RICHTRAU No.123

SLR

global environmental solutions

**Applicant: Richtrau No. 123 (Pty) Ltd**

*DMR Reference Number: NW 30/5/1/2/2/10029 MR*

*DEDECT Reference Number: NWP/EIA/90/2011*

# PROPOSED ESTABLISHMENT OF A PLATINUM MINING OPERATION AND RELATED SURFACE INFRASTRUCTURE -

# MAGAZYNSKRAAL PLATINUM MINE

# ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

**SUBMITTED FOR AN APPLICATION FOR A MINING RIGHT 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 543 OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT (ACT NO. 107 OF 1998)**

## DOCUMENT INFORMATION

| | |
|---|---|
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| **Project Manager** | F Bolton |
| **Author** | F Bolton |
| **Reviewer** | B Stobart (EAPSA) |
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## 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:** | **Richard Gerardus Viring** |
| **Company:** | **Richtrau No.123 (Pty) Ltd** |
| **Identity number:** | **Included in DMR copy only** |

# PROPOSED ESTABLISHMENT OF A PLATINUM MINING OPERATION AND RELATED SURFACE INFRASTRUCTURE - MAGAZYNSKRAAL PLATINUM MINE

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# ACRONYMS AND ABBREVIATIONS

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

| Acronyms / Abbreviations | Definition |
|---|---|
| % | Percentage |
| ABA | Acid Base Accounting |
| AER | Acceptable Environmental Risk |
| Ag | Silver |
| AP | Acid Potential |
| ARD | Acid Rock Drainage |
| ARL | Acceptable Risk Level |
| As | Arsenic |
| Al | Aluminium |
| B | Boron |
| Ba | Barium |
| BID | Background information document |
| BPDM | Bojanala Platinum District Municipality |
| Ca | Calcium |
| Cd | Cadmium |
| CEC | Cation exchange capacity |
| Cr | Chromium |
| Cl | Chloride |
| CN | Coppernicium |
| CO | Carbon monoxide |
| Co | Cobalt |
| $CO_3^{2-}$ | Carbonate |
| Cu | Copper |
| dBA | A-weighted decibel |
| DEA | Department of Environmental Affairs |
| DEDECT | Department of Economic Development, Environment, Conservation and Tourism |
| 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 |
| EIA | Environmental impact assessment |
| EMP | Environmental management programme |
| ESS | Earth Science Solutions |
| ESIA | Environmental Social Impact Assessment |
| F | Fluoride |
| Fe | Iron |
| GDP | Gross domestic profit |
| $HCO_3^-$ | Bicarbonate |
| HPC | Heritage Park Corridor |
| IAPs | Interested and/or affected parties |
| IDP | Integrated Development Plan |

| **Acronyms / Abbreviations** | **Definition** |
|---|---|
| IFC | International Finance Corporation |
| K | Potassium |
| $km^2$ | Square kilometres |
| LOM | Life of mine |
| m | Metres |
| mamsl | Metres above mean sea level |
| m/s | Metres per second |
| $m^2$ | Square metre |
| $m^3$ | Cubic metre |
| MAR | Mean annual runoff |
| mbgl | Metres below ground level |
| Mg | Magnesium |
| MKLM | Moses Kotane Local Municipality |
| mm | Millimetres |
| Mn | Manganese |
| MPRDA | Mineral and Petroleum Resources Development Act |
| MVA | Megavolt ampere |
| MW | Megawatts |
| N | Nitrogen |
| Na | Sodium |
| NAAQS | National Ambient Air Quality Standards |
| NAG | Net Acid Generation |
| NEMA | National Environmental Management Act |
| NEM:AQA | National Environmental Management: Air Quality Act |
| NEM:WA | National Environmental Management: Waste Act |
| Ni | Nickel |
| $NO_2$ | Nitrous oxide |
| $NO_3$.N | Nitrate as Nitrogen |
| NSS | Natural Scientific Services |
| NWPTB | North West Parks and Tourism Board |
| $^{O}C$ | Degrees Celsius |
| Pb | Lead |
| $PM_{10}$ | Particulate matter with a fraction smaller than 10µm (microns) |
| PNP | Pilanesberg National Park |
| $PO_4$ | Phosphate |
| PrSci Nat | Professional natural scientist |
| ROM | Run-of-mine |
| SACNSP | South African Council for Natural Scientific Professions |
| SAHRA | South African Heritage Resources Agency |
| SANS | South African National Standards |
| Sb | Antimony |
| Se | Selenium |
| Si | Silicon |
| $SO_2$ | Sulphur dioxide |
| $SO_4$ | Sulphate |
| SPLP | Synthetic Precipitation Leaching Procedure |
| Sr | Strontium |
| TDS | Total dissolved solids |
| TSF | Tailings storage facility |
| TSP | Total suspended particles |
| UPVZ | Upper Pseudo value zone |

| **Acronyms / Abbreviations** | **Definition** |
|---|---|
| V | Vanadium |
| WHO | World Health Organisation |
| WMA | Water Management Area |
| Zn | Zinc |

# EXECUTIVE SUMMARY

**Introduction**

Richtrau No. 123 (Pty) Ltd (Richtrau) is owned by Pallinghurst Resources Limited, the Bakgatla-Ba-Kgafela Tribe and Anglo Platinum Limited. Richtrau currently hold the prospecting rights for platinum group metals (PGMs) (NW 30/5/1/1/2/1334 PR now NW 30/5/1/1/2/10723 PR) and base minerals (NW 30/5/1/1/2/1680 PR) on the farm Magazynskraal 3 JQ, north of the Pilanesberg National Park in the Moses Kotane Local Municipality, of the Bojanala Platinum District Municipality in the North West Province.

Richtrau proposes to develop a stand-alone underground platinum mining operation and establish related surface infrastructure to support the mining operation. The surface infrastructure that would therefore be established as part of the proposed Magazynskraal Platinum Mine includes:

- two shaft complexes and associated ventilation shafts;
- mineral processing plant;
- waste rock dumps (WRDs);
- tailings storage facility (TSF);
- topsoil stockpiles;
- sewage treatment plant and a temporary waste handling and storage facility; and
- support services and infrastructure (e.g. roads, power supply, water supply).

**Project motivation (need and desirability)**

Based on initial investigations and exploration work conducted to date at the Magazynskraal site, Richtrau believes there is a feasible ore body worth developing. The anticipated market prices in the medium and long-term are considered highly favourable for project development of the Magazynskraal Platinum Mine. The project is expected to benefit nearby communities both directly and indirectly. Direct economic benefits will be derived from wages, taxes and profits. Indirect economic benefits will be derived from the procurement of goods and services and the increased spending power of employees.

**Environmental assessment process**

Prior to commencement of the proposed project, environmental authorisations are required on the basis of an environmental assessment process. The proposed project includes mining activities and therefore authorisation is required from the DMR in terms of the Mineral and Petroleum Resources Development Act, 28 of 2002 (MPRDA). The project incorporates listed environmental activities, therefore authorisation is also required from the Department of Economic Development, Environment, Conservation and Tourism (DEDECT) in terms of the National Environmental Management Act, 107 of 1998 (NEMA). The related environmental assessment process incorporated the following steps:

- the scoping process was conducted to identify relevant environmental, social and economic issues and to define the terms of reference for the required specialist studies and the EIA;

- specialist studies were commissioned in accordance with the relevant terms of reference. The specialists were selected on the basis of their expertise and knowledge of the project area; and
- the EIA report was compiled on the basis of the findings of the specialist studies and the project team.

**Stakeholder engagement**

The stakeholder engagement process commenced prior to scoping and has continued throughout the environmental assessment process. As part of this process, authorities and interested and affected parties (IAPs) were given the opportunity to attend public meetings and focussed meetings, submit questions and comments to the project team, and review the background information document, scoping report and now the EIA and EMP report. All comments that have been submitted to date by the authorities and IAPs have been included in the EIA and EMP report. Further comments arising from the EIA and EMP report review process will be handled in a similar manner.

**Impact assessment summary**

A summary of the potential impacts (detailed in Section 7 of the EIA and EMP report) associated with the proposed project, in the unmitigated and mitigated scenarios for all project phases is included in Table 1 below.

**Table 1: Tabulated summary of potential impacts**

| Impact | Significance | |
|---|---|---|
| | Unmitigated | Mitigated |
| Loss and sterilisation of mineral resources | H | L |
| Hazardous excavations/structures and surface subsidence | H | M |
| Loss of soil resources and land capability due to pollution | H | L |
| Loss of soil resources and land capability due to physical disturbance | H | M |
| Physical destruction of biodiversity | H | M |
| General disturbance of biodiversity | H | M |
| Pollution of surface water | H | L |
| Alteration of drainage patterns | H | M (L - closure) |
| Reduction in groundwater levels / availability | H | M |
| Groundwater contamination | H | M |
| Dust generation | M | L |
| Disturbing noise | M-H | L |
| Negative visual impacts | H | M-H (H for people on site and Lesobeng) (M-L – closure) |
| Disturbance of heritage, cultural and paeleontological sites | M | L |
| Blasting hazards | H | M |
| Road and traffic impacts | H | M |
| Economic impact | H+ | H+ |
| Inward migration | H | M-H |
| Land use | H | M (L- closure) |

**Project timing**

It is expected that construction activities would commence towards the end of 2014 / early 2015, depending whether the project receives positive decisions from the relevant departments. The initial construction activities for the plant, northern shaft and associated infrastructure should take approximately 6 years. Current planning allows for a second construction phase, for the southern shaft and associated facilities, to commence in 2030 for approximately 3 years.

The planned life of mine for the proposed project is estimated at 30 years. However, it should be noted that this could be extended depending on commodity prices and available technology.

**Conclusion**

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

The economic impact assessment concluded that the development of the project will have significant positive economic impacts. Moreover, the integrated alternative land use assessment concluded that the proposed project is the preferred land use alternative.

In conclusion, effective implementation of the EMP in all project phases (including post closure) is required if the project is to proceed in a manner that impacts are mitigated to an acceptable level. Moreover, it is SLR's recommendation that the consolidated project between PPM, Sedibelo and Richtrau be considered in preference to the three independent developments. This will eliminate the need for Magazynskraal specific infrastructure such as the processing plant, TSF and other waste facilities, thereby reducing both the development and impact footprint.

# PROPOSED ESTABLISHMENT OF A PLATINUM MINING OPERATION AND RELATED SURFACE INFRASTRUCTURE - MAGAZYNSKRAAL PLATINUM MINE

## INTRODUCTION AND LEGAL FRAMEWORK

### Introduction

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Richtrau proposes to develop a stand-alone underground platinum mining operation and establish related surface infrastructure to support the mining operation. The surface infrastructure that would therefore be established as part of the proposed Magazynskraal Platinum Mine includes:

- two shaft complexes and associated ventilation shafts;
- mineral processing plant;
- waste rock dumps (WRDs);
- tailings storage facility (TSF);
- topsoil stockpiles;
- sewage treatment plant and a temporary waste handling and storage facility; and
- support services and infrastructure (e.g. roads, power supply, water supply).

The regional and local setting of the proposed project area is outlined in Table 1 below and illustrated in Figure 1 and Figure 2 respectively.

**TABLE 1: PROJECT LOCALITY INFORMATION**

| Aspect | Detail |
|---|---|
| Province | North West |
| Local authority | Moses Kotane Local Municipality (MKLM) and<br>Bojanala Platinum District Municipality (BPDM) |
| Traditional authority | Bakgatla-Ba-Kgafela (BBK) |
| Farm on which the proposed project is located | Magazynskraal 3 JQ |
| Nearest towns | Saulspoort / Moruleng<br>Mogwase<br>Rustenburg<br>Northam |
| Water catchment and management area | The project area falls within the A2 sub-drainage region of the Crocodile River, a major tributary of the Limpopo River. |

As part of a joint venture agreement, Richtrau, Pilanesberg Platinum Mines (Pty) Ltd (PPM) and the Itereleng Bakgatla Mineral Resources (Pty) Ltd) (IBMR), are investigating the possibility of developing three separate projects which are situated on neighbouring farms that could function as one mining operation in future. In addition to the above-mentioned Magazynskraal Platinum Mine, the potential consolidated project would also include:

- PPM, an existing open pit platinum mining operation which currently operates on the farms Tuschenkomst 135 JP and Witkleifontein 136 JP. It is proposed that the existing open pit on the farm Tuschenkomst be extended onto the farms Wilgespruit 2 JQ and Rooderand 46 JQ.
- Sedibelo Platinum Mine (Sedibelo), a developing mine owned and operated by the IBMR, located on the farms Wilgespruit 2 JQ, Portion 1 of Rooderand 46 JQ, Legkraal 45 JQ and Koedoesfontein 42 JQ. In broad terms, the approved Sedibelo operation comprises open pit and underground mining, and associated surface infrastructure. It is proposed that the approved infrastructure be repositioned and new infrastructure be established to optimise the extraction of available mineral resources. These changes will also cater for the potential combined mining operation.

The mining and prospecting rights of each of the above-mentioned developments are held by separate entities. As such, these three developments are the subject of three separate EIAs, and this EIA and EMP report focusses on the proposed Magazynskraal Platinum Mine. The cumulative impacts that may arise from the potential consolidated project are addressed in Section 7.5 of this report.

**FIGURE 1: REGIONAL SETTING OF THE PROPOSED PROJECT AREA**

**FIGURE 2: LOCAL SETTING OF PROPOSED PROJECT AREA**

**Decisions required and legal framework**

Prior to commencement, environmental authorisations are required on the basis of an environmental assessment process. These include:

- an environmental authorisation from the Department of Mineral Resources (DMR) in terms of the Mineral and Petroleum Resources Development Act (MPRDA), 28 of 2002; and
- an environmental authorisation from the Department of Economic Development, Environment, Conservation and Tourism (DEDECT) in terms of the National Environmental Management Act, 107 of 1998 (NEMA).

This report is the environmental impact assessment (EIA) (Section 1) and environmental management programme (EMP) (Section 2) for the proposed project. Given the legal framework above, this report has been compiled strictly in accordance with the MPRDA and the related DMR EIA and EMP report template. It is also in accordance with the NEMA requirements. Table 2 provides a guide to demonstrate this compliance. To assist with cross-referencing in the report, the chapter numbering in the EMP section follows on from the chapter numbering in the EIA section.

**TABLE 2: REQUIREMENTS FOR EIA AND EMP REPORTS**

| MPRDA: Mining Regulations 50 and 51 of Regulation 527 of 23 April 2004 | NEMA: Regulations 31 and 33 of Regulation 543 of 18 June 2010 | Reference in EIA and EMP report |
|---|---|---|
| **Environmental impact assessment (EIA)** | | |
| - | Details of the EAP who compiled the EIA, and his/her expertise to carry our an EIA | Introduction |
| - | Comment on the need and desirability of the proposed activity(ies) in the context of alternatives | Introduction |
| | A description of the need and desirability of the proposed activity | Introduction |
| - | Description of the property on which the activity will be undertaken and the location of the activity on the property | Sections 1.3.1 and 1.4 |
| Assessment of the environment likely to be impacted by the mining operations including cumulative impacts | A description of the environment that may be affected by the activity and the manner in which the physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity; | Section 1 |
| | Description of proposed activity(ies) | Section 2 |
| An assessment of the environmental likely to be affected by the identified alternative land use or developments, including cumulative environment impacts | Description and comparative assessment of alternatives identified during the EIA | Section 4 and 5 |
| An assessment of the nature, extent, duration, probability and significance of the identified potential environmental, social and cultural impacts of the proposed mining operations, including cumulative environmental impacts | Description of environmental issues that were identified during the environmental impact assessment process, an assessment of the significance of each issue and an indication of the extent to which the issue could be addressed by the adoption of mitigation measures; | Section 7 |
| | Description of identified potential alternatives to the proposed activity, including advantages and disadvantages that the proposed activity or alternatives may have on the environment and the | Section 7 |

| MPRDA: MINING REGULATIONS 50 AND 51 OF REGULATION 527 OF 23 APRIL 2004 | NEMA: REGULATIONS 31 AND 33 OF REGULATION 543 OF 18 JUNE 2010 | REFERENCE IN EIA AND EMP REPORT |
|---|---|---|
| | community that may be affected by the activity; | |
| | Assessment of each identified potentially significant impact, including— <br>• cumulative impacts; <br>• the nature of the impact; <br>• the extent and duration of the impact; <br>• the probability of the impact occurring; <br>• the degree to which the impact can be reversed; <br>• the degree to which the impact may cause irreplaceable loss of resources; and <br>• the degree to which the impact can be mitigated; | Section 7 |
| Determine the appropriate migratory measures for each significant impact of the proposed mining operation | Summary of findings and recommendations of specialist reports | Section 7 |
| - | Methodology used to determine impact significance | Section 7.3 |
| An comparative assessment of the identified land use and development alternatives and their potential environmental, social and cultural impacts | - | Section 8 |
| Details of the public engagement process and identification of how all issues raised have been addressed | Details on the public involvement process, including: <br>• steps undertaken in accordance with the plan of study; <br>• list of persons, organisations and organs of state that were registered as interested and affected parties; <br>• summary of comments received from, and a summary of issues raised by registered interested and affected parties, the date of receipt of these comments and the response of the EAP to those comments; and <br>• copies of any representations and comments received from registered interested and affected parties | Section 10 |
| Knowledge gaps, adequacy of predictive measures, assumptions and uncertainties | Description of assumptions, uncertainties and knowledge gaps | Section 11 |
| Description of the arrangement for monitoring and management of environmental impacts | - | Section 12 |
| - | A reasoned opinion as to whether the activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation; | Section 27 |
| - | Environmental impact statement – summary of key findings and comparative assessment of the positive and negative implications of the activity and alternatives | |
| Include appendices for supporting and technical information | Specialist reports as appendices | Section 13 |
| **Environmental management programme/plan (EMP)** | | |
| - | Details of the person who compiled the EMP, and his/her expertise | Introduction |
| Description of management/technical options chosen | Detailed description of the aspects of the activity that covered in the EMP | Section 2 |

| **MPRDA: MINING REGULATIONS 50 AND 51 OF REGULATION 527 OF 23 APRIL 2004** | **NEMA: REGULATIONS 31 AND 33 OF REGULATION 543 OF 18 JUNE 2010** | **REFERENCE IN EIA AND EMP REPORT** |
|---|---|---|
| Description of objectives and specific goals for:<br>• mine closure, and management of identified environmental impacts,<br>• socio-economic conditions as identified in the SLP,<br>• historical and cultural aspects | Information on any proposed management or mitigation measures that will be taken to address the environmental impacts that have been identified in a report contemplated by these Regulations, including environmental impacts or objectives in respect of:<br>• planning and design;<br>• pre-construction and construction activities;<br>• operation or undertaking of the activity;<br>• rehabilitation of the environment; and<br>• closure, where relevant. | Sections 14, 15, 16 and 17 |
| Description of the appropriate technical and management options chosen for each environmental impacts, socio-economic condition and historical and cultural aspect for each phase of the mining operation | Measures to rehabilitate the environment affected by the undertaking of any listed activity or specified activity to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development, including, where appropriate, concurrent or progressive rehabilitation measures. | Section 18 |
| Action plans to achieve the objectives and specific goals that must include a time schedule to implement migratory measures for the prevention, management and remediation of each environmental impact, socio-economic condition and historical and cultural aspects for each phase of the mining operation | Description of the manner in which it intends to:<br>• modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;<br>• remedy the cause of pollution or degradation and migration of pollutants;<br>• comply with any prescribed environmental management standards or practices;<br>• comply with any applicable provisions of the Act regarding closure and financial provisions for rehabilitation, where applicable | Section 19 |
| - | Timeframes within which the measures must be implemented | |
| | Identification of the persons who will be responsible for the implementation of the proposed management or mitigation measures | Section 19 |
| Procedures for environmental related emergencies and remediation | Process to manage any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation | Section 20 |
| Planned monitoring and environmental management performance assessment | Proposed mechanisms for monitoring compliance with and performance assessment against the environmental management programme and reporting thereon | Section 21 |
| Financial provision including the determination of the quantum of the financial provision and details of the method providing for financial provision | Closure plans, including closure objectives | Section 22 |
| Environmental awareness plan | Environmental awareness plan | Section 23 |
| Supporting specialist information | - | Section 24 |
| Capacity to rehabilitate the environment | - | Section 25 |
| Undertaking of the applicant | - | Section 26 |

**Other approvals / permits**

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

- Prior to conducting any water uses as defined in Section 21 of the National Water Act, 36 of 1998, the mine will submit a water use license application (WULA) to the Department of Water Affairs (DWA). This will include any exemptions from Regulation 704 of 4 June 1999. The water uses and exemptions could include:
  - Section 21(g) Water Use Disposing of waste in a manner which could detrimentally impact upon a water resource – waste rock dumps and dirty water storage dams at the proposed operations;
  - Section 21 (j) Water Use Removing water from underground for the safe continuation of an activity - the dewatering of the underground mining areas;
  - Section 21 (c) Water Use Impeding or diverting the flow of water in a watercourse – bridges will be required for the internal roads and the reef transport facility (conveyor) will cross the Lesele and Lesobeng Rivers;
  - Regulation 704 (R704) exemption for Condition 4a – "Locate or place any residue deposit, dam, reservoir, together with any associated structure within 1:100 year flood-line or within a horizontal distance of 100 m of a watercourse or borehole, excluding boreholes drilled specifically to monitor the pollution of ground water, or on ground likely to become water-logged, undermined, unstable or cracked". The TSF may be located within the 1:100 year floodline of a non-perennial tributary of the Bofule River;
  - R704 exemption for Condition 4b – "Carry on any underground or open pit mining, prospecting or any other operation or activity under or within the 1:50 year flood-line or within a horizontal distance of 100 metres from any watercourse or estuary, whichever is greatest". The underground mining operation will take place under the Lesele and Lesobeng Rivers;
  - R704 exemption for Condition 5 – "May not use any residue or substance which causes or is likely to cause pollution of water resource for the construction of any dam or other impoundment or any embankment, road or railway or for any other purpose which is likely to cause pollution of a water resource". The construction of roads and containment facilities may require the use of waste rock.
- Waste related activities listed in terms of the National Environmental Management: Waste Act, 59 of 2008, (NEMWA) require authorisation from DEA.
- All dams with both a wall greater than 5 m and a capacity of 50 000 $m^3$ must be registered as safety risk dams with DWA in terms of the National Water Act, 36 of 1998.
- Prior to damaging or removing heritage resources such as 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.

**EIA approach and process**

A summary of the approach and key steps in the combined EIA process and corresponding activities are outlined in Table 3.

**TABLE 3: EIA PROCESS**

| Objectives | Corresponding activities |
|---|---|
| **Project initiation and application phase (October 2011 – July 2012)** | |
| • Notify the decision making authorities of the project.<br>• Initiate the environmental impact assessment process. | • NEMA application submitted to DEDECT (October 2011)<br>• Mining right application submitted to DMR (June 2012) |
| **Scoping phase (January – November 2012)** | |
| • Identify interested and/or affected parties (IAPs) and involve them in the scoping process through information sharing.<br>• Identify potential environmental issues associated with the project.<br>• Consider alternatives.<br>• Identify any fatal flaws.<br>• Determine the terms of reference for the EIA. | • Notify IAPs of the project and environmental assessment process (social scans, distribution of BIDs, newspaper advertisements, telephone calls and site notices) (January to March 2012)<br>• Public scoping meetings (March 2012)<br>• Distribute scoping report to DMR (August 2012)<br>• Distribute scoping report IAPs and other authorities for review (October 2012)<br>• Distribute scoping report to DEDECT (November 2012) |
| **Detailed specialist investigations (June 2011 – December 2012)** | |
| • Describe the affected environment.<br>• Define potential impacts.<br>• Give management and monitoring recommendations. | • Investigations by technical project team and appointed specialists (see Table 4) of issues identified during the scoping stage including investigations into alternatives. |
| **EIA/EMP phase (November 2012 – September 2013)** | |
| • Assessment of potential environmental impacts.<br>• Design requirements and management and mitigation measures.<br>• Receive feedback on application | • Compilation of EIA and EMP report.<br>• Distribute EIA and EMP report to IAPs, DMR and other authorities for review (January/February 2013).<br>• Feedback meeting with IAPs (March/April 2013).<br>• Record comments (March/April 2013).<br>• Forward IAP comments to DMR (April 2013).<br>• Forward updated report to DEDECT (April 2013).<br>• Circulate record of decisions to all registered IAPs registered. |

**EIA team**

SLR Consulting (Africa) (Pty) Ltd (SLR) is the independent firm of consultants that has been appointed by the applicant company to undertake the environmental assessment and related processes. Fiona Bolton (project manager) has seven years of relevant experience. Brandon Stobart (reviewer) has fifteen years of relevant experience and is registered as an environmental assessment practitioner of South Africa with the Interim Certification Board.

Neither Fiona, Brandon nor SLR has any interest in the project other than fair payment for consulting services rendered as part of the environmental assessment process.

The environmental project team comprises SLR's environmental assessment practitioners, specialist consultants and the technical feasibility team (Table 4).

**TABLE 4: PROJECT TEAM**

| Name | Designation | Tasks and roles | Company |
|---|---|---|---|
| **Environmental impact assessment and public involvement team** | | | |
| Fiona Bolton | Project manager | Management of the assessment process, stakeholder engagement and report compilation. | SLR |
| Caitlin Pringle<br>Michael Willson<br>Victoria Tucker<br>Ntsako Baloyi | Project administrators | | |
| Brandon Stobart | Project reviewer | Report and process review | |
| **Specialist environmental assessment consultant team** | | | |
| Victor von Reiche | Air quality specialist | Air quality assessment | Airshed Planning Professionals |
| Susan Abell | Biodiversity specialist | Biodiversity assessment | Natural Scientific Services |
| Ian Jones | Soil specialist | Soil and land capability assessment | Earth Science Solutions |
| Lorna Ernst<br>Nothabo Tshuma | Social specialist | Social assessment | Managing Transformation Solutions |
| Gerrie Muller | Economic specialist | Economic assessment | Strategy4Good |
| Paul Klimczak<br>Stephen van Niekerk | Hydrologist and engineer | Hydrology, and stormwater management plan | SLR |
| Stephan Meyer | Geohydrologist | Groundwater study | AGES |
| Dr Julius Pistorious | Heritage specialist | Heritage assessment | Private consultant |
| Professor Bruce Rubidge | Palaeontology specialist | Palaeontology assessment | BPI for Palaeontological Research |
| Paul van der Westhuisen | Traffic specialist | Traffic assessment | Siyazi |
| Ben van Zyl | Noise specialist | Noise assessment | Acusolv |
| Mitha Cilliers | Visual specialist | Visual assessment | Newtown Landscape Architects |
| Stephen van Niekerk | Engineer | Closure liability | SLR |
| Guy Wiid | Engineer | Conceptual design of mineralised waste facilities | Epoch |
| **Technical project team** | | | |
| Richard Viring | Richtrau representative | | Richtrau |
| Dean Riley | Project manager | | Platmin |

### Contact details for responsible parties

| | |
|---|---|
| Project applicant | Richtrau No. 123 (Pty) Ltd |
| Postal address | Private Bag X 11<br>Highveld<br>0067 |
| Telephone number | 012 661 4282 |
| Fax number | 012 661 4139 |

| | |
|---|---|
| Contact person | Richard Viring |

**Project Motivation (Need and Desirability)**

Based on initial investigations and exploration work conducted to date at the Magazynskraal site, Richtrau believes there is a feasible ore body worth developing. The anticipated market prices in the medium and long-term are considered highly favourable for project development of the Magazynskraal Platinum Mine. The project is expected to benefit nearby communities both directly and indirectly. Direct economic benefits will be derived from wages, taxes and profits. Indirect economic benefits will be derived from the procurement of goods and services and the increased spending power of employees.

# SECTION 1 – ENVIRONMENTAL IMPACT ASSESSMENT

# 1 DESCRIPTION OF THE BASELINE ENVIRONMENT

This section provides a description of the current baseline conditions of the mine site and surrounding areas within which the project will be undertaken. 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 SLR) to inform the baseline description, provides the results/outcomes of research and/or studies undertaken 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

Information in this section was sourced from the following:

- groundwater study conducted by AGES in 2011 (AGES, 2011);
- groundwater study conducted by AGES in 2013 (AGES, 2013), included in Appendix H;
- prefeasibility study undertaken for the Sedibelo Operations (Barrick, 2008),
- mine residue disposal design report (Epoch, 2012) included in Appendix Q.

**Introduction and link to anticipated impact**

The geology of a particular area will determine the following factors:

- the type of soils present since the soils can be derived from the parent rock material;
- the presence and quality of groundwater and the movement of the groundwater in the rock strata;
- the presence of paleontological resources in the rock strata;
- the potential for acid generation.

All of the above aspects are considered in this EIA in the relevant sections below.

**Data collection**

Regional geological data collection was done through review of available studies and topographical maps. Geological surveys were conducted to determine the project area geology.

Acid Base Accounting (ABA) and leachate analysis was done on pit and waste rock samples from the nearby PPM operations. The acid rock drainage potential was assessed using the ABA tests. Mineralogical examinations and leach tests were also conducted.

**Results**

Regional geology

The proposed project area is situated in the Bushveld Igneous Complex. Centred on the Limpopo Province and extending into the Provinces of Mpumalanga, North West and Gauteng in South Africa, the Bushveld Igneous Complex (BIC) is the largest layered mafic igneous complex on earth, with an exposed surface area of some 67 000km$^2$.. The BIC is an intrusive igneous body, extending about 400km from east to west and about 350km from north to south.

The BIC consists of crystalline material such as norites and pyroxenites. The BIC comprises an unweathered and intact rock matrix with negligible matrix porosity and permeability, and planes of discontinuity in the rock matrix, including both faults and joint plant (collectively referred to as fractures). It is one of three layered igneous complexes in the world where platinum group elements (PGE) are currently mined as a primary product, the others being the Great Dyke in Zimbabwe and the Stillwater Complex in Montana, USA.

The BIC is primarily subdivided into the more or less coeval (2055 Ma) Rustenburg Layered Suite (RLS) and Lebowa Granite Suite (LGS), which consist of ultramafic to mafic layered rocks and granitoids, respectively. The RLS is exposed in a series of lobes, namely the Western, Far Western, Eastern, Northern and Southern (Bethal) lobes.

The RLS reaches a maximum thickness of the order of 9 km in the north-eastern part of the BIC, and is stratigraphically subdivided from the base upwards into the following zones:

- Marginal Zone - consists of contaminated norites, and is up to tens of metres thick, where developed.
- Lower Zone – consists of ultramafic lithologies and has a maximum thickness of approximately 1.7 km.
- Lower Critical Zone - consists of ultramafic lithologies and is chromitite-bearing; the Lower Critical Zone hosts large chromium reserves in the LG and MG series of chromitite layers.
- Upper Critical Zone - consists of alternating norite, pyroxenite, anorthosite and chromitite layers, and has a thickness of up to 600m. This zone is host to the two principal PGE-bearing layers, namely the UG2 chromitite and the Merensky Reef. The Merensky Reef lies near the top of the

Critical Zone, close to the contact with the overlying Main Zone. The UG2 is situated in the footwall of the Merensky Reef, the vertical separation of the two reefs varying from 20 to 400m from one part of the BIC to another. In the north-western part of the Complex, the PGE-bearing Pseudo Reef package occurs between the UG2 and Merensky Reefs.

- Main Zone – consists of noritic to gabbronoritic lithologies up to 2800m thick.
- Upper Zone - consists of ferrogabbronoritic to ferrodioritic lithologies and is up to 2000m thick. It contains of the order of 21 magnetite layers, the lowermost of which host the world's largest vanadium reserves.

Operations geology

The proposed project area is located in the Western Limb of the BIC, where the layers dip at approximately 10 - 20° into the basin. Reefs associated with the proposed project include the UG2 and Merensky reefs. The dip of the ore body varies with depth, from 10° in the proximity of the sub-crop, increasing to an average of 12° with depth. A maximum of 20° is encountered in localised areas. In the project area, the UG2 is the more economically important reef of the two and consists of a main chromitite band and a single stringer which are separated by a 10cm waste parting. The Merensky reef is contained in the Upper Pseudo Value Zone (UPVZ). This zone is defined as an area of minimal and non-existent Merensky footwall. In this area, the Merensky is in close proximity to the Upper Pseudo Reef. The distance between this UPVZ and the UG2 varies between 10m and 24m, averaging at 14.5m. A conceptual illustration of the geological structure is included in Figure 3.

Lineaments

Geographical features identified within and surrounding the proposed project site is described below.

The dominant structures are north-south in orientation with some prominent west-east structures coinciding with drainages from the Pilanesberg complex. There are secondary structures which branch off from the larger features and the drainage lines tend to follow these structures. There are a number of northwest trending dykes, belonging to the Pilanesberg dyke swarm, cross-cutting the Bushveld rocks on the proposed project area. The majority of the dykes are doleritic in composition and form distinctive positive magnetic anomalies.

*Dykes and Faults*

The most prominent structural trends in the greater area are north-south, northwest-southeast and east-west. The northwest-southeast trend corresponds to the orientation of a major dyke swarm. These dykes are collectively termed Pilanesberg dykes, but they vary in composition from syenitic to doleritic.

There is one fault on the Magazynskraal project site as shown in Figure 4, which is located to the south of the proposed TSF and processing plant.

Geochemical analysis of tailings

In the Magazynskraal / Sedibelo East: Geohydrological Preliminary Feasibility Study conducted by AGES (AGES, 2011), two PPM samples of the UG2 and Merensky Reef , which were collected by mine personnel, were sent to an accredited laboratory for ABA and leach tests in order to evaluate the effect of mining on the potential of the minerals and rocks to produce acidic products. These samples were sent to an accredited laboratory for mineralogical, whole-rock chemical, acid base accounting (ABA) and toxicity characteristic leaching procedure (TCLP) analysis.

These samples were of the ore, thus presenting a conservative approach and also represent material that will end up on the tailings storage facility after the minerals are extracted.

*Acid Based Accounting*

Acid-base accounting (ABA) is a method of determining the acid production potential of an ore body to be mined or of mine waste to be generated. The United States Environmental Protection Agency (US EPA) has published a method of determining whether mine waste will produce acid. In this document they state that a net-neutralisation potential of less than 20, a neutralisation potential ratio of less than 1 and a negative neutralisation potential all indicate that a sample could be acid producing. A positive neutralisation potential indicates that the gangue minerals may be able to neutralise any formed acid.

The acid-base accounting results for the two samples are reflected in Table 5.

**TABLE 5: ACID BASED ACCOUNTING (ABA) RESULTS**

| **Acid Based Accounting** | **Sample Identification** | |
|---|---|---|
| | **PPM UG2** | **PPM Merensky** |
| Sample Number | 4523 | 4524 |
| Paste pH | 8.30 | 7.90 |
| Total Sulphur (9%) LECO | <0.01 | <0.07 |
| Acid potential (AP) (kg/t) | 0.31 | 2.07 |
| Neutralising Potential (NP) | 10.21 | 15.12 |
| Net Neutralising Potential (NNP) | 9.90 | 13.04 |
| Net Neutralising potential Ration (NP:AP) | 32.66 | 7.29 |
| Rock type | III | III |

Taking the above mentioned standards of evaluating ABA tests into account, the following conclusions regarding the two samples can be made. Both samples show a potential to produce acid with both having a Net Neutralization Potential (NNP) that fits the US EPA criteria. The positive value of the NNP however indicates that the gangue minerals also present in the samples are of such a nature and concentration that they will neutralize any acid that is produced. This gives the samples a rock type Classification of type III. A type III rock is a non-acid forming rock with a total sulphur percentage of less than 0.25%. In addition, the additional buffering capacity of the regional surface and groundwater will also lend to the neutralisation of any acid produced from oxidising sulphides.

*Leach tests*

Samples of the same material that was used in the ABA testing was sent to an accredited laboratory to conduct leach tests. The results of the leach tests are included in Table 6.

**TABLE 6: TCLP TEST RESULTS (LEACHATE TESTS)**

| Analysis | Sample Identification | |
|---|---|---|
| | PPM UG2 | PPM Merensky |
| pH | 5.1 | 5.1 |
| Electrical Conductivity (EC) (mS/m) | 35 | 32 |
| Total Dissolved Solids (mg/ℓ) | 330 | 335 |
| Total Alkalinity (mg/ℓ) | 328 | 332 |
| $HCO_3^-$ | 400 | 405 |
| $CO_3^{2-}$ | <5 | <5 |
| Cl | <5 | <5 |
| $SO_4$ | <5 | <5 |
| $NO_3$.N | <0.20 | <0.20 |
| F | <0.20 | <0.20 |
| $PO_4$ | <0.20 | <0.20 |
| CN | <0.01 | <0.01 |
| Na | 12 | 12 |
| K | 5.60 | 9 |
| Ca | 102 | 69 |
| Mg | 8 | 22 |
| Al | 0.44 | 0.35 |
| Sb | <0.025 | <0.025 |
| As | <0.010 | <0.010 |
| Ba | 0.18 | 0.15 |
| B | <0.025 | <0.025 |
| Cd | <0.005 | <0.005 |
| Cr | 0.37 | <0.025 |
| Co | <0.025 | <0.025 |
| Cu | <0.025 | <0.025 |
| Fe | 1.53 | 1.45 |
| Pb | <0.020 | <0.020 |
| Mn | 0.74 | 1.22 |
| Ni | 0.05 | 0.43 |
| Se | <0.020 | <0.020 |
| Si | 1.18 | 4.72 |
| Ag | <0.025 | <0.025 |
| Sr | 0.44 | 0.07 |
| V | <0.025 | <0.025 |
| Zn | 0.05 | 0.03 |

The TCLP test indicated that sodium, potassium, calcium, magnesium, iron and manganese are the only chemical constituents that leach in noticeable quantities. Aluminium, chromium, zinc and nickel occur in the leachate in smaller concentrations at pH of 5.5 (Table 6). Of the leachable elements, chromium, iron, manganese and nickel occur in concentrations which are potentially toxic at pH of 5.5. However, the geochemistry of the mine waste facilities and natural environment may hinder the mobility of at least some of these constituents.

Sodium, calcium and potassium are the ions that leach most. This can be expected due to the high concentrations of these elements in the area's lithological and soil make-up. The leachability of chromium out of the sample is insignificant. This is mirrored in the regions groundwater and surface water sample chemistry.

Geochemical analysis of waste rock

Information in this section is sourced from the mine residue disposal design report (Epoch, 2013) included in Appendix Q.

The characterisation of waste rock is based on the specialists' experience and observations of the waste rock dumps at the nearby PPM operations, as well as on previous work done on the characterisation of waste rock geochemistry for PPM. As the reef that would be mined as part of the proposed project is part of the same ore body that was tested and observed at PPM, the results can be extrapolated and applied to this project. In addition, recent studies have been conducted by SLR for similar projects that are also located in the Western Limb of the BIC. As the geology is the same, the results of these studies can be applied to the waste rock resulting from this project.

*Acid Based Accounting (ABA)*

The results from the test work indicated that the waste rock materials have a low to medium acid generating potential. Based on the review of the sulphur species concentrations, carbonate values and the acid and neutralising potentials, the samples are classified as having a medium neutralising potential. It is considered unlikely that acid generation will occur at sulphide concentrations lower than 0.3%. Similar analysis for other projects on the western limb of the BIC also concluded that there is a low risk of acid generation.

*Synthetic Precipitation Leaching Procedure (SPLP)*

Manganese, copper and nickel are only readily leachable and mobile under acidic conditions and, although they can exceed World Health Organisation (WHO) drinking water limits, still fall within the SANS 241 Class II drinking water limits. In some instances, waste rock can be contaminated with blast residues and if this occurs nitrate can be an issue.

Conclusion

The dominant geolological structures are north-south in orientation with some prominent west-east structures coinciding with drainages from the Pilanesberg complex. There are secondary structures which branch off from the larger features and the drainage lines tend to follow these structures. There are a number of northwest trending dykes, belonging to the Pilanesberg dyke swarm, cross-cutting the Bushveld rocks on the proposed project area.

Geochemical tests and analysis indicate that the material from the proposed mining operation would be non-acid generating. There is however the potential for seepage concentrations to exceed the drinking water guideline limits for various parameters. This presents a potential pollution risk for both surface and groundwater in the both the short and long term. It follows that short and long term pollution prevention and/or treatment measures must be considered.

### 1.1.2 CLIMATE

Information in this section was sourced from the hydrology specialist study (SLR, 2013) included in Appendix G and the air specialist study (Airshed, 2013) included in Appendix I.

**Introduction and link to anticipated impact**

As a whole, the various aspects of climate (as discussed below) influence the potential for environmental impacts and related mine design. Specific issues are listed below:

- rainfall influences erosion, vegetation growth, rehabilitation planning, dust suppression and surface water management planning;
- temperature influences air dispersion through impacts on atmospheric stability and mixing layers, vegetation growth, and evaporation which influences rehabilitation planning; and
- wind influences erosion, the dispersion of potential air pollutants and rehabilitation planning.

Meteorological mechanisms govern the dispersion, transformation, and eventual removal of pollutants from the atmosphere. The analysis of hourly average meteorological data is necessary to facilitate a comprehensive understanding of the ventilation potential of the site. The horizontal dispersion of pollution is largely a function of the wind field. The wind speed determines both the distance of downward transport and the rate of dilution of pollutants. The generation of mechanical turbulence is similarly a function of the wind speed, in combination with the surface roughness.

To understand the basis of these potential impacts, a baseline situational analysis is described below.

**Data collection**

*Rainfall and evaporation data*

Rainfall for the site was considered from various sources including weather stations managed by both the South African Weather Services (SAWS) and the Department of Water Affairs (DWA). The rainfall station selected to be representative of the current operation is DWA station A2E021 located approximately 25km north east of the current operation with a rainfall record length of 15 years. For consistency the evaporation for the site was sourced from the same station.

*Mean Annual Precipitation (MAP) and Intensity Depth Frequency (IDF) rainfall*

This data was sourced from the Water Resources (2005) dataset and is based on an interpolated approach using observed rainfall data records. Design storm estimates for various return periods and storm durations were sourced from the Design Rainfall Estimation Software for South Africa, developed by the University of Natal in 2002. This method uses a Regional L-Moment Algorithm in conjunction with a Scale Invariance approach to provide site specific estimates of intensity-depth-frequency (IDF) rainfall, based on surrounding observed records. IDF rainfall estimates were derived from the Smithers and Schulze method based on data taken from the six nearest rain stations which have similar mean annual precipitations and altitudes.

*Temperature and wind*

In the absence of measured surface meteorological data, reference is made to MM5 data obtained for an on-site location for the period January 2008 to December 2010. MM5 (fifth generation meso scale model) is a regional model designed to simulate or predict meso scale atmospheric circulation.

*Atmospheric stability*

Diurnal variation in atmospheric stability was calculated from on-site meteorological data.

**Results**

Regional climate

The proposed project site falls within the Highveld Climatic Zone. Of the mean annual precipitation, 85% falls during summer thunderstorms. The thunderstorms generally occur every 3 to 4 days in summer and are of short duration and high intensity. Temperatures in this climatic zone are generally mild, but low minima can be experienced in winter due to clear night skies. Frost characteristically occurs in the winter months. Generally winds are light, but south-westerly winds associated with thunderstorms are typically strong and gusty (SLR, 2013).

Rainfall and evaporation

The mean annual precipitation (MAP) for the site ranges from 550mm to 700mm (WR2005). Rainfall mainly occurs as a result of thunderstorms between October and March. Hail can be expected, on an average 4-7 times a year (SLR, 2013).

The rainfall station selected to be representative of the proposed project area is DWA station A2E021 located approximately 16km north east of the proposed site with a rainfall record length of 15 years. For consistency the evaporation for the site was sourced from the same DWA gauge. Table 7 presents a summary of the monthly rainfall and evaporation at this station. Table 8 presents the depth-duration-frequency (DDF) rainfall estimates for the proposed site. These estimates are based on data taken from the six nearest rain stations (to the central point on site) which have similar mean annual precipitations and altitudes. A summary of the input stations is presented in Table 9.

Evaporation figures recorded for the area are high. The average annual evaporation is approximately 1 329mm. The highest evaporation occurs in December (more than 160mm) and the lowest evaporation in June (less than 60mm).

**TABLE 7: RAINFALL AND EVAPORATION DISTRIBUTION (STATION A2E021)**

| Month | Rainfall (mm) | Lake evaporation (mm) |
|---|---|---|
| January | 151 | 150 |
| February | 62 | 125 |
| March | 78 | 114 |
| April | 39 | 85 |
| May | 6 | 70 |
| June | 3 | 55 |
| July | 1 | 61 |
| August | 4 | 82 |
| September | 16 | 115 |
| October | 51 | 150 |
| November | 67 | 158 |
| December | 82 | 163 |
| **Total** | **559** | **1329** |

**TABLE 8: DEPTH DURATION FREQUENCY ESTIMATES FOR THE PROPOSED SITE (SLR, 2012)**

| Duration (hours) | Rainfall Depth (mm) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1:2yr | 1:5yr | 1:10yr | 1:20yr | 1:50yr | 1:100yr | 1:200yr |
| 0.08 | 9.9 | 13.6 | 16.1 | 18.6 | 22 | 24.6 | 27.2 |
| 0.167 | 14.6 | 20.2 | 24 | 27.7 | 32.7 | 36.5 | 40.4 |
| 0.25 | 18.5 | 25.5 | 30.2 | 34.9 | 41.2 | 46 | 50.9 |
| 0.5 | 23.4 | 32.2 | 38.3 | 44.2 | 52.2 | 58.3 | 64.5 |
| 0.75 | 26.8 | 37 | 44 | 50.8 | 59.9 | 66.9 | 74.1 |
| 1 | 29.6 | 40.8 | 48.5 | 56 | 66.1 | 73.8 | 81.7 |
| 1.5 | 34 | 46.9 | 55.7 | 64.3 | 75.9 | 84.7 | 93.8 |
| 2 | 37.5 | 51.7 | 61.4 | 70.9 | 83.7 | 93.5 | 103.4 |
| 4 | 44.2 | 61 | 72.4 | 83.7 | 98.7 | 110.3 | 122 |
| 6 | 48.7 | 67.2 | 79.8 | 92.2 | 108.7 | 121.4 | 134.4 |
| 8 | 52.2 | 71.9 | 85.4 | 98.7 | 116.4 | 130.1 | 143.9 |
| 10 | 55 | 75.9 | 90.1 | 104.1 | 122.8 | 137.2 | 151.8 |
| 12 | 57.5 | 79.2 | 94.1 | 108.7 | 128.2 | 143.2 | 158.5 |
| 16 | 61.5 | 84.8 | 100.8 | 116.4 | 137.3 | 153.4 | 169.7 |
| 20 | 64.9 | 89.5 | 106.3 | 122.8 | 144.8 | 161.8 | 179 |
| 24 | 67.8 | 93.4 | 111 | 128.2 | 151.3 | 169 | 187 |

**TABLE 9: DETAILS OF SOUTH AFRICAN WEATHER SERVICES STATIONS IN THE VICINITY OF THE PROPOSED PROJECT SITE**

| Station name | SAWS number | Distance from site (km) | Record length (years) | Mean Annual Precipitation (mm) | Altitude (MAMSL) |
|---|---|---|---|---|---|
| Saulspoort | 0548280_W | 9 | 38 | 611 | 1095 |
| Pilanesberg-Pol | 0548165_W | 14.4 | 79 | 623 | 1280 |
| Drielaagte | 0548483_W | 21.1 | 39 | 572 | 1050 |
| Northam | 0587477_W | 22.9 | 31 | 587 | 1007 |
| Jersey farm | 0587475_W | 26.8 | 28 | 565 | 998 |
| Mahobieskraal | 0547831_W | 29 | 32 | 630 | 1158 |

Temperature

Monthly mean and hourly maximum and minimum temperatures are given in Table 10. Temperatures ranged between 0.4 °C and 34.1 °C. The highest temperatures occurred in December and the lowest in June and July. During the day, temperatures increase to reach maximum at around 14:00 in the afternoon. Ambient air temperatures decreases to reach a minimum at around 06:00 i.e. just before sunrise.

**TABLE 10: AVERAGE TEMPERATURES RECORDED IN THE REGION (MM5 DATA, 2008 TO 2010)**

| Average temperature | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| **Mininum** | 16.4 | 15.1 | 12.6 | 6.0 | 5.0 | 0.4 | 0.9 | 3.1 | 6.4 | 11.1 | 13.1 | 15.4 |
| **Maximum** | 32.8 | 33.6 | 32.4 | 28.0 | 24.8 | 22.4 | 21.1 | 26.0 | 30.3 | 32.5 | 32.6 | 34.1 |
| **Average** | 24.7 | 24.1 | 22.6 | 18.9 | 16.0 | 12.4 | 10. | 14.9 | 19.4 | 22.0 | 23.9 | 24.9 |

Wind

***Wind data and dispersion potential***

The period wind field and diurnal variability in the wind field are shown in Figure 5. Seasonal variation in the wind fiend is shown in Figure 6. The wind field was dominated by winds from the north, north-east and east. The strongest winds (>6 m/s) were also from the east. Calm conditions occurred 12.6% of the time during the 2008 to 2010 period.

There was a shift in the wind field from predominantly northerly, north-easterly and easterly winds during daytime to more frequent winds from the south-east. Wind speeds increased slightly during the night-time conditions with a decrease in calm conditions from 15.2% during the day to 10.1% during the night. Strong winds in excess of 6m/s occurred most frequently during winter months. Calm conditions occurred most frequently during autumn months.

Atmospheric stability

Stable conditions are mostly associated with winds from the east and south-east. Unstable conditions occur most frequently when the wind blows from the west. Neutral conditions are mostly associated with winds from the south-south east and south.

**Conclusion**

The proposed project area is characterised by rainy seasons with heavy thunderstorms that last for short periods at a time. High evaporation rates reduce infiltration rates, while the high rainfall events can increase the erosion potential and the formation of erosion gullies. The presence of vegetation does however allow for surface infiltration thereby reducing the effects of erosion. The mixing of layers resulting in the formation of temperature inversions, and the presence of cloud cover limits the dispersion of pollutants into the atmosphere. Calculations based on available meteorological data indicate stable, neutral and unstable conditions occur 45%, 10% and 45% of the time respectively. Wind speeds of 5m/s and more do occur particularly in the winter months. It is the higher wind speeds that result in dust particle mobilisation. These climatic aspects need to be taken into consideration during rehabilitation and surface water management planning.

### 1.1.3 TOPOGRAPHY

Information in this section was sourced from site visits by the EIA project team, the hydrology specialist study (SLR, 2013) included in Appendix G and landscape characterisation from the visual specialist study (NLA, 2013) included in Appendix K.

**Introduction and link to anticipated impact**

The topography of a particular area will determine the following factors:

- the flow of surface water, and in many cases, also groundwater;
- the depth of soils and the potential for soil erosion, for example, in the case of steep slopes;
- the type of land use, for example flat plains are more conducive to crop farming;
- the aesthetic appearance of the area;
- climatic factors such as wind speeds and direction, for example, wind will be channelled in between mountains along valleys.

Changes in the topography caused by mining related activities could therefore alter all of the above-mentioned aspects of the environment. Mining-related activities have the potential to alter the topography of the site through the establishment of both temporary and permanent infrastructure.

This section provides an understanding of the topographical features relevant to the proposed project area and surrounding area from which to measure potential change.

**Data collection**

The main source of data collection was a series of site visits by the EIA project team, review of topographical maps and a review of the project layout in relation thereto.

**Results**

The proposed project area is relatively flat, at an average elevation of 1060 metres above mean sea level (mamsl), with various non-perennial drainage lines crossing the site. The topographic relief can be described as relatively gently sloping towards the north-east, while the topographic elevation varies between 1040 to 1080mamsl. To the south of the proposed project area is the Pilanesberg Mountain Range and the associated hills that vary between 1 330 and 1 534mamsl. Isolated koppies are located approximately 8km to the west of the project site and vary between 1 211 and 1 266mamsl.

**Conclusion**

Mining activities and surface infrastructure have the potential to alter the topography. An alteration of the natural topography has the potential to present dangers to both animals and people and to alter natural systems such as water flow. The design of surface infrastructure should be such that any changes to topography result in stable topographic features which do not pose significant risk to third parties, limit impacts on the visual character of the area and allow for effective surface water management.

### 1.1.4 SOILS

Information for this section was sourced from the soil specialist study (ESS, 2013) included in Appendix E.

**Introduction and link to anticipated impact**

Soils are a significant component of most ecosystems. As an ecological driver, soil is the medium in which most vegetation grows and a range of vertebrates and invertebrates exist. In the context of mining operations, soil is even more significant if one considers that mining is a temporary land use where-after rehabilitation (using soil) is the key to re-establishing post closure land capability that will support post closure land uses.

Mining projects have the potential to damage the soil resource through physical loss of soil and/or the contamination of soils, thereby impacting on the soils ability to sustain natural vegetation and altering land capability. Contamination of soils may in turn contribute to the contamination of surface and groundwater resources. Loss of the topsoil resource reduces chances of successful rehabilitation and restoration.

**Data collection**

Data was obtained through the review of existing geological information and land type mapping.

A field survey was undertaken during which the different soils were mapped and classified. In addition to this soil samples were taken in order to investigate/log and classify the different soil profiles. The procedure adopted in field when classifying the soil profiles is as follows:

- demarcate master horizons;
- identify applicable diagnostic horizons by visually noting the physical properties such as:
  - depth (below surface)
  - texture (grain size, roundness etc.)
  - structure (controlling clay types)
  - mottling (alterations due to continued exposure to wetness)
  - visible pores (spacing and packing of peds)

- concretions (cohesion of minerals and/or peds)
- compaction (from surface)

- determine the appropriate soil form; and
- establishing provisionally the most likely soil family.

**Results**

Soil forms

The dominant soil forms located within the proposed project areas include Arcadia, Shortlands, Valsrivier and Hutton with sub dominant materials that are made up of soil forms comprising, Hutton, Sepane, Rensburg, Tukulu and Oakleaf. The main soil forms are described below.

*Arcadia (Ar)*

The Arcadia soil forms identified within the project area comprise the following characteristics:

- highly structured soils and exhibits extremely strong vertical columns of structure from the surface;
- generally grey but can be black;
- clay content is between 40 and 65%;
- in their in situ status they are generally poorly leached soils, however they are of an alluvial origin (river derived soils) and therefore have the potential to be highly leached; and
- effective rooting depths (ERD) of approximately 200mm – 400mm.

*Shortlands (Sd)*

The Shortlands and Valsrivier soil forms mapped within the project area comprise the following characteristics:

- exhibit moderate crumbly to weak blocky structure;
- are generally dark red to dark red brown respectively;
- can display evidence of expansive clays (smictite predominantly);
- have moderately to low intake rates; and
- returned an ERD that varies from 200mm - 1200mm.

*Hutton (Hu)*

The Hutton form soils mapped within the project area comprise the following characteristics:

- generally exhibit an apedal to weak crumbly structure;
- are generally pale red/brown to yellow red in colour in the topsoil's and dark orange reds and dark red in colour in the subsoil horizons. The relatively high magnesium and iron content of the parent rocks from which these soils are derived impart the strong red colours noted;
- clay contents vary from as low as 10% to 15% in the sandy topsoil's, and may raise as high as 25%. The subsoil clay percentages range from about 22% to over 65% depending on the position that they occupy in the topographic sequence and the host geology from which they are derived;
- these soils are moderately leached and have formed in-situ; and

- returned an ERD that varies from as shallow as 200mm to greater than 1 100mm.

*Sepane (Se)*

The Sepane forms mapped within the project area comprise the following characteristics:

- moderate to highly structured soils;
- pale colours;
- high clay content;
- classified as having a wetland capability and therefore generally highly leached; and
- the rooting depths that are less than 400mm.

*Rensburg (Rg)*

The Rensburg soils located within the project area comprise the following characteristics:

- the glaycutanic structure is the distinctive feature of these soils, the Rensburg Form comprises a vertic “A” horizon on a gleyed G-horizon;
- are generally pale in colour (grey to grey brown);
- have a high clay content often of a swelling variety;
- are highly leached; and
- the ERD are between 200mm to 400mm.

*Oakleaf (Oa) and Tukulu (Tu)*

The Oakleaf and Tukulu soil forms are similar in physical and chemical character and comprise the following characteristics:

- medium grained sand fraction;
- exhibit structure that is weak to apedal;
- moderate to high intake rates; and
- rooting depths vary from 500mm to 800mm.

<u>Soil physical characteristics</u>

*Soil distribution*

The distribution of the soils (Figure 7) is closely linked to the topography and parent materials from which they are derived. The better drained soils are generally associated with a less basic parent material; while the more structured and more clay rich (less easily drained) soils are associated with the intrusive, basic parent material which underlay the majority of the study area.

*Soil erosion and compaction*

The majority of the soils identified in the proposed project areas can be classified as having a moderate erodibility index. This is largely ascribed to the generally low organic carbon content and the sensitivity of the soils. These factors are offset by the generally gentle to flat topography and the high clay contents. The vulnerability of the “B” horizon to erosion once/if the topsoil is removed must not be under estimated.

The wet and highly structured soils are susceptible to compaction due to the swelling clays that are common in the majority of the materials classified. These soils will need to be managed extremely well, both, during the stripping operation, as well as during the stockpiling/storage and rehabilitation stages.

The concerns around erosion and compaction are directly related to the fact that the protective vegetation cover and topsoil will be disturbed during any mining or construction operation. Once disturbed, the actions of wind and water are increased. Loss of soil (topsoil and subsoil) is extremely costly to any operation, and is generally only evident at closure or when rehabilitation operations are compromised. Well planned management actions during the construction and operational phases will save time and money in the long run, and will have an impact on the ability to successfully “close” an operation once completed.

*Dryland agricultural (production) potential*

Soil forms can be classified as having a good dry land production potential if they exhibit an effective rooting depth of greater than 750mm and a structure that is weaker than weak crumby.

The soil forms Hutton and Shortland can be classified as having a moderate quality grazing status under dry land production potential as they return an effective rooting depth of as shallow as 200mm with a structure that is stronger than weak crumby.

The balance of the soil forms are rated as wilderness or conservation status, with a strong to very strong structure (which is restriction on the effective rooting potential). Soil forms Sepane, Arcadia, Rensburg, Oakland and Tukulu therefore have a poor dry land production potential.

*Irrigation potential*

The irrigation potential for the majority of soil forms identified within the project area is poor due to the highly structure nature of the soil forms and the poor drainage capability. Formal irrigation is not common practise within the proposed project area. For any irrigation to be undertaken in the area, it will require the installation of a number of surface water impoundments as storage during the dry months.

<u>Soil chemical characteristics</u>

*Soil salinity/alkalinity*

In general, it is accepted that the pH of a soil has a direct influence on plant growth. This may occur in a number of different ways, which include:

- the direct effect of the hydrogen ion concentration on nutrient uptake;
- indirectly through the effect on major trace nutrient availability; and
- by mobilising toxic ions such as aluminium and manganese, which restrict plant growth.

A pH range of between 6 and 7 most readily promotes the availability of plant nutrients to the plant, while pH values below 3 or above 9, will seriously affect, and reduce the nutrient uptake by a plant.

The pH of soil forms located within the proposed project area ranges from slightly acid (6.5) to neutral soils (7.8) with values as low as 5.49. Nutrient levels generally reflect high levels of calcium, magnesium and sodium, but there are deficiencies in the levels of potassium and phosphorous, with exceptionally low levels of organic carbon matter.

*Soil fertility*

The soils identified within the proposed project area returned at best moderate levels of some of the essential nutrients required for good plant growth, with sufficient stores of calcium and sodium. However, levels of zinc, phosphorus, magnesium, aluminium, copper and potassium are generally lower than the optimum required. Significantly large areas of soil with a lower than acceptable levels of plant nutrition were mapped across the proposed project area. These poor conditions for growth were further compounded by low permeability and high clay content.

There are no indications of any toxic elements that are likely to limit natural plant growth in the soil forms located within the proposed project area.

*Nutrient Storage and Cation Exchange Capacity (CEC)*

The potential for a soil to retain and supply nutrients can be assessed by measuring the cation exchange capacity (CEC) of the soils. The low organic carbon content and very low clay minerals are detrimental to the exchange mechanisms, as it is these elements which naturally provide exchange sites that serve as nutrient stores. These conditions will result in a low retention and supply of nutrients for plant growth. Low CEC values are an indication of soils lacking organic matter and clay minerals. Typically a soil rich in humus will have a CEC of 300 me/100g (>30 me/%), while a soil low in organic matter and clay may have a CEC of 1-5 me/100g (<5 me/%). Generally, the CEC values for the soils mapped in the proposed project area are moderate to the higher than average clay contents of many of the soils.

**Conclusion**

Soil forms found within the proposed project area are predominately highly structured, relatively shallow soils with a high clay content which allows for high water retention. These soil forms are therefore not highly erodible but are susceptible to compaction. Poor drainage capacity of these soil forms reduces the dry production potential as well as the irrigation potential however, the Hutton and Shortland soil forms will have a moderate dry production potential as they are slightly better drained. These soil forms are difficult to work and have a limited utilization potential. In addition, the soil fertility is low as a result of a deficiency of key nutrients.

These soils will require appropriate management measures during construction and operation to prevent the loss of soil resources through pollution and erosion as soil resources form a crucial role during rehabilitation.

### 1.1.5 PRE-PROJECT LAND CAPABILITY

Information in this section was sourced from the soil specialist study (ESS, 2013), attached in Appendix E, that was undertaken for the proposed project.

**Introduction and link to impact**

The land capability classification is based on the soil properties and related potential to support various land use activities. Mining operations have the potential to significantly transform the land capability. To understand the basis of this potential impact, a baseline situational analysis is described below.

**Data collection**

Land capability within the proposed project area was classified into different classes namely, wetland, arable, grazing and wilderness by applying the classification system in terms of the South African Chamber of Mines Land Capability Rating System. It should however be noted that in order for an area to be classified as a 'wetland' the following criteria are assessed: soil characteristics, topography and vegetation. There are limited areas of wetland soils present within the proposed project area, however these areas do not have all the criteria necessary to be characterised as a wetland. This is supported by the biodiversity specialist study (NSS, November 2012) which has determined that there are no wetlands within the proposed project area. In this regard, this section refers to 'wet based soils' as opposed to wetlands.

