many as five may occur in the first 1000 m above the surface.

Emission sources

The sources of SO_2 and NO_x that occur in the region include industrial emissions, blasting operations at mines, veld burning, vehicle entrainment, vehicle exhaust emissions and household fuel burning. Various local (wind erosion from exposed areas, fugitive dust from agricultural and mining operations, vehicle entrainment from roadways and veld burning) and far-a-field (emitted from remote tall stacks and from large-scale biomass burning in countries to the north of South Africa sources) are expected to contribute to the suspended fine particulate concentrations in the region.

Within the vicinity of the project site, the following is noted:

- There are numerous industrial sources within the Mpumalanga region, however these are limited in the vicinity of the mine and project site.

- Biomass burning including crop-residue burning and wild fires (locally known as veld fires) may represent a significant source of combustion-related emissions.
- Vehicles travelling along roads in the project area contribute to vehicle exhaust emissions.
- The Everest mining operations and vehicles travelling along gravel roads are sources of fugitive dust emissions, if left unmanaged.

Available ambient air monitoring data

Dust fallout at Everest is measured on a daily basis and sampled every two weeks. Three sampling points using four-directional dust buckets are monitored namely the North quarry unit (since June 2009), South quarry unit (since April 2006) and Central unit (since April 2006) (Figure 15). Data provided by the mine for the period April 2006 to January 2010 was analysed and interpreted by Airshed as part of the project's air quality study. Dust fallout results were compared to the recommended South African National Standard (SANS) residential limit of 600 mg/m^2/day and industrial limit of 1 200 mg/m^2/day. Exceedances of both the residential and industrial limits have been recorded at the mine monitoring points (within the mine boundary). These exceedances can be attributed to seasonal changes in wind conditions, increased activities at the mine during certain periods (such as backfilling of the old pits and construction activities) and when the mine was under care and maintenance in late 2008, early 2009 (resulting from the the drying out of the tailings storage facility).

Conclusion

The project site and proposed activities are located in a region where existing ambient air concentrations are influenced, in no specific order by nearby existing mining operations, agricultural activities as well as vehicle entrainment on unpaved road surfaces. These are however limited in the vicinity of the project site. The proposed project has the potential to add to this if not managed correctly. Background particulate concentrations and dust fallout are not known for the site. Understanding the current ambient air quality has assisted in predicting potential impacts associated with the project providing input into an air-related management plan and monitoring programme for the mine.

1.1.8 NOISE BASELINE

Information in this section was sourced from the approved EMP reports for the current mine infrastructure (approved July 2003, December 2009 and May 2010), the Hoogland noise study (Jongens Keet Associates 2011) (Appendix K), an updated baseline noise report (Acusolv, 2012) and should be read with reference to Figure 15 (Section 1.4).

Introduction and link to anticipated impact

Noise generating activities do occur as a result of the mine's existing operations, approximately 2km north of the project site. Some of the noise generating activities associated with the project may cause a

further increase in ambient noise levels in and around the site. This may cause a disturbance to nearby receptors. Potential receptor sites in the vicinity of the mine include private farmsteads and farm labourer residences, residences in the Kiwi community to the north of the mine, and schools/educational facilities to the north of the mine. In the vicinity of the Hoogland project site, receptors include private landowners (the nearest of which is 750m north east of the Hoogland project site) and the natural environment (including the Davel Private Nature Reserve) (described further in Section 1.3.1). As a baseline, this section provides an understanding of existing conditions in the area from which to measure changes as a result of project-related noise.

Data collection

At the time of the first Hoogland noise study, the mine was under care and maintenance and therefore the noise generated by this source could not be measured. Following the review of the initial EIA and EMP report, questions were raised concerning the additional noise sources as a result of the operation of the mine. A follow up noise survey was undertaken in late 2011 for the mine as part of a separate project. The survey was done while the mine was operational and noise monitoring was undertaken at sampling points around the Hoogland project site (Figure 15). The monitoring was conducted for both day and night. Meteorological conditions and the location of sampling points were taken into consideration when determining ambient noise levels. The baseline ambient noise measurements of the current operations from the follow-up survey were found to be in line with those modelled in the initial noise study.

Results

The main sources of noise in the vicinity of the mine and project site include traffic on the farm roads in the area (intermittent noise), general farming activities (not a major source of noise), and the existing mine (Jongens keet Associates, 2011). From the follow up noise survey it was identified by the specialist that a small number of the current mine components contribute to the audible noise footprint in the external environment (Acusolv, 2012). The noise footprint of the mine is convoluted by the mountainous topography. Depending on distance and topography between the mine and the receptor, the level and source of audible mining noise varies. To the west, the audible noise footprint of Everest Mine is curtailed by the high Steenkampsberge mountain range immediately west of the Groot Dwars River valley acting as a topographical noise barrier between the mine and the region west of the mountains. The main source of noise from the existing mine operations are (Acusolv, 2012):

- ventilation equipment;
- crushing and screening plant located on the terrace;
- processing plant; and
- traffic on the tarred access road (Road D874 South) off the Provincial R577 and traffic on the R577.

TABLE 1-12: NOISE MONITORING LOCATIONS AND RESULTS

Monitoring location		Ambient noise (Average level dBA)		Description of sampling point
		Day (L_d)	Night (L_n)	
M1	Residence Nel 1,5 km South of Everest Plant	47	42	Point M1 serves as a representative sample of prevailing ambient noise conditions at the nearest houses immediately south of Everest Platinum Mine (Residences Nel and Groenewald). This is the area where existing Everest mining operations currently have its maximum noise impact on people living in the neighbourhood of the mine. At night, in addition to continuous compressor (fan) noise, the plant and crushers (with variable intensity) are occasionally audible as well. Relative to a typical night-time level of 35 dBA in Rural Districts (SANS 10103), the mine elevates the ambient level by typically 7 dB, which amounts to a significant impact. Although the mine is at times audible during the day, the daytime level of 47 dBA is still in line with typical daytime levels (45 dBA) expected in Rural Districts and is caused primarily by farming and domestic work activities, birds and insects. It is noted that as a result of farming activities, daytime ambient noise levels on farmyards are often much higher than 45 dBA.
M2	Residence Roux 2,5 km East of Everest	57	57	As a result of continuous on-site fan, motor and pump noise (nursery tunnels and Koi ponds) ambient noise at the Roux residence was found to be practically constant at 57 dBA throughout the day and night. This self-generated noise completely masks any mining noise which might have otherwise been audible at this location.
M3	Near houses 3,5 km N-E of Everest	45	37	The ambient noise level in the area does not deviate much from rural. Notwithstanding, the whining sound of the compressor station is clearly audible above the background ambient level (domestic activity, birds and insects). Although not causing a significant noise disturbance impact in terms of quantifiable elevation in ambient level, this noise by virtue of its pure-tone character does constitute a noise nuisance.
M4	Countryside 5 km N-E of Everest	38	34	Ambient noise in this area is determined primarily by birds, insects, occasional traffic on local roads and low intensity community activity. No noise from Everest Mine or any other mining or industrial activity was discernible.
M5	Near houses 7 km NN-E of Everest	39	36	As in the case of M4, ambient noise in this area is determined primarily by birds, insects, occasional traffic on local roads and low intensity community activity. Too far away from Everest Mine and shielded by the topography, no mining-related noise could be detected.
M6	Near main road 4 km S-E of Everest	47	39	Although relatively close to Everest Mine, this area is topographically shielded from direct Everest plant and compressor noise. But the mine does contribute to a rise in ambient level by virtue of product transport trucks and other traffic travelling on the Everest access road. With the level falling off with distance, road noise is expected (calculated) to fall off to rural levels beyond

Monitoring location		Ambient noise (Average level dBA)		Description of sampling point
		Day (L_d)	Night (L_n)	
				500 m distance from the road. Although not detected in the samples taken during the course of the current survey, it can be expected that existing plant-related noise, the compressors in particular, will under certain atmospheric conditions be audible in this area.
M7	Near main road crossing 5 km S-E of Everest	51	41	Like location M6, noise at monitoring location M7 is also shielded from direct Everest operations and compressor noise by the topography. Ambient noise is elevated by general traffic and by truck noise on the main roads. With the level falling with distance, road noise is bound to fall off to rural levels beyond 500 m distance from the nearest main road.
M8	internal project area	43	-	Ambient levels at this location are of no relevance to the mine's existing or future impact on the external environment. A daytime sample taken during a period when (due to a striking action) the mine was not operating and was intended for purposes of information only. With no machine noise audible at this location, the daytime level was caused by natural sounds only, i.e. birds, insects and wind.
-	Sheeprun	45	35	Although no site-specific measurement was taken in this area, it is assumed that the current noise character corresponds to Rural District. This assumption is based on observations made in the initial scoping survey and is confirmed by the findings of the Hoogland noise study [5].
-	Kiwi Primary School	50		No site-specific measurement was taken in this area. Compared to residential locations where maximum impact occurs at night, offices, community centres and educational facilities operating during daytime are much less sensitive to noise. The current noise climate at the Kiwi Primary School and educational facilities to the north of the Everest Platinum Mine is still well within this guideline.

SANS 10103 Guidelines		Day (L_d)	Night (L_n)
Typical levels	Rural Districts	45	35
	Suburban little traffic	50	40
	Urban	55	45
	Urban - With some workshops, business premises & main roads	60	50
	Central business districts	65	55
	Industrial districts	70	60

Notes: L_d – day level L_n – night level

From the initial survey, the pre-mining ambient noise levels were identified to vary from 45dBA during the day to 35dBA during night-time (based on actual measurements). This is typical of a rural/agricultural environment (as defined by SANS 10103:2008). It was calculated by the noise specialist that the existing mining operations have an influence (to varying degrees) on ambient noise levels up to 5km from the mine site (in all directions). It is expected that noise will be mostly constrained by the high hills flanking the Groot Dwars River valley, except in the event of a thermal inversion (which can occur up to 40% in a year) in which case the noise could potentially propagate over the Steenkampsberge. Ambient noise levels along roads (such as the gravel road along the base of the Steenkamspberge) are influenced by traffic noise. From the survey, it was identified that ambient levels exceeded the standards for rural/residential type areas up to 250m from the road edge.

Noise sampling results from the follow up survey conducted by Acusolv (2012) are summarised in Table 1-12.

Conclusion

The typical pre-mining noise climate throughout the study area is that of a rural/agricultural environment. The main sources of noise include traffic (intermittent), farming activities (limited) and the existing mine (24-hr operation). The mine has influenced current ambient noise levels along main roads and within its immediate surrounds. The ambient noise levels adopted for receptor sites within the project area are based on the follow up noise survey specialist recommendations, are summarised below.

Area	**Ambient noise (Average level dBA)**	
	Day level (Ld)	**Night level (Ln)**
Receptors within 2,5 km distance from the Everest Plant	50	40
Receptors in the remainder of the study area	45	35
Educational	50*	-
Wilderness areas	No standard available therefore recommended that level be below that for residential farm houses as far as possible.	

* Indoor noise level should not exceed 40dBA.

1.1.9 VISUAL BASELINE

Information in this section was sourced from the approved EMP reports for the current mine infrastructure (approved July 2003, December 2009 and May 2010) and the Hoogland visual study (NLA 2010) (Appendix L) and should be read with reference to Figure 13 (Section 1.4).

Introduction and link to impacts

The presence of mine infrastructure has altered visual aspects of the area. Project-related activities have the potential to further alter the landscape character of the site and surrounding area through the establishment of temporary infrastructure (such as the open pits, stockpiles and support facilities). As a

baseline, this section provides an understanding of the visual aspects (such as landscape character, sense of place, scenic quality, and sensitive views) of the project area against which to measure potential change as a result of project infrastructure and activities.

Data Collection

Data on the visual resource was collected from 1:50 000 topographical maps, aerial images, site observations and photos taken of the study area from public vantage points. This data was then evaluated qualitatively to provide a description of the visual resource. To assist with the impact assessment, the data was also assessed quantitatively through photo/computer simulations and viewshed analysis to determine the extent of intrusion by project-related infrastructure. Further detail on the methodologies used is provided in the specialist report.

Results

The mine and project site has a remote setting in the Groot Dwars River valley and is screened from main public vantage points, such as the R577 provincial road, by the Steenkampsberge.

- Landscape character and quality

  The mountains that run north south and define the valley associated with the Groot Dwars River dominate the general character of the area. The terrace, flatter in profile, is less spectacular in visual appeal when compared to the Groot Dwars River valley. The visual quality of the Groot Dwars River valley is considered to be very high while the quality of the terrace is considered to be moderate. The lower rating for the terrace is a consequence of the intrusion of man-made elements (geometric forms of windbreaks associated with the orchards and the groves of wattle trees) and the flatter nature of the topography. The Hoogland project is located on the upper slopes (eastern) and across a small ridge line south of the existing mine. In its current state, the vegetation carries high conservation value. Invasive Black wattles have however infested many of the larger drainage lines within the study area.
- Scenic quality / visual resource value

  This is linked to the type of landscapes that occur within an area. In the study area, these range from high to low as follows:
  - high – these include the mountains, valleys and water resources (on- and off-site)
  - moderate – these include the agricultural activities (off-site), with some grazing occurring within the project site
  - low – these include existing mining infrastructure (off-site), power and communication facilities (off-site).

  The overall study area has a moderate visual resource value, as although the resource value is high within the sub-region, the areas surrounding the mine are low.
- Sense of place

Central to the concept of sense of place is that the landscape requires uniqueness and distinctiveness, the extent to which a person can recognise or recall a place as being distinct from other places – as having a vivid and unique character of its own. According to the visual specialist, the general atmosphere of the pre-mining environment was one of quiet rural 'out of the way' farmland set in a beautiful natural valley. Although the landscape has been impacted by the existing mining operation, the sense of place of the study area is informed by the landscape character, as it is the existing land uses (a combination of natural valleys and the surrounding mountains) that define a sense of place. The visitor has the distinct feeling of being in a natural, elevated 'bowl' that opens to the north and which is contained by dramatic topography on three sides. From higher vantage points, especially south of the proposed site, the rural/nature and rugged character of the scene is evident. These factors combine to evoke a strong response in the visitor, creating the perception that the place has a rather unique quality and character. However, there is a sense that the beauty and 'wildness' of the area is being lost to development.

- Views and visibility

  The mine is screened from public vantage points, such as the R577 provincial road, by the Steenkampsberge. Views of the Hoogland project site would be from adjacent properties and properties on the western side of the valley. These views are mostly from privately owned land. In some cases, these private lands are used for small scale tourism.

Conclusion

The project site is located in an area that has a mix of high value resource areas such as the mountains and valley environment and low value resource areas such as the existing mine. This results in a moderate visual resource. The landscape character of the area influences the activities and sense of place experienced by surrounding land uses (Sections 1.3.1). These surrounding uses are limited to agriculture, small scale tourism, protected areas, residential and mining Changing this visual resource further is unavoidable with the development of the project. However, the manner in which construction, operation and rehabilitation of the site takes place can remedy the intrusion to a certain extent during all phases of the project.

1.2 ENVIRONMENTAL ASPECTS WHICH MAY REQUIRE PROTECTION OR REMEDIATION

Environmental aspects both on the site applied for and in the surrounding area which may require protection or remediation during the life of the project are listed below. This list is based on the concise descriptions provided in Sections 1.1 and 1.3.

- Drainage patterns on site after closure
- Stripped and stockpiled soils
- Biodiversity

- Groundwater resources
- Ambient air qualities
- Noise environment
- Visual and landscape quality
- Surrounding land uses, socio-economic conditions and economic activity
- Heritage (and cultural) resources (not disturbed by project infrastructure)

1.3 LAND USES, CULTURAL AND HERITAGE ASPECTS AND INFRASTRUCTURE

1.3.1 LAND USES

Information in this section was sourced from the approved EMP reports for the current mine infrastructure (approved July 2003, December 2009 and May 2010), the various Hoogland specialist studies and site visits undertaken by the Metago EIA team and should be read with reference to Figure 15 (Section 1.4).

Introduction and link to impacts

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

Data collection

Surface right information was provided by Aquarius and confirmed by Metago through a deed search conducted in August 2011. Information on existing prospecting/mineral rights was compiled with input from Aquarius and Metago's knowledge of the area.

The collection of data on land use was done through site observations, studying of topographical maps and satellite images, input from various specialist studies conducted for the Hoogland project and Metago's knowledge of the area.

Results –Surface rights

Surface rights on, immediately adjacent and surrounding the mine and project site are held by the mine, private individuals and the Phetla (Table 13). This table does not represent all interested and/or affected parties (IAPs) registered on the IAP database but does given an indication of land ownership in proximity to the site. Relevant contact details are included in Appendix C. There has been a successful land claim in the area made by the Phetla community (Table 13, Figure 15).

It is expected that should the Hoogland project be approved, Aquarius will obtain the necessary access and lease agreements with the relevant parties.

TABLE 13: SURFACE RIGHTS ON AND SURROUNDING THE MINE AND PROJECT SITE

Farm name	Portion	Title deed number	Registered Landowner
Hoogland 38JT	0	T123832/2007	Bakoni Ba-Phetla Communal Property Association (CPA)
De Kafferskraal 53JT	0 (R/E)	T32333/1985	South African Kiwi Fruit Industry (Pty) Ltd
	R/E 13	T39108/1993	E Van Vuuren
	1	T88615/1998	DCP Nel
	2 and 11	T73180/1997	JC Riekert
	3	T26049/1984	South African Kiwi Fruit Industry (Pty) Ltd
	4, 5, 14 and 19	T17316/1993	TKO Property (Pty) Ltd
	6	T10246/1994	JV Blake
	8	T45962/2003	Aquarius Platinum South Africa (Pty) Ltd
	13	T30809/1993	ME van Vuuren
	15, 17 and 25	T123831/2007	Bakoni Ba-Phetla CPA
	18	(no longer exists – consolidated)	
	27	T17319/1993	Natal Kiwi Orchards (Pty) Ltd
Sterkfontein 52JT	RE	T166144/2005	Bakoni Ba-Phetla CPA
	1, 5 and 6	T41534/2001	Aquarius Platinum South Africa (Pty) Ltd
	3	T63949/1989	Breytenbach Belegings (Pty) Ltd
Sterkfontein 749 JT	0	T171108/2006	Bakoni Ba-Phetla CPA
Triangle 72JT	0	T25846/1975	Breytenbach Belegings (Pty) Ltd
De Berg 71JT	0 and 2	T25846/1975	
	1	T10246/1994	JV Blake
	6	T11852/1970	Republic of South Africa

Results – Mineral / Prospecting rights

Aquarius operates under a converted mining right (Original Mining License No.: ML14/18/2/5071) for portions of the farms Sterkfontein 52-JT, Sterkfontein 749-JT and De Kafferskraal 53-JT and holds a converted prospecting right (DMR Reference No.: MP 30/5/1/1/2/1051 PR, Prospecting Right No.: 132/2007 CPR) for the farm Hoogland 38-JT and the remaining extent of portion 1 of the farm de Kafferskraal 53-JT. The prospecting right was renewed until 12th December 2012. A Section 102 application was submitted to the DMR by Aquarius in May 2010 to amend the mine's approved EMP and to incorporate its prospecting right area into its mining right.

The geological location of the Hoogland ore body is illustrated in Figure 4. This EIA and EMP report covers the mining of this ore body.

Downstream of Aquarius' operations, there a number of mining rights that have been granted to various companies. These mining operations are at various stages in their development (Figure 1).

Results - Land uses

Land uses on and surrounding the mine and project site comprise wilderness/conservation, mining, agriculture and residential. More detail is provided below.

Wilderness/conservation

Large portions of land in the area have been identified to form part of the Mpumalanga Biodiversity Stewardship Programme by the Mpumalanga Tourism and Parks Agency (MTPA). These farms and farm portions are owned by private landowners and as per the documentation received, the contractual requirements to form part of this programme will be completed shortly. The farms identified to be protected areas according to MTPA are:

- Portion 34 of Draaikraal 48-JT
- Portions 13, 14, 21, 31, 32, 33 of Kliprivier 73-JT
- Portion 2 of Sheeprun 50-JT

Taking the above into account these areas will in future be classified as Protected Environment and Nature reserve as contemplated in Section 28 and Section 23 of the National Environmental Management: Protected Areas Act (NEM:PAA) (Act 57 of 2003).

To the south of Everest, on the farms Triangle 72-JT and De Berg 71-JT, is Davel Private Nature Reserve, a protected private nature reserve. From the information available, this reserve is used mainly for private use and small scale tourism.

Mining

The terrace above the valley is occupied by Everest mine infrastructure. An overview of the current operations is given in Section 1.5. Prior to mining, parts of the mining area were used for forestry (gum and pine plantations) and agricultural purposes (kiwi farming, subsistence crop farming and livestock farming). Agricultural activities (to varying degrees) still take place on the terrace in areas near to the current mining operations (Figure 15).

Some prospecting activities have however taken place in the valley resulting in the presence of dirt tracks. Further north, Anglo Platinum's Der Brochen mine and Northam Platinum's Booysendal Mine are at early stages of development (Figure 1).

Residential and community

There are several farmsteads and farm labourer residences located in the area surrounding the mine (Figure 15). In close proximity, to the north east of the proposed Hoogland project site, there are two private landowners, approximately 750m and 1500m respectively, who live and farm on their properties. Associated with these are farm labourer dwellings.

There are several non-landowners who reside on the terrace and cultivate small plots of land next to their homes to produce maize and vegetables for home consumption. Several non-landowners were relocated, in line with a relocation action plan, to make way for mining. These people were relocated to an area adjacent to the Boschfontein Road, north east of the mine (Figure 15). These people are referred to as the Kiwi community. The Kiwi community comprises approximately 260 people. The homes of non-landowners include traditional circular mud huts with grass roofs, brick houses and wooden and/or zinc shacks.

There are two schools on the terrace in the vicinity of the mine, namely the Kiwi Primary School (previously known as the TKO Primary School) and the Everest Early Childhood Development Centre (EECDC) (Figure 15). The Kiwi Primary School caters for approximately 120 children while the EECDC, is a crèche catering for approximately 60 children.

Agriculture - grazing

Vegetation within the broader study area is classified as sour veld. The grazing capacity of the veld ranges between 4 and 6 hectares per Large Animal Unit depending on the veld management skills of the land user. The majority of the land users surveyed indicated that grazing by cattle and game species a land use presently undertaken on their properties. The following land use units are solely used for the purpose of grazing:

- Portions 0 and 1 of Buttonshope 51-JT
- Portion 15 of Kliprivier 73-JT
- Portion 9 of Schaapkraal 42-JT
- Portions 0, 1, 4, 5 and 6 of Sterkfontein 52-JT

A variety of domestic browsers and grazers (cattle, sheep and goat breeds) as well as game species (such as eland, impala, kudu, mountain reedbuck and blesbuck) were identified as grazing on the surveyed land use units.

Watering facilities for the livestock have been erected in some of the cattle camps although most water is sourced from natural wetlands, dams or springs. There are also a number of farmers that source water from boreholes where the provision of electricity is possible as this seems to be the most reliable resource all year round.

On Portions 2, 23 and 45 of the Farm Kliprivier 73 JT, the landowner is currently farming and breeding with an Alpaca stud that is very well adapted in the mountain enclosure specifically because of its preference for high altitudes.

The remainder of the identified land use units have grazing land use in combination with another land use like tourism or agriculture.

Agriculture - Crop Farming

Small portions of land are currently used for irrigated as well as dryland crop farming. In the broader study area, crop cultivation is mostly only possible where the slope permits cultivation and were deep soils are found. Irrigated crops cultivated within the area include Lucerne as well as small areas with orchards while dryland crops are maize, forage crops and small areas of groundnuts. The most important factor for successful crop farming is availability of groundwater for irrigation and the correct soil depth and type.

Most fruit cultivated in the area fall within the deciduous fruit category, of which peaches are the most prominent in the area. This is because of the well-suited environment with the correct chilling units and the high rainfall. The lucrative local market for peaches also contributes to the growth of the market. Unique to the area is the kiwifruit farm. Kiwifruit is well adapted to the mountain enclosure around Everest specifically because of its preference for high altitudes and cold temperatures. Although large areas of the orchard still remains on Portions 3, 4, 7, 18 and 19 of De Kafferskraal 53 JT, it is not actively harvested and marketed. Adjacent to the current mining operations is a kiwi producing farm run by TKO Farming Enterprises and part owned by AQPSA. The farm comprises kiwi orchards, a pack house, offices, residences for farm labourers and farmhouses (occupied by the farm manager). The farm employs 34 full time labourers and 68 casual labourers (during harvesting time). These are sourced from the local community. The kiwi fruit are harvest from April to July. The fruit is sold to various fruit markets including Pick n Pay. The intention is for the farm to be handed over to the community as part of Aquarius' commitment to social investment.

Peaches for the dried fruit market are produced on the farm Sheeprun 179 JT.

Secondary support services/facilities

Infrastructure present in the area is directly linked to the type of land uses occurring in the area as described above. Support infrastructure and facilities identified in the area include (Figure 15):

- Road network (comprising the provincial R577 between Roossenekal and Lydenburg, a tarred district road off the provincial R577 providing access to the mine and surrounding farms, a gravel road along the base of the Steenkampsberge providing access to various farm units).
- Power supply and communication infrastructure

Conclusion

Land uses in the vicinity of the mine include agriculture (cultivation, livestock grazing), residential (private farmstead, rural village) and wilderness (conservation). At the Hoogland project site, the current land use is wilderness and livestock grazing. Private farmsteads are located in close proximity to the site with the

nearest house approximately 750m from the proposed north pit. When considered cumulatively with the current mine operations, there is the potential for these land uses to be impacted by the Hoogland project to varying degrees.

1.3.2 CULTURAL ASPECTS

Cultural aspects of the project area are discussed below as part of the heritage discussion.

1.3.3 HERITAGE (INCLUDING CULTURAL) ASPECTS

Information in this section was sourced from the approved EMP reports for the current mine infrastructure (approved July 2003, December 2009 and May 2010), the Hoogland heritage study (Pistorius 2010) (Appendix M) and the Hoogland palaeontology study (BPI for Palaeontological Research 2011) and should be read with reference to Figure 16 (Section 1.4).

Introduction and link to impacts

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

Heritage resources have been found at and near the site of existing mine infrastructure. These resources ranged in significance from low (such as stone artefacts, stone kraals, stone walled homesteads) to high (stone walls of a church and/or school, grave sites, cemetery, historic house). Resources of social and cultural importance were also identified including a rock gong. The proposed Hoogland project has the potential to disturb both the ground surface (through establishment of infrastructure) as well as soils and rock layers below the surface (through excavations for foundations and open pit mining). In this regard, heritage and palaeontological resources could be disturbed or destroyed. As a baseline, this section identifies the presence of heritage and palaeontological resources at the Hoogland project site and their conservation significance.

Data Collection

Data collection for the heritage survey was done by an accredited specialist through review of available databases, published reports and maps; previous studies done in the region; and site specific field work (including discussions with landowners). Further detail on the methodologies used is provided in the specialist report.

Data collection for the palaeontological survey was done by an accredited specialist through the review of geological information and relevant palaeontological research. No site-specific survey was deemed necessary by the specialist.

Results: Heritage (including cultural) resources

The mine and Hoogland project site are located in an area that can be considered as part of a cultural landscape that is marked by remains dating from the pre-historical into the historical (colonial) period. Stone Age site, Iron Age site and colonial remains therefore are common within such an area. There are two declared heritage sites located approximately 20km from Everest, namely the Mapochs Caves (Erholweni) west of the Groot Dwars Valley and the Groot Dwars River geological occurrence north of Everest.

For the Hoogland project site, the study identified the following resources within the site boundary: historical remains including that of a historical village, a single historical house and stone walls (without any clear context), graveyards and graves (see Table 14, Figure 16).

TABLE 14: HERITAGE RESOURCES IDENTIFIED IN THE PROJECT AREA

Site	Will site be disturbed by project?	Comments	Level of significance
Historical house			
Historical village (V01 – 08)	Yes – located within south pit	A number of dwellings which are located along the lower southern slope of a kopje. The village may have contained as many as ten dwellings which were constructed with mud and which were either attached to stone walls or which were located within the perimeters of stone walls. Only the stone walls of the village have survived.	Medium/High
HH01	Yes – located within north pit	Late 19th century, constructed with dolerite stone. It was probably fitted with a pitched corrugated iron or grass roof. Only part of one wall of this dwelling is still intact. This dwelling was occupied by a bachelor with the name of Ben Willemse during the 1940's. However, it is highly likely that the dwelling served as the original residence of the two Coetzee people who were buried in GY01 close to the dwelling.	Medium/High
Stone walls	Yes – some located within north pit, others will be avoided by the project	These walls are inconspicuous and not associated with any sites.	Medium/Low
Graveyards and graves			
GY01	Yes – located within waste dump	Graveyard holds two graves which are both fitted with dolerite headstones and with cement slabs.	High
GY02	No – but near to project footprint	This graveyard is located within an elongated enclosure which was constructed with stone. It holds the remains of at least thirteen members of the Ba-Phetla community. Most of the graves are demarcated with stones whilst at least five are fitted with cement headstones	High
GY03	No – but near to project footprint	This is a relatively large graveyard with at least fifteen graves of which many are fitted with granite headstones.	High

Site	Will site be disturbed by project?	Comments	Level of significance
G04	Yes – located near edge of the north pit	This single grave is covered with a cement slab and fitted with a cement headstone.	High
G05	No	This is a single grave fitted with a dolerite headstone with no inscription.	High

Results: Paleontological resources

All the rocks in the targeted area are Precambrian in age and do not contain any fossils. The rocks are in places overlain by younger Quaternary alluvium deposits which could host fossils.

Conclusion

Heritage resources do occur in the project area. Some of these resources will be disturbed by project-related infrastructure. These sites are important to the history and culture of South Africa and are protected by national legislation. Any disturbance of these sites requires the necessary permits and further assessment work prior to disturbance. In terms of paleontological resources, there is a limited to no potential for these resources to occur on site.

1.3.4 SOCIO-ECONOMIC PROFILE

Information in this section was sourced from the approved EMP reports for the current mine infrastructure (approved July 2003, December 2009 and May 2010), input from Strategy4Good and Metago's knowledge of the area and should be read with reference to Figure 1 and Figure 15 (Section 1.4).

Introduction and link to anticipated impact

Mines and projects of this nature have the potential to influence various aspects of the socio-economic profile of a community. This baseline section describes the socio-economic status of the region and mine area thereby providing the context within which the operations' potential impacts will occur.

Data collection

Data was sourced from the approved EMP (July 2003) and updated with more recent statistical data and mine-specific data supplied by AQPSA.

Results

The mine falls within the jurisdiction of the Ehlanzeni District Council and the Thaba Chweu Local Municipality in the Mpumalanga Province. Within the local municipality, the mine falls within Ward 5.

<u>Population density, growth and location</u>

The 2010 Quantec EasyData figures indicate that the Mpumalanga Province has a population of approximately 3.6 million people, with an average population density of 47.14 people per km^2, which is

slightly higher than that of South Africa as a whole (at 40.94 people per km^2). The population growth rate over the past decade (2001 to 2010) for Mpumalanga is estimated at 0.8 %. It is expected that population growth will generally focus on the larger towns and cities, which provide economic opportunities such as Witbank, Middelburg and Nelspruit, as well as within rural areas of the province. The Ehlanzeni District has a total of 1 526 237 people and the Thaba Chweu Municipality has a total population of 85 488. Ward 5 has an estimated population of approximately 1300.

At the mine level, there is a rural community referred to as the Kiwi community and private farms. The Kiwi community is made up mainly of people relocated from the site of current mine infrastructure and their families, Kiwi farm workers and their families, and members of the larger Bakone ba Phetla community (following the successful land claim). This Kiwi community houses approximately 260 people.

Where there are private farms, these usually comprise a single households with some associated labourer dwellings.

Employment

The employment situation in the Mpumalanga Province as well as the District is shown below. About 36% of the working-age population (defined as those between the ages of 15 and 65 years according to Statistics South Africa) in the Mpumalanga Province are employed. The percentage of employed people in the Thaba Chweu Municipality is higher at about 45 %.

	Mpumalanga Province	**Ehlanzeni District Council**	**Thaba Chweu Municipality**
Employed	36.32%	33.91%	45.07%
Unemployed	13.53%	12.70%	11.50%
Economically inactive	50.16%	53.38%	43.42%
Total working-age population	100%	100%	100%

Source: Quantec Easy Data, 2009 statistics

Major economic activities and sources of employment

The main sources of employment in the region of the mine are identified below. The table below shows that wholesale and retail trade, catering and accommodation are important sources of employment in the region. Mining employs 9 % of the people in the Mpumalanga Province and has increased from 0.52 % (in 1996) to 13% (in 2010) in the Thaba Chweu Municipality.

Economic Activity Group	**Mpumalanga Province**	**Ehlanzeni District Council**	**Thaba Chweu Local Municipality**
Agriculture, forestry and fishing	8%	8%	8%
Mining and quarrying	9%	3%	13%
Manufacturing	7%	7%	15%
Electricity, gas and water	1%	1%	1%

Economic Activity Group	Mpumalanga Province	Ehlanzeni District Council	Thaba Chweu Local Municipality
Construction	6%	5%	4%
Wholesale and retail trade, catering and accommodation	25%	24%	22%
Transport, storage and communication	4%	4%	5%
Finance, insurance, real estate and business services	11%	13%	9%
Community, social and personal services	14%	16%	10%
General government	15%	19%	14%
Total	**100%**	**100%**	**100%**

Source: Quantec Easy Data, 2010 statistics

In the vicinity of the mine, some people depend on employment on the farms, either seasonally or full time and at the Everest mine. Current estimates indicate that employment on potentially impacted surrounding farms is between 35 (the estimated actual current number) and 171 (the maximum possible number if the relevant farm land was to be used at full productivity) people (Strategy4Good, 2012).

Water supply

The people of the Mpumalanga Province obtain water from different sources as outlined below.

Water Supply Source	Mpumalanga Province	Ehlanzeni District Council	Thaba Chweu Local Municipality
Piped water inside dwelling	26%	18%	33%
Piped water inside yard	35%	29%	35%
Piped water on community stand: distance greater than 200m from dwelling	14%	20%	8%
Piped water on community stand: distance less than 200m from dwelling	16%	23%	17%
Borehole/rain-water tank/well	3%	2%	3%
Dam/river/stream/spring	3%	5%	4%
Water-carrier/tanker/Water vendor	1%	1%	0%
Other/Unspecified/Dummy	2%	2%	0%
Total	**100%**	**100%**	**100%**

Source: Quantec Easy Data, 2010 statistics

Most households in the Thaba Chweu Municipality are able to derive water either from their dwellings or from piped water on the community stand within 200 metres from their dwellings. Both locally and throughout the province, some people still use water from streams.

Most households in the vicinity of the mine obtain water from a yard tap or a communal tap (supplied by boreholes), private boreholes or natural springs. Some obtain water from streams.

Power supply

Over 80 % of households in the province utilise electricity as a source of lighting as outlined below. Most of electricity users are in urban areas. The use of paraffin and candles is common amongst rural households.

Energy Source Used for Lighting	Mpumalanga Province	Ehlanzeni District Council	Thaba Chweu Local Municipality
Electricity	83%	85%	81%
Candles	14%	12%	13%
Gas	0%	0%	0%
Paraffin	2%	2%	5%
Solar/other/unspecified	1%	1%	0%
Total	**100%**	**100%**	**100%**

Source: Quantec Easy Data, 2010 statistics

Other services

Provision of services other than water and power in the Thaba Chweu Municipality and the vicinity of the mine are outlined below. Services such as police stations, high schools, post offices, hospitals and public transport are absent. The local people depend on the nearest town, Lydenburg for services and they depend on lifts to go to Lydenburg.

Socio-economic data	Thaba Chweu Municipality	Everest area
Transportation	Taxis, School busses for school children. The rail passenger network in Thaba Chweu predominantly serves the mining and forestry sectors, and to a lesser extent that of farming (Source: Thaba Chweu IDP 2010/2011)	Mashishing (Lydenburg) – Transportation of mine workers from the compound at Skhila to Everest Mine (Source: Thaba Chweu IDP 2010/2011)
High Schools	Four (two at Mashishing, one at Lydenburg, one at Setageng)	The nearest high school is at Setageng and it is not within walking distance.
Hospitals	Two (one at Lydenburg and one at Sabie)	No hospital in the area. Patients have to travel to town in a situation of no public transport.
Sports and recreation	One rugby field and it belongs to the rugby club. One stadium at Mashishing and one at a high school in Lydenburg	No sporting facilities in the area.
Shopping centres	Lydenburg and Sabie	No shops in the area.
Industry (like mines, textile, manufacturing, etc.)	Mainly farming	One mine and one proposed mine in the area. There are farms, including the Kiwi fruit farm, which employs many people in the area.

Socio-economic data	Thaba Chweu Municipality	Everest area
Police and emergency services	Two police stations (one at Mashishing, one at Sabie, and one at Lydenburg). Two fire stations (one at Sabie and one at Lydenburg). One police station at Marteenshoop	No police stations and emergency services in the area.
Banks: how many or where they are, including ATM's	There are banks and ATMs at Lydenburg and Sabie	No ATMs/ banks in the area.
Post office	Two, one at Lydenburg and another at Sabie	No post office in the area.
Communications (Radio stations)	No radio station in the area	There is a network for the Thobela (Pedi), Jakaranda (Eng/Afr), Ligwalagwala (Seswati), Munghana (Tsonga), Ikwekwezi (Ndebele) radio stations
Cellphone networks	MTN and Vodacom	Vodacom network available in the area. No public phones.
Waste disposal facilities	One landfill site for the Lydenburg magisterial district. Plan to establish waste disposal sites at Sabie and Lydenburg in 2011/2012 (Source: Thaba Chweu IDP 2010/2011)	No waste collection services.

Everest has established an Early Childhood Development Centre adjacent to the existing Kiwi Primary School (previously known as the TKO primary school). These facilities are located near to the mine's operations, along the Boschfontein Road (Figure 15).

1.4 MAPS SHOWING THE SPATIAL LOCALITY AND AERIAL EXTENT OF ENVIRONMENTAL FEATURES

This section includes a series of maps that show the spatial locality and aerial extent of all environmental, cultural/heritage, infrastructure and land use features identified on site and on the neighbouring properties and farms.

- geological maps (Figure 3 and Figure 4)
- a topography and hydrology map (Figure 5)
- soil forms and their land capability identified on the project site (Figure 6)
- vegetation types and key ecological aspects of the area (Figure 7)
- vegetation communities identified on the project site (Figure 8)
- integrated conservation importance (sensitivity) of the project site (Figure 9)
- boreholes (hydrocensus and drilled) in the area (Figure 10)
- a schematic representation of the aquifers present in the project area (Figure 11)
- a schematic representation of groundwater flows and levels (Figure 12)
- landscape character of the area (Figure 13)

- property boundaries (Figure 14)
- land uses on and surrounding the project site (Figure 15)
- heritage resources (Figure 16).

FIGURE 3: GEOLOGICAL MAP OF THE EASTERN LIMB OF THE BUSHVELD COMPLEX

FIGURE 4: GEOLOGY AND STRUCTURAL FEATURES

FIGURE 5: TOPOGRAPHICAL AND HYDROLOGICAL FEATURES OF THE AREA

FIGURE 6: PRE-MINING SOIL TYPES AND ASSOCIATED LAND CAPABILITIES AT THE HOOGLAND PROJECT SITE

FIGURE 7: VEGETATION TYPES AND KEY ECOLOGICAL AREAS IN RELATION TO THE HOOGLAND PROJECT SITE

FIGURE 8: VEGETATION COMMUNITIES REPRESENTED ON HOOGLAND AND SURROUNDING PROPERTIES

FIGURE 9: INTEGRATED CONSERVATION IMPORTANCE

FIGURE 10: BOREHOLES AND SPRINGS IN THE AREA

FIGURE 11: GROUNDWATER ZONES AT HOOGLAND

FIGURE 12: GROUNDWATER LEVELS AND FLOW

FIGURE 13: LAND SCAPE CHARACTER AT THE MINE AND PROJECT SITE

FIGURE 14: PROPERTY BOUNDARIES IN THE VICINITY OF THE MINE AND PROJECT SITE

FIGURE 15: LAND USES ON AND SURROUNDING THE MINE AND PROJECT SITE

FIGURE 16: HERITAGE (AND CULTURAL ASPECTS) RESOURCES IN THE HOOGLAND STUDY AREA

1.5 SUPPORTING DOCUMENTS

The following specialist studies are attached as appendices to this report:

- soils and land capability study (Appendix F)
- biodiversity study (Appendix G)
- hydrological assessment (Appendix H)
- groundwater study (Appendix I)
- air quality study (Appendix J)
- noise studies (Appendix K)
- visual study (Appendix L)
- Phase 1 heritage (and cultural) impact assessment (Appendix M)
- Phase 1 palaeontological study (Appendix N)
- economic study (Appendix O).

