PPM PLANT EXPANSION PROJECT

Environmental Impact Assessment and Environmental Management Programme (inclusive of Interested and Affected Party comments)

Pilanesberg Platinum Mine on Tuschenkomst 135JP and Witkleifontein 136JP

Prepared for:

PILANESBERG Platinum mines
A SEDIBELO PLATINUM MINES GROUP COMPANY

DREAD Reference No.: NWP/EIA/87/2013
DMR Reference No.: NW30/5/1/2/2/320MR

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SLR

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Report Date	March 2019
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BASIS OF REPORT

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PPM PLANT EXPANSION PROJECT

EXECUTIVE SUMMARY

Introduction

PPM is a platinum and chrome mining and mineral processing operation located to the north-west of the Pilanesberg National Park in the North West Province. In broad terms the existing PPM operation comprises an open pit mine (West Pit and East Pit), temporary and permanent waste rock dumps (WRDs), a mineral processing plant complex, a tailings storage facility (TSF) and support services and infrastructure.

PPM proposes to expand the existing PPM mineral processing operations, upgrade the existing sewage treatment plant and relocate the waste storage and handling facility from inside the plant to an area outside the plant. Furthermore, a number of community based initiatives have been established at the mine. These have been included in this report at the request of the DMR.

The proposed project includes activities listed under the Environmental Impact Assessment (EIA) Regulations 2014 (as amended), promulgated in terms of Chapter 5 of the National Environmental Management Act, 1998 (No. 107 of 1998) (NEMA). Such listed activities are prohibited from commencing until authorisation is obtained from the competent authority, which in this case is the North West Department of Rural, Environmental and Agricultural Development (DREAD). The activities that are triggered require a full Scoping and Environmental Impact Assessment (EIA) process to inform the DREAD's decision on the application for environmental authorisation. In addition, the proposed project also requires authorisation from the Department of Mineral Resources (DMR) under Section 102 of the Mineral and Petroleum Resources Development Act, 28 of 2002 (MPRDA) as the project will take place on a mine and requires an amendment to the mine's Environmental Management Programme (EMP).

SLR Consulting (Africa) (Pty) Ltd (SLR) has been appointed as the independent environmental consultant to undertake the EIA process for the proposed project.

This executive summary provides a synopsis of the Environmental Impact Assessment and Environmental Management Programme (EIA and EMPr).

Opportunity to comment on the EIA and EMPr

This EIA and EMP was distributed for a 44-day comment period from **18 March 2019 to 07 May 2019** in order to provide Interested and Affected Parties (I&APs) with an opportunity to comment on any aspect of the proposed project and the findings of the EIA process. Copies of the full report were made available on the SLR website (at https://slrconsulting.com/za/slr-documents/) and at public review venues (Bakgatla-Ba-Kgafela traditional offices in Moruleng (Saulspoort), Pilanesberg Platinum Mine, Moses Kotane Local Municipality in Saulspoort, Rustenburg public library and SLR's offices in Johannesburg).

All comments received during the review process have been included in the Comments and Response Report and addressed in the EIA and EMPr where required. Copies of the comments are included as an appendix to the EIA and EMPr. Any edits to the report are written in Arial and underlined.

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Overview of the project

PPM is one of three mining operations in the North West Province that fall under the Sedibelo Platinum Mines Limited (SPML) group of companies. These three operations lie adjacent to each other, north of the Pilanesberg National Park. While PPM is an operational mine, the other two operations, namely Sedibelo Platinum Mine and Magazynskraal Platinum Mine (with the potential to incorporate the Kruidfontein ore resource) have not yet been constructed.

PPM proposes to expand the existing PPM mineral processing operations to incorporate a hydrometallurgical plant for the extraction of platinum group metals (PGMs) and base metals and a UG2 milling and flotation circuit to process ore from the Sedibelo Platinum Mine (SPM) operation. In addition, PPM is planning to upgrade the existing sewage treatment plant and relocate the waste storage and handling facility from inside the plant to an area outside the plant. The previously proposed modular tailings re-treatment plant for the extraction of PGMs (which would require the re-processing of the existing PPM TSF) and the training centre have been excluded from the scope of the EIA. Project-related infrastructure will be developed within PPM's existing operational footprint. Existing services and infrastructure on site would be used to support the project.

The current mining operation involves accessing the two commonly exploited 'PGE-bearing' reef horizons, the Merensky (silicate) and UG2, in a single open-cast mining operation. PPM will continue to mine in this manner as the plant expansion project proposes changes only to the metallurgical processes and not the open-cast mining plan or method.

Furthermore, a number of community based initiatives have been established at the mine. These have been included in this report at the request of the DMR. These include an aggregate crusher and brick making project, a nursery, a vegetable garden and composting area and a car wash. Community based projects have mainly been established within PPM's plant complex, except the vegetable garden and nursery which has been established immediately adjacent to the TSF's return water dam.

Project timelines

Based on current planning and market conditions, the proposed project would extend the life of PPM's processing facility by a minimum 40 years. Furthermore, there is the possibility that additional concentrate could be sourced from other platinum mining operations in the region and therefore the life of the KELL plant, specifically, could extend beyond this time. The life of the mining operations remains unchanged. The remaining life of the PPM mining operations is 16 years comprising six years for the Tuschenkomst East pit and ten years for the pits on Rooderand, Witkleifontein and Ruighoek. At this stage in the project planning, mining of the pits on Rooderand, Witkleifontein and Ruighoek has not yet been scheduled.

Subject to obtaining environmental authorisations, the construction and commissioning of each component of the mineral processing operations is dependent on market conditions, board approval and funding. At this stage in project planning, it is anticipated that construction could commence in 2021. Subject to the above conditions, the KELL plant is expected to be operational by Year 2023 (following a 24 month construction period) and the additional UG2 circuit is expected to be operational by Year 2025 (following an 18 month construction period). It is estimated to take approximately one to two months to upgrade the sewage treatment facility and relocate the waste storage and handling area

Public participation

The public participation process commenced with the Scoping Phase in December 2013. As part of this process, commenting authorities and interested and affected parties (I&APs) were given the opportunity to attend scoping meetings, submit questions and comments to the project team, review the background information document and the Scoping Report. The draft EIA and EMPR report was made available for public review. All comments submitted to date by the commenting authorities and I&APs have been included and addressed in this Final EIA Report.

Impacts and management measures

This section provides a summary of the identified and assessed potential impacts on the receiving environment in both the unmitigated and mitigated scenarios, including cumulative impacts. All identified impacts are considered both incrementally and cumulatively in the context of the existing PPM operations. The table also provides an indication of the contribution of potential impacts, associated with the proposed project, to the overall cumulative significance rating for the mine.

The table below provides a summary of the potential impacts in no particular order of importance.

TABLE: SUMMARY OF POTENTIAL PROJECT-RELATED IMPACTS

Potential impact	Incremental significance		**Project contribution**	Net cumulative significance	
	Unmitigated	Mitigated		Unmitigated	Mitigated
Biophysical					
Loss of soil resources and land capability through physical disturbance	Negligible		**Negligible**	High	Medium
Loss of soil resources and land capability through contamination	Medium	Low	**Minor**	High	Low
Physical destruction of biodiversity	Negligible		**Negligible**	High	High-Medium
General disturbance of biodiversity	Medium	Low	**Minor**	High	High-Medium
Alteration of surface drainage patterns	-		**-**	High	Low
Contamination of surface water	Medium	Low	**Minor**	High	Low
Reduction in water availability to third parties	-		**-**	High	Medium-Low
Groundwater contamination	Medium	Low Medium[#]	**Minor** **Moderate-Low[#]**	High	Low
Change in ambient air concentrations	-	Medium*	**Moderate***	High	Low Medium*
Increase in ambient noise levels	Low	Low	**Negligible**	Medium	Medium
Change in landscape and related visual aspects	Medium	Medium[1] Low[2]	**Moderate[1]** **Minor[2]**	High	Medium-High
Socio-economic					
Economic impact (positive and negative)	Medium+	High+	**Moderate +**	Medium+	High+
Loss and sterilisation of mineral resources	-		**-**	Medium	Low
Inward migration	Medium	Low	**Minor**	High	Medium
Road disturbance and traffic safety	Medium	Low	**Minor**	High	Medium
Increase in safety risks to third parties and communities	-		**-**	High	Medium
Land use impact	Medium	Low	**Minor**	High	Medium to Low
Heritage and cultural					
Damage or disturbance of heritage (including cultural) and palaeontological resources	-		**-**	High	Low

- denotes 'No impact' or 'No contribution' Ratings are negative unless otherwise specified [1] Construction [2] Operations

[#] Post closure, depending on success of active pump and treat mechanisms

** Presents potential impacts related to chlorine, hydrogen chloride, hydrogen fluoride and ammonia modelled for the KELL plant.*

The assessment of the proposed project presents the potential for moderately significant negative impacts to occur (in the unmitigated scenario) on the biophysical and socio-economic environments in the surrounding area. No heritage or cultural impacts are expected to occur. Although the operational KELL

process presents a new air emission profile for the PPM operations, the plant will be designed and implemented to meet the new plant minimum emission standards and would need to operate under an atmospheric emission license. The medium significance for potential groundwater contamination post-closure is influenced to a large extent by the conservative geochemical modelling and does not take into account active pump and treat mechanisms. Where pump and treat mechanisms and the final rehabilitation of the TSF prevent the migration of a contamination plume affecting third party boreholes, the significance post-closure would be reduced. With mitigation potential impacts on the biophysical environment can be prevented or reduced with the exception of potential visual impacts during the construction phase of the project. Construction phase visual impacts would occur for the duration of the construction phase, although this is considered to be short-term.

The proposed project would contribute positively towards to the local, regional and national economy through capital investment, creation of employment and revenue generation potential. Given the technical nature of the KELL process, PPM's intention is to upskill and transfer existing employees from the concentrator operations to the hydrometallurgical plant. The community based projects and continued implementation of the mine's social and labour plan have direct social development and employment benefits for the relevant communities.

When considering the nature and extent of PPM's approved operations, it should be noted that the net substantive cumulative change is limited. This is linked to the fact that the proposed project would largely be developed within the current footprint and range of activities at the mine noting that the KELL process is a new technology.

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

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ACRONYMS AND ABBREVIATIONS

Acronym / Abbreviation	Definition
%	Percentage
ABA	Acid Base Accounting
AEL	Atmospheric Emissions License
AQMP	Air Quality Management Plan
BBK	Bakgatla-Ba-Kgafela
BEE	Black Economic Empowerment
BIC	Bushveld Igneous Complex
BID	Background Information Document
BPDM	Bojanala Platinum District Municipality
BRNR	Black Rhino Nature Reserve
CARA	Conservation of Agricultural Resources Act
CBA	Critical Biodiversity Area
Cl_2	Chlorine gas
CZ	Critical Zone
DAFF	Department of Agriculture, Fisheries and Forestry
DMR	Department of Mineral Resources
DMS	Dense media separation
DPWRT	Department of Public Works, Roads and Transport
DRDLR	Department of Rural Development and Land Reform
DREAD	Department of Rural, Environmental and Agricultural Development
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
EC	European Commission
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
FSE	Federation for a Sustainable Environment
GDP	Gross Domestic Profit
H_2SO_4	Sulphuric acid
HCl	Hydrochloric acid
HF	Hydrogen fluoride
I&APs	Interested and Affected Parties
IAIAsa	International Association of Impact Assessment South Africa
IDP	Integrated Development Plan
LZ	Lower Zone
mamsl	Metres above mean sea level
MAP	Mean annual precipitation
MAR	Mean annual runoff
MES	Minimum Emission Standards
MKLM	Moses Kotane Local Municipality
M	Marginal
MPRDA	Mineral and Petroleum Resources Development Act
MZ	Main zone
NFEPA	National Freshwater Ecosystem Priority Areas
NEM:BA	National Environmental Management: Biodiversity Act
NEM:WA	National Environmental Management: Waste Act

Acronym / Abbreviation	Definition
NEMA	National Environmental Management Act
NH_3	Ammonia
Non-PAG	Non-Potentially Acid Generating
NWPTB	North West Parks and Tourism Board
O_2	Oxygen
PGE	Platinum group element
PGM	Platinum group metals
PNP	Pilanesberg National Park
PPM	Pilanesberg Platinum Mines (Pty) Ltd
PSA	Platinum South Africa (Pty) Limited
RLS	Rustenburg layered suite
ROM	Run of mine
SAHRA	South Africa Heritage Resource Agency
SANS	South African National Standard
SAWS	South African weather services
SLR	SLR Consulting (Africa) (Pty) Ltd
SO_4	Sulphate
SPM	Sedibelo platinum mine limited
TDS	Total dissolved solids
TSF	Tailings storage facility
TWQR	Target water quality range
UZ	Upper zone
WBPA	Waterberg-Bojanala priority area
WMA	Water management area
WRDs	Waste rock dumps
WUL	Water use license

INTRODUCTION

This chapter describes the purpose of this report, provides a brief description of the project background, the legislative authorisation requirements, introduces the environmental assessment process, presents the structure of the report and outlines the opportunity for comment.

PURPOSE OF THIS REPORT

This Environmental Impact Assessment (EIA) and Environmental Management Programme (EMPr) has been compiled and distributed for review and comment as part of a Scoping and Environmental Impact Assessment process that is being undertaken for the proposed expansion of mineral processing operations at Pilanesberg Platinum Mines (Pty) Ltd (PPM) operations in the North West Province.

This EIA and EMPr provides a description of the proposed project and the affected environment; summarises the EIA process followed to date; identifies and assesses the key project impacts and presents management and mitigation measures that are recommended to enhance positive and limit negative impacts.

Interested and Affected Parties (I&APs) have provided comment on the Draft EIA and EMPr. The document has now been finalised incorporating all comments received during the review period. The EIA and EMPr will be submitted to the North West Department of Rural, Environmental and Agricultural Development (DREAD) for consideration as part of the application for Environmental Authorisation in terms of Chapter 5 of the National Environmental Management Act, 1998 (No. 107 of 1998) (NEMA), as amended. The EIA and EMPr will also be submitted to the Department of Mineral Resources (DMR) as part of a Section 102 application in terms of the Mineral and Petroleum Resources Development Act, 2002 (No. 28 of 2002) (MPRDA).

PROJECT BACKGROUND

PPM is a platinum and chrome mining and mineral processing operation located to the north-west of the Pilanesberg National Park in the North West Province (refer to Figure 1 and Figure 2). In broad terms the existing PPM operation comprises an open pit mine (West Pit and East Pit), temporary and permanent waste rock dumps (WRDs), a mineral processing plant complex, a tailings storage facility (TSF) and support services and infrastructure.

PPM is one of three mining operations in the North West Province that fall under the Sedibelo Platinum Mines Limited (SPML) group of companies. These three operations lie adjacent to each other, north of the Pilanesberg National Park (Figure 1). While PPM is an operational mine, the other two operations, namely Sedibelo Platinum Mine and Magazynskraal Platinum Mine (with the potential to incorporate the Kruidfontein ore resource) have not yet been constructed.

PPM proposes to expand the existing PPM mineral processing operations to incorporate:

- a hydrometallurgical plant for the extraction of platinum group metals (PGMs) and base metals; and
- a UG2 milling and flotation circuit to process ore from the Sedibelo Platinum Mine (SPM) operation.

In addition, the following is planned:

- upgrading of the existing sewage treatment plant; and
- relocation of the waste storage and handling facility from inside the plant to an area outside the plant.

The previously proposed modular tailings re-treatment plant for the extraction of PGMs (which would require the re-processing of the existing PPM TSF) and the training centre have been excluded from the scope of the EIA. Further detail is provided in Section 19. Project-related infrastructure will be developed within PPM's existing operational footprint (Figure 2).

Furthermore, a number of community based initiatives have been established at the mine. These have been included in this report at the request of the DMR. They include:

- an aggregate crusher and brick making project;
- a nursery;
- a vegetable garden and composting area; and
- a car wash.

Community based projects have mainly been established within PPM's plant complex, except the vegetable garden and nursery which has been established immediately adjacent to the TSF's return water dam (Figure 2).

SLR Consulting (Africa) (Pty) Ltd (SLR) has been appointed as the independent environmental consultant to undertake the EIA process for the proposed project.

SUMMARY OF AUTHORISATION REQUIREMENTS

Prior to commencement, environmental authorisations are required on the basis of an EIA. Given that the project commenced prior to December 2014, these include:

- an environmental authorisation from the Department of Mineral Resources (DMR) in terms of the Mineral and Petroleum Resources Development Act, 28 of 2002 (MPRDA); and
- an environmental authorisation from the Department of Rural, Environmental and Agricultural Development (DREAD) in terms of the National Environmental Management Act, 107 of 1998 (NEMA).

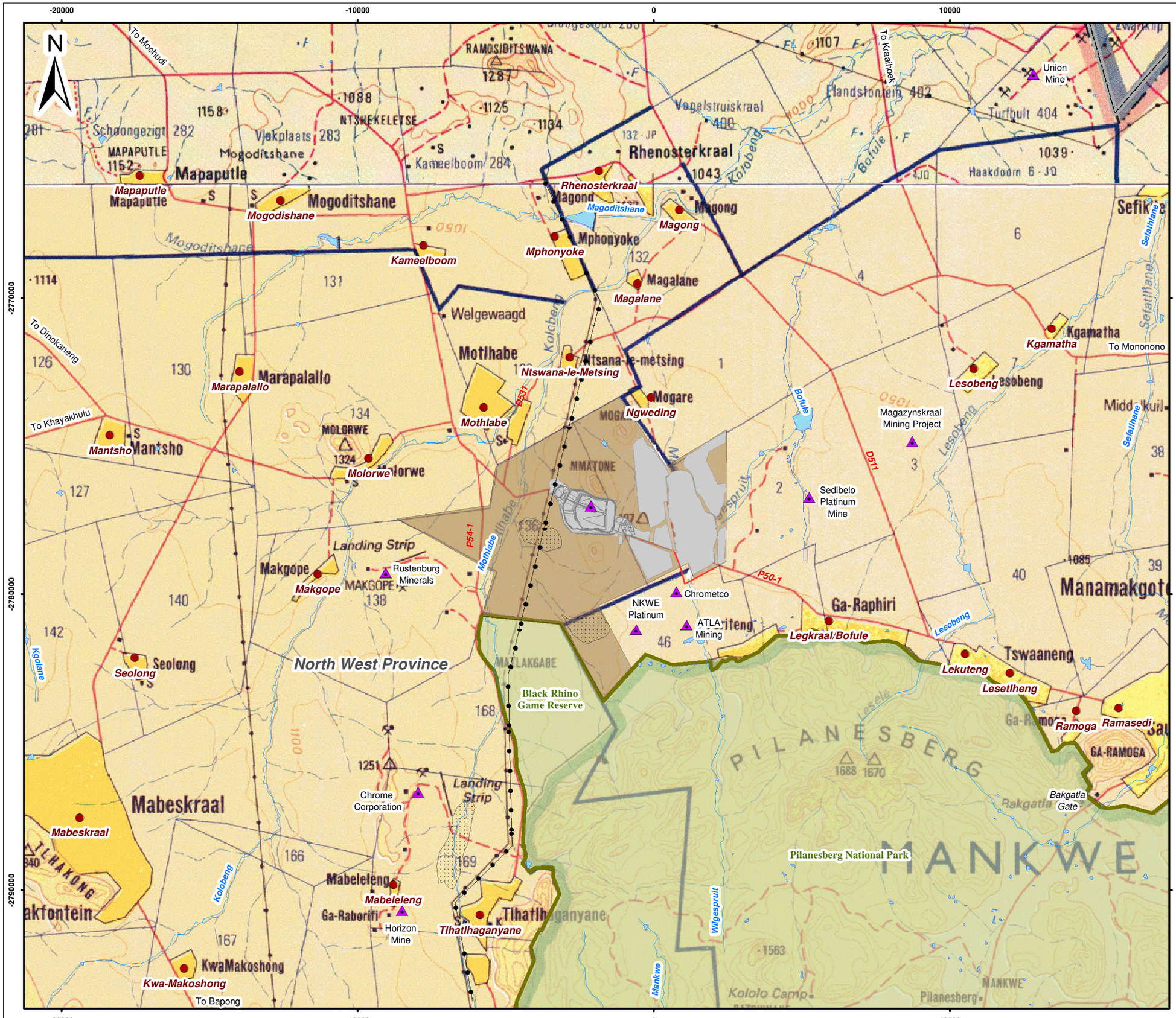
With the addition of the hydrometallurgical plant, an atmospheric emission license (AEL) from the Bojanala Platinum District Municipality in terms of the National Environmental Management: Air Quality Act, 39 of 2004 (NEM:AQA) is also required.

Further detail is provided in Section 3.1. The above does not cover mine health and safety legislation requirements.

EXISTING APPROVALS FOR PPM

A summary of environmental authorisations provided by PPM under which PPM operates is outlined below.

- 2007 EIA and EMPr: catering for the establishment and operation of the PPM (Metago, 2007). The EIA and EMPr was approved by DEDECT in 2007 (DEDECT Ref No: EIA 410/2005NW) in support of scheduled processes and by DMR in 2008 (DMR Ref No: NW30/5/1/2/3/2/1/320MR).
- 2009 EIA and EMPr amendment: catering for diversion of the Z536, relocation of approved infrastructure and the addition of support infrastructure (Metago, 2009). This amendment was authorised by DEDECT in 2011 (DEDECT Ref No. NWP/EIA/36/2008) and by DMR in 2011 (same reference no. as above).
- 2011 EIA and EMPr amendment: to amend the closure objectives of the Tuschenkomst pit from backfilling and re-establishment of land to a water supply and tourism hub facility (Metago, 2011a). This amendment was approved by the DMR in 2012 (same reference no. as above). This authorization is under an appeal process.
- 2011 EIA and EMPr amendment: catering for the extension of the Tuschenkomst pit (Metago, 2011b). This amendment was authorised by the DMR in 2012 (same reference no. as above). At the same time the environmental authorisation for Sedibelo Platinum Mine was transferred to PPM.
- 2012 EIA and EMPr amendment: catering for the mining of chrome at PPM (SLR, 2012). This amendment was authorized by DREAD in 2015 (DREAD Ref No: NWP/EIA/222/2009) and DMR in 2017 (same reference no. as above).



Legend

- Provincial Border
- Towns / Villages
- Mining Related Interests or Operations
- Powerline
- Roads
- Watercourses
- Dams
- Pilanesberg National Park (including Black Rhino Game Reserve)
- Pilanesberg Platinum Mine Mining Right Area
- Existing Pilanesberg Platinum Mine Infrastructure and Activities
- Pilanesberg Platinum Mine Future Open Pits

0 1.5 3 4.5 6 Kilometers

Scale: 1:125 000 @ A3

Projection: Transverse Mercator
Datum: Hartebeeshoek, LO27

PILANESBERG PLATINUM MINES (PTY) LTD

Figure 1

Regional Setting of Pilanesberg Platinum Mines

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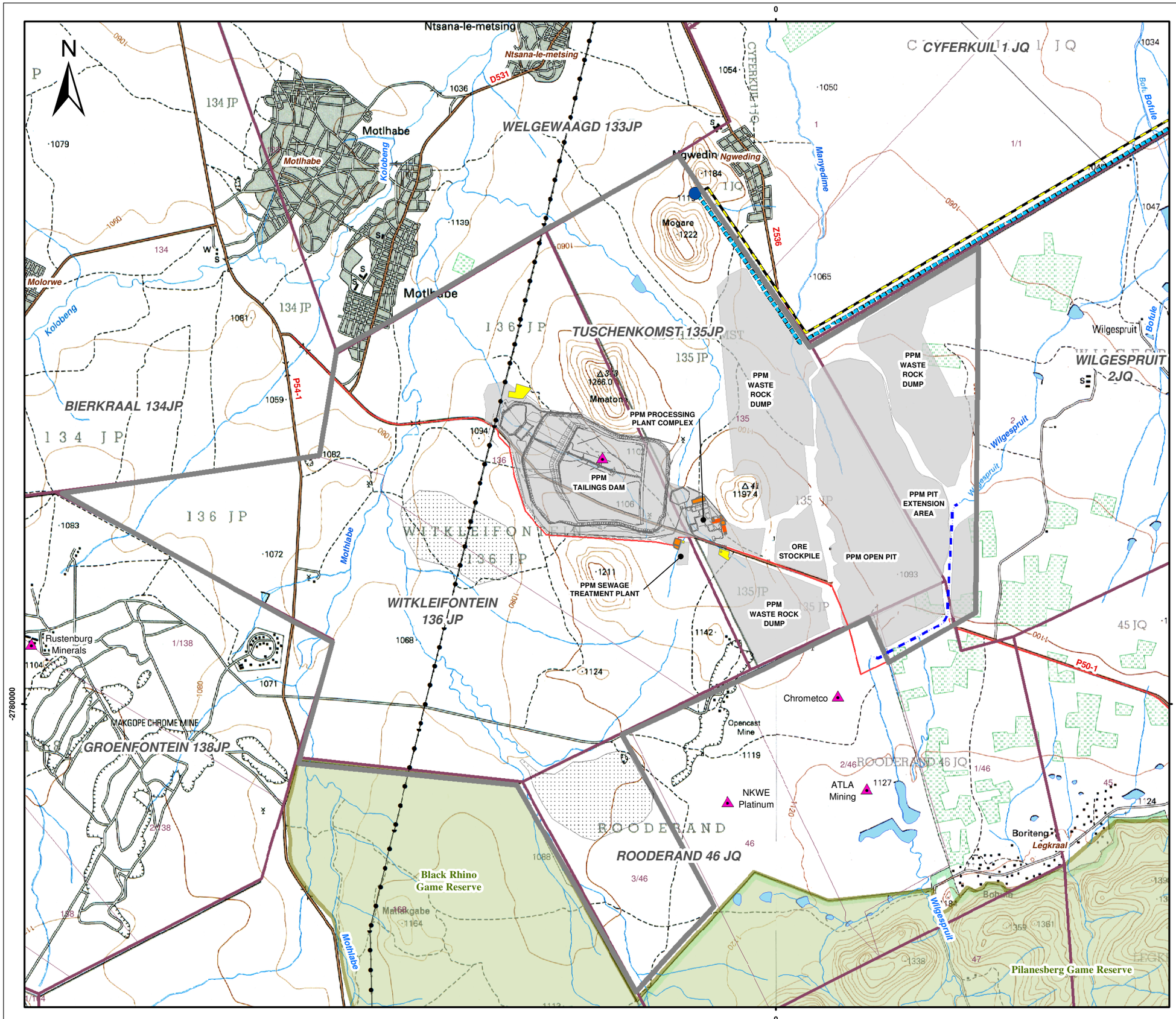

Legend

- Pilanesberg Platinum Mine Mining Right Area
- Existing Pilanesberg Platinum Mine Infrastructure and Activities
- Pilanesberg Platinum Mine Future Open Pits
- Proposed Infrastructure Changes
- Existing Community-Based Projects
- Dams
- Watercourses
- Roads
- Powerline
- Wilgespruit River Diversion
- Magalies Water Pipeline
- Pipeline from Tuschenkomst Reservoir to Sedibelo / Magazynskraal Mining Projects
- Water Reservoir
- Mining and Related Interests or Operations
- Farm Boundaries
- 2/46 Portion Boundaries
- Pilanesberg National Park (including Black Rhino Game Reserve)

0 1 000 Meters

Scale: 1:45 000 @ A3

Projection: Transverse Mercator
Datum: Hartebeeshoek, Lo27

PILANESBERG PLATINUM MINES (PTY) LTD

Figure 2

Local Setting of Pilanesberg Platinum Mines

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EIA ASSESSMENT PROCESS

In accordance with Appendix 3 of GNR 982 the key objectives of this EIA are to:

- determine the policies and legislation relevant to the activity and document how the proposed activity complies with and responds to the policy and legislative context;
- describe the need and desirability of the proposed activity in the context of the development footprint on the preferred site as contemplated in the accepted Scoping Report;
- identify feasible alternatives related to the project proposal;
- ensure that all potential key environmental issues and impacts that will result from the proposed project are identified;
- assess potential impacts of the proposed project alternatives during the different phases of project development;
- identify the most ideal location of the activity within the development footprint of the preferred site based on the lowest level of environmental sensitivity identified during the assessment;
- present appropriate mitigation or optimisation measures to avoid, manage or mitigate potential impacts or enhance potential benefits, respectively; and
- identify residual risks that need to be managed and monitored.

This EIA process consists of a series of steps to ensure compliance with these objectives, the EIA Regulations 2014 (as amended) and MPRDA. The process involves an open, participatory approach to ensure that all impacts are identified and that decision-making takes place in an informed, transparent and accountable manner.

Specialist information and other relevant information has been integrated into the EIA and EMPr.

STRUCTURE OF REPORT

This document has been prepared in accordance with the DMR EMPr Report template format, and was informed by the guidelines posted on the official DMR website. This is in accordance with the requirements of the MPRDA. This report also complies with the requirements of the NEMA and Appendix 3 and Appendix 4 of EIA Regulations 2014 (as amended).

Table 1 provides a summary of the requirements, with cross references to the report sections where these requirements have been addressed.

TABLE 1: STRUCTURING OF THE EIA AND EMPR

EMPr report requirement as per the DMR template	EMPr report requirements as per the 2014 NEMA regulations (as amended)	Reference in the report
Part A of DMR report template	**Appendix 3 of the NEMA regulations**	**Section/Appendix**
The EAP who prepared the report	Details of the EAP who prepared the report	Section 1.2
Expertise of the EAP	Details of the expertise of the EAP, including curriculum vitae	Section 1.3 and Appendix A
Description of the property	The location of the activity, including - the 21 digit Surveyor General code of each cadastral land parcel. Where available the physical address and farm name. Where the required information is not available, the coordinates of the boundary of the property or properties	Section 2.1
Locality plan	A plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale, or, if it is a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken or on land where the property has not been	Section 2.2

EMPr report requirement as per the DMR template	EMPr report requirements as per the 2014 NEMA regulations (as amended)	Reference in the report
	defined, the coordinates within which the activity is to be undertaken	
Description of the scope of the proposed overall activity	A description of the scope of the proposed activity, including all listed and specified activities triggered	Section 3
Description of the activities to be undertaken	A description of the scope of the proposed activity, including all listed and specified activities triggered and being applied for and a description of the associated structure and infrastructure related to the development	Section 3.1 and 3.2
Policy and legislative context	A description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context	Section 4
Need and desirability of the proposed activity	A motivation for the need and desirability for the proposed development including the need and desirability of the activity in the context of the preferred location	Section 5
Motivation for the preferred development footprint within the approved site including	A motivation of the preferred development footprint within the approved site including	Section 6
A full description of the process followed to reach the proposed development footprint within the approved site	A full description of the process followed to reach the proposed development footprint within the approved site	Section 6
Details of the development footprint alternatives considered	Details of all the alternatives considered	Section 6.1
Details of the public participation process followed	Details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs	Section 6.2
Summary of issues raised by I&APs	A summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them	Section 6.3
Environmental attributes associated with the development footprint alternatives	The environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects	Section 6.4
Impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts including the degree of the impacts	The impacts and risks identified, including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts can be reversed, may cause irreplaceable loss of resources and can be avoided, managed and mitigated	Section 6.5
Methodology used in determining the nature, significance, consequence, extent, duration and probability of potential environmental impacts and risks	The methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks	Section 6.6
The positive and negative impacts that the proposed activity (in terms of the initial site layout) and alternative will have on the environment and the community that may be affected	Positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects	Section 6.7
The possible management actions that could be applied and the level of risk	The possible management actions that could be applied and level of residual risk	Section 6.8
Motivation where no alternative sites were considered	If no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such	Section 6.9

EMPr report requirement as per the DMR template	EMPr report requirements as per the 2014 NEMA regulations (as amended)	Reference in the report
Statement motivating the alternative development location within the overall site	A concluding statement indicating the preferred alternatives, including preferred location within the approved site	Section 6.10
Full description of the process undertaken to identify, assess and rank the impacts and risks the activity will impose on the preferred site (in respect of the final site layout) through the life of the activity	A full description of the process undertaken to identify, assess and rank the impacts the activity and associated structure and infrastructure will impose on the preferred location through the life of the activity including a description of all environmental issues and risks that were identified during the environmental impact assessment process and an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of management actions	Section 7
Assessment of each identified potentially significant impact and risk	An assessment of each identified potentially significant impact and risk including cumulative impacts, the nature, significant and consequence of the impact and risk, the extent and duration of the impact and risk, the probability of the impact and risk occurring, the degree to which the impact can be reversed, the degree to which the impact and risk may cause irreplaceable loss of a resources and the degree to which the impact and risk can be mitigated.	Section 8
Summary of specialist reports	Where applicable the summary of the findings and recommendations of any specialist report complying with Appendix 6 of these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report	Section 9
Environmental impact statement	An environmental impact statement which contains a summary of the key findings of the environmental impact assessment, a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers and a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives	Section 10
Proposed impact management objectives and the impact management outcomes for inclusion in the EMPr	Based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation	Section 11
Final proposed alternatives	The final proposed alternatives which respond to the impact management actions, avoidance, and management actions identified through the assessment	Section 12
Aspects for inclusion as conditions of authorisation	Any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation	Section 13
Description of any assumptions, uncertainties and gaps in knowledge	A description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and management actions proposed	Section 14
Reasoned opinion as to whether the proposed activity should or should not be authorised	Reasoned opinion as to whether the proposed 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 15
Period for which environmental authorisation is required	Where the proposed activity does not include operational aspects, the period for which the	Section 16

EMPr report requirement as per the DMR template	EMPr report requirements as per the 2014 NEMA regulations (as amended)	Reference in the report
	environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised	
Undertaking	An undertaking under oath or affirmation by the EAP in relation to the correctness of the information provided in the reports, the inclusion of comments and inputs from stakeholders and I&APs, the inclusion of inputs and recommendations from the specialist reports where relevant and any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties	Section 17
Financial provision	Where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts	Section 18
Deviation from the approved scoping report and plan of study	An indication of any deviation from the approved scoping report, including the plan of study, including any deviation from the methodology used in determining the significance of potential environmental impacts and risks; and a motivation for the deviation	Section 19
Other information required by the competent authority	Any specific information required by the competent authority.	Section 20
Other matter required in terms of section 24(4)(a) and (b) of the Act	Any other matter required in terms of section 24(4)(a) and (b) of the Act	Section 21
Part B of DMR report template	**Appendix 4 of the NEMA regulations**	**Section/Appendix**
Details of EAP	Details of the EAP who prepared the EMPr and the expertise of that EAP to prepare the EMPr, including a curriculum vitae	Section 22
Description of the aspects of the activity	A detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description	Section 23
Composite map	A map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that any areas that should be avoided, including buffers	Section 24
Description of impact management objectives including management statements	A description of the impact management objectives, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all phases of the development including planning and design, pre-construction activities, construction activities, rehabilitation of the environment after construction and where applicable post closure; and where relevant, operation activities	Section 25
The determination of closure objectives		Section 25.1
The process for managing any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation as a result of undertaking a listed activity	-	Section 25.2
Potential acid mine drainage	-	Section 25.3
Steps taken to investigate, assess and evaluate the impact of acid mine drainage	-	Section 25.4

EMPr report requirement as per the DMR template	EMPr report requirements as per the 2014 NEMA regulations (as amended)	Reference in the report
Engineering or mine design solutions to be implemented to avoid or remedy acid mine drainage	-	Section 25.5
Measures that will be put in place to remedy any residual or cumulative impact that may result from acid mine drainage	-	Section 25.6
Volumes and rate of water use required for the mining	-	Section 25.7
Has a water use licence been applied for?	-	Section 25.8
Impacts to be mitigated in their respective phases	-	Section 25.9
Impact management outcomes	A description and identification of impact management outcomes required for the aspects contemplated in paragraph	Section 26
Impact management actions	A description of proposed impact management actions, identifying the manner in which the impact management objectives and outcomes be achieved, and must, where applicable, include actions to avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation; comply with any prescribed environmental management standards or practices; comply with any applicable provisions of the Act regarding closure, where applicable comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable	Section 27
Financial provision		Section 28
Mechanism for monitoring compliance with and performance assessment against the environmental management programme and reporting thereon	The method of monitoring the implementation of the impact management actions	Section 29
	The frequency of monitoring the implementation of the impact management actions	
	An indication of the persons who will be responsible for the implementation of the impact management actions	
	The time periods within which the impact management actions must be implemented	
	The mechanism for monitoring compliance with the impact management actions	
	A program for reporting on compliance, taking into account the requirements as prescribed by the Regulations	
Environmental Awareness Plan	An environmental awareness plan describing the manner in which the applicant intends to inform his or her employees of any environmental risk which may result from their work; and risks must be dealt with in order to avoid pollution or the degradation of the environment	Section 30
Specific information required by the competent authority	Any specific information that may be required by the competent authority	Section 31
Undertaking	-	Section 32

PART A: SCOPE OF ASSESSMENT AND ENVIRONMENTAL IMPACT ASSESSMENT REPORT

1 APPLICANT, EAP AND SPECIALISTS

1.1 APPLICANT DETAILS

The applicant for the project is PPM (details included in Table 1-1 below).

TABLE 1-1: APPLICANT DETAILS

Project applicant	Pilanesberg Platinum Mines (Pty) Ltd
Postal address	Private Bag X 11, Highveld, 0067
Telephone number	012 661 4280
Fax number	012 661 4139
Contact person	Dean Riley

PPM is a wholly-owned operating subsidiary of Sedibelo Platinum Mines Limited (SPML), held via Platmin South Africa (Pty) Limited (PSA) (previously Boynton Investments (Pty) Ltd). Active participation in the control of PSA takes place through representation of PSA's black economic empowerment (BEE) shareholder, the Bakgatla-Ba-Kgafela Tribal Authority, on the Board of Directors of the aforesaid ultimate holding company of PSA, namely SPML.

1.2 DETAILS OF THE EAP WHO PREPARED THE REPORT

As noted in the Introduction, SLR has been appointed as the independent Environmental Assessment Practitioner (EAP) to undertake the EIA process for the proposed project. The details of the EAP project team are provided in Table 1-2.

SLR has no vested interest in the proposed project other than fair payment for consulting services rendered as part of the EIA process and has declared its independence as required by the EIA Regulations 2014 (as amended). An undertaking by the EAP is provided in Section 17.

TABLE 1-2: DETAILS OF THE SLR PROJECT TEAM

General		
Organisation	SLR Consulting (Africa) (Pty) Ltd	
Postal address	PO Box 1596, Cramerview, 2060	
Tel No.	(011) 467 0945	
Fax No.	(011) 467 0978	
Name	**Tasks and roles**	**Email**
Brandon Stobart (SLR)	Review	bstobart@slrconsulting.com
Alex Pheiffer (SLR)	Management of the EIA phase process, including public consultation, process review, specialist study review and report compilation	apheiffer@slrconsulting.com
Clive Phashe (SLR)	Project assistant and public consultation	cphashe@slrconsulting.com

1.3 EXPERTISE OF THE EAPS

Brandon Stobart is a qualified attorney and a certified Environmental Assessment Practitioner (EAP) with 20 years of experience working on both green and brown field capital investment and operational projects in a range of sectors including: industry, infrastructure, power, oil & gas and mining.

Alex Pheiffer holds a Master's Degree in Environmental Management (from the Rand Afrikaans University) and has over 16 years of experience in a range of environmental disciplines, including EIAs, EMPs, Licensing, Environmental Auditing and Monitoring, Review and Public Consultation. She has expertise in a wide range

of projects. She is a Registered PrSciNat (Environmental Science) and is a member of the International Association of Impact Assessment South Africa (IAIAsa).

Clive Phashe holds a Bachelor of Science in Life and Environmental Sciences from the University of Johannesburg. Clive is an Environmental Project Assistant with SLR and has over two years' experience within the environmental consulting field. Clive has assisted in a variety of mining projects since joining the company.

Relevant curricula vitae (including proof of registrations) are attached in Appendix A.

1.4 SPECIALIST STUDIES

Specialist studies have been undertaken to inform the EIA process. The specialist studies involved the gathering of data (desktop and site visit, where applicable) relevant to identifying and assessing environmental impacts that may occur as a result of the proposed project. These impacts have been assessed according to pre-defined rating scales (see Section 6.6). Specialist studies included recommended mitigation measures to minimise potential impacts or optimisation measures to enhance potential benefits as well as monitoring requirements, where required. These have been incorporated into the EMPr. The methodologies applied to each specialist study are included in the specialist reports attached as appendices to this EIA and EMPr.

Specialists who provided input to the EIA process are listed in the table below (Table 1-3).

TABLE 1-3: SPECIALIST STUDIES

Specialist field	Name and Surname	Company	Expertise
Surface water	Kevin Bursey and Chenai Manukare	SLR	Hydrologist
Groundwater	Koos Vivier and James Barrat	Exigo Sustainability (Pty) Ltd	Hydrogeologist
Air quality	Nick Grobler	Airshed Planning Professionals	Air quality specialist
Noise	Reneé von Gruenewaldt	Airshed Planning Professionals	Noise specialist
Visual	Graham A Young	Graham A Young Landscape Architect	Landscape architect
Economics	Werner Neethling	Mercury Financial Consultants	Economist
Traffic	Paul van der Westhuizen	Siyazi Gauteng Consulting Services (Pty) Ltd	Traffic engineer
Heritage	Dr Julius CC Pistorius	Dr Julius CC Pistorius	Archaeologist
Palaeontology	Prof Marion Bamford	University of the Witwatersrand	Palaeobotanist

2 PROPERTY DESCRIPTION

2.1 PROPERTY DESCRIPTION

A description of the property on which the project would be located is provided in Table 2-1 below.

TABLE 2-1: PROPERTY INFORMATION

Aspect	Detail
Farms on which the proposed project is located	Tuschenkomst 135 JP Witkleifontein 136 JP
Application areas (ha)	Not applicable, project activities would take place within existing disturbed footprints.
21 digit surveyor general code	BOJP00000000013500000 BOJP00000000013600000

2.2 PROJECT LOCALITY

A description of the project locality is provided in Table 2-2 below. The regional and local settings are illustrated on Figure 1 and Figure 2, respectively.

TABLE 2-2: PROJECT LOCALITY INFORMATION

Aspect	Detail
Centre co-ordinates for the site	25°6’20.10”S 26°59’15.48”E
Nearest towns	Saulspoort / Moruleng (approximately 16 km east) Ledig (approximately 30 km south) Mogwase (approximately 30 km south-east) Northam (35 km north-east)
Province	North West
Local authority	Moses Kotane Local Municipality (MKLM) and Bojanala Platinum District Municipality (BPDM)
Traditional authority	Bakgatla-Ba-Kgafela (BBK)
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.

3 DESCRIPTION OF THE SCOPE OF THE ACTIVITY

The main aim of the project is to expand PPM's current mineral processing facilities. In this regard, the following is proposed:

- a hydrometallurgical plant (KELL plant) for the extraction of PGMs and base metals; and
- a UG2 milling and flotation circuit to process ore from the Sedibelo Platinum Mine (SPM) operation.