**Results**

The land capability classification as described above was used to classify the land units identified during the pedological survey. The land capability classes for the proposed project area is illustrated in Figure 8 and summarised in Table 11.

<u>Arable</u>

Due to the low rainfall of the area, the land utilisation ability to obtain a return on any cropping system will fall short of the national average unless the water requirements can be augmented through irrigation. There are only limited areas of arable potential.

<u>Grazing</u>

The areas that classify as grazing land (limited) are generally confined to the shallower and transitional hydromorphic soil forms that are moderately well drained (see Section 1.1.4). Should there be rocks or pedocrete fragments present in the upper horizons of these soil groups, it will limit the land capability to wilderness land.

Wilderness/Conservation

The areas that classify as either conservation or wilderness land are found associated with the more structured, and shallower rocky soils.

Wet based soils

Wet based soils are generally dark grey to black in the topsoil horizons, and high in transported clays, and can show pronounced mottling on gleyed backgrounds (pale grey colours) in the subsoils. These soils may occur within the zone of groundwater influence and/or in association with non-perennial surface watercourses.

**TABLE 11: LAND CAPABILITY DISTRIBUTION**

| Land Capability | Area (Ha) | % of Total |
|---|---|---|
| Arable | 530.79 | 17.80% |
| Grazing | 1 269.23 | 42.56% |
| Wilderness | 775.06 | 25.99% |
| Wet based soil | 285.99 | 9.59% |
| Stream | 109.92 | 3.69% |
| Dam | 10.94 | 0.37% |
| Total Area | 2 981.93 | 100.00% |

Evidence of misuse

Cattle grazing is widespread throughout the proposed project area with signs of heavy grazing in the southern section. Evidence of this is clear as bush encroachment of species such as *Dichrostachys cinerea* occurs in the southern section.

**Conclusion**

The pre-mining land capability of the majority of the proposed project area is classified as having either wilderness or low intensity grazing potential. The land capability within the proposed project areas will be changed with the placement of infrastructure. Therefore, impact management and rehabilitation planning is required to achieve acceptable post rehabilitation land capabilities.

### 1.1.6 BIODIVERSITY

Information in this section was sourced from the biodiversity specialist study (NSS, 2012) that was undertaken for the proposed project area (Appendix F).

**Introduction and link to anticipated impact**

In the broadest sense, biodiversity provides value for ecosystem functionality, aesthetic, spiritual, cultural, and recreational reasons. The known value of biodiversity and ecosystems is 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; and
- maintenance of genetic resources

The establishment of mining-related infrastructure and support facilities have the potential to result in the loss of vegetation, habitat and related ecosystem functionality through physical disturbance and/or contamination of soil and/or water resources.

As a baseline, this section provides an outline of the type of vegetation occurring in the proposed project area and the status of the vegetation, highlights the occurrence of sensitive ecological environments including sensitive/ endangered species (if present) that require protection and/or additional mitigation should they be disturbed.

**Data collection**

The data collection for this specific project was carried out in April 2010 and April 2012, however the specialists have collective knowledge of the area which is based on past experience and the following series of surveys conducted on and in the vicinity of the proposed project area:

- Magazynskraal project area
    - April 2010
    - Apirl 2012
- Sedibelo Platinum Mine
    - August 2006
    - February 2007
    - January 2012
- PPM related projects
    - November 2005
    - mid-January 2006
    - March 2006
    - January 2011
    - May 2011

Various sampling methods were used to determine the various vegetation communities within the proposed project area. These sampling methods included field surveys and data analysis. Field surveys used the Braun-Blanquet Cover classes. Data analysis was undertaken using a TWINSPAN analysis to delineate the different vegetation communities and the Detrended Correspondence Analysis ordination to determine the proximity and the relationship between the various vegetation communities.

Methods used during the study of animal life within the proposed project area included a literature review and fieldwork. The main fieldwork components included visual observations (day and night) and live trapping.

Due to the limited availability of water, a brief aquatic survey was conducted at the dam situated within the proposed project area. Macro-invertebrate sampling was done using a standard SASS5 protocol. In terms of fish, recommended methodologies for Fish Response Assessment Index (FRAI) were used.

**Results – Vegetation**

Vegetation types

The propose project area is located within the Dwaalboom Thornveld, which is a component of the Savanna Biome (refer to Figure 9). The Savanna Biome covers a large area and is subdivided into various components, with the Dwaalboom Thornveld comprising a part of the Central Bushveld Bioregion. The features of this vegetation type include plains with layers of scattered, low to medium high, deciduous microphyllous trees and shrubs with a few broad-leaved tree species, and an almost continuous herbaceous layer dominated by grass species. The conservation status of this vegetation type is considered Least Threatened and the conservation target is identified as 19%, with only 6% statutorily conserved.

Vegetation communities

Three plant communities were identified within the proposed project site. These plant communities are discussed below and are illustrated in Figure 10.

*Acacia nilotica – Trachypogon spicatus black turf savanna*

This vegetation unit covers the majority of the proposed project area, with a calculated coverage of 73% of the site. Two variations are recognized within the vegetation unit based on vegetation structure, namely a shorter open woody variation and a taller dense woody (large trees) variation. The species composition remains similar for the two variations, however differences can be detected on Google Earth imagery and are thus included within the mapping of the vegetation cover of the project site. Based on species composition, the two variations are considered to be similar and are thus described here as a single entity.

The typical vegetation structure consists of a low open *Acacia* savanna dominated by *Acacia tortilis* and *Acacia nilotica* trees. Thorny *Asparagus laricinus* shrubs dominate the shady areas below the tree canopy. The average height of the tree canopy is approximately 3m. The herbaceous vegetation is dominated by a mixture of grasses and alien forbs. Typical grass species include *Bothriochloa insculpta* and *Trachypogon spicatus*, while prominent widespread alien forbs included *Zinnia peruviana* and *Bidens pilosa* (Black jacks). A list of the common and characteristic plant species occurring in this vegetation unit is presented below in Table 12.

**TABLE 12: COMMON AND CHARACTERISTIC PLANT SPECIES OF THE *ACACIA NILOTICA* – *TRACHYPOGON SPICATUS* BLACK TURF SAVANNA**

| SPECIES NAME | SPECIES NAME |
|---|---|
| *Acacia nilotica* | *Grewia flava* |
| *Achyranthes aspera** | *Hemarthria altissima* |
| *Agrostis sp.* | *Hibiscus trionum ** |
| *Aristida bipartite* | *Leucas martinicensis* |
| *Asparagus laricinus* | *Pentarrhinum insipidum* |
| *Acacia tortilis* | *Plectranthus sp.* |
| *Bidens pilosa** | *Schukhria pinnata** |
| *Bothriochloa insulpta* | *Searsia sphacelata* |
| *Commelina benghalensis* | *Setaria verticillata* |
| *Commicarpus pentandrus* | *Striga bilbiata* |
| *Cumcumis zeyheri* | *Tagetes minuta** |
| *Cynodon dactylon* | *Trachypogon spicatus* |
| *Dichrostachys cinerea* | *Zinnia peruviana** |
| *Eragrostis lehmanniana* | *Ziziphus mucronata* |
| *Eragrostis rigidior* | - |

* denotes alien plant species

*Grewia flava – Urochloa panicoides red clay Pilanesberg wash savanna*

This vegetation unit covers a calculated area of 21.5% of the proposed project area, and is thus an important component of the vegetation. Two variations are recognized within the vegetation unit based on spatial distribution, but differ from one another as a result of grazing management practices. These are the northern variation occupying 11.6% of the total project area and the southern variation covering 9.9% of the area. The southern variation shows clear evidence of heavy grazing intensity over a long period, with extensive exposed areas of soil. The northern variation is more remote and less accessible due to being separated from the main (P50-1) road by extensive black turf soils. The grass cover in the northern variation is extensive, however still dominated by species tolerant of heavy grazing, particularly *Urochloa panicoides.*

The typical vegetation structure consists of a low open savanna with an average tree height of 2.5 metres and dominated by *Acacia tortilis*, *Grewia flava* and *Dichrostachys cinerea* (Sekelbos) shrubs. *Dichrostachys cinerea* has a tendency to develop dense impenetrable thickets as a result of long term heavy grazing, and is widely evident in the southern variation of this vegetation unit. Herbaceous vegetation is dominated by grass species such as *Heteropogon contortus*, *Eragrostis rigidior*, *Aristida congesta* and *Urochloa panicoides*. Small stapeliads, particularly *Orbea lutea* and *Huernia* species were seen occasionally in this vegetation unit. A list of the common and characteristic plant species occurring in this vegetation unit is presented in Table 13.

**TABLE 13: COMMON AND CHARACTERISTIC SPECIES OF THE *GREWIA FLAVA – UROCHLOA PANICOIDES* RED PILANESBERG WASH SAVANNA**

| SPECIES NAME | SPECIES NAME |
|---|---|
| *Acacia caffra* | *Heteropogon contortus* |
| *Acacia erubescens* | *Ledebouria sp.* |
| *Acacia karroo* | *Lepidium bonariense ** |
| *Acacia mellifera* | *Leucas martinicensis* |
| *Acacia tortilis* | *Lippia rehmannii* |
| *Aristida con.* subsp.*barbicollis* | *Melinis repens* |
| *Aristida con.* subsp.*congesta* | *Oxalis obliquifolia* |
| *Boscia albitrunca* | *Panicum maximum* |
| *Bothriochloa insculpta* | *Rhoicissus tridentate* |
| *Brunsvigia radulosa* | *Salsola kali ** |
| *Chamaecrista comosa* | *Schukhria pinnata** |
| *Chloris virgate* | *Searsia leptodictya* |
| *Cymbopogon pospichillii* | *Searsia pyroides* |
| *Cynodon dactylon* | *Solanum panduriforme* |
| *Dichrostachys cinerea* | *Tagetes minuta ** |
| *Ehretia rigida* | *Themeda triandra* |
| *Enneapogon cenchroides* | *Urochloa panicoides* |
| *Eragrostis rigidior* | *Zinnia peruviana ** |
| *Eriosema cordatum* | *Ziziphus mucronata* |
| *Grewia flava* | - |

* denotes alien plant species

*Buddleja saligna – Digitaria eriantha riparian vegetation*

This vegetation unit covers only a small part of the proposed project area with a calculated coverage of 5.6%, however this unit plays an important role in the area. The riparian vegetation is based around two watercourses that enter the project area with their confluence towards the eastern boundary. The long linear shape of this vegetation unit results in extensive boundaries and interaction with the two previously described vegetation units. Edges of this vegetation unit were confirmed at various points using Riparian delineation techniques. This riparian vegetation unit includes a large dam in the south of the project area.

The typical vegetation structure varies from a dense tall thicket with a canopy height of approximately 4m to an open *Acacia* dominated savanna. The riparian vegetation is prominent in the southern and western entry points of the two streams into the project area, however the riparian vegetation dissipates and increasingly resembles the Black turf savannas towards the eastern boundary at the point of exit of the drainage line from the project area. The taller riparian vegetation is dominated by *Ziziphus mucronata* (Wag-‘n-bietjie) and *Acacia karroo* trees with occasional patches of *Combretum erythrophyllum* trees (River bushwillow). *Buddleja saligna*, *Tarchonanthus camphoratus* and *Gymnosporia buxifolia* (Pendoring) shrubs dominate the lower canopy and vegetation unit edges. The herbaceous layer is typically dominated by *Digitaria eriantha* (Smuts Finger Grass), *Panicum maximum* and *Heteropogon contortus*.

A list of the common and characteristic plant species occurring in this vegetation unit is presented in Table 14.

**TABLE 14: COMMON AND CHARACTERISTIC SPECIES OF THE *BUDDLEJA SALIGNA – DIGITARIA ERIANTHA* RIPARIAN VEGETATION**

| SPECIES NAME | SPECIES NAME |
|---|---|
| *Abutilon angulatum* | *Eragrostis rigidior* |
| *Acacia karroo* | *Gymnosporia buxifolia* |
| *Acacia mellifera* | *Heteropogon contortus* |
| *Acacia tortillis* | *Hyparrhenia hirta* |
| *Bothriochloa insculpta* | *Leucas martinicensis* |
| *Buddleja saligna* | *Panicum maximum* |
| *Carissa bispinosa* | *Schukhria pinnata* * |
| *Chloris virgate* | *Searsia lancea* |
| *Clematis brachiate* | *Searsia pyroides* |
| *Combretum erythrophyllum* | *Solanum panduriforme* |
| *Combretum hereroensis* | *Tagetes minute* * |
| *Crabbea hirsute* | *Themeda triandra* |
| *Cynodon dactylon* | *Xanthium strumarium* * |
| *Diditaria eriantha* | *Zinnia peruviana* * |
| *Diospyros lycioides* | *Ziziphus mucronata* |

* denotes alien plant species

Ecologically sensitive habitats

The *Grewia flava – Urochloa panicoides* red Pilanesberg wash savanna supported the greatest diversity of species of conservation concern. This vegetation unit supported 52% of the observed plant species diversity. Protection of this vegetation unit is important for maintaining diversity within the area. The red Pilanesberg Wash soils are restricted to areas in the vicinity of large rocky outcrops and are thus not widespread in the greater area, and therefore deserve a high level of conservation priority.

The *Buddleja saligna – Digitaria eriantha* riparian vegetation supported the lowest species diversity and the lowest diversity of species of conservation concern. This habitat is however important for maintaining corridor linkages with other areas, and for maintaining water dependant faunal species within the greater area. This vegetation unit should thus be considered sensitive despite a low level of species

The *Acacia nilotica – Trachypogon spicatus* black turf savanna supported intermediate levels of both general plant species diversity and diversity of species of conservation concern. The black turf soils are widespread in the greater area and occupy a significant component of the Dwaalboom Thornveld. The black turf savannas are therefore considered the least sensitive areas within the project area, however they continue to support natural vegetation and should therefore be classified with a medium level of sensitivity.

Endangered or rare species

Table 15 provides a list of the species of Conservation Concern with their observed, or potential to occur in the proposed project area.

**TABLE 15: SPECIES OF CONSERVATION CONCERN FOR THE PROPOSED PROJECT AREA**

| FAMILY | SPECIES NAME | OCCURRENCE ON SITE |
|---|---|---|
| **Declining species** | | |
| AMMARYLLIDACEAE | *Boophonedisticha* | Observed (bt) |
| HYACINTHACEAE | *Drimiaaltissima* | - |
| **Data deficient (taxonomic) species** | | |
| MYROTHAMNACEAE | Myrothamnusflabellifolius | Unlikely |
| **Protected species**** | | |
| AMARYLLIDACEAE | Brunsvigiaradulosa | Observed (pw) |
| AMARYLLIDACEAE | Crinum lugardiae | Observed (rv) |
| APOCYNACEAE | Orbealutea | Observed (pw) |
| ASPHODELACEAE | Aloe zebrina | Observed (pw) |
| CAPPARACEAE | Bosciaalbitrunca | Observed (pw) |
| IRIDACEAE | Gladiolus sp. | Observed (bt) |
| ORCHIDACEAE | Bonateaantennifera | Observed (pw) |
| **Endemic species (not threatened)** | | |
| ACANTHACEAE | Crabbeaangustifolia | Observed (bt) |
| ARALIACEAE | Cussoniatransvaalensis | Unlikely |
| BORAGINACEAE | Ehretiarigida | Observed (pw, rv) |
| CARYOPHYLLACEAE | Dianthus mooiensis | Expected |
| CARYOPHYLLACEAE | Dianthus zeyheri | Expected |
| CELASTRACEAE | Gymnosporiapolyacanthus | Observed (rv) |
| CYPERACEAE | Cyperusindescorus | Unlikely |
| FABACEAE | Rhynchosiaatropurpurea | Possible |
| LOBELIACEAE | Cyphiaassimilis | Possible |
| MALVACEAE | Hermanniaumbratica | Possible |
| MALVACEAE | Triumfettasonderi | Expected |
| POACEAE | Tristachyabiseriata | Expected |
| POLYGALACEAE | Polygala krumanina | Possible |
| SANTALACEAE | Thesiummagalismontanum | Unlikely |
| VAHLIACEAE | Vahliacapensis | Unlikely |
| VITACEAE | Rhoicissus tridentate | Observed (bt) |

**Key:** **- Species protected under the North-West Biodiversity Conservation bill, which incorporates the Transvaal Nature Conservation Ordinance 12 of 1983
bt = Black turf savanna; pw = Red Pilanesberg Wash; rv=Riparian vegetation

<u>Intruder or exotic species</u>

Alien plant species identified in the proposed project area are listed in Table 16, together with their classification in terms of the Conservation of Agriculture Resources Act, 43 of 1983 (CARA)..

**TABLE 16: INTRUDER SPECIES**

| Species Name | Common Name | CARA category |
|---|---|---|
| Achyranthes aspera | - | Category 1 |
| Alternanthera pungens | Paper thorn | Weed |
| Amaranthus hybridus | Pigweed | Weed |
| Bidens pilosa | Black jacks | Weed |
| Cosmos bipinnatus | Cosmos | Weed |
| Schkuhria pinnata | Dwarf marigold | Weed |
| Tagetes minuta | Khakibos | Weed |
| Xanthium strumarium | - | Category 1 |
| Zinnia peruviana | - | Weed |
| Salsola kali | Russian tumbleweed | Weed |
| Ricinus communis | Castor oil plant | - |
| Hibiscus trionm | Bladder Hibiscus | Weed |
| Eleusine coracana | Goosefoot grass | Weed |
| Datura feros | Large thorn apple | Category 1 |
| Physalis angulate | Wild Gooseberry | Weed |

**Results – Animal life**

From a faunal perspective, the proposed project area has been classified into four main habitat types based on vegetation structure, species composition and soil substrate (Figure 10), namely *Acacia* on red apedal soils (ARAS), rivers and riparian (RR), *Acacia* on red transported soils (ARTS) and *Acacia* on black turf soils (ABTS).

Mammals

The proposed project area was found to be particularly rich in mammal species. The ARTS habitat type showed the highest diversity of mammals. At this site, large herds of impala were observed visually within this site while motion-sensitive cameras confirmed the presence of Greater Kudu (*Tragelaphus strepsiceros*) which was detected originally from evidence in the form of spoor. Other mammals recorded by the two baited motion-sensitive cameras at this site included Slender Mongoose (*Galerella sanguinea*), the nocturnal White-tailed Mongoose (*Ichneumia albicauda*), Blackbacked Jackal (*Canis mesomelas*) and the Near-Threatened Brown Hyaena (*Parahyaena brunne*).

Probability lists compiled by the biodiversity specialist based on distribution data revealed that as many as 119 mammalian have the potential to occur within the quarter degree square (QDS) 2527AA covering the entire Magazynskraal area. This represents a very high proportion (86%) of the provincial diversity of mammals. However, this proportion also includes the large diversity of mammals present in the Pilanesberg National Park. The species within this potential species list have been assigned likelihood of occurrence (LoO) ratings. It is worth noting that 17 of the species within this potential list have been listed as having a moderate to low LoO with a further 25 species being regarded as likely to occur only in managed populations in reserves such as Pilanesberg National Park. This leaves a more realistic total of 77 mammal species with a high LoO. In this regard, a LoO score of 1 indicates the highest occurance rating with 4 being low and 5 being restricted to fenced and managed areas only.

Mammal species that were identified on the proposed project area, through actual observation or capture, and through evidence of presence, are listed in Table 17.

**TABLE 17: IDENTIFIED MAMMAL SPECIES**

| SPECIES | COMMON NAME | STATUS* | ARAS | RR | ARTS | ABTS |
|---|---|---|---|---|---|---|
| **Tubilidentata (Ardvark)** | | | | | | |
| *Orycteropusafer* | Ardvark | LC | x | | | |
| **Lagomorpha ( Hares & Rabbits)** | | | | | | |
| *Lepussaxatillis* | Scrub hare | LC | | | x | |
| **Rodentia (Rodents)** | | | | | | |
| *Hystrixafricaeaustralis* | Porcupine | LC | x | | x | |
| *Mastomyscoucha* | Southern multimammate mouse | LC | x | x | | x |
| *Thallomyspaedulcus* | Acacia rat | LC | x | | x | |
| *Aethomyschrysophilus* | Red veld rat | LC | | | x | |
| *Saccostomuscampestris* | Pouched mouse | LC | | | | x |

| SPECIES | COMMON NAME | STATUS* | ARAS | RR | ARTS | ABTS |
|---|---|---|---|---|---|---|
| **Primates (Bush babies, Monkeys & Baboon** | | | | | | |
| *Cercopithecuspygerythrus* | Vervet monkey | LC | | x | | |
| **Insectovora (Insectivores)** | | | | | | |
| *Crocidurafuscomurina* | Tiny mask shrew | DD | | | x | |
| **Chiroptera (Bats)** | | | | | | |
| **Carnivora (Carnivores)** | | | | | | |
| *Parahyaenabrunne* | Brown Hyaena | NT | | | x | |
| *Caracal caracal* | Caracal | LC | | | | x |
| *Genettagenetta* | Small-spotted genet | LC | | x | x | |
| *Galerellasanguinea* | Slender mongoose | LC | | x | x | |
| *Ichneumiaalbicauda* | White – tailed mongoose | LC | | | x | |
| *Atilaxpaludinosus* | Marsh mongoose | LC | | | x | |
| *Canismesomelas* | Black – backed jackal | LC | | | x | x |
| **Artiodactyla (Even-toed Ungulates)** | | | | | | |
| *Tragelaphusstrepsiceros* | Greater kudu | LC | | | x | |
| *Sylvicapragrimmia* | Common duiker | LC | | | x | |
| *Raphiceruscampestris* | Steenbok | LC | | | x | x |
| *Aepycerosmelampus* | Impala | LC | | | x | |
| | **TOTAL** | | **4** | **4** | **15** | **5** |

* IUCN classification LC: least concern; NT: near threatened; DD: data deficient

Birds

As many as 281 bird species have been recorded to date for the QDS 2527AA. A total of 87 species were recorded during the field surveys that were undertaken for the proposed project. The ARTS habitat type showed the highest bird species richness.

A greater than expected representation of raptors was observed on the proposed project area, particularly in the ARAS habitat type. This group contains the greatest proportion of Red Data species because their numbers are declining. This result presents an exception to similar surveys carried out by the biodiversity specialists which usually show an under-representation of this group and therefore highlights the importance of proposed project area in terms of the raptor diversity it supports.

Bird species identified on site, through actual observation and through evidence of presence, are listed in Table 18.

**TABLE 18: IDENTIFIED BIRD SPECIES**

| SPECIES | COMMON NAME | STATUS | ARAS | RR | APWS | ABTS |
|---|---|---|---|---|---|---|
| **Inland water birds** | | | | | | |
| *Ardeacinerea* | Grey Heron | LC | | | x | |
| *Ardea melanocephala* | Black-headed Heron | LC | x | | | |
| *Bubulcus ibis* | Cattle Egret | LC | | | x | |
| **Ducks and wading birds** | | | | | | |
| *Plectropterus gambensis* | Spur-winged Goose | LC | | | x | |
| *Anas undulate* | Yellow-billed Duck | LC | | | x | |

| SPECIES | COMMON NAME | STATUS | ARAS | RR | APWS | ABTS |
|---|---|---|---|---|---|---|
| *Anas erythrorhyncha* | Red-billed Teal | LC | | | x | |
| *Dendrocygna viduata* | White-faced Duck | LC | | | x | |
| *Vanellus coronatus* | Crowned Lapwing | LC | | | x | |
| *Vanellus armatus* | Blacksmith Lapwing | LC | | | x | |
| **Large terrestrial birds** | | | | | | |
| *Dendroperdix sephaena* | Crested Francolin | LC | | | x | |
| *Pternistis natalensis* | Natal Spurfowl | LC | | | x | |
| *Pternistis swainsonii* | Swainson's Spurfowl | LC | x | | x | |
| *Coturnix coturnix* | Common Quail | LC | x | | | |
| *Coturnix delegorguei* | Harlequin Quail | LC | x | | | |
| *Numida meleagris* | Helmeted Guineafowl | LC | | | x | |
| *Lophotis ruficrista* | Red-crested Korhaan | LC | | | x | x |
| *Afrotis afraoides* | Northern Black Korhaan | LC | | | | x |
| *Burinus capensis* | Spotted Thick-knee | LC | | | x | |
| **Raptors** | | | | | | |
| *Falco biarmicus* | Lanner Falcon | NT | | | | x |
| *Falco rupicoloides* | Greater Kestrel | LC | x | | | |
| *Elanus caeruleus* | Black-shouldered Kite | LC | x | | x | |
| *Aquila spilogaster* | African Hawk Eagle | LC | x | | | |
| *Circaetus cinereus* | Brown Snak-eagle | LC | | | | x |
| *Circaetus pectoralis* | Black-chested Snake-eagle | LC | x | | | |
| *Accipiter badius* | Shikra | LC | x | | x | |
| *Melierax gaber* | Gabar Goshawk | LC | x | | x | |
| - | Southern Pale Chanting | | | | | |
| *Melierax canorus* | Goshawk | LC | x | | x | |
| **Owls and nightjars** | | | | | | |
| *Asio capensis* | Marsh Owl | LC | x | | | x |
| *Ptilopsus granti* | Southern White-faced Owl | LC | x | | x | |
| *Caprimulgus tristigma* | Freckled Nightjar | LC | | | x | |
| **Sandgrouse, doves etc** | | | | | | |
| *Streptopelia capicola* | Cape Turtle Dove | LC | x | x | x | x |
| *Streptopelia senegalensis* | Laughing Dove | LC | x | x | x | |
| *Oena capensis* | Namaqua Dove | LC | x | | x | |
| *Corythaixoides concolor* | Grey Go-away-bird | LC | | x | x | |
| *Centropus burchelli* | Burchell'sCoucal | LC | | | x | |
| **Aerial feeders, etc** | | | | | | |
| *Colius striatus* | Speckled Mousebird | LC | | x | x | |
| *Urocolius indicus* | Red-faced Mousebird | LC | | x | | |
| *Halcyon albiventris* | Brown-hooded Kingfisher | LC | | | x | |
| *Coracias caudatus* | Lilac-breasted Roller | LC | x | | x | |
| *Upupa Africana* | African Hoopoe | LC | | | x | |
| *Tockus nasutus* | African Green Hornbill | LC | | | x | |
| *Tocks leucomelas* | Southern Yellow-billed Hornbill | LC | | | x | x |
| *Tockus erythrorhynchus* | Red-billed Hornbill | LC | | x | | |
| *Campethera abingoni* | Golden-tailed Woodpecker | LC | | | x | |
| *Hirundo albigularis* | White-throated Swallow | LC | | | x | |
| **Insect eaters (conspicuous)** | | | | | | |
| *Dicrurus adsimilis* | Fork-tailed Drongo | LC | x | | x | |
| *Corvus albus* | Pied Crow | LC | x | | x | x |
| *Corvus capensis* | Cape Crow | LC | x | | | x |
| *Turdoides bicolor* | Southern Pied-babbler | LC | | x | x | x |
| *Pycnonotus tricolor* | Dark-capped Bulbul | LC | | x | | |
| *Cercotrichas paean* | Kalahari Scrub-robin | LC | x | | | |
| *Parisoma subcaeruleum* | Chestnut-vented Tit-babbler | LC | | x | | |
| *Bradornis mariquensis* | Marico Flycatcher | LC | | x | x | x |
| *Lanius minor* | Lesser Grey Shrike | LC | x | | | |
| *Laniarius atrococcineus* | Crimson-breasted Shrike | LC | | | x | x |

| SPECIES | COMMON NAME | STATUS | ARAS | RR | APWS | ABTS |
|---|---|---|---|---|---|---|
| *Tchagra australis* | Brown-crowned Tchagra | LC | | | x | x |
| *Corvinella melanoleuca* | Magpie Shrike | LC | x | | x | x |
| *Acridotheres tristis* | Common Myna | Alien | x | | | |
| *Lamprotornis nitens* | Cape Glossy Starling | LC | | x | x | |
| **Insect eaters (cryptic)** | | | | | | |
| *Calendulauda sabota* | Sabota Lark | LC | x | | | |
| *Eremomela usticollis* | Burnt-necked Eremomela | LC | | | | x |
| *Cisticola chiniana* | Rattling Cisticola | LC | | x | | |
| *Prinia flavicans* | Black-chested Prinia | LC | | | | x |
| *Anthus cinnamomeus* | African Pipit | LC | | | x | |
| **Oxpeckers and nectar feeders** | | | | | | |
| *Buphagus erythrorhynchus* | Red-billed Oxpecker | NT | | | x | |
| **Seedeaters** | | | | | | |
| *Sporopipes squamifrons* | Scaly-feathered Finch | LC | x | | x | |
| *Ploceus velatus* | Southern Masked-weaver | LC | | | | x |
| *Quelea quelea* | Red-billed Quelea | LC | x | | | |
| *Pytilia melba* | Green-winged Pytilia | LC | | | | x |
| *Lagonosticta rubricata* | African Firefinch | LC | | | | x |
| *Lagonosticta rhodopareia* | Jameson's Firefinch | LC | | | x | |
| *Uraeginthus anglolensis* | Blue Waxbill | LC | | x | x | |
| *Granatina granatina* | Violet-eared Waxbill | LC | x | | x | x |
| *Estrilda erythronotos* | Black-faced Waxbill | LC | | | x | x |
| *Estrilda astrild* | Common Waxbill | LC | | | | x |
| *Vidua regia* | Shaft-tailed Whydah | LC | x | | x | x |
| *Vidua chalybeata* | Village Indigobird | LC | | | x | |
| *Vidua paradisaea* | Long-tailed Paradise-whydah | LC | x | x | x | |
| *Crithagra atrogularis* | Black-throated Canary | LC | x | | | x |
| *Emberiza flaviventris* | Golden-breasted Bunting | LC | | | | x |
| **Total** | | | **31** | **14** | **52** | **25** |

Reptiles

A total of nine species of reptiles from seven families were recorded during the field investigations. The ARTS habitat type showed the highest reptile species richness. Reptile species identified on site, through actual observation or capture, and through evidence of presence, are listed in Table 19.

**TABLE 19: IDENTIFIED REPTILIAN SPECIES**

| SPECIES | COMMON NAME | STATUS | ARAS | RR | ARTS | ABTS |
|---|---|---|---|---|---|---|
| **Harmless to Mildly Venomous Snakes** | | | | | | |
| *Lamprophiscapensis* | Brown house snake | LC | x | | | |
| Crotaphopeltishotamboeia | Red-lipped herald snake | LC | | | x | |
| *Bitisarietans* | Puff adder | LC | | | x | |
| **Lizards, Agamas, Skinks & Chameleons** | | | | | | |
| *Agama aculeate distanti* | Ground agama | LC | | x | | |
| *Chamaeleodilepis* | Flap-necked chameleon | LC | | | x | |
| *Mochlussundevallii* | Sundevall's writhing skink | LC | | | x | |
| *Trachylepisvaria* | Variable skink | LC | | x | | |
| **Geckos** | | | | | | |
| *Lygodactyluscapensis* | Cape dwarf gecko | LC | | x | | |
| **Tortoises and Terrapins** | | | | | | |
| *Pelomedusasubrufa* | Marsh terrapin | LC | | | x | |
| | **Total** | | **1** | **3** | **5** | **0** |

Frogs

The number and abundance of frog species detected on site is influenced by various abiotic and biotic factors within both terrestrial and aquatic environments. Abiotic factors include climatic variables especially rainfall and temperature, the time of year in which species richness data is recorded and water quality. Biotic factors such as predation, food availability and presence of invasive or exotic faunal and floral species further influence the observed on site diversity. A total of nine species from six families were recorded during the field investigations.

Frog species identified on site, through actual observation or capture, and through evidence of presence, are listed in Table 20. Species of frogs that have the potential to occur on site, but which were not detected during the field survey include the Bushveld Rain Frog (*Breviceps adspersus adspersus*), Eastern Olive Toad (*Amietophrynus garmani*), Guttural Toad (*Amietophrynus gutturalis*), Raucous Toad (*Amietophrynus rangeri*), Northern Pygmy Toad (*Poyntonophrynus fenoulheti*), Bubbling Kassina (*Kassina senegalensis*), Snoring Puddle Toad (*Phrynobatrachus natalensis*), Broad-banded Grass Frog (*Ptychadena mossambica*), Common River Frog (*Amieta angolensis*), Giant Bullfrog (*Pyxicephalus adspersus*), African Bullfrog (*Pyxicephalus edulis*) and Natal Sand Frog (*Tomopterna natalensis*).

**TABLE 20: IDENTIFIED FROG SPECIES**

| SPECIES | COMMON NAME | STATUS | ARAS | RR | ARTS | ABTS |
|---|---|---|---|---|---|---|
| **Toads** | | | | | | |
| *Amietophrynus poweri* | Western Olive Toad | LC | X | | | |
| *Poyntonoohrynus vertebralis* | Southern Pygmy Toad | LC | | | | X |
| *Schismaderma carens* | Red Toad | LC | | | X | |
| **Rubber frogs** | | | | | | |
| *Phrynomantis bifasciatus* | Banded Rubber Frog | LC | | | X | |
| **Grass Frogs** | | | | | | |
| *Ptychadena anchietae* | Plain Grass Frog | LC | | | X | |
| **Platannas** | | | | | | |
| *Xenopus laevis* | Common Platanna | LC | | | X | |
| **African Common Frogs** | | | | | | |
| *Cacosternum boettgeri* | Boettger's Caco | LC | | | X | |
| *Tomopterna cryptotis* | Tremolo Sand Frog | LC | | X | | X |
| **Foam Nest Frogs** | | | | | | |
| *Chiromantis xerampelina* | Southern Foam Nest Frog | LC | | | X | |
| **Total** | | | **1** | **1** | **6** | **2** |

Terrestrial macro-invertebrates

A total of 54 species of invertebrate species from eleven orders were recorded throughout the proposed project area, the majority of which were detected within the ARTS habitat type. Invertebrate species that were identified on site, through actual observation or capture, and through evidence of presence, are listed in Table 21.

**TABLE 21: IDENTIFIED INVERTEBRATE SPECIES**

| FAMILY | SPECIES | COMMON NAME | STATUS | ARAS | RR | ARTS | ABTS |
|---|---|---|---|---|---|---|---|
| **Butterflies and Moths** | | | | | | | |
| | *DanausChrysippus* | | - | | | | |
| NYMPHALIDAE | *orientis* | African Monarch | LC | | | x | |
| NYMPHALIDAE | *Melanitis lead helena* | Evening (Twilight) Brown wandering Donkey | LC | | | x | |
| NYMPHALIDAE | *Acraeaneobuleneobule* | Acraea Dancing (Small Orange) | LC | | | | x |
| NYMPHALIDAE | *Telchiniaserena* | Acraea | LC | | | x | |
| NYMPHALIDAE | *Bybliailithyia* | Spotted Joker | LC | | x | x | |
| NYMPHALIDAE | *Hypolimnasmisippus* | Common Diadem | LC | | | x | |
| NYMPHALIDAE | *Junoniahiertacebrene* | Yellow Pansy | LC | | x | | |
| NYMPHALIDAE | *Junoniaoenoneoenone* | Blue Pansy | LC | | | x | |
| | *Tuxentiusmelaena* | | - | | | | |
| LYCAENIDAE | *melaena* | Black Pie | LC | | | x | |
| LYCAENIDAE | *Lampidesboeticus* | Long-tailed Blue | LC | | x | | |
| | *Eicochrysopsmessapus* | | - | | | | |
| LYCAENIDAE | *Mahallakoanea* | Northern Cupreous Blue | LC | | | x | |
| PIERIDAE | *Colotisdanaeannae* | Scarlet Tip | LC | | | x | |
| PIERIDAE | *Colotisauxo* | Sulphur Orange Tip | LC | | | x | |
| PIERIDAE | *Colotiseveninaevenina* | Common Orange Tip | LC | | | x | |
| PIERIDAE | *Colotisagoyeagoye* | Speckled Sulphur Tip | LC | | | x | |
| PIERIDAE | *Belenoisaurotaaurota* | Brown-veined White | LC | | x | | |
| | *Mylothrisagathina* | | - | | | | |
| PIERIDAE | *agathina* | Common Dotted Border | LC | | x | x | |
| NYMPHALIDAE | *Vanessa cardui* | Painted Lady Broad-Bordered Grass | LC | | x | x | |
| PIERIDAE | *Euremabrigittabrigitta* | Yellow | LC | x | | x | x |
| PSYCHIDAE | | Bagworm | - | | | x | x |
| NOCTUIDAE | | Owlet Moth | - | | | | x |
| **Crickets, Locusts, Grasshoppers, Katydids and Bush Crickets** | | | | | | | |
| TETTIGONIDAE | *Tylopsis sp.* | Grass Cricket | - | | | | x |
| | | Garden cricket | - | | x | | |
| BRADYPORIDAE | *Acanthoplussp* | Corn Cricket | - | x | | | |
| ACRIDIDAE | | Locust | - | | | x | |
| ACRIDIDAE | *Truxaloids* | Owlet Moth | - | | x | | |
| **Beetles** | | | | | | | |
| TENEBRIONIDAE | *Somaticusaeneus* | Tar Darkling Beetle | - | x | | | |
| NOCTUIDAE | | Pondo-Pondo Longhorn | - | | | | |
| CERAMBYCIDAE | *Ceroplesisthunbergi* | Beetle | - | | | x | |
| | | Lunate Ladybird | - | | | | x |
| | | Hook-winged Net-winged | - | | | | |
| LYCIDAE | *Lycusmelanurus* | Beetle | - | | x | | |
| TENEBRIONIDAE | | Darkling Beetle | - | | | x | |
| SCARABAEDAE | *Garretanitens* | Green Dung Beetle | - | | | x | |
| **Bugs** | | | | | | | |
| REDUVIIDAE | *Ectrichoda crux* | Millipede Assasin | - | | | x | |
| PYRRHOCORIDAE | | Cotton Stainer | - | | | | x |
| PENTATOMIDAE | | Stinkbug/shieldbug | - | x | | | |
| COREIDAE | | Twig Wilters | - | | | x | |
| **Ants and Wasps** | | | | | | | |
| FORMICIDAE | | Ants | - | x | | | |
| VESPIDAE | | Paper Wasps | - | | | x | |
| **Termites** | | | | | | | |
| TERMITIDAE | *Macrotermsnatalensis* | Termites | - | | | x | |
| **Mantids** | | | | | | | |

| FAMILY | SPECIES | COMMON NAME | STATUS | ARAS | RR | ARTS | ABTS |
|---|---|---|---|---|---|---|---|
| MANTIDAE | *Epioscopomantischalybea* | Mantid | - | | | | x |
| HYMENOPODIDAE | | Flower Mantid | - | x | | | |
| MANTIDAE | *Popaundata* | Stick Mantid | - | | | x | |
| **Stick Insects** | | | | | | | |
| BACILLIDAE | Maransisrufolineatus | Grass Stick insect | - | | | | x |
| **Spiders** | | | | | | | |
| CLUBIONIDAE | | Sac Spider | - | | x | | |
| LYCOSIDAE | | Wolf Spider | - | | | x | |
| AGELINIDAE | *Olorunia sp.* | Grass funnel-web Spider | - | x | x | | |
| NEPHILIDAE | *Nephilasenegalensis* | Nephila Orb-web Spider | - | | | x | |
| HETEROPODIDAE | *Palystes sp.* | Rain Spider | - | | | | x |
| ARANEIDAE | *Araneidae sp.* | Banded Garden Spider | - | | | x | |
| | | sp1 and 3 | - | | | x | |
| | | sp2 | - | | | | x |
| **Centipede** | | | | | | | |
| | - | Centipede | - | x | | | |
| **Milipede** | | | | | | | |
| | - | Milipede | - | | | x | |
| | | **Total** | | **8** | **10** | **29** | **11** |

<u>Rare or endangered species</u>

*Mammals*

The potential species lists compiled for the QDS covering the proposed project area revealed a total of twenty-one mammalian species of Threatened status. This includes one Critically Endangered, three Endangered, seven Vulnerable and ten species of Near Threatened mammals that could potentially occur within the QDS covering the proposed project area (refer to Table 22). Species assigned a LoO of 5 are considered likely to occur only in managed populations such as in well fenced reserves.

Leopard (*Panthera pardus*), although listed as Least Concern by the IUCN Red List is, however, listed by NEMBA as Vulnerable. Other species of mammal without an IUCN status but that are listed as Protected Species in NEMBA include Blackfooted Cat (*Felis nigripes*) and Southern Reedbuck (*Redunca arundinum*).

Photographic evidence of the presence of the Near-Threatened Brown Hyaena (*Parahyaena brunnea*) was obtained from one of the motion-sensitive cameras deployed within the ARTS habitat type. This represents the only IUCN threatened status mammal to be detected within the proposed project area. Although the national Brown Hyaena population is considered to be stable, threats such as persecution for traditional medicine, hunting and poisoning mean that certain localised populations are in decline. Human-induced pressures of this nature are expected to be high considering the extent of settlements in the immediate vicinity of the study area.

Other species IUCN threatened status not detected during the field investigation but have a high LoO within the relevant QDS covering the proposed project area include the Ground pangolin (*Manis* *temminckii*) as well as seven Near-Threatened species. In addition, it should be noted that four species of bats with an IUCN threatened status have a high LoO within the proposed project area.

**TABLE 22: POTENTIALLY OCCURRING RARE OR ENDANGERED MAMMALS**

| SCIENTIFIC NAME | COMMON NAME | LoO |
|---|---|---|
| **Critically endangered** | | |
| *Cloetis percivali* | Short-eared trident bat | 4 |
| **Endangered** | | |
| *Mystromys albicaudatus* | White-tailed mouse | 4 |
| *Lycaon pictus*[1] | African wild dog | 5 |
| *Damaliscus lunatas*[1] | Tsessebe | 5 |
| **Vulnerable** | | |
| *Crocidura maquasiensis* | Maquassie musk shrew | 4 |
| *Rhinolophus blasii* | Blasius's horseshoe bat | 4 |
| *Manis temminckii*[2] | Ground pangolin | 2 |
| *Acinonyx jubatus* | Cheetah | 5 |
| *Panthera leo*[2] | Lion | 5 |
| *Diceros bicornis*[1] | Black rhinoceros – north-eastern race | 5 |
| *Hippotragus niger* | Sable | 5 |
| **Near threatened** | | |
| *Atelerix frontalis*[3] | Southern African hedgehog | 2 |
| *Rhinolophus hildebrandtii* | Hildebrandt's horseshoe bat | 4 |
| *Rhinolophus clivosus* | Geoffroy's horseshoe bat | 2 |
| *Rhinolophus darlingi* | Darling's horseshoe bat | 2 |
| *Miniopterus natalensis* | Natal clinging bat | 2 |
| *Pipistrellus rusticus* | Rusty pipistrelle | 2 |
| *Parahyaena brunnea*[3] | Brown hyaena | 1 |
| *Leptailurus serval* | Serval | 2 |
| *Leptailurus serval*[3] | Spotted-necked otter | 3 |
| *Mellivora capensis*[3] | Honey badger | 2 |
| **Least concern** | | |
| *Redunca arundinum*[2] | Southern Reedbuck | 5 |
| *Felis nigripes*[2] | Black-footed Cat | 2 |
| *Panthera Pardus*[1] | Leopard | 2 |
| **Data deficient** | | |
| *Elephantulus brachyrhynchus* | Short-snouted elephant-shrew | 2 |
| *Graphiurus platyops* | Rock dormouse | 4 |
| *Lemniscomys rosalia* | Single-striped grass mouse | 2 |
| *Tatera leucogaster* | Bushveld gerbil | 2 |
| *Myosorex varius* | Forest shrew | 2 |
| *Suncus lixus* | Greater dwarf shrew | 2 |
| *Suncus infinitesimus* | Least dwarf shrew | 4 |
| *Crocidura mariquensis* | Swamp musk shrew | 2 |
| *Crocidura fuscomurina* | Tiny musk shrew | 1 |
| *Crocidura cyanea* | Reddish-grey musk shrew | 2 |
| *Crocidura silacea* | Lesser grey-brown musk shrew | 3 |
| *Crocidura hirta* | Lesser red musk shrew | 2 |
| *Hipposideros caffer* | Sundevall'sroundleaf bat | 2 |
| *Poecilogale albinucha* | African striped weasel | 2 |

**Key:** [1]Species listed as Endangered in NEMBA
[2]Species listed as Vulnerable in NEMBA
[3]Species listed Protected in NEMBA

**LoO:** 1-Present, 2-High, 3- Moderate; 4 – Low; 5 – Managed Population

*Birds*

Two birds of conservation importance were recorded on-site during the field investigations, namely the Near-Threatened Lanner Falcon (*Falco biarmicus*) and Red-billed Oxpecker (*Buphagus erythrorhynchus*). A Tawny Eagle (*Aquila rapax*), which is listed as Vulnerable, was observed on a neighbouring property and therefore their presence within the proposed project area is highly likely. Other Red Data bird species not observed on site but which are likely to occur, based on distribution data and habitat, include four Vulnerable species namely Denham's Bustard (*Neotis denhami*), African Finfoot (*Podica senegalensis*), Bateleur (*Terathopius ecaudatus*) and African Grass Owl (*Tyto capensis*) as well as three Near-Threatened species the Marabou Stork (*Leptoptilos crumeniferus*), Yellow-throated Sandgrouse (*Pterocles gutturalis*) and Black-winged Pratincole (*Glareola nordmanni*).

As mentioned previously, an abundance of raptors was observed during the field investigations. Although none of these birds are currently Red Listed, the national Raptor population is in decline and the species richness and abundance observed on site highlights the proposed project area, and in particular the ARAS habitat type, as important and in need of protection.

**TABLE 23: POTENTIALLY OCCURRING RARE OR ENDANGERED BIRDS**

| SPECIES | COMMON NAME |
|---|---|
| **Vulnerable** | |
| *Gyps coprotheres* | Cape Vulture |
| *Gyps africanus* | White-backed Vulture |
| *Torgos tracheliotus* | Lappet-faced Vulture |
| *Aquila rapax* | Tawny Eagle |
| *Polemaetus bellicosus* | Martial Eagle |
| *Circus ranivorus* | African Marsh-harrier |
| *Anthropoides paradiseus* | Blue Crane |
| *Ardeotis kori* | Kori Bustard |
| **Near threatened** | |
| *Pelecanus onocrotalus* | Great White Pelican |
| *Mycteria ibis* | Yellow-billed Stork |
| *Ciconia nigra* | Black Stork |
| *Sagittarius serpentarius* | Secretarybird |
| *Falco biarmicus* | Lanner Falcon |
| *Buphagus erythrorhynchus* | Red-billed Oxpecker |

*Reptiles*

Although the Savanna biome supports a high diversity of reptiles, the levels of endemism and the number of IUCN Threatened status species its supports is low. The conservation status of South African reptiles is currently being reviewed in a nationwide reptile conservation assessment. The Reptile Conservation Atlas has yet to be published and there is currently a lack of clarity on the current listing of Threatened species for reptiles in South Africa.

Although none of the potentially occurring species are currently IUCN Red Data listed, two of the species which have a high LoO can be regarded as species of concern, namely the African rock python (*Python natalensis*) which has been sighted on a neighbouring property, and the Transvaal Girdled Lizard (*Cordylus vittifer*).

*Frogs*

No frog species of IUCN threatened status were detected within the proposed project area. However the Near-Threatened Giant Bullfrog (*Pyxicephalus adspersus*) has been previously detected on a neighbouring property. The African Bullfrog (*Pyxicephalus edulis*) is listed as a Protected Species in the National Environmental Management: Biodiversity Act, 10 of 2004 (NEMBA). Both of species of bullfrogs have been detected by the biodiversity specialists during previous surveys in several other areas surrounding the Pilanesberg National Park often in association with highly seasonal pans with a substrate conducive for burrowing. It is the opinion of the specialists that the lack of detection of these species during the faunal survey was more likely a consequence of the time of year in which the investigation was conducted (early winter) rather than the lack of suitable habitat and as such it is highly likely that one or both of these frog species may be present on site.

*Terrestrial Macro-Invertebrates*

Apart from butterflies, comprehensive data of the IUCN status of any particular order of invertebrate is limited. However, a number of invertebrate taxa have been classified as protected in terms of NEMBA. Species of invertebrate taxa of concern include Tiger Beetles (*Dromica spp.*), Fruit Chafers (*Icnestoma spp.*), Monster Tiger Beetles (*Manticora spp.*), Stag Beetles (*Oonotus spp.*), Creeping Scorpions (*Opisthacanthus spp.*), Burrowing Scorpions (*Opistophthalmus spp.*), Flat Rock Scorpions (*Hadogenes spp.*), Horned Baboon Spiders (*Ceratogyrus spp.*), Common Baboon Spiders (*Harpactira spp.*) and Golden Brown Baboon Spiders (*Pterinochilus spp.*).

**Results – Aquatic ecology**

Aquatic communities

*Macro-invertebrate integrity*

The macro-invertebrate diversity associated with the dam systems is low, and is dominated by tolerant taxa.

*Ichythofauna*

There were no fish species sampled within the Magazynskraal Dam, although this does not mean that they are absent. However, only a few species of insensitive hardy species would survive, namely *Clarias gariepinus*, *Pseudiocrenilbarus philander*, *Tilapia sparmanni* and a few *Barbus spp.*

Although the biodiversity specialists are of the opinion that in terms of aquatic biodiversity the Magazynskraal Dam is limited, it will still play a vital role in the ecosystem and surrounding area. The macro-invertebrates present will provide food for a variety of species, and even though fish species were not sampled, they should be present. They will provide food for a variety of water birds, and a functioning food web exists. This is the only semi-permanent water source on the proposed project area, and will provide drinking water for the variety of fauna in the surrounds.

**Conclusion**

There are a number of conservation important faunal and floral species within the proposed project area. In addition, various areas of high ecosystem function and value have been identified within the proposed project area. These areas of conservation significance are illustrated in Figure 11. Where possible this information has been used to influence the proposed surface infrastructure layout, such as the repositioning of infrastructure.

### 1.1.7 SURFACE WATER

The information in this section was sourced from the specialist hydrology study conducted by SLR (2013) included in Appendix G, and the specialist hydrogeological study conducted by AGES (2013) included in Appendix H.

**Introduction and link to anticipated impact**

Surface water resources include drainage lines and paths of preferential flow of stormwater runoff. Mining related activities have the potential to alter the drainage of surface water through the placement of both temporary (such as processing infrastructure and support facilities) and permanent (if present) infrastructure and/or result in the contamination of the surface water resources through seepage and/or spillage of potentially polluting materials, non-mineralised (general and hazardous) and mineralised wastes. 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 hydrological catchments that could be affected by the mine and the status of surface water resources in the mining right area.

**Data collection**

Data used in determining the surface water characteristics include climatic data (Section 1.1.2) and topographical data (Section 1.1.3). Rainfall and evaporation data for the site was considered from various sources including weather stations managed by the SAWS and DWA.

Design storm estimates for various return periods and storm durations were sourced from the Design Rainfall Estimation Software for South Africa, developed by the University of Natal in 2002 as part of a WRC project K5/1060. This method uses a Regional L-Moment Algorithm in conjunction with a Scale Invariance approach to provide site specific estimates of depth-duration-frequency (DDF) rainfall, based on surrounding observed records.

Flood peaks were estimated by the following methods within the Utility Programs for Drainage (UPD) software:

- Rational Method (RM);
- Alternative Rational Method (ARM);
- Standard Design Flood (SDF);
- Empirical methods; and
- Regional Maximum Flood (RMF) method.

An average of the results from all of the above-mentioned methods was taken and used in this study.

Flood lines were determined for identified streams based on the latest contour survey obtained from the applicant and were modelled using HEC-RAS software for both the 1:50 year and 1:100 year rainfall event.

**Results**

Catchments

The proposed project area is located within the quaternary catchments A24D and A24E. With reference to Figure 12, the majority of runoff generated on site drains into the Lesobeng River (A24E) and only a small part in the north-western corner of the site drains into the Bofule River (A24D).

Mean annual precipitation

The mean annual precipitation (MAP) for the site ranges from 575 mm to 648 mm with a site average of 592 mm (WR2005). The average monthly rainfall is included in Table 7.

Mean annual runoff

Details of the quaternary catchments and the catchments associated with the proposed project area are provided in Table 24.

**TABLE 24: MEAN ANNUAL RUNOFF**

| Catchment | Area ($km^2$) | MAR (million $m^3$) |
|---|---|---|
| A24D (complete) | 1 328 | 15.5 |
| A24E (complete) | 688 | 9.86 |
| Lesobeng (until confluence with Sefathlane) | 111 | 1.59 |
| Bofule (until confluence with Kolobeng) | 161 | 1.88 |

Flood peaks and volumes

The peak flow rates relevant to project infrastructure for the 1:50 and 1:100 year return period, as well as the regional maximum flood (RMF) are summarised in Table 25.

**TABLE 25: PEAK FLOWS**

| | | Return period | | |
|---|---|---|---|---|
| Catchment | Area ($km^2$) | 1:50 ($m^3/s$) | 1:100 ($m^3/s$) | RMF ($m^3/s$) |
| Lesele | 25.6 | 128.7 | 174.3 | 373.5 |
| Lesobeng 1 | 28.7 | 121.1 | 164.1 | 396.4 |
| Lesobeng 2 | 67.9 | 249.8 | 338.4 | 620.3 |

Wetlands

No wetlands were identified within the proposed project footprint.

Flood lines

The relevant 100m offset and 1:100 year flood lines are shown on Figure 13. None of the proposed surface infrastructure is located within the 1:100 year flood line or within 100 metres from any watercourses, except the reef transport facility (conveyor).

River diversions

No rivers or streams will be diverted. As part of the proposed project, bridges for internal transport mechanisms will be established to cross the non-perennial Lesobeng River.

Surface water resources within the proposed project area

The non-perennial Lesobeng and Lesele Rivers enter the site from the south and south-west, respectively. Both rivers originate in the higher elevated Pilanesberg Mountains. The Lesele joins the Lesobeng River in the centre of the proposed project area. Approximately 2km downstream of the confluence, the Lesobeng River crosses the eastern boundary of the site and flows in a north-eastern direction into the Sefathlane River.

The 1:50 000 topographic map shows a non-perennial watercourse located in the north eastern corner of the proposed project area that flows in a north westerly direction. The hydrological specialist is of the opinion that this is inaccurate as the topographic survey for the site indicates that this watercourse would have to flow uphill. It is considered more likely that the watercourse would start near the northern boundary of the proposed project area.

A farm dam of approximately 5ha in area is located on site approximately 500m from the southern boundary, however the dam wall is breached at the far eastern side. The watercourse flowing into the dam is braided and meandering. Downstream of the dam multiple channels were identified of which it is assumed only the most eastern one is active during flows. On the basis of the soils and vegetation upstream of the dam wall, is expected that the dam still retains some water during the wet season although not at significant depths.

Surface water use

There is no significant reliance on surface water for community consumption because of the fact that the watercourses (including the breached dam located on the farm Magazynskraal 3 JQ) are dry for most of the year. Aquatic ecosystem reliance is also expected to be limited due to the ephemeral nature of the flow in the streams (only exist for a few days following rain), however this does not negate the importance of surface water flow for certain species who rely on this limited flow.

Surface water quality

Information in this section was sourced from the hydrogeological study conducted by AGES (2013). Detailed information is provided in Appendix H. Monitoring of surface water in the area does not take place on a routine basis as there is little or no flow in the watercourses in the project area.

Hydrocensus data indicates that surface water in the area generally reflects elevated levels of fluoride, aluminium and iron. These parameters are expected to be naturally elevated in the area as a result of the underlying geology. In addition, elevated levels of sodium and chloride have been detected at certain locations.

**Conclusion**

The proposed project and associated activities have the potential to pollute surface water resources that may be used by third parties for domestic and/or limited agricultural activities, as well as for ecosystem functionality. Therefore the proposed project must be managed in a way that pollution of water resources is prevented. In addition, care is required to ensure that the disturbance of surface run-off patterns is limited as far as possible to promote the continued flows of water and nutrients.

### 1.1.8 GROUNDWATER

The information in this section was sourced from the groundwater specialist studies (AGES, 2013) included in Appendix H.

**Introduction and link to impacts**

Groundwater is a valuable resource and is defined as water which is located beneath the ground surface in soil/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. Project related activities such as underground mining, the handling and storage of hazardous materials and handling and storage of mineralised and non-mineralised wastes have the potential to result in the loss of groundwater resources, both to the environment and third party users, through dewatering and/or pollution. As a baseline, this section provides an understanding of the current groundwater conditions (quality, quantity and use) and the potential for dewatering cones of depression and/or pollution plumes to occur as a result of mining-related activities.

**Data collection**

Sources of data include the following:

- review of existing reports, databases and maps;
- falling head tests were conducted on core boreholes within the study area to determine local aquifer parameters; and

- conducting hydrocensus studies (2010 and 2012) to identify water users as well as to determine the quality and quantity of water resources.

**Results**

The complex geology of the area around the project area as described in Section 1.1.1 of this report leads to various geochemical scenarios, especially in the presence of groundwater. Further detail on the interactions between geology and groundwater are discussed in Appendix H.

Groundwater zone (aquifers)

The region consists of a shallow and weathered bedrock aquifer which is also laterally connected to aquifers along the weathered zones associated with drainage lines as well as a deeper, intact fractured bedrock aquifer. The weathered aquifer is between 12m and 50m deep. It is this shallow aquifer that supports most of the rural borehole abstraction for domestic and small scale agricultural purposes. The deeper aquifer has a low matrix hydraulic conductivity and the groundwater regime in this aquifer is essentially connected fractures and mine voids.

The aquifer classification scheme (WRC Parsons, 1995) was created for strategic purposes as it allows the grouping of aquifer areas into types according to their associated supply potential, water quality and local importance as a resource. Table 26 includes the details of this classification scheme as well as the DWA aquifer classification.

**TABLE 26: AQUIFER CLASSIFICATION SCHEME**

| Aquifer system | Defined by Parsons (1995) | Defined by DWA Minimu Requirements (1998) |
|---|---|---|
| Sole source aquifer | An aquifer which is used to supply 50 % or more of domestic water for a given area, and for which there are no reasonably available alternative sources should the aquifer be impacted upon or depleted. Aquifer yields and natural water quality are immaterial. | An aquifer, which is used to supply 50% or more of urban domestic water for a given area for which there are no reasonably available alternative sources should this aquifer be impacted upon or depleted. |
| Major aquifer | High permeable formations usually with a known or probable presence of significant fracturing. They may be highly productive and able to support large abstractions for public supply and other purposes. Water quality is generally very good (<150 mS/m). | High yielding aquifer (5-20 ℓ/s) of acceptable water quality. |
| Minor aquifer | These can be fractured or potentially fractured rocks, which do not have a high primary permeability or other formations of variable permeability. Aquifer extent may be limited and water quality variable. Although these aquifers seldom produce large quantities of water, they are important both for local supplies and in supplying base flow for rivers. | Moderately yielding aquifer (1-5 ℓ/s) of acceptable quality or high yielding aquifer (5-20 ℓ/s) of poor quality water. |
| Non-aquifer | These are formations with negligible permeability that are generally regarded as not containing groundwater in exploitable quantities. Water quality may also be such that it renders the aquifer as unusable. However, groundwater flow through such rocks, although imperceptible, does | Insignificantly yielding aquifer (< 1 ℓ/s) of good quality water or moderately yielding aquifer (1-5 ℓ/s) of poor quality or aquifer which will never be utilised for water supply and which will not contaminate other aquifers. |

| Aquifer system | Defined by Parsons (1995) | Defined by DWA Minimu Requirements (1998) |
|---|---|---|
| | take place, and need to be considered when assessing the risk associated with persistent pollutants. | |
| Special aquifer | An aquifer designated as such by the Minister of Water Affairs, after due process. | An aquifer designated as such by the Minister of Water Affairs, after due process. |

Higher permeability zones are associated with local structures such as faults and contact zones of the dykes. The perennial streams have the potential to have more associated alluvium. The project area is characterised by numerous geological lineaments i.e. faults and dykes. The in-situ stress fields are such that the east –west trending lineaments are all closed. Thus, the only possible open lineaments are the north south trending faults/dykes. These aquifers are classified as minor aquifers according to the Parsons classification.

High yielding water bearing structures are present to the west of the project area and not on site. Due to high recorded yields, these aquifers associated with the Frank Fault can be classified as a major aquifer zone, however poor water quality influences the classification to minor aquifers.

The local area and associated aquifers, limited to the geological faults and contact zones of dykes, was historically classified as a Sole Source Aquifer. This was due to the communities relying on groundwater alone for their basic water requirements. There is no permanent surface water storage in the project area. The classification of a sole source was reviewed (by AGES) due to the supply of water to communities from Magalies Water, although this supply is erratic. Although the villages located on the northern rim of the Pilanesberg National Park are connected to Magalies Water infrastructure it is understood that they are often without potable water. Villages located further to the north and north west of the project area rely solely on groundwater.

Aquifer classification for the project area is therefore not conclusive.

Groundwater flow

There are a number of hydraulic zones that control groundwater flow:

- shallow soil and weathered zones along the drainage lines that influences recharge;
- upper weathered and fractured aquifers i.e. the slate, norite and gabbro in the west and anorthosite, magnetite and pyroxenite towards the east and north-east. The Pilanesberg complex is associated with lava's. These zones form weathered basins with moderate to high groundwater potential;
- fault zones that form permeable linear zones; and
- dykes that are impermeable (some are weathered in the upper weathered zones, which permits flow) and permeable dyke-contact zones.

There are numerous hydraulic zones that influence the groundwater flow balance within the aquifer. The groundwater flow occur in the weathered zone and along discrete lineaments, found from approximately 20mbgl and deeper, it is mainly confined to water bearing structures such as highly weathered fault, fracture and contact zones. The primary aquifer in this area would be the fault zones and contact zones between the intruded dykes and host rocks.

Horizontal groundwater flow directions show that the hydraulic gradient is from the topographical high in the south and north respectively towards the confluence of the drainage systems in the centre of the modelled catchment. From there, the majority of groundwater flow is towards the north east outflow boundary.

Groundwater levels

The water levels in this area are located at depths ranging from 5 – 80 mbgl. The detailed data obtained during the hydrocensus studies are included in the hydrogeological report included in Appendix H.

