mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

SCOPING REPORT

FOR LISTED ACTIVITIES ASSOCIATED WITH MINING RIGHT AND/OR BULK SAMPLING ACTIVITIES INCLUDING TRENCHING IN CASES OF ALLUVIAL DIAMOND PROSPECTING.

SUBMITTED FOR ENVIRONMENTAL AUTHORIZATION IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 AND THE NATIONAL ENVIRONMENTAL MANAGEMENT WASTE ACT, 2008 IN RESPECT OF LISTED ACTIVITIES THAT HAVE BEEN TRIGGERED BY APPLICATIONS IN TERMS OF THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, 2002 (MPRDA) (AS AMENDED).

NAME OF APPLICANT: Nomamix (Pty)Ltd

TEL NO: +27 (0)11 467 5793

FAX NO: +27 (0)86 236 7206

POSTAL ADDRESS: Postnet Suite 911, Private Bag x153, Bryanston, 2021

PHYSICAL ADDRESS: Unit 7, Stratfort Office Park, c/o Cedar & Valley Road, Broad Acres, Fourways, 2196

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REVISION AND APPROVAL

Revision number:	00		
Environmental Management Assistance (Pty) Ltd (EMA) ref:	Nomamix (Pty) Ltd Vygenhoek Project		
Title:	SCOPING REPORT FOR THE LISTED ACTIVITIES IN TERMS OF NEMA AND WASTE MANAGEMENT ACTIVITIES ASSOCIATED WITH THE PROPOSED VYGENHOEK PLATINUM MINE		
Reviewers			
	Name	**Digital Signature**	**Date**
Author	**Anandi Alers** *MSc Geography and Environmental Management* ***EAP*** *Natural Scientist (400016/17) and a professional member of IAIAsa*		11 August 2020
Document reviewer	**Deon Esterhuizen** ***EAP*** *Natural Scientist (400154/09) and a professional member of IAIAsa*		11 August 2020
Document Authorisation	**Taryn Bigwood** *Masters* ***EMA Director*** *Member of LaRSSA, SAAG and IAIAsa*		11 August 2020
Applicant Authorisation	**Walter Murray** **Managing Director at Nomamix (Pty) Ltd**		11 August 2020

EXECUTIVE SUMMARY

Environmental Management Assistance (Pty) Ltd has been appointed as the independent Environmental Assessment Practitioner (EAP) to manage the integrated Scoping and Environmental Impact Assessment (EIA) process associated with the following activities:

- Activities associated to the mining right application; and
- waste management activities listed under Category B in GNR 633 of 24 July 2015 (GG 39020) in accordance with the 2014 EIA regulations (GN R.982) on behalf of the applicant.

Nomamix (Pty) Ltd (the applicant) is proposing an opencast platinum mining development, hereafter to be referred to as the Vygenhoek Platinum Mine, situated on Portions 3 and 7 of the farm Vygenhoek 10 JT situated in the Thaba Chweu Municipality, Mpumalanga.

As part of the scoping assessment, several specialists were appointed to conduct a desktop baseline study with an indication of impacts that could impact the feasibility of the mine. In addition, the terms of reference for the EIA phase have been identified.

Air quality

It is expected that emissions from activities at the proposed mine will most likely result in air quality impacts in terms of dust-fall, PM_{10} and PM_2. No fatal flaws and red flags that could impact on the feasibility of the proposed mine could be determined at this stage of the process.

Climate change

Overall, the expected impact of the ***proposed mine on climate change***, in terms of GHG emissions, is ***expected to be low***, based on the information provided, and assumptions based on researched information only. The ***impact of climate change on the proposed mine*** itself is ***expected to be low*** at present, however further research would be required on predicted impacts over the next 10 years (over the LoM).

Noise

Considering the location of the identified NSD, as well as the area where mining may take place, there is a potential that mining activities may take place within 1,000 – 2,000 m from these NSD. At this distance, mining may result in noise levels that are audible during the day and night. The ***significant of the noise impact could be medium to low***. If mining activities take place closer than 1,000m, the noise impact may be higher.

Terrestrial biodiversity

Results of this scoping assessment, based on an appraisal of available information and a brief site reconnaissance survey, indicate the ***high faunal sensitivity*** of most of the site.

The nature and significance of anticipated impacts on the faunal and avian receiving environment is likely to be ***locally significant, but with a diminishing significance on a regional scale***. , it should be noted that the potential presence of several conservation important species from the site could result in unacceptably high impacts. A comprehensive EIA and compilation of a dedicated EMPr for the proposed development will likely result in lower (but still comparatively high) significance levels of impacts on the faunal and avian environment.

Aquatic biodiversity

The proposed activity is expected to impact on national protected areas targets as well as provincial freshwater conservation targets, both of which are expected to be cumulative in the impact is to be considered with other regional impacts that have or are expected to have on such areas.

In review of the biodiversity categories developed by the Mpumalanga Tourism and Parks Agency from the perspective of freshwater ecosystems, the designation of the watercourse associated with the ***western portion of the area*** under study as being a ***Critical Biodiversity Area (CBA)*** with the ***remainder of the study area*** being classified as ***an Ecological Support Area (ESA)*** in the form of an important sub-catchment and Fish Support Area poses several challenges to the activity proposed (i.e. opencast platinum mining).

Given the ***high sensitivities of the freshwater ecosystem*** associated with the proposed mine, it was further determined that such specialist studies are to be conducted at a detailed level, and that an aquatic and/or wetland compliance statement are not deemed to be applicable on the basis of the sensitivities identified during the present exercise.

Soils

The results of the desktop assessment for the proposed mine find the proposed activity will have a ***medium to low impact*** on the immediate and surrounding soil systems. Implementation and management of proposed mitigation measures will minimize loss of topsoil, prevent contamination of topsoil and stockpiled soil, and prevent overall soil erosion.

Hydrology

This baseline assessment, together with first-hand knowledge of the major hydrological flow regimes gained through visiting the site indicate that the hydrological environment is presently in its natural state, baring a few cattle grazing in the area.

The ***runoff potential*** at the site is ***very high*** due to the combination of very steep topography, limited soil depth, and limited vegetation cover where parent rock is exposed at the surface.

The proposed development of the site will alter the natural flow regime in terms of both water quantity and water quality with potential negative impact to both downstream water users and stream biodiversity. Mitigation measures can however be put in place to help reduce this impact.

Geo-hydrology

The preliminary risk assessment conducted indicated that the proposed mine may have a ***medium to low*** impact on the groundwater environment. It is recommended that a follow-up geohydrological assessment, incorporating numerical flow and transport modelling be undertaken to refine the preliminary risk and impact assessment.

Seismicity

The proposed Vygenhoek mine is situated in an area where seismic intensity is low, and the ***liquefaction hazard*** is "***Marginal***". The natural state of the area is not prone to cause ***collapsible soils*** with a ***very low to low probability of causing landslides.***

Based on the above no further seismic intrusive work would be required. However, it is recommended that a slope stability assessment be conducted to inform the mine plan as soon as mining starts. The slope stability assessment can help prevent landslides typically associated with high walls and steep-sloped areas.

Human Health

Through the desktop research, and considering the magnitude of related mining activities in the adjacent area, no fatal flaws are envisaged, although depending on the timing of the project the potential red flags that relate to health include:

- The current global pandemic known as Coronavirus Disease 2019 (COVID-19) may well impact the short-term timeframes including the 6-month site establishment and potentially the operational 8-month ore production milestone and 14-month steady state production milestone.
- The existing local health infrastructure systems may be negatively impacted by the above COVID-19 pandemic which is currently already under strain and may remain under severe strain in the coming months to a year or two. This could result in a medium-term impact to the local health infrastructure depending on the severity of COVID-19 in the local and provincial settings.
- Potential informal settlements (residents) that have apparently taken up occupancy on the proposed land (as per other Specialists site visit), including neighbouring communities which may be directly adjacent to the proposed project and negatively affected in terms of health.

Socio-economic

Based on this review and a preliminary assessment of potential socio-economic impacts of the proposed project, there are no immediate fatal flaws identified. There is the potential for the livelihoods of people living on and near to the proposed project site to be severely affected. The two houses on the project property and the 25 to 30 houses immediately south of the project site are likely to use the proposed project land to support their livelihoods, such as for grazing livestock, and collecting fire wood, water and other natural resources.

The mining activities could potentially impact the physical assets of the households within close proximity to the proposed project operations. The degree to which this will affect the socio-economic stability of these households or communities will need to be assessed further in the EIA phase.

it is not anticipated that houses will need to be relocated at this stage, as there are no houses within the operational or working area of the mine.

Heritage and Palaeontology

Graves are of high social significance and are the most sensitive from a heritage perspective. The Dwars River Valley has been the location of numerous mining projects and the various projects have a cumulative negative and permanent impact on the heritage resources of the area. Based on the current information obtained for the area at a desktop level it is anticipated that any sites that occur within the proposed development area will have a Generally Protected B (GP.B) or lower field rating apart from graves that could have a Generally Protected A (GP.A) field rating.

The study area is of low and insignificant paleontological sensitivity according to the SAHRIS palaeontological sensitivity map and no further studies are required in this regard.

Traffic

The existing access road (Local Road) that provides access to the proposed mining development site from Road D874 is mostly a single lane gravel road that is shared by vehicle traffic in both directions, has ***limited passing opportunities*** on most sections, and in general is ***suitable for light vehicle traffic*** only and is therefore deemed to not be suitable for mine related vehicle traffic with specific reference to heavy vehicles.

Visual assessment

Notwithstanding the fact that the proposed Vygenhoek Platinum Mine may have a fairly limited area of potential visual exposure, the mine and mining activities, where ***visible from shorter distances*** (e.g. within a 2-5km radius), may constitute a ***high visual prominence***, potentially resulting in a ***high visual impact***. This may become evident should potential sensitive visual receptors be identified within this zone during the EIA phase of the project.

Waste classification and characterisation

Although this application includes the application for a Waste Management Licence (WML), no classification and characterisation has taken part of the scoping phase. Sampling and classification will form part of the EIA investigation where the infrastructures required for the residue stockpile facilities will be determined.

The submission of this report is in compliance with the EIA regulations stipulated in GN R. 982 of the National Environmental Management Act, 1998 (Act no. 107 of 1998), the National Environmental Management Waste Act, 2008 (Act no 59 of 2008), and the Mineral and Petroleum Resources Development Act, 2002 (Act no. 28 of 2002), as amended.

IMPORTANT NOTICE

In terms of the Mineral and Petroleum Resources Development Act (Act 28 of 2002 as amended), the Minister must grant a prospecting or mining right if among others the mining "will not result in unacceptable pollution, ecological degradation or damage to the environment".

Unless an Environmental Authorisation can be granted following the evaluation of an Environmental Impact Assessment and an Environmental Management Programme report in terms of the National Environmental Management Act (Act 107 of 1998) (NEMA), it cannot be concluded that the said activities will not result in unacceptable pollution, ecological degradation or damage to the environment.

In terms of section 16(3)(b) of the EIA Regulations, 2014, any report submitted as part of an application must be prepared in a format that may be determined by the Competent Authority and in terms of section 17 (1) (c) the competent Authority must check whether the application has taken into account any minimum requirements applicable or instructions or guidance provided by the competent authority to the submission of applications.

It is therefore an instruction that the prescribed reports required in respect of applications for an environmental authorisation for listed activities triggered by an application for a right or a permit are submitted in the exact format of, and provide all the information required in terms of, this template. Furthermore please be advised that failure to submit the information required in the format provided in this template will be regarded as a failure to meet the requirements of the Regulation and will lead to the Environmental Authorisation being refused.

It is furthermore an instruction that the Environmental Assessment Practitioner must process and interpret his/her research and analysis and use the findings thereof to compile the information required herein. (Unprocessed supporting information may be attached as appendices). The EAP must ensure that the information required is placed correctly in the relevant sections of the Report, in the order, and under the provided headings as set out below, and ensure that the report is not cluttered with un-interpreted information and that it unambiguously represents the interpretation of the applicant.

OBJECTIVE OF THE SCOPING PROCESS

The objective of the scoping process is to, through a consultative process—

(a) identify the relevant policies and legislation relevant to the activity;

(b) motivate the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location;

(c) identify and confirm the preferred activity and technology alternative through an impact and risk assessment and ranking process;

(d) identify and confirm the preferred site, through a detailed site selection process, which includes an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified alternatives focusing on the geographical, physical, biological, social, economic, and cultural aspects of the environment;

(e) identify the key issues to be addressed in the assessment phase;

(f) agree on the level of assessment to be undertaken, including the methodology to be applied, the expertise required as well as the extent of further consultation to be undertaken to determine the impacts and risks the activity will impose on the preferred site through the life of the activity, including the nature, significance, consequence, extent, duration and probability of the impacts to inform the location of the development footprint within the preferred site; and

(g) identify suitable measures to avoid, manage, or mitigate identified impacts and to determine the extent of the residual risks that need to be managed and monitored.

SCOPING REPORT

2. Contact Person and correspondence address

Environmental Management Assistance (Pty) Ltd has been requested to complete the Scoping and EIA process associated with the application required for a mining right and associated listed activities in terms of the National Environmental Management Act, 1998 (Act 107 of 1998) (NEMA) and the National Environmental Management: Waste Act, 2008 (Act 59 of 2008) (NEMWA) to the Mpumalanga Department of Mineral and Resources and Energy (DMRE) on behalf of Nomamix (Pty) Ltd (applicant) for the proposed Vygenhoek Platinum Mine situated in the Thaba Chweu Municipality, Mpumalanga.

a) Details of

i) Details of the EAP

Name of the Practitioner:	Environmental Management Assistance (Pty) Ltd
Contact person:	Anandi Alers
Tel No.:	+27 (0) 72 604 0455
Fax No. :	+27 (0) 86 226 7324
E-mail address:	anandi.alers@emassistance.co.za

ii) Expertise of the EAP

Environmental Management Assistance (Pty) Ltd (EMA) has appointed Mrs. Anandi Alers (Professional Natural Scientist - 400015/17) as the EAP to manage the application process on behalf of Nomamix (Pty) Ltd.

A detailed portfolio of the team members associated with the management of this project can be found in **Appendix A**.

(1) The qualifications of the EAP

(With evidence attached as ***Appendix A****)*

Mrs. Anandi Alers completed a Master of Science degree in Environmental Management and Geography in 2015 at the North West University (Potchefstroom) under the guidance of Prof. Luke Sandham.

She holds a Bachelors of Science Honours degree in environmental sciences, specialising in Environmental Management and Geography, and a Bachelors of Science degree in Tourism, Zoology, and Geography.

(2) Summary of the EAP's past experience.

(Attach the EAP's curriculum vitae as ***Appendix A****)*

Mrs Anandi Alers has extensive knowledge of the South African EIA process and holds a Master of Science degree in Environmental Management on the subject of EIA follow-up. Her practical experience includes, but is not limited to the following:

- Environmental Management of a number of construction, mining, and industry related projects;
- Environmental auditing of a number of projects against the approved EMPr's and EA (Environmental Authorisations);
- The development and management of an ISO 14001 EMS (Environmental Management Systems) on a number of construction, mining and industry related projects;
- Development and implementation of policies and procedures managing environmental impacts; and
- Managing applications for a number of permits and licences.

A detailed description of all past experiences is available in **Appendix A**.

b) Description of the property

Farm Name:	Portions 3 and 7 of farm Vygenhoek 10 JT
Application area (Ha) :	720.65 ha
Magisterial district:	Ehlanzeni District
Distance and direction from nearest town:	Mashishing is the nearest town, 45km east from the Vygenhoek Project, Mpumalanga Province
21 digit Surveyor General Code for each farm portion:	T0JT00000000001000003 T0JT00000000001000007

c) Locality map

*(show nearest town, scale not smaller than 1:250000 attached as **Appendix B**)*

Find **Appendix B** indicating the locality of the proposed activity.

d) Description of the scope of the proposed overall activity

*(Provide a plan drawn to scale acceptable to the competent authority but not less than 1: 10 000 that shows the location, and area (hectares) of all the aforesaid main and listed activities, and infrastructure to be placed on site and attach as **Appendix C**)*

The detailed site layout plan indicating the location, the area (hectares) of all the main listed activities, and infrastructures to be placed on the associated properties can be found in **Appendix C**.

The section to follow will provide a detailed scope on the proposed activity.

i) Listed and specified activities

Table 1: Listed and specified activities associated to the proposed mining operation

NAME OF ACTIVITY (*All activities including activities not listed) (E.g. Excavations, blasting, stockpiles, discard dumps or dams, Loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors, etc…etc…etc.)*	**Aerial extent of the Activity Ha or m²**	**LISTED ACTIVITY Mark with an X where applicable or affected.**	**APPLICABLE LISTING NOTICE** (*GNR 544, GNR 545 or GNR 546)/NOT LISTED*
All infrastructure areas, development footprints and associated activities.	37 ha	x	GNR983 - Activities 22 & 28 GNR984 - Activities 6, 15, 17 and 21 GNR985 - Activities 12 and 14
Opencast excavations	37 ha	x	GNR983 - Activities 22 & 28 GNR984 - Activities 6, 15, 17 and 21 GNR985 - Activities 12 and 14
Ablutions & change house with sewage treatment plant	160 m²	x	GNR983 - Activities 10 and 25 OR GNR984 - Activities 6 and 25
Topsoil & subsoil stripping & stockpiling	37 ha	x	GNR984 - Activity 15 GNR985 - Activity 12
Residue stockpiles	2500 m²	x	GNR984 - Activities 6 & 15 GNR985 - Activity 12 GNR 633 - Activity 11 GNR 633 - Category B activity 11
Fuel storage	<1 ha	x	GNR984 - Activity 4 GNR985 - Activity 10
RoM & product stockpiling	10 ha	x	GNR984 - Activity 6 GNR985 - Activity 12
Access and hauling along roads	4 ha	x	GNR983 - Activity 24 GNR985 - Activities 4, 14 and 18
Screening plant	<1 ha	x	GNR984 - Activities 6, 15, and 21

Water supply (potable & process)	< 1 ha	x	GNR983 - Activity 9 GNR985 - Activity 14
Water storage (reservoirs / tanks)	< 1 ha	x	GNR983 - Activity 13 GNR984 - Activity 6 GNR985 - Activity 2
Discard disposal (backfilling)	32 ha	x	GNR983 - Activity 22 GNR984 - Activity 6
Storm water runoff management features	< 1 ha	x	GNR983 - Activity 9 GNR984 - Activity 6 GNR985 - Activity 14
Rehabilitation	48 ha	x	GNR983 - Activity 22 GNR921 - Activities B(7) & B(9) GNR 633 - Category A activity 14
Stores, workshops &wash bays	< 1 ha	x	Not listed
Waste generation & storage	< 1 ha	x	Expected waste generation under threshold

ii) Description of the activities to be undertaken

(Describe Methodology or technology to be employed, and for linear activity, a description of the route of the activity)

The surface sub-outcrop of the proposed Vygenhoek Platinum Mine is planned to be mined using an advancing open pit mining method which allows for concurrent filling of the pit. The pit will be used to develop portals which will allow the remainder of the ore to be exploited using underground mining methods. The open pit planned applies a conventional opencast truck and shovel mining philosophy including the following steps:

- Removal of topsoil and storing it at a designated position;
- Removal of the overburden and stockpiling of residue material in designated storage areas;
- Drilling and blasting will be required to break the hard overburden;
- Once the removal of ore has been completed, the pits will be backfilled with the overburden (residue material) behind the advancing face where possible with the remainder placed at the designated residue stockpile areas, separate from the topsoil;
- Drilling and blasting of the ore; and
- Loading and hauling of the ore for stockpiling at the Run-of-Mine (ROM) pad or for transport to the preferred Concentrator.

A portion of the residue is proposed to be used in the construction of haul roads, depending on the outcome from the waste classification. Topsoil will be placed on top of backfill for the purpose of rehabilitation. The ore will be stockpiled on a ROM pad and transported to the Concentrator Plant by trucks. The open pit mining philosophy is based on a contractor-operated operation. A production shift cycle operating 9 hours a day, 6 days a week will be adopted. The open pit layout and the life of mine schedule is presented in **Figure 1** below.

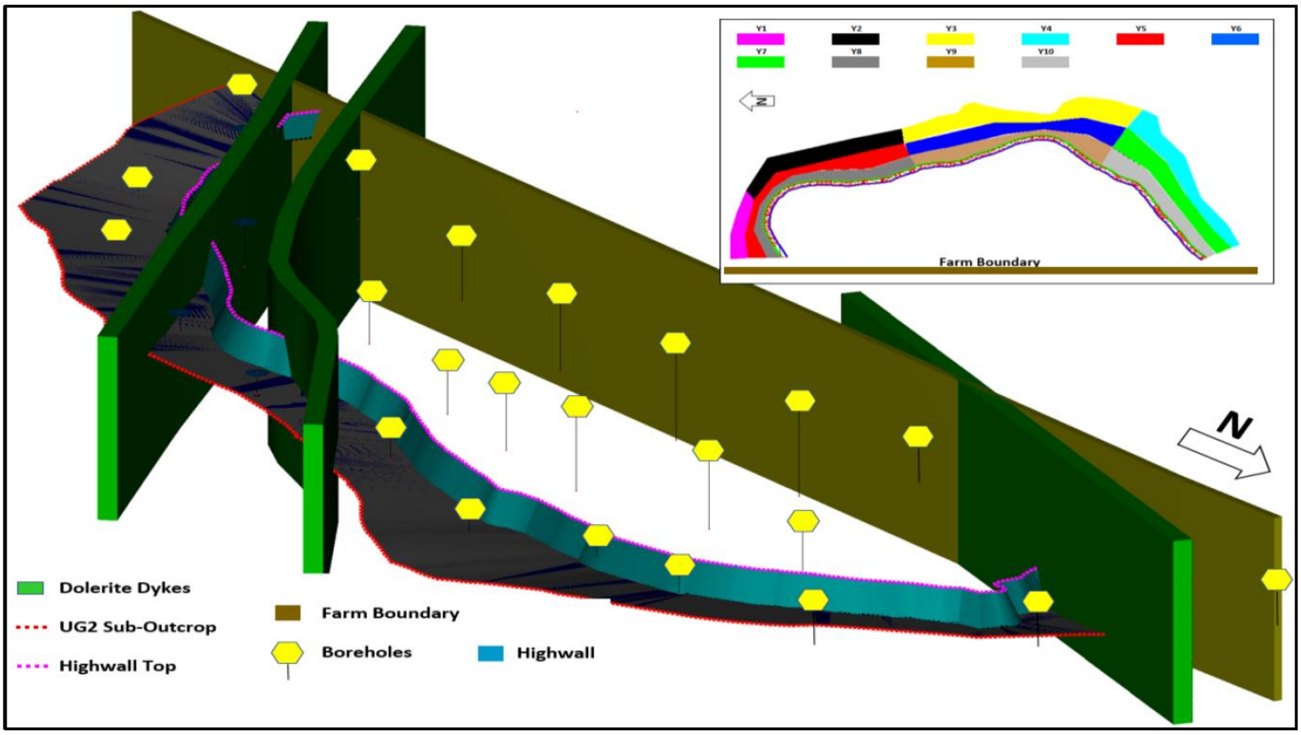


Figure 1: Vygenhoek UG2 pit layout (wireframe) and mining schedule

Resource particulars

The following table summarises the resource particulars:

Item	Detail
Type of Mineral (s)	Platinum Group Metals and all minerals and metals found in mineralogical association therewith and are mined out of necessity together with the Platinum Group Metals, including but not limited to: **Platinum Group Metals:** Platinum (Pt), Palladium (Pd), Rhodium (Rh), Iridium (Ir), Ruthenium (Ru) and Osmium (Os) **Other Precious Metals:** Gold (Au) and Silver (Ag) **Base Metals:** Nickel (Ni), Copper (Cu), Cobalt (Co), Iron (Fe), Vanadium (V) and Chromite (Chrome Ore)
Depth of mineral below surface	The economical layers sub-outcrop on surface to a depth of approx. 150m below surface.

Geological Formation	The proposed Vygenhoek Platinum Mine is located within the Eastern Limb of the Bushveld Ignious Complex (BIC) Chromitite Layers are situated in the Middle Group (MG) and Upper Middle Group (UMG) being UG2, UG1, MG4, MG3, MG2, MG1 and MG0 which occur in the Upper and Lower Critical zones of the BIC. The UG2 Chromitite Layer will be the main target horizon for mining, with UG1 and MG layers as secondary horizons.

Basic overview of the mining method

Open pit mining operation will commence after the site establishment is completed. Initially, the removal of overburden will take place for a period of 6 months before any mining of ore is done. The first ore will be mined in month 8, and ore and waste mining will take place concurrently onwards. The pit will be mined from the North in a southerly direction, with backfilling of the mined-out areas taking place behind as the pit advances.

Factors that had to be taken into account in the mine design strategy included:

- Formal and informal settlements in relation to the planned open pit mining area as well as existing mining activities – a mining restriction zone of mainly 600m was used for design purposes, this correlates to the 600m blast radius;
- Residue stockpiles to be placed away from UG2 sub-outcrop positions, on the highwall side of the maximum highwall position;
- Monthly production of approximately 15,000 tpm of ROM ore;
- The weathering profile of the near-surface material;
- Backfilling of mined out areas as soon as possible to minimize dust and aid in rehabilitation, minimize haulage costs and double handling;
- Operating costs – for mining and administration;
- Selling costs - for the UG2 ROM;
- Mining dilution of 22% were applied after the in-situ resource estimates;
- Due to surface weathering an overall slope angle of 7° from vertical was used to ensure pit stability. The angle could be further steepened in the deeper solid zones, however a safety factor of 7° is preferred with a bench at 20m.

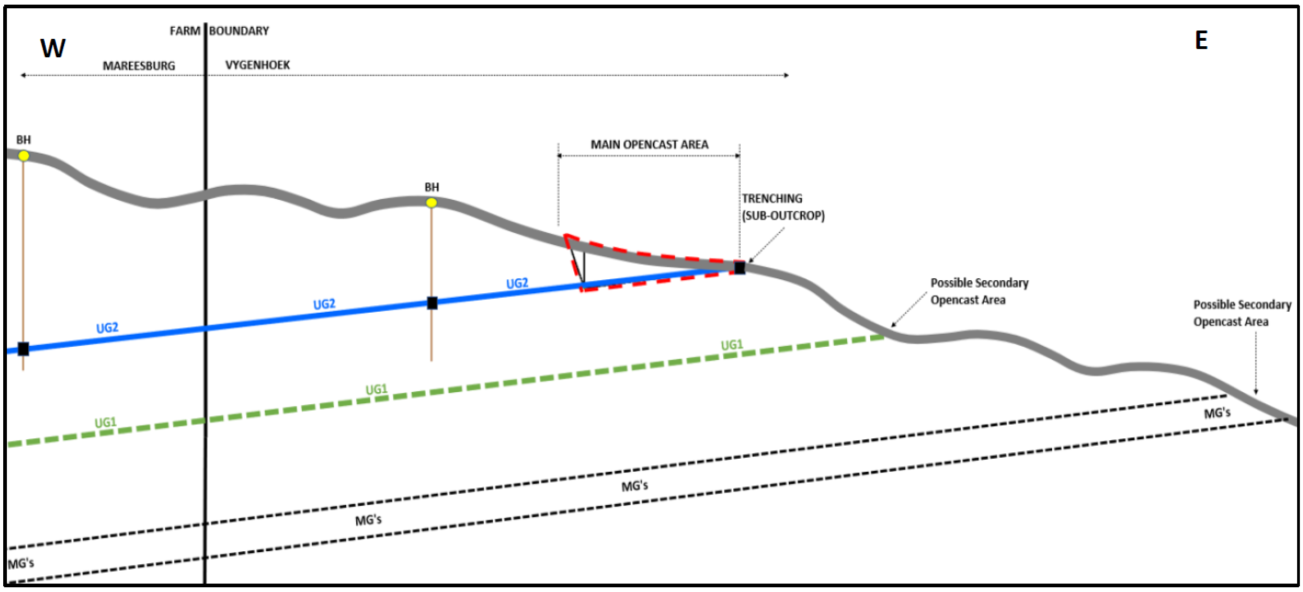


Figure 2: Schematic east-west section

Ramp-up of the mine mainly includes the installation of infrastructure including:

- Workshop
- Administration office
- Lighting of stockpile area and workshop / offices
- Weighbridge

Equipment that will be required to mine ore, includes:

- 5 Dump trucks for the transport of ore from the pit to the stockpile area,
- 2 Utility vehicles for the transport of material and explosives,
- 2 Drill rigs for the drilling of the benches
- 5 Excavators for the stripping of ore and waste
- 2 Bulldozer for the profiling of waste
- 1 Grader for the maintenance of access roads and haul roads
- 1 Water bowser for dust suppression of roads and waste dumps and screening areas.

Maintenance and installation of equipment required to mine in accordance with the health and safety specifications, includes the following:

- Personal Protective Equipment,
- Plant and Equipment,
- Explosives,
- Maintenance of machinery and equipment,

- Rotable spares e.g. axles, engines and electric motors,
- Mining services material,
- Miscellaneous (Lubricants, small tools and consumables) .

The above material and equipment are stored on-site to sustain continuous production in a safe work environment for employees.

e) Policy and Legislative Context

This section will provide the detailed description of the policy and legislative context associated with the proposed Vygenhoek Platinum Mine (**Table 2**).

Table 2: Detailed Policy and legislative context of the proposed Vygenhoek Platinum Mine

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT (A description of the policy and legislative context within which the development is proposed including an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable to this activity and are to be considered in the assessment process);	**REFERENCE WHERE APPLIED**
National Legislation and regulations	
Section 24 of the Constitution of South Africa Act no. 108 of 1996	Adherence with all legislation and regulations that prevents pollution and ecological degradation, promotes conservation, and secures an ecological sustainable development and use of natural resources while promoting justifiable economic and social development.
The Minerals and Petroleum Resources Development Act, 2002 Act No. 28 of 2002 (MPRDA)	• Submission of a mining works programme • Submission of an application to a mining right • Application for Environmental Authorisation A Rehabilitation, closure, and liability plan will need to be developed as part of the mining right application process.
National Environmental Management Act 107 of 1998 (NEMA)	• Development of an EMPr for the proposed activities. • Application for authorisation resulting in the submission of this document.

	• Including emergency response procedures within the submitted EMPr. • Ensuring compliance with a monitoring and audit schedule and plan.
The following regulations in terms of NEMA are applicable:	
GN R. 982: National Environmental Management Act (107 of 1998): Environmental Impact Assessment Regulations, 2014 (2014 EIA regulations)	Independent EAP appointed to ensure adherence with the EIA procedure.
GN R. 983 – 985: Listing notices 1 to 3	A Scoping and EIA process will be completed and a final document to be submitted following the approval of this scoping report to the Department of Mineral Resources.
GN R. 1147: Regulations pertaining to the financial provision for prospecting, exploration, mining or production	Application for authorisation of listed activities in terms of listing notice 1-3 will be submitted together with the submission of the EIR, EMPr, and Rehabilitation, closure, and liability plan following the approval of this scoping report.
National Environmental Management: Air Quality Act 39 of 2004 **(NEMAQA)**	Requirements as stipulated in the Act will be incorporated with the EIR and EMPr to be submitted for approval.
The following regulations in terms of NEMAQA are applicable:	
GN 893: List of activities which result in atmospheric emissions	No licence required at this time of the proposed activity.
GN R. 827: National dust control regulations	Requirements will be incorporated in the EIR and EMPr.
GN R. 283: National atmospheric emissions reporting regulations	Requirements will be incorporated in the EIR and EMPr.
GN R. 1210: National ambient air quality standards	Requirements will be incorporated in the EIR and EMPr.

GN R. 351: Regulations regarding the phasing-out and management of ozone-depleting substances	In the event that any PCB containing product will be used on site this regulation will be applicable. Requirements will be incorporated in the EIR and EMPr.
Atmospheric Pollution Prevention Act of 1965 **GN R. 1651:** Regulations concerning the control of noxious or offensive gasses emitted by diesel-driven vehicles	Requirements will be incorporated in the EIR and EMPr.
National Environmental Management: Waste Act 59 of 208 **(NEMWA)**	All waste management activities associated to the proposed mining operation must comply with the requirements set out by the Act. These requirements will be incorporated in the EIR and EMPr associated to the EA and WML application.
The following regulations in terms of NEMWA are applicable:	
GN R. 634: Waste classification and management regulations	A waste classification will be conducted as part of the EIA phase to determine the classification of the residue stockpiles. The findings of the report conducted by an independent consultant will be incorporated in the final EIR and EMPr associated to the EA and WML application. Requirements will be incorporated in the EIR and EMPr.
GN R. 632: Regulations regarding the planning and management of residue stockpiles and residue deposits from prospecting, mining, exploration or production operation	
GN R. 921: Activities listed requiring a waste management licence (WML)	Listed activity number 11, as amended by GNR 633, lists: "The establishment or reclamation of a residue stockpile or residue deposit resulting from activities which require a mining right in terms of the MPRDA (Act 28 of 2002)" This document serves as the required scoping associated with the application for an EA and WML.
GN R. 633: Amendments to the list of waste management activities that have, or are likely to have, a detrimental effect on the environment	
GN R. 625: National waste information regulations	As listed activity 11 of GN R. 633 will be triggered by the proposed mining activities, GN R. 625 will apply. Therefore, the Vygenhoek Platinum Project must register as a waste

	generator. These requirements will be included in the EIR and EMPr associated to the EA and WML.
GN R. 635: National Norms and Standards for the assessment of waste for landfill disposal	This regulation stipulates the requirements to assess generated waste for disposal to specific designed landfills. As a result, the requirements stipulated in these regulations will be considered in the EIR and EMPr.
GN R. 636: National norms and standards for disposal of waste to landfill	This regulation stipulates the general principles associated to the disposal of waste to landfill. As a result the requirements stipulated in these regulations will be considered in the EIR and EMPr.
GN R. 926: National norms and standards for storage of waste	This regulation describes the general requirements for the management and storage of waste. As a result the requirements stipulated in these regulations will be considered in the EIR and EMPr.
Environmental Conservation Act of 1989 **(ECA)** **GN R. 425:** Waste tyre regulations **GN R. 341:** Regulations for the prohibition of the use, manufacturing, import and export of asbestos and asbestos containing materials	Requirements incorporated will be considered in the EIR and EMPr.
National Water Act 36 of 1998 (NWA)	Application for a Water Use Licence (WUL) will be launched once the required infrastructures associated to the storm water management plan has been determined during the EIA phase. General conditions stipulated in the NWA will be considered in the EIR and EMPr.
The following regulations in terms of NWA are applicable:	

GN 704: Regulations on use of water for mining and related activities aimed at the protection of water resources	An application for a WUL will be launched once the required infrastructures associated to the storm water management plan has been determined during the EIA phase. The requirements will be incorporated in the EIR and EMPr.
Hazardous Substances Act 15 of 1973	Requirements will be incorporated into the EIR and EMPr. Requirements to be incorporated into the Vygenhoek Platinum Health and Safety management plan.
Mine Health and Safety Act of 1996 **GN R. 1237:** Mines and works regulations **GN R. 911**: Mine health and safety regulations	The requirements set out by the listed regulations must be incorporated into the Vygenhoek Platinum Mine Health and Safety Management plan. Some of the requirements associated to the environmental health will be incorporated into the EIR and EMPr. The following specific sections are applicable in this report and the EMPr: • Storage of hazardous substances; • Acquisition of hazardous chemicals.
Fertilizers, farm feeds, agricultural remedies and stock remedies Act 36 of 1947	The requirements specifically related to the use of herbicides and pesticides will be incorporated into the EMPr.
Conservation of Agricultural Resources Act 43 of 1983 (CARA) **GN R. 1048:** Declared Weeds and Invader plants	The requirements will be incorporated into the EIR and EMPr. This act also deals with permitting of land zoned as Agriculture.
National Environmental Management: Biodiversity Act, 2002 **(NEMBA)**	Requirements will be incorporated into the EIR and EMPr. However, before the commencement of site clearance an application must be lodged for the removal of protected species that may be identified during the EIA phase of the mining right application process.

National Veldt and Forest Fire Act 101 of 1998	Measures to prevent the spreading of fires will be incorporated into the EIR and EMPr.
National Forest Act 84 of 1998	Requirements will be incorporated into the EIR and EMPr. However, before the commencement of site clearance an application must be lodged for the removal of protected tree species that may be identified during the EIA phase of the mining right application process.
National Heritage Resources Act 25 of 2000	The EIR & EMPr to be submitted as part of the mining right application document will comply with section 38(8) of the NHRA that stipulates that a Heritage Resources Management (HRM) process must be implemented if an evaluation of the impact of a development on heritage resources is required in terms of the NEMA, the integrated environmental management guidelines issued by the Department of Environment Affairs (DEA), the MPRDA, or any other legislation. The consenting authority (in this instance the DMR) must ensure that the evaluation fulfils the requirements of the South African Heritage Resources Agency (SAHRA) and / or the Provincial Heritage Resources Authority of Gauteng (PHRA-G) in terms of section 38(3) of the NHRA. The NID, HSR and HIA reports completed for the project complies with the aforementioned section. Any comments and recommendations of SAHRA and / or PRHAG must be taken into account prior to the granting of the consent.
Occupational Health and Safety Act (Act 85 of 1993) **GN R.1248**:	Requirements to be incorporated in the Mine Health and Safety plan.
Government Policies	
Waste Management policies	In terms of waste management in South Africa, there are two main policies that will be considered in the development of the EIR and EMPr. The two main policies considered were

	regarding the management and disposal of fluorescent tube disposal and the management of sewage sludge. Best practice principles will be incorporated into the EIR and EMPr.
National Environmental Health Policy	This policy document is intended as a 'broad guideline for the effective implementation and rendering of Environmental Health Services in South Africa'. It incorporates the philosophy of Environmental Health includes principles such as primary prevention, transparency, polluter pays, precautionary principle and cradle to grave.
SANS Standards	
Hazardous substances management	The following two SANS standards will be incorporated into the EMPr: • SANS 10089-1:2008 - Specifications for above-ground storage facilities for petroleum products • SANS 310: 2011 - Storage tank facilities for hazardous chemicals: Above-ground storage tank facilities for flammable, combustible and non-flammable chemicals.
Provincial Legislation	
Mpumalanga Nature Conservation Act (Act 10 of 1998)	Requirements will be incorporated in the EIR and EMPr.
Town-Planning and Township Ordinance (Ordinance no. 15 of 1986)	Requirements will be incorporated in the EIR and EMPr.

f) Need and desirability of the proposed activities

(Motivate the need and desirability of the proposed development including the need and desirability of the activity in the context of the preferred location).

Resource desirability and demand

The proposed Vygenhoek Platinum mine is located in the Eastern limb of the Bushveld Complex. In the Eastern Limb, the Critical Zone is developed over about 150 kilometers of strike length in three areas separated by two down-faulted blocks. The Merensky and UG2 Reefs outcrop over about 130 kilometers, but probably also occur in the down-faulted blocks. In the Eastern Limb, the Merensky Reef is far less distinctive compared to the equivalent reef that is developed within the Western Limb. In the Eastern Limb, the mineralization is hosted within the Merensky pyroxenite and immediately in the underlying anorthosite to norite. Narrow, 2mm to 5mm, chromitite stringers are frequently associated with the Merensky Reef horizon.

The distinctive pegmatoidal pyroxenite, such as that which frequently comprises a part of the Merensky Reef in the Western Limb, is occasionally present beneath the lower chromitite stringer in the Eastern Limb.