2 CURRENT AND PROPOSED MINING OPERATION

INTRODUCTION

Everest is an operational platinum mine, established in 2003. This section provides an overview of the current approved operations and provides detail on the proposed Hoogland opencast project.

The existing Everest operations comprise declines for accessing the underground mine, ventilation shafts, historical rehabilitated opencast mining areas, ore and product stockpiles, topsoil and overburden stockpiles, crushing and screening, a concentrator plant, tailings dam, water management facilities, contractor areas to support the mining and processing operations, main access road and support services and facilities. Further detail is provided below.

The main aim of the Hoogland project is to access additional opencast ore reserves, south of the existing operations. The main project components will include two opencast pits; a temporary waste/overburden and soil stockpile area; storm water controls and in-pit facilities; a small area for parking vehicles, mobile site offices (the old farm house could be used for this purpose), portable ablution facilities and waste collection bins; and a haul road from the mine to the project site. Further detail is provided below.

Estimated project timelines are detailed below.

Aspect	**Mining activities**
Start construction	If the decisions are positive, target date is 4th quarter 2012.
Duration of construction phase	2 – 3 months
Start operation	1st quarter 2013
Life of operation	The estimated life of the project is 6 years however this could increase to 8 depending on the viability of mining the proposed south pit.

OVERVIEW OF THE CURRENT OPERATIONS AT EVEREST MINE

The current Everest infrastructure and activities are presented in Table 15. Reference should be made to the layout on Figure 19 and the flow diagram on Figure 17 when reading this section.

TABLE 15: SUMMARY OF CURRENT INFRASTRUCTURE AND ACTIVITIES

Infrastructure	**Description**
Access road and internal roads	• There are existing roads at the mine. These include a tarred access road off the Provincial R577, an internal tarred service road between the plant and decline areas and a network of gravel haul and service roads.
Helicopter landing pad	• There is a helicopter landing pad near the entrance of the mine, within the mine boundaries.
Conveyors, chairlifts	• There is a conveyor system feeding ore from underground to the crusher plant and from the crusher plant to the processing plant. • Chairlifts are used to transport employees within certain components of

Infrastructure	Description
Pipelines	• There is a network of pipelines distributing water (process, potable and stormwater) throughout the mine, tailings from the processing plant to the tailings dam and return water from the return water dam back to the process.
Exploration drill rigs and network of boreholes	• There is a network of exploration boreholes used to refine the extent of the ore reserves at the mine. This network is extended as mining advances.
Open pits	• Previously mined out and rehabilitated open pit areas, referred to as the historic north pit, historic south pit and central pit. • Rollover rehabilitation of the open pits was done during the mining of the pits.
Declines	• There are three decline systems used to access the underground mine. These include the north decline, south decline and valley decline. • The north decline comprises a three-decline system for men, materials and ore. The south decline comprises a single decline system for ore and materials. The valley decline comprises a single decline for men and materials only. • The original mine portal has been closed and rehabilitated following a surface subsidence above the decline in late 2008.
Ventilation shafts	• Downcast and upcast ventilation shafts exist at the mine, both on the terrace and in the valley.
Explosives	• There is an explosives storage and handling facility at the mine.
Stockpiles	• Stockpiles at the mine comprise topsoil stockpiles, run-of-mine (ROM) stockpiles, emergency stockpiles at the crusher plant, and chrome concentrate stockpiles. These are temporary. • There are two ore silos at the mine, one located near the primary crusher and the second near the plant.
Waste rock facilities	• During the establishment of the original decline small amounts of waste rock (hard overburden) were generated but it was used for the construction of the tailings dam. • There are two waste rock dumps at the mine, one located on the terrace and the second in the valley. These stockpiles are temporary and will be used as building material for the mine where required.
Crushing and screening plant	• There is a primary crusher located at the ROM pad.
Processing plant	• There is one concentrator plant at the mine. This plant is designed to process 250 000 tons run-of-mine ore per month. The plant comprises PGM and chrome processing sections.
Tailings dam	• There is an existing tailings dam at the mine. • The tailings dam has a design capacity of 16.46×10^6 m^3 (typically 3 million tons/annum over 11 years for a dry density of 1.85 t/m^3) and covers an approximate footprint of 90ha.
General and hazardous waste handling facilities, salvage yard	• Domestic and industrial hazardous waste produced by the mine is collected on site in demarcated areas. • There is a central salvage yard for the sorting and temporary storage of waste prior to collection by a waste contractor (Waste Technologist). • Final disposal of waste occurs off site at Holfontein (hazardous waste) and Lydenburg (domestic waste). No on-site landfill facility exists.
Water management facilities	• There are existing water management facilities at the mine. These include a return water dam, a plant process water dam, dirty stormwater dams and settling ponds for the underground operations.
Sewage treatment plants	• There are two sewage treatment plants at the mine, located at the plant and at the shaft area.
Water treatment	• There is no polluted water treatment facility at the mine, apart from the sewage treatment plants and settling facilities.
Contractor's areas	• There are contractor's areas servicing the mining and plant operations. • Each contractor's area comprises some or all of the following facilities depending on their requirements (these activities are however captured in more detail below): offices,

Infrastructure	Description
	workshops, stores, lay down areas, general and hazardous waste management facilities, change houses with ablutions (chemical toilets)
Parking areas	• Parking areas for equipment and site vehicles, busses, mine employees and visitors are located at the plant and mining area
Fuel storage facilities	• Fuel storage and handling facilities at the mine include bulk diesel and bulk oil facilities. These storage and handling facilities are located on concrete surfaces within bunded areas.
Workshops, stores, washbays	• A range of workshops exists at the mine for on-going maintenance and servicing of mine and plant equipment and vehicles. Workshops are located on surface (at the declines and plant) and in the underground mine. • Stores exist at the mine for the storage of mine supplies ranging from every day office supplies to hazardous substances (e.g. process chemicals for the plant). • Washbays for the cleaning of mine equipment and vehicles are located at the contractor's areas.
Offices buildings	• There are office buildings associated with the contractor areas at the plant and decline areas. • There is a main Aquarius office complex located at the plant, near to the entrance of the mine.
Change houses	• Change houses including ablution facilities are located at the contractor's areas at the plant and decline areas.
Laboratory	• A small laboratory forms part of the Plant area
Clinic	• There is a medical clinic on site. This clinic is for use by employees only.
Site canteen/ kitchen	• There is a canteen located at the shaft area for use by employees.
Housing	• No housing facilities exist at the mine.
Power lines, substations, transformers	• Power at the mine is supplied by Eskom. There are on-site substations and transformers used to distribute power throughout the mine. • Power supply to the mine is via an existing 133kV powerline from the Simplon substation. • Within the mine boundary, the power is mainly distributed by 11 kV power lines. • Approximately 30MVA of power is used by the mine at full production.
Compressors	• Compressors for supplying air to the underground mine occur on site.
Telephone lines	• There is a telephone line servicing the mine.
Security, fencing and access control	• There is a security fence around the perimeter of the mine as well as around components of the site. • There is security access control at the entrance to the mine.

Process flow – main process components

A process flow diagram of the main process components activities is presented in Figure 17. Each step in the flow diagram is described in Table 16.

TABLE 16: MAIN COMPONENTS OF THE EXISTING PROCESS FLOW

Stage	Description
Open pit mining (historic)	• Opencast mining has taken place on site. These areas have been mined out and rehabilitated. • The opencast mining operations comprised stripping and temporary stockpiling of topsoil and overburden. The reef was then drilled and blasted to loosen the ore. The ore was loaded and transported via truck to the ROM pad.
Underground mining	• Room-and-pillar stoping methods are used and a minimum stoping height of 1.6 m is maintained to allow the use of mechanised electro-hydraulic, low profile drilling jumbos

Stage	Description
	and low profile load-haul-dump (LHD) units. The size of the pillars will be a function of stope height and depth below surface, which ranges from between 25 to 190 m below surface. As the seam dip angle ranges from 6^{o} to up to 16^{o}, two stoping methods are used. • Wide-reef room-and-pillar stopingis used in all areas where the dip of the reef is less than 10^{o} to 12^{o}. This method is similar to that used at the Kroondal Platinum Mine and in most chrome mines in South Africa. Blasted ore is mucked by load haul dump units (LHDs) and tipped into loading bins feeding conveyors. • Steep room-and-pillar stopingis used where the dip of the reef exceeds 12º. The stopingis undertaken using hand-held rockdrill and leg in combination with electric scraper and hoe for cleaning. Dip scrapers are used to scrape broken material to the flatter lying areas where it is picked up by LHD and transferred to the nearest strike conveyor. • As the faces are mined along strike blasted material istrammed from the face to tipping points. Once the tramming distance exceeds approximately 100 m, strike conveyors are extended to within 20 m of the face. As the faces are mined further along strike, the secondary strike conveyors are extended in 75 to 100 m increments as the stopes are developed.
Waste rock dumps	• There is no waste rock dump. The UG2 reef consists of an upper leader seam separated from the main seam by a pyroxenite parting. As this parting is mineralised, it is mined and processed with the Leader and Main seams.
Ventilation	• There are four ventilation shafts. Two of the ventilation shafts are located in the Groot Dwars River valley. The shafts are raise-bored where possible so that there is limited disturbance of the surface during their development.
Dewatering	• Dewatering activities take place at the mine to ensure safe working conditions both underground and in the previous open pit operations.
Ore stockpiling	• Mined ore is stored mainly in concrete silos and only stored on temporary/emergency stockpiles from time to time. These stockpiles are then reclaimed for treatment in the plant.
Crushing and Screening	• The run of mine (ROM) ore will be subjected only to a single stage crush through a Jaw crusher, located at the portal head. This is to ensure that no rocks larger than 200 mm are fed to the plant.
Milling	• The ore is milled in two ball mills. • The milling process reduces the ore to a size whereby the platinum group metal (PGM) particles in the ore can be coated with the flotation reagents.

Flotation	• In the flotation process, the particles that the PGMs are associated with are coated with reagents that render them hydrophobic. This means that the particles will repel water and will adhere to the air bubbles that are introduced into the slurry to form a froth that floats to the surface of the slurry and is then collected.
	• A number of flotation steps are included to upgrade the froth to an acceptable level.
	• The reagents used in the process are:
	  • Sodium IsoButylXanthate (SIBX) – the “collector” that renders the particles hydrophobic;
	  • Sodium di-thiophosphate (DTP)– the “promoter” that improves the action of the collector;
	  • Polypropylene-glycol – the “frother” that assists in forming a stable froth; and
	  • Carboxy-methyl-cellulose (CMC) – the “depressant” which assists in preventing unwanted waste particles from floating into the froth.
	• The vast majority of these reagents pass with the froth to the plant concentrate. Some residual reagents are left in the waste slurry that will pass to the tailings dam.

Chrome recovery	• Prior to disposal on the tailings dam, the tailings is passed through a spiral plant to recovery chrome.
Filtration	• The final PGM concentrate that contains approximately 160 g of PGMs per tonne of concentrate (from the 3 g per tonne of ore) is filtered using a high-pressure filter.

Stage	Description
	• This produces a filter cake containing approximately 14 % moisture. This process recovers the bulk of the water from the froth and retains it within the plant.
Tailings	• The waste slurry is thickened in thickeners and then pumped to the tailings dam. This process recovers water from the waste and retains it within the plant.
Product handling	• Product (PGM filter cake and chrome concentrate) from the plant is loaded onto covered trucks and transported either to Impala's Refining Services near Rustenburg for further processing or sold.

2.1 MINERAL TO BE MINED

The target minerals to be mined include platinum group metals (PGMs) and associated minerals, the same as the current mining operations.

2.2 MINING METHOD TO BE EMPLOYED

This section should be read with reference to the conceptual process flow diagram (Figure 17), mine progression plan (Figure 18) and site layout drawings (Figure 19 – overall site layout and Figure 20 – Hoogland project site).

2.2.1 MINING OPERATIONS – OPEN PIT MINING

The proposed project will involve the surface mining of two new areas (Figure 20), within a similar UG2 ore body (see Section 1.1.6 for details on the ore body) using the same open pit mining methods (strip mining techniques) as were previously employed by the mine. Mining will initially focus on the North pit, where the resource estimation has been confirmed. Mining of the South pit will depend on the viability of the ore body within this area. Underground mining of the ore reserves is not possible due to the shallow nature of the ore body. Following site preparation and initial earthworks, drill and blast methods will be used to loosen the overburden/rock and ore. Blasting will be undertaken in line with recommended blast management principles (Section 19). Truck and shovel methods will be used to load and haul the materials to the waste dump or run-of-mine (ROM) pad, as appropriate (Figure 17).

The open pit will be developed as a series of pits. Boxcuts will be established at the end of each open pit and mining will progress inwards (Figure 18). The proposed strip mining method is detailed below.

- After stripping topsoil, the mine will strip subsoil to the weathered rock. The weathered and broken rock (broken by blasting) will then be removed from the pit. The soil, subsoil and broken rock will be stockpiled separately.
- The topsoil, subsoil and broken rock will be returned to worked out pits in the following order: broken rock will be placed in the pits first, subsoil will be placed over the broken rock; and then topsoil will be placed over the landscaped subsoil.

FIGURE 17: PROCESS FLOW DIAGRAM SHOWING MAIN PROCESS COMPONENTS

FIGURE 18: MINE PROGRESSION PLAN

Access to the working areas will be maintained through the use of temporary ramps. Ore from the proposed open pit operations will be used to supplement ore from the existing underground mine so as to ensure that the mineral processing plant operates as close as possible to full capacity.

One temporary waste dump is planned for the project (Figure 19 and Figure 20). This waste dump will be used to stockpile overburden and rock from the development of the open pits which will then be used in the rehabilitation of the open pits.

Information on the magnitude of the mining operations is presented in Table 17.

TABLE 17: DATA THAT PROVIDES PERSPECTIVE ON THE MAGNITUDE OF THE MINING OPERATIONS

Features		**Statistics**	**Comments**
Group	**Specific**		
Resource	Resource estimation	A minimum of 3.3 million tonnes	Could increase to 6.6 million tonnes depending on the viability of the south pit
	ROM rate	Approximately 600,000 tonnes run of mine per annum (50,000 tonnes per month)	Could increase to 80,000 tonnes per month depending on the viability of the south pit
	Overburden/rock rate	Approximately 22.5 million m^3	Could increase to 56 million m^3 depending on the viability of the south pit
	Life of mine	Approximately 6 years	This could increase to 8 depending on the viability of the south pit
Dimensions & footprints	Open pit area	Aerial extent: 50ha (final extent south pit) and 44ha (final extent north pit) Depth: On average, 60m Dimensions: ±1km x 0.4km (north pit) and 1.3km x 0.6km (south pit)	The ore body varies in depth between near surface and 80m (at its deepest part).
	Waste (overburden/rock) stockpile	Area covered: ±19ha Estimated height: ±30m	-
Blasting	Number of blasts per day	1 per day	Blasting will be limited to daylight hours on week days. No blasting will take place on the weekends.
	Blasting schedule	3 to 4 times per week	
Employment	Staff: construction	There are 50 construction jobs and 218 operation jobs linked to Hoogland specifically.	Employees needed for Hoogland project contribute to bringing mine back into full production and back in line with employment figures that were in place prior to the mine going onto care and maintenance. AQPSA has stated that the future of the mine is necessarily linked to the implementation of the Hoogland project. Therefore the employment figures extend beyond these 268 Hoogland specific jobs to the 1685 jobs for the project and the mine.
	Staff: operational		
	Operating hours	24 hrs a day, 6 days a week	Where possible, activities will be limited

Features		Statistics	Comments
Group	**Specific**		
			at night and on weekends.

2.3 LIST OF MAIN ACTIONS/ACTIVITIES/PROCESSES ON SITE

Key activities that will take place on site during each phase (construction, operational, decommissioning, closure) of the Hoogland opencast project are listed in Table below. For the purposes of this report, in broad terms, construction is the phase in which the project infrastructure is established, operational covers the production phase of the open pit, decommissioning is when production has ceased, infrastructure is being removed and final site rehabilitation takes place and the closure phase refers to the period of time when maintenance and aftercare of rehabilitated areas and facilities is required to ensure closure objectives are met.

This table reflects the chosen preferred alternative. Alternatives considered in the development of the proposed project plan are discussed in Appendix A. Further design details for components of the project plan, where required, are either included in the specialist reports or in the project action plans (see Section 19).

TABLE 18: LIST OF PROJECT ACTIONS / ACTIVITIES / PROCESSES FOR THE HOOGLAND OPENCAST PROJECT

Main activity/process	Sub-activities	Construction	Operation	Decommissioning	Closure
Exploration Exploration to refine extent of ore reserves.	Drilling, trenching, collection of samples	On-going	On-going		
Site preparation	Selective bush clearing in line with biodiversity management plan (see Section 19)	At start of phase	As mining advances		
	Removal of existing structures such as fencing (if present)	At start of phase			
Earthworks Earthworks on site relate mainly to the moving of soil and rock.	Stripping (including bulldozing) and stockpiling of soil resources in line with the soil management programme (see Section 19)	At start of phase	As mining advances		
	Bulk earthworks including digging trenches, compaction, and berms (stormwater controls as per stormwater management plan – see Section 19)	On-going			
	Establishing a haul road (approximately 2km long, 15m wide – using overburden and fill material)	At start of phase			
	Establishing service roads	At start of phase			
	Grading of roads	On-going	On-going	On-going	
Civil works Civil works on site relate mainly to any steel and concrete work.	Erection of temporary facilities	On-going			
	Concrete work including culverts	On-going			
Open pit mining	Drilling and blasting		On-going		
	Loading and hauling		On-going		
	Dewatering of the open pit		On-going		
	On-going rehabilitation of open pits as mining advances	Included below*			
Waste rock management	Temporary storage on waste dumps (on-site, on surface)		On-going		
	Backfilling of waste into mined out pits		On-going	On-going	
Mineral processing	This will take place at the existing plant – no additional capacity required.				
Tailings management	Existing tailings dam to be used – no additional capacity required.				
Power supply and use	Temporary power generation using diesel generators - <10MW	On-going			

Main activity/process	Sub-activities	Construction	Operation	Decommissioning	Closure
Water supply and use ** continue until infrastructure can be removed or alternative end use identified*	Use of mine allocated water during construction (small amounts) (bowser from existing mine)	On-going			
	Use of dewatered water from open pits (approximately 60m^3/day) (see water balance report –Appendix W)		On-going	On-going	
Stormwater management ** continue until infrastructure can be removed*	Diversion of clean water (via channels and berms)	On-going	On-going	On-going	
	Collection of dirty water using channels and berms	On-going	On-going	On-going	
	In-pit storage of dirty water for re-use *[north in-pit stormwater sumps – ±200,000m^3; south in-pit stormwater sump – ± 133,000m^3*	After rainfall events	After rainfall events	After rainfall events	
Process water management ** continue until infrastructure can be removed*	Collection of dirty water		On-going	On-going	
	Recycling of water back into process		On-going	On-going	
Transport systems ** continue until infrastructure can be removed or alternative end use identified*	Vehicles/machinery movement from mine to project site (via gravel service road)	On-going	On-going	On-going	On-going
	Vehicles/machinery movement within site boundary (via gravel roads)	On-going	On-going	On-going	
	Pumping of process water (polluted) within the site boundary (via pipelines, <400mm)		On-going	On-going	
Non-mineralised (general and industrial hazardous) waste management	Collection of general and hazardous waste on site in dedicated demarcated bins	On-going	On-going	On-going	
	Removal of waste to Everest temporary storage area before removal by contractor	On-going	On-going	On-going	
	Use of portable sanitation facilities	On-going	In pit	In pit	
Site support services ** continue until infrastructure can be removed or alternative end use identified*	Operating office	On-going	On-going	On-going	
	Parking of vehicles	On-going	On-going	On-going	On-going (but limited)
Storage and maintenance services/ facilities	This will take place at the existing mine.				
Site/contract management	Appointment of contractors and workers – off site	At start of phase	At start of phase		
	Site management (monitoring, inspections, maintenance of	On-going	On-going	On-going	On-going

Main activity/process	Sub-activities	Construction	Operation	Decommissioning	Closure
	facilities, security, access control)				
	Environmental awareness training and emergency response	On-going	On-going	On-going	On-going
	Implementing and maintaining management plans	On-going	On-going	On-going	On-going
Demolition	Removal of equipment and facilities			On-going	
	Removal of storm water controls, culverts etc.			On-going	
Rehabilitation*	Rehabilitating open pits and disturbed areas in line with biodiversity management plan (see Section 19)		On-going	On-going	
	Slope stabilisation		On-going	On-going	
	Landscaping		On-going	On-going	
	Restoration of natural drainage patterns as far as practically possible			On-going	
	Initiation of aftercare and maintenance			At end of phase	
Maintenance and aftercare	Monitoring, maintenance and repair of facilities and rehabilitated areas				On-going

2.4 PLAN SHOWING LOCATION AND EXTENT OF OPERATIONS

2.4.1 SITE LAYOUT PLANS

Site layouts include an overall site layout showing both existing and proposed infrastructure (Figure 19) and a zoomed in plan of the Hoogland project site (Figure 20).

The facilities proposed on site for the Hoogland opencast project is provided below (Figure 20).

- Temporary soil stockpile area
- Two opencast pits – referred to as the north and south pits
- Temporary waste dump for overburden and rock (including service roads and ramps)
- Office (use will be made of an existing farm house or mobile site offices will be established)
- In-pit dirty water storage facilities
- Clean and dirty stormwater diversions (berms and channels)
- Haul road between the existing mine and project site
- Internal haul roads within the site boundaries
- A parking area for cars and equipment during working hours
- Portable ablution facilities
- Jojo tank with potable water
- Temporary power generating infrastructure
- Stream crossings
- Security checkpoint at entrance
- Fencing and lighting (with masts) for security and safety reasons

These facilities will be established at the start of construction and remain in place until decommissioning.

FIGURE 19: SURFACE INFRASTRUCTURE LAYOUT (OVERALL SITE LAYOUT)

FIGURE 20: PROPOSED LAYOUT OF THE HOOGLAND PROJECT SITE

2.5 LISTED ACTIVITIES IN TERMS OF NEMA EIA REGULATIONS

The list of activities applied for under NEMA is included in Table 18. These activities have been incorporated into the list of project activities as presented in Table .

TABLE 18: NEMA LISTED ACTIVITIES APPLIED FOR (AS PER APPLICATION DATED MARCH 2010)

Notice and activity no:	Activity description	Activity listing under current regulations and applicability to Hoogland Project	Reason for withdrawal/ Not withdrawing
GNR 386 1 (b)	The construction of facilities or infrastructure, including associated infrastructure for the above ground storage of 1 000 tons or more but less than 100 000 tons of ore.	Activity 2 of GNR 544 - Not Applicable	No ore will be stored on the Hoogland site as it will be trucked from the open pits to the crusher at the mine. This activity is therefore withdrawn in terms of Regulation 76(2) of GNR 543.
GNR 386 1 (k)	The construction of facilities or infrastructure, including associated infrastructure for the bulk transportation of sewage and water, including storm water, in pipelines with (i) an internal diameter of 0.36 metres or more or (ii) a peak throughput of 120 litres per second or more.	Activity 9 or 37 of GNR 544 – Not applicable	Excess mine water will be transported back to the mine via a water bowser.
GNR 386 1 (l)	The construction of facilities or infrastructure, including associated infrastructure for the transmission and distribution of electricity above ground with a capacity of more than 33 kilovolts and less than 120 kilovolts.	Activity 10 of GNR 544 - Not Applicable	The proposed electrical transmission infrastructure will fall within the road reserve of the proposed haul road and will have a capacity of 11 kilovolts. This activity is therefore withdrawn in terms of Regulation 76(2) of GNR 543.
GNR 386 1(m)	The construction of facilities or infrastructure, including associated infrastructure for the possible presence of infrastructure within the 1:10 year flood line of a river or stream or within 32 m from the bank of a river or stream where the flood line is unknown, excluding purposes associated with existing residential use, but including (i) canals, (ii) channels, (iii) bridges, (iv) dams and (v) weirs.	Activity 11 of GNR 544 - Applicable	Sections of the north and south pit are located within the floodlines. The activity remains applicable.

Notice and activity no:	Activity description	Activity listing under current regulations and applicability to Hoogland Project	Reason for withdrawal/ Not withdrawing
GNR 386 1 (n)	The off-stream storage of water, including dams and reservoirs, with a capacity of 50 000 cubic metres or more, unless such storage falls with the ambit of the activity listed in item 6 of Government Notice No. R387 of 2006.	Activity 12 of GNR 544 – Possibly not applicable	The combined volume of the proposed in pit storm water management sumps is approximately 330 000 cubic metres in volume. The activity remains applicable.
GNR 386 1(u)	The construction of facilities or infrastructure, including associated infrastructure for the aboveground cableways and funiculars.	Activity 9 or 21 of GNR 546 - Not Applicable	The mine will haul the ore by truck. This activity is therefore withdrawn.
GNR 386 4	Dredging, excavation, infilling, removal or moving of soil, sand, rock exceeding 5 m^3 from a river or wetland.	Activity 18 of GNR 544 - Applicable	The berms adjacent to the streams will contain the river flow under flood conditions. The north pit covers wetland areas. The activity remains applicable.
GNR 386 7	The above ground storage of a dangerous good, including petrol, diesel, liquid petroleum gas or paraffin, in containers with a combined capacity of more than 30 cubic metres but less than 1000 cubic metres at any one locating or site.	Activity 13 of GNR 544 - Not Applicable	The mine will store a maximum of 8cubic metres of hydrocarbons on site and the existing facilities will be used as far as possible. This activity is therefore withdrawn in terms of Regulation 76(2) of GNR 543.
GNR 386 12	The transformation or removal of natural vegetation of 3ha or more or of any size where the transformation or removal would occur within a critically endangered ecosystem listed in terms of Section 52 of National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)	Activity 15 of GNR 545 – Applicable Activity 14 of GNR 546 - Applicable	The mine activities will be transforming more than 20ha of undeveloped land where >75% of the vegetation cover is indigenous. The activity remains applicable.
GNR 386 13	The abstraction of groundwater at a volume where any general authorization issued in terms of the National Water Act, 1998 (Act No. 36 of 1998) will be exceeded.	Not Applicable	There are no similar listings in GNR's 544, 545 and 546. This activity is therefore withdrawn in terms of Regulation 76(2) of GNR 543.
GNR 386 14	The construction of masts of any material or type and of any height, including those used for telecommunication broadcasting and radio transmission, but excluding- (a) masts of 15 metres and lower exclusively used (i) by radio amateurs; or (ii) for lighting purposes; (b) flag poles; and (c) lightening conductor poles.	Activity 3 of GNR 546 – Not applicable	The proposed lighting masts at the operations will fall within 5km of the Davel Private Nature Reserve (Recognised under NEMPAA). The masts will be temporary in nature and reach a height of 4m. The activity is no longer applicable.

Notice and activity no:	Activity description	Activity listing under current regulations and applicability to Hoogland Project	Reason for withdrawal/ Not withdrawing
GNR 386 15	The construction of a road that is wider than 4 m or that has a reserve wider than 6 m excluding roads that fall within the ambit of another listed activity or which are access roads of less than 30m long.	Activity 22 or 47 of GNR 544 – Applicable Activity 4 or 19 of GNR 546 - Applicable	The proposed haul road will be 15m wide and approximately 2km in length. The activity remains applicable.
GNR 386 19	The development of a new facility or the transformation of an existing facility for the conducting of manufacturing, processes, warehousing, bottling, packaging, or storage which, including associated structures or infrastructure, occupies an areas of 1000 square metres or more outside an existing area zoned for industrial purposes.	Not Applicable	There are no similar listings in GNR's 544, 545 and 546. This activity is therefore withdrawn in terms of Regulation 76(2) of GNR 543.
GNR 386 20	The transformation of an area zoned for use as public open space or for a conservation purpose to another use.	Activity 24 of GNR 544 - Applicable	The mine activities will be transforming more than 20ha of undeveloped land where >75% of the vegetation cover is indigenous. This land is zoned as agricultural. The applicability of this activity therefore requires input from the department.
GNR 386 25	The expansion of or changes to existing facilities for any process or activity, which requires an amendment for an existing permit or license or a new permit or license in terms of legislation governing the release of emissions, pollution, effluent.	Activity 28 of GNR 544 - Applicable	A water use license is required for the project from the Department of water Affairs (DWA). The activity remains applicable.
GNR 387 1 (e)	Any process or activity which requires a permit or license in terms of legislation governing the generation or release of emissions, pollution, effluent or waste and which is not identified in Government Notice No. R386 of 2005 or included in the list of waste management activities published in terms of section 19 of the National Environmental Management : Waste Act, 2008 (Act No. 59 of 2008) in which case the activity is regarded to be excluded from this list	Activity 5 of GNR 545 - Applicable	A water use license is required for the project from the Department of water Affairs (DWA). The activity remains applicable.
GNR 387 1(h)	The manufacturing, storage or testing of explosives, including ammunition, but excluding licensed retail outlets and the legal end use of such explosives.	Not Applicable	There are no similar listings in GNR's 544, 545 and 546. This activity is therefore withdrawn in terms of Regulation 76(2) of GNR 543.

Notice and activity no:	Activity description	Activity listing under current regulations and applicability to Hoogland Project	Reason for withdrawal/ Not withdrawing
GNR 387 1(j)	The bulk transportation of dangerous goods using pipelines, funiculars or conveyors with a throughput capacity of 50 tons or 50 cubic metres or more per day.	Not Applicable	There will be no bulk transportation of liquid or solid dangerous goods. This activity is therefore withdrawn in terms of Regulation 76(2) of GNR 543.
GNR 387 2	Any development activity including associated structures and infrastructure where the total area of the developed area is, or is intended to be, 20 hectares or more.	Activity 15 of GNR 545 - Applicable	The mine activities will be transforming more than 20ha of undeveloped land where >75% of the vegetation cover is indigenous. This land is zoned as agricultural. The applicability of this activity therefore requires input from the department.

In terms of GNR 546, this report has assessed and made public the activities:

- 12 in terms of GNR 546 (a); and
- 13 in terms of GNR 546 (c) (ii) (aa).

2.6 INDICATION OF PHASES AND TIMEFRAMES ASSOCIATED WITH MAIN ACTIONS/ ACTIVITIES/ PROCESSES

An indication of the phases and estimated timeframes in relation to the main actions, activities or processes and infrastructure is provided in Table above.

3 POTENTIAL IMPACTS ON THE BIO-PHYSICAL ENVIRONMENT

3.1 LIST OF POTENTIAL IMPACTS

This section provides a list of potential impacts on environmental aspects (excluding social and cultural aspects – see Section 6) separately in respect of each of the main project actions / activities and processes including activities listed in the NEMA and NEM:WA EIA regulations. The potential impacts are presented for each of the project phases in tabular format (Table 19). The full assessment of impacts is included in Section 7.

TABLE 19: LIST OF POTENTIAL IMPACTS AS THEY RELATE TO PROJECT ACTIONS / ACTIVITIES / PROCESSES (EXCLUDING SOCIAL AND CULTURAL)

Activity	Phase	Impacts (unmitigated)
Exploration Drilling, trenching, sample analysis	Construction Operation	Loss of soil resources and land capability Physical destruction and disturbance of biodiversity Air pollution Disturbing noise
Site preparation Bush clearing, removal of fencing (if present)	Construction Operation	Physical destruction and disturbance of biodiversity Alteration of drainage patterns Air pollution Disturbing noise Negative landscape and visual impact
Earthworks Stripping and stockpiling soils, bulldozing, temporary gravel roads, trenches, and compaction, establishing stormwater controls, road grading	Construction Operation Decommissioning	Hazardous excavations Loss of soil resources and land capability Physical destruction and disturbance of biodiversity Alteration of drainage patterns Pollution of surface water Air pollution Disturbing noise Negative landscape and visual impact
Civil works Erection of facilities, concrete work	Construction	Hazardous excavations Loss of soil resources and land capability Pollution of surface water resources Contamination of groundwater Air pollution Disturbing noise Negative landscape and visual impact
Open pit mining Drilling, blasting, load, hauling, dewatering,	Operation Decommissioning	Hazardous excavations Loss of soil resources and land capability Pollution of surface water resources Dewatering impacts Air pollution Disturbing noise Negative landscape and visual impact

Activity	Phase	Impacts (unmitigated)
Waste rock management Temporary storage	Operation Decommissioning	Hazardous excavations Loss of soil resources and land capability Disturbance of biodiversity Pollution of surface water resources Contamination of groundwater Air pollution Disturbing noise Negative landscape and visual impact
Power supply and use Temporary generation	Construction	Physical destruction and disturbance of biodiversity Negative landscape and visual impact
Water supply Re-use, storage of clean water (in JoJo tanks)	Construction Operation Decommissioning	Hazardous excavations Disturbing noise
Stormwater management Stormwater channels and berms, collection of dirty, in-pit storage for re-use	Construction Operation Decommissioning	Hazardous excavations Loss of soil resources and land capability Alteration of drainage patterns Pollution of surface water resources Contamination of groundwater Disturbing noise
Process water management Collection, in-pit storage of dirty for re-use, recycling	Operation Decommissioning	Hazardous excavations Loss of soil resources and land capability Pollution of surface water resources Contamination of groundwater Disturbing noise
Transport systems Transport to and from site for employees and supplies, movement within site boundary (haul roads)	Construction Operation Decommissioning Closure (limited road)	Physical destruction and disturbance of biodiversity Pollution of surface water resources Air pollution Disturbing noise Negative landscape and visual impact
Non-mineralised (general and industrial hazardous) waste management Collection, transport to existing mine area, portable ablutions on site	Construction Operation Decommissioning Closure (limited)	Loss of soil resources and land capability Pollution of surface water resources Contamination of groundwater Disturbing noise Negative landscape and visual impact
Site support services Operating offices, parking vehicles	Construction Operation Decommissioning Closure (limited)	Loss of soil resources and land capability Disturbance of biodiversity Air pollution Negative landscape and visual impact
Site/contract management Appointment of workers/contractors, site management (monitoring, inspections, maintenance, security, access control), awareness training, emergency response, implementing and maintaining programmes	Construction Operation Decommissioning Closure	Management of the site plays a significant role in all identified impacts
Demolition Removal of equipment and facilities	Construction Decommissioning	Loss of soil resources and land capability Disturbance of biodiversity Air pollution Disturbing noise Negative landscape and visual impact

Activity	Phase	Impacts (unmitigated)
Rehabilitation Rehabilitating open pits, replacing soil, slope stabilisation, landscaping, re-vegetation, restoration	Operation Decommissioning Closure	Hazardous excavations Loss of soil resources and land capability Disturbance of biodiversity Alteration of drainage patterns Pollution of surface water resources Contamination of groundwater Air pollution Disturbing noise Negative landscape and visual impact
Maintenance and aftercare Inspection and maintenance of remaining facilities and rehabilitated areas	Closure	Loss of soil resources and land capability Disturbance of biodiversity Pollution of surface water Air pollution Negative landscape and visual impact

3.2 LIST OF POTENTIAL CUMULATIVE IMPACTS

Potential cumulative impacts associated with the project, were identified by considering the existing land uses (including the existing mine) together with the proposed development, and include:

- Hazardous structures/excavations
- Loss of soil resources and associated natural land capabilities
- Disturbance of biodiversity (land and water based) through physical destruction and general disturbance
- Alteration of drainage patterns
- Pollution of surface water resources
- Contamination of groundwater
- Increase in air pollution
- Increase in disturbing noise levels
- Negative landscape and visual impacts
- Loss of land uses
- Disturbance of heritage resources
- Economic impacts (positive and negative)
- Change in land values

3.3 POTENTIAL FOR ACID MINE DRAINAGE OR GROUNDWATER CONTAMINATION

Information in this section was sourced from the groundwater study (GCS 2010).

3.3.1 GEOCHEMICAL TEST WORK

As part of the mine's approved EMP (July 2003), acid-base accounting tests (ABA) were conducted on rock and tailings samples to determine the potential of exposed rock in the mine workings and the

tailings dam to produce acid rock drainage. These tests were coupled with element enrichment tests to provide an indication of the main soluble chemical constituents that would be present in leachate from exposed rock in the mine workings and from the tailings dam. The materials tested included tailings from Kroondal Platinum Mine, Rustenburg and rock samples from exploration boreholes at Everest.

For the Hoogland project, four waste rock / overburden samples were analysed using acid-base accounting (ABA) to determine the acid generating potential of the material. Leach tests were also conducted to provide an indication of the elements that will become soluble and potentially pollute the environment. These samples are representative of the waste/overburden that will be stockpiled during the operation of the open pits and the used as backfill in the rehabilitation of the pits.

3.3.2 SUMMARY OF RESULTS

The approved EMP report (July 2003) indicated that exposed rock and the tailings from the Everest operations are unlikely to produce acid rock drainage. From the element enrichment tests, it was concluded that water from the tailings dam and the underground workings will have elevated salinity levels, with sulphate being the dominant ion. Water from the tailings could also contain elevated levels of nitrate.

For the Hoogland project, the low sulphide content (<0.25%), high neutralising potential ratio (NPR) ratio and rock classification indicate that there is no potential for acid generation. The major elements that were leached were calcium, magnesium, sodium, silicon, iron, manganese. However, the heavy metals are expected to be retained in the system under normal natural pH and Eh conditions. The ore body to be mined does not contain significant amounts of sulphide minerals that would contribute towards acid rock drainage that would mobilize these elements.

3.3.3 OVERVIEW OF ASSESSMENT AND EVALUATION OF IMPACT

As outlined in Section 7.2.8, the potential for acid groundwater contamination as a result of the Hoogland project is limited.

3.3.4 RECOMMENDATIONS MADE BY THE GEOHYDROLOGY STUDY

No specific recommendations made by the geohydrology study as there is no potential for acid mine drainage occurring as a result of the project.

4 ALTERNATIVE LAND USE OR DEVELOPMENT

4.1 DESCRIPTION OF ALTERNATIVE LAND USE OF THE AREA

The project site is currently used for wilderness (conservation) and livestock grazing. Immediately surrounding land uses are similar to this with the addition of farmsteads and farming. Further afield mining and tourism-type activities take place (see Section 1.3.1 for a detailed description of existing land uses in the area). As an alternative to the development of the opencast project, these current land uses would continue.

It is noted however that some landowners would like to establish a game lodge or some sort of tourism-related facilities in the area. The scale and potential for this however is unknown.

4.2 MAIN FEATURES AND INFRASTRUCTURE RELATED TO ALTERNATIVE LAND USE / DEVELOPMENT

Given the discussion above, no infrastructure development is envisaged to support the existing land uses.

4.3 PLAN SHOWING LOCATION AND EXTENT OF ALTERNATIVE LAND USE / DEVELOPMENT

Not applicable as no infrastructure development envisaged.

5 POTENTIAL IMPACTS OF ALTERNATIVE LAND USE OR DEVELOPMENT

5.1 LIST OF POTENTIAL IMPACTS

Potential impacts, expected to occur as a result of the alternative land use / development include degradation from over-grazing and/or improper veld management.

5.2 LIST OF POTENTIAL CUMULATIVE IMPACTS

Potential cumulative impacts associated with the alternative land use, when compared to the existing land use on site and in the surrounding area, are expected to include:

- Increased pressure on veld resources for grazing purposes – this in turn has the potential to impact on biodiversity (depending on the number of grazers and grazing practises)
- Localised silting of watercourses at road crossings

6 POTENTIAL SOCIAL AND CULTURAL IMPACTS

6.1 LIST OF POTENTIAL IMPACTS ON SOCIO-ECONOMIC CONDITIONS OF THIRD PARTY LAND USE ACTIVITIES

Potential impacts on the socio-economic conditions of other parties land use activities both on site and in the surrounding area are discussed in detail in Section 7 and listed below. This list includes potential impacts on cultural and heritage resources (Section 6.3).

