Applicant: Pilanesberg Platinum Mines (Pty) Ltd

DMR Reference Number: NW 30/5/1/1/3/2/1/320 EM

DEDECT Reference Number: NWP/EIA/222/2009

PILANESBERG PLATINUM MINE CHROME PROJECT

ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PROGRAMME

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

AND

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

DOCUMENT INFORMATION

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IDENTIFICATION OF THE REPORT

Herewith I, the person whose name and identity number is stated below, confirm that I am the person authorised to act as representative of the applicant in terms of the resolution submitted with the application, and confirm that the above report comprises EIA and EMP compiled in accordance with the guideline on the Departments official website and directive in terms of Sections 29 and 39(5) in that regard.	
Full names and surname:	**Dean Riley**
Company:	**Pilanesberg Platinum Mines (Pty) Ltd**
Identity number:	**(Included in submission to DMR)**

PILANESBERG PLATINUM MINE CHROME PROJECT

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ACRONYMS AND ABBREVIATIONS

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

Acronyms / Abbreviations	**Definition**
%	Percentage
ABA	Acid Base Accounting
AER	Acceptable Environmental Risk
AP	Acid Potential
ARL	Acceptable Risk Level
ARLP	Acid Rain Leach Procedure
AGES	Africa Geo-Environmental Services (Pty) Ltd
Al	Aluminium
BID	Background information document
BPDM	Bojanala Platinum District Municipality
BRGR	Black Rhino Game Reserve
BIC	Bushveld Igneous Complex
Ca	Calcium
Cd	Cadmium
CEC	Cation exchange capacity
Cr	Chrome
Cl	Chloride
CO	Carbon monoxide
Cu	Copper
dBA	A-weighted decibel
DEA	Department of Environmental Affairs
DEDECT	Department of Economic Development, Environment, Conservation and Tourism
DMR	Department of Mineral Resources
DRDLR	Department of Rural Development and Land Reform
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWEA	Department of Water and Environment Affairs
EAP	Environmental Assessment Practitioners
EAPSA	Environmental assessment practitioner of Southern Africa
EC	Electrical conductivity (EC)
EIA	Environmental impact assessment
EMP	Environmental management programme
ESS	Earth Science Solutions
ESIA	Environmental Social Impact Assessment
Fe	Iron (Fe)
GDP	Gross domestic profit
IAPs	Interested and/or affected parties
IDP	Integrated Development Plan
K	Potassium
km^2	Square kilometres
LoM	Life of mine
LoP	Life of project
m	Metres
mamsl	Metres above mean sea level
m/s	Metres per second
m^2	Square metre

Acronyms / Abbreviations	**Definition**
m^3	Cubic metre
MAR	Mean annual runoff
mbgl	Metres below ground level
Mg	Magnesium
mm	Millimetres
Mn	Manganese
MPRDA	Mineral and Petroleum Resources Development Act
MVA	Megavolt ampere
MW	Megawatts
N	Nitrogen
NAAQS	National Ambient Air Quality Standards
Na	Sodium (Na)
NEMA	National Environmental Management Act
Ni	Nickel
NO_2	Nitrous oxide
NSS	Natural Scientific Services CC
^OC	Degrees Celsius
PGM	Platinum Group Metals
PM10	Particulate matter with a fraction smaller than 10µm (microns)
PM_{10}	Particulate matter
PNP	Pilanesberg National Park
PPM	Pilanesberg Platinum Mine
PrSciNat	Registered professional in natural science
ROM	Run-of-mine
RWD	Return water dam
SAHRA	South African Heritage Resources Agency
Se	Selenium
SLR	SLR Consulting (Africa) (Pty) Ltd
SPLP	Synthetic Precipitation Leaching Procedure
SO_2	Sulphur dioxide
SO_4	Sulphate (SO_4)
TDS	Total dissolved solids
TSF	Tailings storage facility
TSP	Total suspended particles
WMA	Water Management Area

EXECUTIVE SUMMARY

Pilanesberg Platinum Mines (Pty) Ltd (PPM), a wholly owned subsidiary of Platmin SA (Pty) Ltd (Platmin), is an existing open pit platinum mining operation near the Pilanesberg National Park in the North West Province. PPM proposes to mine the near-surface chrome seams via open pit mining methods and establish related surface infrastructure within the existing mine boundary on the farms Witkleifontein 136 JP and Tuschenkomst 135 JP.

Initially, as presented in the background information document (BID) and Scoping Report, the project scope included the establishment of on-site waste facilities related to the chrome mining operations, namely temporary storage of general and hazardous waste as well as the storage of waste tyres. During the EIA phase of the project, PPM's management team made the decision to remove all waste related activities from the project scope. The decision was made based on the short life span of the chrome project as well as the limited quantity of wastes that would be generated. All waste generated by the proposed chrome operation will be taken to PPM's existing waste facility for temporary storage, recycling, reuse and ultimately disposal at a permitted off site facility. Subsequently the application that was submitted to the Department of Environmental Affairs (DEA) in terms of the National Environmental Management: Waste Act, 59 of 2008 (reference number 12/9/11/L257/7) has been withdrawn.

The proposed project related infrastructure will be located within PPM's existing mining right area. The mine and project area falls within the Moses Kotane Local Municipality and the Bojanala Platinum District Municipality in the North West Province. The location of the project is outlined below.

TABLE 1: PROJECT LOCALITY INFORMATION

Location of project	
Province	North West
District	Bojanala Platinum District
Municipality	Moses Kotane Local Municipality
Farms	Tuschenkomst 135 JP and Witkleifontein 146 JP
Nearest towns	Rustenburg (±60km south east), Brits (±95km south east), Thabazimbi (±80km north east)
Nearest villages	Motlhabe (±5km north east), Ntsana-le-Metsing (±5km north), Ngweding (±4km north) and Legkraal/Bofule (±5km south east)
Catchment	Crocodile River Catchment – Quaternary Catchment A24D

Legal framework and process

Given that the project includes mining activities and that it incorporates several listed environmental activities, the environmental assessment process and report was done and compiled in accordance with the requirements of the Mineral and Petroleum Resources Development Act, 28 of 2002 (MPRDA), the National Environmental Management Act, 107 of 1998 (NEMA) and the regulations there under. Other approvals/permits needed for the project as identified during the process, including an integrated water use license, will be applied for at the required time.

SLR Consulting (Africa) (Pty) Ltd (SLR), previously known as Metago Environmental Engineers (Pty) Ltd, is the independent firm of consultants that has been appointed by the applicant company to undertake the environmental impact assessment (EIA) and related processes. The EIA and environmental management programme (EMP) report is the product of the EIA process and provides a detailed description of the project, presents the results of specialist investigations, identifies and assesses potential impacts and recommends mitigation measures should the project be approved. As part of the EIA process, a stakeholder engagement process was conducted comprising notification of interested and affected parties (IAP) through newsletters, newspaper advertisements, site notices and a background information document; various focussed and general stakeholder meetings; and distribution of reports and report summaries for review. A team of professional specialists and engineers were appointed by SLR to investigate potential issues associated with the development of the project. All issues, concerns and comments raised by IAPs have been addressed in the EIA and EMP report and included in the comments and response report in Appendix D of the EIA and EMP report. Full copies of correspondence are included in Appendix C.

Overview of the project

PPM intends to expand its existing mining operation by accessing the chrome reserves within its mining right area (see Figure A). Within the proposed chrome pit areas (shaded red on Figure A) there will be a number of separate chrome pits that will cover an area of approximately 85 ha. The open pit chrome operation and associated infrastructure will cover a total area of approximately 127 ha and the chrome pits will reach a maximum depth of 25 m. The target mineral is chrome, specifically the LG 2 to LG 6 seams. The mining operations will comprise conventional open pit mining methods – no underground mining is planned. Topsoil, overburden and rock from the chrome development will be stockpiled on-site and will be used for rehabilitation of the site. Run-of-mine (ROM) ore will be temporarily stockpiled on site before being fed through a crushing and screening plant. The crushed chrome ore will be sold to a third party for further processing.

Process water on site will be recycled and re-used as far as possible. Water management facilities for diverting clean water around the site, collecting potentially dirty water from the site and managing potentially polluted process water will be established on site in line with regulatory requirements. Support infrastructure and services required for the chrome operation will, as far as possible, be sourced from the existing facilities that form part of PPM's platinum operations. However, the following support infrastructure and services will be established for the chrome operations: stores, parking, haul roads, power supply and distribution, security and access control, and fencing.

The crushing and screening plant will be designed to treat 120 000 tonnes of run-of-mine (ROM) per annum, producing 96 000 tonnes of product.

FIGURE A: LOCALITY PLAN

It is planned to conduct concurrent rehabilitation of the open pit areas on the farm Witkleifontein 136 JP. The area where the chrome open pit is located on the farm Tuschenkomst 135 JP is demarcated as a mineralised waste facility for the platinum mining operation (Metago, 2009) and as a result, once the chrome pits have been backfilled, the waste rock from the platinum mining operation will be disposed on top this area.

It is estimated that the construction workforce for the chrome operations will peak at 200 temporary jobs with approximately 50 jobs being created during the operation phase. Construction will commence in 2013 should the decisions for the project be positive. The construction phase will last for approximately six months. The design life of the project is four years. It is anticipated that the site will operate during daylight hours only and not on weekends (i.e. 06h00 to 18h00 Monday to Thursday and from 06h00 to 14h00 on a Friday).

Environmental setting

A summary of the environmental aspects that describe the pre-mining environment as informed by specialist studies are listed below:

Geology:

PPM is situated in the Bushveld Igneous Complex. There are four main limbs to the complex, namely the Northern Limb, the Eastern Limb, the Southern Limb and the Western Limb. PPM is located in the Western Limb. The project area is underlain by the gabbroic formations of the Rustenburg Layered Suite (RLS) of the Bushveld Igneous Complex. It is located to the north-west of the prominent Pilanesberg Complex.

Climate:

PPM falls within the Highveld Climatic Zone. The project area is characterised by dry seasons with heavy thunderstorms that last for short periods at a time. High evaporation rates reduce infiltration rates, while the high rainfall levels can increase the erosion potential and the formation of erosion gullies. The presence of vegetation does however allow for surface infiltration thereby reducing the effects of erosion. The mixing of layers resulting in the formation of temperature inversion and the presence of cloud cover limits the dispersion of pollutants into the atmosphere.

Topography:

The area is characterized by a combination of flat plains and isolated koppies. The average elevation of the project area is 1 100 metres above mean sea level (m amsl). There are several isolated koppies to the north of the mine area. These vary between 1 197 and 1 266 m amsl. To the south and east of the mine is the Pilanesberg National Park and the associated hills that vary between 1330 and 1534 m amsl.

Soil and land capability:

Soil forms found within the mining right area are predominately highly structured, relatively shallow soils with a high clay content which allows for high water retention. These soil forms are therefore not highly erodible but are susceptible to compaction as a result of water retention and swelling clays. Poor drainage capacity of these soil forms reduces the dry agricultural production potential as well as the irrigation potential.

Biodiversity:

According to the North West Biodiversity Site Inventory (NW DACET, 2003), the project site is situated within the *Dwaalboom Thornveld* vegetation type, which includes the Mabeskraal Ridge Bushveld (Sourish Mixed Bushveld [Acocks 1998]). The Mabeskraal Ridge Bushveld is one of the critically important habitat types of the province. It is a very limited vegetation type, restricted to a few ridges and hills in a vast plain with clay soils. There are a number of conservation important faunal and floral species that could be located within the project area.

Hydrology (surface water):

PPM is located in the Limpopo Basin, in the catchment of the Crocodile River. The chrome project area falls within the A24D quaternary catchment. The chrome project area is drained by the non-perennial Motlhabe River, which flows into the perennial Kolobeng River. The Kolobeng in turn flows into the perennial Bierspruit which then flows into the Lower Crocodile River to the west of Thabazimbi.

The water quality generally reflects fluoride, manganese, aluminium and iron concentrations elevated above the recommended DWAF domestic use guidelines (DWAF Water Quality Guidelines, 1996).

Groundwater:

Groundwater in the project area varies between 8.14 and 33.8 m below ground level (mbgl) with an average of 22.5 mbgl. The overall water quality of the area is characterised by higher than average magnesium concentrations and high fluoride concentrations. The latter is expected due to runoff and groundwater through-flow from the neighboring alkaline complex of the Pilanesberg. The majority of the communities in the area rely on groundwater for domestic purposes.

Air quality:

Major sources of air pollution in the immediate vicinity of the project site include emissions from various mining operations, vehicle tailpipe emissions (due to the vehicle activity along routes within the area), domestic fuel burning (related to neighbouring communities/settlements), biomass burning (veld fires in agricultural areas within the region), and various miscellaneous fugitive dust sources such as agricultural activities, wind erosion of open areas, and vehicle entrainment of dust along unpaved roads.

Noise:

The proposed project is located immediately south-east of PPM's existing platinum operations. Although the ambient noise levels have been influenced by current mining activities, both on-site and in the surrounding area, there are surrounding land uses that are noise sensitive.

Visual character:

The aesthetic quality of the area has been altered by community and mining activities, particularly on the flat plains between the hills and koppies. However, the isolated koppies and Pilanesberg hills are largely 'untouched' and therefore the visual resource value remains high for these areas.

Land use:

The site for the proposed chrome infrastructure is currently used for mining (as part of PPM's existing platinum operations) and community activities such as grazing. PPM are in the process of developing a relocation action plan in order to evaluate compensation for affected land users. There is also evidence of various excavations that are as a result of old chrome mining activities.

Surrounding land uses include residential areas, ecotourism/hospitality related activities (such as Black Rhino Game Reserve and the Pilanesberg National Park), mining and community activities such as grazing and subsistence farming.

Heritage (including cultural) resources:

Heritage resources include sites of archaeological, cultural or historical importance. Various types of resources were identified within the chrome project area and immediate surrounds. These include stone walled settlements of the Late Iron Age, graveyards, a historical village and homestead, historical mining remains, isolated and randomly scattered stone tools and historical houses. Within the chrome project area, there are stone walled settlements that area rated as having a high significance. The project footprint does not disturb these heritage resources.

Paleontological resources:

The entire project area is underlain by igneous rocks of the Rustenburg Layered Suite of the Bushveld Igneous Complex. It is therefore considered unlikely that paleontological resources will be found within the project area.

Socio-economic setting:

The local level of education in the people that comprise the workforce age (19 to 65 years) is poor with only 4-5% of people with education levels higher than secondary level and only 18% of people having completed secondary education. Excluding the informal sector, the unemployment and/or not economically active rate is high at an estimated 80% of the economically active age. Mining is considered to be the major formal employment provider. Approximately 89% of residents reside in brick structures,

but only 1% of residents of the 89% utilise flush toilets and only 1% receive reticulated water in their dwellings.

Summary of environmental impacts

Potential environmental impacts were identified by SLR in consultation with IAPs, regulatory authorities, specialist consultants and PPM. The range of environmental issues considered in the EIA was given specific context and focus through consultation with authorities and IAPs. All identified impacts are considered in a cumulative manner such that the impacts of the current baseline conditions on and surrounding the site and those potentially associated with the project are discussed and assessed together. A summary of the potential impacts (as per Section 7 of the EIA and EMP report), associated with the chosen alternatives (as per Section 2 of the EIA and EMP report), in the unmitigated and mitigated scenarios is provided in Table 2 below.

TABLE 2: POTENTIAL IMPACTS AND SIGNIFICANCE RATINGS

Impact	Significance	
	Unmitigated	**Mitigated**
Loss and/or sterilisation of mineral resources	L	L
Hazardous excavations/structures/surface subsidence	H	M
Loss of soil resources and land capability through land contamination	H	L
Loss of soil resources and land capability through physical disturbance	H	L
Physical destruction of biodiversity	H	M
General disturbance of biodiversity	H	M –construction to decommissioning L - closure
Contamination of surface water	H	L
Alteration of drainage patterns	L	L
Groundwater contamination	H	L
Dewatering	L	L
Air pollution	H	M – all phases except closure
Noise pollution	M-H – all phases except closure	M – all phases except closure
Negative visual impacts	H	M-H – construction to decommissioning L - closure
Destruction and disturbance of heritage (including cultural) and paleontological resources	M	L
Loss of current and future land uses	H	L
Obstruction of the Heritage Park	H	L
Blasting hazards	H	L
Project-related road use and traffic	H	M
Economic impact (positive impact)	H+	H+
Inward migration	H	M

A summary of the significant impacts (i.e. impacts that are rated as medium or high with mitigation) is provided below.

Hazardous excavations / structures and surface subsidence

All excavations into which or off which people and animals can fall are considered hazardous. If unmanaged, this may be a high impact because the excavations may cause injury or death to people and animals. With the planned security, fencing and warning measures, as included in the EMP, this impact can be managed to an acceptable level.

Physical destruction of biodiversity

Although the project area is used for mining and community activities, it hosts some sensitive habitats with associated flora and fauna species. Species of conservation importance have been previously known to occur in the project area, and their presence will need to be confirmed through a detailed summer investigation prior to the construction of the chrome project. In the managed scenario, the mitigation measures included in the EMP can help reduce the impacts to an acceptable level.

General disturbance of biodiversity

Projects of this nature have the ability to cause general disturbance of biodiversity. In the unmitigated scenario, the chrome project has the potential to cause impacts of high significance. The mitigation measures included in the EMP are designed to prevent unacceptable disturbance of biodiversity and related ecosystem functionality and reduce the impacts to acceptable levels.

Air pollution

There are a number of activities/infrastructure in all phases that have the potential to pollute the air. If unmanaged, this will be high as the current evaluation criteria will be exceeded. In the managed scenario, the mitigation measures included in the EMP can reduce this impact to acceptable levels for the current evaluation criteria.

Noise pollution

Noise pollution can create nuisance that will have different impacts on different receptors because some are very sensitive to noise and others are not. Sensitive receptors such as the surrounding eco-tourism/hospitality are particularly sensitive to an increase in noise, particularly at night. In the unmitigated scenario, this impact is rated as high. The mitigation measures included in the EMP have been designed to prevent an unacceptable increase in disturbing noise and limit nuisance noise at sensitive receptors as far as practically possible.

Negative visual impacts

In the unmitigated scenario, it is expected that the impacts will be high for sensitive receptors such as those at Black Rhino Game Reserve. To date, PPM has not been successful in implementing measures to mitigate visual impacts from the existing operations on sensitive receptors (particularly the Black Rhino Game Reserve). As such, the severity of this impact is high in both the mitigated and unmitigated

scenarios for all project phases, except in the mitigated scenario where it reduces to low in the closure phase.

Project-related road use and traffic

Although the increase in project related traffic is expected to be minimal, it could result in increased accidents (involving people and animals) and increased road damage to public roads. In the unmanaged scenario, this impact is high. In the managed scenario, the largest component of mine related traffic (haul trucks) will use private haul roads and trucks that travel on public roads will be restricted to the R510 and the P50-1. This together with the other safety related measures included in the EMP will mitigate related impacts to an acceptable level.

Socio-economic impacts in general

The chrome project will have a number of positive economic benefits that will impact on the local area, the greater region and South Africa as a country. These benefits include capital investment, employment, support services, and foreign exchange income. In addition, a number of potential negative impacts were identified. These include: informal settlements (and associated problems) and growing pressure on basic services and housing infrastructure. By committing (in the EMP) to a clear recruitment policy, a housing policy that demands formal housing for its employees, and a progressive partnership with local government, the public and police force, PPM is well placed to limit these potential negative impacts to an acceptable level.

Conclusion

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

The assessment of the proposed project presents the potential for significant negative impacts to occur (in the unmitigated scenario in particular) on the bio-physical, cultural and socio-economic environments both on the project sites and in the surrounding area. With mitigation these potential impacts can be prevented or reduced to acceptable levels. It follows that provided the EMP is effectively implemented there is no environmental, social or economic reason why the project should not proceed.

PILANESBERG PLATINUM MINE CHROME PROJECT

INTRODUCTION AND LEGAL FRAMEWORK

Introduction

Pilanesberg Platinum Mines (Pty) Ltd (PPM), a wholly owned subsidiary of Platmin SA (Pty) Ltd (Platmin), is an existing open pit platinum mining operation near the Pilanesberg National Park in the North West Province (see Figure 1 and Figure 2 for the regional and local setting respectively). PPM operates under an approved environmental impact assessment (EIA) and environmental management programme (EMP) and includes open pit mining operations on the farms Tuschenkomst 135 JP, Witkleifontein 136 JP, Rooderand 46 JP and Ruighoek 169 JP as well as a central processing plant and mineralised waste disposal facilities (Metago, 2007). The main components of the current mining operation are located on the farms Tuschenkomst 135 JP and Witkleifontein 136 JP, and include: an open pit on the farm Tuschenkomst 135 JP, known as the Tuschenkomst pit, a processing plant, tailings dam, waste rock dumps, topsoil stockpiles and associated infrastructure. The approved infrastructure layout at PPM is illustrated in Figure 3.

As part of the proposed project, PPM proposes to access chrome seams by establishing additional open pits, topsoil stockpiles, a waste rock dump, crushing and screening plant, a mining contractor's camp and stormwater dams within the existing mining right area on the farms Witkleifontein 136 JP and Tuschenkomst 135 JP.

Initially, as presented in the background information document (BID) and Scoping Report, the project scope included the establishment of on-site waste facilities related to the chrome mining operations, namely temporary storage of general and hazardous waste as well as the storage of waste tyres. During the EIA phase of the project, PPM's management team made the decision to remove all waste related activities from the project scope. The decision was made based on the short life span of the chrome project as well as the limited quantity of wastes that would be generated. All waste generated by the proposed chrome operation will be taken to PPM's existing waste facility for temporary storage, recycling, reuse and ultimately disposal at a permitted off site facility. Subsequently the application that was submitted to the Department of Environmental Affairs (DEA) in terms of the National Environmental Management: Waste Act, 59 of 2008 (reference number 12/9/11/L257/7) has been withdrawn.

The mine and project area falls within the Moses Kotane Local Municipality and the Bojanala Platinum District Municipality in the North West Province.

FIGURE 1: REGIONAL SETTING OF PPM AND THE CHROME PROJECT

FIGURE 2: LOCAL SETTING OF PPM AND THE CHROME PROJECT

FIGURE 3: APPROVED INFRASTRUCTURE LAYOUT AT PPM

FIGURE 4: ZOOM IN OF EXISTING PPM INFRASTRUCTURE (LANDSCAPE)

FIGURE 5: ZOOM IN OF EXISTING PPM INFRASTRUCTURE (PORTRAIT)

Decisions required and legal framework

Prior to the commencement of the project, EIA related environmental authorisation is required from key governmental departments. These include:

- An environmental decision from the Department of Mineral Resources (DMR) in terms of the Mineral and Petroleum Resources Development Act (MPRDA), 28 of 2002 in the form of an approved Environmental Impact Assessment and Environmental Management Programme (EIA and EMP) report. A Section 102 application will be submitted with this report to the DMR by PPM.
- Environmental authorisation from the Department of Economic Development, Environment, Conservation and Tourism (DEDECT) in terms of the National Environmental Management Act, 107 of 1998 (NEMA). The project incorporates several listed activities. An application was submitted by SLR to DEDECT in February 2010 and accepted by the department (Appendix B). The EIA regulation being followed for this project is Regulation 385 (2006 EIA Regulations).

This report is the environmental impact assessment (EIA) (Section 1) and environmental management programme (EMP) (Section 2) for the project. Given the legal framework above, this report has been compiled to meet the requirements of the 2006 EIA Regulations and MPRDA Regulations. In this regard, the new DMR report structure template has been used. To assist with cross-referencing in the report, the chapter numbering in the EMP section follows on from the chapter numbering in the EIA section.

In terms of Regulation 385 of the 2006 EIA Regulations, Table 3 provides a guide to the relevant sections where the information is contained. It should be noted that Section 1 of this document is focussed on the proposed project only, whereas Section 2 (the EMP) addresses the existing PPM operations as well as the proposed project, i.e. a consolidated EMP.

TABLE 3: REQUIREMENTS FOR EIA AND EMP REPORTS

Environmental Regulation 385	**Section in report**
Environmental impact assessment (EIA)	
Description of the property and location of the activity on the property	1.3.1 and 1.4
Details of the person who compiled the EIA, and his/her expertise	Introduction
Details on the public involvement process including –compliance with the PSS, IAP database, issues table, additional comments/objections	10, Appendix A, Appendix B, Appendix C, Appendix D
Comment on the need and desirability of the proposed activity(ies) in the context of alternatives	Introduction
Description and comparative assessment of alternatives identified during the EIA	8
Description of proposed activity(ies)	2
A description of the environment that may be affected by the activity	1
Methodology used to determine impact significance	0
Summary of findings and recommendations of specialist reports	Throughout document
Description of environmental issues, assessment of significance, and extent to which these can be mitigated	7
Assessment to include: cumulative impacts, nature, extent, duration, probability, reversibility of resource loss, mitigation	7
Assumptions, uncertainties and knowledge gaps	11

Environmental Regulation 385	Section in report
Provide an authorisation opinion – with possible conditions	27
Environmental impact statement – summary of key findings and comparative assessment of the positive and negative implications of the activity and alternatives	27
Specialist reports as appendices	See appendices
Environmental management programme/plan (EMP)	
Details of the person who compiled the EMP, and his/her expertise	Introduction
Detailed description of the activity aspects covered in the EMP	2
Details on the management/mitigation measures from planning and design stages through to closure (where relevant)	7.2, 18 and 19
Time frames for implementation where appropriate	19
Identification of responsible persons for implementation	19

Other approvals / permits

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

- Prior to conducting any water uses as defined in Section 21 of the National Water Act, 36 of 1998, PPM will submit a water use license amendment application (WULA) to the Department of Water Affairs (DWA). This will include any exemptions from Regulation 704 of 4 June 1999. The water uses and exemptions could include:
    - Section 21(g) Water Use Disposing of waste in a manner which could detrimentally impact upon a water resource – waste rock dumps and dirty water storage dams at the chrome operations;
    - Section 21 (j) Water Use Removing water from underground for the safe continuation of an activity - the potential dewatering of the open pit areas;
    - Section 21 (c) Water Use Impeding or diverting the flow of water in a watercourse – the stockpiles and chrome pits will destroy the headwaters of non-perennial watercourses;
    - Regulation 704 (R704) exemption for Condition 4a – "Locate or place any residue deposit, dam, reservoir, together with any associated structure within 1:100 year flood-line or within a horizontal distance of 100 m of a watercourse or borehole, excluding boreholes drilled specifically to monitor the pollution of ground water, or on ground likely to become water-logged, undermined, unstable or cracked". The western topsoil stockpile and waste rock dump associated with the chrome operations lie on the headwaters of non-perennial watercourses. The chrome plant (crushing and screening) and mining camp are located adjacent to a non-perennial watercourse;
    - R704 exemption for Condition 4b – "Carry on any underground or open pit mining, prospecting or any other operation or activity under or within the 1:50 year flood-line or within a horizontal distance of 100 metres from any watercourse or estuary, whichever is greatest". The western chrome pit may destroy the headwaters of a non-perennial watercourse. The western topsoil stockpile and waste rock dump are located on non-perennial watercourses;

  - R704 exemption for Condition 5 – "May not use any residue or substance which causes or is likely to cause pollution of water resource for the construction of any dam or other impoundment or any embankment, road or railway or for any other purpose which is likely to cause pollution of a water resource". The construction of roads and containment facilities may require the use of waste rock.
- All dams with both a wall greater than 5m and a capacity of 50 000m^3 must be registered as safety risk dams with DWA in terms of the National Water Act, 36 of 1998.
- Prior to damaging or removing heritage resources such as graves, permissions are required in terms of the National Heritage Act, 25 of 1999, the Ordinance on Exhumations, 12 of 1980, and the Human Tissues Act, 65 of 1983.
- Prior to removing or damaging any protected plant species, the necessary permits will be obtained from DWA in terms of the National Forests Act, 84 of 1998.
- Prior to storage, handling, transportation and disposal of explosives the relevant licenses and written permissions are required in terms of the Explosives Act, 25 of 1956, and the Mine Health and Safety Act, 29 of 1996, as amended.

EIA approach and process

A summary of the approach and key steps in the combined EIA process and corresponding activities are outlined in Table 4.

TABLE 4: EIA PROCESS

Objectives	Corresponding activities
Project initiation and application phase (February – March 2010)	
• Notify the decision making authority of the proposed project. • Initiate the environmental impact assessment process.	• NEMA and NEM:WA applications submitted to DEDECT in February 2010 • DEDECT acknowledge receipt of NEMA application. • NEM:WA application submitted to DWEA • DWEA acknowledge receipt of NEM:WA application • Notify DMR of the process
Scoping phase (April October 2010)	
• Identify interested and/or affected parties (IAPs) and involve them in the scoping process through information sharing. • Identify potential environmental issues associated with the proposed project. • Consider alternatives. • Identify any fatal flaws. • Determine the terms of reference for the ESIA.	• Notify IAPs of the project and environmental assessment process (social scans, distribution of BIDs, newspaper advertisements, telephone calls and site notices) (April – June 2010) • Focussed meeting with traditional council and ward councillors (May 2010) • Two public scoping meetings (June 2010) • Distribute scoping report to DMR, IAPs and other regulatory authorities for review (July 2010). • Submit scoping report (including IAP comments) to DEDECT and DEA (September 2010)

Objectives	Corresponding activities
Detailed specialist investigations (September 2010 to March 2012)	
• Describe the affected environment. • Define potential impacts. • Give management and monitoring recommendations.	• Investigations by technical project team and appointed specialists (see Table 5) of issues identified during the scoping stage including investigations into alternatives.
Retraction of NEMWA application (June 2012)	
• Notify DEA that the application has been retracted	• The NEMWA application was retracted in June 2012
EIA/EMP phase (April – November 2012)	
• Assessment of potential environmental impacts. • Design requirements and management and mitigation measures. • Receive feedback on application	• Compilation of draft EIA and EMP report. • Distribute draft EIA and EMP report to IAPs, DMR and other regulatory authorities for review (July 2012). • Feedback meetings with IAPs (August 2012). • Record comments (August 2012). • Forward final EIA and EMP report to DEDECT for review (August 2012). • Forward IAP comments to DMR (August 2012). • Circulate record of decisions to all registered IAPs registered.

EIA team

SLR Consulting (Africa) (Pty) Ltd (SLR), previously known as Metago Environmental Engineers (Pty) Ltd, is the independent firm of consultants that has been appointed by the applicant company to undertake the environmental assessment and related processes. Fiona Bolton (project manager) has six years of relevant experience. Brandon Stobart (Reviewer) has over 14 years of relevant experience and is certified as an Environmental Assessment Practitioner (EAP) with the Interim Certification Board of Environmental Assessment Practitioners of South Africa (EAPSA).

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

The environmental project team comprises SLR's environmental assessment practitioners, specialist consultants and the technical feasibility team (Table 5).

TABLE 5: PROJECT TEAM

Name	Designation	Tasks and roles	Company
Environmental impact assessment and public involvement team			
Fiona Bolton	Project manager	Management of the assessment process, stakeholder engagement and report compilation.	SLR
Charlene Mureverwi Victoria Tucker	Project administrators		
Stella Moeketse			
Brandon Stobart	Project reviewer	Report and process review	
Specialist environmental assessment consultant team			
Hanlie Liebenberg-Enslin	Air quality specialist	Air quality assessment	Airshed Planning Professionals
Kathy Taggart	Ecological specialist	Ecological assessment	Natural Scientific Services CC
Garry Patterson	Soil and land capability specialist	Soil and land capability assessment	Institute for Soil, Climate and Water
Stephan Meyer	Groundwater specialist	Groundwater assessment and water balance update	AGES
Stephen van Niekerk, Mark Bollaert and Paul Klimczac	Engineer and hydrologist	Hydrology, and stormwater management plan	SLR
Stephen van Niekerk	Engineer	Closure liability	SLR
Dr Julius Pistorius	Heritage consultant	Heritage study	Private Consultant
Professor Bruce Rubidge	Palaeontology specialist	Palaeontology study	BPI for Palaeontological Research
Gerrie Muller	Economic consultant	Economic impact assessment	Strategy4Good
Technical project team			
Dean Riley	Project Manager		Pilanesberg Platinum Mine
Casper Badenhorst	General Manager		
Dimakatso Maserumule	Environmental Officer		

Contact details for responsible parties

PPM is a wholly owned subsidiary of Platmin SA (Pty) Ltd and the relevant contact people are provided in the table below.

Project applicant	Pilanesberg Platinum Mines (Pty) Ltd
Postal address	Private Bag X11 Highveld 0067
Telephone number	012 661 4280
Fax numer	012 661 4139
Contact person/s	Mr Casper Badenhorst (On-site Mine General Manager) Mr Dean Riley (Project Manager) Ms Dimakatso Maserumule (On-site Environmental Compliance Officer)

Project Motivation (Need and Desirability)

From an economic perspective, the proposed project will produce coarse chrome material which will be sold to a third party. The project is expected to benefit nearby communities both directly and indirectly. Direct economic benefits will be derived from wages, taxes and profits. Indirect economic benefits will be derived from the procurement of goods and services and the increased spending power of employees.

SECTION 1 – ENVIRONMENTAL IMPACT ASSESSMENT

It should be noted that this section focusses on the proposed project activities and infrastructure only.

1 DESCRIPTION OF THE BASELINE ENVIRONMENT

This section provides a description of the current baseline conditions of the project site and surrounding areas within which the project will be undertaken. Each discussion provides a link to anticipated impacts and highlights the relevance of the information provided, identifies how data was collected (either by the specialist and/or SLR) to inform the baseline description, provides the results/outcomes of research and/or studies undertaken and concludes with the main findings as relevant to the impact assessment and management plan.

The environmental aspects are discussed as follows:

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

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

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

1.1.1 GEOLOGY

Introduction and link to anticipated impact

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

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

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

Data collection

Geological baseline information was sourced from geological maps and by the geophysical investigations completed by the groundwater specialist as part of the 2006 groundwater study.

Results

Regional and local geology

PPM and the project area are situated in the Bushveld Igneous Complex (BIC). There are four main limbs to the complex, namely the Northern Limb, the Eastern Limb, the Southern Limb and the Western Limb. PPM is located in the Western Limb.

The project area is underlain by the gabbroic formations of the Rustenburg Layered Suite (RLS) of the BIC. It is located just to the north-west of the prominent Pilanesberg Complex. 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 at the contact. The Pilanesberg Complex is intruded into the gabbro norite and anorthosite of the Bushveld Igneous Complex. The Bushveld rocks to the north of the Pilanesberg complex are overlain by quaternary sediments and sand, between 20 and 40m thick. The alluvium zones are expected to form localised perched aquifers or zones of higher recharge. The BIC in this area is bounded to the north, west and south by the Pretoria Group Quartzites and volcanic rocks. Archaean rocks (3800-2500 million years old) are present to the extreme north and are represented by the Swazian Granite Gneiss. These rocks are traditionally considered to be the basement units of the sub-Saharan African continent.

The mineralised horizons that will be targeted by the project are the LG2, LG3, LG4, LG5 and LG6 chrome seams (Figure 6 and Figure 7).

Presence of structural features

There is an extensive network of faults and dykes which is associated with the emplacement of the Pilanesberg Complex. The geology is fractured and intruded by dykes which have followed 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 000m in places. This structure is located some 6km west of the existing Tuschenkomst open pit area and proposed chrome mining area, and extends for more than 25 km in an approximate north-south orientation. There are a number of dykes and faults within the chrome project area.

Geochemical analysis

Geochemical characterisation of waste rock

The waste rock sample test work has been conducted by Epoch Resources (Pty) Ltd (Epoch) in 2006 (Metago, 2007) and 2011 (Metago, 2012). The acid rock drainage potential was assessed using the Acid Base Accounting (ABA) tests. Mineralogical examinations and leach tests were also conducted. As the chrome reef is part of the same ore body that was tested, the results can be extrapolated and applied to

the chrome project.

In addition, recent studies have been conducted by SLR for similar projects that are also located in the Western Limb of the BIC. As the geology is the same, the results of these studies can be applied to the waste rock from the proposed chrome operation at PPM.

Acid Based Accounting (ABA) and Sulphur Speciation

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

Synthetic Precipitation Leaching Procedure (*SPLP)*

SPLP tests are conducted at varying pH values (pH4, pH7 and pH10) to determine the potential leachate quality.

Manganese, copper and nickel are only readily leachable and mobile under acidic conditions and, although they exceed World Health Organisation (WHO) drinking water limits, still fall within the SANS 241 Class II drinking water limits. No exceedances are expected for neutral and alkaline leach conditions.

Other constituents of concern could include nitrate which can exceed applicable limits for all tested pH range.

Conclusion

The geochemical analysis conducted shows that:

- the waste rock will have a net neutral to alkaline leachate composition, and no risk of acid generation is expected; and
- there could be potential for seepage concentrations from the waste rock facilities to exceed the drinking water guideline limits for various parameters.

This presents a pollution risk for both surface and groundwater in the both the short and long term. It follows that short and long term pollution prevention and/or treatment measures must be considered.

Various geological features were identified and present barriers to groundwater flow across them with limited potential for groundwater flow along them.

1.1.2 CLIMATE

Information in this section was sourced from PPM's approved EIA/EMP (Metago, 2007), and the air quality study compiled for the proposed chrome operations EIA/EMP (Airshed, 2012).

Introduction and link to anticipated impact

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

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

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

Data collection

Climatic data was sourced from nearby available weather stations. No on site weather station is available for this purpose.

Rainfall data was sourced from three South African Weather Service stations, namely Pilanesberg A (Station No. 0548290 7), Pilanesberg B (Station No. 0548375 A4) and Pilanesberg – Pol (Station No. 0548165 W).

Results

Regional climate

The mine and proposed project site falls within the Highveld Climatic Zone, as defined by Schulze (1974). Of the mean annual precipitation, 85% falls during summer thunderstorms. The thunderstorms generally occur every 3 to 4 days in summer and are of short duration and high intensity. Temperatures in this climatic zone are generally mild, but low minima can be experienced in winter due to clear night skies. Frost characteristically occurs in the winter months. Generally winds are light, but south-westerly winds associated with thunderstorms are typically strong and gusty.

Average rainfall

The average monthly rainfall data was sourced from the weather stations mentioned above. Over the last seven year period, 1989 recorded the highest rainfall in a year with 630 mm while the lowest of 429 mm was recorded in 1985. The majority of the rainfall is during the summer months of October to March at which time approximately 90 % of the annual rainfall occurs.

Storm rainfall

Data on storms for various return periods are presented in Table 6. 24-hour rainfall depths for various return periods were calculated from one day rainfall results (for the Pilanesberg – Pol station) obtained from Water Research Commission (WRC) software developed in 2001 which has a database of rainfall stations records up to the year 2000. The Pilanesberg – Pol station is the nearest station to the mine with the longest recorded data (79 years).

From the data it can be noted that the highest rainfall event calculated for the area has a return period of 200 years.

TABLE 6: AVERAGE RAINFALL INTENSITIES AND 24-HOUR STORM RAINFALL DEPTHS

Return period / recurrence interval (yrs)	24-hour rainfall depth* (mm)
2	64
5	87
10	103
20	120
50	143
100	162
200	182

Temperature

Air temperature is important, both for determining the effect of plume buoyancy (the larger the temperature difference between the plume and the ambient air, the higher the plume is able to rise), and determining the development of the mixing and inversion layers (Airshed, 2012).

Temperatures in the region tend to be warm to mild with average temperatures ranging between highs of 32°C in the warmer summer months and lows of 3°C in the colder winter months. The annual average temperature is approximately 20°C. The recorded average range of extreme temperatures is between 39°C and -5°C (Metago, 2007).

Wind

Diurnal and seasonal wind roses are presented in Figure 8. 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 9.72% (night-time) to 15.17% during the day.

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 southeast and south-southeast.

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

Evaporation

Evaporation figures recorded for the area are high and indicate that the area is a water deficit area. The average annual evaporation is 2 141 mm. Potential evaporation figures, therefore, exceed the mean annual precipitation (621 mm) by 1 412 mm.

Extreme events

The area experiences a host of extreme events on a regular basis. For instance:

- the area is prone to drought conditions;
- frost is common during the winter period;
- the area typically experiences rainfall in the form of showers and thunderstorms; and
- strong gusty winds are associated with thunderstorms.

Conclusion

The area in which PPM is situated is characterised by seasons with heavy thunderstorms that last for short periods at a time. High evaporation rates reduce infiltration rates while the high rainfall levels can increase the erosion potential and the formation of erosion gullies. The presence of vegetation does however allow for surface infiltration thereby reducing the effects of erosion. The mixing of layers resulting in the formation of temperature inversion and the presence of cloud cover limits the dispersion of pollutants into the atmosphere. The prevailing wind direction is from the eastern sector, and very little wind is recorded from the west. In general wind speeds are below 5.2 m/s and are not able to lift dust particles, however this is dependent on the material type as fine dust and dust that is already airborne can be carried by winds speeds less than 5.2 m/s. These climatic aspects need to be taken into consideration during rehabilitation and surface water management planning.

1.1.3 TOPOGRAPHY

Introduction and link to anticipated impact

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

- the flow of surface water, and in many cases, also groundwater;
- the depth of soils and the potential for soil erosion, for example, in the case of steep slopes;
- the type of land use, for example flat plains are more conducive to crop farming;

- the aesthetic appearance of the area; and
- climatic factors such as wind speeds and direction, for example, wind will be channelled in between mountains along the valley.

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

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

Data collection

Data on topography was sourced by SLR through the studying of topographical maps, a visual assessment conducted by Newtown Landscape Architects (2007) and observations made by SLR during site visits. The topographical maps included both 1:250 000 and 1:50 000 maps of the area.

Results

The mine and proposed project area is located in an area where the topography is characterized by a combination of flat plains and isolated koppies. The ground slopes gently towards the north-west. The average elevation of the project area is 1 100 metres above mean sea level (m amsl). There are several isolated koppies to the north of the mine area. These vary between 1 197 and 1 266 m amsl. To the south and east of the mine is the Pilanesberg National Park and the associated hills that vary between 1330 and 1534 m amsl.

The chrome project area is drained by the non-perennial tributaries of the Motlhabe River and the Wilgespruit.

Conclusion

Mining activities, infrastructure and communities have the potential to alter the topography and the natural state of undisturbed areas. An alteration of the natural topography has the potential to present dangers to both animals and people and to divert/damage surface water resources. The design of future infrastructure should be such that any changes to topography result in stable topographic features which do not pose significant risk to third parties and limit impacts on the visual character of the area.

1.1.4 SOILS

Information in this section was sourced from the soil and land capability study conducted by ARC Institute for Soil, Climate and Water (ARC-ISCW) in 2006 that covered the whole of PPM's mining right area.

Introduction and link to anticipated impact

Soil is an important natural resource and provides ecosystem services such as:

- water filtering;
- providing growth medium for plants, which in turn provide food for plant-eating animals; and
- provide habitat for a wide variety of life forms.

Soil forms rather slowly by the breaking down of rock material and is therefore viewed as a non-renewable resource. Soil determines the type of land use the area is suitable for, for example, soil with low nutrients may not be able to support crop farming.

Soil resources are vulnerable to pollution, erosion and compaction, which could be caused by project-related activities.

Data collection

Data collection was done through review of existing geological information and previous studies conducted for the PPM mining area.

The Chamber of Mines Guideline document (Chamber of Mines 1991) was used to classify the soil units identified during the soil survey. The land capability of the study area was classified into four classes (wetland, arable land, grazing land and wilderness).

Results

Soil type and depth

Soils were classified according to the South African Soil Classification System (Soil Classification Working Group, 1991). A summary of the soils present in the project area including a description of the most important soil characteristics of each soil type such as the dominant soil form and family, soil depth, topsoil texture and underlying material, is provided in Table 7. The location of soil types is illustrated in Figure 9. The soils are dominated by deep, black swelling clays with smaller areas of dark brown, less swelling clays as well as shallow lithosols.

TABLE 7: SUMMARY OF THE SOILS PRESENT IN THE PROJECT AREA

Map unit	Dominant soil form and family	Other soil forms	Effective depth (mm)	Area (Ha)	Description	Agricultural potential
Ar	Ar1100	-	500 - 1200+	48	Dark brown to black, strongly structured, swelling clay soil on hard or weathering rock.	Low to moderate
Va	Va1111	Va1211, Oa1210, Hu3200	900 - 1200+	2.4	Dark reddish brown, apedal to weakly structured, sandy clay loam topsoil on a dark reddish brown, strongly subangular structured, sandy clay loam to clay loam subsoil.	Low to moderate

Map unit	Dominant soil form and family	Other soil forms	Effective depth (mm)	Area (Ha)	Description	Agricultural potential
Gs	Gs1211	Ms1000	250 - 300	76	Brown, apedal to weakly structured, loamy sand to sandy loam topsoil on brown, stony/gravelly subsoil, grading into weathered rock. Soil surface is often stony/rocky.	Low

Soil properties

The black swelling clay (Ar) soils have high clay contents, high cation exchange capacity (CEC) values, are strongly alkaline and have low phosphorus (P) values in their natural state. The other soils have lower clay contents with consequently lower CEC values, are generally less alkaline and also have low P values in the natural state.

Soils found in the proposed chrome mining area have a high clay content which allows for high water retention. Poor drainage capacity of these soil forms reduces the dry production potential as well as the irrigation potential. These soil forms are difficult to work and have a limited utilization potential. In addition, these soils have high alkalinity levels and low phosphorus levels, resulting in a low soil fertility due to a deficit of key nutrients.