The principal target of the Vygenhoek Project is the UG2 Reef. The emplacement model of the UG2 Reef is crystallization into synclinal structures in the floor rocks in which mineralization has “ponded” such as at AngloPlats neighbouring Mototolo Mine. The Critical Zone, which hosts the UG2 Reefs, was previously shown to occur on the Farm Vygenhoek 10JT and chromitite outcrops associated with the UG2 Reef had previously been traced on this farm. Further detailed studies have confirmed that the project area is almost entirely underlain by lithologies of the Rustenburg Layered Suite. The UG2 Reef as developed in the Vygenhoek Project area is mainly developed in two distinct reef types. The first type of occurrence is a composite chromitite band where the Leader Seam and Main Seam are not separated. In these areas, the distinction between the Leader Seam and Main Seam can only be distinguished based on grades and the Pt: Pd ratio in the individual samples. The second type of occurrence is where UG2 chromitite has been split by an internal waste parting which reaches thicknesses of up to 6.78m.

The Vygenhoek Project will not produce the final metals for marketing. The ROM ore will be sold and then a 4E Platinum Group Metals (PGMs) concentrate, consisting of Platinum (Pt), Palladium (Pd), Rhodium (Rh), and Gold (Au), with Nickel, Copper and Chrome as by products, will be produced:

<u>Platinum uses</u>

In addition to its use in jewelry, platinum has many applications as a catalyst, either in its pure form or as an alloy with rhodium. This allows a large range of chemical reactions such as that of reforming petroleum, producing nitric acid, producing pharmaceutical products, and for removing hydrogen and chlorine (particularly in organic chemical synthesis). Platinum is also used in electronics, while its incorruptibility makes it ideal for crucibles (along with Rhodium and Iridium additions) and retorts used in handling high corrosive chemicals or where resistance to high temperatures is required.

<u>Palladium uses</u>

Almost totally corrosion-free, palladium is used in alloy form with other precious metals in electronics (such as electrical contacts, particularly in telephone systems) and as resistance windings, especially where high precision is required. It is also used in electrothermal fuses, particularly in electric furnaces, as well as thermocouples and as a catalyst for the production of ethylene, vitamins A and E, brazing, welding (particularly jewellery), and other uses.

<u>Rhodium uses</u>

With an extremely high resistance to corrosion, rhodium is used to plate steel and brass in order to prevent corrosion from sea water and other elements. Such coatings must be extremely thin and used only when the cost is justified. As an alloy with platinum (containing about 1% rhodium), it is used in thermocouples, electrical equipment and man-made fiber production. It is used as a catalyst in producing nitric acid from ammonia, along with several other catalytic uses. Rhodium has a very high optical reflectivity, which is particularly useful since it is almost un-tarnishable.

Over the last two decades, the automotive sector has emerged as the principle consumer of Platinum, palladium, and rhodium PGMs

Gold uses

Gold is a dense, soft, shiny, malleable and ductile metal. It is one of the least reactive solid chemical elements. Gold has been a valuable and highly sought-after precious metal for coinage, jewellery, and other arts since long before the beginning of recorded history. Gold standards have been the most common basis for monetary policies throughout human history, being widely supplanted by fiat currency only in the late 20th century. The world consumption of new gold produced is about 50% in jewellery, 40% in investments, and 10% in industry. Besides its widespread monetary and symbolic functions, gold has many practical uses in dentistry, electronics, and other fields. Its high malleability, ductility, resistance to corrosion and most other chemical reactions, and conductivity of electricity led to many uses of gold, including electric wiring, coloured-glass production and even gold-leaf eating.

Nickel uses

Nickel is a transition element that exhibits a mixture of ferrous and nonferrous metal properties. Primarily nickel is produced and used in the form of ferro-nickel, nickel oxides and other chemicals, and pure nickel metal. The International Nickel Study Group (INSG, 2012) estimate that about 65% of nickel is used to manufacture stainless steels, and 20% in other steel and non-ferrous alloys, including super alloys, often for highly specialized industrial, aerospace and military applications. About 9% is used in plating and 6% in other uses including coins and a variety of nickel chemicals.

Copper uses

Copper is a ductile metal with very high thermal and electrical conductivity. Pure copper is soft and malleable; an exposed surface has a reddish-orange tarnish. It is used as a conductor of heat and electricity, a building material, and a constituent of various metal alloys. The metal and its alloys have been used for thousands of years. The major applications of copper are in electrical wires (60%), roofing and plumbing (20%) and industrial machinery (15%). Copper is mostly used as a metal, but when a higher hardness is required, it is combined with other elements to make an alloy (5% of total use) such as brass and bronze. A small part of copper supply is used in production of compounds for nutritional supplements and fungicides in agriculture. Machining of copper is possible, although it is usually necessary to use an alloy for intricate parts to get good machinability characteristics.

Market and consumer analysis

The ROM ore from Vygenhoek mine will be sold per contract agreement and then processed to produce a 4E PGM and base metal concentrate. The 4E PGM consist of Platinum, Palladium, Rhodium, and Gold.

The product consumer of the ROM tonnages from the Vygenhoek Mine will be an adjacent Concentrator.

The final product consumers are the:

- Autocatalyst industry;
- Jewellery sector;
- Dental sector;
- Electrical / Electronics sector;
- Chemical industry; and
- Investment market.

Due to the small size of the Vygenhoek project, and to ensure the economic success of the project, the mine will only produce ore and will sell and transport this ore to one of the existing processing plants.

Economic desirability and demand

According to the Ehlanzeni Integrated Development Plan (IDP), there are indications that the local economy has been shifting from primary sector towards tertiary sector activities over the past two decades, however limited direct investment and low skills levels in the region means economic growth has been restricted and unemployment remains high (Ehlanzeni, 2020). Ehlanzeni therefore continues to rely on agriculture, construction, mining, and tourism to provide employment for unskilled labourers (Ehlanzeni, 2020). The major contributors to the Mpumalanga economy are mining (25.2%) and manufacturing (19.3%), however the main economic contributors within Ehlanzeni are community, social and personal services (45.2%), wholesale and retail trade (47%), construction (42.8%), finance (34.6%), transport (39.7%) and agriculture (33%) (Ehlanzeni, 2020).

Mining has contributed between 17 and 26% of the provincial Gross Domestic Product (GDP) over the past decade (Ehlanzeni, 2020). Most of the benefits, however, are only recognised outside of the region, such as through export. Opportunities within the regional mining sector include (Ehlanzeni, 2020):

- Growing demand on the global market for commodities (including platinum);
- Beneficiation of minerals (e.g. jewellery making);
- Platinum Group Metals mining along the eastern limb of the Bushveld Complex;
- New entrants to mainstream industry for Black Economic Empowerment (Mpumalanga Mining
- Energy Preferential Procurement Initiative);
- Small Scale mining; and

- Strategic alliances for share acquisition through Broad Based Black Economic Empowerment.

Key opportunities for local economic development through mining initiatives include local investment, skills development, infrastructure, and technology development and broadening of the supplier base (Ehlanzeni, 2020).

The proposed project is likely to contribute towards the regional economy through direct investment and developing the mining sector.

In addition to the local and national economic benefits of the proposed mining operation, there will also be socio-economic benefits. The following positive impacts are anticipated:

- 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;
- Local and regional employment opportunities. Although smaller in number than employment creation during the construction phase, these will have a significantly longer duration;
- Increased business opportunities for local entrepreneurs through the supply of goods and services to the mine;
- A positive macro-economic impact at a local, regional and provincial level due to operational expenditure, taxes and royalties; and
- Economic and social benefits associated with Corporate Social Responsibility (CSR) and Local Economic Development (LED) initiatives by the mine (See **Appendix D** for the final Social and Labour plan).

The proposed Vygenhoek Platinum Mine operation will have a positive impact on the baseline social-economic conditions of the local communities involved. The mine will create several employment opportunities and preference will be given to the locally unemployed, wherever possible. The mine will contribute towards the socio-economic development of the region as a whole through social upliftment and job creation as primary agents.

However, clear policy guidelines and careful management of project implementation will be required to ensure that benefits for the local population and economy are maximised. For maximising of the positive outcomes, these policy guidelines must be reviewed on a regular basis throughout the entire life cycle of the Vygenhoek operations.

g) Period for which the environmental authorisation is required

The expected life of mine has been determined to be 10 years. However, should the proposed mine development exceed this period, it is recommended that the environmental authorisation be amended at that time.

h) Description of the process followed to reach the proposed preferred site

(NB!! – This section is not about the impact assessment itself; It is about the determination of the specific site layout having taken into consideration (1) the comparison of the originally proposed site plan, the comparison of that plan with the plan of environmental features and current land uses, the issues raised by interested and affected parties, and the consideration of alternatives to the initially proposed site layout as a result.)

During the EIA phase of the mining right application, alternatives in terms of the site layout will be determined as guided by the DEAT (2004) Criteria for determining Alternatives in EIA, Integrated Environmental Management, Information Series 11.

A comprehensive comparison of all potential impacts, both direct, indirect, and cumulative will be considered during the site selection process. Reasonable and feasible alternatives have been considered during the scoping phase to determine the most suitable alternatives, however, will be further assessed during the EIA phase. These alternatives will include the assessment of the following:

- Location alternatives;
- Site layout alternatives;
- Scheduling alternatives;
- Routing alternatives; and
- Design alternatives.

The consideration of alternatives will consider significant constraints such as social, financial, and environmental issues during the evaluation of the alternatives. The preferred option will then be highlighted and presented to the stakeholders to ensure that their views are also taken into account. Once all the alternatives are identified, it may be necessary to focus on a few and to eliminate others. The elimination process will be well documented and substantiated, with an explanation of why certain alternatives are not being considered in detail. A detailed analysis of potential environmental impacts, as well as a consideration of technical and financial aspects, will be given for each of the remaining preferred alternatives during the EIA phase.

i) Details of all alternatives considered

(With reference to the site plan provided as Appendix 4 and the location of the individual activities on site, provide details of the alternatives considered with respect to: (a) the property on which or location where it is proposed to undertake the activity; (b) the type of activity to be undertaken; (c) the design or layout of the activity; (d) the technology to be used in the activity; (e) the operational aspects of the activity; and (f) the option of not implementing the activity.

Based on preliminary assessment during the scoping phase, the sections to follow describes the alternatives that have been considered. These alternatives will be furthered assessed during the EIA phase.

(a) Property on which or location where it is proposed to undertake the activity

No property alternatives have been considered as the envisaged mining operations will occur on properties already utilised for the prospecting operations and where Nomamix (Pty) Ltd is in process to apply for mining rights.

(b) Type of activity to be undertaken

The proposed mining activity relates to the open cast mining of Platinum Group Metals (PGM), particularly the following:

- Platinum group metals: Platinum (Pt), Palladium (Pd), Rhodium (Rh), Iridium (Ir), Ruthenium (Ru) and Osmium (Os);
- Precious metals: Gold (Au) and Silver (Ag); and
- Base metals: Nickel (Ni), Copper (Cu), Cobalt (Co), Iron (Fe), Vanadium (V) and Chromite (Chrome Ore)

No alternatives to mining the material listed have been considered associated to the proposed mining activity.

(c) Design or layout of the activity

The preliminary site layout, as attached in **Appendix C**, in terms of the positioning of haul roads, lay down areas, RoM product stockpile areas, workshops, topsoil and subsoil stockpiles, screening plant, and residue stockpiles was determined by considering both spatial and practical mining operation aspects.

The following factors are considered in planning the lay down area:

- Visual distance from identified local communities;
- Access roads to the mining area;
- Haul distance; and
- Sensitive environmental and social areas.

At the time of submitting this report to the competent authority the following infrastructures did not form part of the site layout:

- Storm water infrastructure; and
- Location of PCD's.

As part of the EIA assessment, all alternatives will be further investigated and assessed. A conceptual storm water management plan with required infrastructures will also be determined. It is therefore recommended that before authorising the activity a detailed site layout plan, with the storm water infrastructures, be submitted indicating the details of the ready to build infrastructures.

(d) Technology to be used in the activity

No alternatives in terms of the technology to be used have been considered during the scoping phase.

(e) Operational aspects of the activity

The proposed activity relates to the open cast mining of PGM's. The operational aspect entails topsoil and subsoil stripping and stockpiling, drilling and blasting, excavations, RoM product hauling and stockpiling, screening, and bulk transport of end product.

The processing of end product may be considered further down in the life cycle of the mine. However, at the present time no processing will occur.

Depending on the financial feasibility, underground mining may be considered as a mining alternative.

(f) The option of not implementing the activity

The "no-go" option for implementing the activity will be further assessed during the EIA phase. However, during the scoping process some sensitive areas have been predetermined based on a desktop analysis and the conceptual site layout plan has been adjusted accordingly.

ii) Details of the Public Participation Process (PPP) followed

(Describe the process undertaken to consult interested and affected parties including public meetings and one on one consultation. NB the affected parties must be specifically consulted regardless of whether or not they attended public meetings. (Information to be provided to affected parties must include sufficient detail of the intended operation to enable them to assess what impact the activities will have on them or on the use of their land.)

A project database will be maintained of all I&APs and stakeholders, i.e. landowner/s; lawful occupiers of affected property, affected community (through ward councillors), traditional leaders if applicable etc.).

Background Information Document (BID) will be distributed to registered and identified I&APs.

Site notices will be placed at the proposed site, local municipality notice boards, and at notice boards at nearest town, i.e. Spar at Vygenhoek/ public library (photographic evidence will be provided).

Newspaper adverts will be placed in the Steelburger and Highlands Panorama newspapers to notify public and I&APs of the proposed project as well as commenting period.

Notices will be placed on EAP's website.

A 30 day public participation consultation process will be run during the public commenting period of the scoping report. This will remain open for a period of 180 days from commencement of public review date.

Stakeholder and I&AP engagement will take place through Focus Group meetings. Presentation to necessary forums, community engagement, and engagement with local authorities will be undertaken. Minutes will be recorded and included in Scoping and EIA reports.

Land claims on affected property will be checked, communicated and dealt with accordingly.

A comments and response report will be maintained during the DMR Project Scoping/ Environmental Impact Assessment process.

All issues raised will be recorded and responded to accordingly.

A public Participation Report will be compiled highlighting all communication and measures undertaken.

iii) Summary of issues raised by I&APs

(Complete the table summarising comments and issues raised, and reaction to those responses)

The following table will be completed once the scoping report has been made available for 30 days.

Table 3: Summary of comments and issues raised by the I&AP

Interested and Affected Parties *List the names of persons consulted in this column, and* *Mark with an X where those who must be consulted were in fact consulted.*		**Date Comments Received**	**Issues raised**	**EAPs response to issues as mandated by the applicant**	**Section and paragraph reference in this report where the issues and or response were incorporated.**
AFFECTED PARTIES					
Landowner/s					

Lawful occupier/s of the land					

					Addressed in the EIR and EMPr submitted for the mining right application process.
					No confirmation received whether future and current Eskom projects will be affected.
					No confirmation received whether future

					and current Eskom projects will be affected. Addressed in the EIR and EMPr submitted for the mining right application process.
Landowners or lawful occupiers on adjacent properties –					
See Appendix T					
Municipal councillor - See Appendix T					
Municipality - See Appendix T					
Organs of state *(Responsible for infrastructure that may be affected Roads Department, Eskom, Telkom, DWA etc.)*					
					Addressed in the EIR and EMPr submitted for the mining right application process.
					Addressed in the EIR and EMPr submitted for the mining right application process.

Communities -					
Dept. Land Affairs -					
Traditional Leaders -					
Dept. Environmental Affairs					
Other Competent Authorities affected -					
OTHER AFFECTED PARTIES					
INTERESTED PARTIES					

Find attached **Appendix E** for the details of all registered I&AP.

iv) Environmental attributes associated with the sites

(The environmental attributed described must include socio-economic, social, heritage, cultural, geographical, physical and biological aspects)

The section to follow describes the environmental attributes associated with the development footprint alternatives.

1) Baseline Environment

In order to determine the baseline environment of the proposed location of the Vygenhoek Platinum Mine, a number of specialist investigations were initiated as part of the mining right application. The specialist assessment required associated to the proposed mining activity was identified using the national web-based screening tool as required by GN 960 of GG no. 42561 dated 5 July 2019.

The section to follow summarises the findings from the baseline/desktop studies undertook by the various appointed specialist. For the purpose of this report, only a summary of the baseline environment, any indication that could impact the feasibility of the mine, and the terms of reference for the EIA will be provided. The detailed reports are attached as appendices.

(a) Type of environment affected by the proposed activity

(Its current geographical, physical, biological, socio- economic and cultural character)

The information in the following sections has been extracted from the specialist desktop assessment as part of the scoping investigation.

I. Rainfall, evaporation, and average climate

Rainfall (Highlands Hydrology, July 2020)

Various weather stations managed by both the South African Weather Services (SAWS) and the Department of Water and Sanitation (DWS) are illustrated in **Figure 3**.

The closest SAWS rainfall station is 593419 W (Martenshoop Police Station), located approximately 9km -east of the site and has an altitude of 1365m above mean sea level. This SAWS station has a record length of 90 years with a Mean Annual Precipitation (MAP) of 689mm. The closest DWS station is B4E003, located approximately 15km to the north-east of the site with a 43-year record and MAP of 679mm, comparing well to SAWS station 593419 W.

The potential for rainfall distributions to change over distance can be significant. **Figure 3** presents the variation in mean annual precipitation (MAP) in the greater area, indicating a steady decrease in MAP from south to north. An alternative and site-specific source of rainfall data was therefore also used to provide average monthly rainfall values for the site as per Lynch (2004).

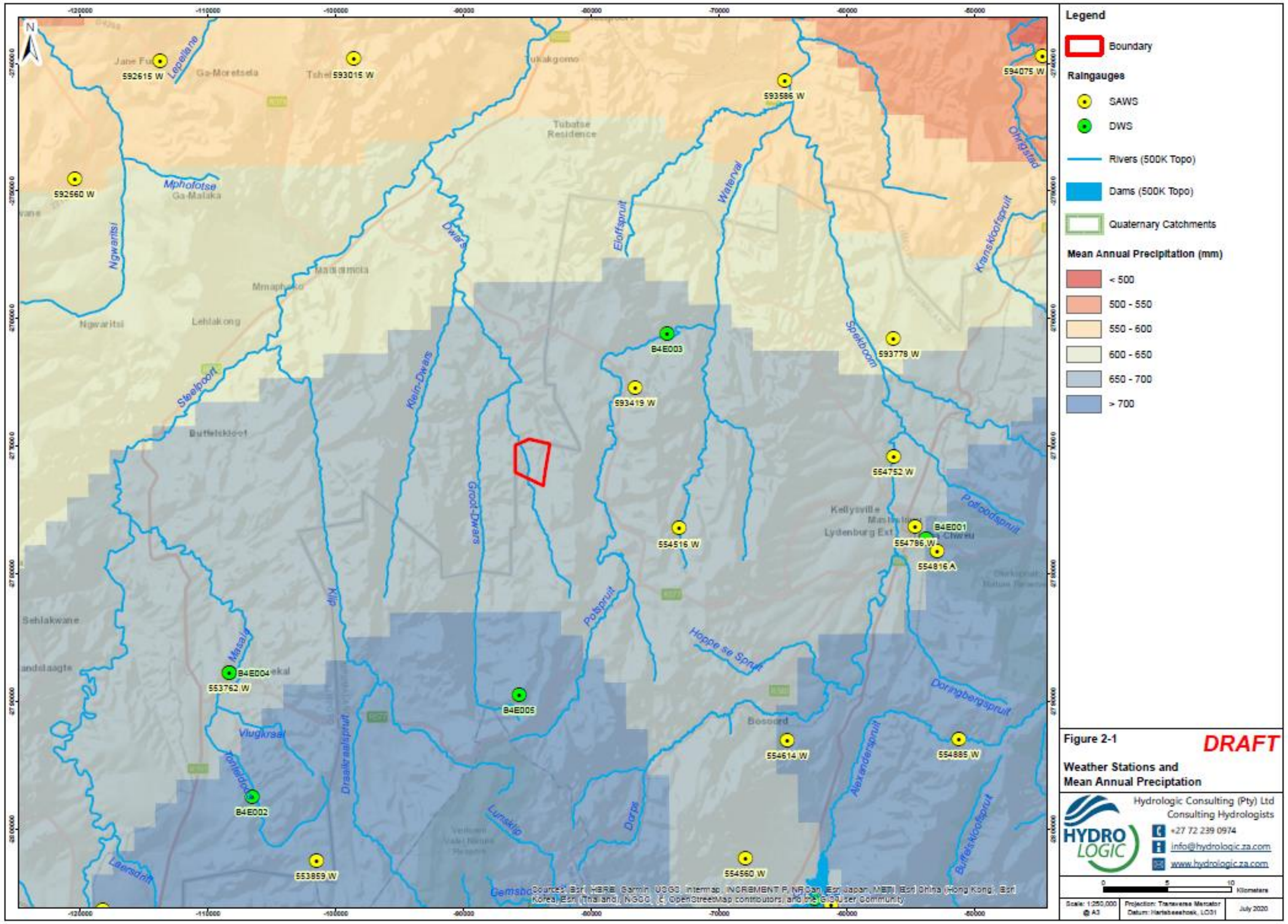


Figure 3: Weather stations and mean annual precipitation

Lynch (2004) includes details on the development of a raster database of monthly rainfall data for Southern Africa. The resultant raster database utilises a geographically weighted regression which took account of factors including latitude, longitude, altitude, slope and distance from the sea when interpolating data from rainfall stations located throughout Southern Africa. **Table 4** presents the average monthly rainfall estimates from Lynch (2004) indicating a MAP of 674mm, comparing well to both SAWS station 593419 W and DWS station B4E003.

Table 4: Average monthly rainfall (Lynch, 2004)

Month	Rainfall (mm)
January	113
February	91
March	76
April	43
May	15
June	7
July	6
August	8
September	22
October	60
November	114
December	119
Total	**674**

Evaporation (Highlands Hydrology, July 2020)

Evaporation data was sourced from the South African Atlas of Climatology and Agrohydrology (Schulze and Lynch, 2006) in the form of A-Pan equivalent evaporation. The average monthly evaporation distribution is presented in **Table 5** and shows the site has an annual A-Pan equivalent evaporation of 1981mm which is considered high in comparison to other areas in South Africa.

Table 5: Monthly A-pan equivalent evaporation (Schulze and Lynch, 2006)

Month	Evaporation (mm)

	A-pan equivalent
January	203
February	164
March	171
April	147
May	133
June	109
July	118
August	154
September	182
October	200
November	197
December	203
Total	**1981**

Average climate (Highlands Hydrology, July 2020)

The average climate for the site is presented in **Figure 4** using the outcome of the investigation into rainfall and evaporation for the site. The combination of rainfall (Pegram, 2016) and evaporation and temperature (Schulze and Lynch, 2006) result in a warm temperate climate with dry winters and hot summers according to the Köppen-Geiger climate classification1. While evaporation is showing as greatly exceeding rainfall, this is representative of the maximum A-Pan equivalent potential evaporation that could occur assuming no limitations are placed on evaporative demand.

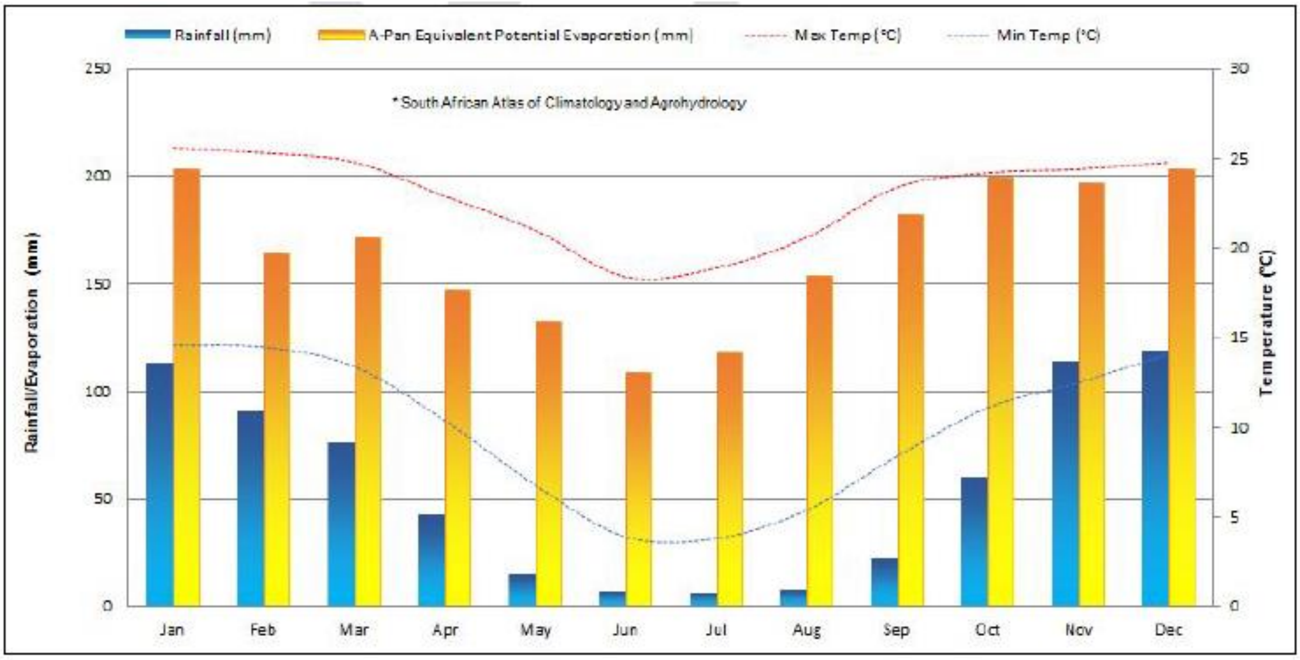


Figure 4: Average monthly climate

II. Regional setting, topography, and sub-catchment

The proposed Vygenhoek Platinum Mine is situated 45 km west of Lydenburg, Mpumalanga Province. The site is situated in Quaternary Catchment B41G of the revised Olifants Water Management Area (WMA 2) (DWS, 2016), which now also includes the Letaba River catchment. Accordingly, the main rivers include the Elands River, the Wilge River, the Steelpoort River, the Olifants River, and the Letaba River. The Olifants River originates to the east of Johannesburg and flows in a northerly direction before gently turning to the east. It is joined by the Letaba River before it enters into Mozambique. More specifically, the proposed Vygenhoek Platinum Mine encompasses the Dwars River and the Klein-Dwars River and their tributaries. Watercourses specifically associated with the proposed Vygenhoek Platinum Mine include two unnamed tributaries of the Dwars River, both of which are considered to be non-perennial in nature.

According to the topography of the watercourses, the reach of the western-most tributary present within the study area is classified as mountain stream, with elements of transitional and mountain headwater streams also present.

Of additional relevance is that watercourses associated with the western portion of the proposed Vygenhoek Platinum Mine are classified within the latest National Biodiversity Assessment as being Critically Endangered and Endangered and are largely not sufficiently protected (Van Deventer et al., 2019).

More detail on the aquatic environment, describing the PES and EIS, is provided in section **1 (a) (VIII).**

Elevations on the site typically range from 1 372 to 1 550 metres above mean sea level (mamsl).

Bare riverbed, dense forest & woodland, natural rock surfaces, fallow land, residential, scattered villages, natural grassland and open woodland land types dominate the sub-catchment (DEA, 2019).

III. Geological Environment (GCS, July 2020)

According to 2530 Barberton-1:250 000 Geological map series (DMEA, 1986) the surface geology is characterised by quaternary sand deposits, Valium aged anorthosite, gabbro and norite (pyroxenite) of the Rustenburg Layered Suite; and cross-bedded quartzite with arenite, shale and conglomerate layers of the Pretoria Group, of the Transvaal Sequence (refer to **Figure 5**).

Stratigraphy

The proposed Vygenhoek Platinum Mine is underlain by gently north and north-west dipping layers of the Bushveld Igneous Complex (BIC), which intruded into the Transvaal Supergroup on the Kaapvaal Craton at about 2060 Ma. The Bushveld Complex consists of two lithological distinct units that are mainly intrusive into the Transvaal Supergroup:

- A lower sequence of layered mafic and ultramafic rocks, known as the Rustenburg Layered Suite (RLS); and
- An overlying unit of granite, known as the Lebowa Granite Suite.
- The chromitite and platinum mineralization is located in the RLS. The Rustenburg Layered Sequence comprises five stratigraphic zones:
- The Marginal Zone (with no economic potential);
- The Lower Zone (containing thin, high-grade chromitite seams); The Critical Zone (hosts all the significant PGM and chromite deposits);
- The Main Zone (locally exploited as dimension stone); and
- The Upper Zone (which host magnetite seams, some of which are exploited for Vanadium and iron ore).

The project area is underlain by the upper portion of the Critical Zone which in this area consists dominantly of anorthosite and mottled anorthosite with rare pyroxenite and chromitite layers (Digby Wells, 2012).

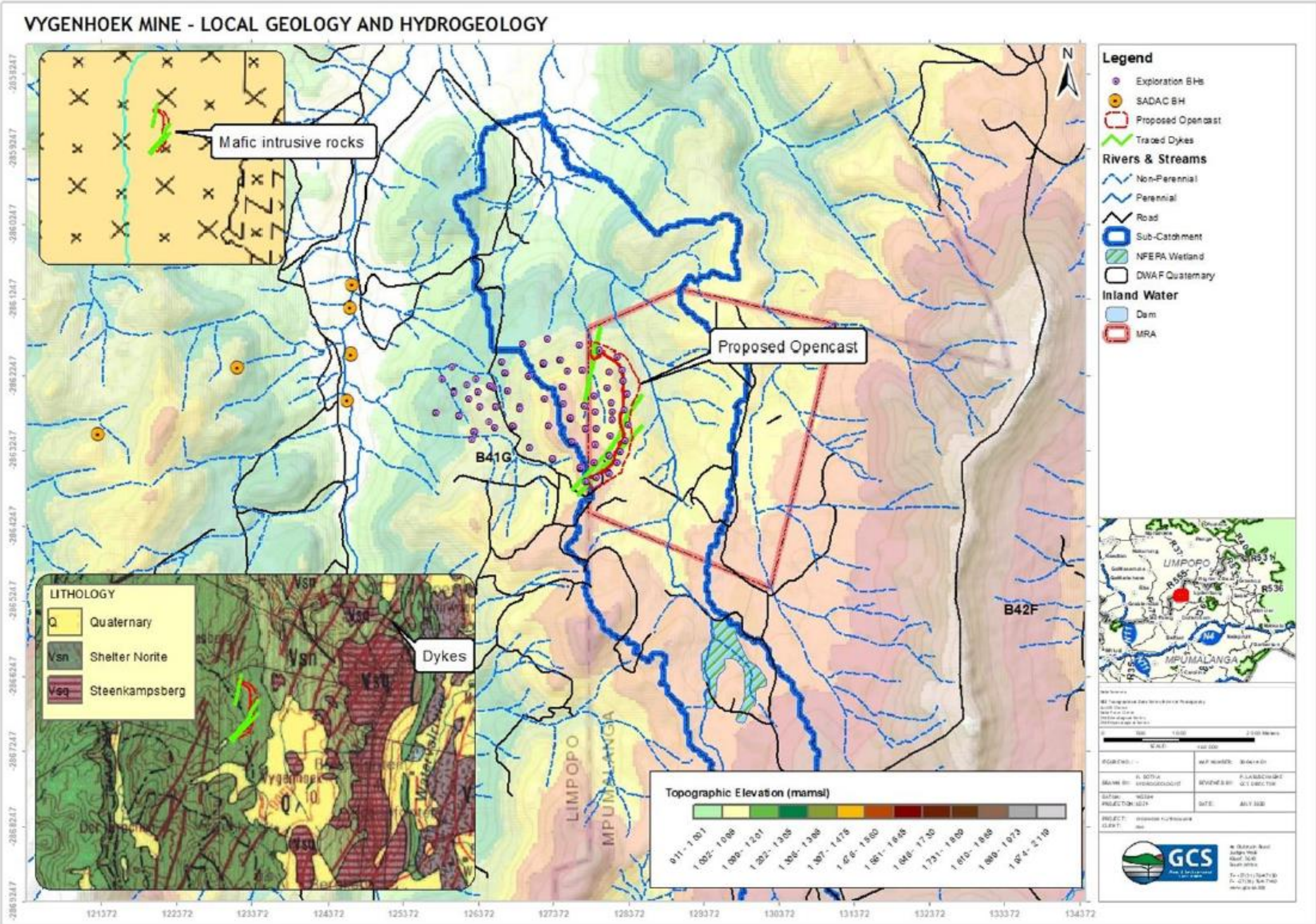


Figure 5: Local geology and hydrogeology

Structural geology

The ore body is an isolated basin-like structure. No major fault zones are expected to occur on the project site. Secondary discontinuities such as joints, shear joints and fault surfaces occur in the area and are likely to be an important control on the direction of groundwater flow (Digby Wells, 2012).

From the aerial magnetic map for the region, published by the Council of Geoscience South Africa (CGS, 2020), several magnetic anomalies associated with intrusive diabase/dolerite is noted (refer to **Figure 6**). The strikes of the magnetic anomalies (rocks) corresponds to NE-SW trending dykes as indicated on the 1:250 000 geological map series for this area and extend underneath Quaternary deposits. The UG2 outcrops are seen from N-S and NW-SE in the western part of the property.

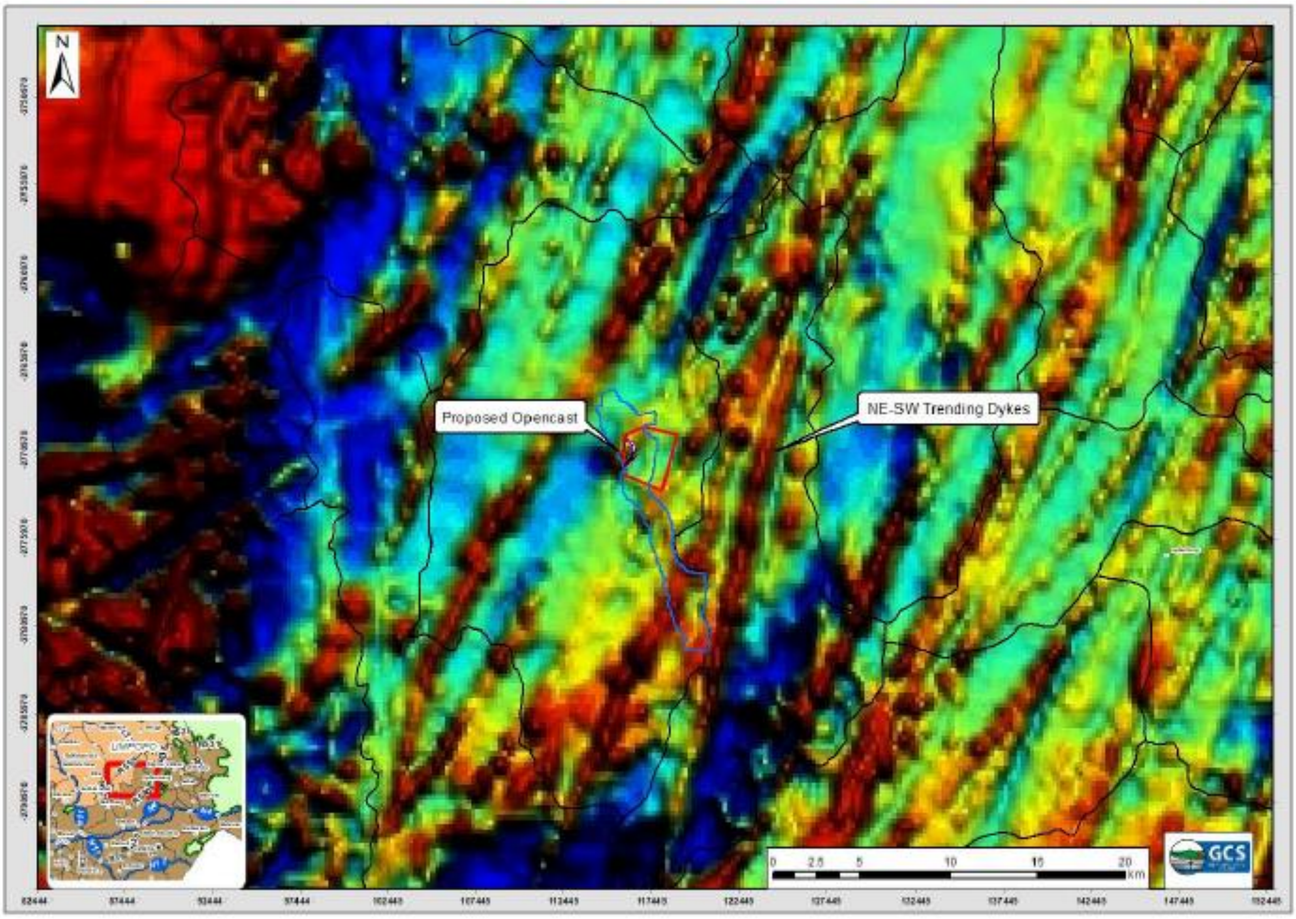


Figure 6: Magnetic map and structural geology (GCS, 2020)

Folding

The stereographic projection of poles to planes of layering illustrates that the Bushveld Complex has been subjected to gentle folding on a NNW-trending fold axis. Field data suggests that the proposed Vygenhoek Platinum Mine area is underlain by an open syncline structure. Such orientated folds may be within the stress field of the generally dextral Steelpoort Fault (Digby Wells, 2012).

Quartzite

Digby Wells (2012) indicated that an inlier of quartzite is found in the Bushveld rocks in the study area, with a sub-circular outcrop approximately 40 m in diameter forming a local topographic high point. The quartzite is presumed to be Pretoria Group, and is fractured in outcrop. Such fractures can be associated with the quartzite itself, or with chilling in the margin of the Bushveld rocks.

Weathering

Feldspars in anorthosite and mottled anorthosite layers are especially prone to chemical weathering, which was found to be particularly intense where surface watercourses flow over the bedrock. It is estimated that the weathered zone may be several metres thick (more than 3 m) in these areas. Weathered areas are characterised by the development of core stones and very soft weathered rock, which is readily eroded into deep (more than 2 m) gullies by flowing surface water. Away from streams, the rocks remain relatively fresh even at the surface (Digby Wells, 2012).

IV. Air Quality (Rayten Environmental, July 2020)

Rayten Environmental (Pty) Ltd conducted the baseline assessment in July 2020. Find **Appendix F** for the detailed report.

Identified sensitive receptors

Few sensitive receptors are located with a 0 – 20km radius of the proposed mine, and these are mainly dwellings/villages, village schools and nature reserves. The Sterkspruit and Verloren Vallei Nature Reserves are located approximately 20km north and west of the proposed mine, respectively Further, few sensitive receptors are located within a 20 - 25 km radius, the largest being the town of Lydenburg and associated educational and health facilities, which are located north of the proposed mine. The discrete receptors will be elaborated further in the modelling report.