In addition, the following is planned:

- upgrading of the existing sewage treatment plant; and
- relocation of the waste storage and handling facility from inside the plant to an area outside the plant.

The current mining operation involves accessing the two commonly exploited 'PGE-bearing' reef horizons, the Merensky (silicate) and UG2, in a single open-cast mining operation. PPM will continue to mine in this manner as the plant expansion project proposes changes only to the metallurgical processes and not the open-cast mining plan or method.

Existing services and infrastructure on site would be used to support the project. Further detail is provided in Section 3.2.

Furthermore, a number of community based initiatives have been established at the mine. These have been included in this report at the request of the DMR. They include:

- an aggregate crusher and brick making project;
- nursery;
- vegetable garden and composting area;
- car wash.

Site layout plans showing the location of existing and proposed project activities / components is illustrated in Figure 3-1 and Figure 3-2.

Legend

- Approved Infrastructure

Proposed Infrastructure Changes

- Hydrometallurgical Plant and Stack
- UG2 Milling and Flotation Section
- Waste Facility and Sorting Area (Relocated from within the plant)
- Upgrade of Existing Sewage Treatment Plant
- Security Perimeter

Existing Community- Based Projects

- Aggregate Crusher
- Brick yard
- Car Wash Bay

Storm Water Management System

- Clean Water Controls
- Dirty Water Controls
- Clean Storm Water Dam
- Dirty Storm Water Dam
- Non-Perennial Tributary of Mothlabe River

0 100 Meters

Scale: 1 : 4 300 @ A3
Projection: Transverse Mercator
Datum: Hartebeeshoek, Lo27

PILANESBERG PLATINUM MINES (PTY) LTD

Figure 3-1

Layout of the Existing & Proposed Mineral Processing Operations Including Community-Based Projects

SLR Consulting (Africa) (Pty) Ltd
P O Box 1596, Cramerview, 2060, South Africa
Tel: +27 (11) 467-0945 Fax: +27 (11) 467-0978

710.16002.00026	2019/03/11

Legend

Approved Infrastructure

Existing Community- Based Projects

Vegetable Garden and Nursery

Composting Site

0 100 Meters

Scale: 1 : 3 000 @ A4
Projection: Transverse Mercator
Datum: Hartebeeshoek, Lo27

PILANESBERG PLATINUM MINES (PTY) LTD

Figure 3-2

Layout of the Community-Based Vegetable Garden and Composting Area

SLR Consulting (Africa) (Pty) Ltd
P O Box 1596, Cramerview, 2060, South Africa
Tel: +27 (11) 467-0945 Fax: +27 (11) 467-0978

710.16002.00026 | 2019/02/25

3.1 LISTED AND SPECIFIED ACTIVITIES

The proposed project triggers various activities for which authorisations are required. The associated listed or specified activities are summarised below.

3.1.1 NEMA AND THE EIA REGULATIONS 2014

The EIA Regulations, 2014 (as amended by GN No. 326 of 7 April 2017) promulgated in terms of Chapter 5 of NEMA provide for control over certain listed activities. These listed activities are detailed in Listing Notice 1 (as amended by GN No. 327 of 7 April 2017), Listing Notice 2 (as amended by GN No. 325 of 7 April 2017) and Listing Notice 3 (as amended by GN No. 324 of 7 April 2017). The undertaking of activities specified in the Listing Notices is prohibited until Environmental Authorisation has been obtained from the competent authority. Such Environmental Authorisation, which may be granted subject to conditions, will only be considered once there has been compliance with the EIA Regulations. The EIA Regulations 2014 (as amended) are applicable are being applied to this project.

The EIA Regulations set out the procedures and documentation that need to be complied with when applying for Environmental Authorisation. Where a development triggers activities listed in Listing Notices 1 and/or 3 and Listing Notice 2, a Scoping and EIA process must be applied to the application. The proposed project would trigger activities specified in Listing Notices 1 and 2 (see Table 3-1) and therefore a Scoping and EIA process is being conducted.

TABLE 3-1: PROJECT ACTIVITIES AND ASSOCIATED LISTED ACTIVITIES IN TERMS OF THE EIA REGULATIONS 2014

Description of the project activity	Aerial extent of the activity (ha)	Listed activity number, applicable listing notice and activity description
Storage of KELL process chemicals on site (Cl_2, O_2, HCl, H_2SO_4)	Within the KELL building Approximately 200 m^3	Activity 14 of Listing Notice 1 (GNR 983) *The development and related operation of facilities or infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic metres or more but not exceeding 500 cubic metres.*
Storage of additional reagents for the UG2 milling and flotation circuit	Extension to the existing reagent store By more than 80 m^3	Activity 51 of Listing Notice 1 (GNR 983) *The expansion and related operation of facilities for the storage, or storage and handling, of a dangerous good, where the capacity of such storage facility will be expanded by more than 80 cubic metres.*
Hydrometallurgical processing	KELL plant: 110 000 tons per month ~ 0.8 ha (within the plant footprint)	Activity 6 of Listing Notice 2 (GNR 984) *The development of facilities or infrastructure for any process or activity which requires a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent, excluding - (ii) activities which are 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 National Environmental Management: Waste Act, 2008 applies.*

Description of the project activity	Aerial extent of the activity (ha)	Listed activity number, applicable listing notice and activity description
Mineral processing	UG2 milling and flotation: 65 000 tons per month ~ 1 ha (within the plant footprint) KELL plant: 110 000 tons per month ~ 0.8 ha (within the plant footprint)	Activity 17 of Listing Notice 2 (GNR 984) *Any activity including the operation of that activity which requires a mining right as contemplated in section 22 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), including -* *(a) associated infrastructure, structures and earthworks, directly related to the extraction of a mineral resource; or* *(b) the primary processing of a mineral resource including winning, extraction, classifying, concentrating, crushing, screening or washing;* *but excluding the secondary processing of a mineral resource, including the smelting, beneficiation, reduction, refining, calcining or gasification of the mineral resource in which case Activity 6 in this Notice applies.*

An application for environmental authorisation in accordance to NEMA has been applied for. The NEMA application was accepted by DEDECT (now DREAD) on 13 February 2014.

3.1.2 NEM:WA

The National Environmental Management: Waste Act, 2008 (No. 59 of 2008) (NEM:WA) regulates all aspects of waste management and has an emphasis on waste avoidance and minimisation. NEM:WA creates a system for listing and licensing waste management activities which may have a detrimental effect on the environment.

Listed waste management activities are included in GN R 921 of November 2013. Category A and B listed waste management activities are subject to a Scoping and EIA process and licensing.

Category C listed waste management activities do not require a waste management license but are subject to the provisions of National Norms and Standards. Although the project includes the relocation of the waste storage and handling facility from inside the plant to an area outside the plant, the expected storage volumes are likely to be below the Category C thresholds. In the event the storage thresholds are triggered, the facility would need to comply with the Norms and Standards for Storage of Waste, 2013. Where sorting, shredding, grinding, crushing, screening or baling of general waste takes place, the facility would need to comply with the National Norms and Standards for the Sorting, Shredding, Grinding, Crushing, Screening or Baling of General Waste, 2017.

At some point in the future if PPM would like to re-process the existing PPM TSF this will trigger a Category B listed activity which will require an application for NEM:WA authorisation.

3.1.3 NEM:AQA

Section 21 of NEM:AQA listed activities provide for emissions standards for the production or processing of precious and associated base metals through chemical treatment (Subcategory 4.17).

The KELL Plant falls within this category and as such requires an Atmospheric Emissions Licence (AEL) to operate. Emissions from the KELL Plant need to be in compliance with the Minimum Emission Standards for Subcategory 4.17 (Table 3-2). Pollutants arising from the KELL Plant include particulates, gaseous combustion pollutants (SO_2 and NO_2), chlorine (Cl_2), hydrogen chloride (HCl), hydrogen fluoride (HF) and possibly ammonia (NH_3).

An application for an AEL will be submitted following receipt of the NEMA decision, if positive.

TABLE 3-2: MINIMUM EMISSION STANDARDS FOR SUBCATEGORY 4.17

Substance or mixture of substances		mg/Nm^3 under normal conditions of 273 Kelvin and 101.3kPa
Common name	Chemical symbol	
Particulate matter	N/A	50
Chlorine	Cl_2	50
Sulphur dioxide	SO_2	400
Hydrogen chloride	HCl	30
Hydrogen fluoride	HF	30
Ammonia	NH_3	100
Oxides of nitrogen	NOx expressed as NO_2	300

3.1.4 NWA

PPM operates with a WUL for its current operations including the TSF (License No. 03/A24D/ACGU/2037) issued in terms of Section 21 of the National Water Act, 36 of 1998 (NWA). The proposed project includes the co-disposal of tailings material from the KELL Plant onto the PPM TSF. The co-disposal of tailings onto the PPM TSF would be done within the current footprint and capacity of the TSF (see Section 3.2.4.3).

3.2 DESCRIPTION OF THE ACTIVITIES

3.2.1 PROJECT OVERVIEW

An overview of the proposed activities and infrastructure associated with each project phase is provided in Table 3-3. Further information pertaining to the proposed activities is presented in the sections below.

3.2.2 PROJECT TIMELINE

3.2.2.1 Development timeline

The construction period for each of the components is anticipated to be:

- approximately 18 months to establish the additional UG2 milling and flotation circuit;
- approximately 24 months to establish the KELL plant; and
- approximately one to two months to upgrade the sewage treatment facility and relocate the waste storage and handling area.

Subject to obtaining environmental authorisations, the construction and commissioning of each component of the mineral processing operations is dependent on market conditions, board approval and funding. At this stage in project planning, it is anticipated that construction could commence in 2021. Subject to the above conditions, the KELL plant is expected to be operational by Year 2023 and the additional UG2 circuit is expected to be operational by Year 2025.

3.2.2.2 Life of mine and plant

Based on current planning and market conditions, the proposed project would extend the life of PPM's processing facility by a minimum 40 years. Furthermore, there is the possibility that additional concentrate could be sourced from other platinum mining operations in the region and therefore the life of the KELL plant, specifically, could extend beyond this time.

The intention by SPML is to mine its mineral resources from west to east, going deeper as mining progresses in an easterly direction. Aligned with this plan is to optimise the use of existing mineral processing facilities and related shared services. In this regard, the PPM UG2 milling and flotation circuit (inclusive of the additional circuit as proposed in this report) would treat UG2 from other SPML's mining operations for the duration of the mining operations. The same applies to the PPM silicate (Merensky) milling and flotation circuit. When the PPM UG2 milling and flotation circuit is operating at full capacity, then the SPM plant would be commissioned. When the SPM plant is operating at full capacity then the Magazynskraal plant would be commissioned.

The life of the mining operations remains unchanged. The remaining life of the PPM mining operations is 16 years comprising six years for the Tuschenkomst East pit and ten years for the pits on Rooderand, Witkleifontein and Ruighoek. At this stage in the project planning, mining of the pits on Rooderand, Witkleifontein and Ruighoek has not yet been scheduled. The life of mine for the other SPML related operations is estimated at 40 years for SPM and a minimum of 30 years for Magazynskraal (as per the respective EMPrs).

3.2.2.3 Operating hours

During construction, activities would take place during day time hours only. Construction facilities would be removed at the end of the construction phase (unless incorporated into the operational phase facilities).

The KELL plant, UG2 circuit and PGM retreatment plant would operate 24 hrs a day, comprising three shifts a day (06h00 to 14h00, 14h00 to 22h00, 22h00 to 06h00).

TABLE 3-3: LIST OF PROPOSED PROJECT ACTIONS / ACTIVITIES / PROCESSES

Main activity/process	Sub-activities	Construction	Operation	Decommissioning	Closure
Site preparation	Removal of existing structures where required.	At start of phase			
	Establishing construction contractor's area within existing footprints.	At start of phase			
Earthworks	Bulldozing, trenching and preparing foundations.	On-going			
Civil works	General building activities and erection of structures (using scaffolding and cranes).	On-going			
	Concrete work.	On-going	For maintenance		
	Steel work (including grinding and welding).	On-going	For maintenance		
	Electrical work.	On-going	For maintenance		
Changes to mineral processing operations (see Section 3.2.3 for further detail)	UG2 milling and flotation for SPM ore.		On-going		
	Hydrometallurgical processing.		On-going		
	Final product storage and handling.		On-going		
Tailings management (see Section 3.2.4.3 for further detail)	Tailings from KELL process combined with tailings from PPM and disposed of onto existing TSF via existing pipelines.		On-going		
Water supply and use	Use of existing supply within existing capacities (from Magalies Water).	On-going	On-going	On-going	
Power supply and use	Use of existing supply within existing capacities (from Eskom and emergency diesel generator plant).	On-going	On-going	On-going	
Stormwater management	Use of existing stormwater controls and capacities.	On-going	On-going	On-going	
Transport systems (see Section 3.2.8 for further detail)	Transport of construction material to site using existing road network.	On-going			
	Transport of staff to and from site (using buses, taxis and private cars) using existing road network and taxi and bus on- and off- loading areas for employees.	On-going	On-going	On-going	Limited
	Transport of supplies, services and waste removal (using trucks and vans) using existing road network.	On-going	On-going	On-going	Limited
	Vehicles/machinery movement within the site boundary (via existing gravel roads)	On-going	On-going	On-going	

Main activity/process	Sub-activities	Construction	Operation	Decommissioning	Closure
Transport systems cont. (see Section 3.2.8 for further detail)	Delivery of coal and chemicals to the plant using existing road network.		On-going		
	Transport of product off-site using existing road network.		On-going		
	Transport of product off-site via helicopter using existing helipad.		On-going		
Non-mineralised (general and industrial hazardous) waste management (see Section 3.2.4.3 for further detail)	Storing and handling waste at the relocated waste storage and handling area.	On-going	On-going	On-going	
	Additional treatment of sewage at the upgraded treatment plant.	On-going	On-going	On-going	
	Disposal of sewage sludge by a contractor at a hazardous landfill site.	On-going	On-going	On-going	
	Re-use of treated sewage sludge for rehabilitation purposes (future use, in consultation with DWS).		On-going	On-going	
Site support services	Use of existing site support services.		On-going	On-going	
Storage and maintenance services/ facilities	Use of existing maintenance services and facilities.		On-going	On-going	
	Storage of coal in covered bunker within the KELL plant building.		On-going		
	Storage of KELL process chemicals within the KELL plant building.		On-going		
	Additional storage of flotation reagents		On-going		
Site management	Appointment of contractors and workers.	At start of phase and on-going	At start of phase and on-going		
	Site management (monitoring, inspections, maintenance of facilities, security, access control) as part of overall site management of the plant.	On-going	On-going	On-going	On-going
	Environmental awareness training and emergency response dealing with project-specific aspects.	On-going	On-going	On-going	
	Implementing and maintaining management plans.	On-going	On-going	On-going	
Demolition	As part of overall demolition of the plant.			On-going	
Rehabilitation	As part of overall rehabilitation of the plant.			On-going	
Maintenance and aftercare	As part of overall maintenance and aftercare of the plant.				As required

3.2.3 CHANGES TO THE MINERAL PROCESSING OPERATIONS

The existing mineral processing operations at PPM comprise a silicate (Merensky-Pseudo reef) section and a UG2 section to cater for the different reefs being mined. The processing operations at PPM incorporate the following main components:

- run of mine (ROM) crushing and screening;
- dense media separation (DMS) for a proportion of the silicate ores;
- DMS waste storage;
- milling and flotation circuits (one UG2 ore circuit and one Merensky ore circuit);
- Merensky (silicate) concentrator plant;
- UG2 concentrator plant;
- tailings storage;
- chemical storage, mixing and dosing systems; and
- final concentrate storage and loading facilities.

The UG2 concentrator has the capacity to process 90 000 tonnes ROM per month, whereas the silicate plant can treat 315 000 tonnes ROM per month. The main purpose of each plant is to produce platinum group element (PGE) concentrate. Filter cake from the flotation concentrate is vacuum filtered on site and then transported by road off-site to a third party smelting facility.

The concentrator plant produces between 4 000 and 5 000 tons of concentrate per month.

The proposed project would incorporate the following additional facilities and processes:

- UG2 milling and flotation section;
- hydrometallurgical plant for the extraction of PGMs and base metals from the flotation concentrate; and
- a modular tailings re-treatment plant for the extraction of PGMs.

Further detail on each component is provided in the sections below.

3.2.3.1 UG2 milling and flotation section

An additional UG2 milling and flotation section is planned to enable the processing of ore from the Sedibelo Platinum Mine on the farm Wilgespruit 2 JQ. This allows for the sharing of existing services.

The additional UG2 milling and flotation circuit would have a production throughput of approximately 65 000 tonnes per annum and would be a duplication of PPM's existing UG2 circuit. The circuit would be constructed within the existing processing plant footprint, adjacent to the current UG2 circuit (Figure 3-1). The additional UG2 circuit would include primary milling and flotation.

Feed from the additional mill feed silo would be fed into the additional primary mill where it would be ground to form a dense slurry. As the slurry exits the mill, it would pass over a screen and spray water would be added. The underflow would pass to the mill discharge sump. The primary milling area would be equipped with two spillage pumps.

In the flotation process, the minerals that the platinum group metals are associated with attach to bubbles of air and are thus separated from the slurry of milled ore. Reagents (same to those used in the current circuit) would be added to the mill slurry. The flotation steps would include two rougher flotation steps and several cleaner flotation steps. After the rougher flotation steps, the slurry would be disposed of as tailings. The concentrate would be upgraded in the cleaner flotation steps. The concentrate would then be passed to the existing concentrator building at PPM.

The flotation circuit would be equipped with dedicated spillage pumps.

Reagents required for the process are discussed in Section 3.2.4. Tailings would be handled as outlined in Section 3.2.4.3 below.

3.2.3.2 Hydrometallurgical plant

The hydrometallurgical plant would treat the concentrate generated from the flotation circuits.

The proposed plant would be designed to process 110 000 tonnes of concentrate per annum of which the PPM plant would likely provide approximately 50% of this capacity, with the additional capacity coming from the planned Sedibelo Platinum Mine when it's commissioned.

The main facilities would include:

- a coal storage bunker;
- chemical stores; and
- a hydrometallurgical (KELL) plant with air abatement equipment,

The hydrometallurgical plant would follow the KELL process and would replace the need to transport concentrate to off-site smelting and base metal refining facilities (Figure 3-3). The hydrometallurgical plant would utilise oxygen (O_2) and sulphuric acid (H_2SO_4) in a sulphate leach extraction process to extract PGMs and base metals from the flotation concentrate and chlorine gas (Cl_2) and hydrochloric acid (HCl) in a chloride leach extraction process to extract PGMs and gold.

The hydrometallurgical process will generate the following products:

- nickel cathode and cobalt concentrate;
- copper cathode;
- PGM and gold sponge concentrate.

The nickel cobalt concentrate and copper cathode will be sold to third parties. The PGM and gold concentrate will be transported to an off-site precious metals refinery for the extraction of the various precious metals or sold to third parties.

With reference to Figure 3-3, three waste streams would be produced and combined with the current concentrator tailings and co-disposed onto the existing TSF, namely:

- neutralised solids from the sulphate based leach process;
- tailings from the chloride extraction process; and
- an iron based tailings from the precious metal recovery circuit.

Further detail on the tailings material is included in Section 3.2.4.3.

3.2.4 STORAGE OF RAW MATERIALS / CHEMICALS

3.2.4.1 Flotation reagents

A raw material off-loading area and reagent store are located in the plant area. Reagents include depressants, a collector, a frother and a flocculent. Storage is on concrete floors in closed vessels or bags. The chemical off-loading, storage and process facilities cater for containment in the form of bunding to 125% of the largest possible volume spill in the area with adequate sump and pump systems. These facilities would be extended to cater for a 20% increase in raw materials needed for the additional UG2 milling and flotation circuit.

3.2.4.2 Coal storage and handling

Coal would be required as a heat source for the KELL process. Approximately 25 tons of coal would be used by the plant per day. Storage of coal on site would be in a covered bunker within the KELL plant building, with a storage capacity of approximately 150 tons. From the storage bunker the coal would be transported to the plant using a conveyor system.

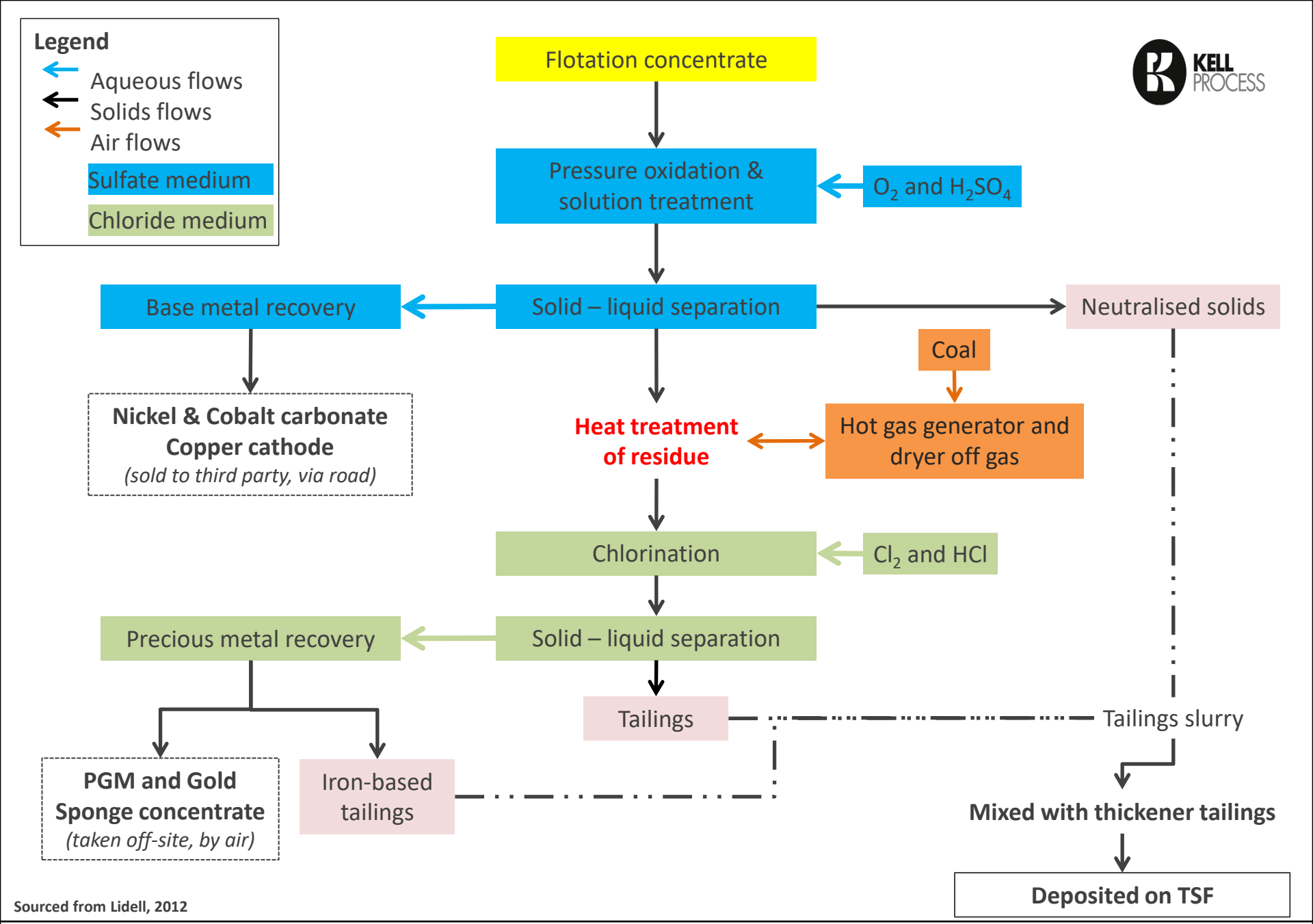


FIGURE 3-3: SCHEMATIC DIAGRAM OF THE PROPOSED KELL PROCESS

3.2.4.3 Chemical storage for the KELL process

A number of process chemicals for the KELL process require storage on site. These materials are considered to be dangerous goods. The combined capacity of dangerous goods stored on site would be less than 500 m^3. Materials requiring storage on site together with the proposed storage method are outlined in Table 3-4.

TABLE 3-4: EXPECTED STORAGE AND HANDLING OF PROCESS MATERIALS

Substance	Storage method
Oxygen (O_2)	Storage tanks
Sulphuric acid (H_2SO_4)	Liquid – In storage tank(s)
Chlorine gas (Cl_2)	Storage tanks
Hydrochloric acid (HCl)	Liquid – In storage tank(s)

All dangerous goods would be stored in bunded areas on impervious floors with a capacity to contain 125% of a spill. Emergency spill kits would be used to clean up spills outside of bunded areas.

3.2.5 TAILINGS MANAGEMENT

A single tailings storage facility (TSF) is located adjacent and west of the PPM mineral processing operations (Figure 3-1). Tailings material which is currently deposited on the TSF originates solely from the Tuschenkomst open pit. As part of the proposed project, tailings would be generated by the additional UG2 milling and flotation circuit established to support ore from SPM as well as the KELL process. Tailings from the KELL process would be combined with the PPM tailings at a ratio of approximately 1:99 before being deposited on the PPM TSF.

It is estimated that tailings from the additional UG2 circuit and KELL process would increase the tailings deposition rate by up to 65 000 tons per month. Based on a review undertaken by the TSF design engineers, the PPM TSF has a remaining capacity of approximately 55 million tonnes. This equates to a remaining life of approximately eight years when taking into account safety and stability requirements (Epoch, 2019). When the capacity of the PPM TSF is reached, tailings would be deposited on one of SPML's TSFs.

While there may be a change in the nature of a small portion of the tailings stream (5 000 tons per month from the KELL process), the geochemistry assessment by Solution H+ has determined that this will not change its geotechnical characteristics (see Section 6.4.1.1) (Epoch, 2019).

In terms of the NEM:WA Waste assessment regulations (Regulation 635 of 2013), the combined KELL and PPM tailings and current PPM tailings fall within the same waste type (Solution H+, 2019).

3.2.6 NON-MINERALISED WASTE MANAGEMENT

The existing non-mineralised waste management activities at PPM comprise sewage treatment and storage and handling of general and hazardous waste.

The proposed project will incorporate the following:

- upgrading of the existing sewage treatment plant; and
- relocation of the waste storage and handling facility from inside the plant to an area outside the plant.

Further detail on each component is provided in the sections below.

3.2.6.1 Upgraded sewage management

The sewage treatment plant on site is designed to treat 120 m^3 per day using an activated sludge reactor system to facilitate biological nutrient removal. It is proposed that the current plant be upgraded to treat an

additional 30 m^3 per day. The proposed upgrade will not change the existing sewage treatment plant process.

The sewage treatment plant consists of an inlet works, surge basin, activated sludge reactor, clarifier tank, sludge drying beds, filtration and disinfection facilities. Screenings consisting of any items that are mistakenly flushed into the sewage system are screened out at the entry to the sewage plant, stored in sealed containers and disposed in accordance with PPM's waste management procedure. Filtered sewage water from the filtration section is disinfected with chlorine using a gas chlorinator (maintaining a residual chlorine level of 1mg/l) and the treated water is pumped back to the concentrator plant for re-use. Dry sludge from the sludge drying beds is removed by a contractor for disposal at an off-site hazardous landfill site (Holfontein). PPM is planning to engage with the DWS to consider the re-use of the sludge as part of rehabilitation of the TSF.

Storage and handling of chlorine on site is in a locked store room in compliance with SABS 0298:1999 Code of Practice.

The plant is operated by a sewage plant contractor. The sewage plant is registered as a Class D facility.

3.2.6.2 Relocated waste storage and handling facility and waste management system

The general and hazardous waste storage and handling facility located within the boundaries of the plant would be relocated to an area outside the plant. The facility would need to adhere to the requirements of the Norms and Standards for Storage of Waste, 2013 and the National Norms and Standards for the Sorting, Shredding, Grinding, Crushing, Screening or Bailing of General Waste, 2017.

Domestic and industrial waste generated during construction and operations would be managed within the above waste management system at PPM and in accordance with PPM's waste management procedure (see Section 27). The types of waste and methods of storage are expected to be the same as the current operations.

3.2.7 PROCESS AND STORMWATER MANAGEMENT

The proposed project would be established within the boundaries of the existing process water and stormwater management system. Existing stormwater controls include:

- Diversion of clean water runoff away from plant infrastructure areas;
- Diversion of dirty water runoff to dirty stormwater dams; and
- Containment of dirty water runoff in stormwater dams for reuse as far as possible.

No new stormwater infrastructure is planned or deemed necessary by the specialist (SLR, 2019b).

3.2.8 ADDITIONAL TRANSPORT REQUIREMENTS

Existing access and transport routes would be utilised. These include the P54-1 (west of the mine) and the R510 (east of the mine), which are connected by the P50-1. The main access road to PPM would be used for the proposed project. No additional access points would be required.

Internal haul roads would be used for transporting ore from the SPM to the additional UG2 milling and flotation circuit. The existing ore conveyor systems would be expanded to link the additional milling circuit to the current circuit. Pipelines would be established to and from the PGM retreatment plant.

Currently, between 4 000 and 5 000 tons of PGM concentrate and approximately 5 000 tons of chromite concentrate per month is transported off site by 30-ton trucks for further processing. Approximately 750 people work at the mine over a 3 x 8 hour shift day and make use of private vehicles and taxis.
An outline of the expected changes in traffic volumes is given in Table 3-5 below.

TABLE 3-5: EXPECTED CHANGES IN TRAFFIC VOLUMES AS A RESULT OF THE PROJECT

Items to be transported		Transport mechanism	Expected changes in traffic volumes
Group	Specific		
Construction			
Staff	Skilled, semi-skilled and unskilled	Private vehicles / taxis / buses	Additional 95 return trips per day
Equipment and structures	Plant equipment, steel	30 to 50 ton trucks	60 to 100 return trips over the 18 to 24 month construction period
		20 to 25 ton articulated trucks	3 to 4 return trips over the 18 to 24 month construction period
	Mobile cranes	20 to 100 ton trucks	4 on site (at peak)
Supplies, construction materials, waste	Contractor trucks	3 to 6 ton trucks	3 to 4 return trips per week
Operational			
Staff: Operational	Skilled, semi-skilled and unskilled	Private vehicles / taxis / buses	Additional 49 return trips per day
Raw materials and waste	Plant chemicals	30-ton trucks or tankers	1 / week
	Coal	30-ton trucks	Addition of 5 return trips per week
	Spares, consumables, waste removal	10 to 30 ton trucks	Within existing trips for the mine
Final product	PGM concentrate	50 ton trucks	Decrease of 4 return trips per day (as concentrate would be transported to KELL plant and not off site)
	Nickel and cobalt carbonate	30 ton truck with trailer (if trailer required)	Addition of 1 return trip every two weeks
	Copper cathode		Addition of 1 return trip every week
	Precious metals	Helicopter	Addition of 1 to 2 flights every week

At the existing community brick making project, customers collect bricks from the site. The project contributes approximately three heavy/light vehicle return trips per day.

3.2.9 WORKFORCE AND HOUSING

The construction phase workforce is expected to be approximately 70 skilled and 300 unskilled people. The operational phase workforce associated with the proposed project is expected to be approximately 70 skilled and 70 unskilled people.

Given the technical nature of the KELL process, PPM's intention is to upskill and transfer existing employees from the concentrator operations to the hydrometallurgical plant. The positions that become available within the concentrator operations would then be used to provide new employment opportunities.

Workers would be sourced from local communities as far as possible and therefore would have their own housing facilities. No housing is planned for the project.

3.2.10 SECURITY AND ACCESS CONTROL

Due to the nature of product that will be produced by the hydrometallurgical plant, additional security measures would be established around the hydrometallurgical plant. This includes a security perimeter with dedicated access control and security.

3.2.11 COMMUNITY BASED PROJECTS

With reference to Figure 3-1, community based projects have been established at PPM's operations. At the request of the DMR these have been included in this report. The projects are outlined below.

- An aggregate crusher and brick making project (6800 m^2 or 0.68 ha) is located next to the DMS stockpile area located on the farm Tuschenkomst 135 JP. DMS material is sorted into sizeable aggregates to produce approximately 8 000 bricks per annum. This is facility is located in an area allocated for the approved DMS stockpile.
- A vegetable garden and nursery (4 000 m^2 or 0.4 ha) is located near the stormwater control dam at the PPM TSF on the farm Witkleifontein 136 JP. The nursery will provide the necessary plants species for rehabilitation of the mine as and when required. As part of the vegetable garden, an organic composting project has been established. The compost is used as fertilizer.
- A car wash bay is located adjacent to the existing sewage treatment plant. Water is recycled from the PPM plant. Grey water from the car wash bay is captured by the mine's existing dirty water control systems.

3.2.12 DECOMMISSIONING AND REHABILITATION

Decommissioning of project infrastructure would form part of the overall decommissioning of the mineral processing plant complex. The PPM mineral processing complex (excluding the KELL plant) would be decommissioned once mining of the SPML's mineral resources are complete. Although the life of the KELL plant and its infrastructure has been designed for a minimum 40-year operational life as assessed in this report, with scheduled maintenance and ongoing equipment replacement/upgrades, it is likely the KELL plant would operate for a significantly longer period. The duration of the KELL plant would ultimately be subject to market economy drivers.

Broadly speaking, the decommissioning phase of the plant would include the removal of infrastructure from site and the rehabilitation of areas. Rehabilitation of disturbed areas will be aligned with the closure objectives for PPM (see Section 28).

Building on the closure objectives and of relevance to the mineral processing plant, the rehabilitation plan aims to (GCS, 2016):

- prevent erosion;
- ensure that all areas are free-draining and non-polluting;
- establish vegetation cover allowing the area to be used for light grazing or wilderness; and
- monitor and manage alien plant invasion on the site.

The rehabilitation plan will be implemented concurrently while the mine is in operation to ensure that the rehabilitation work required during the closure phase is minimized. This will also allow for studies and trials to be conducted while the mine is in operation so as to allow for amendments to be made to the rehabilitation plan where necessary (GCS, 2016). In this regard, PPM has initiated revegetation trials to inform the sustainability of any rehabilitation works.

The short term and long term rehabilitation objectives applicable to the project are as follows (GCS, 2016):

Short term objectives:

- Demolish and remove all infrastructure, as per the closure plan, that will not be handed over to the surrounding communities;

Long term objectives:

- Stable landforms that blend into the surrounding environment;
- Return of native flora and fauna;
- Landforms that allow for the desired land uses; and
- Ensure no negative residual impacts are present.

The rehabilitation plan is a living document and will be reviewed and updated on an on-going basis as part of PPM's financial provisioning.

4 POLICY AND LEGISLATIVE CONTEXT

In accordance with the EIA Regulations 2014 (as amended), all legislation and guidelines that have been considered in the EIA process must be documented. In addition to the specific environmental management acts discussed in Section 3.1, Table 4-1 below provides a summary of the applicable legislative context. Legislative requirements specific to each specialised area are outlined in the respective specialist reports included as appendices to this report.

TABLE 4-1: LEGAL FRAMEWORK

Applicable legislation and guidelines used to compile the report	Reference where applied	How does this development comply with and respond to the policy and legislative context
Mineral and Petroleum Resources Development Act (No. 28 of 2002) (MPRDA) and Regulations	Table 1	PPM is applying for a Section 102 in terms of the MPRDA.
Regulation 632 of 24 July 2015 (as amended) in terms of NEM:WA regarding the planning and management of residue stockpiles and residue deposits from a prospecting, mining, exploration or production operation	Section 3.2.5	These regulations have informed the planning and management of tailings arising from the proposed project.
Regulation 635 of 23 August 2013 in terms of NEM:WA: National Norms and Standards for the Assessment of Waste for Landfill Disposal	Section 3.2.5	These regulations have governed the waste type assessment methodology used for the project.
Regulation 704 of 1999 in terms of the NWA	Sections 3.2.7	These regulations have informed the planning and management of stormwater arising from the proposed project.
Public participation guideline in terms of NEMA (2017)	Section 6.2	This guideline has informed the public participation process.
Guideline on need and desirability (2017)	Section 5	This guideline has informed the consideration of the need and desirability aspects of the proposed project.
National Environmental Management: Biodiversity Act (No. 10 of 2004) (NEM:BA) and related regulations, databases, guidelines, strategies	Section 6.4.1.5	Biodiversity was taken into account as part of project planning.
Conservation of Agricultural Resources Act (No. 43 of 1993) (CARA)	Section 6.4.1.5	Biodiversity was taken into account as part of project planning.
National Heritage Resource Act (No. 25 of 1999)	Section 6.4.1.11 and 27	Heritage has been taken into account as part of project planning.
National Atmospheric Emission Reporting Regulations in terms of the National Environmental Management: Air Quality Act (No. 39 of 2004)	Section 27 and 29	PPM is registered on the National Emissions Inventory System.

5 NEED AND DESIRABILITY OF THE PROJECT

The DEA guideline on need and desirability (GN R891, 20 October 2017) notes that while addressing the growth of the national economy through the implementation of various national policies and strategies, it is also essential that these policies take cognisance of strategic concerns such as climate change, food security, as well as the sustainability in supply of natural resources and the status of our ecosystem services. Thus, the over-arching framework for considering the need and desirability of development in general is taken at the policy level through the identification and promotion of activities / industries / developments required by civil society as a whole. The DEA guideline further notes that at a project level (as part of a BA process), the need and desirability of the project should take into consideration the content of regional and local plans, frameworks and strategies.

5.1 SECURING ECOLOGICAL SUSTAINABLE DEVELOPMENT AND USE OF NATURAL RESOURCES

The expansion of the PPM mineral processing operations would optimise the processing of the mineral resources at PPM, maximising the extraction and recovery of PGMs and base metals. The proposed changes to the mineral processing operations would be located within existing disturbed footprints within the existing plant boundary thereby minimising the loss of additional areas to other land users and related aspects of soils, biodiversity and land use. Processing of Sedibelo ore at the PPM plant optimises the use of the existing mineral processing facilities and related shared services minimising the footprint of the SPML's operational footprint in the short term. Water and power needed for the project would be sourced from the mine's existing allocations and capacity; no additional capacity would be needed reducing the demand on the related natural resources.

In terms of the Bojanala Platinum District Municipality's Environmental Management Framework (EMF) (CEM, 2018), PPM and the proposed project is located in Zone C, Development Zone III (Mining). The PPM mine falls within an area of moderate hydrological, biodiversity and agricultural potential. Mining activities within Zone C should as far as possible be confined to Zone C, be conducted in a sustainable manner, avoid wetlands/aquatic features/high or sensitive biodiversity areas/sensitive topography areas and follow the guidelines in the EMF if they are within a biosphere buffer zone.

Given that the project will not increase the footprint of the plant, potential impacts on biodiversity have been considered from a general disturbance perspective. The findings of the assessment indicate that potential impacts associated with the proposed project can be mitigated to an acceptable level with the implementation of design control measures and mitigation measures (refer to Appendix D for the detailed assessment). Of importance to the project are the isolated ridges, surrounding the existing plant, and the non-perennial Motlhabe River, downstream of the TSF and plant, which are considered sensitive ecological environments. These are important for achieving a final end land use of a wilderness area which would be incorporated into the heritage park corridor. The Motlhabe River is also used by the local community when in flow. No wetlands/aquatic features/high or sensitive biodiversity areas/sensitive topography areas would be disturbed by the project. Specific mitigation measures are outlined in the EMPr (Section 27). In addition there are no biospehere buffer zones near to PPM and the project site.

5.2 PROMOTING JUSTIFIABLE ECONOMIC AND SOCIAL DEVELOPMENT

Community/society priorities are officially expressed through public documents including the provincial and municipal growth and development strategy and spatial development framework documents. In this regard, the Bojanala Platinum District Municipality's Integrated Development Framework (IDP) 2017/2022 notes that the district is located along the Merensky Reef, which accounts for the district municipality being the leader in the production of PGMs and mining being the biggest employer in the district. The IDP also notes that the tourism industry plays a major role in the economy of the district due to the number of public and private game parks including the Pilanesberg National Park and Sun City in the Moses Kotane Local Municipality (BPDM, 2016). As a predominantly rural area, the IDP for the district municipality aims to respond to the objectives set by the National Development Plan 2030 to ensure that the rural areas are turned into vibrant

economies, while urban development is also supported, by channelling spinoffs from sectors such as mining, manufacturing and infrastructure development to optimally grow the district's agriculture, culture and tourism sectors, and reduce poverty, unemployment and inequality. Supporting this, the Moses Kotane Local Municipality IDP 2018/2019 has identified strategic objectives in order to provide a way to measuring progress towards the ideals of the national and provincial government. This includes creating an environment which is conducive to economic growth, instilling an attitude of ownership for development, and developing socially integrated, safe and healthy communities (MKLM, 2018).

The expansion of the PPM mineral processing operations will result in continued positive socio-economic impacts. PPM already contributes to the national South African economy. The proposed project would optimise the processing of the mineral resources at PPM thereby extending the life of the processing facility. This would sustain the current operational workforce and increase the operational phase workforce by approximately 140 employees. 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 spending power of employees (refer to Appendix D for the detailed assessment).

Given the technical nature of the KELL process, PPM's intention is to upskill and transfer existing employees from the concentrator operations to the hydrometallurgical plant. The positions that become available within the concentrator operations would then provide new employment opportunities. With this, current employees and new employees are afforded the opportunity to further their education through the skills development plan, which is part of the mine's social and labour plan (SLP) (PPM, 2015). In addition, supplementary plans to enhance the socio-economic benefits of the mine are also in place, including a career progression plan, a mentorship plan and internships and bursaries. In addition to these social development plans, the mine also has in place an Employment Equity Plan and targets relating to historically disadvantaged South Africans (HDSAs) (PPM, 2015).

Employment and economic development has the potential to improve livelihoods of individuals living in the local area through increased disposable income for individuals and households and the flow of revenue into local services and support sectors. The degree to which this impact would benefit local people and communities depends on the number of new opportunities realised locally and the manner in which income is used to benefit households and individuals.

The community based projects, such as the nursery, vegetable garden and composting facility, waste storage and handling facility, car wash and brick-making facility have direct social development and employment benefits for the relevant communities. These projects together with the mine's SLP allow for local economic development (LED) that is aligned with the BBKTA Master Plan and the IDP of the MKLM.

Due to the expectation of employment associated with mining-related projects there is a potential for negative socio-economic impacts to occur (refer to Appendix D for the detailed assessment). In this regard, an influx of job seekers to an area may in turn increase pressure on existing communities, housing, basic service delivery and raises concerns around safety and security. Management actions to manage and remedy these impacts include the implementation of a health policy on HIV/AIDs and tuberculosis, working together with local and regional authorities to address social service constraints and to monitor and prevent the development of informal settlements. In addition to this, formal communication structures and procurement procedures are required (refer to Section 27 for further detail pertaining to socio-economic related management actions).