- Loss of current land uses through impacts on the bio-physical environment
- Blasting hazards
- Disturbance of heritage resources
- Economic impacts (positive and negative)
- Informal settlements, safety, security and services and associated social ills
- Change in land values

6.2 CULTURAL ASPECTS AND POTENTIAL IMPACTS THEREON

Cultural aspects are discussed as part of heritage discussion below.

6.3 HERITAGE FEATURES AND POTENTIAL IMPACTS THEREON

6.3.1 HERITAGE (AND CULTURAL) FEATURES

Heritage (and cultural) features on site include graveyards, a historical house, a historical village and isolated stone walls (see Section 1.3.3 for further detail). The majority of these will be disturbed by mining activities. The disturbance of these sites is unavoidable due to the location of the ore body. It is also possible that further heritage resources, such as unmarked graves, are uncovered during the development of the mine and site. This is expected to be unlikely but still possible.

Potential impacts on heritage (including cultural) features include the loss of these resources for future generations through physical destruction and/or disturbance (described further in Sections 7.2.15). These resources are protected by national legislation and require mitigation prior to any disturbance.

6.3.2 PALEONTOLOGICAL FEATURES

All the rocks in the targeted area are Precambrian in age and do not contain any fossils. The rocks are in places overlain by younger Quaternary alluvium deposits which could host fossils. It is considered (by the specialist) highly unlikely that any will be uncovered during the development of the

mine (see Section 1.3.3 for further detail). No impacts are therefore expected. Although unlikely, should any fossils be uncovered during the development of the site, a palaeontologist or paleoanthropologist should be consulted as this could open up possibilities for research.

6.4 QUANTIFICATION OF THE SOCIO-ECONOMIC IMPACTS

Land use analysis study was undertaken for the project. Results from the analysis informed the impact assessment described in Section 7.2.12. In this regard, it was identified that the proposed project has the potential to impact on surrounding land uses and economic activity (contributing impact factors are air, noise, visual, blasting), but with mitigation these impacts may be reduced, particularly in the closure phase of the project.

The socio-economic impacts have been assessed and quantified in Section 7.2.18 to 7.2.21. The main conclusions are quantified below:

- The Hoogland project is necessarily linked to the continuation of the Everest Mine. The related economic benefit of proceeding with the project (and by implication the mine) far exceeds the potential economic losses to the surrounding land uses for both GGP and employment.
- Potential negative socio-economic impacts associated with the influx of people, and the formation of informal settlements, are significant but can be mitigated to acceptable levels.
- The potential exist for a negative impact on surrounding land values. This impact is linked to the discussion of land use impacts and related mitigation in Section 7.2.12.

7 ASSESSMENT AND EVALUATION OF POTENTIAL IMPACTS

7.1 LIST OF EACH POTENTIAL IMPACT

Potential environmental impacts were identified by Metago in consultation with IAPs, regulatory authorities, specialist consultants and Aquarius. The impacts are discussed under issue headings in this section. All identified impacts are considered in a cumulative manner such that the current baseline conditions on site and in the surrounding area and those potentially associated with the project are discussed and assessed together.

Potential impacts identified for the project, in no specific order, include:

- Hazardous structures/excavations
- Loss of soil resources and associated natural land capabilities
- Physical destruction of biodiversity (land and water based)
- General disturbance of biodiversity (land and water based)
- Pollution of surface water resources
- Dewatering impacts on groundwater users
- Dewatering impacts on baseflow
- Contamination of groundwater
- Increase in air pollution
- Increase in disturbing noise levels
- Negative landscape and visual impacts
- Loss of current land uses
- Blasting hazards
- Project-related road use and traffic (negligible)
- Disturbance of heritage resources
- Loss of palaeontological resources
- Loss of mineral resources through exploitation and sterilisation
- Economic impacts (positive and negative)
- Informal settlements, safety, security and services and associated social ills
- Change in land values

7.2 IMPACT RATING FOR EACH POTENTIAL IMPACT

The impact rating for each potential impact listed above (Section 7.1) is provided in the section below. The criteria used to rate each impact is outlined in Section 7.3. The introduction to each impact provides an overview of the current state of environment taking into consideration existing impacts at the mine. All identified impacts are considered in a cumulative manner such that the impacts of the

current activities on and surrounding the site and those potentially associated with the project are discussed and assessed together.

Although no direct impacts can physically occur on site as a result of the planning and detailed design phase of the project, there may be specific planning and design management measures that are required to limit or prevent potential impacts. Where relevant, this is specified in the various sections.

The potential impacts are rated with the assumption that no mitigation measures are applied and then again with mitigation. Management measures to address the identified impacts are included in the EMP (Section 2). These are a combination of existing Everest measures and proposed measures, by AQPSA and the EIA team (including specialists), for the Hoogland project site. In most cases (unless otherwise stated), these management measures have been taken into account in the assessment of the significance of the managed/mitigated impacts only and the unmanaged scenario does not take account of either the current or proposed management on site.

An indication of the phases in which the impact will occur is provided below and summarised in Section 7.4 together with the estimated timeframes for each rated impact.

TOPOGRAPHY

7.2.1 ISSUE: HAZARDOUS STRUCTURES / EXCAVATIONS

Introduction

Hazardous structures include all excavations, infrastructure or land forms into or off which third parties (non-mine personnel) and animals can fall and be harmed. Included in this category are facilities that can fail (such as the existing tailings dam, proposed pit side slopes) and in the context of mining, surface settlement can occur if backfilled material is inadequately compacted in mined out open pits (proposed) and if inadequate support is provided in the existing underground mine.

The mine's approved EMP report (approved July 2003) assessed that surface subsidence above the mine workings would not occur due to the support provided underground. Subsidence, although shallow (20cm), has taken place at the mine above the original decline (in late 2008). The subsidence was as a result of a combination of factors: the mine experienced a rainfall event of 220mm in one day and the excessive percolation of water into the mine weakened a geological infill layer. The infill layer is evident in the support pillars in a small upper area of the mine and combined with an increased dead weight due to the rain, the pillar strength was exceeded and the area became unstable and subsided. The mine has since designed a new mine pillar layout based on numerical modelling to ensure that surface subsidence above the underground workings does not re-occur. It

should be noted that apart from the single event described above, no surface subsidence above the rehabilitated open pits has occurred at the mine.

For the Hoogland project, hazardous excavations occur in most project phases from construction through operation to decommissioning and closure (see Section 3, Table for further detail). In the construction and decommissioning phases these hazardous excavations and infrastructure are temporary in nature, usually existing for a few weeks to a few months. The operational phase will present more long term hazardous excavations and infrastructure such as the open pits and waste dump and the closure phase will present final land forms that may be considered hazardous.

Rating of impact

Severity / nature

Hazardous excavations and structures exist at the mine and without mitigation (already implemented by the mine) these would present a potential risk of injury and/or death to both animals (wildlife and livestock) and third parties resulting in a high severity impact. For the Hoogland project site, hazardous excavations and infrastructure include the open pits and temporary stockpiles. In the unmitigated scenario the severity of potential impacts is high. With management, the severity reduces to medium because instead of a potential fatality or major injury the risk would be reduced to minor and/or no injury.

Duration

In the context of this assessment, death or permanent injury to humans and animals is considered long term and permanent, regardless of the phase or mitigation applied.

Spatial scale/extent

For the most part, the direct impacts will be located within the site boundary, but the indirect impacts will extend to the communities to which the people / animals belong. This is applicable to all project phases, with or without mitigation.

Consequence

In the unmitigated and mitigated scenarios, the consequence of this potential impact is high in all project phases.

Probability

In the unmitigated scenario, there is a high possibility that hazardous excavations and infrastructure (as identified above) will present a risk to unaccompanied third parties and free-roaming animals both at the mine and at the Hoogland project site during all phases. After closure, the subsidence above

the backfilled pits may present a risk to third parties and free-roaming animals depending on the effectiveness of mitigation measures applied.

Measures implemented by the mine including access control, security, appropriately backfilled pits and appropriately designed facilities limits the risk of these existing structures posing a hazard to third parties and animals (wildlife and livestock). In addition the existing tailings dam has been built outside of the 1:100 year floodline, reducing the risk of failure.

The proposed management measures for the Hoogland project site will focus on limiting access to third parties and animals and the safety and stability of the open pits and associated stockpiles which reduces the probability of the impact occurring.

Significance

In the unmitigated scenario, the significance of the potential impact is high in all project phases. In the mitigated scenario, the significance of this impact can be reduced to medium-low.

Tabulated summary of the rated cumulative impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	H	H	M	H	H	H
Mitigated	M-L	H	M	H-M	L	M-L

Description of existing and proposed Everest management measures

Discussion of the management measures is provided in the EMP (Section 19).

SOIL AND LAND CAPABILITY

Information based on approved EMP reports for the current mine infrastructure (approved July 2003, December 2009 and May 2010) and the Hoogland soils and land capability survey (ISCW 2010) (Appendix F).

7.2.2 ISSUE: LOSS OF SOIL RESOURCES AND ASSOCIATED NATURAL LAND CAPABILITIES THROUGH PHYSICAL DISTURBANCE, EROSION, COMPACTION AND CONTAMINATION

Introduction

Soil is a valuable resource that supports a variety of ecological systems. Soil resources can be impacted through physical disturbance (including erosion) and/or contamination. Contamination of soils also has the potential to enter both surface and groundwater resources (see Sections 7.2.6 and 7.2.8, respectively). The loss of soil resources has a direct impact on the potential loss of the natural

capability of the land. This section therefore focuses directly on the potential for disturbance and contamination of the soil resource and the effect this has on land capability and soil functionality. Any potential direct impacts on soil will potentially have secondary impacts on the ecological systems that make use of the soil for survival (biodiversity-related issues discussed in Section 7.2.4).

There are a number of activities/infrastructure in all phases that have the potential to result in a loss of soils and associated land capabilities (see Section 3, Table for further detail). In the construction and decommissioning phases these activities are temporary in nature, usually existing from a few weeks to a few months. The operational phase will present more long term activities and the closure phase will present final land forms that may be susceptible to erosion. In rehabilitation, soil is the key to re-establishing post closure land capability and land use.

Rating of impact

Severity / nature

The development of the current mine infrastructure and previous mining of the open pits has disturbed approximately 160ha of soil resources at the mine. This includes a range of soil types (ranging from deeper arable soils to shallow soils in rocky areas) and land capabilities (ranging from arable and grazing to wilderness and wetland capabilities). If unmitigated, the physical disturbance (including contamination) of soil resources can result in a loss of soil functionality as an ecological driver (soil is the medium in which most vegetation grows) and may impact on the soils ability to sustain ecological systems post-mining. In addition to this, where vegetation cover has been removed, exposed land is susceptible to erosion. In the case of erosion (through wind or water), the soils are lost to the area of disturbance. The natural slope gradients at the mine site, which are steep in some areas, add to the erosion potential. In the case of compaction the soils functionality is firstly compromised through a lack of rooting ability and aeration, and secondly the compacted soils are likely to erode because with less inherent functionality there will be little chance for the establishment of vegetation and other matter that naturally protects the soils from erosion. In the case of potential contamination, the use and handling of fuels, lubricants, other potential contaminants and poor waste management could result in a permanent loss of soil resources. Potential seepage and/or dirty runoff from residue waste stockpiles could alter the soil composition, negatively impacting on the chemistry of the soils and thereby impairing growth conditions. Although there is limited potential for acid rock drainage (see Section 3.3), high concentrations of suspended solids and dissolved salts within these seepage/runoff waters could negatively impact soil resources. Without the implementation of mitigation measures (already in place at the mine), this would result in a high severity impact and possibly result in a permanent loss of the natural capability of the soils.

For the Hoogland project, an additional approximate 160ha of soil resources will be disturbed (through physical disturbance and potential erosion) by the development and operation of the open pits and

associated infrastructure. The project site mainly comprises shallow soils with rock (with a grazing and/or wilderness land capability), but is located on a relatively steep gradient. This together with the removal of vegetation for the purposes of mining would exacerbate the potential for erosion. Some parts of the project will disturb deeper more arable type soils (with moderate to low agricultural potential). The use of explosives, fuels and lubricants and poor waste management has the potential to contaminate soil resources. In the unmitigated scenario, when considering the soil disturbance alone the severity is medium for all phases. However when taking into consideration the soil functionality in terms of supporting of the unique biodiversity found on site (see Section 1.1.4), the severity increases to high in the unmitigated scenario. With mitigation, soils can be conserved and re-used (as was done at the previous open pits), the number of pollution events should be significantly less than in the unmitigated scenario, and appropriate controls can be engineered to minimise erosion on the steeper slopes. The combination of these measures reduces the potential severity to medium to low in the mitigated scenario.

Duration

In the unmitigated scenario the loss of soil and related functionality is long term and will continue after the life of the mine. With mitigation, in the case of physical disturbance, the soil is conserved and replaced and in the case of contamination, the potential pollution should either be avoided or remedied. Important related issues are the reaction time of the clean-up team and the chosen remediation methods. This reduces the duration of impacts to within the mine life.

Spatial scale / extent

In the unmitigated scenario for all phases of the project, the potential loss of soil resources and associated land capabilities would extend beyond the site boundary due to the steep terrain and presence of drainage lines as preferential flow paths. With mitigation, the potential loss could be restricted to within the site boundary.

Consequence

In all project phases, the consequence of the impact is high in the unmitigated scenario, however it can be reduced to a medium-low with mitigation.

Probability

In the unmitigated scenario, a loss of soil resource and associated land capability and functionality is definite for all phases. With mitigation, the probability will be reduced because emphasis will be placed on soil conservation and re-establishment, erosion control, on preventing pollution events and on quick and effective remediation if pollution events do occur. The probability of impacts occurring in the mitigated scenario is low to moderate due to the challenges posed by mining and operating in an

area with steep slopes – there is the potential for some erosion post rehabilitation and the presence of drainage lines that act as preferential flow paths.

Significance

In the unmitigated scenario this potential impact is high, however with mitigation it can be reduced to a medium-low.

Tabulated summary of the rated cumulative impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	H	H	M	H	H	H
Mitigated	M-L	M	L	M-L	L-M	M-L

Description of existing and proposed Everest management measures

Discussion of the management measures is provided in the EMP (Section 19).

BIODIVERSITY

Information based on the approved EMP reports for the current mine infrastructure (approved July 2003, December 2009 and May 2010) and the Hoogland biodiversity study (Ecorex 2011) (Appendix G).

In the broadest sense, biodiversity provides value for ecosystem functionality, aesthetic, spiritual, cultural, and recreational reasons. The known ecosystem related value is listed as follows:

- soil formation and fertility maintenance
- primary production through photosynthesis, as the supportive foundation for all life
- provision of food and fuel
- provision of shelter and building materials
- regulation of water flows and water quality
- regulation and purification of atmospheric gases
- moderation of climate and weather
- control of pests and diseases
- maintenance of genetic resources (key for medicines, crop, livestock breeding and game breeding).

7.2.3 ISSUE: PHYSICAL DESTRUCTION OF BIODIVERSITY (LAND AND WATER BASED)

Introduction

There are a number of activities/ infrastructure in all mine phases (see Section 3, Table for further detail) that have the potential to destroy biodiversity. In this regard, the discussion relates to the physical destruction of specific biodiversity areas (including water resource related areas such as watercourses and wetlands), of linkages between biodiversity areas and of related species.

Rating of impact

Severity / nature

The mine and project site are located in an area where the condition of the natural vegetation and associated biodiversity ranges from largely disturbed (in areas where cultivation and forestation have and are taking place – this is usually restricted to the flatter terrace area between the Steenkampsberge and Groot Dwars River valley) to pristine (steeper areas of the Steemkampsberge and within the valley). Within the pristine areas, water based resources such as watercourses and wetland areas do occur. The existing mine infrastructure is located mainly on the flatter terrace where areas had already been largely disturbed by forestry and cultivation. Some disturbance of relatively undisturbed vegetation did occur however the communities were well represented outside of the areas planned for surface infrastructure. While a high diversity of animal species is expected to occur in the region of the mine, animal populations of conservation importance generally did not occur at the sites of the mine infrastructure because these had already been significantly transformed by forestry and agriculture. In the valley, the development of the decline disturbed about 10ha of untransformed vegetation in a near-pristine condition. The development took place on a flattish area within the valley and avoided sensitive habitats as far as possible. However due to the pristine nature of the site, destruction of some habitats and associated fauna (unable to move from the area) was unavoidable. The service road linking the decline to the operations on the terrace crosses a number of ephemeral tributaries, some associated with midslope seepage wetlands (in good ecological state) and some temporary seepage areas (with limited wetland function). When considering the initial mine development together with the valley decline, the severity of potential impacts unmitigated would have been high.

For the Hoogland project site and with reference to the conservation importance/sensitivity map which considers vegetation communities, vertebrates and invertebrates (Figure 9), the proposed project will be located within areas of high and very high conservation importance. Given the ore body's location in a near-pristine ecological environment, within threatened (vulnerable) vegetation types, near to endangered terrestrial ecosystems (as listed in SANBI & DEAT, 2009 as cited in Ecorex 2010), within the 1km buffer zone of a declared protected area and within a highly significant area (as defined in the Mpumalanga Biodiversity Action Plan (Ferrar & Lötter, 2007 as cited in Ecorex 2010)), disturbance of these sensitive communities is unavoidable. With input from specialists and AQPSA, infrastructure

has been limited to the bare minimum required for mining the ore reserves with the bulk of the support services and facilities being provided by the existing mine. Sensitive communities (habitats, flora and fauna) include a breeding site for a Vulnerable bird species (Short-tailed Pippit), potential new type habitat for plant species (*Asclepias* sp.nov), type locality for a new mayfly species, conservation important (vulnerable, near-threatened, threatened) flora, vertebrates and invertebrates including un-described ant species.

In the unmitigated scenario, the natural vegetation/habitat and associated fauna (representing highly diverse and undisturbed ecological systems) of approximately 160ha will either be completed destroyed and/or severely deteriorated through the development of the site. Disturbance and/or destruction of ecological corridors such as wooded drainage lines would disrupt animal movement along these corridors. A further issue to consider is that once areas are disturbed invasive species are often the first to establish, which may result in a vegetation and related biodiversity imbalance.

Although the majority of the existing mine infrastructure has been established within largely disturbed areas, when considered cumulatively with the valley decline and proposed Hoogland development, in the unmitigated scenario the severity of impacts is high. With mitigation, the severity of impacts associated with the existing mine infrastructure reduces to medium (for the valley area) and low (for the terrace area). However with the addition of the Hoogland project site, given that the disturbance will be significant due to opencast mining (with a life of mine of between 6 and 8 years) and within an ecologically sensitive environment providing significant ecosystem functionality (as described above), the severity remains high even with mitigation. Although rehabilitation of the total area will take place with some level of ecological functioning returning through the rehabilitation plan to be developed for the site, the pre-mining diversity and conservation value of the re-established vegetation communities and associated ecosystems may never be restored. Aquarius is also in the process of setting up a biodiversity off-set, which is a compensation tool for the loss of biodiversity, in conjunction with neighbouring mines however this initiative still needs to be proven to be successful.

Duration

In both the unmitigated and mitigated scenarios the loss of biodiversity and related functionality is long term and will continue after the life of the project. Whether the biodiversity and related functionality could be partially restored during the operational and decommissioning phases is unknown.

Spatial scale / extent

Given that biodiversity processes are not confined to the project site and the potential for edging effects exists, the spatial scale of impacts will extend beyond the site boundary in both the

unmitigated and mitigated scenarios. Related issues are the migration of species and linkages between biodiversity areas.

Consequence

In all project phases the consequence is high in the unmitigated scenario and remains high in the mitigated scenario.

Probability

Without any management the probability of losing highly sensitive and irreplaceable biodiversity is definite for all phases. With management, the probability may be reduced because emphasis will be placed on conserving (together with research initiatives) and possibly restoring or offsetting. In this regard, some uncertainty remains about the realistic chances of effectively achieving either the conservation or the restoration, thus the need to consider offsetting. It should be noted that some level of biodiversity could be established through the proposed rehabilitation plan, it is unclear whether the pre-mining status can be restored. With offsetting, there is uncertainty on whether this initiative will be successful.

Significance

In all project phases, the significance of the unmitigated scenario is high. With mitigation this remains high as a result of the Hoogland project site.

Tabulated summary of the rated cumulative impact per phase of the project

Management	Severity	Duration	Spatial Scale	Consequence	Probability of Occurrence	Significance
All project phases						
Unmitigated	H	H	M	H	H	H
Mitigated	H	H	M	H	H-M	H

Description of existing and proposed Everest management measures

Discussion of the management measures is provided in the EMP (Section 19).

7.2.4 ISSUE: GENERAL DISTURBANCE OF BIODIVERSITY (LAND- AND WATER BASED)

Introduction

There are a number of activities/infrastructure (see Section 3, Table for further detail) that have the potential to directly disturb vegetation, vertebrates and invertebrates in all mine phases, particularly in the unmitigated scenario. In the construction and decommissioning phases these activities are temporary in nature, usually existing for a few weeks to a few months. The operational phase will present more long term occurrences and the closure phase will present final land forms that may have pollution potential through long term sedimentation.

Rating of impact

Severity / nature

In the unmanaged scenario, biodiversity will be disturbed in the following ways:

- white light attracts large numbers of invertebrates which become easy prey for predators. This can upset the invertebrate population balances and cause a substantial drain effect ("population sink") on surrounding populations. Other impacts may include interference with normal foraging and mating behaviours.
- people may kill various types of biodiversity for food, for traditional medicine, for sport, for fire wood etc.;
- people may illegally collect and remove vegetation (including medicinal plants), vertebrate and invertebrate species;
- excessive dust fallout from various dust sources (see Section 2) may have adverse effects on the growth of some vegetation resulting in vegetation die-off, and it may cause varying stress on the teeth of vertebrates that have to graze soiled vegetation;
- noise and vibration pollution may scare off vertebrates and invertebrates, disrupt breeding cycles and interfere with communication and prey detection for some species;
- the presence of vehicles in the area can cause road kills especially if drivers speed; and
- pollution emissions and general litter may directly impact on the survival of individual plants, vertebrates and invertebrates.
- reducing stream flow through establishment of stormwater controls

As a collective of disturbances the unmitigated severity is high because of the sensitivity of the biodiversity in the vicinity of the existing mine and proposed project and because of the anticipated high number of disturbance events. In the mitigated scenario, most of these issues can be prevented minimising impacts to a certain degree, which reduces the severity to medium.

Duration

In both the managed and unmanaged scenarios, the impacts are long term in nature because where biodiversity is compromised, killed or removed from the area this impact is likely to extend beyond the life of mine.

Spatial scale / extent

Given that biodiversity processes are not confined to the site, the spatial scale of impacts will extend beyond the site boundary in the unmanaged and managed scenario. Key related issues are the migration of species and linkages between biodiversity areas.

Consequence

In the unmanaged scenario, the consequence of this potential impact is high. In the managed scenario, this reduces to medium because the severity of the impact is reduced.

Probability

Without any management the probability of negatively impacting on biodiversity through multiple disturbance events is high. With management, the probability will be significantly reduced because most of the disturbance types can be controlled through implementation and enforcement of practices, policies and procedures.

Significance

In the unmanaged scenario, the significance of this potential impact is high. In the managed scenario, the significance is reduced to medium because the associated severity, duration and probability are reduced.

Tabulated summary of the rated cumulative impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Mitigated	H	H	M	H	H	H
Unmitigated	M	M	M	M	H-M	M

Description of existing and proposed Everest management measures

Discussion of the management measures is provided in the EMP (Section 19).

SURFACE WATER

Information based on approved EMP reports for the current mine infrastructure (approved July 2003, December 2009 and May 2010) and the Hoogland hydrology study (Metago 2011) (Appendix H).

7.2.5 ISSUE: ALTERATION OF DRAINAGE PATTERNS

The identified impact associated with altering surface water drainage has been addressed in Section 7.2.3. In this regard, the key issue is the loss of periodic surface water flow as an important ecological driver.

7.2.6 ISSUE: POLLUTION OF SURFACE WATER RESOURCES

Introduction

There are a number of pollution sources in all phases of the mine that have the potential to pollute surface water and impact on downstream water users. In relation to the existing mine, the nearest resources are perennial streams (the East and West stream) and rivers (Groot Dwars River) and two agricultural dams (TKO dams). In the vicinity of the Hoogland project site, the nearest resources are non-perennial tributaries of the Groot Dwars River and the perennial Groot Dwars River (approximately 1km west of the project site). In the vicinity of the project site, the river flows in a northerly direction through a steep sided valley. In the vicinity of the mine, there is some reliance on these surface water resources by humans. This discussion therefore focuses on the pollution potential as it relates to ecological resources and commercial livestock associated with surrounding land uses, and provides comment on potential human health impacts post closure.

In the construction and decommissioning phases these potential pollution sources are temporary in nature, usually existing for a few weeks to a few months. Although these sources may be temporary, the potential pollution may be long term. The operational phase usually presents more long term potential sources and the closure phase presents final land forms that may have the potential to contaminate surface water through long term sedimentation. Some of this water seeps into the topsoil. The related pollution issues have been assessed as soil pollution issues in 7.2.2. Biodiversity-related issues are discussed in Section 7.2.4.

Rating of impact

Severity / nature

There are a number of pollution sources associated with the establishment and operation of the mine. According to the mine's approved EMP (July 2003), the most significant release of polluted water to the environment was expected to be seepage from the tailings dam which could impact on the West Stream. For the Hoogland project, in the unmanaged scenario, potential pollution sources from the construction, operational and decommissioning phases include:

- sedimentation from erosion;
- spillage of solvents, paint, fuel, oil, cement; and
- contaminated discharges from the dirty water system including the pits.

Groundwater decant is expected to occur after the open pits are backfilled and dewatering activities cease (refer to the section below on groundwater impacts where this is explained). This decant is expected to daylight in tributaries of the Groot Dwars River and may initially contain elevated total dissolve salts, nitrate and suspended solid concentrations, until the backfill material settles. Once decant water quality reaches the Groot Dwars River, which is largely pristine, this could become an issue of provincial concern after closure.

When considered collectively, the severity of impacts is high in the unmitigated scenario in all project phases. In the mitigated scenario, the mine will prevent polluted water from being released to the environment through the establishment of stormwater control measures that comply with Regulation 704. These will be established in the construction and maintained throughout the operation and decommissioning phases until such time as the infrastructure can be removed. This reduces the severity of the mitigated scenario to low for the construction, operation and decommissioning phases. At closure, the severity could reduce to medium-low depending on the rehabilitation measures applied to reduce the possibility of polluted decant water entering the system.

Duration

The construction, operational and decommissioning phase impacts are expected to have a medium-term duration, however the decant that will daylight into tributaries of the Groot Dwars River may have long-term effects, if unmitigated. With mitigation, this could reduce.

Spatial scale

The construction, operational and decommissioning phase impacts are expected to have impacts beyond the site boundary. This applies to both the unmitigated and mitigated scenarios.

Consequence

The consequence is moderate for the construction, operational and decommissioning phase impacts in the unmitigated, but is high for closure. With mitigation, the consequence at closure reduces to medium.

Probability

The probability of occurrence is definite in the unmitigated scenario for all phases. With mitigation this reduces to medium-low during the construction, operation and decommissioning phases and possible in the closure phase.

Significance

In the unmitigated scenario, the significance of this potential impact is high in all phases. With mitigation it reduces to medium to low during construction, operation and decommissioning and medium at closure.

Tabulated summary of the rated cumulative impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation, decommissioning						
Unmitigated	H	M	M	M	H	H
Mitigated	L	M	M	M	M-L	M-L

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Closure						
Unmitigated	H	H	M	H	H	H
Mitigated	M	L	M	M	M	M

Description of existing and proposed Everest management measures

Discussion of the management measures is provided in the EMP (Section 19).

GROUNDWATER

Information based on approved EMP reports for the current mine infrastructure (approved July 2003, December 2009 and May 2010) and the Hoogland groundwater study (GCS 2010) (Appendix I).

7.2.7 ISSUE: DEWATERING IMPACTS ON GROUNDWATER USERS

Introduction

There is one main activity, namely active dewatering of the pits that has the potential to reduce groundwater levels associated with the Hoogland project (see Section 3, Table for further detail). This activity will commence in the operational phase and will cease in the decommissioning phase. The impacts on biodiversity have been assessed in Section 7.2.4 therefore this section focuses on third party groundwater users and associated land uses (livestock farming, and localised irrigation farming). Included in the discussion is groundwater use from both boreholes and springs.

Rating of impact

Severity / nature

Dewatering activities have taken place at the mine since the mine started operating. As part of the approved EMP and amendments (approved July 2003, December 2009 and May 2010), specialist groundwater studies used a regional groundwater model to estimate pit inflows and to determine the extent of the drawdown depression from active mining activities. The cone of depression was predicted to extend from the Groot Dwars River in the west to the West Stream in the east and up to 1.5 km to the south and north. The potential total loss in groundwater due to mine dewatering was estimated to be less than the groundwater recharge. No third party groundwater users were identified within this zone of influence and therefore no impacts were expected. In terms of impacts on the base flow of rivers, the previous open pit and current underground mining on the terrace were predicted to affect the base flow of West Stream by up to 25% of groundwater flow towards the West Stream. This quantity of groundwater was noted to be 5% of the average flow over the affected reach of the river. It was further predicted that underground mining would impact on the base flow of the Groot Dwars River by up to 250 m^3/day. It was estimated that the quantity of groundwater that potentially could be lost was 0.5% of the average flow over the affected reach of the river. Modelling

of the long-term impacts on the groundwater system indicated that the groundwater levels around the mine would start to recover once production and dewatering stopped. Groundwater studies conducted for the mine as part of the EMP amendments shows a 2m decrease in monitored borehole levels. In the unmitigated scenario, this has a moderate severity. In the mitigated scenario, the severity remains moderate as limited measures are available to mitigate the impact on base flow.

For the Hoogland project, a regional groundwater model was also used to estimate pit inflows and determine potential dewatering impacts. The groundwater study predicted that development of the open pits will intercept groundwater. At the proposed south pit, as mining will take place on top of a hill, it is predicted that a relatively small volume of groundwater captured within the perched water table above the UG2 chromite layer will cause inflows into the open pit resulting in a cone of depression around the pit. It is predicted that once this perched water is dewatered, no additional inflows are expected. The cone of depression is predicted to be limited to the immediate pit boundaries only. At the proposed north pit, mining will take place below the regional groundwater level. The daily inflow volumes into the pit were predicted to be in the order of 50 m^3/day, with maximum inflow volumes expected during the second year of mining to be approximately 60m^3/day. This water will need to be removed from the pit to allow safe working conditions. The resultant cone of depression is expected to increase until the fifth year of mining when steady state conditions will be reached. New groundwater flow contours will develop around the pit and groundwater levels will be lowered by a maximum of 40m. The cone of depression is predicted to be confined to the immediate mining area. The drawdown in groundwater levels will not affect any third party boreholes or springs in the area neighbouring the project site and therefore no impacts of third party users is expected. However a reduction in base flow to streams is expected.

In the decommissioning and closure phases, rain water that infiltrates through the backfilled material will be accumulated by the pit floor and drained to the lowest point of the pit floor. Here rainwater will surface as decant. Groundwater will also drain into the pit from the upper sidewalls. Again this water will follow the pit floor contours where it will decant to the lowest point. As the water decants it will follow the topography to the nearest stream. Hence, the water decanting along the western pit side will be a combination of recharged rainwater and groundwater. This percentage of rainfall recharge through the backfilled area will depend on the replacing of topsoil, the clay content, re-vegetation and slope angles. The general consensus is that the percentage of recharge will be high as 20% after the first year of backfilling. This will become less over time to an average of 5-10% over the long term. After decommissioning, stream flow will increase slightly due to the decant.

Given the discussion above, the severity of dewatering impacts on base flow in the unmitigated operational phase will be high. As there is limited measures to mitigate the loss of base flow during the operations, the severity will remain high in the mitigated scenario.

Duration

In both the unmitigated and mitigated scenarios, the dewatering impacts will be temporary in nature as groundwater levels and base flow to streams are expected to recover at closure.

Spatial scale

In both the unmitigated and mitigated scenarios, the dewatering cone of depression will be limited to the pit boundaries due to the low transmissivities of the surrounding rock and the short duration of dewatering (approximately 6 years). This is a moderate spatial scale.

Consequence

The consequence is medium in both the unmitigated and mitigated scenarios.

Probability

In both the unmitigated and mitigated scenario, regardless of the project phase, the probability of impacts on other groundwater users is unlikely as the cone of depression will be limited to the pit boundaries and there are no springs or third party boreholes within this zone.

For effects on base flow of streams, the probability of impacts occurring during the construction phase is unlikely, but definite during the operational phase. During decommissioning the base flow will recover and will potentially increase post closure due to decant from the open pits.

Significance

In both the unmitigated and mitigated scenario, the significance of impacts will be medium. Limited opportunities exist to manage the issue during the operation of the mine.

Tabulated summary of the rated cumulative impact per phase of the project – effects on surrounding groundwater users

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Unmitigated	Not applicable – no groundwater users will be affected					
Mitigated	Not applicable – no groundwater users will be affected					

Tabulated summary of the rated cumulative impact per phase of the project – effects on base flow

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction – not applicable						
Operation, decommissioning, closure						
Unmitigated / mitigated	H	M	M	M	H	M

Description of existing and proposed Everest management measures

Discussion of the management measures is provided in the EMP (Section 19).

7.2.8 ISSUE: CONTAMINATION OF GROUNDWATER

Introduction

Various communities and landowners rely on groundwater in the vicinity of the mine for domestic and agricultural use, therefore any significant changes to groundwater quality could lead to significant impacts on these other groundwater uses. There are a number of sources in all phases that have the potential to pollute groundwater particularly in the unmitigated scenario. In the construction and decommissioning phases these potential pollution sources are temporary and diffuse in nature, usually existing for a few weeks to a few months. Even though the sources are temporary in nature, related potential pollution can be long-term. The operational phase will present more long-term potential sources and the closure phase will present final land forms that may have the potential to pollute water resources through long-term seepage. Contamination of groundwater could also impact on biodiversity, these impacts are discussed in Section 7.2.4.

Rating of impact

Severity / nature

The mine's approved EMP identified seepage from the existing tailings dam to be the primary source of potential groundwater contamination. For the approved EMP (July 2003), the groundwater impact study focused on the mitigated impact. The measures for the management of the impact were incorporated into the tailings dam design. The severity of the mitigated impact was rated as medium for the operation of the mine and low post closure. Although there have been changes to surface infrastructure at the mine these have not altered the potential for groundwater pollution.

For the Hoogland project, the construction of surface infrastructure will require shallow excavations that are unlikely to impact on the groundwater quality. During the operation of the site, leach tests results have indicated the unlikelihood of acid mine drainage during the stockpiling of overburden, as there are no sulphide minerals present in the samples that were analysed. No contaminant transport groundwater model was constructed for either of the two pits. Prevailing groundwater flow conditions will be towards the open pits. Seepage return flows from overburden stockpiles may contribute towards elevated total dissolved salts and suspended solids within groundwater inflows. Acid mine drainage is not expected from either the waste dump or backfilled material during the operational, decommissioning and closure phases. However, elements that could potentially impact on the water that decants include nitrogen as nitrate from the use of explosives in blasting (concentrations up to 1 600 mg/l). This impact is however assessed as a surface water impact.

Duration

For the existing mine, potential impacts are expected for the life of the mine. At closure, the potential for pollution is expected to decrease. For the Hoogland project, the overburden will be replaced in the open pits as backfill and therefore this impact has a medium duration.

Spatial scale

This impact will extend beyond the site boundary in both the unmitigated and mitigated scenarios.

Consequence

This impact has a low consequence in both the unmitigated and mitigated scenarios of the construction phase, a medium consequence during the mitigated operational phase and a low consequence at the mitigated closure phase.

Probability

The probability of impacts in the mitigated construction phase is low. During operation, decommissioning and closure of the mine site as a whole, the probability of impacts is definite, although limited at the Hoogland project site due limited pollution sources.

Significance

In the mitigated scenario, the significance of this potential impact is low in the construction phase and medium in the remaining phases. This is mainly due to the existing tailings dam and not as a result of the development of the Hoogland project.

Tabulated summary of the rated cumulative impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction						
Unmitigated	L	M	L	L	M	M
Mitigated	L	L	L	L	L	L
Operational and decommissioning						
Mitigated	M	M	M	M	H	M
Closure						
Mitigated	L	M	M	L	H	M

Description of existing and proposed Everest management measures

Discussion of the management measures is provided in the EMP (Section 19).

AIR QUALITY

Information based on approved EMP reports for the current mine infrastructure (approved July 2003, December 2009 and May 2010) and the Hoogland air quality study (Airshed 2011) (Appendix J).

7.2.9 ISSUE: INCREASE IN AIR POLLUTION

Introduction

There are existing activities at the mine that have the potential to impact on ambient air quality. There are a number of similar project-related sources, in all phases, that have the potential to contribute to the existing ambient air quality environment in the unmitigated scenario (see Section 3, Table for further detail). In the construction and decommissioning phases these potential pollution sources are temporary in nature, usually existing for a few weeks to a few months. The operational phase will present more long term potential sources and the closure phase will present final land forms that may have the potential to pollute the air through long term wind erosion. This section focuses on human, animal and plant health impacts.

With projects of this nature (similar to the existing mine operations), the main emissions include: inhalable particulate matter less than 10 microns in size (PM10), larger total suspended particulates (TSP), and gas emissions (such as sulphur dioxide, oxides of nitrogen, carbon monoxide, from vehicle exhausts and blasting). The inhalable components of particulates can cause human health impacts at high concentrations over extended periods, while the larger particulate component can cause animal and plant health impacts. In the case of animals, grazing on soiled vegetation over extended periods reduces teeth life which can reduce animal life expectancy. In the case of plants, soiling of vegetation can reduce growth and productivity and can lead to vegetation die-off.

The comparison of predicted pollutant concentrations to guidelines and standards facilitates a preliminary screening of potential impacts. The following set of health and nuisance evaluation criteria have been used (full details and references are provided in Airshed 2011, Appendix J):

- South African national ambient air quality standards (NAAQS) – daily PM10 (75 microgram/m^3) and annual PM10 (40 microgram/m^3) for human and animal receptors (in the absence of South African or international standards for animal receptors)
- South African TSP (dust fallout) limits and standards for residential (600mg/m^2/day)

Sensitive receptors points in close proximity of the Hoogland project site include two farmsteads (and associated land uses) and the natural environment. In the vicinity of the mine, these include farmsteads, farm labourer residences, educational facilities, the Kiwi community and agricultural land uses (kiwi farm, livestock grazing and subsistence farming) (Section 1.3.1).

Rating of impact

Severity / nature

The air specialist made use of a theoretical model to conservatively predict air quality impacts during the operational phase and qualitatively described impacts from the construction, decommissioning and closure phases. The prediction considered cumulative impacts, i.e. the current mine operations

together with the proposed Hoogland project. In the unmitigated construction (between two and three months) and decommissioning phases, there is the potential for off-site impacts. In the unmitigated operational phase, the model predicted that daily PM10 standards will be exceeded both at the mine/site boundary and off-site (the main receptors within the zone of influence are the natural environment). At the nearest human receptors to the Hoogland project site, predicted PM10 concentrations are in compliance with both the daily and annual standard. For the Hoogland project, predicted CO, SO_2 and NO_2 ground level concentrations (from vehicle exhaust fumes and blasting) are predicted to be within the standards at nearest sensitive human receptors. For dust fallout during the operational phase, the model predicted that the dust fallout rate at the site/mine boundary and therefore off-site will be within the dust fallout limit for residential areas at the nearest human receptor sites. Off-site impacts on the natural environment including the kiwi orchards could occur as a result of the existing tailings dam at the mine.

When considered collectively (PM10 and dust fallout impacts from both the Hoogland project site and the current mine operations), the severity of potential off-site impacts is rated as medium-high for all phases in the unmitigated scenario. With mitigation the severity will reduce, but will still be considered moderate.