Conclusion

The baseline soil information has been used to identify sensitive soil types, to guide the project planning in order to avoid sensitive soil types where possible, to determine how best to conserve the soil resources in the area and allow for proper rehabilitation of the site once mining ceases.

1.1.5 LAND CAPABILITY

Information in this section was sourced from the soil and land capability study conducted by ARC Institute for Soil, Climate and Water (ARC-ISCW) in 2006 that covered the whole of PPM's mining right area.

Introduction and link to impact

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

Data collection

Land capability within PPM's mining right area was classified into different classes, namely arable land and wilderness by applying the classification system in terms of the South African Chamber of Mines Land Capability Rating System.

Results

A total area of 3 456.55 ha was investigated over the entire mining right area during the 2006 survey. Of this approximately 127 ha is relevant to the proposed chrome operation, of which 50.4 ha is of a low to moderate arable potential and 76 ha is classified as wilderness. The land capability is illustrated in Figure 9.

Arable

The mainly smectitic nature, with consequent shrinking and swelling properties, of the dominant Arcadia (turf) soils (**Ar** map unit) means that there is a narrower moisture range for cultivation than most other agricultural soils. If these swelling clay soils become wet, the pores fill up, they saturate easily and drain slowly, causing anaerobic conditions (especially under irrigation) and a deficit of oxygen in the root zone. If allowed to dry out, however, these soils can crack, damaging roots. Surface crusting is also a potential problem, due to the swelling and sealing nature of the soils, which can lead to decreased infiltration rates. However, these black clay soils are naturally fertile, with high cation exchange capacities and moderately high organic carbon contents. If well managed, they can be productive soils.

The other clay soils (**Va** map unit) have somewhat less clay, with less of a swelling nature. They are therefore somewhat easier to cultivate. However, they will still tend to become easily waterlogged in the rainy season.

Wilderness

The **Gs** map unit has land capability class wilderness, due to its shallow, rocky nature.

If subsurface water is available, the soils can be irrigated, bearing in mind the limitations as stated above. However, they require a high level of management in order to properly maintain moisture levels.

Conclusion

The current land capability of the proposed chrome mining area is a mixture of arable and wilderness. However, the arable capability of the soils is limited due to the shrinking and swelling properties mentioned above. The land capability within the proposed chrome mining area will be changed with the placement of infrastructure. Therefore, impact management and rehabilitation planning are required to achieve acceptable post rehabilitation land capabilities.

1.1.6 BIODIVERSITY

Information in this section was sourced from the biodiversity studies carried out for PPM's approved EIA/EMP (NSS, 2006) and for the proposed chrome operations (NSS, 2011). The latter is attached in Appendix F.

Introduction and link to anticipated impact

Biodiversity refers to fauna (animals) and flora (plants). According to the International Union of Conservation of Nature (IUCN) (2011), biodiversity is crucial for the functioning of ecosystems which provide us with products and services which sustain human life. Healthy ecosystems provide us with oxygen, food, fresh water, fertile soil, medicines, shelter, protection from storms and floods, stable climate and recreation.

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

The baseline information on biodiversity in the project area has been used to identify sensitive areas, to guide the project planning in order to avoid sensitive areas where possible, to determine how best to conserve the fauna and flora in the area and allow for proper rehabilitation of the site once mining ceases.

Data collection

Prior to the fieldwork, data collection was done through desktop assessments of available published reports, plant and animal lists and maps. The 2006 field investigation was undertaken between November 2005 and March 2006 which covered terrestrial flora and fauna, as well as aquatic systems. The follow up survey was carried out in January 2011. The 2011 field investigations covered day- and night- time activities. Bat detectors were used to identify different species and to note various behavioural patterns. Further detail on the methodologies used is provided in the specialist report.

Results – Flora

PPM and the chrome project area fall within the greater Savanna Biome, more specifically, with the *Dwaalboom Thornveld* vegetation type, according to Mucina & Rutherford, (2006). The features of this vegetation type include plains with layers of scattered, low to medium high, deciduous microphyllous trees and shrubs with a few broad-leaved tree species, and an almost continuous herbaceous layer dominated by grass species. The conservation status of this vegetation type is considered Least Threatened and the conservation target is identified as 19%, with only 6% statutorily conserved. Before publication of the Vegetation types of South Africa in 2006, the base data for this publication was used to compile the North West Biodiversity Database (NWDACET, 2003) for the province. The vegetation units were further refined for the province. The *Western Transvaal Thornveld* (Mixed Bushveld [Acocks 1998]) is today known as the *Dwaalboom Thornveld* and according to the study conducted in 2003, and pockets within the area was further refined and categorized as the Mabeskraal Ridge Bushveld. Although not categorised in Mucina & Rutherford (2006), provincially these areas are considered one of the critically important habitat types of the province (NWDACET, 2003). It is a very limited vegetation type, restricted

to a few ridges and hills in a vast plain with clay soils. Vegetation types present in the chrome project area is illustrated in Figure 10.

Ecologically sensitive environments

Water courses, rocky outcrops and the Mabeskraal Ridge systems within the PPM and chrome project area can be classed as sensitive ecological environments. These areas are considered important in terms of conservation significance and ecological sensitivity. The location of these sensitive areas in relation to the project area is shown in Figure 11.

Endangered and protected plant species

According to the South African Threatened Species Programme (TSP) list of April 2004, there were approximately 70 Red Data listings within the North West Province, 16 of these species are either listed as Near Threatened or Threatened. Two of the species, *Boscia foetida* subsp*. minima* (Shepherd's Tree) and *Erythrophysa transvaalensis* I.Verd. (Transvaal Red Balloon), have been recorded in Pilanesberg by NWDACE in 2003. In addition, a number of **protected species** were identified within the PPM area and therefore could be expected to occur within the proposed chrome project area. These included: *Boophane disticha* (Fan-leaved Boophane); *Crinum graminicola (*Grass Crinum); *Gladiolus sericeovillosus,* and *Pellaea calomelanos* (Hard Fern); *Acacia erioloba* (Camel Thorn) and *Sclerocarya birrea* (Marula). Permits will be required to remove or translocate any protected species.

Approximately 25% of the species recorded within PPM's mining right area (including the chrome project area) are known for their medicinal use and include protected species such as *Boophane disticha*, and *Pellaea calomelanos*.

Invasive species

A limited number of alien species were located within PPM's mining right area. These could be expected to occur within the proposed chrome project area and include species such as *Tagetes minuta* (Khakibos)*, Zinnia peruviana* (RedStar Zinnia), *Gomphrena celosiodes* (Batchelor's Button), *Hibiscus trionum* (Bladder Weed) and *Conyza* species. The only species that is considered an invasive was *Datura stramonium* (Thorn Apple - Category 1 weed).

In addition, the area in general 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).

Results – Fauna

Twenty one mammal species, fifty three bird species, fifteen reptile and amphibian species, and sixty eight invertebrate species (including insects, scorpions, myriapoda and spiders species) were confirmed

to occur in PPM's mining right area and therefore could be expected to occur within the chrome project area.

A large number of mammals have been recorded for the 2526BB and 2527AA quarter degree grids and, therefore also have the potential to occur on site. It should be noted that the 2527AA quarter degree grid, falls within the boundaries of the Pilanesberg National Park and therefore, some of the species on the list are only likely to occur within the protected boundaries of the Park. A number of these species are of conservation concern:

- **mammal species**: Reddish-grey Musk Shrew, Tiny Musk Shrew, Lesser Red Musk Shrew, Swamp Musk Shrew, Lesser Grey-brown Musk Shrew, Short-snouted Elephant-Shrew, Sundevall's Leaf-nosed Bat, Single-striped Mouse, Forest Shrew, African Weasel, Greater Dwarf Shrew, Bushveld Gerbil, Tsessebe, African Wild Dog, South African Hedgehog, Spotted Hyaena, Brown Hyaena, Serval, Schreiber's Long-fingered Bat, Rusty Bat, Geoffroy's Horseshoe Bat, Darling's Horseshoe Bat, Cheetah, Black Rhinoceros, Rock Elephant Shrew, Roan Antelope, Sable Antelope, Lion, Short-eared Trident Bat and Natal Long-fingered Bat.
- **bird species**: Cape Vulture, African White-backed Vulture, Lappet-faced Vulture, Martial Eagle, Yellow-throated Sandgrouse, Red-billed Oxpecker, Secretary Bird. Although no Red Data listed bird species were found on site, data from the North West Biodiversity Project records a total of six Red Data species for 2526 BB. These Red Data bird species could possibly occur on site.
- **reptile and amphibians**: Giant Bullfrog (recorded on PPM's mining right area), Nile Crocodile, Blunt-tailed Worm Lizard, Striped Harlequin Snake and the South African Python.
- **invertebrate species**: Rock scorpion, Burrowing scorpion, Machequena Acraea, Maseru Copper, Marsh Hottentot Skipper, Morants' Blue, Highveld Blue, Marsh Sylph, Dolomite Hopper, Mite Sandman, Griqua Pied Blue.

<u>Sensitive and endangered species within and adjacent to the proposed chrome project area</u>

Man-made structures such as old mine adits located adjacent to the chrome project area provide habitat for sensitive or threatened species, particularly cave/crevice dwelling bat species such as the Near-Threatened *Miniopterus natalensis* (Natal Long-fingered Bat) and porcupines. While numerous bat species were recorded in this adit during a field investigation in January 2011, recent Google Earth imagery indicates that the neighbouring mining operation has since destroyed the adit. It is unclear whether any open adits are located within PPM's chrome project area and whether these are occupied by bats. The rocky ridge to the north west of PPM's proposed mining camp is considered to be potentially sensitive from a bat roosting perspective (Figure 11).

The Giant Bullfrog (*Pyxicephalus adspersus*) is listed at Near Threatened in terms of the National Red Data List and is known to occur within the PPM mining area (confirmed at the northern breeding pan). A southern pan located in the tributary of the Motlhabe River that originates within the chrome project area

is a potential habitat for Giant Bullfrogs. Giant Bullfrogs are highly dependent on specific environmental conditions, making them susceptible to local extinctions.

Conclusion

The project site and surrounding area is associated with a wide range of biodiversity, even though there has been significant anthropogenic disturbance. Where possible this information has been used to influence design infrastructure and layout. The assessment of impacts and the formulation of mitigation measures will consider both project specific and existing PPM biodiversity information.

1.1.7 HYDROLOGY

The information in this section was sourced from the mine's approved EIA/EMP report (2007) and specialist hydrology study conducted by SLR (2012) included in Appendix G.

Introduction and link to anticipated impact

Surface water resources include drainage lines and paths of preferential flow of stormwater runoff. Project related activities have the potential to alter the drainage of surface water through the placement of both temporary (such as processing infrastructure and support facilities) and permanent (waste rock dumps) infrastructure and/or result in the contamination of the surface water resources through seepage and/or spillage of potentially polluting materials, non-mineralised (general and hazardous) and mineralised wastes. Key to understanding the hydrology of the site is the climatic conditions of the site. As a baseline, this section provides an understanding of the hydrological catchments that could be affected by the project and the status of surface water resources in the project area.

Data collection

Data used in determining the surface water characteristics include climatic data (Section 1.1.2) and topographical data (Section 1.1.3). Rainfall and evaporation data for the site was considered from various sources including weather stations managed by the South African Weather Services (SAWS) and the Department of Water Affairs.

The 24-hour rainfall depths for various return periods were calculated from one day rainfall results obtained from Water Research Commission (WRC) software developed in 2001 which has a database of rainfall stations records up to the year 2000.

Results

Surface drainage and mean annual runoff

The chrome project area is drained by non-perennial tributaries of the Motlhabe and Wilgespruit Rivers (see Figure 12). Drainage in PPM's mining area and the chrome project area is influenced by the

Pilanesberg mountain range and various smaller koppies. The Motlhabe River originates south of the mine and project area, in the north western sector of the Pilanesberg mountain range and flows into the perennial Kolobeng River. The Kolobeng in turn flows into the Bofule River. The Wilgespruit also originates in the Pilanesberg and flows into the Bofule River.

Surface drainage including mean annual runoff

Catchments have been identified in the project area are illustrated in Figure 12 and Figure 13 and the characteristics of the sub-catchments are included in Table 8. By virtue of being non-perennial streams, it is expected that these watercourses will flow for short durations following rainfall events. In addition, the project area lies within the headwaters of the respective sub-catchments and consequently, the nearby non-perennial watercourses can be considered to have limited flow even during heavy rainfall (due to the absence of large upstream contributing areas).

TABLE 8: CATCHMENT CHARACTERISTICS

Description	CW1	CW2	CW3	CW4	CW5
Sub catchment Area (km^2)	0.42	1.03	0.74	0.81	1.16
Runoff Coefficient	0.32	0.35	0.26	0.28	0.24
Time of Concentration (hours)	0.77	0.80	0.97	1.19	0.19
Rainfall Intensity (mm/h) for the 1:100 year event	105.4	101.9	84.9	67.3	67.6

The Mean Annual Runoff (MAR) for the total catchment area associated with the anticipated area of containment for the chrome project was estimated using rainfall-runoff response parameters from WR2005. The rainfall-runoff response of the catchment was assumed to be the same as the regional rainfall-runoff response as determined for the quaternary catchment in which the mine falls. Using the WR2005 quaternary catchments dataset, and an estimated 2.56 km^2 (the total contained area from the project) of the sites runoff being contained, it is estimated that the proposed project will lead to a reduction in the Mean Annual Runoff (MAR) of the quaternary catchment A24D from 19.56 million m^3 to 19.54 million m^3.

Floodlines

Given the relatively low flows expected for the non-perennial water courses and the longitudinal gradient of the watercourses, it is expected that the width of the 1:50 and 1:100 year floodline would be relatively small. Therefore, the 100 m buffer from the centre-line of the water course has been used as it will be wider than the 1:100 year floodline. The 100 m buffer zones for watercourses in the project area are shown in Figure 13. Infrastructure that will be placed within the 100 m buffer zones of the non-perennial watercourses include:

- waste rock dump;
- topsoil stockpile;

- western chrome pit; and
- haul road.

This is discussed further in Section 7.2.8.

Water quality

As part of the current monitoring programme, PPM monitors surface water quality when there is surface water available. The position of the surface monitoring points is illustrated in Figure 14. The water quality generally reflects fluoride, manganese, aluminium and iron concentrations elevated above the recommended DWAF domestic use guidelines (DWAF Water Quality Guidelines, 1996).

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. When present, surface water may be used for domestic and agricultural (livestock watering and irrigation) purposes.

Conclusion

Surface water features relevant to the proposed chrome project are limited to the non-perennial tributaries of the Motlhabe River. The chrome project infrastructure is likely to destroy the headwaters of non-perennial drainage lines and therefore surface water planning is required to limit impacts on flows and water quality.

1.1.8 GROUNDWATER BASELINE

The information in this section was sourced from the groundwater study that was undertaken by AGES (2006) for the mine's approved EIA/EMP and monitoring data.

Introduction and link to impacts

Groundwater is a valuable resource and is defined as water which is located beneath the ground surface in soil/rock pore spaces and in the fractures of lithologic formations. Understanding the geology of the area provides a basis from which to understand the occurrence of groundwater resources. Project related activities such as open pit mining, the handling and storage of hazardous materials and handling and storage of mineralised and non-mineralised wastes have the potential to result in the loss of groundwater resources, both to the environment and third party users, through dewatering and pollution. As a baseline, this section provides an understanding of the current groundwater conditions (quality, quantity and use) and the potential for dewatering cones of depression and pollution plumes to occur as a result of project-related activities.

Data collection

AGES compiled the baseline groundwater quality, depth and modelling data for the mine's approved EIA/EMP in 2006. The historic fieldwork was carried out on 62 boreholes to determine the water quality and natural depth of the groundwater. This data set has been updated with recent monthly water quality and borehole monitoring data.

Results

Regional geology and structural features

PPM and the proposed chrome project site are underlain by gabbroic rocks of the Rustenburg layered suite of the Bushveld Igneous Complex (see Section 1.1.1 for a description of the geology).

Aquifers in the project area have been classified according to Parsons (1995) and the Minimum Requirements (DWAF). There are three possible types of aquifers within the project area as outlined below:

- **Minor aquifer:** The aquifers in the greater study area are classified as Minor Aquifers, which denotes aquifers with yields of less than 1 L/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. The reason being that some communities rely on groundwater alone for their basic water requirements because there is currently no reticulation of surface water to the communities to the north of the PPM and the chrome project area. This should be contextualised by the fact that there is a Magalies Water pipeline to the south and the fact that PPM may require the introduction of an additional water supply pipeline to the north. The timing of this pipeline is unknown.

Regionally, the structural geology plays a role in the location and flow of groundwater resources. An aeromag survey confirmed the location of the dykes that intruded into the fractured and faulted zones. The dominant structures were found to be of north-south orientation with some east-west structures coinciding with drainages from the Pilanesberg. The secondary structures that branch off the major structures are what the drainage lines tend to follow.

The geology in the area form a number of hydraulic zones that are controlled by lithological units, structural geology and surface water features. The zones include:

- 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 form major aquifers in the area;

- weathered norite/gabbro;
- fractured soil bedrock aquifer that underlies the weathered zone; and
- dolerites that act as flow impediments.

Groundwater levels, flow and use

Groundwater in the project area varies between 8.14 and 33.8 m below ground level (mbgl) with an average of 22.5 mbgl. There is a good correlation between the groundwater levels and the contours of the land. The groundwater flow in the area is from the south to the north. Current abstraction practices do not appear to have a significant impact on the natural groundwater gradients.

PPM's groundwater database shows that the groundwater levels vary between 8.14 and 33.8 mbgl with an average of 22.12 mbgl (AGES, 2011). Boreholes in the vicinity of the proposed chrome operations indicate that the water level ranges from 26 to 41 mbgl in the project area. The current depth of the Tuschenkomst pit is 50 m at its deepest point of development, whilst the planned maximum pit depth is 200 m. At the current depth of 50 m, dewatering of the Tuschenkomst pit is becoming a necessity in certain areas. The depth of the proposed chrome pits will be 25 m.

The existing boreholes are distributed along the perennial and non-perennial streams, local dykes and faults. Of the historic boreholes identified in the area, 25 % are used for domestic purposes, 5 % for industrial uses and 15 % for livestock watering. The majority of the communities in the area rely on groundwater for domestic purposes.

Groundwater quality

The historic AGES data (pre mining) 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 is characterised by higher than average magnesium concentrations and high fluoride concentrations. The latter is expected due to runoff and groundwater through-flow from the neighboring alkaline complex of the Pilanesberg.

PPM has an on-going groundwater monitoring programme that consists of eleven monitoring boreholes (see Figure 14). The majority of these monitoring boreholes are located within the mining right area, however a few are located outside the mining right area. Groundwater monitoring frequencies range from quarterly to bi-annually. The borehole water levels are recorded when groundwater samples are taken. Current groundwater data relevant to the proposed project site shows that the water quality of

most monitoring boreholes was of relatively good quality with no impact observed as a result of the mining activities (AGES, 2011).

Conclusion

The current monitoring data shows that water levels and water quality in the vicinity of PPM's operations have not been impacted upon since PPM's mining operation started in 2008. Potential impacts from the proposed chrome operations will need to be effectively managed particularly in regard to contamination of groundwater and dewatering.

1.1.9 AIR QUALITY BASELINE

Information in this section was sourced from air specialist studies that have been undertaken for PPM by Airshed Planning Professionals (Airshed 2006 and Airshed 2009) and the project specific study (Airshed, 2012) included in Appendix I.

Introduction and link to anticipated impact

Existing sources of emissions in the region and the characterisation of existing ambient pollution concentrations is fundamental to the assessment of cumulative air impacts. A change in ambient air quality can result in a range of impacts which in turn may cause a disturbance and/or health impacts to nearby receptors. Potential receptor sites include the residential areas, communities, conservation/hospitality establishments and natural environments that have been described in Section 1.3.1.

Data collection

Data was obtained from the review of existing literature, available studies and monitoring data. In this regard, the two data types are meteorological data (weather data) and dust fallout data.

Results

Emission sources and pollutant types

Major sources of air pollution in the immediate vicinity of the project site include emissions from various mining operations, vehicle tailpipe emissions (due to the vehicle activity along routes within the area), domestic fuel burning (related to neighbouring communities/settlements), biomass burning (veld fires in agricultural areas within the region), and various miscellaneous fugitive dust sources such as agricultural activities, wind erosion of open areas, and vehicle entrainment of dust along unpaved roads.

Source types present in the region and the pollutants associated with such source types were identified as outlined below.

- **Mining sources:** Particulates represent the main pollutant of concern at mining operations. Fugitive emissions mainly comprise of: land clearing operations (i.e. scraping, dozing, and excavating);

material handling operations (i.e. tipping, off-loading, loading and conveyor transfer points); vehicle entrainment from haul roads; wind erosion from open areas and drilling and blasting. These activities mainly result in fugitive dust emissions and small amounts of sulphur dioxide (SO_2), oxides of nitrogen (NOx), carbon monoxide (CO), carbon dioxide (CO_2) and methane released during blasting operations.

- **Vehicle tailpipe emissions:** Emissions resulting from motor vehicles can be grouped into primary and secondary pollutants. While primary pollutants are emitted directly into the atmosphere, secondary pollutants form in the atmosphere as a result of chemical reactions. Significant primary pollutants emitted include CO_2, CO, hydrocarbons (HCs), SO_2, NOx, particulates and lead. Secondary pollutants include nitrogen dioxide (NO_2), photochemical oxidants such as ozone, HCs, sulphuric acid, sulphates, nitric acid, and nitrate aerosols (particulate matter). Toxic hydrocarbons emitted include benzene, 1.2-butadiene, aldehydes and polycyclic aromatic hydrocarbons (PAHs). Benzene represents an aromatic HC present in petrol, with 85% to 90% of benzene emissions emanating from the tailpipe and the remainder from evaporative losses.
- **Domestic fuel combustion:** It is highly likely that certain households within local communities/settlements use coal or wood for space heating and/or cooking purposes. Pollutants arising from the combustion of wood include respirable particulates (PM_{10}), CO and SO_2. Trace amounts of PAHs are also emitted, in particular benzo(a)pyrene and formaldehyde. Coal burning emits large amounts of gaseous and particulate pollutants, including SO_2, heavy metals, total (TSP) and respirable particulates (PM_{10}). Particulate emissions from wood burning have been found to contain about 50% elemental carbon and about 50% condensed hydrocarbons.
- **Biomass burning:** The burning of crop residues and general veld fires represent significant sources of combustion-related emissions in agricultural areas. Biomass burning is an incomplete combustion process and emits CO, methane (CH_4) and (NO_2). About 40% of the nitrogen in biomass is emitted as nitrogen, 10% remains in the ashes and it is assumed that 20% of the nitrogen is emitted as higher molecular weight nitrogen compounds. Further problems arise as the smoke plumes from veld fires results in the reduction of atmospheric visibility.
- **Fugitive dust sources:** These sources are termed fugitive because they are not discharged to the atmosphere in a confined flow stream. Fugitive dust emissions occur as a result of vehicle entrained dust from local paved and unpaved roads, wind erosion from open areas, and dust generated by agricultural activities. The pollutants listed above are released directly by sources and are therefore primary pollutants. The secondary pollutants include NO_2, various photochemical oxidants (ozone), hydrocarbon compounds, sulphur acid, sulphates, nitric acid and nitrate aerosols.

Local air quality

The more significant activities that currently contribute to the air pollution within PPM's mining right area include:

- open pit mining operations;
- minerals handling operations (i.e. tipping of waste rock and ore);

- wind erosion from exposed areas;
- public and mine vehicle activity on unpaved roads;
- vehicle tail pipe emissions;
- crushing; and
- dust generated from the tailings dam.

In addition, there are numerous agricultural and mining activities adjacent to and surrounding PPM that contribute to the local air pollution.

Project area

Dust fallout data

PPM operates a network of dust buckets for the purpose of monitoring monthly fallout in and around the area of operation. Existing monitoring points are illustrated in Figure 15. A summary of dust fallout collected from June 2010 to December 2011 is provided in Table 9.

In general, dust fallout levels at off-site receptor areas are regarded as acceptable as dust fallout levels largely remain within the SANS limit of 600 mg/m²-day. However, during the dry windy months (September to November), some exceedances of this limit have been recorded.

Predicted PM_{10} concentrations

As PPM does not currently monitor PM_{10} concentrations, Airshed has modelled the PM_{10} predictions in both the unmitigated and mitigated scenarios for the current operations (Airshed, 2012). Without monitoring data, it is not possible to ascertain where PPM lies between the unmitigated and mitigated scenarios. As such, predictions for both scenarios are presented below.

In the unmitigated scenario, where no mitigation measures are in place, it is predicted that both the daily and annual limits are exceeded in a number of communities off-site. With mitigation measures in place, the recommended PM_{10} levels for both daily and annual limits are exceeded off-site from time to time, particularly to the east and north of the Tuschenkomst pit due to the proximity of the pit to the mine boundary.

Potential receptor sites

Potential receptor sites include the surrounding communities discussed in Section 1.3.1. The closest community receptor is predicted to be the Ngweding village.

Conclusion

This baseline information will be used to assess the impact of the proposed chrome project. There is potential for elevated dust fallout concentrations and for elevated PM_{10} concentrations. Therefore the design of the project and air mitigation measures must be focused on the control of these impacts.

TABLE 9: SUMMARY OF DUST FALLOUT RESULTS (AIRSHED, 2012)

Sampling Month	Mathlankana School	Ramanotwana School	Ramalebya School	Game Reserve	Crusher Area	Buffer Zone	Pit East	North Pit	Pit West	DMS Waste Dump
Jun-10	--	75	28	--	344	87	480	329	--	--
Jul-10	--	33	28	--	745	235	67	250	--	--
Aug-10	210	340	215	--	2187	302	536	1759	--	--
Sep-10	206	--	140	--	1129	1250	166	504	--	--
Oct-10	368	***225***	115	--	1133	143	279	--	289	--
Nov-10	262	113	126	64	1664	172	39	***169***	217	--
Dec-10	***175***	***113***	***5***	--	***110***	***16***	***11***	--	--	--
Jan-11	46	29	17	--	2553	97	48	***151***	***19***	--
Feb-11	26	75	13	***6***	2113	50	338	55	65	--
Mar-11	***33***	***33***	***360***	--	***82***	***150***	***24***	***31***	***104***	--
Apr-11	21	75	13	--	1512	58	45	--	--	--
May-11	6	35	50	***26***	1578	185	53	***170***	***104***	--
Jun-11	169	39	18	72	1819	122	459	120	100	--
Jul-11	56	26	14	26	806	72	77	142	81	--
Aug-11	146	290	100	344	1767	215	372	36	82	--
Sep-11	600	240	188	360	3279	494	1345	1357	342	--
Oct-11	***932***	***507***	***183***	***658***	***2565***	***544***	***196***	***1111***	***523***	***1483***
Nov-11	***1996***	325	269	249	2390	269	481	845	370	825
Dec-11	347	19	65	--	842	78	535	155	--	448
600 Exceeds SANS Residential Action Level		***1200*** Exceeds SANS Industrial Action Level		***2400*** Exceeds SANS Alert Threshold		Values in ***bold & Italics*** are flagged months, where the collection period was either shorter or longer than the standard measuring period of 30 ±3 days				

1.1.10 NOISE BASELINE

Information in this section was sourced from the acoustic study that was carried out by Francois Malherbe (2006) for PPM's EIA/EMP report (Metago, 2007). The 2006 noise study assessed the noise impacts from all of PPM's approved platinum pits, namely the pits on the farms Tuschenkomst 136 JP (existing), Witkleifontein 136 JP (yet to be developed), Rooderand 46 JQ (yet to be developed), and Ruighoek 169 JP (yet to be developed). The proposed chrome development is located between PPM's approved Tuschenkomst and Rooderand pits (shown in grey in Figure 2) and it is therefore expected that the proposed chrome mining operations would not significantly change the outcome of the 2006 noise study. As such, the 2006 noise study is deemed relevant for the purposes of this report and is attached in Appendix J.

Introduction and link to anticipated impact

Certain noise generating activities associated with the proposed chrome project may cause an increase in ambient noise levels in and around the mine and project site, such as additional blasting, vehicle movement, materials handling and crushing. This may cause a disturbance to nearby receptors. Potential receptor sites include the villages, game lodges and animals that have been described in Section 1.3.1.

Data collection

To quantify the pre-mining day and night ambient noise levels, noise monitoring was undertaken at three sampling points near PPM in 2006. The monitoring was conducted for both day and night. Meteorological conditions and the location of sampling points were taken into consideration when determining ambient noise levels.

Results

The noise sensitive receptors around the proposed chrome project area includes the Legkraal community to the south east of the project area, and the hospitality activities that take place to the south and south-west of the project area (Black Rhino Game Reserve and the Pilanesberg National Park). The pre-mining ambient noise levels at these sensitive receptors varied from 45dBA during the day to 35dBA during the night. In accordance with SANS10103, 2008 this is typical of a rural district. The ambient noise levels were predicted to increase as a result of the PPM platinum operations. No subsequent monitoring has taken place to establish the current ambient noise concentrations.

Conclusion

Although the ambient noise levels have been influenced by current mining activities on site and in the surrounding area, there are surrounding land uses that are noise sensitive and an increase in noise levels as a result of the proposed chrome project could result in further negative impacts for these

receptors. For the purpose of this study, the pre-mining noise levels will be used as a basis from which to assess current PPM and proposed chrome project related impacts.

1.1.11 VISUAL ASPECTS

Introduction and link to anticipated impact

Project-related activities have the potential to alter the landscape character of the site and surrounding area through the establishment of both temporary (such as processing infrastructure, support facilities and open pits) and permanent infrastructure (such the waste rock dump). As a baseline, this section provides an understanding of the visual aspects of the project area against which to measure potential change as a result of project infrastructure and activities.

Data collection

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

Results

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

Landscape character

The proposed chrome mining area lies on the flat plains to the north-west of the Pilanesberg, which physically dominates the project area. The proposed project area is located between the existing PPM mining operation to the north and the Chrometco mining operation to the south. A series of small hills or koppies lie in a general arc north-west of the Pilanesberg. The combination of topographic relief and healthy vegetation cover, give these hills an aesthetic appeal that contributes positively to the sense of place of the project area. Further to the south of the proposed project area are the impressive hills associated with the Pilanesberg National Park. These are the dominant natural feature in the area and can been seen from miles away due to the surrounding flat plains. Their obvious scenic beauty contributes greatly to the sense of place of the project area. The flat plains surrounding the proposed chrome project area are dominated by savannah vegetation and 'punctuated' by koppies. The Pilanesberg National Park and associated private game lodges (including Black Rhino Game Reserve) are major tourist attractions in this area.

Scenic quality / visual resource value

The aesthetic quality of the area has been altered by community and mining activities, particularly on the flat plains between the hills and koppies. Details of the mining and prospecting related activities in the immediately surrounding area are included in Section 1.3.1. However, the isolated koppies and Pilanesberg hills are largely 'untouched' and therefore the visual resource value remains high for these areas.

Sense of place

Central to the concept of sense of place is that the landscape requires uniqueness and distinctiveness, the extent to which a person can recognise or recall a place as being distinct from other places – as having a vivid and unique character of its own. The sense of place of the study area is informed by the landscape character, as it is the existing land uses that define a sense of place. Although the landscape is interrupted by the existing mining operations, the surrounding environment has obvious tourism potential (e.g. Pilanesberg National Park and Black Rhino Game Reserve), especially the area directly north of the Pilanesberg National Park where the combination of flat savannah plains and treed hills evoke a beautiful scene with a strong sense of place.

Visual Context - Views

Areas considered sensitive to the existing mining activities and proposed mining activities include tourist activities, public roads and settlements. Most public views of the mine and proposed chrome project are experienced from people travelling along public roads or visiting people living in the settlements or working on the existing mines. People living in the villages as well as those visiting the Black Rhino Game Reserve would also be visually exposed to the mining activities, which would appear in the fore to the middle distant of views. This will be the same for the proposed chrome project. It is expected that tourists visiting the Pilanesberg National Park would not be able to see the proposed project from roads or tourist camps.

Conclusion

The area can be described as bushveld plains interrupted by the Pilanesberg, koppies to the north and south as well as anthropogenic activities such as mining operations and infrastructure. The visual resource has been altered as a result of mining activities in the area. Those areas that host mining infrastructure and activities have a reduced visual landscape value, however the surrounding undeveloped areas still have a high visual landscape value. It follows that the manner in which construction, operation and rehabilitation of the proposed chrome project takes place is carefully considered from a visual impact and mitigation perspective.

1.2 ENVIRONMENTAL ASPECTS WHICH MAY REQUIRE PROTECTION OR REMEDIATION

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

- drainage patterns on site after closure;
- stripped and stockpiled soils;
- in-situ soils and land capabilities;

- ephemeral tributaries of the Motlhabe River;
- biodiversity;
- groundwater resources;
- ambient air qualities;
- noise environment;
- visual and landscape quality;
- surrounding land uses, socio-economic conditions and economic activity;
- heritage (and cultural) and palaeontological resources; and
- the Heritage Park corridor land use.

1.3 LAND USES, CULTURAL AND HERITAGE ASPECTS AND INFRASTRUCTURE

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

1.3.1 LAND USES

Introduction and link to impacts

Mining activities have the potential to affect land uses both on the site (through land development) and in the surrounding areas (through direct or secondary positive and/or negative impacts). As a baseline, this section outlines existing land tenure including surface and prospecting/mining rights (both on the site and in the surrounding area), describes the land uses on site and in the surrounding area, and identifies third party service infrastructure. This section provides the context within which potential impacts on land uses and existing economic activity may occur.

Data collection

Surface right information was sourced by SLR through a deed search. Information on existing prospecting/mining rights was compiled with input from PPM and SLR's knowledge of the area.

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

Results – Mineral / Prospecting rights

Table 10 provides a summary of the mining and prospecting right holders within PPM's mining right area and the proposed chrome project area. PPM currently holds the prospecting right for chrome on the farm Tuschenkomst 135 JP. As part of this process, PPM have submitted a Section 102 application in terms of the Mineral and Petroleum Resources Development Act, 28 of 2002 (MPRDA) to transfer this

prospecting right into the existing mining right. In terms of Section 102 of the MPRDA, written consent from the Minister must be obtained before the mining right can be amended or varied to include these portions of land.

TABLE 10: MINING / PROSPECTING RIGHTS

Property description	Portion number	Mining / Prospecting Right
MINING RIGHT		
Tuschenkomst 135 JP	The farm	Mining right held by PPM for platinum group metals (PGMs) and associated minerals (except chrome on Tuschenkomst 135 JP) – reference NW30/5/1/2/2/320MR
Witkleifontein 136 JP	The farm	
Rooderand 46 JQ	Portion 4	
Ruigehoek 169 JP	The farm	
PROSPECTING RIGHT		
Tuschenkomst 135 JP	The farm	Prospecting right for chrome held by PPM – reference NW30/5/1/1/2/670PR

Results – Land ownership

The land on which PPM currently operates, and proposes to establish the chrome mining operation, is owned by the State. The surface right owners and corresponding title deed numbers of the land in and surrounding the current platinum mining and proposed chrome mining area are listed in Table 11. These properties are illustrated in Figure 16.

TABLE 11: SURFACE RIGHTS ON AND SURROUNDING THE PROJECT SITE

Farm Name	Portion number	Title deed number	Registered property owner
On the application area			
Tuschenkomst 135 JP	0	T594/1938BP	Republic of South Africa
Witkleifontein 136 JP	0	T9313/1937BP	
	1	T11640/1937BP	
Neighbouring farms			
Rooderand 46JQ	1	T8993/191BP	Republic of South Africa
	2	T16014/1971BP	
	3	T3648/1940BP	
Cyferkuil 1 JQ	Remaining extent	T5284/1937BP	
Groenfontein 138 JP	1	T12741/1937BP,	
	2	T1274/1937BP	
Bierkraal 134 JP	The farm	T9309/1938BP	
Zandspruit 168 JP	0	T7072/2006	African Mining and Trust Co Ltd
	2	T7071/2006	Zandspruit Development Corp Pty Ltd
Wilgespruit 2 JQ	The farm	T1230/1919BP	Bakgatla Ba-Kgafela tribe
Welgewaagd 133 JQ	Remaining extent	T10729/1926	Bakgatla Tribe

Results - Land uses

Context

To give context to the discussion below, PPM and the proposed chrome project site are situated to the north and north-west of the Pilanesberg National Park in the North West Province. PPM lies approximately 60km north-east of the city of Rustenburg, which is a major centre for the platinum mining industry in the Bojanala District Municipality. Land uses on-site are a mixture of mining activities, grazing and community related activities.

The closest main road to PPM and proposed chrome project area is the regional P50-1 provincial road, which runs between R510 in the east and the P54-1 in the west. It is understood that PPM's heavy vehicles mostly make use of the P50-1 and the R510. The condition of the roads in the area is generally good, except the P54-1 which is in a state of disrepair. Traffic related to PPM's existing operation that currently makes use of the public road network includes trucks, buses and small vehicles.

To the south, south-west and north-west of the project area lies various nature reserves including the Pilanesberg National Park and Black Rhino Game Reserve (boundary fence is approximately 2 km south and south-west respectively) and Madikwe Game Reserve (boundary fence is approximately 60 km north-west). There is currently a proposal to link the Pilanesberg National Park and the Madikwe Game Reserve through the Heritage Park Corridor initiative which would effectively extend the size of each reserve significantly.

The land use immediately surrounding the chrome project area is dominated by villages and community related activities, as well as numerous mining-related operations that are located in the area. More detail is provided below.

Residential

The residential areas closest to the proposed chrome project area include:

- Ngweding (approximately 4 km north of the proposed chrome mining activities);
- Motlhabe (approximately 5 km north east of the proposed chrome mining activities);
- Ntsana-le-Metsing (approximately 5.5 km to the north of the proposed chrome mining activities);
- Legkraal (the scattered community approximately 3.5 km to the south east the proposed chrome mining activities);
- the private and commercial lodges associated with the Black Rhino Game Reserve (boundary fence is approximately 2 km south-west of the proposed chrome mining activities, while the lodges are located approximately 3.5 km from the project area); and
- the Rustenburg Minerals employee village (approximately 4.5 km west of the proposed chrome mining activities).

Existing PPM infrastructure

The key existing mine infrastructure includes:

- open pit workings;
- a processing plant for the concentration of both UG2 and Merensky ore;
- mine residue facilities for waste rock and tailings; and
- a significant range of support infrastructure and services for transport, water supply, power supply, repairs, and management of non-mineralised waste.

Other mining operations in the vicinity

The various existing mining operations in the immediate area include:

- Sedibelo Platinum Mine (east of the Tuschenkomst pit) ;
- Chrometco (south of the Tuschenkomst pit); and
- Rustenburg Minerals (south west of the Witkleifontein pit);
- Chrome Corporation - previously the Samancor Batlhako operation (west of the Ruighoek pit);
- Merafe - Xstrata Horizon Mine (south west of the Ruighoek pit);
- Platinum Australia (south of the Tuschenkomst pit); and
- Anglo Platinum (RPM).

Conservation and hospitality

The Pilanesberg National Park fence is approximately 2 km to the south and south-west of the proposed chrome mining activities. This fence incorporates both the Pilanesberg National Park, and the associated lodges, as well as the Black Rhino Game Reserve on the farm Zandspruit 168 JP. The Lebatlane Game Reserve lies north east of PPM.

PPM and the proposed chrome project area fall within the Heritage Park corridor (HPC) initiative. The proposed HPC is being put forward by the North West Parks and Tourism Board (NWPTB) where it is proposed that over 167 000 ha 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. The HPC concept is 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.

Cattle farming

Most of the land in the area, including the proposed chrome project area, has a cattle farming component. The movement of cattle is largely dictated by the availability of grazing and water.

Retail businesses

Most of the retail businesses are located within the major towns of Saulspoort/Moruleng, Northam and Mogwase. Typically the villages on the doorstep of the mine have retail businesses in the form of general traders, supermarkets and taverns.

Irrigated crop farming

Limited crop farming takes place in the area due to the lack of water and suitable soil types. Crop farming typically takes place close to residences and is at a subsistence level.

Secondary support services/facilities

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

- A network of roads exists in the project area. These include the regional P54-1 and R510 (running adjacent to the western and eastern boundary of the Pilanesberg National Park respectively), a number of gravel roads including the D531, P50-1, Z536, and the D511 and several unnamed dirt roads and tracks.
- Water supply in the area is mainly from boreholes. It is understood that a number of the villages in the area have potable water storage and transmission infrastructure but it has fallen into a state of disrepair.
- A significant power line (and associated ESKOM servitude) runs in a north-south direction to the west of PPM's operations. 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. In the vicinity of the mine, there is a low voltage line which follows the P54-1 road.
- Surrounding the mine is the Bakgatla Ba Kgafela Traditional Authority area. This area comprises numerous rural villages, each with varying degrees of infrastructure and service provision. Further detail is provided in the socio-economic section below (Section 1.3.4)

Conclusion

Land uses on and surrounding the proposed chrome project area mainly comprise community activities (grazing), rural villages, mining activities and conservation/hospitality related activities. The information regarding current land uses has been used by the project team to assess impacts on these land users and to inform mitigation measures as required.

1.3.2 CULTURAL ASPECTS

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

1.3.3 HERITAGE, CULTURAL AND PALEONTOLOGICAL RESOURCES

Information in this section was sourced from the Phase I heritage impact assessment (HIA) (Pistorius 2006), the Phase II HIA undertaken for this project (Pistorius 2010) and specialist palaeontological study (BPI for Palaeontological Research 2011). Both of these studies are included in Appendix K.

Introduction and link to impacts

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

Data collection

Data collection for the heritage surveys was done by an accredited specialist through review of available databases, published reports and maps; previous studies done in the region; and site specific field work.

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

Results: Heritage and cultural resources

Heritage resources include sites of archaeological, cultural or historical importance. Various heritage resources have been identified in the wider PPM mining area, as well as the chrome project area. These include stone walled settlements of the Late Iron Age, graveyards, a historical village and homestead, historical mining remains, isolated and randomly scattered stone tools and historical houses. A full list of heritage resources identified within PPM's mining right area have been included in Table 12 and should be read in conjunction with Figure 17.

Heritage resources specific to the chrome project area include stone walled settlements and single isolated settlements (labelled MU01 – 08 and MU12) associated with the Late Iron Age that are located at the foot of the Mukukunupu koppies. These resources are included in Table 12 (shaded grey) and illustrated in Figure 17.

The old mining remains located in the chrome project area that were identified in the Phase I study were thought to be older than sixty years and would therefore have historical significance. A Phase II study confirmed that these mining remains are approximately forty to fifty years in age and therefore have no historic significance.

TABLE 12: HERITAGE RESOURCES IN PPM'S MINING RIGHT AREA, INCLUDING THE CHROME PROJECT AREA

Site	Comments	Significance
Middle Stone Age		
Stone tools	Scattered throughout the project area. These were not geo-referenced as limited in number.	-
Late Iron Age (stone walled settlements)		
RGH01	Damaged extensively when a road was built through it. However contains several archaeological artefacts.	Medium
RGH02	The site is part of a cultural landscape that has been partly damaged in the past.	Medium

Site	Comments	Significance
WKF01	Single isolated settlement	High
WKF02	Single isolated settlement	High
MAT01 to 15	On the outer edge of the townscape – the four villages are in a pristine condition and have not been affected by development in the past.	Medium to High
MOG01 to 09		
PTS01 to 06		
MU09 to 11	Stone walled villages	High
MU01 to 08 and MU12	Stone walled villages	High
Graveyards		
GY01	Historical cemetery – older than 60 years.	High
GY02	Associated with an abandoned historical village.	High
GY03	Currently still in use by the Ruighoek community.	-
Formal graveyards	Associated with villages in the area.	-
Historical remains (older than 60 years)		
HV01	Remains of the old Motlhabe village – associated with graveyard (GY01)	Medium/High
HV02	Remains of a historical homestead which is now dilapidated. Remains may be close to 60 years old.	Medium/High
Mining heritage		
Features 1 to 4	Remains of early prospecting activities (trenches, potholes, scars).	Low
Historical houses		
Historical houses	Within the villages of Motlhabe, Ntsana-le-Metsing, Ngweding and Legkraal. Many are severely dilapidated and some are of little historical significance. Those that are still in good condition are occupied. These houses are protected by the NHRA.	Medium

Abbreviations:
NHRA – National Heritage Resources Act, 25 of 1999;
N/A –not applicable
MU01 to 12 – heritage resources found in the chrome project area.

Results: Palaeontological resources

The main findings of the specialist study are summarised below, with further detail provided in the specialist report.

The area is underlain by igneous rocks of the Rustenberg Layered Suite of the Bushveld Igneous Complex but is exposed only in places. This Complex is an intrusive igneous body comprising a series of ultramafic-mafic layers and a suite of associated granitoid rocks. As these rocks are Precambrian in age and are of igneous origin it is highly unlikely that fossils will be affected by the proposed subsurface mining development.

Overlying the rocks of the Rustenburg Layered suite, the entire area is covered by unconsolidated Quaternary sand deposits. These are the only sedimentary deposits in the area to be affected by mining activities, and as the deposits are not consolidated it is very unlikely that any fossils will be present.

Conclusion

Heritage resources do occur in the project area. The historic mining remains that will be disturbed by the proposed chrome project has been found to be less than sixty years and therefore of no historical significance. It is expected that none of the heritage resources that have been identified will be disturbed by the proposed chrome project. However, should any of the historically or culturally significant sites be disturbed, the necessary permits and further assessment work will be required.