Groundwater use

In addition to aquatic ecosystems, groundwater in the area is mainly used for domestic and agricultural (livestock watering) purposes.

From the boreholes surveyed, 71% (32 boreholes) were not in use, 27% (12 boreholes) were in use and 2% (1 borehole) were destroyed. The purpose of the boreholes drilled and application thereof are as follows:

- 73% (33 boreholes) are used for monitoring purposes;
- 13% (6 boreholes) are used for livestock watering;
- 11% (5 boreholes) are used for domestic supply; and
- one borehole is used for mining purposes.

A number of ecological systems are reliant on surface water resources. There is a possibility that the surface water resources may be linked to groundwater resources and hence an impact on the groundwater levels and quality could directly impact on potentially linked surface water resources. One such system is a stretch of the Bofule River system which is rated as a Level 1 National Freshwater Ecosystem Priority Area (NFEPA) before the confluence with the Wilgespruit on the neighbouring Sedibelo property. In addition, four natural springs are located within the property of the Pilanesberg National Park in the north, north-east and east of portion 5 of the farm Rooderand 46 JQ. The springs flow into a wetland area in a northern direction away from the Pilanesberg complex hills and form a feature that is known as ‘pannetjies’. These springs are perennial and are believed to be the only natural water source for animals and the local ecosystem in the northern section of the Pilanesberg National Park, particularly in the winter months.

Groundwater quality

The detailed data and analysis obtained during the hydrocensus studies as well as groundwater monitoring undertaken at PPM and Black Rhino are included in the hydrogeological report, included in Appendix H.

In terms of South African Water Quality Guidelines Volume 1: Domestic Water Use (drinking water purposes) poor domestic water quality was detected in a number of boreholes due to elevated fluoride concentrations. Elevated fluoride levels occur naturally due to the high concentrations of fluorite in the foyaite formations in the Pilanesberg complex. Elevated concentrations of magnesium have also been recorded in this area. All other non-metal ions tested for were at concentration levels that does not pose any major health effects. The heavy metals manganese, copper, zinc, nickel and lead were all present in small concentrations but pose no health threats if consumed in the case of both livestock and humans. The majority of the groundwater samples can be defined as being of sodium – bicarbonate / calcium / magnesium - bicarbonate nature due to elevated concentrations of the respective cations and anions. The average pH of the sampled boreholes is 8.2 with a slightly higher pH of 8.25 measured in the surface water samples. All the samples show a pH between 7.42 and 9.32.

According to the South African Water Quality Guidelines Volume 7: Aquatic Ecosystems (Second edition, 1996) elevated levels of fluoride, aluminium, zinc, copper, cadmium and selenium were recorded.

**Conclusion**

Groundwater quality data shows high fluoride concentrations as well as occasionally high nitrate, iron, manganese, sulphate and sodium concentrations. The nature of the proposed project is such that it presents the potential for pollution and/or depletion of groundwater resources that in some cases may be used by third parties for domestic, recreation and agricultural uses, as well as ecological purposes. The proposed project must be implemented and managed in a way that pollution and reduction of groundwater resources is prevented.

### 1.1.9 AIR QUALITY

Information in this section was sourced from the air specialist study that was undertaken by Airshed Planning Professionals for the proposed project (Airshed, 2013) included in Appendix I.

**Introduction and link to anticipated impact**

Existing sources of emissions in the region and the characterisation of existing ambient pollution concentrations is fundamental to the assessment of cumulative air impacts. A change in ambient air quality can result in a range of impacts which in turn may cause a disturbance and/or health impacts to nearby receptors. Potential receptor sites include the residential areas (including communities and tourism related activities) and natural environments that have been described in Section 1.3.1. The current land uses in the broader area include mining operations, conservation/eco-tourism ventures and community activities such as livestock grazing and subsistence agricultural activities.

**Data collection**

Data was obtained from the review of existing literature, monitoring data and available studies. In assessing current ambient air quality in the project area, reference was made to available monthly dustfall monitoring data recorded at the nearby PPM over the period June 2010 to December 2011. Reference was also made to the results of dust fall monitoring undertaken at the neighbouring Sedibelo operation. No ambient particulate or gaseous concentration data was available.

A site visit was undertaken to compile a qualitative description of existing sources of atmospheric emission.

**Results**

Regional air quality

Existing sources of air pollution in the region include:

- stack, vent and fugitive emissions from mining activities in the area, including PPM, Chrometco, Ruighoek Chrome Mine to the southwest and the Union Platinum Mine to the north east as well as various other exploration phase mining operations in the area;
- vehicle tailpipe emissions;
- household fuel combustion;
- biomass burning (veld fires); and
- various miscellaneous fugitive dust sources (agricultural activities, wind erosion of open areas, vehicle-entrainment of dust along paved and unpaved roads).

Local air quality

Based on monitoring results obtained from the neighbouring PPM and Sedibelo mines, dust fallout levels at off-site receptor areas are generally regarded as acceptable as dust fallout levels largely remain within the SANS limit of $600mg/m^2$-day. However, during the dry windy months (June – November), some exceedances of this limit have been recorded. Most of the monitoring locations where exceedances have been recorded are located near unpaved roads and it is expected that vehicles travelling on these roads are the reason for the above-mentioned exceedances.

No information is available on the ambient $PM_{10}$ concentration levels in the area.

Potential receptor sites

Potential receptors include the land users on Magazynskraal 3 JQ and farms adjacent to the proposed project area, as well as the surrounding communities discussed in Section 1.3.1.

**Conclusion**

This baseline information will be used to assess the impact of the proposed project. Due to the existing land uses in the area there is potential for elevated dust fallout concentrations and for elevated $PM_{10}$ concentrations. Therefore the design of the project and air mitigation measures must be focused on the control of these impacts.

### 1.1.10 NOISE

Information in this section was sourced from the noise specialist study that was undertaken by Acusolv for the pre-project ambient noise levels (Acusolv, 2012).

**Introduction and link to anticipated impact**

Certain noise generating activities may cause an increase in ambient noise levels in and around the mine. This may cause a disturbance to nearby receptors. Potential receptor sites include the communities, conservation/eco-tourism ventures as well as animals that have been described in Section 1.3.1.

**Data collection**

To quantify the current day and night ambient noise levels, noise monitoring was undertaken at several sampling sites located around the proposed project area. These sampling points were identified to provide a representation of ambient noise levels. The monitoring was conducted for a 24-hour period where possible. Meteorological conditions and the location of sampling points were taken into consideration when determining ambient noise levels.

**Results**

The areas immediately to the north, east and west of the proposed project area are relatively isolated from main road traffic and mining noise. Mining activities in the district have little effect on ambient levels in the immediate surroundings of the proposed project area. In this regard, noise from Pilanesberg Platinum Mine (PPM) situated approximately 6km east of Magazynskraal, was not detected during the field investigations. According to SANS 10103 guidelines the proposed project area is considered a Rural District (the lowest noise category) with typical daytime and night-time ratings of 45 and 35 dBA, respectively.

Due to higher levels of road traffic, as well as commercial and domestic activities, the intrinsic ambient noise levels in the areas and villages to the south of the proposed project area are typically between 5 and 10dB higher than Rural District levels, making the villages that much less sensitive to noise from external sources.

A summary of the ambient noise levels described above for each monitoring point is included in Table 27, while the location of the monitoring points are illustrated in Figure 14.

**TABLE 27: DAY AND NIGHT TIME AMBIENT NOISE LEVELS TAKEN IN CLOSE PROXIMITY TO THE PROPOSED PROJECT AREA**

| Measuring point | Day time (dBA) | Night time (dBA) | Comment / Classification in terms of SANS 10103 |
|---|---|---|---|
| M1 (Ga-Masilela Village) | 51 | 42 | Ambient noise determined by local road traffic and community activity noise. No mining or industrial noise was discernible. Classified as Suburban Residential Districts |
| M2 (Rural area north-west corner of proposed project area) | 44 | 34 | Ambient noise determined primarily by natural sounds and human activity. No mining or industrial noise was discernible. Classified as Rural Districts |
| M3 (Rural area north-west of proposed project area) | 45 | 37 | Very quiet with ambient levels determined primarily by bird, insect and wind sounds. Machine or mining activity noise could be made out in the distance, but levels did not show on the ambient noise readings. Classified as Rural Districts |
| M4 (Rural area north of the proposed project area) | 45 | 35 | Very quiet with an ambient noise determined primarily by bird, insect and wind sounds. Mining noise in the distance was barely audible. Classified as Rural Districts |
| M5 (Rural area north-east of the proposed project area) | 44 | 36 | Very quiet with an ambient noise determined primarily by natural sounds. Road traffic noise from the R510 was barely audible and had no effect on ambient noise readings. Classified as Rural Districts |
| M6 (Mononono village, north-east of the proposed project area) | 50 | 40 | Ambient noise representative of conditions in villages, townships and the built-up residential zones along main roads. Classified as Suburban Residential Districts |
| M7 (Saulspoort village, south-east of the proposed project area) | 55 | 45 | Ambient noise representative of conditions in a built-up zone. Classified as Urban Districts |

**Conclusion**

The majority of the proposed project area and surrounds can be classified as rural in nature with most ambient noise levels emanating from natural sources or from community based activities. Careful design and planning should be taken into consideration during the construction and operation of the proposed project in order to manage disturbing noise levels.

### 1.1.11 VISUAL ASPECTS

Information in this section is taken from the specialist visual report undertaken by Newtown Landscape Architects (NLA, 2013).

**Introduction and link to anticipated impact**

Mining-related activities have the potential to alter the landscape character of the site and surrounding area through the establishment of both temporary (such as shafts, mineral processing infrastructure and support facilities) and permanent infrastructure (such as TSF and WRDs). As a baseline, this section provides an understanding of the visual aspects of the area against which to measure potential change as a result of mine infrastructure and activities.

**Data collection**

Data on the visual resource was collected from 1:50 000 topographical maps and on-site observations.

**Results**

In describing the visual landscape, a number of factors are considered, including landscape character, sense of place and scenic quality. Each of these concepts is discussed below.

It is important to note that the study area defined for the visual study is a 15.0km radius around the proposed project area as beyond this distance, the proposed project components are likely to be ‘absorbed’ into the landscape setting. As such, this section refers to the “study area” and should not be confused with the “project area” which refers to the area in which the proposed infrastructure would be established.

Landscape character

The landscape character of the study area is defined by relatively flat plains, punctuated by isolated hills in the west and the dominant hills associated with the Pilanesberg National Park (PNP) in the south. While the plains have been disturbed by anthropogenic activities, the hills are relatively ‘untouched’ with a dense vegetation cover of bushveld species associated with the Dwaalboom vegetation type. Current land uses in and adjacent to the proposed project area is a combination of grazing, crops, mining, residential and general community activities.

Scenic quality

The scenic quality of an area is linked to the type of landscapes that occurs therein. Scenic quality ranges from high to low as follows:

- high - these include the mountains and koppies, water bodies and natural drainage systems;
- moderate - these include agricultural activities and recreational areas; and
- low - these include towns, communities, roads, railway line, industries and existing mines.

The study area has many positive aesthetic features. This is primarily due to the physical setting, which is dominated by the wooded hills associated with the PNP as well as the isolated hills that protrude above the surrounding plains. Whilst the ‘untouched’ hills are considered to have a high visual quality, the plains tend to have a moderate rating. The lower rating is a consequence of the intrusive nature of anthropogenic elements such as mining and settlement activities. The overall scenic quality of the study area is considered to be moderate to high.

Sense of place

Central to the concept of sense of place is that the landscape requires uniqueness and distinctiveness. In this regard, it is 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. When deriving the sense of place of the study area, the landscape context is considered, as it is the existing land types that define a sense of place. These land types include mining and utility, community / built up, grassland plains and the natural hills.

The proposed project area and adjacent plains are regarded as having a moderate sense of place as the area has been disturbed by anthropogenic activities, however the 'untouched' hills are considered to have a high sense of place. When the overall landscape character is considered, the combination of flat savannah plains and treed hills evoke an aesthetically pleasing scene with a strong sense of place. It should be noted that this area is earmarked for the proposed Heritage Park Corridor (HPC), which aims to link the PNP in the south to the Madikwe Game Reserve in the north-west.

Visual receptors

When viewed from the perspective of tourists and community members, mining activities can be associated with a sense of disenchantment. People who would benefit from the proposed development (employees, contractors, service providers etc.) may not experience this disenchantment but rather view the mine with a sense of anticipation.

Public views (sensitive viewing areas) to the proposed project could be experienced by people living and visiting the adjacent communities, employees travelling to work either at the existing or proposed mine, as well as tourists visiting the attractions in the area or travelling through the area to other destinations.

The following communities would have views of the proposed project components:

- Lesobeng and Kgamatha;
- Mononono;
- Manamakgoteng;
- Saulspoort / Moruleng (including Ramoga);
- Lesetlheng;
- Lekutung;
- Legkraal (including Ga-Masilela, Ga-Riphiri, Boriteng and Bofule);
- Ngweding;
- Magalane;
- Magong;
- Mmantserre; and
- Sefikile.

Visitors to and personnel of the PNP would have views of the proposed project components, however these views will be contained by the valley topography thereby reducing the visual impact on sensitive viewers associated with the PNP. Unobstructed views would occur from the upper sections of the north-facing slopes of the northern section of the PNP.

It is expected that visitors to and personnel of the Black Rhino Reserve would not have views of the proposed project components during the day. However, at night time the lights and glow from the lights associated with the proposed project could make the project more visible.

**Conclusion**

The proposed project area is considered to have a moderate value with respect to scenic quality. However when the wider area is considered, it is considered to have a moderate-high value with a strong sense of place. Key to these factors is that the proposed project area is located in close proximity to the PNP and within the proposed HPC. This information has been used in an effort to try to minimise the visual impact of the proposed project.

## 1.2 ENVIRONMENTAL ASPECTS WHICH MAY REQUIRE PROTECTION OR REMEDIATION

Environmental aspects both on the proposed project area and in the surrounding area which may require protection or remediation during the life of the proposed project are listed below:

- stripped and stockpiled soils;
- in-situ soils and land capabilities;
- biodiversity;
- groundwater resources;
- surface water resources;
- drainage patterns on site after closure;
- the non-perennial Lesobeng and Lesele Rivers;
- ambient air qualities;
- noise environment;
- visual and landscape quality;
- surface blasting and impacts on fauna;
- surrounding land uses, socio-economic conditions and economic activity; and
- heritage (and cultural) and palaeontological resources.

This list is based on the concise descriptions provided in Sections 1.1 and 1.3.

## 1.3 LAND USES, CULTURAL AND HERITAGE ASPECTS AND INFRASTRUCTURE

A description of the specific land uses, cultural and heritage aspects and infrastructure on site and on neighbouring properties/farms is provided in this section. This section identifies whether or not there is potential for the socio-economic conditions of other parties to be affected by the mining operations.

### 1.3.1 LAND USES

**Introduction and link to impacts**

Mining activities have the potential to affect land uses both on the site (through land development) and in the surrounding areas (through direct or indirect positive and/or negative impacts). 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 may occur.

**Data collection**

Surface right information was provided by Richtrau. Information on existing prospecting/mining rights was compiled with input from Richtrau and SLR's knowledge of the area.

Information on the context of the area and the presence of infrastructure was compiled by SLR using information provided by the various specialist studies, observations during site visits and study of aerial and satellite images.

**Results – Mineral / Prospecting rights**

Prospecting rights for platinum group metals (PGMs) and other base metals in the proposed project area are held by Richtrau No. 123 (Pty) Ltd and are detailed below:

- NW30/5/1/2/2/1680PR: gold, silver, nickel, copper, cobalt and chrome; and
- NW30/5/1/2/2/1334PRC: platinum, palladium, iridium, ruthenium, rhodium and osmium.

Other prospecting rights held within the proposed project area include Rise Africa Mining and Exploration (Pty) Ltd (NW30/5/1/1/2/2679PR) for vanadium ore.

**Results – Land ownership**

The farm Magazynskraal 3 JQ is owned by the state. The surface right owners and corresponding title deed numbers of the land in and adjacent to the proposed project area are listed in Table 28, while Figure 15 illustrates the relevant property boundaries.

**TABLE 28: SURFACE RIGHTS ON AND SURROUNDING THE PROPOSED PROJECT SITE**

| Farm Name | Portion number | Title deed number | Registered property owner |
|---|---|---|---|
| **On the proposed project area** | | | |
| Magazynskraal 3 JQ | The farm | T56447/2000 | Republic of South Africa (care of the Department of Rural Development and Land Reform) |
| **Neighbouring farms** | | | |
| Wilgespruit 2 JQ | 0 | T1230/1919BP | Bakgatla-Ba-Kgafela Tribe |
| Wildbeestkuil 9 JQ | 0 | T4278/1921BP | |
| Kruidfontein 40 JQ | 0 | T4028/1898BP | |
| Cyferkuil 1 JQ | 1 | T5284/1937BP | Republic of South Africa |
| Wachteenbeetjeslaagte 4 JQ | 0 | T2403/1948BP | |
| Haakdoorn 6 JQ | 0 | T5990/1937BP | |
| Koedoesfontein 42 JQ * | 0 | T5841/1919BP | Tchinangoe Pilane (1/6 share); Samuel Tilimane Pilane (1/6 share); Noel Pilane (1/6 share); and Bakgatla Tribe (3/6 share) |

*Note: * To date, SLR has not been able to contact Mr Tchinanagoe Pilane. The Bakgatla-Ba-Kgafela has informed SLR that Mr Tchinanagoe Pilane is deceased. No clarification on this matter has been obtained.*

**Results – Land claims**

According to the Department of Rural Development and Land Reform, there are no land claims on the farm Magazynskraal 3 JQ (see Appendix B).

**Results - Land uses**

Context

To give context to the discussion below, the proposed project area is situated approximately 2km north of the PNP in the North West Province. Current land uses on the proposed project area include livestock grazing, crop farming and community activities. The current land uses immediately surrounding the proposed project area include subsistence farming (livestock grazing and crops); formal (villages) and informal (livestock herders and farmers) residential, mining and conservation/eco-tourism activities associated with the PNP. More detail is provided below.

Transport infrastructure

With reference to Figure 1 and Figure 2, a network of roads exists in the vicinity of the proposed project area, including:

- the regional tarred R510 (along the eastern boundary of the PNP);
- the provincial tarred P54-1 (along the western boundary of the PNP);
- the provincial P50-1 (east / west alignment and connects the R510 to the P54-1);
- the D511 gravel road (north-west / south-east alignment that connects the P50-1 to Magong);
- the D531 gravel road (between Motlhabe and Ntswana-le-Metsing); and
- the Z536 gravel road running south from Ngweding (a section of this road has been closed due to PPM's open pit mining operation. There is a temporary fire break road that follows the eastern

boundary of PPM's pit. PPM has applied for and been granted permission to close the Z536 and construct a new road along the northern boundary of the farm Wilgespruit 2 JQ [Metago, 2009]).

Further information on transport infrastructure is included in Section 1.3.2.

Power lines and telecommunications

Significant power lines (and the associated Eskom servitudes) are situated approximately 11 km to the west of the proposed project site in a north-south direction (Figure 2) and along the northern and western boundaries of the Magazynskraal farm (not shown on map). There is a network of low voltage power lines and telephone lines which service the area. These lines usually follow roads before branching off to individual properties. On the proposed project site, there is a low voltage line that follows the internal road network on the farm Magazynskraal 3 JQ.

Water pipelines

There is a Magalies Water pipeline that crosses the proposed project area in an east/west direction along the northern boundary.

Residential

Various informal homesteads are located within and adjacent to the Magazynskraal project area. These include the land users on the proposed project area and on neighbouring farms such as Wilgespruit 2 JQ and Wildebeestkuil 7 JQ.

With reference to Figure 2, the residential areas closest to the proposed project area include:

- livestock herders and subsistence farmers (located on the farm Magazynskraal 3 JQ);
- livestock herders and subsistence farmers (located adjacent to the proposed project area on the farm Wilgespruit 2 JQ)
- Lesobeng and Kgamatha (± 1km east of the proposed project boundary);
- Legkraal (± 1.5km south west of the proposed project boundary)
- Lekutung (± 2km south of the proposed project boundary);
- Lesetlheng (± 3km south east of the proposed project boundary);
- Saulspoort / Moruleng (± 6.5km south east of the proposed project boundary);
- Manamakgoteng (± 7km east of the proposed project boundary);
- Mononono (± 8.5km north east of the proposed project boundary);
- Sefikile (± 9.5km north east of the proposed project boundary);
- Magalane (± 6km north of the proposed project boundary);
- Magong (± 8.5km north east of the proposed project boundary);
- Ngweding (± 6.5km north west of the proposed project boundary);
- Ntswana-le-Metsing (± 9km north west of the proposed project boundary); and

- Motlhabe (± 10.5km north west of the proposed project boundary).

Recreational facilities in the vicinity

Recreational facilities within the vicinity include:

- Pilanesberg National Park located south of the proposed project area, including the following private lodges/park camps which are situated near the north of the PNP:
    - Black Rhino Private Game Reserve;
    - Bakgatla camp; and
    - Ivory Tree Lodge;
- Various lodges and resorts located in the southern section of the Pilanesberg National Park, including Manyane, Bakubung, Kwa Maritane, Tshukudu, Shepherd's Tree;
- Sun City, which lies on the southern edge of the Pilanesberg National Park, approximately 25km south of the proposed site;
- Lebatlhane Nature Reserve located to the north of the proposed project area;
- BBKTA cultural museum based in Saulspoort/Moruleng located south east of the proposed project area;
- Sports centre located in Saulspoort/Moruleng located south east of the proposed project area;
- Madikwe Game Reserve lies approximately 60km to the north west of the proposed site;
- further afield there are a number of hotels, restaurants and sporting facilities located in and around the outskirts of Phokeng and Rustenburg some 60km to the south of the proposed project site.

Proposed Heritage Park Corridor

The proposed HPC is an initiative being put forward by the North West Parks and Tourism Board (NWPTB) where it is proposed that over 167 000ha will be incorporated into the corridor over a 20 year period to allow the joining of the Madikwe Game reserve and the Pilanesberg National Park. This is a piece of land that stretches north of the Pilanesberg towards Dwaalboom and then follows the Dwarsberg Mountain range west before joining the Madikwe Reserve at Molatedi. This initiative forms part of a larger initiative to establish a significant conservation area in the province approaching 1 000 000ha. The proposed concept will be to establish a core corridor that would have the potential to be expanded over time to increase the nature based tourism to the area and thus increase the socio-economic benefits to the area (NWPTB, 2002).

As part of the HPC, two different corridors are planned. The phase 1 corridor is the wider corridor which will be fenced off to contain non-dangerous game on the farms that form part of the southern part of the proposed Heritage Park. It is planned that non-dangerous game, community activities and mining activities would co-exist within this corridor. The phase 2 corridor is likely to be a narrower "Big Five" corridor that will be used exclusively for animal movement between Pilanesberg National Park and

Lebatlhane Game Reserve (and ultimately the Madikwe Game Reserve), and it will exclude community and mining activities.

While the vision of the proposed Heritage Park is supported by a number of stakeholders, there are numerous challenges that currently face this initiative. These include, but are not limited to, a lack of investors, numerous private and community landowners within the corridor which is approximately 100km long and varies in width from 5 to 30km, existing linear infrastructure, as well as existing and proposed developments including mining operations.

Mining

Various mining operations are located in the immediate vicinity of the proposed project and include:

- Sedibelo is situated on the farms Wilgespruit 2 JQ, Portion 1 of Rooderand 46 JQ, Legkraal 45 JQ and Koedoesfontein 42 JQ;
- PPM is situated on the farms Tuschenkomst 135 JP, Witkleifontein 136 JP, Portion 3 of Rooderand 46 JQ, various portions of Ruighoek 169 JP, a portion of Wilgespruit 2 JQ and a portion of Portion 1 of Rooderand 46 JQ;
- Chrometco chrome mine is situated on Portion 2 and the remaining extent of the farm Rooderand 46 JQ.

Additional proposed mining interests in the immediate vicinity include:

- Platinum Australia (Atla Mining), situated on Portion 2 of Rooderand 46 JQ;
- Nkwe Platinum (Portion RE of Rooderand 46 JQ);
- Rise Africa Mining and Exploration (various Portions of the farms Magazynskraal 3 JQ, Wildebeestkuil 7 JQ, Haakdoorn 6 JQ, Middelkuil 38 JQ, Syferkuil 9 JQ)

Other mining operations located further afield include:

- Rustenburg Minerals on the farm Groenfontein 138 JP;
- Chrome Corporation on the farm Ruighoek 169 JP;
- Merafe - Xstrata Horizon Mine on the farms Ruighoek 169 JP and Vogelstruisnek 17 JP;
- Rustenburg Platinum Mines (Union Section) on the farm Zwartklip 405 KQ.

**Conclusion**

Land uses on and immediately surrounding the proposed project area comprises mining, wilderness, ecotourism, livestock grazing, subsistence agriculture and community related activities. Further afield, there are a number of residential areas, recreational facilities and mining operations. Future land uses are important given the proposed heritage Park. The information regarding current and future land uses has been used by the project team to assess impacts on these land uses and to inform mitigation measures as required.

### 1.3.2 TRANSPORT INFRASTRUCTURE BASELINE

Information for this section was sourced from the specialist traffic impact study included in Appendix N (Siyazi, 2013).

**Introduction and link to impacts**

Understanding the nature, use and conditions of existing transport systems relevant to the proposed project provides a basis for understanding a change as a result of project contributions. This section therefore provides an overview of the transport systems with specific focus on road infrastructure.

Traffic furthermore has the potential to impact on noise, air quality and pubic road safety.

**Data Collection**

Relevant data was sourced from a site inspection of the existing road network, traffic surveys, calculations and reference to the relevant traffic impact assessment guideline documents.

Traffic counts (12-hour manual) were conducted at intersections that would potentially be affected by the existing and proposed mining developments. It is standard traffic engineering practice to conduct 12-hour manual traffic counts at all intersections that could potentially be affected by a proposed development, as close as possible to a month-end Friday when traffic movement is expected to be at its highest. From the 12-hour manual traffic counts, the morning (AM) and afternoon (PM) peak hours are determined respectively, and used for any further calculations. The traffic counts were therefore undertaken on Friday, the 27$^{th}$ of January 2012.

**Results**

The various aspects of the traffic baseline are set out below.

Existing Road Network

Access to and from the proposed project site will be from the D511 road that joins the provincial P50-1 road.

Figure 16 provides a diagrammatic outline of the existing road network in the area surrounding the proposed project area. Table 29 provides information regarding the status of relevant road intersections.

**TABLE 29: SUMMARY OF INTERSECTION CONTROL AT INTERSECTIONS UNDER INVESTIGATION**

| Point | Description | Intersection control | Pedestrian activities |
|---|---|---|---|
| A | Intersection of Roads P54-1 and P50-1 | Free-flow on Road P54-1 | Low |
| B | Intersection of Roads P50-1 and D531 | Free-flow on Road P50-1 | Low |
| C | Intersection of Roads D531 and Z536 | Free-flow on Road D531 | Low |
| D | Intersection of Road P50-1 and PPM main office and plant access | Free-flow on Road P50-1 | Low |

| Point | Description | Intersection control | Pedestrian activities |
|---|---|---|---|
| E | Intersection of Road P50-1 and PPM stock pile access | Free-flow on Road P50-1 | Low |
| F | Intersection of Road P50-1 and PPM operations access 1 | Free-flow on Road P50-1 | Low |
| G | Intersection of Road P50-1 and PPM operations access 2 | Free-flow on Road P50-1 | Low |
| H | Intersection of Road P50-1 and Rooderand Platinum Mine access | Free-flow on Road P50-1 | Low |
| I | Intersection of Roads P50-1 and Z536 | Free-flow on Road P50-1 | Low |
| J | Intersection of Road P50-1 and Legkraal Road | Free-flow on Road P50-1 | Low |
| K | Intersection of Roads P50-1 and D5111 | Free-flow on Road P50-1 | Low |

Capacity of road network

The reserve capacity of the various roads in the project area ranges between 700 and 1300 vehicles per lane per hour, depending on the direction of travel. This allows for sufficient reserve capacity between now and 2022 as indicated by the low levels of saturation in Table 32 and Table 33.

Road conditions

The following road conditions were observed:

- the P50-1 is in a fair condition, although there is a lack in sufficient drainage, resulting in numerous large dams during raining seasons;
- the P54-1 is in a fair condition with acceptable riding quality in the proximity of the proposed project areas (i.e. near the intersection with the P50-1). However further to the south, through the village of Tlhatlhaganyane and past the entrance to Black Rhino, the P54-1 is in a state of disrepair;
- the D531 is in a very poor condition with insufficient drainage;
- the Z536 is in a poor condition, lacking drainage on some sections; and
- the D511 is in a fair condition, although the riding quality is poor.

Level of service and degree of saturation

Level of service (LOS) is defined according the criteria as outlined in Table 30 for un-signalled intersections and Table 31 for signalled intersections.

**TABLE 30: LEVEL OF SERVICE CRITERIA FOR UNSIGNALLED INTERSECTIONS**

| LOS | Average total delay | Performance |
|---|---|---|
| A | < 5 | Excellent |
| B | > 5 and < 10 | Very Good |
| C | >10 and < 20 | Good |
| D | >20 and < 30 | Average |
| E | >30 and < 45 | Poor |
| F | >45 | Fail |

**TABLE 31: LEVEL OF SERVICE CRITERIA FOR SIGNALLED INTERSECTIONS**

| LOS | Average total delay | Performance |
|---|---|---|
| A | < 5 | Excellent |
| B | > 5 and < 15 | Very Good |
| C | > 15 and < 25 | Good |
| D | > 25 and < 40 | Average |
| E | > 40 and < 60 | Poor |
| F | > 60 | Fail |

The LOS for the various intersections for the year 2012 and the year 2022, without the proposed mining developments and with the existing PPM mine are outlined in Table 32 AND Table 33 respectively.

The capacity calculations for the traffic impact assessment were conducted for the years 2012 and 2022 respectively. The last mentioned time frame is in line with traffic engineering guidelines and practice and determined by the expected number of vehicle trips that could potentially be generated during any specific peak hour by a specific development.

**TABLE 32: LOS FOR VARIOUS INTERSECTIONS FOR THE YEAR 2012 BASELINE**

| Approach | Friday (AM) | | | Friday (PM) | | |
|---|---|---|---|---|---|---|
| | Delay | LOS | Degree of saturation | Delay | LOS | Degree of saturation |
| Point A: Intersection P54-1 and P50-1 | 7.1 | B | 0.014 | 7.3 | A | 0.033 |
| Point B: Intersection P50-1 and D531 | 4.5 | A | 0.013 | 4.2 | A | 0.020 |
| Point C: Intersection D531 and Z536 | 5.8 | A | 0.006 | 5.3 | A | 0.007 |
| Point D: Intersection P50-1 and PPM offices and plant access | 6.3 | A | 0.019 | 7.6 | B | 0.044 |
| Point E: Intersection P50-1 and PPM stockpile access | 0.8 | A | 0.017 | 0.9 | A | 0.013 |
| Point F: Intersection P50-1 and PPM operations access 1 | 6.3 | A | 0.033 | 4.7 | A | 0.021 |
| Point G: Intersection P50-1 and PPM operations access 2 | 1.3 | A | 0.021 | 1.5 | A | 0.022 |
| Point H: Intersection P50-1 and Rooderand mine access | 0.7 | A | 0.021 | 0.7 | A | 0.021 |
| Point I: Intersection P50-1 and Z536 | 0.7 | A | 0.024 | 1.0 | A | 0.019 |
| Point J: Intersection D531 and Z536 | 2.9 | A | 0.028 | 2.7 | A | 0.029 |
| Point K: Intersection P50-1 and D511 | 0.9 | A | 0.033 | 1.2 | A | 0.033 |

Reference points as indicated in Figure 16

**TABLE 33: LOS FOR VARIOUS INTERSECTIONS FOR THE YEAR 2022 BASELINE**

| Approach | Friday (AM) | | | Friday (PM) | | |
|---|---|---|---|---|---|---|
| | Delay | LOS | Degree of saturation | Delay | LOS | Degree of saturation |
| Point A: Intersection P54-1 and P50-1 | 6.7 | A | 0.015 | 6.3 | A | 0.035 |
| Point B: Intersection P50-1 and D531 | 4.6 | A | 0.016 | 4.5 | A | 0.020 |
| Point C: Intersection D531 and Z536 | 5.9 | A | 0.008 | 5.4 | A | 0.009 |
| Point D: Intersection P50-1 and PPM offices and plant access | 6.2 | A | 0.019 | 7.4 | B | 0.044 |
| Point E: Intersection P50-1 and PPM stockpile access | 0.7 | A | 0.017 | 0.8 | A | 0.014 |
| Point F: Intersection P50-1 and PPM operations access 1 | 6.2 | A | 0.033 | 4.5 | A | 0.021 |
| Point G: Intersection P50-1 and PPM operations access 2 | 1.3 | A | 0.021 | 1.5 | A | 0.023 |
| Point H: Intersection P50-1 and Rooderand mine access | 3.6 | A | 0.027 | 0.6 | A | 0.022 |
| Point I: Intersection P50-1 and Z536 | 0.8 | A | 0.024 | 1.1 | A | 0.020 |
| Point J: Intersection D531 and Z536 | 3.1 | A | 0.032 | 2.8 | A | 0.033 |
| Point K: Intersection P50-1 and D511 | 0.9 | A | 0.039 | 1.2 | A | 0.037 |

Reference points as indicated in Figure 16

**Conclusion**

The growth in the traffic baseline from 2012 to 2022, which includes the current operational PPM, will not impact on the LOS and carrying capacity of the existing road network in the vicinity of the mining projects in the area.

### 1.3.3 SOCIO-ECONOMIC ENVIRONMENT/PROFILE

Information in this section was sourced from specialist socio-economic report (MTS, 2012) that was undertaken for the proposed project and included in Appendix O.

**Introduction and link to anticipated impact**

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

The negative impacts can be both social and economic in nature. In this regard, mining operations can cause:

- an influx of people seeking job opportunities which can lead to increased pressure on basic infrastructure and services (housing, health, sanitation and education), informal settlement development, increased crime, introduction of diseases and disruption to the existing social structures within established communities;
- a change to not only pre-existing land uses, but also the associated social structure and meaning associated with these land uses and way of life. This is particularly relevant in the closure phase when the economic support provided by mines ends, the natural resources that were available to the pre-mining society are reduced, and the social structure that has been transformed to deal with the threats and opportunities associated with mining finds it difficult to readapt; and
- relocation and evacuation of all or parts of communities where the impacts associated with mines are deemed to be highly significant. While the intension of these relocation exercises is often to mitigate environmental impacts, the relocation can itself present a separate range of social, economic and environmental impacts.

**Data collection**

Data was collected through review of available databases and field observations.

**Results**

Provincial level – North West Province

*Population*

The North West Province has a population of approximately 3.1 million residents, with an average household size of 3.0.

*Education*

According to the 2011 Census (Statistics SA, 2011) it was recorded that 34.1% of the adult population had no or limited primary education and 16% had completed matric. Furthermore, only 4.7% of the adult population in the province had completed tertiary education

*Economy*

Provincially it was estimated that, in 2001, the most dominant sector contributing to the North West Province's economy was the mining industry. The sectors with the smallest contributions to the province's employment were utilities and the transportation industry.

*Unemployment and household income*

It was estimated that the employment rate of the North West Province in 2007 was 33.8% while the unemployment rate was 24%.

In 2001, approximately 68% of the provincial population received no form of income. Twenty two percent received between R1 – R1 600 per month, while 8% received between R1 601 – R6 400 per month. Less than 2% received more than R6 401 per month.

*Housing and basic services*

In 2011, within the North West Province, it was estimated that 7% of the population reside in informal dwellings (including informal settlements and backyards), 69% reside in brick dwellings (on a separate stand), and 1% reside in traditional dwellings.

The majority of the population's households have access to piped water, with 15% having to collect water from further than 200m. Approximately 46% of households with toilet facilities utilise pit or bucket latrines. Five percent have no toilet facilities. The dominant energy source that households use for cooking and heating is electricity, followed by paraffin and wood. Refuse removal services are provided to approximately 50% of households, while 42% utilise their own refuse dumps and a small percentage of the population (an estimated 6%) does not have any refuse disposal facilities.

*HIV Status (Provincial)*

The South African National Burden of Disease Study 2000 found that the primary single cause of death in the North West Province was HIV/AIDS. This study also found that the largest proportion of premature mortality in the province was due to HIV/AIDS, indicating a 39.6% of the total years of life lost. The HIV/AIDS prevalence is estimated at approximately 12.5% of the North West Province population. In 2010, approximately 1% (one percent) of the entire province's residents died of AIDS related illness.

Local level – Bojanala District Municipality

*Population*

The population residing within the Bojanala Platinum District Municipality (BPDM) constitutes 1.2million, approximately 39 % of the total population of the North West province. The average household size in BPDM is estimated to be a household size of four.

*Housing*

It is estimated that 29.5% of the BPDM homes are informal dwellings. Approximately 61.6% of the population reside in brick dwellings on a separate stand. A total of 0.8% reside in traditional dwellings.

*Basic Services*

The majority of the population's households have access to piped water, with 74.4% having access. Approximately 37.2% of households have sanitation facilities which utilises flush toilets with a sewage system or septic tank. 4.3% has no access to any toilet facilities. In terms of households' dominant energy source, approximately 77%, 66.4% and 84.2% use electricity as the primary means for cooking, heating and lighting respectively. Other sources for heating and cooking include gas, paraffin, wood and coal. Refuse removal services are provided by a local municipality to 50.9% of households, with a small percentage of the population (an estimated 6.8%) not having any refuse disposal facilities.

*Education*

A significant 28% of the population on average were recorded as having no or limited primary education. A mere 19.2% of the residents across the BPDM were recorded as having completed Grade 12 while an average of only 4.8% have a higher qualification.

*Employment*

It was estimated that the employment rate of the North West Province in 2007 was 36.6% and the unemployment figure 25.3%.

*Economic activity*

According to 2007 statistics, 48.3% of households in the BPDM received no income, with 30.1% of households receiving an income of less than R1600 per month. The most dominant employment sector contributing to the BPDM economy was the mining industry, with employing 28%% of the population.

*HIV Status*

It is difficult to find reliable statistics for HIV/AIDS infection and prevalence rates by district or town, but according to the District Health Barometer (2005/06), the BPDM has the third highest HIV/AIDS prevalence rate in South Africa. The HIV/AIDS prevealence rate among antenatal clinic attendees in 2010 was 29.3%, which was just below the provincial rate of 29.6%.

Local level – Moses Kotane Local Municipality (MKLM)

*Population*

The MKLM has a population of approximately 240 000 residents, with an average household size of 4.0.

*Education*

In Census 2011, it was recorded that 33% of the adult population had no or limited primary education and 19% had completed matric. Furthermore, only 3% of the adult population had completed tertiary education.

*Economy*

In 2001 it was estimated that the most dominant sectors contributing to the local level economy was the mining industry, followed by community services and wholesale/retail trade. The sectors with the smallest contributions to the MKLM's employment were utilities and agriculture.

*Unemployment and household income*

In 2007, it was estimated that the unemployment rate of the MKLM was 26%.

In 2001, approximately 73% of the MKLM's population received no form of income. Nineteen percent received between R1 – R1 600 per month, while 6% received between R1 601 – R6 400 per month. Less than 1% received more than R6 401 per month.

*Housing and services*

In 2011, within the MKLM, it was estimated that 11% of the population reside in informal dwellings (including informal settlements and backyards), 74% reside in brick dwellings (on a separate stand), and 1% reside in traditional dwellings.

The majority of the population's households do not have access to piped water, with almost half having to collect water from further than 200m. Approximately 81% of households with toilet facilities utilise pit or bucket latrines. Three percent have no toilet facilities. The dominant energy source that households use for cooking and heating is electricity, followed by wood and paraffin. Twelve percent of households utilise their own refuse dumps while most (82%) of the population receive refuse removal services and 3% do not have any refuse disposal facilities.

Local level – Communities surrounding the proposed project area

Information was available for the following villages surrounding the project area: Legkraal, Lesetlheng, Magalane, Magong, Motlhabe, Ngweding, Moruleng, Mononono and Sefikile. This information is therefore considered to be representative of the area.

*Population*

In 2001 the population of the communities surrounding the proposed project area was approximately 35 000 residents, with an average household size of 3.6. The population details for relevant communities surrounding the project area are provided in Table 34 below.

**TABLE 34: POPULATION OF COMMUNITIES IN THE REGION**

| Community | Total number of people | Total number of households |
|---|---|---|
| Legkraal | 1284 | 384 |
| Lesetlheng | 2704 | 692 |
| Magalane | 236 | 72 |
| Magong | 1928 | 550 |
| Motlhabe | 2538 | 667 |
| Ngweding | 443 | 150 |
| Moruleng | 19570 | 5036 |
| Mononono | 1975 | 517 |
| Sefikile | 3914 | 1113 |

*Education*

It was recorded that 40% of the adult population had no or limited primary education and 19% had completed matric. Furthermore, only 5% of the adult population had completed tertiary education.

*Economy*

In 2001 it was estimated that the most dominant sector contributing to the community level economy was the mining industry, followed by community services and wholesale/retail trade. The sectors with the smallest contributions to the local employment levels were utilities and agriculture.

*Unemployment and household income*

In 2007, it was estimated that the unemployment rate of the local communities was approximately 30%.

In 2001, approximately 72% of the local population received no form of income. Twenty percent received between R1 – R1 600 per month, while 6% received between R1 601 – R6 400 per month. Less than 0.2% received more than R6 401 per month.

*Housing and services*

In 2001, within the local community level, it was estimated that 8% of the population reside in informal dwellings (including informal settlements and backyards), 86% reside in brick dwellings (on a separate stand), and 4% reside in traditional dwellings.

The majority of the population's households (49%) have to collect water from further than 200m, while approximately 30% have access to piped water. Approximately half the households utilise pit or bucket latrines. Eight percent have no toilet facilities. The dominant energy source that households use for cooking and heating is electricity, followed by wood and paraffin. Nearly all households (96%) utilise their own refuse dumps, while a small percentage (0.2%) are provided with refuse removal services and 3% have no refuse disposal facilities.

**Conclusion**

When considering socio-economic impacts, the existing situation indicates that there is potential for inward migration of people with resultant pressure on basic infrastructure and services (health, education, sanitation, water etc.), informal settlement development, increased crime, introduction of disease and disruption to existing social structures within established communities.

### 1.3.4 CULTURAL ASPECTS

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

### 1.3.5 HERITAGE, CULTURAL AND PALEONTOLOGICAL RESOURCES

Information in this section was sourced from the specialist cultural-heritage study included in Appendix L (Pistorius, 2010) and specialist palaeontological study (BPI for Palaeontological Research, 2011), included in Appendix M.

**Introduction and link to impacts**

Mining operations have the potential to impact heritage, cultural and paleontological resources through the placement of infrastructure and through the related construction and operational activities. To understand the basis of these potential impacts, a situational analysis is described below.

**Data collection**

Data collection for the heritage surveys was done by an accredited specialist through review of available databases, published reports and maps, consulting with relevant spokesperson and site specific field work.

Data collection for the Palaeontological survey was done by an accredited specialist through a review of geological information and relevant palaeontological research.

**Results: Heritage and cultural resources**

Heritage resources include sites of archaeological, cultural or historical importance. The heritage resources that were observed across the farm Magazynskraal 3JQ are concentrated in the southern part of the proposed project area and include:

- remains which are associated with the Late Iron Age, Historical Period or the recent past; and
- heaps of stone with no archaeological (contextual) evidence.

According to the specialist, these remains are limited and are not rich archaeological deposits but merely represent surface finds consisting of scatters of potsherds; stones with abraded surfaces which were used for specific activities (e.g. polishing hut floors); lower grinding stones, and a limited number of upper grinding stones. These remains are associated with the Late Iron Age (AD1600 to AD1880), Historical Period (older than sixty years) and the recent past.

Heritage resources identified in the proposed project area are summarised in Table 35 and illustrated in Figure 17. None of these heritage resources will be disturbed by the proposed project footprint. In addition, no grave sites were identified within the proposed project area.

**TABLE 35: HERITAGE RESOURCES IDENTIFIED IN THE PROPOSED PROJECT AREA**

| NO ON MAP | Description | REMARKS | SIGNIFICANCE |
|---|---|---|---|
| *Upright stones (LIA site)* | | | |
| LIA01 | Upright stones (hut) | Dwelling | Medium to high |
| LIA02 | Hut foundation | Dwelling | |
| LIA03 | Hut foundation | Dwelling | |
| LIA04 | Line with upright stones | Possible dwelling | |
| LIA05 | Circular stone heap (collapsed hut) | Possible dwelling | |
| LIA06 | Hut foundation | Dwelling | |
| LIA07 | Hut foundation | Dwelling | |
| LIA08 | Circular stone heap | Possible dwelling | |
| LIA09 | Haphazard arrangement of stones | - | |
| LIA10 | Line with stones | Possible veranda associated with dwelling | |
| LIA11 | Line with stones | Possible veranda associated with dwelling | |
| LIA12 | Circular stone heap (collapsed hut) | Dwelling | |
| LIA13 | Hut | Dwelling | |
| LIA14 | Hut | Dwelling | |
| LIA15 | Hut | Dwelling | |
| LIA16 | Hut with lower grinding stone | Dwelling | |
| *Scatter of potsherds and other remains (IA site)* | | | |
| IA01 | Scatter of potsherds | Scatter of potsherds | Low |
| IA02 | Random occurring stones | Random occurring stones | |
| IA03 | Random occurring stones | Random occurring stones | |
| IA04 | Clay wall and pile of stones | Possible disintegrated dwelling | |
| IA05 | Pile of stones | Dwelling under construction | |
| IA06 | Pile of stones | Dwelling under construction | |
| IA07 | Pile of stones | Dwelling under construction | |
| IA08 | Circular stone pile | Unknown | |
| IA09 | Haphazard scattered stones and lower grinding stone | Demolished dwelling | |
| IA10 | Scatter of potsherds | Scatter of potsherds | |
| IA11 | Scatter of potsherds | Scatter of potsherds | |

| NO ON MAP | Description | REMARKS | SIGNIFICANCE |
|---|---|---|---|
| IA12 | Scatter of potsherds | Scatter of potsherds | |
| IA13 | Scatter of potsherds | Scatter of potsherds | |
| *Heaps of stones* | | | |
| 14 | Heap of stones | Possible homestead | Low |
| 15 | Heap of stones | Possible homestead | |
| 16 | Heap of stones | Possible homestead | |
| 17 | Heap of stones | Possible homestead | |
| 18 | Heap of stones | Possible homestead | |

**Results: Palaeontological resources**

The proposed project area is underlain by igneous rocks of the Rustenberg Layered Suite of the Bushveld Igneous Complex. The BIC is an intrusive igneous body comprising a series of ultramafic-mafic layers and a suite of associated granitoid rocks. As these rocks are Precambrian in age and are of igneous origin, the specialist is of the opinion that it is highly unlikely that fossils will be affected by the proposed project.

**Conclusion**

Although no heritage, cultural and paleontological resources will be disturbed by the proposed project footprint; these resources are important to the history of South Africa and are protected by national legislation. Any chance finds at the proposed project sites will require a permit from the South African Heritage Resources Agency (SAHRA) if these sites were to be altered.

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

Maps showing 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 are included in the baseline description. These include:

- conceptual geological map (Figure 3);
- geological structure (Figure 4);
- day-time, night-time and seasonal wind roses (Figure 5 and Figure 6);
- soil types in the proposed project area (Figure 7);
- land capabilities in the proposed project area (Figure 8);
- regional vegetation types (Figure 9);
- vegetation based habitat zones (Figure 10);
- areas of conservation concern from a biodiversity perspective (Figure 11);
- hydrological catchments (Figure 12);
- flood lines and relevant subcatchments in the proposed project area (Figure 13);
- noise monitoring locations (Figure 14);
- property boundaries (Figure 15); and
- heritage (and cultural) resources (Figure 17).

## 1.5 SUPPORTING DOCUMENTS

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

- soil and land capability assessment (Appendix E);
- biodiversity assessment (Appendix F);
- hydrological assessment and stormwater management plan (Appendix G);
- groundwater study (Appendix H);
- air study (Appendix I);
- noise study (Appendix J);
- visual study (Appendix K);
- heritage-cultural study (Appendix L);
- palaeontology study (Appendix M);
- traffic study (Appendix N);
- engineering design report (Appendix O);
- economic study; (Appendix P);
- climatic water balance report (Appendix Q); and
- closure cost calculation (Appendix R).

**FIGURE 3: CONCEPTUAL GEOLOGICAL STRUCTURE**

**FIGURE 4: GEOLOGICAL STRUCTURE**

**FIGURE 5: PERIOD, DAY-TIME AND NIGHT-TIME WIND ROSES**

**FIGURE 6: SEASONAL WIND ROSES**

**FIGURE 7: SOIL TYPES IN THE PROPOSED PROJECT AREA**

**FIGURE 8: LAND CAPABILITIES IN THE PROPOSED PROJECT AREA**

**FIGURE 9: REGIONAL VEGETATION TYPES**

**FIGURE 10: VEGETATION-BASED HABITAT ZONES IN THE PROPOSED PROJECT AREA**

**FIGURE 11: AREAS OF CONSERVATION SIGNIFICANCE**

**FIGURE 12: HYDROLOGICAL CATCHMENTS**

**FIGURE 13: FLOOD LINES AND RELEVANT SUBCATCHMENTS IN THE PROPOSED PROJECT AREA**

**FIGURE 14: NOISE MONITORING LOCATIONS**

**FIGURE 15: PROPERTY BOUNDARIES IN THE VICINITY OF THE PROPOSED PROJECT AREA**

**FIGURE 16: EXISTING ROAD NETWORK**

**FIGURE 17: HERITAGE (AND CULTURAL) RESOURCES**

# 2 MINING OPERATION

The main aim of the proposed project is to establish an underground platinum mining operation as well as related surface infrastructure to support the mining operation and the processing of minerals.

## 2.1 MINERAL TO BE MINED

Richtrau currently holds two prospecting rights on the farm Magazynskraal 3 JQ. Richtrau have submitted a mining right application for these prospecting rights and the minerals included therein. Details of the prospecting rights are as follows:

- NW30/5/1/1/2/1680PR: gold, silver, nickel, copper, cobalt and chrome; and
- NW30/5/1/1/2/1334PRC: platinum, palladium, iridium, ruthenium, rhodium and osmium.

## 2.2 MINING METHOD TO BE EMPLOYED

This section should be read with reference to the site layout drawings (Figure 19, Figure 20 and Figure 21).

### 2.2.1 UNDERGROUND MINING

Mining will be underground and access to the mine workings will be via two vertical shaft complexes that will have associated decline clusters.

The UG2 and Merensky Reef / Upper Pseudo Value Zone (MR/UPVZ) are the two reef horizons that will be mined as part of the proposed project. The UG2 and MR/UPVZ dip in a south-east direction on the farm Magazynskraal 3 JQ with an average dip in the region of 12-14° for both mineralised horizons. The average strike-length is approximately 4km. The vertical separation between the UG2 and MR/UPVZ reef horizons is approximately 18m.

A conventional stoping method will be used with breast mining in blocks 210m wide on strike and 252m on dip. Panels will be 21m long with in-stope pillars varying in size with depth from 4m by 4m at 100m below surface to 10m by 10m at 700m below surface. Hand held drills together with explosives will be used to break the rock. Load haul dump trucks will then move the ore from the panels to the central raise rock passes via the advance strike gullies. From there, trucks in the footwall will haul the rock to main level passes that feed the decline conveyor belt which in turn will transport the ore to a central vertical shaft where the ore will be hoisted to surface. Figure 18 provides a conceptual illustration of the mining method.

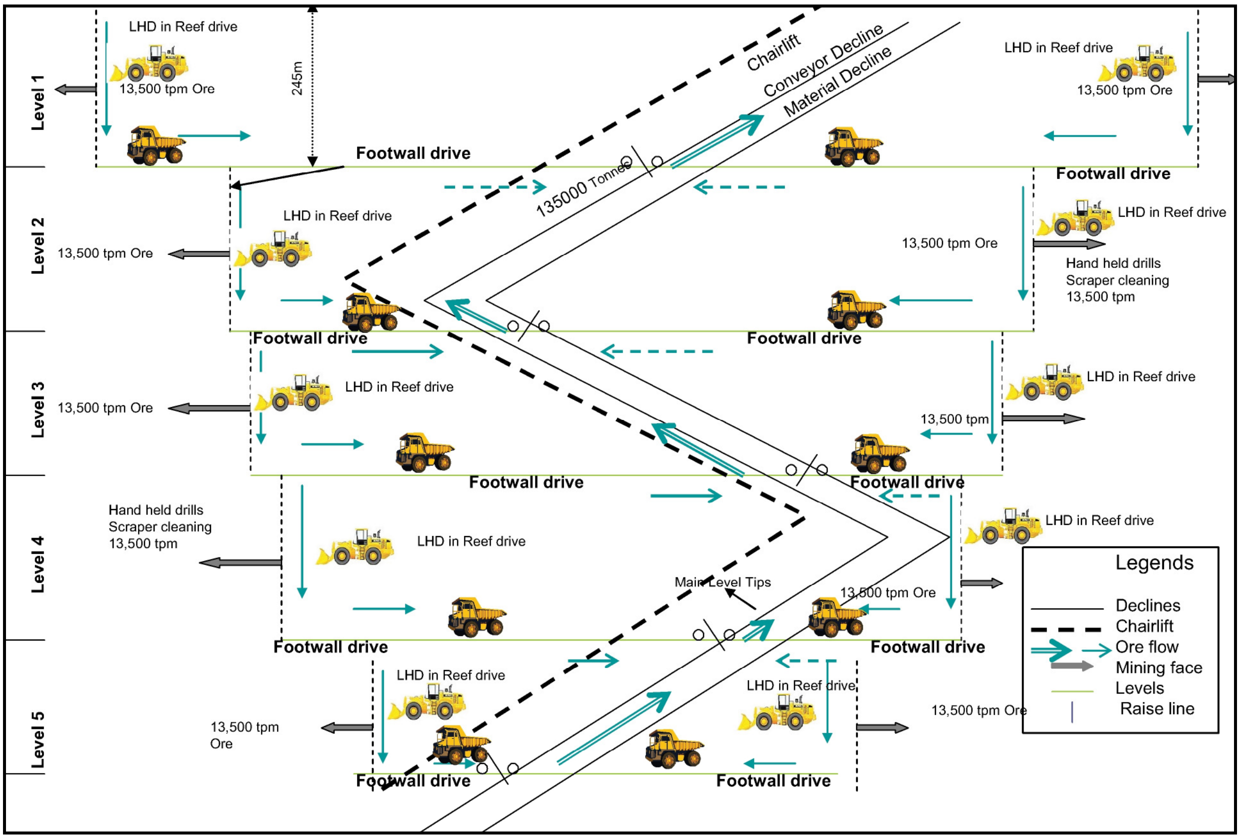


**FIGURE 18: CONCEPTUAL MINING FLOW CHART**

Mining of the MR/UPVZ will utilise the same stoping method as that of the UG2, but lagging by at least 210m, in order not to interfere with the UG2 mining. The MR/UPVZ mining will utilise the infrastructure of that already established for the UG2 mining.

The twin shaft system (main and ventilation shaft) will commence with a pre-sink of the main shaft and establish the sinking stage operations for the main sink. Once the main shaft, ventilation shaft and station development are completed the decline development will advance towards the upper as well as lower levels simultaneously. The decline cluster will then be developed from the shaft on an initial gradient of ±10° to an initial depth of 700m below surface and will be kept at a depth of 50m below the UG2 reef horizon.

It is planned that mining would commence from the main vertical shaft outwards. The northern shaft complex would be developed first. The southern shaft complex would be developed approximately 15 – 20 years after the project has commenced, provided the project received the relevant authorisations.

Information on the magnitude of the mining operation is presented in Table 36.

**TABLE 36: DATA THAT PROVIDES PERSPECTIVE ON THE MAGNITUDE OF THE PROPOSED OPERATIONS**

| Features | | Proposed Magazynskraal Platinum Mine |
|---|---|---|
| **Group** | **Specific** | |
| Underground mining | Depth | An initial depth of approximately 150m, extending to 700m |
| Mining and mineral processing | Target minerals | Platinum, palladium, iridium, ruthenium, rhodium, osmium, gold, silver, nickel, copper, cobalt and chrome |
| | Mineable area | Approximately 304 ha |
| | Resource estimation | Approximately 66 million tonnes |
| | Rate | Approximately 150 kilo tonnes reef per month and 25 kilo tonnes of waste |
| | Life of mine per shaft | Approximately 15 – 20 years per shaft |
| | Mine related surface area and associated surface infrastructure | Approximately 12ha for each shaft complex, 195ha for the tailings storage facility, 23ha for the waste rock dumps, 50ha for the processing plant, 7ha for the waste handling facility, 21ha for topsoil stockpiles, 2ha for the explosives magazine<br>The internal roads will be approximately 7km long and 12m wide, and the reef transport facility (conveyor, including servitudes) will be approximately 6km long and 30m wide. |
| | Blasting | Construction during the shaft sinking phase will typically require one blast per day. Operational blasting will be as required (approximately one per day) |
| Mine residues | Waste rock | Approximately 82 800 000$m^3$ in total |
| | Tailings | Approximately 145 000$m^3$ per month |
| Resource use | Water demand | 160 000$m^3$ per month |
| | Power demand | 31 MVA |
| Employment | Staff: construction | Approximately 2 500 temporary jobs (at peak construction) |
| | Staff: operational | Approximately 2 800 jobs (per shaft) |
| | Operating times | Continuous operations are expected once steady state mining is reached |

## 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 project are listed in Table 37 below. For the purposes of this report, in broad terms, construction is the phase in which the mine infrastructure is established, operational covers the production phase of the mine and plant, decommissioning is when production has ceased, infrastructure is being removed and the site rehabilitated in line with a closure plan 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.