Duration

In both the unmitigated and mitigated scenarios, regardless of the project phase, if human, animal or plant health impacts occur these are potentially long term in nature.

Spatial scale

The spatial scale of the potential impact is directly related to the spatial scale of the dispersion of any air pollution that has the potential to cause human, animal and plant health impacts. In both the unmitigated and mitigated scenario, the potential impacts will extend beyond the site boundary, even though the spatial scale of impacts will decrease.

Consequence

In the unmitigated and mitigated scenarios, the consequence of this potential impact is high in all project phases.

Probability

Without mitigation, the probability of off-site pollution is high. Whether the predicted air pollution will result in human, animal or plant health impacts depends on the extent of the pollution plume, the concentration of the different pollution components, and the exposure of receptors to exceedances of the relevant evaluation criteria. Land neighbouring the mine is used for agricultural activities and the natural environment. Land neighbouring the Hoogland project site is used for livestock grazing and

the natural environment. No exceedances of the standards are expected at the two private farmsteads located near to the Hoogland project site and therefore limited potential exists for human health impacts. The potential for animal and plant health impacts in the unmitigated scenario is possible. This is reduced to unlikely in the mitigated scenario for all project phases.

Significance

In the unmitigated scenario, the significance of this potential impact is high, however, with mitigation the significance can be reduced to a medium.

Tabulated summary of the rated cumulative impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation, decommissioning						
Unmitigated	M-H	H	M	H	H	H
Mitigated	M	H	M	H	L	M
Closure						
Unmitigated	M-H	H	M	H	H	H
Mitigated	L	L	L	L	L	L

Description of existing and proposed Everest management measures

Discussion of the management measures is provided in the EMP (Section 19).

NOISE

Information based on approved EMP reports for the current mine infrastructure (approved July 2003, December 2009 and May 2010) and the Hoogland noise survey (Jongens Keet Associated 2011) (Appendix K).

7.2.10 ISSUE: INCREASE IN DISTURBING NOISE LEVELS

Introduction

Current activities at the mine have impacted on ambient noise levels given the development of the mine is a quiet rural wilderness type area. Apart from influences from the existing mining operations, there are limited other activities (intermittent traffic and farming activities) on site that contribute to ambient noise levels. There are a range of construction, operation and decommissioning project activities that have the potential to generate noise (disturbance and nuisance) and cause related pollution at sensitive receptors (see Section 3, Table for further detail). No noise-related impacts are expected at closure.

In the vicinity of the Hoogland project site, potential sensitive receptors include private landowners, farm labourer dwellings and the natural environment (including the Davel Private Nature Reserve).

General noise disturbance can be defined as an increase in ambient noise levels. Although the legal limit for an increase in ambient noise is 7 dB (national noise regulations), this should not be construed as the upper limit of acceptability. SANS 10103 identifies that an increase of 5 dB is considered a significant impact. Noise nuisance on the other hand is defined by SANS 10103 as any sound which disturbs, or impairs the convenience or peace of any person. These noises are either difficult to capture, or are noises for which the readings registered on sound level meters do not correlate satisfactorily with the annoyance it causes when assessed against standard criteria. Noise nuisance sources presented by the proposed project consist of blasting, reverse alarms and hooters.

For on-site activities, the assessment below focuses on night-time conditions when ambient noise levels are lower and the sensitivity of the environment increases. Given the 24-hour operation of the site, it is expected that if the night-time impact is contained within acceptable levels, then the daytime impact will also fall within acceptable limits. For transport related activities (for ore, commuting and supplies transport) the assessment below focuses on day-time conditions when these types of activities are likely to occur the most.

Potential noise-related impacts on biodiversity (the natural environment) are discussed in Section 7.2.4 and therefore this section focuses on the potential for human-related noise impacts.

It should be noted that as part of the stakeholder engagement process, a number of stakeholders raised concerns about the noise pollution from the current operations and the potential increase in disturbing noise as a result of the proposed project (see Appendix E).

Rating of impact

Severity / nature

Noise pollution will have different impacts on different receptors because some are very sensitive to noise and others are not. For example, mine workers in general do not expect an environment free of work related noise and so they will be less sensitive to environmental noise pollution at work. In contrast, local farmsteads, are likely to be sensitive to unnatural noises and so any change to ambient noise levels because of mine related noise will have a negative impact on them.

Noise generating activities at the mine have influenced the ambient noise climate of the area. The noise specialist calculated that the existing mine has an impact (of varying degrees) on the noise environment up to 5km in all directions. Potentially sensitive receptors within this zone of influence include private farmsteads, farm labourer residences, the Kiwi Primary School, Everest Early Childhood Development Centre, and the Kiwi community. This includes the two sensitive receptor sites in close proximity to the proposed Hoogland project.

For the Hoogland project, during the construction and decommissioning phases, in the unmitigated scenario, noise generated by on-site activities (including hauling of materials along the access road) is predicted by the noise specialist, to have a significant impact on noise sensitive receptors, within a distance of 450m of the site during the day and 1000m of the site at night.

In the operational phase, the noise specialist study has predicted that in the unmitigated scenario, noise from the project (when considered cumulatively with existing mining noise) will raise, to varying degrees, the night-time ambient noise levels for properties surrounding the mine. For the nearest receptor sites to the north east of the Hoogland project site (private farmsteads and farm labourer residences), it is predicted that ambient night-time noise conditions will increase as a result of the project. These receptor sites already experience a significantly degraded noise environment as a result of the current mine operations. Although as the open pit deepens the acoustic screening provided for by the pit walls will attenuate mining noise, surface activities on-site will continue to contribute to audible noise. When considering nuisance noises, in all relevant phases, material handling and vehicle movement on site will make use, to varying degrees, of machinery with reverse alarms and hooters. Movement of vehicles on top of waste dumps are likely to be one of the main contributors to audible noise at night. Blasting-related noise during the operational phases will have a significant impact on nearby receptors, even though the noise source will be intermittent (once a day, three to four times a week).

Given the discussion above, in the unmitigated scenario, for all project phase, potential impacts from on-site activities will have a high severity for the nearest receptor sites to the Hoogland project site when including blasting noise (if construction activities are undertaken at night). Given the already elevated noise levels at these receptors, even with mitigation the severity will remain high. The severity is expected to decrease the further away receptors are from the mine and project site.

Duration

In the unmitigated and mitigated scenarios the noise pollution impacts will continue until the end of the decommissioning phase (approximately 6 years). Whether noise impacts discussed above will have any secondary long term health effects, beyond the life of the project, is unknown. In this regard, it's possible for noise induced stress and related health issues to be felt beyond closure.

Spatial scale

In both the unmitigated and mitigated scenarios the noise impacts will extend beyond the site boundary, regardless of the project phase. The hills of the Steenkampsberge are expected to act as a natural screen to some extent. Depending on climatic conditions, nuisance type noise could occasionally be heard beyond this footprint.

Consequence

In both the unmitigated and mitigated scenarios, the consequence of potential impacts is medium to high.

Probability

In the unmitigated scenario, noise from on-site activities, at the nearest receptor sites, will be definite during all project phases. Limited management options are available.

Significance

In both the unmitigated and mitigated scenarios, the significance of potential impacts is medium to high.

Tabulated summary of the rated cumulative impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation, decommissioning						
Unmitigated	H	M-H	M	M-H	H	M-H
Mitigated	H	M-H	M	M-H	H	M-H
Closure – not applicable						

Description of existing and proposed Everest management measures

Discussion of the management measures is provided in the EMP (Section 19).

VISUAL ASPECTS

Information based on approved EMP reports for the current mine infrastructure (approved July 2003, December 2009 and May 2010) and the Hoogland soils and land capability survey (ISCW 2010) (Appendix F).

7.2.11 ISSUE: NEGATIVE LANDSCAPE AND VISUAL IMPACTS

Introduction

Visual impacts will be caused by activities and infrastructure in all project phases (see Section 3, Table for further detail). These activities will be visible, to varying degrees from varying distances around the project site. During construction, this will be influenced by the increase in activities and removal of vegetation on site. During operation this will be influenced by the presence of infrastructure and development of the open pits and waste dumps and during decommissioning and closure by the closure objectives and effectiveness of rehabilitation measures. The more significant activities and structures are considered to be construction activities, mining of the two open pits, temporary waste/overburden dump and night lighting needed for safety purposes.

Rating of impact

Severity / nature

The severity of visual impacts is determined by assessing the change to the visual landscape. The visual landscape is that of open wilderness grassland with the main man-made intrusion being the existing Everest mine to the north of the project site. The existing mine has altered the visual character of the area. Key issues are: visual intrusion, visibility and visual exposure, and viewer sensitivity. Each of these is discussed below.

In the unmitigated scenario, the visual intrusion of the proposed project when considered cumulatively with the existing mine infrastructure, will be high as additional mining activities are introduced into a new area. The intrusion will remain high until such time as the site is rehabilitated and the vegetation cover re-established. The visual intrusion of the project at night, from construction through to decommissioning, will be high in the unmitigated scenario potentially increasing the existing light pollution already experienced in the area as a result of the mining operation.

Visual exposure is the extent to which infrastructure and activities will be visible. It follows that the closer the infrastructure and activities, the greater the visual exposure. In the unmitigated day scenario, views from adjacent properties (private landowners and farm labourer residences) will present the greatest visual exposure. Farms to the west, south west and south of the site with vantage points looking into the valley (where small-scale tourism-type activities do occur) will experience a moderate to low visual exposure, given the occurrence of ridges as natural screens. At night, the visual exposure will be greatest for farms and tourism activities within the surrounding area. In the unmitigated scenario, the project will add to the existing light pollution of the mine.

Sensitivity of receptors relates to the way in which people will view the visual intrusion. In this regard, it is anticipated that receptors on adjacent properties and along vantage points to the south, south west and west of the site (where tourism-type activities do occur) will be highly sensitive, especially in the unmitigated scenario. Receptors are also expected to be sensitive to the light pollution at night. Even though this impact already occurs due to the current operations, surrounding areas are sensitive to this change (see Appendix E).

Given the above, the unmitigated severity is high is all project phases. With mitigation, the severity would reduce to medium to low but only in the closure and post closure phases, once rehabilitation initiatives have been successful.

Duration

In the unmitigated scenario, visual impacts will be experienced till after the life of mine. In the mitigated scenario, visual impacts would potentially be for the life of the project (approximately 6 years).

Spatial scale

By using a viewshed analysis tool the specialist determined that the project, during the day, will be highly visible within a 1.5km radius around the site. Between 1.5 and 4km, the project will have a moderate visibility and beyond 4km, would have lower visibility. At night, the visual exposure of the project will increase the mine's existing light pollution footprint. It follows that the spatial scale of the impacts will extend beyond the site boundary in the unmitigated scenario for all project phases. With mitigation, the spatial scale will still extend beyond the site boundary for all phases however at closure, re-vegetation of the sites will reduce the project's visibility.

Consequence

In the unmitigated scenario the consequence is high in all project phases. During the construction, operation and decommissioning phases the impact remains high with mitigation. Only in the closure phase does the consequence reduce to a high-medium with mitigation.

Probability

For all project phases, the probability of the visual impact occurring is definite in the unmitigated scenario. In the mitigate scenario, the visual impact will occur

Significance

In the unmitigated scenario, the significance of this potential impact is high in all project phases. In the mitigated scenario, the significance remains high for the construction, operation and decommissioning phases, and reduces to a medium-low during the closure phase.

Tabulated summary of the rated cumulative impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation, decommissioning						
Unmitigated / mitigated	H	H	M	H	H	H
Closure						
Unmitigated	H	H	M	H	H	H
Mitigated	M-L	M	M	M-L	M-L	M-L

Description of existing and proposed Everest management measures

Discussion of the management measures is provided in the EMP (Section 19).

LAND USES

Information based on approved EMP reports for the current mine infrastructure (approved July 2003, December 2009 and May 2010) and Metago's knowledge and experience.

7.2.12 ISSUE: LOSS OF CURRENT LAND USES

Introduction

The range of environmental impacts that could occur as a result of the project were taken into account when considering impacts on surrounding land use. These include: groundwater, noise, visual, air, heritage, soils, blasting, and socio-economic. With this in mind, the main activity that could have an impact on existing land uses is the development of the project site as a whole (see Section 2.3, Table for further detail). These activities will commence in the construction phase and continue for the planned life of the project (approximately 6 years but this could increase to 8 years depending on the viability of the south pit). At closure, the site will be rehabilitated. Although it is unlikely that the current state of the site will be re-instated, the rehabilitation measures will minimise the potential for significant post-closure impacts. This section focuses on the potential loss and/or change of the land uses. Socio-economic related issues are discussed in Sections 7.2.18, 7.2.19 and 7.2.21.

Rating of impact

Severity / nature

The project site is located approximately 2km south of the existing mine. The area is characterised by open wilderness with two private farm units (used for livestock grazing and subsistence farming) located between 750m and 1500m from the project site. These farm units are also located in close proximity (between 800 and 1500m) to the existing mining operations. In addition, the boundary of a private nature reserve (Davel Private Nature Reserve) is located within 500m of the proposed south pit. It has been identified that for each of these land uses the availability of water is identified to be the most important resource for sustainable land use. The loss of groundwater (either through dewatering or pollution) is predicted to outweigh the impacts from noise pollution, air quality, visual impacts, traffic, blasting. Loss of groundwater resources on a farm will result in the farm (and economic activity) not being able to function at its current activity, unless an alternative supply source is identified, while other environmental impacts are only expected to result in a partial loss and/or change in land use. Current land uses on the site will be significantly impacted and lost through the development of the mine. Biodiversity related losses are discussed in Section 7.2.3 and 7.2.4. The immediately neighbouring farms to the project site are expected to experience significant impacts, in the unmitigated scenario, when considering noise, blasting, and visual collectively.

The severity of potential impacts (when considering all relevant environmental aspects cumulatively)

is high, in the unmitigated scenario for the construction, operation and decommissioning phases. In the mitigated scenario, for these phases, the severity could reduce to somewhere between high and medium depending on how effective mitigation measures are in reducing impacts. At closure, the severity in the unmitigated scenario is expected to reduce to medium as mining activities stop and rehabilitation takes places. With mitigation, this could reduce to low.

Duration

In the unmitigated scenario, and using a conservative approach, land use impacts could be experienced after the life of mine. This could be reduced to within the project life, depending on the effectiveness of mitigation measures.

Spatial scale / extent

Based on the predictions by other specialists, it is identified that a cumulative project impact on land uses, when considering all environmental aspects, will extend beyond the site boundary in both the unmitigated and mitigated scenarios.

Consequence

In all phases, in the unmitigated scenario the consequence is high. With mitigation this reduces to somewhere between high and medium.

Probability

The probability of the land use impacts occurring during the construction, operation and decommissioning phases is high in the unmitigated scenario, as this assumes that impacts associated with environmental aspects such as noise pollution, air quality, visual impacts and blasting are unmitigated. With mitigation this reduces to medium. At closure, impacts are still possible in the unmitigated scenario. With mitigation this can reduce to low.

Significance

In the unmitigated scenario, in all project phases, the significance of potential impacts is high. With mitigation, this reduces to somewhere between high and medium during the construction, operation and decommissioning phases and low at closure, depending on the effectiveness of mitigation measures.

Tabulated summary of the rated cumulative impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation, decommissioning						
Unmitigated	H	H	M	H	H	H
Mitigated	H-M	H-M	M	H-M	M	H-M

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Closure						
Unmitigated	M	H	M	H	M	H
Mitigated	L	M	M	M	L	L

Description of existing and proposed Everest management measures

Discussion of the management measures is provided in the EMP (Section 19).

7.2.13 ISSUE: BLASTING HAZARDS

Introduction

The main activity that has the potential to cause blasting hazard is mining of the pit (see Section 2.3, Table for further detail). This activity will occur during the operational phase only.

Blasting activities have the potential to impact on people, animals and structures located in the vicinity of the operation. Blast hazards include ground vibration, airblast, fly rock, blast fumes and dust. Ground vibrations travel directly through the ground and have the potential to cause damage to surrounding structures. Airblasts result from the pressure released during the blast resulting in an air pressure pulse (wave), which travels away from the source and has the potential to damage surrounding structures. Fly rock is the release of pieces of rock over a distance and can be harmful to people and animals and damage structures and property. Blast fumes and dust, caused by the explosion, can be considered significant nuisance factors. Ground vibrations and airblasts have the potential to cause nuisance to people and animals even if blasts occur within legal limits.

Blasting did take place previously at the mine as part of the historic open pit mining operations. These areas have been completed and rehabilitated. This section therefore focuses on the impacts of ground vibration, airblast and flyrock, collectively from the proposed Hoogland project, as they relate to people, biodiversity and associated land uses (livestock farming, subsistence farming). The impacts on air quality have been assessed in Section 7.2.9. Noise related issues are discussed in Section 7.2.10.

Rating of impact

Severity / nature

In the unmitigated scenario, ground vibrations and airblasts can cause damage to third party structures and can be a nuisance for animals and people, within the zone of influence.

When considering fly rock, in the unmitigated scenario, fly rock (of varying sizes) has the potential to travel far distances from the blast site and cause injury and death to people and animals and damage to plants and structures.

Given the proximity of the pit to third party land uses (including farmsteads, farms dams, crop fields), heritage resources (historical village, graveyards) and wild life areas within the zone of influence, the severity of potential unmitigated impacts from blasting hazards is high. With mitigation, the severity can be reduced to low.

Duration

In both the unmitigated and mitigated scenarios, although the blasting hazards (ground vibrations, airblasts, fly rock) will be limited mainly to the operational phase, any injury or death to people and/or animals and damage to structures, plants and/or property will be felt beyond closure.

Spatial scale / extent

In both the unmitigated and mitigated scenarios, potential impacts will be felt outside of the mine boundary but for the most part will still be localised. Injury and/or or death to people will, however, be felt by families and communities beyond the site boundary.

Aspect	**Within 500m of blast site**	**Within 1000m of blast site**	**Within 1500m of blast site**
Natural environment	Ecologically sensitive flora and fauna Buffer zone of Protected Davel Private Nature Reserve	Ecologically sensitive flora and fauna Protected Davel Private Nature Reserve	Ecologically sensitive flora and fauna Protected Davel Private Nature Reserve
Residential	None	A single farmstead with associated outbuildings Farm labourer residences Farm access road	A second farmstead with associated outbuildings Farm labourer residences Farm access road
Agriculture	Livestock	Livestock Agricultural fields Farm dams	Livestock Agricultural fields Farm dams
Heritage*	Graveyards, isolated walls	Graves	Potentially graves associated with the farmstead
Historic exploration	Exploration boreholes	-	-
Mine facilities	Project-related surface infrastructure	-	-

* Excludes those to be mitigated to make way for the project (see Section 7.2.15).

Consequence

In the unmitigated scenario, the consequence of potential impacts from blasting hazards is high. With mitigation this reduces to high-medium.

Probability

In the unmitigated scenario, the probability of blasting hazards resulting in either damage and/or creating a nuisance is possible. In the unmitigated scenario, the recommended blast thresholds could

be exceeded at third party structures where people, animals and third party property occur. With mitigation, this reduces to unlikely or seldom.

Significance

In the unmitigated scenario, the significance of blasting-related impacts is high. This can reduce to low with mitigation.

Tabulated summary of the rated impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction – negligible, when compared to the operational phase						
Operation						
Unmitigated	H	H	M-H	H	M	H
Mitigated	L	H	M-H	M	L	L
Decommissioning and closure – not applicable						

Description of existing and proposed Everest management measures

Discussion of the management measures is provided in the EMP (Section 19).

7.2.14 ISSUE: PROJECT-RELATED ROAD USE AND TRAFFIC

Introduction

Increased traffic on existing public road networks as a result of the mine's operations can result in an inconvenience to current road users, greater accidents (for people and animals) and/or increased road damage. This in turn can put pressure on the relevant roads authority to increase the maintenance programmes and/or upgrade the roads. This section focuses on road capacity and safety related impacts. Safety related impacts have the potential to occur during the construction, operation and decommissioning phases with negligible road use taking place during the closure phase. The impacts are therefore assessed for the first three phases only.

Rating of impact

Severity / nature

The mine's approved EMP (July 2003) identified that the mine will contribute to the traffic in the project area, but that much of the existing traffic in area will be reduced because the Ackerman Sawmill and several families would relocate from the area to make way for mining. It was identified that the unsurfaced roads in the project area would be difficult to traverse in wet weather and that heavy vehicles would carve out ruts in the road rendering the road treacherous and impassable for light vehicles. It was also identified that provincial and local authorities apparently did not have funds for regular repair of the roads. As part of the mine development, Aquarius upgraded the district road that provides access to the mine from the provincial R577 road to a tarred road. The upgrade was planned in consultation with the provincial roads department. In addition, the mine road between the

plant and the decline was tarred. The roads within the mine boundaries are closed for public use. In the unmitigated scenario, the severity of impacts was rated as medium. This reduced to low with mitigation.

As the proposed Hoogland project contributes to bringing the mine back into production, no additional volumes of traffic to those identified in the approved EMP are expected on public roads. The majority of project-related transport will be on internal mine roads closed for public use. The severity of potential impacts therefore remains unchanged.

Duration

In the unmitigated scenario, the duration of impacts was for the life of the mine. With mitigation this reduced to less than the life mine.

Spatial scale

In the unmitigated scenario, potential impacts were predicted to extend beyond the site boundary. With mitigation, these could be restricted to the project site.

Consequence

The consequence is moderate in the unmitigated scenario and reduces to low with mitigation.

Probability

In the unmitigated scenario, the probability of impacts occurring was possible but with mitigation this reduced to unlikely/seldom.

Significance

The significance in the unmitigated scenario is medium. With mitigation this reduces to low.

Tabulated summary of the rated cumulative impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation, decommissioning						
Unmitigated	M	M	M	M	M	M
Mitigated	L	L	L	L	L	L
Closure – no impacts expected						

Description of existing and proposed Everest management measures

Discussion of the management measures is provided in the EMP (Section 19).

HERITAGE (AND CULTURAL)

7.2.15 ISSUE: DISTURBANCE OF HERITAGE RESOURCES

Information based on approved EMP reports for the current mine infrastructure (approved July 2003, December 2009 and May 2010), discussions with mine personnel and the Hoogland heritage survey (Pistorius 2010) (Appendix M).

Introduction

Heritage resources include sites of archaeological, cultural or historical importance. There is a number of activities/infrastructure in all project phases that have the potential to damage heritage resources and result in the loss of the resource for future generations (see Section 3, Table for further detail). For the project, the more significant of these are expected to occur during the construction and operational phases when most of the project infrastructure will be established on site and open pit mining advances. No impacts are expected to occur during the decommissioning and closure phases however the potential for uncovering new heritage resources during the operational and decommissioning phases does exist.

Rating of impact

Severity / nature

The development of the existing mine site has disturbed heritage resources with varying degrees of significance (see Section 1.3.3). Some of these heritage resources included graves. Without mitigation, the severity of disturbing these resources would be high.

The Hoogland project will disturb one graveyard (comprising two graves of the Coetzee family), a historical house (assumed to be associated with the Coetzee graveyard), a single grave (unknown), a historical village (from the late 19th century), and some stone walls. Apart from the stone walls, the above heritage resources have high conservation significance and are protected by national legislation. The remaining heritage resources are located near to the project site and could be disturbed by activities on site if not mitigated. In the unmitigated scenario, the severity of potential impacts will be high. With mitigation, which includes preservation of the heritage (through investigation and data collection), relocation of graves in line with relevant legislation, and the protection of remaining resources, the severity reduces to low.

Duration

In the unmitigated scenario the duration of the potential impact will be long term, as the heritage resources would be permanently lost. With mitigation, the duration of the impact will be less that of the project life.

Spatial scale

Although the actual loss of the resource will be within the site boundary, the unmitigated impact will extend beyond the site boundary. With mitigation, the spatial scale will be reduced to low.

Consequence

In all project phases, the consequence of the impact is high in the unmitigated scenario, however it can be reduced to a low with mitigation.

Probability

Without mitigation, the probability of this impact taking place is definite, due the location of resources within and near to the site. With the implementation of the management measures below, although the heritage resources will be disturbed they will not be lost to future generations.

Significance

In the unmitigated scenario, the significance of the potential impact on heritage resources is high during the construction and operation phases, and medium in the decommissioning. In the mitigated scenario, the significance of this impact can be reduced to low in all project phases, if the correct procedures are followed as identified below.

Tabulated summary of the rated cumulative impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction and operation						
Unmitigated	H	H	M	H	H	H
Mitigated	L	L	L	L	L	L
Decommissioning						
Unmitigated	H	H	M	H	L	M
Mitigated	L	L	L	L	L	L
Closure – no impacts expected						

Description of existing and proposed Everest management measures

Discussion of the management measures is provided in the EMP (Section 19).

7.2.16 ISSUE: LOSS OF PALAEONTOLOGICAL RESOURCES

Information based on the Hoogland palaeontology study (BPI for Palaeontological Research 2011) (Appendix N).

There is limited to no potential for palaeontological resources to occur at the Hoogland project site. No impacts are expected and therefore no assessment is deemed necessary. Nonetheless, should any resources be identified during the development of the site, Everest will implement the chance find procedure in Section 20.2.

SOCIO-ECONOMIC

Information based on approved EMP reports for the current mine infrastructure (approved July 2003, December 2009 and May 2010), Metago's knowledge and experience and the Hoogland economic study (Strategy4Good 2011) (Appendix O).

In the broadest sense, activities associated with the mine and project have socio-economic impacts in all phases. Some of these are considered to be positive impacts and others are considered to be negative impacts. The separate groups of impacts are discussed below.

7.2.17 ISSUE: LOSS OF MINERAL RESOURCES THROUGH EXPLOITATION AND STERILISATION

It is important that no potential future resources be sterilised by the mine or project as it may become feasible to mine them in the future. By the nature of mining projects the geology is exploited for the target minerals. UG2 ore, including chromite reefs and mineralised partings, are currently mined at Everest. The approved EMP report (July 2003) identifies that while geology of the Everest ore body will be permanently changed by mining, the changes in geology will not have significant negative impacts on the health and welfare of people, the well-being of surrounding plant and animal communities and the condition of other natural resources. Mining of the main Everest resource will not sterilise other mineral resources in the region of this ore body. In addition, both the PGMs and chromitite are extracted from the ore during the processing operations before depositing the tailings material on the tailings dam.

For the Hoogland project, the geology will be altered by the mining of the two open pits. However the pits will be backfilled and rehabilitated.

As for the approved EMP report (July 2003), no assessment of impacts is given, as the changes described above will not result in notable negative environmental impacts. The mining of the resource will ensure the continuation of the mine and the resulting socio-economic benefits (Section 7.2.18).

7.2.18 ISSUE: ECONOMIC IMPACTS (POSITIVE AND NEGATIVE)

Introduction

The existing mine and proposed Hoogland project has the potential to impact on the economy both positively through potential growth in the mining sector and investment in social programmes and negatively through the potential loss of existing economic activities. This section focuses on the potential positive and negative economic impacts associated with the project and assesses these collectively.

Rating of impact

Severity / nature

The development of the mine was predicted to have a positive economic impact through:

- employment of a large number of people during both the construction and operational phases;
- generation of substantial offshore revenue;
- payment of large amounts of money in the form of the company payroll;
- payment of significant amounts of money to the government in the form of local, regional and national taxes and levies;
- economic multiplier effect linked to the support of service-sector jobs again, the procurement of large quantities of consumables annually and the outsourcing of service provision to local service providers;
- benefits from the implementation of the mine's social investment programme and SLP commitments.

Changes that have taken place at the mine have aimed to ensure the viability of the mine. The approved EMP (July 2003) identified that positive impacts from the mine could be enhanced if financial resources generated through the project are harnessed to further development of alternative forms of income generation in the region and local area of the project. One example is the purchase and on-going operation of the kiwi farm situated adjacent to the mine's operations. The kiwi farm forms part of Aquarius' long term planning as it is expected that the kiwi farm will be a source of income to local communities. To date Aquarius has implemented various social investment projects through its programme and SLP, however the implementation of these projects was suspended when the mine went under care and maintenance. The mine is currently re-gaining its production output and with this, the associated positive benefits discussed above.

From an incremental perspective, the Hoogland project is expected to employ approximately 50 workers during the construction phase and 218 workers during the operational phase. These employment figures contribute to bringing the mine back into full production. Mining is predicted to have a 1:4 multiplier effect, resulting in four secondary jobs for every job created through the need for support business and services and from the increased spending power of employees and contractors. It is also expected that there could be a negative economic impact on the surrounding land uses (conservation, small scale agriculture, residential and tourism related activities). The related negative impact on farm related employment is not definite because the impacts on surrounding land may be mitigated particularly in the closure phase of the project. However, a conservative assumption has been made by the specialist to enable a relative comparison. In this assumed scenario, the loss of potential employment opportunities to farming if the land were to be used in accordance with current practices is about 35 jobs. This could increase to approximately 103 jobs if the productivity of the farm land was increased by changing the current farming practices.

From a cumulative perspective, AQPSA views Hoogland as a critical project because it is necessarily linked to the continuation of the Everest Mine as a whole. It follows, given current market and operational conditions, that if the Hoogland project does not proceed then the mine may close and be placed in an indefinite period of care and maintenance. This will mean a loss of approximately R699 million GGP per annum and a loss of 1685 jobs. Even when this is period adjusted take account the relatively short 6 year life of the Hoogland project, the number of potential lost jobs is significant at 337 jobs. In comparison, the potential negative impact on the agricultural sector will be much less at approximately R9 million GGP per annum and a loss of between 35 jobs if current farming practices continue and 103 jobs if current farming productivity is improved.

Moreover, if Everest mine were to close this is estimated to have the following potential negative impacts on the regional economy:

- an approximately R3.8 billion (2.8%) loss to the region's economy (this figure includes the direct impact of the mine plus multipliers); and
- a loss of approximately 1 685 (2.9%) of direct jobs and 33 70 (5.7%) of total jobs.

As a cumulative issue, when considering the mine as a whole, in the unmitigated scenario, the economic benefits of the mine are predicted to significantly outweigh the potential losses to surrounding land uses and therefore the positive severity is considered to be high in the unmitigated scenario for all phases. With mitigation, the positive severity can be increased.

Duration

In the normal course, the direct positive and negative economic impacts associated with a mine will occur for the life of mine. Post closure, in the unmitigated scenario, the scale of the impacts will be reduced. There may still be some positive impacts through maintenance and aftercare activities and because it is predicted that the mine would have contributed to a greater economic critical mass, skills, and wealth that can be used in other economic opportunities. There may also still be some negative impacts due to an un-rehabilitated site and the presence of final land forms. With mitigation, the potential negative impacts can be reduced to within the mine life and positive impacts beyond the life of the mine. Collectively these have a medium to long-term duration.

Spatial scale

In the unmitigated and mitigated scenario, the positive and negative impacts will be felt beyond the site boundary and in some instances regionally.

Consequence

The consequence is high positive in the construction, operation and decommissioning phases even without mitigation. At closure, the low consequence without mitigation can improve to high with correct implementation of management measures.

Probability

In the normal course of economic activity the net positive impacts are likely to occur.

Significance

The significance is high positive in the construction, operation and decommissioning phases even without mitigation. At closure, the medium positive significance without mitigation can improve to high with correct implementation of management measures.

Tabulated summary of the rated cumulative impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation, decommissioning						
Unmitigated / mitigated	H+	M-H	H	H+	H	H+
Closure						
Unmitigated	L+	M	M	L+	H	M+
Mitigated	M+	M-H	H	H+	H	H+

Description of existing and proposed Everest management measures

Discussion of the management measures is provided in the EMP (Section 19).

7.2.19 ISSUE: INFORMAL SETTLEMENTS, SAFETY, SECURITY AND SERVICES AND ASSOCIATED SOCIAL ILLS

Introduction

Mining projects of this nature tend to bring with them an expectation of employment. This expectation can lead to the influx of job seekers to an area which in turn increases pressure on social services (education and health), housing, basic service delivery and raises concerns around safety and security. In some cases, the influx is into already established urban areas but for the most part, given the location of mining developments within remote areas, the influx results in the development of informal settlements close to the mine site. Land in the project area is mostly privately owned or owned by the Phetla CPA (Section 1.3.1). This section focuses on the potential for the development of informal settlements and the associated issues as a result of the initial mine development as well as the contribution from the Hoogland project.

Rating of impact

Severity / nature

In the unmitigated scenario, the development of the mine had the potential to attract an influx of job seekers to the area, which could cause an increase of people moving through the area and the development of informal settlements. This situation could be worsened if the mine did not have adequate planning for employee and contractor housing (with linked basic services) and transport. In general, both increased movement of poor people into an area and informal settlements are associated with poor standards of living which can promote disease, crime and a general threat to the safety and security of an area. In addition, poor control of employees and contractors can lead to increased trespassing on private farm land. Linked to this influx of people is the ability of receiving areas to supply basic services such as water, food, electricity and sanitation. The severity of potential impacts associated with the initial mine development is therefore high in the unmitigated scenario. Although the proposed Hoogland project will bring an expectation of employment, existing labour structures will be used. The additional employment created by the project contributes to bringing the mine back to full capacity (following care and maintenance). For this reason it is not expected that the Hoogland project will contribute significantly to the overall impact of the mine. Potential issues associated with inward migration are and continue to be addressed by the mine, reducing the severity to low in the mitigated scenario in all project phases.

Duration

In the normal course, social impacts associated with each phase of the mine will occur for the life of the mine. However, in the unmitigated scenario, issues associated with inward migration could take on a life of their own and therefore are likely to extend long after the life of the project. This applies to the unmitigated scenario of all project phases. With mitigation, the potential impacts can be quickly reversed.

Spatial scale

In the unmitigated and mitigated scenarios, the impacts of inward migration will be felt mainly in the communities surrounding the site.

Consequence

In the unmitigated scenario the consequence associated with inward migration is high. With mitigation this reduces to low.

Probability

In the unmitigated scenario the impact is considered to be definite. With mitigation this probability may be reduced.

Significance

In the unmitigated scenario, the significance of this potential impact is high. In the mitigated scenario, the significance may be reduced to medium-low.

Unmitigated – summary of the rated impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	H	H	M	H	H	H
Mitigated	L	L	M	L	M-L	M-L

Description of existing and proposed Everest management measures

Discussion of the management measures is provided in the EMP (Section 19).

7.2.20 ISSUE: RELOCATION

The development of the mine resulted in the relocation of private landowners and farm labourers. This relocation was done in line with relevant regulations and accepted best practise. For the Hoogland project, there are no people living on the project site. There are two landowners who live between the project site and existing mine. Depending on how effective mitigation is in reducing impacts on these farm units. It is recommended by Metago that these properties be purchased and/or leased for the duration of the Hoogland opencast operations.

7.2.21 ISSUE: CHANGE IN LAND VALUES

Introduction

Concern has been raised by land owners about the impact of the project on surrounding land values, associated tourism and future benefits for family. The mine development as a whole has the potential to impact on land values and associated economic activity. The proposed Hoogland project could add to this impact. The impact on land values could be affected both positively and negatively. Positive impacts are observed where mining companies require land adjacent to mining operations and as such land owners often sell land at a premium. Negative impacts are observed when the productivity of land surrounding mines or the quality of life of landowners/users is compromised by unacceptable negative environmental and social impacts. It is assumed that there is less concern about the scenario where land is purchased at a premium. Land use related losses are discussed in Section 7.2.12. This section focuses on the possibility of land devaluation from unacceptable negative environmental and social impacts.

Rating of impact

Severity / nature

In the unmitigated scenario, some land surrounding the mine and project site will experience unacceptable impacts which are likely to cause a loss in land values and/or economic activity. The severity of potential impacts is expected to be high for farms neighbouring the mine and project site, with the severity reducing the further away the farm unit is from the site. With mitigation which focuses on effective implementation of mitigation measures included in the EIA and EMP report, communication with stakeholders, rehabilitation of disturbed areas (as soon as possible) and compensation (if mine-related loss of land use and/or economic activity occurs after mitigation), the severity reduces to medium-low in the mitigated scenario.

Duration

In the unmitigated scenario, farm values and economic activity could be affected post-closure. With mitigation, the loss in land values to landowners would be avoided (through compensation) or reversed post-closure.

Spatial scale

In both the unmitigated and mitigated scenarios, any property value impacts or loss of economic activity will be experienced beyond the site boundary.

Consequence

A high consequence is expected in the unmitigated scenario. This reduces to medium-low in the mitigated scenario.

Probability

In the unmitigated scenario, it is possible that there will be a decline in property values and economic value of the farm unit. With mitigation, potential impacts would be prevented and/or minimised.

Significance

In the unmitigated scenario, the significance of potential impacts is high. With mitigation this reduces to medium-low depending on the effectiveness of implemented management measures and whether all parties concerned can reach an agreement.

Tabulated summary of the rated cumulative impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	H	H	M	H	M	H
Mitigated	M-L	M-L	M	M-L	M-L	M-L

Description of existing and proposed Everest management measures

Discussion of the management measures is provided in the EMP (Section 19).

7.3 DEFINITION OF CRITERIA USED

Both the criteria used to assess the impacts and the method of determining the significance of the impacts is outlined in Table 20. This method complies with the method provided in the EIA guideline document. Part A provides the approach for determining impact consequence (combining severity / nature, spatial scale and duration) and impact significance (the overall rating of the impact). Impact consequence and significance are determined from Part B and C. The interpretation of the impact significance is given in Part D. Unmitigated scenario is considered for each impact.

TABLE 20: CRITERIA FOR ASSESSING IMPACTS

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

PART B: DETERMINING CONSEQUENCE					
SEVERITY / NATURE = L					
DURATION	Long term	**H**	**Medium**	**Medium**	**Medium**
	Medium term	**M**	**Low**	**Low**	**Medium**
	Short term	**L**	**Low**	**Low**	**Medium**
SEVERITY / NATURE = M					
DURATION	Long term	**H**	**Medium**	**High**	**High**
	Medium term	**M**	**Medium**	**Medium**	**High**
	Short term	**L**	**Low**	**Medium**	**Medium**
SEVERITY / NATURE = H					
DURATION	Long term	**H**	**High**	**High**	**High**
	Medium term	**M**	**Medium**	**Medium**	**High**

	Short term	**L**	**Medium**	**Medium**	**High**
			L	**M**	**H**
			SPATIAL SCALE / EXTENT		

PART C: DETERMINING SIGNIFICANCE					
PROBABILITY (of exposure to impacts)	Definite/ Continuous	**H**	**Medium**	**Medium**	**High**
	Possible/ frequent	**M**	**Medium**	**Medium**	**High**
	Unlikely/ seldom	**L**	**Low**	**Low**	**Medium**
			L	**M**	**H**
			CONSEQUENCE		

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

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

7.4 PHASES AND TIMEFRAMES OF POTENTIAL IMPACTS

An indication of the phases in which impacts could occur is included in Section 7.2. This section also provides an indication of the duration of potential impacts. Potential impacts associated with the project have the potential to occur in almost all project phases and on a continuous basis if unmitigated. With the implementation of the mitigation as presented in Section 19, the monitoring programmes as presented in Section 21 and the emergency response procedures as presented in Section 20 the timeframe of potential impacts will be reduced significantly.

8 COMPARATIVE ASSESSMENT OF IDENTIFIED LAND AND DEVELOPMENT ALTERNATIVES

8.1 ALTERNATIVE LAND USE THAT WILL BE IMPACTED UPON

The site is currently used for livestock grazing and wilderness. Immediately surrounding land uses are similar to this with the addition of farmsteads and subsistence farming. Further afield mining and tourism-type activities take place (see Section 1.3.1 for a detailed description of existing land uses in the area). As an alternative to the development of the opencast project, these current land uses would continue. Given the location of the project within an area with conservation value, no other alternative land use is envisaged.

The proposed project will temporarily prevent the current land uses on site from continuing, for the life of the project. At closure, it is expected that with mitigation, the area could be used for grazing.

8.2 COMPARATIVE LAND USE ASSESSMENT

A comparative assessment was undertaken by the economic specialist, based on information provided by specialist consultants. Results from the study informed the impact assessments described in Sections 7.2.12 and 7.2.18. A full copy of the specialist report is included in Appendix O.