In addition to the above, PPM is committed to contributing to the ecotourism objectives for the area.

6 MOTIVATION FOR THE PREFERRED DEVELOPMENT FOOTPRINT ON THE SITE INCLUDING THE PROCESS FOLLOWED TO DEFINE THE PREFERRED DEVELOPMENT ALTERNATIVES

6.1 DETAILS OF THE DEVELOPMENT FOOTPRINT CONSIDERED

This section describes land use or development alternatives that have been considered for the proposed project and the consequences of not proceeding with the proposed project.

6.1.1 LOCATION OR LAYOUT ALTERNATIVES

For the mineral processing facilities, no location or layout alternatives were considered as mineral processing related infrastructure would need to be placed within and adjacent to the footprint of existing facilities to allow for the sharing of support services (offices, security etc.) and support infrastructure (workshops, stores, water reticulation and electricity etc.). In addition to this, the hydrometallurgical plant would generate a product of high commercial value and has to be located within a highly secure area. The identified site for the hydrometallurgical plant is therefore in an area within the existing plant which is highly visible and is within close proximity to the existing security control points and main office block.

For the waste storage and handling facility, a site outside of the plant within an already disturbed area was identified by PPM as the preferred site. No other alternatives were considered.

For the training centre, two alternative sites were considered by PPM. These included a site outside of the plant within an area earmarked for the chrome recovery plant and the George Stegman Hospital in Moruleng. The George Stegman Hospital in Moruleng was chosen by PPM as the preferred site as this would provide easier access to the community. Therefore the training centre would no longer be established at the mine.

6.1.2 TECHNOLOGICAL ALTERNATIVES

Conventional technologies would be used for the UG2 milling and flotation section and tailings re-treatment plant. No alternate technologies were considered.

The hydrometallurgical plant would be based on a new processing technology, the KELL process, which is the preferred technology for PPM. The key technical features of the KELL process include (Lidell, 2012):

- three main sequential operations, each well proven and commonly utilized;
- very high recoveries of precious metals (Pt, Pd 98-99% Rh 90-95%) and base metals (generally >95%) achieved on all types of concentrates tested;
- separate leaching of the precious metals and base metals chemistries allowing for leach optimization;
- fast leach kinetics (30 min for base metals, 30 min/stage for PGMs);
- optimized selection of materials, e.g. no chlorides in BM leach autoclave;
- positive response to changes in metal variation in concentrate;
- regrind of concentrate is generally not required, saving the high cost of ultra-fine milling;
- selection of PGM and base metal products to suit client requirements.

The KELL process offers an alternative to the conventional platinum smelting and base metal refinery technologies currently being utilised in the South African platinum mining industry. This is considered further under the No-go alternative below.

6.1.3 THE NO-GO ALTERNATIVE

The assessment of this option requires a comparison between the options of proceeding with the project with that of not proceeding with the project. Not proceeding with the project would result in the mineral

processing operations at PPM remaining unchanged. This is discussed further below for each of the main project components.

For the UG2 circuit, if the circuit is not established at PPM it would be established as part of SPM's approved mineral processing plant. This alternative would require a new plant similar to that of PPM's being established on an adjacent property together with the services and infrastructure needed to support such a plant. Processing of Sedibelo ore at the PPM plant optimises the use of the existing mineral processing facilities and related shared services minimising the footprint of the SPML's operational footprint in the short term. By establishing the additional circuit at PPM's existing plant, the use of the PPM plant and existing services and infrastructure is optimised, minimising the footprint of the SPML's operational footprint and minimising additional potential impacts on the environment in the short-term.

For the hydrometallurgical plant, the alternative would be to continue transporting concentrate off-site for processing at conventional smelting and base metal refining facilities. With regards to greenhouse gas (GHG) emissions and the GHG emissions assessment completed by PPM, conventional smelting and refining produces approximately 1 500 kg of carbon dioxide equivalent (CO_2e) per tonne of PGM concentrate, compared with 433 kg CO_2 per tonne for the KELL process. The main reason for this difference is the lower electricity consumption by the KELL process. Given the above, in the current scenario, the off-site GHG impact from conventional smelting and refining is most likely about three times higher than the on-site impact from the KELL process. Given that GHG emissions are considered on a global scale, the potential cumulative impact associated with the proposed project will therefore result in a significant improvement from the current scenario where concentrate is smelted and refined using conventional methods (Integro, 2019).

In summary, when compared to conventional smelting and base metal refining, the KELL process has the following benefits (Lidell, 2012):

- 50 % reduction in total energy consumption;
- 84 % reduction in electrical energy consumption;
- 76 % reduction in energy consumption costs;
- 70 % reduction in CO_2 emissions; and
- 92 % reduction in installed electrical power requirement.

The above does not take into account carbon emissions from the off-site transportation to off-site smelters, which due to the reduced transport requirements would further reduce carbon emissions when compared to the current operations.

6.2 DETAILS OF THE PUBLIC PARTICIPATION PROCESS FOLLOWED

A public participation process was undertaken to inform the EIA process. This section provides a description of the engagement process with interested and affected persons (I&APs) followed during the course of the EIA process. Supporting documentation is included as appendices.

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 I&APs. Key stakeholders identified for the project include:

I&APs:

- landowners, land occupiers and land users on and surrounding SPML properties;
- nine doorstep communities including Lesetlheng, Lekutung, Lekgraal/Bofule, Ramasedi, Ntswana-le-Metsing, Motlhabe, Ngweding, Magalane and Magong;
- Bakgatla ba Kgafela tribal authority;
- ecotourism and conservation areas including the Pilanesberg National Park and Black Rhino Game Reserve;
- mines and industries in the area;

- downstream water users;
- non-government organisations and associations including the Federation for a Sustainable Environment (FSE);

Regulatory authorities:

- North West Department of Rural, Environment and Agricultural Development (DREAD) (previously the Department of Economic Development, Environment, Conservation and Tourism);
- Department of Mineral Resources (DMR);
- Department of Water and Sanitation (DWS) (previously the Department of Water Affairs);
- Department of Agriculture, Fisheries and Forestry (DAFF)
- South Africa Heritage Resource Agency (SAHRA);
- Department of Rural Development and Land Reform (DRDLR) (previously the Department of Land Affairs);
- Department of Public Works, Roads and Transport (DPWRT);
- North West Parks and Tourism Board (NWPTB) (including the Heritage Park Committee);

Local authorities:

- Moses Kotane Local Municipality (MKLM);
- Bojanala Platinum District Municipality (BPDM); and
- relevant ward councillors.

Parastatals:

- Eskom; and
- Magalies Water.

The I&AP database for the project is included in Appendix B. The database is updated on an on-going basis throughout the EIA process.

6.2.1 Public Participation Process undertaken during Scoping

The objective of the scoping public participation process was to notify I&APs about the proposed project and EIA process, provide a reasonable opportunity to register on the project database and to provide comments. Steps undertaken during the Scoping Phase are in Table 6-1 below. Supporting documentation is included in Appendix B.

TABLE 6-1: PUBLIC PARTICIPATION PROCESS UNDERTAKEN DURING THE SCOPING PHASE

Task	Description	Date
Notification - regulatory authorities and IAPs		
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.	June 2012
Landowner notification	The landowners (represented by the DRDLR) were informed in writing.	December 2013
Distribution of the background information document (BID)	A BID was compiled and distributed by email and hand-delivery to I&APs and authorities on the project's public involvement database. The purpose of the BID was to inform I&APs and authorities about the proposed project, 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 I&APs with an opportunity to submit their names, contact details and comments on the project. *(At the time that the BID was compiled, the project scope included the second UG2 milling and flotation circuit, hydrometallurgical plant as well as tailings and chrome recovery facilities. Subsequent to this the project scope changed to include an upgrade to the existing sewage treatment plant, additional waste storage facility, training centre, as well as a number of community based initiatives, namely the aggregate crusher and brick*	March 2014

Task	Description	Date
	making project, composting area, nursery, vegetable garden, waste handling area and car wash. I&APs were notified of the change in project scope in the Scoping Report and Scoping Report summary document.)	
Site notices	Site notices in English and Setswana were placed at key conspicuous positions in and around the project area.	March 2014
Newspaper advertisements	Block advertisements were placed in the Rustenburg Herald, Daily Sun and Sowetan.	March 2014
Loud hailer	Loud hailing took place in the villages where the scoping meetings were to be held to serve as a reminder to community members.	March 2014
SMS notification	SMS notifications were sent out to IAPs registered on the project database to inform IAPs about the scoping meetings to be held.	March 2014
Scoping stage meetings and comments received		
Public scoping meetings	Public scoping meetings were held as follows: • a meeting with the Bakgatla-Ba-Kgafela Tribal authority on 19 March 2014; • nine public scoping meetings were held in doorstep communities between 7 and 11 April 2014. These doorstep communities are Lesetlheng, Lekutung, Lekgraal/Bofule, Ramasedi, Ntswana-le-Metsing, Motlhabe, Ngweding, Magalane and Magong (Motlhabe and Lesetlheng cancelled their meetings); • a scoping meeting was held with Black Rhino Game Reserve (7 April 2014); and • a scoping meeting was held with the Federation for a Sustainable Environment (FSE) (8 May 2014). A presentation was given at each meeting that provided basic information on the project and the environmental process being followed. The same presentation was given at all of the scoping meetings. The meetings were therefore focussed on: • informing IAPs about the proposed project; • informing IAPs about the stakeholder engagement process and how IAPs can have input into the process; • providing information about the baseline environment and obtaining input thereon; • providing information about the potential impacts of the project and obtaining input thereon; and • providing an opportunity for IAPs to raise issues and concerns. These issues and concerns were used to inform the Plan of Study for the EIA Phase.	March – May 2014
Regulatory authority scoping meeting	A regulatory authority meeting was held at the mine on 21 May 2014, and was attended by DMR, DWS and DAFF. 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.	May 2014
Review of scoping report		
Public review of scoping report	Copies of the scoping report were made available for public review from 18 May to 2 July 2015 at the following places: • Villages immediately surrounding the project area, including Lesetlheng; Legkraal; Ramasedi; Ntswana-le-Metsing; Motlhabe; Ngweding; Magalane; Magong; Lekutung; • Bakgatla-Ba-Kgafela traditional offices in Moruleng (Saulspoort); • Moses Kotane Local Municipality in Saulspoort; • Rustenburg public library; • Black Rhino Game Reserve; • Pilanesberg Platinum Mine; • SLR's offices in Johannesburg; and	May – July 2015

Task	Description	Date
	• electronically on a CD, on request. Summaries of the report were hand delivered (to community representatives) or e-mailed to I&APs and authorities that are registered on the public involvement database. In addition, IAPs were notified when the draft Scoping Report was available for review via SMS.	
Authority review of scoping report	Copies of the scoping report were made available for regulatory authority review from 18 May to 2 July 2015.	May – July 2015
Comments received	Comments made during meetings and written received from I&APs have been collated into an Issues and Concerns Report (see Section 6.3).	On-going

6.2.2 PUBLIC PARTICIPATION PROCESS UNDERTAKEN DURING EIA PHASE

This EIA and EMPr provides opportunity for I&APs to comment on the proposed project and findings of the EIA process. Steps undertaken during the EIA Phase are summarised in Table 6-2 below.

TABLE 6-2: PUBLIC PARTICIPATION PROCESS DURING THE EIA PHASE

Task	Description	Date
Review of the EIA and EMPr	The EIA and EMPr was made available for a 44-day (6-week) review and comment period from **18 March to 07 May 2019** (excluding the Easter period and public holidays). Copies of the report were made available on the SLR website and at the following public venues: • Bakgatla-Ba-Kgafela traditional offices in Moruleng (Saulspoort); • Pilanesberg Platinum Mine; • Moses Kotane Local Municipality in Saulspoort; • Rustenburg public library; • SLR's offices in Johannesburg. Copies of the report were made available electronically on a CD, on request. Summaries of the report were e-mailed to registered I&APs and authorities. In addition, I&APs were notified when the report was available for review via SMS. A notification advertisement was also placed in the Daily Sun and Sowetan on 18/19 March 2019 and the Rustenburg Herald on 20 March 2019. A public open day took place on 04 April 2019 in order to provide I&APs an opportunity to interact with the SLR and PPM project team and provide comments on the outcome of the EIA process and related EIA and EMPr. In addition community feedback meetings were scheduled where possible. Minutes of the open day and community meetings are included in Appendix B.	March to April 2019
Submission of EIA and EMPr for decision-making	Following closure of the commenting period, all comments received have been incorporated and responded to in a Comments and Responses Report. Where required the EIA and EMPr have been updated to address comments received. The report including I&AP comments will be submitted to the DREAD for consideration and decision-making. The same report will be submitted by PPM to the DMR in support of the S102 application.	May 2019
I&AP notification of decision	After the DREAD and DMR have reached a decision, registered I&APs will be notified of the outcome of the application, the reasons for the decision and details of the appeal process.	DREAD decision: Expected to be within 107 calendar days from submission to DREAD. DMR decision: Expected to be within 180 working days from submission to DMR.

6.3 SUMMARY OF ISSUES RAISED BY I&APS

All views, issues and concerns raised throughout the EIA process have been captured into the Comments and Responses Report (see Appendix C). The full comments submitted are included in Appendix B and are summarised below.

Proposed project:

- objections to the project;
- the stakeholder engagement process, including potential stakeholder fatigue;
- a lack of communication between communities and the BBKTA, as well as between communities and the mine;
- land ownership issues;
- increase in life of mine (i.e. the processing facilities) and resultant increase in duration of impacts;
- land use issues pertaining to the potential loss of grazing land and the need for community relocation;
- issues relating to rehabilitation and end land use;
- air quality concerns regarding whether the plant expansion will result in increased emissions and the potential for health impacts;
- waste related issues pertaining to the waste resultant from the amendments to the processing plant;
- surface water quality and quantity issues;
- groundwater quantity and quality issues;
- increase in disturbing noise levels;
- additional visual impacts resulting from lighting in particular, as well as the changes to the TSF;
- impacts on graves and preservation of cultural and heritage resources;
- traffic issues relating to potential increased traffic volumes and road safety; and
- negative socio-economic issues relating to the influx of people and associated access to basic needs (sanitation etc), and the lack of employment opportunities and benefits to local communities. Requests were also made for local community members to be upskilled in order to be employed on the mine.

Current operations:

- dust emissions and issues pertaining to dust suppression;
- clarification on the pit extension and resultant increase in life of mine;
- disturbing noise levels as a result of the mining operation;
- relocation of farmers on Wilgespruit 2 JQ and Magazynskraal 3 JQ, as well as the process that will be followed;
- disturbance of grazing land and compensation;
- rehabilitation of open pits once mining has ceased;
- blasting damage to third party infrastructure;
- traffic issues and road safety;
- mistrust and/or lack of communication between communities and PPM, as well as between communities and the BBK; and
- socio-economic issues such as employment of local people, benefits to local communities, skills development.

6.4 ENVIRONMENTAL ATTRIBUTES ASSOCIATED WITH THE PROJECT AND ALTERNATIVES

All project-related infrastructure and associated activities would be undertaken within PPM's existing operational footprint. Environmental attributes within these footprints have already been altered by mining-related facilities and/ or activities. Community based projects have mainly been established within PPM's plant complex, except the vegetable garden and nursery which has been established immediately adjacent to the TSF's return water dam.

For the purposes of providing context and background, this section provides baseline information on relevant environmental (geographical, physical, biological, social, economic, heritage and cultural) aspects associated with the proposed project. These environmental aspects provide the basis from which to understand potential impacts, including cumulative impacts, associated with the proposed project. Information in this chapter has been sourced from the approved EIA and EMPr for the mine (Metago, 2007) and subsequent amendments (where relevant), specialist studies undertaken as part of this EIA process (where applicable) and site visits by the SLR project team. Data collection methods are outlined in the specialist reports included as appendices to this report.

6.4.1 BASELINE ENVIRONMENT

6.4.1.1 Geology

The geology of a particular area can influence a number of aspects of the environment. Of relevance to the proposed project is the link to the presence and quality of groundwater and the movement of the groundwater in the rock strata as well as the potential for acid generation and/or leaching of parameters at concentrations higher than applicable water quality limits. A description of the geology in relation to these is provided below.

a. Regional geology

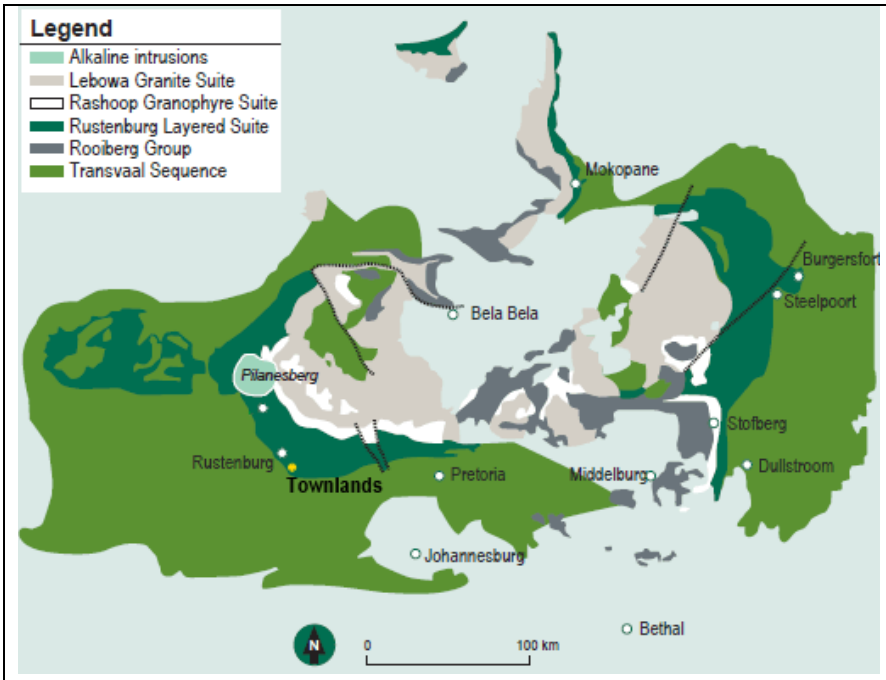
PPM is situated in the Western Limb of the Bushveld Igneous Complex (BIC), a layered igneous complex where platinum group elements (PGE) are currently mined as a primary product (Metago, 2007). The ultramafic/mafic rocks of the BIC are collectively referred to as the Rustenburg Layered Suite (RLS) (Figure 6-1A). The RLS is divided, from the lower to the upper layers, into the Marginal (M), Lower Zone (LZ), Critical Zone (CZ), Main Zone (MZ) and Upper Zone (UZ) (Figure 6-1B). The Critical Zone is the host to all chromium and Platinum Group Metals (PGM) mineralisation within the Bushveld Igneous Complex (Solution H+, 2019).

b. Local geology

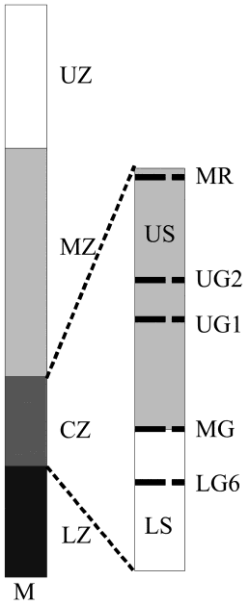
Reefs associated with the mine include the UG2 and Merensky reefs. The mine is located just to the north-west of the prominent Pilanesberg Complex (Figure 6-1). The Pilanesberg Complex is an alkaline syenite-rich intrusive complex containing rare foyaite and lava tuff. Associated with the Pilanesberg Complex is fluoride which influences the groundwater quality. The Pilanesberg Complex is intruded into the gabbro norite and anorthosite of the BIC. The Bushveld rocks to the north of the Pilanesberg complex are overlain by quaternary sediments and sand, between 20 and 40 m thick. These alluvium zones are expected to form localised perched aquifers or zones of higher recharge (along drainage channels) (Metago, 2007).

c. Structures

The geology is fractured and intruded by dykes that follow the weaker areas in the rock units. 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. A regional structure known as the Frank Fault has been identified from drilling and aerial geophysics. This fault transects the geology and displaces up to 1 000 m in places. This structure is located some 6 km west of the existing Tuschenkomst open pit and extends for more than 25 km in an approximate north-south orientation (Metago, 2007).



A – GEOLOGICAL MAP OF BIC



B – STRATIGRAPHY OF BIC

Source: Harck, 2018

FIGURE 6-1: MAP AND STRATIGRAPHY OF THE BUSHVELD IGNEOUS COMPLEX

d. Geochemistry

As part of the 2007 EIA process (Metago, 2007), geochemical tests were conducted on relevant pilot tailings samples. The acid rock drainage potential was assessed using the Acid Base Accounting (ABA) tests. Based on the review of sulphur species concentrations, carbonate values, the acid and neutralising potentials, the tailings samples were classified as having a low neutralising potential with the sulphide content being below the quantification limit. The results of the ABA testing indicated that the tailings materials should not be acid generating.

As part of the proposed project, geochemical tests were conducted on KELL tailings and supernatant, PPM tailings and supernatant, a composite sample of KELL and PPM tailings and a composite sample of KELL and PPM supernatant, where applicable. The supernatant is representative of the contact water that would seep from the TSF footprint. Testwork included ABA, mineralogical testing, leachate testing and geohydraulic characterisation.

The results of the testwork concluded that the geochemical characteristics of the combined KELL and PPM tailings, comprising a combination of current PPM tailings and tailings from the KELL process (expected to be at a ratio of 99:1) and the seepage quality of the combined KELL and PPM tailings, would:

- be non-Potentially Acid Generating (non-PAG) (same as the current PPM tailings);
- have higher salinity due to increases in concentration of major ions, particularly Ca and SO_4, since the combined KELL and PPM tailings contain significantly more gypsum ($CaSO_4 \cdot H_2O$) than the current tailings;
- pose a potential environmental risk due to nickel (Ni) concentrations (that is, Ni exceeds the SANS 241 health guidelines at source, based on geochemical modelling) during the operational and post-operational (drainage) phase; and
- be similar to the predicted PPM tailings seepage quality during the post-drainage (closure) phase.

In addition, the permeability of the combined KELL and PPM tailings would be similar to the current tailings; the seepage volume would not change significantly (Solution H+, 2019).

This information has been used to inform groundwater modelling of potential contamination impacts and the remaining capacity of the PPM TSF.

6.4.1.2 Climate

Various aspects of climate influence the potential for environmental impacts and related project design. Of relevance to the proposed project are those aspects that influence air dispersion and related dust control, rehabilitation planning and surface water and groundwater management. An overview of climatic data used to inform the modelling and prediction of impacts, and planning of management measures is provided below. Detailed information is provided in the referenced specialist studies.

a. Regional climate

PPM falls within the Highveld Climatic Zone. Of the mean annual precipitation, 85% falls during summer thunderstorms. The thunderstorms generally occur every three to four 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 (SLR, 2012).

b. Rainfall and evaporation

Rainfall for the site was considered from available South African Weather Services (SAWS) and Department of Water and Sanitation (DWS) stations. The data indicates a mean annual precipitation (MAP) of 592 mm. This MAP falls within the expected range of rainfall for an area such as the Pilanesberg where the elevated topography increases total rainfall (SLR, 2019b).

Evaporation records show a mean annual evaporation of 1 532.2 mm (SLR, 2019b). Average evaporation figures exceed average rainfall figures by 940 mm. These high evaporation figures indicate that the area is a water deficit area.

When considering the duration and frequency of storm events, available data shows that the 1:50 year and 1:100 year 24-hour storm intensities of 151.5 mm and 169.2 mm, respectively, are close to the largest 1 day rainfall event recorded in 78 years, which was 145.8mm (SLR, 2019b). This data has been used to inform stormwater management requirements for the project.

c. Temperature

Minimum, maximum and average temperatures for PPM, for the period 2013 to 2015 (using modelled meteorological data), indicate temperatures ranging from 1.1°C (in winter) to 34.6°C (in summer). Average temperatures were in the region of 19.5°C (Airshed, 2019a).

d. Wind and atmospheric stability

The prevailing wind direction is from the eastern sector. Very little airflow is recorded from the west. Strong winds are experienced during the day from the east and north, with a decrease in the wind velocity during the night time. No change in the wind direction is reflected during the night with the prevailing winds remaining to be from the east. There is an increase in the number of calm conditions during the day; from 10.7% (night-time) to 13.5% during the day (Airshed, 2019a).

During the summer months, stronger winds are recorded from east and east-northeast. The autumn and spring months show a similar pattern to summer months with prevailing winds from the eastern sector. A high percentage of calm conditions (wind speeds <1 m/s) is reflected during the autumn months. During spring and winter months an increased frequency of strong winds are observed from the south-east and south-southeast (Airshed, 2019a).

In general wind speeds are below 5.2 m/s and are not able to lift dust particles from the ground, however this is dependent on the material type as fine dust and dust that is already airborne can be carried by wind speeds of less than 5.2 m/s (Airshed, 2019a).

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 (Airshed, 2019a).

6.4.1.3 Topography

The topography of a particular area determines a number of factors including the flow of surface water, and in many cases, also groundwater; the type of biodiversity and land use; the aesthetic appearance of the area and climatic factors such as wind speeds and direction.

The topography of the area is characterised by a combination of flat plains and isolated rocky outcrops. PPM's activities take place within the flat plains, with the ground sloping gently towards the north-west. A number of drainage lines cross over these plains, draining in a northerly direction.

The average elevation at PPM is 1 100 metres above mean sea level (mamsl). The isolated rocky outcrops to the north and south lie at elevations of between 1 197 and 1 266 mamsl. To the south of the mine is the Pilanesberg National Park and associated hills that vary between 1 330 and 1 534 mamsl (Metago, 2007).

Open pit mining activities, waste rock dumps and the TSF have altered the local topography and natural drainage patterns. Project related activities are planned to take place within these altered landscapes.

6.4.1.4 Soils and land capability

Soils are a significant component of most ecosystems. Soil forms found within the vicinity of the plant and TSF area are predominately highly structured, relatively shallow soils with a high clay content (turf soils) which allows for high water retention. These soil forms are not highly erodible but are susceptible to compaction. Typically, the agricultural potential of these soils is limited by their high clay content. The pre-mining land capability of the soils in the vicinity of the plant and TSF is classified as wilderness or low intensity grazing potential (Metago, 2007).

Soils and the related land capability within the footprint of PPM's operational areas have been disturbed through the development of the mine and related operations on site. Project related activities are planned to take place within these already disturbed areas.

6.4.1.5 Biodiversity

In the broadest sense, biodiversity provides value for ecosystem functionality, aesthetic, spiritual, cultural, and recreational reasons. Biodiversity and ecosystems influence soils, food and fuel supply, shelter and building materials, water, atmospheric gases, climate and weather, pests and diseases and genetic resources.

a. Vegetation type

The proposed project is located within the Savannah Biome and features one main vegetation type, namely the Dwaalboom Thornveld. 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 approximately 6% is statutorily conserved, mostly within the Madikwe Game Reserve, north of PPM (Metago, 2007).

Pre-mining habitats of relevance to the proposed project are summarised below.

- **On Tuschenkomst 135 JP**: Flat savanna with large rocky outcrops/hills. Low lying areas disturbed by excessive cattle grazing. A non-perennial watercourse (a tributary of the Mothlabe) bisects the farm.
- **On Witkleifontein 136 JP**: Mostly flat open savanna with black turf soils. A small pan, an ephemeral watercourse system and a number of rocky outcrops. Excessive cattle grazing evident.

The rocky outcrops/hills host pockets of vegetation associated with the Dwaalboom Thornveld which has been categorized as the Mabeskraal Ridge Bushveld. Provincially these areas are considered one of the critically important habitat types of the province (NW DACET, 2003). It is a very limited vegetation type, restricted to a few ridges and hills in a vast plain with clay soils (SLR, 2012).

Transformed areas comprising previously cultivated fields and built-up areas do occur within the broader area (Metago, 2007).

b. Floral and faunal species

The ecological characteristics and occurrence of flora and fauna is influenced by PPM's close proximity to the Pilanesberg National Park. Commonly occurring floral species within the Open Acacia Savannah are diverse, ranging from ferns and succulents to grasses, sedges, forbs, shrubs and trees. This is typical of the savannah biome.

A wide range of faunal species have been recorded in the area although the diversity and abundance has been influenced by anthropogenic activities (Metago, 2007). A number of protected red data and conservation important faunal and floral species occur within the area and have been identified during various specialist studies undertaken for PPM. These include mammal, bird, reptile and invertebrate species. The Near-Threatened Natal Long-fingered Bat and Giant Bullfrog have been identified in areas surrounding the mine (Figure 6-2). The previously identified bat habitat has been impacted by third party (non-PPM) mining operations (PPM personal comms.).

A limited number of alien species were identified within PPM's mining right area. In general, the area does contain a threat of further bush encroachment by species such as *Dicrostachys cinerea* (Sickle Bush)*, Acacia karroo* (Sweet Thorn) and *Acacia mellifera* (Blackthorn Acacia).

c. Sensitive ecological environments

Watercourses, rocky outcrops and the Mabeskraal Ridge systems can be classed as sensitive ecological environments. These areas are considered important in terms of conservation significance and ecological sensitivity (Figure 6-2) (Metago, 2007).

d. Regional databases and guidelines

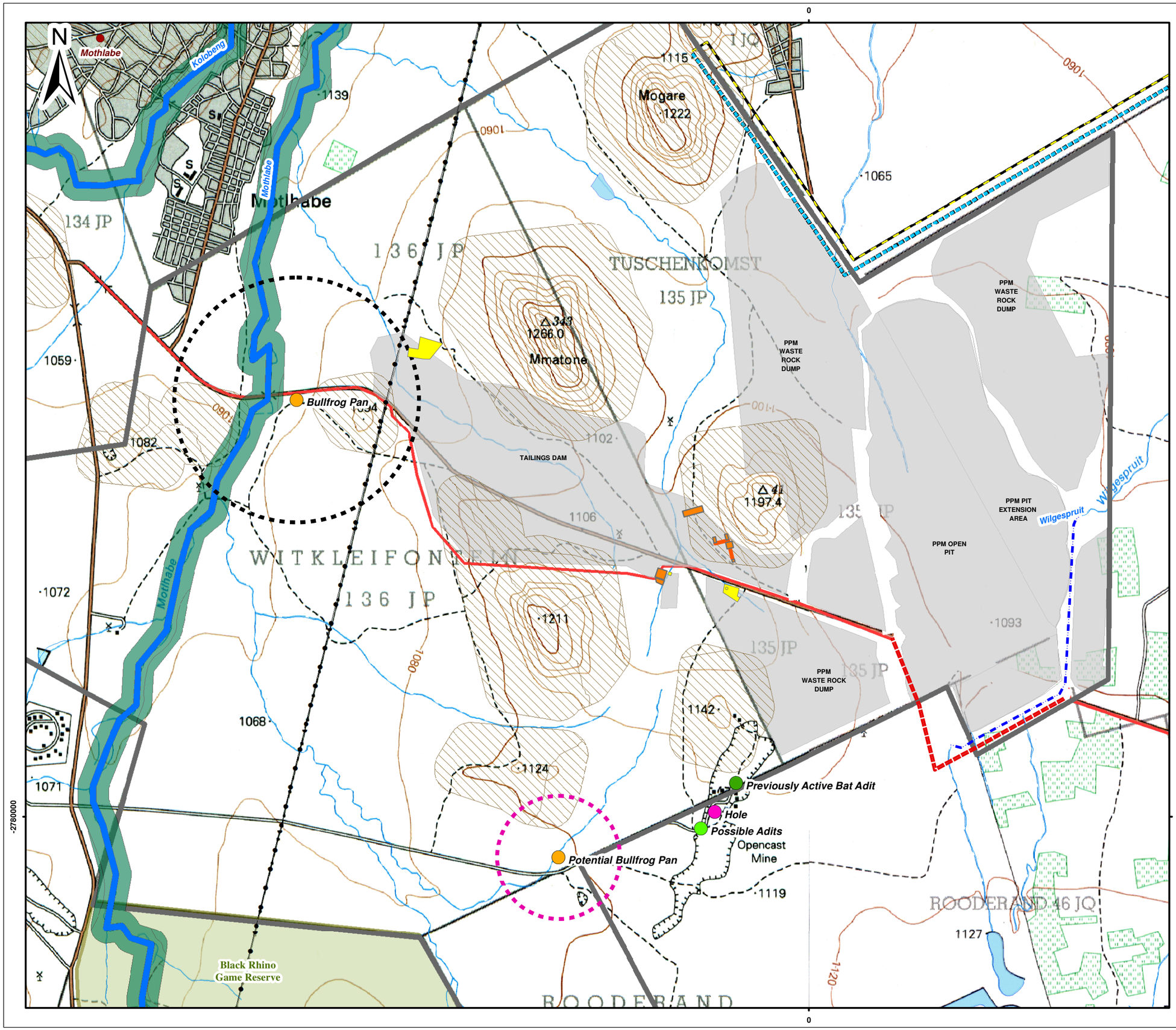
In terms of available databases and guidelines, and of relevance to the proposed project, the following is noted:

- In terms of the North West Conservation Plan (2015), a Category 2 Critical Biodiversity Area (CBA) is located to the north, south and west of PPM's mineral processing complex and TSF. Category 2 CBAs include near-natural landscapes where ecosystems and species remain largely intact and undisturbed; local biodiversity has immediate irreplaceability or some flexibility in terms of area required to meet Biodiversity targets; and the limit of Acceptable Change is being approached, but has not yet been surpassed. In a Category 2 CBA, 60 to 90 % of original vegetation / resources should remain intact following development.
- According to the Mining and Biodiversity Guidelines, the PPM mineral processing complex and TSF are located mainly in an area categorised as having high biodiversity importance. Downstream of the TSF and plant, a corridor along the Motlhabe River is categorised as having highest biodiversity importance. The guideline states that these areas are important for conserving biodiversity, for supporting or buffering other biodiversity priority areas, and for maintaining important ecosystem services for particular communities or the country as a whole.
- In terms of the National Freshwater Ecosystem Priority Areas (NFEPA) the Motlhabe is categorised as Class B: Largely Natural.

e. Aquatic environments

Aquatic environments exist along major drainage lines. Of relevance to the proposed project is the non-perennial Motlhabe River, approximately 1.5 km downstream of the TSF and 5 km downstream of the PPM plant. Flows in this stream are strongly seasonal, with the river being dry for most of the year. The most significant anthropogenic impacts in the catchment include impacts from cattle-watering during times when water is present. The riparian zone consists predominantly of a mix of grass and trees. A high potential for erosion is evident under high flow conditions as a result of the lack of cover by riparian vegetation and large areas of bare soil. Flow variability is considered to be the most important ecological driver in this system (Scientific Aquatic Services, 2018).

The bulk of PPM's infrastructure and activities is located within the flat open savanna. Development has also taken place at the base of rocky ridges located in close proximity to the mineral processing plant complex and TSF (Figure 6-2). Project related activities are planned to take place within these already disturbed areas.



Legend

- Towns / Villages
- Roads
- Powerline
- Proposed Infrastructure Changes
- Existing Community-Based Projects
- Pipeline from Tuschenkomst Reservoir to Sedibelo / Magazynskraal
- Magalies Water Pipeline
- Wilgespruit River Diversion
- P50-1 Diversion
- Watercourses
- Dams
- Pilanesberg Platinum Mine Mining Right Area & Related Infrastructure
- Pilanesberg National Park (including Black Rhino Game Reserve)
- NFEPA Rivers
- 100m River Offset
- Rocky Ridges / Habitats
- Minimum Bullfrog Habitat 500m Buffer
- Minimum Bullfrog Habitat 1000m Buffer

0 500 Meters

Scale: 1:30 000 @ A3

Projection: Transverse Mercator
Datum: Hartebeeshoek, LO27

PILANESBERG PLATINUM MINES (PTY) LTD

Figure 6-2

Sensitive Ecological environments in the Vicinity of the PPM Plant and TSF

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710.16002.00026 | 2019/03/11

6.4.1.6 Surface water

Surface water resources include rivers, drainage lines, paths of preferential flow of stormwater runoff and dams.

a. Catchment

PPM falls within the Limpopo Water Management Area (WMA) (formerly the Crocodile West and Marico WMA) with the major river catchment being the Crocodile River. The project site is located in the west of secondary catchment A2 (Crocodile), within quaternary catchment A24D (SLR, 2019b).

b. Local drainage

Drainage in the project area is influenced by the Pilanesberg mountain range and various smaller rocky outcrops. Drainage originates south of the PPM plant and TSF and flows in a northerly and north easterly direction towards the Motlhabe River. The Motlhabe River feeds into the perennial Kolobeng located approximately 2km north of PPM. The Kolobeng in turn flows into the perennial Bierspruit which then flows into the Lower Crocodile River to the west of Thabazimbi (Figure 2).

The plant and TSF are located in the headwaters of two tributaries of the Motlhabe River. These tributaries are non-perennial with a relatively flat grade. The TSF has been designed and developed as a valley dam between two hills at the top of the catchment of one of the tributaries. Flow from a tributary south of the plant has been diverted via a stormwater channel around PPM's plant and back into the tributary of the Motlhabe River. South of the plant, a clean stormwater dam has been established to control the flow of storm water along the stormwater channel (Figure 3-1) (SLR, 2019b).

c. Mean annual runoff

The mean annual runoff (MAR) for catchment A24D is 15.53 million m^3/annum. The footprint of the mineral processing plant and TSF is approximately 0.4% of the quaternary catchment (SLR, 2019b). Project-related infrastructure would be developed within PPM's existing operational footprint and within the boundaries of existing storm water controls and therefore not contribute to a loss in MAR.

d. Surface water use

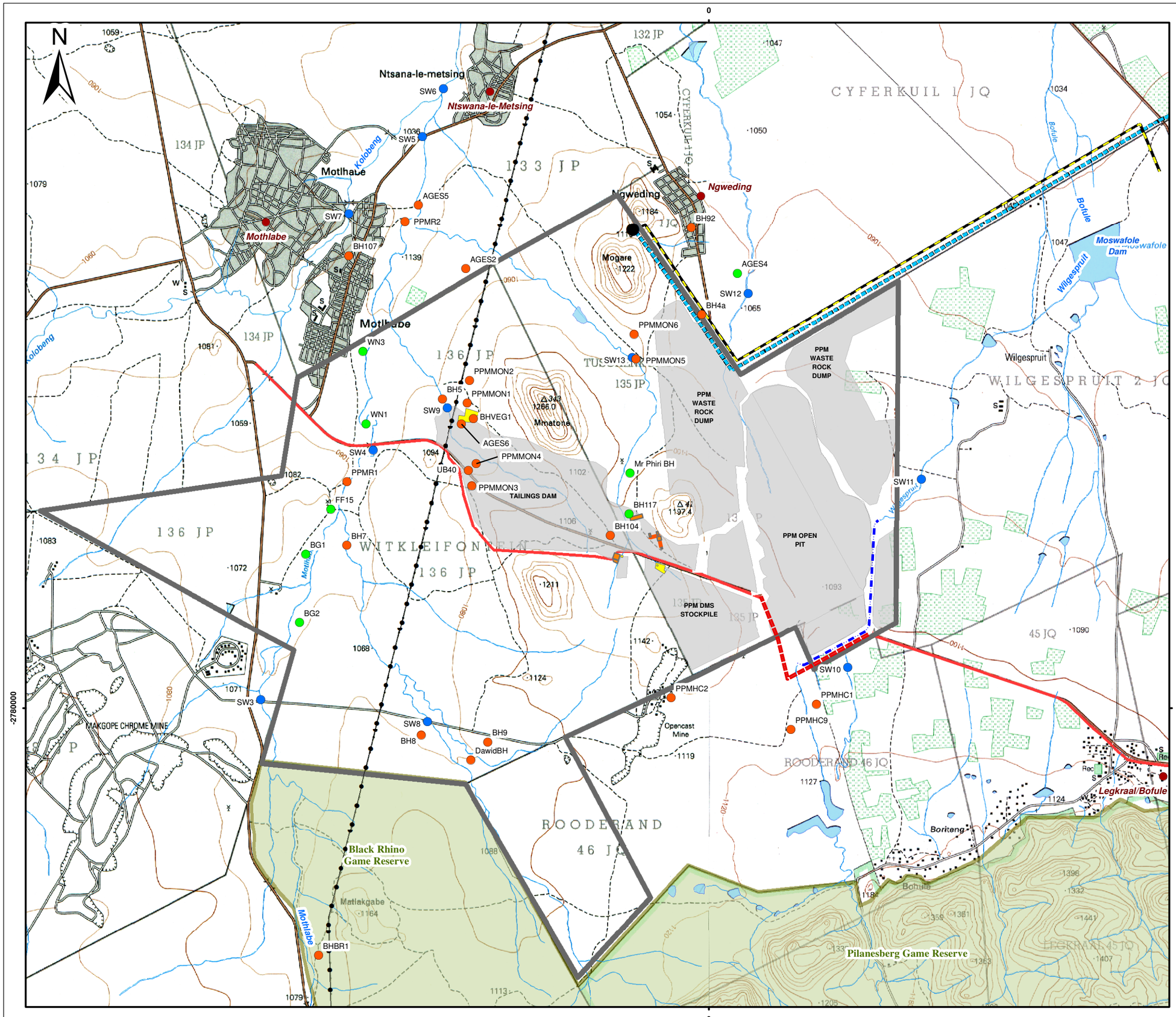
There is no significant reliance on surface water for community consumption because of the fact that the watercourses are dry for most of the year. This leads to higher stress being applied on groundwater as a resource due to the lack of sustainable surface water reservoirs being available (Exigo, 2017).

Aquatic ecosystem reliance is also expected to be limited due to the ephemeral nature of the flow in the streams (only for a few days following rain), however this does not negate the importance of surface water flow for certain species that rely on this limited flow (SLR, 2012).

e. Surface water quality

As part of the mine's monitoring programme, and of relevance to the proposed project, surface water is sampled from a point on the tributary of the Motlhabe, downstream of the TSF (SW9), and a point on the tributary of the Motlhabe, downstream of the plant and waste rock dump (SW13) (Figure 6-3). It should be noted that these two tributaries are non-perennial and therefore only sampled when water is present in the tributaries.

Water quality is compared to pre-mining baseline water qualities (although the baseline data is for the main Motlhabe River and not its ephemeral tributaries), PPM's water use license (WUL) limits and DWS' target water quality range (TWQR) for livestock watering.