**TABLE 37: LIST OF PROJECT ACTIONS / ACTIVITIES / PROCESSES**

| Main activity/process | Sub-activities | Construction | Operation | Decommissioning | Closure |
|---|---|---|---|---|---|
| **Site preparation** | Selective bush clearing in line with biodiversity management plan | On-going | Occasionally, if required | | |
| | Removal of existing structures such as fencing (if present). | On-going | | | |
| | Establishing the construction contractor's area | At start of phase | | | |
| **Geotechnical investigations** | Geotechnical drilling for the site preparations and shaft sinking and geochemical characterisation of material | On-going | | | |
| **Earthworks** Earthworks on site relate mainly to the moving of soil and rock. | Stripping and stockpiling of soil resources in line with soil management programme. | On-going | Occasionally, if required | | |
| | Establishment of borrow pits | On-going | Occasionally, if required | | |
| | Bulldozing activities | On-going | Occasionally, if required | | |
| | Establishing gravel roads | On-going | Occasionally, if required | | |
| | Digging trenches | On-going | For maintenance | | |
| | Foundation excavations and compaction | On-going | | | |
| | Establishing stormwater controls (channels, berms) as per stormwater management plan | At start of phase | Occasionally, if required | | |
| **Civil works** Civil works on site relate mainly to any steel and concrete work. | General building activities and erection of structures | On-going | For maintenance | | |
| | Use of scaffolding and cranes | On-going | For maintenance | | |
| | Concrete work including silos, culverts and plinths | On-going | For maintenance | | |
| | Steel work (including grinding and welding) | On-going | For maintenance | | |
| | Installation of cables/lines and pipelines | On-going | For maintenance | | |
| **Continuous resource estimation** | Surface diamond drilling | On-going | On-going | | |
| **Underground mining** | Initial establishment and sinking of shafts | On-going | For maintenance | | |
| | Drilling and blasting | On-going | On-going | | |
| | Loading and hauling | On-going | On-going | | |
| | Dewatering of the shafts and underground mine sections | On-going | As required | | |
| **Mineral processing** | ROM transported via conveyor to processing plant | | On-going | | |
| | Primary and secondary crushing and screening | | On-going | | |
| | DMS plant | | On-going | | |

| Main activity/process | Sub-activities | Construction | Operation | Decommissioning | Closure |
|---|---|---|---|---|---|
| | Milling | | On-going | | |
| | Floatation | | On-going | | |
| **Waste rock management** | Waste rock stored on dumps (on-site, on surface) | On-going | On-going | | |
| | Final disposal / rehabilitation of waste dumps (on-site, on surface) | | | Permanent | Permanent |
| **Tailings management** | Delivery of tailings from processing plant to the tailings storage facility via pipelines | | On-going | | |
| | Final disposal / rehabilitation of tailings storage facility (on-site, on surface) | | | Permanent | Permanent |
| **Power supply and use** **continue until infrastructure can be removed or alternative end use identified* | Delivery of power to site via Eskom power lines | On-going | On-going | On-going* | |
| | Back-up generators will be used for life threatening activities i.e. ventilation | As required | As required | | |
| | Temporary power will be used during the start-up phase | On-going | | | |
| **Water supply and use** **continue until infrastructure can be removed* | Delivery of clean water to site (water to be tanked in during construction, permanent supply from boreholes) | On-going | On-going | On-going* | |
| | Storage of clean water on site | On-going | On-going | On-going* | |
| **Stormwater management** **continue until infrastructure can be removed or successfully rehabilitated* | Diversion of clean water | On-going | On-going | On-going* | |
| | Collection of dirty water using channels, berms | On-going | On-going | On-going* | |
| | Storage of dirty water in dams for re-use | On-going | On-going | On-going* | |
| **Transport systems** **continue until infrastructure can be removed or alternative end use identified* | Construction, operation and maintenance of gravel roads | On-going | On-going | On-going | |
| | Transport of staff to and from site (using buses, taxi's and private cars) via surfaced and gravel roads | On-going | On-going | On-going | Limited |
| | Transport of supplies, services and waste removal (using trucks and vans) via surfaced and gravel roads | On-going | On-going | On-going | Limited |
| | Vehicles/machinery movement within the site boundary (via gravel roads) | On-going | On-going | On-going | Limited |
| | Pumping of materials (i.e. water, sewage, compressed air, UG slurry/mud) via pipelines | | On-going | On-going* | |
| | Taxi and bus on- and off- loading areas for employees | On-going | On-going | On-going* | |
| | Transport of ROM, soil and waste rock within site boundary via truck and conveyor and hoist | | On-going | On-going | |
| | Transport of product off-site via truck. | | On-going | | |
| **Non-mineralised** | Collection of general and hazardous waste on site | On-going | On-going | On-going | |

| Main activity/process | Sub-activities | Construction | Operation | Decommissioning | Closure |
|---|---|---|---|---|---|
| **(general and industrial hazardous) waste management** | Separation of oil and water at wash bays | On-going | On-going | On-going | |
| | Disposal and/or treatment of contaminated soils | On-going | On-going | On-going | |
| | Temporary storage of general and hazardous waste within dedicated demarcated containers/areas | On-going | On-going | On-going | |
| | Sorting of general and hazardous waste for re-use and/or recycling purposes | On-going | On-going | On-going | |
| | Removal of waste by contractor for recycling, re-use and/or final disposal at permitted waste disposal facilities | On-going | On-going | On-going | |
| | Use of portable sanitation and change houses | On-going | | On-going | |
| | Treatment of sewage at an on-site sewage treatment plant (153 300m$^3$ annual throughput capacity) | | On-going | | |
| | Re-use of treated sewage sludge in the rehabilitation of the TSF side walls. | | On-going | On-going | |
| **Site support services** **continue until infrastructure can be removed or alternative end use identified* | Operating office(s) | On-going | On-going | On-going* | |
| | Parking of vehicles | On-going | On-going | On-going* | |
| | Laboratory at plant | | On-going | | |
| | Change house | On-going | On-going | On-going | |
| | Medical facility | On-going | On-going | On-going | |
| | Security check points at all entrances | On-going | On-going | On-going | |
| | Fencing and lighting for security | On-going | On-going | On-going | |
| **Storage and maintenance services/ facilities** **continue until infrastructure can be removed or alternative end use identified* | Washing of machinery and vehicles (wash bays) | On-going | On-going | On-going* | |
| | Service machinery and vehicles (workshops) | On-going | On-going | On-going* | |
| | Storage (stores, tanks) and handling of non-process materials, consumables and hazardous substances including chemical additives for cement and explosives emulsion, paints, oil/lubricants, hydraulic fluid, diesel | On-going | On-going | | |
| **Housing** | No on site housing is planned | N/A | N/A | N/A | N/A |
| **Site management** | Appointment of contractors and workers | At start of phase and on-going | At start of phase and on-going | At start of phase | |
| | Site management (monitoring, inspections, maintenance of facilities, security, access control) | On-going | On-going | On-going | On-going |
| | Environmental awareness training and emergency response | On-going | On-going | On-going | |
| | On-going rehabilitation of facilities/disturbed areas (where possible) | On-going | On-going | On-going | |

| Main activity/process | Sub-activities | Construction | Operation | Decommissioning | Closure |
|---|---|---|---|---|---|
| | Implementing and maintaining management plans | On-going | On-going | On-going | |
| **Demolition** | Removing mining contractor's camp area (if not incorporated into plant footprint) | At end of phase | | | |
| | Dismantling and demolition of infrastructure and equipment. | | For maintenance | On-going | |
| | Removal of foundations and access roads (no longer needed) | | | On-going | |
| **Rehabilitation** | Rehabilitating construction borrow pits | At end of phase | | | |
| | Replacing soil resources | | As required | On-going | |
| | Slope stabilisation, erosion control and landscaping | On-going | On-going | On-going | On-going |
| | Sealing of shafts with engineered plugs | As required | As required | On-going | |
| | Re-vegetation of disturbed areas and where infrastructure was removed | Where possible | Where possible | On-going | For maintenance |
| | Removal of alien invasive species from rehabilitated sites | On-going | On-going | On-going | On-going |
| | Restoration of natural drainage patterns as far as practically possible | | | On-going | |
| | Rehabilitation of all mineralised waste facilities and other stockpiles (tailings, waste rock) | | On-going | 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 until rehabilitation measures are successful and a closure certificate is obtained |

## 2.4 PLAN SHOWING LOCATION AND EXTENT OF OPERATIONS

### 2.4.1 SITE LAYOUT PLANS

The location of the proposed surface infrastructure is illustrated in Figure 19. A zoomed-in plan of a typical shaft complex is provided in Figure 20, and a zoomed-in plan of the processing plant is provided in Figure 21.

### 2.4.2 SITE FACILITIES DURING THE CONSTRUCTION PHASE

The following facilities are expected to be established during the construction phase:

- contractor's camps;
- workshop/maintenance area for servicing and maintaining equipment and vehicles;
- lay-down area;
- temporary waste collection and storage area;
- wash bay for washing equipment and vehicles;
- store for storing and handling fuel, lubricants, solvents, paints and construction substances;
- parking area for cars and equipment;
- mobile site offices;
- canteen;
- portable ablution facilities;
- clean water reservoir;
- change houses;
- temporary and permanent power generating infrastructure;
- explosives magazine;
- soil and overburden/spoil stockpiles;
- water management infrastructure;
- explosive magazines;
- ventilation infrastructure including fans;
- portable air compressors for the sinking operations;
- settling ponds for the sinking operations;
- security and access control;
- haul roads;
- access roads;
- first aid clinic;
- refrigeration plant; and
- stormwater protection facilities.

These facilities would either be removed at the end of the construction phase or incorporated into the layout of the operational mine.

It should be noted that the site layout plan in Figure 19 does not show all of these construction infrastructure components in detail however, allowance has been made in the designated shaft areas.

### 2.4.3 SITE FACILITIES DURING THE OPERATIONAL PHASE

The following facilities are expected to be established during the operational phase:

- two Ø9m vertical shafts with decline clusters intended for personnel, material and rock hoisting to a depth of 700m. Each underground cluster comprises the following:
  - a conveyor decline 4m high and 5m wide;
  - a material or main access decline at 4m high and 6m wide;
  - a chairlift 3.5m high and 4m wide;
- upcast raise-bore-holes (RBH) with a diameter of Ø3.2m and an initial depth of 700m (shallow shaft) and equipped with 3 surface fans for each shaft complex;
- downcast RBH, with a diameter of Ø3.2m and an initial depth of 700m (shallow shaft) for each shaft complex;
- mineral processing plant;
- waste rock dumps;
- topsoil and ore stockpile/s;
- TSF;
- reef transport facility (conveyors);
- air compressors housed in a building;
- ore, fuel, chemical, material and explosive storage facilities;
- road access and internal roads;
- change houses;
- lamp rooms;
- a medical first aid facility;
- offices;
- shaft access and security offices;
- parking areas;
- fire detection and fire fighting facilities ;
- water storage facilities and surface water control measures: in compliance with R704;
- lighting and communication infrastructure;
- a central sewage treatment plant;
- waste handling and temporary storage station;
- waste incinerator for sorted domestic waste, excluding metal, plastic and glass;
- a complete reticulation system for all services, including:
  - incoming water supply from water board mains (internal diameter of the pipe will be 500mm);
  - compressed air connection into a main compressed air circuit;

- tailings pipelines between the plant and the TSF (internal diameter of the pipe will be 300mm);
- sewage reticulation system;
- overhead 11 and 33kV electrical power lines;
- on-site 11kV substation (at each shaft complex); and
- access roads.

It should be noted that the site layout plan in Figure 19 shows only the main infrastructure components. More detail is associated with the zoomed in figures for the plant and shafts (Figure 20 and Figure 21).

**FIGURE 19: OVERALL INFRASTRUCTURE LAYOUT**

**FIGURE 20: ZOOMED-IN PLAN OF THE PROPOSED SHAFT COMPLEX**

**FIGURE 21: ZOOMED-IN PLAN OF THE PROCESSING PLANT**

**FIGURE 22: STORMWATER MANAGEMENT PLAN**

## 2.5 LISTED ACTIVITIES IN TERMS OF EIA REGULATIONS (NEMA AND NEMWA)

The list of activities applied for under NEMA is included in Table 38. The list of waste-related activities that could be applied for at a later stage is presented in Table 39. The activities associated with NEMA and NEMWA have been incorporated into the list of project activities as presented in Table 37.

It must be noted that the NEMA activities detailed below have been applied for as part of this environmental process. The NEMWA activities detailed below are those that could be applied for at a later stage. The NEMWA activities have not been applied for as part of this environmental process. Richtrau will submit an application at the required time to the relevant decision-making authorities to cater for waste related activities.

**TABLE 38: RELEVANT NEMA LISTED ACTIVITIES**

| Activity Number | Listed Activity | Description of activity |
|---|---|---|
| | **Notice 544, 18 June 2010** | |
| 9 | The construction of facilities or infrastructure exceeding 1 000 metres in length for the bulk transportation of water, sewage or storm water –<br>(i) with an internal diameter of 0,36 metres or more; or<br>(ii) with a peak throughput of 120 litres per second or more,<br>excluding where:<br>(a) such facilities or infrastructure are for bulk transportation of water, sewage or storm water or storm water drainage inside a road reserve; or<br>(b) where such construction will occur within urban areas but further than 32 metres from a watercourse, measured from the edge of the watercourse. | Preliminary design information allows for pipelines longer than 1 000 metres that will be established on-site for the bulk transportation of water and sewage. The internal diameter of the pipelines will exceed 0.36 metres, and the peak throughput will exceed 120 litres per second. |
| 10 | The construction of facilities or infrastructure for the transmission and distribution of electricity –<br>(i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts; or<br>(ii) inside urban areas or industrial complexes with a capacity of 275 kilovolts or more. | Establishment of 33 kilovolt power lines within the project area for the transmission and distribution of electricity. |
| 11 | The construction of:<br>(i) canals<br>(ii)channels;<br>(iii) bridges;<br>(iv) dams;<br>(v) weirs;<br>(vi) bulk storm water outlet structures;<br>(vii) marinas;<br>(viii) jetties exceeding 50 square metres in size;<br>(ix) slipways exceeding 50 square metres in size; or | Bridges will be constructed over watercourses within the project area. |

| Activity Number | Listed Activity | Description of activity |
|---|---|---|
| | (x) buildings exceeding 50 square metres in size; or<br>(xi) infrastructure or structures covering 50 square metres or more;<br>where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line. | |
| 12 | The construction of facilities or infrastructure for the off-stream storage of water, including dams and reservoirs, with a combined capacity of 50 000 cubic metres or more, unless such storage falls within the ambit of activity 19 of Notice R.545 of 2010. | Stormwater dams will be established on-site that will exceed 50 000 cubic metres. A reservoir will be established on-site with a capacity of approximately 2 000 cubic metres. |
| 22 | The construction of a road, outside urban areas,<br>(i) with a reserve wider than 13,5 metres or,<br>(ii) where no reserve exists where the road is wider than 8 metres, or<br>(iii) for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Notice 545 of 2010. | Preliminary design information makes provision for the construction of internal haul roads of approximately 12 metres in width. |
| 37 | The expansion of facilities or infrastructure for the bulk transportation of water, sewage or storm water where:<br>(a) the facility or infrastructure is expanded by more than 1 000 metres in length; or<br>(b) where the throughput capacity of the facility or infrastructure will be increased by 10% or more-<br>excluding where such expansion:<br>(i) relates to transportation or water, sewage or storm water within a road reserve; or<br>(ii) where such expansion will occur within urban areas but further than 32 metres from a watercourse, measured from the edge of the watercourse. | Preliminary design information suggests that infrastructure on the neighbouring property (Sedibelo Platinum Mine) could be extended to transport water and/or sewage. |
| | **Notice 545, 18 June 2010** | |
| 3 | The construction of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of more than 500 cubic metres. | Preliminary design information indicates approximately 600m$^3$ of dangerous goods will be stored on site. |
| 5 | The construction of facilities or infrastructure for any process or activity which requires a permit or license in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent and which is not identified in Notice No. 544 of 2010 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 that Act will apply. | Various activities will require a Water Use License. At this stage, the anticipated water uses include:<br>• the establishment of a TSF and waste rock dumps;<br>• storage of dirty water;<br>• dewatering of underground mining areas; and<br>• watercourse crossings. |
| 15 | Physical alternation of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more; except where such physical alteration takes place for:<br>(i) linear development activities; or<br>(ii) agriculture or afforestation where activity 16 in this schedule will apply. | Preliminary design information indicates that the footprint of proposed surface infrastructure, including a tailings storage facility, waste rock dumps, processing plant area and shaft complexes, will be approximately 320 hectares. |

| Activity Number | Listed Activity | Description of activity |
|---|---|---|
| 16 | The physical alteration of virgin soil to agriculture, or afforestation for the purposes of commercial tree, timber or wood production of 100 hectares or more. | As part of the social and labour plan (SLP) that is required in terms of the Mineral and Petroleum Resources Development Act, 28 of 2002 (MPRDA), Richtrau is considering the possibility of developing the existing subsistence agricultural activities on the farm Magazynskraal 3 JQ into a more productive agricultural venture whereby the community could benefit economically. Initial planning allows for approximately 200 ha of land to be developed into a number of smaller plots that will be managed by individual members of the community. |
| 19 | The construction of a dam, where the highest part of the dam wall, as measured from the outside toe of the wall to the highest pat of the wall, is 5 metres or higher or where the high-water mark of the dam covers an area of 10 hectares of more. | Stormwater dams will be established where the highest part of the dam wall exceeds 5 metres. |
| | **Notice 546, 18 June 2010** | |
| 2 | The construction of reservoirs for bulk water supply with a capacity of more than 250 cubic metres (c) in the North West:<br>(i) a protected area identified in terms of NEMPAA, excluding conservancies<br>(ii) outside urban areas, in<br>(aa) National Protected Area Expansion Strategy Focus areas;<br>(bb) sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority<br>(cc) sites or areas identified in terms of an International Convention;<br>(dd) critical biodiversity areas (Type 1 only) as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;<br>(ee) core areas in biosphere reserves;<br>(ff) areas within 10km from national parks or world heritage sites or 5km from any other protected area identified in terms of NEMPAA or from the core of a biosphere reserve;<br>(iii) in urban areas<br>(aa) areas zoned for use as public open space;<br>(bb) areas designated for conservation use in Spatial Development Frameworks adopted by the competent authority, or zoned for a conservation purpose. | Preliminary design information allows for reservoirs with a capacity of 2 000 cubic metres to be established on site. The project site is located outside urban areas within 5km of the Pilanesberg Park. |
| 3 | The construction of masts or towers of any material or type used for telecommunication broadcasting or radio transmission purposes where the mast:<br>(a) is to be placed on a site not previously used for this purpose, and<br>(b) will exceed 15 metres in height, but excluding attachments to existing buildings and masts on rooftops.<br>(c) in the North West:<br>(i) outside urban areas, in | Preliminary design information allows for the establishment of a 30m telecommunications mast on site. The project site is located outside urban areas, within 5km of the Pilanesberg National Park |

| Activity Number | Listed Activity | Description of activity |
|---|---|---|
| | (aa) a protected area identified in terms of NEMPAA, excluding conservancies;<br>(bb) National Protected Area Expansion Strategy Focus areas;<br>(cc) sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;<br>(dd) sites or areas identified in terms of an International Convention;<br>(ee) Critical biodiversity areas (Type 1 only) as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;<br>(ff) core areas in biosphere reserves;<br>(gg) areas within 10km from national parks or world heritage sites or 5km from any other protected area identified in terms of NEMPAA or from the core of a biosphere reserve;<br>(ii) in urban areas, the following:<br>(aa) areas designated for conservation use in adopted Spatial Development Frameworks, or zoned for a conservation purpose. | |
| 4 | The construction of a road wider than 4 metres with a reserve less than 13,5 metres c) In North West:<br>(i) outside urban areas, in<br>(aa) a protected area identified in terms of NEMPAA, excluding conservancies;<br>(bb) National Protected Area Expansion Strategy Focus areas;<br>(cc) sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;<br>(dd) sites or areas identified in terms of an International Convention;<br>(ee) Critical biodiversity areas (terrestrial Type 1 and 2 and Aquatic Type 1) as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;<br>(ff) core areas in biosphere reserves;<br>(gg) areas within 10km from national parks or world heritage sites or 5km from any other protected area identified in terms of NEMPAA or from the core of a biosphere reserve;<br>(ii) in urban areas, the following:<br>(aa) areas zoned for use as public open space;<br>(bb) areas designated for conservation use in adopted Spatial Development Frameworks, or zoned for a conservation purpose;<br>(cc) natural heritage sites. | Internal haul roads will be established on the project site for mine related traffic. The project site is located outside urban areas, within 5km of the Pilanesberg National Park |
| 14 | The clearance of an area of 5 hectares or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation, except where suck removal of vegetation of require for:<br>1. purpose of agriculture or a forestation inside areas identified in spatial instruments adopted by the competent authority for agriculture or a forestation purposes;<br>2. the undertaking of a process or activity 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;<br>3. the undertaking of a linear activity falling below the threshold in Notice 544 of 2010;<br>a) In Eastern Cape , Free State, KwaZulu-Natal, Gauteng, Limpopo, Mpumalanga, Northern Cape, North-West and Western Cape: (i) all areas outside urban areas. | The project footprint will disturb in excess of 5 hectares of land where the vegetation could be classified as indigenous. The project site is located outside urban areas. |

**TABLE 39: RELEVANT NEMWA LISTED ACTIVITIES**

Note that current planning allows for all of the listed activities in the table below to take place in the waste handling and temporary storage facility illustrated in Figure 19.

| Activity Number | Listed Activity | Description of Activity |
|---|---|---|
| **GN No, R.718 of 3 July 2009, Category A** | | |
| Category A (1) | The storage, including the temporary storage, of general waste at a facility that has the capacity to store in excess of 100m³ of general waste at any one time, excluding the storage of waste in lagoons. | Richtrau proposes to construct a salvage facility as part of its mining and processing operations to sort and store waste from the operations prior to disposal. |
| Category A (4) | The storage of waste tyres in a storage area exceeding 500m². | Richtrau proposes to construct a salvage facility as part of its mining and processing operations to sort and store waste from the operations prior to disposal. The used rubber tyres will be stored and sorted at the proposed salvage facility. |
| Category A (5) | The sorting, shredding, grinding or bailing of general waste at a facility that has the capacity to process in excess of one ton of general waste per day. | Richtrau proposes to construct a salvage facility as part of its mining and processing operations to sort and store waste from the operations prior to disposal. The proposed salvage facility will have the capacity to process more than one ton of general waste per day. |
| Category A (7) | The recycling or re-use of general waste of more than 10 tons per month. | Richtrau proposes to construct a salvage facility as part of its mining and processing operations to sort and store waste from the operations prior to disposal. It is expected that a minimum of 10 tons of general waste will be recycled and/or re-used per month at the salvage facility. |
| Category A (8) | The recovery of waste including the refining, utilisation, or co-processing of the waste at a facility that has the capacity to process in excess of three tons of general waste or less than 500kg of hazardous waste per day, excluding recovery that takes place as an integral part of an internal manufacturing process within the same premises. | Richtrau proposes to construct a salvage facility as part of its mining and processing operations to sort and store waste from the operations prior to disposal. The hazardous waste will be transported to a permitted facility capable of handling the waste. |
| Category A (9) | The biological, physical or physico-chemical treatment of general waste at a facility that has the capacity to process in excess of 10 tons of general waste per day. | Richtrau proposes to construct a salvage facility as part of its mining and processing operations to sort and store waste from the operations prior to disposal. It is expected that this facility will have capacity to process more than 10 tons of general waste per day, and the biological, physical or physic-chemical treatment of waste containers may be required prior to disposal. |
| Category A (18) | The construction of facilities for activities listed in Category A of this Schedule (not in isolation to associated activity). | Richtrau proposes to construct a salvage facility as part of its mining and processing operations to sort and store waste from the operations prior to disposal. |
| **GN No, R.718 of 3 July 2009, Category B** | | |
| Category B (8) | The incineration of waste regardless of the capacity of such a facility. | Preliminary planning indicates that an incinerator might be required for sorted domestic waste, excluding metal, plastic and glass. |

| Activity Number | Listed Activity | Description of Activity |
|---|---|---|
| Category B(7) | The treatment of effluent, wastewater or sewage with an annual throughput capacity of 15 000 cubic metres or more. | Richtrau proposes to establish an on-site sewage treatment facility with an annual throughput capacity of approximately 153 300m$^3$. |
| Category B (11) | The construction of facilities for activities listed in Category B of this Schedule (not in isolation to associated activity). | Richtrau proposes to construct a salvage facility, sewage treatment plant and waste incinerator as part of its mining and processing operations. |

## 2.6 INDICATION OF PHASES AND TIMEFRAMES ASSOCIATED WITH THE 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 37 above.

## 2.7 ADDITIONAL INFORMATION

### 2.7.1 CONSTRUCTION PHASE

#### 2.7.1.1 Workforce and housing

It should be noted that there will be two construction phases, the first of which will be for the initial construction of the plant, northern shaft and associated facilities, and the second construction phase will take place approximately 12 years after the initial construction phase for the southern shaft and associated activities. As a maximum, approximately 2 500 temporary employment opportunities will be created during both construction phases. It is planned that the initial construction phase will last for approximately six years, while the second construction phase will last for a three year period.

The proposal for housing construction workers is to provide workers with a housing allowance. Richtrau is considering measures to ensure that the allowance is spent on accommodation that meets acceptable standards. A formal employment and housing policy will be developed for this issue.

#### 2.7.1.2 Transport systems

Internal gravel roads will be established from the plant to each shaft complex, ventilation shaft, and the TSF. Materials required for the construction phase will be brought to site via the existing road network that surroundings the proposed project (see Section 1.3.1). Access to the proposed project site will be off the D511 (Magong) gravel road.

Approximately 16 taxi's and 15 busses per day are expected to transport staff to and from the site during the construction phase, and approximately 4 trucks per day for transport of materials along the P54-1, R510, P50-1, D511 and site roads.

#### 2.7.1.3 Water supply and management

Water will be brought in by tankers until permanent water supply is established. Approximately 100m$^3$ will be required per day during the construction phase for drinking, dust suppression, and earthworks. It is proposed that water will be sourced from Magalies Water and will be supplied to third party service provider who will manage distribution of water to the proposed Magazynskraal Platinum Mine.

Richtrau plans to contain and re-use contaminated water generated at the shafts.

**Power supply**

Approximately 5MVA will be required during the construction phase. It is proposed that power will be supplied by Eskom from the Spitskop substation, located approximately 40km north of the Magazynskraal project site. A third party service provider will manage the distribution of power to the proposed Magazynskraal Platinum Mine via Sedibelo's existing substation on the eastern boundary of the farm Wilgespruit 2 JQ.

Power will be distributed throughout the proposed project area via 11 and 33kV lines.

#### 2.7.1.4 Waste management

##### *2.7.1.4.1 Sewage*

During the construction phase, mobile enclosed portable toilets will be placed at construction sites. The enclosed chemical toilets will be cleaned and serviced on a regular basis by a contractor. Sufficient toilets will be placed on site to cater for workers.

##### *2.7.1.4.2 Non-mineralised wastes*

The types of waste that could be generated during the construction phase include:

| **General waste** | **Hazardous waste** |
|---|---|
| Domestic waste | Batteries |
| Garden waste | Inorganic chemical waste (i.e. laboratory chemicals) |
| Food waste | Organic compounds and solvents (chemicals etc) |
| Building rubble | Waste oils |
| Paper | Uncontaminated PPE |
| Plastics | WEEE waste (i.e. electrical/electronic equipment) |
| Glass | Health care risk waste (clinic waste) |
| Metals | Sewage sludge |
| Rubber | Contaminated metals, plastic, rubber and wood |
| Wood | Explosive waste |

These wastes will be temporarily handled and stored on-site before being removed for recycling by suppliers, re-use by scrap dealers or disposed at a permitted waste disposal facility.

#### 2.7.1.5 Timing

The initial construction activities for the plant, northern shaft and associated infrastructure should take approximately 6 years. It is expected that construction activities would commence towards the end of 2014 / early 2015, depending on whether the project receives positive decisions from the relevant departments. Current planning allows for the second construction phase, for the southern shaft and associated facilities, to commence in 2030 for approximately 3 years.

### 2.7.2 OPERATIONAL PHASE

#### 2.7.2.1 Workforce and housing

Approximately 2 800 jobs will be created during the operational phase. The proposal for housing operational workers is to provide workers with a housing allowance. Richtrau is considering measures to ensure that the allowance is spent on accommodation that meets acceptable standards. A formal employment and housing policy will be developed for this issue.

#### 2.7.2.2 Transport systems

An outline of the transport mechanisms to be used for the project and an estimate of the number of trips are given in Table 40.

**TABLE 40: OPERATIONAL PHASE TRAFFIC: RAW MATERIALS, ORE, PRODUCT AND STAFF**

| Items to be transported | | Transport mechanism | Estimate of vehicle movements (arrivals and departures) per day – 6 days a week | Most likely route |
|---|---|---|---|---|
| Group | Specific | | | |
| Staff | Skilled, semi-skilled and unskilled | Private vehicles / taxis / private buses | 188 private vehicles, 25 taxis, 29 buses / day | From all directions. With a majority predicted to come from the western side of the project area. |
| Raw materials and domestic waste | Plant and shaft raw materials | 30-tonne trucks | 2 / day | From Rustenburg or Gauteng via the R510 or P54-1 |
| | Explosives | 30-tonne trucks | 2 / week | |
| | Diesel | Tanker | 2 / week | |
| | Spares truck | 30-tonne trucks | 1 / day | |
| | Other consumables | Trucks | 1 / day | |
| | Domestic and industrial waste collection | Trucks | 2 / week | |
| Within the mining operation | Run-of-mine ore | Reef transport facility (conveyor) | Established within the boundaries of the project area | Internal roads and conveyor system described in Section 2.7.2.3. |
| | Waste rock | Trucks and/or conveyor | | |
| | Tailings | Pipelines | | Internal pipelines established for the project. |
| | Process water | Pipelines | | |
| | Potable water | Pipelines | | |
| Product | Concentrate | 50-tonne trucks | 2 / day | To one of the local smelters to the north east of the site |

#### 2.7.2.3 Roads and access points

There is an existing network of roads in the project area as illustrated in Figure 1 and Figure 2. These include:

- the regional P54-1 (running adjacent to the western boundary of the Pilanesberg National Park);

- the regional tarred R510 road through Saulspoort (running adjacent to the eastern boundary of the Pilanesberg National Park); and
- a number of gravel roads including the D531, P50-1, Z536, and the D511.

Additional roads and access points required for the proposed project are detailed below.

Main access to the mine

The main access to the mine will be off the D511 (Magong) road. It is expected that the operation phase traffic would be from all directions – from the south along the P54-1 and P50-1, from the east and west along the P50-1, or from the north along the D511.

As part of PPM's proposed pit extension project, for which an EIA is currently underway, it is proposed that the P50-1 road either be diverted or closed. In this regard, a number of options are currently being considered. At the time that this report was compiled a final decision had not yet been made with regards to the options available for the road network in the area.

Internal roads and transport mechanisms

*Roads*

In addition to the existing gravel roads, additional sections of service roads will be constructed as follows (refer to Figure 19):

- gravel road from the D511 to the mineral processing plant and each of the shaft complexes. Service roads will be constructed to access:
    - the ventilation shafts;
    - WRDs;
    - TSF; and
    - the waste handling and temporary storage facility.

The service roads will be constructed of suitably sized and compacted waste rock.

*Reef transport facility*

A covered conveyor system will be established from each of the shafts to transport ROM ore to the processing plant. The conveyor will be 0.5m above ground and will have a width of approximately 1.5m. The location of the reef transport facility is illustrated in Figure 19. The conveyor system will have a servitude of approximately 14m on either side of the facility to act as a fire break, as well as accommodate service roads, power lines and pipelines.

Changes to current public road infrastructure

If the proposed Magazynskraal project is approved, it is recommended that the intersection at the P50-1 and D511 roads be upgraded. With reference to Figure 23, the following is proposed:

- south bound traffic along the D511 be stop controlled at the intersection with the P50-1 (as is the current practise);
- east and west bound traffic along the P50-1 will be free-flow (as is the current practise);
- a dedicated right turn lane be established on the P50-1 for west bound heavy vehicles turning right onto the D511; and
- a dedicated left turn lane be established on the P50-1 for east bound heavy vehicles turning left onto the D511.

### 2.7.3 WATER SUPPLY AND MANAGEMENT

Richtrau plans to contain and re-use contaminated water generated at the mine. In this regard, there is a high emphasis on the following water use protocol: prevent pollution, recycle/reuse of all process water, treat water where required, and no planned discharge. Recycled water will be insufficient to meet the needs of the project and therefore make-up water will be required.

Apart from rainfall and dewatering from the shafts, the monthly make-up requirements for the proposed project is approximately 160 000$m^3$ per month (see Section 2.7.6.2). Water will be sourced from Magalies Water and will be supplied to a third party service provider who will manage distribution of water to the proposed Magazynskraal Platinum Mine.

### 2.7.4 POWER SUPPLY

Approximately 31MVA would be required during the operational phase. Power will be supplied by Eskom from the Spitskop substation, located approximately 40 km north of the proposed project site. A third party service provider will manage the distribution of power to the proposed Magazynskraal Platinum Mine via the existing substation Sedibelo. From the Sedibelo substation, power will be distributed to an on-site 11kV substation at each shaft, and then distributed throughout the Magazynskraal operations via 11 and 33kV lines adjacent to existing and proposed roads.

### 2.7.5 WASTE MANAGEMENT

#### *2.7.5.1.1 Sewage*

It is proposed that an on-site sewage treatment facility be established with a capacity of approximately 420$m^3$/day. With reference to Section 2.5, Richtrau will submit an application at the required time to the relevant decision-making authorities for waste activities related to NEMWA.

*2.7.5.1.2 Non mineralised waste*

The types of waste that will be generated by the mine are described in Section 2.7.1.4.2 above. These wastes will be temporarily handled and stored on-site being removed for recycling by suppliers / contractors, re-use by scrap dealers or final disposal at permitted waste disposal facilities. Current planning allows for one central waste handling and temporary storage area facility be established on-site (see Figure 19). Each shaft complex will have a smaller collection point to cater for waste produced at the shaft. This waste will be transported to the central handling and temporary storage area on a regular basis. With reference to Section 2.5, Richtrau will submit an application at the required time to the relevant decision-making authorities for waste activities related to NEMWA.

*2.7.5.1.3 Mineralised waste*

Waste rock

Waste rock dumps (WRDs) will be required for the proposed project (refer to Figure 19). The amount of waste rock generated as a result of the proposed operation is provided in Section 2.2.1. Key information on the design principles associated with the WRDs is provided in Table 41, while further detail is included in Appendix Q.

**TABLE 41: DESIGN PARAMETERS OF THE WASTE ROCK DUMPS**

| Feature | Detail |
|---|---|
| Safety classification | Epoch is of the opinion that the WRDs are low hazard facilities |
| Physical dimensions | Total footprint for both WRDs will be 2.47ha<br>The height of both WRDs will be 25m |
| Waste rock transport and deposition | Waste rock from the underground mining operation will be loaded onto mine dump trucks and transported to the waste rock dump site |
| Surface water containment | A toe paddock wall and perimeter access roadway will be constructed to serve as the divide between runoff emanating from the waste dumps and the surrounding surface water environment. The toe paddock wall should be supplemented by the construction of toe paddock cross walls designed to retard the flow of water to the lowest point on the perimeter of the dump. These paddocks will be equipped also with a series of manholes connected to a buried pipe discharging to the pollution control dams. |
| Pollution control dams | Pollution control dams have been placed at the low points on the perimeter of the waste dumps to collect excess water decanting from the toe paddock collection system. The dams have been sized based on the footprint areas reporting to them for a range of rainfall events so as to ensure that they comply with the requirements for containment of excess surface water runoff. The dams all have spillways to allow for the release of excess water in extreme rainfall events. |
| Topsoil stripping | Topsoil in waste rock dump footprint area will be stripped and stockpiled in accordance with the topsoil conservation guide in close proximity to the final toe of the waste rock dump. A stripping depth of 500mm is recommended, however this will depend on the actual depth of topsoil, because enough material must remain available to serve as lining |
| Lining | Clearance of the site will be followed by the compaction of the in-situ clays underlying the waste dump footprint. The in-situ turf clays will be ripped to a depth of 500mm, moisture conditioned as necessary and re-compacted to 98% Modified Proctor density to create a low permeability foundation to the dump. A layer of waste rock or soil should be placed over the compacted footprint as soon as possible after compaction to reduce drying and cracking. The waste dump footprint will be developed in phases as required to accommodate the anticipated production of waste rock |
| Side slopes | The outer slopes of the facilities will have an overall slope no steeper than 1V:3H |

| Feature | Detail |
|---|---|
| Access and access control | Access to the perimeter of the WRDs will be via a roadway constructed to the crest of the toe paddock wall. Each WRD will be fenced. |
| Waste minimisation | Waste rock may be used for the construction of internal mine roads during the construction phase and for the maintenance of roads during the operational phase |
| Dust control | Operational Phase: Watering of roads for dust suppression and concurrent rehabilitation of WRDs to establish vegetative cover.<br>Post Operational Phase: No measures necessary due to the coarse particle size distribution and vegetative cover. |
| Rehabilitation, closure and aftercare | The rehabilitation and closure process will take place concurrently with the development of the dumps and will comprise:<br>• construction of cross walls to benches<br>• placement of topsoil to complete slopes and benches<br>• establishment of vegetation to topsoiled areas<br>• aftercare and maintenance of rehabilitated areas until vegetation is sufficiently established, self sustaining and effective in controlling erosion |

<u>DMS waste</u>

DMS waste, generated by the mineral processing plants, will be disposed on the waste rock dumps mentioned above. It is estimated that approximately 20 000 tonnes of DMS waste will be produced per month.

<u>Tailings storage facility (TSF)</u>

*Foundation conditions*

To date, no geotechnical survey has been undertaken on the farm Magazynskraal 3 JQ. Refer to Section 11.

*Physical characteristics*

The physical characteristics of the tailings products are described in terms of their particle specific gravity (PSG) and particle size distribution (PSD). These characteristics are significant in that they will influence the in-situ dry density of the placed tailings product as well as the behaviour of the material on deposition, and hence the method of deposition. The physical characteristics of the material are summarised as follows:

- the tailings are expected to comprise a mixture of UG2 (100ktpm) and Merensky (50ktpm) tailings with particle specific gravities of 3.2 and 3.6 respectively;
- at an average in-situ void ratio of 1.0 the tailings is expected to have a weighted average in-situ dry density of 1.73t/m$^3$;
- the tailings is expected to be very fine with 75 to 85% by mass passing the 75 micron screen. However this could increase to as much as 90% by mass passing the 75 micron screen; and
- geotechnical parameters for the tailings material have been estimated based on the results of grading and foundation indicator analyses and recent experience in the characterization of similar platinum tailings products.

*Geochemical characterisation*

The geochemical characteristics of the tailings are discussed in Section 1.1.1 and indicate that the tailings materials should not be acid generating.

*Operation and conceptual design of the TSF*

The conceptual design is included in Table 42 and illustrated conceptually in Figure 19. The relevant drawings are included in Appendix O.

**TABLE 42: DESIGN PARAMETERS OF THE TAILINGS STORAGE FACILITY**

| **Feature** | **Detail** |
|---|---|
| Physical dimensions | The footprint area is approximately 106.75ha |
| | The design capacity is 59.15Mt |
| | Final height will be approximately 42m |
| | The side slop gradient will be approximately 1 vertical:4 horizontal |
| Topsoil stripping | A layer of approximately 300mm of topsoil will be stripped from the site footprint and stockpiled for use in the rehabilitation process. The clay layers under the facility will be left in tact |
| Under drains and seepage collection | The control of seepage from the facility will be effected by means of:<br>• a blanket drain and seepage cut-off located around the inside perimeter of the TSF starter embankment in such a way as to prevent a build up in the phreatic surface agains the starter embankment. This drain will also serve to assist in the consolidation of tailings placed in the vicinity of the starter embankment<br>• a toe drain located around the inside toe of the starter embankment in order to reduce the risk of seepage through the wall and assist in preventing a build up in the phreatic surface agains the starter embankment<br>It is proposed that the drains decant to the solution trench. Seepage and excess runoff are intented to flow via the solution trench to the silt trap and lined return water dam located east of the facility |
| Walls and embankments | The starter embankment will be constructed of selected material that will be place, spread and compacted as specified by the contractor. Once the starter embankment crest elevtion is reached, conventional self rainsing operations will be utilised to increase the heigh of the TSF to the final crest elevation |
| Lining | After removal of the topsoil some of the remaining black turf in the basin of the tailings dam will be compacted to restore the in situ clay liner. This process will be repeated immediately in advance of the deposition of tailings to minimise the risk of desiccation cracking |
| Delivery and deposition | The slurry delivery system is expected to comprise a 250NB HDPE slurry delivery pipe to the perimeter of the containment walls with off takes at 200m centres. Depostion should take place either by open ending or using movable lengths of HDPE pipe with holes drilled at intervals to spread the deposition over a wider area as necessary |
| Rate of rise | Maximum rate of rise of 0.97m/year |
| Diversions and stormwater controls | The management of surface water associated with the facility requires the isolation of the site from its surrounding surface water environment. This will be achieved by the construction of:<br>• an elevated perimeter access road constructed of selected waste material. The roadway together with shallow diversion trenches to the western boundary of the TSF should ensure that runoff from the surrounding environment is diverted into the surrounding drainage systems<br>• the construction of an outer paddock wall and paddock cross walls around the perimeter of the TSF in order to capture and contain runoff from the outer slopes of the TSF walls<br>• the outer toe paddock walls will be supplemented by a series of toe paddock cross walls arranged so as to retard the flow of runoff along the toe of the TSF and prevent accumulations of water which may result in erosion damage or overtopping of the system<br>• a series of drain inlets will also be located in the toe paddocks into which accumulations of water in the toe paddocks will decant and flow via a solution trench to the silt trap and lined return water dam |

| Feature | Detail |
|---|---|
| Return water system and slurry pond decant | It is proposed that excess slurry water and storm water runoff be removed from the TSF by means of a 510 ND class 100D spigot socket reinforced concrete penstock pipeline that will decant directly into an energy dissipater. From there the slurry water will flow within the solution trench into the silt trap and then into lined return water dam and storm water control dam in the event of major storm events occurring on site. The excess water will then be pumped back to the plant for re-use<br>The various penstock intake structures would be accessed via a catwalk that will be extended as required and as each intermediate penstock intake becomes covered with tailings |
| Access and access control | Measures that are proposed in order to control access to the site and to ensure the safety of those that may inadvertently enter the area of the facility include:<br>• a 6 strand barbed wire fence to the perimeter of the TSF<br>• a 6 strand barbed wire fence to the perimeter of the silt trap, lined return water dam and storm water control dam<br>• Warning signage to the perimeter of the facility as a whole and also to the return water infrastructure located such that a warning sign is visible from anywhere along the fences<br>• access to the various penstock intake structures will be via the catwalk and catwalk platforms located at each penstock intake structure |
| Monitoring | Monitoring of the tailings dam will be undertaken as detailed in Section 21. |
| Dust control | Most of the dust is expected to be generated from the side slopes and perimeter crest of the tailings dam<br>The vegetated side slopes, and a perimeter berm along the crest of the tailings dam will significantly reduce dust emissions. Dust emissions from the basin of the tailings dam will be suppressed due to the relatively large area comprising either wet tailings (recently deposited) or the supernatant water pool<br>Vehicle traffic on and around the tailings dam during operation phase is minimal, however, on-going wetting of the roads will be carried out (especially during the dry season) to reduce dust emissions and speed limits should be less than 30km/hr. |
| Rehabilitation and closure | Rehabilitation of the TSF will take place concurrently with the operation of the dam. The focus of the rehabilitation and closure will be to establish sustainable landscape functionality. |

*Environmental classification*

In the unmanaged scenario there could be potentially significant impacts but with mitigation, as included in Section 19 of this report, all impacts can be mitigated to an acceptable level.

*Safety classification*

The safety classification of the proposed TSF was determined in accordance with the South African Code of Practice for Mine Residue Deposits (SABS 0286:1998) and the requirements of Mineral Regulation 527 of 23 April 2004. The summarised classification is included in Table 43 below.

**TABLE 43: TAILINGS STORAGE FACILITY - SAFETY CLASSIFICATION**

| Criteria No. | Criteria | | Comment | Safety Classification |
|---|---|---|---|---|
| 1 | No. of residents in Zone of Influence | 0 (Low hazard)<br>1 -10 (Medium hazard<br>>10 (High hazard) | The Lesobeng village is located immediately north east of the TSF site | High hazard |
| 2 | No. of workers in Zone of Influence | <10 (Low hazard)<br>11 – 100 (Medium hazard)<br>>100 (High hazard) | There are unlikely to be any worders in the vicinity of the facility, other than those directly involved in the construction | Low hazard |

| Criteria No. | Criteria | | Comment | Safety Classification |
|---|---|---|---|---|
| 3 | Value of 3rd party property in Zone of Influence | 0 – R2 Million (Low hazard) | The third party infrastructure immediately adjacent to the facility is the Lesobeng village | High hazard |
| | | R2 – R20 million (Medium hazard) | | |
| | | >R20 million (High hazard) | | |
| 4 | Depth to underground mine workings | >200 m (Low hazard) | No underground mining is planned in the vicinity of the facility | Low hazard |
| | | 50 m – 200 m (Medium hazard) | | |
| | | <50 m (High hazard) | | |

With reference to Table 43, the proposed TSF is considered to be a high hazard facility. In accordance with regulation 73 of the MPRDA Regulation 527 (April 2004), a risk analysis is required before project implementation if the project is approved.

### 2.7.6 MINERAL PROCESSING

The mineral processing operations at the proposed Magazynskraal Mine will comprise a silicate (MR/UPVZ reef) section and a UG2 section to cater for the different reefs being mined as well as a DMS section which can be used to optimise either the silicate or UG2 section. The location of the plant is illustrated in Figure 19.

The main purpose of the UG2 concentrator and the silicate plant will be to produce PGE concentrate. The PGE concentrate will be toll treated at one of the smelters/refineries in the North West or Limpopo Provinces. The UG2 and silicate plants will have design capacities of 100 000 and 50 000 tonnes run-of-mine (ROM) per month respectively, whereas the DMS plant will treat approximately 20 000 tonnes ROM per month. Wastes generated by the plants will include tailings (from both concentrators) and DMS waste (from the DMS unit). Tailings will be disposed of in a tailings facility while DMS waste will be disposed on the waste rock dumps. It is proposed to recover chromite from the secondary circuit of the UG2 concentrator using a chrome recovery process. The chromite will be sold by Richtrau.

A detailed description of the processing methods is provided below, while a conceptual diagram outlining the process is included in Figure 24.

<u>Storage of raw materials / chemicals</u>
A raw material off-loading area will be located in the plant area. The following reagents will be stored: two depressants (one at each of the silicate and UG2 plants), a collector, a frother and a flocculent. Other raw materials needed in the process include: medium, magnetic separator effluent.

The chemical off-loading, storage and process facilities will cater for containment in the form of bunding to 110% of the largest possible volume spill in the area with adequate sump and pump systems.

In addition materials will be stored on concrete floors in closed vessels or bags as follows:

- depressant powder – bulk bags;
- collector concentrate solution – storage tanks;
- liquid promoter – storage tank;
- liquid frother – storage tank;
- flocculent – storage tank;
- medium powder ferosilicon – bunded area; and
- magnetic separator liquid, DMS slurries – storage tanks.

Ore receiving

ROM ore will be transported from the shafts to the respective plants (silicate and UG2) by conveyor where it will be tipped into a bin. If tipping directly into the bin is not possible, the ore will be placed on an emergency stockpile adjacent to the bin and then loaded into the bin by a front end loader.

Primary crushing and screening

From the bin, ore will be screened and crushed to a desired size and then conveyed to a storage silo.

For the silicate circuit, the storage silo will be a coarse-ore silo which will feed the secondary crushing section. For the UG2 circuit, the storage silo will be the mill feed silo – no secondary crushing will be required.

Dust collection will be done using a wet scrubber system. The dust slurry will be pumped to a DMS thickener. The UG2 dust will be pumped to the UG2 plant.

Secondary crushing and screening (silicate plant only)

Coarse crushed ore will be screened and crushed to a desired size and then recycled back to the screen. Correctly sized material will be conveyed to a storage silo. Depending on the reef stream, the storage silo will either be the DMS silo or the mill feed silo.

Dust collection will be done using a wet scrubber system. The dust slurry will be pumped to the DMS thickener.

DMS plant

Material from both the UG2 or silicate plant can be processed through the DMS plant, depending on the mine's requirements. Material from the DMS silo will be screened using pulping and spray water. The fine material will pass through to the DMS thickener while the coarser material will be pumped to the DMS section.

*DMS section*

The coarser material will pass to a DMS mixing box, where ferrosilicon (mixed with water), will be added. The resulting slurry will pass into DMS cyclones where it will be separated into material that floats ("floats") and material that sinks ("sinks"). Both the DMS floats and DMS sinks (through two separate circuits) will first pass over drainage panels and rinse screens where the ferrosilicon will be drained back to a tank (circulating medium tank). The floats and sinks will then be washed with a magnetic separator effluent followed by clean water. The resulting water will drain to a second tank (dilute medium tank).

From the tanks, the medium will be pumped back to the medium box.

*DMS thickener*

Fine material, together with slurried dust from the silicate crushing circuit if applicable, will pass to the DMS thickener. The thickener underflow (slimes) will be pumped to the mill discharge sump in the primary milling section while the overflow (water) will be pumped to the process water section.

*DMS products*

The DMS crushed sinks and fine sinks will be discharged into the mill feed bin. The DMS floats will be temporarily stockpiled close to the ROM stockpile area and then trucked to the waste rock dumps.

<u>Milling</u>

Feed from the mill feed silo will be fed into a primary mill where it will be ground to form a dense slurry. For the silicate circuit, mill feed will comprise DMS products (crushed sinks, fine sinks) and silicate crushed ore that did not require DMS. For the UG2 circuit, mill feed will comprise crushed UG2 ore.

As the slurry exits the mill, it will pass over a screen and spray water will be added. The underflow will pass to the mill discharge sump. As indicated above, in the silicate circuit, the DMS thickener underflow (slimes) will also feed into the mill discharge sump. The overflow will pass via a trash removal screen to the primary rougher flotation feed tank. The trash will be dewatered using a sieve. The trash will be stored in a skip and then removed to either the waste handling and temporary storage facility or the waste rock dumps.

The primary milling area will be equipped with two spillage pumps.

<u>Reagent mixing</u>

A combined reagent plant will make up and distribute the various reagents around the plants. Where required, the reagent will either be made up or diluted in a tank using potable water and then stored in storage tanks.

Each make-up area and reagent storage area will be equipped with a dedicated spillage pump.

Flotation

In the flotation process, the minerals that the platinum group metals are associated with attach to bubbles of air and are therefore separated from the slurry of milled ore. The concentrate collected on the bubbles will be upgraded through a series of flotation steps.

Reagents will be added to the mill slurry. The flotation steps will include two rougher flotation steps and several cleaner flotation steps. After the rougher flotation steps, the slurry will be disposed of as tailings. The concentrate will be upgraded in the cleaner flotation steps.

The flotation circuit will be equipped with dedicated spillage pumps. The concentrate will be trucked away.

#### 2.7.6.1 Stormwater management plan

The aim of this stormwater management plan (SWMP) is to fulfil the requirements of Regulation 704, 4 June 1998 (hereafter referred to as R704), promulgated in terms of the National Water Act, 36 of 1998 (NWA) which deals with the separation of clean and dirty water. This SWMP and the associated conceptual designs were developed by SLR.

Clean and dirty areas have been delineated and will be separated by the construction of clean and dirty water diversion infrastructure, as well as dirty water containment facilities. Information on the conceptual design is summarised below. These designs will however be revised during the detailed design phase as required.

Clean water diversion

Clean water diversion channels / berms have been designed to divert clean water around dirty water generating areas (i.e. intercepting clean water runoff and diverting this water around mining activities). These diversions are required to be sized so as to not spill more than once in 50 years in terms of R704.

Dirty water containment

Dirty water containment systems have been designed to ensure dirty water generated on the site is contained. These systems will also contain a channel component. Lining of the dirty water diversions has been included to prevent seepage of any pollutants into the soil profile and subsequent percolation into groundwater. These systems are required to be sized so as not to spill more than once in 50 years in terms of R704.

Dirty areas will be reduced to a minimum to reduce the quantity of dirty water that has to be collected and handled in the process water circuit. In this regard, in all areas where there is storage/handling of hazardous substances (fuel, lubricants, chemicals), there will be containment of spillages on impermeable floors, bund walls, and collection sumps with traps that can contain 110% of the volume of the hazardous substances.

The conceptual SWMP is illustrated in Figure 22. Key features include:

- runoff from clean areas on the project site will be diverted around dirty areas and be allowed to flow into the natural environment;
- stormwater from dirty areas, including the TSF, WRD's, plant, waste handling and temporary storage facility will be conveyed to suitably sized containment dams; and
- stormwater from the topsoil stockpiles will be passed through a settlement dam to allow removal of suspended solids thereafter stormwater will be treated as clean and discharged to the natural environment if monitoring shows that this water does not contain any pollutants.

The dirty water containment dams and recommended volume requirements are as follows:

- plant area – 95 878$m^3$;
- topsoil stockpiles – 11 180$m^3$;
- TSF – 213 323$m^3$;
- waste handling and temporary storage facility – 13 513$m^3$;
- northern shaft and WRD area – 28 224$m^3$; and
- southern shaft and WRD area – 33 250$m^3$.

#### 2.7.6.2 Water balance

A water balance has been developed by AGES for the proposed project. The purpose of the water balance is to provide an initial overview of water use for the project and expected make-up water requirements. The environmental site water balance results for the proposed project are included in Table 44 and illustrated in Figure 25.

**TABLE 44: DATA SUMMARY OF THE PROPOSED PROJECT WATER BALANCE**

| Description | Component | Quantity |
|---|---|---|
| Summary | Mine make up water requirement ($m^3$/t milled) | 0.98 |
| | Mine make up water requirement ($m^3$/d) | 4,909 |
| | Water consumed in mining process ($m^3$/d) | 1 167 |
| | Water in product ($m^3$/d) | 0 |
| | Water consumption in process plant and tailings dam circuit ($m^3$/d) | 3 500 |
| | Waste rock from mining (% of production) | 5% |
| | Water balance error factor (%) | 10% |
| Mining | Mine production – run of mine (t/month) | 175 000 |
| | Mine production – ore (t/month) | 150 000 |
| | Mine production – waste (t/month) | 25 000 |
| | Mine make-up water use ($m^3$/t waste and ore) | 0.20 |
| | Mine make-up water use ($m^3$/d) | 1 167 |
| | Water in ore and waste rock | 15% |
| | Water in ore ($m^3$/d) | 750 |
| | Water in waste rock ($m^3$/d) | 125 |
| Plant | Process plant feed rate (t/month) | 150 000 |
| | Component of ore in plant feed (%) | 0 |
| | Process water consumption ($m^3$/t) | 0.1 |
| | Process water consumption ($m^3$/d) | 500 |
| | Water from ore mined as plant feed ($m^3$/d) | 750 |
| | Product feed (t/d) | 0 |
| | Waste tailings feed (t/d) | 5 000 |
| | Water in product out (%) | 0% |
| | Water in product out ($m^3$/d) | 0 |
| Tailings storage facility | Tailings post crush density (t/$m^3$) | 2.7 |
| | Slurry density (ton/$m^3$) | 1.57 |
| | Slurry water use (tontal water $m^3$/t) | 0.58 |
| | Water loss in tailings circuit (%) | 60 |
| | Evaporation (%) | 35 |
| | Interstitial water lock up (%) | 15 |
| | Seepage (%) | 10 |
| | Water in slurry from plant to tailings dam ($m^3$/d) | 5 000 |
| | Return water to plant ($m^3$/d) | 2 000 |
| | Tailings circuit water consumption ($m^3$/d) | 3 000 |
| | Tailings circuit water consumption ($m^3$/d) | 0.60 |
| | Stormwater on tailings ($m^3$/d) | 413 |
| Waste rock | Water in waste rock ($m^3$/d) | 125 |
| | Rainwater on waste rock from rain events ($m^3$/d) | 1 868 |
| Change house and offices | Number of people | 2 800 |
| | Water use (L/person/day) | 150 |
| | Mine potable / drinking water requirement (L/person/day) | 3 |
| | Change house potable water component (L/person/day) | 150 |
| | Total potable water use ($m^3$/d) | 427 |
| | Total drinking water use ($m^3$/d) | 7 |
| | Sewage water discharge – re-used in process circuit ($m^3$/d) | 384 |
| Other | Water used for dust suppression ($m^3$/d) | 200 |

**FIGURE 23: CONCEPTUAL INTERSECTION LAYOUT**

**FIGURE 24: CONCEPTUAL PROCESS FLOW DIAGRAM**

**FIGURE 25: WATER BALANCE**

#### 2.7.6.3 Agricultural initiative

As part of the social and labour plan (SLP), Richtrau propose to develop an agricultural initiative for community members on the farm Magazynskraal 3 JQ (see Figure 19). It is planned to develop an area of approximately 200ha to enable community members to grow crops for their own use and to sell the surplus produce. Richtrau will assist community members with some resources for the duration of the mining operation.

Discussions with the State (as the landowner), the BBKTA (as the traditional authority) and the community (as the land users) regarding who would be able to participate in this initiative, have yet to take place. The suggested crops to be considered for the agricultural initiative include sunflowers and mielies due to soil types present on site.

### 2.7.7 DECOMMISSIONING AND CLOSURE

Broadly speaking, the decommissioning phase will include the removal of infrastructure from site (except the TSF and WRDs which will be permanent features) and the final rehabilitation of areas where it is required. The broad closure objective is to rehabilitate the area to be economically and environmentally sustainable for the community and the proposed Heritage Park that will use the area in perpetuity. No final surface voids are anticipated as the shafts will be sealed with specifically engineered plugs. It is expected that the underground voids will fill with water once mining ceases presenting the potential for water harvesting of anthropogenic aquifers post closure.

As is required by the relevant mining legislation (Act, 28 of 2002 and Regulation 527), a detailed closure plan will be submitted to the DMR prior to decommissioning and closure. This process will also involve other regulatory authorities and IAPs in a similar fashion to the involvement of people during the EIA process. The detailed closure plan will determine specific closure strategies and action plans taking regulatory, environmental, social, economic and sustainable development principles into account. A critical commitment in this regard is that within the first three years of operation, the mine must establish numerical key performance indicators to measure achievement of the closure land use objectives. These indicators will drive on-going rehabilitation and end closure initiatives.

### 2.7.8 LIFE OF MINE

The planned life of mine for the proposed project is estimated at 30 years. However, it should be noted that this could be extended depending on commodity prices and available technology.

## 2.8 PROJECT ALTERNATIVES

### 2.8.1 STAND-ALONE VERSUS COMBINED MINING OPERATION

As presented in the Scoping Report for the proposed project (SLR, 2012), two key options were considered, namely a stand-alone mining operation and a combined mining operation with either the neighbouring Sedibelo Platinum Mine (Sedibelo) or the existing Pilanesberg Platinum Mine (PPM). Richtrau have taken the decision to establish a stand-alone mining operation.

### 2.8.2 POSITION OF INFRASTRUCTURE

Two alternative sites were considered for the TSF as illustrated in Figure 26. Table 45 shows the TSF selection matrix, including the parameters used to determine the site selection and the rating for each. The parameters considered for each site were given a score of one or two, one being the most preferable, and two being least preferable. The site with the lowest score overall was considered the most preferable. According to the site selection parameters and process followed, Site 2 is the preferred site.

**TABLE 45: SITE SELECTION MATRIX – TAILINGS STORAGE FACILITY**

| **Criteria** | **Site 1** | **Site 2** | **Discussion** |
|---|---|---|---|
| Ecology | 0 | 0 | No relative difference has been identified. |
| Archaeology | 0 | 0 | No relative difference has been identified. |
| Land capability/potential | 0 | 0 | No relative difference has been identified. |
| Groundwater regime and impacts on downstream users | 0 | 0 | Preliminary results show that no relative difference has been identified. |
| Proximity to significant surface water resources and the need for water management such as diversions | 2 | 1 | Site 1 will disturb the non-perennial tributary of the Bofule River. Specialist work indicates that this feature is not significant, if it exists at all, however it is indicated on the 1:50 000 topographical map. |
| Visual impact – related to proximity to proposed Heritage Park and public vantage points | 0 | 0 | No relative difference has been identified. |
| Proximity to residential areas from a dust and noise perspective | 0 | 0 | No relative difference has been identified. Each site is situated less than 1km from existing residential areas (Lesobeng community). |
| Public safety issues/failure zone | 0 | 0 | No relative difference has been identified. |
| Sterilisation of third party minerals | 2 | 1 | From drilling that has taken place, and from Richtrau's understanding of the geology in the area, Site 1 may sterilise vanadium mineral resources the rights for which are held by a third party. Site 2 would not sterilise mineral resources |
| **Total** | **4** | **2** | **Site 2 is the preferred option** |

The location of the shaft complexes are restricuted by the location of the ore body. The processing plant has been located in close proximity to the substation on the neighbouring Sedibelo mine.

### 2.8.3 THE "NO PROJECT" OPTION

The assessment of this option requires a comparison between the options of proceeding with the project with that of not proceeding with the project. Should the proposed project not go ahead, neither the positive socio-economic benefits from the proposed mine, nor the potential negative social and environmental impacts would materialise.

**FIGURE 26: SITE SELECTION OPTIONS FOR TSF**

# 3 POTENTIAL IMPACTS ON THE BIO-PHYSICAL ENVIRONMENT

## 3.1 LIST OF POTENTIAL IMPACTS ON ENVIRONMENTAL ASPECTS

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. The potential impacts are presented for each of the project phases in tabular format (Table 46).

**TABLE 46: LIST OF POTENTIAL IMPACTS AS THEY RELATE TO PROJECT ACTIONS / ACTIVITIES / PROCESSES (EXCLUDING SOCIAL AND CULTURAL)**

| Activity | Phase | Impacts (unmitigated) |
|---|---|---|
| **Site preparation**<br>Bush clearing, removal of infrastructure, establishing construction area | Construction<br>Operation<br>Decommissioning | Physical destruction of biodiversity<br>General disturbance of biodiversity<br>Air pollution<br>Disturbing noise<br>Visual impacts |
| **Earthworks**<br>(for all infrastructure) | Construction<br>Operation<br>Decommissioning | Hazardous structures/excavations/surface subsidence<br>Loss of soil resources and land capability through pollution<br>Loss of soil resources and land capability through physical disturbance<br>Physical destruction of biodiversity<br>General disturbance of biodiversity<br>Pollution of surface water resources<br>Alteration of natural drainage patterns<br>Contamination of groundwater<br>Air pollution<br>Disturbing noise<br>Blasting damage<br>Visual impacts |
| **Civil works**<br>Building activities, erection of structures, concrete work, steel work, electrical installation, establishing pipelines | Construction<br>Operation<br>Decommissioning | Loss and sterilisation of mineral reserves<br>Hazardous structures/excavations/surface subsidence<br>Loss of soil resources and land capability through pollution<br>Pollution of surface water resources<br>Contamination of groundwater<br>Air pollution<br>Disturbing noise<br>Visual impacts |
| **Underground mining**<br>Drilling, blasting, load, hauling, dewatering | Construction<br>Operation<br>Decommissioning | Hazardous structures/excavations/surface subsidence<br>Loss of soil resources and land capability<br>Pollution of surface water resources<br>Contamination of groundwater<br>Dewatering impacts<br>Blasting damage |

| Activity | Phase | Impacts (unmitigated) |
|---|---|---|
| **Mineral processing**<br>Mineral processing plant | Construction<br>Operation<br>Decommissioning | Hazardous structures/excavations/surface subsidence<br>Loss of soil resources and land capability through pollution<br>Physical destruction of biodiversity<br>General disturbance of biodiversity<br>Pollution of surface water resources<br>Alteration of natural drainage patterns<br>Contamination of groundwater<br>Air pollution<br>Disturbing noise<br>Visual impacts |
| **Mine residue management and disposal**<br>Tailings storage facility and waste rock dumps | Operation<br>Decommissioning<br>Closure | Loss and sterilization of mineral resources<br>Hazardous structures/excavations/surface subsidence<br>Loss of soil resources and land capability through pollution<br>Loss of soil resources and land capability through physical disturbance<br>Physical destruction of biodiversity<br>General disturbance of biodiversity<br>Pollution of surface water resources<br>Alteration of natural drainage patterns<br>Contamination of groundwater<br>Air pollution<br>Visual impacts |
| **Power supply and use**<br>Distribution on site | Construction<br>Operation<br>Decommissioning | Hazardous structures/excavations/surface subsidence<br>Loss of soil resources and land capability through pollution<br>Physical destruction of biodiversity<br>General disturbance of biodiversity<br>Pollution of surface water resources<br>Alteration of natural drainage patterns<br>Contamination of groundwater<br>Visual impacts |
| **Water supply and use** | Construction<br>Operation<br>Decommissioning | Hazardous structures/excavations/surface subsidence<br>Loss of soil resources and land capability through pollution<br>Physical destruction of biodiversity<br>General disturbance of biodiversity<br>Pollution of surface water resources<br>Alteration of natural drainage patterns<br>Contamination of groundwater<br>Air pollution<br>Visual impacts |
| **Transport systems** | Construction<br>Operation<br>Decommissioning | Loss of soil resources and land capability through pollution<br>Loss of soil resources and land capability through physical disturbance<br>Physical destruction of biodiversity<br>General disturbance of biodiversity<br>Pollution of surface water resources<br>Alteration of natural drainage patterns<br>Contamination of groundwater<br>Disturbing noise<br>Traffic impacts<br>Visual impacts |

| Activity | Phase | Impacts (unmitigated) |
|---|---|---|
| **Non-mineralised waste management** (general and industrial hazardous) | Construction<br>Operation<br>Decommissioning<br>Closure (limited) | Loss of soil resources and land capability through pollution<br>Loss of soil resources and land capability through physical disturbance<br>Physical destruction of biodiversity<br>General disturbance of biodiversity<br>Pollution of surface water resources<br>Alteration of natural drainage patterns<br>Contamination of groundwater<br>Air pollution<br>Visual impacts |
| **General site management** | Construction<br>Operation<br>Decommissioning<br>Closure | Loss of soil resources and land capability through pollution<br>Loss of soil resources and land capability through physical disturbance<br>Physical destruction of biodiversity<br>General disturbance of biodiversity<br>Pollution of surface water resources<br>Alteration of natural drainage patterns<br>Contamination of groundwater<br>Visual impacts |
| **Other support services and amenities** | Construction<br>Operation<br>Decommissioning | Loss of soil resources and land capability through pollution<br>Loss of soil resources and land capability through physical disturbance<br>Physical destruction of biodiversity<br>General disturbance of biodiversity<br>Pollution of surface water resources<br>Alteration of natural drainage patterns<br>Contamination of groundwater<br>Air pollution<br>Visual impacts |
| **Demolition** | Construction<br>Decommissioning | Hazardous structures/excavations/surface subsidence<br>Loss of soil resources and land capability through pollution<br>Loss of soil resources and land capability through physical disturbance<br>Physical destruction of biodiversity<br>General disturbance of biodiversity<br>Pollution of surface water resources<br>Alteration of natural drainage patterns<br>Air pollution<br>Disturbing noise<br>Blasting damage<br>Visual impacts |
| **Rehabilitation** | Construction<br>Operation<br>Decommissioning | Hazardous structures/excavations/surface subsidence<br>Loss of soil resources and land capability through pollution<br>Loss of soil resources and land capability through physical disturbance<br>Physical destruction of biodiversity<br>General disturbance of biodiversity<br>Pollution of surface water resources<br>Alteration of natural drainage patterns<br>Contamination of groundwater<br>Air pollution<br>Disturbing noise<br>Visual impacts |

| Activity | Phase | Impacts (unmitigated) |
|---|---|---|
| **Maintenance and aftercare** | Closure | Loss and sterilisation of mineral resources<br>Hazardous structures/excavations/surface subsidence<br>Loss of soil resources and land capability through pollution<br>Loss of soil resources and land capability through physical disturbance<br>Physical destruction of biodiversity<br>General disturbance of biodiversity<br>Pollution of surface water resources<br>Alteration of natural drainage patterns<br>Contamination of groundwater<br>Air pollution<br>Visual impacts |

## 3.2 LIST OF POTENTIAL CUMULATIVE IMPACTS

Potential cumulative environmental impacts include:

- hazardous structures/excavations/surface subsidence;
- loss of soil resources and land capability through pollution;
- loss of soil resources and land capability through physical disturbance;
- physical destruction of biodiversity;
- general disturbance of biodiversity;
- pollution of surface water resources;
- contamination of groundwater;
- reduction in groundwater levels;
- alteration of natural drainage patterns;
- air pollution;
- disturbing noise;
- blasting damage;
- traffic impacts;
- visual impacts;
- land use (community land and the proposed Heritage Park); and
- socio-economic.