The issue of the better economic use of alternative land is inextricably linked to the question of what is sustainable development. It is the specialists view that the relevant question is: what is the best sustainable development option for South Africa between Agriculture and Mining for the Hoogland study area? The specialists conclusion is that the best alternative land-use is AQPSA's mining development proposal for Hoogland. The main reasons are:

- In South Africa, employment is the single biggest enhancer or detractor of social stability. It is also the one factor that makes all the difference in a person's material and psychological well-being. Closely linked to employment is income generation. Every generation, as a general principle in economic development, must be afforded the opportunity to advance itself responsibly without compromising the future of the next generation. The applicant's mining development, both from an income generation and employment retention perspective (note this is based on saving jobs at Everest), far outstrips that of the Agricultural GGP from the impacted farms. The related negative impact on farm related employment is not definite, but a conservative assumption has been made by the specialist to enable a relative comparison.
- It is important to re-state that the economic viability of the Everest Mine is at stake if the Hoogland development does not take place and for this reason the short span of the life of mine could be accommodated. It follows, given current market and operational conditions, that if the Hoogland

project does not proceed then the mine may close and be placed in an indefinite period of care and maintenance.

- Thus at stake is the creation/retention of approximately 1 685 jobs compared to 35 jobs (current farming practices) or 103 jobs (if farming productivity was to be increased) that could be lost in the surrounding farm areas in the assumed scenario where the mine may close versus the assumed scenario where mining continues and land uses at the farms are significantly impacted by the mine (this is in itself an assumption because with mitigation interventions some of the land uses and employment may be able to continue particularly in the closure phase of the project). The Time-Adjusted Employment created/retained (6/30 years to adjust for life of mine) for the Hoogland development and the continuation of Everest Mine is 337 and this is still significantly more than potential loss of farm jobs.
- Furthermore, the development takes place on the border of a municipality that is situated in one of the presidential development nodes so identified due to its abject poverty and need for development. Therefore, the industry that creates the most jobs must be seen as the better alternative for land-use. The municipality has a participation rate (employed/working age adults) of just over 30%, thus 3/10 working age adults have formal jobs.
- The impact of mine closure on the local economies will be significantly high – just over 2% for GGP decline and just under 6% decrease in formal jobs. Thus, this is another major reason to recommend the Hoogland development. However, the discontinuation of the Everest operation would not cause an economic catastrophe for the region.

These specialist findings must be read in the following context:

- The mining land-use alternative is best for society if all the mitigation factors recommended in the EMP are strictly adhered to.
- If the only criterion to decision-making was the environment, then the specialist is of the view that the change of land-use is not recommended as the sustainability costs to society would be negative. The benefits to South Africa in terms of income and jobs are the major counter-balancing factors especially considering that given current market and operational conditions, if the Hoogland project does not proceed then the mine may close and be placed in an indefinite period of care and maintenance.

9 LIST OF SIGNIFICANT IMPACTS

A list of significant impacts, when considered **without mitigation** and cumulatively with the existing mine operations, as identified in the assessment conducted in Section 7 is provided below.

- Hazardous structures/excavations (high)
- Loss of soil resources and associated natural land capabilities (high)
- Physical destruction of biodiversity (land and water based) (high)
- General disturbance of biodiversity (land and water based) (high)
- Pollution of surface water resources (high)
- Dewatering impacts on baseflow (medium)
- Contamination of groundwater (medium)
- Increase in air pollution (high)
- Increase in disturbing noise levels (medium-high)
- Negative landscape and visual impacts (high)
- Loss of current land uses (high)
- Blasting hazards (high)
- Mine-related road use and traffic (medium)
- Disturbance of heritage resources (high/medium)
- Economic impacts (positive and negative) (high positive)
- Informal settlements, safety, security and services and associated social ills (high)
- Change in land values (high)

10 STAKEHOLDER ENGAGEMENT PROCESS

This section provides a description of the engagement process with interested and affected persons (IAPs) followed during the course of the environmental assessment process. It outlines how IAPs were identified, confirms the details of the engagement process (with supporting documentation included as appendices), and how issues raised have been addressed.

10.1 IDENTIFICATION OF INTERESTED AND AFFECTED PARTIES

The stakeholder engagement process commenced with a stakeholder analysis that was aimed at identifying parties to be involved during the environmental assessment process and associated communication structures. This was done through review of the mine's existing IAP database, social scans including site visits in the surrounding area, networking and direct consultation with IAPs. The database is being updated on an ongoing basis throughout the environmental process. Key stakeholders identified for the project include:

- IAPs:
  - landowners in and surrounding the project site;
  - land occupiers and community surrounding the project area;
  - downstream mines and industries;
  - non-government organisations and associations;
  - mine employees.
- Regulatory authorities:
  - Department of Mineral Resources (DMR);
  - Department of Economic Development, Environment and Tourism (DEDET);
  - Department of Agriculture, Forestry and Fisheries (DAFF);
  - Department of Water Affairs (DWA);
  - Department of Rural Development and Land Reform (DRDLR);
  - Mpumalanga Tourism and Parks Agency (MTPA)
  - South African Heritage Resources Agency (SAHRA);
- Local authorities:
  - Enhlanzeni District Municipality
  - Thaba Chweu Local Municipality); and

A full list of landowner names, local communities, other IAPs and non-government organisations consulted is provided in the IAPs and regulatory authorities' database included in Appendix C. The database is updated on an ongoing basis throughout the environmental process.

10.2 DETAILS OF ENGAGEMENT PROCESS

Stakeholder engagement is an integral component of any development process. The goal of stakeholder engagement is to facilitate and improve communication between stakeholders (including the applicant) in the interest of facilitating better decision-making and more sustainable development (DEAT, 2002). In accordance with the requirement of Chapter 6 of the EIA Regulations, 2006, a stakeholder engagement programme has been developed to set out a coordinated process through which IAPs are informed of the proposed development and environmental assessment process and provided with an opportunity to provide input into the project plan and proposed mitigation measures. By consulting with authorities and IAPs, the range of environmental issues to be considered in the EIA has been given specific context and focus. Included below is an outline of the process followed, and the people engaged. Additional consultation with IAPs and regulatory authorities was undertaken by AQPSA (a summary is provided in Table D1 attached as part Appendix D).

10.2.1 STEPS IN THE PUBLIC PARTICIPATION PROCESS

Steps in the consultation process that have been conducted to date are set out in Table 21: below.

TABLE 21: CONSULTATION PROCESS WITH IAPS AND AUTHORITIES

Task	Description	Date
Notification - regulatory authorities and IAPs		
Information-sharing with the DMR	An initial project meeting was held with the DMR in Emalahleni to introduce the project consultant and to discuss the conceptual project with the DMR. Minutes from this meeting are presented in Appendix B.	28 January 2010
Information-sharing with immediate landowners	Initial discussions were held with Mr Nel (senior), Mr Nel (junior), Ms Groenewald, Mr van Vuuren and the project was presented to the Bakoni Ba-Phetla Tribal Authority and Royal Council. The purpose of these meetings was to introduce Metago, provide conceptual information regarding the project and to obtain initial comments from the immediate landowners. Minutes from these meetings are presented in Appendix D.	28 and 29 January 2010
Application to DEDET	Formal application was submitted by Metago to DEDET on 02 March 2010. A copy of the relevant parts of the application and the responses are attached in Appendix B.	02 March 2010
Social scan	A social scan of the Hoogland project sites was conducted by Metago. The purpose of the social scan was: • to identify relevant municipal ward councillors, landowners, land occupiers, and other interested and affected parties; • to obtain updated contact details for IAPs; • to identify appropriate communication structures; and • inform IAPs of the project, upcoming public consultation process and associated scoping and EIA/EMP processes. As part of the social scan, direct consultation with landowners took place through informal discussions, focussed meetings and/or telephonic discussions. Issues raised during the social scan have been included in the issues table. One output of the social scan is an IAP database (Appendix C). The IAP database is updated as required.	January - May 2010

Task	Description	Date
Distribution of background information document (BID)	BIDs were distributed to IAPs by email, post and fax using the mine's IAP database and contact details obtained during the social scan, at the public scoping meetings and by fax and/or e-mail to authorities on the project's public involvement database. A copy of the BID (in English) used is attached in Appendix D. The purpose of the BID was to formally inform IAPs and authorities about the project, the environmental assessment process, possible environmental impacts and means of inputting into the environmental assessment process. Attached to the BID was a registration and response form, which provided IAPs with an opportunity to submit their names, contact details and comments on the project to Metago	20 – 26 May 2010
Site notices	Laminated A2 site notices in English and SePedi were placed at key conspicuous positions in and around the project sites. An English version of the advertisement/site notice used is attached in Appendix D.	20 May 2010
Newspaper advertisements	Block advertisements were placed in the Highlands Panorama and the Steelburger/Lydenburg News) (see copies in Appendix D).	20 and 21 May 2010
Scoping stage meetings		
Information-sharing scoping meeting(s)	Information-sharing scoping meetings were held after the World Cup soccer tournament. The purpose of the meetings was to provide IAPs with an outline of the project and environmental assessment process, identify potential issues to be investigated further, provide input into the terms of reference for specialist studies and agree on the way forward. Minutes of the meetings are included in Appendix D.	21-23 July 2010
Regulatory authority scoping meeting	A scoping meeting was held with the regulatory authorities on site. The purpose of the meeting was similar to that of the public scoping meeting, that is to provide regulatory authorities with an outline of the project and environmental assessment process, obtain input into the legal process being followed, identify potential issues to be investigated further, provide input into the terms of reference for specialist studies and agree on the way forward. Minutes of the meeting are included in Appendix B.	14 July 2010
Review of scoping report		
Public review of scoping report	All I&APs on the database were notified of the availability of the scoping report at public venues either through telephone calls, e-mails and through the distribution of executive summaries of the scoping report. Proof of this is contained in Appendix D. Copies of the scoping report were made available for public review at 8 public venues (i.e. around the site, Mashishing [Lydenburg], Johannesburg and Pretoria). The IAP comments received during the scoping report review period are summarised in the comments and response form in Appendix E and full copies of their submissions are contained in Appendix D.	13 – 17 May 2011
Regulatory authority review of scoping report	Copies of the scoping report were provided to the DMR in hard copy and in electronic copy and at the same electronic copies of the report were distributed to the other authorities for review time copies of the Regulatory authority review of the scoping report. Proof of distribution is contained in Appendix B	30 May – 2 July 2011

10.2.2 SPECIALIST TEAM

Upon input from IAPs on the potential impacts that may arise as a result of the proposed development, several specialists (see Table 3 for a complete list of all appointed specialist, their roles and responsibilities) were appointed to assess the potential impact of the proposed development.

Where required, specialists consulted with stakeholders directly during their specialist studies. Details are provided in the specialist reports included as appendices.

10.2.3 REVIEW OF EIA AND EMP BY REGULATORY AUTHORITIES

The initial EIA and EMP report was distributed to the DMR and other regulatory authorities for review in August 2011 as follows:

- seven copies of the report were forwarded to the Limpopo DMR;
- at the same time copies of the report were forwarded to the following regulatory and local authorities: DWA, SAHRA, DAFF, DRDLA, MDEDET, MPTA, Ehlanzeni District Municipality, Thaba Chweu Local Municipality.

The revised EIA and EMP report will be distributed to the same authorities in a similar manner. The only difference is that subsequent to the distribution of the initial EIA and EMP report, the Limpopo DMR has transferred the application to the Mpumalanga DMR. Therefore seven copies of the revised EIA and EMP report will be submitted to the Mpumalanga DMR.

Following the public review period, the EIA and EMP report will also be forwarded to DEDET for review and decision-making.

10.2.4 REVIEW OF THE EIA AND EMP BY IAPS

Copies of the initial draft EIA and EMP report were made available for public review in August 2011 at the following places:

- Everest Platinum Mine (C/o The Receptionist);
- Phetla CPA C/o Paul Rachidi (C/o The CPA Secretary);
- Kiwi Primary School C/o Peggy Ngutshane (School Principal);
- Steenkampsberge Boereverening (C/o Dawie Jacobs);
- Lydenburg Public Library;
- De Berg Conservancy (C/o Chris Davel);
- Library at Metago's offices in Johannesburg; and
- Library at Metago's offices in Pretoria.

Electronic copies of the report were made available to IAPs on request (electronically on CD). A summary of the EIA and EMP report (in English and SePedi) was distributed to all IAPs registered on the project's public involvement database by post and/or e-mail. IAPs were notified of the availability of the report and/or summary for review as well as review periods via newsletter and sms (short text message). IAPs were given 40 days to review the draft report and submit comments in writing to Metago.

All comments received from IAPs during the review period were forwarded to the DMR and included with the final report submitted to DEDET in October 2011.

The revised EIA and EMP report will be made available for public review in the same manner as above. The closing date for comments will be in May 2012.

10.2.5 FEEDBACK OPEN DAYS

Two feedback meetings were arranged, one at the Kiwi Primary School and one at the Steenkampsberge Boereverening. The purpose of these were to provide IAPs with an opportunity to submit final comments of the EIA and EMP report. IAPs will be notified of the details of the feedback meetings via newsletter.

For the revised EIA and EMP report, feedback meetings have been arranged in a similar manner. IAPs will be notified of the feedback meetings via newsletter.

10.3 MANNER IN WHICH ISSUES RAISED WERE ADDRESSED

Stakeholder meetings and public review of the scoping reports provided IAPs an opportunity to comment on the baseline environment and potential impacts of the project (including social and cultural impacts). All the issues and concerns raised have been captured within the EIA and EMP into the comments and response report (Appendix E). The comments and response report provides responses to issues raised and identifies where the issues have been addressed in the EIA and EMP report.

11 ADEQUACY OF PREDICTIVE METHODS, UNDERLYING ASSUMPTIONS AND UNCERTAINTIES

Assumptions, uncertainties and limitations have been discussed throughout the EIA report and in the various specialist studies. The more significant of these are included below.

Environmental assessment limit

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

Predictive models in general

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

Assumptions, uncertainties and limitations associated with the Hoogland project have been discussed throughout the EIA and EMP report and in the various specialist studies. The more significant of these are included below.

Available Information

This EIA and all of the relevant specialist studies were based on the project information available at the time of writing these reports, and is assumed that this information is accurate. Any significant changes to the project description would potentially require a revision to this EIA/EMP.

Specialist Study Limitations

Biodiversity

Ecorex noted the following assumptions and limitations to their study:

- Seasonality: The aquatic assessment was based on a single field survey only, which is considered appropriate for the purposes of this investigation because there is sufficient additional historical data on aquatic ecosystems in the area to be confident with the conclusions of this study. Furthermore, flow conditions during the site visit were ideal for sampling aquatic fauna. Stream faunal composition is also likely to be relatively constant over time because of the naturally low variability of stream flows, and the near-pristine condition of the area. Additional surveys are therefore unlikely to change the conclusions of this study. It was further noted that time constraints did not allow a meaningful time interval between sample periods, so a single late-

summer survey was carried out; this is adequate for the purposes of monitoring as long as future surveys are carried out during the same period

- Un-surveyed Areas: Farm dams on the property were not surveyed, and these could contain additional species of fish, such as trout. The dams were not surveyed because they are not considered to be natural part of the ecosystem, and therefore do not contribute to the assessment of ecological importance and sensitivity. The terrestrial ecosystems to the north of the main stream were not surveyed as these were outside of the planned infrastructure footprint and represented habitats that were well studied in 2007
- Fish Response Assessment Index: The FRAI could not be applied to assess the Present Ecological State of fish in the area because of the naturally low diversity of fish species in the study area (two or three species only)
- Overlooked Species:
    - No survey can cover all invertebrate species present, so the biodiversity estimates provided represent only a few indicator taxa; it is possible that diversity in other groups follows a significantly different pattern from these and hence re-establishment of the selected taxa is not a guarantee that rehabilitation has been equally successful for all invertebrates. A far greater number of invertebrate species belonging to less studied taxa will be present in the study area, and these may include many species that are rare or threatened
    - Termites were not included as an indicator group presents due to a lack of expertise for identification of specimens
    - Experience has shown that obtaining sufficient data on scorpions, mygalomorph spiders and ground beetles to allow their meaningful inclusion in a monitoring programme is extremely time-consuming; these groups were therefore omitted from the quantified survey component of the field work and only surveyed for on the basis of checking for presence of protected and / or rare species
    - Certain plant species, particularly geophytes, will only flower in seasons when conditions are optimal and may thus remain undetected over a four-season survey. Other plant species may be overlooked because of very small size and / or extreme rarity. A sampling strategy will always represent merely a subset of the true diversity of the study area.
- Lack of Data for Invertebrate Groups: assessment of the importance of the Hoogland Extension study area for invertebrates is hampered by the lack of detailed knowledge on most invertebrate species and groups. The assessment in the ecology study is thus based primarily on 1) a desktop assessment of the likelihood of occurrence of species of known conservation significance, and 2) adjustment of these probabilities where confirmation of presence or absence of individual species on the site and/or within specific habitat types was obtained during the field survey. Due to seasonal constraints, for some species such

confirmation was not possible during the field survey carried out, and these will need to be assessed in a follow-up survey in early summer.

Surface water

A number of assumptions were made in undertaking the hydraulic modelling. These assumptions were made in the context of the study and are considered appropriate in view of the level of detail required and the existing site conditions. The key assumptions include:

- That the topographic data provided was of a sufficient accuracy and coverage to enable hydraulic modelling at a suitable level of detail. There are some limitations with the topographic data, however, these limitations are likely to result in a more conservative estimate of flooding in some locations, and as is evident in the results, a buffering distance of 100m encompasses the majority of flooding modelled (all the flood area of in the proposed mine workings).
- The Manning's 'n' value used is considered suitable for use in both the 50 year and 100 year return periods modelled, as well as in representing both the channel and floodplain
- A steady state model has been used to define flooding. The use of a steady state model, assumes that the area of interest is sensitive to peak flows rather than flood volume. Due to the steep topography of the site, peak flows are expected to be suitable for defining flood extents
- A worst case scenario has been modelled whereby individual critical storm durations (corresponding to the time of concentration) have been used for each subcatchment. In reality, a single flood event on a catchment will usually correspond to a single storm duration, which will produce a maximum flood at a particular location along the river. The inclusion of various storm durations consequently predicts the worst flooding for each river subcatchment modelled
- In using a steady state model with subcatchment specific storm durations, the implication is that flood peaks for each of the subcatchments are coincident. However, the routing of different hydrographs generally results in a non-convergence of peaks. The results are consequently likely to be conservative.

Groundwater

GCS noted the following limitations that could negatively influence some of the modelling output data:

- No time series of water level data was available for the newly-drilled monitoring boreholes. Therefore model calibration was limited to steady-state flow conditions.
- Mine plans can change and the rate of mining can also change with time, which will have an effect on the predicted inflow volumes.

The groundwater model was used for prediction, but will have to be re-assessed once more data become available.

Air

The proposed Hoogland Extension Project is located in an area with no local meteorological recordings to reflect the on-site climatic dispersion potential and is surrounded by complex terrain features. To overcome this problem, Airshed made use of meteorological data (specific to the mine site) extracted from the US-EPA CALMET model (which forms part of the CALPUFF suit of models) for the region. The data included hourly average wind speed, wind direction and temperature.

Heritage and paleontological

It is possible that the Phase I Heritage study may have missed heritage resources in the project area as heritage remains may occur in thick clumps of vegetation while others may lie below the surface of the earth and may only be exposed once development commences. If any heritage resources of significance are exposed during the mining project the South African Heritage Resources Authority (SAHRA) will be notified immediately, all construction activities will be stopped and an archaeologist accredited with the Association for Southern African Professional Archaeologist (ASAPA) will be notified in order to determine appropriate mitigation measures for the discovered finds.

Noise

For the noise study, the position of houses/dwellings on the farms was taken off 1:50 000 topographical cadastral maps and verified as far as possible from a field survey and using Google Earth. Even though the latest editions of the maps were used, these are up to 22 years out of date and there may be new dwellings and/or some of the existing buildings shown may be derelict. During the field survey for the noise measurement survey, such aspects were noted where possible.

The mine has been temporarily closed since late 2008. When the noise baseline investigation for the Hoogland Extension Project was undertaken in March 2010, the mine was not yet again operational and thus it was not possible to measure and observe the residual noise climate that had been introduced into the area when the mine was commissioned. The noise impact of the Hoogland Project has to be assessed against the existing mine noise climate and not the pristine condition measured in the area in March 2010. It was therefore necessary to calculate the noise profile of the existing mine.

Geochemistry

Sampling was limited to four representative rock samples collected from the percussion drill chips coming from the four hydro exploration boreholes that were drilled around the Northern Pit. The rock samples are intended to represent the material that will be used to backfill the open pits (overburden) at the end of mining. It is however recommended that additional testing be conducted on representative material while the mine is operational in order to confirm the results of the geochemistry testing conducted for the EIA.

Closure cost calculations

The financial liability calculated is considered to be Class 1 estimate (with an accuracy of between +25% and -15%) based on the overall generic approach as stipulated by the DME Guideline Document. The financial liability only considers the routine costs associated with decommissioning of plant and infrastructure, the restoration of any environmental damage caused predominantly at the pre-production stage, the surface rehabilitation (shaping and vegetating) of waste deposits and material stockpiles, making voids and open pits "safe", and the maintenance and aftercare of all the rehabilitated areas. Site specific aspects such as surface and groundwater remediation have not been costed at this stage – the likelihood of such remediation would only be identified during the on-going operation of the mine and/or by carrying out risk assessment and water pollution potential studies.

Cumulative impacts

All identified impacts have been considered in a cumulative manner such that the current baseline conditions on site and in the surrounding area and those potentially associated with the project are discussed and assessed together.

12 ARRANGEMENT FOR MONITORING AND MANAGEMENT OF IMPACTS

This section describes the arrangements for monitoring and management of environmental impacts. It identifies the impacts that require monitoring programmes and outlines the functional requirements, roles and responsibilities and timeframes for the monitoring programmes. Further detail on each monitoring programme is included in Section 21.1.

12.1 IMPACTS THAT REQUIRE MONITORING PROGRAMMES

Impacts that require monitoring include:

- Hazardous excavations and structures (failure of TSF and water dams)
- Physical destruction and general disturbance of biodiversity
- Dewatering impacts
- Contamination of groundwater
- Increase in air pollution
- Increase in disturbing noise levels
- Blasting hazards
- Noise levels

In addition to the above, the commitments as included in the EMP report will require monitoring to a) ensure that they are being implemented and b) that they are effective in mitigating potential impacts on the environment, socio-economic conditions of third parties and heritage/cultural aspects. This will be done through regular internal auditing by mine personnel.

12.2 FUNCTIONAL REQUIREMENTS OF MONITORING PROGRAMMES

The purpose of the monitoring programmes is to review the mine's impact on various aspects of the environment and to report on changes needed to the management programme as proposed in this report.

As a general approach, the mine will ensure that the monitoring programmes comprise the following:

- a formal procedure
- appropriately calibrated equipment
- where samples require analysis they will be preserved according to laboratory specifications
- an accredited, independent, commercial laboratory will undertake sample analyses
- parameters to be monitored will be identified in consultation with a specialist in the field and/or the relevant authority

- if necessary, following the initial monitoring results, certain parameters may be removed from the monitoring programme in consultation with a specialist and/or the relevant authority
- monitoring data will be stored in a structured database
- data will be interpreted and reports on trends in the data will be compiled by an appropriately qualified person on a quarterly basis
- both the data and the reports will be kept on record for the life of mine.

12.3 ROLES AND RESPONSIBILITIES

The roles and responsibilities for the execution of the monitoring programmes are defined below.

- Group environmental manager:
  - Oversee the role of the site-specific environmental co-ordinator
- SHE Co-ordinator
  - ensure that the monitoring programmes are scoped and included in the annual mine budget
  - identify and appoint appropriately qualified specialists/engineers to undertake the programmes
  - appoint specialists in a timeously manner to ensure work can be carried out to acceptable standards

12.4 TIMEFRAMES FOR MONITORING AND REPORTING

The timeframes for monitoring and reporting thereof are detailed in the monitoring programme (see Section 21.1). A summary is provided below:

Programme	Timeframe and frequency	Reporting
TSF, waste dumps and water dams	All project phases Daily and monthly by dam operators and quarterly by professional engineer	Monthly internally and quarterly by professional engineer
Biodiversity	All project phases Quarterly and annually	Annually by specialist
Groundwater and process water	All project phases Monthly (water levels), quarterly (water qualities), annually (update groundwater model and climatic water balance)	Quarterly and annually by specialists Annually to Department of Water Affairs (DWA)
Air	All project phases Quarterly (dust) and daily (PM10)	Quarterly and annually by specialist Annually to Department of Mineral Resources (DMR) and Department of Economic Development, Environment and Tourism (DEDET)
Noise	Periodically from the start of construction to the end of decommissioning Annually	Annually by specialist
Blasting	During operation of the mine Every blast	Monthly by specialist
Internal auditing	From start of construction to end of closure Every two weeks during construction and decommissioning, and quarterly during operation and closure.	Monthly internally during construction and decommissioning Quarterly internally during operation and closure
External auditing	From start of construction to end of closure Every two years	Every two years to DMR

13 TECHNICAL SUPPORTING INFORMATION

Technical and supporting information included as appendices to this report are listed below.

- project alternatives considered (Appendix A)
- information-sharing with regulatory authorities (Appendix B)
- stakeholder database (Appendix C)
- information-sharing with IAPs (Appendix D)
- comments and response report (Appendix E)
- soil and land capability specialist report (Appendix F)
- biodiversity specialist report (Appendix G)
- hydrological specialist report (Appendix H)
- geo-hydrological specialist report (Appendix I)
- air quality specialist report (Appendix J)
- noise specialist report (Appendix K)
- visual specialist report (Appendix L)
- heritage specialist report (Appendix M)
- palaeontological specialist report (Appendix N)
- economic specialist report (Appendix O)
- water balance specialist report (Appendix Q)

SECTION 2 – ENVIRONMENTAL MANAGEMENT PROGRAMME

14 ENVIRONMENTAL OBJECTIVES AND SPECIFIC GOALS FOR CLOSURE

14.1 ENVIRONMENTAL ASPECTS THAT DESCRIBE THE PRE-MINING ENVIRONMENT

Environmental aspects that collectively describe the pre-mining environment (of the existing mine site and proposed Hoogland site) as informed by the baseline description (Section 1) are listed below. This list serves to guide the setting of environmental objectives for mine closure.

- Topographical features range between flatter terrace areas to steeper valleys
- Soils that support agricultural potential (to varying degrees between arable and grazing) and wilderness potential
- Biodiversity that ranges in sensitivity from very low to medium-high based on vegetation communities, vertebrate and invertebrate groups identified on site
- Perennial and ephemeral drainage patterns
- Moderate to good ground- and surface water quality
- Stable water table providing groundwater as a water supply source and feeding streams in the upper reaches
- Quiet agricultural environment
- Open valley wilderness

Rehabilitation of land disturbed by mining will be undertaken on an on-going basis throughout the life of the mine as soon as land becomes available for rehabilitation. Management measures pertinent to rehabilitation are given in Section 19. A detailed plan for decommissioning and closure of the mine will be submitted to the DMR five years before the mine is decommissioned. This plan will be refined progressively as the mine approaches the end of its life. The framework for the plan as provided in the mine's approved EMP (July 2003) is given in Table 22 below.

TABLE 22: FRAMEWORK FOR DECOMMISSIONING AND CLOSURE PLAN

Subject	Detail
Post-closure land use	• Land at all sites other than the tailings dam sites will be returned to its pre-disturbance agricultural potential.
Rehabilitation and closure objectives	• Restore as much as possible of the project area to a condition consistent with the pre-determined post closure land use objective. • Ensure that the area is left in a condition that poses an acceptable level of risk to public health and safety. • Reduce as far as is practicably possible the need for post closure intervention, either in the form of monitoring or on-going remedial works.
Rehabilitation and closure standards	• The standards against which the success of rehabilitation and closure of the project will be determined and will be formulated in detail during the detailed design, commissioning and operational phases but will, as a minimum, comply with the requirements of South African Law and the company's environmental policy.

Subject	Detail
Decommissioning and closure activities	• Dismantle conveyors, powerlines, pipelines, sewage plant, mineral processing plant, contractors' yards, offices, workshops and other buildings. Load and remove from site for re-sale or disposal at an approved waste site. • Demolish and remove concrete foundations and slabs to an approved waste disposal facility. • Rip and grade the above areas for placement of topsoil. • Rip and grade mine roads for placement of topsoil. • Maintenance of roads required for maintenance and monitoring. • Load from stockpile, haul, place and spread a layer of 200 to 500 mm of topsoil on all areas on which vegetation will be established. • Establish vegetation on topsoiled surfaces, including analysis of topsoil, application of fertilisers, application of seed and hand planting as necessary. • Active maintenance of planted areas for a period of at least a year, including re-seeding and re-planting, weed and alien vegetation control as required. • Passive maintenance of planted areas for a period of 3 years, including re-seeding and re-planting, weed and alien vegetation control as required. • Safety inspections of dams by appropriately qualified professional engineers. • Repairs and upgrades to spillways and associated facilities as required. • Treatment and release of water from dirty water holding ponds that is to be decommissioned. • Decommission and remove pumping equipment and power supply from production boreholes.

14.2 MEASURES REQUIRED FOR CONTAINMENT OR REMEDIATION

Measures required to contain and/or remedy any causes of pollution or degradation or migration of pollutants, both for closure of the mine and post-closure are listed below.

- Implement a waste management procedure for general and hazardous waste on site throughout the project life
- Ensure immediate clean-up of any spills as per the emergency response procedures
- Establish and maintain dirty stormwater control measures in line with regulatory requirements, until such time as potentially polluting areas are rehabilitated
- Contain pollutants at source by storing and handling potentially polluting substances on impermeable substrates, within bunded areas and with the capacity to contain spills
- Design, construct and operate the TSF with decant and drainage systems and runoff control measures
- Design, construct and operate the waste dump with runoff control measures
- On-going rehabilitation of disturbed areas as soon as possible
- Rehabilitate the site in line with a detailed closure plan to be developed at least five years prior to decommissioning

Further detail on the proposed action plans and mitigation measures is included in Section 19.

15 ENVIRONMENTAL OBJECTIVES AND SPECIFIC GOALS FOR MANAGEMENT OF IDENTIFIED ENVIRONMENTAL IMPACTS

The environmental objectives and specific goals for the management of identified environmental impacts are detailed in this section.

15.1 IMPACTS THAT REQUIRE MONITORING PROGRAMMES

Impacts that require monitoring include:

- Physical destruction and general disturbance of biodiversity
- Dewatering impacts on third party users
- Contamination of groundwater
- Increase in air pollution
- Increase in disturbing noise levels
- Blasting hazards

15.2 SOURCE ACTIVITIES

The source activities of potential impacts which require management are detailed in Section 23 and listed below.

- Exploration
- Earthworks
- Open pit mining
- Power supply and use
- Stormwater management
- Transport systems
- Site support services
- Site/contract management
- Rehabilitation
- Site preparation
- Civil works
- Waste rock management
- Water supply and use
- Process water management
- General and hazardous waste management
- Storage and maintenance services/ facilities
- Demolition
- Maintenance and aftercare

15.3 MANAGEMENT ACTIVITIES

Management activities which will be conducted to control the project actions, activities or processes which have the potential to pollute or result in environmental degradation are detailed in Section 19.

Specific environmental objectives and goals to control, remedy or stop potential impacts emanating from the mine which may impact on the bio-physical environment are described below. The information is presented in tabular format (Table 24).

TABLE 23: ENVIRONMENTAL OBJECTIVES – BIO-PHYSICAL

Aspects	Environmental objective
Topography	To ensure that people and animals are not harmed by falling off or into hazardous excavations. To ensure that there is no surface subsidence above the mine workings.
Soils and land capability	To conserve soil resources disturbed by the development of the mine and to ensure that the pre-mining land capability can be restored. To prevent erosion and contamination of soil resources. To restore disturbed land to its pre-disturbance potential at all sites other than the tailings dam site.
Land Use	To prevent injury and to avoid damaging structures. To ensure the mine's alteration and usage of road infrastructure is acceptable to roads authorities and other users of the roads. To prevent failures of mine residue deposits. To respect the tenure rights of the non-landowner households that need to move to make way for mining and to afford them will assistance that is fair and reasonable with relocating their homes. To control blasting so as to prevent injury, unnecessary damage to ecological systems and avoid damaging structures.
Natural Vegetation	To minimise the area of disturbance and disturbance of sensitive habitats. To rehabilitate disturbed land to a stable physical state and prevent proliferation of invasive plants. To prevent disturbance of sensitive animal habitats. To rescue animals from refuges that will be disturbed by the development of infrastructure and mining, including burrows and rock outcrops. To protect watercourses and wetlands and prevent alteration of these habitats directly and indirectly through sedimentation and pollution.
Surface Water	To ensure compliance with the GN 704 Regulations and conditions of approval of water use licences. Minimize the alteration of drainage patterns in the project area. To prevent discharges of contaminated water to the environment. To prevent pollution of water resources in the vicinity of the mine.
Groundwater	To limit the decrease in base flow of streams. To prevent any contamination of water supply to third parties.
Air Quality	To limit public exposure to nuisance dust. To ensure that dust from the mine is not a public health hazard.
Noise	To prevent public exposure to disturbing noise.
Visual aspects	To minimize visual impacts on sensitive views.

15.4 ROLES AND RESPONSIBILITIES

The key personnel in terms of this EIA and EMP report will be a Group Environmental Manager and Site Safety, Health, Environment (SHE) Co-ordinator and Human Resources Manager. As a minimum, these roles as they relate to the implementation of monitoring programmes and management activities will include:

- Group environmental manager:
  - Oversee the role of the site-specific environmental co-ordinator
- SHE Co-ordinator (will report as a minimum to the Group Environmental Manager and Mine Manager)

- ensure that the monitoring programmes are scoped and included in the annual mine budget
- identify and appoint appropriately qualified specialists/engineers to undertake the programmes
- appoint specialists in a timeously manner to ensure work can be carried out to acceptable standards

- Human Resources Manager:
  - manage labour-related aspects for the mine
  - liaise with the relevant structures in terms of the commitments in the SLP
  - ensure that commitments in the SLP are developed and implemented in a timeously fashion
  - establish and maintain good working relations with surrounding communities and landowners

16 ENVIRONMENTAL OBJECTIVES AND SPECIFIC GOALS FOR SOCIO-ECONOMIC CONDITIONS

16.1 ASPECTS OF THE SOCIO-ECONOMIC CONDITIONS

The socio-economic conditions in the vicinity of the mine are described in Section 1.3.4.

16.2 OBJECTIVES AND GOALS

Specific environmental objectives and goals to control, remedy or stop potential impacts emanating from the mine which may impact on communities and IAPs identified in the social and labour plan are described below. The information is presented in tabular format (Table 24).

TABLE 24: ENVIRONMENTAL OBJECTIVES AND GOALS – SOCIO-ECONOMIC CONDITIONS

Aspect	Environmental objective	Goals
Land uses	To prevent unacceptable impacts on surrounding land uses and their economic activity	To co-exist with existing land uses To negatively impact existing land uses as little as possible
Blasting	To minimise the potential for third party damage and/or loss	To protect third party property from mine-related activities, where possible Where damage is unavoidable, to work together with the third parties to achieve a favourable outcome
Traffic	To reduce the potential for safety and vehicle related impacts on road users	To ensure the mine's use of public roads is done in a responsible manner
Socio-economic	To enhance the positive economic impacts and limit the negative economic impacts To limit the impacts associated with inward migration	To work together with existing structures and organisations To establish and maintain a good working relationship with surrounding communities and land owners

17 ENVIRONMENTAL OBJECTIVES AND SPECIFIC GOALS FOR HISTORICAL AND CULTURAL ASPECTS

Environmental objectives and goals in respect of historical and cultural aspects are listed in the table below (Table 25).

TABLE 25: ENVIRONMENTAL OBJECTIVES AND GOALS – HISTORICAL AND CULTURAL ASPECTS

Aspect	Environmental objective	Goals
Heritage and cultural	To prevent unacceptable loss of heritage resources and related information	To protect heritage resources where possible If disturbance is unavoidable, then mitigate impact in consultation with a specialist and the SAHRA and in line with regulatory requirements
Palaeontological resources	To minimise loss of fossil resources and related information	To protect palaeontological resources where possible through mitigation If disturbance is unavoidable, then provide opportunity for research

18 APPROPRIATE TECHNICAL AND MANAGEMENT OPTIONS CHOSEN FOR EACH IMPACT

18.1 PROJECT ACTIONS, ACTIVITIES AND PROCESSES

All activities associated with the project have the potential to cause pollution or environmental degradation. These are described in Section 2 of this EIA and EMP report.

18.2 TECHNICAL AND MANAGEMENT OPTIONS

Appropriate technical and management options chosen to modify, remedy, control or stop any action, activity or process associated with the project which will cause significant impacts on the environment, socio-economic conditions and historical and cultural aspects are listed in the tables in Section 19.

19 ACTION PLAN TO ACHIEVE OBJECTIVES AND GOALS

Action plans to achieve the objectives and goals set out in Section 15 (bio-physical environment), Section 16 (socio-economic conditions) and Section 17 (historical and cultural) above, are listed in tabular format together with timeframes for each action. The action plans include the timeframes and frequency for implementing the mitigation measures as well identifies the responsible party.