Legend

- Towns / Villages
- Roads
- Powerline
- Proposed Infrastructure Changes
- Existing Community-Based Projects
- Water Reservoir
- Pipeline from Tuschenkomst Reservoir to Sedibelo / Magazynskraal
- Magalies Water Pipeline
- Wilgespruit River Diversion
- P50-1 Diversion
- Watercourses
- Dams
- Pilanesberg Platinum Mine Mining Right Area & Related Infrastructure
- Pilanesberg National Park (including Black Rhino Game Reserve)

Water Monitoring Points

- Surface Water
- PPM Monitoring Boreholes
- PPM Water Supply Boreholes

0 1 000 Meters

Scale: 1:48 000 @ A3

Projection: Transverse Mercator
Datum: Hartebeeshoek, LO27

PILANESBERG PLATINUM MINES (PTY) LTD

Figure 6-3

Water Monitoring Points at Pilanesberg Platinum Mine

SLR Consulting (Africa) (Pty) Ltd
P O Box 1596, Cramerview, 2060, South Africa
Tel: +27 (11) 467-0945 Fax: +27 (11) 467-0978

710.16002.00026 | 2019/03/11

When compared to the TWQR for livestock watering, water quality was within the TWQR for most of the monitoring period except for nitrite and electrical conductivity in 2009 (at SW9) and total dissolved solids (TDS) in April 2018 (at SW13). When compared to baseline water quality and WUL limits, water quality results indicate exceedances of a number of parameters. At SW13, exceedances are indicative of influence from the PPM waste rock dump. At SW9, At SW9, exceedances could be as a result of higher evaporation rates closer to surface thereby concentrating any monitored parameters (Exigo, 2019).

The proposed project is planned upstream of these tributaries and could contribute to surface water contamination issues.

6.4.1.7 Groundwater

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.

a. Groundwater occurrence

The geology of the area forms a number of hydraulic zones that are controlled by the lithological units, structural geology and surface water features. These zones include (Exigo, 2017):

- the perennial river aquifer (alluvial and weathered aquifer adjacent to the river);
- weathering and fracturing of the topographical low lying areas forming an important aquifer zone for the community water supply;
- fault and fracture zones forming major aquifers in the area;
- weathered norite/gabbro;
- fractured soil bedrock aquifer that underlies the weathered zone; and
- dolerites that act as flow impediments.

b. Aquifer characteristics

There are three possible types of aquifers within the project area as outlined below (Exigo, 2017):

- Minor aquifer: The aquifers in the greater study area are classified as Minor Aquifers, which denotes aquifers with yields of less than 1l/s.
- Minor to Major aquifer: The fractured systems within the larger Minor Aquifers could form Minor to Major Aquifer zones.
- Sole source aquifer: Some of the localised aquifers could be classified as sole source aquifers despite them being minor aquifers (even though some communities have or will have access to piped water from Magalies Water, some communities rely on groundwater alone for their basic water requirements).

c. Groundwater levels and flow

Pre-mining groundwater in the area sloped away from the Pilanesberg complex, from south to north. The local groundwater flow was influenced by the presence of non-perennial drainage streams, high ground associated with the Pilanesberg mountain range and localised borehole abstractions. There was a good correlation between the water level and the topography indicating that groundwater levels correlated to the contours of the land (Metago, 2007).

When comparing the average monitoring borehole water level for January 2018 to December 2018 to the average pre-mining baseline water level, an increase in water level of 1.28 m was observed (this excludes seepage capturing boreholes). Water level measurements downstream of the TSF from 2008, taking into account rainfall, indicate that the change in water levels downstream of the TSF is due to seepage from the TSF. Water level measurements at the plant and upstream of the TSF from 2008, taking into account rainfall, indicate that there is a steady source increasing water levels at the point. The source is unknown but is assumed by the specialist to be from within the plant (Exigo, 2019).

d. Groundwater quality

The historic pre-mining data indicated that the water quality in the area varied between Class I (good) and Class III (poor) when compared to the South African National Standard (SANS 241:2006). Class I is considered

to be acceptable for lifetime consumption, and is the recommended compliance limit. Class II is considered to represent drinking water for consumption for a limited period. This class specifies a water quality range that poses an increasing risk to consumer's dependant on the concentration of the determinant within the specified range. The overall water quality of the area was characterised by higher than average magnesium concentrations and high fluoride concentrations. The latter was expected due to runoff and groundwater through-flow from the neighboring alkaline complex of the Pilanesberg (Metago, 2007).

The pre-mining water in the study area had an overall Carbonate-Magnesium character indicative of recently recharged waters. This means that the groundwater was derived from recent surface water run-off. The carbonate character confirmed the high total hardness content of water in the area (Metago, 2007).

PPM has an on-going groundwater monitoring programme, implemented since 2008. Of relevance to the proposed project are monitoring points upstream of the TSF (at the plant) and downstream of the TSF. The following is noted (Exigo, 2019):

- The nearest community water supply borehole to the TSF is located in Mothlabe village. The water quality in 2018 complied with the SANS drinking water standards. Previous water quality results have shown elevated levels of nitrates likely due to pit latrines. Other community water supply boreholes are located to the north east of PPM's waste rock dump.
- Statistically significant increasing trends in nitrate and sulphate concentrations were observed at monitoring boreholes downstream of the TSF and upstream of the TSF (at the plant):
    - Upstream of the TSF: Parameters also included chloride and magnesium. None of the dirty water dams at the plant displayed similar water characteristics; it is therefore inferred by the specialist that leakages originating from the plant or pipes, or a possible combination of seepage sources might be contributing to the water quality deterioration observed.
    - Downstream of the TSF: Sulphate concentrations are expected to be due to a tailings plume emanating from the TSF and migrating in a westerly direction, as historically predicted by the groundwater flow model developed for the TSF. Nitrate concentrations might be linked to the TSF and fertiliser used at the nearby vegetable garden.
    - The concentration of seepage in terms of sulphate is higher than background levels but significantly lower than the SANS drinking water standard indicating a low risk to water quality.
- Seepage capturing boreholes are used to mitigate the migration of contamination from the TSF.
- A borehole belonging to a member of the local community is located approximately 450 m north from the plant stormwater dam, and in between the TSF and the PPM Waste Rock Dump. Water abstracted from this borehole is used for his cattle. The overall water quality of the borehole has shown variations in sulphate and nitrate concentrations. All samples taken from the borehole have complied with the TWQR limits for livestock watering.

e. Groundwater users

Boreholes are mainly distributed along perennial and non-perennial streams, local dykes and local faults. These are mainly concentrated to the western side of the Pilanesberg and existing PPM mine (Figure 6-3). Hydrocensus data collected and analysed by Exigo in 2012 and 2014 indicates that:

- more than half of the borehole sites (54%) were not in use at the time of the surveys;
- approximately 56% are used for monitoring and mostly for mining purposes;
- 29% of boreholes are used for domestic and livestock watering – this indicates that the significance of groundwater use for drinking water purposes in this area is less than expected and could be due to the development of new infrastructure which supplies piped water from municipal water supply and/or from the Magalies water scheme to the surrounding villages; and
- the remaining portion (15%) is for mining purposes such as dewatering and process water (it should be noted that water abstraction from boreholes for water supply stopped in December 2016).

6.4.1.8 Air quality

PPM falls within the Waterberg-Bojanala priority area (WBPA). The priority area was declared due to concerns of elevated atmospheric pollutant concentrations within the area. The dominant sectors with regards to major pollutants include industry, mining, residential, motor vehicles and biomass (Department of

Environmental Affairs, 2015). An overview of ambient air quality and potential receptors in vicinity of PPM's operations is provided below.

a. Ambient air quality

Source types present in the area include (Airshed, 2019a):

- stack, vent and fugitive emissions from mining and processing activities;
- vehicle tailpipe emissions;
- household fuel combustion;
- biomass burning (veld fires); and
- various miscellaneous fugitive dust sources (including agricultural activities, wind erosion of open areas, vehicle-entrainment of dust along paved and unpaved roads).

b. Emissions associated with PPM

Emissions from the current PPM mining and processing operations were quantified and simulated when the Air Quality Management Plan (AQMP) for PPM was compiled in 2016. Sources of particulate emissions from the current PPM operations include vehicle entrainment from unpaved roads, material handling of run of mine (ROM) in the pit and at the ROM stockpile, material handling of waste rock in the pit and at the waste rock dump, crushing and screening of ROM, wind erosion from the TSF, waste rock dump and other exposed area and drilling and blasting emissions. The main findings from the AQMP are summarised below (Airshed, 2019a).

- Simulated annual average PM_{10} concentrations exceeded SA NAAQS to the north west of the open pit, including at the southern edges of Ngweding.
- Simulated annual average $PM_{2.5}$ concentrations were in compliance with SA NAAQS at all sensitive receptor locations.
- Simulated dust fallout rates were in exceedance of SA NDCR limit for non-residential areas in the immediate vicinity of the mining and processing operations, but in compliance with the SA NDCR limit for residential areas outside the property boundary.
- Simulated NO_2 and SO_2 concentrations were in compliance with SA NAAQS for the entire study area.

c. Monitoring data

Monitoring data from PPM's air quality monitoring programme generally shows compliance with applicable limits for dust fallout, $PM_{2.5}$ and PM_{10}. Sampled dust fallout rates exceeded the national dust control limits at five monitoring sites during 2015. During 2016 and 2017 sampled dust fallout was in compliance with the limits at all sampling locations. Where exceedances of $PM_{2.5}$ and PM_{10} have been recorded, these were either caused by a veld fire (in 2016) or likely one-time events (in 2017) such as wild fires, activities very close to the sampling locations or high wind gusts (Airshed, 2019a).

d. Potential receptors

There are no permanent potential receptors inside the PPM mining rights boundary, but cattle herders do use the land inside the mining rights boundary for grazing purposes. Due to the nature of the surrounding land use (game reserves, livestock grazing and the Pilanesberg National Park), all areas outside the mining rights boundary including residential areas (mainly rural villages) are considered by the specialist to be sensitive to air emissions (Airshed, 2019a).

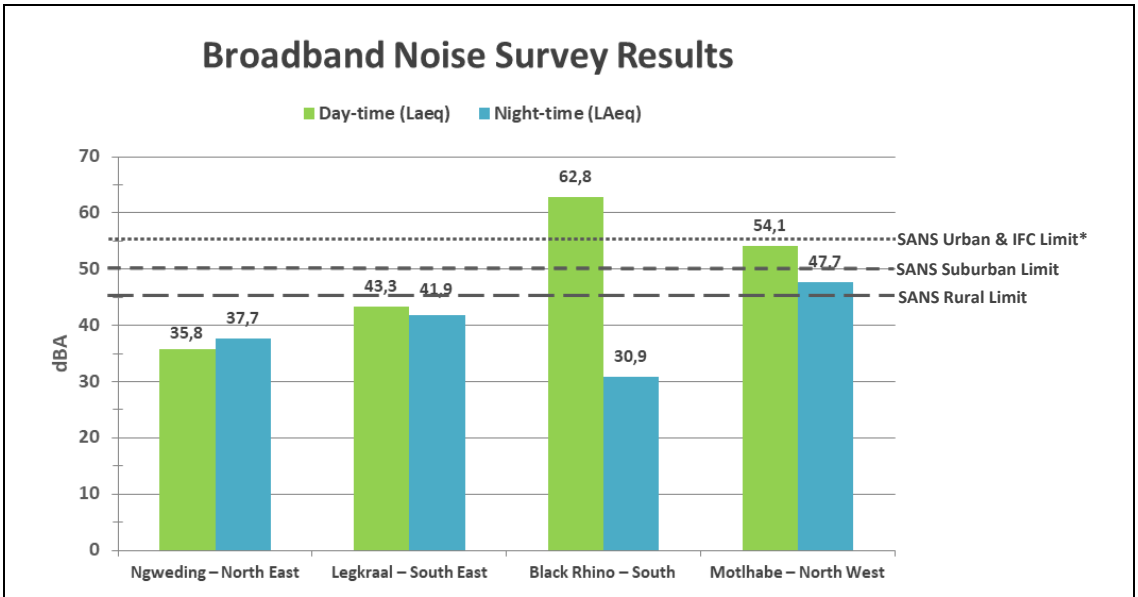
6.4.1.9 Noise

a. Ambient noise environment

Ambient noise levels were measured at Black Rhino Game Reserve to the south, Motlhabe to the north, Ngweding to the north-east and Legkraal to the south east in October 2015. The ambient noise survey captured all noise sources in the area including operational mining and mineral processing activities and community activities (Airshed, 2019b).

The daytime acoustic environment at all sampling locations was influenced by birds, insects, some livestock (goats) and local community activities (Figure 6-4A). At night, mining activities (specifically heavy mining vehicles) were audible at the Ngweding and Black Rhino Game Reserve sampling sites (Figure 6-4B).

With reference to Figure 6-4, the ambient noise levels fall within the range of rural to urban districts as defined by SANS10103 and the IFC noise level guidelines for residential, institutional and educational receptors (Airshed, 2019b).



Sourced from Airshed, 2019b

*IFC Limit is for Residential, institutional and educational receptors

FIGURE 6-4: NOISE SURVEY BROADBAND RESULTS (DAY- AND NIGHT-TIME)

b. Potential receptors

Potential noise receptors identified to be closest to PPM's mineral processing operations include Black Rhino Game Reserve to the south, Motlhabe to the north, Ngweding to the north-east and Legkraal to the south east. Eco-tourism receptors such as the Black Rhino Game Reserve and residential/educational receptors at Motlhabe, Ngweding and Legkraal are expected to be sensitive to changes to the ambient noise environment (Airshed, 2019b).

The pre-mining noise levels have been influenced by the development of the mine and related operations. Project related activities are planned to take place within the existing operational areas of the mineral processing plant and TSF.

6.4.1.10 Visual

In describing the visual landscape a number of factors are considered, including landscape character, scenic quality, sense of place and sensitive views. These are discussed below.

a. Landscape character

The landscape character of the study area is defined by relatively flat plains, punctuated by isolated hills 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. Some of these rocky outcrops have archaeological sites and artefacts of the late iron-age. Current land uses in and adjacent to the site is a combination of mining, grazing, crops, residential and general community activities. The various mining activities stretch in a general arc to the west and north-west of the PNP and can be seen protruding above the horizon line when viewed from residential and tourist areas. Their impact is especially evident at night

when the bright lights are noticeable against the otherwise dark night sky (Newton Landscape Architects, 2019).

b. Scenic quality and sense of place

Scenic quality, which is defined as the heightened visual experience derived from the view of natural and manmade elements of the visual environment, in the study area ranges from high to low as follows:

- high - these include the mountains and rocky outcrops, 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 mines (Newton Landscape Architects, 2019).

Although the PPM operational area, where the proposed expansion project is planned, is considered to have a low scenic quality, the flat savanna plains and treed hills are considered to have a moderate to high value. As a result the overall landscape character is considered to evoke an aesthetically pleasing scene with a strong sense of place. Key to these factors is that PPM (and the proposed project) is in close proximity to the PNP and within the proposed Heritage Park Corridor.

c. Views

Most views of the proposed larger and tall structures would originate in:

- the Black Rhino Nature Reserve (higher elevations);
- Pilanesberg National Park (through the “poort” access to the park);
- along the P5- road running past Legkraal; and
- R565 west of the project area.

Sensitive receptors have been identified by the visual specialist as tourists travelling through the study area and visiting the tourist attractions, including the Pilanesberg National Park and Black Rhino Nature Reserve, and heritage attractions, between Pilanesberg National Park and the Madikwe Game Reserve. Other potentially sensitive receptors include residents and visitors of the nearby villages, particularly Legkraal (Newton Landscape Architects, 2019).

The visual resource has been altered as a result of mining activities in the area. Project related activities are planned to take place within this altered landscape.

6.4.1.11 Traffic

a. Existing road network

There is an existing network of roads that provide access to PPM. These include:

- the regional P54-1 (running adjacent to the western boundary of the Pilanesberg National Park);
- the regional tarred R510 through Saulspoort (running adjacent to the eastern boundary of the Pilanesberg National Park);
- the gravel P50-1 that links the P54-1 and R510 (running along the southern boundary of the PPM operations;
- 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.

b. Traffic data

In order to gain a better understanding of the traffic patterns and movements adjacent to the PPM, manual traffic counts were conducted by a traffic specialist at the intersection of Road P50-1 and the PPM Mine Access Road (Siyazi, 2019). Traffic counts were conducted between 2012 and 2017 (Table 6-3).

TABLE 6-3: CHANGE IN TRAFFIC VOLUMES AT THE INTERSECTION OF ROAD P50-1 AND THE PPM MINE ACCESS ROAD

Date of traffic count	Total vehicles observed (13h00 – 17h00)	Approximate percentage change per annum from last traffic count
Friday 27th January 2012	226	-
Friday 28th March 2014	269	9.1% (increase)
Friday 1 December 2017	257	-1.5% (decrease)
Percentage change per annum from 2012 - 2017		2.64% (increase)

It is possible to conclude that (Siyazi, 2019):

- the increase in vehicle traffic volumes between the relevant traffic counts conducted in 2012 and 2014 was due to other chrome mining activities within the area; and
- vehicle traffic volumes increased slightly with 2.64% between 2012 and 2017 during the relevant hours that the manual traffic counts were conducted which is regarded as normal growth for background traffic within South Africa.

c. Pedestrian activities

Pedestrians were seen using the road network feeding to and from the mine.

6.4.1.12 Heritage, cultural and palaeontological resources

Project-related infrastructure will be developed within PPM's existing operational footprint. No heritage resources occur within this footprint (Pistorius, 2019).

The palaeontological study identified that the oldest rocks, the Magaliesberg Formation sandstones and quartzites, are more than 2100 million years old and represent the regressive shoreline of the Transvaal Basin. In some exposures of the Magaliesburg Formation trace fossils, trails, ripples, etc., generally known as microbially induced sedimentary structures (MISS) have been recorded. These trace fossils are evidence of the past presence of algae and bacteria in the shallow waters, but the organisms are not preserved. They are described as polygons or trails called Manchuriphycus. The site for development is predominantly overlain by the Quaternary sands, alluvium and calcretes. Sands and soils do not preserve fossils because of their aeolian or weathered nature. Very rarely fossils may be covered by aeolian dunes or cemented in pans and their immediate surrounds. No pans have been recorded for this site (Bamford, 2019).

6.4.1.13 Socio-economic profile

PPM is located within the North West Province in the Bojanala District Municipality and Moses Kotane Local Municipality. The mine is situated in a well-established semi-rural area and is surrounded by nine villages with a total population of approximately 12,471 (PPM, 2015).

In 2011, the most dominant industry contributing to the province`s gross domestic profit (GDP) was the mining industry with a contribution of about 33.6%. The next two largest contributing industries were the general government services and the finance sectors respectively. The least contributing industries were the Agriculture and Utilities industries with contributions of 2.10% and 1.40% respectively (PPM, 2015).

An analysis of the socio-economic profile of the area, using data from the 2011 Census, is outlined below (Table 6-4) (PPM, 2015). Locally, the census included the villages of Magong, Ngweding, Motlhabe, Legkraal and Lesetlheng.

TABLE 6-4: SOCIO-ECONOMIC PROFILE OF THE AREA

Aspect	Detail
Population	The total population at a village level equates to 4% of the municipal population. The profile of the local community compares well with that of the region, with an average of 3 people per household.
Employment	The greater part of the population within the province falls within the working age category (15

Aspect	Detail
	to 64 years). On average, 12% of the population within the province were unemployed at the time of the census. Approximately 4% of the economically active population were cited as discouraged job seekers which is indicative of job scarcity within the area. Similar trends are seen at a village level.
Individual monthly income	More than 40% of the individuals within the municipality receive a minimal monthly income of below R1600, while an average of 46% of the individuals did not receive any income at all during the time of the surveys. Similar trends are seen at a village level. This shows that secure and formal income on a monthly basis remains minimal within the North West Province and the surrounding municipal areas.
Education profile	Overall statistics at district and local levels indicate poor educational profiles. This results in a shortage of educated labour, which is a critical problem in the province, with more than 10% of the adult population having received either no schooling or only limited primary education. On average only 5% of the population in the province had completed primary education and a mere 4% were cited to have higher qualifications. In terms of the available skills within all industries in the provincial economy, finance for the extension of education and training will be essential to provide the skills required for a growing regional economy.
Dwelling type	The most dominant type of dwelling is the house/brick structure (80%) followed by informal dwelling such as shacks (ranging from 2% to 7% depending on whether they are situated in backyards or in informal settlements. There is a need for more housing infrastructure to curb the increase in informal settlements especially throughout the district municipality. Based on this it is clear that infrastructure in the surrounding areas is still a high priority.
Potable water access	The majority of households throughout the province and at a village level had access to piped water provided by the municipality. Only a small percentage (less than 5%) still gets water from the dam/pool/stagnant sources. The municipality must provide a source of water to the affected population such that the lack of water sources would not lead to health hazards.
Energy source used for cooking	An average of more than 70% of households has access to electricity for cooking purposes. Less than 20% of households use wood, paraffin and gas for cooking with a very small percentage of people using other means.
Energy source used for heating	An average of 73% of households has access to electricity for heating purposes. Less than 15% of households use wood, paraffin and gas for heating and with a small percentage of people using other means. An average 8% of households have no means of heating at all.
Energy for lighting	More than 90% of households have access to electricity for lighting purposes followed by candles (3%), then paraffin (<1%).
Toilet facilities	Basic services infrastructure appears to be less formalised with 42% of households in the province and 4% at a village level having access to flush toilets. The most dominant type of toilet facilities at the village level is the pit toilet which may be due to the fact that most households are in semi-rural areas.
Refuse removal	In the Moses Kotane Local Municipality a high average of 80% of the households in the area has their waste removed by the local municipality or private company once a week. When looking at the requirements for the area and Moses Kotane`s Municipal Services challenges as set out in their IDP's, provision of water and sanitation as well as infrastructure in the surrounding areas are being addressed as a high priority. On the other hand, at Province level, there is still more than 40% of households that has to use own means to remove refuse.

6.4.2 LAND USES

Although project related infrastructure will be developed within PPM's existing operational footprint, the establishment of additional infrastructure and changes to mineral processing activities has the potential to affect land uses in the surrounding areas (through direct or indirect positive and/or negative impacts). Surrounding land uses 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.

6.4.2.1 Mineral / Prospecting rights

The mining rights for platinum group metals (PGMs) and other base metals in the project area are held by PPM (DMR reference number NW 30/5/1/2/2//320 MR).

To the south of PPM's mining right, on the farm Rooderand 46JQ, mining rights are held as follows:

- Remaining extent of the farm: Sails Group for PGMs and chrome;
- Portion 1: Itereleng Bakgatla Mineral Resources (Pty) Ltd (IBMR) for PGMs and chrome; and
- Portion 2: Sails Group for chrome and Bakgatla/Anglo for PGMs.

Prospecting rights held within the surrounding area include

- Richtrau No. 123 (Pty) Ltd (NW 30/5/1/1/2/10723 PR and NW 30/5/1/1/2/1680 PR) for PGMs and other base metals on the farm Magazynskraal 3 JQ;
- Rise Africa Mining and Exploration (Pty) Ltd (NW30/5/1/1/2/2679PR) for vanadium ore on the farm Magazynskraal 3 JQ; and
- C&L Mining and Resources (Pty) Ltd (NW 30/5/1/2/2/10259 PR) for PGMs, gold, copper, nickel, chromium, cobalt, pyrite, lead, silver and zinc on the Remainder and Portions 1 and 2 of the farm Middelkuil 8 JQ, the farm Kruidfontein 40 JQ and the Remainder and Portions 1 and 2 of the farm Modderkuil 39 JQ.

6.4.2.2 Land ownership

The farms Tuschenkomst 135 JP and Witkleifontein 136 JP are owned by the state. The surface right owners and corresponding title deed numbers of the land in and adjacent to PPM are listed in Table 6-5.

TABLE 6-5: SURFACE RIGHTS ON AND SURROUNDING THE PROPOSED PROJECT SITE

Farm Name	Portion number	Title deed number	Registered surface owner as per title deeds search (January 2019)
Tuschenkomst 135 JP	0	T594/1938BP	Republic of South Africa
Witkleifontein 136 JP	0	T9313/1937BP	Republic of South Africa
	1	T11640/1937BP	
Rooderand 46 JQ	0	T11232/194BP	Republic of Bophuthatswana
	1	T8993/1916BP	Bakgatla-Ba-Kgafela Tribe
	2	T16014/1971BP	Republic of Bophuthatswana
	3	T3648/1940BP	Republic of Bophuthatswana
	4	T18366/2008	Bakgatla-Ba-Kgafela Tribe Communal Property Association
Welgewaagd 133 JP	0	T10729/1926BP	Republic of Bophuthatswana
	1	Refer to registrar	Refer to registrar
	2	T25071/1944BP	Makulbire Thradrack
	3	T49657/2007	Tlale Morategi Israel
Wilgespruit 2 JQ	0	T1230/1919BP	Republic of South Africa
Cyferkuil 1JQ	0	T6482/1937BP	Republic of South Africa
	1	T5284/1937BP	
Groenfontein 138 JP	0	T6770/1937BP	Republic of South Africa
	1	T12741/1937BP	
	2	T12741/1937BP	
	3	Refer to registrar	Refer to registrar
Bierkraal 134JP	0	T9309/1938BP	Republic of South Africa
Zandspruit 168 JP	0	T7072/2006	African Mining - Trust Co Ltd

6.4.2.3 Land claims

According to fax correspondence received from the Department of Rural Development and Land Reform (DRDLR) on 7 June 2012 the Regional Land Claims Commission acknowledged that claims had been lodged, in terms of the restitution of Land rights Act (Act No. 22 od 1994) on the farms Legkraal 45 JQ and Koedoesfontein 42 JQ by the BBKTA community and these have been settled. DRDLR confirmed that there are no claims on their database for the farms Witkleifontein 136 JP, Tuschenkomst 135 JP, Wilgespruit 2 JQ, Magazynskraal 3 JQ and Rooderand 46 JQ. Proof of this correspondence is included in Appendix B.

6.4.2.4 Residential

With reference to Figure 6-5, the residential areas closest to the proposed project area include:

- Ngweding (approximately 2.7 km north);
- Ntswana-le-Metsing (approximately 5 km north);
- Legkraal (approximately 4 km south-east);
- Pilanesberg National Park (approximately 2 km south);
- Black Rhino game reserve (approximately 7 km south);
- Makgope and Molorwe (approximately 11 km west); and
- Motlhabe (approximately 5 km west-north-west).

6.4.2.5 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;
- 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.

6.4.2.6 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 1 000 000 ha. 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 (NW Parks and Tourism Board, 2002).

As part of the proposed HPC, two different corridors are planned. The NWPTB proposes a phase 1 corridor which is the wider corridor and 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. Previously the Lebatlhane Game Reserve was included in this corridor but it no longer operates as a reserve and is used by the community for livestock grazing (pers. comms. NWTB).

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.

6.4.2.7 Mining

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

- 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;
- Sedibelo Platinum Mine (not yet constructed) is situated on the farms Wilgespruit 2 JQ, Portion 1 of Rooderand 46 JQ, Legkraal 45 JQ and Koedoesfontein 42 JQ;
- Magazynskraal Platinum Mine (not yet constructed) is situated on the farm Magazynskraal 3 JQ;
- Sails Group 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:

- Bakgatla/Anglo interests, situated on Portion 2 of Rooderand 46 JQ;
- Sails Group (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;
- Siyanda (Union Section) on the farm Zwartklip 405 KQ.

6.4.2.8 Third party service infrastructure

Power lines (and the associated Eskom servitudes) run along the southern boundary of the farm Wilgespruit 2 JQ and along the eastern boundary within the farm Magazynskraal 3 JQ. The Sedibelo Substation is located on the eastern boundary of the farm Wilgespruit. 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.

A Magalies Water pipeline runs in an east/west direction along the northern boundary of the farm Wilgespruit 2 JQ.

Land uses within the proposed project area are dominated by existing mining activities and associated infrastructure. Land uses 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.

6.4.3 DESCRIPTION OF SPECIFIC ENVIRONMENTAL FEATURES AND INFRASTRUCTURE ON THE SITE

The proposed project components would be located within areas of the mineral processing plant complex already disturbed by existing infrastructure or the TSF. Given this no specific environmental features exist within the site boundaries.

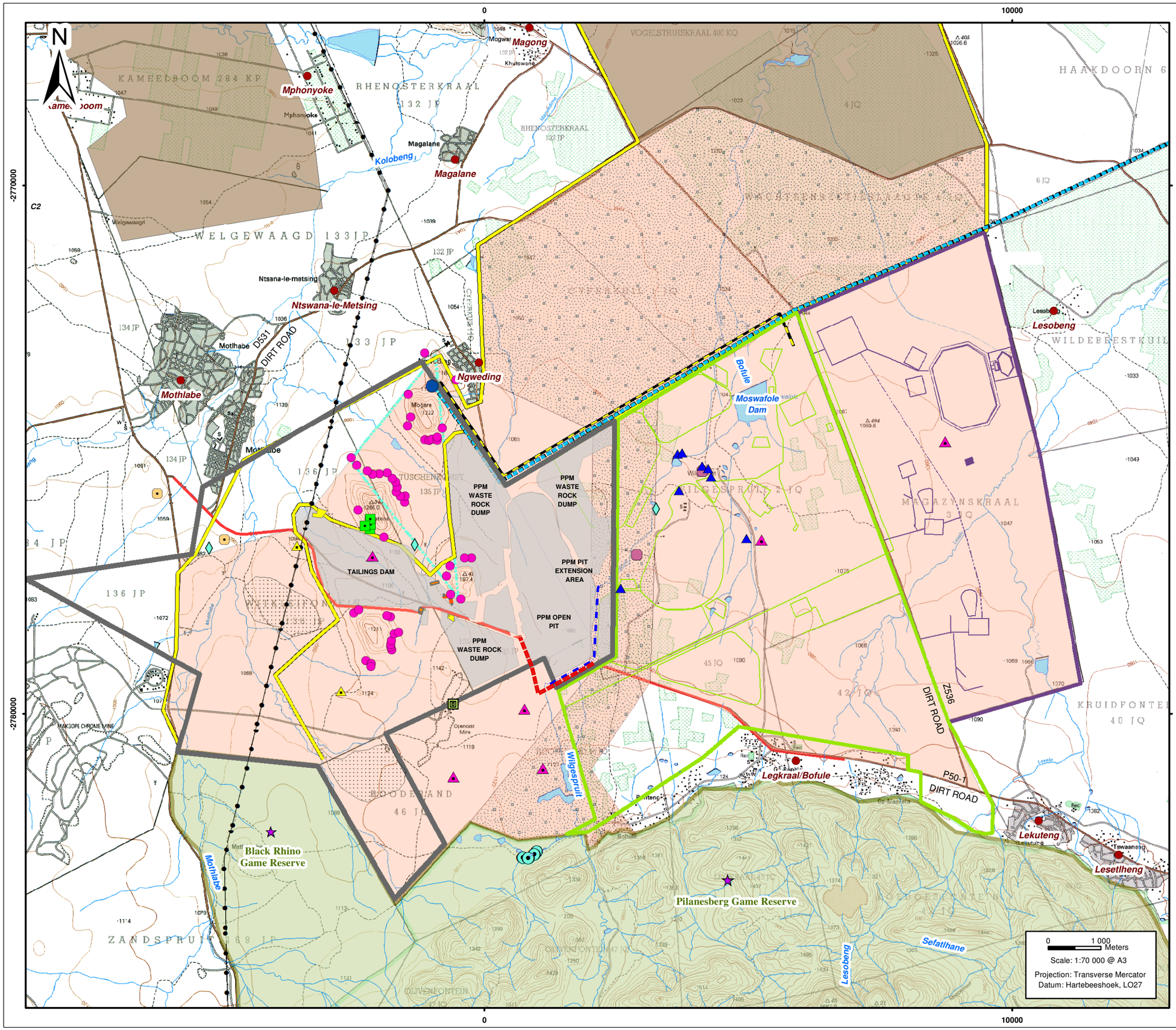
Key environmental features surrounding PPM include the Pilanesberg National Park south of the mine. Linked to the park is the Black Rhino Game Reserve. Watercourses, rocky outcrops and the Mabeskraal Ridge systems surrounding PPM are classed as sensitive ecological environments.

6.4.4 ENVIRONMENT AND CURRENT LAND USE MAP

A conceptual map showing topographical information as well as land uses on and immediately surrounding PPM is provided in Figure 6-5.

6.5 ENVIRONMENTAL IMPACTS AND RISKS OF PROJECT ALTERNATIVES

As noted in Section 6.1, no location or layout alternatives are being considered and as such an assessment of alternatives is not applicable to the project.



Land Use

- Towns / Villages
- Roads
- Watercourses
- Powerline
- Springs and Endorheic Pans
- Tourism Areas
- Mining and Related Interests or Operations
- Water Reservoir
- Pipeline from Tuschenkomst Reservoir to Sedibelo / Magazynskraal
- Magalies Water Pipeline
- Wilgespruit River Diversion
- P50-1 Diversion
- Dams
- Sedibelo Platinum Mine Mining Right Area and Planned Infrastructure
- Magazynskraal Mining Right Area & Related Planned Infrastructure
- Pilanesberg Platinum Mine Mining Right Area & Related Infrastructure
- Pilanesberg Platinum Mine Future Open Pits
- Proposed Infrastructure Changes
- Existing Community-Based Projects
- Heritage Landscape
- Pilanesberg National Park (including Black Rhino Game Reserve)
- Heritage Park Corridor
- Original Dangerous Game Corridor (NWPTB Concept)
- Non Dangerous Game Area
- Proposed Dangerous Game Corridor (PPM)
- Graveyards
- Historical Chrome Mine
- Historical Villages / Homesteads
- Late Iron Age Sites on Hills
- Rudimentary Prospecting Activities
- Settlements From Recent Past
- Stone Age and Iron Age Occurences
- Single and Clusters of Late Iron Age Sites
- Cultivated Land

PILANESBERG PLATINUM MINES (PTY) LTD

Figure 6-5

Local Land Use Map

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6.6 METHODOLOGY USED IN DETERMINING THE SIGNIFICANCE OF ENVIRONMENTAL IMPACTS

The method used for the assessment of environmental issues is set out in Table 6-6. This assessment methodology enables the assessment of environmental issues including: cumulative impacts, the severity of impacts (including the nature of impacts and the degree to which impacts may cause irreplaceable loss of resources), the extent of the impacts, the duration and reversibility of impacts, the probability of the impact occurring, and the degree to which the impacts can be mitigated.

TABLE 6-6: IMPACT ASSESSMENT METHODOLOGY

Note: Part A provides the definition for determining impact consequence (combining intensity, 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.

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

PART B: DETERMINING CONSEQUENCE					
			SEVERITY = L		
DURATION	Long term	**H**	**Medium**	**Medium**	**Medium**
	Medium term	**M**	**Low**	**Low**	**Medium**
	Short term	**L**	**Low**	**Low**	**Medium**
			SEVERITY = M		
DURATION	Long term	**H**	**Medium**	**High**	**High**
	Medium term	**M**	**Medium**	**Medium**	**High**
	Short term	**L**	**Low**	**Medium**	**Medium**
			SEVERITY = H		
DURATION	Long term	**H**	**High**	**High**	**High**
	Medium term	**M**	**Medium**	**Medium**	**High**
	Short term	**L**	**Medium**	**Medium**	**High**
			L	**M**	**H**
			Localised Within site boundary Site	Fairly widespread Beyond site boundary Local	Widespread Far beyond site boundary Regional/ national
			SPATIAL SCALE		

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

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

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

6.7 POSITIVE AND NEGATIVE IMPACTS OF THE PROPOSED ACTIVITY AND ALTERNATIVES

As noted in Section 6.1, no location or layout alternatives are being considered and as such an assessment of alternatives is not applicable to the project. The preferred project alternative is assessed in Section 8.

6.8 POSSIBLE MANAGEMENT ACTIONS THAT COULD BE APPLIED AND THE LEVEL OF RESIDUAL RISK

A summary of issues and concerns raised by I&APs during the EIA process is provided in Section 6.3.

A list of the potential impacts identified by SLR and/or raised by I&APs, as well as the possible management and mitigation measures, is provided in Table 6-7. The level of residual risk after management or mitigation, associated with the proposed project, is also estimated.

6.9 MOTIVATION WHERE NO ALTERNATIVE SITES WERE CONSIDERED

For the mineral processing facilities, no location or layout alternatives were considered as mineral processing related infrastructure would need to be placed within and adjacent to the footprint of existing facilities to allow for the sharing of support services (offices, security etc.) and support infrastructure (workshops, stores, water reticulation and electricity etc.). In addition to this, the hydrometallurgical plant would generate a product of high commercial value and has to be located within a highly secure area. The identified site for the hydrometallurgical plant is therefore in an area within the existing plant which is highly visible and is within close proximity to the existing security control points and main office block.

For the waste storage and handling facility, a site outside of the plant within an already disturbed area was identified by PPM as the preferred site. No other alternatives were considered.

For the training centre, two alternative sites were considered by PPM. These included a site outside of the plant within an area earmarked for the chrome recovery plant and the George Stegman Hospital in Moruleng. The George Stegman Hospital in Moruleng was chosen by PPM as the preferred site as this would provide easier access to the community. Therefore the training centre would no longer be established at the mine.

6.10 STATEMENT MOTIVATING THE PREFERRED ALTERNATIVE

With reference to Sections 6.1 and 6.9, no location or layout alternatives were considered and as such this section is not applicable.

TABLE 6-7: MITIGATION MEASURES AND ANTICIPATED LEVEL OF RESIDUAL RISK

No.	Activity	Potential Impact	Possible Mitigation	Level of Residual Risk
1.	All activities	Loss of soil resources and land capability due to contamination	• PPM will conduct all potentially polluting activities in a manner that pollutants are contained at source. In this regard PPM will ensure that: o all vehicles and equipment will be serviced in workshops and washbays with impermeable floors, dirty water collection facilities and oil traps; o all chemical, fuel, oil storage and handling facilities will be designed and operated in a manner that all spillages are contained in impermeable areas and cannot be released into the environment; o ***storage of coal and KELL plant chemicals will be within appropriately designed containment measures within the existing plant boundary;*** o ***hazardous installations will comply with applicable standards to ensure that containment and safety risks are appropriately addressed and managed;*** o ad hoc spills of potentially polluting substances (whether in dirty areas or in the environment) will be reported to the environmental manager immediately and cleaned up/remediated immediately; o a dirty water management system is implemented; and o the waste management practices as per PPM's waste management procedure and the National Norms and Standards are implemented. • Rehabilitation will commence as soon as mine activities cease. • All rehabilitation initiatives will ensure that land capabilities that support ***the final end land use*** are restored through the conservation and replacement of soil as per the mine's soil conservation procedure, and the re-establishment of biodiversity that naturally occurs in the mine area.	None expected.
2.	All activities	General disturbance of biodiversity	• PPM will continue to implement a biodiversity action plan that will be refined and implemented in consultation with the biodiversity expertise and resources within the Heritage Park initiative (which includes DREAD and NWTPB representation). The mine will ensure that the action plan includes the following management actions: o limit project activities, infrastructure and disturbance to those specifically identified and described in this EIA and EMPr, with controlled access and zero tolerance of disturbances to identified sensitive habitats and associated species of the ridges/rocky outcrops and water course/wetland buffer zones; o any new pipelines will either be buried or lifted off the ground by 50cm to prevent the establishment of a movement barrier for fauna species and to allow movement of smaller organisms; o there will be implementation of an alien/invasive/weed management programme in collaboration with DAgric, DWAF and Working for Water to control the spread of these plants onto and from disturbed areas. Care will be taken to prevent the encroachment of alien plant species into rehabilitated areas; and o there will be collaboration with the Heritage Park representatives in the control of community grazing, medicinal plant harvesting, animal harvesting and fuel plant harvesting in a manner that promotes sustainable use of natural resources. This is particularly relevant for the sensitive habitats. • ***The ridge habitat will be included in the monitoring programme.***	Low

No.	Activity	Potential Impact	Possible Mitigation	Level of Residual Risk
3.	All activities	Contamination of surface water	• Ensure stormwater management measures comply with the provisions of the NWA and Regulation 704 (4 June 1999) or any future amendments thereto. • ***Operate the plant SWD and TSF RWD in line with Regulation 704 and ensure re-use is in line with maintaining sufficient capacity within the dam to cater for a 1:50 year storm event.*** • ***Ensure tailings are handled and deposited taking into account the capacity, safety and stability of the PPM TSF (see Section 3.2.5).*** • ***It is recommended that a sampling point is established downstream and closer to the PPM plant to be able to separate the impacts of the PPM plant and the waste rock dump.*** • ***A study should be conducted by PPM to trace the source of pollutants on site.*** • PPM will continue to implement its surface water monitoring programme (see Section 29). Should any contamination be detected the mine will immediately notify DWS. The mine, in consultation with DWS and an appropriately qualified person, will then notify potentially affected users, identify the source of contamination, identify measures for the prevention of this contamination (in the short term and the long term) and then implement these measures.	None expected.
4.	Mineral processing operations Tailings management Stormwater management Non-mineralised waste management Storage and maintenance services/ facilities Site management Rehabilitation	Groundwater contamination	• ***Telemetry will be installed at all relevant boreholes to monitor the real-time aquifer conditions.*** • ***Geochemical modelling must be reviewed, prior to deposition of the combined KELL and PPM tailings, to verify the results of the current geochemistry modelling.*** • ***The geochemical numerical modelling should be updated to include reactive transport modelling to take the possible precipitation and adsorption of sulphate into account.*** • ***Tailings will be deposited at a ratio of 1.2 % KELL tailings to 98.8 % PPM tailings as this is the ratio that specialist assessments have been based on. In the event that the PPM TSF is developed according to a different schedule to that assumed in the geochemistry assessment, the source term presented will be revised and updated. The groundwater model will be updated to include the revised source term and if necessary additional mitigation implemented in consultation with a specialist.*** • ***PPM will sample the tailings at suitable intervals during the operational life of the TSF to evaluate the heterogeneity in physical and chemical composition. This will provide a data set that allows refined estimates of the post-closure impacts of the TSF to be developed ahead of mine closure.*** • ***KELL tailings will be re-slurried and mixed with recycled process water prior to the PPM tailings thickener to achieve a supernatant water quality equal to or better than the current PPM tailings supernatant.*** • ***Additional seepage capturing boreholes will be established as recommended in the groundwater specialist study.*** • ***Seepage capturing boreholes will be pumped as per the recommended rates in the groundwater specialist study to ensure the desired effect of each hole.*** • ***The TSF surface will be rehabilitated to mimic a recharge of 3% of rainfall from five years post the operational phase. The rehabilitation would include the planting of trees which have a high evapotranspiration rate to effectively minimise the nett infiltration of water from the facility and a clay sealing cap to prevent recharge to the decommissioned TSF. The rehabilitated scenarios must be included in an updated model to demonstrate the efficiency.*** • ***Surface and groundwater remediation will be informed through ongoing surface and groundwater monitoring and by***	Low

No.	Activity	Potential Impact	Possible Mitigation	Level of Residual Risk
			carrying out risk assessment and water pollution potential studies/investigations during mine operations. • ***Revegetation trials (and hence the sustainability of any rehabilitation works) must be investigated as part of operations.*** • PPM will continue monitoring boreholes in the vicinity of the mine (Section 6.15). If contamination is detected, PPM will consult with an appropriate specialist and with DWAF to design and implement a treatment solution. This is likely to involve the capturing of the pollution plume by means of scavenger boreholes and the treatment and/or reuse of the polluted water. • If any mine related contamination is experienced by the boreholes users, PPM will provide compensation which could include an alternative water supply of equivalent water quality. • ***Where studies indicate the potential for contamination of third-party groundwater use post-closure, PPM will implement an active pump and treat system.***	

5.	Site preparation
	Earthworks
	Civil works
	KELL plant
	Transport systems
	Site management
	Demolition
	Rehabilitation
		Change in ambient air concentrations	• Construction sites – target dust control efficiency of 50% achieved by a combination of water suppression and suppression chemicals.
			• Unpaved roads – target dust control efficiency of 75% - achieved by applying 0.0406 litres of water per square meter of road every hour that it is in use by vehicles. In addition, waste rock will be used to surface the dust roads. This will be verified by perimeter dust fallout monitoring. The monitored fallout must be less than 1200mg/m^2/day on the PPM boundaries adjacent to the haul road, and 600mg/m^2/day near residential areas.
			• Tailings dam – target dust control efficiency of 80% on the side slopes and 40% on the top surface – achieved by vegetation establishment on the side slopes and a combination of moisture and vegetation establishment on the top surface. This will be verified by perimeter dust fallout monitoring. Dust fall downwind to be less than 1200mg/m^2/day.
			• Crushing and screening – target dust control efficiency of between 62% and 95% – achieved by adding moisture and capturing dust with wet scrubbers. This will be verified by visual inspection to ensure that there is no plume and perimeter dust fallout monitoring. Dust fall downwind to be less than 1200mg/m^2/day.
			• Stack heights at the KELL Plant will be maximised as far as is economically viable (minimum of 12 m in height).
			• KELL Plant will be designed so that emissions from all point sources are in compliance with the Subcategory 4.17 MES.
			• All stacks will be sampled as soon as the plant is operational, and if any pollutants are in exceedance of the Subcategory 4.17 MES, additional mitigation measures will be implemented.
			• PPM employees and members of the surrounding communities will be educated on the effects of Cl_2 (as well as HCl and HF) exposure and that all symptoms be reported on the PPM complaints register.
			• ***PPM will continue to monitor air quality with the addition of:***
			  ○ ***All stacks will be sampled as soon as the plant is operational.***
			  ○ ***Monitoring will be undertaken in line with an AEL.***
			  ○ ***Annual passive diffusive sampling of Cl_2, HCl and HF at PPM plant boundary to the north and south and at the closest sensitive receptor locations namely the villages of Mothlabe and Ngweding.***
			• In the context of further mining development in the project area, PPM undertakes to facilitate an investigation into cumulative air impact assessments and ambient air quality monitoring with the other possible mining operations if and
				None expected.