As discussed in the Introduction, Richtrau, PPM and the IBMR are planning to establish three separate projects which could operate as one mine in the future. In addition, there are a number of other proposed mining operations in close proximity to the proposed Magazynskraal Mine, the details of which are either unknown or conceptual at this time. Further discussion on the potential cumulative impacts is included in Section 7.5.

## 3.3 POTENTIAL FOR ACID MINE DRAINAGE OR GROUNDWATER CONTAMINATION

Detailed information on these issues is provided in Sections 1.1.1 and 7.2.10. In summary, geochemical tests and analysis indicate that the proposed tailings storage facility and waste rock stockpiles are non-acid generating, but that there is potential for elevated parameters to leach/seep from the tailings and waste rock facilities. This presents a pollution risk for both surface and ground water in both the short and long term.

# 4 ALTERNATIVE LAND USE OR DEVELOPMENT

## 4.1 DESCRIPTION OF ALTERNATIVE LAND USE OF THE AREA

The proposed project area is currently used for activities such as cattle grazing and limited crop cultivation. Refer to Section 1.3.1 for a detailed description of existing land uses within the proposed project area.

As an alternative to the development of the proposed project, these current land uses would continue. It is possible that IAPs on site could consider increasing the current scale of agriculture. This would include increasing their cattle numbers and expanding the extent of current cultivation activities, however this would require considerable investment when considering the land capability of the area (discussed in Section 1.1.5).

The proposed project area does form part of the proposed heritage park corridor (HPC) (discussed in Section 1.3.1). With reference to the current alignment of the proposed HPC (Figure 27), the proposed project area would be included in the non-dangerous game section which is not an alternative land use in the sense that this non dangerous game corridor is intended to incorporate conservation, community and mining activites.

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

Potential features and infrastructure that could be associated with the alternative land use/development are listed below.

| Feature / infrastructure | Description |
|---|---|
| Livestock/game farming | Introducing additional/new livestock/game to the farms<br>Establishing watering holes |
| Roads and game fences | Gravel roads providing access to cultivated lands<br>Gravel/tarred roads (and game fences) providing tourist access within the HPC |
| Agriculture | Preparing and working agricultural fields<br>Abstraction of groundwater from boreholes and surface water from farm dams |
| Tourism | Establishing tourism facilities i.e. accommodation<br>Establishing support infrastructure to service tourist facilities such as power lines and telecommunication structures as well as pipelines for the bulk transportation of water, sewage etc |

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

A plan showing the location and extent of the alternative land use / development in the area is included in Figure 27. Note that it is not possible to include the location and extent of all future alternative land use / developments at this stage as this would depend on the individual landowner's preferences and financial situation.

**FIGURE 27: POTENTIAL ALTERNATIVE LAND USE / DEVELOPMENT**

# 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 described in Section 4 above, are listed below:

| Feature / infrastructure | Potential impacts |
|---|---|
| Livestock/game farming | Increased pressure on veld resources<br>Loss of soils through incorrect management<br>Increased income and associated socio-economic benefits<br>Increased pressure on water resources |
| Roads | Dust generation |
| Water supply | Increased pressure on water resources |
| Agriculture | Alteration of natural drainage patterns<br>Surface and/or groundwater pollution through the use of fertilisers<br>Dust generation from exposed areas<br>Increased income and associated socio-economic benefits |
| Tourism (proposed Heritage Park Corridor, including potential camps and lodges) | Increased pressure on water resources<br>Increased pressure on services such as sewage<br>Increased income and associated socio-economic benefits |

## 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 water resources and related sewage service provision;
- increased pressure on veld resources for grazing purposes; and
- increased income and positive socio-economic benefits.

# 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:

- loss of current land uses (including a loss of revenue and loss of jobs) through impacts on the bio-physical environment;
- dust;
- blasting hazards;
- noise;
- visual;
- project-related road use and traffic;
- economic impacts (positive and negative);
- inward migration.

The potential positive and negative social impacts are indicated in Table 36 below, and economic factors are contained in Table 37.

## 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

The heritage resources that were observed across the farm Magazynskraal 3JQ are concentrated in the southern part of the proposed project area (refer to Section 1.3.5). As these resources will not be disturbed by the proposed project footprint no impacts are expected to occur.

It is possible that further heritage resources are uncovered during the development of the proposed activities. 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 7.2.14). These resources are protected by national legislation and require mitigation prior to any disturbance.

### 6.3.2 PALAEONTOLOGICAL FEATURES

Given the geology of the area, being the Bushveld Igneous Complex, there is no potential for paleontological resources to occur, therefore no impacts are expected to occur.

## 6.4 QUANTIFICATION OF IMPACT ON SOCIO-ECONOMIC CONDITIONS

Refer to Section 7.2.17 for the impact associated with the loss of land as well as the expected contribution to the provincial and national economy by the proposed project. Refer to Appendix O for the relevant specialist study undertaken.

# 7 ASSESSMENT AND EVALUATION OF POTENTIAL IMPACTS

## 7.1 LIST OF EACH POTENTIAL IMPACT

Potential environmental impacts were identified by SLR in consultation with IAPs, regulatory authorities, specialist consultants and Rictrau. 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 proposed project are discussed and assessed together.

Potential impacts that have been identified include:

- loss and sterilization of mineral resources (Section 7.2.1);
- hazardous excavations/structures and surface subsidence (Section 7.2.2);
- loss of soil resources through pollution (Section 7.2.3);
- loss of soil resources and land capability through physical disturbance (Section 7.2.4);
- physical destruction of biodiversity (Section 7.2.5);
- general disturbance of biodiversity (Section 7.2.6);
- pollution of surface water (Section 7.2.7);
- alteration of surface drainage patterns (Section 7.2.8);
- reduction of water availability/levels (Section 7.2.9);
- contamination of groundwater (Section 7.2.10);
- air pollution (Section 7.2.11);
- noise pollution (Section 7.2.12);
- landscape and visual impacts (Section 7.2.13);
- loss of heritage, cultural and paleontological resources (Section 7.2.14);
- blasting impacts (Section 7.2.15);
- road disturbance and traffic impacts (Section 7.2.16);
- economic impacts (Section 7.2.17);
- inward migration (Section 7.2.18); and
- land use impact (Section 7.2.19)

## 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 potential impacts are rated with the assumption that no mitigation measures are applied and then again with mitigation. 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.

### GEOLOGY

#### 7.2.1 ISSUE: LOSS AND STERILISATION OF MINERAL RESOURCES

Information in this section was sourced from the project team.

**Introduction**

Mineral resources can be sterilised and/or lost through the placement of infrastructure and activities in close proximity to mineral resources, by preventing access to potential mining areas, and through the disposal of mineral resources onto mineralised waste facilities.

It is unlikely that the proposed project footprint will sterilise underlying resources as infrastructure has been placed to avoid third party mineral resources and the PGE ore body is located 150m below surface at its shallowest point. Minerals may however be deposited on the TSF as part of the tailings stream.

**Project phase and link to activities/infrastructure**

| Construction | Operational | Decommissioning | Closure |
|---|---|---|---|
| | | | |
| Civil works | Mine residue management and disposal<br>Civil works | Mine residue management and disposal<br>Rehabilitation | Maintenance and aftercare of final land forms and rehabilitated areas |

**Rating of impact**

<u>Severity / nature</u>

The severity of sterilising mineral resources is considered to be high because of the associated potential economic value that is lost when sterilisation occurs.

In the unmitigated scenario, this may occur in the event that the infrastructure is developed or decommissioned in a manner that prohibits the mining of feasible resources, or where feasible mineral resources are disposed of onto mineralised waste facilities in a manner that makes it difficult or impossible to access the resources.

In the mitigated scenario, planning and co-ordination between the mining, infrastructure projects and processing decision makers can help to prevent the unacceptable sterilisation of resources, without compromising safety requirements. The mitigated severity reduces to low.

Duration

Sterilisation related impacts generally extend beyond the life of the project. This is a long term duration.

Spatial scale / extent

The spatial extent of the physical impact is linked to the spatial extent of the proposed project area. This is a localised spatial extent. If one considers the economic nature of the impact, it will extend beyond the site into the broader economy.

Consequence

The unmitigated consequence is high. The mitigated consequence is medium.

Probability

Without mitigation the probability is high as infrastructure could unknowingly be placed on mineral rich areas. With mitigation the probability reduces to low because as a first measure processes are in place to remove PGMs and the balance of minerals prior to deposition on the TSF, and as a second measure there is always the option to re-process the TSF in future.

Significance

The unmitigated significance is high. In the mitigated scenario the significance is low.

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

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

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

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

**Conceptual description of proposed mitigation measures**

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19, Table 57).

Objective

The objective of the mitigation measures is to prevent unacceptable mineral sterilisation.

Actions

Richtrau will incorporate cross discipline planning structures associated with the development of proposed project to avoid and/or minimise mineral sterilisation.

Provision will be made to extract all minerals possible prior to final disposal onto the mineralised waste facilities. Where inefficient processing or lack of technological processes has caused minerals to be disposed onto the mineralised waste facilities, the option of reprocessing the mineralised waste facilities will be considered and implemented where feasible and technological possible.

**Emergency situations**

Not applicable.

## TOPOGRAPHY

### 7.2.2 ISSUE: HAZARDOUS EXCAVATIONS/INFRASTRUCTURE AND SURFACE SUBSIDENCE

Information in this section was sourced from the project team.

**Introduction**

Hazardous excavations and infrastructure include all structures into or off which third parties and animals can fall and be harmed. Included in this category are facilities that can fail, such as the proposed tailings facility. Hazardous excavations and infrastructure occur in all mine phases from construction through operation to decommissioning and closure. 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 and the closure phase will present final land forms that are considered hazardous.

Surface subsidence can occur if insufficient support is left behind in shallow underground mining.

**Project phase and link to activities**

| Construction | Operational | Decommissioning | Closure |
|---|---|---|---|
| | | | |
| Earthworks<br>Civil works<br>Rehabilitation | Shafts<br>Mineral processing facilities<br>Mine residue management and disposal<br>Water supply and storage infrastructure<br>Power supply infrastructure<br>Transport infrastructure<br>Rehabilitation | Demolition<br>Mine residue management and disposal<br>Water supply and storage infrastructure<br>Power supply infrastructure<br>Rehabilitation | Maintenance and aftercare of final land forms and rehabilitated areas |

**Rating of impact**

Severity / nature

As part of the proposed project, hazardous excavations will be dug for foundations during the construction phase, and scaffolding and other such temporary hazardous structures will be used during construction. During the operational phase the shaft sinking will present a hazardous excavation, while shallow underground mining could present a risk of surface subsidence. Hazardous structures could include scaffolding and shaft headgear, the TSF, WRDs and water storage dams. The decommissioning phase will be similar to the construction phase and hazardous structures and excavations will be present during the demolition and site rehabilitation process. The TSF and WRDs will remain in perpetuity and represent residual hazardous structures.

In the unmitigated scenario, surface subsidence from shallow underground mining could result in damage, injury and/or death to both third parties, animals and infrastructure. In addition, most of the identified hazardous excavations and infrastructure present a potential risk of injury and/or death to both animals and third parties. This is a potential high severity.

In the mitigated scenario the severity can be reduced to medium provided security and access control will be implemented at the entrance to the mine as well as facilities such as the TSF and WRDs. The TSF, WRDs and underground mining areas must be designed, established and implemented to prevent and/or mitigate impacts. In addition, sufficient support must be left in the underground mining sections to prevent surface subsidence.

Duration

In the context of this assessment, death or permanent injury is considered a long term, permanent impact.

Spatial scale / extent

Direct impacts associated with hazardous infrastructure and excavations related to the proposed project will be located within the proposed project area, with or without mitigation. Direct impacts associated with the failure of TSF may extend beyond the site boundary. The potential indirect impacts will extend beyond the site boundary to the families/communities to which the injured people and/or animals belong.

Consequence

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

Probability

In the unmitigated scenario, without design and management interventions, the probability of the impact occurring is expected to be high. The mitigation measures will focus on infrastructure safety design and implementation as well as on limiting access to third parties and animals which reduces the probability of the impact occurring.

Significance

In the unmitigated scenario, the significance of this potential impact is high. In the mitigated scenario, the significance of this potential impact is medium because the probability of the potential impact occurring is reduced.

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

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

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

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

**Conceptual description of the proposed mitigation actions**

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19, Table 58).

Objective

The objective of the mitigation measures is to prevent physical harm to third parties and animals from potentially hazardous excavations and infrastructure.

Actions

In order to prevent surface subsidence during the underground mining that takes place close to surface, a rock mechanic must investigate and continually monitor the underground mine workings to ensure that correct mining methodologies and support are implemented and adhered to.

The proposed TSF and associated return water dam will be designed, constructed, operated and closed in a manner to ensure that stability and related safety risks to third parties and animals are addressed. These issues will be monitored according to a schedule that is deemed relevant to the type of facility by a professional engineer. In addition, a detailed geotechnical survey will be undertaken prior to the establishment of any infrastructure, particularly the TSF and WRDs, to ensure the foundations of the proposed site are suitable. If any infrastructure needs to be moved following the geotechnical survey a new site will need to be investigated and the EIA and EMP report (if approved) will need to be revised.

Richtrau will survey areas to be disturbed by the proposed project footprint and update its surface use area map on a routine basis to ensure that the position and extent of all potential hazardous excavations, hazardous infrastructure and subsidence is known. It will furthermore ensure that appropriate management measures are taken to address the related safety risks to third parties and animals.

Until hazardous excavations are rehabilitated and closed, they will each have a barrier to prevent access by people and animals. The barrier may be in the form of fences, walls or berms. In addition, the barriers must have warning signs at appropriate intervals. These warning signs must be in picture format and/or written in English, Afrikaans and Tswana.

Dams with a safety risk (this includes all dams that hold 50 000 $m^3$ of water and that have a wall of 5 m or more) will be monitored by a professional civil engineer in accordance with Section 12.

During decommissioning planning of any part of the mine, provision will be made to address long term safety risks in the decommissioning and rehabilitation phases.

At closure the hazardous structures and excavations and risk of subsidence will be dealt with as follows:

- any remaining land forms such as the TSF and WRDs, will be decommissioned and rehabilitated in a manner that they do not present long-term safety and/or stability risks;
- shaft openings will be properly sealed with an engineered plug and rehabilitated;
- the potential for surface subsidence will have been addressed by providing underground support in mined out areas; and
- monitoring and maintenance will take place to observe whether the relevant long-term safety objectives have been achieved and to identify the need for additional intervention where the objectives have not been met.

Where the mine has caused injury to third parties and/or animals, appropriate compensation will be provided.

**Emergency situations**

If people or animals fall off or into hazardous excavations or infrastructure causing injury, or if any mineralised waste or water facilities fail causing injury to people or animals, the emergency procedures in Section 20 must be followed.

SOILS

### 7.2.3 ISSUE: LOSS OF SOIL RESOURCES AND LAND CAPABILITY THROUGH POLLUTION

Information in this section was taken from specialist soil study (ESS, 2012) included in Appendix E.

**Introduction**

Soil is a valuable resource that supports a variety of ecological functions. The proposed project has the potential to damage soil resources through contamination. Contamination of soils also has the potential to impact both surface and ground water resources (see Sections 7.2.6 and 7.2.10). 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 resources and the effect this has on land capability.

There are a number of sources in all phases that have the potential to pollute soil resources. 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.

**Project phase and link to activities**

| Construction | Operational | Decommissioning | Closure |
|---|---|---|---|
| | | | |
| Earthworks<br>Civil works<br>Site management<br>Transport systems<br>Non-mineralised waste management<br>Rehabilitation | Site management<br>Transport systems<br>Non-mineralised waste management<br>Mine residue management and disposal<br>Water supply infrastructure<br>Power supply infrastructure | Demolition<br>Site management<br>Transport systems<br>Non-mineralised waste management<br>Mine residue management and disposal<br>Water supply infrastructure<br>Power supply infrastructure<br>Rehabilitation | Maintenance and aftercare of final land forms and rehabilitated areas |

**Rating of impact**

Severity/nature

In the unmitigated scenario, pollution of soils from multiple pollution incidentscan result in a loss of land capability as an ecological driver because it can compromise the environment for vegetation and ecosystems that rely on the soil. It could also negatively impact on the chemistry of the soils such that current growth conditions are impaired. This is a high severity in the unmitigated scenario.

In the mitigated scenario the number of pollution events should be significantly less which reduces the potential severity to medium.

Duration

In the unmitigated scenario, most pollution impacts and associated loss in land capability will remain long after closure for all the proposed projects. In the mitigated scenario most of these potential impacts should either be avoided or be remedied within the life of the project, which reduces the duration to low. This will be achieved by the effective reaction time of the clean-up team and the chosen remediation methods.

Spatial scale/extent

In both the unmitigated and mitigated scenarios for all phases relative to the proposed project, the potential loss of soil resources and associated land capabilities will mostly be restricted to within the project boundary.

Consequence

In the unmitigated scenario the consequence is high. In the mitigated scenario the consequence is reduced to medium as the severity and duration of the impact can be reduced.

Probability

In the unmitigated scenario the probability of this potential impact occurring is high. With mitigation, the probability can be reduced to low because emphasis will be placed on preventing pollution events and on quick and effective remediation if pollution events do occur.

Significance

In the unmitigated scenario, the significance of this potential impact is high. In the mitigated scenario, the significance can be reduced to low because with mitigation the severity, duration and probability associated with the potential impact all reduce.

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 | L | H | H | H |

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

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

**Conceptual description of the proposed mitigation actions**

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19, Table 59).

Objective:

The objective of the mitigation measures is to conserve soil resources.

Actions

In the construction, operation and decommissioning phases Richtrau will conduct all potentially polluting activities in a manner that they do not pollute soils. This will be implemented through a procedure(s) covering the following:

- pollution prevention through basic infrastructure design pollution prevention through maintenance of equipment;
- pollution prevention through education and training of permanent and temporary workers;
- pollution prevention through appropriate management of hazardous materials and wastes (refer to Table 47);
- the required steps to enable fast reaction to contain and remediate pollution incidents. In this regard the remediation options include containment and in situ treatment or disposal of contaminated soils as hazardous waste. In-situ treatment is generally considered to be the preferred option because with successful in situ remediation the soil resource will be retained in the correct place. The in situ options include bioremediation at the point of pollution, or removal of soils for washing and/or bio remediation at a designated area after which the soils are returned;
- specifications for post rehabilitation audit criteria to ascertain whether the remediation of any polluted soils and re-establishment of soil functionality has been successful and if not, to recommend and implement further measures.

The designs of any permanent and potentially polluting structures (such as the proposed TSF and WRDs) will take account of the requirements for long term soil pollution prevention, land function and confirmatory monitoring.

**TABLE 47: WASTE MANAGEMENT PRACTICES FOR DOMESTIC WASTE AND INDUSTRIAL WASTE**

| **Items to be considered** | | **Intentions** |
|---|---|---|
| **General** | **Specific** | |
| Classification and record keeping | General | The waste management procedure for the proposed 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 DWAs' 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). |
| | Inventory of wastes produced | An inventory of wastes will be compiled and will include estimated quantities of waste. The inventory will be kept up to date. |
| | Disposal record | Written evidence of safe disposal of waste will be kept. |
| Waste management 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** | |
| | Laydown/ salvage areas | During decommissioning and closure, lay down areas for re-usable non-hazardous materials will be established.<br>Mixing of re-usable materials with other wastes, especially hazardous wastes will be prevented. |
| | General waste | Will be stored in designated skips and removed by an approved contractor for disposal at a licensed facility. |
| | Scrap metal and building rubble | Care will be taken to ensure that scrap metal and building rubble does not become polluted or mixed with any other waste.<br>The scrap metal will be collected in a designated area for scrap metal (salvage yard). It will be sold to scrap dealers. Building rubble will be used to backfill mining voids |
| | Hazardous wastes | Medical waste, laboratory chemicals, explosives packaging, used chemicals and chemical containers will be temporarily stored in sealed containers in a bunded store before removal by an approved waste contractor and disposal in a licensed facility. |
| | 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.<br>Notices will be erected at each waste oil point giving instructions on the procedure for waste oil discharge and collection.<br>An approved subcontractor will remove oil from site. |
| | Any soil polluted by a spill | 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. |
| | Dried sewage sludge and screenings from the sewage plant | All sludge will be removed from site with the screenings as hazardous waste and disposed at a licensed facility, unless authorisation is granted to use the dried and treated sewage sludge as a fertiliser medium for rehabilitation of the TSF side walls. |
| Disposal | Off-site 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 in Rustenburg. For hazardous waste the closest permitted sites are at Rosslyn and Holfontein. |
| Waste transport | Contractor | A qualified waste management subcontractor will undertake the waste transport. The contractor will provide an inventory of each load collected and proof of disposal at a licensed facility. |
| 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. |

**Emergency situations**

Major spillage incidents will be handled in accordance with the emergency procedure attached in Section 20.

### 7.2.4 ISSUE: LOSS OF SOIL RESOURCES AND LAND CAPABILITY THROUGH PHYSICAL DISTURBANCE

**Introduction**

There are a number of activities/infrastructure in all phases that have the potential to disturb soils and related land capability through removal, compaction and/or erosion. The proposed surface infrastructure associated with the proposed mining project will disturb an area of approximately 350ha, with an additional 200ha for the proposed community agricultural initiative. In the construction and decommissioning phases these activities could be temporary in nature, usually existing for 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.

**Project phase and link to activities**

| Construction | Operational | Decommissioning | Closure |
|---|---|---|---|
| | | | |
| Earthworks<br>Civil works<br>Site management<br>Transport systems | Earthworks<br>Site management<br>Transport systems<br>Non-mineralised waste management<br>Mine reside management and disposal<br>Water supply infrastructure<br>Power supply infrastructure | Demolition<br>Site management<br>Transport systems<br>Non-mineralised waste management<br>Mine residue management and disposal<br>Water supply infrastructure<br>Power supply infrastructure | Maintenance and aftercare of final land forms and rehabilitated areas |

**Rating of impact**

Severity/nature

The loss of soil through erosion and/or compaction could occur during all project phases. In the unmitigated scenario, physical soil disturbance can result in a loss of soil functionality as an ecological driver. In the case of erosion, the soils will be lost to the area of disturbance, and in the case of compaction the soils functionality will firstly be 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. Any soils that remain beneath the permanent landforms, i.e. TSF and WRDs (a total footprint of approximately 207ha) will be a lost resource and the associated land capability will be permanently altered. This amounts to a high severity.

In the mitigated scenario, the soils can be conserved and reused to establish land capabilities. This does not apply to the soils that will remain under the TSF and WRDs and the associated land capability of these footprints. The land capability of the area associated with the agricultural initiative will be enhanced through the addition of fertilisers and irrigation. The overall severity reduces to medium with the implementation of mitigation measures.

Duration

In the unmitigated scenario the loss of soil and related land capability is long term and will continue after the life of the proposed project. In the mitigated scenario, the soil is conserved and replaced in all disturbed areas, thereby reducing the duration of the impact to the life of the proposed project. However, for both the unmitigated and mitigated scenarios, the land capability of the areas under the TSF and WRDs will be permanently altered.

Spatial scale/extent

In both the unmitigated and mitigated scenarios for all phases of the proposed project, the potential loss of soil and land capability through physical disturbance will be restricted to within the site boundary.

Consequence

In the unmitigated scenario the consequence is high. With mitigation, the consequence is medium as the severity and duration of the impact is reduced.

Probability

In the unmitigated scenario the probability of this potential impact occurring is high. With mitigation, the probability will be reduced to medium because emphasis will be placed on soil conservation and the re-establishment of land capabilities. As some topsoil can be conserved and used for rehabilitation of the TSF and WRDs, the probability reduces because with appropriate rehabilitation interventions, the long term facilities can create a type of habitat that is appropriate for grazing of wild and domestic animals.

Significance

In the unmitigated scenario the impact is high. In the mitigated scenario the significance of this impact is reduced to medium as the severity, duration and probability are reduced.

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

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

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

| Management | Severity / nature | Duration | Spatial scale / extent | Consequence | Probability of Occurrence | Significance |
|---|---|---|---|---|---|---|
| Construction, operation, decommissioning and closure | | | | | | |
| Mitigated | M | M (H for TSF and WRDs) | L | M | M | M |

**Conceptual description of the proposed mitigation actions**

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19, Table 60).

<u>Objective:</u>

The objective of the mitigation measures is to minimise the loss of soil resources and related land capability through physical disturbance, erosion and compaction.

<u>Actions:</u>

In the construction, operation and decommissioning phases a soil management plan, with the following key components, will be implemented:

- limit the disturbance of soils to what is absolutely necessary for earthworks, on-going activities, infrastructure footprints and use of vehicles; and
- where soils have to be disturbed the soil will be stripped, stored, maintained and replaced in accordance with the specifications of the soil management principles in Table 48.

**TABLE 48: SOIL CONSERVATION PROCEDURE**

| Steps | Factors to consider | Detail |
|---|---|---|
| Delineation of areas to be stripped | | Stripping will only occur where soils are to be disturbed by activities and infrastructure that are described in the EIA/EMP report, and where a clearly defined end rehabilitation use for the stripped soil has been identified. |
| Reference to biodiversity mitigation | | All requirements for moving and preserving fauna and flora according to the biodiversity mitigation measures will be adhered to. |
| Stripping | Topsoil | All usable soil (70cm) will be stripped over areas of deep excavation. Areas planned for offices/material storage will be stripped to a depth of 50cm. Areas for the TSF and WRDs will be stripped to a depth of 75cm where possible in areas of arable soils, and 30-50cm in areas of soils with grazing capability. Areas used for general access roads and servitudes will be stripped to a depth of 15cm. |
| | Subsoil | If present, subsoil will be removed and stockpiled separately to the topsoil. |
| Delineation of stockpiling areas | Location | Stockpiling areas will be identified in close proximity to the source of the soil to limit handling and to promote reuse of soils in the correct areas. |
| | Designation of the areas | Soil stockpiles will be clearly identifiable in terms of soil type and the intended areas of rehabilitation. |
| Stockpile management | Vegetation establishment and erosion control | Rapid growth of vegetation on the topsoil stockpiles will be promoted (e.g. by means of watering or fertilisation). The purpose of this exercise will be to encourage vegetation growth on soil stockpiles and to combat erosion by water and wind. |
| | Storm water controls | Stockpiles will be established with storm water diversion berms to prevent run off erosion. |
| | Height and slope | Soil stockpiles height will be controlled to avoid compaction and damage to the underlying soils. The stockpile side slopes should be flat enough to promote vegetation growth and reduce run-off related erosion. |
| | Waste | No waste material will be placed on the soil stockpiles. |
| | Vehicles | Equipment movement on top of the soil stockpiles will be limited to avoid topsoil compaction and subsequent damage to the soils and seedbank. |
| Rehabilitation of disturbed land: restoration of land capability | Placement of soil | A minimum layer of 50 cm of topsoil will be replaced unless a soils expert advises otherwise. |
| | Fertilisation | Samples of stripped soils will be analysed to determine the nutrient status of the soil before rehabilitation commences. As a minimum the following elements will be tested for: cation exchange capacity, pH and phosphate. These elements provide the basis for determining the fertility of soil. Based on the analysis, fertilisers will be applied if necessary. |

| Steps | Factors to consider | Detail |
|---|---|---|
| | Erosion control | Erosion control measures will be implemented to ensure that the topsoil is not washed away and that erosion gulley's do not develop prior to vegetation establishment. |
| | Restore land function and capability | Apply landscape function analysis and restoration interventions to areas where soil has been replaced as part of rehabilitation, but the land function and capability has not been effectively restored. |

As part of closure planning, the designs of any permanent landforms (e.g. mineralised waste facilities) will take into consideration the requirements for land function, long term erosion prevention and confirmatory monitoring.

As part of the agricultural initiative, no plant species that are classified as Category 1, 2 or 3 species in terms of the Conservation of Agricultural Resources Act, 43 of 1983, will be cultivated.

**Emergency situations**

Not applicable.

## BIODIVERSITY

By way of introduction to this section of the impact assessment, The International Council for Mining and Metals (ICMM) has been instrumental in research and development of good environmental practices in mining. The ICMM's Good Practice Guidance for Mining and Biodiversity provides some useful insights into issues around biodiversity. 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 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; and
- maintenance of genetic resources (key for medicines, crop and livestock breeding).

The proposed project is located in areas that have both habitat and species richness. In this regard, species richness refers to both flora and fauna species.

The assessment covers the following broad issues: physical destruction of biodiversity and related functions, and general disturbances to biodiversity. Each of these issues is individually assessed below.

It must also be noted that the secondary impacts on biodiversity associated with soil erosion, soil compaction, and physical disturbance and pollution of soils have already been assessed in Sections 7.2.3 and 7.2.4.

### 7.2.5 ISSUE: PHYSICAL DESTRUCTION OF BIODIVERSITY

Information in this section was sourced from the specialist biodiversity study (NSS, 2012) included in Appendix F.

**Introduction**

There are a number of activities/infrastructure in all phases that have the potential to destroy biodiversity in the broadest sense. In this regard, the discussion relates to the physical destruction of specific biodiversity areas, of linkages between biodiversity areas and related species which are considered to be significant because of their status, and/or the role that they play in the ecosystem.

**Project phase and link to activities**

| Construction | Operational | Decommissioning | Closure |
|---|---|---|---|
| | | | |
| Site preparation<br>Earthworks<br>Civil works<br>Transport system<br>Site management | Site management<br>Transport system<br>Non-mineralised waste management<br>Mine residue management and disposal<br>Water supply infrastructure<br>Power supply infrastructure | Demolition<br>Site management<br>Transport system<br>Non-mineralised waste management<br>Water supply infrastructure<br>Mine residue management and disposal | Maintenance and aftercare of final land forms and rehabilitated areas |

**Rating of impact**

Severity/nature

High biodiversity areas are functioning biodiversity areas with species diversity and associated intrinsic value. In addition, some of these areas host several red data and protected species. The linking areas have value because of the role they play in allowing the migration or movement of flora and fauna between the areas of high biodiversity which is a key function for the broader ecosystem. The transformation of land for any purpose, including mining and associated activities, increases the destruction of the site specific biodiversity, reduces its intrinsic functionality and reduces the linkage role that undeveloped land fulfils between different areas of biodiversity importance.

Limited infrastructure would be located within the areas considered to be of high and medium-high conservation significance (refer to Figure 11). However, impacts associated with the proposed project include:

- alteration of habitats and vegetation structure;
- habitat fragmentation and corridor restrictions;

- loss of vegetation and foraging habitat;
- disturbance on raptor breeding and foraging;
- destruction of conservation important floral species; and
- disturbance of the riparian zone, either through physical disturbance, stream flow reduction or dewatering (where ground and surface water resources are linked).

When considering the above impacts, the severity is high in the unmitigated scenario. In the mitigated scenario, with correct management and implementation of mitigation measures, the severity reduces to medium until closure and to low thereafter. It is worth noting that in response to the conservation significance ratings for the proposed project area (Figure 11), the position of the WRD associated with the southern shaft has been revised by the project team to limit the disturbance of areas considered to have medium-high significance.

Duration

In the unmitigated scenario, the potential loss of biodiversity and the associated species and habitats will extend beyond the life of the proposed project. With the implementation of mitigation measures, the duration of this potential impact can be reduced, however it is expected that full functionality of the ecosystem would only re-establish during the closure phase. The duration is therefore high in the unmitigated scenario, reducing to medium with mitigation.

Spatial scale/extent

Given that biodiversity processes are not confined to the proposed project areas, the spatial scale of impacts will extend beyond this boundary in both the mitigated and unmitigated scenario. Key related issues are the migration of species, the flow of nutrients and linkages between biodiversity areas. The spatial scale is therefore medium in both the unmitigated and mitigated scenarios.

Consequence

In the unmitigated scenario the consequence is high. In the mitigated scenario the consequence is reduced to medium as the severity and duration of the impact is reduced.

Probability

In the unmitigated scenario the probability of this potential impact occurring is high. With mitigation, the probability can be reduced to medium with the implementation of correct management measures.

Significance

The significance of this impact is high in the unmitigated scenario and can be reduced to medium with mitigation.

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 – summary of the rated impact per phase of the project

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

**Conceptual description of the proposed mitigation actions**

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19, Table 61).

Objective:

The objective of the mitigation measures is to prevent the unacceptable loss of biodiversity and related ecosystem functionality through physical destruction.

Actions:

If the proposed project is approved, Richtrau should reconsider the option of establishing a joint-venture operation with either Sedibelo or PPM in order to limit the physical destruction of biodiversity within the proposed project area. In this regard, should a combined mining operation be established, project related infrastructure on the farm Magazynskraal 3 JQ would be significantly reduced, i.e. the proposed processing plant, TSF and waste handling facility would not be established, which would reduce the potential negative environmental impacts associated with the operations on that site.

In the construction, operation and decommissioning phases Richtrau will implement a biodiversity management plan. The key components are:

- the area to be destroyed will be thoroughly investigated by a suitably qualified ecologist for the removal of conservation important species;
- the disturbance of areas of significance and important linkages between these areas will be prevented so that the species composition and ecosystem functionality remain intact;
- a nursery will be established on-site to ensure successful rehabilitation in the long term;
- any faunal species identified during the plant collection/removal must also be moved with the intention to relocate to a safe but similar habitat in the near vicinity. Emphasis should be placed on all reptile, frog and small mammal species;
- a senior staff member based on-site must be trained in the capture, handling and release of snakes. Snake handling equipment must be readily available on-site at all times;
- larger trees must be avoided during the construction phase. If raptor nesting sites are recorded, necessary buffers must established and no mine personnel allowed into these areas;

- habitat and site specific faunal niches such as large hole-bearing trees, nests, dens and hibenaria such as termataria or rock piles must be avoided where possible;
- an alien invasive programme for the proposed project area will be compiled and implemented to prevent the spread of alien species;
- Richtrau must engage with the relevant stakeholders (including land users, BBKTA, Department of Agriculture and Department of Rural Development and Land Reform) regarding the grazing capacity of the natural vegetation. The grazing capacity must be evaluated, and livestock numbers kept within acceptable limits to reduce bush encroachment and the effects on floral and faunal communities;
- rehabilitation efforts must involve planting of locally sourced indigenous plant species;

As part of closure planning, the designs of any permanent structures (mineralised waste facilities) will take into consideration the requirements for the establishment of long term species diversity, ecosystem functionality, aftercare and confirmatory monitoring.

**Emergency situations**

Not applicable.

### 7.2.6 ISSUE: GENERAL DISTURBANCE OF BIODIVERSITY

Information in this section was sourced from the biodiversity study (NSS, 2012) included in Appendix F.

**Introduction**

There are a number of activities/infrastructure that have the potential to directly disturb vegetation, vertebrates and invertebrates in all project 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 (such as the TSF and WRDs) that may have pollution potential through long term seepage and/or run-off.

**Project phase and link to activities**

| Construction | Operational | Decommissioning | Closure |
|---|---|---|---|
| | | | |
| Site preparation<br>Earthworks<br>Civil works<br>Transport system<br>Site management | Site management<br>Transport system<br>Non-mineralised waste management<br>Mine residue management and disposal<br>Water supply infrastructure<br>Power supply infrastructure | Demolition<br>Site management<br>Transport system<br>Non-mineralised waste management<br>Water supply infrastructure<br>Power supply infrastructure<br>Mine residue management and disposal | Maintenance and aftercare of final land forms and rehabilitated areas |

**Rating of impact**

Severity/nature

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

- lighting can attract large numbers of invertebrates which become easy prey for predators. This can upset the invertebrate population balances;
- power lines can lead to bird kills;
- people may kill various types of species for food, for sport, for fire wood etc;
- people may illegally collect and remove vegetation, vertebrate and invertebrate species;
- excessive dust fallout from various dust sources may have adverse effects on the growth of some vegetation, 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. In some instances the animals may be deterred from passing close to noisy activities which can effectively block some of their migration paths. In other instances, vertebrates and invertebrates that rely on vibration and noise senses to locate and hunt prey, may be forced to leave the vicinity of noisy, vibrating activities;
- the presence of vehicles in the area can cause road kills especially if drivers speed;
- the presence of mine water impoundments and pipelines may lead to drowning of fauna; and
- pollution emissions and general litter may directly impact on the survival of individual plants, vertebrates and invertebrates.

Taken together, the disturbances will have a high severity in the unmitigated scenario. In the mitigated scenario, many of these disturbances can be prevented or mitigated, which reduces the severity to low.

Duration

In both the mitigated and unmitigated scenarios, the impacts are long term because where biodiversity is compromised, killed or removed from the area this impact is likely to exist beyond the life of the project.

Spatial scale/extent

Given that biodiversity processes are not confined to the proposed project areas, the spatial scale of impacts will extend beyond this boundary in both the mitigated and unmitigated scenario. Key related issues are the migration of species and linkages between biodiversity areas. The spatial scale is therefore medium in both the unmitigated and mitigated scenarios.

Consequence

In both the unmitigated and mitigated scenarios the consequence is high.

Probability

Without any mitigation the probability of the impact occurring is high. With mitigation, the probability can be reduced to medium because most of the disturbances can be controlled through implementation and enforcement of practices, policies and procedures.

Significance

The significance of this impact remains high in the unmitigated scenario and can be reduced to medium with mitigation.

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 – summary of the rated impact per phase of the project

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

**Conceptual description of the proposed mitigation actions**

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19, Table 62).

Objective:

The objective of the mitigation measures is to prevent unacceptable disturbance of biodiversity and related ecosystem functionality.

Actions:

In the construction, operation and decommissioning phases Richtrau will ensure that:

- efficient use of lighting to limit impacts on hunting behaviour of nocturnal predators, and where it is required, yellow lighting is used where possible. Lights must be focused and shine downwards to illuminate the required area. Lights must not shine upwards or horizontally away from the site;
- vertebrates should be kept away from the illuminated areas with appropriate fencing where feasible;
- internal power lines may be equipped with bird deterrent measures to prevent bird kills where deemed necessary;
- there is training for workers on the value of biodiversity and the need to conserve the species and systems that occur within the proposed project area;
- there is zero tolerance of the killing or collecting of any biodiversity by anybody working for or on behalf of Richtrau;

- strict speed control measures are used for any vehicles driving within the proposed project area to reduce the incidence of road kills;
- biodiversity education and awareness training for all staff (temporary and permanent) employed by Richtrau or on their behalf. Sightings or findings of fauna must be reported to the environmental officer;
- noisy and/or vibrating equipment will be well maintained to control noise and vibration emission levels;
- all water dams will be fenced off to prevent access by larger animals;
- dust control measures will be implemented (see Section 7.2.11); and
- pollution and litter prevention measures will be implemented (see Sections 7.2.7 and 7.2.3).

As part of closure planning, the designs of any permanent and potentially polluting structures (TSF and WRDs) will take consideration of the requirements for long term pollution prevention and confirmatory monitoring.

Richtrau will monitor the aquatic environment of all potentially affected surface water resources and use the results of the monitoring to implement any other surface water related interventions as deemed appropriate to achieve the mitigation objectives.

**Emergency situations**

Major spillage incidents will be handled in accordance with the emergency procedure attached in Section 20.

## SURFACE WATER

### 7.2.7 ISSUE: POLLUTION OF SURFACE WATER

**Introduction**

There are a number of pollution sources at the mine that have the potential to pollute surface water, particularly in the unmitigated scenario. In the construction and decommissioning phases these potential pollution sources are temporary in nature. Although these sources may be temporary, the potential pollution may be long term. The operational phase will present more long term potential sources and the closure phase will present final land forms (such as the TSF and WRDs) that have the potential to contaminate surface water through long term seepage and/or run-off.

**Project phase and link to activities**

| Construction | Operational | Decommissioning | Closure |
|---|---|---|---|
| | | | |
| Earthworks<br>Civil works<br>Transport systems | Underground mining<br>Transport systems<br>Mineral processing | Underground mining<br>Transport systems<br>Mineral processing | Maintenance and aftercare of final land forms and rehabilitated areas |

| Construction | Operational | Decommissioning | Closure |
|---|---|---|---|
| | | | |
| Site management<br>Water supply and use<br>Non-mineralised waste management<br>Mine residue management and disposal | Site management<br>Water supply infrastructure<br>Non-mineralised waste management<br>Mine residue management and disposal | Site management<br>Water supply infrastructure<br>Non-mineralised waste management<br>Mine residue management and disposal | |

**Rating of impact**

Severity/nature

In the unmitigated scenario, surface water may collect contaminants (hydrocarbons, salts, and metals) from numerous sources. In the unmitigated scenario, potential construction phase pollution sources include:

- sedimentation from erosion;
- spillage from portable toilets, spillage of construction solvents, paint, fuel, oil, cement.

In the unmitigated scenario, potential operation and decommissioning phase pollution sources include:

- spills of operational chemicals, fuel and oil, or leaks from vehicles and equipment;
- contaminated discharges from the dirty water systems including: the processing plant, return water dam, dirty water and waste pipelines, sewage plant, machinery maintenance workshops and washbays;
- spillage from tailings slurry pipelines and associated infrastructure;
- contaminated runoff and seepage from the proposed TSF and WRDs; and
- sedimentation from erosion.

At elevated concentrations these contaminants can be harmful to humans and livestock if ingested directly and possibly even indirectly through contaminated vegetation, vertebrates and invertebrates (impacts on biodiversity have been assessed in Section 7.2.6 and will not be reassessed in this section). The related unmitigated severity is high.

In the mitigated scenario, clean water will be diverted away from the areas disturbed by the proposed project, and contaminated run-off and process water will be contained and re-used in the normal course. The severity can therefore be reduced to medium.

Duration

In the unmitigated scenario the potential impacts are long term, occurring for periods that exceed the life of the proposed project. With mitigation, pollution can be prevented and most impacts can be mitigated within the life of the proposed project.

Spatial scale/extent

In the mitigated and unmitigated scenarios the spatial scale is likely to extend beyond the proposed project area because contamination is mobile once it reaches flowing water courses. This will be more of an issue in the rainy season because the watercourses are non-perennial.

Consequence

In the unmitigated scenario the consequence is high and in the mitigated scenario it is medium.

Probability

In the unmitigated scenario it is likely that there will be significant pollution incidents that would impact on downstream ecosystems and users. The probability is therefore rated as high in the unmitigated scenario. In the mitigated scenario this impact can be reduced to low with the implementation of management and mitigation measures that contain pollution at source or enable fast remediation.

Significance

In the unmitigated scenario, the significance of this potential impact is high for all project phases. In the mitigated scenario, the significance can be reduced to low by reducing the severity, duration and probability of the impact occurring.

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 – summary of the rated impact per phase of the project

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

**Conceptual description of the proposed mitigation actions**

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19, Table 63).

Objective:

The objective of the mitigation measures is to prevent pollution of surface water resources and impacts on other surface water users.

Actions:

In regard to soil/erosion management, pollution prevention and management, and waste management; the procedures, practices and actions included in Section 7.2.3 will be implemented.

In all phases, infrastructure associated with the proposed project will be constructed, operated and maintained so as to comply with the provisions of the National Water Act (36 of 1998) and Regulation 704 (4 June 1999) or any future amendments thereto. In this regard:

- clean water systems are separated from dirty water systems;
- the size of dirty areas are minimised and dirty water is contained in systems that allow the reuse and/or recycling of this dirty water;
- discharges of dirty water may only occur in accordance with authorisations that are issued in terms of the relevant legislation specifications and they must not result in negative health impacts for downstream surface water users. The relevant legislation specifications comprises any applicable authorisation/exemption, the National Water Act (36 of 1998) and Regulation 704, or any future amendment thereto;
- the site wide water balance is refined on an on-going basis with the input of actual flow volumes and used as a decision making tool for water management and impact mitigation; and
- Richtrau will monitor bulk water intake and recycled/reused water on an ongoing basis through the installation of flowmeters and related instrumentation. This information will feed into the site wide water balance. Instrumentation will be calibrated on a regular basis in line with the manufacturer's operating manuals.

PPM, the IBMR and Richtrau will establish a water management committee to ensure that water consumption, recycling and re-use targets are established, monitored and optimised on quarterly basis. This committee should furthermore identify and implement synergies and initiatives across the operations to minimise bulk water intake.

In the construction, operation and decommissioning phases the mine will ensure that all mineralised wastes and non-mineralised wastes are handled in a manner that they do not pollute surface water. This will be implemented through a procedure(s) covering the following:

- pollution prevention through basic infrastructure design pollution prevention through maintenance of equipment;
- pollution prevention through education and training of workers (permanent and temporary);
- pollution prevention through appropriate management of hazardous materials and waste;
- the required steps to enable containment and remediation of pollution incidents; and
- specifications for post rehabilitation audit criteria to ascertain whether the remediation has been successful and if not, to recommend and implement further measures.

The designs of any permanent and potentially polluting structures will take account of the requirements for long term surface water pollution prevention. In addition, where these facilities are associated with groundwater plumes that could impact the quality of surface water resources, Richtrau will implement mitigation measures for as long as is needed to eliminate the risk and achieve the stated mitigation objectives. An example of such a solution is to pump and treat the polluted groundwater so that it does not impact surface water resources.

Richtrau will monitor the water quality (Section 21) in all potentially affected surface water resources and use the monitoring results to implement appropriate mitigation measures to achieve the surface water quality objectives. Where monitoring results indicates that third party water supply has been polluted by Richtrau, Richtrau will ensure that appropriate compensation such as an alternative equivalent water supply will be provided.

**Emergency situations**

Any significant pollution incident is considered an emergency situation. In such instances the emergency procedure included in Section 20 will be followed.

### 7.2.8 ISSUE: ALTERATION OF SURFACE DRAINAGE PATTERNS

Information in this section was sourced from site visits conducted by the EIA project team, and the hydrological study attached in Appendix G (SLR, 2013).

**Introduction**

Natural drainage across the proposed project area is via sheet flow and/or non-perennial tributaries. There are a number of activities/infrastructures which will alter drainage patterns by reducing the volume of run-off into the downstream catchments. No project related infrastructure will be located within the 1:100 year flood lines or within 100m of the non-perennial watercourses on site, however the reef transport facility (conveyor) will cross the non-perennial Lesobeng River.

**Project phase and link to activities**

| Construction | Operational | Decommissioning | Closure |
|---|---|---|---|
| | | | |
| Earthworks<br>Civil works<br>Transport systems<br>Site management<br>Non-mineralised waste management | Earthworks<br>Civil works<br>Transport systems<br>Non-mineralised waste management<br>Mine residue management and disposal<br>Water supply infrastructure<br>Power supply infrastructure<br>Rehabilitation | Demolition<br>Site management<br>Transport systems<br>Non-mineralised waste management<br>Mine residue management and disposal<br>Water supply infrastructure<br>Power supply infrastructure<br>Rehabilitation | Maintenance and aftercare of final land forms and rehabilitated areas |

**Rating of impact**

<u>Severity/nature</u>

During the construction, operation, decommissioning, and to a lesser extent, the closure phases, rainfall and surface water run-off will be collected in all areas that have been designed with water containment infrastructure. The collected run-off will therefore be lost to the catchment and can result in the alteration of drainage patterns. An estimated 3.0km$^2$ of area will be contained for the establishment of the proposed project. This equates to a loss of only 0.3% and 0.1% of the total MAR for the quaternary catchments A24E and A24D respectively. In the context of the affected quaternary catchments this is considered to be a medium severity because the reduction is measurable but will not result in a substantial deterioration in the water reserve and downstream water uses. The overall medium severity rating applies in both the unmitigated (all phases) and mitigated scenario (prior to closure where it reduces to low).

Duration

In the unmitigated scenario, the alteration of drainage patterns will extend beyond closure. In the mitigated scenario, the duration of the alterations will mostly be restricted to the phases before closure.

Spatial scale/extent

In the mitigated and unmitigated scenario the physical alteration of drainage patterns will extend beyond the site boundary as flow reduction impacts could extend further downstream.

Consequence

In the unmitigated scenario the consequence is high for all project phases. In the mitigated scenario the consequence is reduced to medium prior to closure and low thereafter because of reductions in duration and severity.

Probability

In the unmitigated scenario the probability of altering drainage patterns is high. With mitigation, such as limiting the proposed project footprint and associated catchment areas of the infrastructure, the probability can be reduced to medium until closure when it is expected to reduce to low.

Significance

In the unmitigated scenario, the significance of this potential impact is high. In the mitigated scenario, the significance remains medium as the severity and probability of occurrence is reduced.

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 – summary of the rated impact per phase of the project

| Management | Severity / nature | Duration | Spatial scale / extent | Consequence | Probability of Occurrence | Significance |
|---|---|---|---|---|---|---|
| Construction, Operation, Decommissioning | | | | | | |
| Mitigated | M | H | M | M | M | M |
| Closure | | | | | | |
| Mitigated | L | M | M | L | L | L |

**Conceptual description of the proposed mitigation actions**

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19, Table 64).

Objective:

The objective of the mitigation measures is to minimise the alteration of surface drainage in the project area.

Actions:

Richtrau will comply with the terms and conditions of water authorisations/licenses that are granted.

In all phases, project related infrastructure will be constructed, operated and maintained so as to comply with the provisions of the NWA and R704 or any future amendments thereto. Key related issues are:

- clean water systems are separated from dirty water systems; and
- the size of dirty areas are minimised and clean run-off and rainfall water is diverted around dirty areas and back into its normal flow in the environment.

At closure, the objective will be to rehabilitate all remaining facitlities to establish a functionality that eliminates or materially reduces the need for dirty water systems.

**Emergency situations**

No emergency situations have been identified.

## GROUNDWATER

### 7.2.9 ISSUE: REDUCTION OF WATER AVAILABILITY/LEVELS

The information in this section was sourced from the groundwater specialist study (AGES, 2013) included in Appendix H.

**Introduction**

It may be necessary to dewater the underground mine workings in order to establish safe working conditions. This has the potential to cause dewatering which may cause a loss in water supply to surrounding borehole users and groundwater-fed surface water resources. This activity will commence during the shaft sinking operations and will cease in the decommissioning phase. Upon closure, the groundwater levels will be allowed to rebound naturally. AGES is of the opinion that the long term open pit at PPM will not impact on the re-watering of the underground operations at Magazynskraal (AGES, 2011).

**Project phase and link to activities**

| Construction | Operational | Decommissioning | Closure |
|---|---|---|---|
| | | | - |
| Shaft sinking | Underground mining | Dewatering ceases | NA |

**Rating of impact**

Severity / nature

Depletion of the groundwater in the aquifer and simulated change due to dewatering can occur as a result of mining activities. A zone of influence is associated with the mine dewatering during life of mine and could impact neighbouring groundwater users. Modelling predicts potential drawdown levels of between 50 and 450m extending up to 8km from the underground mining operation.

The natural water levels are expected to be restored post closure and the underground operations will flood with time, given that groundwater flow is not completely sealed off during the mining process.

Based on the outcome of the groundwater study (AGES, 2013) surface water resources, if dependant on groundwater, could be negatively affected by mine dewatering. Impacts on surface water resources and biodiversity reliant thereon are assessed in Section 7.2.5. It should be noted that although there is potential for cumulative dewatering impacts on springs to the south of PPM and Sedibelo mines, the additional impact associated with the Magazynskraal operation is not predicted to materially add to the cumulative scenario. This should however be confirmed with on-going monitoring.

Therefore, mining activities during the construction and operational phases could result in a decrease in water levels and subsequent borehole yields to third party users including people and livestock. This is regarded as a high severity in the unmitigated scenario, which could be reduced to medium with mitigation.

Duration

In the unmitigated scenario the duration of the impact is linked to the duration of the dewatering and the recharge time thereafter. It is expected that the duration of dewatering impacts on the boreholes in the vicinity of the operations will extend beyond closure. With mitigation the impact will have a short term duration because affected users can be supplied with an alternative water resource.

Spatial scale / extent

Where dewatering occurs, the spatial scale of the known zone of influence will be localised in close proximity to the mining areas but could impact third parties that are off site, resulting in a medium spatial extent in the unmitigated and mitigated scenarios.

Consequence

The consequence of the impact is rated as high in the unmitigated scenario which is reduced to medium with mitigation.

Probability

In the unmitigated scenario, the precautionary approach is applied and therefore because there is potential for third party boreholes to be influenced by the dewatering cone, the impact probability is high. In the mitigated scenario this is reduced to medium.

Significance

In the mitigated scenario the significance of the impact as a result of dewatering is regarded as high. With mitigation this is reduced to medium.

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

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

**Conceptual description of proposed mitigation measures**

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19, Table 65)

Objective

The objective of the mitigation measures is to prevent water losses to third party water users and ecological sensitive areas.

Actions

Where mine dewatering causes a loss of water supply to third parties an alternative equivalent water supply will be provided by Richtrau until such time as the dewatering impacts cease.

During the operational phase, Richtrau will:

- ensure all potentially affected third party boreholes are included in the ground water monitoring program to ensure that changes in water depths can be identified, where possible;
- establish a joint water monitoring forum between the local mining companies where data is shared and impacts on third party groundwater users are addressed;
- update the groundwater model every two years;
- ensure the mine's water sealing procedures are adhered to for the sealing of discrete fractures to reduce ingress of groundwater in the underground workings.

In the decommissioning and closure phases, Richtrau will:

- update the groundwater flow model with the detailed post closure underground mine voids and the time to flood the underground mine voids should be simulated. A detailed geochemical assessment should be conducted to determine the water quality in the flooded underground mines; and
- clad the TSF and WRDs to limit water ingress due to precipitation on these facilities.

**Emergency situations**

None identified.

### 7.2.10 ISSUE: GROUNDWATER CONTAMINATION

The information in this section was sourced from the groundwater specialist study (AGES, 2013), included in Appendix H.

**Introduction**

There are a number of sources in all mine phases that have the potential to pollute groundwater. In the construction and decommissioning phases some of these potential pollution sources are temporary and diffuse in nature. Even though the sources are temporary in nature, related potential pollution can be long term. The operational phase will present more long term potential pollution sources and the closure phase will present final land forms, such as the proposed TSF and WRDs that may have the potential to pollute water resources through long term seepage and/or run-off.

**Project phase and link to activities**

| Construction | Operational | Decommissioning | Closure |
|---|---|---|---|
| | | | |
| Earthworks<br>Civil works<br>Transport systems<br>Site management<br>Water supply and use<br>Non-mineralised waste management | Underground mining<br>Transport systems<br>Mineral processing<br>Site management<br>Water supply and use<br>Non-mineralised waste management<br>Mine residue management and disposal | Underground mining<br>Transport systems<br>Mineral processing<br>Site management<br>Water supply and use<br>Non-mineralised waste management<br>Mine residue management and disposal | Maintenance and aftercare of final land forms and rehabilitated areas |

**Rating of impacts**

Severity/nature

Two types of pollution sources are broadly considered namely diffuse pollution, which includes ad hoc spills and discharges of polluting substances, and point source pollution which includes longer term pollution associated with sources such as the proposed TSF and WRDs. Geochemical results indicate that there is no material risk of acid mine drainage. Groundwater modelling identified that there is potential for groundwater contamination (nitrates and sulphates amongst other parameters) associated with the proposed TSF and WRDs. This contamination has potential to influence ground and surface water resources. In the case of groundwater resources there is potential for contamination of borehole water used for livestock watering and for domestic use by on site herders. In the case of surface water, the link between ground and surface water has not been established, but the application of the precautionary approach leads to the possibility that groundwater contamination could influence on site non-perennial drainage lines. This is a high severity in the unmitigated scenario.

In the mitigated scenario the severity can be reduced to medium because of pollution prevention and/or mitigation measures.

Duration

In the unmitigated scenario, groundwater contamination and the potential related health impacts are long term in nature and can extend beyond the life of the project. With mitigation the pollution and related impacts can be prevented or mitigated during the life of the project which reduces the duration to medium.

Spatial scale/extent

The groundwater model shows that in both the unmitigated and mitigated scenarios, groundwater contamination and related impacts are not expected to extend beyond the mining right area. Notwithstanding this, there is potential for boreholes used by herders, livestock and/or wildlife to be affected which is a medium spatial scale in that the contamination extends beyond the infrastructure footprints.

Consequence

The consequence is high in the unmitigated scenario. With mitigation this reduces to medium.

Probability

The probability of the impact occurring relies on a causal chain that comprises three main elements:

- does contamination reach water resources?
- will people and animals utilise this contaminated water?
- is the contamination level harmful?

The first element is that contamination reaches the ground and surface water resources within and adjacent to the proposed project area. Without mitigation the probability is high, but with mitigation it reduces to low.

The second element is that third parties, livestock and/or wildlife consume the contaminated water. There is a possibility for this to occur through the consumption of both groundwater and surface water. The hydrocensus that was undertaken for the proposed project shows that of the boreholes on site and in the surrounding area, 25% are in use for domestic and livestock watering purposes. In addition, although livestock and wildlife may drink surface water when it is available this is not their constant water supply because for most of the year the watercourses are dry. Without mitigation the probability is high, but with mitigation it reduces to low.

The third element is that some contaminants will be at a level which is harmful to humans and livestock. This is influenced both by the quality of any discharged water and by the diluting effect of any the receiving water bodies particularly in the rainy season. Without mitigation the probability is high, but with mitigation it reduces to medium.

Significance

In the unmitigated scenario the significance is high, with mitigation it reduces to medium.

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 – summary of the rated impact per phase of the project

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

**Conceptual description of proposed mitigation measures**

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19, Table 66)

Objective

The objective of the mitigation measures is to prevent pollution of ground water resources and related harm to water users.

Actions:

Richtrau will comply with both the National Water Act (36 of 1998) and Regulation 704 (4 June 1999) or any future amendments thereto, and the terms and conditions of water authorisations/licenses.

In the construction, operation and decommissioning phases the mine will ensure that all mineralised wastes and non-mineralised wastes are handled in a manner that they do not pollute groundwater. This will be implemented through a procedure(s) covering the following:

- pollution prevention through basic infrastructure design;
- pollution prevention through education and training of workers (permanent and temporary);
- pollution prevention through appropriate management of materials and non-mineralised waste;
- the required steps to enable containment and remediation of pollution incidents; and
- specifications for post rehabilitation audit criteria to ascertain whether the remediation has been successful and if not, to recommend and implement further measures.

All infrastructure that has the potential to pollute groundwater resources will be designed and implemented in a manner that pollution is addressed post closure.

Infrastructure that has the potential to cause groundwater contamination will be identified and included in a groundwater pollution management plan which will be implemented as part of the operational phase. This plan has the following principles:

- determine potential pollution sources;
- determine the extent of potential contamination plumes;
- design and implement intervention measures to prevent, eliminate and/or control the pollution plume. In terms of the TSF this may include: measures to reduce ponding and remove water from the dam, interception trenches along the perimeter of the dam, scavenger wells, a pump and treat system, and final capping amongst others. In terms of the WRDs this may include: measures to contain seepage, measures to contain runoff and final capping;
- monitor all potential impact zones to track pollution and mitigation impacts;
- where monitoring results indicate that third party water supply has been polluted by Richtrau, Richtrau will ensure that an alternative equivalent water supply will be provided.

Groundwater monitoring should continue post closure to assess the migrations of any groundwater contamination (nitrates and sulphates amongst other parameters) originating from the permanent on-site facilities i.e. TSF and WRDs.

**Emergency situations**

Any significant pollution incident is considered an emergency situation. In such instances the emergency procedure included in Section 20 will be followed.

## AIR QUALITY

Information in this section is derived from the specialist air study (Airshed, 2013), included in Appendix I.