In terms of palaeontological resources, there is a limited potential for these resources to occur on site. However, if uncovered during the course of the mining operations, this could open up possibilities for research.

1.3.4 SOCIO-ECONOMIC ENVIRONMENT/PROFILE

Information in this section was sourced from PPM's approved EIA/EMP report (Metago, 2007).

Introduction and link to anticipated impact

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

Data collection

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

Results

Provincial level – North West Province

Population

Approximately 4 million people reside in the North West Province. The North West Province is accountable for approximately 12% of South Africa's total population. Of this approximately 52% are of a working age between 19 and 65 years and 41% below 19 years. The population of the North West is comparatively well balanced in gender terms.

Education

The level of education in the people that comprise the workforce age (19 to 65 years) is poor. Of these people only 18% have completed secondary education and only 6% have received education higher than secondary level.

Economy/employment

Excluding the informal sector, the unemployment/not economically active rate is high at an estimated 68% of the economically active age. The main contributors to employment in the province are

construction, mining, wholesale retail and agriculture. In this regard, the North West Province contributed about 7% GDPR to the South African economy in 2001, and it was the largest contributor (± 35%) to the mining and quarrying industry of South Africa. Even so, the income statistics indicate that 60% of the working population receive under R1600 per month and 29% receive between R1600 and R6400 per month.

Housing and services

High rates of urbanisation and associated informal settlements appear to be a key feature of the province. This is evidenced by increasing housing and service backlogs, as well as significant levels of investment being made into permanent structures located in urban areas. 67% of residents in the province reside in brick structures but only 33% of residents of the 67% utilise flush toilets and only 18% receive reticulated water in their dwellings.

Municipal level – Moses Kotane Local Municipality

Population

Approximately 100 000 people reside in the MKLM area. Of this approximately 80% are of a working age between 19 and 65 years and 17% are below 19 years.

Education

As is the case for the province, the local level of education in the people that comprise the workforce age (19 to 65 years) is poor. Of these people only 18% have completed secondary education and only 6% have received education higher than secondary level.

Economy/employment

Excluding the informal sector, the unemployment/not economically active rate is high at an estimated 75% of the economically active age. Mining, construction and the wholesale retail trade are the major employment providers. Income statistics indicate that 52% of the working population receive under R1600 per month and 40% receive between R1600 and R6400 per month.

Housing and services

75% of residents reside in brick structures but only 9% of residents of the 75% utilise flush toilets and only 8% receive reticulated water in their dwellings.

Local level – villages

Population

Approximately 6000 people reside in the villages surrounding PPM's current operations. Approximately 58% of the population is of working age (between 19 and 65 years).

Education

Compared to provincial and local municipality figures, the local level of education in the people that comprise the workforce age (19 to 65 years) is poor with only 4-5% of people with education levels higher than secondary level and only 18% of people having completed secondary education. The outlook in terms of providing readily available skills to new developments is therefore bleak.

Economy/employment

Excluding the informal sector, the unemployment and/or not economically active rate is high at an estimated 80% of the economically active age. Mining is considered to be the major formal employment provider. Income statistics indicate that 3% of households received no income, 69% of households received less than or equal to R1600 per month, and 28% of households received between R1601 and R6400 per month.

Housing and services

Approximately 89% of residents reside in brick structures, but only 1% of residents of the 89% utilise flush toilets and only 1% receive reticulated water in their dwellings.

Conclusion

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

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

Maps showing the spatial locality and aerial extent of all environmental, cultural/heritage, infrastructure and land use features identified on site and on the neighbouring properties and farms are included in the baseline description. These include:

- geological maps (Figure 6 and Figure 7);
- day-time, night-time and seasonal wind roses (Figure 8);
- soil forms and land capabilities (Figure 9);
- vegetation communities identified on the project site (Figure 10);
- areas of significance from a biodiversity perspective (Figure 11);
- a topography and hydrology map (Figure 12);
- hydrological catchments and 100 m watercourse buffer in the project area (Figure 13);
- surface and ground water monitoring points (Figure 14);
- dust fallout monitoring points (Figure 15);
- property boundaries (Figure 16);
- heritage resources (Figure 17).

1.5 SUPPORTING DOCUMENTS

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

- soil and land capability study (Appendix E);
- biodiversity study (Appendix F);
- hydrological assessment and stormwater management plan (Appendix G);
- climatic water balance (Appendix H);
- air study (Appendix I);
- noise study (Appendix J);
- phase II heritage impact assessment and paleontological studies (Appendix K);
- economic study (Appendix L); and
- preliminary waste rock design report (Appendix M)

FIGURE 6: CONCEPTUAL CROSS SECTION OF GEOLOGY

FIGURE 7: LOCATION OF CHROME REEFS

FIGURE 8: DAY-TIME, NIGHT-TIME AND SEASONAL WIND ROSES

FIGURE 9: SOIL FORMS AND LAND CAPABILITIES

FIGURE 10: VEGETATION COMMUNITIES IDENTIFIED ON THE PROJECT SITE

FIGURE 11: AREAS OF SIGNIFICANCE FROM A BIODIVERSITY PERSPECTIVE

FIGURE 12: TOPOGRAPHICAL AND HYDROLOGICAL FEATURES OF THE PROJECT AREA

FIGURE 13: HYDROLOGICAL CATCHMENTS

FIGURE 14: SURFACE AND GROUND WATER MONITORING POINTS

FIGURE 15: DUST FALLOUT MONITORING POINTS

FIGURE 16: PROPERTY BOUNDARIES IN THE VICINITY OF THE PROJECT SITE

FIGURE 17: HERITAGE (AND CULTURAL) RESOURCES WITHIN THE PROJECT SITE

2 PROPOSED MINING OPERATION

The main aim of the project is to mine the near-surface chrome seams within PPM's mining right area before the reserves are sterilised by infrastructure related to the existing platinum mining operations.

2.1 MINERAL TO BE MINED

The target mineral to be mined is chrome, specifically the LG2 to LG6 seams.

2.2 MINING METHOD TO BE EMPLOYED

This section should be read with reference to the drawings Figure 18 and Figure 19.

2.2.1 OPEN PIT MINING

The mining method to be employed with regards to the chrome mining operations will comprise conventional open pit mining methods. No underground mining is planned due to the nature and depth of the ore body. Following site preparation and initial earthworks, drill and blast methods will be used to loosen the overburden/rock and ore. Truck and shovel methods will be used to load and haul the waste materials to the waste rock dump and the run-of-mine (ROM) to the relevant delivery point.

There will be a number of separate relatively shallow (maximum depth of 25 m) chrome pits established that will cover an area of approximately 85 ha. Ore will be loaded into trucks and transported via the haul roads from the open pit to the crushing and screening plant. The ore will be crushed and screened to achieve a desired material size before selling the ore to a third party.

With regards to rehabilitation, the following is planned:

- **chrome open pits located on Witkleifontein 136 JP:** at this stage it is anticipated that the Witkleifontein chrome pits will be a maximum of 10 m deep. The removal of the overburden above the ore body will be done as a bulk operation using excavators and trucks. The material will be placed in the previously mined out areas thus ensuring that the rehabilitation will be done concurrently to the mining. Waste rock will be used to backfill the mined out area, and then topsoil will be placed over the waste rock and vegetation will be re-established. Excess waste rock will be disposed on the proposed waste rock dump that will be located to the west of the chrome pits (see Figure 2). Backfilling operations must take the possibility of surface subsidence into account. This may require the calculation of a bulking factor and the initial creation of a slight swell above ground level. Final replacement of topsoil onto the backfilled overburden/waste rock material should be done with the understanding that if subsidence occurs thereafter, re stripping of topsoil and additional

backfilling with overburden/waste rock will be required. Thereafter the topsoil will have to be replaced.

- **chrome pits located on Tuschenkomst 135 JP:** at this stage it is anticipated that the Tuschenkomst chrome pits will be a maximum of 25 m deep. The Tuschenkomst chrome pits are located in an area that is an approved mineralised waste facility for the existing platinum mining operations (Metago, 2009). Although the 2009 EIA/EMP stated that this area would be used for dense media separation (DMS) waste, this is currently being amended as part of a separate process so that this area may be used to dispose waste rock. The removal of the overburden above the ore body will be done as a bulk operation using excavators and trucks. The material will be placed in the previously mined out areas thus ensuring that backfilling of the pits will be done concurrently to the mining. Excess waste rock from the Tuschenkomst chrome pits will be disposed on the proposed waste rock dump on the farm Witkleifontein 136 JP, as well as on the approved mineralised waste facility on the farm Tuschenkomst 135 JP (Figure 2). With regards to the approved mineralised facility on Tuschenkomst 135 JP, waste rock from the existing platinum operations and the proposed chrome operations will be deposited directly onto the area once the chrome has been mined. The final waste facility will be shaped and re-vegetated accordingly.

Information on the magnitude of the mining operation is presented in Table 13.

TABLE 13: DATA THAT PROVIDES PERSPECTIVE ON THE MAGNITUDE OF THE CHROME MINING OPERATION

Features		**Chrome operations**
Group	**Specific**	
Open pits	Depth	A maximum of 25 m
Mining and mineral processing	Target minerals	Chrome seams
	Mineable area	85 ha
	Resource estimation	200 000 tones
	Rate	1 540 000 tonnes per annum (tpa) of mine ROM
		120 000 tpa of ROM will be processed through the plant
		96 000 tpa of product
	Types and quantity of equipment (used at one time)	6 dump trucks
		2 excavators
		1 grader,
		1 dozer
		1 water cart
	Life of project	Four years
	Mine related surface area and associated surface infrastructure	Approximately 85 ha for the open pit area Approximately 50 ha for support infrastructure
	Blasting	Blasting will be scheduled to coincide with PPM's existing blast schedule.
Mine residues	Waste rock	Approximately 3 126 000 tons in total
Resource use	Power demand	1MVA
	Water demand	Approximately 8 ML per month
Employment	Staff: construction	Approximately 200 temporary jobs
	Staff: operation	Approximately 50 permanent jobs
	Operating times	The chrome operations would be during week-day daylight hours only, i.e. 06h00 to 18h00 Monday to Thursday, and 06h00 to 14h00 on a Friday.

2.3 LIST OF MAIN ACTIONS/ACTIVITIES/PROCESSES ON SITE

Key activities that will take place on site during each phase (construction, operational, decommissioning, closure) of the project are listed in Table 14 below. For the purposes of this report, in broad terms, construction is the phase in which the mine infrastructure is established, operational covers the production phase of the mine and plant, decommissioning is when production has ceased, infrastructure is being removed and the site rehabilitated in line with a closure plan and the closure phase refers to the period of time when maintenance and aftercare of rehabilitated areas and facilities is required to ensure closure objectives are met.

TABLE 14: LIST OF PROJECT ACTIONS / ACTIVITIES / PROCESSES

Main activity/process	Sub-activities	Construction	Operation	Decommissioning	Closure
Site preparation	Selective bush clearing in line with PPM's biodiversity management plan	On-going	On-going	As required	
	Removal of existing structures such as fencing (if present)	On-going	As required	As required	
	Establishing the construction contractor's area	At start of phase			
Earthworks Earthworks on site relate mainly to the moving of soil and rock.	Stripping and stockpiling of soil resources in line with PPM's soil management programme.	On-going	As required	As required	
	Bulldozing activities	On-going	As required	As required	
	Establishing gravel roads	On-going	As required	As required	
	Digging trenches and foundations	On-going	As required	As required	
	Establishing stormwater controls (channels, berms) as per stormwater management plan	At start of phase	As required	As required	
Civil works Civil works on site relate mainly to any steel and concrete work.	General building activities and erection of structures	On-going	As required	As required	
	Foundation excavations and compaction	On-going	As required	As required	
	Use of scaffolding and cranes	On-going	As required	As required	
	Concrete work including silo's culverts and plinths	On-going	As required	As required	
	Steel work (including grinding and welding)	On-going	As required	As required	
	Installation of cables/lines and pipelines	On-going	As required	As required	
	Installing reinforcement steel	On-going	As required	As required	
Open pit mining	Drilling and blasting	At start of phase	On-going		
	Removal of waste rock by dozing and load and haul	On-going	On-going		
	Stockpiling of waste rock for backfilling / disposal	On-going	On-going		
	Removal of ore by dump trucks and transported to crusher plant		On-going		
	Water management facilities include: - collection of dirty run-off water for re-use - clean run-off and drainage sheet flow will be diverted around dirty areas	On-going	On-going	On-going	
	Dewatering of open pit		As required		
	Delivery of ROM from truck and transferred to conveyors and stored on in silo's		On-going		

Main activity/process	Sub-activities	Construction	Operation	Decommissioning	Closure
Mineral processing	Crushing and screening		On-going		
	Fine material sent to platinum processing plant				
	Water management facilities including: - collection of dirty run-off, process water and spills using sumps, pipes canals, pumps and dams - storage facilities for receiving recycled process water, clean make-up potable water and stormwater - diversion of clean water around infrastructure	On-going	On-going		
	Construction and utilisation of site supporting services including: - stores for oil, grease, conveyor lining, general equipment and spares - workshops and wash bays - laydown areas for contractors - ROM and product stockpiles	On-going	On-going		
Waste rock management	Waste rock will either be used for backfilling of open pits or disposed on the waste rock dump	On-going	On-going	On-going	
Tailings management	Fine material that is generated at the crusher plant will be sent to the existing platinum processing plant. Tailings is produced from the platinum process, and will be disposed on PPM's existing tailings storage facility				
Power supply and use **continue until infrastructure can be removed or alternative end use identified*	Delivery of power to site via Eskom power lines	On-going	On-going	On-going*	
Water supply and use **continue until infrastructure can be removed*	Delivery of clean water to site (water to be piped in)	On-going	On-going	On-going*	
	Storage of clean water on site (potable water 15m^3)	On-going	On-going	On-going*	

Main activity/process	Sub-activities	Construction	Operation	Decommissioning	Closure
Stormwater management **continue until infrastructure can be removed or successfully rehabilitated*	Diversion of clean water	On-going	On-going	On-going*	
	Collection of dirty water using channels, berms	On-going	On-going	On-going*	
	Storage of dirty water in dams for re-use	On-going	On-going	On-going*	
Transport systems **continue until infrastructure can be removed or alternative end use identified*	Construction, operation and maintenance of gravel and tar roads.	On-going	On-going	On-going	
	Transport of staff to and from site (using buses, taxi's and private cars via surfaced and gravel roads)	On-going	On-going	On-going	
	Transport of supplies and services (using trucks and vans via surfaced and gravel roads) using the R510 and P50-1	On-going	On-going	On-going	Limited
	Vehicles/machinery movement within the site boundary (via gravel roads)	On-going	On-going	On-going	Limited
	Pumping of materials (i.e. water) via pipelines with a diameter of 0.25 metres		On-going	On-going*	
	Taxi and bus on- and off- loading areas for employees	On-going	On-going	On-going*	
	Transport of ROM, soil and waste rock within site boundary via truck and conveyor		On-going	On-going	Limited
	Transport of chrome product off site via truck. Route will be determined by the location of the buyer		On-going		
Non-mineralised (general and industrial hazardous) waste management	Collection of general and hazardous waste generated by the chrome project and transportation to PPM's exiting waste facilities.	On-going	On-going	On-going	
	Separation of oil and water at wash bays	On-going	On-going	On-going	
	Disposal and/or treatment of contaminated soils	On-going	On-going	On-going	
Site support services **continue until infrastructure can be removed or alternative end use identified*	Operating office(s)	On-going	On-going	On-going*	
	Parking of vehicles	On-going	On-going	On-going*	
Storage and maintenance services/ facilities **continue until infrastructure can be removed or alternative end*	Washing of machinery and vehicles (wash bays)	On-going	On-going	On-going*	
	Service machinery and vehicles (workshops)	On-going	On-going	On-going*	
	Storage (stores, tanks) and handling of non-process materials (consumables), including sand, rock, equipment, steel, paints, gas (welding), fuel, lubricants, oil, hydraulic	On-going	On-going		

Main activity/process	Sub-activities	Construction	Operation	Decommissioning	Closure
use identified	fluid, cement, chemical additives for cement and explosives emulsion				
Housing	No on site housing is planned	N/A	N/A	N/A	N/A
Site /contract management	Appointment of contractors and workers	At start of phase and on-going	At start of phase and on-going	At start of phase	
	Site management (monitoring, inspections, maintenance of facilities, security, access control)	On-going	On-going	On-going	
	Environmental awareness training and emergency response	On-going	On-going	On-going	
	On-going rehabilitation of facilities/disturbed areas (where possible)	On-going	On-going	On-going	
	Implementing and maintaining management plans	On-going	On-going	On-going	
Demolition *$ unless alternative end land or infrastructure use is identified during the detailed closure planning*	Removing mining contractor's camp area (if not incorporated into plant footprint)	At end of phase (if applicable)		At end of phase	
	Dismantling and demolition of infrastructure and equipment		For maintenance	On-going$	
	Removal of equipment		For maintenance	On-going$	
	Removal of foundations and access roads (no longer needed)			On-going$	
Rehabilitation	Backfill and rehabilitating of open pits with provision for surface subsidence		On-going	On-going	
	Replacing soil resources	On-going	On-going	On-going	
	Landscaping	On-going	On-going	On-going	
	Re-vegetation of disturbed areas and where infrastructure was removed	On-going	On-going	On-going	
	Removal of alien invasive species from rehabilitated sites	On-going	On-going	On-going	
	Restoration of natural drainage patterns as far as practically possible	On-going	On-going	On-going	
	Rehabilitation of all waste dumps		On-going	On-going	
	Initiation of aftercare and maintenance			At end of phase	
Maintenance and aftercare	Monitoring, maintenance and repair of facilities and rehabilitated areas				On-going until rehabilitation measures are successful and a closure certificate is obtained

2.4 PLAN SHOWING LOCATION AND EXTENT OF OPERATIONS

2.4.1 SITE LAYOUT PLANS

The location of the proposed chrome pits and related surface infrastructure in relation to the existing PPM infrastructure is provided in Figure 2, and zoomed-in plan of the chrome operations is shown in Figure 18. The detailed layout of the chrome crushing plant is provided in Figure 19.

2.4.2 SITE FACILITIES DURING CONSTRUCTION

While the existing infrastructure relating to the platinum operations will be used as far as possible, the following facilities are expected to be established on site during the construction phase:

- contractors laydown area;
- workshops, stores, wash-bays, lay down areas, office(s), ablution facilities (chemical toilets);
- handling and storage area for construction materials (paints, solvents, oils, grease);
- stockpiles;
- water management facilities;
- run of mine (ROM) pads;
- haul roads;
- temporary access roads; and
- temporary services (water, electricity).

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

2.4.3 SITE FACILITIES DURING OPERATION

The following facilities will be established on site during the operational phase:

- open pits;
- ore stockpiles (within the plant area);
- topsoil stockpiles;
- waste rock dump;
- crushing and screening plant;
- conveyors;
- haul roads;
- mining camp;
- office(s) and ablutions;
- chemical, fuel, and material storage facilities;
- parking areas;

- lighting infrastructure;
- water storage facilities and surface water control measures (in compliance with R704);
- portable ablution facilities;
- reticulation systems for all services:
    - incoming water supply line from the mine's water board mains (internal diameter of the pipe will be 250 mm);
    - overhead 22kV electrical power lines;
    - access roads.

It should be noted that the site layout plan in Figure 18 shows only the main infrastructure components.

FIGURE 18: ZOOM-IN OF CHROME OPERATIONS

FIGURE 19: CHROME CRUSHING AND SCREENING PLANT LAYOUT

2.5 LISTED ACTIVITIES IN TERMS OF EIA REGULATIONS (NEMA)

The list of activities applied for under NEMA is included in Table 15. These activities have been incorporated into the list of project activities as presented in Table 14. The conceptual locations of these activities are illustrated in Figure 18.

TABLE 15: NEMA LISTED ACTIVITIES APPLIED FOR (AS PER APPLICATION DATED FEBRUARY 2010)

Regulation and Activity number	Activity description	Description of activity
R.386 1(b)	The construction of facilities or infrastructure, including associated structures or infrastructure, for the above ground storage of 1 000 tons or more but less than 100 000 tons of ore.	Preliminary design information caters for 10 000 tons of chrome ore that will be stored on run of mine (ROM) pad within the project site.
R.386 1(m)	The construction of facilities or infrastructure, including associated structures or infrastructure, for any purpose in the one in ten year flood line of a river or stream, or within 32 metres from the bank of a river or stream where the flood line is unknown, excluding purposes associated with the existing residential use, but including (i) canals; (ii) channels; (iii) bridges; (iv) dams; and (v) weirs.	Conceptual design information allows for infrastructure to be constructed within 32 m of a watercourse (see Section 1.1.7)
R.386 13	The abstraction of groundwater at a volume where any general authorization issued in terms of the National Water Act, 1998, (Act No. 36 of 1998) will be exceeded.	It is planned that boreholes that were previously used as monitoring boreholes will be used for monitoring purposes as well as abstraction to control seepage.
R.386 15	The construction of a road that is wider than 4 metres or that has a reserve wider than 6 metres, excluding roads that fall within the ambit of another listed activity or which are access roads of less than 30 metres long.	Preliminary design information indicates that the haul road will be a 12 metre gravel road.
R.386 16	The transformation of undeveloped, vacant or derelict land to (a) establish infill development covering an area of 5 hectares or more, but less than 20 hectares; or (b) residential, mixed, retail, commercial, industrial or institutional use where such development does not constitute infill and where the total area to be transformed is bigger than 1 hectare.	Approximately 127 ha will be disturbed as a result of the chrome project.

Regulation and Activity number	Activity description	Description of activity
R.386 25	The expansion of or changes to existing facilities for any process or activity, which requires an amendment of an existing permit or license or a new permit or license in terms of legislation governing the release of emissions, pollution, effluent unless the facility for the process or activity is included in the list of waste management activities published in terms of Section 19 of NEM:WA in which case the activity is regarded to be excluded from the list.	Various activities will require an amendment to PPM's water use license application. At this stage, these water uses include: • 21(g) Disposing of waste in a manner which could detrimentally impact upon a water resource: the chrome project includes a waste rock dump and dirty water storage dams. • 21(j) Removing water from underground for the safe continuation of an activity: as part of the chrome project there is potential for dewatering of the chrome pits. • 21(c) Impeding or diverting the flow of water in a watercourse: the chrome pits and stockpiles will destroy the headwaters of non-perennial watercourses.
R.387 1(h)	The construction of facilities or infrastructure, including associated structures or infrastructure, for the manufacturing, storage or testing of explosives, including ammunition, but excluding licensed retail outlets and the legal end use of such explosives.	Explosive material, such as emulsion, will be stored on site. The emulsion will be stored at the mining camp.
R.387 2	Any development activity, including associated structures and infrastructure, where the total area of the developed area is, or is intended to be, 20 hectares or more.	Approximately 127 ha will be disturbed as a result of the chrome project.
R.387 6	The construction of a dam where the highest part of the dam wall, as measured from the outside toe of the wall to the highest part of the wall is 5 metres or higher or where the high-water mark of the dam covers an area of 10 ha or more.	Preliminary designs allow for stormwater dams with walls greater than 5 metres in height

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

An indication of the phases and estimated timeframes in relation to the main actions, activities or processes and infrastructure is provided in Table 14 above.

2.7 ADDITIONAL INFORMATION

2.7.1 CONSTRUCTION PHASE

2.7.1.1 Workforce and housing

During the construction phase it is estimated that there will be an average of 200 temporary workers on site for a period of approximately six months. No housing will be provided on site. Existing accommodation facilities in the region will be used by the contractors.

2.7.1.2 Transport systems

Temporary (gravel) road access will be provided to the chrome operations from PPM's existing platinum operations.

Approximately four buses and ten small vehicles per day are expected to transport staff to and from site during the construction phase, and approximately two trucks per day for transporting materials along the R510, P50-1 and site roads.

2.7.1.3 Water supply

Water during construction is needed for dust suppression, sanitation and domestic use. This water will be sourced from the mine's current water supply (i.e. Magalies Water Board as well as local/regional boreholes). The quantity of water to be used will be approximately 50 m^3 per day during the construction phase.

2.7.1.4 Power supply

Power for the construction phase will be sourced from Eskom via the existing 132 kV line. The line feeds into an on-site 40 MVA substation and power is then distributed throughout PPM's mining operation via 22 kV lines.

2.7.1.5 Waste management

2.7.1.5.1 Sewage

During the construction phase, enclosed portable toilets will be placed at construction sites. The enclosed chemical toilets will be cleaned and serviced twice a week by a contractor. Sufficient toilets will be placed on site to cater for workers. Sewage will be transported to PPM's existing sewage treatment

plant. Due to the limited number of employees during the construction phase, the existing system is capable of handling the additional load.

2.7.1.5.2 Non-mineralised wastes

The types of waste that could be generated during construction include: hazardous wastes (such as packaging for hazardous materials, used oil and lubricants), general industrial waste (such as scrap metal, building rubble), and domestic waste (such as packaging, food wrapping and office waste). These wastes will be taken to PPM's existing waste facility, where it will be temporarily stored before being removed for recycling by suppliers, reuse by scrap metal dealers or final disposal at permitted waste disposal facilities

PPM has developed and implements an existing waste management procedure that considers the waste management hierarchy and sound environmental practices for the handling and temporary storage of wastes on site.

2.7.1.6 Timing

The construction phase will take approximately six months, starting in 2013 should the chrome project be approved by the relevant authorities.

2.7.2 OPERATIONAL PHASE

2.7.2.1 Workforce and housing

Approximately 50 permanent employment opportunities will be created during the operational phase of the chrome project. No housing will be provided on site. Existing accommodation facilities in the region will be used by the contractors.

2.7.2.2 Transport systems

Internal gravel haul roads will be constructed for the open pit chrome mining operation and will be used to transport ore and waste rock to the appropriate stockpiles or to the plant.

Approximately one bus and four small vehicles per day are expected to transport staff to and from site, and approximately two trucks per day for the transport of materials along the R510, P50-1 and site roads.

The final product will be transported via road to third party buyers. It is expected that approximately six trucks per day will transport the chrome product from the site. The transport route will be determined by the location of the third party, however it is expected that trucks will be routed along the P50-1 to the R510.

2.7.2.3 Water supply and use

Water for the operational phase will be sourced from the same sources that are being considered for the construction phase (Magalies Water Board and local/regional boreholes). It is estimated that 150 m^3 of water will be required per day during the construction phase.

PPM plans to contain and re-use water collected in the open pits in accordance with the National Water Act, 36 of 1998 (NWA) and Regulation 704, 4 June 1998 (Regulation 704) in terms of clean and dirty water separation and management.

2.7.2.4 Power supply

The estimated power supply requirement for the chrome project is approximately 1 MVA. Power will be sourced from Eskom via the existing 132 kV line. The line feeds into an on-site 40 MVA substation and power is then distributed throughout the mining operations via 22 kV lines.

2.7.2.5 Waste management

2.7.2.5.1 Sewage

There is an existing sewage treatment plant at the mine that will be used to treat sewage generated as a result of the chrome operations. During the operational phase, enclosed portable toilets will be placed at the chrome project area. The enclosed chemical toilets will be cleaned and serviced twice a week by a contractor. Sufficient toilets will be placed on site to cater for workers. As the chrome project will not significantly increase the operational workforce at the mine, the existing sewage treatment facility has capacity to take the additional load.

2.7.2.5.2 Non-mineralised wastes

The types of waste that could be generated at the chrome operations include: hazardous industrial waste (such as packaging for hazardous materials, used oil and lubricants, and waste tyres), general industrial waste (such as scrap metal, and building rubble), and domestic waste (such as packaging, food waste and office waste). These wastes will be taken to PPM's existing waste facility, where it will be temporarily stored before being removed for recycling by suppliers, reuse by scrap metal dealers or final disposal at permitted waste disposal facilities.

2.7.2.5.3 Mineralised waste disposal

Waste rock disposal

Material that must be blasted as well as any waste rock from the open pit mining will be used to backfill the chrome pits. Excess waste rock will either be disposed onto the proposed dedicated waste rock dump located on the farm Witkleifontein 136 JP (Figure 2), or onto the area on the farm Tuschenkomst 135 JP that is demarcated as a mineralised waste facility for the existing platinum operations. The proposed waste rock dump on the farm Witkleifontein 136 JP will remain on surface once the chrome

mining activities have ceased. Key information on the design principles associated with this waste rock dump is provided below.

TABLE 16: DESIGN FEATURES FOR THE WASTE ROCK DUMP

<table>
<tr><th>Feature</th><th>Detail</th></tr>
<tr><td colspan="2">Safety classification</td></tr>
<tr><td>Safety classification</td><td>Epoch has determined the safety classification as Low in accordance with the South African Code of Practice for Mine Residue Deposits (SANS 10286:1998) and the requirements of Mineral Regulation 527 of 23 April 2004).
<table>
<tr><th>Criteria No.</th><th>Criteria</th><th>Comment</th><th>Safety Classification</th></tr>
<tr><td>1</td><td>No. of Residents in Zone of Influence</td><td>There are no residential areas in the vicinity of the waste dump</td><td>Low Hazard</td></tr>
<tr><td>2</td><td>No. of Workers in Zone of Influence</td><td>There are unlikely to be any workers in the vicinity of the facilities other than those involved in their construction</td><td>Low Hazard</td></tr>
<tr><td>3</td><td>Value of third party property in zone of influence</td><td>There is no third party infrastructure immediately adjacent to any of the residue disposal facilities</td><td>Low Hazard</td></tr>
<tr><td>4</td><td>Depth to underground mine workings</td><td>No underground mining is planned in the vicinity of the residue deposits.</td><td>Low Hazard</td></tr>
</table></td></tr>
<tr><td colspan="2">Preliminary design principles</td></tr>
<tr><td>Physical Dimensions</td><td>Footprint area for the WRD will be approximately 11.26 ha.
The height of the WRD will be 30 – 45 m.</td></tr>
<tr><td>Chemical characteristics</td><td>The chemical characteristics of waste rock are discussed in section 1.1.1 and show no significant acid generating or contamination characteristics.</td></tr>
<tr><td>Waste Rock Transport and Deposition</td><td>Excess waste rock from the chrome pits will be loaded onto mine dump trucks and transported to the waste rock dump site.</td></tr>
<tr><td>Diversion / Stormwater management</td><td>Stormwater trenches / berms around the upstream boundaries of the waste rock dump that direct clean stormwater run-off around and away from the waste rock dump.</td></tr>
<tr><td>Topsoil Stripping</td><td>Topsoil in waste rock dump footprint area will be stripped and stockpiled in accordance with the topsoil conservation guide in close proximity to the final toe of the waste rock dump. A stripping depth of 500mm is recommended, however this will depend on the actual depth of topsoil, because enough material must remain available to serve as lining.</td></tr>
<tr><td>Lining</td><td>Clearance of the site will be followed by the compaction of the in-situ clays underlying the waste dump footprint. The in-situ turf clays will be ripped to a depth of 500mm, moisture conditioned as necessary and re-compacted to 98% Modified Proctor density to create a low permeability foundation to the dump. A layer of waste rock or soil should be placed over the compacted footprint as soon as possible after compaction to reduce drying and cracking. The waste dump footprint will be developed in phases as required to accommodate the anticipated production of waste rock.</td></tr>
<tr><td>Side slopes</td><td>The outer slopes of the facility will have an overall slope no steeper than 1V:3H.</td></tr>
<tr><td>Access and Access Control</td><td>The haul roads will be used for access. A perimeter fence around the waste rock dump is not planned. Rather a perimeter fence around the whole chrome mining area will be installed.</td></tr>
<tr><td>Waste Minimisation</td><td>Waste rock may be used for the construction of internal mine access and haul roads during the construction phase and for the maintenance of roads during the operational phase for the chrome project as well as in other areas of the PPM operation.</td></tr>
<tr><td>Dust Control</td><td>Operational Phase: Watering of roads for dust suppression and concurrent rehabilitation to establish vegetative cover.
Post Operational Phase: No measures necessary due to the coarse particle size distribution and vegetative cover.</td></tr>
<tr><td>Closure</td><td>Decommissioning of a WRD will include:
• Protecting the sides and top surfaces of the WRD against wind and water erosion.
• Upgrading and securing water drainage on the WRD to ensure that the capping layer is not subject to erosion.
• Providing permanent stormwater management to avoid ingress of water into the WRD.</td></tr>
</table>

2.7.2.6 Mineral processing

The ore from the chrome operation will be processed at an on-site chrome crushing and screening plant which would be located in close proximity to the existing platinum processing plant (Figure 2). An overview of the conceptual project production process is provided below and illustrated in Figure 20.

Materials handling and storage

Handling and storage of materials at the chrome crusher plant will include the following:

Ore stockpiles: Run-of-mine ore (ROM) stockpiles.

Intermediary process materials: As part of the process, materials will be transported via conveyors where required and stored on stockpiles.

Crushing and screening

Crushing and screening will be done to achieve a desired material size before selling the ore to a third party as 'lumps'.

The fines will be treated for platinum ground metals (PGMs) in the existing PPM processing plant. The waste from the platinum processing plant will be disposed on the existing facilities as is the current practice.

FIGURE 20: CONCEPTUAL PROCESS FLOW DIAGRAM FOR CHROME OPERATIONS

2.7.2.7 Stormwater management plan

The aim of this stormwater management plan (SWMP) is to fulfill the requirements of Regulation 704, promulgated in terms of the NWA, which deals with the separation of clean and dirty water. This SWMP and associated conceptual designs were developed by SLR.

Clean and dirty areas have been delineated in Figure 22. This will be achieved by the construction of clean and dirty water diversion infrastructure, as well as dirty water containment facilities. Information on the conceptual design is summarized below. These designs will however be revised during the detailed design phase as required.

Clean water diversion

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

Dirty water diversion

Dirty water containment systems have been designed to ensure dirty water generated on the site is contained. These systems will also contain a channel component. Lining of the dirty water diversions has been included to prevent seepage of any pollutants into the soil profile and subsequent percolation into groundwater. The proposed stormwater drainage channels and catchment areas are presented in Figure 22. All stormwater diversion berms and channels, except for those in the vicinity of a watercourse, have been designed to convey flows generated during a 1:50 year rainfall event. The berms and channels in the vicinity of a watercourse (perennial or non-perennial), have been sized to convey the 1:100 year flow event. The typical dirty water diversion berm is illustrated in Figure 21 and information on the sizing of the channels is provided in Table 17.

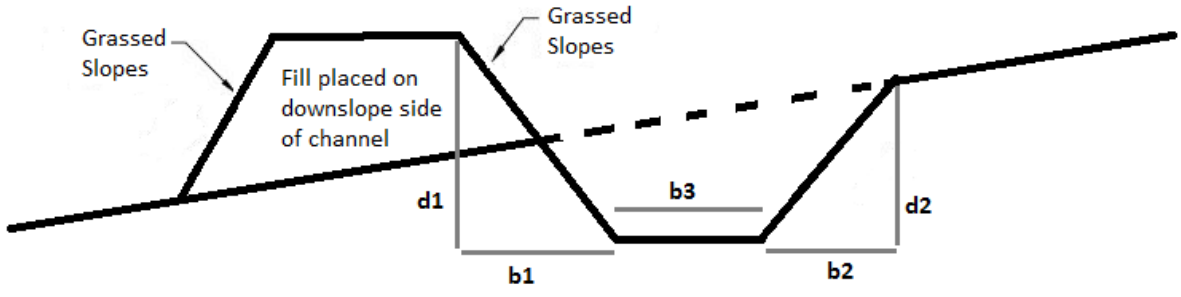

FIGURE 21: STORMWATER DIVERSION CHANNEL

TABLE 17: DIRTY WATER DRAINAGE CHANNEL SIZING

Parameters			**Values**									
Catchment Name			DW1		DW2		DW3		DW4		DW5	
Catchment Flow (Q_{50})		m^3/s	5.6		5.5		6.5		3.4		6.7	
Channel Reference			South	East	South	West	West	East	West	East	West	East
% of Flow Q_{50} per Channel			50%	50%	75%*	57%	27%	73%	50%	50%	50%	50%
Channel Design Flow		m^3/s	2.8	2.8	4.1	3.1	1.8	4.8	1.7	1.7	3.4	3.4
Dimensions	b1	m	1.4	1.4	1.2	1.1	1.2	1.2	0.8	0.9	1.4	1.4
	d2	m	0.9	0.9	0.8	0.7	0.8	0.8	0.5	0.6	0.9	0.9
	b2	m	1.4	1.4	1.2	1.1	1.2	1.2	0.8	0.9	1.4	1.4
	d2	m	0.9	0.9	0.8	0.7	0.8	0.8	0.5	0.6	0.9	0.9
	b3	m	1.0	1.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Slope		m/m	0.004	0.002	0.012	0.012	0.002	0.014	0.011	0.011	0.006	0.006
Mannings N Value		n/a	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025
Velocity		m/s	1.6	1.2	2.6	2.4	1.1	2.8	1.9	2.1	1.9	1.9
Capacity of Channel		m^3/s	3.4	3.0	4.6	3.4	2.0	4.9	1.7	2.4	4.0	4.0

Dirty water containment

In total four dirty water containment dams are required at the chrome project site, two of which have already been constructed as part of the existing platinum operations. Lining of the dirty water dams has been included to prevent seepage of any pollutants into the soil profile and subsequent percolation into groundwater. Containment facilities for stormwater from dirty areas of the site should be designed to accommodate runoff from the 1:50 year design rainfall (24 hour) event. Refer to Table 18 below for the volumes of the relevant dams. Detailed information is provided in the specialist report included in Appendix G.

TABLE 18: CONTAINMENT DAMS – VOLUME REQUIREMENTS

Containment Dam	**Containment Required (m^3)**
DW 1	57 089
DW 2	28 633
DW 3	40 401
Plant & mining camp	5 301

FIGURE 22: CLEAN AND DIRTY WATER SEPARATION AT THE CHROME OPERATION

2.7.2.8 Water Balance

A project specific water balance was developed by AGES for the proposed chrome project. The purpose of the water balance is to provide an initial overview of water use for the project and expected make-up water requirements. The environmental site water balance results for the PPM chrome project are included in Table 19 and illustrated in Figure 23.

TABLE 19: DATA SUMMARY OF THE CHROME PROJECT SITE WATER BALANCE

Description	Component	Quantity
Summary	Mine make up water requirement (m^3/ton milled)	0.48
	Mine make up water requirement (m^3/d)	159
	Water consumed in mining process (m^3/d)	5
	Water in product (m^3/d)	0
	Water consumption in process plant (m^3/d)	0
	Waste rock from mining (% of total production)	94%
	Water balance error factor (%)	10%
Mining	Mine production – run of mine (t/month)	158 000
	Mine production – ore (t/month)	10 000
	Mine production – waste (t/month)	148 000
	Mine make-up water use (m^3/ton waste + ore)	0.001
	Mine make-up water use (m^3/d)	5
	Water in ore and waste rock	15%
	Water in ore (m^3/d)	50
	Water in waste rock (m^3/d)	740
	Storm and rainwater into mine shaft – 1:50 year storm even (not for water supply (m^3/d)	0
	Fissure Water into mine workings (m^3/d)	0
Plant	Process plant feed rate (t/month)	10 000
	Component of ore in plant feed (%)	80%
	Process water consumption (m^3/ton)	0
	Process water consumption (m^3/d)	0
	Water from ore mined as plant feed (m^3/d)	50
	Product feed (ton/d)	267
	Waste feed (ton/d)	67
	Water in product out (%)	0%
	Water in product out (m^3/d)	0
Waste rock	Water in waste rock (m^3/d)	740
	Rainwater on waste rock from rain events (m^3/d)	745
Change houses and offices	No of people	250
	Water use (L/person/day)	150
	Mine potable/drinking water requirement (L/person/day)	3
	Change house potable water component (L/person/day)	150
	Total potable water use (m^3/d)	38
	Total drinking water use (m^3/d)	0.6
	Sewage water discharge (m^3/d)	34
Other	Water used for dust suppression (m^3/d)	150

2.7.2.9 Life of project

The life of the proposed PPM chrome project will be four years. In this regard, the following is planned:

- the construction of the plant and associated surface infrastructure will take approximately six months;

- the proposed mining of the chrome pits on the farm Witkleifontein 135 JP will take place for approximately two months;
- the proposed mining of the chrome pits on the farm Tuschenkomst 136 JP will take place for approximately two years; and
- the final void of the proposed chrome pits on the farm Tuschenkomst 136 JP will be filled using waste rock from the existing platinum operations. This is expected to take six to twelve months.

The proposed chrome mining operation will not extend the overall life of PPM.

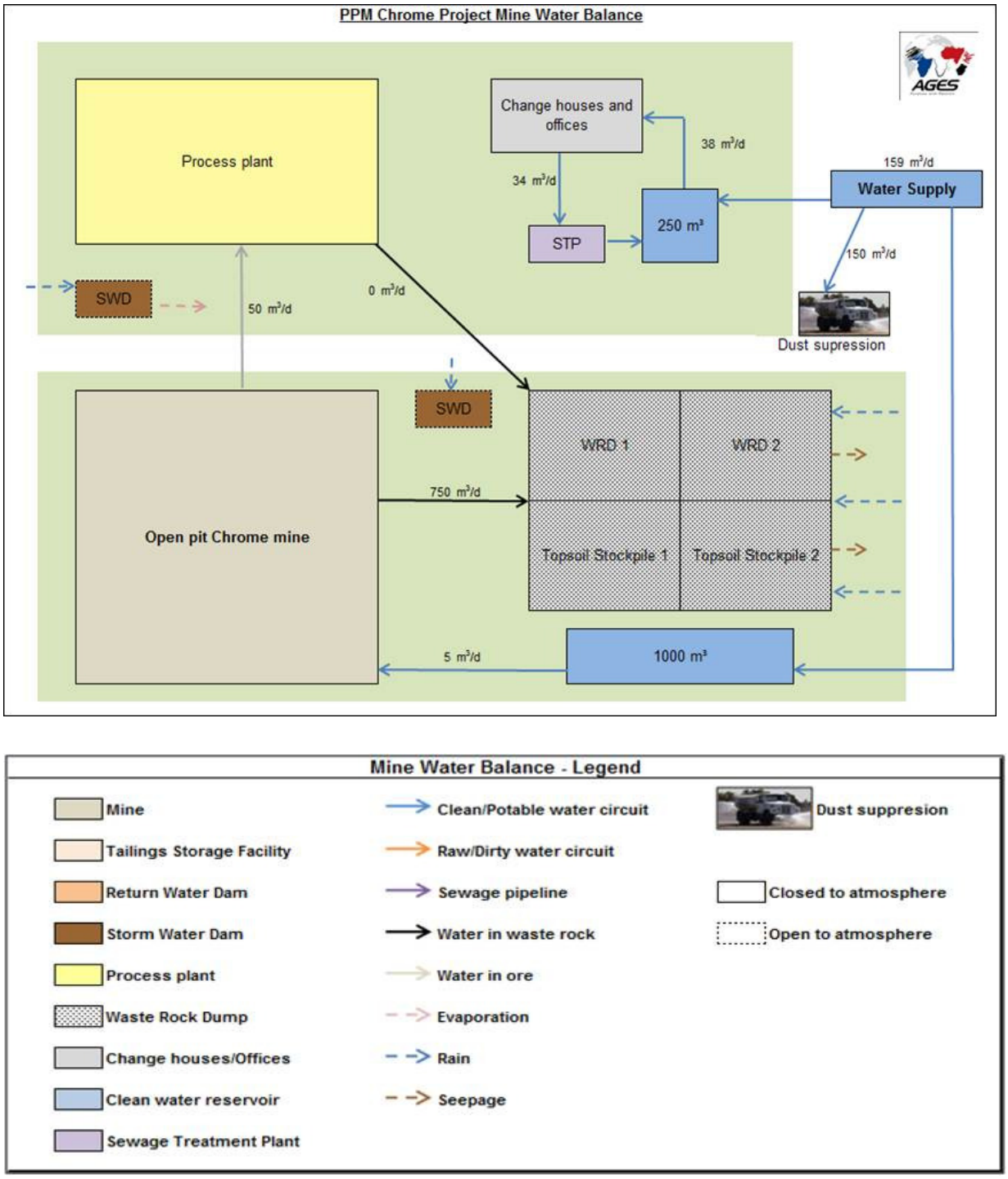

FIGURE 23: PPM CHROME PROJECT WATER BALANCE (PROVIDED BY AGES)

3 POTENTIAL IMPACTS ON THE BIO-PHYSICAL ENVIRONMENT

3.1 LIST OF POTENTIAL IMPACTS ON ENVIRONMENTAL ASPECTS

This section provides a list of potential impacts on environmental aspects (excluding social and cultural aspects – see Section 6) separately in respect of each of the main project actions / activities and processes. The potential impacts are presented for each of the project phases in tabular format (Table 20).