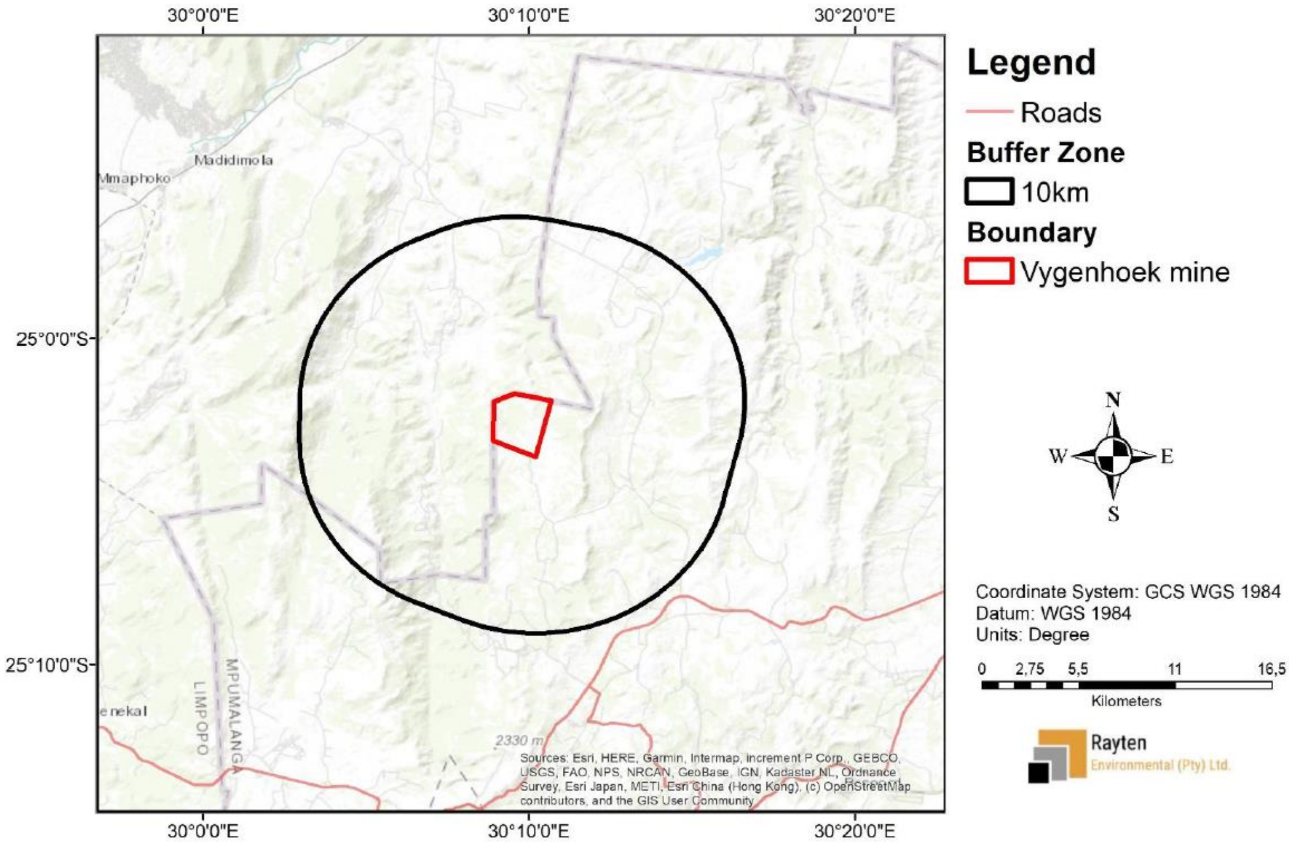


Figure 7: Site locality for the proposed Vygenhoek Platinum Mine

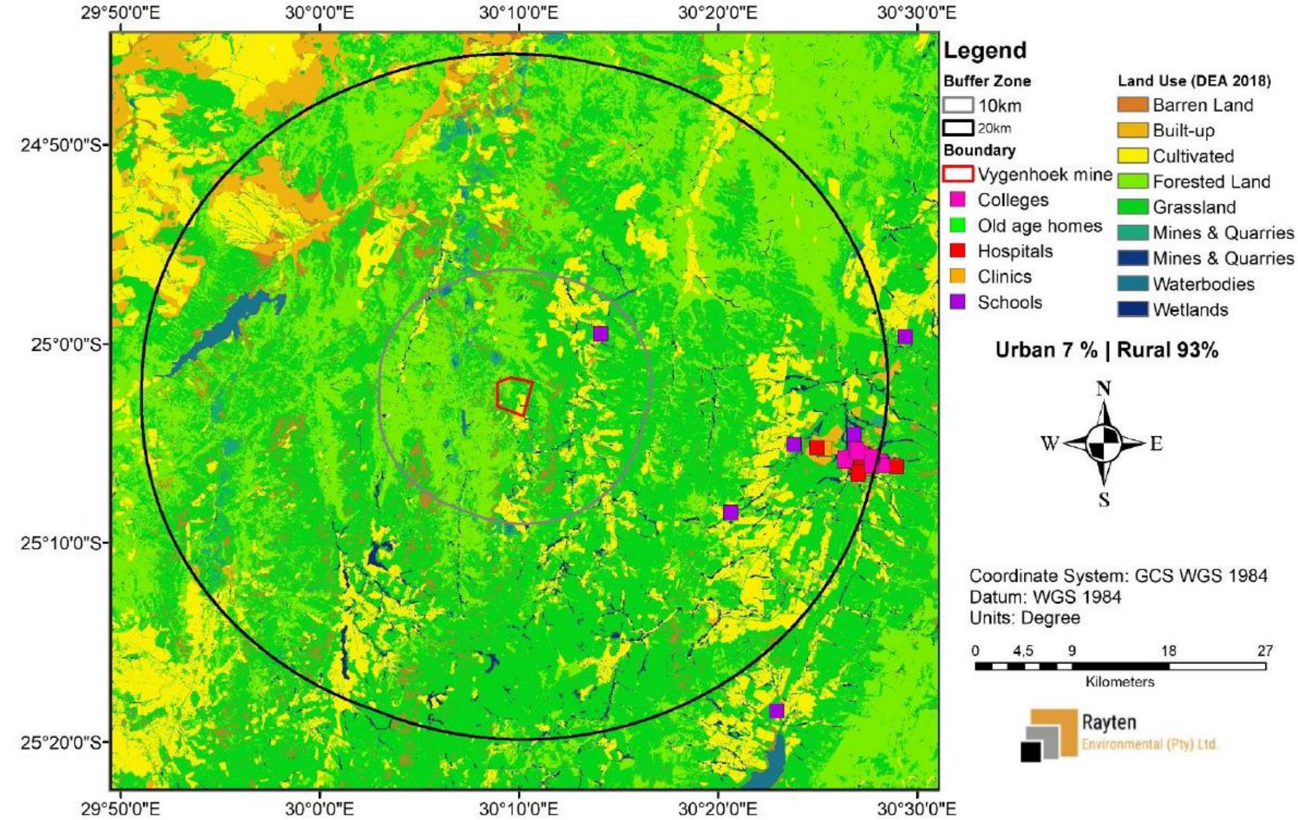


Figure 8: Land use surrounding the proposed Vygenhoek Platinum Mine

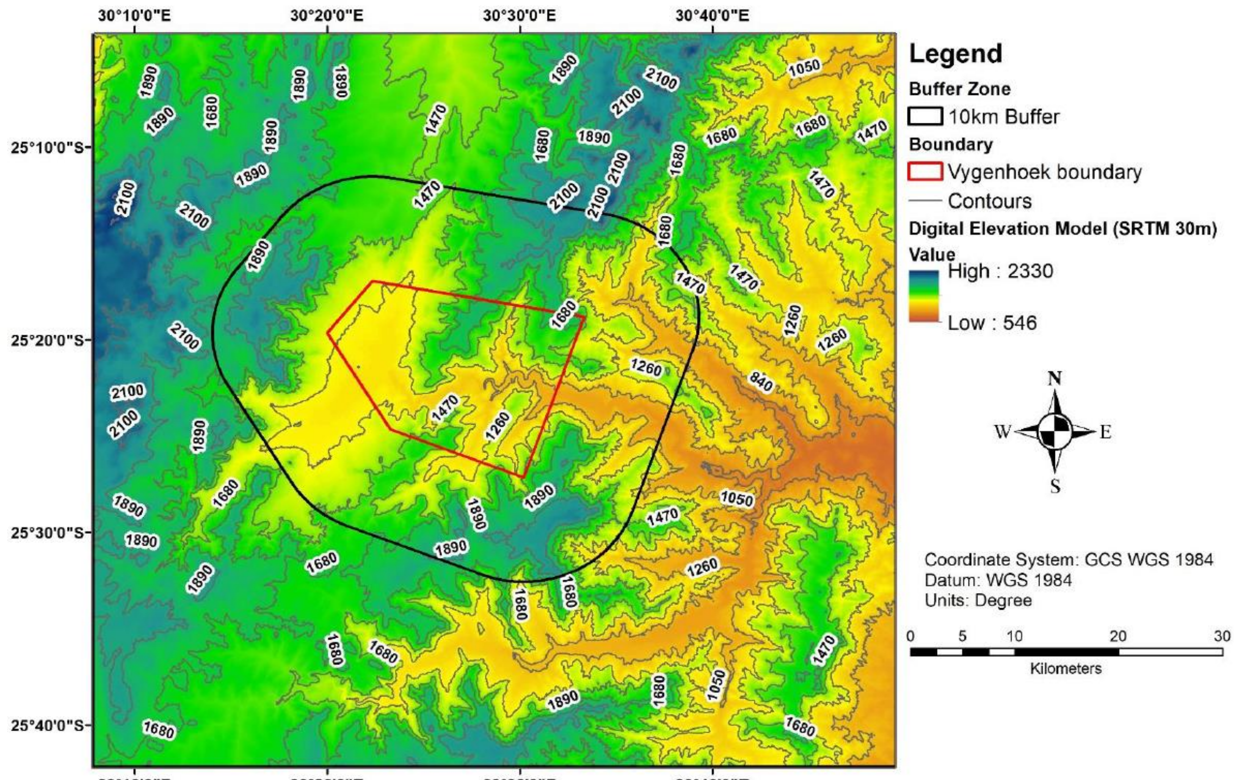


Figure 9: Topography surrounding the proposed Vygenhoek Platinum Mine

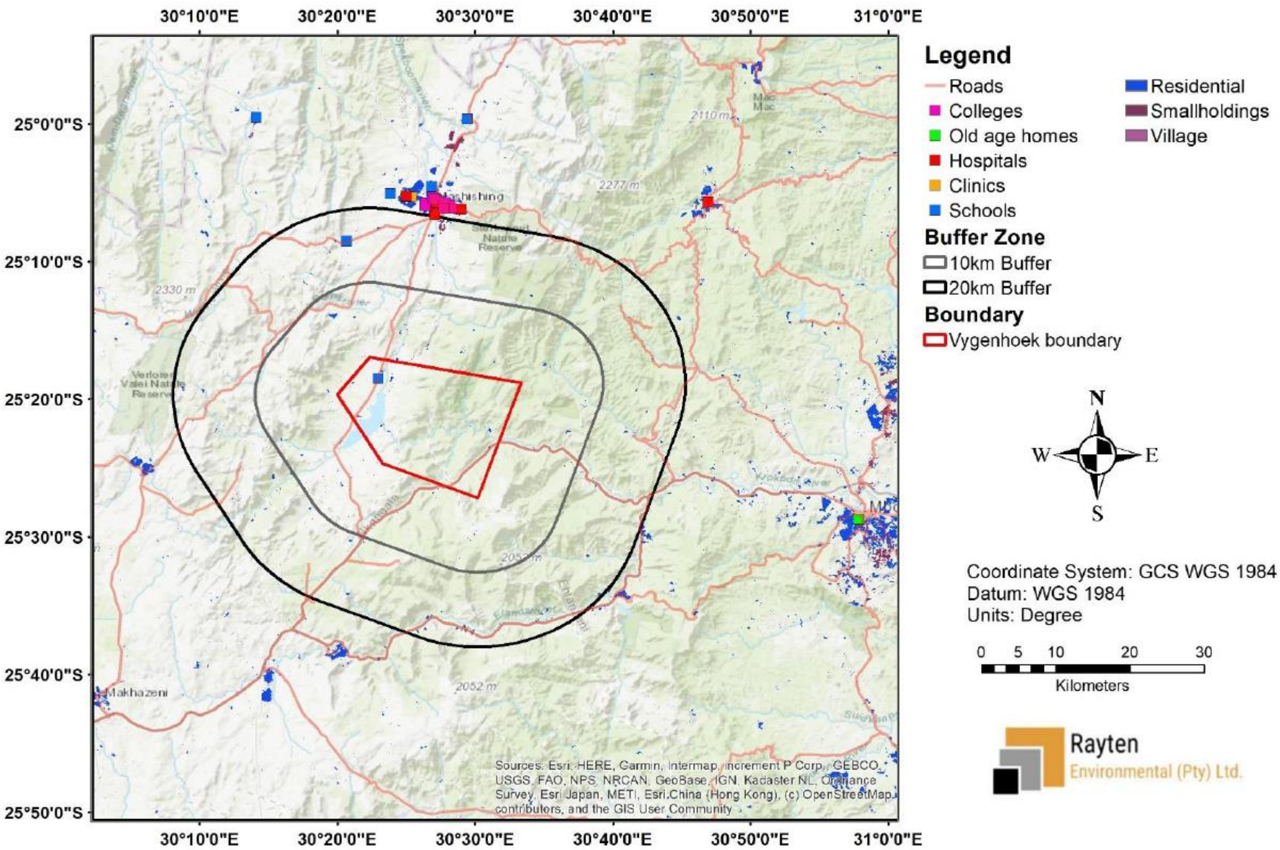


Figure 10: Sensitive receptors surrounding the proposed Vygenhoek Platinum Mine

Baseline assessment

Meteorological overview

Meteorological processes will determine the dispersion and dilution potential of pollutants emitted into the atmosphere. The vertical dispersion of pollution is governed by the stability of the atmosphere as well as the depth of the surface mixing layer. Horizontal dispersion of pollution is defined by dominant wind fields. Therefore, meteorological parameters including temperature, precipitation, wind speed and wind direction are of significance as they will influence the degree to which pollution will accumulate or disperse in the atmosphere.

As per the Code of Practice for Air Dispersion Modelling in Air Quality Management in South Africa (DEA, 2014), representativeness of the meteorological data is influenced by the following four factors:

- Proximity of the meteorological site to the area being modelled;
- Complexity of the terrain;
- Exposure of the meteorological measurement site; and
- Period of data collection.

MM5 modelled meteorological data was used for the project area. MM5 meteorological data was obtained from Lakes Environmental for the period January 2017 to December 2019. MM5 is a PSU/NCAR meso-scale model used to predict meso-scale and regional-scale atmospheric circulation. The model provides integrated model meteorological data, which can be used in a wide range of applications. This model is often used to create weather forecasts and climate projections. Details of the meteorological data obtained are summarised in **Table 6** below.

The South African dispersion modelling regulations requires a minimum of 3-years of meteorological data for input into the dispersion model. The meteorological overview given below is with reference to the data used for input into the model. The meteorological data is representative of recent prevailing weather conditions that will likely be experienced at the project site.

Table 6: Meteorological data details

Meteorological Data Details	
Met Data Information	**Description**
Met data type	MM5 AERMET-Ready (Surface & Upper Air Data)
Datum	WGS 84
Closest Town	Lydenburg - South Africa
Co-ordinates of centre of met grid:	
Latitude	25.045084° S
Longitude	30.162327° E
Time zone	UTC +2 hours
Period of record	January 2017 - December 2019
Met Station Parameters	**Description**
Anemometer height	13 m
Station base elevation	1463 m
Upper air adjustment	-2 hours
Grid Cell Information	
Cell centre	25.045084°S, 30.162327° E
Cell dimension	12km * 12km
Surface Met Data	**Description**
File format	SAMSON file
Output interval	Hourly
Upper Air Data	**Description**
Format	TD-6201- Fixed Length
Reported in	GMT

Output interval	00Z and 12Z
Models used to process met data	
Model used to process data for wind roses	WR Plot
Model used to process data for AERMOD	AERMET

Local wind field

Figure 11 below provides the period wind rose plot for the proposed Vygenhoek Platinum Mine for the period January 2017 to December 2019. The predominant wind directions for the period are observed from the south-east (~24.1% of the time) and east-south-east (~12.01% of the time). Additional low frequency winds are observed form the north-north-west (7.22% of the time). Wind speeds for the three-year period were generally moderate to fast with calm conditions, defined as wind speeds less than 1 m/s, observed for 4.33% of the time (**Figure 11**).

The morning (AM) and evening (PM) period wind rose plots for the period January 2017 to December 2019 are given in **Figure 12** below and show diurnal variation in the wind field data. During the morning (AM) period, high frequency winds are mainly observed from the south-east and east-south-east; as opposed to the evening (PM) period, where winds are predominantly observed from the south-east, north-north-west, and east-south-east/north-west (Figure 12). Greater variation in winds is observed during the evening period.

There is slight seasonal variation in winds at the proposed Vygenhoek Platinum Mine, as shown in Figure 13 below. Over the different seasons, south-easterly and east-south-easterly winds prevail. Additional less frequent easterly, northerly, south-south-westerly, and north-westerly winds are observed. Easterly and northerly winds prevail in summer and spring, respectively, while south-south-westerly winds are observed during autumn and winter. North-westerly winds prevail in autumn. Wind speeds were generally high during all seasons, which could subsequently facilitate dust emissions from stockpiles, onsite and offsite activities.

Based on the prevailing wind fields for the period January 2017 to December 2019, emissions from activities at the proposed Vygenhoek Platinum Mine will likely be transported towards the north-westerly and west-north-westerly quadrants. Moderate to fast wind speeds observed during all the time periods, may result in effective dispersion and dilution of emissions from the proposed mine operations; however, higher winds speeds can also facilitate fugitive dust emissions from open exposed areas such as stockpiles and opencast areas.

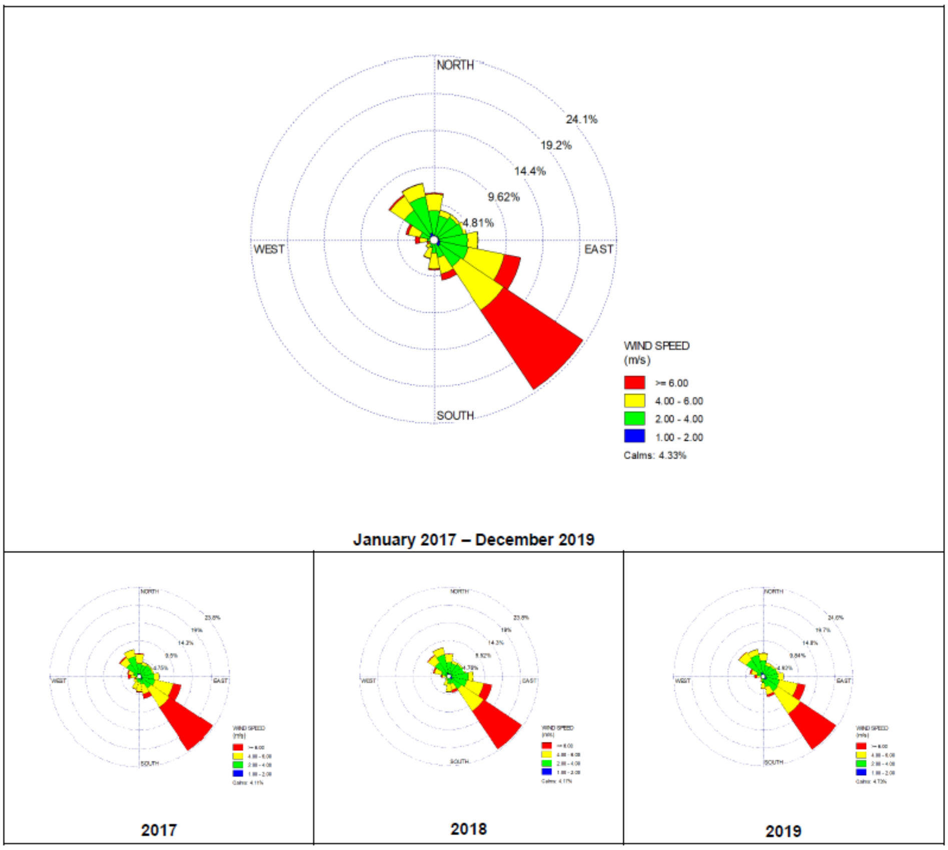


Figure 11: Period wind rose plots for the proposed Vygenhoek Platinum Mine for the period January 2017 – December 2019

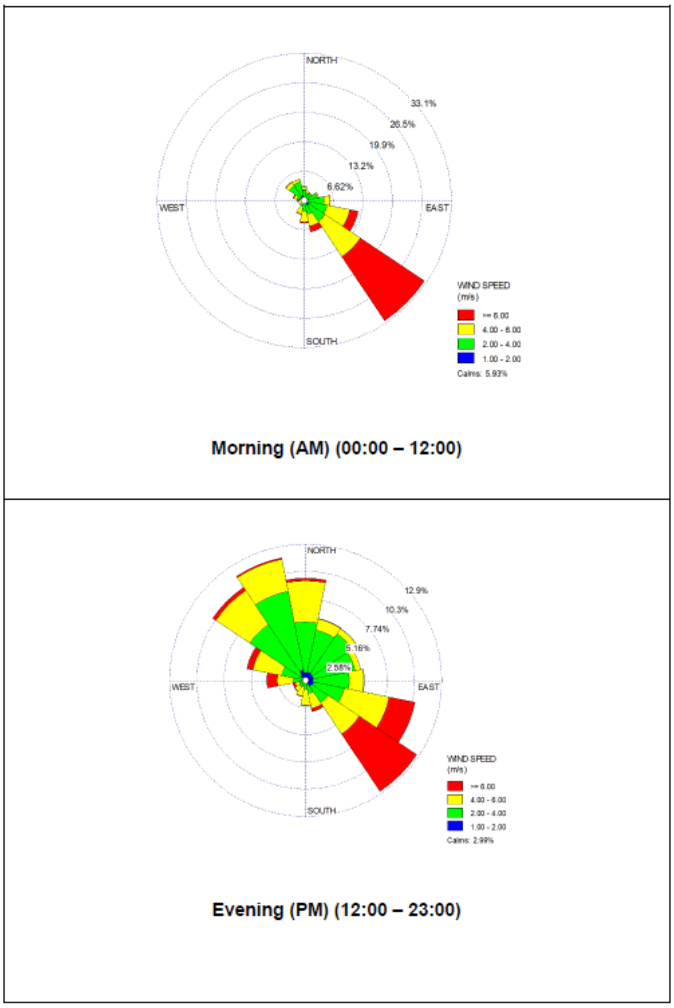


Figure 12: Morning (AM) (00:00 – 12:00) and evening (PM) (12:00 – 23:00) period wind rose plots for proposed Vygenhoek Platinum Mine for the period January 2017 – December 2019

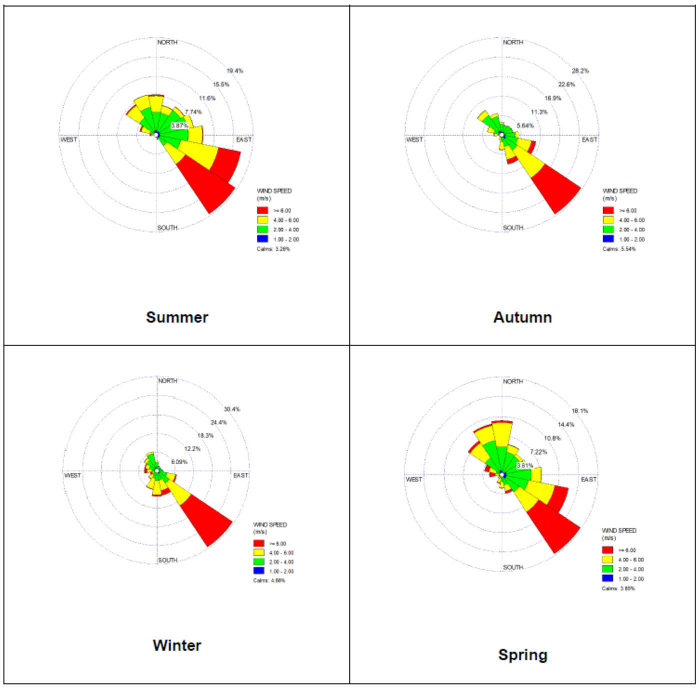


Figure 13: Seasonal variation of winds for the proposed Vygenhoek Platinum Mine for the period January 2017 – December 2019

Baseline air quality concentration

The existing air quality situation is usually evaluated using available monitoring data from permanent ambient air quality monitoring stations and dust-fall networks operated near the project site. There was no South African Air Quality Information System (SAAQIS) data available (that could be determined) to present background concentrations for SO_2, NO_2, CO, PM_{10} and $PM_{2.5}$ concentrations at the project site, nor are there any dust-fall networks that we know of. Therefore, baseline air quality at the proposed Vygenhoek Platinum Mine could not be assessed.

Surrounding sources of air pollution

Existing key sources of air pollution surrounding the proposed Vygenhoek Platinum Mine were identified during a desktop exercise and were limited, with the main pollution source being forestry activity/plantations in surrounding areas (**Figure 14** and **Figure 15**).

Mining, refuse dumps, villages and industrial activity were identified as additional sources of air pollution but to a minimal extent. Mining activities are mostly concentrated south of the proposed mine, while industrial activities and refuse dumps are mainly located to the north. Villages and associated solid fuel combustion activities are concentrated north to north-west of the proposed mine within 15 – 20km radius.

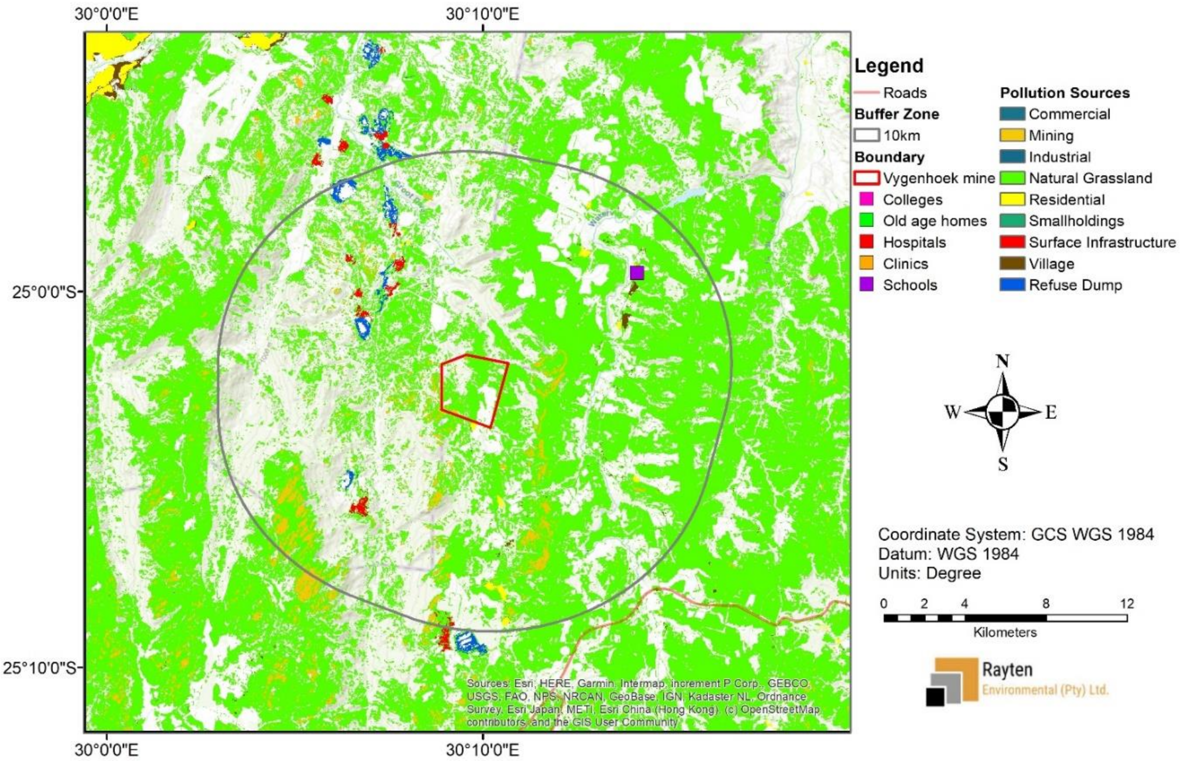


Figure 14: Identified surrounding emission sources within 10km of the proposed Vygenhoek Platinum Mine

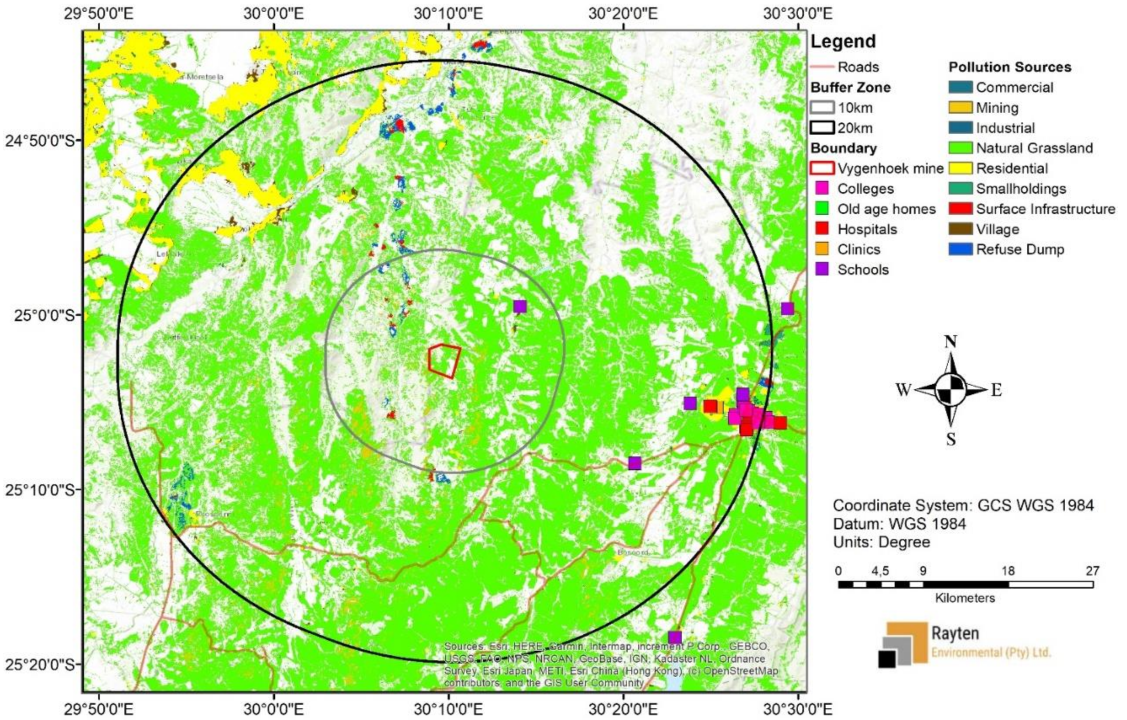


Figure 15: Identified surrounding emission sources within 20km of the proposed Vygenhoek Platinum Mine

Preliminary air quality impact assessment

Dust-fall, PM_{10} and $PM_{2.5}$ are key pollutants of concern associated with operational activities at the proposed Vygenhoek Platinum Mine and will be emitted from the following key sources:

Dust and Particulate Emissions:

- Drilling and blasting at the opencast pit;
- Bulldozing (profiling of waste);
- Materials handling operations (truck loading/offloading operations);
- Transportation of material (trucks);
- Material storage: Stockpiling,
- Excavators (stripping ore and waste and loading trucks);
- Wind erosion from exposed areas (i.e. the open cast pit, exposed surfaces, and material stockpile areas); and
- Vehicle dust entrainment on unpaved roads.

It is expected that emissions from activities at the proposed mine will most likely result in air quality impacts in terms of dust-fall, PM10 and PM2. However, as the impact assessment has not yet been conducted (this will be done after the dispersion modelling exercise), no fatal flaws and red flags that could impact on the feasibility of the Mine could be determined in this baseline assessment report. These will be determined in the final AQIA report.

Terms of reference for the EIA

A detailed emissions inventory will be compiled for the proposed Vygenhoek Platinum Mine operations as part of the EIA phase and the impact of these on air quality will be assessed through dispersion modelling using AERMOD. The results of the assessment will include dispersion isopleth plots and will be presented in the final Air Quality Impact Assessment report.

V. Climate change impact assessment (Rayten Environmental, July 2020)

Rayten Environmental (Pty) Ltd conducted the baseline assessment in July 2020. Find **Appendix G** for the detailed report.

The main objective of the Climate Change Impact Assessment Baseline report is to assess the potential contribution of the project towards climate change, through the emission of GHGs. GHGs the proposed mine could emit include CO_2, CH_4 and N_2O. Additionally, the effects that climate change could have on the project will also be assessed. The terms of reference and scope of work for this climate change impact assessment baseline report are to describe the existing status of the biophysical environmental, in terms of climate, that will be affected by the mining activity, as well as to provide a list and description of potential impacts identified on the biophysical environment in terms of climate. A GHG emissions inventory and carbon footprint of the mining activity was thus not undertaken.

With the mining being undertaken by means of an open cast mining method, the following activities, which are expected to result in direct GHG emissions, will be undertaken: construction of support facilities and infrastructure, blasting to break down the hard overburden, blasting of the ore, transport of the ore to various stockpiles as well as to the Concentrator, waste management, a conservancy tank, combustion of fuels in mine vehicles, machinery and a generator, etc. A possible incinerator may be installed at a later stage for treating sewage screenings. Energy indirect GHG emissions will result from the use of imported electricity, heat or steam consumed onsite. Other indirect GHG emissions may occur, such as from employee commute and business travel, and the transportation of goods and services to and from the mine, when not controlled by the mining company itself. Therefore, assessment of impacts from the mining activity should not only focus on direct GHG emissions, but also on upstream and downstream emissions through the supply chain.

MM5 meteorological data for the project area for the period 01 January 2017 – 31 December 2019 was used to determine the prevailing meteorological conditions at the site.

Baseline Assessment

Identified GHG activities for the proposed Vygenhoek Mine

In terms of GHG emitting activities, the proposed Vygenhoek Platinum Mine would trigger the following activities in terms of Annexure 1 of the National GHG Emission Reporting Regulations (Government Gazette No. 40762 of 3 April 2017), if the applicable reporting thresholds are exceeded:

Applicable activities:

- Sector: Energy
  - 1A2i – Fuel Combustion Activities, Mining and Quarrying (if exceeding the 10MW reporting threshold)
- Sector: Waste
  - 4D1 – Domestic Wastewater Treatment and Discharge (if exceed ≥2 million litres/day reporting threshold); *the mine will only have a conservancy tank which will be pumped out every 3 months by a designated service provider and treated offsite at Steelpoort Sewage. However, conservancy tanks release GHG emissions in the form of CH_4, and these should be accounted for.
  - 4C1 – Waste Incineration (if a waste incinerator for treating sewage screenings is installed at a later stage) (if incinerating 1 tonne per hour or more, which is the reporting threshold)

Despite the above, and the related reporting thresholds, when reporting on Climate Change impacts, all emissions should be calculated, so as to obtain a holistic overview of the company's GHG emissions, and overall contribution to climate change.

Assumptions on the impact of the proposed mine on climate change

The applicant will own the proposed Vygenhoek Platinum Proposed mine, however the mining work itself will be outsourced to an external contractor. The applicant will have full financial and operational control over the mining activities, however, in terms of the contractor to whom the mining will be outsourced, the contractor will be responsible for all emissions as the mining machinery will be owned by them. The applicant does not own any mining equipment and machinery.

There are proposed mining operations to be undertaken at the site and surrounding the site. The following activities are expected to be key sources of GHG emissions at the proposed mine:

- Blasting (fugitive emissions resulting from the combustion of a complete explosives mix);
- Truck and mining equipment emissions from combustion of fuels;
- Other combustion processes (e.g. gas, diesel & oil combustion);
- Transportation of the ore to the concentrator located offsite;
- Conservancy tank;
- Possible incinerator for treating sewage screenings;

- Electricity consumption from the workshop, administrative office, weighbridge, and additional lighting of stockpile areas; and
- Construction of required infrastructure onsite.

Other possible indirect GHG emission sources, include, but are not limited to:

- Employee commute and business travel;
- Transportation of the conservancy tank waste to Steelpoort Sewage for treatment offsite; and
- Transportation of general and hazardous waste offsite.

At this stage, GHG calculations will not be undertaken, however a general overview of potential contribution of certain activities towards climate change are discussed below. It is recommended that GHG calculations to estimate the proposed carbon footprint of the proposed mine be undertaken as part of the EIA phase. This will assist in establish the extent of the proposed mine's contribution towards climate change.

Blasting

The applicant expects to use 0.8 – 1.2 kg of explosives per m^3 of hard overburden and hard UG2 (Reef). Explosives will not be used on topsoil, soft overburden and soft UG2 (Reef). Waste volumes over the 10-year LoM is expected to be 6 108 487 m^3, of which 90% will be hard overburden. To determine the potential contribution of this blasting (in terms of GHG emissions) to climate change, one would need to calculate the GHG emissions thereof. Information on the type of explosives used, the mass of the fossil fuel (if applicable) in the explosives, and the carbon content of the fossil fuel may be required.

According to Goswami & Brent (n.d.), GHG emissions from the detonation of explosives are of the order of 1 tonne of CO_2 for every 5 tonnes of explosives consumed. However, upstream emissions from the manufacture of ammonium nitrate can range from the equivalent of 1 to 4 tonnes of CO_2 for every tonne of explosives. In terms of the direct detonation of the explosives at the proposed mine, it can be estimated, based on a maximum usage of 1.2 kg of explosives used per m^3 of hard overburden, and the calculation of '1 tonne of CO_2 for every 5 tonnes of explosives consumed' that CO_2 emissions would be around 1 319.434 tonnes of CO_2 from the 6 597.17 tonnes of explosives used.

Diesel consumption

Diesel consumption is expected to be 160 000 litres per month. This equates to 19 200 000 litres over the 10-year LoM. 2.5% of the diesel used will be for the generators to generate electricity, while 97.5% will be for the mining operations. A total of 54 386.02 tonnes of CO_{2eq} would thus be emitted over the LoM, from combustion of diesel, based on the figures provided, as using IPCC default emission factors and calorific values for diesel.

Fossil fuel combustion is a major source of CO_2 emissions. CH_4 and N_2O are related to vehicle km travelled rather than fuel consumption and account for 5% of diesel engine emissions in terms of CO_2 equivalent (Amoako, *et al.* 2018). Diesel would mostly be used in mobile sources on the proposed mine. Mobile equipment includes dump trucks, utility vehicles, drill rigs, excavators, bulldozers, a grader and a water bowser. A small percentage of diesel would be used in stationary combustion (in the generators). Most proposed mines use diesel fuel only.

Liquefied Petroleum Gas (LP Gas) consumption

According to the World LP Gas Association (2007), the GHG footprint of LP Gas is relatively small compared to other fuels in terms of total emissions and emissions per unit of energy consumed. LP Gas has the lowest on-site emission rate of the major energy sources, with the exception of natural gas. Furthermore, LP Gas is not a GHG when released into the air as it is primarily a combination of propane and butane molecules, along with trace amounts of other compounds; the exact composition of which varies around the world. LP Gas vapor is not persistent in the atmosphere. It is commonly removed by natural oxidation in the presence of sunlight or knocked down by precipitation faster than it takes for it to become well-mixed and have impacts on global climate. Current measurements have not found a global climate impact from the emissions of propane or butanes.

It is expected that 1 800 kg of LP Gas (used on a rental basis from a service provider) will be consumed by the proposed mine per month, which equates to 216 000 kg (216 tonnes) over the 10-year LoM. A total of 645.22 tonnes of CO_{2eq} will thus be emitted over the LoM, from the use of LP Gas in the mining operations.

Electricity consumption

Information has not been provided on whether the proposed mine will make use of grid (Eskom) electricity on-site.

The proposed mine will have 2 stationary generators (with 1 being a back-up generator). The proposed mine expects to consume about 4 000 litres of diesel per month in these generators, which it is assumed will be used to electrify the infrastructure (workshop, administration office, weighbridge, and additional lighting of the stockpile area). GHG emissions thereof have been included under diesel consumption.

Construction of infrastructure onsite

Infrastructure expected to be constructed onsite include a workshop, administration office, security and access control area, onsite change houses / ablution facilities, contractor camp, surface water management areas (such as water supply dams, pollution control dams, proposed mine residue facility return water dams, and dirty storm water controls), storage areas, etc. It has not been established whether the buildings to be constructed will be permanent structures, or if they will be temporary, such as in the form of moveable storage containers for the workshop and offices. The physical construction of buildings will generate more GHG emissions that the placement of temporary structures that can be used elsewhere after closure of the proposed mine.