### 7.2.11 ISSUE: AIR POLLUTION

**Introduction**

There are a number of activities/infrastructure associated with mining operations that have the potential to pollute the air. In the construction and decommissioning phases these activities are temporary in nature. The operational phase will present more long term activities and the closure phase will present final land forms that may have the potential to pollute the air through long term wind erosion.

With projects of this nature, the main emissions include: inhalable particulate matter less than 10 microns in size ($PM_{10}$), larger total suspended particulates (TSP) associated with dust fall out, and limited gas emissions. Gaseous pollutants (such as sulphur dioxide, oxides of nitrogen, carbon monoxide, etc.) derived from vehicle exhausts and blasting are regarded as negligible in comparison to particulate emissions. At certain concentrations, each of these contaminants can have health and/or nuisance impacts.

**Project phase and link to activities**

| Construction | Operational | Decommissioning | Closure |
|---|---|---|---|
| | | | |
| Earthworks<br>Civil works<br>Transport systems<br>Site management<br>Non mineralised waste facilities | Transport systems<br>Site management<br>Materials handling<br>Non mineralised waste facilities<br>Mine residue management and disposal | Transport systems<br>Site management<br>Non mineralised waste management<br>Mine residue management and disposal<br>Rehabilitation | Maintenance and aftercare of final land forms and rehabilitated areas |

**Rating of impact**

Severity/nature

In order to determine the potential for health impacts, the evaluation criteria outlined in Table 49 have been used. The more stringent 2015 National Ambient Air Quality Standards (NAAQS) have been applied to this assessment as the operational phase activities would occur in approximately 2020, should the proposed project receive the relevant environmental authorisations.

**TABLE 49: AIR POLLUTION CRITERIA EVALUATION**

| Contaminant | Averaging Period | Evaluation criteria | Source |
|---|---|---|---|
| $PM_{10}$ | Daily | Current - 120 microgram/m$^3$<br>2015 - 75 microgram/m$^3$ | NEM:AQA – National Ambient Air Quality Standards, GN 1210, December 2009 |
| | Annual | Current - 50 microgram/m$^3$<br>2015 - 40 microgram/m$^3$ | |
| TSP | Industrial | Current draft - 1 200 microgram/ (m$^2$-day) | |
| | Residential | Current draft - 600 microgram/ (m$^2$-day) | |

Gaseous emissions from vehicles and equipment are expected to be insignificant and therefore this assessment will focus on TSP and $PM_{10}$ emissions which may impact on human health.

The modelled $PM_{10}$ and dust fall out concentrations associated with the proposed project are expected to be limited in both the unmitigated and mitigated scenarios. No exceedances of either the annual or daily $PM_{10}$ evaluation criteria are predicted at any of the nearby communities in the mitigated scenario. Predicted dust fall out rates in both the mitigated and unmitigated scenario are not expected to exceed the limit of $600mg/m^2$-day at any of the nearby communities.

However, exceedances of the evaluation criteria for both $PM_{10}$ and dust fall out are expected to occur in certain areas on the farm Magazynskraal 3 JQ, which could impact on the crop farmers and livestock herders on site.

The severity of the potential impact is medium in the unmitigated scenario for all off-site receptors, and could be high for crop farmers and livestock herders, depending on the proximity to the high impact zone. With reference to Figure 18, the land users located north of the proposed processing plant would fall into the high impact zone. The severity of this impact can be reduced to low with mitigation.

Duration

Without mitigation the duration of the health impacts could extend beyond closure. With mitigation, the duration of impacts will be limited to the life of the project.

Spatial scale/extent

Although there are no predicted exceedances at the off-site communities, the spatial scale of the potential impact extends beyond the site boundary in both the mitigated and unmitigated scenarios.

Consequence

Without mitigation the consequence is high. With mitigation the consequence reduces to low.

Probability

The probability that there will be elevated dust emissions is high in the unmitigated scenario. Moreover, given that there are crop farmers and livestock herders on Magazynskraal 3 JQ, this could result in a human health impact because without mitigation measures these land users could be exposed to elevated dust concentrations that are above the evaluation criteria in certain areas of the farm. This can be reduced to low with the implementation of management and mitigation measures such as moving the affected persons to areas of the farm where impacts are acceptable.

Significance

The significance has been rated as high; however this can be mitigated to low through a reduction in the severity and probability.

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 | M (H for land users on site) | H | M | H | H | H |

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

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

**Conceptual description of the proposed mitigation actions**

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19, Table 67).

Objective

The objective of the mitigation measures is to minimise the generation of dust and related health impacts.

Actions

The proposed target controls on the various sources are provided below:

- materials handling operations – 50% control efficiency through effective water sprays;
- crushing and screening activities – 80% control efficiency through effective water sprays.

In the construction, operational and decommissioning phases, the following management and mitigation measures will be implemented:

- the area of disturbance will be limited as far as practically possible;
- dust will be supressed on unpaved roads through the use of chemical binding agents and/or water sprays combined with vehicle speed controls;
- dust controls at material handling points (loading and offloading) by water sprays;
- rehabilitation and re-vegetation of all decommissioned areas and concurrent rehabilitation of the side slopes of the operational TSF and WRDs;
- maintenance of all vehicles and equipment to achieve optimal exhaust emissions;
- dust will be monitored at the closest sensitive receptors, including. the over-night dwellings of crop farmers and livestock herders;
- as part of closure planning the designs of any permanent and potentially polluting structures (TSF and WRDs) will incorporate measures to address long-term pollution prevention and confirmatory monitoring.

**Emergency situations**

Not applicable.

**AMBIENT NOISE**

Information in this section is derived from the specialist noise study (Acusolv, 2012) included in Appendix J.

### 7.2.12 ISSUE: NOISE POLLUTION

**Introduction**

Two types of noise are distinguished, i.e. noise disturbance and noise nuisance. The former is noise that can be registered as a discernible reading on a sound level metre and the latter, although it may not register as a discernible reading on a sound level metre, may cause nuisance because of its tonal character (e.g. distant humming noises). The proposed project presents the possibility of generating noise (both disturbing and nuisance) in the project phases prior to closure.

The SANS guidelines (SANS10103, 2008) stipulate that noise levels from a development that cause ambient background noise levels to increase by up to 3dBA is acceptable (note that this is the upper limit). Ambient noise levels that increase by 5dBA as a result of a development are considered to be significant. These evaluation criteria will be used for this assessment. It should be noted that some receptors are more sensitive than others, particularly the conservation and eco-tourism activities located to the south and south-west of the proposed project area. In this regard, any increase in noise levels could be noticeable and could impact on current land uses.

Potential noise impacts related to biodiversity have been addressed in Section 7.2.6 and therefore this section will focus on the potential human related noise impacts.

**Project phase and link to activities**

| Construction | Operational | Decommissioning | Closure |
|---|---|---|---|
| | | | N/A |
| Site preparation<br>Earthworks<br>Civil works<br>Site management<br>Transport systems | Site management<br>Transport systems<br>Materials handling<br>Mine residue management and disposal<br>Rehabilitation | Demolition<br>Transport systems<br>Rehabilitation | - |

**Rating of impact**

Severity/nature

The mine is not expected to exceed the evaluation criteria at the surrounding villages or the Pilanesberg National Park. The evaluation criteria could be exceeded for livestock herders that move around the area, particularly in the zone approximately 1.5km to the north, north-west and west of the proposed project area. It should however be noted that the area immediately west of the proposed project area is currently being developed as the Sedibelo Platinum Mine. Figure 19 shows the location of a dwelling, north of the proposed processing plant, associated with the crop farmers and/or livestock herders that falls within this 1.5km zone. In the unmitigated scenario, the severity is expected to be medium for most receptors, except the livestock herders when they are present in the high impact zone. With mitigation, the severity reduces to low.

Duration

The duration of the potential impacts would be restricted to the phases prior to closure in both the mitigated and unmitigated scenarios. This is a medium duration.

Spatial scale/extent

In both the unmitigated and mitigated scenarios the noise impacts will extend beyond the proposed project boundary. This is a medium spatial scale.

Consequence

In the unmitigated scenario, the consequence is medium. With mitigation, the consequence is low.

Probability

In the unmitigated scenario, the probability is high. With the implementation of mitigation measures, as detailed below, the probability can be reduced to low.

Significance

The unmitigated significance is rated as medium during the construction and decommissioning phases, and medium-high during the operational phase. The significance is expected to reduce to low for all phases in the mitigated scenario.

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

| Management | Severity / nature | Duration | Spatial scale / extent | Consequence | Probability of Occurrence | Significance |
|---|---|---|---|---|---|---|
| Construction and decommissioning | | | | | | |
| Unmitigated | M | M | M | M | H | M |
| Operational | | | | | | |
| Unmitigated | M<br>(H for livestock herders in high impact zone) | M | M | M | H | M-H |

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

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

**Conceptual description of the proposed mitigation actions**

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19, Table 68).

Objective:

The objective of the mitigation measures is to prevent public exposure to disturbing noise.

Actions:

All vehicles and equipment will be maintained to limit noise emissions.

All noise complaints will be documented, investigated and reasonable efforts made to address the area of concern. Options available for reducing noise impacts include but are not limited to:

- limiting the operating times for noise generating activities;
- equipping noise sources with silencers;
- construction of noise attenuation measures; and
- consulting a noise specialist for mitigation advice.

Prior to the establishment of the processing plant, Richtrau will relocate the livestock herders and/or crop farmers and the associated infrastructure currently located north of the proposed processing plant to an area on Magazynskraal 3 JQ where noise levels are within the recommended levels. This will be done in consultation with the farmers and livestock herders. Futhermore, Richtrau will establish a monitoring point on the northern boundary of the farm Magazynskraal 3 JQ in consultation with a suitably qualified noise specialist. Should ambient noise levels increase by more than 3dBA Richtrau will either implement additional noise attenuation measures in consultation with a specialist if necessary. In the case of the livestock herders, specific interventions are likely to be required, which may include relocation to quieter parts of the farm on which they are located.

Specific noise monitoring will be conducted in accordance with Section 21.

**Emergency situations**

Not applicable.

## VISUAL ASPECTS

### 7.2.13 ISSUE: NEGATIVE LANDSCAPE AND VISUAL IMPACTS

**Introduction**

Negative visual impacts will be caused by activities and infrastructure in all project phases. During construction, this will be influenced by the increase in activities and clearing of vegetation on-site. During operation this will be influenced by the presence of infrastructure such as the processing plant and shafts as well as the development of the TSF and WRDs; and during decommissioning and closure by the closure objectives and effectiveness of rehabilitation measures. The more significant visual impacts relate to the larger infrastructure components (such as the processing plant and shafts), infrastructure that will remain in perpetuity (such as the TSF and WRDs), and night lighting.

**Project phase and link to activities**

| Construction | Operational | Decommissioning | Closure |
|---|---|---|---|
| | | | |
| Site preparation<br>Earthworks<br>Civil works<br>Site management<br>Transport system | Civil works<br>Transport system<br>Site management<br>Non-mineralised waste management<br>Mine residue management and disposal<br>Water supply infrastructure<br>Power supply infrastructure | Demolition<br>Transport system<br>Site management<br>Non-mineralised waste management<br>Mine residue management and disposal<br>Water supply infrastructure<br>Power supply infrastructure | Maintenance and aftercare of final land forms and rehabilitated areas |

**Rating of impact**

Severity/nature

The severity of visual impacts is determined by assessing the change to the visual landscape as a result of project related infrastructure and activities. As discussed in Section 1.1.11, the visual landscape is determined by considering: landscape character, sense of place, scenic quality, sensitivity of the visual resource and sensitive views. In this regard, the proposed project area is considered to have a moderate value, however when considering the wider area the value increases and is considered to be moderate to high.

When considering the potential change to the visual landscape the key issues are: landscape impact, visual exposure, and sensitivity of receptors. Each of these issues is discussed below.

Landscape impact is linked to the changes to the character of the landscape caused by the physical presence of surface infrastructure related to the proposed project. In this regard, the proposed surface infrastructure will protrude above the vegetation line and contrast with the existing landscape profile (topography, colour and texture). In addition, the proposed surface infrastructure would dominate the landscape due to the size, scale and engineered characteristics.

Visual exposure (Figure 28) relates to distance, as well as the degree of intrusion which is also influenced by weather and light conditions. The proposed surface infrastructure would result in the following impacts on surrounding receptors:

- high impact: crop farmers and livestock herders on Magazynskraal 3 JQ;
- moderate impact: Lesobeng, Kgamatha Lesetlheng, Lekutung and the eastern sections Legkraal (Ga-Riphiri and Ga-Masilela), north-facing slopes on the northern boundary of the PNP, as well as the section of the P50-1 to the south of the proposed project; and
- low impact on the following: Manamakgoteng, Mononono, Sefikile, Magong, Magalane, Ngweding, western sections of Legkraal (Boriteng and Bofule) and Mmantserre.

Sensitivity of visual receptors refers to the fact that the visual impact varies according to the sensitivity of the receptors in the project area. It should be noted that concerns regarding visual impacts raised during the scoping phase consultations were only received from the eco-tourism and conservation ventures to the south and south-west of the proposed project, which include the proposed heritage park corridor. Due to the nature of these ventures they are particularly sensitive to visual impacts.

In the unmitigated scenario, the severity is regarded as high for all project phases. With mitigation, the impact can be reduced to medium-high for all project phases prior to closure, where the severity reduces to low.

Duration

In the unmitigated scenario the duration is high because the impacts will continue beyond the life of the proposed project. In the mitigated scenario the impacts are unlikely to extend beyond the life of the proposed project as all of the sites will have been rehabilitated, including the TSF and WRDs which will remain in perpetuity.

Spatial scale/extent

The visual impacts will extend beyond the proposed project area in both the unmitigated and mitigated scenarios. This is a medium spatial scale.

Consequence

The consequence in the unmitigated scenario is high. With mitigation it reduces to medium, and low after closure the consequence reduces to low.

Probability

In both the unmitigated and mitigated scenarios, the probability of this potential impact occurring is high for all project phases except closure when it reduces to medium in the mitigated scenario.

Significance

In the unmitigated scenario, the significance is high. With mitigation, the significance is medium-high for all project phases except after closure where the significance reduces 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 – summary of the rated impact per phase of the project

| Management | Severity / nature | Duration | Spatial scale / extent | Consequence | Probability of Occurrence | Significance |
|---|---|---|---|---|---|---|
| Construction, operation, decommissioning | | | | | | |
| Mitigated | M-H (H for people on site and Lesobeng) | M | M | M | H | M-H (H for people on site and Lesobeng) |
| Closure | | | | | | |
| Mitigated | M-L | M | M | M-L | M | M-L |

**Conceptual description of the proposed mitigation actions**

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19, Table 69).

Objective:

The object of the mitigation measures is to minimise visual impacts on sensitive receptors.

Actions:

In the construction and operation phases the following visual mitigation techniques will be implemented:

- limit the clearing of vegetation;
- limit the emission of visual air emission plumes (dust emissions);
- use of visual screening berms in areas where there are sensitive visual receptors;
- paint structures and buildings in colours (e.g. browns and greens) that reflect and compliment the natural landscape;
- the use of lighting will be limited to project requirements and measures will be implemented to limit light pollution impacts on surrounding areas. In this regard, night lighting will be fitted with fixtures to prevent light spillage and focus the light on precise mine activities and infrastructure, fitted as low to the ground as is practicable, and most security lights will be activated with movement sensors;
- on-going vegetation establishment on rehabilitated areas and the TSF side slopes that reflects the natural vegetation of the area;
- the slopes of the waste rock dumps will be contoured, landscaped and vegetated during the operational phase of the mine to allow any problematic areas to be rectified during the life of the mine; and

- Richtrau will develop the rehabilitation and closure plan in close partnership with the NWPTB to ensure that visual impacts on the proposed Heritage Park are minimised as far as possible.

In the decommissioning phase Richtrau will implement its closure plan which involves the removal of infrastructure, and the rehabilitation and re-vegetation of cleared areas and any final landforms that will remain post closure. These final landforms should be rehabilitated in a manner that achieves both landscape functionality (particularly with regards to the proposed Heritage Park Corridor) and limits and/or enhances the long term visual impact. The waste rock dumps will be designed, contoured and constructed with closure in mind. The WRD side slopes will be flattened to 1V:4H general slope, and will be re-vegetated using a combination of indigenous vegetation, including but not limited to trees, shrubs, grasses and aloe species to mimic the vegetation cover of natural topographical features in the area.

At closure, final landforms will be managed through an aftercare and maintenance programme to limit and/or enhance the long term post closure visual impacts.

**Emergency situations**

Not applicable.

**FIGURE 28: VISUAL EXPOSURE**

## HERITAGE, PALEONTOLOGICAL AND CULTURAL RESOURCES

### 7.2.14 ISSUE: DISTURBANCE OF HERITAGE (INCLUDING CULTURAL) RESOURCES

Information in this section is derived the from the specialist heritage-cultural study (Pistorius, 2010) included in Appendix L and the specialist palaeontology study (Rubidge, 2010) included in Appendix M.

**Introduction**

Heritage resources include sites of archaeological, cultural or historical importance. There are a number of activities/infrastructure in all phases prior to closure that have the potential to damage heritage (including cultural) resources and result in the loss of the resource for future generations. 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. Limited impacts are expected during the decommissioning phase, and no impacts are expected to occur during closure, however the potential for uncovering new heritage resources during the all phases prior to closure does exist.

**Project phase and link to activities**

| Construction | Operational | Decommissioning | Closure |
|---|---|---|---|
| | | | N/A |
| Site preparation<br>Earthworks<br>Civil works<br>Transport systems<br>Site management | Site preparation<br>Earthworks<br>Transport systems<br>Site management<br>Water supply infrastructure<br>Power supply infrastructure | Demolition<br>Site management<br>Transport systems | - |

**Rating of impact**

Severity/nature

With reference to Section 1.3.5, limited heritage (and cultural) resources are present on the proposed project area. The resources that have been identified are concentrated in the southern portion of the proposed project area and will not be disturbed by the proposed footprint. In the unmitigated scenario, the severity is rated as medium as the heritage resources could be disturbed inadvertently. With mitigation the severity reduces to low.

No paleontological resources are expected to be found in the proposed project area and therefore this impact is not assessed further.

Duration

In the unmitigated scenario, the loss of heritage resources will be permanent. With mitigation, the heritage resources can be protected and therefore the duration would be short term.

Spatial scale/extent

The spatial scale is limited to the proposed project area in both the unmitigated and mitigated scenarios.

Consequence

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

Probability

In the unmitigated scenario, the probability of this potential impact occurring is medium. With mitigation, the probability reduces to low as the heritage resources would be protected.

Significance

In the mitigated scenario the significance of this potential impact is medium. With mitigation, the significance remains low as the severity, duration and probability is reduced.

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

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

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

| Management | Severity / nature | Duration | Spatial scale / extent | Consequence | Probability of Occurrence | Significance |
|---|---|---|---|---|---|---|
| Construction, operational, decommissioning | | | | | | |
| Mitigated | L | L | L | L | L | L |

**Conceptual description of the proposed mitigation actions**

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19, Table 70).

Objective:

The objective of the mitigation measures is to minimise the disturbance of heritage resources.

Actions:

Richtrau will ensure that all workers (temporary and permanent) are educated about heritage and cultural resources that may be encountered and about the need to conserve these.

In the event that new heritage and/or cultural and/or paleontological resources are discovered, the mine will follow a chance find emergency procedure, which includes the following:

- all work at the find will be stopped to prevent damage;
- an appropriate heritage specialist will be appointed to assess the find and related impacts; and
- permitting applications will be made to SAHRA, if required.

In the event that any graves are discovered during the construction, operational or decommissioning phases these will be avoided and preserved as a first priotiy. If damamge is unavoidable, prior to damaging or destroying any identified graves, permission for the exhumation and relocation of graves must be obtained from the relevant descendants (if known) and the relevant local and provincial authorities. The exhumation process must comply with the requirements of the relevant Ordinance on Exhumations, and the Human Tissues Act, 65 of 1983.

**Emergency situations**

The uncovering of graves and heritage (including cultural) sites is considered an emergency situation. In such instances the emergency procedure included in Section 20 will be followed.

## LAND USES

### 7.2.15 ISSUE: BLASTING HAZARDS

**Introduction**

The main activity that has the potential to cause a blasting hazard is the establishment of the shaft sinking during the construction phase. During the operational phase, blasting will take place as part of underground mining, but most of the mining will take place between 150 and 700m below surface and blasting is therefore not expected to have a significant impact.

The issues regarding the effects of blasting on animals in the Pilanesberg National Park are discussed in Section 7.2.6 and will not be assessed in this section.

**Project phase and link to activities**

| Construction | Operational | Decommissioning | Closure |
|---|---|---|---|
| | N/A | N/A | N/A |
| Earthworks<br>Shaft sinking | - | - | - |

**Rating of impact**

Severity/nature

Surface blasting will be limited to the initial shaft sinking phase. Blasting that takes place during the operational phase, i.e. for underground mining, is not expected to impact surface users and therefore is not assessed further.

The people, livestock and/or structures within the proposed project area could be vulnerable to injury or damage as a result of fly rock. In addition, dwellings associated with the livestock herders and crop farmers are particularly vulnerable to damage from ground vibration or air blast from surface or near surface blasting.

In the unmitigated scenario, this impact it is considered to have high severity. With mitigation, the blast design and impact controls will reduce the potential for exceeding the recommended limits which reduces the severity to medium.

Duration

Generally speaking damage to infrastructure can be repaired in the short term, however injury or death is considered to have a long-term duration.

Spatial scale/extent

Blast impacts may extend beyond the proposed project boundary particularly in the unmitigated scenario. This should however be limited to within the site boundary with the implementation of management and mitigation measures. Table 50 below outlines the proximity of the shaft areas to third party infrastructure.

**TABLE 50: PROXIMITY OF STRUCTURES TO SHAFT AREAS**

| Structures within 100m | Structures within 500m | Structures within 1 000m |
|---|---|---|
| Livestock grazers / crop farmers<br>Livestock | Livestock grazers / crop farmers<br>Livestock | Livestock grazers / crop farmers<br>Livestock<br>Powerlines<br>Public D511 road<br>Potential infrastructure associated with livestock grazers / crop farmers |

Consequence

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

Probability

The probability of injury to third party or damage to third party infrastructure is considered to be high in the unmitigated scenario. This can be reduced to low with the implementation of management and mitigation measures.

Significance

The significance is rated as high in the unmitigated scenario. This can be mitigated to medium by reducing the spatial scale and probability.

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

| Management | Severity / nature | Duration | Spatial scale / extent | Consequence | Probability of Occurrence | Significance |
|---|---|---|---|---|---|---|
| Construction | | | | | | |
| Unmitigated | H | H | M | H | H | H |

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

| Management | Severity / nature | Duration | Spatial scale / extent | Consequence | Probability of Occurrence | Significance |
|---|---|---|---|---|---|---|
| Construction | | | | | | |
| Mitigated | M | H | L | M | L | M |

**Conceptual description of the proposed mitigation actions**

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19, Table 71).

Objective:

The objective of the mitigation measures is to prevent injury to third parties and damage to third party infrastructure through blasting.

Actions:

As a general rule, no blasting will take place within 500m of third party structures. Where Richtrau would like to blast in areas within this 500m distance, a project specific risk assessment will be completed and additional project specific mitigation measures will be implemented, subject to approval by the relevant stakeholders and/or authority(ies).

Blasting during the construction phase will be scheduled to take place in the afternoons and will be limited to week days if possible.

A blast management plan will be implemented for surface and near surface blasts which will include:

- pre-mining crack surveys of any structures within the potential impact zone
- design of blasts to prevent injury to people and livestock and to prevent damage to structures. As a minimum the blast design will achieve:
    - a fly rock impact zone limit of 500m;
    - a peak particle velocity limit of less than 12mm/s at third party structures that are built according to building industry standards and which is further reduced in the case of third party structures that are not built according to building industry standards;
    - an air blast limit of 125dB at third party structures.
- communication of the planned blast programme to interested and affected parties;
- pre-blast warning and evacuation to clear people, traffic, moveable property and livestock from the potential fly rock impact zone;
- blast monitoring to verify the effectiveness of the blast design and blast execution;
- audit and review to adjust the blast design where necessary to achieve the stated objectives;
- formal documented investigation and response for all third party blast related complaints; and
- remediation of all impacts caused by blasting.

**Emergency situations**

Any injury or death from fly rock is considered an emergency situation. In such instances the emergency procedure included in Section 20 will be followed.

### 7.2.16 ISSUE: ROADS AND TRAFFIC IMPACTS

Information in this section is taken from the specialist traffic study included in Appendix N.

**Introduction**

Traffic impacts are expected from construction through to the end of the decommissioning phase when trucks, buses, taxis and smaller vehicles will make use of the public and private transport network in and adjacent to the project area. The key potential traffic related impacts are on road capacity and public safety.

**Project phase and link to activities**

| Construction | Operational | Decommissioning | Closure |
|---|---|---|---|
| | | | N/A |
| Transport systems (including the movement of staff and raw materials) | Transport systems (including the movement of staff, consumables and product) | Transport systems (including the movement of staff and dismantled infrastructure) | - |

**Rating of impact**

Severity/nature

Approximately 16 bus, 15 taxi, 42 private vehicle and 4 truck trips per day are expected during the construction phase. During the operational phase approximately 29 bus, 188 private vehicle, 25 taxi and 6 trucks are expected per day. The decommissioning phase traffic is expected to be less than that of the construction phase, and traffic during the closure phase is expected to be insignificant. With reference to Figure 1, employees that are expected to make use of bus, taxi and private vehicles are expected to travel to the mine from all directions. Heavy trucks bring raw materials to the mine will use the R510 and travel along the P50-1, while heavy trucks transporting product are expected to travel eastwards along the P50-1 and north along the R510.

In the unmitigated scenario, the increase in mine related traffic could create increased safety risks (in terms of injury and death) to pedestrians and animals in the area as well as other road users. It is also likely that the increased traffic will contribute to the poor condition of the roads in the area. This is a high severity.

In the mitigated scenario, the traffic specialist is of the view that the service level and safety of the roads will not be compromised by the additional project related traffic. With the implementation of mitigation measures, the impacts on animal safety and road degradation can also be reduced. This is a medium severity because the frequency of potential accidents is expected to reduce.

Duration

Any serious injury or death is a long term impact in both the unmitigated and mitigated scenarios.

Spatial scale/extent

Possible accident sites could be located within or outside the proposed project area and the indirect impacts associated with any injuries or fatalities will extend to the communities to which the injured people/animals belong. This is a medium spatial scale.

Consequence

The consequence is high in both unmitigated and mitigated scenarios.

Probability

In the unmitigated scenario the probability of traffic accidents occurring is medium because although the possibility exists, accidents do not occur on a continuous basis. With mitigation this reduces to low.

Significance

The unmitigated significance is high. With mitigation the significance is medium.

Unmitigated – summary of the rated 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 | M | H |

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

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

**Conceptual description of the proposed mitigation actions**

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19, Table 72).

Objective:

The objective of the mitigation measures is to limit mine related road disturbance and accidents and/or injury to people and livestock.

Actions:

In the construction, operation and decommissioning phases Richtrau will implement a transport safety programme to achieve the mitigation objectives. Key components of the programme include education, training, awareness, and transport system maintenance.

The intersection of the P50-1 and D511 must be upgraded in consultation with the MKLM and NWDRT in accordance with the safety considerations recommended by the professional traffic and roads engineer.

In this regard dedicated right and left turn lanes must be provided where heavy vehicles are expected to turn onto the D511 to ensure the safe operation of the intersection (refer to Figure 23).

A dedicated public transport loading and off-loading area must be provided on the property of the proposed project for workers and visitors.

Should sections of the D511 be upgraded to paved road for mine access in the future, a dedicated right turn lane for north bound traffic must be provided as part of the intersection layout because it is only in this direction that vehicles could form a queue waiting to turn right into the project area.

Detailed investigations should be conducted in conjunction with the relevant road authorities and surrounding mines in terms of the existing quality and potential life span of the existing road surface layers of the roads where consumables, workers and product will be transported. Richtrau must approach the relevant road authorities and request that discussions be held with the other mining operations in the area to establish a joint initiative for the maintenance of roads used by mine-related traffic.

**Emergency situations**

In the event of mine related road accidents the emergency procedure included in Section 20 will be followed.

**ISSUE: SOCIO-ECONOMIC IMPACTS**

The information in this section is derived from MTS and S4G.

### 7.2.17 ISSUE: ECONOMIC IMPACT

Information in this section was sourced from the economic specialist study (Strategy4Good, January 2013) included in Appendix P.

**Introduction**

The development of the proposed project has the potential to impact on the economy both positively through potential growth in the mining sector and negatively through the potential loss of existing economic activities.

With regards to the potential impact on the economic viability of the eco-tourism ventures to the south and south-west of the proposed project area, it is expected that the proposed project would not have an impact on these developments for the following reasons:

- the eco-tourism ventures are currently operating, seemingly successfully, with existing mining developments in the area;
- Black Rhino Game Reserve boundary is located approximately 12km west of the proposed project area and it is unlikely that tourists and/or visitors to the reserve will experience significant negative impacts related to the proposed project; and
- it is expected that tourists and visitors to the Pilanesberg National Park would not experience significant impacts from the proposed project. However tourists and visitors in the northern wilderness section of the PNP may be aware of the proposed development, particularly from a visual perspective if looking north from the top of the hills associated with the wilderness section.

**Rating of impact**

Severity/nature

The amount of land potentially lost as a result of the proposed project (approximately 350 hectares) is small in agricultural terms, while the anticipated investment of approximately R6 billion and job creation of approximately 2 800 jobs associated with the proposed project is significant. For the purposes of this assessment, the term eco-agriculture refers to both the current (subsistence crop farming and livestock grazing) and future (potential eco-tourism associated with the proposed Heritage Park) land uses.

The following positive and negative aspects apply:

- the net gross domestic product (GDP) gain to the economy as a result of the proposed project amounts to R7.9 billion;
- the net employment added to the economy is estimated at 2 356 jobs;
- the estimated price per hectare for eco-agricultural land is R19 000, while the land at Black Rhino has been estimated at R100 000 per hectare;
- the total economic addition to land value by the proposed project is calculated as R2.9 billion. The potential loss of the eco-agricultural land is calculated at R102 million, thus giving a net positive R2.8 billion to the local economy.

It follows that without mitigation the economic contribution from the proposed projects is high and the potential loss to eco-agriculture is relatively low in comparison so the net impact severity is high positive. With mitigation, Richtrau, the BBKTA, and land users (current and potential future) should work together to increase the net positive severity further. This could include identifying alternative unutilised land for the continuation of some of the affected farming and/or establish agricultural initiatives as mentioned in Section 2.7.6.3, as well as taking future potential land uses into consideration.

Duration

The positive economic impacts described above will be limited to the life of the proposed project. After closure there may still be some positive impacts through maintenance and aftercare activities.

Spatial scale/extent

In both the mitigated and unmitigated scenarios, the spatial scale is high because it will extend far beyond the proposed project area on a regional and national scale.

Consequence

The consequence is high in both unmitigated and mitigated scenarios.

Probability

The probability is considered to be high in both the unmitigated and mitigated scenarios for all project phases until closure.

Significance

The significance has been rated as high positive in both the unmitigated and mitigated scenarios for all project phases until closure

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+ | M | H | H | H | H+ |

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

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

**Conceptual description of the proposed mitigation actions**

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19, Table 73)

Objective:

The objective of the mitigation measures is to maximise the positive socio-economic benefits.

Actions:

Richtrau will ensure that:

- it (and its contractors) hire local people from the closest communities where possible;

- it extends its formal bursary and skills development programmes to the closest communities to increase the number of local skilled people and thereby increase the potential local employee base;
- it procures local goods and services from the closest communities where possible;
- it implements a procurement mentorship programme which provides support to local business from the enquiry to project delivery stages;
- where farming and/or livestock grazing land is lost to mining, the affected farmer(s) will be provided with alternative suitable land by facilitating discussions with the State and the BBKTA. If this is not feasible alternative compensation will be provided;
- it assists with the development of the proposed Heritage Park initiative;
- it incorporates economic considerations into its closure planning from the outset;
- that these closure planning considerations cover the skilling of employees for the downscaling, early closure and long term closure scenarios; and
- it identifies and develops sustainable business opportunities and skills, independent from mining, for members of the local communities to ensure continued economic prosperity beyond the life of mine.

**Emergency situations**

Not applicable.

### 7.2.18 ISSUE: INWARD MIGRATION

Information in this section was sourced from the socio-economic study (MTS, 2012) included in Appendix O.

**Introduction**

Projects of this nature tend to bring with them an expectation of employment in all project phases prior to closure. This expectation can lead to the influx of job seekers to an area which in turn increases pressure on existing communities, housing, basic service delivery and raises concerns around safety and security. This section focuses on the potential for the inward migration and associated social issues.

**Rating of impact**

Severity/nature

The effects of inward migration can be significant. These effects could include, but not be limited to:

- potential establishment or expansion of informal settlements;
- increased pressure on housing, water supply infrastructure, sanitation and waste management systems and infrastructure, health care and community services and infrastructure;
- potential for increased pressure on natural resources such as water, fauna, flora and soils;
- increase in crime (including poaching);

- disruption of existing social structures; and
- spread of disease, most notably HIV/Aids and tuberculosis.

It is not possible to predict how significant the inward migration may be, however this impact severity has been rated as high in line with the precautionary approach. It may be possible to mitigate this impact by managing expectations with regard to employment and by limiting inward migration through the BBKTA.

Duration

In the normal course, social impacts would occur for the life of the proposed project, however negative social issues associated with inward migration can continue beyond the life of the proposed project, particularly in the unmitigated scenario.

Spatial scale

The impacts of inward migration could extend beyond the project boundary into nearby communities and conservation areas in both the unmitigated and mitigated scenarios.

Consequence

In the unmitigated scenario the consequence associated with inward migration is high. With mitigation, the consequence can be reduced to medium.

Probability

In the unmitigated scenario the probability of this impact occurring is considered to be possible. With mitigation, impacts associated with inward migration are considered to be less likely, but they are unlikely to be eliminated.

Significance

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

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 – summary of the rated impact per phase of the project

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

**Conceptual description of the proposed mitigation actions**

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19, Table 74).

Objective

The objective of the mitigation measures is to limit inward migration and related social impacts.

Actions

Richtrau will ensure the following with regards to recruitment, procurement and training:

- good communication with all job and procurement opportunity seekers will be maintained throughout the recruitment process. The process must be seen and understood to be fair and impartial by all involved. The personnel in charge of resolving recruitment and procurement concerns must be clearly identified and accessible to potential applicants;
- the precise number of new job opportunities (permanent and temporary) and procurement opportunities will be made public together with the required skills and qualifications. The duration of temporary work will be clearly indicated and the relevant employees/contractors provided with regular reminders and revisions throughout the temporary period;
- recruitment and procurement, by Richtrau and its contractors, will be preferentially provided to people in the communities where possible, that are closest to the proposed project. In order to be in a position to achieve this, a skills register of people within the closest communities will be maintained. Richtrau will also preferentially provide bursaries and training to people that reside in these closest communities; and
- there will be no recruitment or procurement at the gates of the proposed project. All recruitment will take place off site, at designated locations in the closest communities. All procurement will be through existing, established procurement and tendering processes that will include mechanisms for empowering service providers from the closest communities.

Richtrau will work with its neighbours, local authorities and law enforcement officials to monitor and prevent the development of informal settlements near the proposed project area and to assist where possible with crime prevention within surrounding area.

Richtrau will implement a health policy on HIV/ADS and tuberculosis. This policy will promote education, awareness and disease management both in the workplace and in the home so that the initiatives of the workplace have a positive impact on the communities from which employees are recruited. Partnerships will be formed with local and provincial authorities to maximise the off-site benefits of the policy.

Richtrau will work closely with the local and regional authorities, the BBKTA and other mines/industry in the area to be part of the problem solving process that needs to address social service constraints.

Richtrau will implement a stakeholder communication, information sharing and grievance mechanism to enable all stakeholders to engage with Richtrau on both socio-economic and environmental issues. In this regard, quarterly stakeholder meetings will be held with surrounding communities and IAPs.

**Emergency situations**

The establishment of informal settlements in the area is considered an emergency situation. Procedures outlined in Section 20 will be followed.

### 7.2.19 LAND USE IMPACT

Information in this section was sourced from on-site observations and the project team.

**Introduction**

There are project related activities and infrastructure that may have an impact on other land uses in the proposed project areas in all mine phases.

**Project phase and link to activities**

| Construction | Operational | Decommissioning | Closure |
|---|---|---|---|
| Site preparation<br>Earthworks<br>Civil works<br>Site management<br>Transport systems<br>Non-mineralised waste management<br>Rehabilitation | Site management<br>Transport systems<br>Non-mineralised waste management<br>Mine residue disposal and management<br>Water supply infrastructure<br>Power supply infrastructure<br>Rehabilitation | Demolition<br>Site management<br>Transport systems<br>Non-mineralised waste management<br>Mine residue disposal and management<br>Rehabilitation | Maintenance and aftercare of final land forms and rehabilitated areas |

**Rating of impact**

Severity/nature

With reference to Figure 2, the various existing and proposed land uses in and surrounding the proposed project area includes:

- community activities (including residential, livestock grazing and subsistence agricultural activities);
- mining and prospecting related activities;
- roads and power lines;
- eco-tourism ventures;
- the proposed Heritage Park Corridor that aims to link the Pilanesberg National Park to the Madikwe Game Reserve;

The location of identified dwellings and cattle kraals associated with the crop farmers and livestock herders on the farm Magazynskraal 3 JQ are illustrated in Figure 19.

These land uses may be affected by one or more of the following potential environmental and social impacts:

- hazardous infrastructure and excavations (including shafts, water storage dams, TSF and WRDs);
- land clearing (vegetation and soil) for infrastructure and activities;
- destruction / disturbance of biodiversity;
- surface and groundwater quality and quantity impacts;
- dust generation;
- noise pollution;
- traffic related safety impacts;
- blasting hazards (surface blasts only);
- visual impacts; and
- inward migration.

The potential land use impacts associated with the proposed project is set out in Table 51.

**TABLE 51: LAND USE IMPACTS**

| **Potential Impacts** | **Land uses** | | | |
|---|---|---|---|---|
| | **Community activities** | **Mining / prospecting** | **Eco-tourism / proposed HPC** | **Roads / power lines** |
| **Hazardous infrastructure / excavations** | Mine-related infrastructure will pose a safety threat to livestock and people particularly without mitigation. In the mitigated scenario, operation risks will be managed with site access control. At closure, structures would have been rehabilitated to re-instate safe landscape function. | Risk of damage and/or injury with any dam failure especially in the unmitigated scenario. In the mitigated scenario, operation risks will be managed with site access control. At closure, structures would have been rehabilitated to re-instate safe landscape function. | Mine-related infrastructure will pose a safety threat to wildlife and people particularly without mitigation. In the mitigated scenario, operation risks will be managed with site access control. At closure, structures would have been rehabilitated to re-instate safe landscape function. | Risk of damage with any dam failure especially in the unmitigated scenario. In the mitigated scenario, operation risks will be managed with site access control. At closure, structures would have been rehabilitated to re-instate safe landscape function. |
| **Land clearing** | Disruption of activities without mitigation. In the mitigated scenario, alternative land would be provided. | No impact expected. | Additional dust generation and spread of alien invasive species without mitigation. In the mitigated scenario the project footprint will be limited. | No impact expected. |

| Potential Impacts | Land uses | | | |
|---|---|---|---|---|
| | **Community activities** | **Mining / prospecting** | **Eco-tourism / proposed HPC** | **Roads / power lines** |
| **Surface water quality and quantity** | Possible pollution of water used by livestock without mitigation.<br>In the mitigated scenario, pollution incidents would be prevented or reduced. | No impact expected. | Possible pollution of water used by animals without mitigation.<br>In the mitigated scenario, pollution incidents would be prevented or reduced. | No impact expected. |
| **Groundwater quality and quantity** | Possible pollution and/or loss of water used by livestock without mitigation.<br>In the mitigated scenario, pollution incidents would be prevented or reduced and/or alternative water supply would be provided. | No impact expected. | Possible pollution and/or loss of water used by animals without mitigation.<br>In the mitigated scenario, pollution incidents would be prevented or reduced and/or alternative water supply would be provided. | No impact expected. |
| **Destruction / disturbance of biodiversity** | No impact expected. | No impact expected. | Potential loss of biodiversity particularly without mitigation.<br>In the mitigated scenario, the project footprint would be limited and site management measures implemented. | No impact expected. |
| **Dust generation** | Nuisance impact that can impact on grazing quality and cattle teeth without mitigation.<br>In the mitigated scenario, dust suppression would be implemented. | No impact expected. | Nuisance impact that can impact on grazing quality and grazing animals' teeth without mitigation.<br>Visual impact particularly in the unmitigated scenario.<br>In the mitigated scenario, dust suppression would be implemented. | No impact expected. |
| **Noise pollution** | Nuisance impact that can affect sensitive receptors without mitigation.<br>In the mitigated scenario, noise attenuation measures would be implemented or over-night dwellings would be relocated to areas within the farm boundary where noise levels are acceptable. | No impact expected. | Nuisance impact that can affect sensitive receptors without mitigation.<br>In the mitigated scenario, noise attenuation measures would be implemented | No impact expected. |

| Potential Impacts | Land uses | | | |
|---|---|---|---|---|
| | **Community activities** | **Mining / prospecting** | **Eco-tourism / proposed HPC** | **Roads / power lines** |
| **Traffic related safety** | Increased risk of accidents involving people and/or animals without mitigation. In the mitigated scenario, traffic controlling measures will be implemented. | No impact expected. | Increased risk of accidents involving people and/or animals without mitigation. In the mitigated scenario, traffic controlling measures will be implemented. | Increased risk of accidents involving people and/or animals without mitigation. In the mitigated scenario, traffic controlling measures will be implemented. |
| **Blasting hazards** | Risk of damage and/or injury from fly rock without mitigation. In the mitigated scenario, blasting will be controlled. | Risk of damage and/or injury from fly rock without mitigation. In the mitigated scenario, blasting will be controlled. | No impact expected. | Risk of damage and/or injury from fly rock without mitigation. In the mitigated scenario, blasting will be controlled. |
| **Visual impacts** | Visual impact that will add to the views of the existing mining activities and infrastructure particularly in the unmitigated scenario. In the mitigated scenario, visual screens will be established. | No impact expected. | Visual impact that will add to the views of the existing mining activities and infrastructure particularly in the unmitigated scenario. In the mitigated scenario, visual screens will be established. | No impact expected. |
| **Inward migration** | Possible land invasion by job seekers without mitigation. In the mitigated scenario there would be collaboration between the relevant parties. | No impact expected. | Possible land invasion by job seekers without mitigation. In the mitigated scenario there would be collaboration between the relevant parties. | No impact expected. |

Taking the above into consideration, the severity of the unmitigated potential impacts on the non-mining land uses is high. With mitigation that is focussed on prevention and/or controls for each environmental and social impact type, the severity can be reduced. Due to the nature of the proposed mining operation, i.e. underground mining, it is expected that current land uses will be able to continue during all phases of the mine. Where less land is available for crop farming and/or livestock grazing, alternative land off-site and/or financial compensation will be provided to those people directly affected by mine related infrastructure. The proposed agricultural initiative will also help to offset land lost to agriculture, particularly if the affected land users have an opportunity to be involved in this initiative. Impacts on roads and power lines can largely be eliminated by implementing traffic control measures and appropriate blast design. Impacts on the proposed HPC can be reduced to medium during operations by controlling the environmental impacts. This can be reduced to medium-low upon closure once the site has been rehabilitated however the TSF and WRDs will remain in perpetuity which requires carfeul implementation of rehabilitation measures to achieve a grazing/wilderness post closure land function.

Duration

In the unmitigated scenario the impact on land use will extend beyond mine closure. With mitigation the majority of the land use impacts are expected to be limited to the phases prior to mine closure.

Spatial scale

The spatial scale extends beyond the proposed project area.

Consequence

The consequence is high in the unmitigated scenario, reducing to medium with mitigation in all phases prior to closure. During the closure phase, it reduces to low.

Probability

In the unmitigated scenario, where environmental and social impacts are uncontrolled, the probability that land uses will be impacted by mining is definite. With mitigation, the probability reduces to medium prior to closure and low post closure.

Significance

The unmitigated significance is high. With mitigation, the significance reduces to medium in all phases prior to closure, where it reduces to 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 – summary of the rated impact per phase of the project

| Management | Severity / nature | Duration | Spatial scale / extent | Consequence | Probability of Occurrence | Significance |
|---|---|---|---|---|---|---|
| Construction, operation, decommissioning | | | | | | |
| Mitigated | M | M | M | M | M | M |
| Closure | | | | | | |
| Mitigated | L (M-L for TSF / WRDs) | M | M | L | L | L |

**Conceptual description of the proposed mitigation actions**

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19, Table 75).

Objective

The objective of the mitigation measures is to prevent unacceptable negative impacts on surrounding land uses.

Actions

Richtrau will implement the EMP commitments with a view not only to prevent and/or mitigate the various environmental and social impacts, but also to prevent negative impacts on surrounding land uses.

Closure planning will incorporate measures to achieve the future land use plans for the community and the proposed HPC. Richtrau will specifically liaise with the NWPTB, community and tourism related stakeholders regarding the infrastructure that will remain post-closure (i.e. TSF and WRDs) in order to minimise long term land use impacts on the proposed HPC.

Where there is a risk of damage to existing infrastructure, this will be diverted and/or relocated in consultation with the relevant stakeholders.

As the proposed project is an underground mining operation, it is expected that the current land uses will be able to continue to a large extent. It may however be necessary to relocate the over-night dwellings of the livestock herders to the east and south of the proposed project area, away from project related infrastructure. Should this be necessary, it will be done in consultation with the farmers and the livestock herders.

In the scenario where less land is available for crops and/or grazing, alternative land and/or compensation will be provided to all affected land users within the proposed project area. The provision of alternative land will be addressed in consultation with the Bakgatla-Ba-Kgafela Traditional Authority and the Department of Rural Development and Land Reform.

If a situation arises where any other surrounding land use is negatively affected by the mine, Richtrau will take steps to prevent the impact. If the land use impact cannot be prevented, Richtrau will work with landowners in the area to provide alternative land that is acceptable to the affected land user for the land use. Alternatively, Richtrau will provide compensation for mine-related loss of land use.

**Emergency situations**

Not applicable.

## 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 52. 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.

## 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.

**TABLE 52: 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.**

## 7.5 CUMULATIVE IMPACTS

As discussed in the Introduction, Richtrau, PPM and the IBMR are planning to establish three separate projects which could operate as one mine in the future. In addition, there are a number of other proposed mining operations in close proximity to the proposed Magazynskraal Mine, the details of which are either unknown or conceptual at this time. As neither SLR nor the applicant companies (Richtrau, PPM and the IBMR) have control over the surrounding operations or the mitigation measures that would be implemented, further discussion on the potential cumulative impacts of the proposed stand-alone projects for PPM, Sedibelo and Magazynskraal only is provided below.

As an overarching statement, the significance of the cumulative potential environmental and social impacts could be greatly reduced if Richtrau reconsider the stand-alone mining operation for Magazynskraal and utilise mineral processing and disposal facilities at either PPM or Sedibelo. In this regard, should a combined mining operation be established, project related infrastructure on the farm Magazynskraal 3 JQ would be significantly reduced, i.e. the proposed processing plant, TSF and waste handling facility would not be established, which would reduce the potential negative environmental impacts associated with the operations on that site

### 7.5.1 LOSS AND STERILISATION OF MINERAL RESOURCES

Mineral resources can be sterilised and/or lost through the placement of infrastructure and activities in close proximity to mineral resources, by preventing access to potential mining areas, and through the disposal of mineral resources onto mineralised waste facilities.

In the unmitigated scenario, infrastructure on the three project sites could be placed in such a way that third party minerals are sterilised, and minerals not extracted at the processing plant are deposited on the TSF as part of the tailings stream.

In the mitigated scenario planning and co-ordination between the relevant stakeholders will assist in preventing the unacceptable sterilisation of resources. In addition, processes are in place to remove minerals prior to deposition on the TSF, and as a second measure there is always the option to re-process the TSF in future. Chrome recovery operations which extract chrome resources from the UG2 tailings streams during favourable market conditions, could also be considered.

### 7.5.2 HAZARDOUS STRUCTURES/EXCAVATIONS/SURFACE SUBSIDENCE

Hazardous excavations and infrastructure include all structures into or off which third parties and animals can fall and be harmed, i.e. foundations, scaffolding, open pits, shaft headgear, waste rock dumps etc. Also included in this category are facilities that can fail, such as water storage dams and tailings storage facilities. Hazardous excavations and infrastructure will be present on all three project sites and will occur in all phases of the development from construction through operation to decommissioning and closure. Surface subsidence can occur if insufficient support is left behind in shallow underground mining. Slope failure can occur on the WRDs, TSFs or the partially flooded pit if the angle of repose of the side walls has not been engineered correctly.

In the unmitigated scenario, there would be a number of hazardous structures and excavations at all three project sites that could pose significant risks of injury and/or death to both animals and third parties.

With the implementation of mitigation measures, as discussed in Section 7.2.2, these risks can be managed to acceptable levels.

### 7.5.3 LOSS OF SOIL RESOURCES AND LAND CAPABILITY THROUGH POLLUTION

The proposed projects have the potential to damage soil resources through contamination. If soil resources are lost and/or damaged through contamination, the land capability of the area will be compromised. When considering the three project sites, the number of potential pollution sources increases and therefore the potential impact increases in magnitude.

In the unmitigated scenario, there would be a number of potential pollution sources at all three project sites that could damage soil resources through contamination which would result in a significant loss of soil resources.

In the mitigated scenario, as discussed in Section 7.2.3, emphasis will be placed on preventing pollution events and on quick and effective remediation if pollution events do occur.

### 7.5.4 LOSS OF SOIL RESOURCES AND LAND CAPABILITY THROUGH PHYSICAL DISTURBANCE

There are a number of activities and infrastructure in all phases that have the potential to disturb soils and related land capability through removal, compaction and/or erosion. The proposed surface infrastructure associated with the three project sites will disturb an area of approximately 2 000ha. Any soils that remain beneath the permanent landforms, i.e. TSFs and WRDs, or are disturbed as part of PPM's proposed extension of the flooded Tuschenkomst pit will be a lost resource and the associated land capability will be permanently altered.

In the unmitigated scenario, physical soil disturbance can result in a loss of soil functionality as well as a loss of soil resources in the case of erosion. When considered cumulatively for all three project sites, the loss of soil resources as a result of physical disturbance and the subsequent impacts on land capability is considered to be significant.

In the mitigated scenario, soils can be conserved and reused to establish land capabilities as discussed in Section 7.2.4. This does not apply to the soils that will remain under the TSFs and WRDs or that will be disturbed as part of the pit extension, as well as the associated land capability of those areas.

### 7.5.5 PHYSICAL DESTRUCTION OF BIODIVERSITY

There are a number of activities and infrastructure related to all three project sites that have the potential to destroy biodiversity through the physical destruction of specific biodiversity areas, of linkages between biodiversity areas and related species which are considered to be significant because of their status, and/or the role that they play in the ecosystem. When considering the three project sites, the cumulative footprint of the operations has the potential to damage the ecological functionality of a significant amount of land, some of which has been rated as having high species diversity and habitat richness. A secondary impact associated with inward migration is the potential for the physical destruction of biodiversity through poaching.

In the unmitigated scenario, the potential impacts associated with the three project sites would be similar to those discussed in Section 7.2.5, however the magnitude of the potential impacts would be greater.

In the mitigated scenario, the applicant companies would implement a biodiversity action plan. It would be preferable if one biodiversity action plan was developed for all three operations to ensure continuity and that the NWPTB and relevant communities are involved in the development and implementation of the plan. This will enable a co ordinated approach to biodiversity conservation and the re-establishment of ecological functionality through rehabilitation and restoration. This is particularly important in the context of the proposed Heritage Park.

### 7.5.6 GENERAL DISTURBANCE OF BIODIVERSITY

There are a number of activities and infrastructure resulting from all three project sites that have the potential to directly disturb vegetation, vertebrates and invertebrates. As mentioned in Section 7.2.5, the known ecosystem related value is listed as follows:

- soil formation and fertility maintenance;
- primary production through photosynthesis, as the supportive foundation for 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; and
- maintenance of genetic resources (key for medicines, crop and livestock breeding).

The proposed projects could result in the following disturbances to biodiversity:

Disturbance of river systems

A stretch of the Bofule river system is rated as a National Freshwater Ecosystem Priority Area (NFEPA) before the confluence with the Wilgespruit on the Sedibelo property. In terms of water resources, this section of the Bofule (Category B- Largely Natural), emanating from the Pilanesberg, is ranked as a Level 1 NFEPA.

Habitat fragmentation

The PPM, Sedibelo and Magazynskraal properties have been earmarked to form part of the propsed Heritage Corridor between Pilanesberg National Park and Madikwe Game Reserve. Surface infrastructure associated with the mining developments will fragment greater habitats and will place restrictions on corridor movement.

Riparian habitats are linear habitats that provide important corridors for faunal and floral species, and are an important route for flow of genetic material that maintains the cohesion within and between different ecosystems. Activities associated with these projects and the potential of increased anthropogenic impacts will result in intrusions into the riparian habitats in the form of road and linear infrastructure crossings, additional settlements, possible increase in cultivation and direct displacement of riparian habitat for mining infrastructure.

Lowering of groundwater levels

Open pit and underground mining activities will require dewatering activities and is expected to result in a reduction in the groundwater levels. The Wilgespruit/Bofule and the Lesele Rivers are ephemeral systems and associated riparian vegetation depends on surface and subterranean flows. Dewatering from the three projects and the associated lowering of the groundwater table could result in the loss of larger trees within the riparian vegetation, causing a deterioration of that habitat.

Impact of reduced flow along drainage line on biodiversity post closure

As part of the Tuschenkomst pit flooding and extension projects, PPM has indicated the intention to divert the flow of water from the Wilgespruit into the pit and subsequently use that water for community settlements in the area. The point of diversion from the Wilgespruit would be upstream of the PPM site, and would reduce flows along this river to the limited quantities of water that enter the system downstream of the point of take-off. The flows would thus be reduced drastically, and could result in considerable loss of riparian vegetation along the river. It is important to note that mining activities are planned upstream of PPM and which could destroy the headwaters of the Wilgespruit.

In the unmitigated scenario, the potential impacts associated with the three project sites would be similar to those discussed in Section 7.2.6 however the magnitude would be greater and possibly be more intense where areas of influence from neighbouring project sites overlap. Issues that are not discussed in Section 7.2.6 but which could be significant are the impacts on the river systems, particularly the Wilgespruit and Bofule Rivers located on the PPM and Sedibelo properties.

In the mitigated scenario, a number of the potential impacts can be reduced or prevented with the implementation of management measures. Although it is planned that the flow of the Wilgespruit would be simulated by the controlled pumping of a suitable quality water (treated if necessary) from the Tuschenkomst flooded pit into the downstream sections of the Wilgespruit, it is yet to be seen if this will be successful.

### 7.5.7 POLLUTION OF SURFACE WATER RESOURCES

There are a number of pollution sources at the mine that have the potential to pollute surface water, particularly in the unmitigated scenario. Surface water may collect contaminants such as hydrocarbons, salts, and metals from numerous sources. At elevated concentrations these contaminants can be harmful to humans and livestock if ingested directly and possibly even indirectly through contaminated vegetation, vertebrates and invertebrates (impacts on biodiversity have been assessed above and are not included in this discussion). In addition, polluted surface water has the potential to pollute shallow groundwater resources. This issue is addressed in Section 7.5.10.

In the unmitigated scenario, the number of potential pollution sources from all three project sites is substantial. As a result, it is expected that the magnitude of the impacts would increase and contamination levels could be elevated in some areas.

In the mitigated scenario, clean water will be diverted away from disturbed areas and contaminated run-off and process water will be contained and re-used. In addition, all infrastructure associated with the three project sites will be constructed, operated and maintained so as to comply with the provisions of the National Water Act (36 of 1998) and Regulation 704 (4 June 1999) or any future amendments thereto. The applicant companies will also ensure that all mineralised wastes and non-mineralised wastes are managed in a manner that they do not pollute surface water, including in the post closure scenario.

### 7.5.8 ALTERATION OF SURFACE DRAINAGE PATTERNS

Natural drainage across the project sites is via sheet flow and/or non-perennial tributaries. There are a number of activities and infrastructures associated with the three projects which will alter drainage patterns by reducing the volume of run-off into the downstream catchments. Rainfall and surface water run-off will be collected in all areas that have been designed with water containment infrastructure. In addition, as part of the proposed PPM pit extension and pit flooding projects it is planned that the Wilgespruit be diverted into the Tuschenkomst pit at the end of operations. It should be noted that there are settlements and other mining operations in the upper reaches of the Bofule and Wilgespruit tributaries prior to these rivers flowing through the project sites.

In the unmitigated scenario, the collected rainfall and surface water run-off from all three project sites will be lost to the catchment and can result in the alteration of drainage patterns. The proposed diversion of the Wilgespruit into the Tuschenkomst pit would also result in a loss to the catchment.

In the mitigated scenario, the applicant companies will ensure that the size of dirty areas is minimised and clean run-off and rainfall water is diverted around dirty areas and back into its normal flow in the environment. With regards to the proposed diversion of the Wilgespruit into the Tuschenkomst pit it is planned that the flow of the Wilgespruit would be simulated by a release of water of suitable quality (treated if necessary) from the Tuschenkomst flooded pit into the section of the Wilgespruit downstream of the pit, however it is yet to be seen if this will be successful. A combined storm water management plan should be developed for the PPM, Sedibelo and Magazynskraal operations as the sites and river systems thereon are closely connected.

### 7.5.9 REDUCTION IN GROUNDWATER LEVELS / AVAILABILITY

It will be necessary to dewater the open pits and underground mine workings associated with the three projects in order to establish safe working conditions. This may cause a loss in water supply to surrounding borehole users and groundwater-fed surface water resources. There is potential for cumulative dewatering impacts on the springs located within the Pilanesberg National Park, to the south of PPM and Sedibelo mines, however the additional impact associated with the Magazynskraal operation is not predicted to materially add to the cumulative scenario. This should be confirmed with on-going monitoring.

In the unmitigated scenario, there is the potential for the cumulative zone of influence to extend further from the project sites and therefore increase the significance of this potential impact.

In the mitigated scenario, should any loss of groundwater be attributed to the mining operations, the applicant companies will provide alternative water supply of the same or better quality. It should be noted that while this impact is relatively easy to mitigate with regards to people and livestock, the impact on ecosystems that are reliant on groundwater resources would be difficult if not impossible to mitigate due to complexities within these systems.

PPM, Sedibelo and Magazynskraal should establish a water forum to manage water related issues, and encourage other mining operations and industries in the area to join.

One groundwater model for the PPM, Sedibelo and Magazynskraal operations should be established and updated on an annual basis.

### 7.5.10 CONTAMINATION OF GROUNDWATER

There are a number of sources at all three project sites that have the potential to pollute groundwater. Some of these sources may be temporary in nature while others (such as the TSFs and WRDs) have the potential for long term seepage. Broadly speaking, two types of pollution sources are considered. The one type is diffuse pollution which includes ad hoc spills and discharges of polluting substances. The other type is point source pollution which includes more long term pollution associated with sources such as the TSFs and WRDs. Geochemical results indicate that there is no material risk of acid mine drainage but there is potential for groundwater contamination associated with the proposed TSFs and WRDs.

In the unmanaged scenario, this contamination has potential to influence third party boreholes and surrounding surface water resources. Considering all three project sites would have both diffuse and point pollution sources, including TSFs and WRDs, it is expected that the magnitude of the impact would increase and contamination levels could be elevated in some areas where the zone of influence from neighbouring operations could overlap.

In the mitigated scenario, management measures such as those included in Section 7.2.10 will be implemented by the applicant companies to minimise the pollution of groundwater resources.

### 7.5.11 AIR POLLUTION

The main contaminants associated with the three project sites include inhalable particulate matter less than 10 microns in size ($PM_{10}$), larger total suspended particulates (TSP) that relate to dust fallout, and gas emissions mainly from vehicles. At certain concentrations, each of these contaminants can have health and/or nuisance impacts.

In the unmitigated scenario the number of potential pollution sources from all three project sites is significant. As a result, it is expected that the magnitude of the impact would increase and contamination levels could be elevated in some areas where the zone of influence from neighbouring operations could overlap.

With the implementation of mitigation measures such as those discussed in Section 7.2.11, dust generation can be reduced. However, in the cumulative scenario, there is the potential for all the mines to result in off site exceedances at surrounding communities. It is therefore recommended that the applicant companies establish a $PM_{10}$ monitoring station at a selection of communities in consultation with a suitably qualified air specialist. Results from these monitoring stations should be used to evaluate the effectiveness of each mine's mitigation measures and where necessary these need to be revisited.

### 7.5.12 NOISE POLLUTION

As discussed in Section 7.2.12, two types of noise are distinguished, i.e. noise disturbance and noise nuisance. The three project sites present the possibility of generating both types of noise in the project phases prior to closure. It should be noted that some receptors are more sensitive than others, particularly the eco-tourism ventures located to the south and south-west of the three project sites. In this regard, any increase in noise levels could be noticeable and could impact on current land uses.

In the unmitigated scenario, the cumulative noise impacts associated with the three project sites is expected to be significant, particularly from the perspective of the eco-tourism ventures located to the south and south-east of the project sites. Land users within and immediately adjacent to the three project sites may experience significant (> 5dBA) increases in ambient noise levels.

With mitigation, noise impacts can be reduced to some extent by implementing noise attenuation measures. The applicant companies will need to monitor noise levels and act accordingly should levels exceed the evaluation criteria stipulated in the SANS guidelines (SANS10103, 2008). Nuisance noise is more difficult to mitigate and this impact may remain of high significance for the eco-tourism ventures located to the south and south-east of the project sites.