TABLE 26: ACTION PLAN – HAZARDOUS STRUCTURES AND EXCAVATIONS AND SUBSIDENCE MANAGEMENT

Phase of operation	Activities	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Earthworks Civil works	**H**	**M-L**	• Establish security control measures. • Undertake regular patrols of mine perimeter. • Educate third parties on potential dangers. • Design and construct all stockpiles and residue facilities in line with relevant management plans. • In case of injury or death due to hazardous excavations, follow the emergency response procedure as referenced in Section 20.2.	At start On-going On-going As required As required	Once off Daily Quarterly As required As required	Site Manager Security Manager SHE Coordinator SHE Coordinator SHE Coordinator
Operation	Open pit mining Backfilling of open pits Underground mining Waste rock and tailings management Mineral processing Process water management Stormwater management Site/contract management Rehabilitation	**H**	**M-L**	• Maintain security control measures. • Undertake regular patrols of mine perimeter. • Backfill open pits according to the rehabilitation plan. • Barriers such as fencing, walls or berms will be used to prevent access by humans and animals to active pits and other hazards. The barriers will have warning notices at appropriate intervals in English, Afrikaans and Pedi and using pictures where appropriate. • Backfill and landscape other excavations e.g. pipeline excavations etc. • The boxcuts will be backfilled once the development of the declines is completed such that the tunnel entrances to the declines will be evident on surface. • Operate all stockpiles and residue facilities in line with relevant management plans and COPs. • Excess backfill will be placed in open pits when backfilling to prevent subsidence through consolidation of overburden during the life of the mine so that there will be no subsidence remaining at closure. • Adequate support will be provided in the underground workings to ensure that there is no subsidence. A professional rock engineer will design pillar dimensions for underground support and to ensure no subsidence. • The mine will contact the DMR's Directorate of Mine Surveyors to obtain specifications for the monitoring of subsidence above mine workings. The mine will then monitor subsidence according to these specifications. • If subsidence is detected, the mine will immediately identify the cause and implement appropriate mitigation measures to prevent further subsidence. Where necessary, land disturbed by subsidence will be landscaped. • Educate third parties on potential dangers.	On-going On-going On-going On-going As required As required As required On-going As required As required As required As required As required On-going	As required Daily Constant Quarterly As required As required As required Daily As required As required As required As required As required Quarterly	SHE Coordinator Security Manager SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator

Phase of operation	Activities	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				• In case of injury or death due to hazardous excavations, follow emergency response procedure as referenced in Section 20.2.	As required	As required	SHE Coordinator
Decommission	Waste rock and tailings management Seal declines and vent shafts Rehabilitation Process water management	**H**	**M-L**	• Seal decline and vent shafts with an engineered seal in accordance with specifications provided by the DMR. • Rehabilitate the site in line with recommended rehabilitation plan. • Educate third parties on potential dangers. • In case of injury or death due to hazardous excavations, follow emergency response procedure as referenced in Section 20.2.	As required As required As required As required	As required As required Quarterly As required	SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator
Closure	Final landforms (residue facilities)	**H**	**M-L**	• Repair and maintain security measures at residue facilities	Timeframe to be agreed upon with authorities	As required	SHE Coordinator

TABLE 27: ACTION PLAN – LOSS OF SOIL RESOURCES

Phase of operation	Activities	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Exploration Site preparation Earth- and civil works Process- and stormwater Transport systems Non-mineralised waste Site support services Storage and maintenance services / facilities Site/contract management	**H**	**M-L**	• Limit the project footprint and activities to that in the approved EMP and amendments and current EMP amendment. • Strip, store and maintain soils in line with the soil conservation procedure (this includes measures for erosion control) (Table 28). • Prevent dirty water runoff and spillages from entering the environment (impermeable substrates, bunds, stormwater control, catchment paddocks). • Where practical, rehabilitate in line with rehabilitation plan as soon as possible. • Implement the following at the open pits: - Strip the top 500 mm of soil and then strip subsoil to the weathered rock. The weathered and broken rock (broken by blasting) will then be removed from the pit. The soil, subsoil and broken rock will be stockpiled separately. - The topsoil, subsoil and broken rock will be returned to worked out pits in the following order: broken rock will be placed in the pits first, subsoil will be placed over the broken rock; and then topsoil will be placed over the landscaped subsoil. - Care will be taken to ensure that the mixing of topsoil is limited, subsoil and broken rock during the handling of these materials.	On-going On-going On-going On-going On-going As required	On-going As required As required On-going On-going As required	SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator
Operation	Exploration Open pit mining Backfilling of open pits Underground mining Waste rock and tailings Mineral processing Process- and stormwater Transport systems Non-mineralised waste Site support services Storage and maintenance services / facilities Site/contract management	**H**	**M-L**				

Phase of operation	Activities	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				- At least 500 mm of topsoil will be placed over 500 mm of subsoil when rehabilitating the pits. This will ensure that the depth of the soil is at least 1 m.			
				• Vegetation establishment in disturbed areas will be undertaken as soon as is practical.	On-going	On-going	SHE Coordinator
				• Where disturbed areas cannot be re-vegetated during the life of the mine appropriate measures will be taken to control erosion. These may include: contours; berms; runoff diversion canals; energy dissipaters; and application of straw mulches or soil binders to exposed soils.	As required	As required	SHE Coordinator
				• The mine will implement the Department of Agriculture in the design of effective erosion control measures on bare soils as follows: - Erosion control measures, such as contours, are required in all areas where slope gradients exceed 2% (1:50) - Engineered erosion control measures are required where slope gradients exceed 7% (1:15).	As required	As required	SHE Coordinator
				• The mine will ensure that erosion controls are included in the designs of linear infrastructure and points of water discharge. Linear infrastructure will be inspected on a weekly basis to check that the associated water management infrastructure is effective in controlling erosion.	On-going	On-going	SHE Coordinator
				• Energy dissipaters will be constructed at points where there are concentrated discharges of water to the environment (such as culverts and outflows of water from diversion berms or canals).	As required	As required	SHE Coordinator
				• The mine will conduct all potentially polluting activities in a manner that pollutants are contained at source. In this regard the mine will ensure that: - adequate sanitary facilities will be provided at construction sites and areas away from the mine ablution blocks; - storage areas and vehicle maintenance areas will be surfaced and will have appropriate runoff containment measures, such as bunds and canals, in place; - all vehicles and equipment will be serviced regularly in workshops and washbays with impermeable floors, dirty water collection facilities and oil traps and according to a pre-planned maintenance programme; - all chemical, fuel, oil storage and handling facilities will be designed and operated in a manner that all spillages are contained in impermeable areas and cannot be released into the environment; - pipelines will be monitored continuously to limit spillage;	On-going	On-going	SHE Coordinator

Phase of operation	Activities	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				- ad hoc spills of potentially polluting substances (whether in dirty areas or in the environment) will be reported to the environmental manager and cleaned up/remediated immediately; - a dirty water management system, as set out in Table 31, is implemented; and - the waste management practices, as set out in Table 29 below, will be implemented. • If soils become contaminated, appropriate remedial measures will be identified in consultation with an appropriately qualified specialist. If necessary, the polluted soils will be classified as waste and will be discarded at an appropriate permitted waste site. After removal of the contaminated soils, the affected areas will be landscaped and rehabilitated. • Handle major spillage incidents in accordance with emergency response procedure (see Section 20.2).	As required As required	As required As required	SHE Coordinator SHE Coordinator
Decommission	Process- and stormwater Demolition Seal declines and vent shafts Waste rock and tailings Rehabilitation	**H**	**M-L**	• Limit the project footprint and activities to that in the approved EMP and amendments and current EMP amendment. • Replace soils in line with soil conservation procedure (Table 28). • Prevent dirty water runoff and spillages from entering the environment until such time as infrastructure is removed. • Rehabilitate disturbed areas in line with recommended rehabilitation plan. • Handle major spillage incidents in accordance with emergency response procedure (see Section 20.2).	On-going As required On-going Where possible As required	On-going As required As required As required As required	SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator
Closure	Maintenance and aftercare Final land forms (residue facilities)	**H**	**M-L**	• Repair erosion gullies and maintain erosion control measures.	Timeframe to be agreed upon with authorities	As required	SHE Coordinator

TABLE 28: SOIL CONSERVATION PROCEDURE

Steps	Considerations	Detail
Delineation of areas to be stripped		Stripping will only occur where soils are to be disturbed and when an end-use for the stripped soil has been identified.
Delineation of stockpiling areas	Location and footprint	Suitable stockpiling areas will be identified, preferably in close proximity to the source of the topsoil. The areas will be calculated on the basis of the expected soil volume.
	Storm water controls	Stockpiles will be established within the bounds of storm water management infrastructure.
	Designation of the areas	Soil stockpiles will be clearly identified as such.
Stripping	Invasive vegetation	Invasive plants, such as wattle will be removed, before topsoil is stripped.
	Topsoil	The top 200 to 500 mm of soil ('topsoil') will be stripped first and put aside, together with any vegetation cover present (only large bushes to be removed prior to stripping).
Stockpiles	Topsoil/ subsoil	Topsoil will be stockpiled separately from any subsoils and rock.
	Erosion control	Rapid growth of vegetation on the stockpiles will be promoted (by means of watering to prevent erosion by water and wind.
	Waste	No waste material will be placed on the soil stockpiles.
	Prevention of compaction	To avoid compaction and consequent damage to the soils, equipment movement on the stockpiles will be limited and the height of the stockpiles will not exceed 5 m.
Rehabilitation of disturbed land: restoration of land capability	Replacement of topsoil at other sites	At least 200 mm will be placed on disturbed sites to facilitate rehabilitation of disturbed land. At least 500 mm will be placed on disturbed sites that are to be returned to arable land capability.
	Fertilisation	Samples of stripped soils will be analysed to determine the nutrient status. Fertilisers will be applied if/ as required.
	Erosion control	Erosion control measures will be implemented to ensure that the topsoil is not washed away and erosion gulleys do not develop in the arable land.

TABLE 29: NON-MINERALISED WASTE MANAGEMENT PRACTICES

Items to be considered		Intentions
General	**Specific**	
Classification and record keeping	General	The waste management procedure for the mine will cover the storage, handling and transportation of waste to and from the mine. The mine will ensure that the contractor's responsible are made aware of these procedures.
	Waste opportunity analysis	In line with DWAFs' strategy to eliminate waste streams in the longer term, the mine will assess each waste type to see whether there are alternative uses for the material. This will be done as a priority before the disposal option.
	Classification	Wastes will be broadly classified in terms of the DWAF Minimum Requirements for Waste Disposal (DWAF, 1998).
	Waste minimisation and recycling	Opportunities to minimise waste production will be identified and taken where possible. Where possible wastes will be recycled.
Waste disposal facilities	Collection points	Designated waste collection points will be established on site. Care will be taken to ensure that there will be sufficient collection points with adequate capacity and that these are serviced frequently.

Items to be considered		**Intentions**
General	**Specific**	
	On site waste disposal facilities	At present there is no intention to develop waste disposal facilities on site. No waste disposal facility will be developed by the mine without the relevant permissions. These permissions include an environmental authorisation (from DALA) in terms of the National Environmental Management Act and a waste permit (from DEAT) in terms of the Environment Conservation Act.
	Offsite waste disposal facilities	Waste will be disposed of at appropriate permitted waste disposal facilities as outlined below. For general waste the closest permitted site is Lydenburg. For hazardous waste the closest permitted site is at Holfontein.
Waste transport	Contractor	An approved waste management subcontractor, working to local authority standards, will undertake the waste transport.
Disposal of different types of waste	Hazardous wastes	Disposal at a permitted hazardous waste disposal facility.
	Non-hazardous waste	Disposal at a permitted non-hazardous waste disposal facility.
	Any soil polluted by a spill	If spills do occur and soils become contaminated, the appropriate remedial measures will be identified in consultation with an appropriately qualified specialist. If remediation of the soil in situ is not possible, the soils will be classified as a waste in terms of the Minimum Requirements and will be disposed of at an appropriate permitted waste facility. After removal of the contaminated soils, the affected areas will be landscaped and rehabilitated.
	Building rubble	Care will be taken to ensure that building rubble does not become polluted or mixed with any other waste. The building rubble will be used to backfill excavations.
	Laydown areas	During decommissioning and closure, lay down areas for re-usable non-hazardous materials will be established. Mixing of re-usable materials with other wastes, especially hazardous wastes will be prevented.
	Scrap metal	Care will be taken to ensure that scrap metal does not become polluted or mixed with any other waste. The scrap metal will be collected in a designated area for scrap metal (scrap yard). It will be sold to scrap dealers.
	Oil and grease	Oil and grease will be collected in suitable containers at designated collection points. The collection points will be bunded and underlain by impervious materials to ensure that any spills are contained. Notices will be erected at each waste oil point giving instructions on the procedure for waste oil discharge and collection. An approved subcontractor will remove oil from site.
Banned practices	Long-term stockpiling of waste	Stockpiling of waste is a temporary measure. Waste stockpiling sites must have an impervious floor, be bunded and have a drainage system for collection and containment of water on the site.
	Burying of waste	No wastes other than mine residues will be placed on site.
	Burning of waste	Waste may only be burned in legally approved incinerators.

TABLE 30: ACTION PLAN - BIODIVERSITY

Phase of operation	Activities	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Exploration Site preparation Earthworks and civil works Transport systems Power supply Site support services Storage and maintenance services / facilities Site/contract management	**H**	**H**	• Limit the project footprint and activities to that in the approved EMP and amendments and current EMP consolidation. • Surface disturbance will be kept to a minimum. Activities will be concentrated in disturbed areas as far as is possible. Human and vehicular activity will be restricted to construction and operational sites. • Mine staff will be made aware the following plant habitats close to the mine site need to be protected from disturbance: - the Bushveld in the Groot Dwars River valley to the west of the mine site; - the Ridge Grassland on the ridge above the ore body; - the riparian wetland along West Stream between the tailings dam site and mining area; - the riparian wetland along East Stream where the mine access road crosses the stream; - the Protea Woodland to the south and south-east of the plant and tailings dam area. • An appropriately qualified vegetation specialist will be appointed to check these habitats mentioned above on a quarterly basis to see that they are not being disturbed by mining-related activities and there is no encroachment of invasive plants into these habitats. • Vehicle movement off road in the habitats mentioned above will be prohibited. • An appropriately qualified zoologist will be appointed to clear all active burrows at the sites of mine infrastructure and the open pit mining area before construction and mining activities commence. • A herpetologist will be appointed to undertake search and rescue operations at the potentially affected rocky outcrops before the construction phase of mining commences. • Prior to the commencement of mining, Aquarius will commission a fish study to check whether *Barbusmotebensis* is present in this stream. This species and sensitive aquatic invertebrates, such as the mayflies *Demoreptusnatalensis* and *Adenophlebiaauriculata*, and the rare blackfly *Simuliumkatangae* would provide useful indicators for monitoring environmental compliance. • Mine staff is prohibited from collecting plants and cutting firewood and hunting or harming animals • No waste will be disposed of in or around the mine area, waste	On-going Pre-construction and on-going On-going On-going On-going Pre-construction and on-going Pre-construction and on-going Pre-construction Construction On-going	On-going Once off and on-going On-going On-going On-going On-going As required Once-off Once-off On-going	SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator
Operation	Exploration Open pit mining Underground mining Waste rock and tailings Mineral processing Power supply Transport systems Site support services Storage and maintenance services / facilities Site/contract management	**H**	**H**				

Phase of operation	Activities	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				will be disposed of at an off-site waste disposal facility (Table 29).			
				• The number of stream crossings will be minimised and culverts will be designed so that they do not alter flow in the stream. Stream crossings will be inspected for erosion and damaged areas will be repaired immediately.	On-going	On-going	SHE Coordinator
				• In compliance with the GN 704 Regulations, Aquarius will ensure that its stormwater collection facilities and dirty-water holding facilities are designed for the 1:50 year storm event. This means that there will be no discharges of dirty water from the mine site unless there is an extreme storm event.	On-going	On-going	SHE Coordinator
				• Storm water management infrastructure will be installed before any construction and mining activities commence to ensure that sediments are not washed into West Stream from these sites.	Pre-construction and on-going	On-going	SHE Coordinator
				• Topsoil will be conserved as outlined in Table 28.	On-going	On-going	SHE Coordinator
				• Topsoil will be returned to the area from where it was removed where possible. Care will be taken to ensure that topsoil stripped from areas where invasive plants are abundant is not placed elsewhere.	On-going	On-going	SHE Coordinator
				• Invasive plants will be removed from land adjacent to mine infrastructure sites, up to 500 m from the mine infrastructure sites.	On-going	On-going	SHE Coordinator
				• An alien/invasive/weed management programme will be implementation in collaboration with DAgric, DWA and Working for Water to control the spread of these plants onto disturbed areas. Care will be taken to prevent the encroachment of alien plant species into rehabilitated areas.	On-going	On-going	SHE Coordinator
				• Generally, where vegetation is to be planted, a mixture of commercially available seeds that germinate reliably (high seed viability) will be used. The species to be used will be indigenous (no exotic plant species will be used) and will be selected on the basis of their ability to bind and cover soil (afford erosion protection) and their tolerance of prevailing environmental conditions. Species that can become invasive or a problem in the future cultivation of the rehabilitated land will be avoided. Species that will enhance the arable potential of soils will be used where possible.	As required	As required	SHE Coordinator
				• A detailed programme for vegetation establishment on the tailings dam will be prepared as part of the detailed design of the tailings dam.	Pre-construction and on-going	On-going	SHE Coordinator
				• **Aquarius will participate in a conservancy if a conservancy is established in the region and it overlaps with the project**	On-going	On-going	SHE Coordinator

Phase of operation	Activities	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				area.			
				• Prevent dirty water runoff and spillages from entering the environment (bunds, stormwater control)	On-going	On-going	SHE Coordinator
				• Control dust in line with the dust management plan.	On-going	On-going	SHE Coordinator
				• Control blast hazards in line with the blast management plan.	On-going	On-going	SHE Coordinator
				• Set up and undertake biodiversity monitoring (see programme in Section 20)	On-going	On-going	SHE Coordinator
				• Aquarius will consider rehabilitation of the riparian wetland along West Stream through removal of existing drainage furrows and berms in the seasonal and permanent zones of the wetland. (Such furrows are present below the walls of the Ackerman and TKO Dams, they prevent an even distribution of sub-surface and surface water flow and can cause desiccation of the wetlands and loss of functionality and change in vegetal cover.)	Construction	Once-off	SHE Coordinator
				• When upgrading the East Stream road crossing, Aquarius will consider rehabilitation of the stream to prevent further degradation. This would require upgrading the existing road crossings to allow free flow of floodwaters, and the construction of gabions and/or introduction of straw bales at key erosion points. Rehabilitation of in-stream habitats should aim to recreate the same mix of habitats that was present prior to the development. Where possible, activities that are likely to disturb the streams should start upstream and work downstream, so that the recovery process can start immediately, without further disturbance from upstream disturbance.	Pre-construction	Once-off	SHE Coordinator
				• Lighting will be positioned so that it does not shine onto natural habitats	On-going	On-going	SHE Coordinator
				• **The mine implements a biodiversity action plan that will be refined and implemented in consultation with the biodiversity expertise and resources of an ecological specialist and the MTPA. This action plan will aim at preserving and restoring the natural ecology of the area. This action plan will be in place prior to the commencement of the project and it will include additional detail on the following management actions:**	Pre-construction	Once-off	SHE Coordinator
				- **establishing an off-site conservation area (within the SCPE) as a trade-off for disturbing the flora and fauna of the project area and its surroundings. The area must be representative of vegetation communities within the project area and must be at least 5 to 10 times larger than the project site of 10.3ha. This should preferably be done in conjunction with adjacent**	On-going	On-going	SHE Coordinator

Phase of operation	Activities	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				landowners/nearby mining operations to ensure that a substantial area is conserved. The option of declaring a Special Nature Reserve should be investigated. The area must be conserved in perpetuity and must be protected by appropriate legislation.			
				- **zero tolerance of disturbances to vegetation communities outside of the project boundaries. In the case of tributaries the zone is defined by the greater of 100m or the 1:50 year floodline (Regulation 4(b) of Regulation 704). For this particular project, 100m will be greater and therefore applies;**	On-going	On-going	SHE Coordinator
				- **no person will be allowed to collect firewood or any other plant resources from the surrounding vegetation or be allowed to poach or hunt animals;**	On-going	On-going	SHE Coordinator
				- **where road will cross drainage lines, the engineering design work of culverts and stormwater controls will be done in consultation with a qualified ecologist with water course related expertise to limit the destruction of habitat and species and to promote re-establishment thereof. Where the road crosses several drainage lines in close proximity, this area will be considered holistically. Where possible, pebbles, rocks and biodiversity will be re-established and the crossing routes will be scanned for sensitive fauna and flora prior to construction;**	As required	As required	SHE Coordinator
				- **Aquarius will protect drainage lines and wetlands, as far as possible – where possible, activities that are likely to disturb streams should start upstream and work downstream so that the recovery process can start immediately without further disturbance from upstream disturbance.**	Pre-construction and on-going	As required	SHE Coordinator
				- **there will be planning on the removal of fauna and flora (plants and seeds) species prior to disturbance by mining activities and infrastructure. This will include planning on the collection, preservation, cultivation and re-use of these species in ongoing restoration practices. Special attention will be paid to conservation-important species (flora and fauna) and also ensuring the regrowth of fauna-specific plants, especially conservation-important fauna. Links will also be made to the soil conservation procedure and actions;**	Pre-construction and on-going	Once-off and on-going	SHE Coordinator

Phase of operation	Activities	Sig		Technical and management options	Action plan		
		UM	M		**Timeframe**	**Frequency**	**Responsible parties**
				- **the mine will obtain permits from the MPTA and DWAF for the removal or destruction of any protected plant species in accordance with the Mpumalanga Nature Conservation Act and the National Forests Act, 84 of 1998;**	Pre-construction	Once-off	SHE and Mine Managers
				- **The mine commits to offsetting 10 hectares for every hectare disturbed for new approvals granted**	Pre-construction	Once-off	SHE and Mine Managers
				- A 100m buffer zone where possible, will be observed from all streams and riparian zones, unless encroachment of the 100m or 1:100 year floodline has been authorized by the Department of Water Affairs	Pre-construction and on-going	On-going	SHE Coordinator
				- The Environmental Compliance Officer will visit sensitive areas adjacent to the impact footprint and check for evidence of any illegal harvesting on a regular basis. Transgressors should be prosecuted under the Mpumalanga Nature Conservation Act (No.10 of 1998).	On-going	On-going	SHE Coordinator
				- **The low voltage powerline route will be designed to avoid obvious fly-through routes for large birds and "bird flappers" will be installed along the length of the powerline route.**	Pre-construction	Once-off	SHE Coordinator
				- An invertebrate monitoring programme will be implemented as outlined in Section 20.	On-going	On-going	SHE Coordinator
				1. Detailed baseline studies of the selected indicator groups (ants and leafhoppers) and *Pycnasylvia* in the main vegetation types that will suffer direct impacts (Tristachya-Themeda Grassland and Thicket in the proposed North Pit, Tristachya-Themeda Grassland and Themeda-Bracharia Grassland in the proposed South Pit). For each vegetation type an area within the direct impact zone and a control area outside of this zone (outside of the 500m buffer zone) will be selected and surveyed (a single control site could be used for the two affected areas of Tristachya-Themeda Grasslands).	Pre-construction and on-going	On-going	SHE Coordinator
				2. Annual surveys will be conducted at the control sites at the same time each year for the entire operational life of the open pits, to provide a measure of naturally occurring inter-annual variation so that this can be distinguished from mining-related impacts and rehabilitation progress Indicator species will be determined.	On-going	On-going	SHE Coordinator
				- Management of lighting: 1. Externally visible lighting will be kept to an absolute	On-going	On-going	SHE Coordinator

Phase of operation	Activities	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				minimum, and wherever possible long-wavelength light sources (i.e. yellow/orange) will be used.			
				2. Internal lighting will as far as possible be shielded by blinds, curtains or by eliminating outward-facing windows in building designs, to prevent spillage of light into the surrounding natural environments.	On-going	On-going	On-going
				3. Where external lighting of structures is essential, light sources will be directed inward so as to light up the structure and result in this becoming a large diffuse light source, rather than having bright point sources directed outward into the natural environment.	On-going	On-going	SHE Coordinator
				4. Long-wavelength light sources will be used (at least 550 nm, preferably longer than 575 nm), preferably low-pressure sodium vapour, or yellow LEDs, as these result in very low disturbance of insect populations. Less preferable, but still better than mercury vapour or halogen lamps, would be high pressure sodium vapour or warm white LEDs. Another alternative would be the use of ultraviolet (UV) filters which can reduce insect attraction to high pressure mercury vapour lamps to below that of high pressure sodium vapour lamps. Fluorescent lights, including compact versions, will not be used outdoors, as a significant amount of UV light is emitted by these, and this is highly attractive to insects.	On-going	On-going	SHE Coordinator
				- Management of blasting:			
				1. Low-noise output machinery will be used wherever such options are available	On-going	On-going	SHE Coordinator
				2. Adequate berms will be constructed around the open pits and other areas where machinery is operational to limit sound levels in the surrounding environment.	On-going	On-going	SHE Coordinator
				3. Blasting will be limited to the minimum possible number of occurrences per day.	On-going	On-going	On-going
				- Management of invasive plant species:			
				1. Institute strict control over materials brought onto site, which will be inspected for potential invasive species and / or steps taken to eradicate these before transport to the site. Two possible approaches would be a visual inspection of all materials, particularly those that have been stockpiled in high-risk locations, for presence of invasive species and apply topical control (e.g. direct spraying with	On-going	On-going	SHE Coordinator

Phase of operation	Activities	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				low residual insecticides) when necessary; or routine fumigation or spraying of all materials with appropriate low-residue insecticides prior to transport to or in a quarantine area on site.			
				2. Disturbed areas will be rehabilitate as quickly as possible to reduce the area where invasive species would be at a strong advantage and most easily able to establish.	On-going	On-going	SHE Coordinator
				3. A monitoring programme will be implemented to detect alien invasive species.	On-going	On-going	SHE Coordinator
				4. An eradication / control programme will be implemented for early intervention of invasive species, so that their spread to surrounding natural ecosystems can be prevented.	On-going	On-going	SHE Coordinator
				5. Monitoring programmes and control measures will be developed with reference to inter alia information provided by the IUCN SSC Invasive Species Specialist Group (http://www.issg.org/).	On-going	On-going	SHE Coordinator
				- Protection of wetlands:			
				1. The waste rock stockpile will be relocated to transformed land away from wetlands.	On-going	On-going	SHE Coordinator
				2. Prospecting roads will be routed to avoid unnecessary steep gradients.	Pre-construction	As required	SHE Coordinator
				3. Stream crossings and mobilisation of sediments will be minimised by using drainage pipes, culverts or large cobbles.	Pre-construction	As required	SHE Coordinator
				4. 100m buffer zones of natural vegetation will be implemented either side of streams and riparian zones, where possible.	Pre-construction and on-going	On-going	SHE Coordinator
				5. Stormwater from the road and other stormwater will be diverted into natural vegetation buffer zones before discharging into streams.	On-going	On-going	SHE Coordinator
				6. Bulldozing soils into streams or wetlands will be avoided.	On-going	On-going	SHE Coordinator
				• Everest will establish a nursery on site. Where possible plants from the project sites will be relocated to the nursery. The nursery will be sited such that it provides a variety of habitats to support the potential relocated species. Where necessary this will be done in consultation with an appropriately qualified specialist.	Pre-construction	On-going	SHE Coordinator

Phase of operation	Activities	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Decommission	Demolition Seal declines and vent shafts Waste rock and tailings Power supply Transport systems Site support services Site/contract management Rehabilitation	**H**	**H**	• Limit the project footprint and activities to that in the approved EMP and amendments and current EMP amendment. • All land disturbed by mining, other than the residue facilities, will be rehabilitated to a stable physical state and its pre-mining potential. The residue facilities will be vegetated to prevent erosion and reduce their visual impact. • Prevent dirty water runoff and spillages from entering the environment until such time as infrastructure is removed. • Minimise groundwater pollution in line with the relevant residue facility management plans. • Control dust in line with dust management plan. • Undertake biodiversity monitoring programme (see Section 21). • Rocks and boulders form an integral part of the landscape and are vital habitat for numerous plants that do not occur away from such outcrops therefore careful attention will be paid to ensuring that the reconstructed landscape includes such rock formations. It may be necessary to stockpile suitable rocks separately from the main subsoil stockpiles as far as possible. • Seeding of the reconstructed landscape must be carried out using a mix of locally occurring plant species that are confirmed to occur adjacent to the haul road route at the areas of impact. It is also strongly recommended that clumps of grass and herbaceous plants, representing as many of the species present as possible, be translocated to a nursery and later replanted into the reconstructed landscape.	On-going On-going On-going On-going On-going As required As required As required	On-going On-going On-going On-going On-going As required As required As required	SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator As required
Closure	Final land forms (residue facilities)	**H**	**H**	• Monitor vegetation establishment in line with rehabilitation plan. • Continued monitoring of specifically the invertebrate control sites and the rehabilitated pit areas after mining operations have ceased until mine closure will be conducted. Repeat surveys will be carried out annually for at least the first three years post-rehabilitation, after which the frequency the may be reduced, initially to every second year and then every 3-5 years until rehabilitation targets have been reached.	Timeframe to be agreed upon with authorities	As required	SHE Coordinator

TABLE 31: ACTION PLAN – ALTERING OF DRAINAGE PATTERNS

Phase of operation	Activities	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Exploration Site preparation Earthworks Stormwater management Site/contract management	H	M	• Limit the project footprint and activities to that in the approved EMP and amendments and current EMP amendment. • Aquarius will obtain all the required water use licences and will apply with the conditions of approval of these licences. • The flows in the West and East Streams will not be obstructed. • The number of stream crossings will be minimised and culverts will be designed so that they do not alter flow in the streams. • Stream crossings will be inspected regularly for any culvert blockages and erosion of abutments and overflow areas, particularly during and after floods. Blockages will be cleared and damaged areas will be repaired immediately. • There are no discharges of dirty water from the mine site unless there is an extreme storm event. • Storm water controls have been designed in accordance with the requirements of Regulation 704, corresponding DWA M6.1 Operational Guideline, the requirements of DWA as stipulated in the water licence, and will be done by an appropriately qualified engineer. • The stormwater for existing infrastructure is managed as follows: - Plant stormwater pond: Runoff from the plant site drains into the plant stormwater pond. - Decline stormwater pond: Runoff from the site of the original decline (which subsequently collapsed), the ROM silo and the ROM stockpile area drain into a stormwater pond downgradient of these sites. - Overburden stockpile stormwater pond: Runoff from the original overburden stockpile area drain into a stormwater pond downgradient of this area. - Polluted water treatment facility: Water from the mine workings is treated at the decline site before it is distributed to the plant site. Oil is removed from the water by oil traps and suspended solids are removed in settling tanks. - Open pits: Clean runoff is diverted around the pit areas and channeled into the tributaries it would normal flow into. Rain that falls into the pits and groundwater that seeps into the pits (negligible) are directed to a sump within the pits from where it is pumped to the existing decline stormwater dam. - Declines: Clean runoff is diverted around the decline areas and channeled into the tributaries it would normal flow into.	On-going On-going On-going Construction On-going On-going Construction Construction	On-going On-going On-going Once-off On-going On-going Once-off As required	SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator
Operation	Exploration Open pit mining Underground mining Stormwater management Site/contract management	H	M				
Decommission	Rehabilitation Stormwater management Site/contract management	H	M				

Phase of operation	Activities	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				Contaminated runoff from the decline areas is directed to dedicated stormwater collection dams.			
				• Any significant breach of the stormwater management infrastructure is considered an emergency situation. In such instances the emergency procedure included in section 20 will be followed.	As required	On-going	SHE Coordinator
				• Subsidence above the workings will be monitored. If any subsidence that will cause alteration of drainage patterns is detected, this will be reported without delay to DMR and DWA. If necessary, appropriate remedial measures will be identified in consultation with these departments and implemented.	On-going	On-going	SHE Coordinator
				• Maintain stormwater controls (through inspection and repair).	On-going	On-going	SHE Coordinator
				• The following Stormwater Management Plan will be implemented for the Hoogland Extension Project (refer to Figure 20):	Construction	Once-off	SHE Coordinator
				- The dirty water areas will be operated as separate dirty areas and all water generated from within them will be contained according to GN 704.			
				- Dirty water diversions have been sized for the waste rock dump and soil stockpile. The diversions will consist of both an earthfill berm and excavated channel. The berm component will be constructed from the material excavated from the channel and supplemented by topsoil stockpiling if required. The side slopes for all berms and channels will be kept constant at 1 vertical: 1.5 horizontal. These will be lined to prevent seepage and will be in place for the life of mine and will as a minimum contain the 1:50 year flood event. A typical dirty water containment earth berm and channel is recommended by Metago in the relevant specialist report (Appendix H).			
				- These diversions will route dirty water into the two sumps located in the northern opencast area. The dirty water generated by incident rainfall over the northern and southern opencast areas will be contained within their respective sumps. Final design of the sumps will need to include the addition of groundwater ingress and any additional process water such that the surface water storage volume requirement is not compromised. In-pit water which compromises the surface water store will need to be removed as part of the pit dewatering plan. The containment of dirty water within the opencast areas will be achieved through inclusion of a berm around the pit to			

Phase of operation	Activities	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				prevent the escape of dirty water into the environment. - A detailed design of the stormwater management plan must still be undertaken, and it will include sufficient engineering input to ensure the dirty water berm and channel surrounding the waste rock dump is placed sufficient distance from the river system to ensure the waste rock dump is not flooded during extreme events. Furthermore, the size and construction material to be used for the construction of the berm component surrounding the waste rock dump will form part of the detailed stormwater design. - Flood protection should be considered for locations where the opencast area is within a vertical distance of 10m above the river bank. In order to confirm the need for flood protection, detailed hydraulic modelling and/or analysis of topographic data with regards to the opencast pit development may be necessary.			
Closure	Final land forms (residue facilities)	**H**	**M**	• Maintain stormwater controls (through inspection and repair) until such time as facilities can be removed. • Monitor re-instated drainage patterns to ensure natural flow patterns occur as far as possible.	6 years On-going	On-going As required	SHE Coordinator SHE Coordinator

TABLE 32: ACTION PLAN - SURFACE WATER POLLUTION

Phase of operation	Activities	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Exploration Site preparation Earthworks and civil works Process- and stormwater management Non-mineralised waste management Site support services Storage and maintenance services / facilities Site/contract management	**H**	**M-L**	• The mine compiles with the requirements of GN 704 Regulations and the corresponding DWAF M6.1 Operational Guideline. All storm water controls are able to contain the 1:50 year storm event and maintain 0,8m freeboard • There are no discharges of dirty water from the mine site unless there is an extreme storm event, with a recurrence interval exceeding 1:50 years. • All contaminated water is contained and reused. This includes treated sewage effluent. • Storm water management infrastructure will be installed before any construction and open pit mining activities commence to ensure that sediments are not washed into the West Stream,	Design On-going On-going Construction	Once off On-going On-going Once-off	SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator

Phase of operation	Activities	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Operation	Open pit mining Underground mining Backfilling of open pits Waste rock and tailings management Mineral processing Process- and stormwater management Transport systems Non-mineralised waste management Site support services Storage and maintenance services / facilities Site/contract management	**H**	**M-L**	ephemeral tributaries in the vicinity of project infrastructure and the Groot Dwars River. • The tailings storage facility will managed according to the Tailings code of practise and the relevant operating manual. • The return water dam will be lined with clay. • Storage areas and vehicle maintenance areas will be surfaced and will have appropriate runoff containment measures, such as bunds or canals, in place. • The mine will avoid contamination of soils and will implement appropriate remedial measures if incidents of spillage occur. • The mine will implement good waste management practices (Table 29). • Environmental conditions will be included in construction contracts, thereby making contractors aware of the necessity to prevent accidental spillages by the implementation of good housekeeping practices. • Adequate sanitary facilities will be provided at the construction sites for infrastructure outside of the mine boundaries. • The water balance for the mine will be refined on an ongoing basis during the life of the mine. Flow meters will be installed in the mine water circuit to enable refinement of the water balance. The water balance will be used to check on an ongoing basis that the capacity of the dirty water holding facilities is adequate, taking the operational distribution and use of water into account. An annual report on the mine water balance will be submitted to DWA. This will provide information on the status of the water balance in the wet season and the dry season and under conditions of extreme rainfall. • There will be an emergency management system, including procedures and training for dealing with incidents. • Potential pollution sources and relevant control measures are provided below:	On-going Construction Construction On-going On-going Pre-construction and on-going for additional work Construction On-going As required On-going	On-going Once-off Once-off On-going On-going Once-off then on-going Once-off On-going As required On-going	SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator

Water source	Control measures
Groundwater inflow and rainfall into pits	• Collection of dirty water for re-use • Adequate settlement time • Oil trap • Good housekeeping
Groundwater inflow to underground workings	• Collection of dirty water for re-use • Adequate settlement time

Phase of operation	Activities	Sig		Technical and management options		Action plan			
		UM	M			Timeframe	Frequency		Responsible parties
					• Possible use of flocculants • Oil trap • Good housekeeping				
				Runoff from overburden dumps	• Clean water diversion (bunds/ canals).				
				Runoff from ore stockpiles	• Clean water diversion (bunds/ canals). • Dirty water collection (bunds).				
				Runoff from the plant area	• Clean water diversion (bunds/ canals). • Dirty water collection in a stormwater holding pond • Good housekeeping (clean up of spills) • Leak detection				
				Process water circuit; slurry and return water pipelines	• Refine the mine water balance. • Leak detection • Good housekeeping (maintenance of equipment)				
				Tailings dam and return water dam	• Compacted lining • Stream diversion around the tailings dam • Toe paddocks around the tailings dam for collection and evaporation of runoff • Drains for seepage collection – these will be designed so that they are as effective as reasonably possible in collecting seepage from the dam				
				Run-off from roads	• Erosion control measures • Vehicle maintenance				
				• The mine will monitor water quality as outlined in section 21. Should any contamination be detected at the compliance monitoring points, the mine will immediately notify the Regional Director of DWA. It will then identify the source of					

Phase of operation	Activities	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				contamination, identify measures for the prevention of this contamination (in the short term and the long term) and then implement these measures.			
				• All hazardous chemicals (new and used), dirty water, mineralised wastes and non-mineralised wastes will be stored, used and handled in a manner that they do not contaminate.	On-going	On-going	SHE Coordinator
				• Reagents will be properly stored and handled. Material Safety Data Sheets (MSDS) will be kept and adhered to.			
				• Spill kits will be kept in all areas where potentially polluting substances are dispensed and stored and staff will be trained to use it.	On-going	On-going	SHE Coordinator
				• Cement and cement aggregate will be stored and mixed on impermeable covers. Concrete will not be mixed directly on the ground.	On-going	On-going	SHE Coordinator
				• Emptied cement bags will be stored in weatherproof containers and disposed of regularly and will not be used for any other purpose.	On-going	On-going	SHE Coordinator
				• Provide and maintain adequate sanitation facilities.			
				• No sanitation facilities will be located within 100 m of a watercourse.	On-going	On-going	SHE Coordinator
				• Hazardous and/or polluting substances will be stored in sealed containers within impermeable, bunded areas with sufficient capacity to contain 110 % of the contained materials. All spilled materials must drain to sumps with oil traps that must also be equipped to allow collection and removal of spilled substances	On-going	On-going	SHE Coordinator
				• Vehicles and equipment will be properly maintained and oil or fuel leaks will be repaired immediately upon detection.	On-going	On-going	SHE Coordinator
				• Any spills will be cleaned up immediately.	On-going	On-going	SHE Coordinator
				• Spill kits or sorp materials will be kept on hand to clean up spills. Once used, this material will be treated as hazardous waste and disposed of accordingly.	On-going	On-going	SHE Coordinator
				• Development of the opencast pits will factor in the steep-sided topography such that rock and soil debris is prevented from falling down the slope and subsequently degrading water quality.	On-going	On-going	SHE Coordinator
				• Additional sampling rounds should be undertaken during both the dry and wet seasons, with additional sampling locations included to account for the current site layout.	On-going On-going	On-going On-going	SHE Coordinator SHE Coordinator

Phase of operation	Activities	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Decommission	Waste rock and tailings management Process- and stormwater management Transport systems Non-mineralised waste management Site support services Storage and maintenance services / facilities Site/contract management Demolition Rehabilitation	**H**	**M-L**	• Prevent dirty water runoff and spillages from entering the environment (bunds, stormwater control, catchment paddocks) until such time as infrastructure is removed • Prevent erosion runoff as per soil management plan • Continue monitoring surface water in accordance with section 21 • Handle major spillage incidents in line with emergency response procedure (see Section 20).	On-going On-going On-going As required	On-going On-going On-going As Required	SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator
Closure	Maintenance and aftercare Final land forms (residue facilities)	**H**	**M**	• Maintain stormwater controls (through inspection and repair) until such time as facilities can be removed. • Surface water in line with monitoring programme (Section 21).	Timeframes to be agreed upon with authorities	On-going As required	SHE Coordinator SHE Coordinator

TABLE 33: ACTION PLAN – GROUNDWATER DEWATERING

Phase of operation	Activities	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Operation	Open pit mining Underground mining	**M**	**M**	• Dewatering will only take place to ensure the safe workings of both the open pit and underground operations. Unnecessary dewatering will be avoided. • Dewater in accordance with the water licence once obtained from DWA. • Reuse water removed from underground in the process. • Groundwater monitoring boreholes will be monitored (water levels) on a quarterly basis (Section 21). The results will be compared to simulated water levels and the extent of the cone of depression will be analysed accordingly. • Exploration boreholes will be sealed to minimise groundwater inflow into mine workings and lowering of water levels. • **No mining will take place closer than 100 m from the Groot Dwars River or through the dyke parallel to the river, whichever is the nearest.** • Should the communities relying on groundwater be impacted by a drop in the groundwater table caused by the mine, the mine will provide the community with water of equal quantity and quality.	On-going On-going On-going On-going On-going On-going On-going	On-going On-going On-going On-going On-going On-going On-going	SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator
Decommission Closure	Cessation of dewatering	**M**	**M**	• Continue to monitor groundwater levels in monitoring boreholes to check groundwater rebound	Timeframe to be agreed upon with authorities	Quarterly	SHE Coordinator

TABLE 34: ACTION PLAN – GROUNDWATER POLLUTION

Phase of operation	Activities	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Process- and stormwater management Non-mineralised waste management Storage and maintenance services / facilities Site contract management	**M**	**L**	• The soils underlying the tailings dam will be compacted to minimise infiltration. • The time that the tailings dam ponds are situated on soils will be minimised as far as is possible. (The faster new ground is blanketed by less permeable tailings, the less water will infiltrate into the unsaturated zone). • The return water dam will be lined to prevent any seepage.	Construction On-going Construction	Once-off On-going Once-off	SHE Coordinator SHE Coordinator SHE Coordinator