However, the footprint in terms of infrastructure is relatively small compared to other proposed mines. If a processing plant were constructed onsite, this would have resulted in a greater GHG emissions profile. Larger proposed mines may have processing plants, concentrator plants, smelters, etc all onsite, and owned, which would result in a substantially larger GHG emission profile.

It should however be noted that, although the ore will be processed by a concentrator not owned and managed by The applicant, the proposed mine is in part responsible for the GHG emissions generated by the concentrator, due to the role they play in feeding the concentrator with the raw materials needed to undertake their own processes.

Sewage treatment

A sewage treatment plant is not planned on being installed, however there will be a conservancy tank. This conservancy tank will be pumped out by a designated service provider every 3 months. The sewage will then be treated offsite at Steelpoort Sewage (about 40 km from the proposed mine). Information has not been provided on the amount of sewage that will be contained in the conservancy tank. Conservancy tanks emit CH_4, and additional information would be required to calculate the GHG emissions thereof. That being said, the emissions from the conservancy tank are expected to be low. The tank will not be at full capacity throughout the 3-month periods between being emptied, and the tank itself will only service the 14 employees from The applicant and 44 employees from the mining contractor, and any service providers that may visit the proposed mine.

Waste

The proposed mine will undertake temporary handling and storage of general and hazardous waste on-site. Hazardous waste may include oils, chemical waste, lubricants, fuels, explosives, raw material stockpiles, etc. General non-hazardous waste may include office waste, food waste, scrap metal, plastics and wood waste.

It is assumed that this will either be collected by an external contractor or transported by the proposed mine to a landfill site capable of handling hazardous waste. To estimate GHG emissions from waste generated by the proposed mine, the waste would need to be categorised into the appropriate waste streams, after which the required IPCC waste stream model will be applied to calculate the GHG emissions.

CH_4 emissions from waste stored temporarily onsite are not expected to generate any significant GHG emissions. CH_4 is generated as a result of degradation of organic material under anaerobic conditions, therefore it is only the total mass of decomposing material currently in the solid waste disposal site (SWDS) that matters, and not what (and how much) waste was deposited in that year. CH4 emissions can however be calculated once the projected amount of waste (waste composition) to be deposited annually at the SWDS is known.

These GHG emissions are also considered to be other indirect GHG emissions as, although generated by the proposed mine, they will be managed by another organisation.

Potential incinerator

Emissions associated with waste incineration are CO_2, CH_4 and N_2O. The most significant of these would be CO_2. Proposed impacts from such an incinerator can only be established once information is provided on waste quantities and composition of the waste that would be screened. The quantity of waste screened (which will then be incinerated), and subsequent GHG emissions emitted, would however be assumed to be low, based on the population the sewage system (conservancy tank) will serve. Passing of sewage through screens is generally undertaken to separate and remove material to avoid blocking and damaging pipe works, pumps, valves and equipment.

Other indirect GHG emissions

The impact of other indirect GHG emissions cannot be assessed at this stage, however they are expected to be low.

A contractor camp will be constructed onsite, which should significantly reduce the majority of employee commute. In terms of transportation of the ore from the proposed mine site to the concentrator, it is assumed that transportation thereof will be undertaken by the mining contractor, and that the GHG emissions thereof have been accounted for under diesel consumption emissions. The concentrator to be used is considered to be adjacent to the proposed mine, thereby reducing distance to be travelled to deliver the ore, and reducing fuel consumption, and subsequently GHG emissions.

The general and hazardous waste generated by the proposed mine, as discussed above, will be ultimately managed by another organization (presumable the waste disposal site selected), and the GHG emissions are therefore also considered to be other indirect GHG emissions.

Other impacts on climate change

During the construction phase, it is expected that some clearing of land may be required in terms of removing vegetation. This will result in the loss of carbon sink capacity due to vegetation not being available to convert the CO_2 emitted to oxygen. Current Google Earth images show the land as partially barren, however at the proposed pit location there are numerous trees and bushes that would most likely be cleared away.

Assumptions on the impact of climate change on the proposed mine

The level of impact associated with climate change on the proposed mining activity associated with the applicant – Vygenhoek Platinum Proposed mine is assessed below.

The impacts of climate change are already being seen in South Africa, and are projected to intensify over the coming decades. These impacts vary across the country, but are projected to include changes to long-term temperature and rainfall patterns (MSDF, 2018). An increase in extreme weather events including floods and droughts is also projected. Climate change is more than simply an increase in global temperatures; it encompasses changes in regional climate characteristics, including temperature, humidity, rainfall, wind and severe weather events, which also have economic and social dimensions.

Climate change poses significant threats to the basic provisions of life including water, the environment, health, and food production. Assuming moderate to high increases in greenhouse gas concentrations such as carbon dioxide, regional modelling scenarios indicate that the in north-eastern South Africa (which includes Mpumalanga) there have already been notable shifts in climate with significant increases in average temperatures (MSDF, 2018). This is further illustrated by stating that for the period 1995-2006, 11 of the 12 years ranked among the 12 warmest years on record since 1850. Observed trends include more frequent heat waves, and colder days and nights becoming less frequent.

Mpumalanga Province is expected to experience higher minimum, average and maximum temperatures over the next few decades. These temperature changes would be accompanied by increasing incidence and intensity of drought, possibly even in regions where total rainfall increases (such as along the Mpumalanga escarpment). Total annual rainfall is expected to increase by between 85 and 303 mm per year, with distinct increases along the escarpment (MSDF, 2018).

Water demand in Mpumalanga has increased due to rapid industrialisation, mining, urbanization and population growth, and it is stated that the province is unlikely to meet the water availability due to the climate change impact on the province.

The impacts of climate change pose serious risks for the mining sector. “The mining sector is extremely energy-intensive and one of the major emitters of greenhouse gases. Total CO_2 emissions vary across the industry, largely depending upon the type of resource proposed mined as well as the design and nature of the mining process. It is widely recognised that available mining deposits are increasingly deeper and of declining ore grade. This will lead to growing demands for water as well as greater proposed mine waste, thereby raising energy consumption, and increasing the industry’s climate footprint” (Ruttinger, 2016). Some of the world’s largest mining operations currently operate in remote, climate sensitive regions. The industry is not relocatable should natural environmental conditions become unsupportive for varying reasons. The mining sector requires a number of suitable natural conditions including, but not limited to, a habitable climate, access to water resources and supporting infrastructure to extract resources and process them for future domestic and/or international use.

Changing climatic conditions will have both direct (operational and performance-based) and indirect (securing of supplies and rising energy costs) impacts on the mining sector. These include but are not limited to water-related impacts (droughts, floods, storms, etc); heat-related impacts (bush fires and heat strokes); and sea level rise.

As discussed by Ruttinger (2016), key climatic impacts on various stakeholders across the resources sector, can include, but are not limited to:

- Increased demand for water conservation during droughts
- Increased demand for emergency services during flood events
- Reduced asset operating life
- Health and Safety risks for workforce
- Inability to meet performance targets resulting in impacts on share prices
- Increased demand for changing infrastructure design standards

- Increase in costs of water
- Disrupted access routes, leading to forced proposed mine closures
- Potential employment loss due to lack of safe access to sites
- Conflicts with other water users in the region over water availability
- Force Majeure, sometimes also leading to disputes around delivery obligations
- Supply chain breakdowns

Mining operations typically use large volumes of water to proposed mine and process proposed minerals. Vygenhoek Platinum Proposed mine will however not be processing any of the ore. The proposed mine expects to consume 2 500 m^3 of water per month for dust control, and 20 000 litres per month of water obtained from a borehole, for use at the offices. It can therefore be assumed that water will not be used in the open cast pit. The representative of the proposed mine has also confirmed that they will only obtain water from a borehole, and none of it will be recycled or reused. There will also not be any wastewater treatment undertaken onsite. With the proposed mine not processing its own ore, its dependence on water is substantially reduced, thereby minimising the impact of climate change on water resources, and on the proposed mine itself. The concentrator will however use more water to process the ore. If there are water shortages, this will impact the concentrator's ability to process the proposed mine's ore, which will then negatively impact the proposed mine's ability to sell its ore. If the concentrator is unable to take ore to process due to water shortages, the proposed mine may need to stockpile the ore until such time as the situation improves, or it will have to transport its ore further distances for processing in locations not experiencing water shortages. This will however influence diesel combustion, thereby increasing the proposed mine's GHG emissions from mobile combustion sources.

Dust suppression is an important mitigation measure for proposed mines. Excessive dust combined with windy conditions can have far reaching impacts, particularly on local communities and biodiversity. Rising temperatures and warmer, drier conditions in summer can exacerbate dust emissions. Therefore, dust control measures are especially important in hot, dry conditions. In most proposed mines, dust suppression involves spraying water to suppress the dust. Vygenhoek Platinum Proposed mine will make use of a water bowser for dust suppression of roads and waste dumps and screening areas. Should water shortages occur, or if the borehole dries up, the proposed mine will not be able to access water easily for dust suppression, and other general water requirements. It is assumed that the borehole will be fed by the Dwars River. Threats to the river system are largely attributed to the surrounding agricultural land uses which have impacted on the local aquatic ecosystems, as well as the increase in mining operations within the larger area. The river itself runs adjacent to the open cast pit (refer to **Figure 16**).

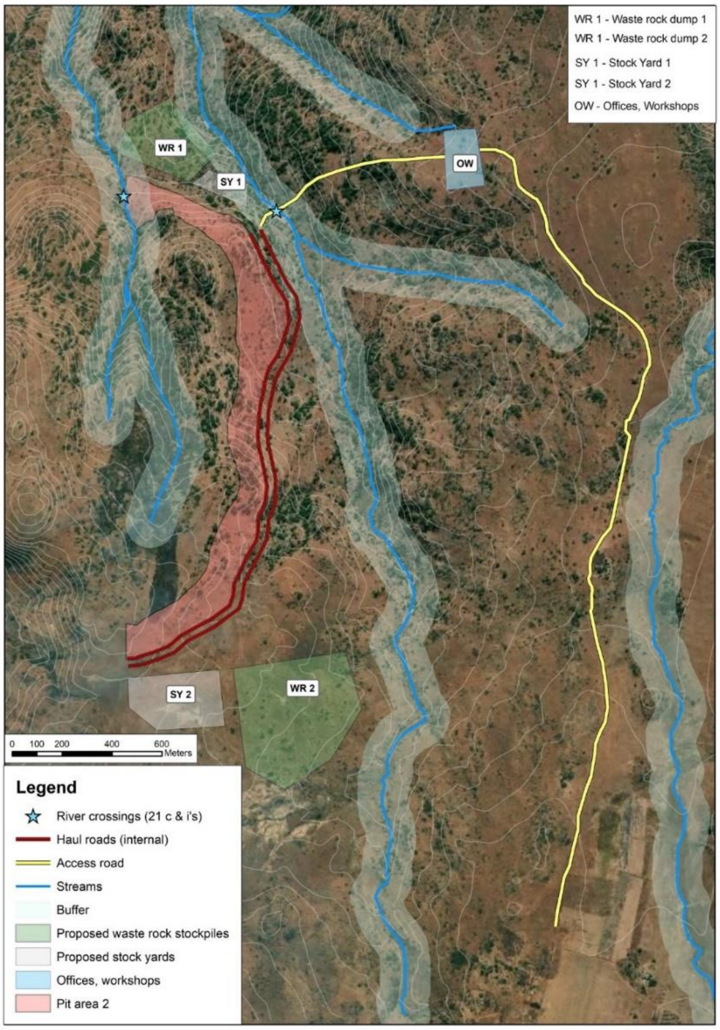


Figure 16: Site layout within the river system

The potential impact of climate change remains uncertain, and it is not possible to predict specific trends of the possible impacts it may have on the area. However, it can be anticipated that seasonal variations and fluctuations in water availability may increase. The variations between wet and dry periods may also become more pronounced and severe.

Flooding associated with high rainfall events has the potential to result in unplanned discharges from water storage dams at the operations. Infrastructure at Vygenhoek Platinum Proposed mine such as buildings, storm water controls, water dams, wastewater collection and treatment systems, tailings and waste disposal ponds, transportation infrastructure such as river crossings and roads can all be easily affected by extreme conditions caused by changes in weather patterns.

Terms of reference for the EIA

A preliminary climate change impact assessment was undertaken as part of the scoping phase of the EIA. This was based on information provided by the client, as well as a desktop study, to identify potential issues that are likely to be of importance during the EIA, and to eliminate those that are of little or no concern.

It is recommended that, for the EIA phase of the project, that an in-depth GHG calculation project be undertaken to obtain a clear understanding of the proposed impact of the project on climate change (during construction, operation and closure), in terms of its GHG emissions. This will assist in confirming the preliminary risks identified (in terms of the mine's potential contribution towards climate change) and will look at minimum values as well as maximum worst case scenario figures, to gain a holistic view of potential emissions.

Summary and conclusions

The main conclusions based on the information obtained during the Baseline Assessment can be summarised as follows:

Vygenhoek Platinum Proposed mine is expected to have a small footprint in terms of infrastructure, with a few offices, workshop, contractor camp, etc to be constructed. The mining will be completely outsourced to a mining contractor. The mining contractor owns the mining machinery and equipment. The proposed mine will not have a processing plant. Ore will be stored until there are sufficient stockpiles to send to the preferred concentrator for processing, however the proposed mine may utilise a mobile crusher at a later stage.

Mines in general are large consumers of electricity, fossil fuels and water. The water to be utilised will be obtained from a borehole. It will be used for dust suppression and water at the offices. It is therefore assumed that water will not be used at the pit, thus water requirements may be considered to be lower. Water usage should remain relatively stable (no expected sudden increases required, unless drier temperatures and more frequent stronger winds require more frequent dust suppression to be undertaken). It was indicated that diesel generators will be used for electricity, and an assumption was therefore made that grid electricity will not be used. Diesel usage will however be predominantly for use in mining vehicles and machinery. Fossil fuel use is thus expected to be low, compared to other proposed mines that have conveyor belts, crushers, processing plants, etc. Additionally, the preferred concentrator that will be used to process the ore is considered to be "adjacent" to the proposed mine, which lessens the use of diesel for transport of the ore to the plant.

Climate change itself can have various impacts on proposed mines. With Vygenhoek Platinum Proposed mine relying on water extraction from a borehole, there is a risk of the water drying up. Research has shown that the Mpumalanga Province has had water shortages, an increase in average temperatures, and varying weather and rainfall patterns. Increased temperatures can result in faster evaporation rates, which may impact the proposed mine in terms of their water storage capacity (in their water supply dams, proposed mine residue facility return water dams, and pollution control dams). Increased rainfall can also impact the proposed mine in terms of flooding of the pit resulting in downtime, as well as damage to river crossings and infrastructure, etc. increased wind speeds and evaporation rates may also result in increased dust flareups, resulting in the requirement of increased dust suppression. Not only will this require additional water requirements, but the dust itself will have adverse impacts on the employees and any surrounding communicates in the area.

Overall, the expected impact of the proposed mine on climate change, in terms of GHG emissions, is expected to be low, based on the information provided, and assumptions based on researched information only. The impact of climate change on the proposed mine itself is expected to be low at present, however further research would be required on predicted impacts over the next 10 years (over the LoM).

VI. Noise (Enviro Acoustic Research, June 2020)

Enviro Acoustic Research (Pty) Ltd conducted the baseline assessment in July 2020. Find **Appendix H** for the detailed report.

Potential noise-sensitive developments

Several of the closest receptors (Noise-sensitive developments or NSD) was identified considering available aerial images (Google Earth ©). A number of structures were identified, though the status of these structures were not defined. It is likely that a number of these structures will be used for residential activities.

If mining activities are to take place to the west of the project focus area, active mining could take place within 2,000 m from the closest NSD.

Due to the residential activities taking place, the proposed mining activity should not change the existing ambient sound levels with more than 7 dB (a disturbing noise as defined by the National Noise Control Regulations, R154 of January 1992). In addition, mining activities should not raise the total noise levels higher than 45 dBA (the noise limit for residential use as recommended by the World Health Organization).

Current ambient sound levels

The site was not visited for this brief assessment, but, the author has measured ambient sound levels at various locations in South Africa, with the typical ambient sound levels for quiet areas illustrated in **Figure 17**. This data represent more than 50,000 measurements (sound levels and wind speed), with the data presented to illustrate the impact of wind speed on sound levels. While there are other mining activities to the west of the proposed project, the distance to these mining activities as well as the topography will limit the impact from these activities on the focus area.

From **Figure 17**, it can be seen that the expected ambient sound levels will be between 30 and 40 dBA, typical of a rural noise district. The main source of noise in rural areas relates to faunal activity (birds and insects), with sounds from dwellings raising the noise levels temporary due to transient sounds (voices, passing vehicles, household activities).

Potential noise impact

For most mining projects, four potential zones of impacts could roughly be classified (although it does depend on the size of the operation and type of activities), namely:

- Zone closer than 500m from mining activities. Mining noises will be clearly audible both day and night and the mining noises could be the dominant noise, especially at night. Noise levels will be significant, will change the ambient sound levels significantly and could be considered disturbing. The significant of the noise impact could be high. Noise complaints are expected. Monthly to quarterly noise monitoring must take place at these receptors.

- Zone between 500 – 1,000m from mining activities. Mining should be audible during the day and clearly audible at night. Noise levels could be significant during quiet times and mining noises may change the ambient sound levels, especially at night. The change in ambient sound levels can be measured. Noise-sensitive receptors may considering the noises to be disturbing during quiet periods, such as at night. The significant of the noise impact could be medium. Some receptors may complain. Quarterly to annual noise monitoring must take place at these receptors.
- Zone between 1,000 – 2,000m from mining activities. Mining noises may be audible during quiet times in the day and audible at night. The mining activity may change ambient sound levels in quiet environments, although it may be difficult to define at times. Noise-sensitive receptors will be unlikely to complain about noises. The significant of the noise impact could be medium to low. Noise levels from mining activities are generally less than 45 dBA further than 1,000m from the mining activities. Annual noise monitoring is recommended at some of these receptors.
- Zone further than 2,000m from mining activities. Mining noises may be audible up to a distance of 2,000m (audible up to 4,000m during quiet periods at night with certain meteorological conditions). The significant of the noise impact would be low. Once-off (pre-operational) measurement could be undertaken and locations this far could be used to define typical ambient sound levels for the area (if pre-operational data are not available).

The above-mentioned guidelines are used when identifying the potential impact of noise on surrounding communities.

Summary findings

Considering the location of the identified NSD, as well as the area where mining may take place, there is a potential that mining activities may take place within 1,000 – 2,000 m from these NSD. At this distance, mining may result in noise levels that are audible during the day and night. **The significant of the noise impact could be medium to low. If mining activities take place closer than 1,000m, the noise impact may be higher.**

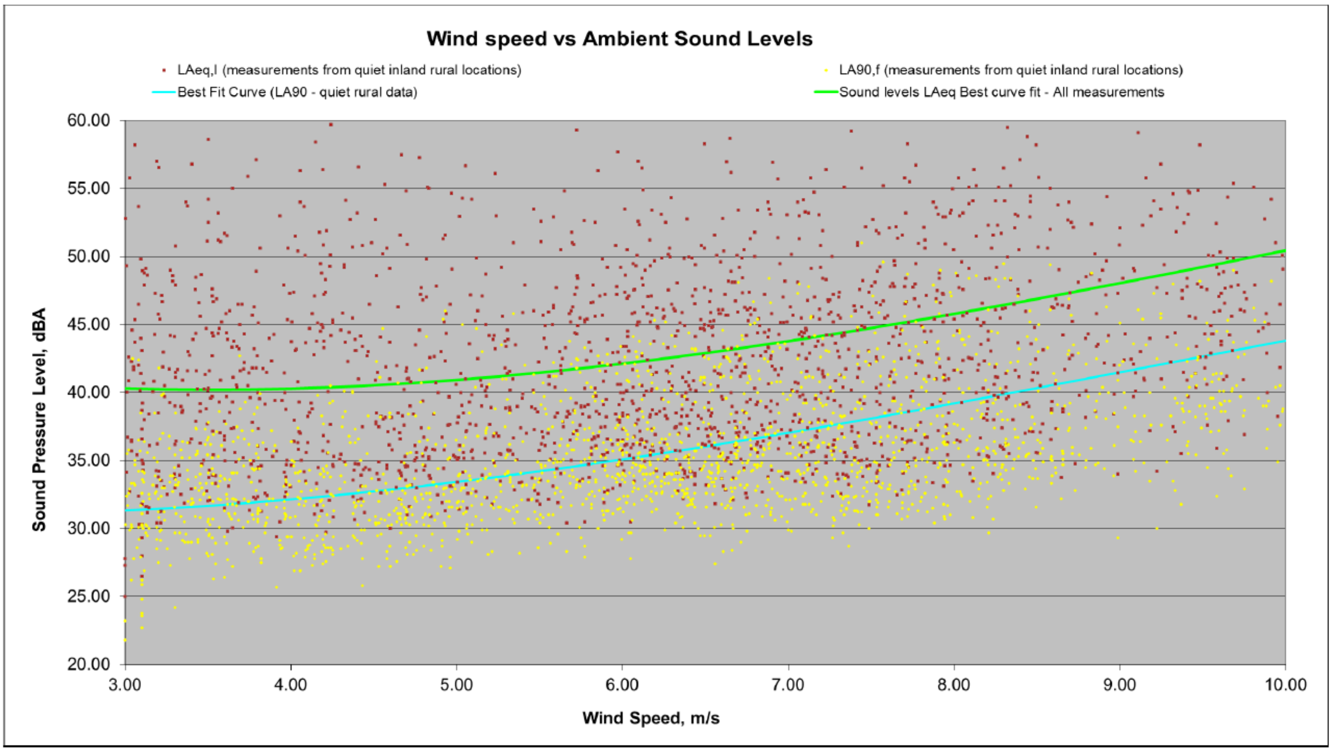


Figure 17: Potential ambient sound levels in quiet inland location

Due to the risk of the noise impact, it is recommended that the proposed mining activity be evaluated in detail using a noise propagation model considering:

- the actual mining layout and the proposed mining activities (equipment and the average use of these equipment);
- the topography and surface characteristics of the surrounding area; and
- actual ambient sound levels (requiring a future site visit and ambient sound level measurements).

VII. Terrestrial Biodiversity (Bathusi Environmental Consulting, July 2020)

Bathusi Environmental Consulting conducted the baseline assessment in July 2020. Find **Appendix I** for the detailed report.

Biophysical environment

The proposed site comprises mostly of natural woodland and grassland habitat. Subsistence agricultural activity and settlements characterise the southern part of the site where slopes are gentle, and soils are deeper and less rocky. Land capability is generally low and not economically sustainable.

The Mpumalanga Biodiversity Sector Plan information source categorises the proposed site mostly as ‘Other Natural Areas’, while deteriorated areas (anthropogenic) are encapsulated in Moderately and Heavily modified areas. The author is in general agreement with this categorisation. However, the local importance of the Vulnerable Sekhukhune Montane Grassland and the critical importance of the Dwars Rivier are not adequately reflected.

A review of available information pertaining to the presence of declared and informal protected areas in the immediate region of the proposed site indicates the general sensitivity and level of conservation efforts, with numerous nature reserves, conservancies and protected areas situated within proximity to the site. The Sekhukhuneland Centre of Plant Endemism (a threatened ecosystem) and De Berg Conservancy (bordering the site to the west) is of particular importance to this site.

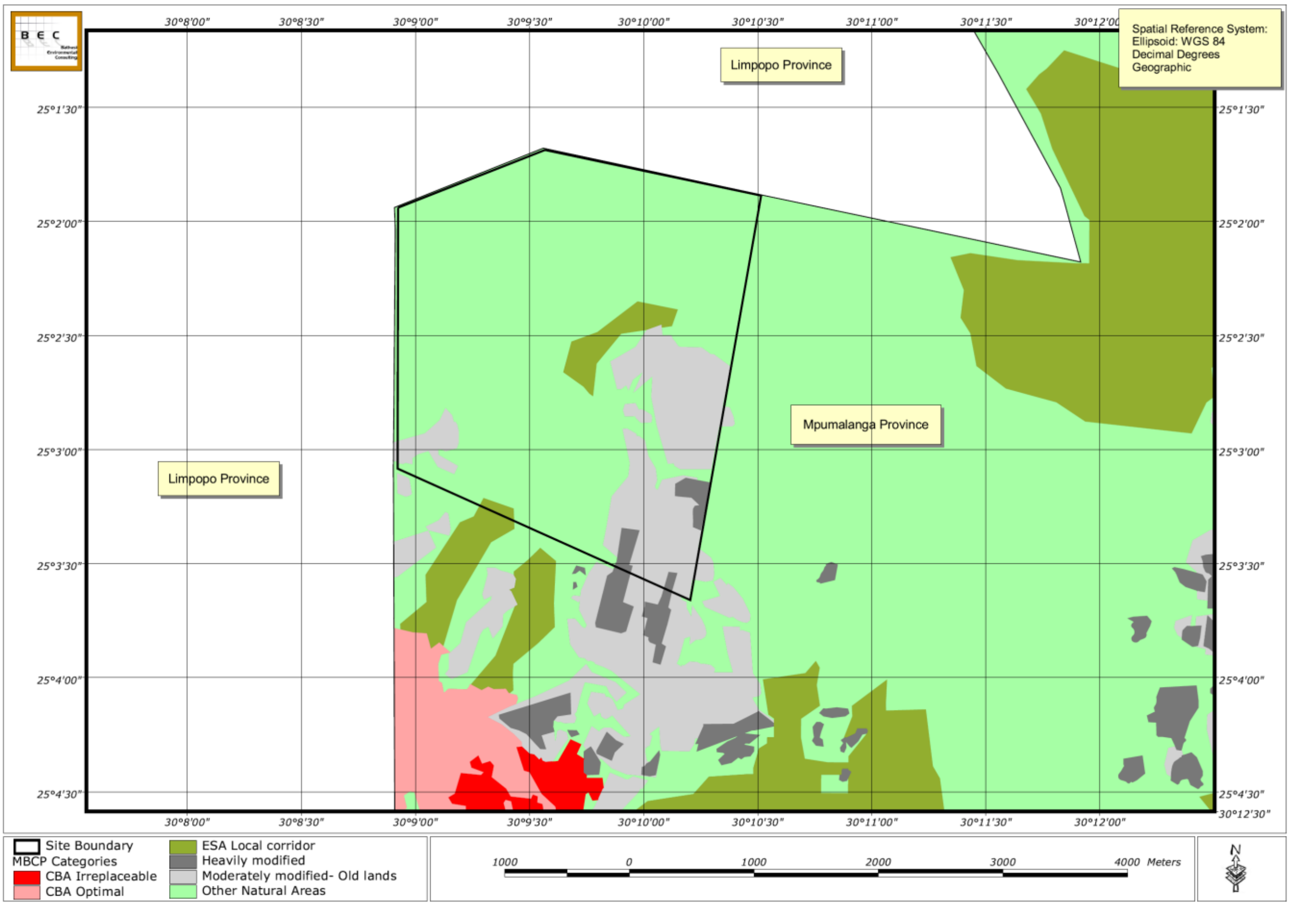


Figure 18: The study site in relation to the Mpumalanga Biodiversity Sector Plan conservation categories

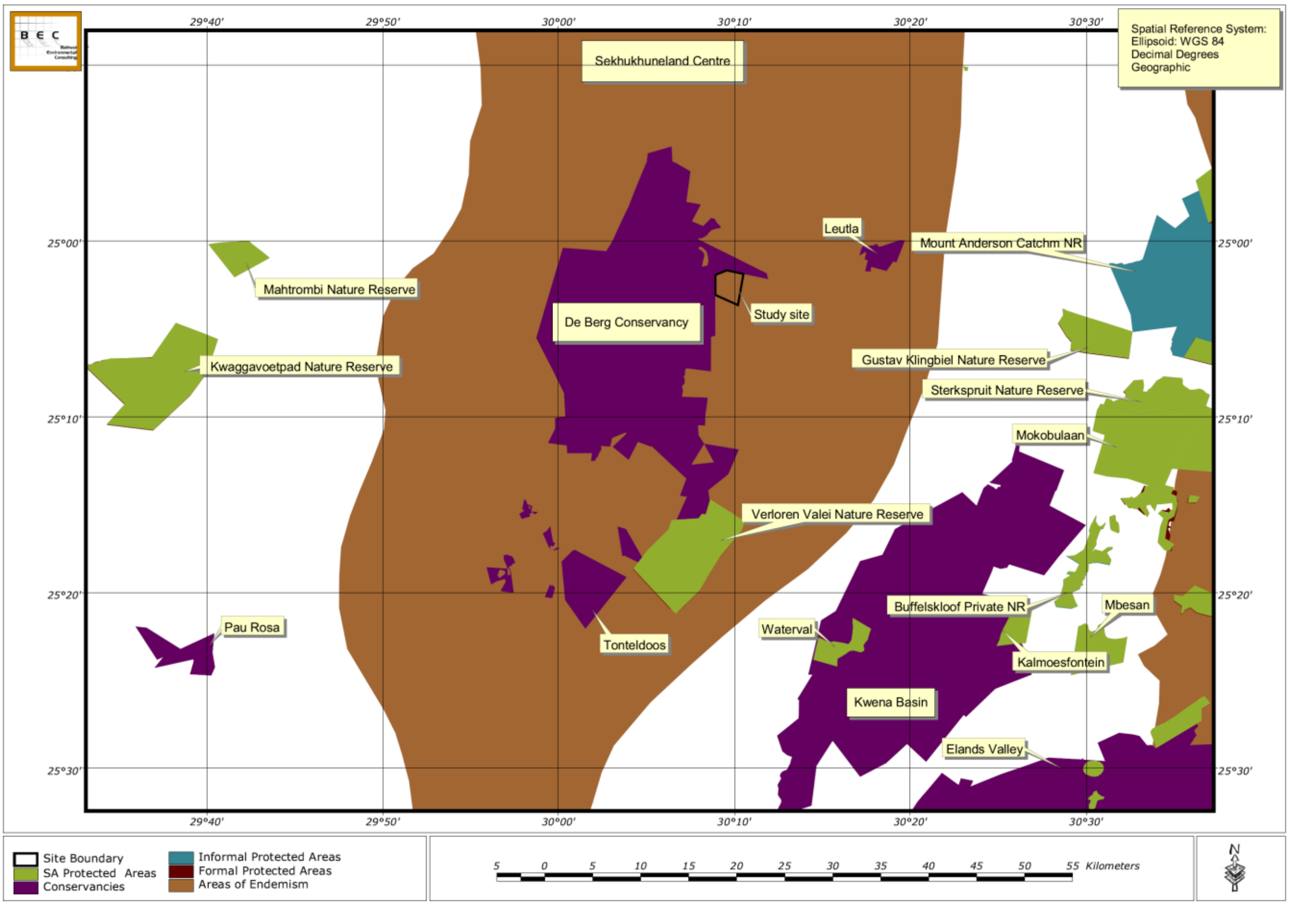


Figure 19: Areas of conservation importance in the region of the site

Botanical scoping assessment

The following key results were obtained from the Botanical Scoping Assessment:

- The study site is spatially situated across the ecotonal interface of the Grassland and Savanna Biomes, specifically comprising of the Sekhukhune Montane Grassland (Vulnerable) in the western part of the study site and Sekhukhune Mountain Bushveld (Least Concern) comprising the eastern part of the study site.
- Information extracted from the NEWPOSA information source (2020) provides for the known high floristic diversity of the general region, with approximately 556 plant species within ¼-degree grid 2530AA, reflecting the ecotonal convergence between the Grassland and Savanna Biomes, as well as manifesting as numerous and complex ecological types and micro-habitat types.
- Results of the brief site investigation confirmed the natural (unperturbed) status of the vegetation and the comparatively high floristic diversity, correlating to the disparity in physiognomic attributes (savanna vs grassland, plains vs ridges and outcrops).
- A review of web-based information and recent surveys conducted in the general surrounds of the study site revealed the known presence of numerous plants species of conservation consideration within the immediate region, reflecting on the local and regional importance of remaining natural habitat. EIA surveys would therefore

need to consider various seasonal assessments to accurately evaluate the presence and abundance of these plants within the proposed development footprints.

- The vegetation of the site is highly complex, correlating to a multitude of biophysical attributes, including underlying geology, soils, soil depth, slopes and aspects, and rockiness/ exposed rock and manifesting as mosaical interrelated grassland, savanna and wetland habitat types. An appraisal of physiognomic attributes and results of a brief site investigation revealed the presence of the following **preliminary and broad-scale** habitat types within the site (to be sampled, delineated, mapped, and described during the EIA phase of the project):
  - *Themeda – Tristachya* rocky grassland plains and crests (medium-high floristic sensitivity);
  - *Eragrostis* grassland plains and deteriorated grassland (high floristic sensitivity);
  - Erosion Gulleys (medium-low floristic sensitivity);
  - Perennial and non-perennial drainage lines and associated hydromorphic vegetation types (high floristic sensitivity);
  - *Lydenburgia - Maytenus* Wooded Rocky Midslopes and Thickets (medium-high floristic sensitivity);
  - *Acacia* thickets (medium floristic sensitivity); and
  - *Maytenus – Cussonia* (medium-high floristic sensitivity);
- The following list of generic impacts on the floristic environment is anticipated.
  - Impacts on/ losses of taxa of conservation importance and habitat associated with conservation important taxa;
  - Local depletion of biodiversity, harvesting, etc.;
  - Loss of natural habitat, including essential habitat refugia, atypical and unique/ restricted habitat types, ecological processes, services, and infrastructure (within the study area).
  - Deterioration of untransformed habitat in areas surrounding the project area, with specific reference to sensitive habitat types/ species situated in proximity to the activity;
  - Altered quality and ecological functionality (including fire, erosion) of surrounding areas and natural habitat;
  - Decreased aesthetic appeal of the landscape;
  - Increased plundering of natural resources due to increased human encroachment, accessibility to the site, etc.;
  - Exacerbation of existing levels of habitat fragmentation and isolation; and
  - Cumulative impacts on local/ regional and national conservation targets and obligations (loss of natural grassland habitat);
- Considering the suggested project layout, impacts on the botanical receiving environment are likely to be significant and high. Aspects that will contribute to the significance include the known presence of protected plant species and habitat that is sensitive and important on a local and regional scale.
- Indirect impacts are generally interpreted with an analysis of nearby and adjacent habitat types in mind. Considering the proximity to sensitive and important riparian habitat, and the dictating topographical nature of the site, anticipated indirect impacts are likely to be severe and significant.
- The comparative small size of the proposed project will result in losses of some natural habitat on a local scale. While these losses are significant on a local scale, the regional significance is anticipated to be comparatively low. However,

the increase of mining activities on a local and regional scale will have devastating effects on areas of remaining natural habitat. In particular, conservation efforts within a region where few formalised and legal protective efforts are present, will be affected adversely. Aspects such as habitat fragmentation and isolation, increased pressure from anthropogenic influx to the area and increased activities will undoubtedly result in significant long-term effects.

Despite anticipated significant and high impacts on the botanical receiving environment, ***no aspects was noted that would require the enforcement of the 'No-Go' Option for this project***. Typically, this would constitute the known presence of Critically Endangered habitat or species within the proposed footprint and the undeniably impacts from the proposed development on these habitat or species. The obvious high sensitivity of the floristic receiving environment, as well as the known presence of numerous plant species of (lower) conservation consideration, will inevitably result in impacts of a severe and significant nature, but the development of an extensive and detailed mitigation approach is likely to render most of the potential and likely impacts of an acceptable/ manageable nature and significance. Such a mitigation approach is likely to be costly and extensive, with possible liabilities that might include an extensive monitoring plan and (possibly) Biodiversity Offset Strategy.

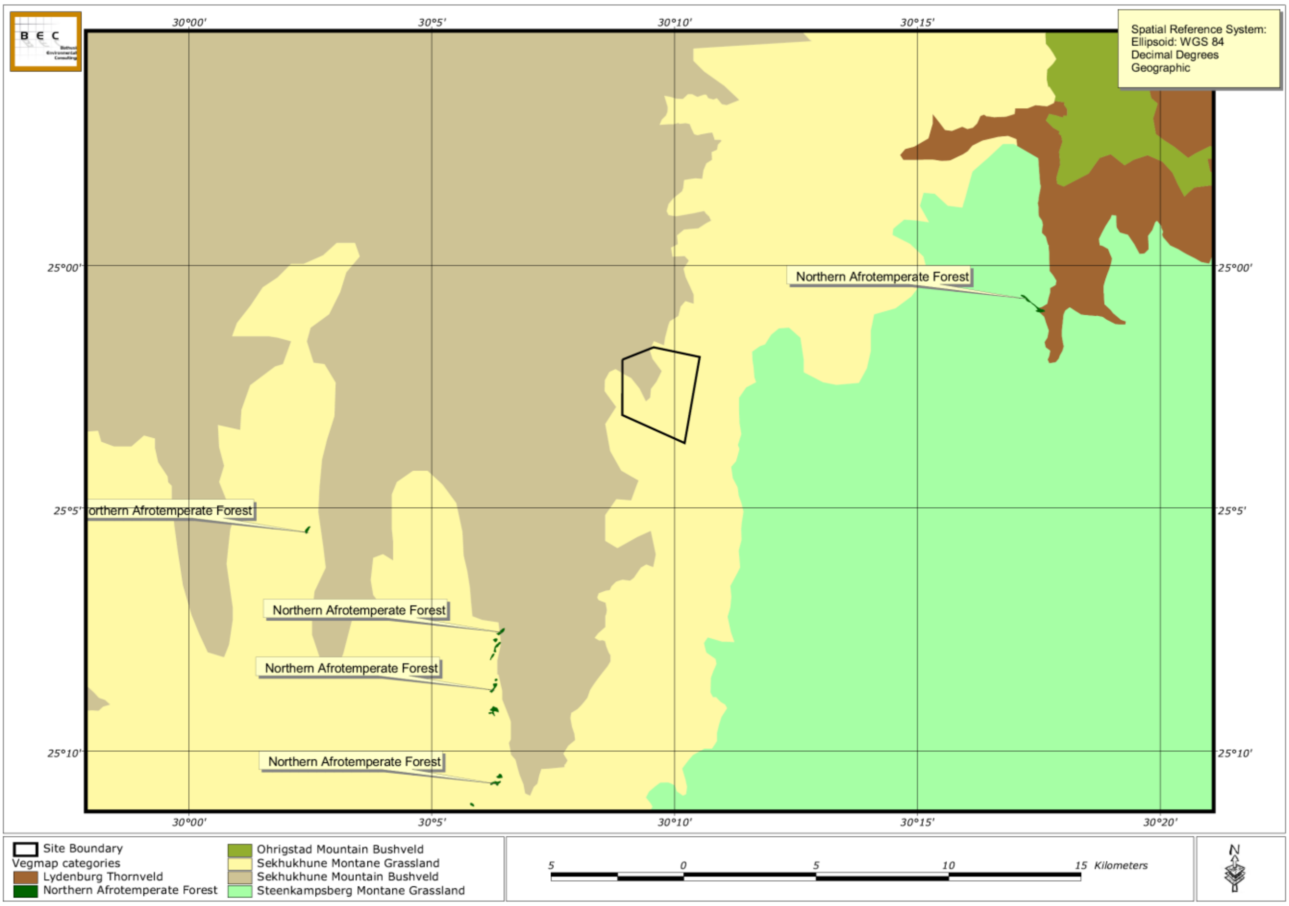


Figure 20: Vegmap (2018) ecological types of the immediate region

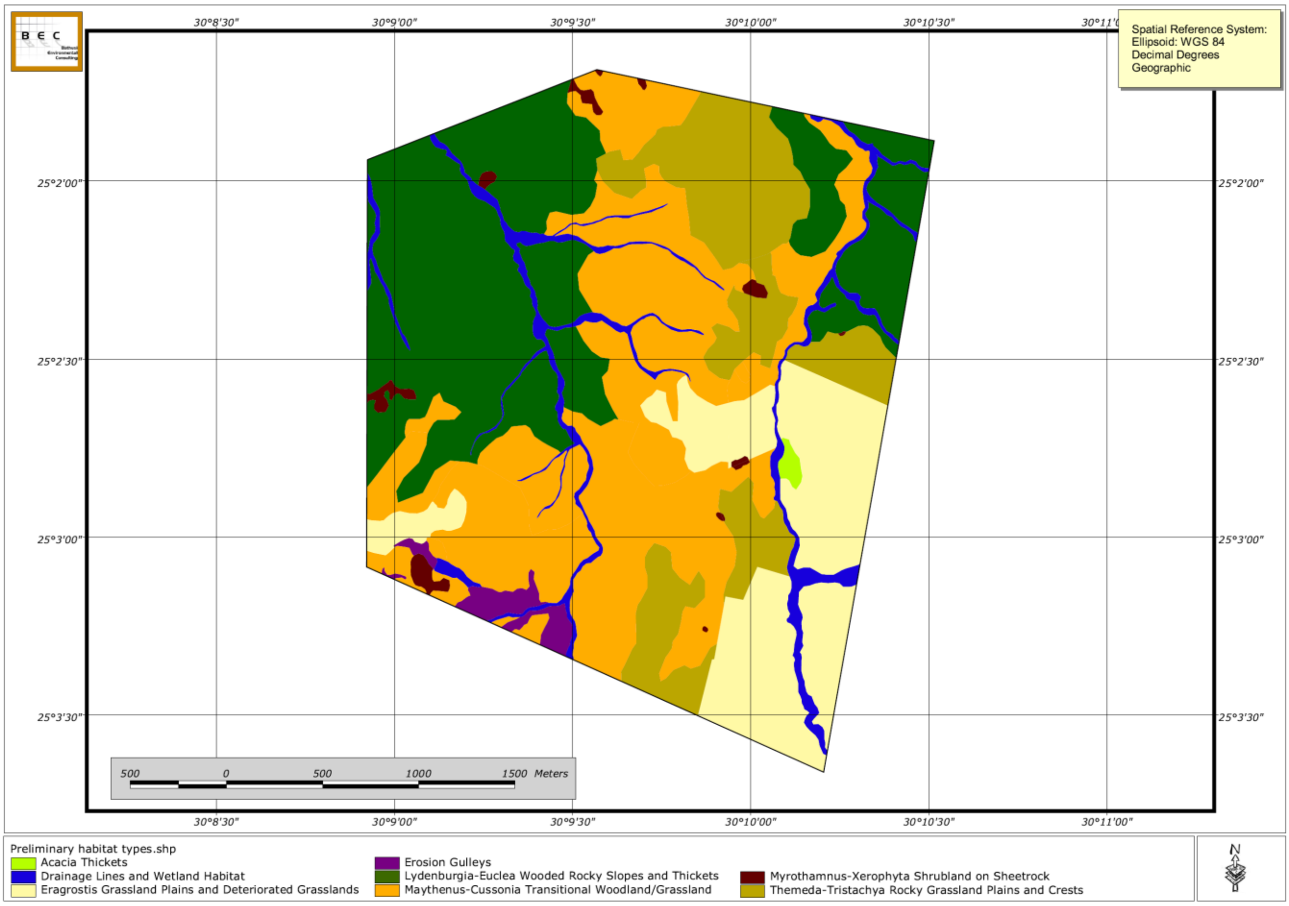


Figure 21: Preliminary indication of broad-scale habitat types within the study area

Faunal and avifaunal scoping assessment

The following key considerations pertaining to the faunal and avian environment were identified and noted:

- A total of 69 mammal species could potentially occur on the study site, of which 50 species (72 % of expected richness) have a high probability of occurrence.
- Nine threatened and near threatened mammal species could occur on the study site, which included two endangered species, three vulnerable species and four near threatened species. Of these, the vulnerable Leopard (*Panthera pardus*), vulnerable Cohen's Horseshoe Bat (*Rhinolophus cohenae*), near threatened Serval (*Leptailurus serval*), near threatened Brown Hyaena (*Parahyaena brunnea*) and near threatened African Clawless Otter (*Aonyx capensis*) have a high probability to be present.
- Approximately 12 frog species could occur on the study area, of which none are classified as threatened or near threatened species.
- The reptile composition on the study site was poorly known with only 21 species currently known from 2530AA. The various outcrops on the study site provided habitat for two lizard species of conservation concern namely the Sekhukhune Flat Lizard (*Platysaurus orientalis orientalis*) and the FitzSimons' Flat Lizard (*Platysaurus orientalis fitzsimonsi*).