TABLE 20: LIST OF POTENTIAL IMPACTS AS THEY RELATE TO PROJECT ACTIONS / ACTIVITIES / PROCESSES (EXCLUDING SOCIAL AND CULTURAL)

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

Activity	Phase	Potential impacts (unmitigated)
Chrome processing Crushing and screening plant	Construction Operation Decommissioning	Hazardous excavations Loss of soil resources and land capability Physical destruction and disturbance of biodiversity Pollution of surface water resources Alteration of natural drainage patterns Contamination of groundwater Air pollution Disturbing noise Visual impacts
Waste rock management Storage, final disposal	Operation Decommissioning Closure (final land form)	Hazardous excavations Loss of soil resources and land capability Disturbance of biodiversity Pollution of surface water resources Contamination of groundwater Air pollution Disturbing noise Negative landscape and visual impact
Power supply and use Internal site distribution	Construction Operation Decommissioning	Hazardous excavations Loss of soil resources and land capability Disturbance of biodiversity Pollution of surface water resources Alteration of natural drainage patterns Contamination of groundwater Visual impacts
Water supply and use Delivery on site, storage of clean water	Construction Operation Decommissioning	Hazardous excavations Loss of soil resources and land capability Disturbance of biodiversity Pollution of surface water resources Alteration of natural drainage patterns Contamination of groundwater Air pollution Visual impacts
Dirty water management Collection, storage of dirty water for re-use, recycling	Construction Operation Decommissioning	Hazardous excavations Loss of soil resources and land capability Pollution of surface water resources Contamination of groundwater Disturbing noise
Stormwater management Stormwater channels and berms, collection of dirty water, storage for re-use	Construction Operation Decommissioning	Hazardous excavations Loss of soil resources and land capability Alteration of drainage patterns Pollution of surface water resources Contamination of groundwater Disturbing noise
Transport systems Use of access points, road transport to and from site for employees and supplies, movement within site boundary (haul roads, conveyors, pipelines), taxi areas	Construction Operation Decommissioning	Loss of soil resources and land capability Disturbance of biodiversity Pollution of surface water resources Alteration of natural drainage patterns Contamination of groundwater Disturbing noise Traffic impacts Visual impacts

Activity	Phase	Potential impacts (unmitigated)
Non-mineralised waste management Transportation of waste materials to PPM's existing waste facility	Construction Operation Decommissioning Closure (limited)	Air pollution Disturbing noise Visual impacts
Site / contract management Appointment of workers/contractors, site management (monitoring, inspections, maintenance, security, access control), awareness training, emergency response, implementing and maintaining programmes	Construction Operation Decommissioning Closure	Management of the site plays a significant role in all identified impacts
Storage and maintenance services/ facilities Washing vehicles and machinery, storage and handling non-process materials	Construction Operation Decommissioning	Loss of soil resources and land capability Pollution of surface water resources Contamination of groundwater Disturbing noise
Site support services Operating offices, parking vehicles	Construction Operation Decommissioning	Loss of soil resources and land capability Disturbance of biodiversity Air pollution Visual impacts
Demolition Dismantling, demolition, removal of equipment	Operation (as part of maintenance) Decommissioning	Hazardous structures/excavations Loss of soil resources and land capability Disturbance of biodiversity Air pollution Disturbing noise Visual impacts
Rehabilitation Replacing soil, slope stabilisation, landscaping, re-vegetation, restoration	Construction Operation Decommissioning Closure	Hazardous excavations Loss of soil resources and land capability Disturbance of biodiversity Pollution of surface water resources Alteration of natural drainage patterns Contamination of groundwater Air pollution Disturbing noise Visual impacts
Maintenance and aftercare Inspection and maintenance of remaining facilities and rehabilitated areas	Closure	Loss of soil resources and land capability Disturbance of biodiversity Pollution of surface water resources Air pollution Visual impacts

3.2 LIST OF POTENTIAL CUMULATIVE IMPACTS

Potential cumulative environmental impacts include:

- hazardous structures/excavations/surface subsidence;
- loss of soil resources and land capability through pollution;
- loss of soil resources and land capability through physical disturbance;
- physical destruction of biodiversity;
- general disturbance of biodiversity;
- pollution of surface water resources;
- contamination of groundwater;
- alteration of natural drainage patterns;
- air pollution;
- disturbing noise;
- blasting damage; and
- visual impacts.

3.3 POTENTIAL FOR ACID MINE DRAINAGE OR GROUNDWATER CONTAMINATION

Recent studies have been conducted on waste rock samples taken from the Western Limb of the BIC. As PPM also falls on the western limb, and the geology is the same as where the samples were taken, the results of these studies can be applied to the waste rock from the proposed chrome operation at PPM. See Section 1.1.1 for further detail.

4 ALTERNATIVE LAND USE OR DEVELOPMENT

4.1 DESCRIPTION OF ALTERNATIVE LAND USE OF THE AREA

The proposed chrome project area is located within the PPM mining right area and is currently used for mining related activities and community activities (such as cattle grazing). It should be noted that the area on the farm Tuschenkomst 135 JP where the open chrome pit will be located is demarcated as a mineralised waste dump for PPM's existing platinum mining operations (Metago, 2009).

The surrounding land uses are similar and include mining/prospecting operations, residential villages, community activities (cattle grazing and subsistence agriculture) with the addition of conservation and hospitality/tourism operations (such as the Pilanesberg National Park, Black Rhino Game Reserve and the proposed future Heritage Park) (see Section 1.3.1 for a detailed description of existing land uses in the area).

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

Potential features and infrastructure that could be associated with the alternative land use/development are listed below and fall within the type of infrastructure found in the surrounding area (see Section 1.3).

- farm dwellings associated with grazing and limited crop farming; and
- non dangerous and dangerous game corridors, and associated infrastructure, that form part of the proposed future Heritage Park.

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

A plan showing the location and extent of the alternative land use / development is included in Figure 24, and includes PPM's mining right area as well as the proposed future Heritage Park.

FIGURE 24: POTENTIAL ALTERNATIVE LAND USE / DEVELOPMENT

5 POTENTIAL IMPACTS OF ALTERNATIVE LAND USE OR DEVELOPMENT

5.1 LIST OF POTENTIAL IMPACTS

Potential impacts, expected to occur as a result of the alternative land use / development described in Section 4 above, are listed below.

Impacts currently associated with the existing agricultural activities in the project area include:

- soil erosion due to excessive grazing;
- loss of sensitive biodiversity areas and conservation important species due to livestock grazing, cropping and illegal harvesting of fauna and flora for food, firewood, medicinal purposes, sport etc;
- dust generation due to excessive grazing;
- contamination of surface water due to a lack of sanitation facilities at the farm dwellings;
- damage to heritage resources; and
- noise levels associated with these activities are generally low.

Depending on the plans for the Heritage Park, the following impacts could occur:

- loss of biodiversity if any land is cleared for the establishment of surface infrastructure;
- loss of soil resources through erosion, compaction of contamination during construction of surface infrastructure;
- dust generation due to site clearing;
- contamination of surface water and soil during construction of surface infrastructure due to accidental spills of materials or leaks from vehicles and equipment;
- surface and groundwater contamination if sanitation facilities are very basic, such as the case of pit latrines, or inadequate, or if the system requires a discharge of treated sewage effluent;
- it is assumed that no heritage resources would be damaged or disturbed;
- noise levels associated with these activities are expected to be low; and
- visual impact of surface infrastructure.

5.2 LIST OF POTENTIAL CUMULATIVE IMPACTS

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

- air pollution with respect to dust;
- surface and groundwater contamination;
- loss of soil resources;
- loss of biodiversity; and
- increased pressure on water resources.

6 POTENTIAL SOCIAL AND CULTURAL IMPACTS

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

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

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

6.2 CULTURAL ASPECTS AND POTENTIAL IMPACTS THEREON

Cultural aspects are discussed as part of heritage discussion below.

6.3 HERITAGE FEATURES AND POTENTIAL IMPACTS THEREON

6.3.1 HERITAGE (AND CULTURAL) FEATURES

A detailed description of heritage (including cultural resources) in and around the project area is provided in Section 1.3.3 and Figure 17. Heritage resources that occur within the proposed chrome project area include:

- MU01 – 08 and MU12: single and cluster stone walled villages associated with the Late Iron Age and qualify as archaeological remains.

The significance of these resources has been determined as high (refer to Section 1.3.3). The potential impact on these resources has been assessed in Section 7.2.14 as having a medium significance in the unmitigated scenario. This however can be reduced to low with mitigation as project related infrastructure is not planned where the heritage resources are located, thereby reducing the severity and probability of the impact occurring. Refer to Section 7.2.14 for more information.

6.3.2 PALAEONTOLOGICAL FEATURES

As outlined in Section 1.3.3, although the geological formations on site have the potential to host fossils, it is highly unlikely that any will be uncovered during the development of the chrome mine. This is because the project area is mostly underlain by an intrusive igneous body. These rocks are Precambrian in age and are of igneous origin, and therefore it is highly unlikely that fossils will be found on site. Refer to Section 1.3.3 for more information.

6.4 QUANTIFICATION OF IMPACT ON SOCIO-ECONOMIC CONDITIONS

Socio-economic impacts have been assessed in Sections 7.2.18 (economic impacts) and 7.2.19 (inward migration impacts). The main findings are as follows:

- the proposed chrome project will have positive economic impacts by contributing to the national economy, generating limited additional jobs at PPM and the creation of jobs in support services (downstream effect); and
- the significance of inward migration has been rated as high for all phases in the unmitigated scenario. This can however be mitigated to moderate by reducing the severity and probability.

7 ASSESSMENT AND EVALUATION OF POTENTIAL IMPACTS

7.1 LIST OF EACH POTENTIAL IMPACT

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

Potential impacts identified for the project include:

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

7.2 IMPACT RATING FOR EACH POTENTIAL IMPACT

The impact rating for each potential impact listed above (Section 7.1) is provided in the section below. The criteria used to rate each impact is outlined in Section 0. The potential impacts are rated with the assumption that **no mitigation measures** are applied and then again with mitigation. An indication of the phases in which the impact will occur is provided below and summarised in Section 7.4 together with the estimated timeframes for each rated impact.

GEOLOGY

7.2.1 ISSUE: LOSS AND STERILISATION OF MINERAL RESOURCES

Introduction

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

Activities and infrastructure – link to mine phase

Construction	Operation	Decommissioning	Closure
Civil works	Civil works Waste rock management Open pit mining Mineral processing Tailings management	Rehabilitation – related to mineralised waste facilities and backfilling pits	Maintenance and aftercare of final land forms and rehabilitated areas

Rating of impact

Severity / nature

The nature of this project is to extract minerals prior to deposition of waste material from the platinum operations in order to avoid sterilisation. The severity of this impact is therefore low in both the unmitigated and mitigated scenarios.

Duration

As the chrome reserves will be mined before the waste material is deposited, the duration is considered to be low in both the unmitigated and mitigated scenarios.

Spatial scale / extent

The spatial extent of the physical impact is linked to the project area. This is a localised spatial extent in both the unmitigated and mitigated scenarios.

Consequence

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

Probability

As the aim of the proposed project is to extract the chrome reserves prior to deposition of waste material from the platinum operations, the probability of this impact occurring is low in both the unmitigated and mitigated scenarios.

Significance

The significance is low in both the unmitigated and mitigated scenarios.

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

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

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

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

Conceptual description of proposed mitigation measures

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19, Table 32).

Objective

To prevent unacceptable mineral sterilisation.

Actions

PPM will continue to incorporate cross discipline planning structures for all new mining and infrastructure developments to avoid mineral sterilisation. A key component of the cross cutting function is the mine resource manager.

Mine workings will be developed and designed so as not to limit the potential to exploit deeper mineral resources.

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

Emergency situations

None identified.

TOPOGRAPHY

7.2.2 ISSUE: HAZARDOUS EXCAVATIONS/STRUCTURES/SURFACE SUBSIDENCE

Introduction

Hazardous excavations and infrastructure include all structures into or off which third parties and animals can fall and be harmed. Hazardous excavations and infrastructure occur in all mine phases from construction through operation to decommissioning and closure. In the construction and decommissioning phases these hazardous excavations and infrastructure are temporary in nature, usually existing for a few weeks to a few months. The operational phase will present more long term hazardous excavations and infrastructure and the closure phase will present final land forms that could be considered hazardous.

Activities and infrastructure – link to mine phase

Construction	Operation	Decommissioning	Closure
Earthworks Civil works Rehabilitation	Earthworks Civil works Open pit mining Waste rock management Mineral processing Tailings management Water supply infrastructure Power supply infrastructure Transport systems Rehabilitation	Earthworks Civil works Demolition Rehabilitation	Maintenance and aftercare of final land forms and rehabilitated areas

Rating of impact

Severity / nature

Hazardous excavations will be dug for foundations during the construction phase, and scaffolding and other such temporary hazardous structures will be used during construction. During the operational phase, mining will occur at surface (to a maximum depth of 25 m) and therefore pose a significant risk in terms of hazardous excavations, and the hazardous structures will include the waste rock dump and water storage dams. The decommissioning phase will be similar to the construction phase and hazardous structures and excavations will be present during the demolition and site rehabilitation process. The waste rock dump will remain in perpetuity and represents a hazardous structure. In the unmitigated scenario, most of the identified hazardous excavations and infrastructure present a potential risk of injury and/or death to both animals and third parties. This is a potential high severity. With mitigation, the severity reduces to medium.

Duration

Should death or permanent injury occur, this is considered a long term, permanent impact.

Spatial scale / extent

For the most part, the direct impacts will be located within the project area, but the indirect impacts will extend to the communities to which the people / animals belong. This applies to the unmitigated and mitigated scenario.

Consequence

In both the unmitigated and mitigated scenario, the consequence of this potential impact is high.

Probability

In the unmitigated scenario the probability is considered to be medium, as local people and animals do traverse the site, however the existing PPM safety data indicates limited incidents. This can be reduced to low with the implementation of management and mitigation measures which restrict access to the site.

Significance

In the unmitigated scenario, the significance of this potential impact is high. In the mitigated scenario, the significance of this potential impact is medium because there will be a reduction in the probability that the impact occurs.

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

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

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

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

Conceptual description of proposed mitigation measures

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19, Table 33).

Objective

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

Actions

PPM will survey its mining right area and update its mining right area map on a routine basis to ensure that the position and extent of all potential hazardous excavations and hazardous infrastructure is known. It will furthermore ensure that appropriate management measures are taken to address the related safety

risks to third parties and animals. During the construction and operation, the safety risks associated with identified hazardous excavations, subsidence and infrastructure will be addressed through one or more of the following:

- fencing, berms, barriers and/or security personnel to prevent unauthorised access;
- warning signs in English, Afrikaans and Setswana. Warning pictures can be used as an alternative.

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

At closure, the hazardous infrastructure will either have been removed or decommissioned and rehabilitated in a manner that it does not present a long term safety and/or stability risk. In this regard:

- the western chrome pit (on the farm Witkleifontein 135 JP) will be backfilled and rehabilitated. The eastern chrome pit (on the farm Tuschenkomst 136 JP) will be incorporated into the mineralised waste facility that forms part of the platinum mining operations. Waste from the platinum operations will be disposed on top of this area as approved in the 2009 EMP amendment (Metago, 2009);
- the potential for surface subsidence will have been addressed by providing a bulking factor for western chrome pit that will be backfilled and rehabilitated;
- monitoring and maintenance will take place to observe whether the relevant long term safety objectives have been achieved and to identify the need for additional intervention where the objectives have not been met.

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

Emergency situations

If people or animals fall off or into hazardous excavations or infrastructure causing injury, or if any mineralised waste or water facilities fail causing injury to people or animals, PPM's emergency response procedure will be initiated.

SOIL AND LAND CAPABILITY

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

7.2.3 ISSUE: LOSS OF SOIL RESOURCES AND LAND CAPABILITY THROUGH CONTAMINATION

Introduction

There are a number of sources in all phases that could pollute soils and reduce land capability particularly in the unmitigated scenario. Contamination of soils also has the potential to enter both surface and ground water resources (see Sections 7.2.7 and 7.2.9). In the construction and decommissioning phases these potential pollution sources are temporary in nature, usually existing for a few weeks to a few months. Although the sources are temporary in nature, the potential related pollution can have long term effects. The operational phase will present more long term potential sources while the closure phase will present final land forms that may have potential to contaminate soils through long term seepage and/or run-off.

Activities and infrastructure – link to mine phase

Construction	Operation	Decommissioning	Closure
Earthworks Civil works Site management Transport systems Non-mineralised waste management Storage and maintenance services/ facilities Rehabilitation	Earthworks Civil works Site management Transport management Non-mineralised waste management Storage and maintenance services/ facilities Open pit mining Waste rock management Mineral processing Water supply infrastructure Power supply infrastructure Rehabilitation	Demolition Earthworks Civil works Site management Transport systems Non-mineralised waste management Storage and maintenance services/ facilities Waste rock management Water supply infrastructure Power supply infrastructure Rehabilitation	Maintenance and aftercare of final land forms and rehabilitated areas

Rating of impact

Severity / nature

Contamination of soils due to accidental spills and leaks from equipment can occur during all project phases, which is expected to have a high severity. This is because plants and animals rely on this valuable resource for sustenance. If such spills are prevented and/or contained and minimised through the implementation of management and mitigation measures, the severity could be reduced to moderate. This applies to all project phases.

Duration

In the unmitigated scenario, most pollution impacts and the associated loss in functionality will remain after closure. In the mitigated scenario most of these potential impacts should either be avoided or be remedied within the life of the mine. Important related issues are the reaction time of the clean-up team and the chosen remediation methods.

Spatial scale / extent

Potential soil pollution will be restricted to the chrome project area. This applies to the unmitigated and mitigated scenario, and in all project phases.

Consequence

In the unmitigated scenario, the consequence of this potential impact is high. In the mitigated scenario, the consequence reduces to medium with the implementation of management and mitigation measures that reduce the severity and duration of the impact.

Probability

Without any mitigation the probability of impacting on soils through pollution events is high. With mitigation, as per the current practise at PPM, the probability will be reduced to low because emphasis will be placed on preventing pollution events and on quick and effective containment and remediation if a pollution event does occur. This applies to all project phases.

Significance

In the unmitigated scenario, the significance of this potential impact is high. In the mitigated scenario, the significance reduces to low with the implementation of management and mitigation measures to reduce the severity, duration and probability associated with the potential impact.

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

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

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

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

Conceptual description of proposed mitigation measures

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19, Table 34).

Objective

The objective of the measures is to prevent pollution of soils.

Actions

In the construction, operation and decommissioning phases the mine will ensure that all hazardous chemicals (new and used), dirty water, mineralised wastes and non-mineralised wastes are transported,

handled and stored in a manner that they do not pollute soils. This will be implemented through a procedure(s) covering the following:

- pollution prevention through basic infrastructure design;
- pollution prevention through maintenance of equipment that can spill polluting substances;
- pollution prevention through education and training of workers (permanent and temporary);
- pollution prevention through appropriate management of hazardous materials and wastes;
- waste management practises, as set out in Table 21 below;
- adequate sanitation facilities, such as chemical toilets, will be installed and maintained throughout the life of the project. These facilities will be serviced by an appropriate service provider and the waste will be disposed at PPM's existing sewage treatment plant.
- the required steps to enable fast reaction to contain and remediate pollution incidents. In this regard the remediation options include containment and in-situ treatment or disposal of contaminated soils as hazardous waste. In-situ treatment is generally considered to be the preferred option because with successful in-situ remediation, the soil resource will be retained in the correct place. The in-situ options include bio-remediation at the point of pollution, or removal of soils for washing and/or bio-remediation at the designated area after which the soils are returned; and
- specifications for post-rehabilitation audit criteria to ascertain whether the remediation of any polluted soils and re-establishment of soil functionality has been successful and if not, to recommend any implement further measures.

The designs of any permanent and potentially polluting structures (mineralised waste facilities) will take account of the requirements for long term soil pollution prevention, land function and confirmatory monitoring.

TABLE 21: WASTE MANAGEMENT PRACTICES FOR DOMESTIC AND INDUSTRIAL WASTE

Items to be considered		**Intentions**
General	**Specific**	
Classification and record keeping	General	The waste management procedure for PPM will cover the storage, handling and transportation of waste to and from the mine. The mine will ensure that the contractor's responsible are made aware of these procedures.
	Waste opportunity analysis	In line with DWAFs' strategy to eliminate waste streams in the longer term, PPM will assess each waste type to see whether there are alternative uses for the material. This will be done as a priority before the disposal option.
	Classification	Wastes will be broadly classified in terms of the DWAF Minimum Requirements for Waste Disposal (DWAF, 1998).
	Inventory of wastes produced	An inventory of wastes will be compiled and will include estimated quantities of waste. The inventory will be kept up to date.
	Disposal record	Written evidence of safe disposal of waste will be kept.
Waste management facilities	Collection points	Designated waste collection points will be established on site. Care will be taken to ensure that there will be sufficient collection points with adequate capacity and that these are serviced frequently.

Items to be considered		Intentions
General	**Specific**	
	Laydown areas	During decommissioning and closure, lay down areas for re-usable non-hazardous materials will be established. Mixing of re-usable materials with other wastes, especially hazardous wastes will be prevented.
	General waste	Will be stored in designated skips and removed by an approved contractor for disposal at a licensed facility.
	Scrap metal and building rubble	Care will be taken to ensure that scrap metal and building rubble does not become polluted or mixed with any other waste. The scrap metal will be collected in a designated area for scrap metal (scrap yard). It will be sold to scrap dealers. Buidling rubble will be used to backfill mining voids
	Hazardous wastes	Medical waste, laboratory chemicals, explosives packaging, used chemicals and chemical containers will be temprarily stored in sealed containers in a bunded store before removal by an approved waste contractor and disposal in a licenced facility.
	Oil and grease	Oil and grease will be collected in suitable containers at designated collection points. The collection points will be bunded and underlain by impervious materials to ensure that any spills are contained. Notices will be erected at each waste oil point giving instructions on the procedure for waste oil discharge and collection. An approved subcontractor will remove oil from site.
	Any soil polluted by a spill	If remediation of the soil *in situ* is not possible, the soils will be classified as a waste in terms of the Minimum Requirements and will be disposed of at an appropriate permitted waste facility.
	Dried sewage sludge and screeniings from the sewage plant	The first option is to make use of the sludge as part of the fertilising medium for re-vegetation of the tailings dam. Any excess sludge will be removed from site with the screenings as hazardous waste and disposed at a licensed facility.
Disposal	Off site waste disposal facilities	Waste will be disposed of at appropriate permitted waste disposal facilities as outlined below. For general waste the closest permitted site is in Rustenburg. For hazardous waste the closest permitted sites are at Rosslyn and Holfontein.
Waste transport	Contractor	A qualified waste management subcontractor will undertake the waste transport. The contractor will provide an inventory of each load collected and of proof of disposal at a licensed facility.
Banned practices	Long-term stockpiling of waste	Stockpiling of waste is a temporary measure. Waste stockpiling sites must have an impervious floor, be bunded and have a drainage system for collection and containment of water on the site.
	Burying of waste	No wastes other than mine residues will be placed on site.
	Burning of waste	Waste may only be burned in legally approved incinerators.

Emergency situations

Major spillage incidents will be handled in accordance with PPM's emergency response procedure.

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

Introduction

There are a number of activities/infrastructure in all phases that have the potential to disturb soils and related land capability through removal, compaction, and/or erosion. In the construction and

decommissioning phases these activities are temporary in nature, usually existing for a few weeks to a few months. The operational phase will present more long term activities and the closure phase will present final land forms that may be susceptible to erosion.

Activities and infrastructure – link to mine phase

Construction	Operation	Decommissioning	Closure
Earthworks – for all surface infrastructure Site management Transport systems Site support services Rehabilitation	Earthworks – for all surface infrastructure Site management Transport systems Non-mineralised waste management Site support services Open pit mining Waste rock management Mineral processing Water supply infrastructure Power supply infrastructure Rehabilitation	Demolition Earthworks Site management Transport systems Non-mineralised waste management Site support services Waste rock management Water supply infrastructure Power supply infrastructure Rehabilitation	Maintenance and aftercare of final land forms and rehabilitated areas

Rating of impact

Severity / nature

The project footprint is 127 ha. In the unmitigated scenario, the loss of soil through erosion and compaction will occur during all project phases and is considered to be a high severity. In the case of erosion, the soils will be lost to the area of disturbance, and in the case of compaction, the soils' functionality will firstly be compromised through a lack of rooting ability and aeration, and secondly the compacted soils are likely to erode because with less inherent functionality there will be little chance for the establishment of vegetation and other matter that naturally protects soils from erosion. With the implementation of management and mitigation measures, the severity can be reduced to low.

Duration

In the unmitigated scenario the loss of soil and related functionality is long term and will continue after the life of the mine. In the mitigated scenario, the soil is conserved, replaced and the functionality restored (excluding the mineralised waste areas) which reduces the duration of the impact to a medium.

Spatial scale / extent

Physical disturbance of the soil will be restricted to the area of direct influence of the infrastructure and/or activities associated with the project and therefore have a low spatial scale. This applies to both the mitigated and unmitigated scenarios for all project phases.

Consequence

In the unmitigated scenario, the consequence of this potential impact is high. In the mitigated scenario this reduces to low with the implementation of management and mitigation measures that reduce the severity and duration of the impact.

Probability

Without any mitigation the probability of losing soils and its functionality is definite. With mitigation, the probability is reduced to low because emphasis is placed on soil conservation and function re-establishment. This applies to all project phases.

Significance

In the unmitigated scenario, the significance of this potential impact is high. In the mitigated scenario, the significance is reduced to low with the implementation of management and mitigation measures that reduce the severity, duration and probability of the impact.

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

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

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

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

Conceptual description of proposed mitigation measures

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19, Table 35).

Objective

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

Actions

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

- limit the disturbance of soils to what is absolutely necessary for earthworks, on-going activities, infrastructure footprints and use of vehicles;
- where soils have to be disturbed the soil will be stripped, stored, maintained and replaced in accordance with the specifications of the soil management principles in Table 22; and
- as part of closure planning, the designs of any permanent landforms (mineralised waste facilities) will take into consideration the requirements of land function, long-term erosion prevention and confirmatory monitoring.

TABLE 22: SOIL MANAGEMENT PRINCIPLES

Steps	Factors to consider	Detail
Delineation of areas to be stripped		Stripping will only occur where soils are to be disturbed by activities that are described in this EIA and EMP report, and where a clearly defined end rehabilitation use for the stripped soil has been identified.
Reference to biodiversity action plan		All requirements for moving and preserving fauna and flora according to the biodiversity action plan will be adhered to. Moreover, requirements for the re-establishment of landscape functionality are relevant to the rehabilitation phase.
Stripping	Topsoil	A minimum of 50cm of topsoil will be stripped for the Ar and Va soil forms. A minimum of 25cm of topsoil will be stripped for the Gs soil form.
	Subsoil	If present, subsoil will be removed and stockpiled separately to the topsoil.
Delineation of stockpiling areas	Location	Stockpiling areas have been identified in close proximity to the source of the soil to limit handling and to promote reuse of soils in the correct areas.
	Designation of the areas	Soil stockpiles will be clearly marked to identify both the soil type and the intended area of rehabilitation.
Stockpile management	Vegetation establishment and erosion control	Rapid growth of vegetation on the topsoil stockpiles will be promoted (e.g. by means of watering or fertilisation). The purpose of this exercise will be to encourage vegetation growth on soil stockpiles and to combat erosion by water and wind.
	Storm water controls	Stockpiles will be established with storm water diversion berms to prevent run off erosion.
	Height and slope	Soil stockpiles height will be restricted to avoid compaction and damage to the underlying soils. The ideal stockpile height for storage periods greater than 3 years is 1.5m. For short term stockpiles (less than 3 years) the maximum allowable height is 15m but these stockpiles should be benched. Each bench should ideally be 1.5m high and 2m wide. The stockpile side slopes should be 1 vertical: 3 horizontal to promote vegetation growth and reduce run-off related erosion.
	Waste	No waste material will be placed on the soil stockpiles.
	Vehicles	Equipment movement on top of the soil stockpiles will be limited to avoid topsoil compaction and subsequent damage to the soils and seedbank.
Rehabilitation of disturbed land: restoration of land capability	Placement of soil	A minimum layer of 50cm of topsoil will be replaced for the Ar and Va soil forms. A minimum layer of 25cm of topsoil will be replaced for the Gs soil form.
	Fertilisation	A few samples of stripped soils will be analysed to determine the nutrient status of the soil. As a minimum the following elements will be tested for: cation exchange capacity, pH and phosphate. These elements provide the basis for determining the fertility of soil. Based on the analysis, fertilisers will be applied if necessary.
	Erosion control	Erosion control measures will be implemented to ensure that the topsoil is not washed away and that erosion gulleys do not develop prior to vegetation establishment.
Pollution of soils	In situ remediation	If soil (whether stockpiled or in its undisturbed natural state) is polluted, the first management priority is to treat the pollution by means of in situ bio-remediation. The acceptability of this option must be verified by an appropriate soils expert and by DWAF, on a case by case basis, before it is implemented.
	Off site disposal	If in situ treatment is not possible or acceptable then the polluted soil must be classified according to the Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste (DWAF 1998) and disposed at an appropriate, permitted, off-site waste facility.

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

Emergency situations

None identified.

BIODIVERSITY

Biodiversity is crucial for the functioning of ecosystems which provide us with products and services which sustain human life. Healthy ecosystems provide us with oxygen, food, fresh water, fertile soil, medicines, shelter, protection from storms and floods, stable climate and recreation.

Secondary impacts on biodiversity associated with soil erosion, soil compaction, and physical disturbance and pollution of soils have already been assessed in Sections 7.2.3 and 7.2.4 and will not be repeated below.

7.2.5 ISSUE: PHYSICAL DESTRUCTION OF BIODIVERSITY

Introduction

There are a number of activities/infrastructure in all phases that have the potential to destroy biodiversity through loss and/or transformation of habitat, loss of plant and animals species of conservation importance and disruption of animal movements. This will impact upon ecosystem functionality that the biodiversity supports. The value of biodiversity is outlined in Section 1.1.6. It is in this context that the impacts on biodiversity are assessed below.

Activities and infrastructure – link to mine phase

Construction	Operation	Decommissioning	Closure
Site preparation Earthworks Site management Transport systems Site support services Rehabilitation	Site preparation Earthworks Site management Transport systems Non-mineralised waste management Site support services Open pit mining Waste rock management Mineral processing Water supply infrastructure Power supply infrastructure Rehabilitation	Demolition Earthworks Site management Transport systems Non-mineralised waste management Site support services Waste rock management Water supply infrastructure Power supply infrastructure Rehabilitation	Maintenance and aftercare of final land forms and rehabilitated areas

Rating of impact

Severity / nature

The main infrastructure components will impact directly on biodiversity in the following ways:

- loss of biodiversity (fauna and flora) within the footprint areas; and
- habitat fragmentation and associated reduced capacity for species movements.

The following fauna and flora is relevant with respect to biodiversity in the chrome project area:

- *Dwaalboom Thornveld* vegetation type dominates the area;
- sensitive ecological environmental such as watercourses, rocky ridges and Mabeskraal Ridge systems; and
- habitat for various bat species (previously known to occur in the area [NSS, 2011]), including the Near-threatened *Miniopterus natalensis* (Natal long-fingered bat).

As described above, and in Section 1.1.6, the general area is known to provide habitat for a number of bat species, include species of conservation importance. However, it seems that the neighbouring mining operation has destroyed the bat adit located adjacent to the proposed chrome project area (NSS, 2011) and it is unclear whether or not these species still occur in the area.

Where possible, the project footprint has been designed to avoid the sensitive ecological environments listed above.

Due to the uncertainty surrounding the presence of bat species on the project site a conservative approach has been taken in this assessment. In the unmitigated scenario the severity of this impact is rated as high for all project phases. The severity of this impact can be reduced to medium, provided the chrome project footprint is limited as far as possible and that any open adits found within the chrome project area are not disturbed. The severity of this impact could be further reduced if PPM provided suitable alternative habitat for bat species such as bat roosts and/or boxes (see Appendix F for more detail).

Duration

The destruction of biodiversity could have a long-term effect if unmitigated. With effective mitigation the duration can be reduced to somewhere between medium and long term.

Spatial scale / extent

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

Consequence

The consequence of this potential impact is high for all project phases, in the unmitigated scenario. This can be reduced to medium because the severity and duration of the impact is reduced.

Probability

In the unmitigated scenario, the probability is considered to be high for all project phases. With mitigation, the probability may be reduced as the chrome project footprint will be limited to that described in this EIA, restoration efforts will be focussed on ecosystem functionality and PPM will commission a suitable qualified specialist to undertake a detailed adit and bat habitat search prior to the construction of the chrome operations.

Significance

In the unmitigated scenario, the significance of this impact is high. However, this can be reduced to medium in the mitigated scenario.

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

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

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

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

Conceptual description of proposed mitigation measures

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19, Table 36).

Objective

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

Actions

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

- to limit the disturbed area as far as practically possible;
- to prevent the disturbance of sensitive areas as far as practically possible;
- where new areas will be disturbed, the following process will be implemented:
    - delineation of proposed area to be disturbed;
    - obtain any relevant permits for the removal of protected plant species and trees;
    - relocation of species that can effectively be relocated, especially protected species and species of conservation importance. Relevant specialists will be consulted to get advice on appropriate relocation techniques;

- restoration of the ecosystem functionality, as far as is possible, in areas that have been physically rehabilitated;
- follow up audits and monitoring, in the short and long term, to determine the success of the relocation, rehabilitation and restoration activities in terms of a range of species and ecosystem function performance indicators

PPM will commission an appropriately qualified specialist to conduct a detailed adit and bat habitat search during the spring of 2012 / summer of 2013. Any adits on PPM property that provide habitat for bat species will not be disturbed. PPM will implement the management and mitigation measures recommended by the specialist, within reason.

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

Emergency situations

None identified.

7.2.6 ISSUE: GENERAL DISTURBANCE OF BIODIVERSITY

Introduction

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

Activities and infrastructure – link to mine phase

Construction	Operation	Decommissioning	Closure
Site preparation Earthworks for all surface infrastructure Site management Transport systems Site support services Rehabilitation	Site preparation Earthworks for all surface infrastructure Site management Transport systems Non-mineralised waste management Site support services Open pit mining Waste rock dumps Mineral processing Water supply infrastructure Power supply infrastructure Rehabilitation	Site preparation Demolition Earthworks Site management Transport systems Non-mineralised waste management Site support services Waste rock dumps Water supply infrastructure Power supply infrastructure Rehabilitation	Maintenance and aftercare of final land forms and rehabilitated areas

Rating of impact

Severity / nature

Biodiversity will be disturbed in the following ways:

- white light attracts large numbers of invertebrates which become easy prey for predators. This can upset the invertebrate population balance. Lighting can also affect the foraging patterns of nocturnal species such as owls and bats;
- harvesting and killing of plant and animal species for medicinal use, food, fire wood, sport, persecution of predators such as jackal and hyena. This could reduce populations of smaller ungulates e.g. dassies, duiker, porcupine, and cause the loss of non-target species from indiscriminate trapping methods, eg snares. Increased wood harvesting could cause a loss of cover for faunal species and tree nesting habitat for birds, particularly hole-nesting bird species, e.g. woodpeckers etc;
- 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 may scare off certain species. 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, animals 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;
- blasting could harm species in the fly rock zone;
- the presence of mine water impoundments and pipelines may lead to drowning of fauna;
- alteration of surface water flow could impact on certain habitats, i.e. pans downstream of the proposed chrome operation that are potential habitat for the near-threatened Giant Bullfrog (*Pyxichephalus adspersus*) which are known to occur within PPM's mining right area;
- increased presence of alien animal species such as dogs and cats could cause increased predation on small fauna and genetic contamination of wild cat populations; and
- contamination of water and soil and general litter may directly impact on the survival of individual plants, vertebrates and invertebrates.

The disturbance of biodiversity has been rated as having a high severity during all project phases. In the mitigated scenario, many of these disturbances can be prevented or mitigated to acceptable levels, which reduces the severity to low.

Duration

In the unmitigated scenario, the impacts are long term because where biodiversity is compromised, killed or removed from the area this impact is likely to exist beyond the life of the mine. With mitigation, many

of the disturbance impacts will be reduced and the duration will be linked to the life of the project. This will reduce to medium.

Spatial scale / extent

Given that biodiversity processes are not confined to the project site, the spatial scale of impacts will extend beyond the site boundary in the unmitigated and mitigated scenario. This is a medium spatial scale.

Consequence

In the unmitigated scenario, the consequence of this potential impact is high. In the mitigated scenario, this reduces to medium because the severity and duration of the impact is reduced.

Probability

The probability has been rated as high for all project phases because by nature mining operations are intrusive. This can however be mitigated to medium for the construction, operation and decommissioning phases. The probability after closure can be mitigated to low because only the waste rock dumps will remain and the seepage and runoff contamination risk can be managed.

Significance

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

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

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

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

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

Conceptual description of proposed mitigation measures

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19, Table 37).

Objective

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

Actions

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

- the use of light is kept to a minimum, and where it is required, yellow lighting will be used where possible;
- where lighting is non-essential motion detector spot lights will be used where possible.;
- vertebrates should be kept away from the illuminated areas with appropriate fencing where feasible;
- internal power lines may be equipped with bird deterrent measures to prevent bird kills where deemed necessary;
- there is training for workers (temporary and permanent) of the value of biodiversity and the need to conserve the species and systems that occur within the mining right area;
- there is a zero tolerance of the killing of collecting of any biodiversity by anybody working for or on behalf of PPM;
- strict speed control measures are used for any vehicle driving within the mining right area;
- noisy and/or vibrating equipment will be well maintained to control noise and vibration emission levels;
- all water dams will be fenced off to prevent access by larger animals;
- dust control measures will be implemented as outlined in Section 7.2.11;
- surface and ground water management measures will be implemented as outlined in Sections 7.2.7 and 7.2.9;
- soil pollution will be prevented and managed as outlined in Section 7.2.3;
- blasting hazards will be managed as outlined in Section 7.2.16;
- concurrent and final rehabilitation of the waste rock dumps as outlined in Table 16;
- concurrent rehabilitation of areas no longer required for mining activities;
- implementation of an alien/invasive/weed management programme to control the spread of these plants onto and from disturbed areas through active eradication, establishment of natural species and through on-going monitoring and assessment. In this regard, the use of herbicides will be limited and will only be used under strict controls if alternative less intrusive eradication methods are not successful.

As part of closure planning, the designs of any permanent and potentially polluting structures (mineralised waste facilities) will take into consideration the requirements for long term pollution prevention, ecosystem function and confirmatory monitoring.

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

Emergency situations

Major spillage incidents will be handled in accordance with PPM's emergency response procedure.

Certain instances of injury to animals may be considered emergency situations. These will be managed in accordance with PPM's emergency response procedure.

SURFACE WATER

7.2.7 ISSUE: POLLUTION OF SURFACE WATER RESOURCES

Introduction

There are a number of pollution sources in all project phases that have the potential to pollute surface water and impact on downstream users. In the construction and decommissioning phases these potential pollution sources are temporary in nature, usually existing for a few weeks to a few months. Although these sources may be temporary, the potential pollution may be long term. The operational phase will present more long term potential sources and the closure phase will present final land forms that may have potential to contaminate surface water through long term seepage and/or run-off.

Activities and infrastructure – link to mine phase

Construction	Operation	Decommissioning	Closure
Earthworks Civil works Site management Transport systems Non-mineralised waste management Storage and maintenance services/ facilities Stormwater management Rehabilitation	Earthworks Civil works Site management Transport management Non-mineralised waste management Storage and maintenance services/ facilities Open pit mining Waste rock management Mineral processing Chrome processing Water supply infrastructure Power supply infrastructure Stormwater management Rehabilitation	Demolition Earthworks Civil works Site management Transport systems Non-mineralised waste management Storage and maintenance services/ facilities Waste rock dumps Water supply infrastructure Stormwater management Power supply infrastructure Rehabilitation	Maintenance and aftercare of final land forms and rehabilitated areas

Rating of impact

Severity / nature

Surface water resources downstream of the proposed project infrastructure and activities could be polluted if there are discharges of contaminated substances into these resources. Potential construction and decommissioning phase pollution sources include:

- sedimentation from erosion;
- spillage of sewage, construction solvents, paints, fuel, lubricants, cement or leaks from vehicles and equipment.

Potential operational phase pollution sources include:

- spills of potentially polluting materials such as chemicals, fuel and lubricants;

- contaminated discharges from the dirty water systems including: dirty water containment facilities, stockpile areas, workshops etc;
- contaminated runoff and seepage from the waste rock dumps; and
- sedimentation from erosion.

In the normal course all contaminated water will be contained in the dirty water system and re-used.

After closure the waste rock dump will remain in perpetuity and represent a residual water quality impact.

In the unmitigated scenario, the uncontrolled discharge of contaminated water could impact the health of ecosystems, biodiversity (including potential bullfrog habitat), livestock and human users. The severity of pollution of surface water resources is high during all project phases. With mitigation, the severity can be reduced to medium for all project phases.

Duration

The impact of surface water could have long-term effects on the flora and fauna it supports during all project phases. The implementation of management and mitigation measures could reduce the duration.

Spatial scale / extent

The spatial scale of the potential unmitigated impacts could extend beyond the project area because contamination is mobile once it reaches flowing water courses. It should however be noted that the river systems in the project area are non-perennial and therefore the spatial scale is limited. This applies to all project phases in both the unmitigated and mitigated scenarios.

Consequence

The consequence of this impact is high in the unmitigated scenario, and can be reduced to a medium in the mitigated scenario.

Probability

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

Significance

In the unmitigated scenario, the significance of this impact is high. In the mitigated scenario, the significance is reduced to low because of the reduction in severity and probability of occurrence.

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

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

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

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

Conceptual description of proposed mitigation measures

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19, Table 38).

Objective

The objective of the mitigation measures is to prevent pollution of surface water resources and related harm to surface water users.

Actions

The following management and mitigation measures will be implemented during all project phases:

- an amendment to PPM's water use license application will be submitted with respect to all relevant water uses and R704 exemptions required for this project;
- the requirements of any water use license issued by DWA, R704 (unless exemptions are issued by DWA) and the NWA of 1998 will be complied with;
- the project footprint and associated area of disturbance will be minimised as far as practically possible;
- erosion and stormwater management measures will be implemented to prevent the loss of topsoil and resultant sedimentation of watercourses;
- the stormwater management plan will be implemented as outlined in Section 2.7.2.7;
- all contaminated water will be contained and re-used;
- adequate sanitation facilities, such as chemical toilets, will be installed and maintained throughout the life of the project. These facilities will be serviced by an appropriate service provider, and the waste shall be disposed at PPM's existing sewage treatment plant. No sanitation facilities may be located within 100 m of a watercourse;
- all hazardous chemicals (new and used), mineralised wastes and non-mineralised wastes will be handled in a manner that they do not pollute surface water. This will be implemented through a procedure(s) covering the following pollution prevention aspects:
    - basic infrastructure design that is adequate to contain polluting substances. Part of this requirement will be that the area where hazardous and/or polluting substances can be spilled will be minimised and contained. The storage method of all these substances is to contain them in sealed containers with impermeable, bunded areas with sufficient excess capacity

(minimum 110% of capacity). All spilled materials must drain to sumps with oil traps that must also be equipped to allow collection and removal of spilled substances. Concrete will not be mixed directly on the ground. Plastic liners and mixing trays will be used at all times. Waste concrete and sediment sludge will be scraped off the site of the batching plant daily and removed to an approved landfill site in order to prevent pollution during times of rain. Cement contaminated water will be collected, stored and disposed of at a site approved by the site engineer;

- maintenance of equipment that can spill polluting substances. This includes the maintenance of vehicles and equipment and oil or fuel leaks will be fixed immediately upon detection in designated wash bays that are fitted with impermeable dirty water collection sumps and separators;
- education and training of workers (permanent and temporary);
- implementation of the required steps to enable containment and remediation of pollution incidents;
- specifications for post rehabilitation audit criteria to ascertain whether the remediation has been successful and if not, to recommend and implement further measures;

- activities on the banks of watercourses will be minimised as far as possible;
- permanent watercourse crossings will be designed and constructed so that the normal flow of water in the watercourses is unaffected;
- polluted soils will be treated in accordance with Section 7.2.3;
- the designs of any permanent and potentially pollution structures (e.g. waste rock dumps) will take account of the requirements for long-term surface water pollution prevention;
- PPM will monitor the water quality in all potentially affected surface water resources (refer to Section 12) and use the results of the monitoring to implement any other surface water quality related interventions as deemed appropriate to achieve the mitigation objectives;
- Where monitoring identifies that third party water supply has been polluted by PPM, an alternative equivalent water supply will be provided by PPM.

Emergency situations

Discharge incidents that my result in pollution of surface water resources will be handled in accordance with PPM's emergency response procedure.

7.2.8 ISSUE: ALTERATION OF DRAINAGE PATTERNS

Introduction

There are a number of activities/infrastructures which could alter drainage patterns and result in the reduction of surface runoff in the catchment to downstream water users throughout all phases of the project.

Activities and infrastructure – link to mine phase

Construction	Operation	Decommissioning	Closure
Earthworks Civil works Site management Transport systems Non-mineralised waste management Site support services Rehabilitation	Earthworks Civil works Site management Transport systems Non-mineralised waste management Site support services Open pit mining Waste rock dumps Mineral processing Water supply infrastructure Rehabilitation	Demolition Earthworks Civil works Site management Transport systems Non-mineralised waste management Site support services Waste rock dumps Water supply infrastructure Rehabilitation	Maintenance and aftercare of final land forms and rehabilitated areas

Rating of impact

Severity / nature

The following infrastructure will be placed within the 100 m buffer zone of watercourses:

- waste rock dump;
- western topsoil stockpile;
- haul road;
- western chrome pit.

The effective watercourses are however small non-perennial streams and in most cases the disturbance is at the stream headwaters. The establishment of surface infrastructure related to the chrome project will result in a loss of water falling in these containment areas to the natural environment. This loss of mean annual runoff (MAR) has been estimated using rainfall-runoff response parameters from WR2005. An estimated 2.55 km^2 of area will be contained for the establishment of chrome related surface infrastructure. This equates to a loss of 0.11 % of the total MAR for the quaternary catchment A24D.