Phase of operation	Activities	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Operation	Tailings and waste rock management Process- and stormwater management Non-mineralised waste management Storage and maintenance services / facilities Site contract management	-	M	• Monitoring of groundwater quality will take place in accordance with section 21 and water quality predictions will be updated. Contaminant plumes will be intercepted by scavenger wells, should contamination be unacceptable. • A water monitoring report will be submitted to DWAF annually and additional studies will be undertaken based on the monitoring results. • Contaminated mine water will be pumped directly to the plant and be used in the ore processing process. Oil traps will remove oil and suspended solids will be settled out. By using dirty water in the plant, less clean water is used or contaminated by holding ponds. • The residue facility footprints will be minimised and the underlying material compacted to reduce the seepage rates into the underlying material • Potentially polluting facilities designed by an appropriately qualified engineer in line with regulatory requirements. • Construct and maintain dirty water dams with appropriate lining. • If monitoring indicates a mine-related decrease in groundwater quality at third party boreholes, appropriate measures will be taken to rectify the contamination situation, to provide the affected third parties with an alternative water supply, and/or to possibly purchase affected farms. • In the event of any significant pollution incident follow the emergency response procedure (see Section 20).	On-going On-going On-going On-going Construction Construction On-going As required	Quarterly Annually On-going On-going Once-off Once-off On-going As required	SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator
Decommission	Tailings and waste rock management Process- and stormwater management Non-mineralised waste management Storage and maintenance services / facilities Site contract management	-	M				
Closure	Final land forms (residue facilities)	-	M	• The open pit areas will be rehabilitated in such a way as to allow free runoff and limit infiltration. Stormwater control measures established at the start of the open pit operations will remain, for as long as required to provide sufficient time for the overburden to consolidate and prevent unnecessary infiltration of rehabilitated areas. • Newly drilled monitoring boreholes will be used to monitor rebound groundwater levels and intercept decant before it reaches the topography.	As required Timeframe to be agreed upon with authorities	As required Quarterly	SHE Coordinator SHE Coordinator

TABLE 35: ACTION PLAN – AIR POLLUTION

Phase of operation	Activities	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction Operation Decommission	Exploration Site preparation Earthworks and civil works Transport systems Site support services Site/contract management Open pit mining Backfilling of open pits Waste rock and tailings management Mineral processing Demolition Rehabilitation	H	M	• Dust suppression of disturbed surfaces at construction sites and gravel roads used by the mine with water and coupled with chemical surfactants on gravel roads if required.	On-going	On-going	SHE Coordinator
				• Disturbance of vegetation cover will be reduced to a minimum.	On-going	On-going	SHE Coordinator
				• The establishment of vegetation cover on disturbed surfaces and the completed sections of the tailings dam will be promoted throughout the life of the mine i.e. concurrent rehabilitation.	On-going	On-going	SHE Coordinator
				• Conveyors will be partially covered by doghouse covers.	On-going	On-going	SHE Coordinator
				• The service road linking the Valley and terrace operations will be an asphalt/tarred road.	Construction	Once-off	SHE Coordinator
				• Dust emissions on unpaved roads will be managed as follows: - the extent of unpaved roads will be minimised - traffic volumes will be restricted and vehicle speeds reduced as appropriate - binding the surface material or enhancing moisture retention, with wet suppression and chemical stabilization	On-going	On-going	SHE Coordinator
				• A 75% dust control efficiency is required to realise a significant reduction in ground level concentrations from all on-site haul roads.	On-going	On-going	SHE Coordinator
				• Dust will be supressed with water at the crushers. The nozzle pressure of water sprays at the crusher will be below 60 psi to avoid stirring the dust cloud and reducing the capture efficiency of the ventilation system. Water sprays are expected to realise a 50% control efficiency.	On-going	On-going	SHE Coordinator
				• Dust control equipment will be maintained and inspected on a regular basis to ensure that the expected control efficiencies are attained.	On-going	On-going	SHE Coordinator
				• The sidewalls of the tailings dam will be vegetated. The vegetation cover will be such to ensure at least 80% dust control efficiency. The top surface area will have 50% wet beach area if feasible.	On-going	On-going	SHE Coordinator
				• A water spraying system will be installed on the surface of the tailings dam covering the outer perimeter of the dam, spraying water when wind exceeds 4 m/s.	On-going	On-going	SHE Coordinator
				• Dust control measures for open areas will include wet suppression, chemical suppressants, vegetation establishment and the placement of wind breaks as appropriate.	On-going	On-going	SHE Coordinator

Phase of operation	Activities	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				• Source based performance to be implemented include: - Dustfall immediately downwind of the tailings facility will be < 1200 mg/m²/day and dustfall at sensitive receptors will be <600 mg/m²/day. - Dustfall at on-site roads and in the immediate vicinity will be less than 1200 mg/m2/day and dustfall at sensitive receptors will be <600 mg/m²/day. - Absence of visible dust plume at all tipping points and outside the crushers during crushing operations and dustfall in the immediate vicinity of various sources will be<1200 mg/m2/day and dustfall at sensitive receptors will be <600 mg/m²/day.	On-going	On-going	SHE Coordinator
				• Conduct dust monitoring as outlined in section 21. The monitoring data will be analysed and interpreted and an annual air quality report will be produced.	On-going	On-going	SHE Coordinator
				• If monitoring determines that unacceptable dust emissions is occurring, immediate steps will be taken to address the issue in consultation with a suitable air quality specialist.	On-going	On-going	SHE Coordinator
Closure	Maintenance and aftercare Final land forms (residue facilities)	**H**	**L**	• Monitor and maintain vegetation cover on final land forms and rehabilitated areas	Timeframe to be agreed upon with authorities	On-going	SHE Coordinator

TABLE 36: ACTION PLAN – DISTURBING NOISE

Phase of operation	Activities	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Exploration Site preparation Earthworks and civil works Process- and stormwater management Transport systems Non-mineralised waste management Storage and maintenance services/facilities Site/contract management	**M-H**	**M-H**	• **Noise screens/ acoustic barriers are established between the open pits and sensitive areas and between the plant and sensitive areas if required. The screens are designed so that nearby houses and TKO Farm School are not exposed to disturbing noise.**	Construction	Once-off	SHE Coordinator
				• **Potentially noisy components, such as the compressor house, was fitted with noise suppression systems or mounted in acoustically designed enclosures.**	Construction	Once-off	SHE Coordinator
				• Ventilation extraction fans used for the underground activities were fitted with acoustic silencers and be mounted (recessed) so as to minimize radiation into the environment.	On-going	On-going	SHE Coordinator
Operation	Exploration Open pit mining Backfilling of open pits	**M-H**	**M-H**	• No surface or near surface blasting may take place at night (between 18h00 and 06h00) or on the weekend between Fridays at 18h00 and Mondays at 06h00	On-going	On-going	SHE Coordinator

Phase of operation	Activities	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
	Underground mining Waste rock and tailings management Mineral processing Process- and stormwater management Transport systems Non-mineralised waste management Storage and maintenance services/facilities Site/contract management			• A good maintenance management scheme is implemented to ensure that vehicles and plant and equipment are properly maintained thus reducing the occurrence of excessive emissions.	On-going	On-going	SHE Coordinator
				• **A bus system for transporting mine staff to and from work was established to reduce vehicular traffic.**	On-going	On-going	SHE Coordinator
				• The mine records and responds without delay to complaints about disturbing noise.	On-going	On-going	SHE Coordinator
				• Local residents will be notified of any potentially noisy field survey works or other works during the planning and design phase of the Hoogland Extension Project and these activities will be undertaken at reasonable times of the day(not at night or on weekends).	On-going	On-going	SHE Coordinator
Decommission	Demolition Rehabilitation Site/contract management	**M-H**	**M-H**	• Consideration must be given to noise mitigation measures required during the construction phase which will be included in tender document specifications and relevant designs.	Construction	As required	SHE Coordinator
				• Construction site yards and other noisy fixed facilities will be located well away from noise sensitive areas adjacent to the development sites.	Construction	Once-off	SHE Coordinator
				• Where possible, stationary noisy equipment (for example compressors, pumps, pneumatic breakers,) will be encapsulated in acoustic covers, screens or sheds. Portable acoustic shields will be used in the case where noisy equipment is not stationary (for example drills, angle grinders, chipping hammers, poker vibrators).	On-going	On-going	SHE Coordinator
				• Noisy construction activities will be restricted to reasonable hours during the day and early evening. Specifically, blasting will take place to a regular programme and will be restricted to the period between 08h00 and 16h00.	Construction	On-going	SHE Coordinator
				• In the event of unavoidable noisy construction activities in the vicinity of noise sensitive areas, the mine will liaise with local residents on how best to minimise the impact.	Construction	On-going	SHE Coordinator
				• Machines in intermittent use will be shut down in the intervening periods between work or throttled down to a minimum.	On-going	On-going	SHE Coordinator
				• Operations will aim to meet the noise standard requirements of the Occupational Health and Safety Act (Act No 85 of 1993).	On-going	On-going	SHE Coordinator
				• Staff working in areas where the 8-hour ambient noise levels exceed 75dBA will wear ear protection equipment.	On-going	On-going	SHE Coordinator
				• The source-based noise performance of less than 70dBA at	On-going	On-going	SHE Coordinator

Phase of operation	Activities	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				the property boundary of the mine will be implemented as specified for industrial districts in SANS 10103. Where the noise level at any external site is presently at or exceeds the 70dBA maximum, the existing level shall not be increased by more than indicated as acceptable in SANS 10103.			
				• The latest technology incorporating maximum noise mitigation measures will be designed into the system. When ordering plant and machinery, manufacturers will be requested to provide details of the sound power level (SPL). Where possible, those with the lowest SPL (most quiet) will be selected.	Design	Once-off	SHE Coordinator
				• The design process will consider, inter alia, the following aspects: - The position and orientation of buildings on the site. - The design of the buildings to minimise the transmission of noise from the inside to the outdoors. - The insulation of particularly noisy plant and equipment.	Design	Once-off	SHE Coordinator
				• The temporary dumps of spoil rock and overburden (berms) from the open cast pit excavations will, where possible, be used as interim noise attenuation barriers. Specifically such berms should be constructed (where necessary) around both Hoogland Extension Project open pits.	On-going	On-going	SHE Coordinator
				• The National Noise Control Regulations and SANS 10103:2008 will be used as the main guidelines for addressing the potential noise impact.	On-going	On-going	SHE Coordinator
				• At the start of the Hoogland Extension Project implementation, the noise footprint of each discrete element will be established by measurement in accordance with the relevant standards, namely SANS ISO 8297:1994 and SANS 10103. The character of the noise (qualitative aspect) will also be checked to ascertain whether there is any nuisance factor associated with the operations.	Construction	Once-off	SHE Coordinator

TABLE 37: ACTION PLAN – LANDSCAPE AND VISUAL

Phase of operation	Activities	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Exploration Site preparation Earthworks and civil works Rehabilitation Site/contract management	H	H	• Land disturbance will be limited to what is absolutely necessary. • As much existing vegetation (other than invasive plants) is retained wherever possible construction of any infrastructure to act as dust collectors and to break the monotony of vast expanses of exposed earth. • Good 'housekeeping' (keeping the site tidy and neat) is essential during site development. • The outside slopes of the tailings dam are rehabilitated with grasses and/or groundcover vegetation. • Dust is suppressed in line with the air management plan. • Final shaping of remaining land forms will be implemented such that the final profile of the rehabilitated open pit mining areas and the sides and the top of the tailings dam are formed to emulate natural contours of the area. • Harsh steep engineered slopes will be avoided during rehabilitation, instead the rehabilitated landscape will emulate natural contours of the area. • Natural vegetation is allowed to intrude onto the site. • A combination of tall indigenous trees and shrubs are planted along the periphery and within the plant site to partially absorb views of the plant. • The Casuarinas windbreaks are maintained in a healthy growing condition as far as is possible. • Buildings and structures are painted with colours that reflect and complement the natural tan and dark greens of surrounding landscape. Pure whites and pure blackcolours are avoided. • External surfaces of buildings and structures are articulated or textured to create interplay of light and shade and to reduce the potential glare, shiny or bare metal will be avoided. • Paved surfaces are paved with 'earthy' tones that complement the natural red/brown colours and textures of the soils in the area. • There is on-going rehabilitation of the open pit areas. • Light fixtures are installed that provide precisely directed illumination to reduce light "spillage" beyond the immediate surrounds of the plant, and declines and vent shafts but which still illuminate the buildings/roads. High pole top flood and security lighting is avoided where possible.Peripheral security lighting will be movement activated and will not be kept on if	On-going Construction On-going On-going On-going Rehabilitation Rehabilitation On-going Once-off On-going On-going On-going On-going On-going On-going	On-going Once-off On-going On-going On-going Once-off Once-off On-going Once-off On-going On-going On-going On-going On-going On-going	SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator SHE Coordinator
Operation	Underground mining Open pit mining Backfilling of open pits Waste rock and tailings management Mineral processing Power supply Transport systems Non-mineralised waste management Site support services Rehabilitation	H	H				
Decommission	Waste rock and tailings management Power supply Transport systems Non-mineralised waste management Site support services Demolition Rehabilitation	H	H				

Phase of operation	Activities	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				practical. • Service roads must follow the natural contours of the land to avoid extensive cut or fill areas.	Construction	Once-off	SHE Coordinator
Closure	Final land forms (residue facilities)	**H**	**M-L**	• Monitor and maintain vegetation cover.	Timeframe to be agreed upon with authorities	As required	SHE Coordinator

TABLE 38: ACTION PLAN – LAND USES

Phase of operation	Activities	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Development of the mine	**H**	**M-H**	• Purchase/lease farms within application boundary	Pre-construction	Once off	SHE Coordinator
Operation	Presence and operation of the mine	**H**	**M-H**	• Effective implementation of all mitigation measures as outlined in this EMP report to reduce its overall impact on the environment and surrounding land-uses.	On-going	On-going	SHE Coordinator
Decommission	Presence and rehabilitation of the mine	**H**	**M-H**	• If a situation arises where any surrounding land use is negatively affected by the mine, Everest will promptly take steps to address the cause of the impacts. If, despite the implementation of remedial steps, the land use impact cannot be addressed, Everest will compensate the relevant land owners accordingly.	As required	As required	SHE Coordinator
Closure	Final land forms (residue facilities)	**H**	**L**	• Monitor and maintain rehabilitated areas	Timeframe to be agreed upon with authorities	As required	SHE Coordinator

TABLE 39: ACTION PLAN – BLASTING HAZARDS

Phase of operation	Activities	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Initial development of declines	-	-	• Blasts are designed using recognized formulae and by an expert in the field of blasting so that no damage is caused by blasting vibrations.	Pre-blast	Every blast	Mine Manager
Operation	Open pit mining	**H**	**L**	• All structures and services within 500 m of the blast are marked on a site plan.	Pre-blast	Every blast	Mine manager
				• Structures in the immediate vicinity of the blasts are checked in the presence of the owner and a record of the condition of the structures is taken.	Pre-blast	Every blast	Mine manager
				• Extra control of blast detonation and the projection of fly rock	As required	As required	Mine manager

Phase of operation	Activities	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				(mat or bags covers) are applied where blasting is undertaken in built up areas.			
				• All regulatory authorities with service infrastructure and/or providing services in the area are consulted to determine what safety precautions have to be applied.	On-going	On-going	Mine manager SHE Coordinator
				• The mine has obtained the necessary approvals for blasting in terms of the Minerals Act and Explosives Act. The mine complies with the conditions of these approvals.	On-going	On-going	Mine manager SHE Coordinator
				• The mine applies the blasting principle that the maximum peak particle velocity is less than 12.5 mm/s at a distance of 500 m from a blast in the open pits. The mine will purchase properties with structures within 500 m of the workings. In addition airblast at third party structures is kept below the recommended threshold (125dB) and flyrockis contained within 500m from the blast and for every blast, this zone is cleared of people and animals.	On-going	On-going	Mine manager SHE Coordinator
				• Blasting must be undertaken during daylight hours. • The mine will undertake a thorough crack survey of the potentially affected structures. This will include a photographic record of the structures.	On-going As required	On-going As required	Mine manager SHE Coordinator
				• The mine will inform the surrounding community of its blasting programme.	On-going	On-going	SHE Coordinator
				• No surface or near surface blasting will take place at night (between 18h00 and 06h00) or on the weekend between Fridays at 18h00 and Mondays at 06h00.	On-going	On-going	Mine manager SHE Coordinator
				• The mine must respond immediately to any blast related complaints. These complaints and the follow up actions will be dated, documented and kept as records for the life of mine.	On-going	On-going	Mine manager SHE Coordinator
				• For each blast, the mine observes the following procedural safety steps: - The flyrock danger zone associated with each blast is delineated and people and animals are cleared from this zone before every blast - An audible warning is given at least three minutes before the blast is fired.	On-going	On-going	Mine manager SHE Coordinator
				• Monitor blasts (see section 21). • If monitoring data confirms that blast-related damage and/or nuisance has occurred the mine will, in consultation with the relevant third party, take steps to investigate and rectify any damage and to limit any further potential for damage and/or nuisance.	On-going If required	On-going If required	SHE Coordinator Mine manager SHE Coordinator

TABLE 40: ACTION PLAN - TRAFFIC

Phase of operation	Activities	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Transport systems Site/contract management	**M**	**L**	• Aquarius upgraded the district road that provides access to the mine from the provincial R577 road to an all-weather gravel road.	Pre-construction	Once-off	SHE Coordinator
Operation	Transport systems Site/contract management	**M**	**L**	• The mine roads constructed between the plant and the decline and the open pit haul road are all-weather gravel roads. These roads are closed for public use.	Pre-construction	Once-off	SHE Coordinator
Decommission	Transport systems Site/contract management	**M**	**L**	• Trucks carrying concentrates from the mine are not overloaded – there is no spillage from the trucks that could damage roads and be hazardous to other road users.	On-going	On-going	SHE Coordinator
				• The mine records and responds, appropriately and without delay, to any complaints about usage of roads by mine vehicles.	On-going	On-going	SHE Coordinator
				• Any road accident involving or caused by project related traffic is handled in accordance with the emergency response procedure as referenced in Section 20.2	As required	As required	SHE Coordinator

TABLE 41: ACTION PLAN – HERITAGE AND CULTURAL RESOURCES

Phase of operation	Activities	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Site preparation Earthworks Site / contract management	**H**	**L**	• Limit the project footprint and activities to that in the approved EMP and amendments and current EMP amendment.	On-going	On-going	SHE Coordinator
				• Disturbance of the archaeological and historical sites and graves are avoided where possible.	On-going	On-going	SHE Coordinator
Operation	Tailings and waste rock management Open pit mining Decline establishment Stormwater management Site/contract management	**H**	**L**	• All identified archaeological sites are registered with the SAHRA.	On-going	On-going	SHE Coordinator
				• Permits in terms of Section 35 of the National Heritage Resources Act were obtained for disturbance of archaeological sites for the establishment of initial mine infrastructure.	Pre-construction	Once-off	SHE Coordinator
Decommission	Demolition Rehabilitation Site/contract management	**M**	**L**	• Permits will also be obtained for the Hoogland Extension Project for the removal of historical sites. These include the historical village (medium to high heritage significance), a colonial dwelling (medium to high heritage significance) and stone walls (medium to low cultural significance). These sites will be subjected to a Phase II heritage study by an accredited specialists in order to apply for the require permits.	Pre-construction	Once-off	SHE Coordinator

Phase of operation	Activities	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				• Permissions were obtained for the exhumation and relocation of graves for the initial mine establishment.	Pre-construction	Once-off	SHE Coordinator
				• Graves within the Hoogland Extension Project Area will be preserved in situ where possible. These graves and graveyards will be demarcated with walls or fencing, and relatives wishing to visit the graves will be allowed access.	Pre-construction	Once-off	SHE Coordinator
				• Where graves have to be moved for the Hoogland Extension Project, the relevant permissions will be obtained. The exhumation of human remains and the relocation of graveyards are regulated by various laws, regulations and administrative procedures. This task will be undertaken by forensic archaeologists or by reputed undertakers who are acquainted with all the administrative procedures and relevant legislation. Permission will have to be obtained from the descendants of the deceased (if known), the National Department of Health, the Provincial Department of Health, the Premier of the Province and the local police.	Pre-construction	Once-off	SHE Coordinator
				• All heritage sites not impacted on by the actual development of infrastructure will be marked on the site layout plan.	On-going	On-going	SHE Coordinator
				• All sites preserved in situ will be regularly inspected for signs of encroachment and/or damage.	On-going	On-going	SHE Coordinator
				• All workers (temporary and permanent) will be educated about the heritage sites that may be encountered.	On-going	Induction and annually	SHE Coordinator
				• Any chance finds of heritage sites will follow the emergency procedure as referenced in Section 20.2	As required	As required	SHE Coordinator

TABLE 42: ACTION PLAN – PALEONTOLOGICAL RESOURCES

Phase of operation	Activities	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Earthworks	-	-	• Limit the project footprint and activities to that in the approved EMP and amendments and current EMP amendment.	On-going	On-going	SHE Coordinator
Operation	Open pit mining	-	-	• Educate all workers (temporary and permanent) about the heritage sites that may be encountered.	On-going	Induction and annually	SHE Coordinator
				• Although no paleontological resources are expected, any chance finds will follow the emergency response procedure (Section 20.2).	As required	As required	SHE Coordinator

TABLE 43: ACTION PLAN – MINERAL STERILISATION

Phase of operation	Activities	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Development of the mine	-	-	• Detailed design of all mine infrastructure takes into consideration the presence of mineral reserves on site, and placement of any permanent infrastructure in areas that could potentially sterilize the minerals is avoided.	Pre-construction	Once-off	COO

TABLE 44: ACTION PLAN – ECONOMIC IMPACTS (POSITIVE AND NEGATIVE)

Phase of operation	Activities	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Development of the mine	**H+**	**H+**	• The mine established and regularly updates a skills database of people in the area and contractors are encouraged to preferentially employ locals.	Pre-construction and on-going	Once-off and on-going	HR Manager
Operation	Presence and operation of the mine	**H+**	**H+**	• Non-core activities are identified and prioritized for local service providers. Local service providers are identified and requested to tender for the provision of the various services.	On-going	On-going	Procurement Manager
Decommission	Presence and rehabilitation/closure of the mine	**H+**	**H+**	• The mine supports the principle of Black Economic Empowerment (BEE) through procurement of the services of BEE contractors and suppliers. The mine strives to identify and invite BEE companies to tender for the provision of services at the mine.	On-going	On-going	Procurement Manager
				• The mine continues to implement the commitments in its social and labour plan in accordance with the employment, procurement and social investment principles of the Mining Charter. In this respect: - **Recruitment, selection and employment equity:** The objective of sound recruitment, selection and equity policy is to ensure that the mine is staffed with competent, committed employees and that the benefits of internal appointments and local recruitment are realised. Everest will ensure that its recruitment process incorporates the following: (1) a policy of appointments from within should be applied where current employees with the necessary skills, competence and potential are available – formal succession and career planning should facilitate this process; (2) where internal appointments are not viable, recruitment must be aimed at employing members of local communities;	On-going	On-going	Mine Manager SLP Co-ordinator HR Manager Procurement Manager

Phase of operation	Activities	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				(3) selection of employees should be based upon defined competency and skill requirements which should be available for scrutiny in the form of job specifications; (4) selection processes should be defensible and visibly fair – proper records of recruitment and selection practices should be kept; and (5) medical screening should be restricted to conditions relevant to the job as defined in the job specifications. - **Longer-term options for achieving sustainable productivity:** (1) award bursaries to students who have shown commitment to their careers on condition that bursary holders can be retained within the company as far as possible; (2) provide learnership opportunities to ensure focused growth and development. Learnership programmes equip people with relevant skills identified in the industry and therefore contribute to the economic growth and development of the country; and (3) provide all staff with access to skills training, and for those staff identified as having potential, facilitate career progression as part of a career management process. • Start closure planning as soon as practically possible. • Incorporate economic considerations into closure planning	At least 5 years prior to decommissioning	Once-off	Mine Manager SHE Coordinator
Closure	Maintenance and aftercare	**M+**	**H+**	• Monitor site in line with closure objectives and goals	Timeframe to be agreed upon with authorities	On-going	SHE Coordinator

TABLE 45: ACTION PLAN – SOCIAL IMPACTS (POSITIVE AND NEGATIVE)

Phase of operation	Activities	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Development of the mine	H	M-L	• The mine established a social investment programme to enhance the socio-economic benefits and mitigate the negative socio-economic impacts of the development. The social investment programme aims to address the identified needs of surrounding communities.	Pre-construction and on-going	Once-off then on-going	SHE Coordinator
Operation	Presence and operation of the mine	H	M-L	• Discussions were held with the South African Police Force regarding the policing of the area.	Pre-construction and on-going	Once-off then on-going	SHE Coordinator
Decommission	Presence and rehabilitation/closure of the mine	H	M-L	• A forum was established whereby the mine and surrounding land users communicate on a regular basis to ensure that the mine is in a position to attend to any concerns of farmers promptly.	Pre-construction and on-going	Once-off then on-going	SHE Coordinator
				• A joint strategy was developed with local authorities, the local police force and local farmers to deal with squatters.	Pre-construction and on-going	Once-off then on-going	SHE Coordinator
				• The mine continues to implement the commitments in its Social and Labour Plan in accordance with the employment, procurement and social investment principles of the Mining Charter. In this respect: - **Housing:** a. Everest will endeavour to work with local government and private stakeholders (such as but not limited to, property developers, estate agents, private land owners and financial institutions) to investigate the potential for and planning around the development of appropriate housing within the local area to assist the local workforce to meet its own housing requirements within the formal housing sector and facilitate long term investment in the local economy through the monthly income from the mine. This amounts to long term solutions to housing, facilitated through public-private partnerships, and will facilitate long term, sustainable development and assist in preventing the establishment of unsustainable, informal settlements which is problematic for the company and local government at the end of the life of the mine. b. Everest management will not be associated with employees residing in illegal informal settlements. Squatting on Everest land will not be permitted at any time and measures to facilitate the prevention of squatting on land in the vicinity of its operations will be implemented. Contractors will be required to	On-going	On-going	Mine Manager SLP Co-ordinator HR Manager Procurement Manager

Phase of operation	Activities	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				keep a record of employee's physical addresses. c. Where hostel accommodation is provided, it will be of an acceptable standard. This includes hygienic ablution facilities, proper washing facilities with hot and cold running water, hygienic feeding facilities, suitable security of access, and avoidance of overcrowding. Single-sex hostel accommodation is not an acceptable solution to the housing needs of Everest's workforce, and whilst it may be utilized to meet short-term needs during construction periods where there is a lack of alternative accommodation, it will not be permitted as a long-term housing strategy. • Start closure planning as soon as practically possible. • Incorporate social considerations into closure planning. • The establishment of informal settlements in the area is considered an emergency situation. In such instances the emergency procedure included in Section 20 will be followed.	At least 5 years prior to decommissioning If required	Once-off If required	Mine Manager SHE Coordinator SHE Coordinator
Closure	Maintenance and aftercare	**H**	**M-L**	• Monitor site in line with closure objectives and goals.	Timeframe to be agreed upon with authorities	On-going	SHE Coordinator

20 PROCEDURES FOR ENVIRONMENTAL EMERGENCIES AND REMEDIATION

20.1 ONGOING MONITORING AND MANAGEMENT MEASURES

The on-going monitoring as described in Section 21 will be undertaken to provide early warning systems necessary to avoid environmental emergencies.

20.2 PROCEDURES IN CASE OF ENVIRONMENTAL EMERGENCIES

Emergency procedures apply to incidents that are unexpected and that may be sudden, and which lead to serious danger to the public and/or potentially serious pollution of, or detriment to the environment (immediate and delayed). Procedures to be followed in case of environmental emergencies are described in the table below (Table 46).

20.2.1 GENERAL EMERGENCY PROCEDURE

The general procedure that should be followed in the event of all emergency situations is as follows.

- Applicable operational managers must be notified of an incident upon discovery;
- Area to be cordoned off to prevent unauthorised access and tampering of evidence;
- If residue facilities/dams, stormwater diversions, etc., are partially or totally failing and this cannot be prevented, the emergency siren is to be sounded (nearest one available). After hours the Plant Manager on shift must be notified;
- Take photographs and samples as necessary to assist in investigation;
- Report the incident to the responsible person of the Safety, Health Environment and Quality (Environment) department (or equivalent);
- The Environment department must comply with Section 30 of the National Environmental Management Act (107 of 1998) such that:
    - The Environment department must immediately notify the Director-General (DWEA, DMR and Inspectorate of Mines as appropriate), the South African Police Services, the relevant fire prevention service, the provincial head of DEDET, the head of the local municipality, the head of the regional DWA office and any persons whose health may be affected of;
        - The nature of the incident;
        - Any risks posed to public health, safety and property;
        - The toxicity of the substances or by-products released by the incident; and
        - Any steps taken to avoid or minimise the effects of the incident on public health and the environment.
    - The Environment department must as soon as is practical after the incident:

- Take all reasonable measures to contain and minimise the effects of the incident including its effects on the environment and any risks posed by the incident to the health, safety and property of persons;
- Undertake clean up procedures;
- Remedy the effects of the incident; and
- Assess the immediate and long term effects of the incident (environment and public health);

o Within 14 days the Environment department must report to the Director-General DWEA, the provincial head of DEDET, the head of the local municipality, the head of the regional DWA office such information as is available to enable an initial evaluation of the incident, including:

- The nature of the incident;
- The substances involved and an estimation of the quantity released;
- The possible acute effects of the substances on the persons and the environment (including the data needed to assess these effects);
- Initial measures taken to minimise the impacts;
- Causes of the incident, whether direct or indirect, including equipment, technology, system or management failure; and
- Measures taken to avoid a recurrence of the incident.

20.2.2 IDENTIFICATION OF EMERGENCY SITUATIONS

The site wide emergency situations that have been identified together with specific emergency response procedures are outlined in Table 46.

20.3 TECHNICAL, MANAGEMENT AND FINANCIAL OPTIONS

Technical, management and financial options that will be put into place to deal with the remediation of impacts in cases of environmental emergencies are described below:

- The applicant will appoint a competent management team with the appropriate skills to develop and manage a mine of this scale and nature.
- To prevent the occurrence of emergency situations, the mine will implement as a minimum the mine plan and mitigation measures as included in this EIA and EMP report.
- On an annual basis, the mine will undertake a risk assessment as part of its auditing procedures to identify and check potential risks associated with its operations. The findings of the risk assessment will be reported to mine management to be actioned.
- As part of its annual budget, the mine will allow a contingency for handling of any risks identified and/or emergency situations.
- Where required, the mine will seek input from appropriately qualified people.

TABLE 46: EMERGENCY RESPONSE PROCEDURES

Item	Emergency Situation	Response in addition to general procedures
1	Spillage of chemicals, engineering substances and waste	Where there is a risk that contamination will contaminate the land (leading to a loss of resource), surface water and/or groundwater, the mine will: • Notify residents/users downstream of the pollution incident. • Identify and provide alternative resources should contamination impact adversely on the existing environment. • Cut off the source if the spill is originating from a pump, pipeline or valve (e.g. TSF delivery pipeline, refuelling tanker) and the infrastructure 'made safe'. • Contain the spill (e.g. construct temporary earth bund around source such as road tanker). • Pump excess hazardous liquids on the surface to temporary containers (e.g. 210 litre drums, mobile tanker, etc.) for appropriate disposal. • Remove hazardous substances from damaged infrastructure to an appropriate storage area before it is removed/repaired.
2	Discharge of dirty water to the environment	Apply the principals listed for Item 1 above. To stop spillage from the dirty water system the mine will: • Redirect excess water to other dirty water facilities where possible; • Pump dirty water to available containment in the clean water system, where there is no capacity in the dirty water system; and • Carry out an emergency discharge of clean water and redirect the spillage to the emptied facility. • Apply for emergency discharge as a last resort.
3	Pollution of surface water	Personnel discovering the incident must inform the Environment department of the location and contaminant source. Apply the principals listed for Item 1 above. Absorbent booms will be used to absorb surface plumes of hydrocarbon contaminants. Contamination entering the surface water drainage system should be redirected into the dirty water system. The Environment department will collect in-stream water samples downstream of the incident to assess the immediate risk posed by contamination.
4	Groundwater contamination	Use the groundwater monitoring boreholes as scavenger wells to pump out the polluted groundwater for re-use in the process water circuit (hence containing the contamination and preventing further migration). Investigate the source of contamination and implement control/mitigation measures.
5	Burst water pipes (loss of resource and erosion)	Notify authority responsible for the pipeline (if not mine responsibility). Shut off the water flowing through the damaged area and repair the damage. Apply the principals listed for Item 1 above if spill is from the dirty/process water circuit.
6	Flooding from failure of surface water control	Evacuate the area downstream of the failure. Using the emergency response team, rescue/recover and medically treat any injured personnel.

Item	Emergency Situation	Response in addition to general procedures
	infrastructure	Temporarily reinstate/repair stormwater diversions during the storm event (e.g. emergency supply of sandbags). Close the roads affected by localised flooding or where a stormwater surge has destroyed crossings/bridges.
7	Risk of drowning from falling into water dams	Attempt rescue of individuals from land by throwing lifeline/lifesaving ring. Get assistance of emergency response team whilst attempting rescue or to carry out rescue of animals. Ensure medical assistance is available to recovered individual.
8	Veld fire	Evacuate mine employees from areas at risk. Notify downwind residents and industries of the danger. Assist those in imminent danger/less able individuals to evacuate until danger has passed. Provide emergency fire fighting assistance with available trained mine personnel and equipment.
9	Overtopping or failure of the tailings dam	Sound the alarm to evacuate danger area. Pump water from top of dam and follow redirection of water as indicated in Item 2 above. Stop pumping tailings to the TSF. Recover casualties resulting from dam failure using the emergency response team. Make the remaining structure safe. Apply the principles of Item 1 above.
10	Falling into hazardous excavations	Personnel discovering the fallen individual or animal must mobilise the emergency response team to the location of the incident and provide a general appraisal of the situation (e.g. human or animal, conscious or unconscious, etc.). The injured party should be recovered by trained professionals such as the mine emergency response team. A doctor (or appropriate medical practitioner)/ambulance should be present at the scene to provide first aid and transport individual to hospital.
11	Road traffic accidents (on site)	The individual discovering the accident (be it bystander or able casualty) must raise the alarm giving the location of the incident. Able personnel at the scene should shut down vehicles where it is safe to do so. Access to the area should be restricted and access roads cleared for the emergency response team. Vehicles must be made safe first by trained professionals (e.g. crushed or overturned vehicles). Casualties will be moved to safety by trained professionals and provided with medical assistance. Medical centres in the vicinity with appropriate medical capabilities will be notified if multiple seriously injured casualties are expected.
12	Development of informal settlements	The mine will inform the local authorities (municipality and police) that people are illegally occupying the land and ensure that action is taken within 24hrs.
13	Injury from fly rock	The person discovering the incident will contact the mine emergency response personnel to recover the injured party and provide medical assistance.

Item	Emergency Situation	Response in addition to general procedures
		Whilst awaiting arrival of the emergency response personnel, first aid should be administered to the injured party by a qualified first aider if it is safe to do so.
14	Uncovering of graves and sites	Personnel discovering the grave or site must inform the Environment department immediately. Prior to damaging or destroying any of the identified graves, permission for the exhumation and relocation of graves must be obtained from the relevant descendants (if known), the National Department of Health, the Provincial Department of Health, the Premier of the Province and the local Police. The exhumation process must comply with the requirements of the relevant Ordinance on Exhumations, and the Human Tissues Act, 65 of 1983.
15	Uncovering of fossils	Personnel discovering the fossil or potential site must inform the Environment department immediately. Should any fossils be uncovered during the development of the site, a palaeontologist or palaeo-anthropologist will be consulted to identify the possibility for research.

21 PLANNED MONITORING AND EMP PERFORMANCE ASSESSMENT

21.1 PLANNED MONITORING OF ENVIRONMENTAL ASPECTS

Environmental aspects requiring monitoring are listed below.

- Water resources – see Section 21.1.1 for details
- Air – see Section 21.1.2 for details
- Noise – see Section 21.1.3 for details
- Biodiversity – see Section 21.1.4 for details
- Biomonitoring – see Section 21.1.5 for details
- Blasting – see Section 21.1.6 for details
- Tailings dam, waste dumps and other water dams – see Section 21.1.7 for details

21.1.1 WATER RESOURCES

Table 47 and Table 48 below set out the monitoring points, programme and parameters to be monitored as part of the mine's groundwater and surface water programme. Where required, third-party boreholes will be included in the mine's monitoring programme. The water quality parameters may be modified on the basis of input from an appropriate specialist and DWA. It is also possible that the programme will be modified as part of the water license amendment process. The frequency of monitoring may be amended depending on the results of the monitoring programme and with approval from DWA.

Should any contamination be detected at the compliance monitoring points, the mine will immediately notify the Regional Director of DWA. It will then identify the source of contamination, identify measures for the prevention of this contamination (in the short term and the long term) and then implement these measures.

Surface water monitoring points will also include points important to the operation (on-site). These are:

- return water dam;
- plant water;
- open pit water; and
- sewage treatment plant (out).

It should be noted that many of the existing boreholes in the areas where mining has occurred were destroyed through the mining activities and therefore limited monitoring data for groundwater qualities and depth is available. New boreholes have been drilled and were monitored during the latter half of 2007.

FIGURE 21: PROPOSED MONITORING NETWORK

TABLE 47: GROUND AND SURFACE WATER MONITORING POINTS

Water type	BH / Sample	Location/Comment	Longitude	Latitude	Quality	Water level
Ground Water	ESM2/ESM10	Down-gradient of TSF	-85396	-2783492	A2 (monthly) + A3 (6 monthly)	Quarterly
	ESM3	Down-gradient of TSF	-85234	-2783953	A2 (monthly) + A3 (6 monthly)	Quarterly
	ESM5	Down-gradient of TSF return water dam	-85107	-2782752	A2 (monthly) + A3 (6 monthly)	Quarterly
	ESM6	Up-gradient of plant and TSF	-84265	-2784316	A2 (monthly) + A3 (6 monthly)	Quarterly
	ESM7	Down-gradient of tailings dam, next to the major N-S striking dyke	-85183	-2783153	A2 (monthly) + A3 (6 monthly)	Quarterly
	ESM8		-84114	-2783792	A2 (monthly) + A3 (6 monthly)	Quarterly
	ESM11	Monitoring of extent of cone of dewatering	-85922	-2781803	-	Quarterly
	ED20	Monitoring of extent of cone of dewatering	-87231	-2783483	-	Quarterly
	ED35	Monitoring of extent of cone of dewatering	-88757	-2783095	-	Quarterly
	ED40	Downstream (south west)	-88058	-2782894	-	Monthly
	BH5581	In eastern mining block	-87653	-2783365	-	Monthly
	ED49	North of eastern mining block	-86294	-2782213	A2 (monthly) + A3 (6 monthly)	Monthly
	ED48	South of eastern block	-86826	-2783933	A2 (monthly) + A3 (6 monthly)	Monthly
	ED45	South west of eastern block	-87374	-2784254	A2 (monthly) + A3 (6 monthly)	Monthly
	ED22	South west of eastern block and south east of western block	-87491	-2784010	A2 (monthly) + A3 (6 monthly)	Monthly
	BH5611	In western mining block	-88351	-2783785	-	Monthly
	BH5612	In western mining block	-88028	-2783032	-	Monthly
	ED23	In western mining block	-87870	-2783284	-	Monthly
	ED38	Downstream (west)	-88191	-2782645	A2 (monthly) + A3 (6 monthly)	Monthly
	ED40	Downstream (south west)	-88071	-2782887	-	Monthly

Water type	BH / Sample	Location/Comment	Longitude	Latitude	Quality	Water level
	ED28	On or near to the western dyke system before Groot Dwars River	-88999	-2783673	A2 (monthly) + A3 (6 monthly)	Monthly
	ED30		-88961	-2783975	A2 (monthly) + A3 (6 monthly)	Monthly
	ED31		-89004	-2783383	A2 (monthly) + A3 (6 monthly)	Monthly
	ED33		-88731	-2783868	A2 (monthly) + A3 (6 monthly)	Monthly
	ED34		-88859	-2783246	A2 (monthly) + A3 (6 monthly)	Monthly
	ED35		-88755	-2783067	A2 (monthly) + A3 (6 monthly)	Monthly
	Abstraction boreholes	As required	-	-	A2 (monthly) + A3 (6 monthly)	Volume measured daily
	GCS 1	Eastern perimeter of open pit	-86220	-2785713	A2 (monthly) + A3 (6 monthly)	Quarterly
	GCS 2		-86331	-2785837	A2 (monthly) + A3 (6 monthly)	Quarterly
	GCS 3	South-east perimeter of open pit	-86579	-2786393	A2 (monthly) + A3 (6 monthly)	Quarterly
	GCS 4	Southern perimeter of open pit	-86804	-2786271	A2 (monthly) + A3 (6 monthly)	Quarterly
Surface Water	E1	In the East Stream, below the larger TKO dam (below the confluence of East and West Streams)	-85007	-2766349	A5 monthly	n/a
	E2	in the East Stream entering the TKO dam	-84615	-2781149	A5 monthly	
	E3	In the East Stream, upstream of the point where the access road to the mine crosses the stream	-83430	-2783049	A5 monthly	
	W1	In the West Stream entering the TKO dam	-84921	-2780258	A5 monthly	
	W2	In West Stream, upstream of the point where the access road to the mine crosses the stream	-85310	-2783861	A5 monthly	
	GD1	Downstream of mine	-88419	-2777867	A5 monthly	
	GD2	Downstream of mine before confluence with East Stream	-88480	-2778599	A5 monthly	
	GD3	Downstream of mine	-89005	-2782408	A5 monthly	

Water type	BH / Sample	Location/Comment	Longitude	Latitude	Quality	Water level
	GD4	Upstream of mine	-89042	-2785284	A5 monthly	
	GD5	Downstream of confluence of tributary associated with Hoogland Extension infrastructure	-89061	-2784767	A5 monthly	
	GD6	Upstream of Confluence. Stream which passes between the two opencast areas	-87399	-2785612	A5 monthly	
	GD7	Before Confluence with GD6, on stream which passes to the east of the northern opencast	-87412	-2785587	A5 monthly	
	GD8	Before confluence of stream which passes east of northern opencast. Near waste rock dump.	-86199	-2785685	A5 monthly	
	GD9	Upstream of all proposed mining works.	-86240	-2786404	A5 monthly	
Mine infrastructure points	GD4	Tailings dam return water (seepage)	-89042	-2785284	A2 (monthly) + A3 (6 monthly)	Volume measured daily
	GD5	Sewage effluent water	-89061	-2784767	A4 (monthly)	
	3	Underground water disposed at the return water dam			A1 (monthly	
	4	Underground water abstracted			-	

Note:
1) In addition to the above borehole monitoring, mine abstraction volumes will be monitored monthly. The quality of the abstracted water will be monitored quarterly.
2) Mine dewatering water and plant process water will also be monitored.
3) Water monitoring points will be surveyed and indicated on the detailed map of mine infrastructure.
4) Bold items are required as per the current water licence.