- Approximately 249 bird species were expected to occur on the wider study area (including adjacent habitat), of which 92 species were observed during the orientation site visit of July 2020.
- A total of nine bird species of conservation concern have been recorded in the wider study area which included seven threatened species and two near threatened species.
- The vulnerable Southern Bald Ibis (*Geronticus calvus*) was observed on the study site during the orientation site visits.
- A number of invertebrate species of conservation concern could potentially occur on the study site, of which the restricted range cicada species, namely *Pycna sylvia* is known to be present on the Farm Vygenhoek 10.
- A number of potential impacts were anticipated during the proposed mining operations, especially when corresponding to the various habitat units on the study site. These would include:

Results of this faunal and avian scoping assessment indicates that the proposed mining operations will potentially have the following negative issues (impacts):

- Direct and permanent loss of natural fauna habitat within the development/mining footprints during the construction, operational and also the decommissioning phases. The decommissioning or closure phase will entail rehabilitation of the lost habitat.
- Direct loss of fossorial fauna taxa, taxa of low mobility and/or habitat specialists (e.g. flightless invertebrates, nymphs of *Pycna sylvia*, rupicolous taxa) confined to rocky substrates;
- Indirect loss of threatened and near threatened bird and mammal species due to the displacement from the area during the construction and operational phases;
- Decreased habitat quality of surrounding areas due to peripheral impacts such as spillages, litter, increased erosion, contaminants, etc.
- Indirect ecological impacts at all phases pertaining to the loss of the ecological connectivity across the study site and regional habitat fragmentation associated with negative impacts on population viability;
- Increased plundering of natural resources and poaching of wildlife due to increased human encroachment and accessibility to the site;
- Subsequent habitat change and changes to the local fauna community structure and composition (mainly generalists and secondary species) during decommissioning/rehabilitation; and
- Cumulative impacts on local/regional and national conservation targets and obligations (e.g. loss of natural grassland habitat).

Results of this scoping assessment, based on an appraisal of available information and a brief site reconnaissance survey, indicate the ***high faunal sensitivity*** of most of the site.

The nature and significance of anticipated impacts on the faunal and avian receiving environment is likely to be ***locally significant, but with a diminishing significance on a regional scale***. Certain habitat types, notably those that will be directly affected by the mining activities, exhibit attributes of high sensitivity and the effect of habitat destruction and disruptive activities within the mining sites as well as habitat spatially situated within proximity of the activities, will undoubtedly be severe. It should be noted that no Red Flag was identified during this particular assessment, it should be noted that the potential presence of several conservation important species from the site could result in unacceptably high impacts. A comprehensive EIA and compilation of a dedicated EMPr for the proposed development will likely result in lower (but still comparatively high) significance levels of impacts on the faunal and avian environment.

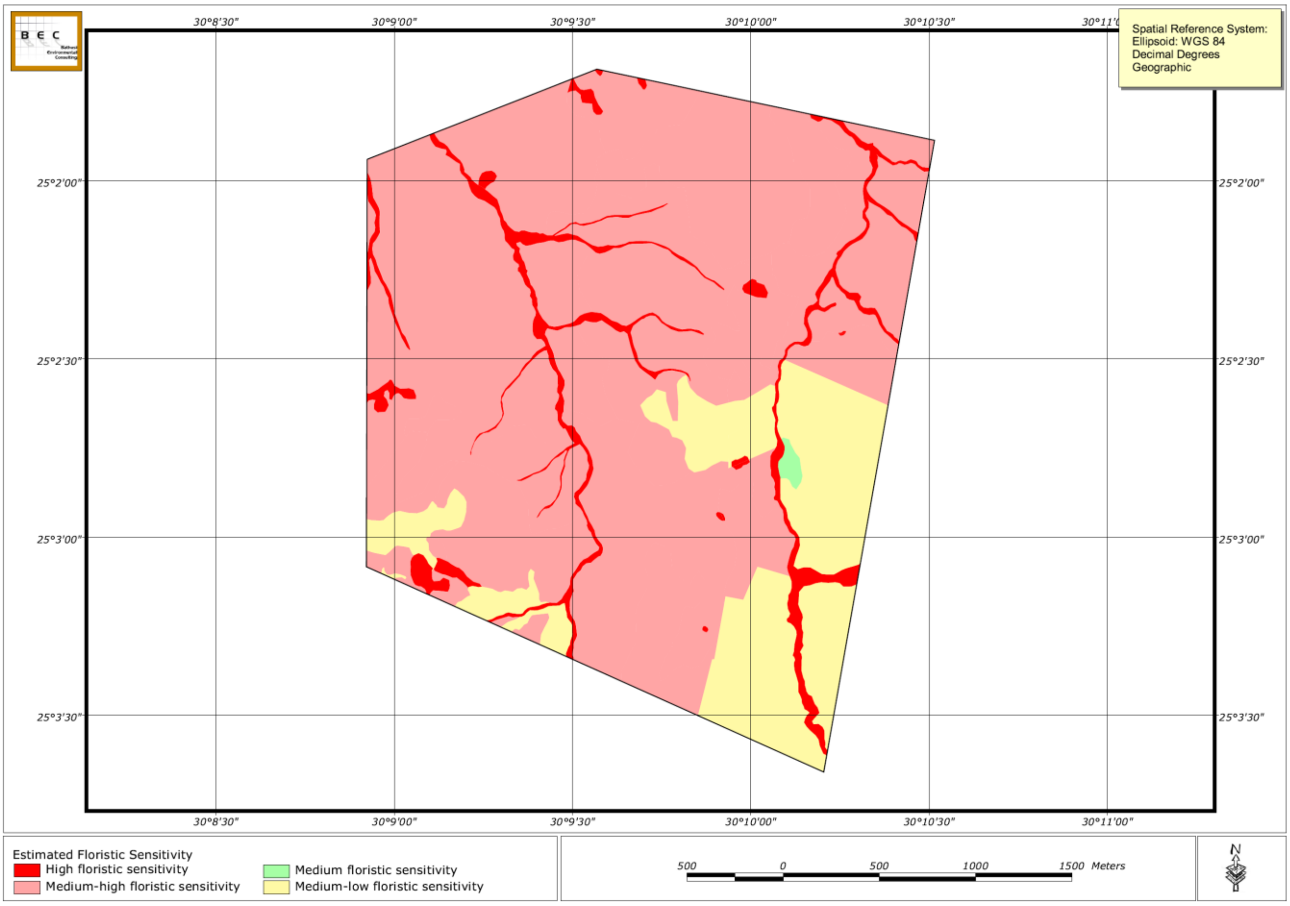


Figure 22: Estimated floristic sensitivity of the study site

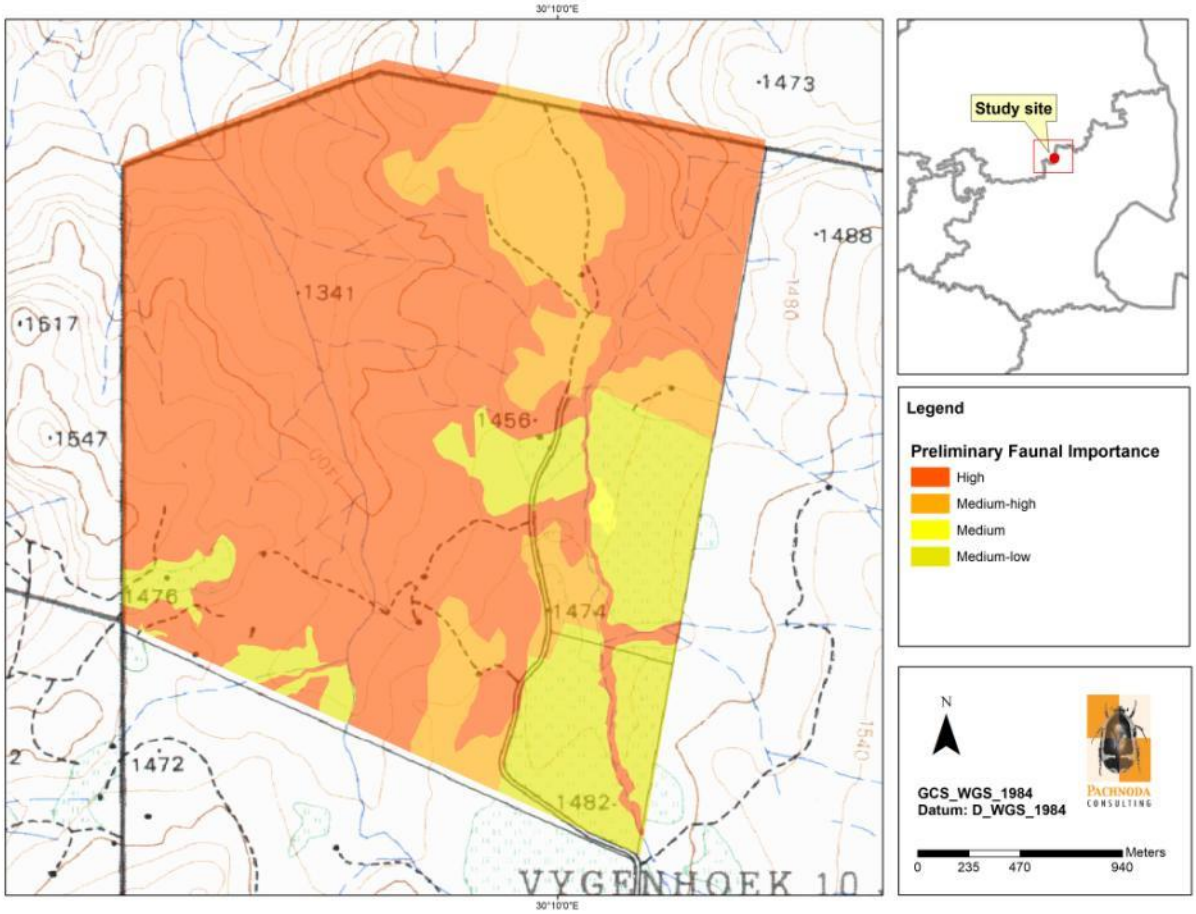


Figure 23: Preliminary faunal importance (sensitivity) of the broad-scale habitat units on the study site

Terms of reference for EIA

The following schedule and time allowance is suggested:

- EIA Austral Summer/Wet Season Surveys - preferably 2 surveys during the height of the growing season, which is typically between November and March (preferably November and December. Consideration for multiple surveys is suggested to allow for univoltine[1] butterfly activity.
- Red Data distribution and geo-location survey – a single survey to determine the relative abundance and geo-location of specific animal species for permitting requirements and/or determining the extent of occurrence of sub-populations of confirmed species. This survey should ideally be conducted prior to the submission of the EIA application to inform decision making and to highlight project liabilities.

[1] Producing a single generation per year, and especially a single brood of eggs capable of hibernating

VIII. Aquatic Biodiversity (Ecology International, July 2020)

Given the desktop nature of the present study, the results presented relied upon the availability of desktop spatial information pertaining to the natural features associated with the study area. The accuracy of the information presented is thus strongly dependant on the accuracy of the spatial datasets interrogated, as well as interpretation of vegetation units from available aerial imagery.

Freshwater ecosystem characteristics

Protected areas

According to the Department of Environmental Affairs' Protected Area Database (DEA, 2019), no formally Protected Areas are associated with the proposed Vygenhoek Platinum Mine study area. However, the De Hoop Private Nature Reserve (declared in 1959) and the De Hoop Protected Environment (declared in 2019) are located approximately 15km west of the proposed Vygenhoek Platinum Mine study area, while the J.M. Beetge Private Nature Reserve (declared in 1956) is located approximately 11km east of the proposed Vygenhoek Platinum Mine study area and the Davel Private Nature Reserve (declared in 1965) is located approximately 15km south of the proposed Vygenhoek Platinum Mine study area. In addition, the Verloren Valei Nature Reserve international Ramsar Site is located approximately 20km south of the proposed Vygenhoek Platinum Mine study area.

The proposed Vygenhoek Platinum Mine study area is however located within a National Protected Area Expansion Strategy focus area, namely the Mesic Highveld Grasslands focus area (**Figure 24**).

Focus areas for land-based protected area expansion are large, intact and unfragmented areas of high importance for biodiversity representation and ecological persistence, suitable for the creation or expansion of large protected areas. The focus areas were identified through a systematic biodiversity planning process undertaken as part of the development of the National Protected Area Expansion Strategy 2008 (NPAES). They present the best opportunities for meeting the ecosystem-specific protected area targets set in the NPAES and were designed with strong emphasis on climate change resilience and requirements for protecting freshwater ecosystems. These areas should not be seen as future boundaries of protected areas, as in many cases only a portion of a particular focus area would be required to meet the protected area targets set in the NPAES. They are also not a replacement for fine-scale planning which may identify a range of different priority sites based on local requirements, constraints and opportunities (Government of South Africa, 2008).

Mining and biodiversity guidelines

Published in 2013, the Mining and Biodiversity Guidelines provides a tool to facilitate the sustainable development of South Africa's mineral resources in a way that enables regulators, industry and practitioners to minimise the impact of mining on the country's biodiversity and ecosystem services. It provides the mining sector with a practical, user-friendly manual for integrating biodiversity considerations into the planning processes and managing biodiversity during the operational phases of a mine, from exploration through to closure. From a business perspective, the document explains the value for mining companies of adopting a risk-based approach to managing biodiversity. The early identification and assessment of mining impacts on biodiversity provides an opportunity to put in place environmental management plans and actions that reduce risks to biodiversity, people and business (Department of Environmental Affairs et al., 2013).

The purpose of the Mining and Biodiversity Guidelines was to identify and categorize biodiversity priority areas sensitive to the impacts of mining to support mainstreaming of biodiversity issues in decision making in the mining sector. In order to do this, a composite raster layer was developed based on a large number of individual biodiversity spatial datasets held by SANBI, distinguishing between four categories of biodiversity priority areas in relation to their importance from a biodiversity and ecosystem service point of view as well as the implications for mining in these areas. The guidelines therefore provide explicit direction in terms of where mining-related impacts are legally prohibited, where biodiversity priority areas may present high risks for mining projects, and where biodiversity may limit the potential for mining. The spatial outputs of the guidelines associated with the proposed Vygenhoek Platinum Mine study are presented in **Figure 25**.

Based on the outputs of the Mining and Biodiversity Guidelines, the proposed Vygenhoek Platinum Mine study area falls almost entirely within areas classified as being of highest biodiversity importance, and thus posing the highest risk for the proposed activity from a biodiversity perspective. This category includes biodiversity priority areas where mining is not legally prohibited, but where there is a very high risk that due to their potential biodiversity significance and importance to ecosystem services (e.g. water flow regulation and water provisioning) that mining projects will be significantly constrained or may not receive necessary authorisations. These areas include (Department of Environmental Affairs et al., 2013):

I. Critically endangered (CR) and endangered (EN) ecosystems, recognised as threatened ecosystems in terms of the Biodiversity Act.
II. Critical Biodiversity Areas (CBAs), (or areas of equivalent status such as irreplaceable and highly significant areas) from provincial spatial biodiversity plans.
III. River and wetland Freshwater Ecosystem Priority Areas (FEPAs), and a 1km buffer of these specific river and wetland FEPAs.
IV. Ramsar sites.

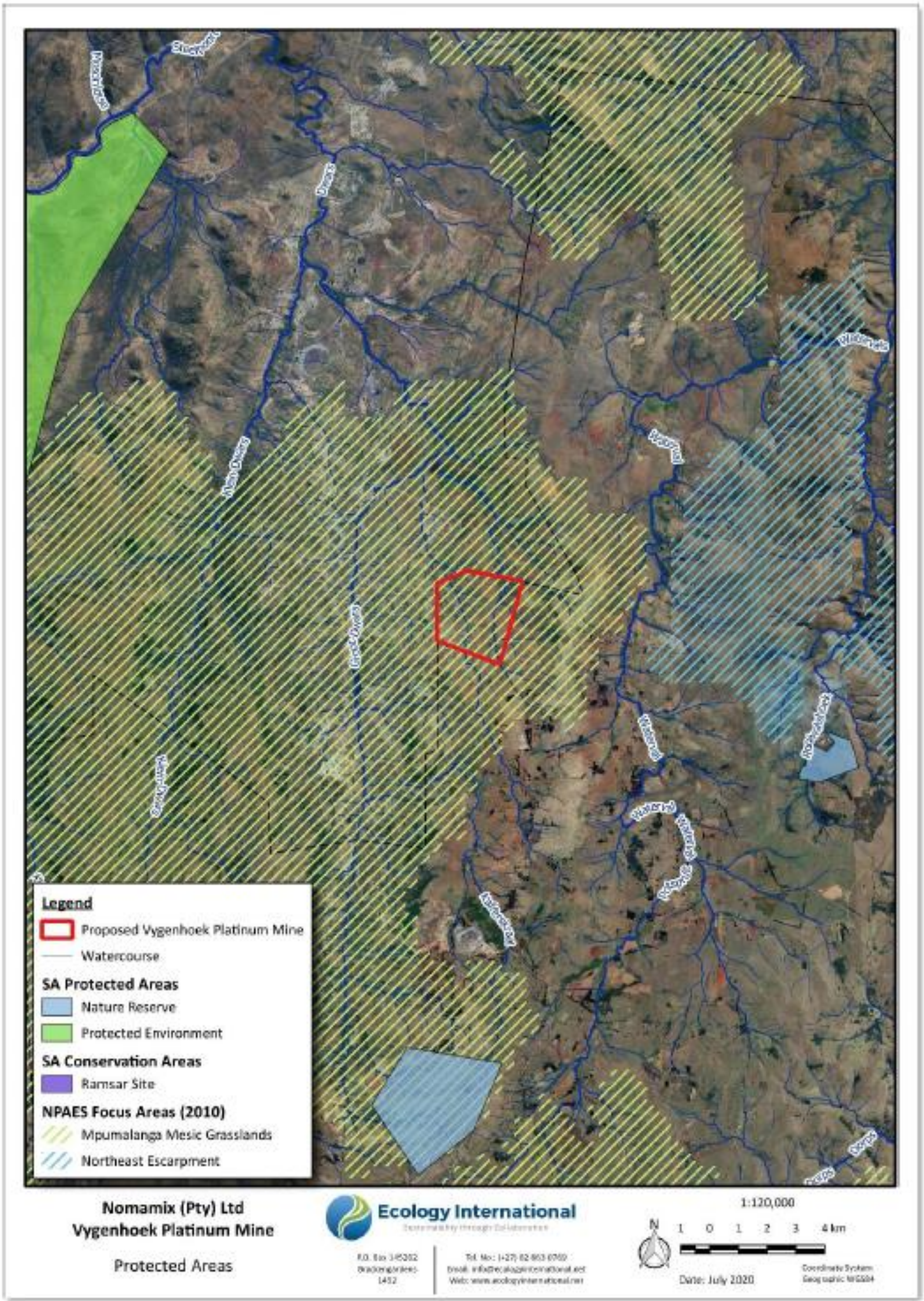


Figure 24: Protected areas and protected area expansion strategy focus areas associated with the proposed Vygenhoek Platinum Mine study area

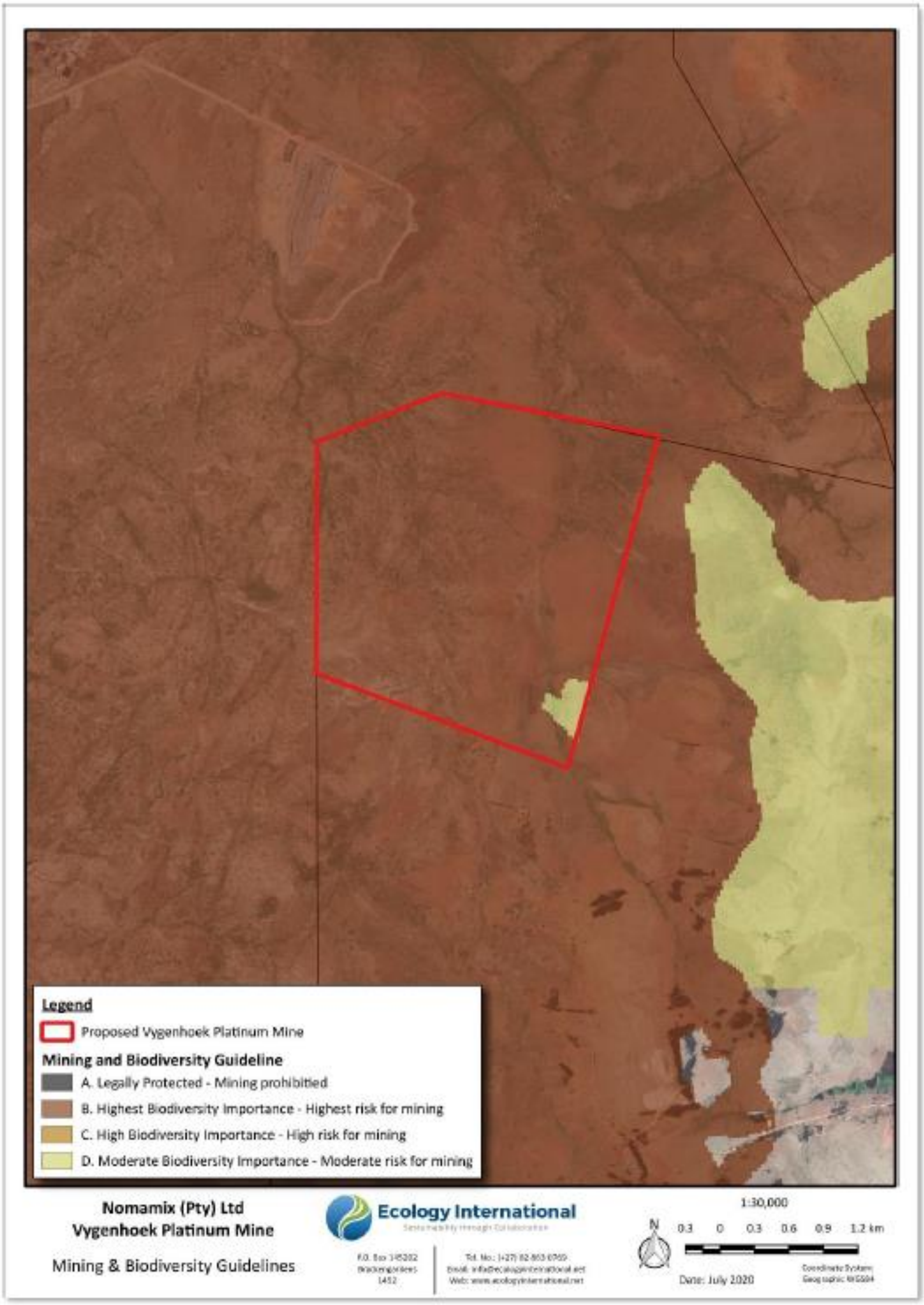


Figure 25: Outputs of the mining and biodiversity guidelines associated with the proposed Vygenhoek Platinum Mine area

The importance of the biodiversity features in these areas and the associated ecosystem services (e.g. water flow regulation and water provisioning) is sufficiently high that, if their existence and condition are confirmed, the likelihood of a fatal flaw for new mining projects is very high. These areas are viewed as necessary to ensure protection of biodiversity, environmental sustainability, and human well-being. Mining in such areas may be out of place within the framework of national environmental management policies, norms and standards (Department of Environmental Affairs et al., 2013).

Aquatic biodiversity

Freshwater ecoregions of the world

The proposed Vygenhoek Platinum Mine study area is located within the Southern Temperate Highveld freshwater ecoregion, which is delimited by the South African interior plateau sub-region of the Highveld aquatic ecoregion, of which the main habitat type, in terms of watercourses, is regarded as Savannah-Dry Forest Rivers. Aquatic biotas within this bioregion have mixed tropical and temperate affinities, sharing species between the Limpopo and Zambezi systems. The Southern Temperate Highveld freshwater ecoregion is considered to be bio-regionally outstanding in its biological distinctiveness and its conservation status is regarded as Endangered. The ecoregion is defined by the temperate upland rivers and seasonal pans (Nel et al., 2004; Darwall et al., 2009; Scott, 2013).

National ecoregional typing

Ecoregional typing at a national level based on spatially variable combinations of causal factors including physiography, climate, geology, soils and potential natural vegetation. Accordingly, the study area is located primarily within the Eastern Bankenveld Ecoregion, and more specifically within Level II Ecoregion 9.02.

Associated water resources

As mentioned in previous section, the proposed Vygenhoek Platinum Mine is located within Quaternary Catchment B41G which encompasses the Dwars River and the Klein-Dwars River and their tributaries. Watercourses specifically associated with the proposed Vygenhoek Platinum Mine include two unnamed tributaries of the Dwars River, both of which are considered to be non-perennial in nature (**Figure 26**). According to the topography of the watercourses, the reach of the western-most tributary present within the study area is classified as mountain stream, with elements of transitional and mountain headwater streams also present (**Figure 27**). Of additional relevance is that watercourses associated with the western portion of the proposed Vygenhoek Platinum Mine are classified within the latest National Biodiversity Assessment as being Critically Endangered and Endangered and are largely not sufficiently protected (Van Deventer et al., 2019) (**Figure 28**).

According to the Department of Water and Sanitation (2014), the reach of the watercourse located within the western portion of the study area is considered to be in a pristine ecological state (Ecological Category A), whereas the ecological importance and the ecological sensitivity are estimated to be high and very high, respectively. **Table 7**, **Table 8** and **Table 9** provide a summary of the determinants of the Present Ecological State, ecological importance and ecological sensitivity of the western-most watercourse within the proposed Vygenhoek Platinum Mine study area. Given the scale of the assessment utilised by the Department of Water and Sanitation (2014), the watercourse located within the eastern portion of the proposed Vygenhoek Platinum Mine study area was not assess.

Table 7: Present Ecological State of watercourses associated with the proposed Vygenhoek Platinum Mine study area, according to the Department of Water and Sanitation (2014)

Present Ecological State	
Instream habitat continuity modification	Small
Rip/wetland zone continuity modification	Small
Potential instream habitat mod act.	Moderate
Riparian-wetland zone mod	Small
Potential flow mod act.	Moderate
Potential physico-chemical mod activities	Small
Default Ecological Category	**A (Pristine)**

Table 8: Ecological importance of watercourses associated with the proposed Vygenhoek Platinum Mine study area, according to the Department of Water and Sanitation (2014)

Ecological Importance	
Invert representivity (per secondary catchment)	Very high
Invert rarity (per secondary catchment)	Very high
Fish representivity (per secondary catchment)	Low
Fish representivity (per secondary catchment)	Low
Fish rarity (per secondary catchment)	Moderate
Ecological importance: riparian-wetland-instream vertebrates (excl. fish)	High
Riparian-wetland natural veg rating based on % natural veg in 500m	Very high
Riparian-wetland natural veg importance based on expert rating	Low
Ecological importance: riparian-wetland-instream vertebrates (excl. fish)	High
Riparian-wetland zone migration link	Very high
Habitat diversity	High
Habitat size (length)	Low
Instream migration link	Very high
Instream habitat integrity class	High
Riparian-wetland zone habitat integrity class	Very high
Mean Ecological Importance Rating Class	High

Table 9: Ecological sensitivity of watercourses associated with the proposed Vygenhoek Platinum Mine study area, according to the Department of Water and Sanitation (2014)

Ecological Sensitivity	
Fish physico-chemical sensitivity	Very High
Fish no-flow sensitivity	Very High
Invertebrate physico-chemical sensitivity	Very High
Invertebrate velocity sensitivity	Very High
Riparian-wetland-instream vertebrates (excl. fish) intolerance to water level/flow changes	High
Stream size sensitivity to modified flow/water level changes	Very High
Riparian-wetland vegetation intolerance to water level changes	Low
Mean Ecological Sensitivity Rating Class	**Very High**

Associated wetland features

The majority of the proposed Vygenhoek Platinum Mine study area further falls within the Mesic Highveld Group 7 wetland vegetation group, while the north-western extent of the site falls within the Central Bushveld 1 wetland vegetation group. According to Macfarlane et al. (2014), wetlands within the Mesic Highveld Group 7 wetland vegetation group is considered to be Endangered, whereas wetlands within the Central Bushveld 1 wetland vegetation group is considered to be Critically Endangered. Review of data within the National Wetland Map (Version 5) suggests that no wetland features are located within the proposed Vygenhoek Platinum Mine study area, although one wetland (a seepage wetland) is located upslope (south) of the study area. However, wetland mapping confidence for the associated sub-quaternary catchments is acknowledged by Van Deventer et al. (2018) as having a low to medium confidence, and as such the further identification of wetland features within the study area is likely.

The probability of further wetland features being associated with the study area was determined through the development of a Topographical Wetness Index (TWI) model based on 5m contour data obtained from the Department of Rural Development and Land Reform, which quantifies topographic control on hydrological processes within the study area. Given that the model is a function of both the slope and the upstream contributing area per unit width orthogonal to the flow direction, the model is primarily designed for hillslope catenas. Based on the results obtained (**Figure 29**), it can be determined that there is a high probability of several additional wetland areas occurring within the study area other than those identified within the National Wetland Map (Version 5), and as such the actual extent of wetland areas associated with the study area is expected to be far greater than that captured within existing databases. Such wetlands are likely to include valley-bottom wetlands as well as seepage wetlands that are supported through hillslope hydrological processes as *well as those that may be expressed due to geological control.*

Strategic water source areas

Strategic Water Source Areas (SWSAs) are landscapes where a relatively large volume of runoff produces water for the majority of South Africa. Strategic water source areas can be regarded as natural 'water factories', supporting growth and development needs that are often a far distance away. Deterioration of water quality and quantity in these areas can have a disproportionately large negative effect on the functioning of downstream ecosystems and the overall sustainability of growth and development in the regions they support (Nel et al., 2013)

Based on available spatial data, the proposed Vygenhoek Platinum Mine study area is not within any identified SWSA. Based on available data, it was determined that the Mpumalanga Drakensberg surface water SWSA is located approximately 21km south and approximately 36km east of the proposed Vygenhoek Platinum Mine study area, whereas the Northern Lowveld Escarpment groundwater SWSA and the Northern Highveld groundwater SWSA are located approximately 45km east and approximately 50km south-west of the proposed Vygenhoek Platinum Mine study area, respectively.

National freshwater ecosystem priority areas

The National Freshwater Ecosystem Priority Areas (NFEPA) project represents a multi-partner project between the Council for Scientific and Industrial Research (CSIR), South African National Biodiversity Institute (SANBI), Water Research Commission (WRC), Department of Water Affairs (DWA; now Department of Water and Sanitation, or DWS), Department of Environmental Affairs (DEA), WWF, South African Institute of Aquatic Biodiversity (SAIAB) and South African National Parks (SANParks). More specifically, the NFEPA project aims to:

- Identify Freshwater Ecosystem Priority Areas (hereafter referred to as 'FEPAs') to meet national biodiversity goals for freshwater ecosystems; and
- Develop a basis for enabling effective implementation of measures to protect FEPAs, including free-flowing rivers.

The first aim uses systematic biodiversity planning to identify priorities for conserving South Africa's freshwater biodiversity, within the context of equitable social and economic development. The second aim comprises a national and sub-national component. The national component aims to align DWS and DEA policy mechanisms and tools for managing and conserving freshwater ecosystems. The sub-national component aims to use three case study areas to demonstrate how NFEPA products should be implemented to influence land and water resource decision-making processes at a sub-national level (Driver et al., 2011). The project further aims to maximize synergies and alignment with other national level initiatives such as the National Biodiversity Assessment (NBA) and the Cross-Sector Policy Objectives for Inland Water Conservation.

Based on current outputs of the NFEPA project (Nel et al., 2011; Figure 30), the catchments within which the proposed Vygenhoek Platinum Mine study area falls are classified as a FEPA catchment on the basis of the presence of river ecosystem types and the potential presence of Opsaridium peringueyi (Southern Barred Minnow; considered Vulnerable at a provincial level). The closest confirmed location of the species to the study area is however the Steelpoort River approximately 20km from the study area, although its presence within the Dwars River cannot be ruled out.

FEPA catchments such as those associated with the present study area achieve biodiversity targets for river ecosystems and threatened/near-threatened fish species, and were identified in rivers that are currently in a good condition (Ecological Category A or B), and their FEPA status indicates that they should remain in a good condition in order to contribute to national biodiversity goals and support sustainable use of water resources (Driver et al., 2011). River ecosystem types comprise distinct combinations of Level 1 ecoregions, flow descriptions, and slope categories, and are used for representing the diversity of rivers across the country. Within the context of the NFEPA project, river ecosystem types were regarded as coarse-filter surrogates of biodiversity, conserving the diversity of many common and widespread species, and their associated habitats.

No FEPA-classified wetlands or wetland clusters were noted to be associated with the proposed Vygenhoek Platinum Mine study area.