No.	Activity	Potential Impact	Possible Mitigation	Level of Residual Risk
			when they reach a final level of feasibility and/or approval.	

6.	Earthworks
	Civil works
	Mineral processing operations
	Transport systems
	Site management
	Demolition
	Rehabilitation
		Increase in ambient noise levels	• ***Any change in the noise emission characteristics of equipment should serve as trigger for withdrawing it for maintenance.***
			• ***Equipment with lower sound power levels must be selected. Vendors should be required to guarantee optimised equipment design noise levels.***
			• ***In managing noise specifically related to truck and vehicle traffic, efforts should be directed at:***
			  ○ ***Maintaining road surfaces regularly to avoid corrugations, potholes etc.***
			  ○ ***Avoiding unnecessary idling times.***
			  ○ ***Considering alternatives to the traditional reverse 'beeper' alarm where these are aligned with mine health and safety requirements.***
			• ***Where possible, other non-routine noisy activities such as construction, decommissioning, start-up and maintenance, will be limited to day-time hours.***
			• The mine will record and respond without delay to complaints about disturbing noise. All such complaints will be documented and recorded as incidents. The measures taken to address these complaints will be included in the documentation. These records will be kept for the life of mine.
				None expected.

7.	Earthworks Civil works Mineral processing operations Tailings management Transport systems Site management Demolition Rehabilitation Maintenance and aftercare	Change in landscapes and related visual aspects	• Implement the air pollution control system to avoid plumes of dust that can reduce visibility. • Paint structures and buildings in colours (browns and greens) that reflect and compliment the natural landscape. • All vegetation that is planted as part of rehabilitation should reflect the natural vegetation of the area. • 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. • **PPM will have sustained engagements with stakeholders including the Pilanesberg National Park and Black Rhino Game Reserve on visual and sense of place related impacts.**	Low
8.	All activities	Economic impact	• PPM will implement the commitments in its social and labour plan (SLP) in accordance with the employment, procurement and social investment principles of the Mining Charter.	Medium Positive

9.	All activities	Inward migration	Recruitment and relationship with surrounding communities
			• PPM will ensure that its policies incorporate the following:
			  ○ effective and timeous communication with community leaders who can attest to a fair and transparent process amongst the community rather than challenging the mine on the community's behalf over jobs and recruitment;
			  ○ good communication with all job seekers will be maintained throughout the recruitment process. The process must
				Low

No.	Activity	Potential Impact	Possible Mitigation	Level of Residual Risk
			be seen and understood to be fair and impartial by all involved; o there will be no recruitment at the construction/operational site. All recruitment will take place on set dates and at an arranged venue - preferably a formal gathering place in a nearby community; o there will be no ad hoc hiring of temporary casual labour, no matter how small and temporary the job (washing of vehicles or litter clearance). A sign clearly indicating that there will be no recruitment at the construction site will be erected at the entrance to the site. Also, a list of available temporary workers in the area will be drawn up and kept by PPM in the event that temporary labour is required; o notice of tender applications will be advertised through the community leaders. Appropriate timeframes will be given for the submission of tender documents. The mine's community liaison officer should be contacted in this regard. o local authorities will be requested to remove any informal settlements in the vicinity of the mine that are occupied by people who are there in the hope of obtaining employment. This must be carried out immediately; and o there will be no worker accommodation on site. All workers who are not resident in the vicinity should be accommodated in a formal accommodation in order to obtain their housing allowance. <u>Safety and security</u> • In regard to crime, PPM will communicate with the local police force particularly in the context of developing strategies for combating crime in the vicinity of the project and surrounding communities. <u>Hygiene/disease - HIV/AIDS</u> • Disease and particularly HIV/AIDS is not a problem only for PPM, its employees and contractors, but it is also a local community problem. As a result, successful mitigation of this impact will also depend on the intensity in which it is addressed by other structures such as the health department, the local municipality, education departments, etc. • PPM will ensure that its employees and contractors are made aware of the issues surrounding the spread of HIV and AIDS in the area. This awareness will be promoted by initiatives such as training and development, peer education, community interventions and visual awareness campaigns. Prevention and management strategies also need to be introduced. Voluntary Counselling and Testing (VCT) is a vital aspect to any HIV/Aids management programme. All stakeholders at PPM need to agree to a rigorous VCT programme. Once a high level of VCT is taking place it is possible to define the magnitude of the problem and begin to develop appropriate strategies for dealing with it.	
10.	Transport systems Site management	Road disturbance and traffic safety	• ***Implement the planned upgrades to the P50-1.*** • ***Construction phase shifts will start and end outside of the main operating shift times.*** • ***Delivery of heavy loads which includes plant construction materials and components will be scheduled at times other than the background traffic peak periods.*** • ***Provide pedestrian walkways along the mine access road to ensure a split between vehicular and pedestrian movements and to ensure a safe environment for pedestrians.*** • ***From a road safety point of view, as part of paving the relevant sections of Road P50-1, dedicated right turn lanes and public transport loading and off-loading facilities will be provided where the road reserves allows.***	None expected.

No.	Activity	Potential Impact	Possible Mitigation	Level of Residual Risk
11.	All activities	Land use impacts	• Effective implementation of all mitigation measures as outlined in the EMPr to reduce the overall impact on the environment and surrounding land uses.	Low

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

7.1 DESCRIPTION OF THE PROCESS UNDERTAKEN TO IDENTIFY IMPACTS

Biophysical and socio-economic impacts associated with the proposed project were identified through a review of the 2007 EIA and EMPr and subsequent amendments, site visits undertaken by SLR and specialists, specialist studies and input from I&APs during the public participation process.

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

A description of the assessment methodology used to assess the severity of identified impacts (including the nature of impacts and the degree to which impacts may cause irreplaceable loss of resources), the extent of the impacts, the duration and reversibility of impacts, the probability of the impact occurring, and the degree to which the impacts can be mitigated is provided in Section 6.6.

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

A description of the environmental impacts and risks identified during the EIA is included in Section 8 and Appendix D.

7.4 ASSESSMENT OF THE SIGNIFICANCE OF EACH IMPACT AND RISK AND AN INDICATION OF THE EXTENT OF TO WHICH THE ISSUE AND RISK CAN BE AVOIDED OR ADDRESSED BY THE ADOPTION OF MANAGEMENT ACTIONS

The assessment of the significance of potential impacts, including the extent to which impacts can be avoided or mitigated, is included in Section 8 and Appendix D.

8 ASSESSMENT OF EACH IDENTIFIED POTENTIALLY SIGNIFICANT IMPACT AND RISK

A summary of the assessment of the biophysical and socio-economic impacts associated with the proposed project is provided in Table 8-1 below. A full description of the assessment is included in Appendix D.

The impacts presented below reflect potential incremental impacts for PPM and are specific to the proposed project. Where incremental impacts change the overall significance assessment for the mine this is indicated in the table OR All project related impacts would contribute to the cumulative impacts of the mine, none of the identified impacts would change the overall significance assessment for the mine, except when considering the duration if impacts and that the proposed project would add an additional 40 years to the life of the plant.

TABLE 8-1: ASSESSMENT OF SIGNIFICANT IMPACTS AND RISKS

No.	Activity	Potential Impact	Affected Aspect	Phase	Significance (unmitigated)	Management actions Type	Significance (mitigated)	Extent to which the impact can be avoided or mitigated
1.	All activities	Loss of soil resources and land capability due to contamination	Soil and land capability	C, O, D, Cl	Medium	• Limit project footprint • Control through waste management practices • Control through appropriate design (incl. access roads) • Closure planning and rehabilitation • Remedy through emergency response procedures (see Section 30.2)	Low	High
2.	All activities	General disturbance of biodiversity	Biodiversity	C, O, D, Cl	Medium	• Implement biodiversity action plan • Limit project footprint • Alien invasive species management programme • Monitoring • Rehabilitation	Low	High
3.	All activities	Contamination of surface water	Surface water	C, O, D, Cl	Medium	• Management through appropriate design • Implementation of Storm water Management Plan • Management through waste management practises • Surface water monitoring • Compensation	Low	High

No.	Activity	Potential Impact	Affected Aspect	Phase	Significance (unmitigated)	Management actions Type	Significance (mitigated)	Extent to which the impact can be avoided or mitigated
						• Remedy through emergency response procedures (see Section 30.2)		
4.	Mineral processing operations Tailings management Stormwater management Non-mineralised waste management Storage and maintenance services/ facilities Site management Rehabilitation	Groundwater contamination	Groundwater	C, O, D, Cl	Medium	• Groundwater monitoring • Implementation of Storm water Management Plan • Management through compensation • Management through appropriate design • Remedy through emergency response procedures (see Section 30.2)	Low Medium[#]	High
5.	Site preparation Earthworks Civil works KELL plant Transport systems Site management Demolition Rehabilitation	Change in ambient air concentrations	Air quality	C, O,	-	• Permitting in line with requirements • Management through appropriate design • Air quality monitoring • Complaints register	Medium*	High
6.	Earthworks Civil works Mineral processing operations Transport systems Site management Demolition Rehabilitation	Increase in ambient noise levels	Noise	C, O	Low	• Manage through noise controls • Conduct noise monitoring	Low	High
7.	Earthworks Civil works Mineral processing operations Tailings management	Change in landscapes and related visual aspects	Visual	C, O, D, Cl	Medium	• Limit project footprint • Manage through visual controls • Rehabilitation • Stakeholder engagement	Medium[1] Low[2]	High

No.	Activity	Potential Impact	Affected Aspect	Phase	Significance (unmitigated)	Management actions Type	Significance (mitigated)	Extent to which the impact can be avoided or mitigated
	Transport systems Site management Demolition Rehabilitation Maintenance and aftercare							
8.	All activities	Economic impact	Socio-economic	C, O, D	Medium+	• Control through the monitoring of socio-economic conditions • Remedy through emergency response procedures (see Section 30.2)	High+	High
9.	All activities	Inward migration		C, O, D, Cl	Medium	• Control through good communication, recruitment and procurement processes • Co-operation with government health and safety structures to address the spread of disease, HIV/AIDS • Communication with local police force to combat crime	Low	
10.	Transport systems Site management	Road disturbance and traffic safety	Traffic	C, O	Medium	• Road upgrade including safety considerations • Remedy through emergency response procedures (see Section 30.2)	Low	High
11.	All activities	Land use impacts	Land use	C, O, D, Cl	Medium	• Mitigate all environmental and social impacts	Low	High

- denotes 'No impact' or 'No contribution' Ratings are negative unless otherwise specified [1] Construction [2] Operations

[#] Post closure, depending on success of active pump and treat mechanisms

** Presents potential impacts related to chlorine, hydrogen chloride, hydrogen fluoride and ammonia modelled for the KELL plant.*

9 SUMMARY OF SPECIALIST REPORT FINDINGS

Recommendations from specialist studies that informed the impact assessment are summarised in Table 9-1 below. The complete specialist reports have been attached at the appendices to this EIA and EMPr.

TABLE 9-1: SUMMARY OF SPECIALIST RECOMMENDATIONS

Study undertaken	Recommendation of specialist	Specialist recommendations that have been included in the EIA report (mark with an x)	Reference to applicable section in this report
Surface water	• It is recommended that a sampling point is established downstream and closer to the PPM plant to be able to separate the impacts of the PPM plant and the waste rock dump. • Furthermore, a study should be conducted by PPM to trace the source of pollutants on site. • The water balance and storm water management plan must be reviewed and updated throughout the life of the mine and operations until determination of closure liabilities for the PPM Mine.	X X X	Section 27 and Appendix E
Groundwater	• The geochemical modelling needs to be reviewed to verify results therein. • Update the geochemical numerical modelling to include reactive transport. • Update the numerical groundwater model to include reactive transport to take the possible precipitation and adsorption of sulphate into account. The simulation period can also be increased once the geochemical modelling and results have been reviewed and verified. • The monitoring programme needs to be reviewed to observe additional gaps in data collection and mass migration monitoring. • Surface geophysical surveys need be completed surrounding the TSF to identify preferential flow paths where additional seepage capturing boreholes can be drilled. The model simulations were based on 10 conceptual additional seepage capturing boreholes. • Drilling, equipping, and pumping of additional seepage capturing boreholes need be done to reduce the mass migration impact. These seepage capturing boreholes should be properly maintained and the efficiency audited. • Aquifer tests need to be performed on the newly drilled seepage capturing boreholes to determine the recommended rates at which each hole needs to be pumped. • Telemetry needs to be installed at all relevant boreholes to monitor the real-time aquifer conditions. • Reduction of recharge onto TSF surface during the post-operational needs to be achieved by rehabilitation and revegetation e.g. planting trees which have a high evapotranspiration rate to effectively minimise nett infiltration water from the facility. A clay sealing cap also needs to be installed post operations to thwart recharge to the de-commissioned TSF. The rehabilitated scenarios must be included in an updated model to demonstrate the efficiency. • The current seepage capturing boreholes need to be pumped as per the recommended rates to ensure the desired impacts of each hole.	X X X X X X X X X X	Section 27 and Appendix F

Study undertaken	Recommendation of specialist	Specialist recommendations that have been included in the EIA report (mark with an x)	Reference to applicable section in this report
Air quality	• The KELL Plant should be operated with all pollutant emissions below the Subcategory 4.17 MES to avoid health impacts at nearby sensitive receptor locations. • The stacks at the KELL Plant must be at least 5 metres in height but should be maximised as far as is economically viable. All stacks must be sampled as soon as the plant is operational. • In addition to the current air quality monitoring undertaken at PPM, annual sample of Cl_2, HCL and HF be conducted at the closest potentially sensitive receptor locations namely Motlhabe and Ngweding. If sampled concentrations exceed the assessment criteria, sources of these pollutants should be investigated and mitigation measures implemented if applicable. • PPM employees as well as members of the surrounding communities must be educated on the effects of Cl_2, HCL and HF exposure and that all symptoms be reports on the PPM complaints register.	X X X X	Section 27 and Appendix G

Noise	• All diesel-powered equipment and plant vehicles must be kept at a high level of maintenance. This should particularly include the regular inspection and, if necessary, replacement of intake and exhaust silencers. Any change in the noise emissions characteristics of equipment should serve as a trigger for withdrawing it for maintenance.
	• Equipment with lower sound power levels must be selected. Vendors should be required to guarantee optimised equipment design noise levels.
	• In managing noise specifically related to truck and vehicle traffic, efforts must be directed to:
	  ○ Minimise individual vehicle engine, transmission, and body noise/vibration. This is achieved through the implementation of an equipment maintenance programme.
	  ○ Maintain road surface regularly to avoid potholes, corrugations etc.
	  ○ Avoid unnecessary idling times.
	  ○ Minimise the need for trucks/equipment to reverse. This will reduce the frequency at which disturbing but necessary reverse warnings will occur. Alternatives to the traditional reverse “beeper” alarm such as a “self-adjusting” or “smart” alarm could be considered. These alarms include a mechanism to detect the local noise level and automatically adjust the output of the alarm so that it is 5 to 10 dB above the noise level near the moving equipment.
	• Where possible, other non-routine noisy activities such as construction, decommissioning, start-up and maintenance, should be limited to day-time hours.
	• A noise complaints register must be kept.
		X
		X
		X
		X
		PPM has indicated that this cannot be implemented due to specific Mine Health and Safety requirements.
		X
		X
			Section 27 and Appendix H

Visual	• As little as possible vegetation must be removed during the construction phase. • Ensure, wherever possible, all existing natural vegetation is retained and incorporated into site rehabilitation. • Dust suppression techniques must always be in place during all phases. • Only the footprint and a small “construction buffer zone” around the project activities must be exposed. In all other areas, natural vegetation must be retained. • During all phases, roads will require an effective dust suppression management programme, such as the	X X X X X	Section 27 and Appendix I

Study undertaken	Recommendation of specialist	Specialist recommendations that have been included in the EIA report (mark with an x)	Reference to applicable section in this report
	use of non-polluting chemicals to retain moisture in the road surface. • Install light fixtures that provide precisely directed illumination to reduce light "spillage" beyond immediate surrounds. • Avoid high pole top security lighting along the periphery of the various sites. • Minimise the number of light fixtures to the bare minimum, including security lighting. • Security lighting should only be used where necessary and carefully directed, away from sensitive viewing areas. • Where possible, lights must be directed downwards so as to avoid illuminating the sky.	 X X X X X	
Economics	• Hire people from surrounding area as far as possible. • Introduce 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. • Where possible, produce local goods and services from closest communities. • Facilitate local involvement in indirect business and service opportunities. • Implement a procurement mentorship programme which provides support to local and black owned businesses during the construction and operational phases. • Identify and develop sustainable business opportunities and skills, independent from the project for members of the local communities to ensure continued economic prosperity beyond the life of the project.	X X X X X X	Section 27 and Appendix K
Traffic	• Consider the provision of bus transport for the transportation of unskilled construction workers in order to reduce the number of vehicle trips anticipated to be generated during the construction phase. • Consider planning for construction workers shift starting and ending times to be different from that of the existing mining operations • Schedule delivery of heavy loads which includes plant construction materials and components at times other than the background traffic peak periods. • Pedestrian walkways must be provided along the mine access road to ensure a split between vehicular and pedestrian movements and to ensure a safe environment for pedestrians. • Should relevant sections of Road P50-1 be upgraded to paved road in future, dedicated right turn lanes must be provided as part of the intersection layout at all existing access intersections to the PPM mine to ensure that traffic flow of the main road is not blocked by vehicles waiting to turn right.	PPM has indicated that bus transport has been considered previously and not implemented due to conflict with taxi services. X X X X	Section 27 and Appendix J

Study undertaken	Recommendation of specialist	**Specialist recommendations that have been included in the EIA report (mark with an x)**	**Reference to applicable section in this report**
Closure	• Site specific aspects such as surface and groundwater remediation have not been costed at this stage – the likelihood of such remediation must be identified through ongoing surface and groundwater monitoring and/or by carrying out risk assessment and water pollution potential studies/investigations during mine operations. • Revegetation trials (and hence the sustainability of any rehabilitation works) is currently ongoing and must be addressed as part of operations.	X X	Section 27 and Appendix M
TSF Capacity Review	• Based on the evaluation of the TSF capacity as described above, it is recommended that the remaining capacity and operational performance of the TSF be monitored closely to facilitate planning for additional tailings storage capacity, should it be required.	X	Section 27 and Appendix N

10 ENVIRONMENTAL IMPACT STATEMENT

10.1 SUMMARY OF KEY FINDINGS OF THE EIA

This section provides a summary of the findings of identified and assessed potential impacts on the receiving environment in both the unmitigated and mitigated scenarios, including cumulative impacts. A summary of the potential impacts (as per Section 8), associated with the preferred alternatives (as per Section 6), in the unmitigated and mitigated scenarios for all project phases is included in Table 10-1 below.

The table also provides an indication of the contribution of potential impacts, associated with the proposed project, to the overall cumulative significance rating for the mine.

TABLE 10-1: SUMMARY OF POTENTIAL PROJECT-RELATED IMPACTS

Potential impact	Incremental significance		**Project contribution**	Net cumulative significance	
	Unmitigated	Mitigated		Unmitigated	Mitigated
Biophysical					
Loss of soil resources and land capability through physical disturbance	Negligible		**Negligible**	High	Medium
Loss of soil resources and land capability through contamination	Medium	Low	**Minor**	High	Low
Physical destruction of biodiversity	Negligible		**Negligible**	High	High-Medium
General disturbance of biodiversity	Medium	Low	**Minor**	High	High-Medium
Alteration of surface drainage patterns	-		-	High	Low
Contamination of surface water	Medium	Low	**Minor**	High	Low
Reduction in water availability to third parties	-		-	High	Medium-Low
Groundwater contamination	Medium	Low Medium[#]	**Minor** **Moderate-Low[#]**	High	Low
Change in ambient air concentrations	-	Medium*	**Moderate***	High	Low Medium*
Increase in ambient noise levels	Low	Low	**Negligible**	Medium	Medium
Change in landscape and related visual aspects	Medium	Medium[1] Low[2]	**Moderate[1]** **Minor[2]**	High	Medium-High
Socio-economic					
Economic impact (positive and negative)	Medium+	High+	**Moderate +**	Medium+	High+
Loss and sterilisation of mineral resources	-		-	Medium	Low
Inward migration	Medium	Low	**Minor**	High	Medium
Road disturbance and traffic safety	Medium	Low	**Minor**	High	Medium
Increase in safety risks to third parties and communities	-		-	High	Medium
Land use impact	Medium	Low	**Minor**	High	Medium to Low
Heritage and cultural					
Damage or disturbance of heritage (including cultural) and palaeontological resources	-		-	High	Low

- denotes 'No impact' or 'No contribution' Ratings are negative unless otherwise specified [1] Construction [2] Operations

[#] Post closure, depending on success of active pump and treat mechanisms

** Presents potential impacts related to chlorine, hydrogen chloride, hydrogen fluoride and ammonia modelled for the KELL plant.*

The assessment of the proposed project presents the potential for moderately significant negative impacts to occur (in the unmitigated scenario) on the biophysical and socio-economic environments in the surrounding area. No heritage or cultural impacts are expected to occur. Although the operational KELL process presents a new air emission profile for the PPM operations, the plant will be designed and implemented to meet the new plant minimum emission standards and would need to operate under an atmospheric emission license. The medium significance for potential groundwater contamination post-closure is influenced to a large extent by the conservative geochemical modelling and does not take into account active pump and treat mechanisms. Where pump and treat mechanisms and the final rehabilitation of the TSF prevent the migration of a contamination plume affecting third party boreholes, the significance post-closure would be reduced. With mitigation potential impacts on the biophysical environment can be prevented or reduced with the exception of potential visual impacts during the construction phase of the project. Construction phase visual impacts would occur for the duration of the construction phase, although this is considered to be short-term.

The proposed project would contribute positively towards to the local, regional and national economy through capital investment, creation of employment and revenue generation potential. Given the technical nature of the KELL process, PPM's intention is to upskill and transfer existing employees from the concentrator operations to the hydrometallurgical plant. The community based projects and continued implementation of the mine's social and labour plan have direct social development and employment benefits for the relevant communities.

When considering the nature and extent of PPM's approved operations, it should be noted that the net substantive cumulative change is limited. This is linked to the fact that the proposed project would largely be developed within the current footprint and range of activities at the mine noting that the KELL process is a new technology.

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

10.2 FINAL SITE MAP

The final preferred site layout plan is included in Figure 3-1.

10.3 SUMMARY OF THE POSITIVE AND NEGATIVE IMPLICATIONS AND RISKS OF THE PROPOSED ACTIVITY AND IDENTIFIED ALTERNATIVES

With reference to Sections 6.1 and 6.9, no location or layout alternatives were considered and as such this section is not applicable.

11 IMPACT MANAGEMENT OBJECTIVES AND OUTCOMES FOR INCLUSION IN THE EMPR

Based on the outcome of the EIA and where applicable the recommendations from specialists the proposed management objectives and outcomes specific to the proposed project and for inclusion into the EMPr are detailed in this section.

Specific environmental objectives to control, remedy or prevent potential impacts emanating from the proposed project are provided in Table 11-1 below. These objectives align with the objectives in the approved PPM EMPr and subsequent amendments. Only those objectives specific to the proposed project are included below.

TABLE 11-1: MANAGEMENT OBJECTIVES AND OUTCOMES

Aspect	Management objective	Outcome
Soil and land capability	To rehabilitate disturbed areas in line with the management plans. To accommodate the present land uses of communal grazing and/or wilderness.	Rehabilitation that supports post-closure land uses.
Biodiversity	To prevent the unacceptable disturbance and loss of biodiversity and related ecosystem functionality through physical destruction and general disturbance.	Limit the area of disturbance as far as practically possible.
Surface water	To prevent unacceptable alteration of drainage patterns and related reduction of downstream surface water flow and to prevent pollution of surface water resources.	Ensure surface water quality remains within acceptable limits for both domestic and agricultural purposes. Ensure that the reduction of the volume of runoff into the downstream catchment is limited to what is necessary and that natural drainage patterns are re-established as part of rehabilitation in order to prevent unacceptable alteration of drainage patterns and related reduction of downstream surface water flow.
Groundwater	To prevent pollution of groundwater resources and related harm to water users and to prevent losses to third party water users.	Ensure groundwater quality remains within acceptable limits for both domestic and agricultural purposes. To ensure that groundwater continues to be available to current users.
Air	To prevent air pollution health impacts.	Ensure that any pollutants emitted as a result of the project remains within acceptable limits so as to prevent health related impacts.
Noise	To prevent public exposure to disturbing noise.	Ensure that any noise generated as a result of the project remains within acceptable limits to avoid the disturbance of third parties.
Visual	To limit negative visual impacts.	Limit negative visual views.
Socio-economic	To enhance the positive economic impacts and limit the negative economic impacts. To enhance the sustainability of the project into the future by building capacity.	Work with existing structures and organisations to establish and maintain a good working relationship with surrounding communities, local authorities and landowners in order to limit the impacts associated with inward migration. Enhance the positive economic impacts by working together with existing structures and organisations.

Aspect	Management objective	Outcome
Traffic	To prevent mine-related road disturbance.	Ensure the mine's use of public roads is done in a responsible manner
Land uses	To prevent unacceptable impacts on surrounding land uses and their economic activity.	Co-exist with existing land uses. Impact existing land uses as little as possible.
Heritage Park	To prevent damage and/or loss to the proposed heritage park corridor zones. To not restrict the development and functioning of the corridor.	Support future land uses of the area.
Public involvement	To build meaningful relationships with all stakeholders.	

12 FINAL PROPOSED ALTERNATIVES

With reference to Sections 6.1 and 6.9, no location or layout alternatives were considered and as such this section is not applicable.

13 ASPECTS FOR INCLUSION AS CONDITIONS OF THE AUTHORISATION

Management actions including monitoring requirements, as outlined in Sections 27 and 29 respectively, should form part of the conditions of the environmental authorisation.

With reference to Regulation 26 of GNR 982 of NEMA, additional conditions that should form part of the environmental authorisation that are not specifically included in the EMPr report include compliance with all applicable environmental legislation whether specifically mentioned in this document or not and which may be amended from time to time.

14 ASSUMPTIONS, UNCERTAINTIES, LIMITATIONS AND GAPS IN KNOWLEDGE

Assumptions, uncertainties and limitations have been discussed throughout the EIA and EMPr and in the various specialist studies. The more significant of these are included in Table 14-1 below.

TABLE 14-1: QUALIFICATIONS, ASSUMPTIONS AND LIMITATIONS

Aspect	Qualifications, assumptions and limitations
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 PPM adhere to these.
Predictive models in general	• All predictive models are only as accurate as the input data provided to the modellers. If any of the input data is found to be inaccurate or is not applicable because of project design changes that occur over time, then the model predictions will be less accurate.
General	• It is assumed that SLR has been provided with all relevant project information and that it was correct and valid at the time it was provided. • There will be no significant changes to the project description or surrounding environment between the completion of the EIA process and implementation of the proposed project that could substantially influence findings and recommendations with respect to mitigation and management. • Specialists assessed potential impacts from the construction and operational phases separately. These have been assessed collectively in the EIA and EMPr by the EAP, using the information provided by specialists. This provides an assessment of the overall project.
Cumulative assessment	• Cumulative assessment commentary is included in the impact assessment under the various aspect headings. This takes account of current operations and the surface infrastructure changes and the plant expansion.
Climate data	• Climatic data for temperature and wind were sourced from MM5 meteorological data for the period 2013 to 2015. Data from this time period is still considered relevant to the study as the meteorological conditions within the study area have not shown any significant historical changes.
Noise	• Estimates of sound power levels were sourced from default noise “emission factors” for heavy industrial, light industrial and commercial areas, developed by the European Commission’s (EC) Working Group Good Practice Guide. These default noise levels were used in the absence of a detailed source inventory. • All activities were assumed to be 24 hours per day, 7 days per week. • Although other existing sources of noise within the area were identified (such as existing mining activities, community noise from residential areas, etc.), such sources were not quantified but were taken into account during the survey.
Visual	• The study uses the worst-case scenario (unmitigated) in predicting impacts (day time and night time). • The viewshed analyses considered only the topography of the area and did not factor in any features such as existing trees, structures and other obstacles. This means that the spatial patterns generated in the analyses are inclined towards the worst case-scenario rather than the actual situation; visibility of the Project is therefore qualified by on-site observations. • The study focussed on viewing areas from public and tourist zones located within a 10 km radius of the project site, as deemed appropriate by the specialist.
Air	• At the time that the study was conducted there was no information available regarding the KELL Plant stack locations or stack parameters. All stacks were assumed to be at the centre of the plant footprint as provided by PPM. All stacks were assumed to be at least 5 metres high and conservatively modelled with a height of 5m. • It was assumed that the KELL Plant will be designed to comply with the Subcategory 4.17 Minimum Emission Standards. • Routine emissions from the proposed operations were simulated. Atmospheric releases occurring as a result of non-routine conditions were not included in the dispersion modelling. • There will always be some error in any geophysical model, but it is desirable to structure the model in such a way to minimise the total error. A model represents the most likely outcome of an ensemble of experimental results. The total uncertainty can be thought of as the sum of three components: the uncertainty due to errors in the model physics; the uncertainty due to data errors; and the uncertainty due to stochastic processes (turbulence) in the atmosphere. Nevertheless, dispersion modelling is generally accepted as a necessary and valuable tool in air

Aspect	Qualifications, assumptions and limitations
	quality management.
Geochemistry	• In the event that the PPM TSF is developed according to a different schedule to that assumed in the geochemistry assessment, the source term presented would need to be revised and updated. Factors associated with the development of the TSF affect the dynamics of seepage from the TSF and are likely to change the contaminant mass loss from the TSF footprint. • For the post-closure drainage, it was assumed that the TSF final elevation, deposition rate, and operational life would have specific characteristics. These are detailed in the specialist report.
Groundwater	• The 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. • Model boundaries were assumed to be a combination of no-flow and outflow boundaries. • Community water use / wellfield at PPM were included. Seepage capturing boreholes surrounding the TSF played a large role in the transient mass calibration. • The groundwater model is based on specific assumptions related to the aquifer, flow system, recharge potential and structural geology. These are detailed in the specialist report. • The modelling approach was based on the precautionary principle in areas where there is little or a lack of data. This means that the simulated impacts should be larger than 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. • The groundwater model made use of the source term modelling completed by Solution H+ (2019) and is deemed by the groundwater specialist as being very conservative.
Surface water	• The dynamic water balance is based on specific assumptions related to rainfall data and stormwater catchments. These are detailed in the specialist report.
TSF	• Based on the evaluation of the TSF capacity as included in the Epoch report, it is recommended that the remaining capacity and operational performance of the TSF be monitored closely to facilitate planning for additional tailings storage capacity, should it be required.
Closure cost	• The DMR Guideline Document is a “high-level” closure liability estimate that does not necessarily address all the mine related closure issues (hence the replacement of the DMR Guideline as at 19 February 2020, and the implementation of the Financial Provisioning Regulations – with specific guidance and instruction when developing closure plans). • The calculated financial closure liability only considers the routine costs associated with decommissioning of plant and infrastructure, the restoration of any environmental damage caused predominantly at the pre-production stage, and the maintenance and aftercare of the rehabilitated sites. • This closure liability calculation currently assumes that all infrastructure will be demolished, and that the mine infrastructure has zero salvage value. Further work to identify exactly what infrastructure may remain post closure to support the proposed community water supply scheme for livestock, irrigation or human consumption still needs to be undertaken. • Site specific aspects such as surface and groundwater remediation have not been costed at this stage – the likelihood of such remediation will be identified through ongoing surface and groundwater monitoring and/or by carrying out risk assessment and water pollution potential studies/investigations during mine operations. This issue will be dealt with as part of detailed closure planning as per the Financial Provisioning Regulations (GNR 1147). • Revegetation trials (and hence the sustainability of any rehabilitation works) is currently ongoing and will be addressed as part of operations, as well as, the requirements of a detailed closure plan (as per GNR 1147). • The current financial closure liability does not make allowance for the development of a detailed closure plan, final groundwater modelling, drafting of engineering drawings and specifications, procurement of specialist work, and any administration and site supervision costs. These expenses should be accounted for by PPM in the operations expenditure of the mine.

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

15.1 REASONS WHY THE ACTIVITY SHOULD BE AUTHORIZED OR NOT

The assessment of the proposed project presents the potential for moderately significant negative impacts to occur (in the unmitigated scenario) on the biophysical and socio-economic environments in the surrounding area. No heritage or cultural impacts are expected to occur. Although the operational KELL process presents a new air emission profile for the PPM operations, the plant will be designed and implemented to meet the new plant minimum emission standards and would need to operate under an atmospheric emission license. The medium significance for potential groundwater contamination post-closure is influenced to a large extent by the conservative geochemical modelling (as concluded by the groundwater specialist study) and does not take into account active pump and treat mechanisms. Where pump and treat mechanisms and the final rehabilitation of the TSF prevent the migration of a contamination plume affecting third party boreholes, the significance post-closure would be reduced. With mitigation potential impacts on the biophysical environment can be prevented or reduced with the exception of potential visual impacts during the construction phase of the project. Construction phase visual impacts would occur for the duration of the construction phase, although this is considered to be short-term.

The proposed project would contribute positively towards to the local, regional and national economy through capital investment, creation of employment and revenue generation potential. Given the technical nature of the KELL process, PPM's intention is to upskill and transfer existing employees from the concentrator operations to the hydrometallurgical plant. The community based projects and continued implementation of the mine's social and labour plan have direct social development and employment benefits for the relevant communities.

When considering the nature and extent of PPM's approved operations, it should be noted that the net substantive cumulative change is limited. This is linked to the fact that the proposed project would largely be developed within the current footprint and range of activities at the mine noting that the KELL process is a new technology.

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

15.2 CONDITIONS THAT MUST BE INCLUDED IN THE AUTHORISATION

15.2.1 SPECIFIC CONDITIONS FOR INCLUSION IN THE EMPR

Refer to Section 13.

15.2.2 REHABILITATION REQUIREMENTS

Refer to Section 28.

16 PERIOD FOR WHICH AUTHORISATION IS REQUIRED

The changes to the mineral processing operations would extend the life of the plant by a minimum of 40 years. Therefore the period required for the EA is 40 years.

17 UNDERTAKING

I, Alex Pheiffer, the Environmental Assessment Practitioner responsible for compiling this report, undertake that:

- the information provided herein is correct;
- comments and inputs from stakeholders and I&APs have been included and correctly recorded in this report;
- inputs and recommendations from the specialist reports have been included where relevant; and
- any information provided to I&APs and any responses to comments or inputs made is correct or was correct at that time.

Signature of EAP

15/03/2019
Date

Signature of commissioner of oath

15 - March - 2019
Date

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18 FINANCIAL PROVISION

18.1 METHOD TO DERIVE THE FINANCIAL PROVISION

The closure liability calculation for the proposed project has been prepared as an addendum to the latest current financial closure liability calculation (Digby Wells and Associates, 2018) for PPM and incorporates only the proposed infrastructure changes at PPM.

The latest current financial closure liability for PPM (as at end December 2017) was calculated by Digby Wells and Associates as per the DMR guideline document of January 2005. As per the DMR guideline, PPM is classified as a Class B (medium risk) mine, with a medium environmental sensitivity based on the pre-mining environment of the mining area and proximity of the mine to local communities.

This addendum to the financial closure liability for the proposed infrastructure changes at PPM (as at December 2018) has also been calculated in accordance with the DMR guideline document (SLR, 2019a).

The amount determined for financial provision for the project is provided in Section 28.

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

The amount required in order to manage and rehabilitate the environmental disturbance (as a result of the changes to the mineral processing operations) is provided for in the operating costs.

19 DEVIATIONS FROM SCOPING REPORT AND APPROVED PLAN OF STUDY

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

The assessment methodology used in the assessment of potential impacts (see Section 6.6) is as per the approved Plan of Study for EIA presented in the final Scoping Report.

19.2 DEVIATION FROM THE SCOPING REPORT

Deviations from the scoping report are outlined in Table 19-1 below together with a motivation for the deviation.

TABLE 19-1: DEVIATIONS FROM THE SCOPING REPORT

No.	Deviation from scoping report	Motivation
1.	The scoping report made provision for a modular tailings re-treatment plant for the extraction of PGMs, which would require the re-processing of the existing PPM TSF.	The re-mining and re-processing of the PPM TSF has been excluded from the scope of the EIA. The re-mining of the PPM TSF would trigger Category B Activity 11 of NEM:WA, namely the reclamation of a residue stockpile or residue deposit resulting from activities which require a mining right, exploration right or production right in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002). PPM already holds the mining right for the said minerals. During the course of the EIA process, waste management legislation changed with the changes now requiring a waste management license for the above-mentioned activity. At the time of submitting the NEMA EA application and scoping report to DREAD, although the remining of the PPM TSF was described, the NEM:WA waste management licensing process was not identified as being applicable to the project. Given that this component of the mineral processing facilities would only be implemented in the future, at the end of the life of the PPM TSF (in approximately eight years), this component of the project has been excluded from the project scope. Application for the necessary licenses would be made closer to the estimated implementation date of this component provided this is still part of PPM's plans at that point.
2.	Training centre	The scoping report made provision for the training centre (an ABET facility), located within the plant, to be relocated to an area outside the plant, to make space for the proposed hydrometallurgical (KELL) plant. Further refinement of the project plan has resulted in the training centre being proposed at an alternative location, namely the George Stegman hospital in Moruleng. This location would make the training centre more accessible to community members and minimise the interaction of community members with PPM operational activities.
3.	Community-based initiatives	At the time of the scoping report, some of the community-based initiatives had been established while others where in the planning phase. Subsequent to the submission of the scoping report, all community-based initiatives as described in this report have been established at the mine.

20 SPECIFIC INFORMATION REQUIRED BY THE COMPETENT AUTHORITY

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

The impacts associated with socio-economic conditions are discussed in Appendix D. Management and management actions identified to address any socio-economic impacts are included in Section 27.

No person will be directly affected by the project given that no I&APs currently reside within the proposed footprint area. However, other direct incremental impacts include:

- Road and traffic safety (**LOW** significance with mitigation);
- 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 (**LOW** significance with mitigation); and
- Positive economic impacts (**MEDIUM +** significance with mitigation).

Indirect incremental socio-economic impacts include:

- Contamination of ground and surface water resources through long term seepage and/or runoff (**LOW** significance with mitigation);
- Air pollution sources that can have a negative impact on ambient air quality (**NEGLIGIBLE** significance for dust fallout, **LOW** significance for particulate, SO_2 and NO_2 emissions and **MEDIUM** significance for Cl_2, HCl, HF and NH_3 emissions);
- Increase in disturbing noise levels (**LOW** significance even without mitigation); and
- Visual impacts on this receiving environment may be caused by activities and infrastructure (**MEDIUM** significance with mitigation during construction and **LOW** significance with mitigation during operations).

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

Not applicable. No national estate will be affected as part of the project.