### 7.5.13 NEGATIVE LANDSCAPE AND VISUAL IMPACTS

The visual landscape is determined by considering: landscape character, sense of place, scenic quality, sensitivity of the visual resource and sensitive views. In this regard, the project sites are considered to have a moderate value as they have been disturbed by anthropogenic activities. However when considering the wider area which includes the 'untouched' hills, the value is considered to be moderate to high. Views of the project sites will be from the surrounding communities and public roads as well as the eco-tourism ventures located to the south and south-west.

In the unmitigated scenario, the combined negative visual impacts associated with the three project sites is expected to be significant, particularly from the perspective of the eco-tourism ventures located to the south and south-west of the project sites as they are considered to be sensitive receptors. This statement is supported by the fact that this is the only stakeholder group who have raised concerns about visual impacts (refer to the comments and response report in Appendix D).

With mitigation, negative visual impacts can be reduced to some extent by using berms, vegetation screens, light shading and good practise. However, tourists and people visiting the eco-tourism ventures will have elevated views of the project sites as a result of the hills associated with the northern section of the Pilanesberg National Park. Therefore the negative visual impacts are expected to remain of high significance for this group of stakeholders.

### 7.5.14 DISTURBANCE OF HERITAGE (INCLUDING CULTURAL) RESOURCES

Heritage resources include sites of archaeological, cultural or historical importance. There are a number of activities and infrastructure related to all three project sites that have the potential to damage heritage (including cultural) resources and result in the loss of the resource for future generations.

No cumulative impacts resulting from the three projects have been identified.

### 7.5.15 BLASTING DAMAGE

Injury to third parties and livestock may be caused by fly rock. Damage to third party infrastructure may be caused by fly rock, ground vibration, and/or air blast. Blast related impacts are most pertinent for surface and near surface blasts. In this regard, this section focuses on open pit mining associated with the PPM and Sedibelo operations, and the blasting required for the establishment of shafts for underground mining at Sedibelo and Magazynskraal.

In the unmitigated scenario, blasts can impact on people, livestock, fauna and structures within and adjacent to the three project sites, as well as public roads and road users in the case of the proposed PPM pit extension.

With mitigation, blasts can be designed to reduce the number of recommended level violations. Generally speaking, blast related impacts are not expected to extend more than 2km from the area where the blast takes place. It is recommended that the applicant companies schedule the blasts at each operation to minimise impacts. If necessary, this should be done in consultation with an appropriately qualified specialist.

### 7.5.16 TRAFFIC IMPACTS

The key potential traffic impacts relate to road capacity and public safety. The specialist is of the opinion that mine-related traffic from the three project sites would have a manageable impact on the relevant road network in terms of roads capacity and safety. As part of EIA and EMP that is currently underway for PPM's proposed expansion of the Tuschenkomst pit, it is proposed that the P50-1 road will be diverted immediately to the south of the proposed pit expansion on Portion 1 the farm Rooderand 46 JQ (refer to Route D-4 in Appendix N).

In the unmitigated scenario, the increase in mine related traffic from the three project sites could result in increased safety risks (in terms of injury and death) to pedestrians and animals in the area as well as other road users. It is also likely that the increased traffic from the three project sites will contribute to the poor condition of the roads in the area.

In the mitigated scenario, the specialist has recommended a number of mitigation measures be implemented as part of the three projects (see Appendix N) and the relevant affected roads are maintained to an acceptable standard to ensure the transport of workers, consumables, mined products and the overall use by commuters. In this regard, it is recommended that the applicant companies engage with the relevant authorities (i.e. the Moses Kotane Local Municipality and the North West Department of Roads, Transport and Community Safety) and encourage them to establish a joint initiative with all the mining operations in the area to maintain and/or upgrade the affected roads.

### 7.5.17 ECONOMIC IMPACTS

The cumulative impact of the three projects will have a significant net positive impact on the provincial and national economy. It is expected that the cumulative economic impacts associated with the projects will occur for a minimum of 40 years. Linked to this is the effect of the three operations on surrounding land uses. In this regard, the potential loss of the contribution to the provincial and national economy from agriculture and tourism is relatively low in comparison. It is however noted that certain endeavours, such as the proposed hotel site at Black Rhino Game Reserve, may be less feasible in the medium term as a result of the current and proposed mining operations north of the Pilanesberg National Park.

When considering the three projects and related job creation opportunities the impacts are potentially significant in that:

- approximately 2 500 temporary employment opportunities will be created during the construction phase and a further 2 800 jobs will be created during the operational phase for the Magazynskraal project;
- in the case of the Sedibelo an estimated 6000 construction jobs of varying lengths and 3860 permanent and 125 long term contractor jobs will be created during the operational phase; and
- the 1628 staff employed at PPM (386 permanent, and 1242 contract) will retain their jobs for the additional six years life of mine.

Without mitigation the economic contribution from the three projects is significant and the potential loss to agriculture and tourism is relatively low in comparison.

With mitigation, the applicant companies, in consultation with the BBKTA, land users, the Department of Agriculture and the Department of Rural Development and Land Reform could identify alternative unutilised land for the continuation of some of the affected livestock grazing and farming. This will limit the loss to agriculture and increase the net positive severity further. In addition, the applicant companies must rehabilitate the land to be economically and environmentally sustainable in order to meet the needs of both the community and the proposed Heritage Park. A co-operative framework must be established to enable ecotourism (especially Black Rhino and the Heritage Park) and the mining operations to move forward together.

#### 7.5.18 INWARD MIGRATION

When considering all three projects and the related employment opportunities, it could lead to an influx of job seekers to the area which in turn increases pressure on existing communities, housing, basic service delivery and raises concerns around future land uses as well as safety and security.

It is not possible to predict how significant the inward migration may be, as it would depend on individuals' choices to move to the area in search of work. It is however possible that this could be a significant impact. It may be possible to mitigate this impact by managing expectations with regard to employment, by limiting inward migration through the BBKTA, and by working in close collaboration with the local authorities. Furthermore, all the mines in the area will need to work together with the communities and other relevant authorities to manage this issue.

#### 7.5.19 LAND USE IMPACTS

The cumulative land use impacts associated with the three project sites would be similar to those discussed in Section 7.2.19.

In the unmitigated scenario, when considered cumulatively for all three project sites, the impact on land uses would increase in magnitude and is therefore considered to be significant.

With mitigation that is focussed on prevention and/or controls for each environmental and social impact type as discussed throughout Sections 7 and 19, the impacts can be reduced to some extent.

#### 7.5.20 DISPLACEMENT OF PEOPLE

The development of the PPM pit extension and Sedibelo projects will result in the displacement of an unknown number of communal cattle farmers on the farms Wilgespruit 2 JQ and Portion 1 of Rooderand 46 JQ. These farmers employ farm hands who in turn have associated housing and kraal structures on the abovementioned properties. There will also be community members who feel that they have historic links to sections of farm land project site.

The consultation process with the BBKTA with regards to the compensation and potential relocation of resident farmers has commenced. This process will be driven by PPM to ensure that all affected parties are compensated fairly and that the process followed is the correct one.

In unmitigated scenario, the significance of this potential impact is high. With mitigation, the people and property can be relocated to the satisfaction of all stakeholders and in a manner that will ensure the farmers and farm hands are in the same or better position than present.

# 8 COMPARATIVE ASSESSMENT OF IDENTIFIED LAND AND DEVELOPMENT ALTERNATIVES

## 8.1 ALTERNATIVE LAND USES WHICH COULD BE IMPACTED ON

The alternative land uses that could be affected have been described and assessed in Section 7.2.4. These include agricultural and residential activities.

## 8.2 RESULTS OF SPECIALIST COMPARATIVE LAND USE ASSESSMENT

Information in this section is derived from the specialist study (Strategy4Good, January 2013) undertaken for the proposed project, included in Appendix P.

The specialist study concludes that the proposed project is the best land use alternative. Firstly, the socio-economic valued added by the project significantly outstrips the opportunity costs of the current land-use (as well as the potential future land use associated with the proposed Heritage Park) that would be lost. Secondly, the socio-economic benefits outweigh the potential environmental risks (in the mitigated scenario) and for this reason the project is also acceptable on an integrated sustainable development basis.

It is important to understand that in the mitigated scenario, both agricultural and eco-tourism activities can be established on the farm, so the mining related change in land use is temporary.

# 9 LIST OF SIGNIFICANT IMPACTS

A list of significant impacts related to the proposed Magazynskraal Platinum Mine, when considered **without mitigation**, as identified in the assessment conducted in Section 7 is provided below.

- loss and sterilisation of mineral resources (high)
- hazardous structures / excavations and surface subsidence (high);
- loss of soil resources through pollution (high);
- loss of soil resources through physical disturbance (high);
- physical destruction of biodiversity (high)
- general disturbance of biodiversity (high);
- pollution of surface water resources (high);
- alteration of drainage patterns (high);
- reduction in groundwater levels / availability (high);
- groundwater contamination (high);
- increase in air pollution (medium);
- increase in disturbing noise levels (medium-high);
- negative landscape and visual impacts (high);
- disturbance of heritage, cultural and paeleontological resources (medium);
- blasting hazards (high);
- project-related road use and traffic (high);
- economic impacts (high positive);
- inward migration (high); and
- land use impacts (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.

Effective and equitable engagement between stakeholders contributes to the identification of key issues of concern and possible solutions, as well as of relevant local or traditional knowledge. This helps to ensure that environmental considerations are taken into account in the planning, design and decision-making phases for proposals that may have a significant effect on the environment. In this way the potential negative impacts of a proposal or activity may be minimised and the positive benefits can be maximised.

## 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 a deeds search of the relevant properties within the project site and immediately adjacent portions of land, social scans including site visits in the surrounding areas, networking and direct discussions with IAPs. Key stakeholders identified for the project include:

**IAPs:**

- landowners, land occupiers and communities on and surrounding the project areas;
- tribal authorities/communities;
- mines and industries in the area;
- non-government organisations and associations;

**Regulatory authorities:**

- Department of Mineral Resources (DMR);
- Department of Economic Development, Environment, Conservation and Tourism (DEDECT);
- Department of Water Affairs (DWA);
- Department of Environmental Affairs;
- South Africa Heritage Resource Agency (SAHRA);
- Department of Agriculture, Forestry and Fishery (DAFF);
- Department of Rural Development and Land Reform (DRDLR) (previously the Department of Land Affairs);
- Department of Transport, Roads and Community Safety (DTRCS);
- North West Parks and Tourism Board (NWPTB);
- Regional Land Claims Commission;

**Local authorities:**

- Moses Kotane Local Municipality (MKLM);

- Bojanala Platinum District Municipality (BPDM); and
- relevant ward councillors.

A summary list of stakeholder groups and how they were consulted is attached in Appendix C.

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 A. The database is updated on an on-going 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 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. Refer to Section 10.3 for a list of issues that were identified during the engagement process.

As discussed in the Introduction of the EIA and EMP report, there is a possibility that the PPM, Sedibelo and proposed Magazynskraal mines will combine to form one mining operation. Subsequently, and due to the timing of the three projects, one stakeholder engagement process was conducted for the three projects. The reasons for the combined stakeholder engagement process was to limit stakeholder fatigue (i.e. attending numerous meetings), to limit any potential confusion caused by the number of proposed projects in the area, and to provide the future plans for the area in a transparent manner. The following combined activities were undertaken as part of the stakeholder engagement process:

- one social scan was undertaken for the three project areas;
- newspaper advertisements detailing the three projects was published in local and national newspapers;
- site notices detailing the three projects were place in and around the three project sites;
- a combined background information document (BID) was produced providing details of the three projects;
- focussed and general scoping meetings were held to present the proposed projects.

Further detail is provided in Section 10.2.1 below.

### 10.2.1 STEPS IN THE PUBLIC PARTICIPATION PROCESS

Steps in the process that have been conducted to date are set out in Table 53 below.

**TABLE 53: PARTICIPATION PROCESS WITH IAPS AND AUTHORITIES**

| Task | Description | Date |
|---|---|---|
| Notification - regulatory authorities and IAPs | | |
| Submission of applications DEDECT and DMR | A NEMA application was submitted to DEDECT in October 2011. The DEDECT issued an acceptance letter dated 16 November 2011.<br>A mining right application was submitted to the DMR in June 2012. The DMR issued an acceptance letter dated 27 July 2012.<br>Copies of the acceptance letters are included in Appendix B. | October 2011<br><br>June 2012 |
| Consultation with land claims commissioner | The land claims commissioner was consulted in order to verify if any land claims had been lodged on any of the proposed farms. Refer to Appendix B for a copy of the response received from the land claims commissioner. | February 2012 |
| Social scan | A social scan of the project sites was carried out by SLR. The purpose of the social scan was::<br>• to identify relevant municipal ward councillors, traditional community leaders, landowners, land occupiers, and other interested and affected parties;<br>• to obtain contact details for IAPs;<br>• to identify appropriate communication structures; and<br>• inform IAPs of the project, upcoming public process and associated scoping and EIA processes.<br>As part of the social scan, notification and information-sharing took place through formal and informal discussions, focussed meetings and/or telephonic discussions.<br>SLR encountered some difficulty engaging with all of the land users on the proposed project areas. These IAPs were not always willing to discuss the proposed projects and the BBKTA set up communication structures in such a way that they are the contact point for this stakeholder group.<br>A record of discussions and minutes of meetings are included in Appendix C. Issues raised are included in the comments and response report in Appendix D.<br>One output of the social scan is an IAP database (Appendix A). The IAP database is updated as required throughout the environmental process. | February 2012 |
| Initial meetings with tribal structures | A focused meeting was held with representatives from the BBKTA to introduce the proposed projects and seek advice on the community consultation strategy.<br>A focused meeting was held with the kgosana's from the communities to introduce the proposed project and share information.<br>Minutes of these meetings are included in Appendix C. | December 2011 |
| Distribution of the combined background information document (BID) | BIDs were distributed by hand (during the social scan and at the scoping meetings) and e-mail to IAPs and authorities on the project's public involvement database. The purpose of the BID was to inform IAPs and authorities about the proposed projects, the environmental assessment process, possible environmental impacts, and means of providing input 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. A copy of the BID in English and Setswana are provided in Appendix C. | February and March 2012 |
| Site notices | Laminated A2 site notices in English and Setswana were placed at key conspicuous positions in and around the project sites. Copies of the site notices are included in Appendix C together with photos of where the site notices were placed. | January and February 2012 |
| Newspaper advertisements | Block advertisements were placed in one national (The Sowetan) and one local newspaper (The Rustenburg Herald) on 27 January 2012. Copies of the advertisements are included in Appendix C. | January 2012 |

| Task | Description | Date |
|---|---|---|
| Loud hailing | Loud hailing took place in the villages where the scoping meetings were held three days prior to the meeting to serve as a reminder to community members. | March 2012 |
| Scoping stage meetings and comments received | | |
| Public scoping meetings | General and focussed public scoping meetings were held with the following stakeholders:<br>• Federation for a Sustainable Environment (FSE) – 29 February 2012.<br>• Pilanesberg National Park, Heritage Park and surrounding industry – 06 March 2012.<br>• Black Rhino Game Reserve – 07 March 2012.<br>• Saulspoort / Moruleng – 05 March 2012.<br>• Manamakgoteng – 06 March 2012<br>• Lekutung – 05 March 2012.<br>• Mononono – 07 March 2012<br>• Kgamatha / Lesobeng – 08 March 2012<br>• Lekgraal / Bofule – 09 March 2012<br>• Ramasedi – 09 March 2012<br>• Ntswana-le-Metsing – 10 March 2012<br>• Motlhabe – 10 March 2012<br>• Sefikile / Spitskop – 12 March 2012<br>• Ngweding – 12 March 2012<br>• Magalane – 13 March 2012<br>• Magong – 13 March 2012<br><br>A presentation was given at each meeting that provided basic information for the three projects and the environmental process being followed. The same presentation was given at all of the scoping meetings. The meetings were therefore focussed on:<br>• informing IAPs about the proposed projects;<br>• informing IAPs about the stakeholder engagement process and how IAPs can have input into the process;<br>• providing information about the baseline environment and obtaining input thereon;<br>• providing information about the potential impacts of the project and obtaining input thereon; and<br>• providing an opportunity for IAPs to raise issues and concerns. These issues and concerns have been documented in the Comment and Response Report (Appendix D) and used to inform the Plan of Study for the EIA Phase.<br><br>Minutes of the meetings are included in Appendix C.<br><br>It should be noted that the Lesetlheng community meeting was arranged at the Lesetlheng Primary School on 5 March 2012 at 13:00. Upon arrival the Lesetlheng community requested that this meeting be postponed until the 17 March 2012 and requested that the directors of PPM, IBMR, Richtrau as well as the leaders of the BBKTA be invited to this meeting. The meeting (17 March 2012) did not take place as it was not possible for the directors and leaders of the various entities to attend and another meeting was subsequently arranged for 19 May 2012. The community requested that the meeting be moved to 27 May 2012. Due to civil unrest in the area the May meeting was cancelled. A meeting between representatives from the Lesetlheng community and SLR took place on 26 July 2012. One of the outcomes of the meeting was a formal request, in writing, from SLR to meet with the Lesetlheng community as part of the EIA consultation process. It is understood that the Lesetlheng representatives communicated the request to the community, who responded by stating that they do not want to participate further in the consultation process until various conditions have been met. Copies of this correspondence are included in Appendix C. | March – June 2012 |

| Task | Description | Date |
|---|---|---|
| Regulatory authority scoping meeting | A regulatory authority meeting was held on 06 March 2012. The purpose of the meeting was to provide regulatory authorities with an outline of the project and to 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 have been included in Appendix B. | March 2012 |
| Review of scoping report | | |
| Public review of scoping report | Copies of the scoping report were made available for public review at the following places:<br>• Villages immediately surrounding the project area, including Lesetlheng; Manamakgoteng; Lekutung; Sefikile/Spitskop; Mononono; Kgamatha/Lesobeng; Legkraal; Ntswana-le-Metsing; Motlhabe; Ngweding; Magalane; Magong;<br>• Bakgatla-Ba-Kgafela traditional offices in Saulspoort;<br>• Moses Kotane Local Municipality in Saulspoort;<br>• Rustenburg public library;<br>• Black Rhino Game Reserve;<br>• Pilanesberg Platinum Mine;<br>• SLR's offices in Johannesburg; and<br>• electronically on a CD, on request.<br><br>Summaries of the report were sent by post or e-mail to all IAPs and authorities on the project's public involvement database.<br>In addition, IAPs were notified when the report was available for review via SMS. In some cases full copies of the report were provided to IAPs on request. | October 2012 |
| Authority review of scoping report | Seven hard copies and one electronic copy of the scoping report was submitted to the DMR. The DMR distributes the reports to the relevant authorities as required<br>In addition, the following departments received copies of the scoping report from SLR: DEDECT, DWA, DAFF, SAHRA, DRDLR; DTRCS, NWPTB, Bojanala Platinum District Municipality and the Moses Kotane Local Municipality.<br>Copies of the scoping reports were forwarded to DEDECT following authority and public review. | August 2012<br><br>October 2012<br><br>January 2013 |

### 10.2.2 SPECIALIST TEAM

Upon input from IAPs on the potential impacts that may arise as a result of the development, several specialists (see Table 4 for a complete list of all appointed specialist, their roles and responsibilities) were appointed to assess the potential impact of the development. Details are provided in the specialist reports included as appendices.

### 10.2.3 REVIEW OF EIA AND EMP REPORT BY REGULATORY AUTHORITIES

Seven copies of the EIA and EMP report were submitted to the DMR on 24 January 2012 to meet the Department's submission date for the mining right application. As the groundwater specialist study had not been completed by the January submission date, the EIA and EMP report has subsequently updated and seven copies of the revised report were submitted to the DMR on 22 March 2013.

In addition, the following Departments will receive a copy of the revised EIA and EMP report from SLR in late March / early April 2013: DWA, DEDECT, DA, DRDLR, SAHRA, NWPTB, Bojanala Platinum District Municipality and Moses Kotane Local Municipality.

Once the relevant authorities have issued their respective decisions, the IAPs will be notified by e-mail and post in accordance with the instructions from these authorities.

### 10.2.4 REVIEW OF THE EIA AND EMP REPORT BY IAPS

Copies of the EIA and EMP report will be made available for public review at the following places:

- Villages immediately surrounding the project area, including Lesetlheng; Manamakgoteng; Lekutung; Sefikile/Spitskop; Mononono; Kgamatha/Lesobeng; Legkraal; Ntswana-le-Metsing; Motlhabe; Ngweding; Magalane; Magong;
- Bakgatla-Ba-Kgafela traditional offices in Saulspoort;
- Moses Kotane Local Municipality in Saulspoort;
- Rustenburg public library;
- Black Rhino Game Reserve;
- Pilanesberg Platinum Mine; and
- SLR's offices in Johannesburg.

Electronic copies of the report will be made available to IAPs on request (electronically on CD).

A summary of the EIA and EMP report (in English and/or Setswana) will be compiled and distributed to all IAPs registered on the project's public involvement database by hand, post and/or e-mail. IAPs will be notified of the availability of the EIA and EMP report/summary for review as well as review periods via newsletter, through established community leadership and representative structures, and via SMS. IAPs will be given 30 days to review the EIA and EMP report and submit comments in writing to SLR.

### 10.2.5 FEEDBACK MEETINGS

Feedback on the EIA and EMP report will be provided at the planned stakeholder's feedback meetings. IAPs will be notified once the details of the meeting has been finalised. The purpose of the feedback meetings is to provide IAPs with:

- an opportunity to discuss the outcomes of the EIA process; and
- a chance to submit comments on the EIA and EMP report.

The details of the feedback meeting will be distributed to IAPs together with a summary of the EIA and EMP report.

## 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 views, issues and concerns raised have been captured into the comments and response report (Appendix D).** 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 AND 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.

## 11.1 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 Richtrau will adhere to these.

## 11.2 PREDICTIVE MODELS IN GENERAL

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

## 11.3 GEOLOGY

None.

## 11.4 CLIMATE

None.

## 11.5 TOPOGRAPHY

None.

## 11.6 SOILS

None.

## 11.7 LAND CAPABILITY

None.

## 11.8 BIODIVERSITY

### 11.8.1 VEGETATION LIMITATIONS

Sampling method

As an alternative to other vegetation cover sampling methods, the Braun-Blanquet cover-abundance scale was used to analyse vegetation. It is reported that the Braun-Blanquet method requires only one third to one fifth the field time required to other similar methods. In addition, cover-abundance ratings are better suited than density values to elucidate graphically species-environment relationships. For extensive surveys this method provides sufficiently accurate baseline data to allow environmental impact assessment as required by regulatory agencies. However problems that have been detected with this sampling method include:

- it can be seen as subjective and dependent upon the experience and knowledge of the vegetation type by the surveyor. The cover estimate may vary from observer to observer; and
- there also may be a problem when the cover estimate is very close to two different classes (on the border so to speak) and then it is for the observer to decide which class it should be allocated to.

Sampling season

Although the majority of the sampling was conducted during the summer season, it must be noted that the absence of species on site does not conclude that the species is not present at the site as species emerge and flower at different times of the year. Reasons for not finding certain species may be due to:

- sampling season does not coincide with flowering season of specific floral species;
- the disturbed nature of the site;
- the inconspicuous nature of species; and
- lack of species presence.

### 11.8.2 ANIMAL LIFE LIMITATIONS

The time available for the trapping field visit was limited, and sampling was conducted in late summer. It should be noted that the absence of species on site during site visits does not conclude that the species are not present. Reasons for not finding certain species may be due to:

- breeding season of animals does not correlate with the time of the survey;
- lack of suitable habitat and foraging potential on site for animal species;
- the disturbed nature of the site;
- the inconspicuous nature of species; and
- high species mobility and therefore lack of species presence at the time of the survey.

In addition, the area received higher than average rainfall prior to the site visit. This made the parts of the proposed project area inaccessible and therefore trapping sites tend to be located along the periphery of the study area.

## 11.9 SURFACE WATER

A number of assumptions were made in undertaking the hydraulic modelling. These assumptions are 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:

- the topographic data provided was of a sufficient accuracy and coverage to enable hydraulic modelling at a suitable level of detail
- hydraulic structures such as culverts at the site boundary were not modelled as part of the study. This limitation in the model is based on the assumption that only minor structures are likely to be present. The size of the peak flows occuring would easily inundate any minor hydraulic structure present, effectively 'drowing out' their effect
- the Manning's 'n' values used is considered suitable for use in the return periods modelled, as well as in representing both the channel and floodplain
- steady state hydraulic modelling was undertaken, which assumes the flow is continuous at the peak rate. This is a conservative approach as it ignores the effect of storage within the system and therefore produces higher flood levels than would be expected to occur in reality
- a subcritical flow regime was selected for running of the steady state model. This flow regime gave a more conservative estimate than when using a mixed flow regime (which is tailored to both subcritical and supercritical flows).

## 11.10 GROUNDWATER

The following general assumptions and limitations are applicable to the groundwater study:

- rainfall data used was recorded at Station 0548280 at Saulspoort Hospital. This is not on site and the distance could show minor influences on the rainfall recorded. No daily rates were used;
- recharge rates used in the groundwater balance were estimated and long term monitoring will need to confirm the accuracy;
- runoff estimates were based on the PPM pit flooding study;
- aquifer storativity cannot be measured and literature values were used;
- deep aquifer parameters (below 200 mbgl) is uncertain and should be assessed with packer testing on core boreholes;
- model boundaries were assumed to be a combination of no-flow and outflow boundaries;
- community water use / well-field at PPM were included;
- the environmental water balance was compiled for steady state requirements once peak productions volumes are reached;
- the aquifer classifications were influenced by the erratic water supply to the local villages by Magalies water;

- surface water sampling is rare due to high surface water runoff and short period of residence time.

The area north of Pilanesberg is affected by numerous dykes (assumed to be impermeable) and highly conductive fault zones which form local groundwater compartments. The faults zones were assumed to be younger than the dyke swarms and cut through the dyke swarms, however, this should be confirmed with geophysics and drilling, as the dykes could influence the radius of influence (ROI) of the mine dewatering substantially.

The groundwater regime north of the Pilanesberg Intrusive Complex is highly heterogeneous due to complex faulting and intrusions, which ultimately influence the groundwater flow patterns. Several assumptions were during the construction of a groundwater flow model. The following assumptions, based on data collected during field surveys, and model limitations are applicable to the simulated scenarios:

- prior to development, the flow system is in equilibrium and therefore in steady state;
- recharge from rainfall over the area is between 1.7% and 2.5% of MAP i.e. 625 mm/a;
- aquifer system is represented by a three dimensional system consisting of 13 hydraulic zones in layer 1 and 8 hydraulic zones in layer 2. The faults, dykes and drainage weathered zones were modelled discretely and form part of the total number of hydraulic zones;
- some of the management scenarios were simulated in steady-state;
- modelling approach was based on the precautionary principle in areas where there were little or a lack of data. This means that the simulated impacts should be larger than would be in the actual case. The real effect of the mining activities will only be quantified by additional site characterisation and monitoring that should be used to update the model before the implementation and on an on-going basis;
- faults are 100m wide in their horizontal influence and are believed to be more than 100m deep vertically. It is planar and vertical in orientation and is connected to smaller faults which were also assigned higher transmissivity parameters;
- open cast and underground mines are modelled as drains which take water out of the system;
- accuracy and scale of the assessment will result in deviations at point e.g. individual boreholes.

When assumptions were made or reference values used, a conservative approach was followed. A groundwater model is a representation of the real system. It is therefore an approximation, and the level of accuracy depends on the quality of the data that is available. The purpose of the model was not to simulate the actual field conditions (i.e. every dyke and fracture), but to simulate the proposed mining and related activities and influence on the receiving environment.

The numerical simulations were constructed to represent a period starting in 2007 due to mining operations at PPM and ending in 2039, i.e. a 32 year simulation. The numerical model included the following proposed mining simulations:

- Magazynskraal Underground (UG) Mine: 700 m deep, 2014 – 2039 (25 year LoM).

In the cumulative scenario the following was added:

- current Tuschenkomst Open Pit: 2008 – 2026 (18 year LoM)
- Sedibelo Open Pit: 120 m deep, 2013 – 2021 (8 year LoM). The pit could extend to 170 m deep. Once the pit extends to this depth, the groundwater flow model should be updated accordingly;
- Sedibelo Central Underground (UG) Mine: 600 m deep, 2022 – 2032 (10 year LoM);
- Sedibelo East Underground (UG) Mine: 600 deep, 2022 – 2037 (15 year LoM).

It should also be noted that the model was run for the life of mine as indicated in the AGES report and as such excluded post closure scenarios.

The following actions should be undertaken to improve the understanding and management of groundwater related issues:

- the hydrocensus should be extended to include the Pilanesberg National Park;
- aquifer testing should be conducted to provide a better understanding of the flow properties;
- a detailed geotechnical investigation should be undertaken to understand the clay layer properties;
- detailed mapping of preferential pathways, borehole drilling and aquifer testing of the shallow weathered zone and deeper fractured zone is required and the groundwater models should be updated;
- the aquifer(s) classification should be updated on the basis of the improved information;
- the potential link between ground and surface water resources requires quantification;
- an ecosystem study should be undertaken to determine the potential significance of the impact on the springs.

## 11.11 AIR

The most important limitations to the air quality impact assessment that should be noted are listed below:

- the quantification of sources of emission was restricted to the approved Sedibelo and proposed Magazynskraal operations;
- information required to calculate emissions from fugitive dust sources for proposed mining operations were provided by SLR;
- routine emissions from mining operations were estimated and modelled;
- fugititive emissions related to construction activity were not included as no detailed information was available regarding these activities. Construction impacts are however transient in nature and

not expected to contribute significantly to background dust fall out levels and $PM_{10}$ concentrations provided effective migitation measures are implemented;

- no on-site meteorological data was available and use was made of calculated MM5 meteorological data;
- a minimum of 1 year, and typically 3 to 5 years of meteorological data are generally recommended for use in atmospheric dispersion modelling for air quality impact assessment purposes. Three years of meteorological data were used in the atmospheric dispersion modelling;
- no site specific detailed particle size fraction data for the TSF was available and use was made of participle data from PPM opertaions. As a worst case scenario it was assumed that the moisture content for the Sedibelo and Magazynskraal TSF would be 1%;
- the impact assessment was limited to airborne particulates (including TSF and $PM_{10}$) and did not include assessment of ageous pollutants from vehicle exhausts (including carbon monoxide (CO), diesel particulate matter, nitrogen oxides ($NO_x$) and sulphur dioxide ($SO_2$) of $PM_{2.5}$. Impacts related to gaseous emissions were not included due to: (i) a lack of duel use data from heavy equipment used on-site and underground; and (ii) impacts are not expected to be significant. PM2.5 emissions are mostly as a result of combustion processes and not from fugitive dust emissions related to mining activities;
- it was assumed that all processing operations will have ceased by the closure phase of the project. The potential for impacts during this phase will depend ont eh extent of demolition and rehabilitation efforts during closure and on features which will remain. Information regarding the extent of demolition and/or rehabilitation procedures were limited and therefore not included int eh emissions inventory or the dispersion modelling.

## 11.12 NOISE

The baseline ambient noise levels were measured and estimated based on a physical inspection, aided by sampling and probing measurements. Since no facilities suitable for long-duration unattended recordings were available, ambient noise levels were probed and samples taken in which the level was averaged over sufficiently long time durations to obtain good estimates of the average ambient level. This involved time-integrated averaging for a period long enough for the running average to converge to a constant level with less than 1 dB variance. A-weighted, equivalent continuous sound pressure levels LAeq (dBA) were measured, using an integrating sound analyser.

## 11.13 VISUAL

None.

## 11.14 TRAFFIC

A model was prepared with the traffic modelling software Transcad to allow for more accurate distribution of potential trips to be generated by the proposed mining developments in order to determine the impact on the level of service. The following traffic distributions, based on village population statistics, were assumed in terms of the distribution of vehicles trips expected to be generated respective workforces at the relevant mines:

- Kameelboom Area: 2%;
- Makgope Area: 3%;
- Motlhabe / Mankwe Area: 10%;
- Ngweding Area: 2%;
- Rhenosterkraal Area 7%;
- Bofule 3%;
- Legkraal Area 3%; and
- Mogwase Area 70%.

Trip generation rates, the number of vehicle trips which are expected to be generated by the proposed mining developments and the distribution of the vehicle trips to and from the respective areas of the development during the construction and operational phases respectively were based on information provided by Richtrau. Where information was not available, trip generation rates were based on the South African Trip Generation Rates, Second Edition, 1995 and assumptions made based on the experience of the traffic specialist.

The anticipated traffic volumes expected from the proposed Rooderand project were included as part of the background traffic growth as part of this report.

## 11.15 HERITAGE AND CULTURAL RESOURCES

It is possible that the study may have missed heritage resources in the proposed project area as heritage sites 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 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.

The methods used and underlying assumptions are based on human effort (search and observe, outcomes of earlier/previous surveys in wider area) and as such is subject to human error.

## 11.16 PALAEONTOLOGICAL RESOURCES

A specialist paleontological desktop study was undertaken by BPI for Paleontological Research. The methods used and assumptions made are considered adequate for this area.

## 11.17 SOCIO-ECONOMIC

The most significant limitations are detailed below:

- socio-economic data was sourced from both the 2001 and 2011 census data;
- the availability and or willingness of relevant representatives (farmers, headmen and the community development workers as well as the municipal representative) to discuss matters, pertaining to the proposed project;
- representatives from villages falling outside of the scope of the SEIA (such as the villagers north of the Pilanesberg who have historical ties and are currently making use of the land) were not interviewed;
- community unrest during the period of the SEIA, from May to June 2012, specifically with relevance to the community of Lesetlheng. The unrest not only impacted on the timeframes for completion of the SEIA (access to community and the mining operations) but also the willingness to speak to an external parties for fear of retribution; and
- the envisioned period of time for the entire SEIA was three (3) months (March to May 2012), but due to the community unrest other reports contributing to the SEIA were only completed and reviewed in the last quarter of 2012.

## 11.18 ECONOMIC

The following relating to the cost-benefit analysis was assumed:

- the mining project being evaluated is economically viable;
- all the financial information provided to the specialist is correct; and
- the study was limited in its scope as it uses “inferred economic data”, which is limited to desktop research, telephonic interviews and relied on independent information from the environmental assessment team.

In addition, the potential impacts of certain environmental factors (i.e. those relating to groundwater) were assumed without specialist confirmation (refer to Section 11.10 above). It was assumed that the potential groundwater contamination impact would be medium in the mitigated scenario, and the potential reduction of groundwater levels would be low in the mitigated scenario. Should the specialist groundwater study show that the assumed impacts are incorrect, the land-use economic impact assessment would need to be revisited.

## 11.19 LAND USE

The alignment of the proposed Heritage Park dangerous game corridor, as illustrated in a number of figures throughout this EIA and EMP report, is a recent option that was tabled by Pilanesberg Platinum Mine as part of the EIA for the amendment of PPM's closure objections, i.e. partial backfilled and flooding of the Tuschenkomst pit (SLR, 2012). While this option is available in the short term should the proposed Heritage Park choose to use it, the Heritage Park may rather choose to use the original option (or some modified version thereof) as proposed by the NWPTB in 2002 as the longer term solution. In both scenarios, the farm Magazynskraal 3 JQ falls in the proposed non-dangerous game corridor (see Section 1.3.1 for details) and therefore is not critical to the establishment of the proposed dangerous game corridor.

## 11.20 GEOCHEMICAL ANALYSIS

No site specific waste samples have been tested. The geochemical analysis used in this report was based on samples from PPM, located approximately 5km west of the proposed project. Due to the close proximity of the sites, it was assumed that the geochemical characteristics on the proposed project site are the same as that of the samples that were tested.

A critical success factor for any geochemical characterisation program is the selection of representative samples considering material type (e.g. lithology), spatial (e.g. vertical and horizontal area to be mined) and compositional (e.g. all material types based on sulphur content) representation as well as sample storage and handling (e.g. fresh or weathered samples). Additional testing should therefore be conducted on actual samples from the mining operation.

## 11.21 GEOTECHNICAL

No geotechnical study has been undertaken for the proposed project site. If any infrastructure needs to be re-positioned following the geotechnical study the EIA and EMP report will need to be revised accordingly.

## 11.22 CLOSURE COST CALCULATIONS

The closure cost calculations are based on the technical information and site layout as provided by the technical project team, and are assumed accurate at the time of compiling the report.

## 11.23 CUMULATIVE ASSESSMENT

The cumulative assessment of PPM's proposed pit extension, Sedibelo's proposed changes to surface infrastructure and the proposed Magazynskraal Mine was carried out qualitatively rather than quantitatively. In this regard, the assessment was informed by SLR's knowledge of PPM's existing operation as well as the following specialist studies which assessed the cumulative impacts of the Sedibelo and proposed Magazynskraal operations:

- traffic;
- air;
- visual;
- groundwater; and
- socio-economic.

The cumulative assessment only included the three above-mentioned projects and did not include other existing or proposed mining operations in the area.

# 12 ARRANGEMENTS 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.

## 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 (habitats and species);
- reduction in groundwater levels / availability;
- contamination of groundwater;
- pollution of surface water;
- increase in air pollution;
- increase in disturbing noise levels;
- blasting hazards; and
- project-related road use and traffic.

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 impacts from the proposed project 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, Richtrau 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; and
- both the data and the reports will be kept on record for the life of mine.

## 12.3 ROLES AND RESPONSIBILITIES

The Richtrau board will appoint a senior executive, who amongst other duties, will be responsible for environmental management and will ensure that the necessary resources required for implementing and maintaining the EMP commitments and an effective environmental management system are provided on an operational level. This will include the monitoring programme. The roles and responsibilities for the planning and execution of the monitoring programmes are defined below.

Senior Executive and Environmental Department 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; and
- 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). A summary is provided below:

| Programme | Timeframe and frequency* | Reporting* |
|---|---|---|
| Waste dumps and water dams | All project phases<br>On-going by dam operators and quarterly by professional engineer | On-going internally and quarterly by professional engineer |
| Biodiversity | All project phases | Annually by specialist |
| Groundwater and process water | All project phases<br>Monthly (water levels), quarterly (water qualities), annually (update groundwater model and climatic water balance). | Quarterly and annually by specialists<br>Annually to DWA |
| Surface water | All project phases<br>Quarterly (water qualities) | Quarterly and annually by specialists<br>Annually to DWA |
| Air | All project phases<br>Monthly (dust) | Quarterly and annually by specialist<br>Annually to the DMR and DEA |
| Noise | From the start of construction to the end of decommissioning<br>Annually as a minimum (dependant on stakeholder complaints) | Annually by specialist |
| Blasting | During operation of the mine<br>Every blast | Monthly by specialist |
| Traffic aspects | As required (dependant on stakeholder complaints) | As required |

| Programme | Timeframe and frequency* | Reporting* |
|---|---|---|
| Internal auditing | From start of construction to end of closure<br>On-going | As required |
| External auditing | From start of construction to end of closure<br>Every two years | Every two years to DMR |

** The requirements of any water use license take precedence over these timeframes.*

# 13 TECHNICAL SUPPORTING INFORMATION

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

- soils and land capability specialist report (Appendix E);
- biodiversity specialist report (Appendix F);
- hydrological specialist report (Appendix G)
- hydrogeological specialist report (Appendix H);
- air quality specialist report (Appendix I);
- noise specialist report (Appendix J);
- visual specialist report (Appendix K);
- cultural-heritage specialist report (Appendix L);
- palaeontological specialist report (Appendix M);
- traffic specialist report (Appendix N);
- socio-economic specialist report (Appendix O);
- economic specialist report (Appendix P);
- engineering design report (Appendix Q); and
- closure liability calculations (Appendix R).

# 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 describe the pre-mining environment as informed by the baseline description (Section 1) are listed below. This list serves to guide the setting of environmental objectives for mine closure.

- relatively flat topography;
- pre-mining soils supported grazing and wilderness land capabilities and/or uses;
- a functioning ecosystem;
- non-perennial drainage patterns;
- poor quality groundwater as a result of elevated flouride concentrations; and
- quiet rural environment.

## 14.2 MEASURES REQUIRED FOR CONTAINMENT OR REMEDIATION

Measures required to contain 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 procedure (Section 20);
- 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/or operation of TSF with decant and drainage systems and runoff control measures;
- design, construct and operate the waste dumps with runoff control measures;
- rehabilitate the site in line with a detailed closure plan to be developed during the operational phase 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:

- hazardous excavations and structures (water dams, TSF and WRDs);
- physical destruction and general disturbance of biodiversity;
- dewatering impacts on third party users;
- contamination of groundwater;
- pollution of surface water;
- increase in air pollution;
- increase in disturbing noise levels;
- blasting hazards; and
- traffic increase and road use.

## 15.2 ACTIVITIES AND INFRASTRUCTURE

The source activities of potential impacts which require management are detailed in Section 2.3 and listed below.

- site preparation
- earthworks
- civil works
- underground mining
- tailings storage facility (TSF)
- waste rock dumps (WRDs)
- water supply infrastructure
- power supply infrastructure
- transportation system
- non-mineralised waste management
- general site management
- demolition
- rehabilitation
- 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.

## 15.4 ROLES AND RESPONSIBILITIES

The key personnel to ensure compliance to this EMP report will be the Operations Executive, the Environmental Department Manager and the Stakeholder Engagement Manager. As a minimum, these roles as they relate to the implementation of monitoring programmes and management activities will include:

- Senior Operational Manager and Environmental Department Manager:
  - ensure that the monitoring programmes and audits are scoped and included in the annual mine budget;
  - identify and appoint appropriately qualified specialists/engineers to undertake the programmes;
  - appoint specialists in a timeously manner to ensure work can be carried out to acceptable standards;
- Stakeholder Engagement Department:
  - 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;
  - facilitate stakeholder communication, information sharing and grievance mechanism.

# 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 0.

## 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 are described below. The information is presented in tabular format (Table 54).

**TABLE 54: 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<br>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 project-related activities, where possible<br>Where damage is unavoidable, to work together with the third parties to achieve a favourable outcome<br>To ensure public safety |
| 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 work together with existing structures and organisations |
| Informal settlements | To limit the impacts associated with inward migration | To establish and maintain a good working relationship with surrounding communities, local authorities and land owners |
| Relocation | To prevent the risk of harm and injury to people and animals and the damage of associated buildings | To work together with existing structures and organisations<br>To establish and maintain a good working relationship with surrounding communities and land owners |
| Evacuation | To prevent to potential of third party harm and injury | To protect third parties and property from harm and injury as a result of the project-related activities<br>To ensure public safety |

# 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 55).

**TABLE 55: 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<br>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<br>If disturbance is unavoidable, then provide opportunity for research |

# 18 APPROPRIATE TECHNICAL AND MANAGEMENT OPTIONS

## 18.1 PROJECT ACTIONS, ACTIVITIES AND PROCESSES

All activities associated with the proposed 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 mine which will cause significant impacts on the environment, socio-economic conditions and historical and cultural aspects are listed in the table below (Table 56) and described in detail in Section 7. In addition to these, the mine will implement an environmental management system to assist in the implementing and monitoring of commitments included in this EIA and EMP report.

**TABLE 56: TECHNICAL AND MANAGEMENT OPTIONS**

| Potential impact | Technical and management options |
|---|---|
| Loss and sterilization of mineral resources | Mine workings will be developed and designed taking cognisance of potential ore reserves<br>Extraction of all possible minerals prior to final disposal |
| Hazardous excavations and infrastructure | Construction of berms, fencing, barriers and access control<br>Warning signs<br>Sealing of shafts<br>Implement monitoring programme<br>Implement an emergency response procedure |
| Loss of soil resources and land capability through pollution | Implement hazardous waste, dirty water and mineralised and non-mineralised waste management procedures<br>Permanent infrastructure designs to take long term soil prevention, land function and confirmatory monitoring into account |
| Loss of soil and land capability through physical disturbance | Implementation of a soil management plan<br>Limiting disturbance of soil to what is necessary<br>Stripping, storing, maintenance and replacement of topsoil in accordance to soil management procedures |
| Physical destruction of biodiversity | Implementation of the biodiversity management plan<br>Restrict project footprint<br>Limit disturbance on highly sensitive biodiversity areas<br>Implementation of monitoring programmes<br>Rehabilitate disturbed areas |
| General disturbance of biodiversity | Prevention of the killing of animal species and harvesting of plant species<br>Implementation of dust control measures<br>Pollution prevention measures (water and soil)<br>Prevention of the disturbance of ecosystems |

| Potential impact | Technical and management options |
|---|---|
| Pollution of surface water resources | Appropriate design of polluting facilities and pollution prevention facilities (by qualified person)<br>Implement and maintain storm water controls that meet regulatory requirements<br>Implement site-specific soil management plan<br>Implement a monitoring programme (water use, process water quality, surface water quality, rainfall-related discharge quality)<br>Implement emergency response procedure<br>Implementation and maintenance of licence requirements |
| Alteration of natural drainage lines | Implement and maintain storm water controls that meet regulatory requirements |
| Contamination of groundwater | Appropriate design of pollution facilities<br>Correct handling of hazardous wastes, mineralised and non-mineralised wastes<br>Compensation for loss<br>Implement and maintain terms and conditions of regulatory requirements<br>Implementation of a monitoring programme<br>Implement emergency response procedure<br>Implementation and maintenance of licence requirements |
| Dewatering | Compensation for loss<br>Implementation of monitoring programme |
| Air pollution | Implementation of air quality management plan<br>Implementation an air quality monitoring programme<br>Control dust plumes<br>Implementation of an air complaints procedure<br>Maintenance of abatement equipment<br>Implement an emergency response procedure<br>Authorise all scheduled processes (if required)<br>Compliance with relevant licence requirements (if required) |
| Noise pollution | Maintenance of vehicles and equipment in good working order<br>Implementation of a noise complaints procedure<br>Reducing operational hours<br>Education and awareness training of workers<br>Equip machinery with silencers<br>Construction of noise attenuation measures<br>Relocate people experiencing unacceptable increase in ambient noise |
| Blasting damage | Implementation of a blast management plan<br>Pre-mining crack survey<br>Communication of planned blasting times with stakeholders (for surface and near-surface blasts)<br>Pre-blast warning (for surface and near-surface blasts)<br>Monitoring blasts<br>Audit and review to adjust blast design were necessary<br>Investigate blast related complaints<br>Rectify damage to third party structures<br>Implementation of a blasting complaints procedure<br>Implement emergency response procedure<br>Implement an evacuation plan |

| Potential impact | Technical and management options |
|---|---|
| Traffic increase | Implementation of a traffic safety programme<br>Implement speed allaying measures where appropriate e.g. speed humps<br>Ensure dust is effectively controlled on unpaved road so as not to reduce visibility<br>Education and awareness training of workers<br>Use of pedestrian crossing by pedestrians<br>Placement of signage to create awareness<br>Maintenance of the transport systems<br>Implementation of a traffic complaints procedure<br>Implement emergency response procedure |
| Visual impacts | Limit the clearing of vegetation<br>Limit the emission of visual air plumes<br>Use of screening berms<br>Concurrent rehabilitation<br>Painting infrastructure to compliment the surrounding environment where possible<br>Implementation of a closure plan<br>Management through care and aftercare |
| Heritage and cultural | Limit project infrastructure, activities and related disturbances as far as practically possible<br>Project specific heritage studies will be conducted to identify any resources should the project footprint change<br>Education and awareness training of workers<br>Apply for the relevant permits to remove or destroy heritage resources<br>Exhumation and relocation of graves where required according to legal requirements<br>Implement emergency response procedure<br>Maintain communication channels with the NWPTB regarding the proposed Heritage Park and align the mine's future planning accordingly |
| Economic impact | Hire people from closest communities<br>To extend the formal bursary and skills development to closest communities<br>Implement a procurement mentorship programme<br>Local procurement of goods and services as far as possible<br>Compensation for loss of land use<br>Closure planning to make consideration for skills, economic consideration and the needs of future land use |
| Inward migration | Good communication in terms of recruitment, procurement and training<br>Number of temporary and permanent new job opportunities and procurement will be made public<br>Employment and procurement opportunities provided to closest communities as far as practically possible<br>No recruitment at the mine gate<br>Notify unsuccessful job seekers<br>Encourage formal housing of employees and implement contractual requirement for contractors to ensure formal housing for workers, both temporary and permanent<br>Maintain a skills profile for the nearest communities<br>Monitor and prevent the development of informal settlements through the interaction with neighbours, local authorities and law enforcement officials<br>Implement a health policy on HIV/AIDs and tuberculosis to promote awareness and training<br>Addressing social service constraints and social problems relating to education, health, water supply, solid waste management, sanitation and housing<br>Implement emergency response procedure |
| Relocation | Conduct any required relocation in accordance with the principles and requirements of the World Bank International Finance Corporation Resettlement Action Plan guideline<br>Ensure transparent communication with the affected people and the BBKTA |
| Land use | Implementation of EMP commitments that focus on environmental and social impacts<br>Take necessary steps to prevent negative impact on surrounding land<br>Closure planning to incorporate measures to achieve future land use plans |

# 19 ACTION PLANS 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 57: ACTION PLAN – LOSS AND STERILISATION OF MINERAL RESOURCES**

| Phase of operation | Activities (see Table 37) | Sig | | Technical and management options | Action plan | | |
|---|---|---|---|---|---|---|---|
| | | UM | M | | Timeframe | Frequency | Responsible parties |
| Construction | Civil works | H | L | • Incorporate cross discipline planning structures for development of proposed project. | At start | Once off | Mine resource manager |
| Operation | Civil works<br>Mine residue management and disposal | H | L | • Extraction of mineral resources prior to final disposal. | On-going | On-going | Mine resource manager |
| Decommission | Mine residue management and disposal<br>Rehabilitation | H | L | | | | |
| Closure | Maintenance and aftercare of rehabilitated areas | H | L | | | | |

**TABLE 58: ACTION PLAN – HAZARDOUS STRUCTURES / EXCAVATIONS AND SURFACE SUBSIDENCE**

| Phase of operation | Activities (see Table 37) | Sig | | Technical and management options | Action plan | | |
|---|---|---|---|---|---|---|---|
| | | UM | M | | Timeframe | Frequency | Responsible parties |
| Construction | Earthworks<br>Civil works<br>Rehabilitation | H | M | • The proposed TSF and associated return water dam will be designed, constructed, operated and closed in a manner to ensure that stability and related safety risks to third parties and animals are addressed. It will furthermore be monitored according to a schedule that is deemed relevant to the type of facility by a professional engineer. | On-going | On-going | Professional engineer |
| Operation | Shafts<br>Mineral processing facilities<br>Mine residue management and disposal<br>Water supply and storage infrastructure<br>Power supply infrastructure<br>Transport infrastructure<br>Rehabilitation | H | M | • In addition, a detailed geotechnical survey will be undertaken prior to the establishment of any infrastructure, particularly the TSF and WRDs, to ensure the foundations of the proposed site are suitable. If any infrastructure needs to be moved following the geotechnical survey a new site will need to be investigated and the EIA and EMP report (if approved) will need to be revised. | Prior to construction | Once-off | Professional engineer |
| | | | | • Richtrau will survey area to be disturbed by the proposed project footprint and update its surface use area map on a routine basis to ensure that the position and extent of all potential hazardous excavations, hazardous infrastructure and subsidence is known. It will furthermore ensure that appropriate management measures are taken to address the related safety risks to third parties and animals. | On-going | On-going | Senior operational manager |
| Decommission | Demolition<br>Mine residue management and disposal<br>Rehabilitation<br>Water supply and storage infrastructure<br>Power supply infrastructure | H | M | • The safety risks associated with identified hazardous excavations, subsidence and infrastructure will be addressed through one or more of the following:<br>o fencing, berms, barriers and/or security personnel to prevent unauthorized access;<br>o warning signs in the appropriate languages (s) Warning pictures can be used as an alternative | As required | Once-off | Senior operational manager |
| | | | | • Professional civil engineer to monitor dams with safety risk. | On-going | As required | Professional engineer |
| | | | | • During decommissioning planning of any part of the mine, provision will be made to address long term safety risks in the decommissioning and rehabilitation phases. | As required | As required | Senior operational manager |
| Closure | Maintenance and aftercare of final land forms and rehabilitated areas | H | M | • At closure the hazardous structures and excavations and risk of subsidence will be dealt with as follows:<br>o any remaining land forms such as the TSF and WRDs, will be decommissioned and rehabilitated in a manner that they do not present long-term safety and/or stability risks;<br>o shaft openings will be properly sealed with an engineered plug and rehabilitated;<br>o the potential for surface subsidence will have been addressed by providing underground support in mined out areas;<br>o monitoring and maintenance will take place to observe whether the relevant long-term safety objectives have been achieved and to identify the need for additional intervention where the objectives have not been met | As required | As required | Senior operational manager |
| | | | | • Where Richtrau has caused injury or death to third parties and/or | As required | As required | Senior Operational Manager |

| Phase of operation | Activities (see Table 37) | Sig | | Technical and management options | Action plan | | |
|---|---|---|---|---|---|---|---|
| | | UM | M | | Timeframe | Frequency | Responsible parties |
| | | | | animals, appropriate compensation will be provided<br>• In case of injury or death due to hazardous excavations, follow emergency response procedure in Section 20 will be followed | As required | As required | Senior Operational Manager |

## TABLE 59: ACTION PLAN – LOSS OF SOIL RESOURCES AND LAND CAPABILITY THROUGH POLLUTION

| Phase of operation | Activities (see Table 37) | Sig UM | Sig M | Technical and management options | Action plan: Timeframe | Action plan: Frequency | Action plan: Responsible parties |
|---|---|---|---|---|---|---|---|
| Construction | Earthworks<br>Civil works<br>Site management<br>Transport systems<br>Non-mineralised waste management<br>Rehabilitation | H | L | • In the construction, operation and decommissioning phases Richtrau will conduct all potentially polluting activities in a manner that they do not pollute soils. This will be implemented through a procedure(s) covering the following:<br>○ pollution prevention through basic infrastructure design pollution prevention through maintenance of equipment;<br>○ pollution prevention through education and training of permanent and temporary workers;<br>○ pollution prevention through appropriate management of hazardous materials and wastes (Table 47);<br>○ the required steps to enable fast reaction to contain and remediate pollution incidents. In this regard the remediation options include containment and in situ treatment or disposal of contaminated soils as hazardous waste. In-situ treatment is generally considered to be the preferred option because with successful in situ remediation the soil resource will be retained in the correct place. The in situ options include bioremediation at the point of pollution, or removal of soils for washing and/or bio remediation at a designated area after which the soils are returned;<br>○ specifications for post rehabilitation audit criteria to ascertain whether the remediation of any polluted soils and re-establishment of soil functionality has been successful and if not, to recommend and implement further measures. | On-going | On-going | Senior Operational Manager |
| Operation | Site management<br>Transport systems<br>Non-mineralised waste management<br>Mine residue management and disposal<br>Water supply infrastructure<br>Power supply infrastructure | H | L | | | | |
| Decommission | Demolition<br>Site management<br>Transport systems<br>Non-mineralised waste management<br>Mine residue management and disposal<br>Water supply infrastructure<br>Power supply infrastructure<br>Rehabilitation | H | L | • The designs of any permanent and potentially polluting structures (such as the proposed TSF and WRDs) will take account of the requirements for long term soil pollution prevention, land function and confirmatory monitoring. | As required | As required | Senior Operational Manager |
| | | | | • In case of any major spillage incidents the emergency response procedure in Section 20 will be followed | As required | As required | Senior Operational Manager |
| Closure | Maintenance and aftercare of final land forms and rehabilitated areas | H | L | | | | |

### TABLE 60: ACTION PLAN – LOSS OF SOILS AND LAND CAPABILITY THROUGH PHYSICAL DISTURBANCE

| Phase of operation | Activities (see Table 37) | Sig | | Technical and management options | Action plan | | |
|---|---|---|---|---|---|---|---|
| | | UM | M | | Timeframe | Frequency | Responsible parties |
| Construction | Earthworks<br>Civil works<br>Site management<br>Transport systems | H | L | • In the construction, operation and decommissioning phases a soil management plan, with the following key components, will be implemented:<br>o limit the disturbance of soils to what is absolutely necessary for earthworks, on-going activities, infrastructure footprints and use of vehicles;<br>o where soils have to be disturbed the soil will be stripped, stored, maintained and replaced in accordance with the specifications of the soil management principles in Table 48.<br>• As part of closure planning, the designs of any permanent landforms (e.g. mineralised waste facilities) will take into consideration the requirements for land function, long term erosion prevention and confirmatory monitoring<br>• As part of the agricultural initiative, no plant species that are classified as Category 1, 2 or 3 weeds in terms of the Conservation of Agricultural Resources Act, 43 of 1983, will be cultivated. | On-going<br>As required<br>As required | On-going<br>As required<br>As required | Senior Operational Manager<br>Senior Operational Manager<br>Senior Operational Manager |
| Operation | Earthworks<br>Site management<br>Transport system<br>Non-mineralised waste management<br>Mine reside management and disposal<br>Water supply infrastructure<br>Power supply infrastructure | H | L | | | | |
| Decommission | Demolition<br>Site management<br>Transport systems<br>Non-mineralised waste management<br>Mine residue management and disposal<br>Water supply infrastructure<br>Power supply infrastructure | H | L | | | | |
| Closure | Maintenance and aftercare of final land forms and rehabilitated areas | H | L | | | | |

## TABLE 61: ACTION PLAN – PHYSICAL DESTRUCTION OF BIODIVERSITY

| Phase of operation | Activities (see Table 37) | Sig | | Technical and management options | Action plan | | |
|---|---|---|---|---|---|---|---|
| | | UM | M | | Timeframe | Frequency | Responsible parties |
| Construction | Site preparation<br>Earthworks<br>Civil works<br>Transport system<br>Site management | H | M | • If the proposed project is approved, Richtrau should reconsider the option of establishing a joint-venture operation with either Sedibelo or PPM in order to limit the physical destruction of biodiversity within the proposed project area.<br>• In the construction, operation and decommissioning phases Richtrau will implement a biodiversity management plan. The key components are:<br>o the area to be destroyed will be thoroughly investigated by a suitably qualified ecologist for the removal of conservation important species;<br>o the disturbance of areas of significance and important linkages between these areas will be prevented so that the species composition and ecosystem functionality remain intact;<br>o a nursery will be established on-site to ensure successful rehabilitation in the long term;<br>o any faunal species identified during the plant collection/removal must also be moved with the intention to relocate to a safe but similar habitat in the near vicinity. Emphasis should be placed on all reptile, frog and small mammal species;<br>o a senior staff member based on-site must be trained in the capture, handling and release of snakes. Snake handling equipment must be readily available on-site at all times;<br>o larger trees must be avoided during the construction phase. If raptor nesting sites are recorded, necessary buffers must established and no mine personnel allowed into these areas;<br>o habitat and site specific faunal niches such as large hole-bearing trees, nests, dens and hibenaria such as termataria or rock piles must be avoided where possible;<br>o an alien invasive programme for the proposed project area will be compiled and implemented to prevent the spread of alien species;<br>o Richtrau must engage with the relevant stakeholders (including land users, BBKTA, Department of Agriculture and Department of Rural Development and Land Reform) regarding the grazing capacity of the natural vegetation. The grazing capacity must be evaluated, and livestock numbers kept within acceptable limits to reduce bush encroachment and the effects on floral and faunal communities;<br>o rehabilitation efforts must involve planting of locally sourced indigenous plant species. | Pre-construction<br><br>On-going | Once off<br><br>On-going | Richtrau Senior Management Team<br><br>Senior Operational Manager |
| Operation | Site management<br>Transport system<br>Non-mineralised waste management<br>Mine residue management and disposal<br>Water supply infrastructure<br>Power supply infrastructure | H | M | | | | |
| Decommission | Demolition<br>Site management<br>Transport system<br>Non-mineralised waste management<br>Water supply infrastructure<br>Mine residue management and disposal | H | M | | | | |
| Closure | Maintenance and aftercare of final land forms and rehabilitated areas | H | L | • The designs of any permanent structures (mineralised waste facilities) will take into consideration the requirements for the establishment of long term species diversity, ecosystem functionality, aftercare and confirmatory monitoring | As required | As required | Senior Operational Manager |

## TABLE 62: ACTION PLAN – GENERAL DISTURBANCE OF BIODIVERSITY

| Phase of operation | Activities (see Table 37) | Sig | | Technical and management options | Action plan | | |
|---|---|---|---|---|---|---|---|
| | | UM | M | | Timeframe | Frequency | Responsible parties |
| Construction | Site preparation<br>Earthworks<br>Civil works<br>Transport system<br>Site management | H | M | • In the construction, operation and decommissioning phases Richtrau will ensure that:<br>○ efficient use of lighting to limit impacts on hunting behaviour of nocturnal predators, and where it is required, yellow lighting is used where possible. Lights must be focused and shine downwards to illuminate the required area. Lights must not shine upwards or horizontally away from the site;<br>○ vertebrates should be kept away from the illuminated areas with appropriate fencing where feasible;<br>○ internal power lines may be equipped with bird deterrent measures to prevent bird kills where deemed necessary;<br>○ there is training for workers on the value of biodiversity and the need to conserve the species and systems that occur within the proposed project area;<br>○ there is zero tolerance of the killing or collecting of any biodiversity by anybody working for or on behalf of Richtrau;<br>○ strict speed control measures are used for any vehicles driving within the proposed project area to reduce the incidence of road kills;<br>○ noisy and/or vibrating equipment will be well maintained to control noise and vibration emission levels;<br>○ biodiversity education and awareness training for all staff (temporary and permanent) employed by Richtrau or on their behalf. Sightings or findings of fauna must be reported to the environmental officer;<br>○ all water dams will be fenced off to prevent access by larger animals;<br>○ dust control measures will be implemented (see Section 7.2.11);<br>○ pollution and litter prevention measures will be implemented (see Section 7.2.3 and 7.2.7). | On-going | On-going | Senior Operational Manager |
| Operation | Site management<br>Transport system<br>Non-mineralised waste management<br>Mine residue management and disposal<br>Water supply infrastructure<br>Power supply infrastructure | H | M | | | | |
| Decommission | Demolition<br>Site management<br>Transport system<br>Non-mineralised waste management<br>Water supply infrastructure<br>Power supply infrastructure<br>Mine residue management and disposal | H | M | | | | |
| | | | | • As part of closure planning, the designs of any permanent and potentially polluting structures (TSF and WRDs) will take consideration of the requirements for long term pollution prevention and confirmatory monitoring. | On-going | On-going | Senior Operational Manager |
| | | | | • Richtrau will monitor the aquatic environment of all potentially affected surface water resources and use the results of the monitoring to implement any other surface water related interventions as deemed appropriate to achieve the mitigation objectives. | On-going | On-going | Senior Operational Manager |
| Closure | Maintenance and aftercare of final land forms and rehabilitated areas | H | M | • Major spillage incidents will be handled in accordance with the emergency procedure attached in Section 20. | As required | As required | Environmental site manager |