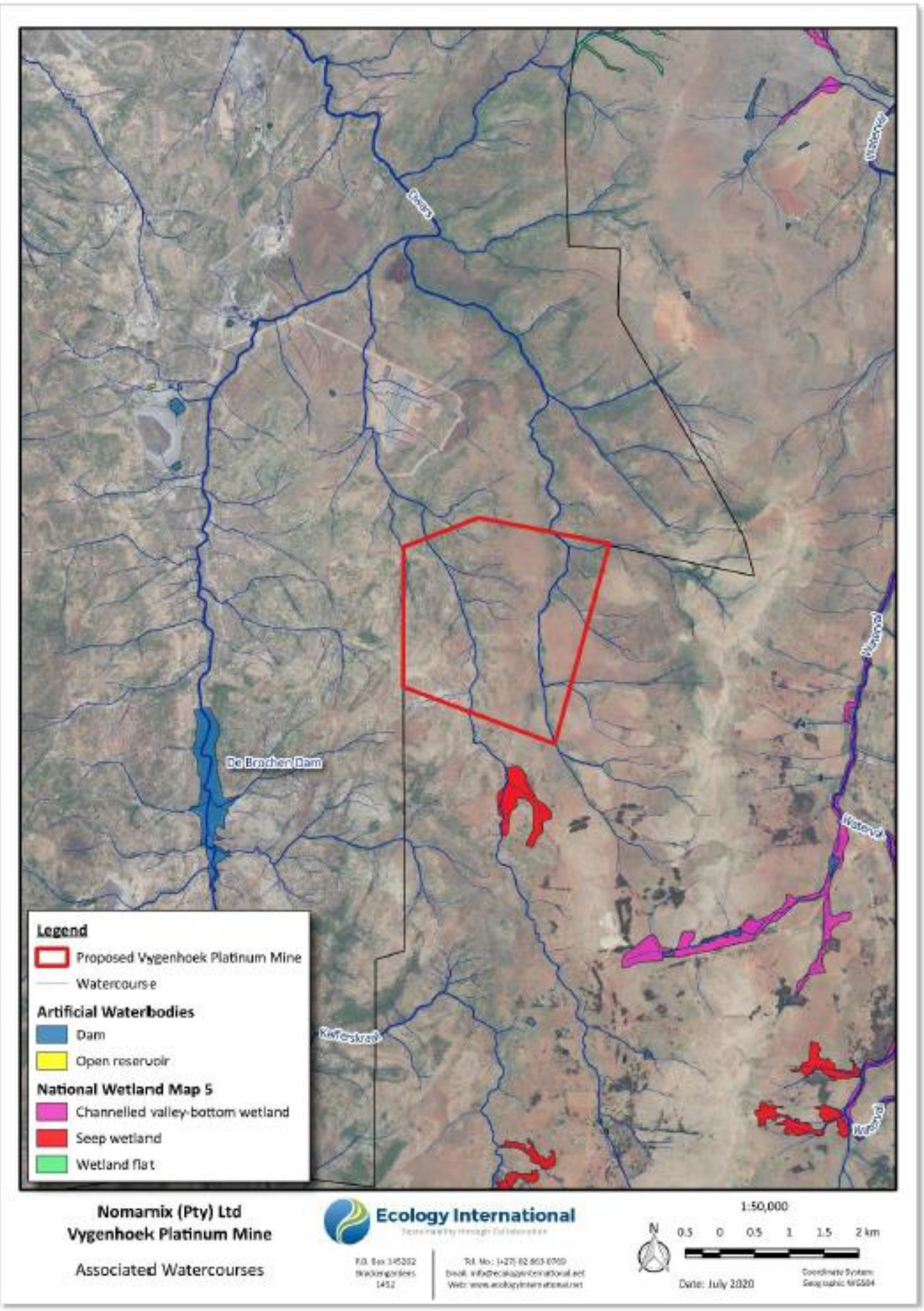


Figure 26: Water resource associated with the proposed Vygenhoek Platinum Mine study area

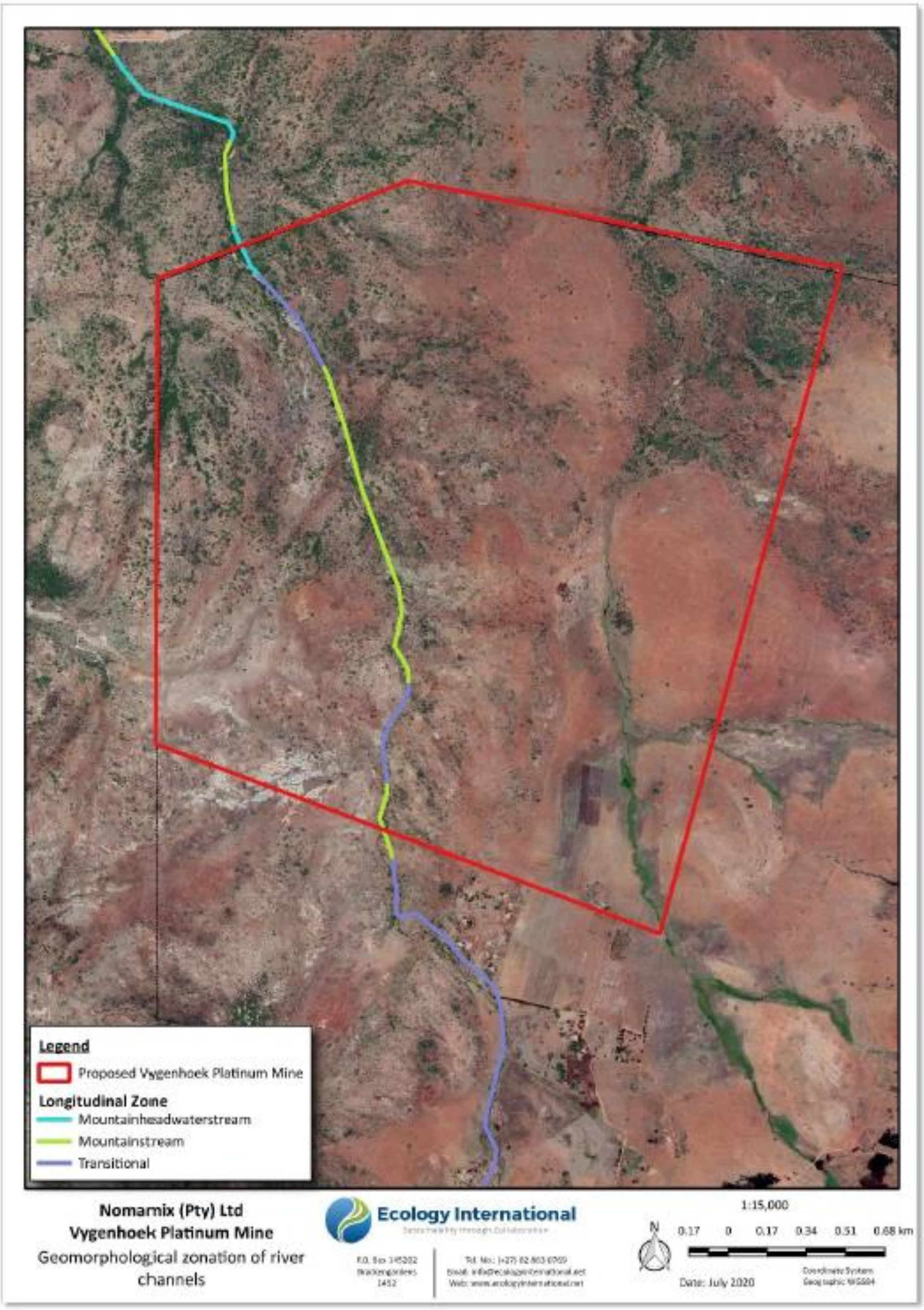


Figure 27: Geomorphic zonation of watercourse associated with the proposed Vygenhoek Platinum Mine study area

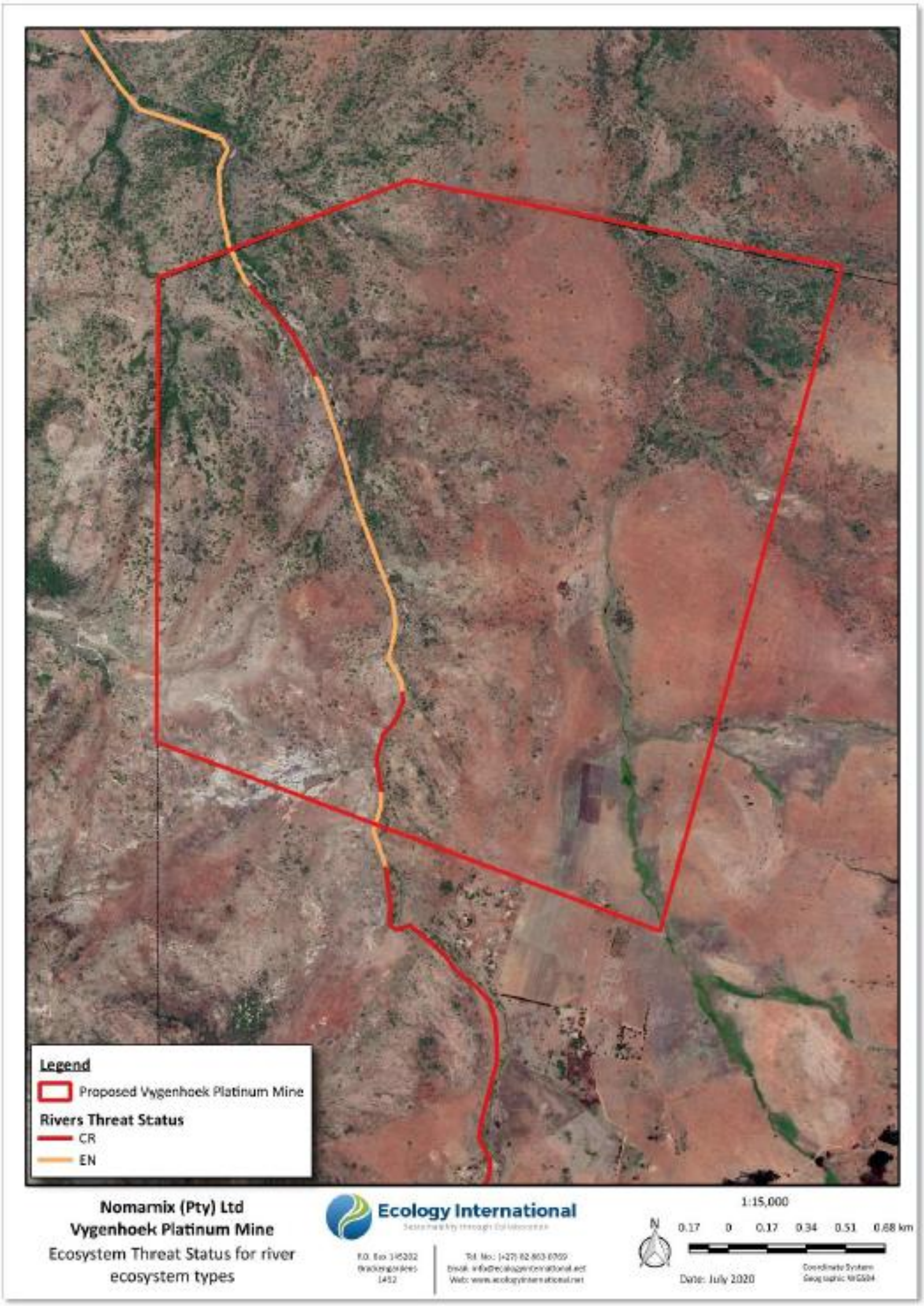


Figure 28: Ecosystem threat status for river ecosystem types associated with the proposed Vygenhoek Platinum Mine study area (Van Deventer et al, 2019)

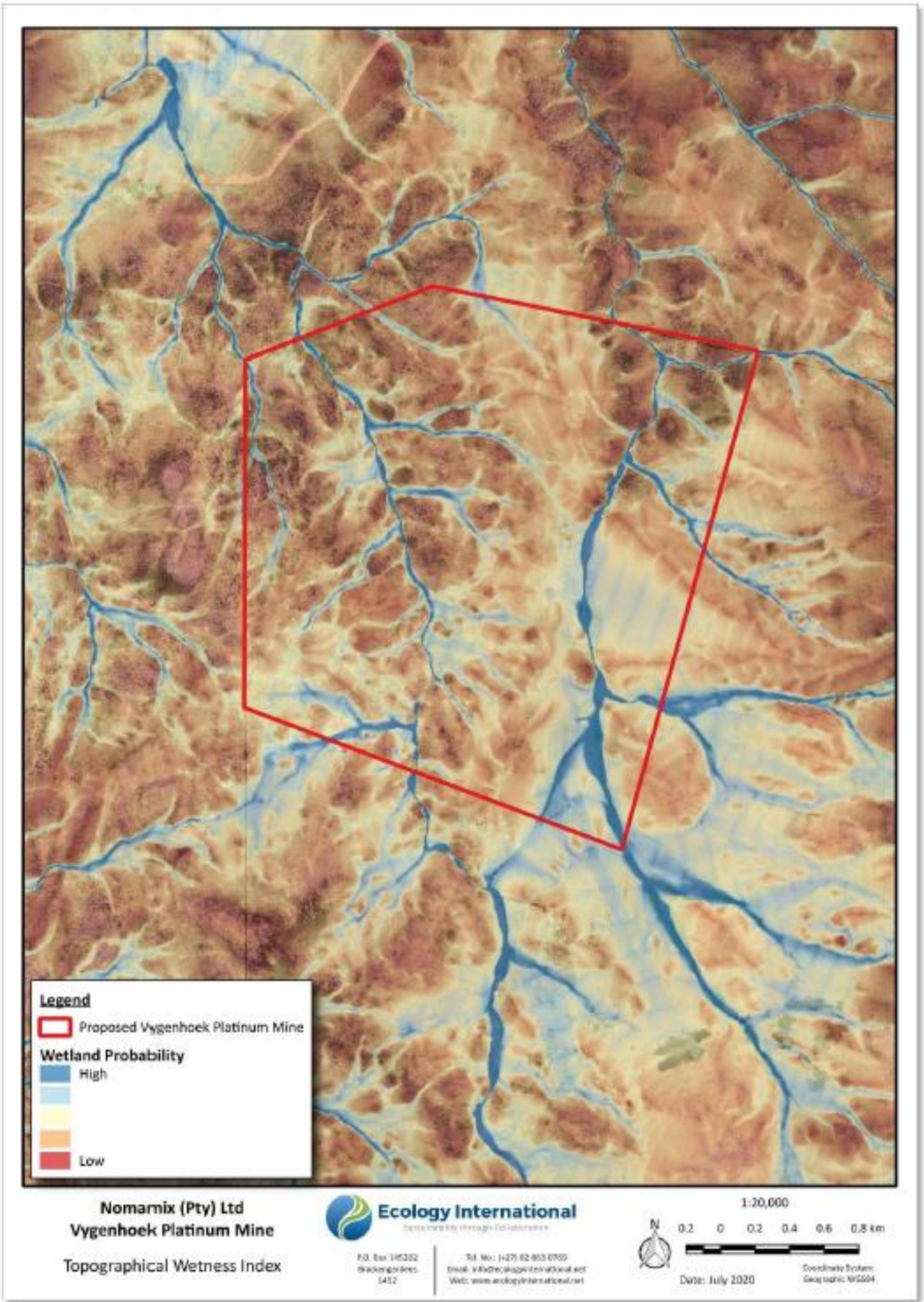


Figure 29: Topographical Wetness Index model developed for the study area based on 5 m contour data, indicating a high probability of wetland features to occur within the proposed Vygenhoek Platinum Mine study area based on topographical drivers

<u>Mpumalanga biodiversity sector plan</u>

The Mpumalanga Biodiversity Sector Plan (MBSP) is a comprehensive environmental inventory and spatial plan that is intended to guide conservation and land use decisions in support of sustainable development (Lötter & Ferrar, 2006; Lötter 2014; Mpumalanga Tourism and Parks Agency, 2014). The MBSP maps the distribution of the Province's known biodiversity into several categories for both the terrestrial and freshwater realms. These are ranked according to ecological and biodiversity importance and their contribution to meeting the quantitative targets set for each biodiversity feature.

According to the latest revision of the freshwater component of provincial biodiversity sector plan (Mpumalanga Tourism and Parks Agency, 2019), the watercourse located within the western portion of the study area is classified as a Critical Biodiversity Area (CBA), whereas the remainder of the study area is classified as an Ecological Support Area (ESA) on the basis of being an important sub-catchment (**Figure 31**).

In an attempt to make the land-use guidelines of the MBSP more useful to the broader planning community (particularly those in the municipal system), the categories obtained by the MBSP were integrated with the existing zonation definitions used in other planning schemes, so far as possible, making it easier for biodiversity priorities to be adequately represented in existing spatial planning systems, including the Spatial Planning and Land Use Management Act (Act 16 of 2013). Based on the land-use guidelines of the MBSP, opencast mining is expected to compromise the biodiversity objective determined for the are in question, and according to Mpumalanga Tourism and Parks Agency (2014) is not permissible (Figure 32). In contrast, underground mining within the area adjacent to the watercourse, while still considered to potentially compromise the biodiversity objective, are only permissible under certain conditions, although proximity to the associated watercourse needs to be taken into consideration due to identified sensitivities (Mpumalanga Tourism and Parks Agency, 2014) (**Figure 33**).

Aquatic fauna

Data pertaining to the presence of aquatic faunal species potentially associated with the proposed Vygenhoek Platinum Mine study area was obtained from Darwall et al. (2009), Department of Water and Sanitation (2014), and various scientific collection databases including the Global Biodiversity Information Facility, Freshwater Biodiversity Information System, South African Institute for Aquatic Biodiversity, Albany Museum, and from the provincial records of Mpumalanga Tourism and Parks Agency. Based on the results obtained, the following is the estimated aquatic faunal diversity that could be associated with the proposed Vygenhoek Platinum Mine study area (Appendix A):

- Approx. 12 species of fish, two of which are of conservation concern either at a national or provincial level, and a further one is considered to be Data Deficient;
- Approx. 106 species of Odonata (Dragonflies and Damselflies), five of which are of conservation concern;
- Approx. two species of crab, neither of which of conservation concern; and
- Approx. 16 species of mollusc, one of which is listed as Data Deficient.

Table 10 provides a list of aquatic species of conservation concern occurring or potentially occurring within the proposed Vygenhoek Platinum Mine study area.

It should be noted that two of the fish species identified as potentially being associated with the proposed Vygenhoek Platinum Mine study area represent undescribed species, namely Enteromius sp. nov. 'South Africa' (Sidespot Barb;

currently regarded as Near Threatened) and Enteromius sp. 'Ohrigstad' (Ohrigstad Barb; currently regarded as Data Deficient).

Similar to Enteromius neefi Greenwood, 1962 which was described from the Kabompo River in northern Zambia, populations of the southern Enteromius sp. nov. 'South Africa' occur in headwater streams of the Limpopo system south to the Phongolo River and south-west into the Vaal River in South Africa and Swaziland. The taxonomic status of the southern Enteromius sp. nov. 'South Africa' still needs to be determined, but it is presently regarding as an undescribed species. Although the geographical distribution of Enteromius sp. nov. 'South Africa' is regarded as being fairly widespread within the Limpopo System in South Africa, many subpopulations are isolated and are severely impacted on by threats. In Swaziland, only a single record was found in over 200 collection sites and it was assessed as regionally Critically Endangered in Swaziland (Bills et al., 2004). The species is experiencing continuous threats such as forestry and associated sedimentation and river crossings preventing fish movement as well as stream regulation and mining with associated pollution. Although, it is known from a large number of locations and is still widespread, the impacts of the multiple threats for the species could lead to its decline and it is thus assessed as Near Threatened within the latest IUCN Red List Assessment, although is it acknowledged that this species should be monitored to assess the impacts of these threats (Roux & Hoffman, 2017).

Table 10: Aquatic species of special concern potentially associated with the proposed Vygenhoek Platinum Mine study area

Species	Common Name	Red List Category	Assessment	Endemism
Mollusca				
Burnupia caffra	-	DD	Regional - South Africa	Not endemic
Odonata				
Diplacodes pumila	Dwarf Percher	EN	Regional - South Africa	Endemic
Gomphidia quarrei	Southern Fingertail	NT	Regional - South Africa	Not endemic
Phyllomacromia monoceros	Black Cruiser	NT	Regional - South Africa	Not endemic
Pseudagrion assegaii	Spearhead Sprite	VU	Regional - South Africa	Not endemic
Pseudagrion makabusiense	Green-striped Sprite	NT	Regional - South Africa	Not endemic
Fish				
Enteromius sp. 'Ohrigstad'	Ohrigstad Barb	DD	N/A	#N/A

Enteromius sp nov south africa	Sidespot Barb	NT	Global	Endemic
Oreochromis mossambicus	Mozambique Tilapia	VU	Global	Not endemic

* EN = Endangered; DD = Data Deficient; LC = Least Concern; NT = Near Threatened; VU = Vulnerable;

Similarly, it is recognised that many records currently ascribed to Enteromius motebensis and Enteromius anoplus in the eastern Lowveld may be synonymous with a new species Enteromius sp. nov. "Ohrigstad" proposed by Engelbrecht & Van Der Bank (1996), which was assessed previously as taxonomically Data Deficient by Darwall et al. (2009). This confusion between the various species identified is largely due to the overlap of morphological characteristics exists between Enteromius anoplus and Enteromius sp. 'Ohrigstad' that makes separation between the species difficult from a macroscopic perspective. Nonetheless, given the taxonomic uncertainty surrounding the 'Ohrigstad' lineage, all records from the Eastern Lowveld catchments were recognised as Enteromius anoplus for the purpose of the latest IUCN Red List Assessment, accepting that a taxonomic revision of this group is required (Woodford, 2017). Although treated as separate species for the present study, the Enteromius anoplus and Enteromius sp. 'Ohrigstad' species potentially present within the catchments associated with the present study area are likely to represent a single undescribed lineage of the Chubbyhead Barb complex, although further detailed taxonomic studies are required to inform this likelihood. For the purpose of the present study however, these species are listed separately based on available collection records.

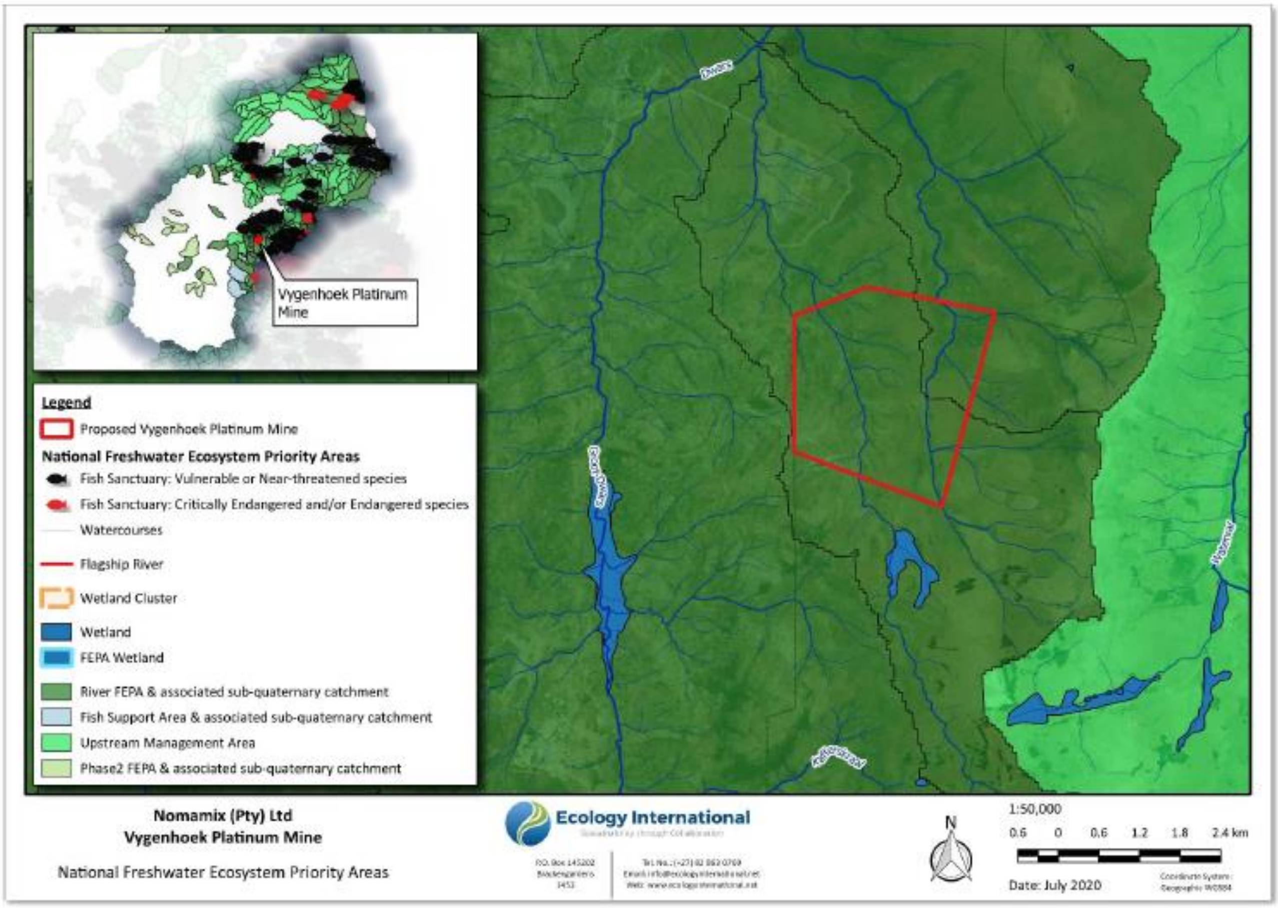


Figure 30: National freshwater ecosystem priority areas associated with the proposed Vygenhoek Platinum Mine study area (Nel et al, 2011)

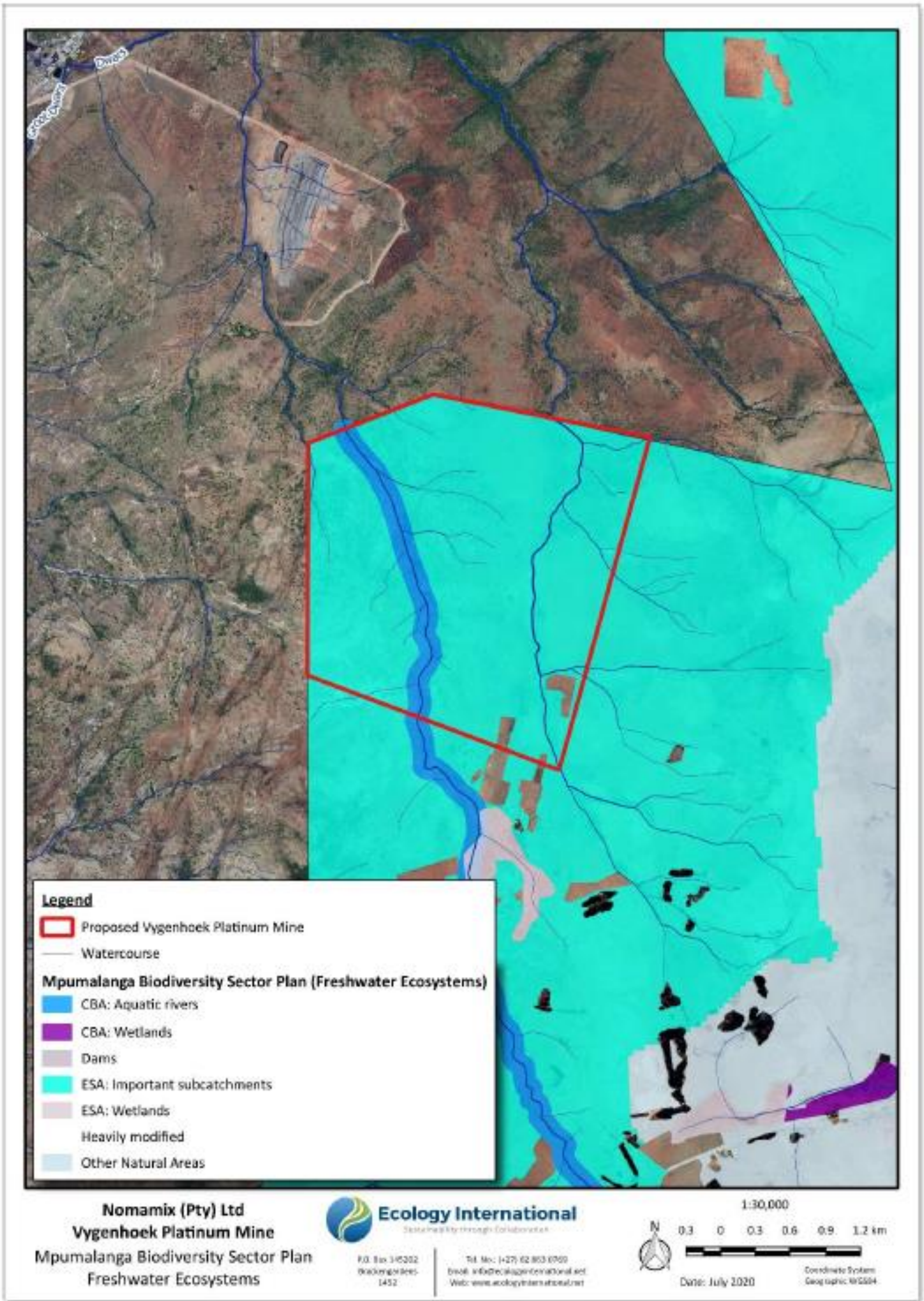


Figure 31: Mpumalanga biodiversity sector plan outputs for freshwater ecosystems associated with the proposed Vygenhoek Platinum Mine study area (Mpumalanga Tourism and Parks Agency, 2014; updated 2019)

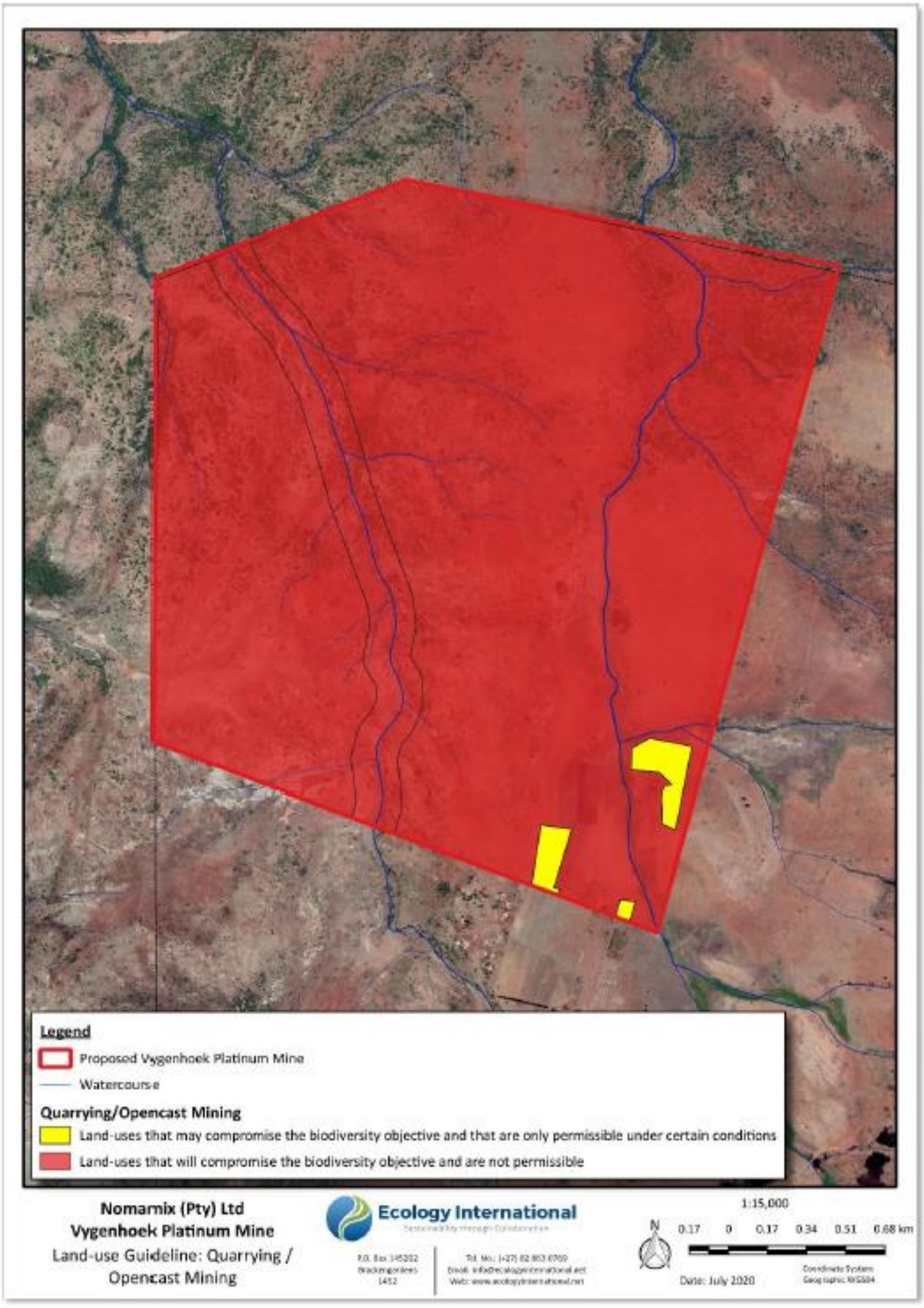


Figure 32: Mpumalanga Biodiversity Sector Plan land-use guidelines for quarrying and opencast mining associated with the proposed Vygenhoek Platinum Mine study area, based on freshwater ecosystem outputs (Mpumalanga Tourism and Parks Agency, 2014)

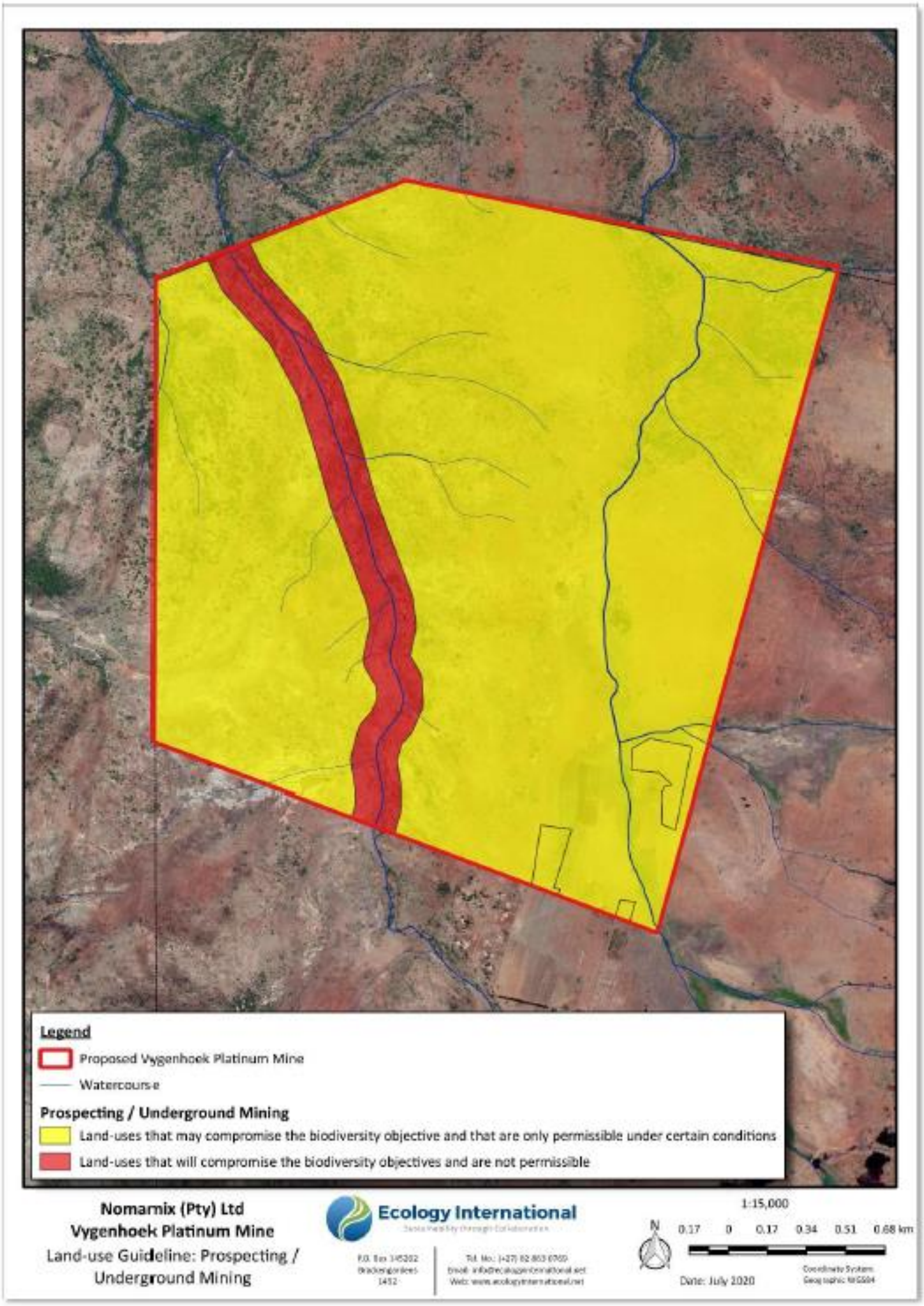


Figure 33: Mpumalanga Biodiversity Sector Plan land-use guidelines for prospecting and underground mining associated with the proposed Vygenhoek Platinum Mine study area, based on freshwater ecosystem outputs (Mpumalanga Tourism and Parks Agency, 2014)

Provisional identification and description of potential impacts

Any activities associated with a natural system, whether historic, current, or proposed, will impact on the surrounding environment, usually in a negative way. The purpose of this phase of the study was to identify potential impacts associated with the site establishment, mining and its related activities and includes but are not limited to the following:

- Direct impacts are those impacts directly linked to the project (e.g. clearing of land). These can be temporary or remain as residual impacts;
- Indirect impacts are those impacts resulting from the project that may occur beyond or downstream of the boundaries of the project site and/or after the project activity has ceased (e.g. migration of pollutants from road surfaces);
- Induced impacts are impacts that are not directly attributable to the project, but are anticipated to occur because of the presence of the project (e.g. impacts of associated expansion of residential settlements with increased pressure on biodiversity); and
- Cumulative impacts are those impacts from the project combined with the impacts from past, existing and reasonably foreseeable future projects that would affect the same biodiversity or natural resources (e.g. a number of roads in the same catchment or ecosystem type collectively affected water quality or flow).

Many of the above impacts are not only a result of the direct impact on a particular species, but rather due to what is known as the 'Edge Effect', which can be explained as follows: Ecosystems consist of a mosaic of many different patches. The size of natural patches affects the number, type and abundance of species they contain. At the periphery of natural patches, influences of neighbouring environments become apparent; this then is the 'Edge Effect'. Patch edges may be subjected to degradation due factors such as increased levels of heat, dust, desiccation, disturbance, invasion of exotic species and other negative agents. Edges seldom contain species that are rare, habitat specialists or species that require larger tracts of undisturbed core habitat to survive in the long term. Fragmentation due to development reduces core habitat and greatly extends edge habitat, which causes a shift in the species composition, which in turn puts great pressure on the dynamics and functionality of ecosystems (Perlman & Milder, 2005).

Nature of impacts

Direct loss of wetland features

The potential presence of wetland features with the proposed mining area is likely to result in the direct loss of potential wetland features present. The proposed activity is further expected to result in impacts to drivers of wetland features adjacent to and/or downstream of the proposed mining areas, resulting in the degradation and loss of ecosystem services provided by wetlands.

Erosion and sedimentation of wetlands and watercourses adjacent to and downstream of the proposed mining activities

While the placement of various infrastructure associated with the propose mine may not result in the direct loss of wetland habitat, activities associated with the establishment of the mine is likely to impact the adjacent and downstream watercourses through the clearing of natural vegetation, altered overland flow and sediment transport. Further, the use of heavy machinery within the construction footprint will lead to soil compaction, which increases the runoff of water over the topsoil and the reduction in stormwater infiltration into the soil profile, therefore increasing the likelihood of erosion gully formation and the deposition of sediment within associated watercourses. In addition, the presence of bare soil associated with stockpiles during mining activities will result in a change in the stormwater runoff volume and velocity entering adjacent wetland systems.

Water quality deterioration

Mismanagement of mine-generated waste and pollutants (including hydrocarbons, construction waste, hazardous chemicals, etc.) is likely to result in these substances or their derivatives entering and polluting the sensitive aquatic environments either directly through surface runoff during rainfall events, or subsurface water movement. An increase in pollutants will lead to changes in the water quality of the wetlands and watercourses, affecting their ability to act as ecological corridors within the development landscape. The linked nature of the wetland systems to downstream water resources will result in pollutants being carried downstream from the mine construction site having consequences on further downstream users.

Various stockpiles will be likely be located within the area, including overburden, topsoil, throw out and emergency stockpiles, and will be characterised by bare soil and steep side slopes that generate significant surface run-off. Run-off from these stockpiles is likely to be sediment rich, while carbonaceous stockpiles (if any) might also generate acid rock drainage as pyrites in the overburden are exposed to oxygen. Where run-off from these stockpiles enters adjacent wetlands, water quality deterioration is likely to result, including increases in turbidity, sulphates, and metal concentrations (e.g. aluminium and Iron), and a drop in pH.

Loss of biodiversity

Mining activities, including blasting, is expected to result in the loss of biodiversity features within the immediate area, as result in a depauperate aquatic biodiversity assemblage downstream of the proposed mining activities. This impact is of particular relevance given that currently-undescribed fish species of conservation concern are known to be present within the watercourses downstream of the study area, and may utilise the watercourses associated with the proposed mine for spawning or breeding purposes. The blasting associated with mining therefore has the potential to disrupt spawning or breeding behaviour through generation of vibrations and movement of aquatic habitat. Noise generated through mining activities is further expected to result in a localised decrease in amphibian species as a result of decreased mate attraction during breeding periods.

Invasive alien plant species encroachment

Alien invasive trees and shrubs are expected to increase within the area as the tend to invade areas that have been disturbed (e.g. on stockpiles and excavated or eroded areas). Such disturbed areas are likely to act as seed areas that will ultimately facilitate the invasion of associated watercourses and riparian areas. Alien species generally out-compete indigenous species for water, light, space and nutrients as they are adaptable to changing conditions and are able to easily invade a wide range of ecological niches, posing an ecological threat as they alter habitat structure, lower biodiversity (both number and "quality" of species), change nutrient cycling and productivity, and modify food webs.