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

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

PART B: ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

22 DETAILS OF THE EAP

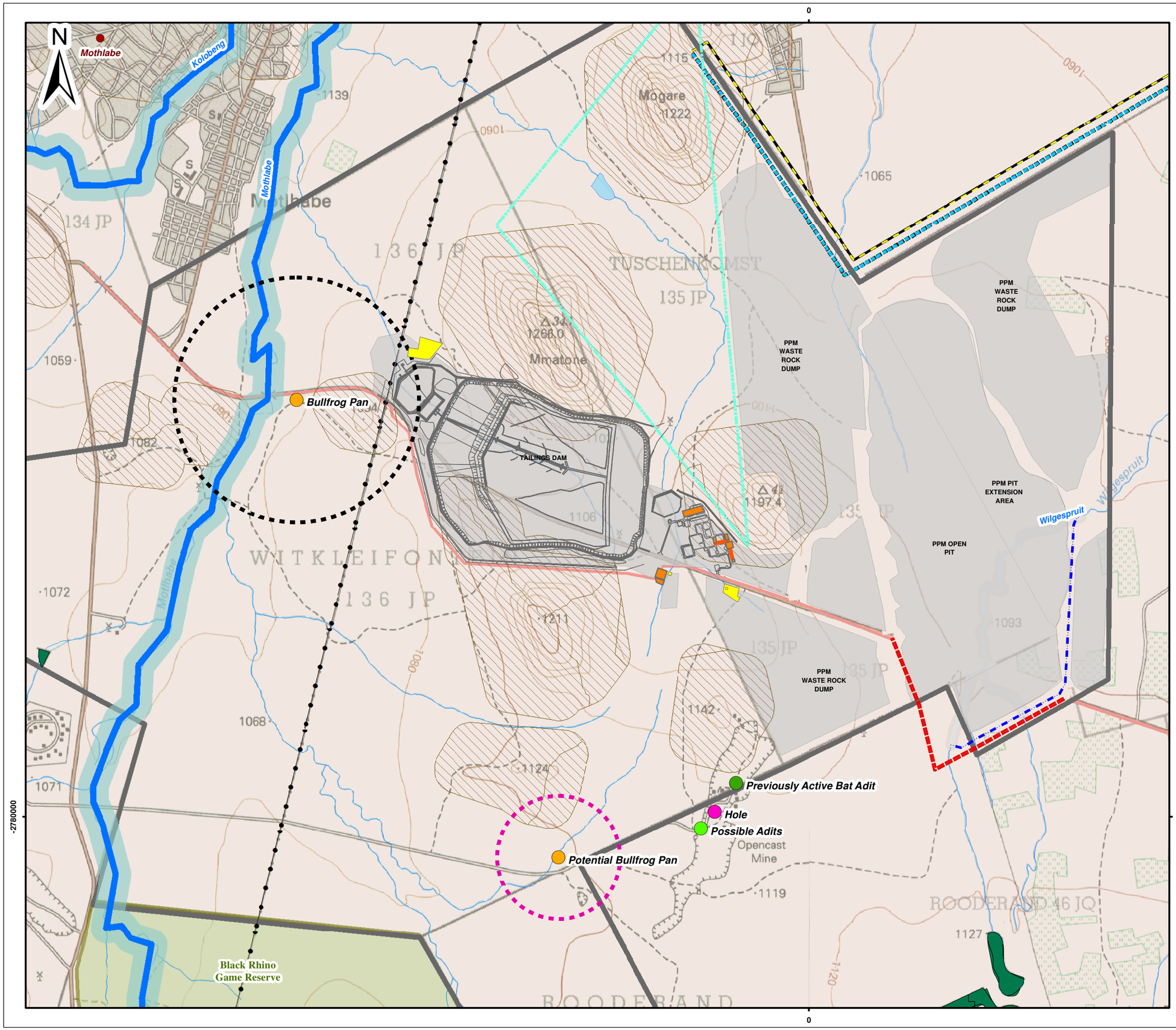
The details of the EAPs who undertook the EIA process and prepared this EMPr are provided in Part A, Section 1.

23 DESCRIPTION OF THE ASPECTS OF THE ACTIVITY

The activities covered by this EMPr are fully described in Part A, Section 3.

24 COMPOSITE MAP

A composite map including all surface infrastructure (existing and proposed) superimposed on environmentally sensitive areas of the preferred site is included in Figure 24-1.



Legend

- Towns / Villages
- Roads
- Powerline
- Pipeline from Tuschenkomst Reservoir to Sedibelo / Magazynskraal
- Magalies Water Pipeline
- Wilgespruit River Diversion
- P50-1 Diversion
- Watercourses
- Dams
- Pilanesberg Platinum Mine Mining Right Area & Related Infrastructure
- Proposed Infrastructure Changes
- Existing Community-Based Projects
- NFEPA Wetlands
- NFEPA Rivers: Class B Largely Natural
- 100m River Offset
- Rocky Ridges / Habitats
- Dwaalboom Thornveld :Least Threatened (Mucina &Rutherford 2012)
- Pilanesberg National Park (including Black Rhino Game Reserve)
- Heritage Landscape
- Minimum Bullfrog Habitat 500m Buffer
- Minimum Bullfrog Habitat 1000m Buffer

0 500 Meters

Scale: 1:30 000 @ A3

Projection: Transverse Mercator
Datum: Hartebeeshoek, LO27

PILANESBERG PLATINUM MINES (PTY) LTD

Figure 24-1

Composite Map

SLR Consulting (Africa) (Pty) Ltd
P O Box 1596, Cramerview, 2060, South Africa
Tel: +27 (11) 467-0945 Fax: +27 (11) 467-0978

710.16002.00026	2019/03/11

25 DESCRIPTION OF THE IMPACT MANAGEMENT OBJECTIVES INCLUDING MANAGEMENT STATEMENT

25.1 DETERMINATION OF CLOSURE OBJECTIVES

The closure objectives for the project are aligned with the closure objectives of PPM (see Sections 3.2.12 and 28.1).

25.2 PROCESS FOR MANAGING ENVIRONMENTAL DAMAGE AS A RESULT OF UNDERTAKING THE ACTIVITY

The management actions outlined in Section 27 have been identified in order to manage and reduce impacts associated with the proposed project in order to prevent unnecessary damage to the environment. In the event that incidents occur that may result in environmental damages the emergency response procedure as outlined in Section 30.2 will be implemented to avoid pollution or degradation.

25.3 POTENTIAL RISK OF ACID MINE DRAINAGE

Of relevance to the proposed project is the co-disposal of tailings from the KELL process with tailings from the flotation circuits.

2007 Geochemical assessment of PPM tailings

As part of the 2007 EIA process (Metago, 2007), geochemical tests were conducted on relevant pilot tailings samples. The acid rock drainage potential was assessed using the Acid Base Accounting (ABA) tests. Based on the review of sulphur species concentrations, carbonate values, the acid and neutralising potentials, the tailings samples were classified as having a low neutralising potential with the sulphide content being below the quantification limit. The results of the ABA testing indicated that the tailings materials should not be acid generating.

2017 Geochemical assessment of KELL process and PPM tailings

As part of the current proposed project, geochemical tests were conducted on KELL process supernatant (on its own) as well as composite samples of tailings (KELL tailings + PPM tailings) and supernatant (KELL supernatant + PPM supernatant). The acid rock drainage potential was assessed using the Acid Base Accounting (ABA) tests. All tailings samples were classified as non-PAG (non-potentially acid generating) (Solution H+, 2019).

25.4 STEPS TAKEN TO INVESTIGATE, ASSESS AND EVALUATE THE IMPACT OF ACID MINE DRAINAGE

With reference to Section 25.3, the tailings material is not acid generating and as such this section is not applicable.

25.5 ENGINEERING OR MINE DESIGN SOLUTIONS TO AVOID OR REMEDY ACID MINE DRAINAGE

With reference to Section 25.3, the tailings material is not acid generating and as such this section is not applicable.

25.6 MEASURES IN PLACE TO REMEDY RESIDUAL OR CUMULATIVE IMPACT FROM ACID MINE DRAINAGE

With reference to Section 25.3, the tailings material is not acid generating and as such this section is not applicable.

25.7 VOLUMES AND RATE OF WATER USE FOR MINING

Water for the proposed project would be sourced from PPM's existing Magalies Water supply within existing capacities. PPM has an allocation of 24,2 Ml/day. The PPM operations currently use approximately a third of this allocation.

Water at PPM is recycled and reused in the process. Where make-up water is required to supplement process water, the design requirements are as follows:

- Additional UG2 milling and flotation circuit: approximately 39 000 m^3/month (1,3 Ml/day); and
- KELL process: approximately 2 670 m^3/month (0,089 Ml/day).

25.8 HAS A WATER USE LICENCE BEEN APPLIED FOR?

PPM holds a WUL (License No. 03/A24D/ACGU/2037) authorising water uses in terms of Section 21 of the NWA.

25.9 IMPACTS TO BE MITIGATED IN THEIR RESPECTIVE PHASES

The assessment of potential impacts is included in Section 8 and Appendix D. Management actions which will be implemented to avoid and minimise potential impacts are detailed in Section 27.

26 IMPACT MANAGEMENT OUTCOMES

Table 26-1 below provides a description of the outcomes and identifies the standard of impact management required in order to manage, remedy, control or modify potential impacts. The management actions identified to achieve these outcomes and objectives are described in Section 27.

TABLE 26-1: DESCRIPTION OF IMPACT MANAGEMENT OUTCOMES

Activity	Potential Impact	Affected Aspect	Phase	Management actions Type	Standard to be Achieved (Impact management objectives)
All activities	Loss of soil resources and land capability due to contamination	Soil and land capability	Construction Operational Decommissioning Closure	• Limit project footprint • Control through waste management practices • Control through appropriate design (incl. access roads) • Closure planning and rehabilitation • Remedy through emergency response procedures (see Section 30.2)	To rehabilitate disturbed areas in line with the management plans. To accommodate the present land uses of communal grazing and/or wilderness.
All activities	General disturbance of biodiversity	Biodiversity	Construction Operational Decommissioning Closure	• Implement biodiversity action plan • Limit project footprint • Alien invasive species management programme • Monitoring • Rehabilitation	To prevent the unacceptable disturbance and loss of biodiversity and related ecosystem functionality through physical destruction and general disturbance.
All activities	Contamination of surface water	Surface water	Construction Operational Decommissioning Closure	• Management through appropriate design • Implementation of Storm water Management Plan • Management through waste management practises • Surface water monitoring • Compensation • Remedy through emergency response procedures (see Section 30.2)	To prevent unacceptable alteration of drainage patterns and related reduction of downstream surface water flow and to prevent pollution of surface water resources.
Mineral processing operations Tailings management Stormwater management Non-mineralised waste management Storage and maintenance services/ facilities Site management Rehabilitation	Groundwater contamination	Groundwater	Construction Operational Decommissioning Closure	• Groundwater monitoring • Implementation of Storm water Management Plan • Management through compensation • Management through appropriate design • Remedy through emergency response procedures (see Section 30.2)	To prevent pollution of groundwater resources and related harm to water users and to prevent losses to third party water users.

Activity	Potential Impact	Affected Aspect	Phase	Management actions Type	Standard to be Achieved (Impact management objectives)
Site preparation Earthworks Civil works KELL plant Transport systems Site management Demolition Rehabilitation	Change in ambient air concentrations	Air quality	Construction Operational	• Permitting in line with requirements • Management through appropriate design • Air quality monitoring • Complaints register	To prevent air pollution health impacts.
Earthworks Civil works Mineral processing operations Transport systems Site management Demolition Rehabilitation	Increase in ambient noise levels	Noise	Construction Operational	• Manage through noise controls • Conduct noise monitoring	To prevent public exposure to disturbing noise.
Earthworks Civil works Mineral processing operations Tailings management Transport systems Site management Demolition Rehabilitation Maintenance and aftercare	Change in landscapes and related visual aspects	Visual	Construction Operational Decommissioning Closure	• Limit project footprint • Manage through visual controls • Rehabilitation • Stakeholder engagement	To limit negative visual impacts.
All activities	Economic impact	Socio-economic	Construction Operational Decommissioning	• Control through the monitoring of socio-economic conditions • Remedy through emergency response procedures (see Section 30.2)	To enhance the positive economic impacts and limit the negative economic impacts. To enhance the sustainability of the project into the future by building capacity.
All activities	Inward migration		Construction Operational Decommissioning Closure	• Control through good communication, recruitment and procurement processes • Co-operation with government health and safety structures to address the spread of disease, HIV/AIDS • Communication with local police force to combat crime	

Activity	Potential Impact	Affected Aspect	Phase	Management actions Type	Standard to be Achieved (Impact management objectives)
Transport systems Site management	Road disturbance and traffic safety	Traffic	Construction Operational	• Road upgrade including safety considerations • Remedy through emergency response procedures (see Section 30.2)	To prevent mine-related road disturbance.
All activities	Land use impacts	Land use	Construction Operational Decommissioning Closure	• Mitigate all environmental and social impacts	To prevent unacceptable impacts on surrounding land uses and their economic activity.

27 IMPACT MANAGEMENT ACTIONS

Management actions identified to prevent, reduce, control or remedy the assessed impacts are presented in Table 27-1 below.

It is important to note that management actions will include any measures outlined in the original EIA and EMPr (Metago, 2007) and subsequent amendments (Metago, 2009; Metago, 2011a; Metago, 2011b) and any additional management actions identified as part of the current project, where relevant. Any additional management actions are indicated in ***italics***. The action plans include the timeframes for implementing the management actions together with a description of how management actions comply with relevant standards. Management actions and recommendations identified by specialists have been summarised and are included in the table below.

TABLE 27-1: DESCRIPTION OF IMPACT MANAGEMENT ACTIONS

No.	Activity	Potential Impact	Management actions	Time Period for Implementation	Responsible parties	Compliance with Standards
1.	All activities	Loss of soil resources and land capability due to contamination	• PPM will conduct all potentially polluting activities in a manner that pollutants are contained at source. In this regard PPM will ensure that: ○ all vehicles and equipment will be serviced in workshops and washbays with impermeable floors, dirty water collection facilities and oil traps; ○ all chemical, fuel, oil storage and handling facilities will be designed and operated in a manner that all spillages are contained in impermeable areas and cannot be released into the environment; ○ ***storage of coal and KELL plant chemicals will be within appropriately designed containment measures within the existing plant boundary;*** ○ ***hazardous installations will comply with applicable standards to ensure that containment and safety risks are appropriately addressed and managed;*** ○ ad hoc spills of potentially polluting substances (whether in dirty areas or in the environment) will be reported to the environmental manager immediately and cleaned up/remediated immediately; ○ a dirty water management system is implemented; and ○ the waste management practices as per PPM's waste management procedure and the National Norms and Standards are implemented. • Rehabilitation will commence as soon as mine activities cease. • All rehabilitation initiatives will ensure that land capabilities that support ***the final end land use*** are restored through the conservation and replacement of soil as per the mine's soil conservation procedure, and the re-establishment of biodiversity that naturally occurs in the mine area.	All phases	Plant manager and Environmental manager	Hazard installations in line with applicable standards.

No.	Activity	Potential Impact	Management actions	Time Period for Implementation	Responsible parties	Compliance with Standards
2.	All activities	General disturbance of biodiversity	• PPM will continue to implement a biodiversity action plan that will be refined and implemented in consultation with the biodiversity expertise and resources within the Heritage Park initiative (which includes DREAD and NWTPB representation). The mine will ensure that the action plan includes the following management actions: o limit project activities, infrastructure and disturbance to those specifically identified and described in this EIA and EMPr, with controlled access and zero tolerance of disturbances to identified sensitive habitats and associated species of the ridges/rocky outcrops and water course/wetland buffer zones; o any new pipelines will either be buried or lifted off the ground by 50cm to prevent the establishment of a movement barrier for fauna species and to allow movement of smaller organisms; o there will be implementation of an alien/invasive/weed management programme in collaboration with DAgric, DWAF and Working for Water to control the spread of these plants onto and from disturbed areas. Care will be taken to prevent the encroachment of alien plant species into rehabilitated areas; and o there will be collaboration with the Heritage Park representatives in the control of community grazing, medicinal plant harvesting, animal harvesting and fuel plant harvesting in a manner that promotes sustainable use of natural resources. This is particularly relevant for the sensitive habitats. • ***The ridge habitat will be included in the monitoring programme.***	All phases	Environmental Manager	NEM:BA Alien and Invasive Species Regulations (2014)
3.	All activities	Contamination of surface water	• Ensure stormwater management measures comply with the provisions of the NWA and Regulation 704 (4 June 1999) or any future amendments thereto. • ***Operate the plant SWD and TSF RWD in line with Regulation 704 and ensure re-use is in line with maintaining sufficient capacity within the dam to cater for a 1:50 year storm event.*** • ***Ensure tailings are handled and deposited taking into account the capacity, safety and stability of the PPM TSF (see Section 3.2.5).*** • ***It is recommended that a sampling point is established downstream and closer to the PPM plant to be able to separate the impacts of the PPM plant and the waste rock dump.*** • ***A study should be conducted by PPM to trace the source of pollutants on site.***	All phases	Engineering and Environmental Managers	Regulation 704 of 1999 in terms of the NWA WUL

No.	Activity	Potential Impact	Management actions	Time Period for Implementation	Responsible parties	Compliance with Standards
			• ***The water balance and storm water management plan must be reviewed and updated throughout the life of the mine and operations until determination of closure liabilities for the PPM Mine.*** • PPM will continue to implement its surface water monitoring programme (see Section 29). Should any contamination be detected the mine will immediately notify DWS. The mine, in consultation with DWS and an appropriately qualified person, will then notify potentially affected users, identify the source of contamination, identify measures for the prevention of this contamination (in the short term and the long term) and then implement these measures.			
4.	Mineral processing operations Tailings management Stormwater management Non-mineralised waste management Storage and maintenance services/ facilities Site management Rehabilitation	Groundwater contamination	• ***Telemetry will be installed at all relevant boreholes to monitor the real-time aquifer conditions.*** • ***Geochemical modelling must be reviewed, prior to deposition of the combined KELL and PPM tailings, to verify the results of the current geochemistry modelling.*** • ***The geochemical numerical modelling should be updated to include reactive transport modelling to take the possible precipitation and adsorption of sulphate into account.*** • ***Tailings will be deposited at a ratio of 1.2 % KELL tailings to 98.8 % PPM tailings as this is the ratio that specialist assessments have been based on. In the event that the PPM TSF is developed according to a different schedule to that assumed in the geochemistry assessment, the source term presented will be revised and updated. The groundwater model will be updated to include the revised source term and if necessary additional mitigation implemented in consultation with a specialist.*** • ***PPM will sample the tailings at suitable intervals during the operational life of the TSF to evaluate the heterogeneity in physical and chemical composition. This will provide a data set that allows refined estimates of the post-closure impacts of the TSF to be developed ahead of mine closure.*** • ***KELL tailings will be re-slurried and mixed with recycled process water prior to the PPM tailings thickener to achieve a supernatant water quality equal to or better than the current PPM tailings supernatant.*** • ***Additional seepage capturing boreholes will be established as recommended in the groundwater specialist study.*** • ***Seepage capturing boreholes will be pumped as per the recommended rates in the groundwater specialist study to ensure the desired effect of***	All phases	Environmental Manager	WUL

No.	Activity	Potential Impact	Management actions	Time Period for Implementation	Responsible parties	Compliance with Standards
			each hole. • ***The TSF surface will be rehabilitated to mimic a recharge of 3% of rainfall from five years post the operational phase. The rehabilitation would include the planting of trees which have a high evapotranspiration rate to effectively minimise the nett infiltration of water from the facility and a clay sealing cap to prevent recharge to the decommissioned TSF. The rehabilitated scenarios must be included in an updated model to demonstrate the efficiency.*** • ***Surface and groundwater remediation will be informed through ongoing surface and groundwater monitoring and by carrying out risk assessment and water pollution potential studies/investigations during mine operations.*** • ***Revegetation trials (and hence the sustainability of any rehabilitation works) must be investigated as part of operations.*** • PPM will continue monitoring boreholes in the vicinity of the mine (Section 6.15). If contamination is detected, PPM will consult with an appropriate specialist and with DWAF to design and implement a treatment solution. This is likely to involve the capturing of the pollution plume by means of scavenger boreholes and the treatment and/or reuse of the polluted water. • If any mine related contamination is experienced by the boreholes users, PPM will provide compensation which could include an alternative water supply of equivalent water quality. • ***Where studies indicate the potential for contamination of third-party groundwater use post-closure, PPM will implement an active pump and treat system.***			
5.	Site preparation Earthworks Civil works KELL plant Transport systems Site management Demolition Rehabilitation	Change in ambient air concentrations	• Construction sites – target dust control efficiency of 50% achieved by a combination of water suppression and suppression chemicals. • Unpaved roads – target dust control efficiency of 75% - achieved by applying 0.0406 litres of water per square meter of road every hour that it is in use by vehicles. In addition, waste rock will be used to surface the dust roads. This will be verified by perimeter dust fallout monitoring. The monitored fallout must be less than 1200mg/m^2/day on the PPM boundaries adjacent to the haul road, and 600mg/m^2/day near residential areas. • Tailings dam – target dust control efficiency of 80% on the side slopes and 40% on the top surface – achieved by vegetation establishment on the side	All phases	Environmental Manager	National Atmospheric Emission Reporting Regulations in terms of the NEM:AQA. AEL

No.	Activity	Potential Impact	Management actions	Time Period for Implementation	Responsible parties	Compliance with Standards

			slopes and a combination of moisture and vegetation establishment on the top surface. This will be verified by perimeter dust fallout monitoring. Dust fall downwind to be less than 1200mg/m^2/day.
			• Crushing and screening – target dust control efficiency of between 62% and 95% – achieved by adding moisture and capturing dust with wet scrubbers. This will be verified by visual inspection to ensure that there is no plume and perimeter dust fallout monitoring. Dust fall downwind to be less than 1200mg/m^2/day.
			• Stack heights at the KELL Plant will be maximised as far as is economically viable (minimum of 12 m in height).
			• KELL Plant will be designed so that emissions from all point sources are in compliance with the Subcategory 4.17 MES.
			• All stacks will be sampled as soon as the plant is operational, and if any pollutants are in exceedance of the Subcategory 4.17 MES, additional mitigation measures will be implemented.
			• PPM employees and members of the surrounding communities will be educated on the effects of Cl_2 (as well as HCl and HF) exposure and that all symptoms are reported on the PPM complaints register.
			• ***PPM will continue to monitor air quality with the addition of:***
			  ○ ***All stacks will be sampled as soon as the plant is operational.***
			  ○ ***Monitoring will be undertaken in line with an AEL.***
			  ○ ***Annual passive diffusive sampling of Cl_2, HCl and HF at PPM plant boundary to the north and south and at the closest sensitive receptor locations namely the villages of Mothlabe and Ngweding.***
			• In the context of further mining development in the project area, PPM undertakes to facilitate an investigation into cumulative air impact assessments and ambient air quality monitoring with the other possible mining operations if and when they reach a final level of feasibility and/or approval.			

6.	Earthworks Civil works Mineral processing operations Transport systems Site management	Increase in ambient noise levels	• ***All diesel-powered equipment and plant vehicles must be kept at a high level of maintenance. Any change in the noise emission characteristics of equipment should serve as trigger for withdrawing it for maintenance.*** • ***Equipment with lower sound power levels must be selected. Vendors should be required to guarantee optimised equipment design noise levels.*** • ***In managing noise specifically related to truck and vehicle traffic, efforts should be directed at:***	All phases	Environmental Manager	Not applicable.

No.	Activity	Potential Impact	Management actions	Time Period for Implementation	Responsible parties	Compliance with Standards
	Demolition Rehabilitation		○ ***Minimise individual vehicle engine, transmission, and body noise/vibration through the implementation of an equipment maintenance programme.*** ○ ***Maintaining road surfaces regularly to avoid corrugations, potholes etc.*** ○ ***Avoiding unnecessary idling times.*** ○ ***Considering alternatives to the traditional reverse 'beeper' alarm where these are aligned with mine health and safety requirements.*** • ***Where possible, other non-routine noisy activities such as construction, decommissioning, start-up and maintenance, will be limited to day-time hours.*** • The mine will record and respond without delay to complaints about disturbing noise. All such complaints will be documented and recorded as incidents. The measures taken to address these complaints will be included in the documentation. These records will be kept for the life of mine.			
7.	Earthworks Civil works Mineral processing operations Tailings management Transport systems Site management Demolition Rehabilitation Maintenance and aftercare	Change in landscapes and related visual aspects	• Implement the air pollution control system to avoid plumes of dust that can reduce visibility. • Paint structures and buildings in colours (browns and greens) that reflect and compliment the natural landscape. • All vegetation that is planted as part of rehabilitation should reflect the natural vegetation of the area. • 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. • **PPM will have sustained engagements with stakeholders including the Pilanesberg National Park and Black Rhino Game Reserve on visual and sense of place related impacts.**	All phases	Environmental Manager	Not applicable.
8.	All activities	Economic impact	• PPM will implement the commitments in its social and labour plan (SLP) in accordance with the employment, procurement and social investment principles of the Mining Charter.	All phases	Administration/ HR and Environmental Manager	Not applicable.
9.	All activities	Inward migration	Recruitment and relationship with surrounding communities • PPM will ensure that its policies incorporate the following: ○ effective and timeous communication with community leaders who can attest to a fair and transparent process amongst the community	All phases	Plant Manager, Administration/ HR and Environmental	Not applicable.

No.	Activity	Potential Impact	Management actions	Time Period for Implementation	Responsible parties	Compliance with Standards
			rather than challenging the mine on the community's behalf over jobs and recruitment; o good communication with all job seekers will be maintained throughout the recruitment process. The process must be seen and understood to be fair and impartial by all involved; o there will be no recruitment at the construction/operational site. All recruitment will take place on set dates and at an arranged venue - preferably a formal gathering place in a nearby community; o there will be no ad hoc hiring of temporary casual labour, no matter how small and temporary the job (washing of vehicles or litter clearance). A sign clearly indicating that there will be no recruitment at the construction site will be erected at the entrance to the site. Also, a list of available temporary workers in the area will be drawn up and kept by PPM in the event that temporary labour is required; o notice of tender applications will be advertised through the community leaders. Appropriate timeframes will be given for the submission of tender documents. The mine's community liaison officer should be contacted in this regard. o local authorities will be requested to remove any informal settlements in the vicinity of the mine that are occupied by people who are there in the hope of obtaining employment. This must be carried out immediately; and o there will be no worker accommodation on site. All workers who are not resident in the vicinity should be accommodated in a formal accommodation in order to obtain their housing allowance. <u>Safety and security</u> • In regard to crime, PPM will communicate with the local police force particularly in the context of developing strategies for combating crime in the vicinity of the project and surrounding communities. <u>Hygiene/disease - HIV/AIDS</u> • Disease and particularly HIV/AIDS is not a problem only for PPM, its employees and contractors, but it is also a local community problem. As a result, successful mitigation of this impact will also depend on the intensity in which it is addressed by other structures such as the health department, the local municipality, education departments, etc. • PPM will ensure that its employees and contractors are made aware of the issues surrounding the spread of HIV and AIDS in the area. This awareness		Manager	

No.	Activity	Potential Impact	Management actions	Time Period for Implementation	Responsible parties	Compliance with Standards
			will be promoted by initiatives such as training and development, peer education, community interventions and visual awareness campaigns. Prevention and management strategies also need to be introduced. Voluntary Counselling and Testing (VCT) is a vital aspect to any HIV/Aids management programme. All stakeholders at PPM need to agree to a rigorous VCT programme. Once a high level of VCT is taking place it is possible to define the magnitude of the problem and begin to develop appropriate strategies for dealing with it.			
10.	Transport systems Site management	Road disturbance and traffic safety	• ***Implement the planned upgrades to the P50-1.*** • ***Construction phase shifts will start and end outside of the main operating shift times.*** • ***Delivery of heavy loads which includes plant construction materials and components will be scheduled at times other than the background traffic peak periods.*** • ***Provide pedestrian walkways along the mine access road to ensure a split between vehicular and pedestrian movements and to ensure a safe environment for pedestrians.*** • ***From a road safety point of view, as part of paving the relevant sections of Road P50-1, dedicated right turn lanes and public transport loading and off-loading facilities will be provided where the road reserves allows.***	All phases	Plant Manager	Not applicable.
11.	All activities	Land use impacts	• Effective implementation of all mitigation measures as outlined in the EMPr to reduce the overall impact on the environment and surrounding land uses.	All phases	Environmental Manager	Not applicable.

28 FINANCIAL PROVISION

28.1 DETERMINATION OF THE AMOUNT OF THE FINANCIAL PROVISION

28.1.1 DESCRIPTION OF THE CLOSURE OBJECTIVES AND THE ALIGNMENT WITH THE BASELINE ENVIRONMENT

The closure objectives for the project are aligned with the closure objectives of PPM. The closure objective for the mineral processing plant complex including the TSF is to establish the pre-mining potential of the land – wilderness/ecotourism and grazing land (Metago, 2007). This is being further refined through on-going closure planning where the final end land use would likely be a wilderness area which would be incorporated into the heritage park corridor (GreenMind, 2016).

28.1.2 CONFIRMATION THAT THE CLOSURE OBJECTIVES HAVE BEEN CONSULTED WITH LANDOWNERS AND I&APS

The closure objectives are outlined in this report which has been made available to I&APs, including landowners for review and comment.

28.1.3 REHABILITATION PLAN

The scale and aerial extent of the proposed activities at closure is indicated on the site infrastructure plan (see Figure 3-1).

The rehabilitation objectives for the project are aligned with the rehabilitation objectives of PPM. In this regard the short term and long term rehabilitation objectives applicable to the project are as follows (GCS, 2016):

Short term objectives:

- Demolish and remove all infrastructure, as per the closure plan, that will not be handed over to the surrounding communities;

Long term objectives:

- Stable landforms that blend into the surrounding environment;
- Return of native flora and fauna;
- Landforms that allow for the desired land uses; and
- Ensure no negative residual impacts are present.

28.1.4 COMPATIBILITY OF THE REHABILITATION PLAN WITH THE CLOSURE OBJECTIVES

It can be confirmed that the rehabilitation plan is compatible with the closure objectives given that the closure objectives were taken into account during the determination of the financial provision.

28.1.5 CALCULATE AND STATE THE QUANTUM OF THE FINANCIAL PROVISION

The current financial closure liability associated with the proposed infrastructure changes at PPM (as at December 2018) is R 12,682,495 (CV including VAT) (Appendix M) (SLR, 2019a).

28.1.6 CONFIRMATION THAT THE FINANCIAL PROVISION WILL BE PROVIDED

The additional financial provision will be provided in the form of a financial guarantee.

29 MECHANISMS FOR MONITORING COMPLIANCE WITH AND PERFORMANCE AGAINST THE EMPR

Environmental impacts requiring monitoring are listed in Table 29-1 below.

In line with the 2007 EIA and EMPr, as a general approach, PPM will ensure that the monitoring programmes comprise the following:

- a formal procedure;
- appropriately calibrated equipment;
- where sample 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.

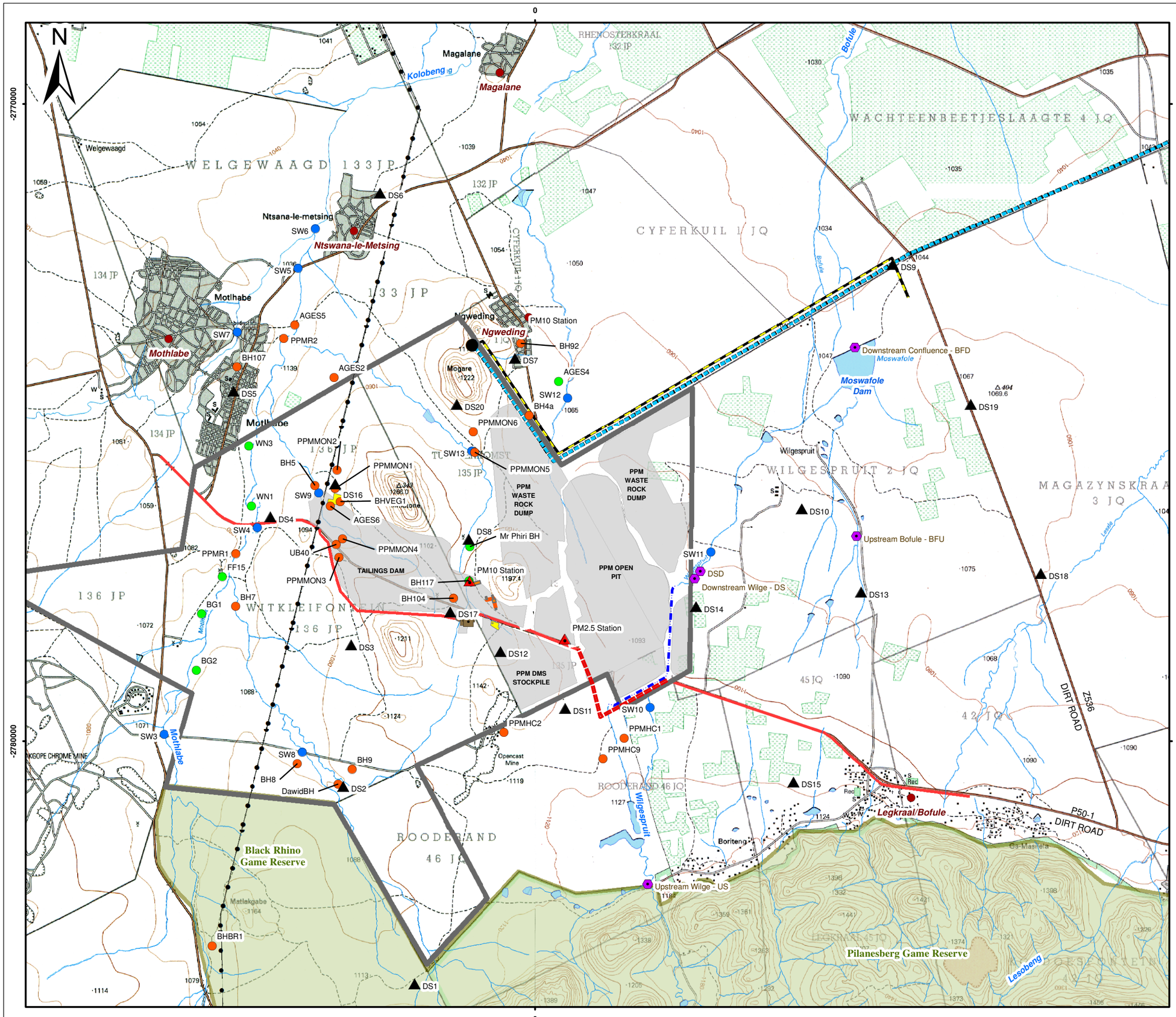
TABLE 29-1: MONITORING OF COMPLIANCE AND PERFORMANCE IN TERMS OF EMPR

No.	Impact	Parameter	Functional requirements for monitoring				Responsible person	Frequency	Reporting mechanism	Recommended action
			Location of monitoring	Key performance indicator	Method of monitoring	Thresholds / standards				
1	**EMPr MONITORING AND PERFORMANCE ASSESSMENT**									
1.1	Overall impact of the project	EMPr, EA conditions, project scope as provided for in this report	Site activities	Compliance	Site inspection and verification of monitoring data	EMPr and EA conditions	Construction Manager, EO and ECO	Monthly (ECO) Annually	Internal reports External audit report for submission to GDARD	Implement additional measures where required
1.2	Overall impact of the project	As above and including method statements and procedures	Site activities	Compliance	As above including photographic record, incident register, complaints register	EMPr and EA conditions	Construction Manager, EO and ECO	Weekly (EO) Monthly (ECO)	Internal reports	Implement additional measures where required
1.3	Overall impact of the project	EMPr, EA conditions, project scope as per this report	Site activities	Compliance	Site inspection and verification of monitoring data	EMPr and EA conditions Audit in terms of NEMA	SHE Manager	Monthly Annually	Internal reports External audit report for DMR submission	Implement additional measures where required
2	**WATER**									
2.1	Surface water quality	As per WUL	Motlhabe tributary downstream of plant and TSF (Figure 29-1)	Meet WUL limits	Grab sampling	Compare against pre-mining baseline quality, WUL limits and relevant TWQR	SHE Manager and appropriately qualified specialist	Monthly or when water is available in the tributaries	Internal and external reports	Implement additional measures in consultation with authorities and water specialist
2.2	Groundwater quality		Boreholes as shown in Figure 29-1	Meet WUL limits; however, if contamination does migrate off site corrective action must be taken.	Grab sampling	Compare against pre-mining baseline quality, WUL limits and relevant TWQR		Monthly	Internal and external reports	
3	**BIOMONITORING**									
3.1	Flora and fauna	As per Biodiversity Action Plan	Within the ridge habitat	Present ecological state and species	Site survey	As set by biodiversity specialist	SHE Manager and appropriately qualified specialist	Every season	Internal reports and part of rehabilitation planning	Implement additional measures where required

No.	Impact	Parameter	Functional requirements for monitoring				Responsible person	Frequency	Reporting mechanism	Recommended action
			Location of monitoring	Key performance indicator	Method of monitoring	Thresholds / standards				
4	**AIR**									
4.1	Climate	Meteorological	On-site	Measure rainfall, evap, temperature, wind data	Daily records	Not applicable	SHE Manager and appropriately qualified specialist	Continuous with monthly reporting	Internal report and database	Not applicable
4.2	Air emissions	$PM_{2.5}$, PM_{10}, SO_2 and NO_2	At monitoring points (Figure 29-1)	NAAQS limits (Table 29-2)	Ambient	NAAQS limits		Every six months	Internal and external reports	Implement additional measures in consultation with DMR and specialist.
4.3	Dust fallout	TSP	At monitoring points (Figure 29-1)	NDCR for residential areas (Table 29-2)	Dust buckets (as per the NDCR)	NDCR for residential areas		Continuous	Internal and external reports	
4.4	Air emissions	Cl_2, HCl, HF AND NH_3	At PPM plant boundary to north and south and at closest residential receptors (namely Mothlabe and Ngweding	International guidelines (Table 29-2)	Passive diffusive	International guidelines		Annual	Internal and external reports	Investigate source and Implement additional measures in consultation with specialist.
4.5	Emissions from KELL plant	As per AEL	As per AEL	As per AEL	As per AEL	As per AEL		As per AEL	As per AEL	As per AEL
5	**NOISE**									
5.1	Increase in ambient noise levels	dBA	At monitoring points (Figure 29-1)	<3 dBA increase from ambient noise levels	Day and night measurements with suitable instruments	<3 dBA increase from ambient noise levels	SHE Manager and appropriately qualified specialist	Annually	Internal and external reports	Implement additional measures in consultation with DMR and noise specialist.
6	**SOCIAL**									
6.1	Negative social impacts	Development's impact on local communities	Surrounding areas	Meaningful stakeholder records	Document and process review	Awareness of communication channels,	Stakeholder Manager	Every three months	Internal report	Implement additional measures in consultation with authorities and specialist.

TABLE 29-2: AIR QUALITY EVALUATION CRITERIA

Pollutant	Averaging period	Limit values		Frequency of exceedance	Compliance date
		Concentration (µg/m³)	Dustfall rate (mg/m2/day)	Occurrences per year	
$PM_{2.5}$	24 hour	40	-	4	1 January 2016 – 31 December 2029
	24 hour	25	-	4	1 January 2030
	1 year	20	-	Not applicable	1 January 2016 – 31 December 2029
	1 year	15	-	Not applicable	1 January 2030
PM_{10}	24 hour	75	-	4	Immediate
	1 year	40	-	Not applicable	Immediate
SO_2	1 hour	350	-	88	Immediate
	24 hours	125	-	4	Immediate
	1 year	50	-	Not applicable	Immediate
NO_2	1 hour	200	-	Not applicable	Immediate
	1 year	40	-	Not applicable	Immediate
Cl_2	Acute	170	-	-	-
	Sub-chronic	5.8	-	-	-
	Chronic	0.2	-	-	-
HCl	Acute	2100	-	-	-
	Chronic	20	-	-	-
HF	Acute	240	-	-	-
	Chronic	14	-	-	-
Dustfall – residential areas	-	-	D < 600	Two within a year, not sequential months	-
Dustfall – non-residential areas	-	-	600 < D < 1200		-



Legend

- Towns / Villages
- Roads
- Powerline
- Proposed Infrastructure Changes
- Existing Community-Based Projects
- Water Reservoir
- Pipeline from Tuschenkomst Reservoir to Sedibelo / Magazynskraal
- Magalies Water Pipeline
- Wilgespruit River Diversion
- P50-1 Diversion
- Watercourses
- Dams
- Pilanesberg Platinum Mine Mining Right Area & Related Infrastructure
- Pilanesberg National Park (including Black Rhino Game Reserve)

Monitoring Points

- Dust
- Noise
- Air Quality Monitoring Locations
- Bio-Monitoring Sites
- Surface Water
- PPM Monitoring Boreholes
- PPM Water Supply Boreholes

0 1 000 Meters

Scale: 1:58 000 @ A3

Projection: Transverse Mercator
Datum: Hartebeeshoek, LO27

PILANESBERG PLATINUM MINES (PTY) LTD

Figure 29-1

Monitoring Network

SLR Consulting (Africa) (Pty) Ltd
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Tel: +27 (11) 467-0945 Fax: +27 (11) 467-0978

710.16002.00026	2019/03/11

30 ENVIRONMENTAL AWARENESS PLAN

30.1 MANNER IN WHICH APPLICANT INTENDS TO INFORM EMPLOYEES OF THE ENVIRONMENTAL RISKS

This section describes the environmental awareness plan for PPM. 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.

30.1.1 ENVIRONMENTAL POLICY

PPM's environmental policy is displayed prominently at the mine entrance and key notice boards at the mine's business units. PPM's environmental policy is described below:

- to minimise the impact of PPM's mining operations on the environment wherever possible;
- to comply with all applicable environmental legislation and the commitments contained in PPM's EMPr;
- 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, particularly with regard to the proposed Heritage Park Corridor; and
- to provide relevant and constructive consultation/public participation on the management of the potential environmental impacts posed by the mine in the future.

30.1.2 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:

- 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.
- 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 EMPr 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.
- Environmental awareness training:
  - The mine 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-mine 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).
- Review and update the environmental topics identified in the EMPr.
- All mine projects will be designed to minimise impact on the environment and to accomplish closure/rehabilitation objectives.
- PPM will maintain records of all environmental training, monitoring, incidents, corrective actions and reports.
- Contractors and employees will be contractually bound to participate in the achievement of environmental policy objectives and compliance with the EIA and EMPr.

30.1.3 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.

30.1.3.1 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;
  - PPM'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 (for example, proximity of watercourses, vulnerability of groundwater, proximity of local communities and industries, etc);
  - specific environmental aspects, for example spillage of hydrocarbons at workshops;
  - impact of environmental aspects, for example hydrocarbon contamination of local watercourses resulting in loss of resource to downstream users;
  - PPM's duty of care (specifically with respect to waste management); and
  - purpose and function of PPM'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 PPM 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.

30.2 MANNER IN WHICH RISKS WILL BE DEALT WITH TO AVOID POLLUTION OR DEGRADATION

30.2.1 ON-GOING MONITORING AND MANAGEMENT MEASURES

The monitoring programme as described in Section 29 will be undertaken to provide early warning systems necessary to avoid environmental emergencies associated with the proposed project.

30.2.2 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 30-1).

30.2.2.1 General Emergency Procedure

The general procedure that should be followed in the event of all emergency situations is outlined below. The contents of the procedure has been taken from PPM's approved EMPr and aligned with the NEMA requirements.

- During construction, the Construction Manager and ECO must be notified of an incident upon discovery.
- During operations, the incident must be reported immediately to Environmental Department for emergencies involving environmental impacts or to the Safety Department in the case of injury.
- Area to be cordoned off to prevent unauthorised access and tampering of evidence.