## TABLE 63: ACTION PLAN – POLLUTION OF SURFACE WATER RESOURCES

| Phase of operation | Activities (see Table 37) | Sig | | Technical and management options | Action plan | | |
|---|---|---|---|---|---|---|---|
| | | UM | M | | Timeframe | Frequency | Responsible parties |
| Construction | Earthworks<br>Civil works<br>Transport systems<br>Site management<br>Water supply and use<br>Non-mineralised waste management<br>Mine residue management and disposal | H | L | • In all phases, infrastructure associated with the proposed projects will be constructed, operated and maintained so as to comply with the provisions of the NWA and R704 or any future amendments thereto. In this regard:<br>○ clean water systems are separated from dirty water systems;<br>○ the size of dirty areas are minimised and dirty water is contained in systems that allow the reuse and/or recycling of this dirty water;<br>○ discharges of dirty water may only occur in accordance with authorisations that are issued in terms of the relevant legislation specifications and they must not result in negative health impacts for downstream surface water users. The relevant legislation specifications comprises any applicable authorisation/exemption, the National Water Act (36 of 1998) and Regulation 704, or any future amendment thereto;<br>○ the site wide water balance is refined on an on-going basis with the input of actual flow volumes and used as a decision making tool for water management and impact mitigation.<br>○ Richtrau will monitor bulk water intake and recycled/reused water on an ongoing basis through the installation of flowmeters and related instrumentation. This information will feed into the site wide water balance. Instrumentation will be calibrated on a regular basis in line with the manufacturer's operating manuals | On-going | On-going | Senior Operational Manager |
| Operation | Underground mining<br>Transport systems<br>Mineral processing<br>Site management<br>Water supply infrastructure<br>Non-mineralised waste management<br>Mine residue management and disposal | H | L | | | | |
| Decommission | Underground mining<br>Transport systems<br>Mineral processing<br>Site management<br>Water supply infrastructure<br>Non-mineralised waste management<br>Mine residue management and disposal | H | L | • PPM, the IBMR and Richtrau will establish a water management committee to ensure that water consumption, recycling and re-use targets are established, monitored and optimised on quarterly basis. This committee should furthermore identify and implement synergies and initiatives across the operations to minimise bulk water intake. | On-going | Quarterly | Senior Operational Manager |
| | | | | • In the construction, operation and decommissioning phases the | On-going | On-going | Senior Operational Manager |

| Phase of operation | Activities (see Table 37) | Sig | | Technical and management options | Action plan | | |
|---|---|---|---|---|---|---|---|
| | | UM | M | | Timeframe | Frequency | Responsible parties |
| Closure | Maintenance and aftercare of final land forms and rehabilitated areas | H | L | mine will ensure that all mineralised wastes and non-mineralised wastes are handled in a manner that they do not pollute surface water. This will be implemented through a procedure(s) covering the following:<br>○ pollution prevention through basic infrastructure design pollution prevention through maintenance of equipment;<br>○ pollution prevention through education and training of workers (permanent and temporary);<br>○ pollution prevention through appropriate management of hazardous materials and waste;<br>○ the required steps to enable containment and remediation of pollution incidents; and<br>○ specifications for post rehabilitation audit criteria to ascertain whether the remediation has been successful and if not, to recommend and implement further measures. | | | |
| | | | | • The designs of any permanent and potentially polluting structures will take account of the requirements for long term surface water pollution prevention. In addition, where these facilities are associated with groundwater plumes that could impact the quality of surface water resources, Richtrau will implement mitigation measures for as long as is needed to eliminate the risk and achieve the stated mitigation objectives. An example of such a solution is to pump and treat the polluted groundwater so that it does not impact surface water resources. | As required | As required | Senior Operational Manager |
| | | | | • Richtrau will monitor the water quality (Section 21) in all potentially affected surface water resources and use the monitoring results to implement appropriate mitigation measures to achieve the surface water quality objectives. Where monitoring results indicates that third party water supply has been polluted by Richtrau, Richtrau will ensure that appropriate compensation such as an alternative equivalent water supply will be provided. | On-going | On-going | Senior Operational Manager |
| | | | | • In case of a major incident the emergency response procedure in Section 20 will be followed. | As required | As required | Senior Operational Manager |

**TABLE 64: ACTION PLAN – ALTERATION OF DRAINAGE PATTERNS**

<table>
<tr><th rowspan="3">Phase of operation</th><th rowspan="3">Activities (see Table 37)</th><th colspan="2">Sig</th><th rowspan="3">Technical and management options</th><th colspan="3">Action plan</th></tr>
<tr><th rowspan="2">UM</th><th rowspan="2">M</th><th rowspan="2">Timeframe</th><th rowspan="2">Frequency</th><th rowspan="2">Responsible parties</th></tr>
<tr></tr>
<tr><td>Construction</td><td>Earthworks<br>Civil works<br>Transport systems<br>Site management<br>Non-mineralised waste management</td><td></td><td></td><td rowspan="4">• Richtrau will comply with the terms and conditions of water authorisations/licenses that are granted.<br>• In all phases, project related infrastructure will be constructed, operated and maintained so as to comply with the provisions of the NWA and R704 or any future amendments thereto. Key related issues are:<br>○ clean water systems are separated from dirty water systems; and<br>○ the size of dirty areas are minimised and clean run-off and rainfall water is diverted around dirty areas and back into its normal flow in the environment.</td><td rowspan="4">Pre-construction</td><td rowspan="4">Once off</td><td rowspan="4">Senior Operational Manager</td></tr>
<tr><td>Operation</td><td>Earthworks<br>Civil works<br>Transport systems<br>Non-mineralised waste management<br>Mine residue management and disposal<br>Water supply infrastructure<br>Power supply infrastructure<br>Rehabilitation</td><td></td><td></td></tr>
<tr><td>Decommission</td><td>Demolition<br>Site management<br>Transport systems<br>Non-mineralised waste management<br>Mine residue management and disposal<br>Water supply infrastructure<br>Power supply infrastructure<br>Rehabilitation</td><td></td><td></td></tr>
<tr><td>Closure</td><td>Maintenance and aftercare of final land forms and rehabilitated areas</td><td></td><td></td></tr>
</table>

## TABLE 65: ACTION PLAN – REDUCTION OF GROUNDWATER LEVELS / AVAILABILITY

| Phase of operation | Activities (see Table 37) | Sig | | Technical and management options | Action plan | | |
|---|---|---|---|---|---|---|---|
| | | UM | M | | Timeframe | Frequency | Responsible parties |
| Construction | Shaft sinking | H | M | • Where mine dewatering causes a loss of water supply to third parties an alternative equivalent water supply will be provided by Richtrau until such time as the dewatering impacts cease.<br>• During the operational phase, Richtrau will:<br>○ ensure all potentially affected third party boreholes are included in the ground water monitoring program to ensure that changes in water depths can be identified, where possible;<br>○ establish a joint water monitoring forum between the local mining companies where data is shared and impacts on third party groundwater users are addressed;<br>○ update the groundwater model every two years;<br>○ ensure the mine's water sealing procedures are adhered to for the sealing of discrete fractures to reduce ingress of groundwater in the underground workings. | On-going<br>On-going | On-going<br>On-going | Senior Operational Manager<br>Senior Operational Manager |
| Operation | Underground mining | H | M | | | | |
| Decommission | Dewatering ceases | H | M | • In the decommissioning and closure phases, Richtrau will:<br>○ update the groundwater flow model with the detailed post closure underground mine voids and the time to flood the underground mine voids should be simulated. A detailed geochemical assessment should be conducted to determine the water quality in the flooded underground mines;<br>○ clad the TSF and WRD's to limit water ingress due to precipitation on these facilities. | On-going<br>On completion | As requierd<br>Once off | Senior Operational Manager<br>Senior Operational Manager |
| Closure | NA | - | - | - | - | - | - |

**TABLE 66: ACTION PLAN – CONTAMINATION OF GROUNDWATER RESOURCES**

| Phase of operation | Activities (see Table 37) | Sig | | Technical and management options | Action plan | | |
|---|---|---|---|---|---|---|---|
| | | UM | M | | Timeframe | Frequency | Responsible parties |
| Construction | Earthworks<br>Civil works<br>Transport systems<br>Site management<br>Water supply and use<br>Non-mineralised waste management | H | M | • Richtrau will comply with both the National Water Act (36 of 1998) and Regulation 704 (4 June 1999) or any future amendments thereto, and the terms and conditions of water authorisations/licenses<br>• In the construction, operation and decommissioning phases the mine will ensure that all mineralised wastes and non-mineralised wastes are handled in a manner that they do not pollute groundwater. This will be implemented through a procedure(s) covering the following:<br>○ pollution prevention through basic infrastructure design;<br>○ pollution prevention through education and training of workers (permanent and temporary);<br>○ pollution prevention through appropriate management of materials and non-mineralised waste;<br>○ the required steps to enable containment and remediation of pollution incidents; and<br>○ specifications for post rehabilitation audit criteria to ascertain whether the remediation has been successful and if not, to recommend and implement further measures.<br>• All infrastructure that has the potential to pollute groundwater resources will be designed and implemented in a manner that pollution is addressed post closure<br>• Infrastructure that has the potential to cause groundwater contamination will be identified and included in a groundwater pollution management plan which will be implemented as part of the operational phase. This plan has the following principles:<br>○ determine potential pollution sources;<br>○ determine the extent of potential contamination plumes;<br>○ design and implement intervention measures to prevent, eliminate and/or control the pollution plume. In terms of the TSF this may include: measures to reduce ponding and remove water from the dam, interception trenches along the perimeter of the dam, scavenger wells, a pump and treat system, and final capping amongst others. In terms of the WRDs this may include: measures to contain seepage, measures to contain runoff and final capping;<br>○ monitor all potential impact zones to track pollution and mitigation impacts;<br>○ where monitoring results indicate that third party water supply has been polluted by Richtrau, Richtrau will ensure that an alternative equivalent water supply will be | On-going<br>On-going<br>On-going<br>On-going | On-going<br>On-going<br>On-going<br>On-going | Senior Operational Manager<br>Senior Operational Manager<br>Senior Operational Manager<br>Senior Operational Manager |
| Operation | Underground mining<br>Transport systems<br>Mineral processing<br>Site management<br>Water supply and use<br>Non-mineralised waste management<br>Mine residue management and disposal | H | M | | | | |
| Decommission | Underground mining<br>Transport systems<br>Mineral processing<br>Site management<br>Water supply and use<br>Non-mineralised waste management<br>Mine residue management and disposal | H | M | | | | |
| Closure | Maintenance and aftercare of final land forms and rehabilitated areas | H | M | | | | |

| Phase of operation | Activities (see Table 37) | Sig | | Technical and management options | Action plan | | |
|---|---|---|---|---|---|---|---|
| | | UM | M | | Timeframe | Frequency | Responsible parties |
| | | | | provided.<br>• Groundwater monitoring should continue post closure to assess the migrations of any groundwater contamination (nitrates and sulphates amongst other parameters) originating from the permanent on-site facilities i.e. TSF and WRDs. | 6 years | Quarterly | Senior Operational Manager |

## TABLE 67: ACTION PLAN – AIR POLLUTION

| Phase of operation | Activities (see Table 37) | Sig | | Technical and management options | Action plan | | |
|---|---|---|---|---|---|---|---|
| | | UM | M | | Timeframe | Frequency | Responsible parties |
| Construction | Earthworks<br>Civil works<br>Transport systems<br>Site management<br>Non mineralised waste facilities | H | L | • The proposed target controls on the various sources are provided below:<br>○ materials handling operations – 50% control efficiency through effective water sprays;<br>○ crushing and screening activities – 80% control efficiency through effective water sprays. | On-going | On-going | Senior Operational Manager |
| Operation | Transport systems<br>Site management<br>Materials handling<br>Non mineralised waste facilities<br>Mine residue management and disposal | H | L | • In the construction, operational and decommissioning phases, the following management and mitigation measures will be implemented:<br>○ the area of disturbance will be limited as far as practically possible;<br>○ dust will be supressed on unpaved roads through the use of chemical binding agents and/or water sprays combined with vehicle speed controls;<br>○ dust controls at material handling points (loading and offloading) by water sprays;<br>○ rehabilitation and re-vegetation of all decommissioned areas and concurrent rehabilitation of the side slopes of the operational TSF and WRDs;<br>○ maintenance of all vehicles and equipment to achieve optimal exhaust emissions;<br>○ dust will be monitored at the closest sensitive receptors, including. the over-night dwellings of crop farmers and livestock herders;<br>○ as part of closure planning the designs of any permanent and potentially polluting structures (TSF and WRDs) will incorporate measures to address long-term pollution prevention and confirmatory monitoring | On-going | On-going | Senior Operational Manager |
| Decommission | Transport systems<br>Site management<br>Non mineralised waste management<br>Mine residue management and disposal<br>Rehabilitation | H | L | | | | |
| Closure | Maintenance and aftercare of final land forms and rehabilitated areas | H | L | | | | |

**TABLE 68: ACTION PLAN – INCREASE IN NOISE DISTURBANCE**

| Phase of operation | Activities (see Table 37) | Sig | | Technical and management options | Action plan | | |
|---|---|---|---|---|---|---|---|
| | | UM | M | | Timeframe | Frequency | Responsible parties |
| Construction | Site preparation<br>Earthworks<br>Civil works<br>Site management<br>Transport systems | M | L | • All vehicles and equipment will be maintained to limit noise emissions.<br>• All noise complaints will be documented, investigated and reasonable efforts made to address the area of concern. Options available for reducing noise impacts include but are not limited to:<br>○ limiting the operating times for noise generating activities;<br>○ equipping noise sources with silencers;<br>○ construction of noise attenuation measures;<br>○ consulting a noise specialist for mitigation advice. | On-going<br><br>On-going | On-going<br><br>On-going | Senior Operational Manager<br><br>Senior Operational Manager |
| Operation | Site management<br>Transport systems<br>Materials handling<br>Mine residue management and disposal<br>Rehabilitation | M-H | L | | | | |
| Decommission | Demolition<br>Transport systems<br>Rehabilitation | M | L | • Prior to the establishment of the processing plant, Richtrau will relocate the livestock herders and/or crop farmers and the associated infrastructure currently located north of the proposed processing plant to an area on Magazynskraal 3 JQ where noise levels are within the recommended levels. This will be done in consultation with the farmers and livestock herders. Futhermore, Richtrau will establish a monitoring point on the northern boundary of the farm Magazynskraal 3 JQ in consultation with a suitably qualified noise specialist. Should ambient noise levels increase by more than 3dBA Richtrau will either implement additional noise attenuation measures, in consultation with a specialist if necessary. In the case of the livestock herders, specific interventions are likely to be required, which may include relocation to quieter parts of the farm.<br>• Specific noise monitoring will be conducted in accordance with Section 21. | As required<br><br>On-going | As required<br><br>On-going | Senior Operational Manager<br><br>Senior Operational Manager |
| Closure | N/A | - | - | • | | | |

## TABLE 69: ACTION PLAN – VISUAL IMPACTS

| Phase of operation | Activities (see Table 37) | Sig | | Technical and management options | Action plan | | |
|---|---|---|---|---|---|---|---|
| | | UM | M | | Timeframe | Frequency | Responsible parties |
| Construction | Site preparation<br>Earthworks<br>Civil works<br>Site management<br>Transport system | H | M-H (H*) | • In the construction and operation phases the following visual mitigation techniques will be implemented:<br>o limit the clearing of vegetation;<br>o limit the emission of visual air emission plumes (dust emissions);<br>o use of visual screening berms in areas where there are sensitive visual receptors;<br>o paint structures and buildings in colours (e.g. browns and greens) that reflect and compliment the natural landscape;<br>o the use of lighting will be limited to project requirements and measures will be implemented to limit light pollution impacts on surrounding areas. In this regard, night lighting will be fitted with fixtures to prevent light spillage and focus the light on precise mine activities and infrastructure, fitted as low to the ground as is practicable, and most security lights will be activated with movement sensors;<br>o on-going vegetation establishment on rehabilitated areas and the TSF side slopes that reflects the natural vegetation of the area.<br>o Richtrau will develop the rehabilitation and closure plan in close partnership with the NWPTB to ensure that visual impacts on the proposed Heritage Park are minimised as far as possible. | On-going | On-going | Senior Operational Manager |
| Operation | Civil works<br>Transport system<br>Site management<br>Non-mineralised waste management<br>Mine residue management and disposal<br>Water supply infrastructure<br>Power supply infrastructure | H | M-H (H*) | | | | |
| Decommission | Demolition<br>Transport system<br>Site management<br>Non-mineralised waste management<br>Mine residue management and disposal<br>Water supply infrastructure<br>Power supply infrastructure | H | M-H (H*) | • Richtrau will implement its closure plan which involves the removal of infrastructure, and the rehabilitation and re-vegetation of cleared areas and any final landforms that will remain post closure. These final landforms should be rehabilitated in a manner that achieves both landscape functionality (particularly with regards to the proposed Heritage Park Corridor) and limits and/or enhances the long term visual impact. | On-going | On-going | Senior Operational Manager |
| Closure | Maintenance and aftercare of final land forms and rehabilitated areas | H | M-H (H*) | • At closure, final landforms will be managed through an aftercare and maintenance programme to limit and/or enhance the long term post closure visual impacts. | | | |

* people living on the farm Magazynskraal 3 JQ and the Lesobeng community

## TABLE 70: ACTION PLAN – HERITAGE (INCLUDING CULTURAL) AND PALEONTOLOGICAL RESOURCES

| Phase of operation | Activities (see Table 37) | Sig | | Technical and management options | Action plan | | |
|---|---|---|---|---|---|---|---|
| | | UM | M | | Timeframe | Frequency | Responsible parties |
| Construction | Site preparation<br>Earthworks<br>Civil works<br>Transport systems<br>Site management | M | L | • Richtrau will ensure that all workers (temporary and permanent) are educated about heritage and cultural resources that may be encountered and about the need to conserve these.<br>• In the event that new heritage and/or cultural and/or paleontological resources are discovered, the mine will follow a chance find emergency procedure, which includes the following:<br>o all work at the find will be stopped to prevent damage<br>o an appropriate heritage specialist will be appointed to assess the find and related impacts;<br>o permitting applications will be made to SAHRA, if required<br>• In the event that any graves are discovered during the construction, operational or decommissioning phases, these will be avoided and preserved as a first priotiy. If damamge is unavoidable, prior to damaging or destroying any identified graves, permission for the exhumation and relocation of graves must be obtained from the relevant descendants (if known) and the relevant local and provincial authorities. The exhumation process must comply with the requirements of the relevant Ordinance on Exhumations, and the Human Tissues Act, 65 of 1983. | On-going<br><br>As required<br><br>As required | On-going<br><br>As required<br><br>As required | Senior Operations Manager<br><br>Senior Operations Manager<br><br>Senior Operations Manager |
| Operation | Site preparation<br>Earthworks<br>Transport systems<br>Site management<br>Water supply infrastructure<br>Power supply infrastructure | M | L | | | | |
| Decommission | Demolition<br>Site management<br>Transport systems | M | L | | | | |
| Closure | Not applicable | - | - | - | - | - | - |

## TABLE 71: ACTION PLAN – BLASTING HAZARDS

| Phase of operation | Activities (see Table 37) | Sig | | Technical and management options | Action plan | | |
|---|---|---|---|---|---|---|---|
| | | UM | M | | Timeframe | Frequency | Responsible parties |
| Construction | Earthworks<br>Establishment of shaft portals | H | L | • As a general rule, no blasting will take place within 500m of third party structures. Where Richtrau would like to blast in areas within this 500m distance, a project specific risk assessment will be completed and additional project specific mitigation measures will be implemented, subject to approval by the relevant stakeholders and/or authority(ies). | On-going | On-going | Senior Operational Manager |
| | | | | • Blasting during the construction phase will be scheduled to take place in the afternoons and will be limited to week days if possible. | Construction | As required | Senior Operational Manager |
| | | | | • A blast management plan will be implemented for surface and near surface blasts which will include:<br>○ pre-mining crack surveys of any structures within the potential impact zone<br>○ design of blasts to prevent injury to people and livestock and to prevent damage to structures. As a minimum the blast design will achieve:<br>▪ a fly rock impact zone limit of 500m;<br>▪ a peak particle velocity limit of less than 12mm/s at third party structures that are built according to building industry standards and which is further reduced in the case of third party structures that are not built according to building industry standards;<br>▪ an air blast limit of 125dB at third party structures. | On-going | On-going | Senior Operational Manager |
| | | | | ○ communication of the planned blast programme to interested and affected parties; | Construction | As required | Senior Operational Manager |
| | | | | ○ pre-blast warning and evacuation to clear people, traffic, moveable property and livestock from the potential fly rock impact zone; | As required | As required | Senior Operational Manager |
| | | | | ○ blast monitoring to verify the effectiveness of the blast design and blast execution; | As required | As required | Senior Operational Manager |
| | | | | ○ audit and review to adjust the blast design where necessary to achieve the stated objectives; | As required | As required | Senior Operational Manager |
| | | | | ○ formal documented investigation and response for all third party blast related complaints; and | As required | As required | Senior Operational Manager |
| | | | | ○ remediation of all impacts caused by blasting. | As required | As required | Senior Operational Manager |
| | | | | • Any injury or death from fly rock is considered an emergency situation. In such instances the emergency procedure included in Section 20 will be followed. | As required | As required | Senior Operational Manager |
| Operation | N/A | - | - | - | - | - | - |
| Decommission | N/A | - | - | - | - | - | - |
| Closure | N/A | - | - | - | - | - | - |

**TABLE 72: ACTION PLAN – TRAFFIC**

| Phase of operation | Activities (see Table 37) | Sig | | Technical and management options | Action plan | | |
|---|---|---|---|---|---|---|---|
| | | UM | M | | Timeframe | Frequency | Responsible parties |
| Construction | Transport systems | H | M | • In the construction, operation and decommissioning phases Richtrau will implement a transport safety programme to achieve the mitigation objectives. Key components of the programme include education, training, awareness, and transport system maintenance. | On-going | On-going | Senior Operational Manager |
| Operation | Transport systems | H | M | • The intersection of the P50-1 and D511 must be upgraded in consultation with the MKLM and NWDRT in accordance with the safety considerations recommended by the professional traffic and roads engineer. In this regard dedicated right and left turn lanes must be provided where heavy vehicles are expected to turn onto the D511 to ensure the safe operation of the intersection (refer to Figure 23). | Construction | Once-off | Senior Operational Manager |
| Decommission | Transport systems | H | M | • A dedicated public transport loading and off loading area must be provided on the property of the proposed project for workers and visitors. | Construction | Once-off | Senior Operational Manager |
| | | | | • Should sections of the D511 be upgraded to paved road for mine access in the future, a dedicated right turn lane for north bound traffic must be provided as part of the intersection layout. | As required | Once-off | Senior Operational Manager |
| | | | | • Detailed investigations should be conducted in conjunction with the relevant road authorities and surrounding mines in terms of the existing quality and potential life span of the existing road surface layers of the roads where consumables, workers and product will be transported. Richtrau must approach the relevant road authorities and request that discussions be held with the other mining operations in the area to establish a joint initiative for the maintenance of roads used by mine-related traffic. | On-going | On-going | Senior Operational Manager |
| Closure | Not applicable | - | - | - | - | - | - |

**TABLE 73: ACTION PLAN – ECONOMIC IMPACTS**

| Phase of operation | Activities (see Table 37) | Sig | | Technical and management options | Action plan | | |
|---|---|---|---|---|---|---|---|
| | | UM | M | | Timeframe | Frequency | Responsible parties |
| Construction | All activities | H+ | H+ | • Richtrau (and its contractors) will hire local people from the closest communities where possible. | As required | As required | Stakeholder Engagement Department |
| Operation | | H+ | H+ | • Richtrau will extend its formal bursary and skills development programmes to the closest communities to increase the number of local skilled people and thereby increase the potential local employee base | On-going | On-going | Stakeholder Engagement Department |
| Decommission | | H+ | H+ | • Richtrau will procure local goods and services from the closest communities where possible | On-going | On-going | Stakeholder Engagement Department |
| Closure | | H+ | H+ | • Richtrau will implement a procurement mentorship programme which provides support to local business from the enquiry to project delivery stages | On-going | On-going | Stakeholder Engagement Department |
| | | | | • Where farming and/or livestock grazing land is lost to mining, the affected farmer(s) will be provided with alternative suitable land by facilitating discussions with the State and the BBKTA. If this is not feasible alternative compensation will be provided | As required | As required | Stakeholder Engagement Department |
| | | | | • Richtrau will assist with the development of the proposed Heritage Park initiative | On-going | On-going | Senior Operational Manager |
| | | | | • Richtrau will incorporate economic considerations into its closure planning from the outset. These closure planning considerations will cover the skilling of employees for the downscaling, early closure and long term closure scenarios | As required | As required | Stakeholder Engagement Department |
| | | | | • Richtrau will identify and develop sustainable business opportunities and skills, independent from mining, for members of the local communities to ensure continued economic prosperity beyond the life of mine | As required | As required | Stakeholder Engagement Department |

## TABLE 74: ACTION PLAN – INWARD MIGRATION

| Phase of operation | Activities (see Table 37) | Sig | | Technical and management options | Action plan | | |
|---|---|---|---|---|---|---|---|
| | | UM | M | | Timeframe | Frequency | Responsible parties |
| Construction | All activities | H | M-H | • Richtrau will ensure the following with regards to recruitment, procurement and training:<br>○ good communication with all job and procurement opportunity seekers will be maintained throughout the recruitment process. The process must be seen and understood to be fair and impartial by all involved. The personnel in charge of resolving recruitment and procurement concerns must be clearly identified and accessible to potential applicants;<br>○ the precise number of new job opportunities (permanent and temporary) and procurement opportunities will be made public together with the required skills and qualifications. The duration of temporary work will be clearly indicated and the relevant employees/contractors provided with regular reminders and revisions throughout the temporary period;<br>○ recruitment and procurement, by Richtrau and its contractors, will be preferentially provided to people in the communities where possible, that are closest to the proposed project. In order to be in a position to achieve this, a skills register of people within the closest communities will be maintained. Richtrau will also preferentially provide bursaries and training to people that reside in these closest communities;<br>○ there will be no recruitment or procurement at the gates of the proposed project. All recruitment will take place off site, at designated locations in the closest communities. All procurement will be through existing, established procurement and tendering processes that will include mechanisms for empowering service providers from the closest communities. | On-going | On-going | Stakeholder Engagement Department |
| Operation | All activities | H | M-H | • Richtrau will work with its neighbours, local authorities and law enforcement officials to monitor and prevent the development of informal settlements near the proposed project area and to assist where possible with crime prevention within surrounding area. | On-going | On-going | Stakeholder Engagement Department |
| Decommission | All activities | H | M-H | • Richtrau will implement a health policy on HIV/ADS and tuberculosis. This policy will promote education, awareness and disease management both in the workplace and in the home so that the initiatives of the workplace have a positive impact on the communities from which employees are recruited. Partnerships will be formed with local and provincial authorities to maximise the off-site benefits of the policy. | On-going | On-going | Stakeholder Engagement Department |
| Closure | All activities | H | M-H | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | • Richtrau will work closely with the local and regional authorities, the BBKTA and other mines/industry in the area to be part of the problem solving process that needs to address social service constraints. | On-going | On-going | Stakeholder Engagement Department |
| | | | | • Richtrau will implement a stakeholder communication, information sharing and grievance mechanism to enable all stakeholders to engage with Richtrau on both socio-economic and environmental issues. In this regard, quarterly stakeholder meetings will be held with surrounding communities and IAPs. | On-going | On-going | Stakeholder Engagement Department |

**TABLE 75: ACTION PLAN – LAND USE IMPACTS**

| Phase of operation | Activities (see Table 37) | Sig | | Technical and management options | Action plan | | |
|---|---|---|---|---|---|---|---|
| | | UM | M | | Timeframe | Frequency | Responsible parties |
| Construction | All activities | H | M | • Richtrau will implement the EMP commitments with a view not only to prevent and/or mitigate the various environmental and social impacts, but also to prevent negative impacts on surrounding land uses. | On-going | On-going | Senior Operational Manager |
| Operation | All activities | H | M | | | | |
| Decommission | All activities | H | M | | | | |
| Closure | All activities | H | L (M for TSF / WRDs) | • Closure planning will incorporate measures to achieve the future land use plans for the community and the proposed HPC. Richtrau will specifically liaise with the NWPTB, community and tourism related stakeholders regarding the infrastructure that will remain post-closure (i.e. TSF and WRDs) in order to minimise long term land use impacts on the proposed HPC. | On-going | On-going | Senior Operational Manager |
| | | | | • Where there is a risk of damage to existing infrastructure, this will be diverted and/or relocated in consultation with the relevant stakeholders. | As required | As required | Senior Operational Manager |
| | | | | • Alternative land and/or compensation will be provided to all affected land users within the proposed project area. The provision of alternative land will be addressed in consultation with the Bakgatla-Ba-Kafela Traditional Authority and the Department of Rural Development and Land Reform. If a situation arises where any other surrounding land use is negatively affected by the mine, Richtrau will take steps to prevent the impact. If the land use impact cannot be prevented, Richtrau will work with landowners in the area to provide alternative land that is acceptable to the affected land user for the land use. Alternatively, Richtrau will provide compensation for mine-related loss of land use. | As required | As required | Senior Operational Manager |

# 20 PROCEDURES FOR ENVIRONMENTAL EMERGENCIES AND REMEDIATION

## 20.1 ON-GOING 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 76).

### 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, storm water 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 Operations Engineer on shift must be notified;
- take photographs and samples as necessary to assist in investigation;
- report the incident immediately to the environmental department for emergencies involving environmental impacts or to the safety department in the case of injury;
- the Environmental Department must comply with Section 30 of the National Environmental Management Act (107 of 1998) such that:
    - the Environmental Department must immediately notify the Director-General (DWA, DEA, DMR and Inspectorate of Mines as appropriate), the South African Police Services, the relevant fire prevention service, the provincial head of DEDECT, 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 Environmental 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);
- Within 14 days the Environmental Department must report to the DWA and DEA, the provincial head of DEDECT, the regional manager of the DMR, the head of the local and district municipality, the head of the regional DWA office or any other relevant authority 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 76.

**TABLE 76: EMERGENCY SITUATIONS AND RESPONSE**

| 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:<br>Notify residents/users downstream of the pollution incident.<br>Identify and provide alternative resources should contamination impact adversely on the existing environment.<br>Cut off the source if the spill is originating from a pump, pipeline or valve (e.g. tailings delivery pipeline, refuelling tanker) and the infrastructure 'made safe'.<br>Contain the spill (e.g. construct temporary earth bund around source such as road tanker).<br>Pump excess hazardous liquids on the surface to temporary containers (e.g. 210 litre drums, mobile tanker, etc.) for appropriate disposal.<br>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.<br>To stop spillage from the dirty water system the mine will:<br>• redirect excess water to other dirty water facilities where possible;<br>• pump dirty water to available containment in the clean water system, where there is no capacity in the dirty water system; and<br>• carry out an emergency discharge of clean water and redirect the spillage to the emptied facility.<br>• apply for emergency discharge as a last resort. |
| 3 | Pollution of surface water | Personnel discovering the incident must inform the Environmental Department of the location and contaminant source.<br>Apply the principals listed for Item 1 above.<br>Absorbent booms will be used to absorb surface plumes of hydrocarbon contaminants.<br>Contamination entering the surface water drainage system should be redirected into the dirty water system.<br>The Environmental 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).<br>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).<br>Shut off the water flowing through the damaged area and repair the damage (if the mine's pipeline).<br>Apply the principals listed for Item 1 above if spill is from the dirty/process water circuit. |

| ITEM | EMERGENCY SITUATION | RESPONSE IN ADDITION TO GENERAL PROCEDURES |
|---|---|---|
| 6 | Flooding from failure of surface water control infrastructure | Evacuate the area downstream of the failure.<br>Using the emergency response team, rescue/recover and medically treat any injured personnel.<br>Temporarily reinstate/repair storm water diversions during the storm event (e.g. emergency supply of sandbags).<br>Close the roads affected by localised flooding or where a storm water 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.<br>Get assistance of emergency response team whilst attempting rescue or to carry out rescue of people and/or animals.<br>Ensure medical assistance is available to recovered individual. |
| 8 | Veld fire | Evacuate mine employees from areas at risk.<br>Notify downwind residents and industries of the danger.<br>Assist those in imminent danger/less able individuals to evacuate until danger has passed.<br>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.<br>Pump water from top of dam and follow redirection of water as indicated in Item 2 above.<br>Stop pumping tailings to the TSF.<br>Recover casualties resulting from dam failure using the emergency response team.<br>Make the remaining structure safe.<br>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).<br>The injured party should be recovered by trained professionals such as the mine emergency response team.<br>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.<br>Access to the area should be restricted and access roads cleared for the emergency response team.<br>Vehicles must be made safe first by trained professionals (e.g. crushed or overturned vehicles).<br>Casualties will be moved to safety by trained professionals and provided with medical assistance.<br>Medical centres in the vicinity with appropriate medical capabilities will be notified if multiple seriously injured casualties are expected.<br>A nearby vet should be consulted in the case of animal injury. |
| 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 24 hours. |

| ITEM | EMERGENCY SITUATION | RESPONSE IN ADDITION TO GENERAL PROCEDURES |
|---|---|---|
| 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.<br>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 Environmental Department immediately.<br>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.<br>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 Environmental Department immediately.<br>Should any fossils be uncovered during the development of the site, a palaeontologist or paleoanthropologist will be consulted to identify the possibility for research. |

## 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;
- in order 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;
- the mine has an environmental management system in place where all operation identify, report, investigate, address and close out environmental incidents;
- 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.

# 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;
- blasting – see Section 21.1.5 for details; and
- tailings storage facility, waste dumps and other water dams – see Section 21.1.6 for details.

### 21.1.1 WATER RESOURCES

**Ground and surface water**

Table 77 below sets out the monitoring parameters for both ground and surface water on and off the proposed project area. The locations of the proposed monitoring points as well as the frequency of monitoring are included in Table 78 and are illustrated in Figure 29. The 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 integrated water license process.

**TABLE 77: MONITORING PARAMETERS FOR ANALYSIS AND REPORTING**

| | | |
|---|---|---|
| **In field measurements** | | |
| pH | Electrical conductivity | Temperature |
| **Laboratory analysis** | | |
| pH | Ammonium | Calcium |
| Electrical conductivity | Iron | Magnesium |
| Temperature | Lead | Sodium |
| Sulphate | Nickel | Potassium |
| Total dissolved salts (TDS) | Zinc | Nitrate |
| Total alkalinity as $CaCO_3$ | Copper | Sodium absorption rate |
| Fluoride | Manganese | Total hardness as $CaCO_3$ |
| Phosphate | COC | Aluminium |
| Cobalt | Chromium | Chlorine |
| Cadmium | Carbonate | - |

**TABLE 78: MONITORING NETWORK AND FREQUENCY**

| Site ID | Latitude | Longitude | Type | Frequency |
|---|---|---|---|---|
| KP108 | 27.05000 | -25.05000 | Groundwater | Quarterly |
| MBH 11 | 27.12210 | -25.02410 | Groundwater | Quarterly |
| MBH 34 | 27.09780 | -25.14720 | Groundwater | Quarterly |
| KP105 | 27.08000 | -25.11000 | Groundwater | Quarterly |
| RBH 14 | 27.02730 | -25.14260 | Groundwater | Quarterly |
| KP107 | 27.03000 | -25.12000 | Groundwater | Quarterly |
| MagMon1 | 27.09300 | -25.07745 | Groundwater | Quarterly |

| Site ID | Latitude | Longitude | Type | Frequency |
|---|---|---|---|---|
| MagMon2 | 27.08722 | -25.06236 | Groundwater | Quarterly |
| MagMon3 | 27.07455 | -25.04604 | Groundwater | Quarterly |
| MagMon4 | 27.09240 | -25.10979 | Groundwater | Quarterly |
| MagMon5 | 27.08927 | -25.10366 | Groundwater | Quarterly |
| MagMon6 | 27.08240 | -25.08668 | Groundwater | Quarterly |
| MagMon7 | 27.08403 | -25.09216 | Groundwater | Quarterly |
| MagSW1 | 27.07604 | -25.10924 | Surface Water | Monthly |
| MagSW2 | 27.10942 | -25.12469 | Surface Water | Monthly |
| MagSW3 | 27.13234 | -25.05034 | Surface Water | Monthly |
| MagSW4 | 27.06336 | -25.02114 | Surface Water | Monthly |

If monitoring indicates a mine-related decrease in groundwater supply to third parties or groundwater quality at third party boreholes, appropriate measures will be taken to prevent the decrease from occurring or rectify the contamination situation, and/or to provide the affected third parties with an alternative equivalent water supply.

**Process water**

Process water from dirty water dams will be monitored according to the parameters in Table 77.

Rainfall related discharges are monitored as required according to the parameters in Table 77. If the quality of the monitored discharge is above acceptable levels, additional measures will be identified and implemented to prevent the future potential for surface water related pollution.

**Water balance**

The water balance is updated on a monthly basis from recorded flow measurements and production figures. This is done by an appropriately qualified person. The water balance is used to check on an on-going basis that the capacity of the dirty water holding facilities is adequate.

### 21.1.2 AIR QUALITY

A minimum of 3 dust buckets will be established at the proposed project site. With reference to Figure 29, the dust buckets wil be placed on the boundaries of the mining right area as well as at the over-night dwellings associated with the crop farmers and/or livestock herders on Magazynskraal 3 JQ (it is probably that the over-night dwellings will be relocated from the current location to quieter areas of the farm). It is expected that the proposed monitoring network will compliment the existing network of dust buckets at Sedibelo. The target off-site dust fallout reading is less than 600mg/m$^2$/day. This must also be implemented at the above-mentioned over-night dwellings located on site. The buckets will be monitored on a monthly basis.

$PM_{10}$ monitoring stations to be installed at selected community in co-operation with surrounding mines.

### 21.1.3 NOISE

Noise monitoring will be done on an annual basis, as a minimum, to confirm that implemented noise management measures are effective. Monitoring will be done by an appropriately qualified environmental noise specialist. The noise measurement points will be selected by the specialist and may be modified on the basis of input from IAPs. A report will be produced to document the measurement points, the methodology used, the measured results and recommendations, if required, to further minimise the mine's impact.

### 21.1.4 BIODIVERSITY MONITORING PROGRAMME

**On-going monitoring**

Should the proposed surface infrastructure layout change a detailed baseline study of selected fauna and flora groups within the impact zone will be undertaken. During operation and decommissioning, Richtrau will implement a monitoring programme which will be aimed at monitoring selected indicator species. This monitoring programme, which will include the species selection and determination of monitoring intervals, will be performed by an appropriately qualified specialist.

**Alien invasive species programme**

During operation, decommissioning and closure Richtrau will implement an alien invasive/weed management programme to control the spread of these plants onto and form disturbed areas. This will be achieved by active eradication and the establishment of natural species and through on-going monitoring and assessment. The use of herbicides will be limited and focussed and will only be used under strict controls. Herbicides will be selected to ensure least residual harm. Herbicides will be administered by suitably qualified people.

Continued monitoring will be undertaken to ensure that the alien invasive species have been eradicated and are controlled for both controlled sites as well as rehabilitated areas. Repeat surveys should be carried out annually for at least the first three years post-rehabilitation.

**Rehabilitation**

For each area requiring rehabilitation specific landscape functionality objectives will be set with expert input and the associated targets and monitoring program will follow accordingly.

### 21.1.5 BLASTING

Prior to the construction phase, Richtrau will undertake a pre-blast baseline survey as detailed in the action plan (Table 71). Monitoring of all blasts will take place on a continuous basis.

#### 21.1.6 MINERALISED WASTE FACILITIES AND WATER DAMS

In addition to the abovementioned environmental monitoring programmes, all mineralised waste facilities and water dams will be monitored to ensure stability, safety and prevention of environmental impacts. The frequency of the monitoring and the qualification of the monitoring personnel will be determined on an infrastructure specific basis.

The findings will be documented for record-keeping and auditing purposes and addressed where relevant to achieve the stated objectives.

**FIGURE 29: MONITORING NETWORK**

## 21.2 AUDITING AND PERFORMANCE ASSESSMENTS

The Environmental Department manager will conduct internal management audits against the commitments in the EMP. These audits will be conducted on an on-going basis until final closure. 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 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 and rehabilitation cost estimate, submitted annually to the DMR in accordance to DMR requirements;
- water monitoring reports, submitted annually to DWA – these reports will not only present monitoring data but will also provide interpretations of trends in the data and reporting on compliance with water quality guidelines;
- air monitoring reports, submitted to the relevant authority (currently under review); and
- detailed plan for decommissioning/closure, submitted in accordance to DMR requirements.

# 22 FINANCIAL PROVISION

The information in this section was sourced from the closure cost calculation study completed by SLR (Appendix R).

## 22.1 PLAN SHOWING LOCATION AND AERIAL EXTENT OF PROPOSED OPERATION

A plan showing the location and aerial extent of the operation is provided in Figure 19.

## 22.2 ANNUAL FORECASTED FINANCIAL PROVISION

The annual forecasted financial provision for the first 10 years of the proposed project, as well as the scheduled closure amount is provided in Table 79 below.

**TABLE 79: FINANCIAL PROVISION (SLR, 2012)**

| Date | Year | Financial liability incurred during the year (excl. VAT) | Progressive financial liability (excl. VAT) | Progressive liability as a % of LOM liability |
|---|---|---|---|---|
| Dec. 2014 | Year 1 | R 8,920,656.12 | R 8,920,656.12 | 11.36% |
| Dec. 2015 | Year 2 | R 14,741,278.71 | R 23,661,934.83 | 30.14% |
| Dec. 2016 | Year 3 | R 43,312,142.91 | R 66,974,077.74 | 85.30% |
| Dec. 2017 | Year 4 | R 2,684,042.78 | R 69,658,120.52 | 88.72% |
| Dec. 2018 | Year 5 | R 914,723.74 | R 70,572,844.26 | 89.89% |
| Dec. 2019 | Year 6 | R 914,723.73 | R 71,487,567.99 | 91.05% |
| Dec. 2020 | Year 7 | R 914,723.74 | R 72,402,291.73 | 92.22% |
| Dec. 2021 | Year 8 | R 914,723.74 | R 73,317,015.47 | 93.38% |
| Dec. 2022 | Year 9 | R 914,723.74 | R 74,231,739.21 | 94.55% |
| Dec. 2023 | Year 10 | R 1,225,088.74 | R 75,456,827.95 | 96.11% |
| Dec. 2038 | LOM | R 3,054,536.21 | R 78,511,364.16 | 100% |

## 22.3 CONFIRMATION OF AMOUNT TO BE PROVIDED

The amount that has been provided for the proposed Magazynskraal Platinum Mine is R78 511 364.16 (excluding VAT).

## 22.4 METHOD OF PROVIDING FINANCIAL PROVISION

The funding method is in accordance with the DMR methods.

# 23 ENVIRONMENTAL AWARENESS PLAN

This document describes the environmental awareness plan for the proposed Magazynskraal Platinum Mine. The purpose of the environmental awareness plan is to ensure that all personnel and management 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 the mine to achieve the objectives of the environmental policy.

## 23.1 ENVIRONMENTAL POLICY

A copy of the mine's environmental policy will be displayed prominently at the mine entrance and key notice boards at the mine's business units. The mine's environmental policy is described below:

- to minimise the impact of Richtrau's mining operations on the environment wherever possible;
- to comply with all applicable environmental legislation and the commitments contained in Richtrau's Environmental Management Programme (EMP) report.
- to ensure that all mine 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.
- to establish and maintain a good relationship with surrounding communities, industries and other interested and affected parties, with regard to the mine's activities;
- to develop a localised environmental strategy with the local authority and nearby industries; and
- to provide relevant and constructive consultation/public participation on the management of the potential environmental impacts posed by the mine in the future.

## 23.2 STEPS TO ACHIEVE THE ENVIRONMENTAL POLICY OBJECTIVES

The mine's environmental policy will be realised by setting specific and measurable objectives. It is proposed that new objectives are set throughout the life of mine, but initial objectives are as follows:

1. Appointment of Senior Executive

The Richtrau board will appoint a senior executive, who amongst other duties, will be responsible for environmental management and will ensure that the necessary resources required for implementing and maintaining the EMP commitments and an effective environmental management system are provided on an operational level.

2. Management of environmental responsibilities:

The mine will establish and appoint an Environmental/SHE Manager at senior mine management level, who will be provided with all necessary resources to carry out the management of all environmental aspects of the site as a primary function, for example:

- compliance with environmental legislation and EMP commitments;
- implementing and maintaining an environmental management system;
- developing environmental emergency response procedures and coordinating personnel during incidents;
- manage routine environmental monitoring and data interpretation;
- environmental trouble shooting and implementation of remediation strategies; and
- closure planning.

3. Communication of environmental issues and information:

Meetings, consultations and progress reviews will be carried out, and specifically the mine will:

- set the discussion of environmental issues and feedback on environmental projects as an agenda item at all company board meetings;
- provide progress reports on the achievement of policy objectives and level of compliance with the approved EIA and EMP report to the Department of Mineral Resources;
- ensure environmental issues are raised at monthly mine management executive committee meetings and all relevant mine wide meetings at all levels; and
- ensure environmental issues are discussed at all general liaison meetings with local communities and other interested and affected parties.

4. Environmental awareness training:

Richtrau will provide environmental awareness training to individuals at a level of detail specific to the requirements of their job, but will generally comprise:

- basic awareness training for all prior to granting access to site (e.g. short video presentation requiring registration once completed). Employees and contractors who have not attended the training will not be allowed on site;
- general environmental awareness training will be given to all employees and contractors as part of the Safety, Health and Environment induction programme. All non Richtrau personnel who will be on site for more than five days must undergo the environmental induction training; and
- 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).

5. Review and update the environmental topics already identified in the EMP which currently includes the following issues:
- geology (sterilisation of mineral resource);
- topography (hazardous excavations and surface subsidence);
- soil management (loss of soil resource);
- land capability (loss of land with agricultural and conservation/eco-tourism potential);
- surrounding land use (traffic management, agriculture, and damage from blasting);
- management of biodiversity (impacts on land and water related habitats and species);
- surface water management (alteration of surface drainage and pollution of surface water);
- groundwater management (reduction in groundwater levels/availability and groundwater contamination);
- management of air quality (dust generation);
- noise (specifically management of disturbing noise);
- visual aspects (reduction of negative visual impacts);
- heritage resources (management of archaeological, cultural, historical and paleontological sites);
- socio-economic impacts (management of positive and negative impacts); and
- interested and affected parties.

6. All mine projects will be designed to minimise impact on the environment and to accomplish closure/rehabilitation objectives.

7. Richtrau will maintain records of all environmental training, monitoring, incidents, corrective actions and reports.

8. Contractors and employees will be contractually bound to participate in the achievement of environmental policy objectives and compliance with the EIA and EMP report.

## 23.3 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:
- the importance of conformance with the environmental policy, procedures and other requirements of good environmental management;
- the significant environmental impacts and risks of individuals work activities and explain the environmental benefits of improved performance;
- individuals roles and responsibilities in achieving the aims and objectives of the environmental policy; and
- the potential consequences of not complying with environmental procedures.

#### 23.3.1 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:

- Module 1 – Basic training plan applicable to all personnel entering the site:
    - short (15 minute) presentation to indicate the site layout and activities at specific business units together with their environmental aspects and potential impacts.
    - individuals to sign off with site security on completion in order to gain access to the site.
- Module 2 – General training plan applicable to all personnel at the site for longer than 5 days:
    - general understanding of the environmental setting of the mine (e.g. local communities and industries and proximity to natural resources such as rivers);
    - understanding the environmental impact of individuals activities on site (e.g. excessive production of waste, poor housekeeping, energy consumption, water use, etc);
    - indicate potential site specific environmental aspects and their impacts;
    - Richtrau's environmental management strategy;
    - identifying poor environmental management and stopping work which presents significant risks;
    - reporting incidents;
    - examples of poor environmental management and environmental incidents; and
    - procedures for emergency response and cleaning up minor leaks and spills.
- Module 3 – Specific training plan:
    - environmental setting of the workplace (e.g. proximity of watercourses, vulnerability of groundwater, proximity of local communities and industries, etc);
    - specific environmental aspects such as:
        - spillage of hydrocarbons at workshops;
        - spillage of explosive liquids in the open pits;
        - poor waste management such as mixing hazardous and general wastes, inappropriate storage and stockpiling waste large amounts of waste;
        - poor housekeeping practices; and
        - poor working practices (e.g. not carrying oil changes in designated bunded areas).
    - impact of environmental aspects, for example:
        - hydrocarbon contamination of local watercourses resulting in loss of resource to downstream users;
        - groundwater contamination also resulting in loss of resource due to potential adverse aesthetic, taste and health effects; and

        - dust impacts on local communities (nuisance and health implications).
    - Richtrau's duty of care (specifically with respect to waste management); and
    - purpose and function of Richtrau'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.

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 Richtrau will:

- conduct refresher training/presentations on environmental issues for mine employees (permanent and contractors) at regular intervals.
- 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.
- 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

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

- soils and land capability report (Appendix E);
- biodiversity report (Appendix F);
- hydrological report (Appendix G);
- hydrogeological report (Appendix H);
- air quality report (Appendix I);
- noise report (Appendix J);
- visual report (Appendix K);
- cultural-heritage report (Appendix L);
- palaeontology report (Appendix M);
- traffic report (Appendix N);
- socio-economic report (Appendix O);
- economic report (Appendix P);
- engineering design report (Appendix Q); and
- calculation of financial closure liability report (Appendix R).

# 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

Information in this section was provided by Richtrau and was extracted from the budget that was complied as part of the mine works programme. This budget will be updated on an annual basis.

| Environmental costs | | | |
|---|---|---|---|
| | **Environmental monitoring and maintenance** | **Socio-economic** | **Total** |
| **Year 1** | R4 244 200 | R245 350 | R4 489 550 |
| **Year 2** | R4 244 200 | R162 250 | R4 406 450 |
| **Year 3** | R4 244 200 | R1 193 950 | R5 438 150 |
| **Year 4** | R4 244 200 | R7 000 | R4 251 200 |
| **Year 5** | R4 244 200 | - | R4 244 200 |
| **Year 6** | R4 244 200 | - | R4 244 200 |
| **Year 7** | R4 244 200 | - | R4 244 200 |
| **Year 8** | R4 244 200 | - | R4 244 200 |
| **Year 9** | R4 244 200 | - | R4 244 200 |
| **Year 10** | R4 244 200 | - | R4 244 200 |

## 25.2 AMOUNT PROVIDED FOR

The amount required as per the above budget will be provided for in the Richtrau budgeting period.

## 26 UNDERTAKING SIGNED BY APPLICANT

| COMMITMENT/UNDERTAKING BY APPLICANT |
|---|

I, RICHARD GERARDUS VIKING ........................

the undersigned and duly authorised thereto by

LICHTRAIN NO. 123 (PTY) LTD ........................

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: NORTH WEST (include relevant province).

Signed at: CENTURION

On: 20 MARCH 2013

Signature: ........................

Designation: LICHTRAIN REPRESENTATIVE

| **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 proposed project plan as defined by Richtrau, 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) associated with the proposed project, in the unmitigated and mitigated scenarios for all project phases is included in Table 80 below.

**TABLE 80: TABULATED SUMMARY OF POTENTIAL IMPACTS**

| **Impact** | **Significance** | |
|---|---|---|
| | **Unmitigated** | **Mitigated** |
| Loss and sterilisation of mineral resources | H | L |
| Hazardous excavations/structures and surface subsidence | H | M |
| Loss of soil resources and land capability due to pollution | H | L |
| Loss of soil resources and land capability due to physical disturbance | H | M |
| Physical destruction of biodiversity | H | M |
| General disturbance of biodiversity | H | M |
| Pollution of surface water | H | L |
| Alteration of drainage patterns | H | M (L - closure) |
| Reduction in groundwater levels / availability | H | M |
| Groundwater contamination | H | M |
| Dust generation | M | L |
| Disturbing noise | M-H | L |
| Negative visual impacts | H | M-H (H for people on site and Lesobeng) (M-L – closure) |
| Disturbance of heritage, cultural and paeleontological sites | M | L |
| Blasting hazards | H | M |
| Road and traffic impacts | H | M |
| Economic impact | H+ | H+ |
| Inward migration | H | M-H |
| Land use | H | M (L- closure) |

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

The economic impact assessment concluded that the development of the project will have significant positive economic impacts. Moreover, the integrated alternative land use assessment concluded that the proposed project is the preferred land use alternative.

In conclusion, effective implementation of the EMP in all project phases (including post closure) is required if the project is to proceed in a manner that impacts are mitigated to an acceptable level. Moreover, it is SLR's recommendation that the consolidated project between PPM, Sedibelo and Richtrau be considered in preference to the three independent developments. This will eliminate the need for Magazynskraal specific infrastructure such as the processing plant, TSF and other waste facilities, thereby reducing both the development and impact footprint.

**Fiona Bolton (EAP)**
**(Project Manager)**

**Brandon Stobart (EAPSA)**
**(Project Reviewer)**

*SLR Consulting (Africa) (Pty) Ltd*

## 28 REFERENCES

Airshed Planning Professionals (Pty) Ltd. January 2013. Air quality impact for the Sedibelo and Magazynskraal Platinum Mines. Report No.: 11MEE11 Rev 1.0.

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Siyazi Gauteng (Pty) Ltd. November 2012. Traffic impact assessment: proposed developments related to the following platinum mines in the area: Existing Pilanesberg Platinum Mines (Pty) Ltd. Tuschenkomst pit extension and associated infrastructure situated on the farms Wilgespruit 2JQ and Portion 1 of the farm Rooderand 46JQ; IBMR's proposed changes to surface infrastructure at Sedibelo Platinum Mine, situated on the farms Wilgespruit 2JQ, Portion 1 of the farm Rooderand 46JQ, Legkraal 45JQ and Koedoesfontein 42JQ; Richtrau No.123 (Pty) Ltd. Proposed Magazynskraal Mine situated on the farm Magazynskraal 3JQ. Report reference 11057.

Strategy4Good. January 2013. Magazynskraal alternative land-use economic impact assessment.

**APPENDIX A: STAKEHOLDER DATABASE**

**APPENDIX B: INFORMATION-SHARING WITH REGULATORY AUTHORITIES**

- Relevant sections of the NEMA application submitted to DEDECT (26 October 2011)
- DEDECT acknowledged receipt of application (16 November 2011)
- Correspondence received from the DRDLR with regards to the BBKTA CPA (5 December 2011)
- Invitation to regulatory authorities meeting (9 February 2012)
- South African Heritage Resource Agency comments on the background information document (29 February 2012)
- Authority scoping meeting minutes including attendance registers and presentation (6 March 2012)
- Correspondence from the Department of Rural Development and Land Reform regarding potential land claims (7 June 2012)
- Relevant sections of the revised NEMA application submitted to DEDECT to include an additional listed activity (27 October 2012)
- Minutes from DEDECT site visit and meeting (15 November 2012)
- Moses Kotane District Municipality comments on Scoping Report (19 November 2012)
- DEDECT comments on Scoping Report (13 December 2012)
- Focussed meetings with DRDLR regarding the engagement of stakeholders (7 September 2012)
- Focussed meetings with DMR regarding the engagement of stakeholders (3 October 2012)
- DMR comments on Scoping Report (17 January 2013)

**APPENDIX C: INFORMATION-SHARING WITH IAPS**

- Initial focussed meeting minutes including attendance register and presentations:
    - Kgosana Kobedi Pilane (12 December 2011)
    - BBKTA and ward councillors (14 December 2011)
    - Moses Kotane Mayoral Committee (21 December 2011)
- Proof of landowner notification to BBKTA and DRDLR (1 February 2012)
- Notification letter sent to IAPs in English and Setswana regarding the proposed projects and public meetings (1 February 2012)
- Background Information Document (in English and Setswana) for information-sharing purposes
- Site notice in English and Setswana, and photographs showing the placement of site notices
- Newspaper advertisements placed in The Rustenburg Herald and The Sowetan (27 January 2012)
- Focused Scoping meeting minutes including attendance registers
    - North West Ecoforum (29 February 2012)
    - NWPTB, Heritage Park and surrounding industry (6 March 2012)
    - Black Rhino Game Reserve (7 March 2012)
    - Lesetlheng representatives (26 July 2012)
- Public Scoping meeting minutes including attendance registers
    - Lesetlheng (5 March 2012)
    - Moruleng (5 March 2012)
    - Lekutung (6 March 2012)
    - Manamakgoteng (6 March 2012)
    - Mononono (7 March 2012)
    - Kgamata- Lesobeng (8 March 2012)
    - Legkraal- Bofule (9 March 2012)
    - Ramasedi (9 March 2012)
    - Mothlabe (10 March 2012)
    - Ntswana-le-Metsing (10 March 2012)
    - Ngweding (12 March 2012)
    - Sefikile (12 March 2012)
    - Magalane (13 March 2012)
    - Magong (13 March 2012)
- Scoping meeting presentation delivered at focused and public meetings
- Written comments received from IAPs during the scoping consultation process
- Correspondence with representatives from the Lesetlheng community
- Written comments received from IAPs during the review of the draft and final scoping report

**APPENDIX D: COMMENT AND RESPONSE REPORT**

**APPENDIX E: SOILS STUDY**

Specialist report prepared by ESS, January 2013

**APPENDIX F: BIODIVERSITY STUDY**

Specialist report prepared by NSS, November 2012

**APPENDIX G: HYDROLOGICAL STUDY**

Specialist report prepared by SLR, January 2013

**APPENDIX H: HYDROGEOLOGICAL STUDY**

Specialist report prepared by AGES, March 2013

**APPENDIX I: AIR QUALITY STUDY**

Specialist report prepared by Airshed Planning Professionals, January 2013

**APPENDIX J: NOISE STUDY**

Specialist report prepared by Acusolv, October 2012

**APPENDIX K: VISUAL STUDY**

Specialist report prepared by Newtown Landscape Architects, January 2013

**APPENDIX L: CULTURAL-HERITAGE STUDY**

Specialist report prepared by Dr Julius Pistorius, August 2010

**APPENDIX M: PALAEONTOLOGY STUDY**

Specialist report prepared by Professor Bruce Rubidge, February 2011

**APPENDIX N: TRAFFIC STUDY**

Specialist report prepared by Siyazi, November 2012

**APPENDIX O: SOCIO-ECONOMIC STUDY**

Specialist report prepared by MTS, December 2012

**APPENDIX P: ECONOMIC STUDY**

Specialist report prepared by Strategy4Good, January 2013

**APPENDIX Q: ENGINEERING DESIGN REPORT**

Specialist report prepared by Epoch, January 2013

**APPENDIX R: CLOSURE COST CALCULATION STUDY**

Specialist report prepared by SLR, March 2012

# RECORD OF REPORT DISTRIBUTION

| | |
|---|---|
| **Project Number:** | B001-03 |
| **Title:** | Proposed establishment of a platinum mining operation and related surface infrastructure - Magazynskraal Platinum Mine |
| **Report Number:** | 2 |
| **Proponent:** | Richtrau No. 123 (Pty) Limited |

| Name | Entity | No. of copies | Date issued | Issuer |
|---|---|---|---|---|
| Phumudzo Nethwadzi | Department of Mineral Resources | 7 | March 2013 | F Bolton |
| Caroline Shai | Department of Water Affairs | 1 | To be confirmed | F Bolton |
| Andrew Saloman | South African Heritage Resources Agency | 1 | To be confirmed | F Bolton |
| Piet Theron | Department of Agriculture, Forestry and Fisheries | 1 | To be confirmed | F Bolton |
| Jacqueline Nkosi | Department of Rural Development and Land Reform | 1 | To be confirmed | F Bolton |
| Hennie Niehaus | Department of Public Works, Roads and Transport | 1 | To be confirmed | F Bolton |
| Johnson Maoka | North West Parks and Tourism Board | 1 | To be confirmed | F Bolton |
| Moremi Lesejane | Heritage Park | 1 | To be confirmed | F Bolton |
| Sandra Mafisa | Moses Kotane Local Municipality | 2 | To be confirmed | F Bolton |
| Thami Matshego | Bojanala Platinum District Municipality | 1 | To be confirmed | F Bolton |
| KP Pilane | Bakgatla-Ba-Kgafela Tribal office | 1 | To be confirmed | F Bolton |
| Chris Bason | Black Rhino Game Reserve | 1 | To be confirmed | F Bolton |
| Setshedi Rasepae | Lesetlheng | 1 | To be confirmed | F Bolton |
| Kgosana Ntshole | Manamakgoteng | 1 | To be confirmed | F Bolton |
| Motsitsi Pilane | Lekutung | 1 | To be confirmed | F Bolton |
| Tidimalo Kgatlhang | Sefikile / Spitskop | 1 | To be confirmed | F Bolton |
| D Molefe | Mononono | 1 | To be confirmed | F Bolton |
| Dan Segale | Kgamatha / Lesobeng | 1 | To be confirmed | F Bolton |
| Mac Deatswana | Lekgraal / Bofule | 1 | To be confirmed | F Bolton |
| Moses Mmankgaki | Ramasedi | 1 | To be confirmed | F Bolton |
| Meme Moeng | Ntswana-le-Metsing | 1 | To be confirmed | F Bolton |
| Kgosana Tlhabane Pilane | Motlhabe | 1 | To be confirmed | F Bolton |
| Marks Mweletsi | Ngweding | 1 | To be confirmed | F Bolton |
| Masuku Mathithibala | Magalane | 1 | To be confirmed | F Bolton |
| Mr. Leoto | Magong | 1 | To be confirmed | F Bolton |
| Livhuwani Kutame | Department of Economic Development, Environment, Conservation and Tourism | 5 | After public review | F Bolton |