The alteration of drainage patterns as described above will be relevant to the construction, operational and decommissioning phases, as well as to the closure phase due to the waste rock dump that will remain in perpetuity and the fact that site rehabilitation could never truly restore topography and surface drainage to its pre-disturbed state. Given the small loss to MAR the severity in relation to surface flow is low in both the unmitigated and mitigated scenarios.

Duration

The alteration of drainage patterns will be long term and extend beyond the life of the project due to the remaining waste rock dump and the fact that site rehabilitation could never truly restore the topography and surface drainage to its pre-disturbed state. This applies to all project phases in both the unmitigated and mitigated scenarios.

Spatial scale / extent

The physical alteration of drainage patterns and flow reduction impacts will occur within the project area. Although the flow reduction impacts could extend further downstream, this is unlikely to be as noticeable due to the non-perennial nature of the watercourses. The spatial extent is therefore considered to be localised.

Consequence

In both the unmitigated and mitigated scenarios, the consequence is medium for all phases.

Probability

The alteration of drainage patterns is definite, but the magnitude of the reduced flows is unlikely to be noticed downstream as there is minimal flow during the year, and the proposed project will decrease the MAR by 0.11%. The impact probability is low in both the unmitigated and mitigated scenarios.

Significance

The significance of this impact is low as the severity, spatial extent and probability are considered to be low.

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

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

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

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

Conceptual description of proposed mitigation measures

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19, Table 39).

Objective

The objective of the mitigation measures is to prevent unacceptable alteration of drainage patterns and related reduction of downstream surface water flow.

Actions

In all phases, mine infrastructure will be constructed, operated and maintained so as to comply with the provisions of the National Water Act (36 of 1998) and Regulation 704 (4 June 1998) or any future amendments thereto. Key related issues are that:

- an amendment to the PPM water use license application will be submitted with respect to all relevant water uses and R704 exemptions for this project;
- the requirements of any water use license issues by DWA will be complied with;
- stream crossing will be designed so as to not interfere with the natural flow of the relevant streams. In this regard, all relevant water uses and exemption from R704 will be applied for.
- the location of all activities and infrastructure should be outside of the specified zones and/or flood lines of watercourses. If this is unavoidable the necessary exemptions/approvals will be obtained;
- clean and dirty water will be separated and clean water will be diverted around dirty area and allowed to return to its normal flow path as outlined in the stormwater management plant (refer to Section 2.7.2.7);
- the project footprint and associated area of disturbance will be minimised as far as practically possible; and
- site rehabilitation will aim to restore surface drainage patterns as far as practically and economically feasible.

Emergency situations

None identified.

GROUNDWATER

7.2.9 ISSUE: CONTAMINATION OF GROUNDWATER

Introduction

There are a number of sources in all project phases that have the potential to pollute groundwater, particularly in the unmitigated scenario. In the construction and decommissioning phases these potential pollution sources are temporary and diffuse in nature, usually existing for a few weeks to a few months. Even though the sources are temporary in nature, related potential pollution can be long term. The operational phase will present more long term potential sources such as the waste rock dump and the closure phase will present final land forms that may have the potential to pollute water resources through long-term seepage.

Activities and infrastructure – link to mine phase

Construction	Operation	Decommissioning	Closure
Earthworks Civil works Site management Transport systems Non-mineralised waste management Site support services Rehabilitation	Earthworks Civil works Site management Transport systems Non-mineralised waste management Site support services Open pit mining Waste rock management Mineral processing Water supply infrastructure Power supply infrastructure Rehabilitation	Demolition Earthworks Civil works Site management Transport systems Non-mineralised waste management Site support services Waste rock management Water supply infrastructure Power supply infrastructure Rehabilitation	Maintenance and aftercare of final land forms and rehabilitated areas

Rating of impact

Severity / nature

The following sources have the potential to pollute groundwater for this project:

- accidental spills and leaks;
- seepage from dirty water dams; and
- the waste rock dump has the potential to impact upon groundwater during all project phases, as well as after closure through seepage.

Each of these has been discussed below.

Contamination from spills and leaks on surface could involve a range of contaminants such as hydrocarbons or hazardous chemicals.

There is potential for seepage from dirty water dams which could include a range of contaminants such as hydrocarbons.

Waste rock related to platinum mining operations generally shows a no to low risk of acid generation, with a neutral to alkaline leachate quality predicted. It is possible that blast residue nitrates may exceed water quality guidelines and that certain trace elements may exceed water quality limits depending on actual pH conditions. At source concentrations, nitrate levels could exceed recommended drinking water standards for humans, but would be below the recommended limit for livestock. Side effects of elevated nitrate levels can include methaemoglobinaemia in infants and mucous membrane irritation in adults.

Contamination from the above-mentioned sources has potential to influence third party boreholes and the surrounding surface water resources because of the link between ground and surface water, and therefore may impact on both people and animals in the surrounding area. This impact has therefore been rated as having a high severity in all project phases, and this can be mitigated to low with the implementation of appropriate infrastructure design, pollution prevention and collection systems, and

concurrent rehabilitation of the WRD. The footprint of the WRD should be progressively developed ahead of deposition, i.e. only the area to be used for dumping in one year will be prepared at a time and a layer of waste rock will be used as cover to prevent the clay liner from drying out and cracking. The WRD will also be rehabilitated concurrently with the operation of the WRD, which will minimise seepage into the WRD.

Duration

The duration of groundwater impacts could be long-term for all the impacts described above. This can however be reduced to the life of the project with the implementation of management and mitigation measures.

Spatial scale / extent

Unmitigated groundwater pollution impacts may extend beyond the proposed project boundaries, and therefore has a medium scale. Mitigated groundwater pollution impacts will be confined to the proposed project areas and therefore reduces to a low spatial scale.

Consequence

The unmitigated consequence is rated as high. With mitigation this reduces to low.

Probability

The probability of the impact occurring relies on a causal chain that comprises three main elements:

- Does contamination reach groundwater resources?
- Will people and animals utilise this contaminated water?
- Is the contamination level harmful?

The first element is that contamination reaches the ground and surface water resources adjacent to the proposed project areas. In the unmitigated scenario this may occur, though with mitigation such as infrastructure design, pollution prevention and collection systems, and concurrent rehabilitation of the WRD it would be unlikely.

The second element is that third parties and domestic/wild animals use this contaminated water for drinking purposes. There is a possibility for this to occur through the consumption of both groundwater and surface water, albeit limited in the case of human consumption because although there is a heavy reliance on groundwater in the area, there are no third party boreholes in the immediate vicinity of the proposed chrome project area. In addition, although domestic/wild animals may drink surface water when it is available this is not their constant water supply because for most of the year the watercourses are dry.

The third element is that some contaminants will be at a level which is harmful to humans and domestic/wild animals. This is influenced both by the quality of any discharged water and by the diluting effect of any of the receiving water bodies. Geochemistry studies on platinum mine waste rock dumps have shown that nitrate contamination can occur at a source concentration above recommended drinking water standards for humans but below the recommended limits for livestock. This does not mean that that every waste rock dump will exhibit similar features but the conservative assumption is made for the purposes of this assessment. The waste rock dump will be lined with low permeability clay and therefore a small proportion of leakage through the liner is expected. This leachate leaking through the liner will migrate downwards through the unsaturated zone and combine with regional groundwater. Aside from the fact that a small proportion of the leakage is expected to seep through the liner, geochemical processes in the waste rock dump and unsaturated zone may occur which may change nitrate concentrations (e.g. a reduction to nitrogen of a proportion of the nitrates).

As a combination, the unmitigated impact probability is medium and the mitigated probability is low.

Significance

The significance of contamination has been rated as high in the unmitigated scenario, however this can be mitigated to low by reducing the severity and probability.

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

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

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

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

Conceptual description of proposed mitigation measures

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19, Table 40).

Objective

The objective of the mitigation measures is to prevent pollution of groundwater resources and related harm to water users.

Actions

PPM will comply with both the National Water Act (36 of 1998) and Regulation 704 (4 June 1999) or any future amendments thereto, and the terms and conditions of water authorisations/licenses.

The following management and mitigation measures will be implemented during all project phases:

- pollution prevention through basic infrastructure design such as lining of dirty water dams, seepage collection from waste rock dumps and containment of hazardous spills in areas used for storing and handling hazardous materials;
- pollution prevention through education and training of workers (permanent and temporary);
- pollution prevention through appropriate management of materials and non-mineralised waste;
- the required steps to enable containment and remediation of pollution incidents; and
- specifications for post rehabilitation audit criteria to ascertain whether the remediation has been successful and if not, to recommend and implement further measures.

Infrastructure that has the potential to cause groundwater contamination will be identified and included in a groundwater pollution management plan which will be implemented as part of the operational phase. This plan has the following principles:

- determine potential pollution sources;
- determine the extent of the existing or potential contamination plume;
- design and implement intervention measures to prevent, eliminate and/or control the pollution plume;
- monitor all existing and potential impact zones to track pollution and mitigation impacts; and
- where monitoring results indicates that third party water supply has been polluted by PPM, PPM will ensure that an alternative equivalent water supply will be proved.

Emergency situations

Discharge incidents that may result in pollution of groundwater resources will be handled in accordance with PPM's emergency response procedure.

7.2.10 ISSUE: DEWATERING

Introduction

The main activity that can cause dewatering in the operation and decommissioning phases is active dewatering of the pit. Groundwater may have to be pumped to surface from the workings to ensure a safe working environment. The impacts on biodiversity have been assessed in Section 7.2.5 therefore this section focuses on third party groundwater users and associated land uses.

Activities and infrastructure – link to mine phase

Construction	Operation	Decommissioning	Closure
N/A			N/A
	Open pit mining	Open pit mining	

Rating of impact

Severity / nature

Any loss of water to third party groundwater users is a high severity. With the implementation of management and mitigation measures, the severity can be reduced to low.

Duration

The duration of impacts is linked to the duration of the dewatering and the recharge time thereafter. Should dewatering impacts occur, it is expected that the duration of dewatering impacts will not extend beyond closure in the unmitigated scenario. This is a medium rating. With mitigation the impact will be short term and therefore has been rated as low.

Spatial scale / extent

Generally speaking, where dewatering occurs the spatial scale of the known dewatering cones will be localised and in close proximity to the mining areas.

Consequence

In the unmitigated scenario the consequence is medium. With mitigation it reduces to low.

Probability

PPM's existing Tuschenkomst pit is located adjacent to the proposed chrome pits. Dewatering at the Tuschenkomst pit commenced when mining reached a depth of 50 m. Given that the proposed chrome pits will be mined to a maximum depth of 25 m, it is highly unlikely that groundwater would flow into the chrome pits. It follows that the potential for dewatering is highly unlikely and therefore any impacts on boreholes in the surrounding area is considered highly unlikely. The probability of this impact is rated low in both the unmitigated and mitigated scenarios.

Significance

In the unmitigated and mitigated scenario the significance is low for all relevant project phases.

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

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction and closure						
Not applicable						
Operational and decommissioning						
Unmitigated	H	M	L	M	L	L

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

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction and closure						
Not applicable						
Operational and decommissioning						
Mitigated	L	L	L	L	L	L

Conceptual description of proposed mitigation measures

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19, Table 41).

Objective

The objective of the mitigation measures is to prevent water losses to third party water users.

Actions

All potentially affected third party boreholes will be included in PPM's groundwater monitoring programme to ensure that changes in water depths can be identified.

If PPM's dewatering causes a loss of water supply to third parties an alternative equivalent water supply will be provided by PPM until such time as the dewatering impacts cease.

Emergency situations

None identified.

AIR QUALITY

7.2.11 ISSUE: AIR POLLUTION

Introduction

There are a number of activities/infrastructure in all project phases that have the potential to pollute the air. In the construction and decommissioning phases these activities are temporary in nature. The operational phase will present more long term activities and the closure phase will present final land forms that may have the potential to pollute the air through long term wind erosion.

The potential impact from the proposed chrome operation in isolation is expected to be minor. However, this impact is being assessed cumulatively and therefore takes into consideration PPM's existing mining operation and the proposed chrome operation.

Activities and infrastructure – link to mine phase

Construction	Operation	Decommissioning	Closure
Site preparation Earthworks Civil works Site management Transport systems Non-mineralised waste management Site support services Rehabilitation	Site preparation Earthworks Civil works Site management Transport systems Non-mineralised waste management Site support services Open pit mining Waste rock management Mineral processing Rehabilitation	Site preparation Demolition Earthworks Civil works Site management Transport systems Non-mineralised waste management Site support services Waste rock management Rehabilitation	Maintenance and aftercare of final land forms and rehabilitated areas

Rating of impact

Severity / nature

In the operational phase the main contaminants include: inhalable particulate matter less than 10 microns in size (PM_{10}), larger total suspended particulates (TSP) that relate to dust fallout, and gas emissions mainly from vehicles. The construction and decommissioning phases will be similar. At closure there will only be potential for PM_{10} and TSP emissions. At certain concentrations, each of these contaminants can have health and/or nuisance impacts.

Emissions from vehicles and blasting are expected to be minimal. TSP (fallout) emissions are predicted to be below the evaluation criteria at communities surrounding the mine. The focus of this assessment is therefore on the PM_{10} emissions which may have human health impacts.

In order to determine the potential for health impacts, the evaluation criteria outlined in Table 23 have been used.

TABLE 23: AIR POLLUTION EVALUATION CRITERIA

Contaminant	Averaging Period	Evaluation criteria	Source
PM_{10}	Daily	Current - 120 microgram/m^3 2015 - 75 microgram/m^3	NEM: AQA – National Ambient Air Quality Standards, GN 1210, December 2009
	Annual	Current - 50 microgram/m^3 2015 - 40 microgram/m^3	

Modelling results for the unmitigated scenario, for all phases, indicate that cumulative ambient PM_{10} concentrations (predicted current concentrations plus the predicted additional unmitigated dust emissions from the proposed chrome project) may exceed the current and/or 2015 evaluation criteria at some of the surrounding residential areas. As a first level health impact screening exercise this indicates the potential for legal non-compliance and unacceptable human health impacts, which amounts to a high severity.

The air quality assessment concludes that with mitigation, the predicted PM_{10} ambient concentrations (predicted current concentrations plus the predicted additional mitigated dust emissions from the

proposed chrome project) will be in compliance with the current evaluation criteria, even though the current daily evaluation criteria may be exceeded close to the Ngweding community. There is a possibility that this evaluation will change in 2015 when more stringent evaluation criteria apply. In the proposed 2015 scenario, evaluation criteria may be exceeded at communities further afield, such as Ntsana-le-Metsing and Motlhabe. The severity is reduced to medium for all receptors except the communities mentioned above in the 2015 scenario where it reduces to medium-high.

Duration

Without mitigation the duration of the health impacts could extend beyond closure. With mitigation, the duration of impacts will be limited to the phase prior to closure.

Spatial scale

The spatial scale of the impact will extend off the project site in both the unmitigated and mitigated scenarios.

Consequence

In the unmitigated scenario the consequence is high for all project components in all phases. With mitigation the consequence reduces to medium.

Probability

The health impact probability is linked to the probability of ambient concentrations exceeding the evaluation criteria. Given that there is potential for exceedances of the criteria, for PM_{10} in particular, the probability is high in the unmitigated scenario. With mitigation the probability reduces to medium except for the above-mentioned communities in the future scenario.

Significance

The significance has been rated as high for all project phases in the unmitigated scenario. However, with the implementation of management and mitigation measures this can be reduced to medium.

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

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

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

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, Operation, Decommission						
Mitigated	M (possibly M-H for some communities in	M	M	M	M (H for some communities in	M

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
	2015)				2015)	
Closure						
Mitigated	L	L	L	L	L	L

Conceptual description of proposed mitigation measures

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19, Table 42).

Objective

The objective of the mitigation measures is to prevent air pollution health impacts.

Actions

PPM will implement a dynamic air quality management plan that covers:

- the identification of sources (emissions inventory)'
- the implementation of source based controls;
- the use of source and receptor based performance indicators and monitoring strategies;
- the use of source and receptor based mitigation measures;
- the use of internal and external auditing; and
- review and plan adjustment as required.

In the construction, operation and decommissioning phases, the specific mitigation measures included in Table 24 will be implemented for the main emission sources: drilling and blasting, materials handling operations, wind erosion, vehicles, and crushing.

TABLE 24: AIR QUALITY MANAGEMENT PLAN

Aspect	Impact	Management actions/objectives
Drilling and blasting	PM_{10} concentrations and dust fallout	• Drilling to be with vacuum packs and additional water to ensure minimal dust generation. • Blasting to only occur between 12h00 and 15h00 and only on cloudless days.
Materials handling operations	PM_{10} concentrations and dust fallout	• Water sprays at all main loading and offloading points, including in pit loading and unloading at the waste rock dumps and ROM stockpiles. • Ensure tip distance is minimal, i.e. drop height into truck. • Wind sheltering of unloading operations.
Wind erosion	PM_{10} concentrations and dust fallout	• Ensure water sprays at and around all stockpiles to insure 50% control efficiency. • Ensure vegetation of TSF, WRDs and topsoil stockpiles side slopes up to 1m from the top. Vegetation cover should be dense to ensure >80% control efficiency. • No visual dust from TSF and WRD during episodes of strong winds.

Vehicle activity on unpaved haul and access roads	PM_{10} concentrations, dust fallout and gaseous emissions	• Continuous water sprays on in-pit roads, haul roads to WRD and ROM stockpiles and on-site where front-end-loaders, shovels, other vehicles move to ensure >75% control efficiency. • Chemical suppressants on permanent haul roads to WRDs and to ROM stockpiles to ensure >90% control efficiency. • Haul roads are the most significant contributor to particulate emissions, a speed limit on all haul roads of 10km/hr will be implemented. • Speed limit of 40km/hr will be implemented on the access road.
Crushing and screening	PM_{10} concentrations and dust fallout	• Water sprays at primary crushers to ensure 50% control efficiency.
Nearest sensitive receptor	PM_{10} concentration monitoring	• A PM_{10} sampler will be placed at the nearest sensitive receptor (Ngweding) to monitor ambient PM_{10} concentrations at this location.

Emergency situations

None identified.

AMBIENT NOISE

7.2.12 ISSUE: INCREASE IN DISTURBING NOISE LEVELS

Introduction

Two types of noise are distinguished: noise disturbance and noise nuisance. The former is noise that can be registered as discernible reading on a sound level metre and the latter, although it may not register as a discernible reading on a sound level metre, may cause nuisance because of its tonal character (e.g. distant humming noises). The impacts of both noise types are assessed below.

There are a range of construction, operation and decommissioning activities that have the potential to generate noise and cause related disturbance and nuisance. No impacts area associated with the closure phase.

Activities and infrastructure – link to mine phase

Construction	Operation	Decommissioning	Closure
			N/A
Site preparation Earthworks Civil works Site management Transport systems Rehabilitation	Site preparation Earthworks Civil works Transport systems Open pit mining Mineral processing Rehabilitation	Demolition Earthworks Civil works Transport systems Rehabilitation	

Rating of impact

Severity / nature

Noise pollution can create nuisance that will have different impacts on different receptors because some are very sensitive to noise and others are not. The ecotourism/hospitality related activities associated with Black Rhino Game Reserve and the Pilanesberg National Park are sensitive to noise related activities, particularly at night. Sources of noise pollution associated with the project include construction activities, the operational plant (particularly crushing), vehicle movement (including reverse hooters), blasting, and materials handling.

While an increase in ambient noise levels of between 0 and 5dBA is generally considered acceptable for developments, it must be noted that due to the land uses surrounding the project area (specifically the ecotourism/hospitality related activities) this is not applicable for this project as any increase in noise that is audible is likely to cause high severity impacts in the context of the ecotourism and hospitality land uses. Noise monitoring data is not available for the current PPM operations, however a number of complaints have been raised by the stakeholders at Black Rhino Game Reserve and the Pilanesberg National Park. The severity of this impact is rated as high in the unmitigated scenario. The severity could be reduced to medium with the implementation of management and mitigation measures.

Duration

In both the unmitigated and mitigated scenarios the noise pollution impacts will occur until the closure phase of the mine. This is a medium duration.

Spatial scale / extent

In both the unmitigated and mitigated scenarios the noise impacts will extend to surrounding areas. This is a medium spatial scale.

Consequence

The unmitigated and mitigated consequence is medium.

Probability

The probability of occurrence is high in all phases (except closure) but can be mitigated to medium with the implementation of management and mitigation measures.

Significance

The unmitigated significance up to the point of closure is medium-high, while the mitigated significance is rated as medium.

Unmitigated – summary of the rated impact per phase of the project – on-site activities

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

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

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation and decommissioning						
Unmitigated	M	M	M	M	M	M
Closure						
Not applicable						

Conceptual description of proposed mitigation measures

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19, Table 43).

Objective

The objective of the mitigation measures is to prevent an unacceptable increase in disturbing noise and limit nuisance noise at sensitive receptors as far as practically possible.

Actions

During all project phases, disturbing noise can be limited as follows:

- where possible, PPM will use waste rock and topsoil stockpiles to maintain a noise berm around the mining operations;
- a noise berm will be constructed to the south of the chrome crushing and screening plant to limit noise impacts on eco-tourism ventures to the south and south-east of the operation;
- no blasting will take place for the chrome project at night or weekends (from Friday 14h00 to Monday 06h00);
- activities associated with the chrome operations (including mining and the crushing and screening plant) will be limited to operating hours of 06h00 and 18h00 Monday to Thursday, and from 06h00 to 14h00 on a Friday;
- all vehicles and equipment will be maintained to restrict noise impacts;
- all noise complaints will be documented, investigated and reasonable efforts made to address the area of concern;
- a monitoring campaign is being conducted at Black Rhino Game Reserve. Where necessary, noise monitoring will be used as part of the investigatory process into noise complaints and as part of the assessment of the impact and mitigation;
- options available for reducing noise impacts include but are not limited to:
    - changing operating hours;
    - equipping noise sources with silencers or screens; and

- construction of noise attenuation measures (e.g. berms, placing noise sources sub surface etc.).

PPM will, in consultation with a noise specialist, engage with representatives from the Black Rhino Game Reserve and the Pilanesberg National Park to identify any additional receptor specific measures to address the impacts of current and future mining operations.

Emergency situations

None identified.

VISUAL ASPECTS

7.2.13 ISSUE: NEGATIVE VISUAL IMPACTS

Introduction

Visual impacts may be caused by activities and infrastructure in all project phases. The more significant visual impacts relate to the larger infrastructure components (such as open pit mining, processing facilities and mineralised waste facilities).

Activities and infrastructure – link to mine phase

Construction	Operation	Decommissioning	Closure
Site preparation Earthworks Civil works Site management Transport systems Non-mineralised waste management Site support services Rehabilitation	Site preparation Earthworks Civil works Site management Transport systems Non-mineralised waste management Site support services Open pit mining Waste rock management Mineral processing Water supply infrastructure Power supply infrastructure Rehabilitation	Site preparation Demolition Earthworks Civil works Site management Transport systems Non-mineralised waste management Site support services Waste rock management Water supply infrastructure Power supply infrastructure Rehabilitation	Maintenance and aftercare of final land forms and rehabilitated areas

Rating of impact

Severity / nature

The severity of visual impacts is determined by assessing the change to the visual landscape as a result of project related infrastructure and activities. As discussed in Section 1.1.11, the visual landscape is determined by considering: landscape character, sense of place, scenic quality, sensitivity of the visual resource and sensitive views. In this regard, the proposed project area and the greater PPM mining right area is considered to have a varied visual landscape with the koppies having high value, and the plains having either a medium (disturbed by community activities) or low (disturbed by mining activities) value.

When considering the potential change to the visual landscape the key issues are: visual exposure, visual intrusion and sensitivity of receptors. Each of these is discussed below.

Visual exposure is the extent to which project infrastructure and activities will appear in the various views. It follows that the closer the infrastructure and activities, the greater the visual exposure. Tourist views at Black Rhino Game Reserve boundary will be approximately 2 km away, while the views from the lodges will be approximately 4 km away. The related visual exposure to sensitive receptors is considered high, particularly at night.

Visual intrusion is the extent to which the infrastructure and activities contrast with the visual landscape and whether it can or cannot be absorbed by the landscape. The visual intrusion of the current mine is considered to be medium-high during the day due to the rural nature of the area, and high during the night because of the added influence of lights. The visual intrusion from the proposed chrome mining operation will have the same rating as the current operations.

Mitigation measures (such as the strategic position of the waste rock dump and topsoil stockpiles) should decrease the severity for visitors to the Black Rhino Game Reserve. However, the establishment of the waste rock dump will only commence during the operational phase and will take a number of months to effectively act as a visual screen. This will however assist with blocking the view of PPM's existing platinum processing plant in the long term.

To date, PPM has not been successful in implementing measures to mitigate visual impacts from the existing operations on sensitive receptors (particularly the Black Rhino Game Reserve). As such, the severity of this impact is high in both the mitigated and unmitigated scenarios for all project phases, except in the mitigated scenario where it reduces to low in the closure phase.

Duration

The duration of this impact is expected to be long-term for all project phases in the unmitigated scenario because the impacts will extend beyond the life of the project for the daytime impacts in particular. In this regard, night time impacts will be limited to the project life when the use of night lights will stop. In the mitigated scenario, the duration will be reduced to the life of the project, and only the rehabilitated waste rock dumps will remain after closure.

Spatial scale / extent

Visual impacts will extend beyond the project area in both the unmitigated and mitigated scenarios. This is a medium spatial scale.

Consequence

The consequence in the unmitigated scenario is high. With mitigation it reduces to medium in the construction, operation and decommissioning phases, and low in the closure phase.

Probability

The probability of the visual impact occurring is high in the unmitigated scenario. With mitigation the visual impact will be medium-high until the end of decommissioning and low at closure.

Significance

The unmitigated significance is high. The mitigated significance reduces to a medium-high before closure and low after closure.

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

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

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

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

Conceptual description of proposed mitigation measures

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19, Table 44).

Objective

The objective of the mitigation measures is to limit negative visual impacts.

Actions

In the construction and operation phases the following visual mitigation techniques will be implemented:

- limit the clearing of vegetation;
- supress dust to prevent a visual dust cloud;
- use of visual screening berms in areas where there are sensitive visual receptors;
- on-going establishment of vegetation on rehabilitated areas. All vegetation planted should reflect the natural vegetation of the area;
- painting infrastructure with colours (browns and greens) that blend in with the surrounding environment where possible; and

- 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 non-essential lighting will be activated with motion sensors.

PPM will, in consultation with a visual specialist, engage with representatives from the Black Rhino Game Reserve to identify any additional receptor specific measures to address the impacts of current and future mining operations.

Emergency situations

None identified.

HERITAGE, PALEONTOLOGICAL AND CULTURAL RESOURCES

7.2.14 ISSUE: DESTRUCTION OF HERITAGE, PALEONTOLOGICAL AND CULTURAL RESOURCES

Introduction

There are a number of activities/infrastructure in all phases prior to closure that have the potential to damage heritage, cultural and paleontological resources and result in the loss of the resource for future generations. Heritage and cultural resources include sites of archaeological, cultural or historical importance. Given the geology of the mining right area, it is unlikely that paleontological resources will occur and therefore this impact is not assessed further.

Activities and infrastructure – link to mine phase

Construction	Operation	Decommissioning	Closure
			N/A
Earthworks for all surface infrastructure Civil works Site management Transport systems Site support services Rehabilitation	Earthworks for all surface infrastructure Site management Transport management Non-mineralised waste management Site support services Open pit mining Waste rock dumps Mineral processing Water supply infrastructure Power supply infrastructure Rehabilitation	Demolition Earthworks Site management Transport systems Non-mineralised waste management Site support services Waste rock dumps Water supply infrastructure Power supply infrastructure Rehabilitation	

Rating of impact

Severity / nature

A wide range of heritage and cultural resources have been identified and mapped within PPM's mining right area (see Figure 17). Heritage resources within the proposed chrome project area include stone walled settlements associated with the Late Iron age. These are located at the base of the Mukukunupu koppie. The impact severity is medium in the unmitigated scenario as these resources could be

damaged accidentally during the construction of the haul road. The severity can be reduced to low in the mitigated scenario with the implementation of management and mitigation measures such as fencing off the heritage sites prior to the construction phase and educating employees.

Duration

If heritage resources are removed, damaged or destroyed the impact duration is long term.

Spatial scale / extent

The spatial extent is low as the impacts are confined to the project area.

Consequence

The consequence in the unmitigated scenario is medium, however this impact can be reduced to low with the implementation of management and mitigation measures.

Probability

It is planned that the location of infrastructure related to the chrome mining operation will not impact on the identified heritage resources in the project area. The impact probability is medium in the unmitigated scenario and can be reduced to low with mitigation.

Significance

The unmitigated significance is medium and the mitigated significance is low.

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

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation and decommissioning						
Unmitigated	M	H	L	M	M	M
Closure						
Not applicable						

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

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation and decommissioning						
Mitigated	L	H	L	L	L	L
Closure						
Not applicable						

Conceptual description of proposed mitigation measures

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19, Table 45).

Objective

The objective of the mitigation measures is to prevent the loss of heritage, cultural and paleontological resources.

Actions

Proposed infrastructure, activities and related disturbance linked to the chrome project will be limited to those specifically identified and described in this report. Should future plans require a change in the mine footprint that will affect any of the identified heritage and cultural resources, a phase II heritage impact assessment will be conducted, and if necessary, PPM will apply for a permit to the North West Heritage Resources Agency (SAHRA) to remove/destroy the resource.

All workers (temporary and permanent) will be educated about the heritage and cultural sites that may be encountered in their area of work and about the need to conserve these.

In the event that new heritage, cultural and/or paleontological resources are discovered, the mine will follow an emergency response procedure, which includes the following:

- work at the find will be stopped to prevent damage;
- an appropriate heritage specialist will be appointed to assess the find and related impacts; and
- permitting applications will be made to SAHRA if needed.

Emergency situations

None identified.

LAND USES

7.2.15 ISSUE: LOSS OF CURRENT AND FUTURE LAND USES

Introduction

There are activities and infrastructure that forms part of the proposed chrome project that has the potential to impact on other current and future land uses in the PPM mining right area in all mine phases. As indicated in Section 1.3.1, the current land use on the project site is grazing, while future land uses include the proposed Heritage Park.

It is noted that landowners on the farm Zandspruit 168 JP (Black Rhino Game Reserve) are concerned that the proposed chrome project will negatively impact on their current land use, i.e. eco-tourism/hospitality (see Appendix D). It is SLR's opinion that, provided that the mitigation measures for the chrome project are successfully implemented, the proposed chrome operation will not materially change the impacts already associated with PPM's existing operation. In this regard, it must be noted that numerous complaints regarding current impacts from current activities have been made by these land owners and land

users. More detail is provided in the Comments and Response Report attached in Appendix D. This assessment therefore focusses on current and future land uses within the proposed chrome project area.

Activities and infrastructure – link to mine phase

Construction	Operation	Decommissioning	Closure
Site preparation Earthworks Civil works Site management Transport systems Non-mineralised waste management Site support services Rehabilitation	Site preparation Earthworks Site management Transport systems Non-mineralised waste management Site support services Open pit mining Waste rock dumps Mineral processing Water supply infrastructure Power supply infrastructure Rehabilitation	Site preparation Demolition Earthworks Site management Transport systems Non-mineralised waste management Site support services Waste rock dumps Water supply infrastructure Power supply infrastructure Rehabilitation	Maintenance and aftercare of final land forms and rehabilitated areas

Rating of impact

Severity / nature

Loss of grazing land

Infrastructure related to the chrome project will impact on 127 ha of land, some of which is currently used by community members as grazing land. In the unmanaged scenario this would impact directly on the livelihood of the farmers because their herds would have to survive on smaller areas of land. This may result in loss of livestock condition, reduction in herd sizes, and/or over grazing. In the unmitigated scenario the severity of this impact is high. Impacts on the farmers can largely be eliminated with the provision of alternative appropriate land and/or compensation. PPM is in the process of developing a relocation action plan for farmers affected by the mining operations. This reduces the severity to low.

Obstruction of Heritage Park Corridor (HPC)

The proposed chrome project is located within the proposed HPC, more specifically, in the area currently demarcated as the non-dangerous game section (see Figure 24). All project related infrastructure will be temporary, with the exception of the waste rock dump that will remain in perpetuity to act as a visual berm to screen the mining operation from sensitive receptors located to the south west of PPM.

The collective mine developments in the area could act as an obstacle within the proposed HPC. In this regard, the NWPTB has evaluated a number of alternative corridors between the Pilanesberg National Park and the Madikwe Game Reserve. These include:

- the initial alignment of the proposed heritage park corridor (2002) which included the farms Zandspruit 168 JP, Rooderand 46 JQ, Witkleifontein 136 JP, Tuschenkomst 135 JP and Wilgespruit 2 JQ. This alignment was prior to the development of either PPM or the Sedibelo Platinum Mine to the east and other mining interests to the west;
- the revised NWPTB heritage park corridor proposal (2007) took into consideration the various

planned mining developments and was therefore limited to a dangerous game corridor between PPM and Sedibelo Platinum Mine (on the farm Wilgespruit 2 JQ), with non-dangerous areas to the east and west of this corridor within the mine areas (see Figure 24).

Given the cumulative layout of PPM's operation, the proposed Tuschenkomst pit flooding project and the approved Sedibelo Platinum Mine, the 2007 HPC revision is no longer feasible in so far as the dangerous game corridor is concerned. An alternative option for the corridor has been tabled by PPM. 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 (see Figure 24). The favoured option avoids the koppies, the PPM tailings facility while traversing Witkleifontein 136 JP. The NWPTB representatives have requested that PPM ensure the size and side slopes of waste rock dumps do not restrict or endanger wildlife movement. 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. The NWPTB acknowledge that obstacles including the village of Ngweding, as well as PPM's waste rock dump adjacent to the Tuschenkomst pit and the Tuschenkomst pit flooding project will remain at the entrance to the farm Cyferkuil 1 JQ. The NWPTB agree in principle to use the current alignment as a starting point.

The severity of this impact on the HPC in the unmitigated scenario is high for all project phases. The severity can be reduced to low for all phases with the implementation of mitigation measures, such as effective rehabilitation of all disturbed areas.

Duration

In the unmitigated scenario the impacts on land use will extend beyond project closure. With mitigation, the majority of the land use impacts are expected to be limited to the life of chrome project.

Spatial scale / extent

As the land use impacts will affect areas out with the project area the spatial scale is rated as medium. This applies to both the unmitigated and mitigated scenarios in all project phases.

Consequence

The unmitigated consequence is high. With mitigation, it reduces to low.

Probability

In the unmitigated scenario the probability is considered to be high for all project phases. With the implementation of management and mitigation measures the probability reduces to medium.

Significance

In the unmitigated scenario the impact is rated high. With mitigation, the significance is low as the severity and duration can be reduced.

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

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

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

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

Conceptual description of proposed mitigation measures

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19, Table 46).

Objective

The objective of the mitigation measures is to prevent unacceptable negative impacts on surrounding land uses and ensure that the land within the project area can be used successfully after closure.

Actions

During all phases, the mitigation measures outlined for the following impacts will be implemented:

- noise (Section 7.2.12);
- dust generation (Section 7.2.11);
- surface and ground water quality and quantity impacts (Sections 7.2.7, 7.2.9, 7.2.10);
- blasting hazards (Section 7.2.16);
- inward migration (Section 7.2.19); and
- visual impacts (Section 7.2.13).

PPM will compile an inventory of affected farmers including the type and size of each farmer's livestock herd. Talks will be held with the Department of Agriculture, PPM and the affected farmers to identify and access alternative grazing land of similar quantity and quantity. Alternatively, financial compensation will be provided for the loss of grazing land.

Any areas no longer required will be rehabilitated during all phases, and the waste rock dump will be concurrently rehabilitated.

During decommissioning, all surface infrastructure will be removed, with the exception of the waste rock dump. The project area on the farm Tuschenkomst 136 JP will not be rehabilitated as this area is demarcated as a mineralised waste facility for the platinum operations (Figure 3) (Metago, 2009). The chrome project area on the farm Witkleifontein will be properly rehabilitated to as close as possible to the pre-disturbed land capabilities outlined in Section 1.1.4. In addition, PPM will develop the rehabilitation and closure plan in close partnership with the NWPTB to ensure that impacts on the proposed Heritage Park are minimised as far as possible and the proposed future land use is not inhibited.

Emergency situations

None identified.

7.2.16 ISSUE: BLASTING HAZARDS

Introduction

Blast related impacts will be experienced during the construction, operation and possibly the decommissioning phases. Issues related to blasting dust and blasting noise have been assessed as part of Sections 7.2.11 and 7.2.12 respectively. The impacts assessed in this section relate to infrastructure damage and/or harm to third parties and livestock.

Activities and infrastructure – link to mine phase

Construction	Operation	Decommissioning	Closure
			N/A
	Open pit mining		-

Rating of impact

Severity / nature

Injury to third parties and livestock may be caused by fly rock. Damage to third party infrastructure may be caused by:

- fly rock;
- ground vibrations; and/or
- air blast.

To give spatial context to this discussion, Table 25 below provides an indication of the proximity of non-mine (third party) infrastructure to the proposed open chrome pits (see Figure 2).

TABLE 25: PROXIMITY OF STRUCTURES, PEOPLE AND ANIMALS TO THE PROPOSED CHROME PITS

	within 500m	within 1 000m	within 1 500m
Tuschenkomst chrome pits	Livestock and wild animals The P50-1 dirt road (including pedestrians and vehicles) Chrometco infrastructure and associated staff	Livestock and wild animals The P50-1 dirt road (including pedestrians and vehicles) Chrometco infrastructure and associated staff	Livestock and wild animals The P50-1 dirt road (including pedestrians and vehicles) Chrometco infrastructure and associated staff
Witkleifontein chrome pit	Livestock and wild animals Chrometco infrastructure and associated staff	Livestock and wild animals Chrometco infrastructure and associated staff The P50-1 dirt road (including pedestrians and vehicles)	Livestock and wild animals Chrometco infrastructure and associated staff The P50-1 dirt road (including pedestrians and vehicles)

Fly rock generation is related to the energy or mass of explosives and the containment of the energy on all sides of the blast area. In general, larger blast-holes tend both to throw larger rocks and to threaten over greater distances. Containment of fly rock is important because it has the potential to cause injury and death to people and animals. It can also damage structures. In unmanaged scenarios fly rock can extend up to 1 000 m from the blast site. This could harm animals and/or structures listed in the 1 000 m zone of Table 25 above. In the managed scenario, this can be kept within a range of less than 500 m.

Ground vibrations from blasting travel directly through the ground. The related impact on structures (such as buildings) depends on velocity and frequency of vibrations and the integrity of the built structures. The United States Bureau of Mines (USBM) standard of 12 mm/s peak particle velocity is applied as a general guideline for blast management in South Africa as a “safe” limit for brick and mortar structures in the usual range of blasting vibration frequencies (4 – 12 Hz). In the unmanaged scenario structures could be at risk outside of the zone where peak particle velocities greater than 12 mm/s are generated by blasting. In the managed scenario, assuming that the blast design will consistently result in a peak particle velocity of 12 mm/s at all third party structures, these should not be damaged. However, the blanket application of this guideline is the subject of debate because permanent displacements along existing cracks in sub-standard buildings (often associated with rural houses) can be induced by lower vibrations. As a result the blast design must be specific to manage impacts on surrounding structures.

Airblast is an air pressure pulse that has both a high frequency audible sound and a low frequency inaudible concussion. If the pressure is great enough damage can be caused to structures. Generally speaking, airblasts of 125dB or less should not cause damage to surrounding structures.

In the unmanaged scenario, this impact it is considered to be a high. With mitigation, the blast design and impact controls will reduce the potential for exceeding the recommended limits which reduces the severity to medium.

Duration

While damage to infrastructure can be repaired in the short term, injury or death is considered to have a long-term duration. This cannot be significantly mitigated.

Spatial scale / extent

In the mitigated scenario blast impacts should be contained within the project area. In the unmitigated scenario, blast impacts may extend to surrounding areas.

Consequence

The unmitigated consequence is high. With mitigation the consequence is medium.

Probability

The project area is located in a rural setting, with limited third party structures. However, the project area is used for cattle grazing and is traversed by local people to a limited extent. As such. the probability of injury to third party or damage to third party infrastructure is considered to be medium in the unmitigated scenario. This can be reduced to low with the implementation of management and mitigation measures

Significance

In the unmitigated scenario, the significance of blasting-related impacts is high. In the mitigated scenario, the significance is reduced to low.

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

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

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

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Operation						
Mitigated	M	H	L	M	L	L
Construction, decommissioning and closure						
Not applicable						

Conceptual description of proposed mitigation measures

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19, Table 47).

Objective

The objective of the mitigation measures is to prevent blast related damage to structures and/or injury to people and livestock.

Actions

PPM will implement a blast management plan which has the following key principles:

- pre-mining crack surveys of structures within 1 500 m of the blast. All parties that exist and/or that have service infrastructure and/or provide services within 1 500 m of the chrome pits will be informed prior to mining, about the blast programme and associated safety precautions;
- design of blasts to prevent injury to people and livestock and to prevent damage to structures. As a minimum the blast design will achieve:
    - a fly rock impact zone limit of less than 500 m;
    - a peak particle velocity limit of less than 12 mm/s at third party structures that are built according to building industry standards and of 3 mm/s at third party structures that are not built according to building industry standards;
    - an air blast of less than 125 dB at third party structures.
- communication of the planned blast programme to interested and/or affected parties;
- an audible pre blast warning will be given at least three minutes before the blast is fired to evacuate and clear people, moveable property and livestock from the potential fly rock impact zone;
- blasting at the chrome operations will take place three times a week. No blasting at the chrome operations will take place from Friday 14h00 to Monday 06h00;
- blast monitoring to verify the effectiveness of the blast design and blast execution. Monitoring data will be interpreted and incorporated into monitoring reports, which will be made available to IAPs on request;
- audit and review to adjust the blast design where necessary to achieve the stated objectives;
- formal documented investigation and response for all third party blast related complaints; and
- remediation of impacts caused by blasting.

Where PPM has caused blast related damage it will provide appropriate compensation.

Emergency situations

If a person or animal is injured by blasting activities this must be handled in accordance with PPM's emergency response procedure.

7.2.17 ISSUE: PROJECT-RELATED ROAD USE AND TRAFFIC

Introduction

Traffic impacts are expected from construction through to the end of the decommissioning phase when trucks, buses, taxis and smaller vehicles make us of public and private transport network in and adjacent

to the PPM mining right area. The key potential traffic related impacts are on road capacity and public safety.

Activities and infrastructure – link to mine phase

Construction	Operation	Decommissioning	Closure
			N/A
Transport systems, including the movement of staff and raw materials	Transport systems including the movement of staff, consumables and product.	Transport systems including the movement of staff and dismantled infrastructure	-

Rating of impact

Severity / nature

Roads in the vicinity of the PPM operation are currently utilised by PPM, other mines in the area and public vehicles. As part of the chrome operation, approximately four buses, ten small vehicles and two trucks per day are expected during the construction phase, and one bus, four small vehicles and six trucks per day for the operational phase. PPM's vehicles will travel on the P50-1 and R510. The decommissioning phase traffic is expected to be less than that of the construction phase. This increase in traffic related to the proposed project is not expected to result in additional impacts regarding road capacity, however traffic accidents have the potential to occur, injuring people and animals. In the unmitigated scenario the severity is high. In the mitigated scenario the severity reduces to medium because the frequency of potential accidents is expected to reduce.

Duration

Any serious injury or death is a long term impact in both the unmitigated and mitigated scenarios. This cannot be significantly mitigated.

Spatial scale / extent

The accident site could be located within or outside the mining right area and the indirect impacts associated with any injuries or fatalities will extend to the communities to which the injured people/animals belong. This is a medium scale in both the unmitigated and mitigated scenarios.

Consequence

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

Probability

In the unmitigated scenario the probability of traffic accidents is medium. With mitigation this impact reduces to low probability, and this is supported by the PPM records which show a low frequency of road accidents.

Significance

The unmitigated significance is high. With the implementation of management and mitigation measures this reduces to medium as the probability is reduced.

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

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

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

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation, decommissioning						
Mitigated	M	H	M	H	L	M
Closure						
Not applicable						

Conceptual description of proposed mitigation measures

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19, Table 48).

Objective

The objective of the mitigation measures is to prevent transport related accidents and/or injury to people and livestock.

Actions

In the construction, operation and decommissioning phases PPM will implement a transport safety programme to achieve the mitigation objectives. Key components of the programme include education, training, awareness, and transport maintenance.

PPM will fence off sections of the haul road where there is a danger to livestock.

Emergency situations

If a person or animal is injured in the event of a mine related road accident it must be handled in accordance with PPM's emergency response procedure.

SOCIO-ECONOMIC

Mining projects generally have positive impacts such as job and income creation, and negative socio-economic impacts such as unwanted inward immigration during all project phases. The assessment below considers the economic and social impacts separately.

7.2.18 ISSUE: ECONOMIC IMPACT (POSITIVE AND NEGATIVE)

Introduction

The development of the chrome operations has the potential to impact on the economy both positively through potential growth in the mining sector, and negatively through the potential loss of existing economic activities.