- If dams or storm water controls are partially or totally failing and this cannot be prevented, the emergency siren is to be sounded (nearest one available). After hours the Plant Manager on shift must be notified.
- Take photographs and samples as necessary to assist in investigation.
- 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 (DMR, DWS, and Inspectorate of Mines as appropriate), the South African Police Services and relevant fire prevention service, the provincial head of DREAD or municipality, the head of the regional DWS 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 Director-General (DMR, DWS, as appropriate), the provincial head of DREAD and the local municipality, the head of the regional DWS office such information as is available to enable an initial evaluation of the incident, including:
    - the nature of the incident;
    - the substances involved and an estimation of the quantity released;
    - the possible acute effects of the substances on the persons and the environment (including the data needed to assess these effects);
    - initial measures taken to minimise the impacts;
    - causes of the incident, whether direct or indirect, including equipment, technology, system or management failure; and
    - measures taken to avoid a recurrence of the incident.

30.2.2.2 Identification of Emergency Situations

Emergency situations that have been identified for the proposed project together with specific emergency response procedures are outlined in Table 30-1. The procedures below have been taken from PPM's EMPr.

TABLE 30-1: EMERGENCY SITUATIONS AND RESPONSE

No.	Emergency Situation	Response in Addition to General Procedures
1	Spillage of chemicals, engineering substances and waste	Where there is a risk that contamination will contaminate the land (leading to a loss of resource), surface water and/or groundwater, the mine will: • Notify residents/users downstream of the pollution incident. • Identify and provide alternative resources should contamination impact adversely on the existing environment. • Cut off the source if the spill is originating from a pump, pipeline or valve (e.g. tailings delivery pipeline, refuelling tanker) and the infrastructure 'made safe'. • Contain the spill (e.g. construct temporary earth bund around source such as road tanker). • Pump excess hazardous liquids on the surface to temporary containers (e.g. 210 litre drums, mobile tanker, etc.) for appropriate disposal. • Remove hazardous substances from damaged infrastructure to an appropriate storage area before it is removed/repaired.
2	Discharge of dirty water to the environment	Apply the principals listed for Item 1 above. To stop spillage from the dirty water system the mine will: • redirect excess water to other dirty water facilities where possible; • pump dirty water to available containment in the clean water system, where there is no capacity in the dirty water system; and • carry out an emergency discharge of clean water and redirect the spillage to the emptied facility. Apply for emergency discharge as a last resort.
3	Contamination of surface water	Personnel discovering the incident must inform the Environmental Department of the location and contaminant source. Apply the principals listed for Item 1 above. Absorbent booms will be used to absorb surface plumes of hydrocarbon contaminants. Contamination entering the surface water drainage system should be redirected into the dirty water system. The 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). Investigate the source of contamination and implement control/mitigation measures.
5	Burst water pipes (loss of resource and erosion)	Notify authority responsible for the pipeline (if not mine responsibility). Shut off the water flowing through the damaged area and repair the damage (if the mine's pipeline). Apply the principals listed for Item 1 above if spill is from the dirty/process water circuit.
6	Flooding from failure of surface water control infrastructure	Evacuate the area downstream of the failure. Using the emergency response team, rescue/recover and medically treat any injured personnel. Temporarily reinstate/repair storm water diversions during the storm event (e.g. emergency supply of sandbags). Close the roads affected by localised flooding or where a storm water surge has destroyed crossings/bridges.

No.	Emergency Situation	Response in Addition to General Procedures
7	Risk of drowning from falling into water dams	Attempt rescue of individuals from land by throwing lifeline/lifesaving ring. Get assistance of emergency response team whilst attempting rescue or to carry out rescue of people and/or animals. Ensure medical assistance is available to recovered individual.
8	Veld fire	Evacuate mine employees from areas at risk. Notify downwind residents and industries of the danger. Assist those in imminent danger/less able individuals to evacuate until danger has passed. Provide emergency firefighting assistance with available trained mine personnel and equipment.
9	Overtopping or failure of the tailings dam	Sound the alarm to evacuate danger area. Pump water from top of dam and follow redirection of water as indicated in Item 2 above. Stop pumping tailings to the TSF. Recover casualties resulting from dam failure using the emergency response team. Make the remaining structure safe. Apply the principles of Item 1 above.
10	Road traffic accidents (on site)	The individual discovering the accident (be it bystander or able casualty) must raise the alarm giving the location of the incident. Able personnel at the scene should shut down vehicles where it is safe to do so. Access to the area should be restricted and access roads cleared for the emergency response team. Vehicles must be made safe first by trained professionals (e.g. crushed or overturned vehicles). Casualties will be moved to safety by trained professionals and provided with medical assistance. Medical centres in the vicinity with appropriate medical capabilities will be notified if multiple seriously injured casualties are expected. A nearby vet should be consulted in the case of animal injury.
11	Escape of dangerous wild animals from proposed heritage park corridors	Notify the park manager of the siting of dangerous wild animals. Ensure personnel get to safety (i.e. with buildings or vehicles).
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.
13	Uncovering of fossils	If fossils are found once excavations have commenced work in the area will stop. PPM will bring in a palaeontologist to assess the fossils and collect a representative sample. Work will only continue with the approval of the specialist.

30.2.3 TECHNICAL, MANAGEMENT AND FINANCIAL OPTIONS

The 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 project of this scale and nature.
- To prevent the occurrence of emergency situations, the mine will implement as a minimum the plan and mitigation measures as included in this EIA and EMP report.
- On an annual basis, PPM will undertake a risk assessment as part of its auditing procedures to identify and check potential risks associated with its operations. The findings of the risk assessment will be reported to mine management to be actioned.
- As part of its annual budget, PPM will allow a contingency for handling of any risks identified and/or emergency situations.
- Where required, PPM will seek input from appropriately qualified people.

31 SPECIFIC INFORMATION REQUIRED BY THE COMPETENT AUTHORITY

The following documents will be submitted to the DMR from the start of construction until mine closure:

- As noted in Section 29, an environmental audit report in line with legislation relevant at the time, prepared by an independent person, will be submitted to the DMR at intervals indicated in the environmental authorisation. The purpose of the environmental audit report is to ensure compliance with the conditions of the environmental authorisation and the EMPr; and
- The financial provision will be updated in line with legislation relevant at the time on an annual basis and submitted to the DMR.

32 UNDERTAKING

I, Alex Pheiffer, the Environmental Assessment Practitioner responsible for compiling this report, undertake that:

- the information provided herein is correct;
- comments and inputs from stakeholders and I&APs have been included and correctly recorded in this report;
- inputs and recommendations from the specialist reports have been included where relevant; and
- any information provided to I&APs and any responses to comments or inputs made is correct or was correct at that time.

Signature of EAP

15/03/2019
Date

Signature of commissioner of oath

15 March 2019
Date

OREN JAN VAN VREDE
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33 REFERENCES

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APPENDIX A: PROOF OF EAP QUALIFICATIONS AND CURRICULUM VITAE OF EAP

APPENDIX B: STAKEHOLDER ENGAGEMENT DOCUMENTS

APPENDIX C: COMMENTS AND RESPONSE REPORT

APPENDIX D: DETAILED ASSESSMENT OF POTENTIAL IMPACTS

DETAILED ASSESSMENT OF POTENTIAL IMPACTS

The potential impacts described in this appendix have been identified by the EIA project team with input from specialists, regulatory authorities and I&APs. The sequence in which these issues are listed are in no order of priority or importance. The assessment and rating of potential impacts has been informed by specialist studies, where relevant. These are attached as appendices to the EIA and EMPr.

Identified impacts are first discussed and assessed incrementally to understand the potential contribution to impacts as a result of the project. Cumulative assessment commentary is included in the impact assessment under the various aspect headings. This takes account of current operations including surface infrastructure changes, the pit extension (as assessed in the 2007 EIA and EMPr and subsequent amendments where applicable) and the plant expansion.

The potential impacts are rated with the assumption that no mitigation measures are applied and then again with mitigation, unless otherwise stated.

The mitigated assessment assumes that technical design controls, as included in the project scope (see Section 3.2), would be included in the detailed design of the project and implemented when the project components are constructed and operated.

A) IMPACT ON BIOPHYSICAL ENVIRONMENT

1. ISSUE: LOSS OF SOIL RESOURCES AND LAND CAPABILITY THROUGH PHYSICAL DISTURBANCE

Project-related infrastructure and activities would be developed within PPM's existing mineral processing plant complex and TSF footprint. The areas earmarked for development are either occupied by existing mine infrastructure or have been disturbed by activities within the plant complex and TSF. No new areas would be disturbed. Community based projects have mainly been established within PPM's plant complex, except the vegetable garden and nursery which has been established immediately adjacent to the TSF's return water dam.

With an extension to the life of PPM's mineral processing facilities, the duration of impacts associated with the mineral processing plant would extend by the same time period. The proposed project however would not change the duration of impacts associated with the PPM TSF or the mining operations. Once the TSF reaches its full capacity, deposition of tailings would take place on one of SPML's TSFs. The remaining life of the mining operations remains unchanged.

In the context of the above discussion and considering the nature and extent of PPM's approved operations, the proposed project will add negligible additional impacts. It follows that the proposed project will not change the significance of the impacts associated with the approved operations albeit that some of these that could be associated with the plant have the potential to occur for an extended period. The net cumulative significance rating for the overall cumulative impacts remains **HIGH** without mitigation and **MEDIUM** with mitigation.

2. ISSUE: LOSS OF SOIL RESOURCES AND LAND CAPABILITY THROUGH CONTAMINATION

Description of impact

In the context of mining- and mineral processing related operations, soils play a key role in rehabilitation of disturbed areas and establishing ecosystem functionality. This in turn supports post-closure land uses.

Although infrastructure and activities would be developed within PPM's existing mineral processing plant complex, the proposed project still has the potential to damage soil resources through contamination. Sources of contamination would exist during both the construction and operational phases. In the construction phase these activities are temporary in nature, usually existing from a few weeks to a few

months. Although the sources are temporary in nature, the potential related pollution can have long term effects. The operational phase would present more long term activities. Contamination of soils also has the potential to indirectly (through runoff and seepage) impact surface and groundwater resources (discussed further in Sections A6 and A8) which could indirectly impact biodiversity resources (discussed further in Section A4).

Impact assessment

During construction, contamination of soil resources would occur through the use and handling of construction materials and the presence of construction type equipment and machinery on site leaking or spilling hydrocarbons. During operations contamination of soil resources could occur through the use and handling of processing plant raw materials and chemicals, spillages of sewage as well as tailings spillages. Additionally poor waste management practices could result in soil contamination. This could alter the soil composition, negatively impacting on the chemistry of the soils and affecting the use of the soils as part of site rehabilitation at decommissioning.

The existing reagent storage area would be extended to cater for the handling and storage of raw materials needed for the additional UG2 circuit. This would include provision for the containment of 125% of the largest possible volume spill, in the event a spill occurs. For the storage and handling of coal and chemicals for the KELL process, it is planned for PPM to apply the same containment measures. These would be within the KELL process building. In addition due to the hazardous nature of these chemicals, any storage on site would comply with standards for hazardous installation. As part of the proposed project the sewage treatment plant at PPM will be upgraded, minimising the potential for spillage events.

During both construction and operations, although contaminant events are possible, it is expected that the scale and frequency of contaminant events would be relatively low given the control measures that are already in place for the existing plant and TSF. Where there are quick reaction times and effective remediation measures applied, the duration and probability of potential impacts reduces.

Contamination of soil resources through project-related activities is therefore considered to be of **MEDIUM** significance without mitigation and **LOW** with mitigation (see Table E1 below).

With an extension to the life of PPM's mineral processing facilities, the duration of contamination impacts associated with the mineral processing plant would extend by the same time period. The proposed project however would not change the duration of impacts associated with the PPM TSF or the mining operations. Once the TSF reaches its full capacity, deposition of tailings would take place on one of SPML's TSFs. The remaining life of the mining operations remains unchanged. Once mining of the Tuschenkomst pit is complete, rehabilitation of the pit would commence in line with the mine's rehabilitation plan.

In the context of the above discussion and considering the nature and extent of PPM's approved operations, the proposed project will add minor additional impacts. It follows that the proposed project will not change the significance of the impacts associated with the approved operations albeit that some of these that could be associated with the plant have the potential to occur for an extended period. The net cumulative significance rating for the overall cumulative impacts remains **HIGH** without mitigation and **LOW** with mitigation.

Mitigation

In addition to applying mitigation measures as per PPM's EMPrs, the mitigation measures outlined below will be applied to project-specific activities:

- Storage of coal and chemicals will be within appropriately designed containment measures within the existing plant boundary.
- Hazardous installations will comply with applicable standards to ensure that containment and safety risks are appropriately addressed and managed.

Monitoring

Monitoring will include visual inspections of areas for signs of contamination as part of auditing (Section 29).

Emergency situations

Major spillage incidents will be handled in accordance with the emergency procedure attached in Section 30.2.

TABLE E1: IMPACT SUMMARY – CONTAMINATION OF SOIL RESOURCES

Issue: Loss of soil resources and land capability through contamination		
Phases: All		
Criteria	Without Mitigation	With Mitigation
Severity	Minor deterioration	Minor deterioration
Duration	Quickly reversible	Quickly reversible
Extent	Localised	Localised
Consequence	Low	Low
Probability	Possible	Unlikely
Significance	Medium	Low
Nature of cumulative impacts	Minor contribution to cumulative impacts, impacts would remain within the range previously assessed.	
Degree to which impact can be reversed	Mainly reversible where bioremediation of soils takes place.	
Degree to which impact may cause irreplaceable loss of resources	Low due to the already disturbed nature of the project footprints.	
Degree to which impact can be mitigated	High.	
Residual impacts	With mitigation, no residual impacts are expected.	

3. ISSUE: PHYSICAL DESTRUCTION OF BIODIVERSITY

Project-related infrastructure and activities would be developed within PPM's existing mineral processing plant complex and TSF footprint. The areas earmarked for development are either occupied by existing mine infrastructure or have been disturbed by activities within the plant complex and TSF. No new areas would be disturbed. Community based projects have mainly been established within PPM's plant complex, except the vegetable garden and nursery which has been established immediately adjacent to the TSF's return water dam.

With an extension to the life of PPM's mineral processing facilities, the duration of impacts associated with the mineral processing plant would extend by the same time period. The proposed project however would not change the duration of impacts associated with the PPM TSF or the mining operations. Once the TSF reaches its full capacity, deposition of tailings would take place on one of SPML's TSFs. The remaining life of the mining operations remains unchanged. Once mining of the Tuschenkomst pit is complete, rehabilitation of the pit would commence in line with the mine's rehabilitation plan.

In the context of the above discussion and considering the nature and extent of PPM's approved operations, the proposed project will add negligible additional impacts. It follows that the proposed project will not change the significance of the impacts associated with the approved operations albeit that some of these that could be associated with the plant have the potential to occur for an extended period. The net cumulative significance rating for the overall cumulative impacts remains **HIGH** without mitigation and **HIGH-MEDIUM** with mitigation.

4. ISSUE: GENERAL DISTURBANCE OF BIODIVERSITY

Description of impact

In the broadest sense, biodiversity provides value for ecosystem functionality, aesthetic, spiritual, cultural, and recreational reasons. Biodiversity and ecosystems influence soil, food and fuel supply, shelter and building materials, water, atmospheric gases, climate and weather, pests and diseases and genetic resources.

All project-related infrastructure and associated activates would be undertaken within PPM's existing mineral processing plant complex; no additional footprints would be disturbed. A number of activities associated with the establishment of additional infrastructure and changes to the mineral processing operations have the potential to disturb biodiversity in the broadest sense given PPM's location in an area that has both habitat and species richness.

Impact assessment

Sensitive ecological environments of relevance to the proposed project include a number of rocky ridges located adjacent to the north, south and east of the plant and TSF, as well as two non-perennial tributaries of the Motlhabe River located downstream of the plant and TSF (Figure 6-2). Existing activities at PPM would have influenced biodiversity and more specifically these sensitive environments 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
- contamination emissions (water and air) and general litter may directly impact on the survival of individual plants, vertebrates and invertebrates.

The establishment of additional infrastructure during the construction phase and changes in the mineral processing operations have the potential to add to these through requirements for additional lighting, increased workforce on site or people seeking employment, dust fallout during construction, additional noise and vibration sources, and a change in air emissions. The severity of project related impacts would to a certain extent be mitigated by existing controls that have been implemented by PPM.

Disturbance to biodiversity through project-related activities is therefore considered to be of **MEDIUM** significance without mitigation and **LOW** with mitigation (see Table E2 below).

With an extension to the life of PPM's mineral processing facilities, the duration of impacts associated with the mineral processing plant, with the potential to disturb biodiversity, would extend by the same time period. The proposed project however would not change the duration of impacts associated with the PPM TSF or the mining operations. Once the TSF reaches its full capacity, deposition of tailings would take place on one of SPML's TSFs. The remaining life of the mining operations remains unchanged. Once mining of the Tuschenkomst pit is complete, rehabilitation of the pit would commence in line with the mine's rehabilitation plan.

In the context of the above discussion and considering the nature and extent of PPM's approved operations, the proposed project will add minor additional impacts. It follows that the proposed project will not change the significance of the impacts associated with the approved operations albeit that some of these that could

be associated with the plant have the potential to occur for an extended period. The net cumulative significance rating for the overall cumulative impacts remains **HIGH** without mitigation and **HIGH-MEDIUM** with mitigation.

Mitigation

Mitigation measures as per PPM's EMPrs will be applied to project-specific activities.

Monitoring

The following monitoring will be added to PPM's biodiversity monitoring programme (Section 29):

- Inclusion of the ridge habitat as part of the monitoring programme.

Emergency situations

None identified.

TABLE E2: IMPACT SUMMARY – GENERAL DISTURBANCE OF BIODIVERSITY

Issue: General disturbance of biodiversity		
Phases: All		
Criteria	Without Mitigation	With Mitigation
Severity	Minor deterioration	Minor deterioration
Duration	Beyond closure	Life of the project
Extent	Beyond the site boundary	Beyond the site boundary
Consequence	Medium	Low
Probability	Possible	Seldom
Significance	Medium	Low
Nature of cumulative impacts	Minor contribution to cumulative impacts, impacts would remain within the range previously assessed.	
Degree to which impact can be reversed	Partially reversible once disturbance activities no longer take place, however this will take time.	
Degree to which impact may cause irreplaceable loss of resources	Possible, if unmitigated, because the plant and TSF are located between three isolated ridges considered to be sensitive ecologically environments.	
Degree to which impact can be mitigated	High	
Residual impacts	With mitigation, limited residual impacts are expected.	

5. ISSUE: ALTERATION OF SURFACE DRAINAGE PATTERNS

The development of infrastructure has the potential to alter drainage patterns by reducing the volume of run-off into the downstream catchments. Project-related infrastructure and activities however would be developed within PPM's existing stormwater management system. No additional footprint would be added to the mineral processing plant complex or the TSF. Community based projects have mainly been established within PPM's plant complex, except the vegetable garden and nursery which has been established immediately adjacent to the TSF's return water dam. Where projects require the capturing of potential dirty stormwater runoff, these occur within the boundaries of PPM's stormwwater management system. No incremental impacts are expected.

With an extension to the life of PPM's mineral processing facilities, the duration of impacts associated with the loss of runoff to downstream catchments, as a result of the stormwater containment measures at the mineral processing plant, would extend by the same time period. The proposed project however would not change the duration of impacts associated with the PPM TSF or the mining operations. The remaining life of the mining operations remains unchanged. Once mining of the Tuschenkomst pit is complete, rehabilitation of the pit would commence in line with the mine's rehabilitation plan.

When considering the project's impact cumulatively with the approved PPM operations, no cumulative impacts would occur. The significance rating for the overall mine remains **HIGH** without mitigation and **LOW** with mitigation.

6. ISSUE: CONTAMINATION OF SURFACE WATER

Description of impact

The construction of additional infrastructure, increased activities on site and changes in the mineral processing operations have the potential to present additional sources of surface water contamination. In the construction phase these activities are temporary in nature, usually existing from a few weeks to a few months. Although the sources are temporary in nature, the potential related contamination can have long term effects. The operational phase would present more long term activities. These sources could impact on downstream surface water uses including livestock watering. Potential impacts on biodiversity have been assessed in Section A8 above.

Impact assessment

During construction, contamination of surface water could occur through the use and handling of construction materials and the presence of construction type equipment and machinery on site, leaking or spilling hydrocarbons. During operations contamination of surface water could occur through the use and handling of additional processing plant reagents and chemicals and spillages of sewage. Activities and sources associated with the proposed project would be similar to those already taking place on site with the addition of coal and chemical storage and handling for the KELL process. 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.

Given the development and operation of the proposed project within the boundaries of existing stormwater management measures, any potential contamination is expected to be contained within PPM's stormwater management system (see Section 3.2.7). An increase in activity on site is likely to have a minor contribution to cumulative impacts. The stormwater dam at the plant has been confirmed to have sufficient capacity to cater for PPM's dirty stormwater runoff if abstraction and re-use from the dam is done at a specific rate (SLR, 2019b). Tailings handling and deposition will be done taking into account the capacity, safety and stability of the PPM TSF (see Section 3.2.5) and within the existing stormwater management system of PPM's TSF. Therefore any potential spillages would be avoided or contained during normal operations.

Surface water monitoring results from PPM's monitoring programme does show a decrease in water quality in the non-perennial tributaries of the Motlhabe River, downstream of the plant and TSF when compared to pre-mining baseline water qualities of the Motlhabe River (see Section 6.4.1.6). It is also noted by PPM that two extreme rainfall events have occurred at the mine resulting in flood-related discharges to the environment from the plant stormwater dam.

Important to note is that there is no significant reliance on surface water for community consumption or livestock watering because of the fact that the watercourses 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 for a few days following rain).

Contamination of surface water resources through project-related activities is therefore considered to be of **MEDIUM** significance without mitigation and **LOW** with mitigation (see Table E3 below).

With an extension to the life of PPM's mineral processing facilities, the duration of contamination impacts associated with the mineral processing plant would extend by the same time period. The proposed project however would not change the duration of impacts associated with the PPM TSF or the mining operations. Once the TSF reaches its full capacity, deposition of tailings would take place on one of SPML's TSFs. The remaining life of the mining operations remains unchanged. Once mining of the Tuschenkomst pit is complete, rehabilitation of the pit would commence in line with the mine's rehabilitation plan.

When considering the project's impact cumulatively with the approved PPM operations, although an increase in activity on site is likely to have a minor contribution to cumulative impacts, the significance rating for the overall mine remains **HIGH** without mitigation and **LOW** with mitigation.

Mitigation

In addition to continuing to implement mitigation measures as per PPM's EMPrs, the mitigation measures outlined below will be applied to project-specific activities:

- Ensure all project-related activities (construction and operational) take place within the boundaries of existing containment measures and existing stormwater management measures.
- Operate the plant SWD and TSF RWD in line with Regulation 704 and ensure re-use is in line with maintaining sufficient capacity within the dam to cater for a 1:50 year storm event.
- Ensure tailings are handled and deposited taking into account the capacity, safety and stability of the PPM TSF (see Section 3.2.5).
- A study should be conducted by PPM to trace the source of pollutants on site.
- The water balance and storm water management plan must be reviewed and updated throughout the life of the mine and operations until determination of closure liabilities for the PPM Mine.

Monitoring

Monitoring will continue as per the approved EMPr (see Section 29). A sampling point should be established downstream and closer to the PPM plant to be able to separate the impacts of the PPM plant and the waste rock dump. Where monitoring shows exceedances of applicable limits as a result of PPM's activities, additional mitigation will be implemented in consultation with an appropriately qualified specialist.

Emergency situation

In the event of a significant contamination incident and/or failure of the dam or TSF, the emergency response procedures outlined in Section 30.2 would be implemented.

TABLE E3: IMPACT SUMMARY – CONTAMINATION OF SURFACE WATER

Issue: Contamination of surface water		
Phases: All		
Criteria	Without Mitigation	With Mitigation
Severity	Minor deterioration	Negligible change
Duration	Beyond closure	Less than the project life
Extent	Beyond the site boundary	Within the site boundary
Consequence	Medium	Low
Probability	Possible	Unlikely
Significance	Medium	Low
Nature of cumulative impacts	Minor contribution to cumulative impacts, impacts would remain within the range previously assessed.	
Degree to which impact can be reversed	Partially reversible once disturbance activities no longer take place, however this will take time.	
Degree to which impact may cause irreplaceable loss of resources	Possible given the importance of drainage systems as sensitive ecologically environments	
Degree to which impact can be mitigated	High	
Residual impacts	With mitigation, no residual impacts are expected.	

7. ISSUE: REDUCTION OF WATER AVAILABILITY TO THIRD PARTIES

Water for the project would be sourced from PPM's existing Magalies Water Board allocation. No additional water sources would be developed for the proposed project. No incremental impacts are expected from the proposed project.

With an extension to the life of PPM's mineral processing facilities, the use of water from Magalies Water associated with the mineral processing plant would extend by the same time period. The proposed project however would not change the life of the mining operations. Once mining of the Tuschenkomst pit is complete, rehabilitation of the pit would commence in line with the mine's rehabilitation plan and the use of water for mining activities associated with the Tuschenkomst pit would cease.

When considering the project's impact cumulatively with the approved PPM operations, no cumulative impacts would occur. The significance rating for the overall mine remains **HIGH** without mitigation and **MEDIUM-LOW** with mitigation.

8. ISSUE: GROUNDWATER CONTAMINATION

Description of impact

The construction of additional infrastructure and increased mineral processing activities on site can result in seepage of contaminants into the groundwater system. In the construction phase these activities are temporary in nature, usually existing from a few weeks to a few months. Although the sources are temporary in nature, the potential related contamination can have long term effects. The operational phase would present more long term activities. These sources could impact on third party groundwater users including community supply and livestock watering. Potential impacts on biodiversity have been assessed in Section A4 above.

Impact assessment

On-going monitoring and water management at the mine has identified the presence of a contamination plume migrating from the TSF, as previously predicted in the 2007 EIA and EMPr. A potential source of contamination has also been identified to occur within the plant. Mitigation measures including seepage capturing boreholes have been implemented at the TSF to control the migration of seepage from the TSF (Exigo, 2019). A borehole within the plant, previously used for water supply, is being operated as seepage capturing borehole to minimise the migration of contamination from the plant area. In addition the source of the contamination from the plant is being investigated.

The ore processed at the additional UG2 circuit would be sourced from Sedibelo Platinum Mine (SPM), located adjacent to PPM's current Tuschenkomst pit. The geology and therefore the ore from SPM is similar to that mined at PPM. As a result tailings from this additional circuit would have similar characteristics to PPM's existing tailings stream. No incremental impacts on potential groundwater contamination as a result of the additional UG2 circuit are expected.

Seepage from spillages of fuels and lubricants, process reagents and chemicals, sewage and other potential contaminants could result in contamination of groundwater resources. The incremental increase in related groundwater contamination is assessed by the specialist to be of **MEDIUM** significance without mitigation and of **LOW** significance with mitigation during the construction and operational phases (see Table E4 below). No impacts are expected at closure.

When considering the deposition of tailings, geochemical analysis of the combined KELL and PPM tailings stream indicated that the tailings would not be acid generating (same as the current PPM tailings), the seepage volume would not change significantly, and that nickel concentrations from the proposed combined KELL and PPM tailings may pose a potential environmental risk during the operational and post-operational (drainage) phases prior to closure (see Section 6.4.1.1).

Groundwater modelling was conducted to quantify the potential impact on the groundwater due to the geochemical properties of the combined KELL and PPM tailings. Although nickel was identified as a potential pollutant of concern in the geochemical analyses, the groundwater study has concluded that nickel would not migrate more than 50 m (using a conservative mobility factor) from the source. The modelling, using sulphate (SO_4) concentrations, simulated a current scenario, the potential contamination plume at the end of the life of the PPM TSF (assuming no reprocessing) and 50 years post the operational phase of the TSF. The modelling results present the findings outlined below (Exigo, 2019).

- The current approved tailings dam source contains a modelled SO_4 concentration of 208 mg/ℓ - the surrounding mass migration does not exceed the SANS drinking water limits but does exceed DWS's Class 1 water type limit of 200 mg/ℓ.
- During operations:
  - The combined KELL and PPM tailing's SO_4 concentration was calculated, through geochemical modelling, to be 435 mg/ℓ, at source (below the TSF) which is under the SANS drinking water limit.
  - The tailing's seepage quality associated with the combined KELL and PPM tailings is predicted to take approximately seven years to seep from the TSF pool on the surface of the TSF to the bottom of the tailings (Solution H+, 2019).
  - The simulated migration plume in the unmitigated scenario (considering no additional seepage capturing boreholes) would migrate from the TSF at a concentration below the SANS drinking water limit.
  - Mitigation (making provision for an additional 10 seepage capturing boreholes) would reduce the predicted impact zone by 36% when compared to the unmitigated scenario. This mitigation would be required regardless of the proposed project and is in line with the impact assessment and mitigations measures as included in the 2007 EIA and EMPr. No third party boreholes are located within the mitigated impact zone.
- Post-closure phase of the TSF:
  - The combined KELL and PPM tailing's SO_4 concentration was calculated, through geochemical modelling, to be 1 595 mg/ℓ at source (below the TSF).
  - The simulated SO_4 migration plume in the unmitigated scenario (considering no additional seepage capturing boreholes and active pumping ceases 5 years post operation) and the mitigated scenario (making provision for an additional 10 seepage capturing boreholes, active pumping ceases 5 years post operation, and rehabilitation of the TSF surfaces) exceeds the baseline groundwater concentration at the Mothlabe River approximately 1.5 km downstream of the TSF but does not exceed the SANS 241:2015 drinking water limit.
  - Mitigation would reduce the predicted impact zone by 16% when compared to the unmitigated scenario. No third party boreholes are located within the unmitigated or mitigated impact zones.

The incremental increase in groundwater contamination and related potential for health impacts as a result of the additional KELL plant, is assessed to be of **LOW** significance even without mitigation in the operational phase; of **MEDIUM** significance without mitigation and **LOW** significance with mitigation in the decommissioning and closure phase and of **MEDIUM** significance without and with mitigation in the post-closure phase (see Table E4 below). The medium significance post-closure is influenced to a large extent by the conservative geochemical modelling and does not take into account active pump and treat mechanisms. Where pump and treat mechanisms and the final rehabilitation of the TSF prevent the migration of a contamination plume affecting third party boreholes, the significance post-closure would be reduced.

With an extension to the life of PPM's mineral processing facilities, the duration of contamination impacts associated with the mineral processing plant would extend by the same time period. The proposed project however would not change the duration of impacts associated with the PPM TSF or the mining operations. Once the TSF reaches its full capacity, deposition of tailings would take place on one of SPML's TSFs and the PPM TSF would be rehabilitated, unless authorisation for the re-processing of the TSF is obtained. The remaining life of the mining operations remains unchanged. Once mining of the Tuschenkomst pit is complete, rehabilitation of the pit would commence in line with the mine's rehabilitation plan.

In the context of the above discussion and considering the nature and extent of PPM's approved operations, the proposed project has the potential to add additional impacts if unmitigated, specifically in the post-closure phase, depending on operational mitigation measures and the source concentration of the TSF. The net cumulative significance rating for the overall cumulative impacts remains **HIGH** without mitigation and **MEDIUM-LOW** with mitigation. The medium significance post-closure is influenced to a large extent by the conservative geochemical modelling and does not take into account active pump and treat mechanisms. Where pump and treat mechanisms and the final rehabilitation of the TSF prevent the migration of a contamination plume affecting third party boreholes, the significance post-closure would be reduced.

Mitigation

In addition to continuing to implement mitigation measures as per PPM's EMPrs, the mitigation measures outlined below will be applied to project-specific activities:

- Telemetry will be installed at all relevant boreholes to monitor the real-time aquifer conditions.
- Geochemical modelling will be reviewed, prior to deposition of the combined KELL and PPM tailings, to verify the results of the current geochemistry modelling (the conclusion from the groundwater specialist is that the geochemical modelling is very conservative).
- The geochemical numerical modelling will be updated to include reactive transport modelling to take the possible precipitation and adsorption of sulphate into account.
- Tailings will be deposited at a ratio of 1.2 % KELL tailings to 98.8 % PPM tailings as this is the ratio that specialist assessments have been based on. In the event that the PPM TSF is developed according to a different schedule to that assumed in the geochemistry assessment, the source term presented will be revised and updated. The groundwater model will be updated to include the revised source term and if necessary additional mitigation implemented in consultation with a specialist.
- PPM will sample the tailings at suitable intervals during the operational life of the TSF to evaluate the heterogeneity in physical and chemical composition. This will provide a data set that allows refined estimates of the post-closure impacts of the TSF to be developed ahead of mine closure.
- KELL tailings will be re-slurried and mixed with recycled process water prior to the PPM tailings thickener to achieve a supernatant water quality equal to or better than the current PPM tailings supernatant.
- Additional seepage capturing boreholes will be established as recommended in the groundwater specialist study.
- Seepage capturing boreholes will be pumped as per the recommended rates in the groundwater specialist study to ensure the desired effect of each hole.
- The TSF surface will be rehabilitated to mimic a recharge of 3% of mean annual runoff from five years post the operational phase. The rehabilitation would include the planting of trees which have a high evapotranspiration rate to effectively minimise the nett infiltration of water from the facility and a clay sealing cap to prevent recharge to the decommissioned TSF. The rehabilitated scenarios must be included in an updated model to demonstrate the efficiency.
- Revegetation trials (and hence the sustainability of any rehabilitation works) must be investigated as part of operations.
- Surface and groundwater remediation will be informed through ongoing surface and groundwater monitoring and by carrying out risk assessment and water pollution potential studies/investigations during mine operations.
- Where studies indicate the potential for contamination of third-party groundwater use post-closure, PPM will implement an active pump and treat system.

Monitoring

Monitoring will continue as per the approved EMPr (see Section 29). Where monitoring shows exceedances of applicable limits as a result of PPM's activities, additional mitigation will be implemented in consultation with an appropriately qualified specialist.

Emergency situation

In the event of a significant contamination incident and/or failure of the dam or TSF, the emergency response procedures outlined in Section 30.2 would be implemented.

TABLE E4: IMPACT SUMMARY – CONTAMINATION OF GROUNDWATER

Issue: Contamination of groundwater affecting third party water use		
Phases: Operations and Closure		
Criteria	Without Mitigation	With Mitigation
Severity	Moderate to minor change	Minor (Slight) change
Duration	Life of the project	Life of the project
Extent	Beyond the site boundary, local	Within the site boundary
Consequence	Medium	Low
Probability	Possible	Possible - Unlikely (with pump and treat mechanisms)
Significance	Medium	Medium-Low
Nature of cumulative impacts	Minor contribution to cumulative impacts, impacts would remain within the range previously assessed.	
Degree to which impact can be reversed	Possible with pumping and treatment.	
Degree to which impact may cause irreplaceable loss of resources	Possible but with mitigation this can be minimised.	
Degree to which impact can be mitigated	High if long term measures are implemented where required.	
Residual impacts	The potential for residual impacts depends on the success of any pump and treat mechanisms and the final rehabilitation of the TSF to prevent the migration of a contamination plume affecting third party boreholes post-closure.	

9. ISSUE: CHANGE IN AMBIENT AIR CONCENTRATIONS

Description of impact

The construction of additional infrastructure and changes in the mineral processing operations presents activities that would contribute to ambient air concentrations. Ambient air concentrations can result in odour, nuisance (dust fallout) and health inhalation impacts. The specialist is of the opinion that odour impacts from gaseous pollutants will be negligible (Airshed, 2019a) and therefore the assessment below focuses on dust fallout and health inhalation impacts.

The UG2 milling and flotation circuit is not expected to result in atmospheric emissions apart from dust generated during the construction of the plant. The hydrometallurgical (KELL) plant is expected to be the only additional source of emissions from the proposed project during the operational phase (Airshed, 2019a).

Pollutants of concern associated with the proposed project include particulates (PM_{10} and $PM_{2.5}$), for all project components, and for the KELL process, gaseous combustion pollutants (SO_2 and NO_2), chlorine (Cl_2), hydrogen chloride (HCl), hydrogen fluoride (HF) and possibly ammonia (NH_3). Emissions from the community aggregate crusher were simulated in 2016 and included as part of the baseline for this assessment. In order to understand the potential for health inhalation impacts, the simulated results have been compared to available South African National Ambient Air Quality Standards (SA NAAQS) for PM_{10}, $PM_{2.5}$, SO_2, and NO_2 and international guidelines (in the absence of South African standards) for Cl_2, HCl, HF and NH_3. Information on potential impacts on vegetation and grazing quality is limited to dust and based on European studies. No information is available on potential impacts as a result of exposure to gaseous pollutants (Airshed, 2019a).

The construction phase presents activities that are temporary in nature. The operational phase would present more long term activities and related emission sources. It is expected that residential (including grazing and outdoor community related activities) and eco-tourism facilities would be most vulnerable to health risks from air quality. Potential air quality impacts on biodiversity are discussed in Section A4.

Impact assessment

During construction dust generated during earthworks, demolition of existing infrastructure and the movement of vehicles may contribute to elevated particulate matter levels in the air. This could result in increased dustfall on a local scale and higher particulate matter loads. Given that the construction phase is relatively short, the related significance is considered by the specialist to be **LOW** even without mitigation. Given that dust related impacts could occur during the construction phase, the significance remains **LOW** with mitigation (Airshed, 2019a). The same would apply to the decommissioning phase.

Given that the UG2 milling and flotation circuit is not expected to result in atmospheric emissions during the operational phase, the discussion below focuses on the KELL process. The operational KELL process presents a new emission profile for the PPM operations. Atmospheric emissions would be generated from the leach extraction and heat generating (using coal) processes in the plant. Where the KELL Plant is operated at or below the Subcategory 4.17 New Plant Minimum Emission Standards, the air quality modelling predicted the following for the KELL plant (Airshed, 2019a):

- Daily SO_2 concentrations could exceed the SA NAAQS for an area in the immediate vicinity of the KELL Plant (mainly within the PPM plant boundary) (this is due to the use of coal as a fuel source);
- Hourly SO_2 and NO_2 concentrations could exceed the SA NAAQS limit values for up to 2 km north east and north west from the PPM plant boundary and around the base of the ridge to the north and south of the PPM Plant and TSF (this is due to the use of coal as a fuel source);
- Annual Cl_2 concentrations could exceed the identified chronic (i.e. third party exposure of 365 days or more) guidelines for Cl_2 for up to 500 m north of the PPM plant boundary, up to 2 km south west of the PPM plant boundary and around the base of the ridge to the north and south of the PPM Plant and TSF;
- Daily Cl_2 concentrations could exceed the identified sub-chronic (i.e. third party exposure of 14 to 364 days or more) guidelines for Cl_2 for up to 400 m north, north east and south west of the PPM plant boundary and around the base of the ridge to the north of the PPM TSF;
- Hourly Cl_2 concentrations could exceed the identified acute (i.e. third party exposure of 1 to 14 days or more) guidelines for Cl_2 for up to 200 m north east of the PPM plant boundary;

All other pollutants of concern are below the SA NAAQS or international guidelines.

Although exceedances of applicable health screening limits (for SA NAAQS) or maximum risk levels (for international guidelines) have the potential to occur outside the PPM plant boundary, no exceedances are predicted to occur at any third party residential or ecotourism receptors. Exceedances are however predicted to occur where grazing takes place and at the community-based projects south of the PPM plant. It should however be noted that the maximum risk levels (for international guidelines) considers the people most sensitive to substance-induced effects. Exposure to a level above the maximum risk level does not mean that adverse health effects will occur but is an indication of the related potential.

With regards to chlorine, short term exposure to high concentrations of chlorine gas has the potential to damage tissues if it comes into contact with moist tissues such as the eyes, throat, and lungs. Long-term complications in humans may occur after breathing in high concentrations of chlorine. Exposure to environmental concentrations result in similar physiological responses, the results are likely to be much less severe.

Animals in general are more resilient to air pollutants than humans. Regardless, it is considered unlikely that cattle would be grazing in the short term exceedance zone or would remain in the long term exceedance zone for extended periods.

The mitigated incremental impact on air quality as a result of the KELL process is considered by the specialist to be of **NEGLIGIBLE** significance for dust fallout, **LOW** significance for particulate, SO_2 and NO_2 emissions and **MEDIUM** significance for Cl_2, HCl, HF and NH_3 emissions (see Table E5 below). Only the mitigated assessment for Cl_2, HCl, HF and NH_3 emissions is reflected in the table below as this is the more significant impact associated with the KELL plant. In addition, the KELL plant will need to be designed and implemented in such a manner that emissions comply with the Minimum Emission Standards for a New Plant (see Section 3.1.3).

Emissions from the KELL process would occur over a long period (potentially greater than 40 years). The only other emissions associated with the mineral processing plant relate to vehicle entrainment from unpaved roads. With the extension to the life of the mineral processing plant the duration of impacts would extend by the same time period. The proposed project however would not change the duration of impacts associated with the PPM TSF or the mining operations. Once the TSF reaches its full capacity, deposition of tailings would take place on one of SPML's TSFs and the PPM TSF would be rehabilitated, unless authorisation for the re-processing of the TSF is obtained as part of a separate process. The remaining life of the mining operations remains unchanged. Once mining of the Tuschenkomst pit is complete, rehabilitation of the pit would commence in line with the mine's rehabilitation plan.

The specialist has concluded that the contribution of the KELL plant to existing cumulative impacts is expected to be negligible for the following reasons (Airshed, 2019a):

- PM_{10} and $PM_{2.5}$ impacts from the KELL Plant are simulated to be localized to the KELL Plant operations;
- SO_2 and NO_2 impacts from the current PPM operations are insignificant based on dispersion modelling simulations previously completed for the current PPM operations and SO_2 and NO_2 sampling conducted in the vicinity of the current Genset;
- Cl_2, HCl, HF and NH_3 are not emitted by the current PPM operations.

When considering the above discussion, the cumulative significance rating remains **HIGH** without mitigation and **LOW** with mitigation, for all emissions except the KELL plant. For the KELL plant, the significance rating is **MEDIUM** with mitigation for Cl_2, HCl, HF and NH_3.

Mitigation

In addition to continuing to implement mitigation measures as per PPM's EMPrs, the mitigation measures outlined below will be applied to project-specific activities:

- Stack heights at the KELL Plant will be maximised as far as is economically viable (minimum of 12 m in height).
- KELL Plant will be designed so that emissions from all point sources are in compliance with the Subcategory 4.17 MES.
- All stacks will be sampled as soon as the plant is operational, and if any pollutants are in exceedance of the Subcategory 4.17 MES, additional mitigation measures will be implemented.
- PPM employees and members of the surrounding communities will be educated on the effects of Cl_2 (as well as HCl and HF) exposure and that all symptoms be reported on the PPM complaints register.