Impact on provincial freshwater conservation targets

The proposed activity is expected to impact on national protected areas targets as well as provincial freshwater conservation targets, both of which are expected to be cumulative in the impact is to be considered with other regional impacts that have or are expected to have on such areas.

Possible red flags/fatal flaws

Maintaining biodiversity patterns and ecological processes, and the ecosystem services derived from these, requires integrated management over large areas of land. In this regard, Mpumalanga Tourism and Parks Agency undertook a planning exercise to incorporate biodiversity priorities into land-use planning and decision-making by multiple land-use sectors, ultimately resulting in a set of land-use guidelines. The overall purpose of these land-use guidelines is to promote the effective management of biodiversity as required in Section 41(a) of the Biodiversity Act (Act 10 of 2004, as amended) and in terms of the National Environmental Management Act (Act 107 of 1998, as amended). The guidelines provide advice on which land-uses and activities are most compatible with maintaining the ecological integrity of Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs), and other parts of the landscape, based on the desired management objectives for the land and the anticipated impact of each land-use activity on biodiversity patterns and ecological processes. These guidelines are intended primarily to guide planning and decision-making in terrestrial and freshwater CBAs and ESAs on land outside of protected areas (Mpumalanga Tourism and Parks Agency, 2014).

In review of the biodiversity categories developed by the Mpumalanga Tourism and Parks Agency from the perspective of freshwater ecosystems, the designation of the watercourse associated with the western portion of the area under study as being a CBA with the remainder of the study area being classified as an ESA in the form of an important sub-catchment and Fish Support Area poses several challenges to the activity proposed (i.e. opencast platinum mining). Based on the land-use guidelines of the MBSP, opencast mining is expected to compromise the biodiversity objective determined for the area in question, and accordingly is not permissible by the Mpumalanga Tourism and Parks Agency (2014).

Of further relevance to be present study would be the potential and/or confirmed presence of undescribed fish species within the watercourses associated with and downstream of the study area. These species, once considered extensions of as known species, have recently been acknowledged to be novel species that are yet to be described taxonomically, and their distribution and relationship with other similar species determined. As underestimation of species diversity has been identified as a major impediment to the implementation of effective conservation strategies to prevent biodiversity loss (see Bickford et al., 2007), failure to consider such species within the context of the proposed activity is likely to pose a significant flaw to the environmental application process.

Terms of reference for environmental impact assessment

Based on the results obtained during the present study, it was determined that both aquatic and wetland specialist studies will be required to inform the Environmental Impact Assessment. In this regard, all aquatic and wetland studies are ensure compliance with the procedures for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the National Environmental Management Act (Act 107 of 1998) and Water Use Licence Application process. Given the high sensitivities of the freshwater ecosystem associated with the proposed mine, it was further determined that such specialist studies are to be conducted at a detailed level, and that an aquatic and/or wetland compliance statement are not deemed to be applicable on the basis of the sensitivities identified during the present exercise.

A detailed Terms of Reference for the aquatic and wetland assessments is provided below, and should be ready together with the minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the National Environmental Management Act (Act 107 of 1998), as well as the Natural Scientific Professions Act (Act 27 of 2003).

<u>*Aquatic specialist assessment*</u>

In addition to the general requirements for specialist studies, the following are deemed applicable to aquatic specialist assessments:

- Ideally, two seasonal aquatic studies are to be conducted for the purpose of establishing a baseline for the associated aquatic ecosystem and to inform a monitoring approach to be undertaken should the proposed mine receive authorisation. Where the aquatic assessment is to be conducted during a single season only, a single comprehensive aquatic ecosystem assessment is to be conducted following sufficient summer rainfall and inundation of the associated watercourses for a period of at least six (6) weeks prior to the study commencing. As such, it is expected that unless significant early summer rainfall occurs within the upper catchment, studies of the associated aquatic ecosystem are expected to take place within the middle part of the summer period (i.e. December to February);
- Aquatic macroinvertebrates sampled within the study area, specifically Mollusca and Odonata, are to be identified to the lowest possible taxonomic level (i.e. lower than Family level) in order to determine the possible presence of species of conservation concern;
- An assessment of the adult Odonata associated with the study area is to be undertaken;
- A detailed ichthyofaunal assessment is to be undertaken within the watercourses adjacent to and downstream of the proposed mining area. During the assessment, the relative density and diversity of fish species is to be investigated for each site, with specific attention given to the presence of species of conservation concern and as-yet undescribed species;
- All aquatic data collection is to be done in a manner that is non-destructive, unless the relevant permits are obtained from the Mpumalanga Tourism and Parks Agency. Any samples collected on-site are to be lodged with the South African Institute for Aquatic Biodiversity (SAIAB);
- Potential spawning habitat for identified species of conservation concern, Protected and/or endemic species is to be identified, and the potential impact of blasting activities thereon determined;
- Determination of the Present Ecological State of the associated watercourses is to be determined by the EcoStatus approach (i.e. by means of the Macro-Invertebrate Response Assessment Index, Fish Response Assessment Index, etc.);

- A detailed monitoring programme is to be developed as part of the assessment, that will take effect immediately upon authorisation so as to allow for collection of suitable pre-mining data that will inform the monitoring of potential impacts;
- The aquatic specialist must provide input into a biodiversity management plan to be developed for the mine, with specific consideration given to the identified sensitivities;
- The identified aquatic specialist who is to conduct the aquatic assessment is to have expertise in aquatic macroinvertebrate identification below family level, have expertise in fish taxonomy and identification, and have expertise in the application of the EcoStatus suite of indices.
- Ideally, the identified aquatic specialist is to have >10 years' experience in conducting aquatic assessments. Where this is not possible, the specialist is to have at least 5 years' experience in conducting specialist aquatic assessments, with proven competence in freshwater fish assessments.

Wetland specialist assessment

In addition to the general requirements for specialist studies, the following are deemed applicable to wetland specialist assessments:

- Wetland within the study area as well as within 1km of the study area are to be delineated using the guidelines as published by the DWAF (2005) entitled "A Practical Field Procedure for Identification and Delineation of Wetlands and Riparian Areas". However, a pragmatic approach should be taken if any problematic soil types are encountered, and the delineated of wetlands in such soil types supported;
- The wetland delineation component of the specialist report should include the following information as a minimum:
  - A description of how and when the delineation was done;
  - A description of the catchment, landscape, landscape position, topography (slopes – concave, convex, flat etc., and slope changes), vegetation, soils and hydrological conditions including a summary of the available information used to determine the extent of wetland habitat;
  - Review of historical imagery and anecdotal evidence;
  - Where appropriate, the incorporation of field datasheets as appendices which should include a description of site conditions of representative sample points that adequately describe the delineation. In some cases, particularly for difficult sites, the sample points should be described from both inside and outside the delineated wetland boundary;
  - Site maps identifying the boundary of the wetland within the study area, plus an indication if the wetland extends outside the site boundary, albeit only at a desktop level if access is restricted or difficult in those areas, and the location of all data collection points recorded during the study. This should also include Information on the type and date of imagery used to support the delineation;
  - All sample points used by the delineator to determine the boundary of the wetland must be recorded using a Global Positioning System (GPS). The GPS used during the study and the accuracy of the GPS should be stipulated in the reporting to highlight potential inaccuracies in the boundaries presented on the map;

- All delineated wetlands are to be classified according to Ollis et al. (2013);
- All delineated wetlands to be assessed in terms of health and functionality (hydrological, ecological and ecosystem services) using recognised tools (e.g. Wet-Health, Wet-EcoServices, Wet-IHI, etc.), taking cognisance of recent findings regarding the limitations of such tools on certain hydrogeomorphic types. Where wetlands are transformed, the assessment needs to include potential levels of functionality that could be expected with iterative levels of rehabilitation;
- Consideration should at all times be given to the drivers and responses of wetland formation/support for delineated wetlands when considering potential impacts associated with the proposed activity. In this regard, the wetland specialist is to take cognisance of the findings obtained from the hydropedological assessment of the site in determining the potential impact on landscape-level wetland drivers;
- The wetland specialist must provide input into a biodiversity management plan to be developed for the mine, with specific consideration given to the identified sensitivities;
- Ideally, the identified wetland specialist conducting the assessment is to have >10 years' experience in conducting aquatic assessments. Where this is not possible, the specialist is to have at least 5 years' experience in conducting specialist wetland assessments. Additional expertise in soil science is mandatory given the potential for problematic soils to be present within the study area.

IX. Soils (Viljoen & Associates, July 2020)

Viljoen & Associates (Pty) Ltd conducted the baseline assessment in July 2020. Find **Appendix K** for the detailed report.

Baseline soil environment

Figure 34 shows the distribution of the different soils types identified and classified according to the latest version of the *South African Taxonomical Soil Classification System* into different soil types within Portions 3 and 7 of Farm Vygenhoek.

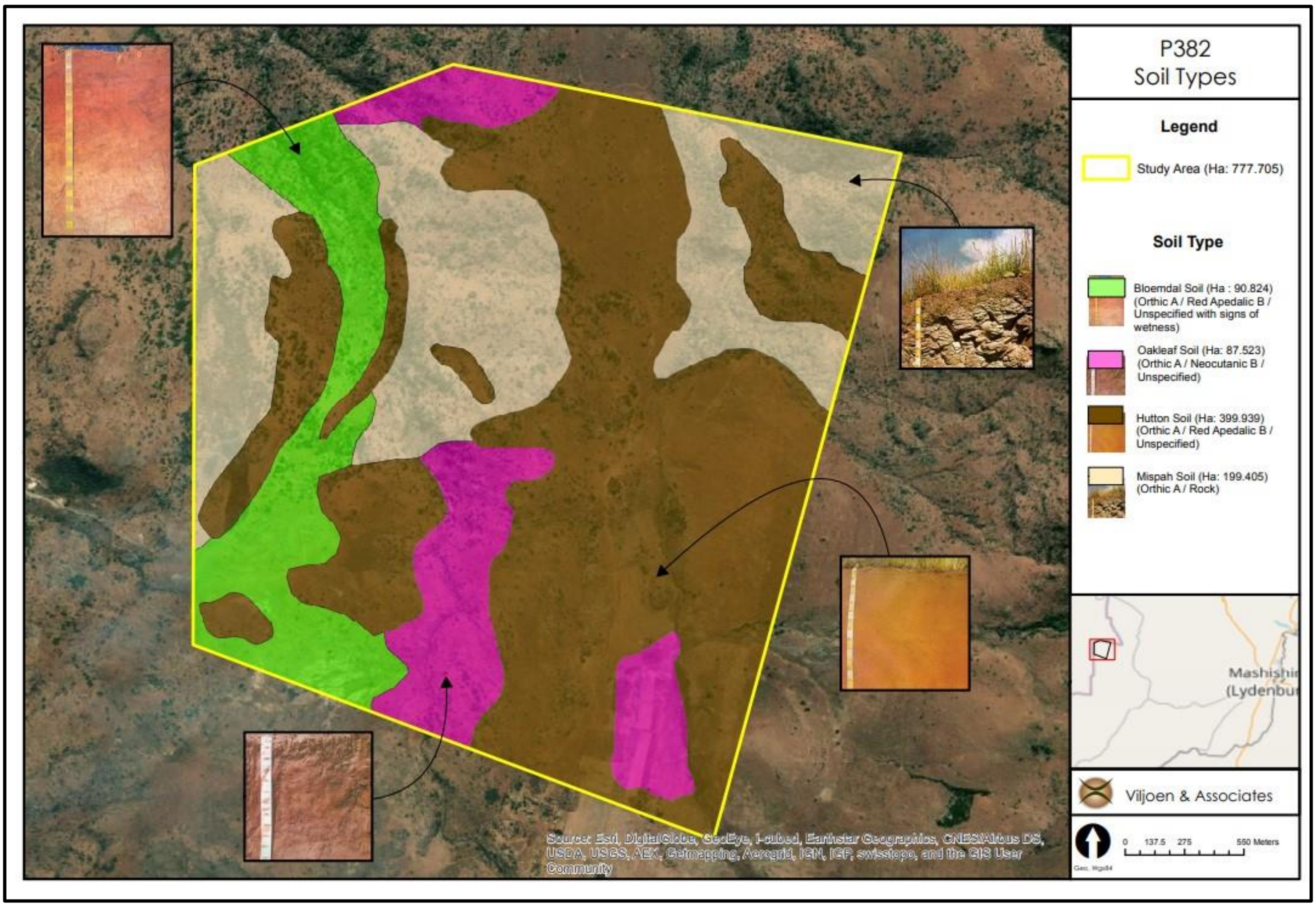


Figure 34: Soil types of the proposed Vygenhoek Platinum mine

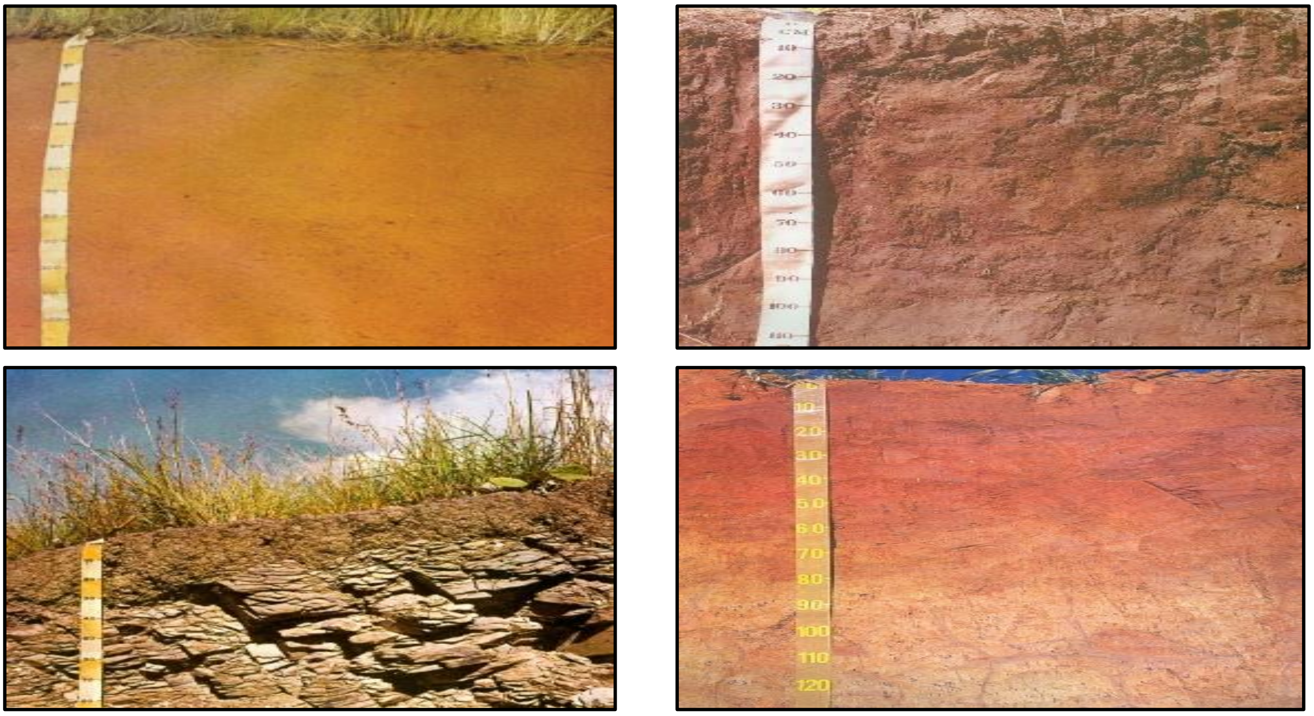


Figure 35: Hutton, Oakleaf, Bloemdal (top left to right) and Mispah soils (bottom left to right)

- Orthic A – Horizon: Is a surface horizon containing abundance of organic material darkened by organic matter, occurring over virtually the full range of soil forming conditions encountered in South Africa. The horizon excludes the properties of organic, humic, vertic or melanic topsoil horizons;
- Rock: This horizon will be represented by the underlying geology, *i.e.* andesite, shale, sandstone, *etc.* It offers extreme resistance to root and water penetration;
- Neocutanic B – Horizon: The horizon diagnostically is characterised to have very little structure due to the low clay content and the presence of predominantly 1:1 layer silicates.
- Red Apedalic B – Horizon: Characterised by 1:1 clay minerals, *i.e.* kaolinite and oxides of iron and manganese. The clay percentage ranges between 10 and 20% (*hydrometer method*) and due to the low clay content there is a lack of structure.

The soil types are summarised in **Table 11**:

Table 11: Soil types expected at the proposed Vygenhoek Platinum Mine

SOIL TYPE	DIAGNOSTIC HORIZONS	EFFECTIVE DEPTH (MM)
Hutton	Orthic A – Horizon/Red Apedalic B – Horizon/Unspecified	>300
Oakleaf	Orthic A – Horizon/Neocutanic B – Horizon/Unspecified	>300
Bloemdal	Orthic A – Horizon/Red Apedalic B – Horizon/ Unspecified with signs of wetness	>300
Mispah	Orthic A – Horizon/Rock	<300

Agricultural potential

The agricultural potential was assessed using the following formula as a function of various variables:

YIELD (kg ha^{-1}) = R/B x ED/A x C x X

R – Rainfall (mm);
B - Species growth characteristics factor;
ED - Effective depth of the soil;
A - Soil wetness factor for textural classes of soil above effective depth;
C - Correction factor for aeration of soil; and
X - Fixed coefficient for species.

The main variables determining the soil's agricultural potential for maize (**Table 12**) include the **average rainfall** (mm), **soil depth** (mm) and **water management & holding capacity**. The yield estimates in Table 12 exclude any other management practices, *i.e.* fertilisation, cultivar, plant density, *etc.* that can make a significant difference in yield.

The Hutton, Oakleaf and Bloemdal soils have high agricultural potential under dryland and irrigation conditions. However, the main constraint for optimum production is the availability of water for irrigation purposes. Production under dryland conditions of 30,000 plants/ha with average rainfall of 450mm/year will not be sustainable, especially during the summer period with extreme heat units. Production under irrigation conditions would require 6,100m^3/ha/year of water for 100,000 plants/ha, which is the equivalent of 30,000l/ha 24hours, 7 days per week. There is also the possibility that water quality could not be sufficient for irrigation purposes. The Mispah soil are not suitable for agricultural purposes.

Table 12:Agricultural potential of soil

SOIL TYPE	AGRICULTURAL POTENTIAL	
	DRY LAND	IRRIGATION
Hutton	Medium	High
Oakleaf	Medium	High
Bloemdal	Medium	High
Mispah	Low	Low

Topsoil

The amount of available topsoil to be stripped prior to mining operations could be under estimated and should be treated conservatively as a finite resource. A basic unit of 10,000m^2 300mm deep can potentially yield 3,000m^3 of topsoil at a bulk density ranging between 1,375 – 1,850kg/m^3. An increment of 100mm depth could yield an additional 1,000m^3 or could be lost due to inappropriate stripping practices.

Considering the above basic volume calculations (**Figure 36**) it is obvious that due care must be exercised when stripping topsoil.

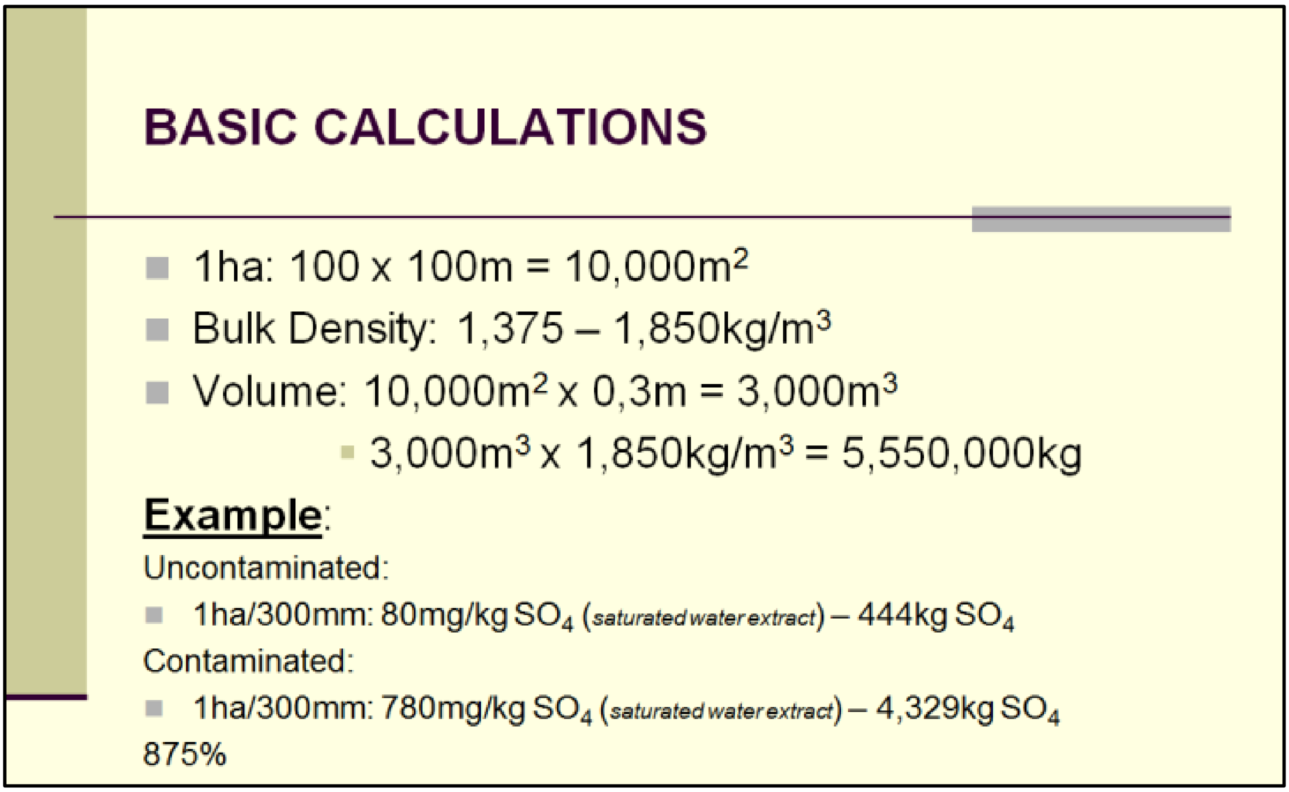


Figure 36: Basic volume calculations

The ***South African Taxonomical Soil Classification System*** is comprised of 53 different soil types (**Figure 37**) each soil type is characterised by a sequence of diagnostic horizons.

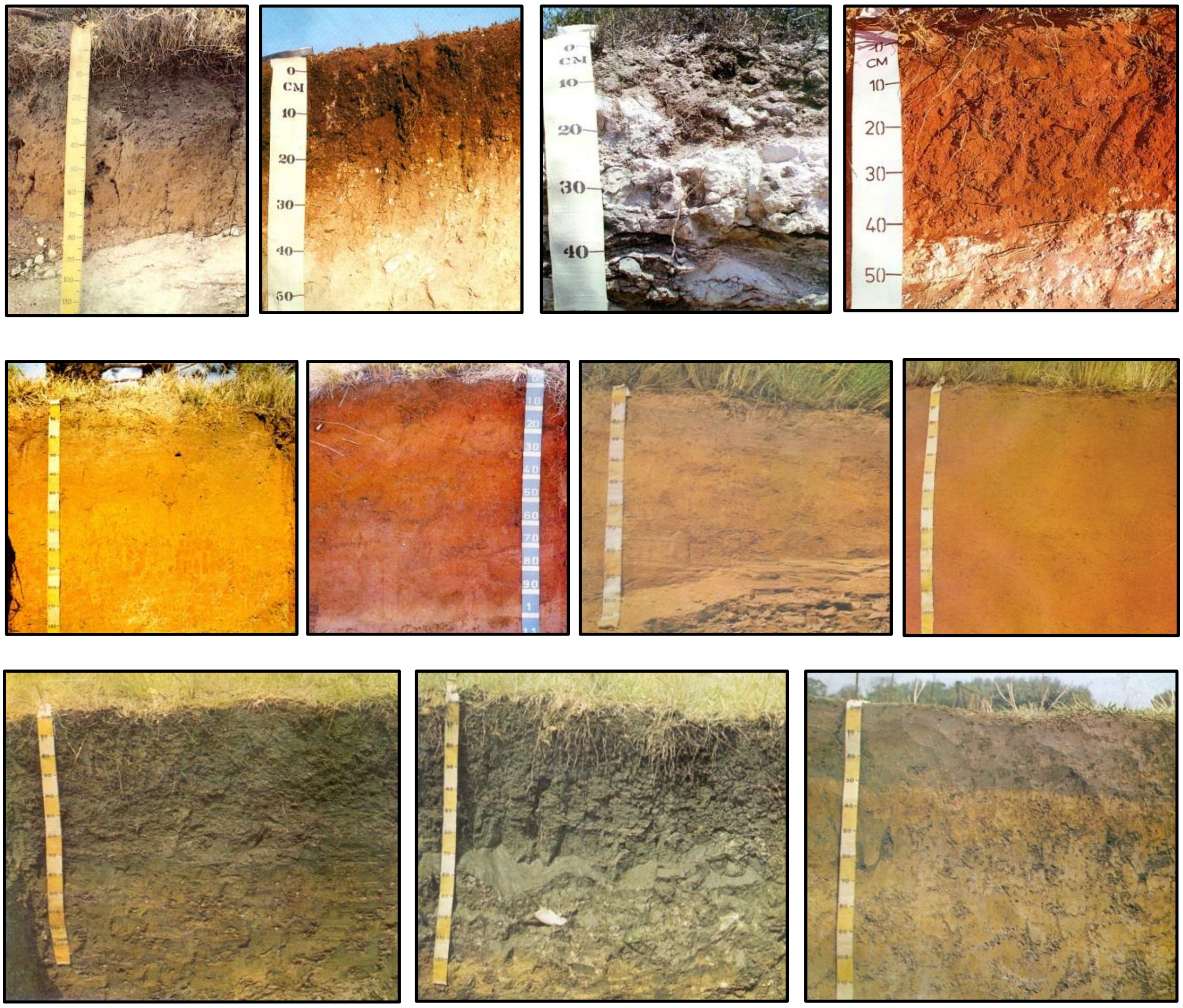


Figure 37: Soil Types (Examples from South African Taxonomical Soil Classification System)

Soils can be formed *in situ* from underlying geology through natural weathering and/or could be transported and deposited through wet and dry geological periods. The soil will be a function of the mineralogy from which it was derived and which will determine its prevailing chemical, physical and mechanical properties.

Consideration should be given to different diagnostic soil horizons when stripping topsoil, *i.e.* certain layers can be stripped and mixed together and certain layers should be stockpiled separately. Careful consideration and planning should be given to different soil layers and thickness during topsoil stripping for rehabilitation purposes, which should not be dictated solely by civil engineering geotechnical criteria.

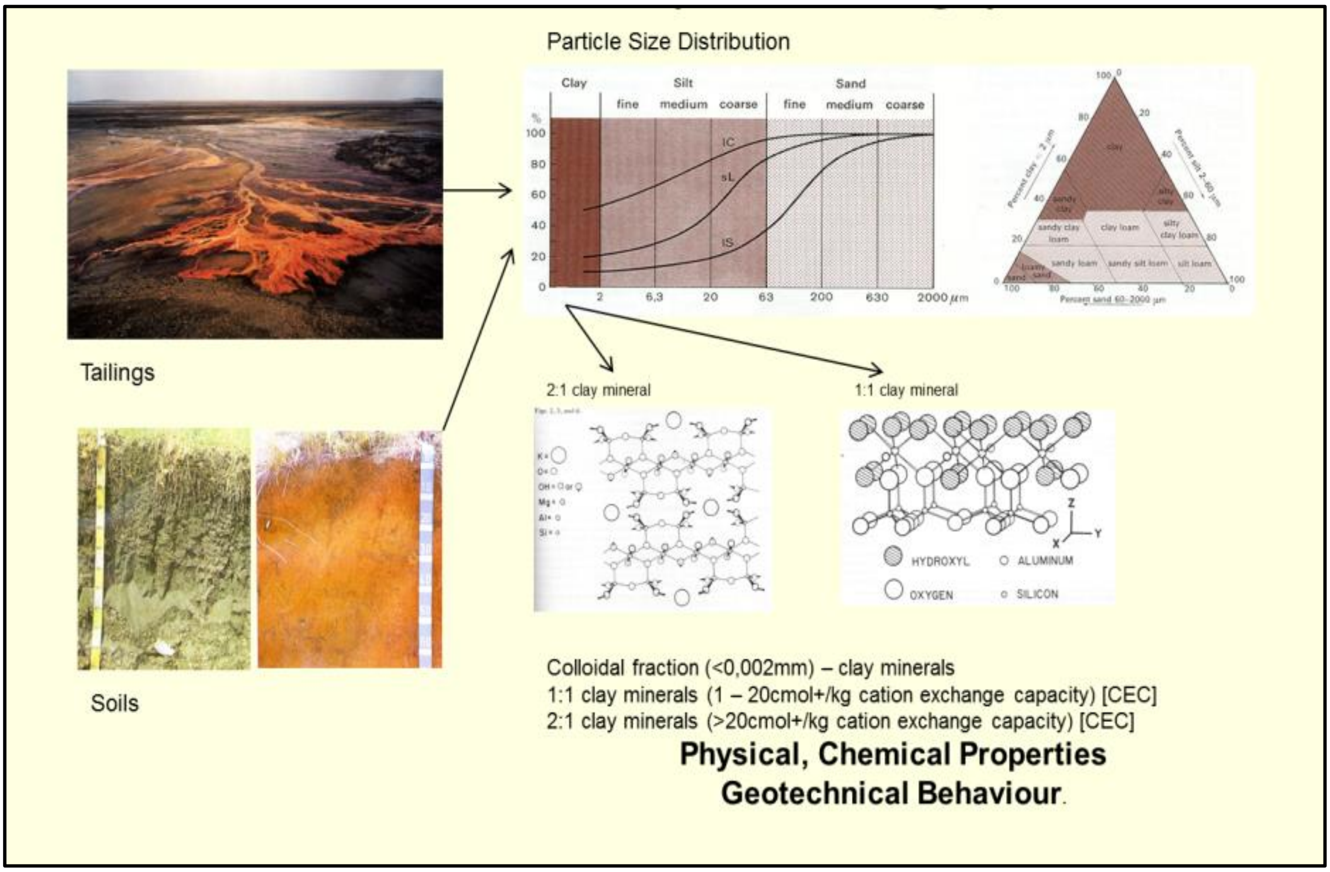


Figure 38: Influence of colloidal fraction in topsoil stripping

Clay mineralogy (**Figure 38**) is the primary diagnostic criteria for soil layer identification and selection during topsoil stripping and stockpiling. The colloidal fraction (*particles <0,002mm*) can be divided in 1:1 layer and 2:1 layer silicates and should not be mixed and stockpiled together. Organic material, bulk density and seeds are secondary diagnostic criteria for horizon selection to be stripped and stockpiled.

A conservative estimate of anticipated available topsoil to be stripped is summarised in **Table 13**.

Table 13: Available topsoil for rehabilitation purposes

Soil Type & Average Effective Depth (mm)	Size (ha)	Available Volume (m^3)
Hutton (1,200)	399,93	4,793,160
Oakleaf (1,200)	87,52	1,052,240
Bloemdal (1,200)	90,82	1,089,840
Mispah (300)	199,40	598,200
TOTAL		**7,533,440m^3 @ BD: 1,275kg/m^3**

An estimated total 2,511ha could potentially be covered 300mm thick at a bulk density of 1,275kgm^3 during rehabilitation taking into consideration a 10% loss of topsoil due to handling, compaction *etc*.

Preliminary Impact Assessment

Table 14: Possible impacts associated to the proposed Vygenhoek Platinum Mine

Nature: Loss of topsoil due to stripping, handling and placement of soil associated with pre-construction land clearing and rehabilitation.		
	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Long Term (4)	Short Term (1)
Magnitude	Moderate (6)	Low (4)
Probability	Very Probable (4)	Very Probable (4)
Significance	**Moderate (44)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Irreversible	Reversible
Irreplaceable loss of resources?	Irreplaceable	Replaceable
Can impacts be mitigated?	Yes	
Mitigation measures: • Strip all usable soil, irrespective of soil depth.		
Cumulative impact: • Cumulative impact of loss of topsoil due to stripping and placement associated with pre-construction land clearing and rehabilitation is rated as low because effective mitigation measures are available.		
Residual impact: • Minor localised loss of topsoil		
Nature: Change of soil's physical, chemical and biological properties due to loss of topsoil due to erosion, stockpiling, mixing of deep and surface soils during handling, stockpiling and subsequent placement.		
	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Long Term (4)	Short Term (1)
Magnitude	Moderate (8)	Low (4)
Probability	Very Probable (5)	Very Probable (4)
Significance	**Moderate (65)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	Irreplaceable	Irreplaceable
Can impacts be mitigated?	Yes	

Mitigation measures:

- Implement live placement of soil where possible, improve organic status of soils, maintain fertility levels and curb topsoil loss.

Cumulative impact:

- Cumulative impact of soil's physical, chemical and biological properties due to loss of topsoil, due to erosion, stockpiling, mixing of deep surface soils during handling, stockpiling and subsequent placement is considered to be low because effective mitigation measures can be implemented.

Residual impact:

- Minor localised degradation of topsoil's chemical, physical and biological properties.

Nature: Change of natural surface topography due to reprofiling of surface after stripping.

	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Long Term (4)	Short Term (1)
Magnitude	Moderate (8)	Low (4)
Probability	Very Probable (5)	Very Probable (4)
Significance	**Moderate (65)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Irreversible	Reversible
Irreplaceable loss of resources?	Irreplaceable	Replaceable
Can impacts be mitigated?	Yes	

Mitigation measures:

- Implement surface digital terrain mapping to ensure surface water control measures are implemented to ensure free draining system with minimal soil erosion.

Cumulative impact:

- Cumulative impact of the change of surface topography due to reprofiling of surface after stripping is considered to be low because effective mitigation measures can be implemented.

Residual impact:

- Minor changes in topography and localised degradation of topsoil's chemical, physical and biological properties.

Nature: Loss of land with high agricultural potential and land capability.

	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Low (4)
Probability	High Probable (4)	High Probable (4)

<table>
<tr><td>Significance</td><td>Moderate (40)</td><td>Low (16)</td></tr>
<tr><td>Status (positive or negative)</td><td>Negative</td><td>Negative</td></tr>
<tr><td>Reversibility</td><td>Medium</td><td>Medium</td></tr>
<tr><td>Irreplaceable loss of resources?</td><td>No</td><td>No</td></tr>
<tr><td>Can impacts be mitigated?</td><td colspan="2">Direct impacts cannot be mitigated but direct impacts can be minimised and avoided through adequate planning of layout and rehabilitation.</td></tr>
<tr><td colspan="3">Mitigation measures:
Loss of agricultural land due to establishment of infrastructure is a long term loss and no mitigation measures exist. Mitigation is restricted to limitation of extent of impact to the immediate area of impact and minimisation of off-site impacts.
Loss of agricultural land due to opencast mining is a temporary loss which can be mitigated by appropriate backfilling and re-placement of stockpiled topsoil. If done correctly, most of the original agricultural potential will be restored.</td></tr>
<tr><td colspan="3">Cumulative impact:
Soil erosion may arise due to altered surface water runoff. Management and erosion control measures should be implemented.</td></tr>
<tr><td colspan="3">Residual impact:
Loss of agricultural land is a long term loss, limited to the footprint of the infrastructure, which is a minimal percentage of the surface area of the land. Agriculture can still continue on the rest of the unoccupied areas.</td></tr>
</table>

The results of the Impact Assessment for the proposed mine on Portions 3 and 7 Farm Vygenhoek find the proposed activity will have a medium to low impact on the immediate and surrounding soil systems. Implementation and management of proposed mitigation measures will minimize loss of topsoil, prevent contamination of topsoil and stockpiled soil and prevent overall soil erosion.

Terms of reference for EIA

It is recommended to conduct ground truthing of the Desktop Scoping Soil Specialist Assessment of Portions 3 and 7 Farm Vygenhoek 777 ha. Extrapolation from aerial photo interpretation, i.e. mainly Google images combined with site visit and previous data from similar projects in close proximity still leaves a gap in terms of the confidence levels of the estimated data. A survey grid is required to confirm soil types that will yield more accurate data in terms of effective depth, land use & land capability, agricultural potential and suitability of soils for rehabilitation. More accurate soil management plan can be recalibrated from this data, as well as soil sample analyses data characterising soil chemistry and physics. It will enable identifying a potential fatal flaw to assess if soils are prone to erosion due to dispersion anomalies. The refinement of data can be conducted once site selection has been confirmed.

X. Hydrology (Highlands Hydrology, July 2020)

Highlands Hydrology (Pty) Ltd conducted the baseline assessment in July 2020. Find **Appendix L** for the detailed report.

Hydrological summary

As discussed in section **1) (a) II**, the rivers at the site drain in a northerly direction joining the Groot-Dwars River approximately 5km downstream, which then joins the Dwars River, which flows into the Steelpoort/Tubatse River, the Olifants River, and ultimately Limpopo River before reaching the Indian Ocean.

There is one perennial river at the site which drains majority of the site. This perennial river has a network of non-perennial streams associated with it (**Figure 39**). The second largest stream located on the eastern side of the site is non-perennial (according to the 1:50 000 topographical data) but showed substantial flow emanating from it during the site visit which was done during the dry season (July). The combination of these two streams drains majority of the site.

The site is steep, particularly in the valleys associated with the streams. There is fairly large plateau area with gentle slopes located between the perennial stream and eastern non-perennial stream.

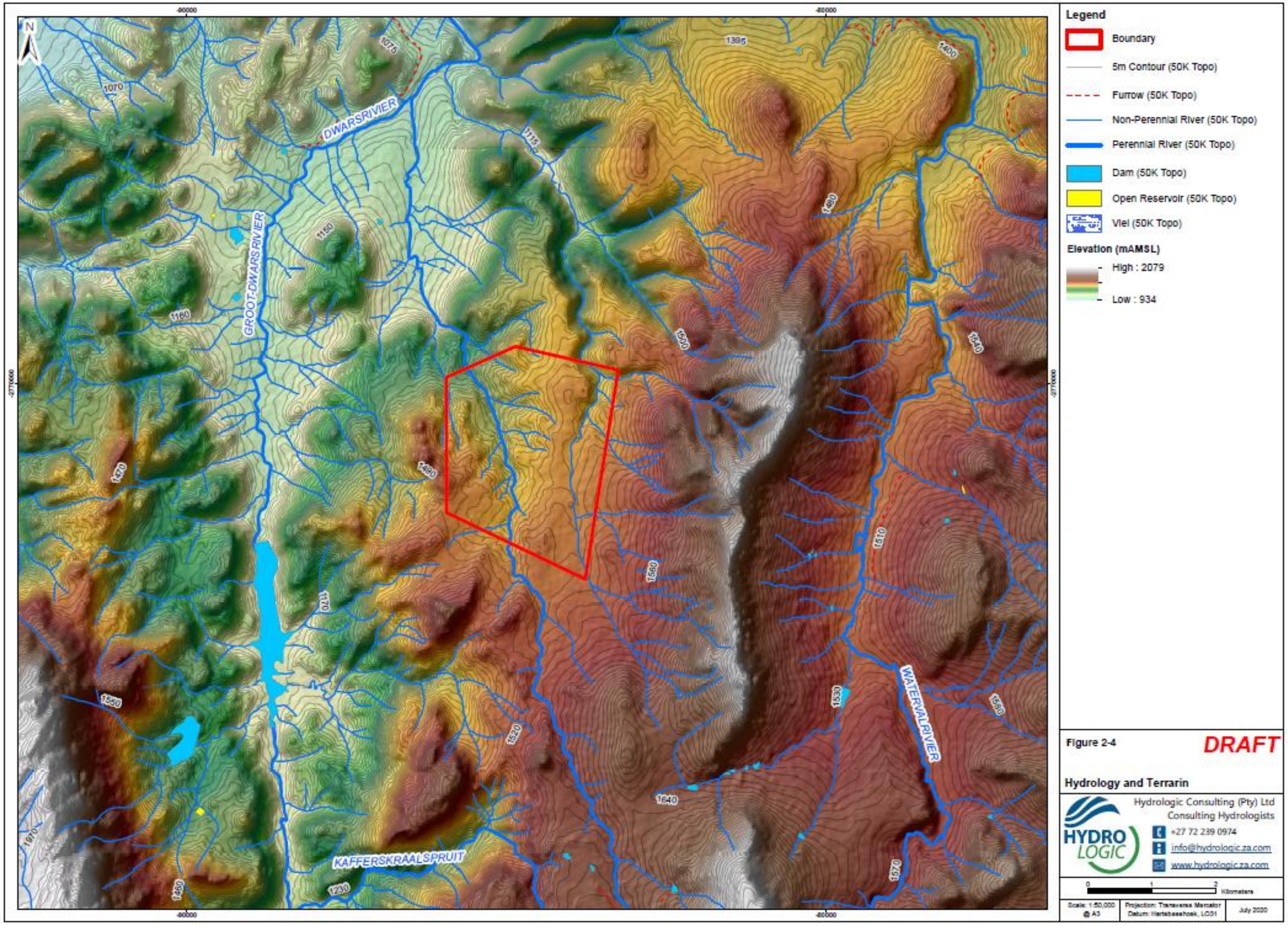


Figure 39: Hydrology and terrain

The runoff potential at the site is very high due to the combination of very steep topography, limited soil depth, and limited vegetation cover where parent rock is exposed at the surface. This results in a reduced capacity for water to infiltrate into the soil profile. **Figure 40** below are some of the photos taken during the site visit, which help illustrate the discussion above.