Activities and infrastructure – link to mine phase

Construction	Operation	Decommissioning	Closure
			N/A
Earth works Site management Transport systems Site support services Rehabilitation	Earthworks Site management Transport systems Non-mineralised waste management Site support services Water supply infrastructure Power supply infrastructure Rehabilitation	Demolition Earthworks Site management Transport systems No-mineralised waste management Site support services Water supply infrastructure Power supply infrastructure Rehabilitation	-

Rating of impact

Severity / nature

For this project, the amount of grazing land (127 ha) is small in agricultural terms. The anticipated investment of approximately R138 million and creation of 50 jobs per annum is also relatively small in mining terms. Strategy4Good compared the economic benefits of the proposed project to that of the current cattle grazing activities over the full life of the project. This was achieved as follows (Strategy4Good, 2012):

- comparison of the new mining investment with the potential loss of property values; and
- comparing the present value of the net economic value added by the proposed mining project relative to potentially impacted agricultural production from grazing.

Values for the proposed project and the cattle farming industry were inputted based on macro-economic databases.

The comparison determined the following (Strategy4Good, 2012):

- the proposed projects' net present value exceeds that of the current agricultural activities by R217,3 million (over 40 years for agriculture and 5 years of mining);
- the proposed project is likely to retain 34 more jobs than the current agricultural activities (after multipliers) (over 40 years for agriculture and 5 years of mining).

Duration

The positive economic impacts described above will be limited to the life of the project. After closure there may still be some positive impacts through maintenance and aftercare activities. However, it

should be noted that PPM plans to continue operating well beyond the life of the proposed chrome project, and the overall mine will therefore continue to impact positively on the region and the country as a whole long after the closure of the chrome operations.

Spatial scale

The positive economic impacts will be far-reaching in both the mitigated and unmitigated scenarios for all project phases until closure.

Consequence

The consequence has been rated as high in both the mitigated and unmitigated scenarios for all project phases until closure.

Probability

The probability is considered to be high in both the mitigated and unmitigated scenarios for all project phases until closure.

Significance

The significance has been rated as high in both the mitigated and unmitigated scenarios for all project phases until closure.

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

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation, decommissioning						
Unmitigated	H+	M+	H+	H+	H+	H+
Closure						
Not applicable						

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

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation, decommissioning						
Mitigated	H+	M+	H+	H+	H+	H+
Closure						
Not applicable						

Conceptual description of proposed mitigation measures

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19, Table 49).

Objective

The objective of the mitigation measures is to enhance the positive economic impacts and limit the negative economic impacts. Part of this objective is to enhance the contribution to the local economy in particular.

Actions

The mine will ensure that:

- it (and its contractors) hire local people from the closest communities where possible;
- it extends its formal bursary and skills development programmes to the closest communities to increase the number of local skilled people and thereby increase the potential local employee base;
- it procures local goods and services from the closest communities where possible;
- it implements a procurement mentorship programme which provides support to local business from the enquiry to project delivery stages;
- where farming land is lost to mining, the affected farmer will be provided with alternative suitable land and if this is not feasible alternative compensation will be provided;
- it incorporates economic considerations into its closure planning from the outset;
- that these closure planning considerations cover the skilling of employees for the downscaling, early closure and long term closure scenarios;
- that these closure planning considerations cover the needs for future farming for the downscaling, early closure and long term closure scenarios; and
- it identifies and develops sustainable business opportunities and skills, independent from mining, for members of the local communities to ensure continued economic prosperity beyond the life of mine.

Emergency situations

None identified.

7.2.19 ISSUE: INWARD MIGRATION

Introduction

Mines tend to bring with them an expectation of employment in all project phases prior to closure. This expectation can lead to the influx of job seekers to an area which in turn increases pressure on existing communities, housing, basic service delivery and raises concerns around safety and security. Related to this is the possibility of theft and poaching of wild roaming animals on surrounding farms such as the Pilanesberg National Park and Black Rhino Game Reserve. This section focusses on the potential for inward migration and associated social issues.

Rating of impact

Severity / nature

In the unmitigated scenario, the mine will attract job seekers to the area, which is likely to cause an increase of people moving through the mining right area, pressure on the capacity of existing communities and possibly also the development of informal settlements. This situation can be worsened if the mine does not undertake adequate planning for employee and contractor housing and transport. In general, both increased movement of poor people into an area and informal settlements are associated

with poor standards of living which can promote diseases, crime and a general threat to the safety and security of an area (including poaching). Linked to this influx of people is the potential inability of receiving areas to supply basic services such as water, food, electricity, health, education and sanitation.

It is not possible to predict how significant the inward migration may be, however this impact severity has been rated as high in line with the precautionary approach. With mitigation, measures can be taken to prevent the establishment of informal settlements, to limit the pressure on infrastructure and services, and to promote on-going safety and security of the existing community.

Duration

In the normal course, social impacts associated with the project will occur for the life of the project, but negative social issues associated with inward migration can continue beyond closure of the project, particularly in the unmitigated scenario.

Spatial scale

In both the unmitigated and mitigated scenarios, the impacts of inward migration could extend beyond the project area and into the surrounding communities. This is a medium spatial scale.

Consequence

The consequence has been rated as high in both the unmitigated and mitigated scenarios for all project phases. .

Probability

The probability is considered to be medium as PPM is an existing operation and if this impact were to have occurred it would have done so when the mine started. In addition, the consultation process for this project has provided information regarding employment opportunities for this project, and clearly states that this new chrome project has limited employment opportunities. With mitigation, impacts associated with inward migration are considered to be less likely, but they are unlikely to be eliminated.

Significance

In the unmitigated scenario, the significance of this impact is high. With mitigation this can be mitigated to a medium by reducing the severity and probability.

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

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

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

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

Conceptual description of proposed mitigation measures

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19, Table 50).

Objective

The objective of the mitigation measures is to limit inward migration and related social impacts.

Actions

As the chrome project will be considered and extension of PPM's existing platinum operations, the commitments in the Social and Labour Plan (SLP) will be extended to the chrome operations.

Recruitment and relationship with surrounding communities

PPM will ensure that its recruitment process incorporates the approved social and labour plan (SLP) requirements.

Pressure on existing services (i.e. housing)

The focus of these actions is to prevent the establishment of informal settlements.

PPM will continue to closely monitor the location and living conditions of all its workers during the development and operation of the open pit mine to ensure that everyone is adequately accommodated. Monitoring records will be kept for the life of mine.

It is imperative that there is good recruitment discipline among the company and its contractors, and a strong commitment from authorities to act swiftly at the first sign of an informal settlement. It should also be stressed that these measures must not impede the free movement of labour or infringe on the rights of individuals to look for work. Rather, they must be used to prevent job seekers from illegally occupying land and establishing impromptu informal settlements where no services currently exist.

All contractors and sub-contractors working on behalf of the developer must comply with the recruitment process. If possible, other developers and employers in the immediate area should adhere to the same process. The following additional points must be adhered to in the PPM recruitment process:

- 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

- there will be no worker accommodation at the construction site. All construction workers who are not resident in the vicinity should be accommodated in a secure, access-controlled construction village situated away from the construction site.

Crime and disease

With regards 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, surrounding communities and surrounding landowners and land users.

Disease and particularly HIV/AIDS is not only a problem 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 will be introduced. Voluntary Counselling and Testing (VCT) is a vital aspect to any HIV/AIDS management 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.

Emergency situations

The establishment of any informal settlements in the area is considered an emergency situation that will be handled in accordance with PPM's emergency response procedure.

7.3 DEFINITION OF CRITERIA USED

Both the criteria used to assess the impacts and the method of determining the significance of the impacts is outlined in Table 26. This method complies with the method provided in the EIA guideline document. Part A provides the approach for determining impact consequence (combining severity / nature, spatial scale and duration) and impact significance (the overall rating of the impact). Impact consequence and significance are determined from Part B and C. The interpretation of the impact significance is given in Part D. Unmitigated scenario is considered for each impact.

7.4 PHASES AND TIMEFRAMES OF POTENTIAL IMPACTS

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

TABLE 26: CRITERIA FOR ASSESSING IMPACTS

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

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

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

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

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

8 COMPARATIVE ASSESSMENT OF IDENTIFIED LAND AND DEVELOPMENT ALTERNATIVES

8.1 ALTERNATIVE LAND USES WHICH COULD BE IMPACTED ON

In accordance with the current land use in the vicinity of the proposed project site, the sites proposed for the chrome project could, as an alternative to the project, be used as a waste disposal facility for the existing platinum mining operations or cattle grazing.

The proposed chrome project area is located within the proposed Heritage Park. In the mitigated scenario it is unlikely that the proposed chrome project will impact on the proposed Heritage Park for the following reasons:

- the limited life of the chrome project;
- all surface infrastructure will be removed, with the exception of the waste rock dump which will remain in perpetuity, and open pits will be backfilled; and
- all disturbed areas will be rehabilitated.

8.2 RESULTS OF SPECIALIST COMPARATIVE LAND USE ASSESSMENT

Regulation 50 of the Mineral and Petroleum Resources Development Act, 28 of 2002 (MPRDA) has two distinct components, the first being a straight analysis of the economic value of land between a mining project and the alternative land-use, and the second being an opinion on the sustainable development quality of the project relative to the alternative land-use. The latter requires the integration of all the social, environmental and economic impacts of the project on a cost-benefit basis. The specialist reports are attached in Appendix L.

The specialist comparative land use assessment concludes that the proposed chrome project is positive from a sustainability perspective. The socio-economic valued added by the chrome project exceeds the opportunity costs of the current land-use that would be lost. In addition, the socio-economic benefits outweigh the potential environmental risks (in the mitigated scenario) and for this reason the project is also acceptable on an integrated sustainable development basis.

9 LIST OF SIGNIFICANT IMPACTS

A list of significant impacts as identified in the assessment conducted in Section 7 is provided below.

TABLE 27: SIGNIFICANT IMPACTS AND SIGNIFICANT RATINGS

Impact	Significance	
	Unmitigated	**Mitigated**
Loss and/or sterilisation of mineral resources	L	L
Hazardous excavations/structures/surface subsidence	H	M
Loss of soil resources and land capability through land contamination	H	L
Loss of soil resources and land capability through physical disturbance	H	L
Physical destruction of biodiversity	H	M
General disturbance of biodiversity	H	M –construction to decommissioning L - closure
Contamination of surface water	H	L
Alteration of drainage patterns	L	L
Groundwater contamination	H	L
Dewatering	L	L
Air pollution	H	M – all phases except closure
Noise pollution	M-H – all phases except closure	M – all phases except closure
Negative visual impacts	H	M-H – construction to decommissioning L - closure
Destruction and disturbance of heritage (including cultural) and paleontological resources	M	L
Loss of current and future land uses	H	L
Obstruction of the Heritage Park	H	L
Blasting hazards	H	L
Project-related road use and traffic	H	M
Economic impact (positive impact)	H+	H+
Inward migration	H	M

10 STAKEHOLDER ENGAGEMENT PROCESS

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

10.1 IDENTIFICATION OF INTERESTED AND AFFECTED PARTIES

The stakeholder engagement process commenced with a stakeholder analysis that was aimed at identifying parties to be involved during the environmental assessment process and associated communication structures. This was done through a deeds search of the relevant properties within the project site and immediately adjacent portions of land, social scans including site visits in the surrounding areas, networking and direct discussions with IAPs. Key stakeholders identified for the project include:

- **IAPs:**
  - landowners, land occupiers and communities on and surrounding the project areas;
  - tribal authorities/communities;
  - mines and industries in the area;
  - non-government organisations and associations;
  - Pilanesberg National Park, including Black Rhino Game Reserve;
- **Regulatory authorities:**
  - Department of Economic Development, Environment, Conservation and Tourism (DEDECT);
  - Department of Environment Affairs (DEA);
  - Department of Mineral Resources (DMR);
  - Department of Water Affairs (DWA);
  - South Africa Heritage Resource Agency (SAHRA);
  - Department of Agriculture, Fisheries and Forestry (DAFF);
  - Department of Rural Development and Land Reform (DRDLR) (previously known as the Department of Land Affairs);
  - North West Parks and Tourism Board (NWPTB);
  - North West Department of Roads and Public Works (NWDRPW);
  - Department of Health;
- **Local authorities:**
  - Bojanala Platinum District Municipality (BPDM), Moses Kotane Local Municipality (MKLM) and relevant ward councillors.

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

10.2 DETAILS OF ENGAGEMENT PROCESS

Stakeholder engagement is an integral component of any development process. The goal of stakeholder engagement is to facilitate and improve communication between stakeholders (including the applicant) in the interest of facilitating better decision-making and more sustainable development (DEAT, 2002). In accordance with the requirement of Chapter 6 of the EIA Regulations, 2006, a stakeholder engagement programme has been developed to set out a coordinated process through which IAPs are informed of the proposed development and environmental assessment process and provided with an opportunity to provide input into the project plan and proposed mitigation measures. By consulting with authorities and IAPs, the range of environmental issues to be considered in the EIA has been given specific context and focus. Included below is an outline of the process followed, and the people engaged. Refer to Section 10.3 for a list of issues that were identified during the engagement process.

10.2.1 STEPS IN THE PUBLIC PARTICIPATION PROCESS

Steps in the process that have been conducted to date are set out in Table 28 below.

TABLE 28: PARTICIPATION PROCESS WITH IAPS AND AUTHORITIES

Task	Description	Date
Notification - regulatory authorities and IAPs		
Application to DMR, DEDECT and DEA	Formal applications were submitted to the relevant departments.	February 2010
Consultation with land claims commissioner	The land claims commissioner was consulted in order to verify if any land claims had been lodged on any of the proposed farms. Refer to Appendix B for a copy of the response received from the land claims commissioner.	February 2012
Social scan	A social scan of the project area was conducted by SLR. The purpose of the social scans was: • to identify relevant municipal ward councillors, landowners, land occupiers, and other interested and affected parties; • to obtain contact details for IAPs; • to identify appropriate communication structures; and • inform IAPs of the project, upcoming public process and associated scoping and EIA/EMP processes. As part of the social scan, notification and information-sharing took place through informal discussions, focussed meetings and/or telephonic discussions. A record of discussions and minutes of meetings are included in Appendix C. Issues raised are included in the comments and response report in Appendix D. One output of the social scan is an IAP database (Appendix A).	April - May 2010

Task	Description	Date
Distribution of background information document (BID)	A background information document (BID) was compiled by SLR for information-sharing purposes. The purpose of the BID was to inform IAPs and authorities about the project, the environmental assessment process, possible environmental impacts and means of inputting into the environmental assessment process. Attached to the BID was a registration and response form, which provided IAPs with an opportunity to submit their names, contact details and comments on the project. BIDs were distributed to IAPs by email, post and fax using contact details obtained during the social scan, at the scoping meetings and by fax and/or e-mail to authorities on the project's public involvement database. A copy of the BID in English and Setswana is attached in Appendix C.	May 2010
Site notices	Laminated A2 site notices in English and Setswana were placed at key conspicuous positions in and around the project site, including: Motlhabe Community Shop; Isilahgopo General Dealer (Motlhabe); Motlhabe Community Hall; Moagi Supermarket (Ntsana le Metsing); Kutlwanong General Dealer (Ngweding); Unice's Tuck Shop (Ngweding); Molatlhegi Butchery (Lesetlheng); Refilwe Cafe (Legkraal). Copies of the site notices are included in Appendix C together with photos of where the site notices were placed.	May 2010
Newspaper advertisements	Block advertisements were placed in one national (The Daily Sun) and one local newspaper (Rustenburg Herald) on 21 May 2010. Copies of the advertisements are included in Appendix C.	May 2010
Scoping stage meetings and comments received		
Focussed stakeholder scoping meetings	Focussed stakeholder scoping meetings were held with stakeholder groups through the planned stakeholder engagement programme and/or requests received from IAPs. The purpose of these focussed meetings was to identify and understand the stakeholder groups and to understand and agree communication structures to be used for the process. In addition to this, the purpose of the meetings was also to provide IAPs with an outline of the project and environmental assessment process, identify potential issues to be investigated further, provide input into the terms of reference for specialist studies and agree on the way forward. These groups included the Pilanesberg National Park and Black Rhino Game Reserve. Minutes of the meetings are included in Appendix C. Issues raised are included in the comments and response report in Appendix D.	August and October 2010
Public scoping meetings	Two public scoping meetings were held in Legkraal and Motlhabe respectively. The meetings were held in English and Setswana. The purpose of the meetings was to provide IAPs with an outline of the project and environmental assessment process, identify potential issues to be investigated further, provide input into the terms of reference for specialist studies and agree on the way forward. Minutes of the meetings are included in Appendix C. Issues raised are included in the comments and response report in Appendix D.	June 2010
Regulatory authority scoping meeting	A regulatory authorities scoping meeting, including site visit, was held on 22 June 2010. The purpose of the meeting was similar to that of the public scoping meetings, that is, to provide regulatory authorities with an outline of the project and environmental assessment process, identify potential issues to be investigated further, provide input into the terms of reference for specialist studies and agree on the way forward. Minutes of the meeting are included in Appendix B. Issues raised are included in the comments and response report in Appendix D.	June 2010

Task	Description	Date
Written comments	Written comments were received by SLR during the scoping process. Copies of the comments are included in Appendix C and a summary is included in the comments and response report in Appendix D.	May – September 2010
Distribution of draft scoping report for review		
Authority review of draft scoping report	The following authorities were involved in the review process: DMR, DEDECT, DEA, DWA, SAHRA, NDA, DRDLR, NWPTB, NWDRPW, Bojanala Platinum District Municipality and Moses Kotane Local Municipality.	July 2010
Public review of scoping report	Copies of the scoping report and summary were made available for public review at BBKTA offices in Saulspoort, community forums of Ngweding, Motlhabe, Ntsana-le-Metsing, Legkraal, Moses Kotane Municipal Offices in Saulspoort, Black Rhino Game Reserve, Rustenburg Library and at SLR's offices in Fourways, Johannesburg.	August - September 2010
Scoping stage meetings held following the distribution of the report		
DEDECT site visit	At the request of the Department, a site visit was undertaken on 4 February 2011. Minutes of the meeting are included in Appendix B.	
Written comments	Written comments were received by SLR following the review of the scoping report. Copies of the comments are included in Appendix C, and a summary is included in the comments and response report in Appendix D.	August - September 2010
Distribution of final scoping report for review		
Authority review of final scoping report	The scoping report was submitted to the DMR, DEDECT and DEA for review and consideration.	September 2010
Delay in the environmental process		
Updating - regulatory authorities and IAPs		
Distribution of newsletter	A newsletter updating IAPs on the delay in the environmental assessment process was distributed by SLR via post and email to all parties registered on the project's public involvement database. A copy of the newsletter is attached in Appendix C.	September 2011

10.2.2 SPECIALIST TEAM

Upon input from IAPs on the potential impacts that may arise as a result of the proposed development, several specialists (see Table 5 for a complete list of all appointed specialist, their roles and responsibilities) were appointed to assess the potential impact of the proposed development. Details are provided in the specialist reports included as appendices.

10.2.3 REVIEW OF EIA AND EMP BY REGULATORY AUTHORITIES

Six copies of the draft EIA and EMP report were submitted to the DMR for review on 5 July 2012.

Following public review, five copies of the final EIA and EMP report (including IAP comments) will be forwarded by SLR to DEDECT in line with NEMA.

Once the DMR and DEDECT have issued their respective records of decisions, the IAPs will be notified by e-mail and post in accordance with the instructions from the respective departments.

10.2.4 REVIEW OF THE EIA AND EMP BY IAPS

Copies of the draft EIA and EMP report will be made available for public review at the following places:

- Bakgatla-Ba-Kgafela Traditional Council offices in Saulspoort;
- Moses Kotane Municipal Offices in Saulspoort;
- Ngweding community forum;
- Motlhabe community forum;
- Ntsana-le-Metsing community forum;
- Legkraal community forum;
- Rustenburg Library;
- Black Rhino Game Reserve;
- Pilanesberg National Park;
- SLR's offices in Fourways, Johannesburg.

Electronic copies of the report will be made available to IAPs on request (electronically on CD).

IAPS will be notified when the reports are available for public review via a newsletter (post or email) and sms.

All comments received from IAPs during the review period will be forwarded to the DMR and included with the final report that is submitted to DEDECT.

10.2.5 FEEDBACK OPEN DAYS

Two feedback meetings have been arranged, one in Motlhabe and one in Legkraal. The purpose of these is to provide IAPs with:

- an opportunity to discuss the outcomes of the EIA process
- a chance to submit comments on the EIA and EMP report.

The details of the feedback meetings have been distributed to IAPs together with a summary of the EIA and EMP report.

10.3 MANNER IN WHICH ISSUES RAISED WERE ADDRESSED

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

11 ADEQUACY OF PREDICTIVE METHODS AND ASSUMPTIONS, AND UNCERTAINTIES

This section identifies knowledge gaps and reports on the adequacy of predictive methods, underlying assumptions and uncertainties encountered in the compilation of specialist reports and this EIA and EMP report. Information is based on the specialist reports and findings of the SLR EIA team.

11.1 ENVIRONMENTAL ASSESSMENT LIMIT

The assessment focussed 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 will adhere to these.

11.2 TECHNICAL PROJECT INFORMATION

The EIA is being completed prior to the completion of a feasibility study. The level of detail for the technical information was therefore limited. Any significant changes to the project description will, however, require potential revision of this EIA/EMP report.

11.3 SPECIALIST STUDIES

Soils and land capability study

Limitations to the accuracy of the pedological mapping (as recognised within the pedological industry) are accepted at between 50% (reconnaissance mapping) and 80% (detailed mapping), while the degree of certainty for the soils physical and chemical (analytical data) results are based on “composite” samples taken from the dominant soil types mapped in the study area.

No specific study was undertaken for the proposed project. However, ISWC conducted a study over the entire PPM mining right area (which includes the proposed chrome project area). Information was abstracted from this report relevant to the current project area. The reconnaissance pedological study was carried out on a fixed grid of 250 x 250 m.

Biodiversity

The limited time available to conduct field investigations and the instinctive nature of many faunal species to avoid human encounters makes it difficult to conduct a complete census of faunal species within a specific habitat. Surveying faunal diversity over a short time period has severe limitations; nevertheless sampling within different habitats under such restriction does provide data of sufficient quality to assess the relative sensitivities of habitats in a manner that can be used to predict impacts.

Although the sampling was conducted during the peak of summer season, it must be noted that the absence of species on site does not conclude that the species is not present at the site. Reasons for not finding certain species may be due to:

- sampling season: although summer field assessments are the best times to determine regular bat activity, some species of bats, e.g. Natal long-fingered bat (*Miniopterus natalensis*) and Temminck's myotis (*Myotis tricolor*) conduct seasonal migrations. Hence, their potential absence during one particular sampling run, cannot conclude they do not utilise a site;
- the inconspicuous nature of the species; and
- low level of species presence.

Echolocation operates over ranges of metres so any monitoring based on echolocation, samples only a few metres of space, depending on the type and intensity of the call. One must therefore, be cautious when extrapolating data from echolocation surveys over large areas. The accuracy of the species assignation is also very dependent on the quality of the calls one uses and any assignation should be confirmed with capture data.

In addition, NSS was reliant on the findings of the previous NSS biodiversity assessment and knowledge of the PPM mine and environmental managers for finding old adits that may be potentially impacted. No co-ordinates or maps of known adits were supplied to NSS. Added to that, the development boundaries changed between the January 2011 field assessment and the current June 2012 NSS report revision. Therefore, it is recommended that NSS go out again towards the end of 2012 in spring to assess any potential adits within the most recent boundaries on the PPM property.

Hydrology

Data used in determining the surface water characteristics include climatic data and topographical data. Rainfall and evaporation data for the site was considered from various sources including weather stations managed by the South African Weather Services (SAWS) and the Department of Water Affairs.

The 24-hour rainfall depths for various return periods were calculated from one day rainfall results obtained from Water Research Commission (WRC) software developed in 2001 which has a database of rainfall stations records up to the year 2000.

Assumptions are based on inputs into flood hydrology modelling being as representative as possible. Where uncertainties are prevalent, a degree of conservatism was used.

Groundwater

No specialist groundwater study was carried out for this project. AGES provided a professional opinion with regards to the potential for dewatering as a result of the chrome operations. These assumptions are based on human effort and as such are subject to human error.

Air

The most important assumptions and limitations of the air quality impact assessment are summarised as follows:

- the quantification of existing sources of emissions is restricted to the PPM operations. Although other sources were identified in the region, air emissions form the sources were not included due to a lack of readily available information. Quantification of these sources was beyond the scope of the current study.
- information required for calculating emissions from fugitive dust sources for the proposed mining operations were provided by PPM personnel. The assumption was made that this information is correct. This information was used together with internationally recognised emission factors.
- only routine emissions from the mining operations were modelled. Atmospheric releases occurring as a result of accidents were not accounted for.
- a minimum of one year, and typically three to five years of meteorological data are generally recommended for use in atmospheric dispersion modelling for air quality impact assessment purposes. Three years of meteorological data were used in the atmospheric dispersion modelling. The simulations are therefore considered to be a representative sample.

Noise

Although no specialist noise assessment was conducted for this project, information from the 2006 study was used in the compilation of this report. No monitoring data is available to determine the current baseline ambient noise levels and therefore the pre-mining baseline noise levels have been used. The 2006 noise study assessed the noise impacts from all of PPM's approved platinum pits, namely the pits on the farms Tuschenkomst 136 JP (existing), Witkleifontein 136 JP (yet to be developed), Rooderand 46 JQ (yet to be developed), and Ruighoek 169 JP (yet to be developed). The proposed chrome development is located between the Tuschenkomst and Rooderand pits (Figure 2) and it is therefore assumed that the proposed project would not significantly change the outcome of the 2006 noise study.

It should be cautioned that predicted noise levels and contours are not to be taken as absolute as predicted levels are valid for the assumptions made in respect of meteorological and other conditions.

Since meteorological conditions in particular are highly variable, levels produced at a distance by a source at a constant acoustic output will vary considerably, even during the course of a single day-time or

night-time period. Variance in noise level due to changes in atmospheric conditions increases with distance from the source.

Visual

No specialist visual assessment was conducted for this project.

Economic

The following relating to the cost-benefit analysis was assumed:

- the mining project being evaluated is economically viable
- all the financial information provided to the specialist is correct
- the study is limited in its scope as it uses "inferred economic data", which is limited to desktop research, telephonic interviews and relied on independent information from the environmental assessment team.

A specialist comparative land use assessment was not undertaken for the proposed project. The assessment was conducted by SLR, and was based on experience with similar projects.

Blasting

No specialist blasting assessment was conducted for this project.

Traffic

No specialist traffic assessment was conducted for this project.

Heritage and cultural aspects

Heritage and cultural

It is possible that some heritage and cultural resources have not been discovered and/or recorded. If any new heritage and cultural resources are exposed PPM's chance find procedure will be implemented.

Palaeontological

The methods used and assumptions made are considered adequate for this study area as most of the rocks of the area are Precambrian in age and thus have almost no chance of delivering fossils.

Socio-economic

No specialist socio-economic study was conducted for this project. Data from the mine's approved EIA/EMP report, which was obtained from the 2001 Census, was used.

Geochemistry

No waste rock is yet available from the proposed chrome operations. Geochemical tests have been conducted for similar projects with the same geology that are located in the Bushveld Igneous Complex. The results of these tests have been extrapolated and applied to the chrome project. Based on the uniform lithologies of the Bushveld Igneous Complex underlying the site and mineralised horizons mined, the samples are considered representative of the waste rock that will be generated by the proposed chrome project. A critical success factor for any geochemical characterisation program is the selection of representative samples considering material type (e.g. lithology), spatial (e.g. vertical and horizontal area to be mined) and compositional (e.g. all material types based on sulphur content) representation as well as sample storage and handling (e.g. fresh or weathered samples). Additional testing should therefore be conducted once the actual samples are available.

Closure cost calculations

The closure cost calculations are based on the technical information and site layout as provided by the technical project team, and are assumed accurate at the time of compiling this report.

12 ARRANGEMENTS FOR MONITORING AND MANAGEMENT OF IMPACTS

This section describes the arrangements for monitoring and management of environmental impacts. It identifies the impacts that require monitoring programmes and outlines the functional requirements, roles and responsibilities and timeframes for the monitoring programmes. Further detail on each monitoring programme is included in Section 21.

12.1 IMPACTS THAT REQUIRE MONITORING PROGRAMMES

Impacts that require monitoring include:

- hazardous excavations and structures;
- physical destruction and general disturbance of biodiversity;
- dewatering impacts on third party users;
- contamination of groundwater;
- contamination of surface water
- increase in dust;
- increase in disturbing noise levels; and
- blasting hazards.

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

12.2 FUNCTIONAL REQUIREMENTS OF MONITORING PROGRAMMES

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

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

- a formal procedure;
- appropriately calibrated equipment;
- where samples require analysis they will be preserved according to laboratory specifications;
- an accredited, independent, commercial laboratory will undertake sample analyses;
- parameters to be monitored will be identified in consultation with a specialist in the field and/or the relevant authority;
- if necessary, following the initial monitoring results, certain parameters may be removed from the monitoring programme in consultation with a specialist and/or the relevant authority;
- monitoring data will be stored in a structured database;

- data will be interpreted and reports on trends in the data will be compiled by an appropriately qualified person on a quarterly basis; and
- both the data and the reports will be kept on record for the life of mine.

12.3 ROLES AND RESPONSIBILITIES

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

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

12.4 TIMEFRAMES FOR MONITORING AND REPORTING

The timeframes for monitoring and reporting thereof are detailed in the monitoring programme (see Section 21). A summary is provided below:

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

13 TECHNICAL SUPPORTING INFORMATION

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

- stakeholder database (Appendix A);
- information-sharing with regulatory authorities (Appendix B);
- information-sharing with IAPs (Appendix C);
- comments and response report (Appendix D);
- soil and land capability specialist report (Appendix E);
- biodiversity specialist report (Appendix F);
- hydrological specialist report (Appendix G);
- water balance specialist report (Appendix H)
- air quality specialist report (Appendix I);
- noise assessment (Appendix J);
- heritage (including cultural) and palaeontological specialist reports (Appendix K);
- economic specialist report (Appendix L);
- preliminary design report for the waste rock dumps (Appendix M); and
- closure cost calculation specialist study (Appendix N).

SECTION 2 – ENVIRONMENTAL MANAGEMENT PROGRAMME

It should be noted that this section addresses the existing PPM operations as well as the proposed project, i.e. a consolidated operation.

14 ENVIRONMENTAL OBJECTIVES AND SPECIFIC GOALS FOR CLOSURE

14.1 ENVIRONMENTAL ASPECTS THAT DESCRIBE THE PRE-MINING ENVIRONMENT

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

- relatively flat topography;
- pre-mining soils that have the ability to support arable land capability (with good water management), low intensity grazing and wilderness potential;
- a functioning ecosystem;
- non-perennial drainage patterns;
- moderate to good groundwater quality;
- stable water table providing groundwater as a water supply source;
- existing mining operations in close proximity (Section 1.3.1);
- existing tourism and conservation/hospitality operations in close proximity (Section 1.3.1);
- quiet rural environment.

14.2 MEASURES REQUIRED FOR CONTAINMENT OR REMEDIATION

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

- implement a waste management procedure for general and hazardous waste on site;
- ensure immediate clean-up of any spills as per the emergency response procedures;
- establish and maintain dirty stormwater control measures in line with regulatory requirements, until such time as potentially polluting areas are rehabilitated
- contain pollutants at source by storing and handling potentially polluting substances on impermeable substrates, within bunded areas and with the capacity to contain spills;
- design, construct and operate the waste dumps with runoff control measures;
- control dust emissions through the implementation of the air quality management plan; and
- rehabilitate the site in line with a detailed closure plan to be developed prior to decommissioning.

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

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

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

15.1 IMPACTS THAT REQUIRE MONITORING PROGRAMMES

Impacts that require monitoring include:

- hazardous excavations and structures;
- physical destruction and general disturbance of biodiversity;
- pollution of surface water resources;
- contamination of groundwater;
- increase in air pollution;
- increase in noise levels;
- blasting hazards; and
- heritage aspects.

15.2 SOURCE ACTIVITIES

The source activities of potential impacts which require management are detailed in Section 2.3 and listed below.

- Earthworks
- Waste rock management
- Water supply and use
- Power supply and use
- Stormwater management
- Non-mineralised waste management
- Site support services and amenities
- Site management
- Rehabilitation
- Site preparation
- Civil works
- Open pit mining
- Mineral processing operations
- Process water management
- Transport systems
- Storage and maintenance services/ facilities
- Demolition
- Maintenance and aftercare

15.3 MANAGEMENT ACTIVITIES

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

15.4 ROLES AND RESPONSIBILITIES

The existing management team at PPM will oversee the proposed chrome mining operations. The key personnel to ensure compliance with this EMP report will be the operations executive, the environmental manager and the stakeholder development manager. As a minimum, these roles as they relate to the implementation of monitoring programmes and management activities will include:

- environmental site manager:
  - ensure that the monitoring programmes and audits are scoped and included in the annual mine budget;
  - identify and appoint appropriately qualified specialists/engineers to undertake the programmes;
  - appoint specialists in a timeously manner to ensure work can be carried out to acceptable standards;
- stakeholder engagement department:
  - manage labour-related aspects for the mine;
  - liaise with the relevant structures in terms of the commitments in the SLP;
  - ensure that commitments in the SLP are developed and implemented in a timeously fashion;
  - establish and maintain good working relations with surrounding communities and landowners;
  - facilitate stakeholder communication and information-sharing mechanisms (quarterly stakeholder meetings will be held as a minimum); and
  - facilitate grievance mechanisms.

16 ENVIRONMENTAL OBJECTIVES AND SPECIFIC GOALS FOR SOCIO-ECONOMIC CONDITIONS

16.1 ASPECTS OF THE SOCIO-ECONOMIC CONDITIONS

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

16.2 OBJECTIVES AND GOALS

Specific environmental objectives and goals to control, remedy or stop potential impacts emanating from the chrome mine which may impact on communities and IAPs identified in the social and labour plan are described below. The information is presented in tabular format (Table 29).

TABLE 29: ENVIRONMENTAL OBJECTIVES AND GOALS – SOCIO-ECONOMIC CONDITIONS

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

17 ENVIRONMENTAL OBJECTIVES AND SPECIFIC GOALS FOR HISTORICAL AND CULTURAL ASPECTS

Environmental objectives and goals in respect of historical and cultural aspects are listed in the table below (Table 30).

TABLE 30: ENVIRONMENTAL OBJECTIVES AND GOALS – HISTORICAL AND CULTURAL ASPECTS

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

18 APPROPRIATE TECHNICAL AND MANAGEMENT OPTIONS

18.1 PROJECT ACTIONS, ACTIVITIES AND PROCESSES

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

18.2 TECHNICAL AND MANAGEMENT OPTIONS

Appropriate technical and management options chosen to modify, remedy, control or stop any action, activity or process associated with the project which will cause significant impacts on the environment, socio-economic conditions and historical and cultural aspects are listed in the table below (Table 31). In addition to these, the mine will implement an environmental management system to assist in the implementing and monitoring of commitments included in this EIA and EMP report.

TABLE 31: TECHNICAL AND MANAGEMENT OPTIONS

Potential impact	Technical and management options
Mineral sterilisation	Mine workings will be developed and designed taking cognisance of potential ore reserves Extraction of all possible minerals prior to final disposal
Hazardous structures	Establish and maintain site security measures Control site and facility access Backfill open pits Appropriate design of stockpiles with the potential to fail (and by qualified person) Implement monitoring programme Implement an emergency response
Loss of soil resources and land capability through pollution	Implement hazardous waste, dirty water and mineralised and non-mineralised waste management procedures Permanent infrastructure designs to take long-term soil prevention, land function and confirmatory monitoring into account
Loss of soil resources and land capability through physical disturbance	Implementation of a soil management plan Limit disturbance of soil to what is necessary Stripping, storing, maintenance and replacement of topsoil in accordance with soil management procedures
Physical destruction of biodiversity	Implement a biodiversity management plan Restrict project footprint Provide alternative habitat (where appropriate and necessary) Implement a monitoring programme Rehabilitate disturbed areas
General disturbance of biodiversity	Prevention of the killing of animal species and harvesting of plant species Implementation of dust control measures Pollution prevention measures (water, soil etc) Prevention of the disturbance of ecosystems
Alternation of drainage patterns	Avoid alteration of watercourses as far as practically possible Implement and maintain stormwater controls that meet regulatory requirements Authorise all water uses as defined in the NWA Compliance with relevant licence requirements

Potential impact	Technical and management options
Surface water pollution	Appropriate design of polluting facilities and pollution prevention facilities (by qualified person) Implement and maintain stormwater controls that meet regulatory requirements Implement site-specific soil management plan Implement a monitoring programme (water use, process water quality, rainfall-related discharge quality) Implement emergency response Authorise all water uses as defined in the NWA Compliance with relevant licence requirements
Groundwater contamination	Appropriate design of polluting facilities (by qualified person) Correct handling of hazardous wastes, mineralised and non-mineralised wastes Compensation for loss Implementation of a monitoring programme Implement emergency response Authorise all water uses as defined in the NWA Compliance with relevant license requirements
Dewatering	Compensation for loss Implementation of a monitoring programme Authorise all water uses as defined in the NWA Compliance with relevant license requirements
Air pollution	Implementation of air quality management plan Implementation of an air quality monitoring plan Control dust plumes Implementation of an air complaints procedure Maintenance of abatement equipment Implement an emergency response
Noise pollution	Maintenance of equipment and machinery in good working order Equip machinery with silencers Construction of noise attenuation measures Implementation of noise monitoring programme Implementation of a noise complaints procedure Reducing operational hours Blast when conditions are more favourable Educate workers
Visual impacts	Limit the clearing of vegetation Limit the emissions of visual dust plumes Use of screening berms Concurrent rehabilitation Painting infrastructure to compliment the surrounding environment Implementation of a closure plan Management through care and aftercare
Blast hazards	Implementation of a blast management plan Conduct pre-blast crack survey Communication of planned blast times with stakeholders Pre-blast warning Monitor blasts Audit and review to adjust blast design where necessary Rectify damage to third party structures Implementation of a blast complaints procedure Implement an emergency response

Potential impact	Technical and management options
Traffic increases	Implementation of a traffic safety programme Implement speed allaying measures where appropriate, e.g. speed humps where necessary Education and awareness training of workers Enforce strict speed limits on mine access roads Ensure dust is effectively controlled on unpaved roads so as not to reduce visibility Placement of signage to create awareness Maintenance of the transport systems Implementation of traffic complaints procedure Implement an emergency response
Heritage (and cultural)	Limit project infrastructure, activities and related disturbances as far as practically possible Avoid heritage and cultural resources as far as practically possible Apply for the relevant permits to remove or destroy heritage sites (if applicable) Exhumation and relocation of graves according to legal requirements (if applicable) Mark remaining heritage sites on plan Inspect sites for encroachment and/or damage Education and awareness training of workers Implement emergency response with respect to the chance find procedure for heritage, cultural and paleontological resources
Economic impact	Hire people from closest communities as far as practically possible Extend the formal bursary and skills development to closest communities Implement a procurement mentorship programme Local procurement of goods and services as far as practically possible Compensation for loss of land use Closure planning will consider skills, economic consideration and the needs of future farming
Inward migration	Good communication in terms of recruitment, procurement and training Number of temporary and permanent new job opportunities and procurement will be made public Employment and procurement opportunities provided to closest communities as far as practically possible No recruitment at the mine Notify unsuccessful job seekers Encourage formal housing of employees and implement contractual requirement for contractors to ensure formal housing for workers, both temporary and permanent Maintain a skills profile for the nearest communities Monitor and prevent the development of informal settlements through the interaction with neighbours, local authorities and law enforcement officials Implement a health policy oh HIV/AIDS and tuberculosis to promote awareness and training Implement an emergency response
Land uses	Implementation of EMP commitments that focus on environmental and social impacts Take necessary steps to prevent negative impact on surrounding land Compensation for loss Closure planning to incorporate measures to achieve future land use plans

19 ACTION PLANS TO ACHIEVE OBJECTIVES AND GOALS

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

The significance ratings (for both the mitigated and unmitigated scenarios) included in the action plan tables below refer to the assessment of impacts in this EIA report, i.e. the proposed chrome operations at PPM.