Monitoring

In addition to monitoring as per PPM's EMPrs, the monitoring outlined below will be applied to project-specific activities (see Section 29):

- All stacks will be sampled as soon as the plant is operational.
- Monitoring will be undertaken in line with an AEL.
- Annual passive diffusive sampling of Cl_2, HCl and HF at PPM plant boundary to the north and south and at the closest sensitive receptor locations namely the villages of Mothlabe and Ngweding. If sampled concentrations exceed the assessment criteria, sources of these pollutants should be investigated and mitigation measures implemented if applicable.

Where monitoring shows exceedances of applicable limits as a result of PPM's activities, additional mitigation will be implemented in consultation with an appropriately qualified specialist.

Emergency situation

In the event of exposure to high concentrations of chlorine, the emergency response procedures outlined in Section 30.2 would be implemented.

TABLE E5: IMPACT SUMMARY – AMBIENT AIR CONCENTRATIONS

Issue: Increase in ambient air concentrations		
Phases: Construction and operations		
Criteria	Without mitigation	With Mitigation
Severity	-	Substantial deterioration
Duration	-	Life of the project
Extent	-	Beyond the site boundary
Consequence	-	Medium
Probability	-	Possible
Significance	-	Medium
Nature of cumulative impacts	Negligible	
Degree to which impact can be reversed	Once the plant is decommissioned, the source of impacts would cease. However where health related impacts occur, these may not be reversible.	
Degree to which impact may cause irreplaceable loss of resources	Not applicable	
Degree to which impact can be mitigated	High.	
Residual impacts	With mitigation, it is unlikely that air quality health impacts would be felt at sensitive receptors.	

10. ISSUE: INCREASE IN AMBIENT NOISE LEVELS

Description of impact

Construction of the additional infrastructure and changes to the mineral processing operations present activities that could contribute to ambient noise levels both during the day and at night. Project activities have the potential to cause a noise disturbance and/or nuisance at potentially sensitive receptors. A maximum increase in noise levels of 3 dBA above background levels was used to inform the assessment (IFC noise guideline). For a person with average hearing acuity, an increase of less than 3 dBA in the general ambient noise level is not detectable (Airshed, 2019b).

Noise pollution will have different impacts on different receptors because some are very sensitive to noise and others are not. It is expected that conservation and eco-tourism, residential and educational facilities would be most vulnerable to noise disturbances from the proposed project. Potential noise impacts on biodiversity are discussed in Section A3.

Impact assessment

Based on noise monitoring surveys, the daytime acoustic environment at all sampling locations was influenced by birds, insects, some livestock (goats) and local community activities while at night, mining activities (specifically heavy mining vehicles) were audible at the Ngweding and Black Rhino Game Reserve sampling sites. Although mining activities were audible, the night-time acoustic environment was below the SANS 10103 (2008) suburban and rural limits, respectively (Section 6.4.1.9).

Noise modelling undertaken for the proposed project predicted that the additional stationary and mobile equipment associated with changes to the mineral processing operations would result in a less than 1 dBA increase in ambient noise levels both during the day and at night at potential receptor sites. According to SANS 10103 (2008) no reaction would be expected from the community for increased noise levels up to 1

dBA. Reverse alarms and other impulsive sounds would have a nuisance effect, especially where these activities take place at night.

The incremental impact on human noise receptors is considered by the specialist to be of **LOW** significance even without mitigation (see Table E6 below).

With an extension to the life of PPM's mineral processing facilities, the duration of impacts associated with the mineral processing plant would extend by the same time period. The proposed project however would not change the duration of impacts associated with the PPM TSF or the mining operations. Once the TSF reaches its full capacity, deposition of tailings would take place on one of SPML's TSFs and the PPM TSF would be rehabilitated, unless authorisation for the re-processing of the TSF is obtained through a separate process. The remaining life of the mining operations remains unchanged. Once mining of the Tuschenkomst pit is complete, rehabilitation of the pit would commence in line with the mine's rehabilitation plan.

When considering the project's impact cumulatively with the approved PPM operations, and that the contribution of noise sources from the proposed project would have a negligible effect on cumulative impacts, the significance rating for the overall mine remains **MEDIUM** without and with mitigation.

Mitigation

In addition to continuing to implement mitigation measures as per PPM's EMPrs, the mitigation measures outlined below will be applied to project-specific activities:

- All diesel-powered equipment and plant vehicles must be kept at a high level of maintenance. Any change in the noise emission characteristics of equipment should serve as trigger for withdrawing it for maintenance.
- Equipment with lower sound power levels must be selected. Vendors should be required to guarantee optimised equipment design noise levels.
- In managing noise specifically related to truck and vehicle traffic, efforts should be directed at:
  - Minimise individual vehicle engine, transmission, and body noise/vibration through the implementation of an equipment maintenance programme.
  - Maintaining road surfaces regularly to avoid corrugations, potholes etc.
  - Avoiding unnecessary idling times.
- Where possible, other non-routine noisy activities such as construction, decommissioning, start-up and maintenance, will be limited to day-time hours.
- A noise incidents register will be kept.

Monitoring

Monitoring will continue as per the approved EMPr (see Section 29). Where monitoring shows exceedances of applicable limits as a result of PPM's activities, additional mitigation will be implemented in consultation with an appropriately qualified specialist.

Emergency situations

None identified.

TABLE E6: IMPACT SUMMARY – INCREASE IN AMBIENT NOISE LEVELS

Issue: Increase in ambient noise levels affecting potential human receptors		
Phases: Construction, operation and decommissioning		
Criteria	Without Mitigation	With Mitigation
Severity	Change not measurable	Change not measurable
Duration	Life of the project	Life of the project
Extent	Localised	Localised
Consequence	Low	Low
Probability	Seldom/Unlikely	Seldom/Unlikely
Significance	Low	Low

Nature of cumulative impacts	Negligible
Degree to which impact can be reversed	Once the plant is decommissioned, the source of impacts would cease.
Degree to which impact may cause irreplaceable loss of resources	Not applicable.
Degree to which impact can be mitigated	High.
Residual impacts	With mitigation, no residual impacts are expected.

11. ISSUE: CHANGE IN LANDSCAPE AND RELATED VISUAL IMPACTS

Description of impact

An impact on the visual environment is assessed by considering the change to the visual landscape as a result of project related infrastructure and activities. The visual landscape is determined by considering: landscape character, sense of place, scenic quality, sensitivity of the visual resource and sensitive views.

The existing PPM mine and other surrounding mining activities already have a high negative effect on the visual environment of the study area (Newton Landscape Architects, 2019). Although project related infrastructure will be developed within PPM's existing operational footprint, the establishment of additional infrastructure and changes to mineral processing activities has the potential to further alter the landscape character of the site and surrounding area.

Although the specific operational area of PPM, where the proposed project is planned, is considered to have a low scenic quality, the flat savannah plains and treed hills are considered to have a moderate to high value. As a result the overall landscape character is considered to evoke an aesthetically pleasing scene with a strong sense of place. Key to these factors is that PPM (and the proposed plant expansion project) is in close proximity to the PNP and within the proposed Heritage Park Corridor (Section 6.4.1.10).

The more significant activities and structures that would contribute to the visual impact would be an increase in activities during construction of the structures; the physical presence of structures during operations; changes to the mineral processing activities that would extend the life of the PPM processing plant by an additional 40 years; and night lighting on the upper levels of the structures needed for safety purposes. During the decommissioning / closure phases the visibility of the project would be influenced by activities associated with the disassembly of structures (Newton Landscape Architects, 2019).

Impact assessment

Within the context of the current plant's most prominent structures i.e. the silos and the DMS plant which are approximately 42m and 36m high respectively, only the tallest components of the proposed project i.e. UG2 milling and flotation circuit (23m) would be partially visible to sensitive receptors visiting and living in the Black Rhino Nature Reserve (BRNR), the Pilanesberg National Park (PNP) and Legkraal village located to the south west and south of PPM. The hydrometallurgical plant (5m) and its stack (using an assumed height of 15m for the purposes of this assessment) would be visible from the PNP and Legkraal village but not BRNR. However, the facilities would be seen in the background of views and would blend with existing structures. The physical presence of these structures would therefore result in a minor increase in visual intrusion. Additional lights from the proposed project would contribute to the existing negative impact of mining / plant activities at night on sensitive tourist and residential areas (Newton Landscape Architects, 2019).

It is predicted by the specialist that the project, in the unmitigated scenario, would exert a **MEDIUM** significance incremental impact on the visual and aesthetic environment when compared against the landscape baseline comprised of mining, village and tourist land use activities (Figure E1) (see Table E7 below). Project components would be built into existing mineral processing operations located on the farms

Witkleifontein 136 JP and Tuschenkomst 135 JP (Figure E2). With mitigation, the predicted incremental significance would be **MEDIUM during construction** and **LOW during operations**.

At closure, facilities would be removed and the incremental impact of the proposed project would be insignificant with the implementation of mitigation measures.

With an extension to the life of PPM's mineral processing facilities, the duration of visual impacts associated with the mineral processing plant would extend by the same time period. The proposed project however would not change the duration of impacts associated with the PPM TSF or the mining operations. Once the TSF reaches its full capacity, deposition of tailings would take place on one of SPML's TSFs and the PPM TSF would be rehabilitated, unless authorisation for the re-processing of the TSF is obtained through a separate process. The remaining life of the mining operations remains unchanged. Once mining of the Tuschenkomst pit is complete, rehabilitation of the pit would commence in line with the mine's rehabilitation plan.

In the context of the above discussion and considering the nature and extent of PPM's approved operations, the proposed project will add moderate additional impacts during construction and minor additional impacts during operations. The net cumulative significance rating for the overall cumulative impacts remains **HIGH** without mitigation and **MEDIUM-HIGH** with mitigation.

Mitigation

Mitigation measures as per PPM's EMPrs will be applied to project-specific activities.

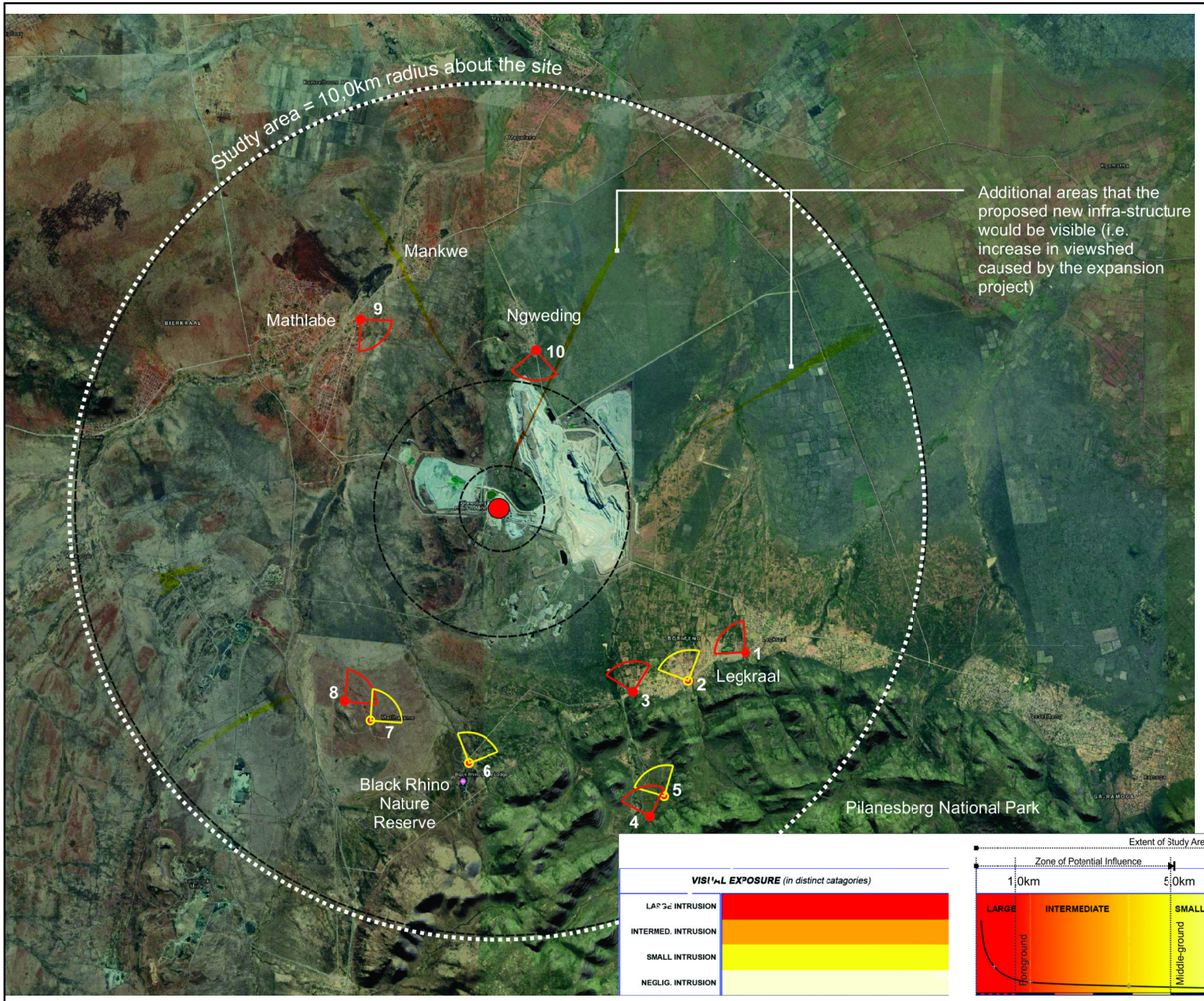
In addition, PPM will have sustained engagements with stakeholders including the Pilanesberg National Park and Black Rhino Game Reserve on visual and sense of place related impacts.

Emergency situations

None identified.

TABLE E7: IMPACT SUMMARY – NEGATIVE LANDSCAPE AND VISUAL IMPACTS

Issue: Change in the landscape and related visual impacts affecting sensitive views		
Phases: Construction, Operation, Decommissioning		
Criteria	Without Mitigation	With Mitigation
Severity	Minor loss or alteration	Minor loss or alteration
Duration	Life of the project	Less than the project life
Extent	Far beyond the site boundary	Localised
Consequence	Medium	Low
Probability	Possible	Possible (during construction) Unlikely (during operations)
Significance	Medium	Medium (during construction) Low (during operations)
Nature of cumulative impacts	Moderate contribution to cumulative impacts during construction although it should be noted that this is a relatively short period. Minor contribution to cumulative impacts during operations. Impacts would remain within the range previously assessed.	
Degree to which impact can be reversed	Removal of infrastructure and rehabilitation would reverse the impact.	
Degree to which impact may cause irreplaceable loss of resources	Low. The visual environment of the project site has already been compromised by existing operations.	
Degree to which impact can be mitigated	High, when considering glare and lighting mitigation measures.	
Residual impacts	No residual impact is anticipated. Once built the structure would form part of the altered visual environment and aesthetics of the site.	



LEGEND

Project Site

Zone of Potential Influence 10km
Fore (1km) and Middle-ground views around project site (up to 5km)

VIEWSHED OFFSET

The offsets used are the heights of the proposed buildings as provided by the developer.

Note: Although the viewshed indicates high visibility - due to the existing bush, only the upper portions of the taller buildings will be visible from public viewing areas along the R104 and R512/3 roads.

1 Direction of view — View Points - Simulations

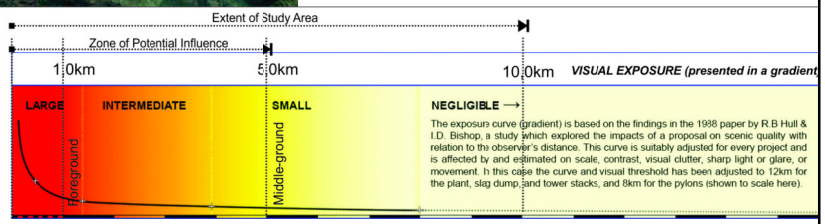
1 Direction of view — View Points

POTENTIAL CONFLICT AREAS

Conflict areas are a sensitive viewing point occurring within a 5.0km radius of the proposed project site i.e. fore and middeground views that occur within the zone of potential influence (study area).

These areas include residential areas as well as tourist roads / destinations.

Within this range the viewer could experience high (foreground view 0 - 1,0km) to moderate (middle-ground view 1,0km - 5,0km) visual exposure of the proposed development

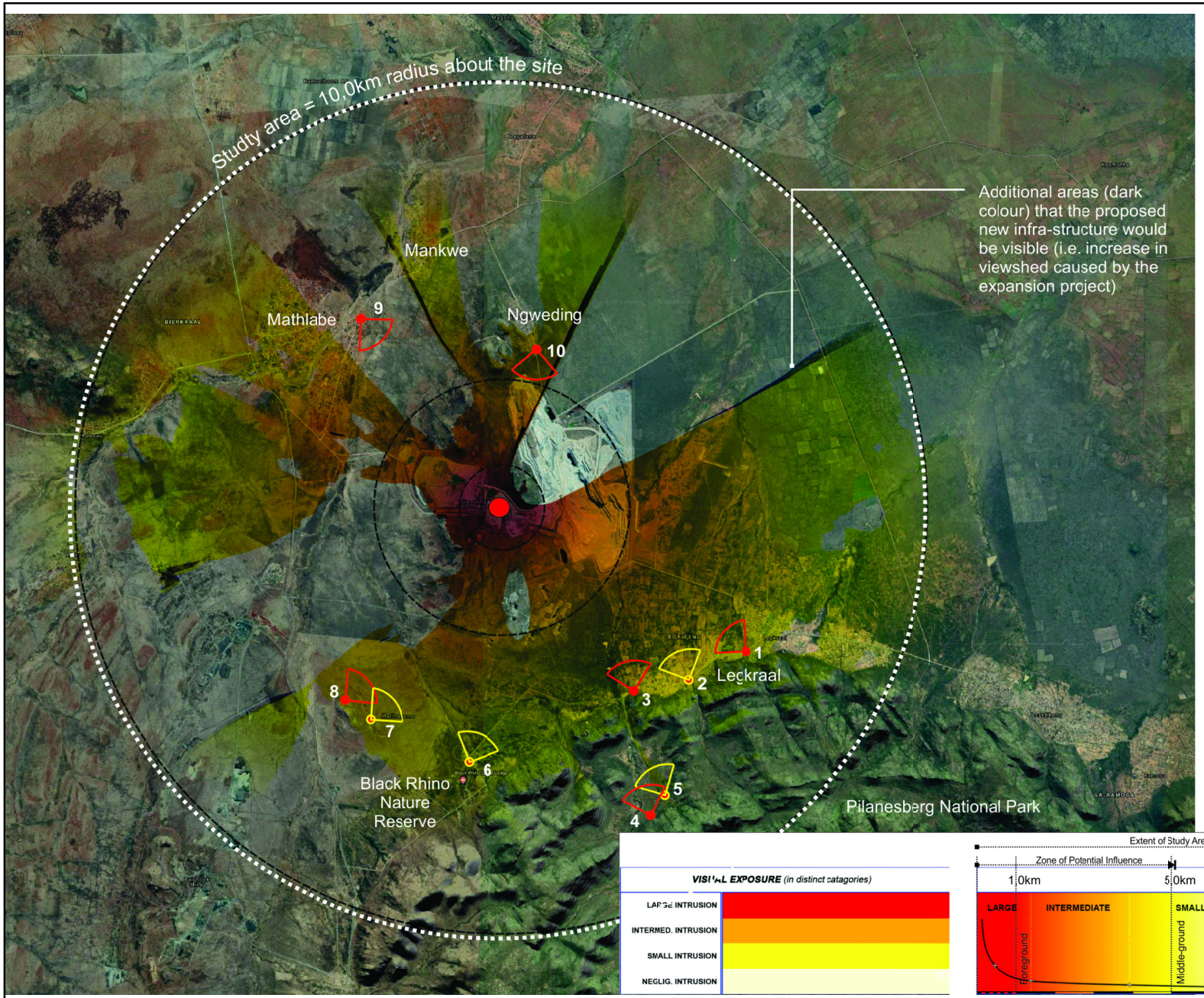


SIMULATED VIEWSHED SHOWING INCREMENTAL INCREASE IN VISIBILITY

02/2019

710.16002.00026

FIGURE E-1



LEGEND

Project Site

Zone of Potential Influence 10km
Fore (1km) and Middle-ground views around project site (up to 5km)

VIEWSHED OFFSET

The offsets used are the heights of the proposed buildings as provided by the developer.

Note: Although the viewshed indicates high visibility - due to the existing bush, only the upper portions of the taller buildings will be visible from public viewing areas along the R104 and R512/3 roads.

1 Direction of view — View Points - Simulations

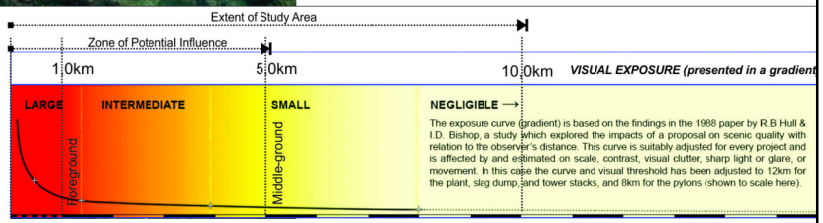
1 Direction of view — View Points

POTENTIAL CONFLICT AREAS

Conflict areas are a sensitive viewing point occurring within a 5.0km radius of the proposed project site i.e. fore and middleground views that occur within the zone of potential influence (study area).

These areas include residential areas as well as tourist roads / destinations.

Within this range the viewer could experience high (foreground view 0 - 1,0km) to moderate (middle-ground view 1,0km - 5,0km) visual exposure of the proposed development



SIMULATED VIEWSHED SHOWING THE CUMULATIVE VISIBILITY OF THE EXISTING PLANT WITH THE ADDITIONAL PROCESSING OPERATIONS

02/2019

710.16002.00026

FIGURE E-2

B) IMPACT ON SOCIO-ECONOMIC ENVIRONMENT

1. ISSUE: ECONOMIC IMPACT

Description of impact

The proposed project has the potential to continue to impact on the local and regional economy on both a positive and negative level. Negative impacts may arise from the potential loss in land value and loss of economic activities associated with current and potential future land use opportunities. It should however be noted that several mines, including PPM are already operating, or in development stage, in the area and existing economic activities, particular those associated with tourism have been exposed to mining in the region for a number of years. It should also be noted that the eco-tourism ventures in the region continue to function in the context of existing and developing mining activities in the area (Mercury Financial Consultants, 2019). Positive impacts may arise from increased foreign investment and income; direct benefits such as wages, taxes and profits; indirect benefits such as the procurement of goods and services, and the increased spending power of employees induced impacts as a result of increased personal income or spending power.

Impact assessment

The proposed project will add to mineral processing activities on site and extend the life of the plant by an additional 40 years. For the KELL process, the life of the plant could extend beyond this. The related economic impacts include (Mercury Financial Consultants, 2019):

- sustaining the employment of 365 people (working at the current mineral processing operations) - this equates to a present economic value of R1.93 billion over 40 years;
- creating opportunity for additional job creation with approximately:
    - 370 jobs in the construction phase equating to a present economic value of R93.8 million over a 24-month construction period;
    - 140 jobs in the operational phase equating to R323 million in present economic value over 33 years;
- community-based projects would continue to employ additional members from the local community and support local economic development;
- revenue could potentially increase as a result of an additional 2% recovery through the KELL process, additional chrome recovery, and additional metal recovery from the tailings re-treatment plant – no additional PGM reserves will be accessed and therefore a potential increase in revenue will only be associated with additional metal recovery;
- concentrate does not need to be transported to an off-site smelter, which will result in an operational cost saving and potentially increased profits;
- existing toll smelting and base metals refining contracts with external smelting operations would be terminated, negatively impacting on the revenue of these operations, although toll treating is often not the main source of revenue.

In addition to the direct and indirect economic impacts discussed above, PPM through its corporate social investments and social and labour plan, contributes towards the local economic development in the area. The proposed project will continue to contribute towards positive socio-economic benefits to its employees and surrounding communities which includes but is not limited to the following:

- community based projects;
- development of skills through its skills development plan – the proposed project would upskill existing employees from the concentrator plant to the KELL plant;
- career progression and mentorship plans, internships and learnership programs to provide learners with an occupational qualification;
- employment equity plan targeting historically disadvantaged South Africans (HDSAs); and
- investment in infrastructure development through local economic development and integrated development programmes.

The proposed project would not contribute to the same level or magnitude as a new mining operation but it will still positively contribute towards to the local, regional and national economy through capital

investment, creation of employment and revenue generation potential (Mercury Financial Consultants, 2019).

Given that infrastructure will be located within the existing PPM operational footprint, there will be no economic displacement of current competing land uses. When considering eco-tourism ventures in the region, these continue to function in the context of existing and developing mining activities in the area and it is not expected that the project will adversely affect these businesses. It is expected that tourists and visitors to the Pilanesberg National Park would continue (Mercury Financial Consultants, 2019). In the unmitigated scenario it is possible that land surrounding the project will experience some degree of additional negative social and environmental impact, which could impact on current land use values. This has been raised as a concern a number of times by landowners at the Black Rhino Game Reserve, with specific reference to noise and visual impacts from PPM. In the scenario where the project successfully implements the stipulated environmental and social management measures, the net substantive change is limited. This is linked to the fact that the proposed project would largely be developed within the current footprint and range of activities at the mine noting that the KELL process is a new technology. In addition, the proposed project would not change the duration of impacts associated with the PPM TSF or the mining operations. Once the TSF reaches its full capacity, deposition of tailings would take place on one of SPML's TSFs and the PPM TSF would be rehabilitated, unless authorisation for the re-processing of the TSF is obtained as part of a separate process. The remaining life of the mining operations remains unchanged. Once mining of the Tuschenkomst pit is complete, rehabilitation of the pit would commence in line with the mine's rehabilitation plan.

The combined incremental economic impact is considered to be of **MEDIUM (positive)** significance without and **HIGH (positive)** with mitigation (see Table E8 below).

When considering the project's impact cumulatively with the approved PPM operations, the project would have a moderate positive contribution to cumulative impacts. The significance rating for the overall mine remains **MEDIUM positive** without mitigation and **HIGH positive** with mitigation.

Mitigation

PPM will continue to implement mitigation measures as per its approved EMPrs.

Emergency situations

None identified

TABLE E8: IMPACT SUMMARY – ECONOMIC IMPACT (POSITIVE AND NEGATIVE)

Issue: Economic impact (positive and negative)		
Phases: All		
Criteria	Without Mitigation	With Mitigation
Severity	Minor improvement	Moderate improvement
Duration	Life of the project	Beyond closure
Extent	Local to regional	Local to regional
Consequence	Medium	High
Probability	Possible	Possible
Significance	Medium (positive)	High (positive)
Nature of cumulative impacts	Moderate positive contribution to cumulative impacts, with an extension to the duration of potential positive impacts.	
Degree to which impact can be reversed	Not applicable	
Degree to which impact may cause irreplaceable loss of resources	Not applicable	

Degree to which impact can be mitigated	High
Residual impacts	Positive economic impacts could extend beyond the life of the plant through training and skills development.

2. ISSUE: 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.

Important to note is that there has been no sterilisation of minerals by the placement of surface infrastructure at the mine. Given that project infrastructure would be located within PPM's existing plant and TSF footprint or adjacent to PPM's operations (for certain of the community-based projects), no sterilisation impacts as a result of the placement of infrastructure are expected. Any PGMs or base metals in the PPM TSF would be available for recovery through future reprocessing of the TSF. In addition, the proposed changes to the mineral processing operations aim to maximise the recovery of PGMs and base metals from the mined ores through the addition of a hydrometallurgical plant. As such the proposed project minimises the loss of economically viable mineral resources through disposal is not considered an issue.

With an extension to the life of PPM's mineral processing facilities, the duration of impacts associated with the mineral processing plant would extend by the same time period. The proposed project however would not change the duration of impacts associated with the PPM TSF or the mining operations.

When considering the project's impact cumulatively with the approved PPM operations, no cumulative impacts would occur. The significance rating for the overall mine remains **MEDIUM** without mitigation and **LOW** with mitigation.

3. ISSUE: INWARD MIGRATION

Description of impact

Mining related projects including mineral processing operations tend to bring with them an expectation of employment in all 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. Related to this is the possibility of theft and poaching of wild roaming animals on surrounding land such as the Pilanesberg National Park and Black Rhino Game Reserve.

Impact assessment

The proposed project will create new employment opportunities. The establishment of additional infrastructure and changes in mineral processing operations would take place at an existing operation. Contractors will also be used where required, especially during the construction phase. The potential exists for inward migration of people seeking employment and the associated social issues and pressures. Given the high rate of unemployment and related economic factors, people are seeking job opportunities where possible. The expectation associated with employment opportunities would increase due to the increase in the scale of the operations. Although the increase in the scale of the operations is relatively small given the plant's current capacity, the increase in scale may be perceived to be significant. This would place increased pressure on housing and related infrastructure and services. This situation can be worsened if the mine does not undertake adequate planning for employee and contractor housing and transport.

In the normal course, inward migration and the development of informal settlements would occur at the start of each of the construction and operational phases, but negative social issues associated with inward migration can continue beyond closure. The probability is considered to be low as PPM is an existing

operation and if this impact were to have occurred it would have done so when the mine started. No informal settlements have developed in the surrounding communities. Although mitigation can reduce inward migration, it's unlikely to be eliminated.

The incremental impact is considered to be of **MEDIUM** significance without mitigation reducing to **LOW** significance with mitigation (see Table E9 below).

With an extension to the life of PPM's mineral processing facilities, the expectation associated with employment opportunities could remain for the extended duration of the plant. The proposed project however would not change the remaining life of PPM's mining operations. It may be possible that once the mining activities cease, the expectation for employment would reduce. Nonetheless, as indicated above, negative social issues could extend beyond this period.

In the context of the above discussion and considering the nature and extent of PPM's approved operations, the proposed project will add minor additional impacts, if unmitigated. It follows that the proposed project will not change the significance of the impacts associated with the approved operations albeit that some of these that could be associated with the plant have the potential to occur for an extended period. The net cumulative significance rating for the overall cumulative impacts remains **HIGH** without mitigation and **MEDIUM** with mitigation.

Mitigation

PPM will continue to implement mitigation measures as per its approved EMPrs.

Emergency situations

The establishment of informal settlements in the area is considered an emergency situation. In such instances the emergency procedure included in Section 30.2 will be followed.

TABLE E9: IMPACT SUMMARY – INWARD MIGRATION

Issue: Inward migration		
Phases: All		
Criteria	Without Mitigation	With Mitigation
Severity	Minor deterioration	Minor deterioration
Duration	Beyond closure	Beyond closure
Extent	Beyond the site boundary	Beyond the site boundary
Consequence	Low	Low
Probability	Possible	Seldom
Significance	Medium	Low
Nature of cumulative impacts	Minor contribution to cumulative impacts, impacts would remain within the range previously assessed.	
Degree to which impact can be reversed	When PPM activities cease, the expectation of employment would cease however social related issues and pressures would likely remain, if unmitigated.	
Degree to which impact may cause irreplaceable loss of resources	Not applicable	
Degree to which impact can be mitigated	High with co-operation from other operations in the area, the local municipality and the BBKTA.	
Residual impacts	Negative social issues could continue beyond the project.	

4. ISSUE: ROAD DISTURBANCE AND TRAFFIC SAFETY

Description of impact

The establishment of additional infrastructure and changes in mineral processing operations has the potential to contribute cumulatively to traffic related impacts. Traffic impacts are expected from construction through to decommissioning when vehicles will make use of the existing public transport network in and adjacent to PPM.

Access for the proposed project is from PPM's existing access intersection on Road P50-1. The existing access point was evaluated by the traffic specialist in terms of available sight distances, safety and functionality and sufficient space for vehicles passing stationary vehicles waiting to make turning movements. No additional accesses are deemed necessary (Siyazi, 2019).

Traffic furthermore has the potential to impact on noise, air quality and pubic road safety. Noise and air quality impacts are assessed in Sections A10 and A9, respectively. The assessment below therefore focusses on road capacity and safety related aspects.

Impact assessment

The proposed project would contribute to existing traffic volumes during the construction phase. It is estimated that the proposed project would add an additional 95 private vehicle/taxis a day, 4 x 30-50 ton trucks a month and 4 small trucks a week to the existing transport network (Section 3.2.8). Abnormal loads transporting cranes and plant infrastructure would also take place during construction. This would be for a relatively short period of time (18 to 24 months).

During operations, it is estimated that the proposed project would add an additional 49 private vehicle/taxis a day to the transport network. The transport of approximately 5 000 tons of PGM concentrate off site per month (4 x 50 ton trucks a day) would no longer take place as the concentrate would be processed further within the plant boundaries. This would be replaced by the transport of product off site via road, using 30-ton trucks (with a trailer, if required) and via air (helicopter). The related trips including the delivery of plant chemicals and coal is estimated at 6 trucks or tankers a week (Section 3.2.8).

In the unmitigated scenario (excluding the current upgrade to the P50-1 road), although the increase in PPM-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, owing to the type, nature and location of the proposed project, the traffic specialist is of the opinion that (Siyazi, 2019):

- the vehicle trips anticipated to be generated during the construction phase will have a manageable impact; and
- the vehicle trips anticipated to be generated during the operational phase will have an insignificant and manageable impact.

Notwithstanding the above, any serious injury or death as a result of project-related traffic is a long term impact in both the unmitigated and mitigated scenarios. Possible accident sites could be located within or outside the project area and the indirect impacts associated with any injuries or fatalities would extend to the communities to which the injured people/animals belong. Although the possibility exists, accidents do not occur on a continuous basis.

The incremental impact of road disturbance and traffic safety is considered to be of **MEDIUM** significance without mitigation reducing to **LOW** significance with mitigation (see Table E10 below).

With an extension to the life of PPM's mineral processing facilities, the duration of road disturbance and traffic safety impacts associated with the mineral processing plant would extend by the same time period. The proposed project however would not change the duration of impacts associated with the mining operations. The remaining life of the mining operations remains unchanged.

When considering the project's impact cumulatively with the approved PPM operations and that the relevant section of the P50-1 is currently being upgraded, the proposed project is expected to have a minor

contribution to cumulative impacts. The significance rating for the overall mine remains **HIGH** without mitigation and **MEDIUM** with mitigation.

Mitigation

In addition to continuing to implement mitigation measures as per PPM's EMPrs, the mitigation measures outlined below will be applied to project-specific activities:

- Implement the planned upgrades to the P50-1.
- Construction phase shifts will start and end outside of the main operating shift times.
- Delivery of heavy loads which includes plant construction materials and components will be scheduled at times other than the background traffic peak periods.
- Provide pedestrian walkways along the mine access road to ensure a split between vehicular and pedestrian movements and to ensure a safe environment for pedestrians.
- From a road safety point of view, as part of paving the relevant sections of Road P50-1, dedicated right turn lanes and public transport loading and off-loading facilities will be provided where the road reserves allows.

Emergency situations

In the event of mine related road accidents the emergency procedure included in Section 30.2 will be followed.

TABLE E10: IMPACT SUMMARY – ROAD DISTURBANCE AND TRAFFIC SAFETY

Issue: Road disturbance and traffic safety		
Phases: Construction		
Criteria	Without Mitigation	With Mitigation
Severity	Minor change	Minor change
Duration	Long term	Long term
Extent	Beyond the site boundary	Beyond the site boundary
Consequence	Medium	Medium
Probability	Possible	Seldom
Significance	Medium	Low
Nature of cumulative impacts	Minor given the current upgrade of the P50-1 to address safety related issues.	
Degree to which impact can be reversed	Any accidents that occur as a result of project related traffic is irreversible.	
Degree to which impact may cause irreplaceable loss of resources	Not applicable.	
Degree to which impact can be mitigated	High	
Residual impacts	Any accidents that occur as a result of project related traffic would likely have residual impacts. The potential for accidents would, however, cease when operations cease.	

5. ISSUE: INCREASE IN SAFETY RISKS TO THIRD PARTIES AND COMMUNITIES

Project-related infrastructure and activities would be undertaken within PPM's existing mineral processing plant complex and TSF footprint. Security access and control measures are already in place in these areas. Access to construction sites or operational areas by third parties or animals and exposure to related safety risks is therefore considered highly unlikely. Potential health risks as a result of air emissions are discussed in Section A9 above.

With an extension to the life of PPM's mineral processing facilities, the duration of safety risks associated with the mineral processing plant would extend by the same time period. The proposed project however

would not change the duration of impacts associated with the PPM TSF or the mining operations. Once the TSF reaches its full capacity, deposition of tailings would take place on one of SPML's TSFs. The remaining life of the mining operations remains unchanged.

When considering the project's impact cumulatively with the approved PPM operations, no cumulative impacts would occur. The significance rating for the overall mine remains **HIGH** without mitigation and **MEDIUM** with mitigation.

6. ISSUE: LAND USE IMPACT

Description of impact

There is potential for current and future land uses in and surrounding the PPM mining right area to be impacted on by the proposed project. These land uses include a mix of community and eco-tourism type land uses including the proposed Heritage Park corridor (HPC).

Impact assessment

Given that infrastructure will be located within the existing PPM operational footprint, there will be no additional loss of community grazing land and no additional footprint loss of the proposed HPC.

With regards to surrounding land uses, in the unmitigated scenario, it is possible that land uses surrounding the project will experience some degree of additional negative environmental and social impacts. The key related potential environmental impacts include off-site emissions of water, air and noise; visual impacts; traffic related safety risks and the influx of job seekers with related social ills. It should however be noted that several mines, including PPM are already operating, or in development stage, in the area and existing land uses have been exposed to mining in the region for a number of years. Important to note is that eco-tourism ventures in the region continue to function in the context of existing and developing mining activities in the area (Mercury Financial Consultants, 2019). In the scenario where the project successfully implements the stipulated environmental and social management measures, potential additional impacts on surrounding land uses can be prevented and/or minimised.

The incremental impact on surrounding land uses is assessed to have a **MEDIUM** significance without mitigation and a **LOW** significance with mitigation (see Table E11 below).

With the extension of the life of the mineral processing operations, the proposed project may potentially delay the onset of alterative land use activities including the use of rehabilitated land for community grazing. Important to note is that the extension of life of the mineral processing facilities does not apply to the PPM TSF or mining operations. Once the TSF reaches its full capacity, deposition of tailings would take place on one of SPML's TSFs and the PPM TSF would be rehabilitated, unless authorisation for the re-processing of the TSF is obtained as part of a separate process. Once mining of the Tuschenkomst pit is complete, rehabilitation of the pit would commence in line with the mine's rehabilitation plan.

With regards to the HPC, given the existing and planned mining operations in the area, alternatives to the dangerous game component of the heritage park corridor have been considered by PPM and the NWPTB. Under this alternative the HPC has been aligned on a westerly route on the farms Zandspruit 168 JP, Rooderand 46 JQ, Witkleifontein 136 JP and Tuschenkomst 135 JP (refer to Figure 6-5). In principle the NWPTB agreed with the revised alignment on 1 August 2011. In the case of the heritage park land use PPM has committed to working with NWPTB and will continue discussing the issue of ensuring that this corridor is maintained at its maximum width while passing through PPM's mining right area (SLR, 2012).

When considering the project's collective land use impact cumulatively with the approved PPM operations, the proposed project is expected to have a minor contribution to cumulative impacts. This is linked to the fact that the proposed project would largely be developed within the current footprint and range of activities at the mine noting that the KELL process is a new technology. The cumulative significance rating for the overall mine remains **HIGH** without mitigation and **MEDIUM to LOW** with mitigation.

Mitigation

The following measures are recommended:

- Effective implementation of all mitigation measures as outlined in the EMPr to reduce the overall impact on the environment and surrounding land uses.

Emergency situation

None identified.

TABLE E11: IMPACT SUMMARY – CHANGE IN LAND USE

Issue: Change in land use		
Phases: All		
Criteria	Without Mitigation	With Mitigation
Severity	Minor change or disturbance	Minor change or disturbance
Duration	Beyond closure	Life of the project
Extent	Beyond the site boundary	Beyond the site boundary
Consequence	Medium	Low
Probability	Possible	Seldom
Significance	Medium	Low
Nature of cumulative impacts	Minor contribution to cumulative impacts, impacts would remain within the range previously assessed.	
Degree to which impact can be reversed	Once the plant is decommissioned, the source of impacts would cease.	
Degree to which impact may cause irreplaceable loss of resources	The degree to which land use impacts can be reversed is linked to the degree that environmental and social impacts as outlined in this report can be reduced.	
Degree to which impact can be mitigated	Mitigation of land use impacts is linked to the mitigation of environmental and social impacts as outlined in this report.	
Residual impacts	With mitigation, limited residual impacts are expected.	

C) IMPACT ON HERITAGE RESOURCES (INCLUDING PALAEONTOLOGICAL RESOURCES)

7. ISSUE: DAMAGE TO OR DISTURBANCE OF HERITAGE (INCLUDING CULTURAL) AND PALAEONTOLOGICAL RESOURCES RESULTING IN A LOSS OF THE RESOURCE

Project-related infrastructure and activities would be developed within PPM's existing mineral processing plant complex and TSF footprint. The areas earmarked for development are either occupied by existing mine infrastructure or have been disturbed by activities within the plant complex and TSF. No new areas would be disturbed. Community based projects have mainly been established within PPM's plant complex, except the vegetable garden and nursery which has been established immediately adjacent to the TSF's return water dam. As there will be no disturbance of new areas, no heritage resources will be impacted by the project.

The proposed site predominantly lies on Quaternary sands and alluvium that overlie the non-fossiliferous Rustenburg Layered Suite and contains platinum group metals (PGM). There is a very small chance that the small outcrop of Magaliesburg Formation (Pretoria Group, Transvaal Supergroup) could contain trace fossils of "microbially induced sedimentary structures". Most of the Quaternary Kalahari sands and alluvium do not preserve fossils because they are aeolian and weathered but if pans (not visible on Google Earth) are present then there is a very small chance that fossil plants or bones might be preserved. Although there is a very small chance that fossils might occur in the project area a Chance Find Protocol should be included in the EMPr.

The extension to the life of PPM's mineral processing facilities does affect heritage or palaeontological related impacts at the mine.

When considering the project's impact cumulatively with the approved PPM operations, no cumulative impacts would occur. The significance rating for the overall mine remains **HIGH** without mitigation and **LOW** with mitigation.

APPENDIX E: HYDROLOGICAL STUDY

APPENDIX F: HYDROGEOLOGICAL STUDY

APPENDIX G: AIR QUALITY STUDY

APPENDIX H: NOISE STUDY

APPENDIX I: VISUAL STUDY

APPENDIX J: TRAFFIC STUDY

APPENDIX K: ECONOMIC STUDY

APPENDIX L: CULTURAL-HERITAGE STUDY AND PALAEONTOLOGY STUDY

APPENDIX M: CLOSURE LIABILITY CALCULATION

APPENDIX N: TSF CAPACITY REVIEW

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Title:	PPM Plant Expansion Project
Report Number:	For Decision-Making
Proponent:	Pilanesberg Platinum Mines (Pty) Limited

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