In terms of the above monitoring requirements, parameter evaluation differs depending on the monitoring source. Five different sets of analysis are included in the issued license and can be found in Table 48. The water qualities will be compared to the DWAF Water Quality Reserve Standards, Steelpoort River (B41H, B41J), and also the SAWQG's for Domestic Use (DWAF 1996) as a secondary guideline.

TABLE 48: MONITORING PARAMETERS FOR ANALYSIS AND REPORTING

A1	**A2**	**A3**	**A4**	**A5**
EC	pH	Cr_6	Faecal Coliforms	pH
TDS	EC	Cr	COD	EC
TSS	TDS	Cu	pH	TSS
NO_3	TSS	Cd	Ammonia (ionised and un-ionised) as N	Alkalinity as $CaCO_3$
SO_4	Cl	Fe	Nitrite/Nitrate as N	Ca
Cl	F	Mn	Chlorine as free Chlorine	Cl
Ca	NO_3	V	Suspended Solids	Mg
Mg	SO_4		EC	K
Na	Alkalinity as $CaCO_3$		Ortho-Phosphate as Phosphorus	Na
Cr_6	Hardness as $CaCO_3$		Flouride	NO_3
Fe	Ca			SO_4
Mn	Mg			COD
	Na			Fe
	K			Mn
	Fe			F
	NH_4			V
	Mn			Cr
	Al			

In terms of groundwater levels, the results will be compared to simulated water levels and the extent of the cone of depression will be analysed accordingly. Time series data will be applied for future model calibration purposes.

The flow of the Groot Dwars River will be monitored through a visual inspection and measuring stick methods. An underground mining management plan will be developed where specific management procedures in terms of dykes and river systems are stipulated.

The monitoring data will be documented, interpreted and reports on trends in the data will be submitted to DWA on an annual basis. The annual monitoring reports will also contain:

- biomonitoring results;
- results of monitoring sediments in the West Stream; and
- updates to and the status of the mine water balance.

21.1.2 AIR QUALITY

Currently monitoring of dust fallout is undertaken at the Everest Mine, consisting of three directional buckets. These buckets are currently placed as follows:

- South east of the tailings dam between the tailings dam and the processing plant (central unit);
- Adjacent to the run-of-mine stockpile (quarry unit); and
- Downwind of the Valley infrastructure.

As directional buckets are not the standard that the SANS limits are based on, it is recommended that the directional dust fallout buckets be replaced or operated in conjunction with single dust fallout buckets (according to the ASTM method). Two additional single dust buckets will be placed at Hoogland as follows:

- Along the proposed haul road
- Downwind of the proposed Hoogland open pits

The target on-site dust fallout reading should be 1200mg/m^2/day. The target off-site dust fallout reading should be 600mg/m^2/day. As with the current operations, the buckets will be monitored on a quarterly basis. The results will be compared to the DEAT dust fallout categories.

21.1.3 NOISE

Noise will be periodically monitored at selected sensitive receptors to verify the results of the noise modelling.

21.1.4 BIODIVERSITY

Aquarius will monitor the following habitats on a quarterly basis to see that they are not being disturbed by mining-related activities and there is no encroachment of invasive plants into these habitats:

- the Bushveld in the Groot Dwars River valley to the west of the mine site;
- the Ridge Grassland on the ridge above the ore body;
- the riparian wetland along West Stream between the tailings dam site and mining area;
- the riparian wetland along East Stream where the mine access road crosses the stream; and
- the Protea Woodland to the south and south-east of the plant and tailings dam area.

Monitoring for the Valley Project includes:

- Detailed baseline studies of the indicator groups in the main vegetation types that will suffer direct impacts (*Acacia-Euclea* and *Acacia-Cussonia* Open Rocky Woodlands). For each vegetation type an area within the direct impact zone and a control area outside of this zone (preferably outside of the 500m buffer zone) should be selected and surveyed.

- Regular monitoring (preferably annually), by repeat surveys of the control sites at the same time each year for life of the mine, to provide a measure of naturally occurring inter-annual variation so that this can be distinguished from mining-related impacts and rehabilitation progress. Frequency of monitoring is dependent on the expected duration of mining operations; for an operational life shorter than 5 years, annual monitoring would be recommended, while for longer operational periods (5-10 or 10-20 years) less frequent (every second or third year) might be adequate to provide an adequate baseline and indication of natural inter-annual variation.
- Continued monitoring of both the control sites and the rehabilitated areas after mining operations have ceased until mine closure; repeat surveys should be carried out annually for at least the first three years post-rehabilitation, after which the frequency may be reduced, initially to every second year and then every 3-5 years until rehabilitation targets have been reached.

Rehabilitation targets include:

- Ant and leafhopper biodiversity levels (total species number estimates) should return to at least 90% of baseline average, with diversity/evenness indices at least 90% of mean baseline values and at least 70% similarity of community species composition to baseline measure. Rank abundance plot slopes, which are expected to become significantly steeper in the early stages of rehabilitation, should have regained a similar pattern to that obtained from the baseline studies if rehabilitation is to be considered complete.
- All scorpion species recorded from the site (6 to date) should be re-established at densities of at least 80% of average baseline levels.
- *Pycna sylvia* populations should be re-established at no less than 80% of baseline average levels.

Modification of these targets may be necessary if high inter-annual variation in control site data is encountered; this should be done in consultation with MTPA and the specialist responsible for implementing the monitoring program.

Monitoring specific to the Hoogland Project will include:

- Regular visits by the Environmental Compliance Officer to sensitive areas adjacent to the impact footprint (particularly thickets and rocky outcrops) to check for evidence of any poaching (such as snares). Transgressors should be prosecuted under the Mpumalanga Nature Conservation Act (No.10 of 1998);
- A final invertebrate survey is required in October-November to confirm the presence of the cicada *Pycna sylvia* and *Dromica* beetle species. Confirmation of these species could add areas of high sensitivity to the project area;
- Where rehabilitation of habitat is to take place, an invertebrate monitoring programme should be implemented as follows:

- Detailed baseline studies of the selected indicator groups (ants and leafhoppers) and *Pycna sylvia* in the main vegetation types that will suffer direct impacts (Tristachya-Themeda Grassland and Thicket in the proposed North Pit, Tristachya-Themeda Grassland and Themeda-Bracharia Grassland in the proposed South Pit): for each vegetation type an area within the direct impact zone and a control area outside of this zone (preferably outside of the 500m buffer zone) should be selected and surveyed (a single control site could be used for the two affected areas of Tristachya-Themeda Grassland);
- Regular monitoring (preferably annually), by repeat surveys of the control sites at the same time each year for the entire operational life of the pits, to provide a measure of naturally occurring inter-annual variation so that this can be distinguished from mining-related impacts and rehabilitation progress; and
- Continued monitoring of both the control sites and the rehabilitated pit areas after mining operations have ceased until mine closure; repeat surveys should be carried out annually for at least the first three years post-rehabilitation, after which the frequency may be reduced, initially to every second year and then every 3-5 years until rehabilitation targets have been reached.

Rehabilitation targets for the Hoogland Extension Project include:

- Return ant and leafhopper biodiversity levels (total species number estimates) to at least 90% of baseline average, with diversity/evenness indices at least 90% of mean baseline values and at least 70% similarity of community species composition to baseline measure. Rank abundance plot slopes, which are expected to become significantly steeper in the early stages of rehabilitation, should have regained a similar pattern to that obtained from the baseline studies if rehabilitation is to be considered complete.
- Re-establishment *of Pycna sylvia* populations at no less than 80% of baseline average levels.

Modification of these targets may be necessary if high inter-annual variation in control site data is encountered; this should be done in consultation with MTPA and the specialist responsible for implementing the monitoring programme.

21.1.5 BIOMONITORING

The mine's biomonitoring programme includes monitoring points upstream and downstream of the mine's operations in the East stream, West Stream and Groot Dwars River. The current biomonitoring points are included in Table 49 below. These points should correlate with the existing surface water monitoring points. If this is not possible, the surface water monitoring points should be moved to also cater for the biomonitoring requirements. An appropriately qualified specialist will undertake biomonitoring bi-annually – in the wet season and in the dry season, every year. This will include studies of habitat integrity. The ecological standard recommended for West Stream is Ecological Class B. Coupled with the

biomonitoring, annual monitoring of sediments in the streambed of the West Stream, East Stream and Groot Dwars River will be undertaken by a qualified geomorphologist. Prior to construction, a baseline habitat integrity study including photographs of the river and baseline study of sediments was to be undertaken.

The biomonitoring program was initiated in the winter of 2006. Biomonitoring sites were at points on the eastern tributary E1 and the Groot Dwars River (GD3) (Renamed GD B1 in the bio-monitoring report) downstream of the areas of potential impact related to Everest Platinum Mine. The monitoring program was continued into 2007 and 2008, but was cancelled from summer 2008 to December 2009. As such one high and low flow cycle of monitoring was missed during this period. Biomonitoring was reinstated in November 2009 at the points listed in Table 49 below. Sites were assessed using visual assessment techniques, water quality measurements, habitat assessments and assessments of the aquatic macro-invertebrate according to various assessment indices. Sediment samples were taken and analysed to determine spatial variations in the concentrations of various elements and compounds, and to identify potential areas of concern. In addition, the fish community of the TKO dams was assessed to determine impacts on the community structure and the health of the population. Toxicological assessment of three process water sites took place in order to define the risk that the mine's process water poses to the receiving environment.

TABLE 49: LOCATION OF THE BIOMONITORING POINTS

Site	Latitude	Longitude	Description
E2	25° 07" 31.3 S	30° 09" 27.7 E	Located on Kafferskraalspruit downstream of a large farm dam
GD B1	25° 08" 15.3 S	30° 05" 29.6 E	Located downstream of all the Everest Platinum operations in the Groot Dwars river catchment in an extremely remote area
RC1	25° 09" 33.3 S	30° 10" 22.3 E	Located upstream of the mine haul road crossing over the western tributary of the East Stream
RC2	25° 09" 30.0 S	30° 10" 23.3 E	Located downstream of the mine haul road crossing over the western tributary of the East Stream

Biomonitoring will also be conducted at the Hoogland surface water points (GD 5-9 in Table 47) unless there is no suitable habitat to allow monitoring, in which case, more appropriate points will be selected by the relevant specialists during the next sampling round.

21.1.6 BLASTING

Prior to the construction phase of the Hoogland project, Everest will undertake a pre-blast baseline survey of structures within 2km of the project site.

Monitoring of each blast will take place for the duration of blasting activities. Points for off-site vibration and airblast monitoring will be identified in consultation with surrounding landowners and a blast

monitoring specialist. The monitoring results will be documented and maintained for record-keeping and auditing purposes.

21.1.7 TAILINGS DAM, WASTE DUMPS AND OTHER WATER DAMS

In addition to the abovementioned environmental monitoring programmes, the following issues will, as a minimum and where applicable, be monitored by the dam operators on a monthly basis and a professional engineer on a quarterly basis:

- the location and size of the supernatant pool, elevation and position of the phreatic surface, slope stability, adequacy of freeboard, presence of seepage, and functioning of drains, condition of pipelines and valves, incidence of layering
- pumping flow rates between, from and into the various dams and TSF
- vegetation cover and success rate of vegetation establishment in rehabilitated areas such as side slopes
- groundwater pollution aspects as detailed above
- dust generation
- erosion damage and general condition of facilities including catchment paddocks, drainage systems, sumps, silt traps.

In addition to the above, monitoring of all water dams will include:

- daily monitoring of water levels and operation of pumps and pump motor control systems.
- monthly monitoring to include:
  - Dipping of leak detectors to check integrity of liners (where relevant)
  - Physical inspection for damage to liner
  - Presence of seepage, erosion damage, wall movement, vegetation on outer slope, condition of riprap, condition of spillways
  - Condition of fences, access gates, signage, safety ropes, life rings
  - Capacity of silt trap, cleaning and removal of silt (when required).

The findings will be documented and maintained for record-keeping and auditing purposes.

21.2 AUDITING AND PERFORMANCE ASSESSMENTS

The environmental manager will conduct internal management audits against the commitments in the consolidated EMP and project plan in the relevant EIAs. During the construction and decommissioning phases, these audits will be conducted every two weeks. In the operational and closure phases, these audits will be conducted on a quarterly basis. The audit findings will be documented for both record keeping purposes and for informing continual improvement. In addition, and in accordance with mining

regulation R527, an independent professional will conduct an EMP performance assessment every 2 years. The site's compliance with the provisions of the EMP and the adequacy of the EIA and EMP report relative to the on-site activities will be assessed in the performance assessment.

21.3 FREQUENCY FOR REPORTING

As a minimum, the following documents will be submitted to the relevant authorities from the start of construction until mine closure:

- EMP performance assessment, submitted every two years to DMR
- updated closure cost estimate, submitted annually to the DMR
- water monitoring reports, submitted annually to DWA
- detailed plan for decommissioning/closure, submitted to DMR at least five years prior to decommissioning.

22 FINANCIAL PROVISION

The information in this section was sourced from the closure cost calculation study completed by Metago (Appendix P).

22.1 PLAN SHOWING LOCATION AND AERIAL EXTENT OF PROPOSED OPERATION

A plan showing the location and aerial extent of the proposed operation is provided as Figure 20 (Section 2.4). A plan showing the annual progression of the mining operation relative to the overall plan is included as Figure 18 (Section 2.2).

22.2 ANNUAL FORECASTED FINANCIAL PROVISION

The annual forecasted financial provision for the six years of operation together with the progress total in Year 6 is provided in the table below (Table 50) and the principles of matching and accrual applied.

TABLE 50: FINANCIAL PROVISION (FOR ESTIMATED LIFE OF OPERATIONS)

Year	Cumulative financial liability (Incl. VAT)	Percentage platinum reserves extracted and processed	Cumulative financial liability (Incl. VAT) based on Matching and Accrual Principle
0	R 0	0 %	R 0
1	R 38,568,408	5.9 %	R 2,275,536
2	R 44,882,080	24.3%	R 10,906,345
3	R 51,195,752	42.8 %	R 21,911,782
4	R 57,509,424	61.3 %	R 35,253,277
5	R 63,823,095	79.8 %	R 50,930,830
6	R 66,979,931	100 %	R 66,979,931

22.3 CONFIRMATION OF AMOUNT TO BE PROVIDED

The amount of financial provision that will be provided should the right be granted is R2.3 million (covering the first year of operation).

22.4 METHOD OF PROVIDING FINANCIAL PROVISION

The financial provision will be provided in the form of a financial guarantee.

23 ENVIRONMENTAL AWARENESS PLAN

23.1 THE PURPOSE OF THE ENVIRONMENTAL AWARENESS PLAN

The purpose of the environmental awareness plan is to ensure that all personnel (contractors, miners, machine operators, management, etc) understand the general environmental requirements of the site. In addition, greater environmental awareness must be communicated to personnel involved in specific activities which can have a significant impact on the environment and ensure that they are competent to carry out their tasks on the basis of appropriate education, training and/or experience. The environmental awareness plan should enable Everest to achieve the objectives of the environmental policy.

23.2 ENVIRONMENTAL POLICY

At present Everest have developed a safety policy and are in the process of developing an environmental policy. Consideration will be given to combining these policies together to form an overall site wide safety, health and environmental (SHE) policy. Everest will display the environmental policy prominently at the mine entrance and key notice boards at the mine's business units. Everest's environmental policy is described below:

1. To minimise the impact of Everest's mining operations on the environment wherever possible by carrying out activities in an environmentally responsible manner;
2. Develop and maintain a positive environmental culture by demonstrating to employees good environmental management is everyone's responsibility, for example:
    - Holding all employees accountable for environmental performance by including it as a factor in job performance assessments;
    - Encourage communication of new ideas/suggestions by offering awards for positive contributions.
3. To comply with all applicable environmental legislation and the commitments contained in Everest's approved EIA/EMP report and amendments as a minimum requirement;
4. To ensure that all Everest's employees, contractors and sub-contractors:
    - Are aware of the impact of their activities on the environment;
    - Are informed about the measures required to prevent, mitigate and manage environmental impacts; and
    - Apply these principles whilst carrying out their work.
5. Investigate and report all environmental incidents and near misses to reduce the potential for recurrence.
6. To establish and maintain a good relationship with surrounding communities, industries and other interested and affected parties, with regard to Everest's activities;
7. To develop a localised environmental strategy to preserve and promote awareness of the pristine natural environment encountered in the area; and

8. To provide relevant and constructive consultation/public participation on the management of the potential environmental impacts posed by the mine in the future.

23.3 STEPS TO ACHIEVE THE ENVIRONMENTAL POLICY OBJECTIVES

Everest's environmental policy will be realised by setting specific, measurable and achievable objectives. It is proposed that new objectives are set throughout the life of mine, but initial objectives are as follows:

1. Management of environmental responsibilities:
    a. Everest will establish and appoint an Environmental Manager at senior mine management level. The Environmental Manager will be responsible to the General Manager and must be trained to a standard sufficient to be competent in post. The Environmental Manager will be provided with all necessary resources (personnel and equipment) to carry out the management of all environmental aspects of the site, for example:
        i. Compliance with environmental legislation and EIA/EMP commitments;
        ii. Implementing and maintaining an environmental management system;
        iii. Developing environmental emergency response procedures and coordinating personnel during incidents;
        iv. Manage routine environmental monitoring and data interpretation;
        v. Environmental trouble shooting and implementation of remediation strategies; and
        vi. Closure planning.
2. Communication of environmental issues and information:
    a. Meetings, consultations and progress reviews will be carried out, and specifically Everest will:
        i. Set the discussion of environmental issues and feedback on environmental projects as an agenda item at all company board meetings;
        ii. Provide progress reports on the achievement of policy objectives and level of compliance with the approved EIA/EMP report to the Department of Mineral Resources;
        iii. Ensure environmental issues are raised at monthly mine management executive committee meetings and all relevant mine wide meetings at all levels; and
        iv. Ensure environmental issues are discussed at all general liaison meetings with local communities and other interested and affected parties.
3. Environmental awareness training:
    a. Everest will provide environmental awareness training to individuals at a level of detail specific to the requirements of their job, but will generally comprise:
        i. Basic awareness training at induction for all individuals to be on site generally less than five days.
        ii. General environmental awareness training will be given at advanced induction to all employees and contractors who will be on site longer than five days.

iii. Specific environmental awareness training will be provided to personnel whose work activities can have a significant impact on the environment (e.g. workshops, waste handling and disposal, sanitation, etc).

4. Review and update the environmental topics already identified in the EIA/EMP which currently includes the following issues:

a. Geology (sterilisation of mineral resource);

b. Topography (hazardous excavations and surface subsidence);

c. Soil management (loss of soil resource);

d. Land capability (loss of land with agricultural and conservation/ecotourism potential);

e. Surrounding land use (traffic management, reduction in land available to livestock grazing and damage from blasting);

f. Management of biodiversity (impacts on land and water related habitats and species);

g. Surface water management (alteration of surface drainage and pollution of surface water);

h. Groundwater management (reduction in groundwater levels/availability and groundwater contamination);

i. Management of air quality (dust generation);

j. Noise (specifically management of disturbing noise);

k. Visual aspects (reduction of negative visual impacts);

l. Heritage resources (management of archaeological, cultural and historical sites);

m. Socio-economic impacts (management of positive and negative impacts); and

n. Interested and affected parties.

5. All mine projects will be designed to minimise impact on the environment and to accomplish closure/rehabilitation objectives.

6. Everest will ensure that records of all environmental training, monitoring, incidents, corrective actions and reports are maintained.

7. Contractors and employees will be contractually bound to participate in the achievement of environmental policy objectives and compliance with the EIA/EMP report.

23.4 TRAINING OBJECTIVES OF THE ENVIRONMENTAL AWARENESS PLAN

The environmental awareness plan ensures that training needs are identified and that appropriate training is provided. The environmental awareness plan should communicate:

1. The importance of conformance with the environmental policy, procedures and other requirements of good environmental management;

2. The significant environmental impacts and risks of individuals work activities and explain the environmental benefits of improved performance;

3. Individuals roles and responsibilities in achieving the aims and objectives of the environmental policy; and

4. The potential consequences of not complying with environmental procedures.

23.4.1 GENERAL CONTENTS OF THE ENVIRONMENTAL AWARENESS PLAN

To achieve the objectives of the environmental awareness plan the general contents of the training plans are as follows:

1. Module 1 – Basic training plan applicable to all personnel entering the site for less than five days:
    a. Short (15min) presentation to indicate the site layout and activities at specific business units together with their environmental aspects and potential impacts.
    b. Individuals to sign off on completion to proceed with work.
2. Module 2 – General training plan applicable to all personnel at the site for longer than five days:
    a. General understanding of the environmental setting of the mine (e.g. pristine ecological environment, local communities and proximity to natural resources such as rivers);
    b. Understanding the environmental impact of individuals activities on site (e.g. excessive production of waste, poor housekeeping, energy consumption, water use, etc), many of the principals of which can be applied off site (e.g. in the home);
    c. Indicate potential site specific environmental aspects and their impacts;
    d. Everest's environmental management strategy;
    e. Identifying poor environmental management and stopping work/activities which present significant risks (e.g. storage and handling of hazardous chemicals outside designated areas);
    f. Procedures and key personnel for reporting incidents;
    g. Examples of poor environmental management and environmental incidents; and
    h. Procedures for emergency response and cleaning up minor leaks and spills.
3. Module 3 – Specific training plan:
    a. Environmental setting of the workplace (e.g. proximity of watercourses, vulnerability of groundwater, proximity of local communities and industries, etc);
    b. Specific environmental aspects such as:
        i. Spillage of hydrocarbons at workshops;
        ii. Spillage of explosive liquids in the open pits;
        iii. Poor waste management such as mixing hazardous and general wastes, inappropriate storage and stockpiling waste large amounts of waste;
        iv. Poor housekeeping practices; and
        v. Poor working practices (e.g. not carrying out oil changes in designated bunded areas).
    c. Impact of environmental aspects, for example:
        i. Hydrocarbon contamination of local watercourses resulting in loss of resource to downstream users;
        ii. Groundwater contamination also resulting in loss of resource due to potential adverse aesthetic, taste and health effects; and

iii. Dust impacts on local communities (nuisance and health implications).

d. Everest's duty of care (specifically with respect to waste management); and

e. Purpose and function of Everest's environmental management system.

Individuals required to complete Module 3 (Specific training module) will need to complete Modules 1 and 2 first. On completion of the Module 3, individuals will be subject to a short test (written or verbal) to ensure the level of competence has been achieved. Individuals who fail the test will be allowed to re-sit the test after further training by the training department. In addition to the test, individuals involved in activities that pose a significant potential risk the environment will be assessed formally on their performance in the workplace. The actual contents of the training modules will be developed based on a training needs analysis.

Key personnel will be required to undergo formal, external environmental management training (e.g. how to operate the environmental management system, waste management and legal compliance).

In addition to the above Everest will:

a. Conduct refresher training/presentations on environmental issues for mine employees (permanent and contractors) at regular intervals.
b. Promote environmental awareness using relevant environmental topic posters displayed at strategic locations on the mine. These topics will be changed monthly, and will be reviewed annually by the Environmental Manager to ensure relevance.
c. Participate and organise events which promote environmental awareness, some of which will be tied to national initiatives e.g. National Arbor Week, World Environment Day and National Water Week.

24 TECHNICAL SUPPORTING INFORMATION

Technical and supporting information included as appendices to this report, not already attached in terms of the EIA, are listed below.

- Calculation of financial closure liability report (Appendix P).

25 CAPACITY TO MANAGE AND REHABILITATE THE ENVIRONMENT

This section outlines the applicant's capacity to rehabilitate and manage negative impacts on the environment.

25.1 AMOUNT REQUIRED TO MANAGE AND REHABILITATE THE ENVIRONMENT

Estimated costs for implementing the technical and management options associated with the Hoogland project as identified in Section 19 are included in the table below (Table 51). The costs are either once off costs or an annual cost and have been determined at 2011 rates. Please note that the costs included in the table are based on conceptual estimates only. These costs are in addition to those are spent by the mine for its current operations.

TABLE 51: ESTIMATED COSTS FOR IMPLEMENTING TECHNICAL AND MANAGEMENT OPTIONS ASSOCIATED WITH THE HOOGLAND PROJECT

Component	Detail	Estimated costs	
		Once off	Annual
Detailed design	Includes costs associated with the detailed design of facilities	Up to R10 million	-
Site engineering	Everest employees will do some of the engineering work in-house. This amount is a portion of expected wages for the period leading up to construction.	± R1 million	-
Site services	Includes maintenance of facilities and services of general management activities at the project site	-	±R1 million
Site management	Includes activities that will be conducted by the mine personnel as part of their daily jobs	-	±R1.5 million
Construction cost	Includes facilities and activities that will be established and conducted during the development of the site, including support facilities, diversions, culverts, water storage facilities	± R10 million	-
Implement an EMS system	Includes implementing system, personnel training and on-going implementation	R200,000	Incl. above
Environmental aspects	The costs associated with the mitigation of environmental impacts are mainly catered for in the detailed design, construction, site services and site management costs outlined above	Incl. above	Incl. above
Rehabilitation costs	Rehabilitation of the site have been catered for as part of the closure cost calculation	Incl. below	Incl. below
Specialist input	It is expected that specialist input will be needed for some of the mitigation measures, for each of the monitoring programmes, for external auditing and updating of the closure cost calculation. It is assumed that existing specialist work at the mine will be extended to service the Hoogland project site.	R1.5 million	R500,000
Compensation	Compensation for land uses on and surrounding the site if determined to be appropriate will need to be determined in consultation with the relevant parties.	To be determined	To be determined
	Total	±R22,7 million	±R3 million

Component	Detail	Estimated costs	
		Once off	Annual
Closure cost for life of mine	Based on closure cost calculation compiled by Metago	±R67 million (at Dec 2017 based on current rates)	-

25.2 AMOUNT PROVIDED FOR

The amount as outlined in Table 51 above will be provided for in the mine budget.

26 UNDERTAKING SIGNED BY APPLICANT

COMMITMENT/UNDERTAKING BY APPLICANT

I, Abraham Johannes van Ghent

the undersigned and duly authorised thereto by

.....

undertake to adhere to the requirements and to the conditions set out in the approved EMP with the exception of the exemption(s) and amendment(s) agreed to be relevant by the Regional Manager: _____ (include relevant province).

Signed at: .....

On: .....

Signature: .....

Designation: General Manager

REGIONAL MANAGER: _____ REGION

In terms of the Mineral and Petroleum Resources Development Act, 2002 (Act 28 of 2002) this document of ..... is approved subject to the conditions as set out in the letter of approval.

Signed at: .....

On: .....

Signature: .....

Designation: .....

REGIONAL MANAGER: _____

27 ENVIRONMENTAL IMPACT STATEMENT & CONCLUSION

This document presents the project plan as defined by Everest, presents findings of specialist studies, identifies and assesses potential impacts on the receiving environment in both the unmitigated and mitigated scenarios, including cumulative impacts, and identifies measures together with monitoring programmes to monitor and mitigate potential impacts.

A summary of the potential impacts (as per Section 7 of the EIA and EMP report), associated with the chosen alternatives (as per Section 2 and Appendix A of the EIA and EMP report), in the unmitigated and mitigated scenarios for all project phases is included in Table 52 below. The assessment of the proposed project presents the potential for significant impacts to occur on the bio-physical, cultural and socio-economic environments both on the site and in the surrounding area.

The economic impact assessment concluded that the development of the Hoogland project is the preferred economic land use alternative and that the economic benefits of the project are significantly positive. A key related issue that has been raised by AQPSA is that the continuation of Everest mine is necessarily linked to the implementation of the Hoogland project. From a cumulative perspective, it follows, given current market and operational conditions, that if the Hoogland project does not proceed then the mine may close and be placed in an indefinite period of care and maintenance. This will mean a loss of approximately R699 million GGP per annum and a loss of 1685 jobs. Even when this is period adjusted to take account of the relatively short 6 year life of the Hoogland project, the number of potential lost jobs is significant at 337 jobs. In comparison, the potential negative impact on the agricultural sector (without land use mitigation) will be less at approximately R9 million GGP per annum and a loss of between 35 jobs if current farming practices continue and 103 jobs if current farming productivity is improved.

Everest will go a long way to mitigating the potential negative environmental and social impacts by committing to apply the findings of the cumulative assessment and related mitigation objectives and actions to its project. However, potential negative impacts on the biodiversity will remain as high negative residual impacts even with mitigation. In this regard the specialist is of the view that some of the proposed project development zones are fatally flawed from a biodiversity perspective. For the following impacts the significance with mitigation would reduce to somewhere between high and medium depending on the success of implemented mitigation measures: impacts from the general disturbance of biodiversity, impacts from pollution of surface water (at closure only), impacts on noise levels, impacts on visual aspects, and loss/change of current land uses as it relates to the above issues.

It follows that there will be people that oppose the project development on the grounds of the negative environmental and social impacts, but there will also be people that support the project on the grounds of

the positive economic impacts. Ultimately, the decision makers will be required to prioritise either the positive economic impacts or the negative environmental and social impacts.

Hylton Allison
(Project Manager)

Alex Pheiffer (PrSciNat)
(Project Author & Reviewer)

Metago Environmental Engineers (Pty) Ltd

TABLE 52: TABULATED SUMMARY OF POTENTIAL IMPACTS

Section	Potential impact	Significance of the impact (the ratings are negative unless otherwise specified)							
		Construction		Operation		Decommissioning		Closure	
		Unmitigated	Mitigated	Unmitigated	Mitigated	Unmitigated	Mitigated	Unmitigated	Mitigated
Topography	Hazardous structures and excavations posing risk to third parties	H	M-L	H	M-L	H	M-L	H	M-L
Soils and land capabilities	Loss of soil resources (from physical disturbance, erosion, contamination) and associated natural land capabilities	H	M-L	H	M-L	H	M-L	H	M-L
Biodiversity	Physical destruction of biodiversity (including aquatic environments)	H	H	H	H	H	H	H	H
	General disturbance of biodiversity	H	M	H	M	H	M	H	M
Surface water	Pollution of surface water resources	H	M-L	H	M-L	H	M-L	H	M
Groundwater	Dewatering impacts affecting third party users	No impacts expected							
	Dewatering impacts affecting base flow	No impacts expected		M	M	M	M	M	M
	Contamination of groundwater	M	L	-	M	-	M	-	M
Air quality	Increase in air pollution	H	M	H	M	H	M	H	L
Noise	Increase in disturbing noise levels	M-H	M-H	M-H	M-H	M-H	M-H	No impacts expected.	
Visual impacts	Negative landscape and visual impact	H	H	H	H	H	H	H	M-L

Section	Potential impact	Significance of the impact (the ratings are negative unless otherwise specified)							
		Construction		Operation		Decommissioning		Closure	
		Unmitigated	Mitigated	Unmitigated	Mitigated	Unmitigated	Mitigated	Unmitigated	Mitigated
Land use	Loss of current land uses	H	M-H	H	M-H	H	M-H	H	L
	Blasting hazards	No impacts expected.		H	L	No impacts expected.		No impacts expected.	
	Project-related road use and traffic	M	L	M	L	M	L	No impacts expected.	
Heritage (and cultural)	Destruction and disturbance (indirect) of heritage resources	H	L	H	L	M	L	No impacts expected.	
	Loss of palaeontological resources	No impacts expected.							
Socio-economic impacts	Loss of mineral resources through sterilisation	No impacts expected.							
	Economic impact (positive and negative)	H+	H+	H+	H+	H+	H+	M+	H+
	Informal settlements, safety, security and services and associated social ills	H	M-L	H	M-L	H	M-L	H	M-L
	Change in land values	H	M-L	H	M-L	H	M-L	H	M-L

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Metago Environmental Engineers (Pty) Ltd
Consulting Engineers and Scientists

RECORD OF REPORT DISTRIBUTION

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Proponent:	Aquarius Platinum (South Africa) (Pty) Ltd

Name	Entity	Copy No.	Date issued	Issuer
R. Mellet	Aquarius Platinum, South Africa (Pty) Ltd	1-2	March 2012	H. Allison
N.E. Dzivhani	Department of Mineral Resources	3-9	March 2012	H. Allison
M. Malapane	Department of Water Affairs – regional Office, Lydenburg	10	March 2012	H. Allison
H. Botha	Mpumalanga Parks & Tourism, Loskop	11	March 2012	H. Allison
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H. Mbatha	Enhlanzeni District Municipality – Municipal Manager	15	March 2012	H. Allison
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E. Groenewald	Landowner	18	March 2012	H. Allison
Public review	Reception – Everest Platinum Mine	19	March 2012	H. Allison
Public review	Principal, Kiwi Primary School C/o P Ngutshane	20	March 2012	H. Allison
Public review	Chairman, Steenkampsberge Boerevereniging C/o D. Jacobs (TBC)	21	March 2012	H. Allison
Public review	Lydenburg Public Library	22	March 2012	H. Allison
Public review	Willow Creek C/o A van Jaarsveld	23	March 2012	H. Allison
Public review	De Berg Conservancy C/o C. Davel	24	March 2012	H. Allison
Metago library	Metago SLR - Johannesburg	25	March 2012	H. Allison
Metago library	Metago SLR - Pretoria	27	March 2012	H. Allison
R. Luyt	Department of Economic Development, Environment and Tourism	28 electronic	Following public review	A Pheiffer
M. Lotter	Mpumalanga Parks & Tourism, Lydenburg	electronic	March 2012	H. Allison

APPENDIX A: PROJECT ALTERNATIVES CONSIDERED

This appendix provides a description of the project alternatives considered in the development of the project plan as detailed in the EIA and EMP report and was compiled by the Metago EIA team with input from the various specialist studies.

PROJECT ALTERNATIVES CONSIDERED

Given the nature of the project (open cast mining) and the limited support infrastructure needed, limited alternatives were available for consideration. These are discussed below.

Alternative mining methods

Aquarius is proposing an open cast mining method to access the Hoogland ore body. This proposed method suits the shallow nature of the ore body (approximately 80m at its deepest part). Underground mining of the ore body is not possible or feasible.

Transport options

Two access routes were considered for the project. These included:

- the existing gravel farm road leading off the tarred mine access road (this road provides access to the occupied farm units north of the Hoogland site)
- a project-specific service road leading from the existing crusher to the project site.

Initially it was planned to use the farm access road for employees and visitors and the project-specific service road for hauling ore and materials between the mine and the project site. However, given that the farm road crosses in front of two private property entrances, it was decided by Aquarius to restrict all project-related traffic to the service road proposed between the mine and project site.

In terms of mechanisms for transporting ore, although initial consideration was given to the use of a conveyor to transport ore from the Hoogland project site to the mine, this option was not considered feasible by Aquarius for the following reasons:

- the cost of building the conveyor given the relatively short life of the project and low transport volumes, and
- the need to establish a crusher plant at the Hoogland site in order to reduce the ore to a desired size for conveying purposes – Aquarius wanted to limit the infrastructure required at the project site. In addition, a crusher is usually a significant source of both noise and dust emissions.

Surface infrastructure layout options

Given the location of the ore body, limited options exist for the placement of infrastructure. Surface infrastructure has been placed as close to each other as possible to minimise the disturbance footprint. No other alternative was considered.

Services and processing operations

As far as possible, existing services, infrastructure and processes at the mine will be used. This has limited the need to develop significant infrastructure at the Hoogland project site. Maximising the use of existing services is the only feasible option considered.

Sewage sludge management options

The alternatives of off-site disposal or on-site use of the sludge have been considered. The criteria considered for these alternatives were waste minimisation, long term closure objectives, and environmental protection. Use of the treated sludge for on-site rehabilitation of disturbed areas is considered to be the best alternative if the sludge is declassified and its use licensed. Alternatively, off-site disposal will take place.

The "no-project" option

The assessment of this option requires a comparison between the alternative of proceeding with the project with that of not proceeding with the project. Proceeding with the project attracts potential economic benefits and potential negative environmental and social impacts. Not proceeding with the project leaves the status quo. In the unmitigated scenario, assuming no measures are implemented to control the mine's operations, the significance of potential impacts could be high. With the mitigation and monitoring as outlined in the EIA and EMP report, the significance of some impacts will remain high due to the ecological sensitivity of the natural environment and the presence of receptor sites within close proximity of the proposed Hoogland operations. A comparative assessment of the project development versus the alternative land use (which is the current land use) is given in Section 8 of the EIA and EMP report.

APPENDIX B: INFORMATION SHARING WITH REGULATORY AUTHORITIES

APPENDIX C: STAKEHOLDER DATABASE

APPENDIX D: INFORMATION-SHARING WITH IAPS

APPENDIX E: COMMENT AND RESPONSE REPORT

APPENDIX F: SOIL AND LAND CAPABILITY STUDY

APPENDIX G: BIODIVERSITY STUDY

APPENDIX H: HYDROLOGICAL STUDY INCLUDING CONCEPTUAL STORMWATER MANAGEMENT PLAN

APPENDIX I: GEOHYDROLOGICAL STUDY

APPENDIX J: AIR QUALITY STUDY

APPENDIX K: NOISE STUDIES

APPENDIX L: VISUAL STUDY

APPENDIX M: HERITAGE (INCLUDING CULTURAL ASPECTS) STUDY

APPENDIX N: PALAEONTOLOGICAL STUDY

APPENDIX O: ECONOMIC STUDY

APPENDIX P: FINANCIAL PROVISION CALCULATION

APPENDIX Q: CLIMATIC WATER BALANCE