TABLE 32: ACTION PLAN – LOSS AND STERILISATION OF MINERAL RESOURCES

Phase of operation	Activities (see Table 14)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Earth works Civil works	L	L	• Incorporate cross discipline planning structures for all new mining and infrastructure developments	At start	Once off	Mine resource manager
Operation	Civil works Tailings dam Open pit mining Mineralised waste dumps Flooding the Tuschenkomst pit and storing water	L	L	• Extraction of mineral resources prior to final disposal • Mine workings will be developed and designed so as not to limit the potential to exploit deeper minerals • Discussions will continue to be held between PPM and Batlhako once the location of the relevant MG chromite seams in the southern project area (Ruighoek pit) has been established. If necessary, PPM will reposition the temporary stockpiles to provide Batlhako with the necessary access.	On-going At start On-going	On-going Once off On-going	Mine resource manager Mine resource manager Mine resource manager
Decommission	Waste rock management Rehabilitation Process water management	L	L	• PPM will seek compensation from Sedibelo (with regards to the Tuschenkomst pit extension)	On-going	As required	PPM management
Closure	Maintenance and aftercare of rehabilitated areas	L	L				

TABLE 33: ACTION PLAN – HAZARDOUS STRUCTURES / EXCAVATIONS / SURFACE SUBSIDENCE

Phase of operation	Activities (see Table 14)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Earthworks Civil works	H	M	• All existing and proposed mineralised waste facilities and water dams will be designed and constructed in a manner to ensure stability related safety risks to third parties and animals are addressed. It will furthermore be monitored according to a schedule that is deemed relevant to the type of facility by a professional engineer.	On-going	On-going	Professional engineer
Operation	Earthworks Civil works Open pit mining Waste rock dumps Mineral processing Tailings dam Water supply and storage infrastructure Power supply infrastructure Transport infrastructure Rehabilitation	H	M	• Erection of fencing, berms, barriers and/or placement of security personnel to prevent unauthorised access related to all aspects of proposed and current projects (both on and off mine property).	As required	Once-off	Environmental site manager
				• Educate third parties about potential risks.	As required	As required	Environmental site manager
				• Placement of warning signs in English, Afrikaans and Setswana at appropriate intervals on barriers at all hazardous excavations and structures. Warning pictures can be used as an alternative.	On-going	As required	Environmental site manager
				• Design, construct and operation waste rock dumps in line with stockpile management plan which requires a side slope of 1V:3H (overall slope)	As required	As required	Environmental site manager
Decommission	Earthworks Civil works Demolition Rehabilitation	H	M	• The final partially backfilled and flooded Tuschenkomst pit wall slope designs will ensure safe entry to and exit from the pit for both people and animals and storm water berms must not become obstacles to movement up and down the side slopes	As required	As required	Environmental site manager
				• A safety zone of 350 m from the pit edge will be established and mapped indicating a restricted area around the Tuschenkomst pit (including the expansion zone) to prevent structures, people or animals reaching this zone.	As required	As required	Environmental site manager
				• During decommissioning planning of any part of the mine, provision will be made to address long term safety risks in the decommissioning and rehabilitation phases.	As required	As required	Environmental site manager
				• In case of injury or death due to hazardous excavations, follow emergency response procedure in Section 20 will be followed. PPM will also consider appropriate compensation case by case.	As required	As required	Environmental site manager
Closure	Maintenance and aftercare of final land forms and rehabilitated areas	H	M	• At closure of any part of the mine, the hazardous infrastructure will either have been removed or decommissioned and rehabilitated in a manner that it does not present a long term safety and/or stability risk.	As required	As required	Environmental site manager
				• At closure of any part of the mine the hazardous excavations and subsidence will have been dealt with as follows: o all pits will have been backfilled and rehabilitated, with the exception of the Tuschenkomst platinum pit (which will be partially backfilled and flooded) and the chrome pits on Tuschenkomst 136 JP as this is demarcated as a mineralised waste facility; o the potential for surface subsidence will have been addressed by providing a bulking factor for backfilled pits;	As required	As required	Environmental site manager

Phase of operation	Activities (see Table 14)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				○ final replacement of topsoil onto the backfilled overburden/waste rock material should be done with the understanding that if surface subsidence occurs thereafter, re stripping of topsoil and additional backfilling with overburden/waste rock will be required. Thereafter topsoil will have to be replaced. ○ Specific backfilling and compaction techniques, in consultation with an appropriately qualified civil engineer, will be used to prevent subsidence for the re-establishment of the temporary Wilgespruit and the P50-1 road diversions. ○ monitoring and maintenance will take place to observe whether the relevant long term safety objectives have been achieved and to identify the need for additional intervention where the objectives have not been met.			
				• Repair and maintain security measures at the partially backfilled and flooded Tuschenkomst pit.	6 years	As required	Environmental site manage
				• Repair and maintain partially backfilled and flooded Tuschenkomst pit berm wall.	6 years	As required	Environmental site manage
				• Manage and monitor the safety zone above the eastern high wall of the partially backfilled and flooded Tuschenkomst pit.	6 years	As required	Environmental site manage
				• In case of injury or death due to hazardous excavations, the emergency response procedure in Section 20 will be followed. PPM will also consider appropriate compensation on a case by case basis.	As required	As required	Environmental site manager

TABLE 34: ACTION PLAN – LOSS OF SOIL RESOURCES AND LAND CAPABILITY THROUGH CONTAMINATION

Phase of operation	Activities (see Table 14)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Earthworks Civil works Site management Transport system Non-mineralised waste management Site support services Rehabilitation	H	L	• PPM will ensure that waste management practices as set in Table 21 are implemented. • PPM will implement the soil conservation procedure as set out in Table 22. • In the construction, operation and decommissioning phases the mine will ensure that all hazardous chemicals (new and used), dirty water, mineralised wastes and non-mineralised wastes are transported, handled and stored in a manner that they do not pollute soils. This will be implemented through a procedure(s) covering the following: o pollution prevention through basic infrastructure design; o pollution prevention through maintenance of equipment that can spill polluting substances; o pollution prevention through education and training of workers (permanent and temporary); o pollution prevention through appropriate management of hazardous materials and wastes; o adequate sanitation facilities, such as chemical toilets, will be installed and maintained where necessary (including throughout the life of the chrome project). These facilities will be serviced regularly by an appropriate service provider; o the required steps to enable fast reaction to contain and remediate pollution incidents. In this regard the remediation options include containment and in-situ treatment or disposal of contaminated soils as hazardous waste. In-situ treatment is generally considered to be the preferred option because with successful in-situ remediation, the soil resource will be retained in the correct place. The in-situ options include bio-remediation at the point of pollution, or removal of soils for washing and/or bio-remediation at the designated area after which the soils are returned; and o specifications for post-rehabilitation audit criteria to ascertain whether the remediation of any polluted soils and re-establishment of soil functionality has been successful and if not, to recommend any implement further measures.	On-going On-going On-going	On-going On-going On-going	Environmental site manager Environmental site manager Environmental site manager
Operation	Earthworks Civil works Site management Transport systems Non-mineralised waste management Site support services Open pit mining Mineral processing Tailings dam	H	L				
Operation	Earthworks Civil works Site management Transport systems Non-mineralised waste management Site support services Open pit mining Mineral processing Tailings dam	H	L	• The designs of any permanent and potentially polluting structures (mineralised waste facilities) will take account of the requirements for long term soil pollution prevention, land function and confirmatory monitoring. • PPM will conduct all potentially polluting activities in a manner that pollutants are contained at source. In this regard PPM will ensure that:	On-going On-going	On-going On-going	Environmental site manager Environmental site manager

Phase of operation	Activities (see Table 14)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
	Water supply infrastructure Power supply infrastructure			○ all vehicles and equipment will be serviced in workshops and washbays with impermeable floors, dirty water collection facilities and oil traps; ○ a dirty water management system is implemented; ○ 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; ○ 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. • In case of any major spillage incidents the emergency response procedure in Section 20 will be followed.	As required	As required	Environmental site manager
Decommission	Demolition Earthworks Civil works Site management Transport systems Non-mineralised waste management Site support services Tailings dam Water supply infrastructure Power supply infrastructure Rehabilitation	H	L				
Closure	Maintenance and aftercare of final land forms and rehabilitated areas	H	L				

TABLE 35: ACTION PLAN – LOSS OF SOIL RESOURCES AND LAND CAPABILITY THROUGH PHYSICAL DISTURBANCE

Phase of operation	Activities (see Table 14)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Earthworks Site management Transport systems Site support services Rehabilitation	H	L	• All stream diversions will incorporate appropriate energy dissipaters for erosion potential.	As required	As required	Environmental site manager
				• Limit the disturbance of soils to what is absolutely necessary for earthworks, on-going activities, infrastructure footprints and use of vehicles	On-going	On-going	Environmental site manager
Operation	Earthworks Site management Transport systems Non-mineralised waste management Site support services Open pit mining Tailings dam Rehabilitation	H	L	• Stripping, storage and maintenance of soil in accordance with soil management procedures included in Table 22.	On-going	On-going	Environmental site manager
				• As part of closure planning, the designs of any permanent landforms (e.g. mineralised waste facilities) will take into consideration the requirements for land function, long term erosion prevention and confirmatory monitoring.	As required	As required	Environmental site manager
				• Rehabilitation will commence as soon as mine activities cease. In the case of the open pits rehabilitation can be implemented on an ongoing basis. All rehabilitation initiatives will ensure that current land capabilities are restored through the conservation and replacement of soil, and the re-establishment of biodiversity that occurs naturally in the mine area. In this regard, PPM will initiate a biodiversity re-establishment project that is capable of supplying the required grasses, bushes and trees. This biodiversity project will be initiated at the beginning of the construction phase.	On-going	On-going	Environmental site manager
				• Where practical, rehabilitate areas in line with the rehabilitation plan as soon as possible.	As required	As required	Environmental site manager
				• In case of a major incident the emergency response procedure in Section 20 will be followed.	As required	As required	Environmental site manager
				• Offset the loss of the soils of the Wilgespruit lost to the partially backfilled and flooded Tuschenkomst pit (and extension) by reducing erosion and improving land management in the upper Wilgespruit and Bofule catchments in co-operation with the key stakeholders.	On-going	On-going	Environmental site manager
				• PPM will restrict access and egress points to the community water supply pipeline corridors, where they cross sensitive areas. This action will be to prevent erosion and compaction of the soils.	On-going	On-going	Environmental site manager
				• Stabilise the banks of the Wilgespruit, the bank above the partially backfilled and flooded Tuschenkomst pit high wall, the WRD side slopes and the pipeline routes with erosion control methods such as suitable indigenous grass suited for turf soils and gabions. Begin rehabilitation test sections as soon as possible.	As required	As required	Environmental site manager
				• Stabilise the Motlhabe tributary banks, the banks below the WRD located adjacent to the partially backfilled and flooded Tuschenkomst pit, erosion control methods such as suitable indigenous grass suited for turf soils and gabions. Reduce the impact of cattle on this area.	As required	As required	Environmental site manager

Phase of operation	Activities (see Table 14)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				• Soils will be replaced in the same sequence they were removed. Rehabilitation will take place with locally indigenous plant species.	As required	As required	Environmental site manager
				• Ensure that precipitation and sheet flow is not restricted from coming into contact with the riparian zone and wet soils.	As required	As required	Environmental site manager
Decommission	Demolition Earthworks Site management Transport systems Non-mineralised waste management Site support services Tailings dam Rehabilitation	H	L	• Limit the disturbance of soils to what is absolutely necessary of decommissioning activities, and on-going activities, infrastructure footprints and use of vehicles.	On-going	On-going	Environmental site manager
				• Maintenance and replacement of soil in accordance with soil management procedures included in Table 22.	On-going	On-going	Environmental site manager
				• In case of a major incident the emergency response procedure in Section 20 will be followed	As required	As required	Environmental site manager
Closure	Maintenance and aftercare of final land forms and rehabilitated areas						

TABLE 36: ACTION PLAN – PHYSICAL DESTRUCTION OF BIODIVERSITY

Phase of operation	Activities (see Table 14)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Site preparation Earthworks Civil works Transport systems Power supply infrastructure Site support services Storage and maintenance services / facilities Site/contract management	H	M	• Construction phase activities to be controlled by an environmental control officer (ECO).	On-going	On-going	Environmental site manager
				• An ecologist should be present during construction to identify conservation important flora that can be avoided or transplanted.	Construction phase	On-going	Environmental site manager
				• A local nursery should be established where local indigenous plants that will be used for rehabilitation can be transferred and propagated.	Construction phase	On-going	Environmental site manager
				• Limit the project footprint and activities to those described in EIA reports.	On-going	On-going	Environmental site manager
				• Limit water supply pipeline routes as follows: 6m wide corridor for manual excavation and 15m wide for machine excavation; and haul roads routes to 35m wide corridor for manual excavation and 40m wide for machine excavation. All construction related activities must be contained within this servitude.	On-going	On-going	Environmental site manager
Operation	Open pit mining Waste rock and tailings Mineral processing Power supply Transport systems Site support services Storage and maintenance services / facilities Site/contract management	H	M	• Confine water pipeline routes, haul road routes and associated construction activities to the road reserve and existing river crossings where possible, preferably in winter.	As required	As required	Environmental site manager
				• In the event there is no infrastructure present where there is a river crossing an engineer will ensure that community water supply pipelines are laid at right angles to the water course and at sufficient depth under the watercourse so that it is not exposed during any flow periods.	As required	As required	Environmental site manager
				• Demarcate the water supply pipeline and haul road footprint for the entire construction phase.	As required	On-going	Environmental site manager
				• With regards to the community water supply pipelines: infrastructure and related activities will avoid conservation important plant communities (i.e. protected faunal species areas including riparian and floodplain areas). This includes the wet area near the Horizon Mine in the south which forms suitable breeding habitat for the protected African Bullfrog.	Construction phase	Once off	Environmental site manager
				• The community water supply pipeline route should avoid the *Sclerocarya birrea – Aloe marlothii* Woody Outcrop and the *Mundulea sericea – Aloe greatheadii* Rocky Outcrops as these are regarded as No-Go areas.	Construction phase	Once off	Environmental site manager
				• With regards to the community water supply pipelines: minimise disturbance and footprint area within *Spirostachys africanum – Huernia zebrine* corridor, the *Combretum erythrohyllum* Riparian Woodland and the *Cynodon dactylon – Cyperus sexangularis* Floodplain.	Construction phase	Once off	Environmental site manager
Decommission	Demolition Waste rock and tailings Power supply Transport systems Site support services Site/contract management Rehabilitation	H	M	• Community water supply pipelines will not be routed perpendicularly up steep slopes and rather have a more gradual alignment which zig-zags up the slope.	Construction phase	Once off	Environmental site manager
				• Community water supply pipelines crossing the Rocky Outcrops should pass through natural gaps existing in the rocky outcrops rather than blasting a pathway though large boulders.	Construction phase	Once off	Environmental site manager
				• There will be no leakages along the pipeline, particularly when crossing	On-going	On-going	Environmental site manager

Phase of operation	Activities (see Table 14)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				water courses, as this will change the flow regime of these systems and could result in increased erosion and sedimentation			
				• Vehicular access to outcrops and ridges will be limited.	On-going	On-going	Environmental site manager
				• All vehicles will be limited to roads during construction.	Construction phase	Once off	Environmental site manager
				• Any work within a wetland will take place with an approved DWA license.	On-going	On-going	Environmental site manager
				• Where possible large and prominent trees should be avoided.	On-going	On-going	Environmental site manager
				• Site specific faunal niches (large hole bearing trees, nests, dens, termateria or rock piles) will be avoided or preserved where it is possible to divert servitudes.	On-going	On-going	Environmental site manager
				• Contractors should be provided with an alternative fuel source to reduce incidents where trees are cut for fuel.	On-going	On-going	Environmental site manager
				• Implementation of an alien/invasive/weed management programme to control the spread of these plants onto and from disturbed areas through active eradication, establishment of natural species and through on-going monitoring and assessment. In this regard, the use of herbicides will be limited and will only be used under strict controls if alternative less intrusive eradication methods are not successful.	Pre-construction and on-going	Once off and on-going	Environmental site manager
				• Implement and maintain a biodiversity management plan to minimize destruction and disturbance by the mine. The biodiversity plan will be refined in consultation with the biodiversity expertise and resources within the Heritage Park initiative (including NWPB and DEDECT). This biodiversity plan will include the following management actions:	Pre-construction and on-going	Once off and on-going	Environmental site manager
				o PPM will limit mine infrastructure, activities and disturbance to those specifically identified and described in EIA/EMP reports, with controlled access and zero tolerance of disturbances to the identified sensitive habitats and associated species of the ridges/rocky outcrops and water course/wetland buffer zones. In the case of water courses the zone is defined by the greater of 100 m or the 1:50 year floodline (Regulation 4(b) of Regulation 704). In the case of the pans that host the bullfrogs the zone is 500 m around the pans;			
				o power lines will be high enough for all game (the tallest being giraffe) to move thereunder without harm;			
				o where the open pits and haul road cross over or go through the water courses, the engineering design work of diversions and crossings will be done in consultation with a qualified ecologist with water course related expertise to limit the destruction of habitat and species and to promote re-establishment thereof. Where possible, pebbles, rocks and biodiversity will be re-established in the diversions and the diversion routes will be scanned for sensitive fauna and flora prior to construction;			
				o there will be controlled access and zero tolerance of disturbances to			

Phase of operation	Activities (see Table 14)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				biodiversity corridors between the ridges/rocky outcrops on the south of Witkleifontein and those further to the north. This is particularly important for the area to the west of the tailings return water dam and the area between the tailings dam and the plant where pipelines will be lifted off the ground by 50 cm and sunk beneath the ground in some places to prevent the establishment of a movement barrier for fauna species; o there will be planning on the removal of fauna and flora (plants and seeds) species prior to disturbance by mine infrastructure and activities. This will include planning on the preservation, cultivation and re-use of these species in ongoing rehabilitation. Links will also be made to the soil conservation procedure and actions; 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; 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 and biodiversity corridors. o where new areas will be disturbed, the following process will be implemented: ▪ delineation of proposed area to be disturbed; ▪ obtain any relevant permits for the removal of protected plant species and trees; ▪ relocation of species that can effectively be relocated, especially protected species and species of conservation importance. Relevant specialists will be consulted to get advice on appropriate relocation techniques; ▪ restoration of the ecosystem functionality, as far as is possible, in areas that have been physically rehabilitated; ▪ follow up audits and monitoring, in the short and long term, to determine the success of the relocation, rehabilitation and restoration activities in terms of a range of species and ecosystem function performance indicators.			

Phase of operation	Activities (see Table 14)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				• Set up and undertake biodiversity monitoring (see programme in Section 21.1.4).	On-going	On-going	Environmental site manager
				• Establishment of a nursery for plant transplanting (i.e. protected, medicinal and rehabilitation plants). Transplant conservation important/protected flora that are within the mine footprint pre-construction with the necessary permits.	As soon as possible	On-going	Environmental site manager
				• Rehabilitate any disturbed areas in line with rehabilitation plan.	As required	As required	Environmental site manager
Closure	Maintenance and aftercare of final land forms and rehabilitated areas	H	M-H	• Monitor vegetation establishment in line with rehabilitation plan	As required	As required	Environmental site manager

TABLE 37: ACTION PLAN – GENERAL DISTURBANCE OF BIODIVERSITY

Phase of operation	Activities (see Table 14)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Site preparation Earthworks Civil works Transport systems Power supply Site support services Storage and maintenance services / facilities Site/contract management	H	M	• The use of light is kept to a minimum, and where it is required, yellow lighting is used where possible.	On-going	On-going	Environmental site manager
				• Where lighting is non-essential, motion detector spot lights will be used where possible.	On-going	On-going	Environmental site manager
				• Vertebrates should be kept away from the illuminated areas with appropriate fencing where feasible.	On-going	On-going	Environmental site manager
				• Internal power lines may be equipped with bird deterrent measures to prevent bird kills where deemed necessary.	On-going	On-going	Environmental site manager
				• There is training for workers on the value of biodiversity and the need to conserve the species and systems that occur within the mining right area.	As required	As required	Environmental site manager
Operation	Site preparation Earthworks Site management Open pit mining Waste rock dumps Tailings dam Non mineralised waste management Mineral processing Water and power supply Transport systems Site support services Storage and maintenance services / facilities Site management	H	M	• There is zero tolerance of the killing, harassing or collecting of any biodiversity by anybody working for or on behalf of PPM	On-going	On-going	Environmental site manager
				• Strict speed control measures are used for any vehicles driving within the mining right area.	On-going	On-going	Environmental site manager
				• Noisy and/or vibrating equipment will be well maintained to control noise and vibration emission levels.	On-going	On-going	Environmental site manager
				• All water dams will be fenced off to prevent access by larger animals.	As required	As required	Environmental site manager
				• Dust control measures will be implemented as outlined in Section 7.2.11.	On-going	On-going	Environmental site manager
				• Surface and ground water management measures will be implemented as outlined in Sections 7.2.7 and 7.2.9.	On-going	On-going	Environmental site manager
				• Soil pollution will be prevented and managed as outlined in Section 7.2.3.	On-going	On-going	Environmental site manager
				• Blasting hazards will be managed as outlined in Section 7.2.16.	On-going	On-going	Environmental site manager
				• Pollution and litter prevention measures will be implemented.	On-going	On-going	Environmental site manager
				• Prevent dirty water runoff, spillages and sediment from entering the environment (bunds, stormwater control).	On-going	On-going	Environmental site manager
				• Prevent hydrocarbon and cement spills.	On-going	On-going	
				• Concurrent and final rehabilitation of the waste rock dump associated with the chrome project as outlined in Table 16.	On-going	On-going	Environmental site manager
Decommission	Site preparation Demolition Earthworks Site management Transport systems Non-mineralised waste management Site support services Waste rock dumps Tailings dam Water and power supply infrastructure Rehabilitation	H	M	• Concurrent rehabilitation of areas no longer required for mining activities.	On-going	On-going	Environmental site manager
				• As part of closure planning, the designs of any permanent and potentially pollution structures (mineralised waste facilities) will take consideration of the requirements for long term pollution prevention and confirmatory monitoring.	As required	As required	Environmental site manager
				• Develop and implement community land use management and rehabilitation plans to minimise destruction and disturbance by the mine.	On-going	On-going	Environmental site manager
				• Control dust in line with dust management plan.	On-going	On-going	Environmental site manager
				• Control blast hazards in line with the blast management plan.	On-going	On-going	Environmental site manager
				• No water should be abstracted from any surface water bodies and should be acquired at the mine.	On-going	On-going	Environmental site manager
				• All ablutions will be located 100 m from any watercourse.	On-going	On-going	Environmental site manager

Phase of operation	Activities (see Table 14)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
	Re-diversion of the Wilgespruit into the Tuschenkomst pit			• Implement a staff and a contractor awareness plan including; o Preventing the harming of fauna and damage to flora; o discouraging the feeding of wildlife and introduction of pets, o prevention of recreational activities within the project area. • Soils within the pipeline routes should be replaced continuously, and in the same sequence, during the construction process and this should allow the vegetation found on the turf soils to re-establish	On-going Construction phase	On-going On-going	Environmental site manager Environmental site manager
Closure	Maintenance and aftercare of final land forms and rehabilitated areas	H	L	• Minimise groundwater pollution in line with tailings and waste rock management plan (drainage systems, concurrent rehabilitation where possible). • PPM will monitor the aquatic environment of all potentially affected surface water resources and use the results of the monitoring to implement any other surface water related interventions as deemed appropriate to achieve the mitigation objectives. This will be out sourced as part of PPM's biomonitoring in accordance to acceptable practice. • Contractor awareness programme will be implemented. Examples are posters, pamphlets, induction programmes which include: o Importance of the area for supporting endemic and threatened species; o Importance of protecting all types of indigenous species to maintain the integrity of ecological food chains; o Procedures to avoid / manage encounters with venomous snakes, and not kill these creatures unnecessarily; o Contact list for competent snake handlers in the greater vicinity should be compiled with their agreement to be called should dangerous snakes enter the mine facilities and need to be removed; o A top 10 alien invasive list, including why these species are considered alien and what must be done to minimise the spread of these species. • In consultation with specialists, NWPTB (Heritage Park manager and ecologists) the different slopes and habitats should be planned around the partially backfilled and flooded Tuschenkomst pit during the backfilling phase. At the same time the contouring and re-vegetation of the WRD adjacent to the Tuschenkomst pit should be carried out with the abovementioned stakeholders. • Installation of a flow gauge monitoring network Wilgespruit and Bofule Rivers to determine the potential impacts. • Implement a reserve determination for the downstream Rivers within the Bierspruit Catchment. Specifically to be able to assess the immediate downstream portion of the Bofule River. • Studies implemented on the aquatic communities within this semi-ephemeral system is required. Further monitoring of the system during	On-going On-going As required On-going On-going On-going As required	On-going On-going As required On-going On-going On-going As required	Environmental site manager Environmental site manager Environmental site manager Environmental site manager Environmental site manager Environmental site manager Environmental site manager

Phase of operation	Activities (see Table 14)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				the summer months to determine the significance of semi-arid region streams to fauna.			
				• Consider a biodiversity offset along the Moswa and Bofule River systems and a change to the conceptual plan for Sedibelo/Magazynskraal to conserve these systems;	Once off	As required	Environmental site manager
				• Implementation of a Bullfrog Management Plan (i.e. 1km buffer zone around known Bullfrog Breeding sites	On-going	On-going	Environmental site manager
				• Consult with the BBKTA to remove cattle grazing from along the river systems	On-going	On-going	Environmental site manager
				• Biodiversity awareness and land use management plan should be implemented in consultation with DAFF and the communities for the communities surrounding the mine.	On-going	On-going	Environmental site manager
				• As part of the biodiversity management plan develop and alien invasive species management plan with the communities surrounding the project area and continue with this 3 years post rehabilitation.	As required	As required	Environmental site manager
				• Once the Wilgespruit is diverted into the Tuschenkomst pit, suitable quality water will be pumped out of the pit into the lower Wilgespruit to simulate ephemeral flow in accordance with the minimum in-stream flow requirements and to maintain artificial refuge pools along the affected section of the watercourse. The release point of in-pit water into the Wilgespruit must be equipped with energy dissipaters and erosion protection measures. Erosion protection should be planned with an engineer in the event of die back of the riparian vegetation and the de-stabilisation of the river banks.	On-going	On-going	Environmental site manager, engineer and specialist
				• Create a sustainable aquatic and terrestrial environment around and in the flooded Tuschenkomst pit by creating a sequence of ponds of increasing size that should be filled which overflow into one another and eventually into the final large pit. (i.e. different habitats of a relatively permanent nature could be created within these pits including sediment traps, sand banks, aquatic plant habitats, dead trees for roosting	On-going	On-going	Environmental site manager, NWPTB and ecologist
				• Monitoring of the riparian vegetation and aquatic and terrestrial faunal habitat during the life of the mine, to assess the impacts associated with the dewatering of the Tuschenkomst Pit, the existing river diversion.	On-going	On-going	Environmental site manager and specialist
				• The side slopes and storm water berms along the benches of the WRDs should not be constructed as to restrict the movement of migrating wildlife.	On-going	On-going	Environmental site manager, engineer and specialist
				• Investigate the establishment of a regional conservancy to ensure the protection of corridors during the life of the mines, thus sustaining the viability of the Heritage Corridor concept.	On-going	On-going	Environmental site manager
				• Prior to any construction of the Lesetlheng extension of the central pipeline route (CPR) a specialist will be appointed to assess this area.	As required	As required	Environmental site manager
				• In case of a major incident the emergency response procedure in Section 20 will be followed.	As required	As required	Environmental site manager

TABLE 38: ACTION PLAN – POLLUTION OF SURFACE WATER RESOURCES

Phase of operation	Activities (see Table 14)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Site preparation Earthworks Civil works Process- and stormwater management Non-mineralised waste management Site support services Storage and maintenance services / facilities Site/contract management	H	L	• Compliance to the National Water Act (36 of 1998) and Regulation 704 (4 June 1999): o Keep clean water and dirty water system separate; o Clean run-off and rainfall water is diverted around dirty areas and back into its normal flow in the environment; o Location of all activities and infrastructure should be outside of the specified zones and /or floodlines of watercourses. If this is unavoidable the necessary exemptions/approvals will be obtained; o Size of dirty water areas are minimized and dirty water is contained in systems that allow the reuse and/or recycling of this dirty water. These systems will be routinely inspected to detect possible breaches and implement preventative or corrective action.	On-going	On-going	Environmental site manager
Operation	Open pit mining Waste rock management Mineral processing Process- and stormwater management Transport systems Non-mineralised waste management Site support services Storage and maintenance services / facilities Site/contract management Re-diversion of the Wilgespruit into the Tuschenkomst pit Flooding of Tuschenkomst pit	H	L	• All hazardous chemicals, mineralised waste and non-mineralised waste must be handled in a manner that they do not pollute surface water. This will be implemented by means of the following: o Pollution prevention through basic infrastructure design; o Pollution prevention through maintenance of equipment that can spill polluting substances; o Pollution prevention through education and training of workers (permanent and temporary). o Required steps to enable containment and remediation of pollution incidents. o Areas in which hazardous and/or polluting substances can be spilled will be minimized and contained on impermeable floors with bund walls and sumps with traps. These bunded areas will be capable of holding 125% of the volume of hazardous/polluting substances that could be spilled therein;	On-going	On-going	Environmental site manager
Decommission	Waste rock dumps Tailings dam Process- and stormwater management Transport systems Non-mineralised waste management Site support services Storage and maintenance	H	L	o Adequate sanitation facilities will be installed and maintained where necessary. These facilities will be serviced by an appropriate service provider on a regular basis. No sanitation facilities may be located within 100 m of a watercourse. o The designs of any permanent and potentially polluting structures (e.g. mineralised and non-mineralised waste facilities) will take account of the requirements for long term surface water pollution prevention.	On-going As required	On-going As required	Environmental site manager Environmental site manager

Phase of operation	Activities (see Table 14)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
	services / facilities Site/contract management Demolition Rehabilitation			• Erosion and stormwater management measures will be implemented to prevent the loss of topsoil and resultant sedimentation of watercourses.	On-going	On-going	Environmental site manager
Closure	Maintenance and aftercare of final land forms and rehabilitated areas	H	L	• Erosion and stormwater management measures will be implemented to prevent the loss of topsoil and resultant sedimentation of watercourses.	On-going	On-going	Environmental site manager
				• Activities on the banks of watercourses will be minimised as far as possible.	On-going	On-going	Environmental site manager
				• Permanent water course crossings will be designed and constructed so that the normal flow of water in the watercourse is unaffected.	As required	As required	Environmental site manager
				• Polluted soils will be treated in accordance with Section 7.2.3.	On-going	On-going	Environmental site manager
				• PPM will monitor the water quality (Section 21.1.1) in all potentially affected surface water resources and use the monitoring results to implement appropriate prevention and mitigation measures to achieve surface water quality objectives. This will include surface water sampling points both up and downstream (where possible) of the mining operations in the following water courses: the Motlhabe, potentially affected tributaries of the Motlhabe, the Manyedime, and the Wilgespruit.	On-going	On-going	Environmental site manager
				• Should any contamination be detected the mine will immediately notify DWA. The mine, in consultation with DWA 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.	As required	As required	Environmental site manager
				• Where monitoring identifies that third party water supply has been polluted by PPM, an alternative equivalent water supply will be provided by PPM.	As required	As required	Environmental site manager
				• Establish professionally designed facilities	On-going	On-going	Environmental site manager
				• Control third party access to the partially backfilled and flooded Tuschenkomst pit to prevent exposure to potentially polluted water.	On-going	On-going	Environmental site manager
				• Set up and maintain flow metres in the mine water circuit.	ASAP and on-going	On-going	Environmental site manager
				• Update the groundwater model to verify the potential for water to collect in the partially backfilled and flooded Tuschenkomst pit. Depending on the results of the model, the mitigation measures may need to be revised.	As required	As required	Environmental site manager
				• Monitor quality of rainfall-related discharge in line with monitoring programme (Section 21).	On-going	On-going	Environmental site manager

Phase of operation	Activities (see Table 14)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				• Establish the cause of the ammonia pollution within surface water in the area. In the event that it is a man-made source this should be mitigated accordingly.	On-going	On-going	Environmental site manager
				• Specifications for post rehabilitation audit criteria to ascertain whether the remediation has been successful and if not, to recommend and implement further measures.	As required	As required	Environmental site manager
				• In case of a major incident the emergency response procedure in Section 20 will be followed.	As required	As required	Environmental site manager

TABLE 39: ACTION PLAN – ALTERATION OF DRAINAGE PATTERNS

Phase of operation	Activities (see Table 14)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Earthworks Civil works Non-mineralised waste management Transport system Stormwater management Site support services Site management	L	L	• Detailed design of stormwater facilities to be done by an appropriately qualified engineer in line with stormwater management plan. • Establish and maintain (through inspection and repair) stormwater controls in line with stormwater management plan. • All stream diversion and road crossing detailed designs will be designed in accordance with the requirements of Regulation 704, the requirements of DWA as stipulated in the water license, and will be done by an appropriately qualified engineer. These designs will consider the biodiversity and rehabilitation requirements detailed in Table 33, Table 36 and Table 37. • Culverts will be designed so that there is no channeling of water that will result in erosion downstream of stream crossings. • The footprint and associated catchment of all infrastructure will be minimized to limit the impact on stream flow reduction. • The location of all activities and infrastructure should be outside of the specified zones and/or flood lines of watercourses. If this is unavoidable the necessary exemptions/approvals will be obtained. • Clean and dirty water will be separated and clean water will be diverted around dirty areas an allowed to return to its normal flow path as outlined the stormwater management plan. • Site rehabilitation will aim to restore surface drainage patterns as far as practically and economically possible. • PPM will ensure that water from the partially backfilled and flooded Tuschenkomst pit (including the extension) is pumped into the Wilgespruit to maintain a seasonal base flow thereby supplementing the ground water resources used by cattle herders and cattle downstream of the project site. • Ensure that the maximum amount of clean storm water run-off enters the Wilgespruit between the diversion point and the confluence with the Bofule. • PPM will ensure that the toe of the WRD adjacent to the Tuschenkomst pit is re-enforced and does not impact the tributary of the Motlhabe. • In case of significant breach of stormwater controls, implement emergency response procedure (Section 20).	Design At start Design Design Design On-going On-going As required At start and on-going On-going On-going As required	Once off Once off Once off Once off Once off On-going On-going As required On-going On-going On-going As required	Environmental site manager Environmental site manager Environmental site manager Environmental site manager Environmental site manager Environmental site manager Environmental site manager Environmental site manager Environmental site manager Environmental site manager Environmental site manager Environmental site manager
Operation	Earthworks Civil works Site management Transport systems Non-mineralised waste management Site support services Open pit mining Mineral processing Waste rock dumps Tailings dam Water and power supply infrastructure Stormwater management Rehabilitation	L	L				
Decommission	Demolition Earthworks Civil works Site management Transport systems Non-mineralised waste management Site support services Waste rock dumps Tailings dam Water and power supply infrastructure Stormwater management Rehabilitation	L	L				

Phase of operation	Activities (see Table 14)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Closure	Maintenance and aftercare of final land forms and rehabilitated areas	L	L	• Monitor re-instated drainage patterns to ensure natural flow patterns occur as far as possible	On-going	As required	Environmental site manager

TABLE 40: ACTION PLAN – CONTAMINATION OF GROUNDWATER RESOURCES

Phase of operation	Activities (see Table 14)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Process- and stormwater management Non-mineralised waste management Storage and maintenance services / facilities Site contract management	H	L	• Prior to the commencement of the mine, PPM will conduct a detailed hydrocencus of all boreholes that are in use in the potentially affected zones to verify whether there are additional boreholes to those that have already been identified. This hydrocencus will confirm the borehole location, water depth, water quality and water use for each identified borehole. All potentially affected boreholes will be included in the water monitoring programme for boreholes located both on and off the mine site.	At start	Once off	Environmental site manager
Operation	Waste rock management Process- and stormwater management Non-mineralised waste management Storage and maintenance services / facilities Site contract management Re-diversion of the Wilgespruit into the Tuschenkomst pit Flooding of the Tuschenkomst pit	H	L	• Boreholes, adjacent to the tailings facility and between the tailings facility and the potentially affected third party boreholes, will be part of the monitoring programme. If contamination is detected PPM will consult with an appropriate specialist and with DWA 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. The long term post closure options for pollution prevention and/or water abstraction and treatment will also form part of the management measures that are designed and implemented.	On-going	On-going	Environmental site manager
				• PPM will comply with both the NWA and Regulation 704 and conditions of water authorisations/licenses.	On-going	On-going	Environmental site manager
Decommission	Waste rock dumps Process- and stormwater management Non-mineralised waste management Storage and maintenance services / facilities Site contract management Re-diversion of the Wilgespruit into the Tuschenkomst pit Flooding of the Tuschenkomst pit	H	L	• Pollution prevention through: o Basic infrastructure design; o Maintenance of equipment; o Dirty water containment dams will be lined; o Education and training of workers (permanent and temporary); o Appropriate management of hazardous chemicals, materials and non-mineralised waste; o Required steps to enable containment and remediation of pollution incidents; • Specifications for post rehabilitation audit criteria to ascertain whether the remediation has been successful and if not, to recommend and implement further measures.	On-going	On-going	Environmental site manager
Closure	Maintenance and aftercare of final land forms and rehabilitated areas Re-diversion of the Wilgespruit into the	H	L	• Future infrastructure will be designed and implemented in a manner that pollution is prevented in all mine phases.	Design	As required	Environmental site manager
				• Existing infrastructure that has the potential to pollute groundwater will be identified and included into the groundwater management plan which will be implemented as part of the	On-going	On-going	Environmental site manager

Phase of operation	Activities (see Table 14)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
	Tuschenkomst pit Flooding of the Tuschenkomst pit			operational phase. This plan includes: o Determining potential pollution sources and the extent of the pollution plume; o Design and implement intervention measures to prevent and/or eliminate the pollution plume; o Monitoring existing and potential impact zones to track pollution and mitigation impacts; o Where pollution negatively impacts third parties, PPM will provide an alternative equivalent supply.			
				• Implementation of PPM's groundwater monitoring programme (Section 21.1.1) in order to monitor groundwater quality within and surrounding the mining right area.	On-going	On-going	Environmental site manager
				• Determine Ammonia and Nitrate contamination source.	Immediately	Monthly	Environmental site manager and specialist
				• A full spectrum of water parameters in the partially backfilled and flooded Tuschenkomst pit (including anions and heavy metals) will be monitored in accordance with the current programme. Specific attention will be given to tracking changes in the following: Al3+; Fe2+; NO2-; NO3-; F-.	On-going	On-going	Environmental site manager
				• The relevant entity responsible for the partially backfilled and flooded Tuschenkomst pit will: o follow the necessary requirements of the Water Service Act (108 of 1997) for the provision of potable water to the communities, will either be followed directly or via MKLM; o be required to implement a comprehensive quality control system to ensure that the distributed water is always of an acceptable drinking standard	As required	As required	The relevant water supply entity
				• In the event of a major incident the emergency response procedure in Section 20 will be followed.	As required	As required	Environmental site manager

TABLE 41: ACTION PLAN – DEWATERING

Phase of operation	Activities (see Table 14)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	N/A	-	-	-	-	-	-
Operation	Open pit mining Re-diversion of the Wilgespruit into the Tuschenkomst pit Flooding of the Tuschenkomst pit	L	L	• PPM will implement a groundwater monitoring programme (see Section 21.1.1) in order to monitor groundwater quality within and immediately surrounding the mining right area. • All potentially affected third party boreholes will be included in PPM's groundwater monitoring programme to ensure that changes in water depths can be identified. • Re-calibrate the current model every 3 years, including all the relevant parameters. • Where PPM's dewatering causes a loss of water supply to third parties an alternative equivalent water supply will be provided by PPM until such time as the dewatering impacts cease. • Maintain the optimum backfill volume within the Tuschenkomst pit to allow the pit water to recover to the 1025 mamsl level faster.	On-going On-going On-going As required On-going	On-going On-going On-going As required On-going	Environmental site manager Environmental site manager Environmental site manager Environmental site manager Environmental site manager
Decommission	N/A	-	-	-	-	-	-
Closure	N/A	-	-	-	-	-	-

TABLE 42: ACTION PLAN – AIR POLLUTION

Phase of operation	Activities (see Table 14)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Site preparation Earthworks Civil works Transport systems Site support services Site/contract management	H	M	• Limit the disturbance of land to what is absolutely necessary and in accordance with the existing mine infrastructure layout.	On-going	On-going	Environmental site manager
				• Implement the air quality management plan included in Table 24.	On-going	On-going	Environmental site manager
				• Set up and undertake monitoring in line with recommended programme in Section 21.1.2.	On-going	Quarterly	Environmental site manager
Operation	Open pit mining Waste rock dumps Tailings dam Mineral processing Transport systems Site support services Site/contract management Pipeline route	H	M	• PPM will implement air quality monitoring on each of the seven diesel powered generators when they are in use. The emissions will be monitored for pollutants such as carbon monoxide, (CO), sulphur dioxide (SO_2), nitrogen dioxide (NO_2) and diesel particulate matter (DPM), which would emanate as a result of the operational phase of the diesel generators in the peak power plant. NO_2 monitoring can be undertaken using passive diffuse sampling to determine the ambient conditions. The monitoring system will have emission analysis with history graphs, trends and alarms.	As required	As required	Environmental site manager
Decommission	Waste rock and tailings management Demolition Rehabilitation	H	M	• PPM will apply dust suppression on unpaved roads through chemical binding agents and/or water sprays combined with vehicle speed controls. 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.	On-going	On-going	Environmental site manager
				• Dust controls at the TSF 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.	On-going	On-going	Environmental site manager
				• Dust controls at the crushing and screening operation by water sprays and/or 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.	On-going	On-going	Environmental site manager
				• Limit vehicle speeds.	On-going	On-going	Environmental site manager
				• Where possible, all dust generating sources should be located as close as possible to each other.	On-going	On-going	Environmental site manager
				• If monitoring data confirms that unacceptable dust emissions is occurring, immediate steps will be taken to address the issue in consultation with a suitable air quality specialist.	As required	As required	Environmental site manager
				• Implementation of a complaints procedure.	On-going	On-going	Environmental site manager
				• In the context of further mining development in the project	ASAP (dependant	As required	

Phase of operation	Activities (see Table 14)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				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.	on surrounding mining operations)		
				• In case of a major incident the emergency response procedure in Section 20 will be followed.	As required	As required	Environmental site manager
Closure	Maintenance and aftercare of final land forms and rehabilitated areas	H	M	• As part of closure planning, the designs of any permanent and potentially polluting structures (particularly mineralised waste facilities) will, on the basis of modelling, incorporate measures to address long term pollution prevention.	As required	As required	Environmental site manager
				• Monitor and maintain vegetation cover on final land forms and rehabilitated areas.	6 years	On-going	Environmental site manager

TABLE 43: ACTION PLAN – INCREASE IN NOISE DISTURBANCE

Phase of operation	Activities (see Table 14)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Site preparation Earthworks Civil works Transport systems Site management	M-H	M	• All vehicles and equipment will be maintained to restrict noise emissions.	On-going	On-going	Environmental site manager
				• Where possible, PPM mine will use waste rock and topsoil stockpiles to maintain a noise berm around the mining operations. Noise sources will be placed sub surface where possible.	On-going	On-going	Environmental site manager
Operation	Earthworks Civil works Transport systems Open pit mining Mineral processing Site management Rehabilitation Pipeline repair	M-H	M	• Implementation of a noise complaints procedure. Complaints need to be documented, addressed and reasonable efforts made to address the area of concern. Measures taken to address complaints will be documented. Records will be kept for the life of mine.	On-going	On-going	Environmental site manager
				• Where necessary, noise monitoring will be used as part of the investigatory process into noise complaints.	On-going	Quarterly	Environmental site manager
				• With regards to the platinum operations, no blasting will take place at night or on Sundays. No mining activities will take place at the Rooderand pit between Thursday at 22h00 and Mondays at 06h00.	On-going	On-going	Environmental site manager
Decommission	Demolition Earthworks Civil works Rehabilitation Site management	M-H	M	• With regards to the chrome operations, no blasting will take place at night or weekends (from Friday 14h00 to Monday 06h00). Activities associated with the chrome operations (including mining and the crushing and screening plant) will be limited to operating hours of 06h00 and 18h00 Monday to Thursday, and from 06h00 to 14h00 on a Friday;	On-going	On-going	Environmental site manager
				• PPM will, in consultation with a noise specialist, engage with representatives from the Black Rhino Game Reserve and the Pilanesberg National Park to address the impacts of the current and future mining operations so that it is acceptable to all parties.	ASAP	As required	Environmental site manager
				• Educate workers on the noise impacts of their actions.	On-going	On-going	Environmental site manager
				• Investigate the use of alternative reverse alarms.	As required	As required	Environmental site manager
				• Notify affected communities of pending work.	As required	As required	Environmental site manager
				• Set up and undertake noise monitoring in line with recommended programme (see Section 21.1.3).	Pre-construction and on-going	Once off and on-going	Environmental site manager
Closure	N/A	-	-	-	-	-	-

TABLE 44: ACTION PLAN – VISUAL IMPACTS

Phase of operation	Activities (see Table 14)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Earthworks Civil works Site management Rehabilitation Non mineralised waste management Site support services	H	M-H	• Ensure that the absolute minimum amount of vegetation and land is disturbed during site development and operation. This is extremely important on the boundaries of the operation where vegetation can assist with screening. Vegetation can be planted to act as screens between the mine and sensitive viewers.	On-going	On-going	Environmental site manager
				• On-going establishment of vegetation in rehabilitated areas. All vegetation that is planted as part of rehabilitation should reflect the natural vegetation of the area.	On-going	On-going	Environmental site manager
Operation	Site preparation Earthworks Civil works Open pit mining Waste rock dumps Tailings dam Mineral processing Water and power supply Transport systems Non-mineralised waste management Site support services Rehabilitation Flooding of the Tuschenkomst pit	H	M-H	• Implement air pollution control system to avoid plumes of dust that can reduce visibility.	On-going	On-going	Environmental site manager
				• Paint structures, buildings and large equipment with colours (browns and greens) that reflect and compliment the natural landscape.	As required	As required	Environmental site manager
				• Night lighting will be: o fitted with fixtures to prevent light spillage and focus the light on precise mine activities and infrastructure; o fitted as low to the ground as is practicable; o most security and non-essential lights will be activated with motion sensors.	On-going	On-going	Environmental site manager
				• Ore transport from the Ruighoek and Rooderand will be restricted to hours between 05h00 and 22h00.	On-going	On-going	Environmental site manager
				• PPM will, in consultation with a visual specialist, engage with the representatives from Black Rhino Game Reserve and Pilanesberg National Park to address the impacts of current and future mining operations.	ASAP	As required	Environmental site manage
Decommission	Earthworks Civil works Waste rock dumps Tailings dam Mineral processing facilities Water and power supply Transport systems Non-mineralised waste management Support services Site management Demolition Rehabilitation Flooding of the Tuschenkomst pit	H	M-H	• Contouring, shaping and vegetating of the permanent waste rock dumps into a final landform that blends in with the surrounding koppies.	As required	As required	Environmental site manager
				• Construct and operate waste dumps as low as possible in height in order to reduce the visibility and intrusiveness (unless they are being used as a visual screen).	As required	As required	Environmental site manager
				• The perimeter of the partially backfilled and flooded Tuschenkomst pit area should be landscaped to act as a natural functional water impoundment.	On-going	On-going	Environmental site manager
				• Include a professional landscape architect in closure design of any final land forms.	Pre-closure	Once off	Environmental site manager
				• Rehabilitate the site and disturbed areas in line with recommended rehabilitation plan (use indigenous vegetation, avoid harsh slopes, remove all infrastructure unless alternative	As soon as possible	As required	Environmental site manager

Phase of operation	Activities (see Table 14)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				end use is identified.			
Closure	Maintenance and aftercare of final land forms and rehabilitated areas	H	L	• Final land forms will be managed through a care and maintenance programme to limit long term post closure visual impacts.	As required	As required	Environmental site manager

TABLE 45: ACTION PLAN – HERITAGE PALEONTOLOGICAL AND CULTURAL RESOURCES

Phase of operation	Activities (see Table 14)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Earthworks Site management Transport systems Site support services Rehabilitation Pipeline installation	M	L	• Prior to damaging or destroying any of the identified heritage resources, PPM will engage a heritage specialist to conduct a phase 2 heritage investigation and apply for a permit to the North West Heritage Resources Agency.	As required	As required	Environmental site manager
				• Place infrastructure to avoid identified resources.	Pre-construction	Timeously	Environmental site manager
				• All heritage sites not impacted on by the initial development of the site will be marked on the site layout plan.	Pre-construction	Timeously	Environmental site manager
Operation	Earthworks Site management Transport systems Non-mineralised waste management Site support services Open pit mining Waste rock dumps Tailings dam Water and power supply infrastructure Rehabilitation Pipeline repair	M	L	• Inspect sites for encroachment and/or damage.	On-going	On-going	Environmental site manager
				• PPM will, in consultation with a heritage expert, representatives of the proposed Heritage Park and the North West Heritage Resources Authority, develop and implement a cultural heritage management programme. This programme will be aimed at enhancing the provincial and national significance of the preserved heritage landscape between the koppies of Mogare, Mmatone and Patswane (see Figure 17). In this regard, there will be a zero tolerance of mine related activities or infrastructure in this landscape.	On-going	On-going	Environmental site manager
				• A Phase 2 heritage impact assessment will be carried out before development of the WRD adjacent to the Tuschenkomst pit can occur in the area and before the heritage landscape can be impacted or (PTS01-03) destroyed. Prior to any construction of this WRD extension a specialist will be appointed to assess this area.	Immediately	As required	Environmental site manager
Decommission	Demolition Earthworks Site management Transport systems Non-mineralised waste management Site support services Waste rock dumps Tailings dam Water and power supply infrastructure Rehabilitation	M	L	• Design the WRD adjacent to the Tuschenkomst pit away from the heritage landscape and provide a buffer of greater than 250 m.	On-going	On-going	Environmental site manager
				• Formalise the co-ordinates of the heritage landscape and ensure that no future mine infrastructure will encroach or be built in this area to retain its sense of place and value to society and the future heritage park.	Immediately	On-going	Environmental site manager
				• All workers (temporary and permanent) will be educated about the heritage and cultural sites that may be encountered in their area of work and about the need to conserve these.	As required	As required	Environmental site manager
				• In the event that new heritage and/or cultural resources are discovered, the mine will follow an emergency procedure, which includes the following: o work at the find will be stopped to prevent damage; o an appropriate heritage specialist will be appointed to assess the find and related impacts; o permitting applications will be made to SAHRA, if required.	As required	As required	Environmental site manager
				• In the event that any graves are discovered, prior to damaging	As required	As required	Environmental site manager

Phase of operation	Activities (see Table 14)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				or destroying any identified graves, permission for exhumation and relocation of graves must be obtained from the relevant descendants (if known) and the relevant local and provincial authorities. • In the case of a major incident, the emergency response procedure in Section 20 will be followed • Prior to any construction of the Lesetlheng extension of the central pipeline route (CPR) a specialist will be appointed to assess this section of the route.	As required Prior to construction	As required Once off	Environmental site manager Environmental site manager
Closure	Not applicable	-	-	-	-	-	-

TABLE 46: ACTION PLAN – LAND USE

Phase of operation	Activities (see Table 14)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Site preparation Earthworks Civil works Site management Transport systems Non-mineralised waste management Site support services Rehabilitation Partial backfilling and flooding of the Tuschenkomst pit	H * H #	L * L #	• PPM will implement the EMP commitments with a view not only to prevent and/or mitigate the various environmental and social impacts, but also to prevent negative impacts on surrounding land uses.	As required	As required	Environmental site manager
				• If a situation arises where any surrounding land use is negatively affected by the mine, PPM will take steps to prevent the impact. If the land use impact cannot be prevented, PPM will work with landowners in the area to provide alternative land that is acceptable to the affected land user for the land use. Alternatively, PPM will provide compensation for mine-related loss of land use.	As required	As required	Environmental site manager
				• PPM will compile an inventory of affected farmers including the type and size of each farmer's livestock herd. Talks will be held with the Department of Agriculture, PPM and the affected farmers to identify and access alternative grazing land of similar quantity and quantity. Alternatively, financial compensation will be provided for the loss of grazing land	Pre-construction and as required	Once off and as required	Environmental site manager
Operation	Site preparation Earthworks Civil works Site management Transport systems Non-mineralised waste management Site support services Open pit mining Mineral processing facilities Tailings dam Water and power supply infrastructure Rehabilitation Partial backfilling and flooding of the Tuschenkomst pit	H * H #	L * L #	• Any areas no longer required will be rehabilitated during all phases, and the waste rock dumps will be concurrently rehabilitated.	On going	On going	Environmental site manager
				• PPM and BBKTA will ensure that the cattle herders affected by the partial backfilling and flooding of the Tuschenkomst pit will have access to equivalent grazing areas (size), veld condition and watering points on the farm Wachteenbeetjeslaagte 4 JQ. Should this not adequately address the proposed loss to the cattle herders, PPM will provide additional compensation where relevant.	On going	On going	PPM management
				• In the case of the heritage park land use PPM commits to working with NWPTB and surrounding mining interests: o to maximise the heritage park corridor and width, o to maximise accessibility by wildlife, and o to ensure that the design of the final waste rock dump(s) (height, width, side wall slope and storm water management) does not restrict the effective functioning of the heritage park corridor.	On going	On going	PPM management
Decommission	Site preparation Demolition Earthworks Civil works Site management Transport systems Non-mineralised waste management Site support services Tailings dam Water and power supply infrastructure	H * H #	L * L #	• PPM will play a facilitation role in the establishment of the Heritage Park corridor outer fence of the phase 1 non-dangerous game corridor on the farms on and adjacent to its operations and activities. PPM will be involved with the phase 2 Big Five fence going forward	On going	On going	Environmental site manager
				• If the Heritage Park corridors are established before PPM is closed, emergency situations may arise if certain animals	As required	As required	Environmental site manager

	Rehabilitation Partial backfilling and flooding of the Tuschenkomst pit			(particularly dangerous animals) breach the fences and gain access to mining areas where workers could be in mortal danger. In such instances the emergency procedure included in Section 20 will be followed.			
Closure	Maintenance and aftercare of final land forms and rehabilitated areas	H * H #	L * L #	• Closure planning will incorporate measures to achieve the future land use plans for the land within PPM's mining right area.	Pre-closure	As required	Environmental site manager

Notes: * - Loss of grazing land; # - Obstruction of Heritage Park Corridor

TABLE 47: ACTION PLAN – BLASTING DAMAGE

Phase of operation	Activities (see Table 14)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Earthworks	H	L	• Implementation of a blast management programme (Section 21.1.5)	On-going	On-going	Environmental site manager
Operation	Open pit mining	H	L				
Decommission	Demolition	H	L	• Conduct a pre-crack survey of structures within the potential impact zone (1 500 m).	As required	As required	Environmental site manager
				• Design blasts to prevent injury to people and livestock and to prevent damage to structures. As a minimum, the blast design will ensure a peak particle velocity is less than 12.5 mm/s at all village boundaries and at other third party buildings such as the lodges at Black Rhino Game Reserve and the proposed hotel at the Zandspruit Development Corporation.	On-going	On-going	Environmental site manager
				• The air blast will be less than 125 dB at third party structures.	On-going	On-going	Environmental site manager
				• All structures and services within 1 500 m of the blast will be marked on a site plan and surveyed photographically in the presence of the owner before mining takes place. All parties that exist and/or have service infrastructure and/or that provide services within 1 500 m of the open pits will be informed, prior to mining, about the blast programme and associated safety precautions.	On-going	On-going	Environmental site manager
				• Communication of the planned blast programmed to interested and/or affected parties.			
				• Before mining at the Tuschenkomst (including future extensions), Ruighoek and Witkleifontein pits, the P50-1 dirt road, the Ruighoek dirt road and the Eskom power line may require temporary diversion or closure depending on the proximity of the blast – the safe limit being 500 m.	Pre-mining	As required	Environmental site manager
				• For each blast, PPM will observe the following procedural safety steps: o A fly rock danger zone of 500 m associated with each blast is delineated and people and animals are cleared from this zone before every blast; o An audible warning is given at least three minutes before the blast is fired.	On-going	On-going	Environmental site manager
				• In general, blasting will take place four times a week at the Ruighoek and Tuschenkomst pits, and three times a week at the Witkleifontein, Rooderand and chrome pits. Blast times are restricted to afternoons. No blasting will take place at the Tuschenkomst, Witkleifontein and Ruighoek pits on Sundays. Blasting at the Rooderand pit will be restricted to Monday morning to Thursday afternoon. Blasting at the chrome pits will be restricted to Monday morning to Friday afternoon.	On-going	On-going	Environmental site manager

Phase of operation	Activities (see Table 14)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				• PPM will respond immediately to any blast related complaints. There will be a formal documented investigation and response for all third party blast related complaints. Documentation will be kept for the life of mine. Where PPM has caused blast related damage it will provide appropriate compensation.	On-going	On-going	Environmental site manager
				• Blast monitoring to verify the effectiveness of the blast design and blast execution. Monitoring data will be interpreted and incorporated into monitoring reports, which will be made available to IAPs on request.	On-going	Quarterly	Environmental site manager
				• Audit and review to adjust the blast design where necessary to achieve the stated objectives.	As required	As required	Environmental site manager
				• In case of a major incident the emergency response procedure in Section 20 will be followed.	As required	As required	Environmental site manager
Closure	N/A	-	-	-	-	-	-

TABLE 48: ACTION PLAN – TRAFFIC

Phase of operation	Activities (see Table 14)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Transport systems	H	M	• Design of new roads, road improvements and road diversions to be done by an appropriately qualified person.	Design	Once off	Environmental site manager
Operation	Transport systems	H	M	• Obtain approval from roads authority for required new roads, road improvements and diversions.	Pre-construction	Once off	Environmental site manager
Decommission	Transport systems	H	M	• All new public roads will be constructed in accordance with the specifications of the relevant roads authority. In this regard, the following is applicable: o a long term diversion around the tailings dam of the P50-1; o a short term diversion around the Tuschenkomst pit of the P50-1; o a new intersection between the Witkleifontein haul road and the diverted P50-1; o a new intersection on the P50-1 for accessing the plant and the haul road to Ruighoek/Rooderand; o a new intersection on the P54-1 to cater for the new haul road and the existing public gravel road running past the Rustenburg Minerals Village. A short section of the existing public gravel road will have to be re routed; o closure of the Z536 south of Ngweding village, and construction of a new road along the northern boundary of the farm Wilgespruit 2 JQ.	Design	Once off	Environmental site manager
				• Where any new road crosses watercourses/streams, PPM will ensure that the flow of these streams is not impeded by establishing appropriately designed culverts that do not reduce or restrict stream flow.	Design	Once off	Environmental site manager
				• Approach other mines in the area, and the North West Roads Department about a joint initiative for upgrading the P54-1.	Pre-construction and on-going	On-going	Environmental site manager
				• Upgrade intersections in line with specialist recommendations and traffic management plan	Pre-construction	Once off	Environmental site manager
				• Following the closure of the Z536, the new road that will be constructed on the farm Wilgespruit 2 JQ will be fenced on either side.	On completion	Once off	Environmental site manager
				• Fence off sections of haul roads where there is a danger to livestock.	As required	As required	Environmental site manager
				• The P50-1 will be closed when blasting within 500 m of the road takes place and delays will be kept to a minimum.	On-going	On-going	Environmental site manager
				• Implementation of traffic complaints procedure.	On-going	On-going	Environmental site manager
				• Implement speed allaying measures on PPM's access roads.	As required	As required	Environmental site manager
				• Enforce strict speed limits on PPM's access roads.	On-going	On-going	Environmental site manager

Phase of operation	Activities (see Table 14)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				• In case of a major incident the emergency response procedure in Section 20 will be followed.	As required	As required	Environmental site manager
Closure	Not applicable	-	-	-	-	-	-

TABLE 49: ACTION PLAN – ECONOMIC (POSITIVE AND NEGATIVE)

Phase of operation	Activities (see Table 14)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	All activities	H+	H+	• PPM (and its contractors) will hire local people from the closest communities where possible.	As required	As required	Stakeholder engagement department
Operation	All activities	H+	H+	• PPM will extend its formal bursary and skills development programmes to the closest communities to increase the number of local skilled people and thereby increase the potential local employee base.	On going	On going	Stakeholder engagement department
Decommission	All activities	H+	H+	• PPM will ensure it procures local goods and services from the closest communities where possible.	On going	On going	Stakeholder engagement department
				• PPM will implement a procurement mentorship programme which provides support to local businesses from the enquiry to project delivery stages.	On going	On going	Stakeholder engagement department
				• Where farming land is lost to mining, the affected farmer will be provided with alternative suitable land and if this is not feasible alternative compensation will be provided.	As required	As required	Stakeholder engagement department
				• PPM will identify and develop sustainable business opportunities and skills, independent from mining for members of the local communities to ensure continued economic prosperity beyond the life of mine.	As required	As required	Stakeholder engagement department
				• 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.	On going	On going	Stakeholder engagement department
				• With regards to the water supply scheme, the key focus is on ensuring long term sustainability, particularly at the point of handover from PPM to the MKLM There is also the spending power could be increased, should agreement be reached between PPM and MKLM and the employment formalised	On-going	On-going	PPM management
				• With regards to the community water supply scheme, PPM will:			
				○ capacity building of the MKLM technical and financial teams;	On-going	On-going	PPM management
				○ a sufficient handover period where PPM remains actively involved;	On-going	On-going	PPM management
				○ start closure planning as soon as practically possible to ensure a sustainable handover to the MKLM this includes technical and financial capacity building within the MKLM by PPM	On-going	On-going	PPM management
				○ identify indigent community members that will qualify for government grants to pay for water.	At least 5 years prior to decommission	On-going	Environmental site manager
				○ remain actively involved for a sufficient period of time after hand over to ensure long term success of the supply scheme;	On-going	On-going	HR manager

				○ incorporate economic considerations into closure planning ○ empower, support and use local people for employment and local business for procurement as far as possible. ○ enhance local economic development ○ provide, where possible, wealth creation and life skills training to assist employees post closure ○ Implement the commitments in the social and labour plan in accordance with the employment, procurement and social investment principles of the Mining Charter. ○ Implement the land use (Table 46) and land management measures.	On-going On-going On-going On-going On-going On-going	On-going On-going On-going On-going On-going On-going	HR manager HR manager HR manager HR manager Environmental site manager Environmental site manager
Closure	All activities	H+	H+	• Incorporation of economic considerations into closure planning from the outset. • Closure planning considerations cover the skilling of employees for the downscaling, early closure and long term closure scenarios. • With regards to the water supply scheme, the key focus is on ensuring long term sustainability, particularly at the point of handover from PPM to the MKLM There is also the spending power could be increased, should agreement be reached between PPM and MKLM and the employment formalised	As required As required On-going	As required As required On-going	Stakeholder engagement department Stakeholder engagement department PPM management

TABLE 50: ACTION PLAN – INWARD MIGRATION

Phase of operation	Activities (see Table 14)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	All activities	H	M	• In terms of recruitment, procurement and training: o good communication with all job and procurement opportunity seekers will be maintained throughout the recruitment process. The process must be seen and understood to be fair and impartial by all involved. The personnel in charge of resolving recruitment and procurement concerns must be clearly identified and accessible to potential applicants; o the precise number of new job opportunities (permanent and temporary) and procurement opportunities will be made public together with the required skills and qualifications. The duration of temporary work will be clearly indicated and the relevant employees/contractors provided with regular reminders and revisions throughout the temporary period; o recruitment and procurement, by PPM and its contractors, will be preferentially provided to people in the communities that are closest to the mine. In order to be in a position to achieve this PPM will maintain a skills register of people within the closest communities. PPM will also preferentially provide bursaries and training to people that reside in these closest communities; o there will be no recruitment or procurement at the gates of the mine. All recruitment will take place off site, on set dates and at an arranged venue – preferably a formal gathering place in a nearby community. All procurement will be through existing, established procurement and tendering processes that will include mechanisms for empowering service providers from the closest communities; o unsuccessful job seekers will be notified once the recruitment process is complete.	On-going	On-going	Stakeholder engagement department
Operation	All activities	H	M				
Decommission	All activities	H	M				
				• PPM will continue to closely monitor the location and living conditions of all its workers during the development and operation of the mine to ensure that everyone is adequately accommodated. Monitoring records will be kept for the life of mine.	On-going	On-going	Stakeholder engagement department
				• PPM will work with its neighbours, local authorities and law enforcement officials to monitor and prevent the development of informal settlements near the mine and to assist where possible with crime prevention within the vicinity of the mine.	On-going	On-going	Stakeholder engagement department

Phase of operation	Activities (see Table 14)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				• PPM will implement a health policy on HIV/AIDS and tuberculosis. This policy will promote education, awareness and disease management both in the workplace and in the home so that the initiatives of the workplace have a positive impact on the communities from which employees are recruited. Prevention and management strategies will be introduced. Voluntary Counseling and Testing (VCT) is a vital aspect of a 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.	On-going	On-going	Stakeholder engagement department
				• PPM will implement a stakeholder communication information sharing and grievance mechanism to enable all stakeholders to engage with PPM on both socio-economic and environmental issues.	On-going	Quarterly	Stakeholder engagement department
				• The establishment of any informal settlements is considered to be an emergency situation that will be handled in accordance with the PPM emergency response procedure (Section 20).	As required	As required	Stakeholder engagement department
Closure	N/A	-	-	-	-	-	-

TABLE 51: ACTION PLAN – RELOCATION

Phase of operation	Activities (see Table 14)	Technical and management options	Action plan		
			Timeframe	Frequency	Responsible parties
Construction	Open pit mining (Tuschenkomst pit)	• With regards to the Tuschenkomst pit extension onto Wilgespruit 2 JQ: o PPM will take responsibility for the resettlement action plan. o PPM will appoint a resettlement professional to design and implement a resettlement action plan. The appointed specialist will carry out a social survey and census of the affected site to determine the number of people and livestock and to identify all associated infrastructure. o Resettlement will take place prior to the components of the operational phase that will necessitate resettlement and the plan must cover the relevant components from the World Bank Operational Directive on Involuntary Resettlement.	On-going On-going On-going	On-going On-going On-going	PPM management PPM management PPM management
Operation	Open pit mining (Tuschenkomst pit)				
Decommission	Open pit mining (Tuschenkomst pit)				
Closure	Open pit mining (Tuschenkomst pit)				

TABLE 52: ACTION PLAN – PUBLIC INVOLVEMENT

Phase of operation	Activities (see Table 14)	Technical and management options	Action plan		
			Timeframe	Frequency	Responsible parties
Construction	All activities	• PPM will communicate with its neighbouring communities and other key stakeholders through quarterly stakeholder meetings. This forum is intended to facilitate information sharing and environmental impact management relevant to PPM and its associated infrastructure and activities.	On-going	Quarterly	Stakeholder engagement department
Operation	All activities				
Decommission	All activities				
Closure	N/a	-	-	-	-

20 PROCEDURES FOR ENVIRONMENTAL EMERGENCIES AND REMEDIATION

20.1 ON-GOING MONITORING AND MANAGEMENT MEASURES

The on-going monitoring as described in Section 21 will be undertaken to provide early warning systems necessary to avoid environmental emergencies.

20.2 PROCEDURES IN CASE OF ENVIRONMENTAL EMERGENCIES

Emergency procedures apply to incidents that are unexpected and that may be sudden, and which lead to serious danger to the public and/or potentially serious pollution of, or detriment to the environment (immediate and delayed). Existing procedures at PPM that will be followed in case of environmental emergencies are described in the table below (Table 53).

20.2.1 GENERAL EMERGENCY PROCEDURE

The general procedure that should be followed in the event of all emergency situations is as follows.

- Applicable operational managers must be notified of an incident upon discovery;
- Area to be cordoned off to prevent unauthorised access and tampering of evidence;
- If residue facilities/dams, stormwater diversions, etc., are partially or totally failing and this cannot be prevented, the emergency siren is to be sounded (nearest one available). After hours the Plant Manager on shift must be notified;
- Take photographs and samples as necessary to assist in investigation;
- Report the incident to the responsible person of the Safety, Health Environment and Quality (Environment) department (or equivalent);
- The Environment department must comply with Section 30 of the National Environmental Management Act (107 of 1998) such that:
    - The Environment department must immediately notify the Director-General (DWEA, DMR and Inspectorate of Mines as appropriate), the South African Police Services, the relevant fire prevention service, the provincial head of DEDECT, the head of the local municipality, the head of the regional DWA office and any persons whose health may be affected of;
        - The nature of the incident;
        - Any risks posed to public health, safety and property;
        - The toxicity of the substances or by-products released by the incident; and
        - Any steps taken to avoid or minimise the effects of the incident on public health and the environment.
    - The Environment department must as soon as is practical after the incident:

- Take all reasonable measures to contain and minimise the effects of the incident including its effects on the environment and any risks posed by the incident to the health, safety and property of persons;
- Undertake clean up procedures;
- Remedy the effects of the incident; and
- Assess the immediate and long term effects of the incident (environment and public health);

o Within 14 days the Environment department must report to the Director-General DWEA, the provincial head of DEDECT, the head of the local municipality, the head of the regional DWA office such information as is available to enable an initial evaluation of the incident, including:

- The nature of the incident;
- The substances involved and an estimation of the quantity released;
- The possible acute effects of the substances on the persons and the environment (including the data needed to assess these effects);
- Initial measures taken to minimise the impacts;
- Causes of the incident, whether direct or indirect, including equipment, technology, system or management failure; and
- Measures taken to avoid a recurrence of the incident.

20.2.2 IDENTIFICATION OF EMERGENCY SITUATIONS

The site wide emergency situations that have been identified together with specific emergency response procedures are outlined in Table 53.

20.3 TECHNICAL, MANAGEMENT AND FINANCIAL OPTIONS

Technical, management and financial options that will be put into place to deal with the remediation of impacts in cases of environmental emergencies are described below.

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

TABLE 53: EMERGENCY RESPONSE PROCEDURES

Item	Emergency Situation	Response in addition to general procedures
1	Spillage of chemicals, engineering substances and waste	Where there is a risk that contamination will contaminate the land (leading to a loss of resource), surface water and/or groundwater, PPM 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. refuelling tanker) and the infrastructure 'made safe'. • Contain the spill (e.g. construct temporary earth bund around source such as road tanker). • Pump excess hazardous liquids on the surface to temporary containers (e.g. 210 litre drums, mobile tanker, etc.) for appropriate disposal. • Remove hazardous substances from damaged infrastructure to an appropriate storage area before it is removed/repaired.
2	Discharge of dirty water to the environment	Apply the principals listed for Item 1 above. To stop spillage from the dirty water system the mine will: • Redirect excess water to other dirty water facilities where possible; • Pump dirty water to available containment in the clean water system, where there is no capacity in the dirty water system; and • Carry out an emergency discharge of clean water and redirect the spillage to the emptied facility. • Apply for emergency discharge as a last resort.
3	Pollution of surface water	Personnel discovering the incident must inform the Environment department of the location and contaminant source. Apply the principals listed for Item 1 above. Absorbent booms will be used to absorb surface plumes of hydrocarbon contaminants. Contamination entering the surface water drainage system should be redirected into the dirty water system. The Environment department will collect in-stream water samples downstream of the incident to assess the immediate risk posed by contamination.
4	Groundwater contamination	Use the groundwater monitoring boreholes as scavenger wells to pump out the polluted groundwater for re-use in the process water circuit (hence containing the contamination and preventing further migration). Investigate the source of contamination and implement control/mitigation measures.
5	Burst water pipes (loss of resource and erosion)	Notify authority responsible for the pipeline (if not mine responsibility). Shut off the water flowing through the damaged area and repair the damage (if PPM 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 (e.g. open pits). Using the emergency response team, rescue/recover and medically treat any injured personnel. Temporarily reinstate/repair stormwater diversions during the storm event (e.g. emergency supply of sandbags).

Item	Emergency Situation	Response in addition to general procedures
		Close the roads affected by localised flooding or where a stormwater surge has destroyed crossings/bridges.
7	Risk of drowning from falling into water dams	Attempt rescue of individuals from land by throwing lifeline/lifesaving ring. Get assistance of emergency response team whilst attempting rescue or to carry out rescue of animals. Ensure medical assistance is available to recovered individual.
8	Veld fire	Evacuate mine employees from areas at risk. Notify downwind residents and industries of the danger. Assist those in imminent danger/less able individuals to evacuate until danger has passed. Provide emergency fire fighting assistance with available trained mine personnel and equipment.
9	Injury from fly rock	The person discovering the incident will contact the mine emergency response personnel to recover the injured party and provide medical assistance. Whilst awaiting arrival of the emergency response personnel, first aid should be administered to the injured party by a qualified first aider if it is safe to do so.
9	Falling into hazardous excavations	Personnel discovering the fallen individual or animal must mobilise the emergency response team to the location of the incident and provide a general appraisal of the situation (e.g. human or animal, conscious or unconscious, etc.). The injured party should be recovered by trained professionals such as the mine emergency response team. A doctor (or appropriate medical practitioner)/ambulance should be present at the scene to provide first aid and transport individual to hospital.
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.
11	Escape of dangerous wild animals from proposed heritage site corridors	Notify the park manager of sighting of dangerous wild animals. Ensure personnel get to safety (i.e. within 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 24hrs.

Item	Emergency Situation	Response in addition to general procedures
13	Uncovering of graves and sites	Personnel discovering the grave or site must inform the Environment department immediately. Prior to damaging or destroying any of the identified graves, permission for the exhumation and relocation of graves must be obtained from the relevant descendants (if known), the National Department of Health, the Provincial Department of Health, the Premier of the Province and the local Police. The exhumation process must comply with the requirements of the relevant Ordinance on Exhumations, and the Human Tissues Act, 65 of 1983.
14	Uncovering of fossils	Personnel discovering the fossil or potential site must inform the Environment department immediately. Should any fossils be uncovered during the development of the site, a palaeontologist or palaeoanthropologist will be consulted to identify the possibility for research.

21 PLANNED MONITORING AND EMP PERFORMANCE ASSESSMENT

21.1 PLANNED MONITORING OF ENVIRONMENTAL ASPECTS

Environmental aspects requiring monitoring are listed below.

- Water resources – see Section 21.1.1 for details
- Air – see Section 21.1.2 for details
- Noise – see Section 21.1.3 for details
- Biodiversity – see Section 21.1.4 for details
- Blasting – see Section 21.1.5 for details
- Tailings, waste dumps and other water dams – see Section 21.1.6 for details

21.1.1 WATER RESOURCES

Surface- and Ground- water

PPM has an existing surface- and ground- water monitoring programme that was developed in consultation with an appropriately qualified specialist. Table 54 sets out PPM's existing surface- and ground- water monitoring points within the mining right and surrounding area as well as the frequency which water quality and quantity are measured. Table 55 sets out the parameters that are monitored. Due to the non-perennial watercourses in the area, surface water is monitored when it is available. Water quality analyses results are classified in terms of the DWAF Guidelines Domestic Water Supply (1999).

TABLE 54: SURFACE- AND GROUND- WATER MONITORING PROGRAMME

Reference	Location		Frequency	
			Water quality	Water level
Groundwater				
BH 116	-25.11618	27.01724	Quarterly	Monthly
AGES 4	-25.07491	27.00370	Quarterly	Monthly
BH 4	-25.08257	27.00020	Quarterly	Monthly
BH 104	-25.10564	26.98734	Quarterly	Monthly
UB 40	-25.09801	26.96908	Quarterly	Monthly
AGES 6	-25.09259	26.96816	Quarterly	Monthly
BH 117	-25.10315	26.98976	Quarterly	Monthly
WN 3	-25.08405	26.95551	Quarterly	Monthly
WN 1	-25.09256	26.95590	Quarterly	Monthly
FF 15	-25.10256	26.95136	Quarterly	Monthly
BG 1	-25.10785	26.94812	Quarterly	Monthly
BG 2	-25.11582	26.94732	Quarterly	Monthly
FF 6	-25.12479	26.94321	Quarterly	Monthly
FF 1	-25.16578	26.94386	Quarterly	Monthly
FF 3	-25.16570	26.94485	Quarterly	Monthly
FF 5	-25.16812	26.94461	Quarterly	Monthly
BH 92	-25.06953	26.99778	Quarterly	Monthly

Reference	Location		Frequency	
			Water quality	Water level
BH 107	-25.07284	26.95367	Quarterly	Monthly
BH 7	-25.10678	26.95342	Quarterly	Monthly
Dawid BH	-25.13197	26.96936	Quarterly	Monthly
BH14	-25.18987	26.93300	Quarterly	Monthly
Surface water				
Pit	-25.10972	27.00869	Quarterly	Not applicable
RWD	-25.09638	26.97014	Monthly	Not applicable
Process water tank	-25.10613	26.99058	Quarterly	Not applicable
SW1	-25.19939	26.93281	When in flow	Not applicable
SW2	-25.17182	26.94135	When in flow	Not applicable
SW3	-25.12520	26.94244	When in flow	Not applicable
SW4	-25.09553	26.95680	When in flow	Not applicable
SW5	-25.05880	26.96321	When in flow	Not applicable
SW6	-25.05351	26.96592	When in flow	Not applicable
SW7	-25.06827	26.95369	When in flow	Not applicable
SW8	-25.12770	26.96391	When in flow	Not applicable
SW9	-25.09055	26.96615	When in flow	Not applicable
SW10	-25.12268	27.01150	When in flow	Not applicable
SW11	-25.10625	27.01621	When in flow	Not applicable
SW12	-25.07745	27.00487	When in flow	Not applicable

TABLE 55: MONITORING PARAMETERS FOR ANALYSIS AND REPORTING

In field measurements		
pH	Electrical conductivity	Total dissolved salts
Laboratory analysis		
pH	Chloride	Chrome(VI)
Electrical conductivity	Fluoride	Copper
Temperature	Magnesium	Iron
Dissolved Oxygen	Nitrate as N	Lead
Total dissolved salts (TDS)	Potassium	Manganese
Alkalinity as $CaCO_3$	Sodium	Cadmium
Acidity as H+	Sulphate	Selenium
Ammonia as N	Aluminium	Barium
Calcium	Arsenic	Boron
Mercury	Zinc	-

If monitoring indicates a mine-related decrease in groundwater supply to third parties or groundwater quality at third party boreholes, appropriate measures will be taken to prevent the decrease from occurring or rectify the contamination situation, to provide the affected third parties with an alternative water supply, and/or to possibly purchase affected farms.

FIGURE 25: MONITORING NETWORK

Surface and ground water monitoring points.

Process water

Process water quality from dirty water dams will be monitored on a quarterly basis. The parameters to be monitored are outlined in Table 55.

Rainfall related discharges will be monitored as required according to the parameters in Table 55 . If the quality of the monitored discharge is above acceptable levels, additional measures will be identified and implemented to prevent the future potential for surface water related pollution.

Water balance

The climatic water balance for PPM will be updated on an annual basis. This will be done by an appropriately qualified person. Flow metres will be installed in the mine water circuit to provide actual data on water flows to confirm or amend predictions made in the water balance model. The water balance will be used to check on an on-going basis that the capacity of the dirty water holding facilities is adequate.

21.1.2 AIR QUALITY

As part of PPM's existing air management plan, the monitoring programme will be amended to include additional dust buckets at the chrome operations in consultation with an appropriately qualified air specialist. In this regard, a dust bucket will be established at the centre of the chrome operations as well as on the P50-1 to the east of PPM. Monitoring of both source and receptor sites will be conducted. The target on-site dust fallout reading is 1200mg/m^2/day. The target off-site dust fallout reading is 600mg/m^2/day.

All dust buckets will be monitored on a monthly basis. A report will be produced to document the measurement points, the methodology used, the measured results and recommendations, if required, to further minimise the mine's impact. Additional buckets can be placed at the request of surrounding IAPs.

A PM_{10} sampler will be placed at the nearest sensitive receptor (Ngweding) to monitor ambient PM_{10} concentrations at this location, confirm the modelling results and to determine a measured baseline for future studies.

It is recommended that PPM, the local municipality and the other existing and proposed mines in the area collaborate to establish a weather station to track wind direction, wind speed and rainfall and to establish a PM_{10} monitor for ambient conditions.

21.1.3 NOISE

Noise monitoring will take place on an annual basis. Monitoring points will include, but will not be limited to, sensitive receptors in close proximity to PPM namely, the village of Ngweding and Black Rhino Game Reserve.

21.1.4 BIODIVERSITY

Selecting suitable indicator groups Relocation/ provision of alternative habitats

Prior to construction of future projects, detailed baseline studies of selected fauna and flora indicator groups within vegetation communities that will be directly impacted will be undertaken by an appropriately qualified specialist. For each vegetation type an area within the direct impact zone and a control area outside of this zone (preferably outside of the 500m buffer zone) should be selected and surveyed. These indicator species will form an important part during the rehabilitation of the site during closure.

Alien invasive species program

During operation, decommissioning and closure, PPM will implement an alien invasive / weed management programme to control the spread of these plants onto and from disturbed areas. This will be achieved by active eradication and the establishment of natural species and through on-going monitoring and assessment. The use of herbicides will be limited and will only be used under strict controls if alternative less intrusive eradication methods are not successful.

Continued monitoring will be undertaken to ensure that the alien invasive species have been eradicated and are controlled for both controlled site and rehabilitated areas. Repeat surveys should be carried out annually for at least the first three years post-rehabilitation.

Rehabilitation targets

Rehabilitation targets are set as follows:

- return biodiversity levels of indicator species (total species number estimates) to at least 90% of baseline average;
- achieve diversity/evenness indices of at least 90% of average baseline values;
- achieve at least 70% similarity of community species composition to baseline measure;
- rank abundance plot slopes, which are expected to become significantly steeper in the early stages of rehabilitation, should have regained a similar pattern to that obtained from the baseline studies if rehabilitation is to be considered complete.

21.1.5 BLASTING

Prior to the construction phase of the chrome project and any future projects, PPM will undertake a pre-blast baseline survey as detailed in the action plan (Section 19).

Monitoring of each blast will take place for the duration of blasting activities. Points for off-site vibration and airblast monitoring will be identified in consultation with surrounding landowners and a blast monitoring specialist. Monitoring of ground vibration will be done on a monthly basis to verify that the peak particle velocity is less than 12,5mm/s at the boundary of villages and before it reaches any third party structures. In regard to airblast monitoring the limit at the same monitoring point is less than 125dBA. The monitoring results will be documented and maintained for record-keeping and auditing purposes.

21.1.6 MINERALISED WASTE FACILITIES AND WATER DAMS

In addition to the abovementioned environmental monitoring programmes, the following issues will, as a minimum and where applicable, be monitored by a professional engineer on a quarterly basis:

- phreatic surface, slope stability, adequacy of freeboard, integrity of walls, the position of the pools, silt trap sediment, presence of seepage, and functioning of drains;
- the success of vegetation establishment on the outer side walls; and
- erosion damage.

The findings will be documented and maintained for record-keeping and auditing purposes, and addressed where relevant to achieve the stated objectives.

21.2 AUDITING AND PERFORMANCE ASSESSMENTS

The environmental manager will conduct internal management audits against the commitments in the EMP. These audits will be conducted on an on-going basis until final closure. The audit findings will be documented for both record keeping purposes and for informing continual improvement. In addition, and in accordance with mining regulation R527, an independent professional will conduct an EMP performance assessment every two years. The site's compliance with the provisions of the EMP and the adequacy of the EMP report relative to the on-site activities will be assessed in the performance assessment.

21.3 FREQUENCY FOR REPORTING

As a minimum, the following documents will be submitted to the relevant authorities from the start of construction until mine closure:

- EMP performance assessment, submitted every two years to DMR;

- updated closure and rehabilitation cost estimate, submitted annually to the DMR;
- water monitoring reports, submitted annually to DWA – these reports will not only present monitoring data but will also provide interpretations of trends in the data and reporting on compliance with water quality guidelines;
- air monitoring reports, submitted annually to the DMR and DEDECT
- detailed plan for decommissioning/closure, submitted to DMR at least five years prior to decommissioning.

22 FINANCIAL PROVISION

The information in this section was sourced from the closure cost calculation study completed by SLR (Appendix N).

22.1 PLAN SHOWING LOCATION AND AERIAL EXTENT OF PROPOSED OPERATION

A plan showing the location and aerial extent of the proposed operation is provided in Figure 26.

22.2 ANNUAL FORECASTED FINANCIAL PROVISION

The current financial closure liability associated with the PPM Chrome Project (as at July 2014 and at life of project [July 2017]) is R 7,536,274.88 (incl. VAT) and R 12,723,487.76 (incl. VAT) respectively.

TABLE 56: FINANCIAL PROVISION (SLR, 2012)

Year	Financial provision (R, excluding VAT)
1	7 536 274.88
2	+5 083 976.55
3	+1 642 892.1
4*	(-1 539 655.77)
Life of project	**12,723,487.76**

* Backfilling of the eastern and western pits is complete. Most of the area of the eastern pit and a section of the western pit now forms part of a Waste Rock Dump for the on-going PPM Platinum mining operations.

22.3 CONFIRMATION OF AMOUNT TO BE PROVIDED

This will be confirmed in consultation with the DMR.

22.4 METHOD OF PROVIDING FINANCIAL PROVISION

The funding method is in accordance with the DMR methods.

FIGURE 26: SURFACE LAYOUT OF THE ENTIRE PPM OPERATION INCLUDING THE PROPOSED CHROME OPERATIONS

23 ENVIRONMENTAL AWARENESS PLAN

This section includes an environmental awareness plan for the mine. The plan describes how employees will be informed of environmental risks which may result from their work, the manner in which the risk must be dealt with in order to avoid pollution or degradation of the environment and the training required for general environmental awareness and the dealing of emergency situations and remediation measures for such emergencies.

All contractors that conduct work on behalf of PPM are bound by the content of the EMP and a contractual condition to this effect will be included in all such contracts entered into by the mine. If contractors are used, the responsibility for ensuring compliance with the EMP will remain with 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 PPM to achieve the objectives of the environmental policy.

23.1 ENVIRONMENTAL POLICY

PPM will display the environmental policy 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 Environmental Management Programme (EMP) report;
- to ensure that all PPM's employees, contractors and sub-contractors:
  - are aware of the impact of their activities on the environment;
  - are informed about the measures required to prevent, mitigate and manage environmental impacts; and
  - apply these principles whilst carrying out their work.
- to establish and maintain a good relationship with surrounding communities, industries and other interested and affected parties, with regard to PPM'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.

23.2 STEPS TO ACHIEVE THE ENVIRONMENTAL POLICY OBJECTIVES

PPM'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:
  - PPM will establish and appoint an Environmental 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 PPM 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 EMP to the Department of Minerals 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:
  - PPM 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-PPM personnel who will be on site for more than five days must undergo the SHE 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 already identified in the EMP which currently includes the following issues:
  - topography (hazardous excavations);
  - soil and land capability management (loss of soil resource);
  - management of biodiversity;
  - surface water management (alteration of surface drainage and pollution of surface water);
  - groundwater management (reduction in groundwater levels/availability and groundwater contamination);
  - management of air quality (dust generation);
  - noise (specifically management of disturbing noise);
  - visual aspects (reduction of negative visual impacts);
  - surrounding land use (traffic management, blast management, land use loss);
  - heritage resources (management of sites);
  - socio-economic impacts (management of positive and negative impacts).
- all mine projects will be designed to minimise impacts 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 EMP report.

23.3 TRAINING OBJECTIVES OF THE ENVIRONMENTAL AWARENESS PLAN

The environmental awareness plan ensures that training needs are identified and that appropriate training is provided. The environmental awareness plan should communicate:

- the importance of conformance with the environmental policy, procedures and other requirements of good environmental management;
- the significant environmental impacts and risks of individuals work activities and explain the environmental benefits of improved performance;
- individuals roles and responsibilities in achieving the aims and objectives of the environmental policy; and
- the potential consequences of not complying with environmental procedures.

23.3.1 GENERAL CONTENTS OF THE ENVIRONMENTAL AWARENESS PLAN

To achieve the objectives of the environmental awareness plan the general contents of the training plans are as follows:

- Module 1 – Basic training plan applicable to all personnel entering the site:

  - short (15min) presentation to indicate the site layout and activities at specific business units together with their environmental aspects and potential impacts; and
  - 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 five days:
  - general understanding of the environmental setting of the mine (e.g. close to Pilanesberg National Park, 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, noise, 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 (e.g. proximity of watercourses, vulnerability of groundwater, proximity of local communities and industries, etc.);
  - specific environmental aspects such as:
    - spillage of hydrocarbons at workshops;
    - spillage of explosive liquids in the open pits;
    - poor waste management such as mixing hazardous and general wastes, inappropriate storage and stockpiling large amounts of waste;
    - poor housekeeping practices;
    - poor working practices (e.g. not carrying out oil changes in designated bunded areas);
    - excessive noise generation and unnecessary use of hooters; and
    - protection of heritage resources (including palaeontological resources).
  - impact of environmental aspects, for example:
    - hydrocarbon contamination resulting in loss of resource (soil, water) to downstream users;
    - groundwater contamination also resulting in loss of resource due to potential adverse aesthetic, taste and health effects; and
    - dust impacts on local communities (nuisance and health implications).
  - 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; and
- participate and organise events which promote environmental awareness, some of which will be tied to national initiatives e.g. National Arbour Week, World Environment Day and National Water Week.

24 TECHNICAL SUPPORTING INFORMATION

Technical and supporting information included as appendices to this report, not already attached in terms of the EIA, are listed below:

- soil and land capability study (Appendix E);
- biodiversity study (Appendix F);
- hydrological assessment and stormwater management plan (Appendix G);
- climatic water balance (Appendix H);
- air study (Appendix I);
- noise study (Appendix J);
- phase II heritage impact assessment and paleontological studies (Appendix K);
- economic study (Appendix L); and
- preliminary waste rock design report (Appendix M)

25 CAPACITY TO MANAGE AND REHABILITATE THE ENVIRONMENT

This section outlines the applicant's capacity to rehabilitate and manage negative impacts on the environment.

25.1 AMOUNT REQUIRED TO MANAGE AND REHABILITATE THE ENVIRONMENT

The mine manages the environmental impacts throughout the value chain and puts preventative and mitigating measures in place to achieve this. It is the mines policy to always adopt best practice and the capital budget provided by the mine to manage all identified environmental aspects for a four year period from the 2013 financial year is R12.7 million. The direct operational budget for the 2013 financial year is R10 000.00 per month.

25.2 AMOUNT PROVIDED FOR

The amount required as per the above budget has been provided for in the current PPM budgeting period.

26 UNDERTAKING SIGNED BY APPLICANT

COMMITMENT/UNDERTAKING BY APPLICANT

I,.....

the undersigned and duly authorised thereto by

.....……

undertake to adhere to the requirements and to the conditions set out in the approved EMP with the exception of the exemption(s) and amendment(s) agreed to be relevant by the Regional Manager: _____ (include relevant province).

Signed at: .....…….……

On: .....

Signature: ……...…….

Designation: ……..…….

REGIONAL MANAGER: __NORTH WEST_____ REGION

In terms of the Mineral and Petroleum Resources Development Act, 2002 (Act 28 of 2002) this document of ……. is approved subject to the conditions as set out in the letter of approval.

Signed at: .....……...

On: .....

Signature: ……..

Designation: ……..

REGIONAL MANAGER: _____

27 ENVIRONMENTAL IMPACT STATEMENT & CONCLUSION

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

A summary of the potential impacts (as per Section 7 of the EIA/EMP report), associated with the chosen alternatives (as per Section 2 of the EIA/EMP report), in the unmitigated and mitigated scenarios for all project phases is included in Table 57 below.

TABLE 57: TABULATED SUMMARY OF POTENTIAL IMPACTS

Impact	Significance	
	Unmitigated	Mitigated
Loss and/or sterilisation of mineral resources	L	L
Hazardous excavations/structures/surface subsidence	H	M
Loss of soil resources and land capability through land contamination	H	L
Loss of soil resources and land capability through physical disturbance	H	L
Physical destruction of biodiversity	H	M
General disturbance of biodiversity	H	M –construction to decommissioning L - closure
Contamination of surface water	H	L
Alteration of drainage patterns	L	L
Groundwater contamination	H	L
Dewatering	L	L
Air pollution	H	M – all phases except closure
Noise pollution	M-H – all phases except closure	M – all phases except closure
Negative visual impacts	H	M-H – construction to decommissioning L - closure
Destruction and disturbance of heritage (including cultural) and paleontological resources	M	L
Loss of current and future land uses	H	L
Obstruction of the Heritage Park	H	L
Blasting hazards	H	L
Project-related road use and traffic	H	M
Economic impact (positive impact)	H+	H+
Inward migration	H	M

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

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

Fiona Bolton (EAP)
(Project Manager)

Brandon Stobart (EAPSA)
(Project Reviewer)

SLR Consulting (Africa) (Pty) Ltd

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APPENDIX A: STAKEHOLDER DATABASE

APPENDIX B: INFORMATION-SHARING WITH REGULATORY AUTHORITIES

- Correspondence received from land claims commission (May 2012)
- DEDECT acknowledged receipt of application (1 March 2010)
- DEA acknowledged receipt of application (19 March 2010)
- Minutes of regulatory authority site meeting held on 22 June 2010
- Minutes of DEDECT site visit held on 4 February 2011
- DMR comments on the scoping report (dated 16 March 2011)
- DEA comments on the scoping report (dated 16 September 2011)
- DEDECT comments on the scoping report (dated 3 March 2011)
- Retraction of the waste application (dated 15 June 2012)

APPENDIX C: INFORMATION-SHARING WITH IAPS

- Minutes of focussed stakeholder meetings:
  - Bakgatla-Ba-Kgafela tribal council (4 May 2010)
  - Headmen from affected villages (18 May 2010)
  - Pilanesberg National Park and Black Rhino Game Reserve representatives (3 August 2010)
  - Black Rhino Game Reserve stakeholders (30 September 2010)
- Background information document (in English and Setswana) for information-sharing purposes
- Site notice (in English and Setswana) and photos showing where site notices were displayed
- Newspaper advertisements placed in The Daily Sun and The Rustenburg Herald on 21 May 2010
- Minutes of public scoping meetings:
  - Public scoping meeting held in Legkraal (19 June 2010)
  - Public scoping meeting held in Motlhabe (19 June 2010)
- Scoping report summary and cover letter (in English and Setswana)
- Written comments received from IAPs
- SLR newsletter informing IAPs on the delay in the environmental assessment process (23 August 2011)

APPENDIX D: COMMENT AND RESPONSE REPORT

APPENDIX E: SOIL AND LAND CAPABILITY STUDY

Specialist report prepared by the ARC-Institute for Soil, Climate and Water (ARC-ISCW) , March 2006 (including a professional opinion from the ARC-ISCW dated 12 September 2011 stating that soil properties would not have changed since the original study was undertaken).

APPENDIX F: BIODIVERSITY STUDY

Specialist report prepared by Natural Scientific Services, February 2011

APPENDIX G: HYDROLOGICAL STUDY

Specialist report prepared by SLR Consulting, March, 2012

APPENDIX H: CLIMATIC WATER BALANCE

Specialist report prepared by AGES, June 2012

APPENDIX I: AIR QUALITY STUDY

Specialist report prepared by Airshed Planning Professionals, March 2012

APPENDIX J: NOISE IMPACT STUDY

Specialist report prepared by Francois Malherbe, February 2007

APPENDIX K: HERITAGE (INCLUDING CULTURAL) AND PALEONTOLOGICAL STUDIES

Phase II HIA report prepared by Dr Julius Pistorius and Sydney Miller, September 2010

Paleontological report prepared by Professor Bruce Rubidge, February 2011

APPENDIX L: ECONOMIC STUDY

Land use analysis report prepared by Strategy4Good, January 2012

Integrated sustainable development analysis report prepared by Strategy4Good, July 2012

APPENDIX M: PRELIMINARY ENGINEERING DESIGN OF WRD

Specialist report prepared by Epoch, May 2012

APPENDIX N: CLOSURE COST CALCULATION STUDY

Specialist report prepared by SLR Consulting, June 2012

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