Figure 40: Photos taken during Highlands Hydrology's site visit

1-Day design rainfall depths

For the development of a storm water management plan, design rainfall was the most important rainfall variable to consider as it is the driver behind design (peak) flows.

Design storm estimates for various recurrence intervals (RI) and storm durations were sourced from the Design Rainfall Estimation Software for South Africa (DRESSA), developed by the University of Natal in 2002 as part of a WRC project K5/1060 (Smithers and Schulze, 2002). This method uses a Regional L-Moment Algorithm (RLMA) in conjunction with a Scale Invariance approach to provide site-specific estimates of design rainfall (depth, duration and frequency), based on surrounding station records. WRC Report No. K5/1060 (WRC, 2002) provides more detail on the verification and validation of the method. **Table 15** presents the DRESSA design storm estimates for the site.

The design rainfall estimates (24-hour storm) using the above technique have been compared to that obtained in TR102 (Design Rainfall Depths at Selected Stations in South Africa) for the 593419 W (Martenshoop Police Station) rainfall station located approximately 10 km north-east of the site.

Table 15: 24-hour storm depth

Recurrence Interval (Years)	Rainfall depth (24 hour) (mm)	
	DRESSA (Smithers/Schulze)	**TR102**
2	57	53
5	78	73
10	94	87
20	109	101
50	131	122
100	148	138
200	167	155

The DRESSA design storm estimates compare well to that of TR102 for the specific SAWS station. It is recommended that the DRESSA design storm estimates be used for all flood hydrology calculation and modelling due to them being site specific as well as the slight conservatism associated with them, compared to TR102.

It is important to note, that no allowances for climate change have been made. A risk analysis using the expected life of a structure or process will indicate the relevance of considering climate change (i.e. as the expected life increases the influence of climate change increases).

Potential hydrological impacts

In terms of hydrological impacts, the following should be noted and considered in more detail during the detailed hydrological assessment and Environmental Impact Assessment (EIA):

- Alteration to natural stream flow volumes:
    - Clean and dirty areas will need to be kept separate as guided by Government Notice 704 (GN704). This means that dirty water generating catchments will need to be contained and reused in the process water circuit.
    - This will have a potential negative impact on both downstream water users as well as stream biodiversity.
- Alteration of natural drainage pattern:

  - Changes to catchment characteristics such as the removal of vegetation and associated increase in hardstanding at the site will increase runoff potential during rainfall events.
  - This will have a potential negative impact on both downstream water users as well as stream biodiversity.
- Alteration of natural water quality:
  - Water quality will be detrimentally affected by the proposed operation through potential chemicals used in the operation, including blasting.
  - Water quality will also be detrimentally affected though an increased sediment load resulting from increased erosion in catchments associated with the proposed operation.
  - This will have a potential negative impact on both downstream water users as well as stream biodiversity.

Based upon the baseline investigation as well as site visit confirming green-field conditions and pristine hydrological environment, it can be concluded that there will be a negative impact of the proposed operation on receiving water resources. Mitigation measures can however be put in place to help reduce this impact.

Recommendations

Baseline information including rainfall, evaporation, design event rainfall, temperature, as well as site topography and regional and local catchment hydrology have been considered in this baseline hydrological assessment for the proposed Vygenhoek Platinum Mine.

This baseline assessment, together with first-hand knowledge of the major hydrological flow regimes gained through visiting the site indicate that the hydrological environment is presently in its natural state, baring a few cattle grazing in the area.

The runoff potential at the site is very high due to the combination of very steep topography, limited soil depth, and limited vegetation cover where parent rock is exposed at the surface.

The proposed development of the site will alter the natural flow regime in terms of both water quantity and water quality with potential negative impact to both downstream water users and stream biodiversity. Mitigation measures can however be put in place to help reduce this impact.

It is recommended that during the detailed hydrological investigation and EIA, the following items are addressed, with mitigation measures recommended where applicable:

- Floodline modelling and stream buffers
- Conceptual Storm Water Management
- Mean Annual Runoff Assessment
- Static Water Balance
- Water Quality Monitoring
- Hydrological Impact Assessment

XI. Geo-hydrology (GCS, July 2020)

Desktop hydrocensus /groundwater users in the area

A review of SADC GIP (2020) and GRIP (2016) data for the study area indicates that there are seven (7) registered boreholes within a 5km radius of the proposed opencast mine. The groundwater users identified are listed in **Table 16**. The boreholes plot towards the west of the proposed opencast workings and fall within a different sub-catchment. Limited water quality and quantity data is available.

Existing use should be confirmed by undertaking a ground-truthed hydrocensus within the study area.

Table 16: Boreholes identify within a 5 km radius of the site

Borehole ID	Latitude (WGS84)	Longitude (WGS84)	Elevation (mamsl)	EC (mS/m)	Yield (l/sec)	Depth (m)	Water Level (mbgl)
SADAC 658654	-24.99924	30.17753	1463	*No Data*	3.3	80	*No Data*
SADAC 606151	-25.02753	30.12019	1046	51.4	*No Data*	*No Data*	*No Data*
SADAC 605899	-25.03	30.12	1062	55.7	*No Data*	*No Data*	*No Data*
SADAC 605898	-25.035	30.1201	1072	72.9	*No Data*	*No Data*	*No Data*
SADAC 605923	-25.03999	30.11961	1074	59	*No Data*	*No Data*	*No Data*
SADAC 680949	-25.03641	30.10669	1316	*No Data*	*No Data*	130	90
SADAC 680950	-25.04369	30.09003	1367	*No Data*	*No Data*	162	128
SADAC 680955	-25.06646	30.10781	1307	*No Data*	*No Data*	40	*No Data*
SADAC 680935	-25.03396	30.23309	1526	*No Data*	0.64	31.7	14
SADAC 680953	-25.0434	30.23586	1554	*No Data*	*No Data*	162	17
SADAC 680916	-25.0673	30.2331	1686	*No Data*	*No Data*	13.7	*No Data*

SADAC 680932	-25.13395	30.21642	1729	*No Data*	4	48	4
SADAC 680922	-25.15062	30.16642	1718	*No Data*	0.15	68	11.5
SADAC 680937	-25.15062	30.23308	1760	*No Data*	1.51	22.6	7.6
SADAC 680951	-25.15812	30.23503	1744	*No Data*	*No Data*	42	*No Data*
Average Water level (mbgl)				*38.9*			

Depth to groundwater

Literature suggests a groundwater depth in the order of 17 mbgl (King et al., 1998; DWAF, 2006) on a quaternary catchment scale. Available data (refer to previous section) indicates a water level range from 4 to 128 mbgl.

Available data suggest that there is a linear relationship between the groundwater elevation and topography elevation (refer to **Figure 41**, R ≈ 98%), which suggests that the level of the regional groundwater table is highly likely to mimic the topography.

Bayesian interpolation of available groundwater level data was applied to the area to conceptualise the groundwater flow. Figure 42 indicates the generated Bayesian interpolated groundwater elevations for the area.

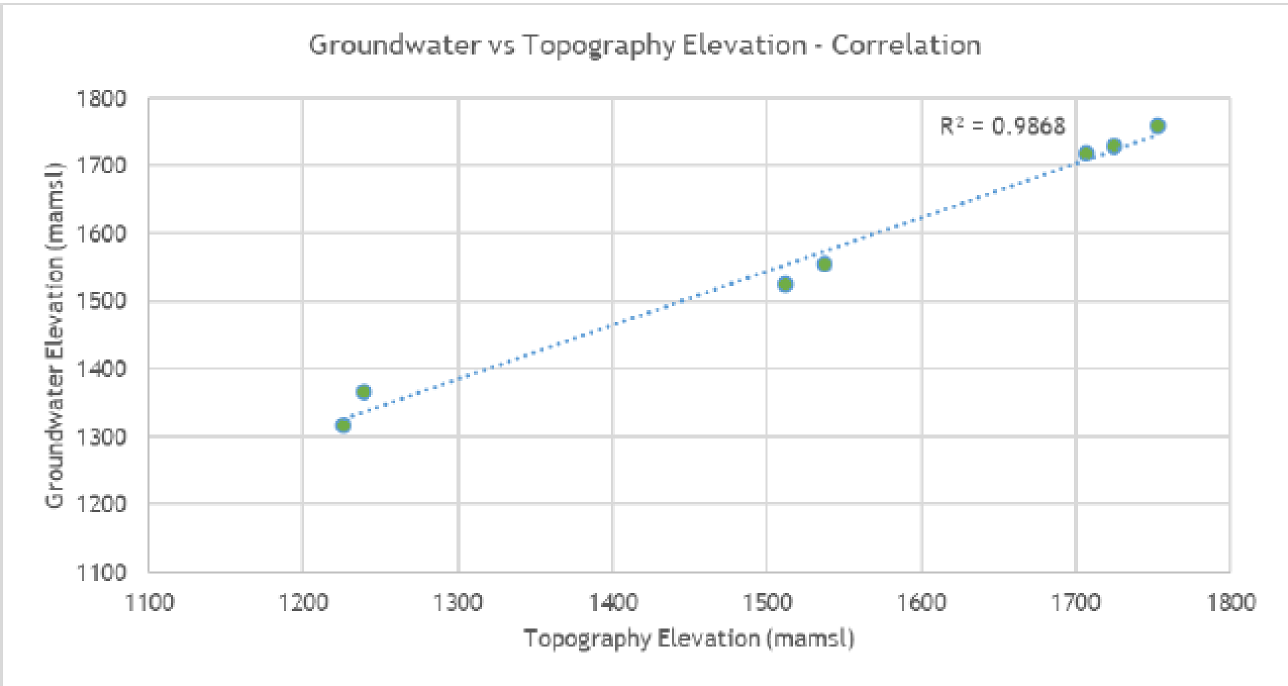


Figure 41: Groundwater elevation vs. topography elevation – correlation

Saturated hydraulic conductivity

Transmissivity (T) values for the weathered aquifer range between 0.001-5 m2/d with S-values in the order of 0.001-0.0001 (Digby Wells, 2012). The permeability of the deeper fractured bedrock aquifer, in the absence of open fracture systems, is characteristically low and estimated to be in the order of 0.0003-0.004 m/d (T of 0.00003-0.0004 m2/d). The storativity for this aquifer varies between 0.001-0.0001. Slightly higher permeability (0.0047 m/d) and transmissivity values up to 4.32x10-4 m2/d are associated with dolerite dyke contacts.

Catchment scale groundwater quality

Literature suggests that the electrical conductivity (EC) for the underlying aquifer generally ranges between 0 – 70 mS/m (milli Siemens/metre) and the pH ranges from 6 to 8. This means that groundwater abstracted from the aquifer can generally be used for domestic and recreational use (DWAF, 1998).

Ambient water quality (pre-mining) should be further evaluated by undertaking a follow-up geohydrological assessment.

Groundwater quantity

An Intermediate Groundwater Reserve Determination (IGRD) was conducted for the study area to establish the groundwater reserve. The IGRD aims to quantify the groundwater reserve and likely mining-related impacts on the reserve.

It is necessary, from a groundwater point of view, to quantify the groundwater quantity and likely future impacts on quantity.

The IGRD considers the following parameters:

- Effective recharge from rainfall and specific geological conditions;
- Basic human needs for the sub-catchment;
- Groundwater contribution to surface water (baseflow);
- Existing and proposed abstraction; and
- Surplus reserve.

The data used for the calculation was derived from the WRC 90 Water Resources of South Africa 2012 Study (WRC, 2015) and Groundwater Resource Assessment Ver. 2 (GRAII) datasets (DWAF, 2006).

Existing groundwater usage (EU)

None of the identified SADAC GIP and GRIP boreholes fall within the delineated sub-catchment. Hence, the sub-catchment is poorly exploited and no EU is allocated to the sub-catchment.

As stated previously, existing users should be confirmed by undertaking a ground-truthed hydrocensus within the study area.

Basic human needs (BHN)

Available data suggest the sub-catchment is poorly exploited and no BHN is reserved.

Proposed groundwater usage (PU)

No PU is reserved in the water balance and should be confirmed as soon as mining commences. Any dewatering activities at the proposed Vygenhoek Platinum Mine will fall under PU and may impact groundwater quantity.

Groundwater balance

The groundwater balance and hence the reserve determination on a sub-catchment scale is summarised below:

- GWavailable = (Re) - (EU + BHN + BF)

Where:

- Gwavailable = Available groundwater for use.
- Re = Effective recharge to the aquifer.
- BF = Baseflow to surface water streams.
- EU = Existing groundwater abstraction / use (identified on sub-catchment, excluding applicant).
- BHN = Basic Human Needs.

Calculations:

- Re (sub-catchment) = 26.21 km² x 39.9 mm/yr = 1 045 779 m³/a (2 865.14 m³/day)
- BHN = 0 m³/day (based on available data).
- EU = 0 m³/day (based on available data).
- BF = 9.76 mm/yr x 26.21 km² = 255 809.6 m³/a (647.61 m³/day)
- $Gw_{available}$ = (2 865.14- [0 + 0 + 647.61]) m³ = +2 217.53 m³/day

The groundwater balance indicates a surplus-value of approx. + 2 217.53 m³/day available for abstraction on a sub-catchment scale. Hence, if groundwater dewatering and use at the Vygenhoek mine exceeds the surplus amount, the groundwater reserve may be negatively impacted.

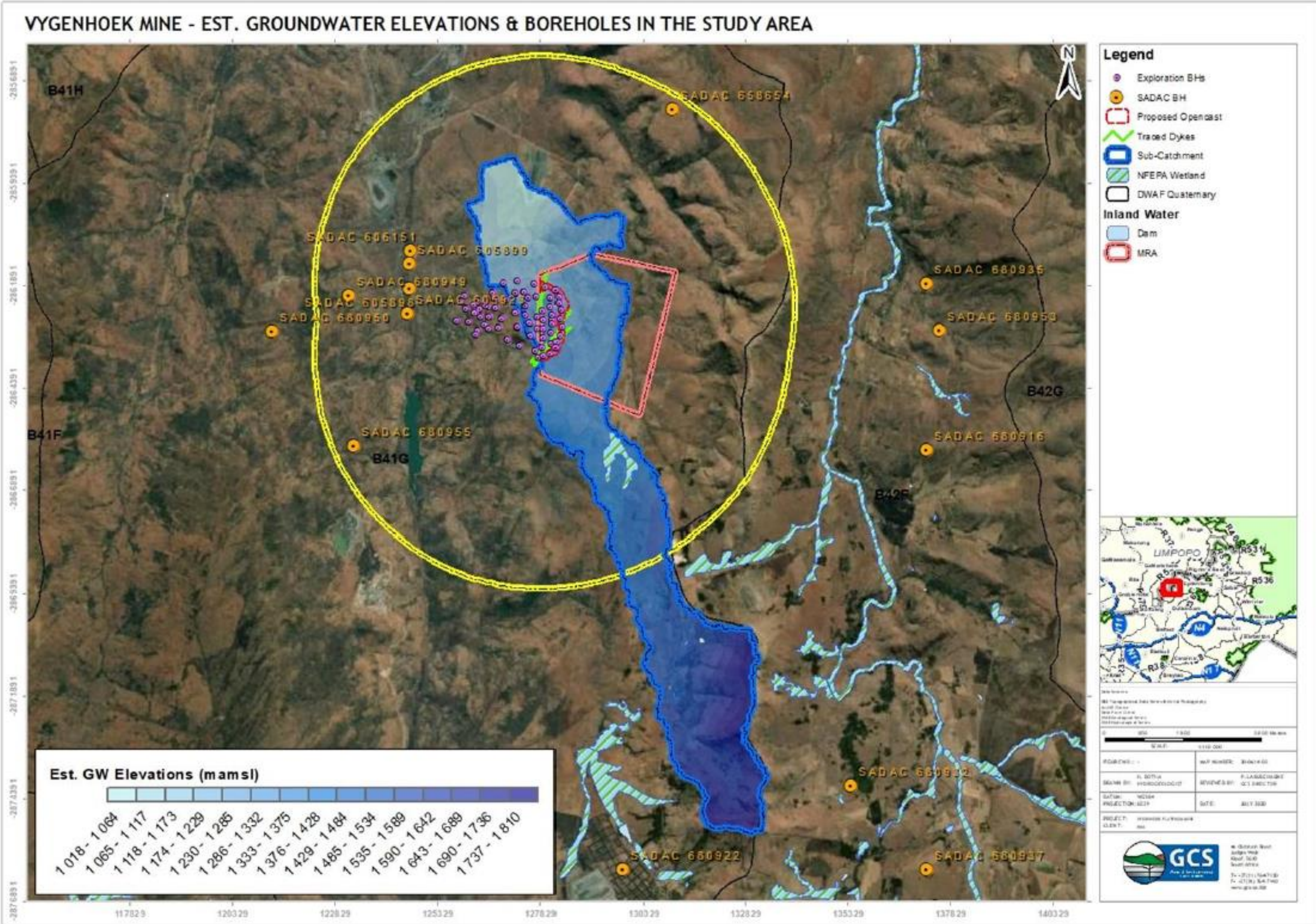


Figure 42: Est. groundwater elevation and groundwater users

Preliminary risk and impact assessment

The anticipated hydrogeological risk with regards to the project infrastructure and activities, in terms of likely contributors to groundwater risk, were assessed. The source-pathway-receptor (SPR) model (DWAF, 2008) was used to model potential pollution sources and primary receptors within the study area.

Preliminary site conceptual model

The preliminary site conceptual model (SCM) for the Proposed Vygenhoek mine is shown in **Figure 43**, below.

Ore floor elevation data and anticipated geological occurrences were derived from available site data. The SCM should be updated when a ground-truthed geohydrological investigation (i.e. drilling and geophysical investigations) is undertaken.

Potential groundwater pollution migration velocities

Based on available aquifer data and Darcy's Law[1] for groundwater flow through a saturated medium and aquifer hydraulic conductivity (K), the following pollution migration rates are likely:

- Weathered aquifer zones:
  - K values for the aquifer rock in the study area range from 0.01-0.001 m/day.
  - Based on the average hydraulic gradient of the area (0.04 to 0.7), pollution migration velocities in the range 1 x 10-4 to 0.01 m/day, are likely.
  - The above mentioned suggest very slow-moving groundwater through the study area.
- Fractured aquifer zones
  - K values for the fractured aquifer is estimated in the order of 0.0047 m/day.
  - Based on the average hydraulic gradient of the area (0.04 to 0.7), pollution migration velocities in the range 1 x 10-4 to 0.06 m/day, are likely.
  - The above mentioned suggest very slow-moving groundwater through the study area.
- Dolerite contact zones:
  - Pollution migration is expected to be several orders of magnitude higher than the weathered and fractured zone. The pollution migration velocities can only be determined if boreholes drilled into these structures are pump tested.

It is recommended that groundwater flow velocities and poor-quality pollution plume migration should be further evaluated via numerical flow and transport modelling.

Preliminary decant areas

Decant was assessed based on the bayesian extrapolated water levels and ore floor elevations. The decant areas are deemed preliminary and should be re-evaluated during the follow-up geohydrological assessment. Due to the mining depth and the estimated groundwater table, no decant points were identified (refer to **Figure 44**). Decant probability is low, based on available data.

The status of decanting and likelihood should be re-evaluated when more site water level and drilling data is available.

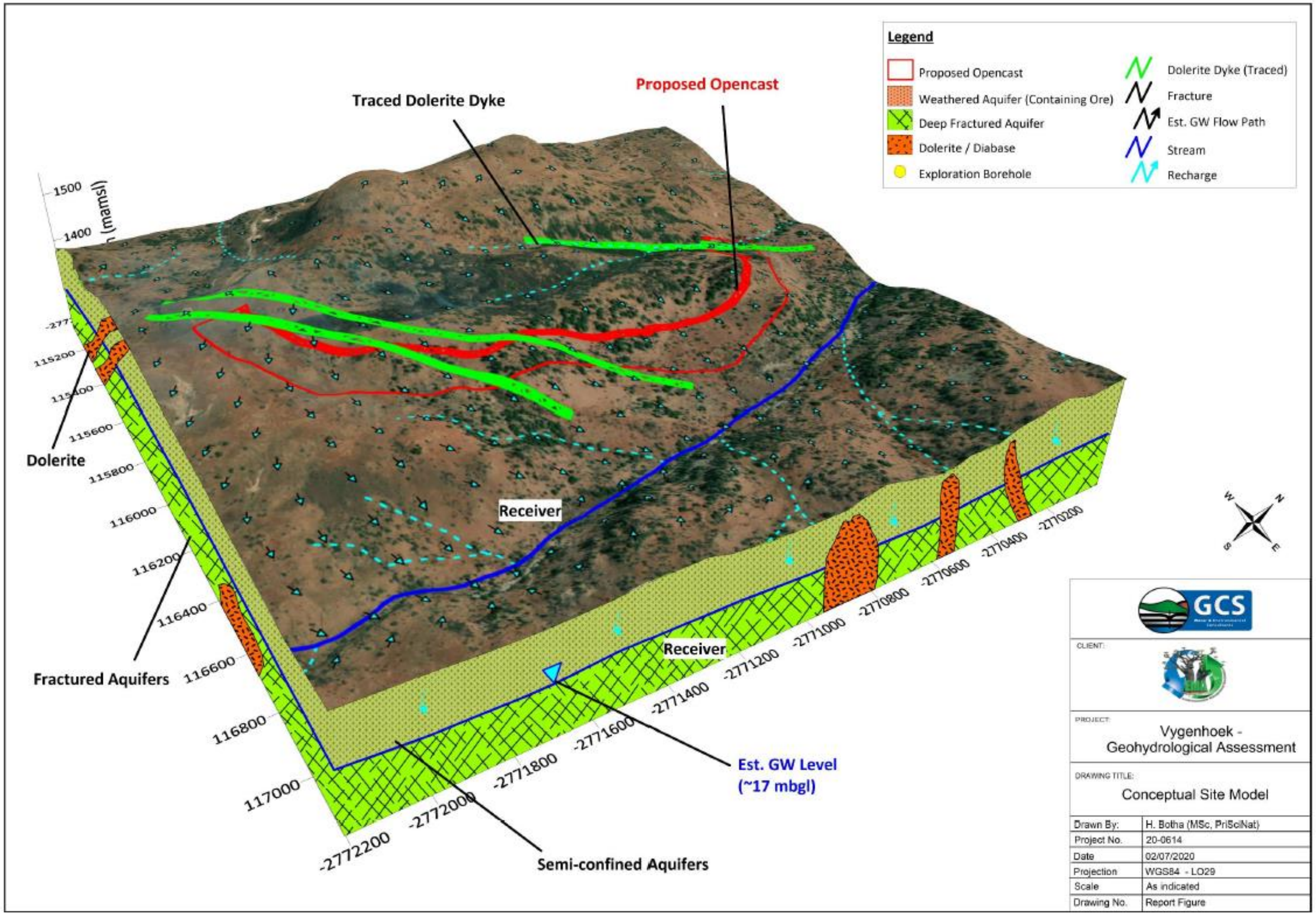


Figure 43: Site conceptual model

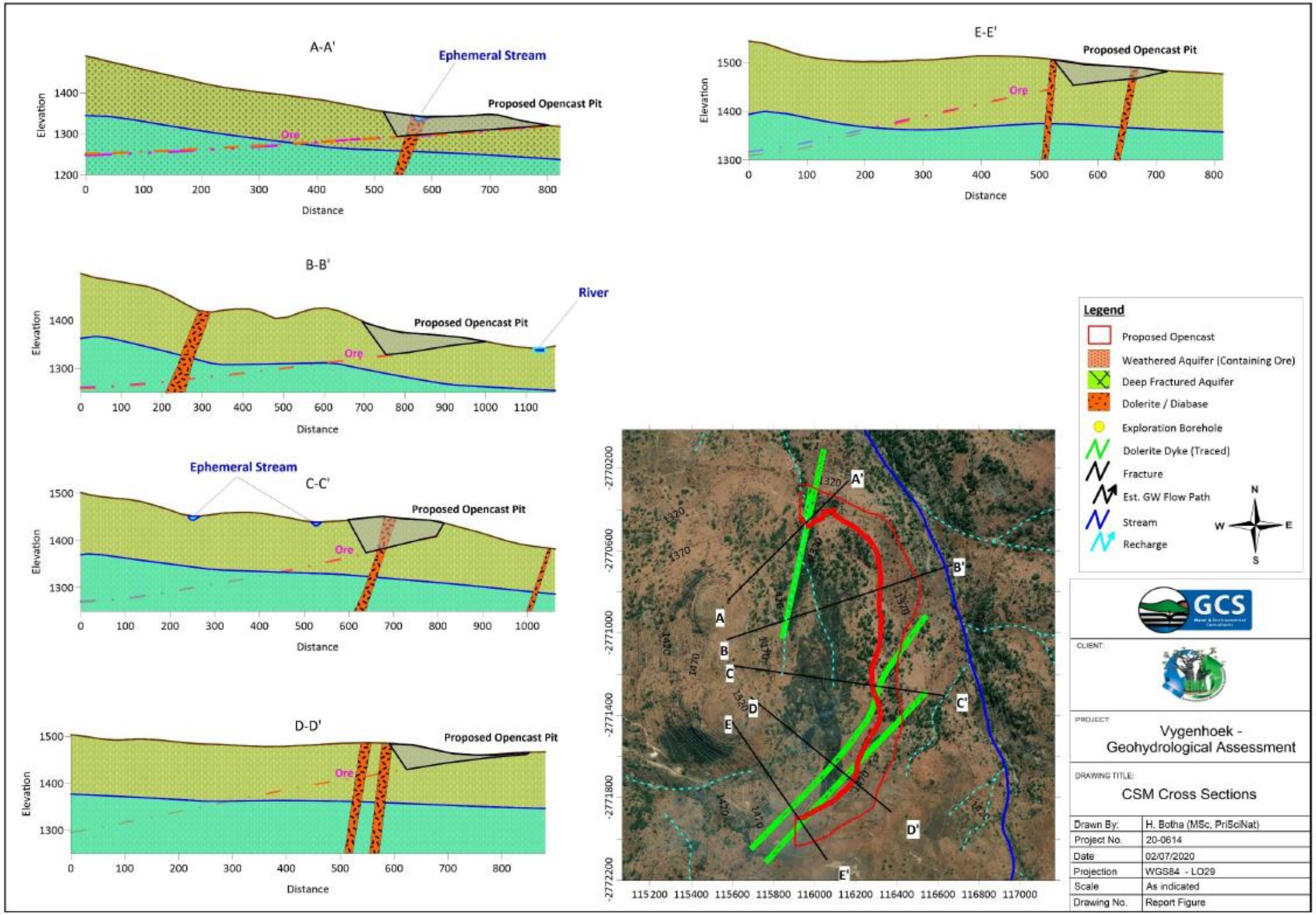


Figure 44: Cross section

Preliminary impacts and mitigation measures

Risk assessment entails the understanding of the generation of a hazard, the probability that the hazard will occur, and the consequences should it occur.

Key assumptions made:

- The risk/impact assessment conducted for the site is based on available data, as discussed earlier in the report.
- The risk/impact assessment incorporates a worst-case scenario approach.
- Average aquifer transmissivity and groundwater velocities calculated previously, applied to the general study area.
- Groundwater levels mimic the topography.
- Bayesian interpolation of available on-site water level was applied to conceptualise the groundwater flow and groundwater depth in the study area.

The anticipated geohydrological impacts are indicated in and **Figure 45**. **Table 17** list preliminary impacts and mitigation measures for the Proposed Vygenhoek Mine.

It is recommended that a follow-up geohydrological assessment, incorporating numerical flow and transport modelling be undertaken to refine the preliminary risk and impact assessment.

Table 17: Preliminary risk assessment

POTENTIAL ENVIRONMENTAL IMPACT	APPLICABLE AREA	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION						
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP
Matters About Hydrogeology (Groundwater Related Impacts)																	
Pre-Mining / Preparation Phase																	
• Exposure of soils, leading to increased runoff from cleared areas and erosion of the watercourses, and thus increased the potential for sedimentation of the watercourses. • Soil compaction; and • Soil erosion.	Site preparation, including placement of contractor laydown areas and storage (i.e. temporary stockpiles, bunded areas etc.) facilities	Earthworks	6	2	1	6	54	-	M	• Only excavate areas applicable to the project area. • Cover excavated soils with a temporary liner to prevent contamination. Keep the site clean of all general and domestic wastes. • All development footprint areas to remain as small as possible and vegetation clearing to be limited to what is essential. • Retain as much indigenous vegetation as possible. • Exposed soils to be protected by means of a suitable covering. • Existing roads should be used as far as practical to gain access to the site, and crossing the rivers in areas where no existing crossing is apparent should be unnecessary, but if it is essential crossings should be made at right angles.	2	1	1	3	12	-	L
	Disturbing vadose zone during soil excavations / infilling activities	Earthworks	6	2	1	6	54	-	M		2	2	1	3	15	-	L
Surface water contamination	Leakages from vehicles and machines.	Mechanised machinery	2	1	1	5	20	-	L	• Visual soil assessment for signs of contamination at vehicle holding, parking and activity areas. • Place oil drip trays under parked construction vehicles and hydraulic equipment at the site.	0	1	1	2	4	-	L

POTENTIAL ENVIRONMENTAL IMPACT	APPLICABLE AREA	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION						
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP
Operational Phase																	
Soil disturbance	Opencast pits	Earthworks	3	3	2	4	32	-	M	• Only excavate areas applicable to the project area. • Cover excavated soils with a temporary liner to prevent contamination. • Keep the site clean of all general and domestic wastes. • All development footprint areas to remain as small as possible and vegetation clearing to be limited to what is essential. • Retain as much indigenous vegetation as possible.	1	3	2	4	24	-	L
Hydrocarbon spills	Opencast pits	Mechanised machinery	4	3	2	4	36	-	M	Park vehicles in areas lined with concrete or fitted oil traps. Ensure vehicles are in good condition and not leaking fuel or oil when entering the mining areas. Do not service machinery in the opencast areas. Have oil & fuel spill kits on site.	2	2	2	2	12	-	L
Poor quality seepage from overburden dumps into the aquifer and downstream surface water bodies (non-perennial streams).	Opencast pits	Seepage	4	3	2	4	36	-	M	Reduce footprint areas to minimize the reaction flow path of rainfall water.	4	2	2	3	24	-	L
Drawdown of the regional water table as the opencast workings flood. Possible reduced baseflow of streams within 500 m of the workings.	Opencast pits	Aquifer drawdown	6	2	2	2	20	-	L	Water level monitoring in nearby boreholes.	6	1	2	2	18	-	L

POTENTIAL ENVIRONMENTAL IMPACT	APPLICABLE AREA	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION						
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP
Flooding of the opencast workings while operational. Potentially from contact zones or 1:100Y flooding events.	Opencast pits	Flooding	6	2	2	3	30	-	M	Ensure that dewatering pumps are on standby to dewater should there be any seepage or accumulated rainwater in the pits. This is likely only to occur during high precipitation events or if mining intercepts a contact area under hydraulic pressure.	6	1	2	3	27	-	L
Closure / Decommissioning Phase																	
Poor quality mine drainage into nearby non-perennial streams and the groundwater aquifer system.	Opencast pits	Seepage	4	5	2	4	44	-	M	Divert poor quality water to treatment facilities. Backfill the area which is likely to form a pit lake. Capping/covering of the pits to reduce infiltration and subsequent poor quality seepage. Moreover, co-disposal will decrease poor quality AMD (as proved by the kinetic leach testing). Update predictive groundwater flow and geochemical numerical models yearly. Water monitoring for a term at least 2-3 years after pit closure, to reconfirm closure objectives.	4	5	2	3	33	-	M
	Overburden dumps	Seepage	4	5	4	4	52	-	M		4	5	2	3	33	-	M
Decant from the opencast workings.	Opencast pits	Decant	1	1	1	1	3	-	L	Ensure opencast workings are infilled below the regional groundwater table (if possible). However, if infilling must proceed above the remaining water level than it should be below the identified decant levels - to be re-evaluated in follow up-geohydrological studies). Water quality monitoring.	1	1	1	1	3	-	L

POTENTIAL ENVIRONMENTAL IMPACT	APPLICABLE AREA	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION						
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP
Drawdown of the regional water table as the opencast workings flood. Possible reduced baseflow of streams within 500 m of the workings.	Opencast pits	Aquifer drawdown	6	5	2	2	26	-	L	Water level monitoring in nearby boreholes.	6	5	2	1	13	-	L
Subsidence of surface topography	Opencast pits	Collapsible soils for infilled areas.	4	2	1	5	35	-	M	Infilling material should be compacted to ensure a stable work platform. Stability testing before capping layer is installed.	4	1	1	1	6	-	L

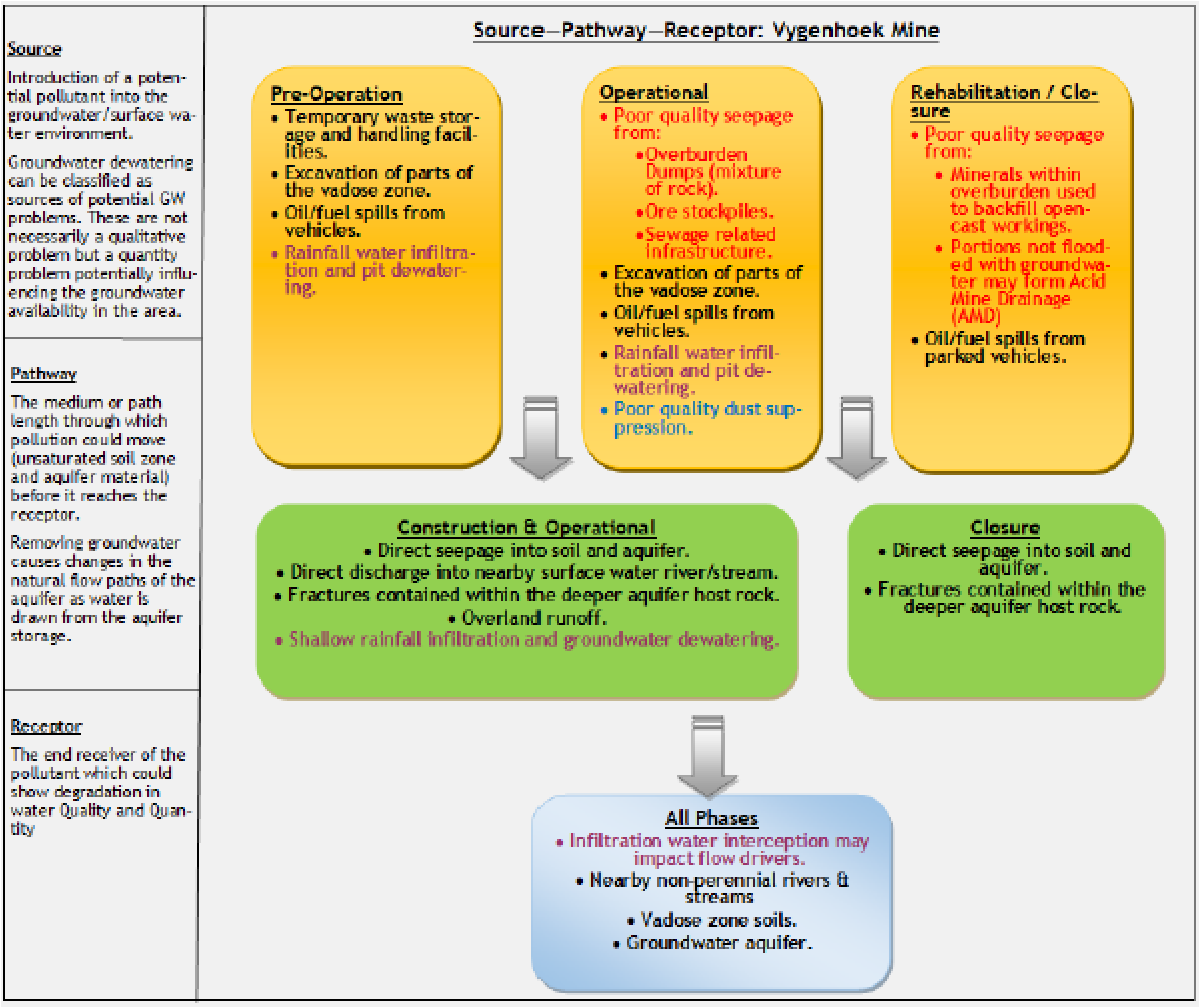


Figure 45: Vygenhoek Source-Pathway-Receptor

Terms of reference for EIA

- It is recommended that a follow-up hydrological assessment be undertaken before mining:
    - A geophysical assessment of the mining areas should be undertaken as soon as the areas are cleared for mining. It is important to map preferential groundwater flow paths towards the receiving environment and to update the groundwater risk assessment. Subsequently, dedicated groundwater monitoring boreholes should be drilled in these preferential flow path areas to update and improve the proposed monitoring network.
    - At least three (3) constant rate pump tests should be undertaken (once-off) as part of the monitoring programme, to update aquifer hydraulic parameters and the site conceptual models.
    - A geochemical assessment including geochemical testing of ore and overburden rock is recommended to update the source terms for the mine.
- Develop a numerical groundwater flow and transport model to:
    - Evaluate preferential flow paths and groundwater migration velocities.
    - Evaluate long term and post-closure transport movement into the surrounding aquifer;

- Track preferential flow paths and changes to groundwater flow;
- Ensure no monitoring network gaps exist (i.e. check if the monitoring network is representative of the site); and
- Update the numerical groundwater model annually.

- Undertake baseline water quality sampling and a hydrocensus to verify existing groundwater users in the study area; and baseline water quality (ambient water quality).
- A groundwater management and acid mine drainage (AMD) management plan should be formulated to ensure the impact on the groundwater environment is limited and mitigated.

XII. Seismicity (GCS, July 2020)

Southern Africa is, by global standards, a seismically quiet region as it is far from the boundaries of tectonic plates and active continental rifts. Seismicity in South Africa arises from both natural sources (e.g. plate tectonic forces, buoyant uplift of the continent after erosion) and human-induced sources (e.g. rock failure caused by mining-induced stresses, slip on faults caused by changes in load and pore fluid pressure during the filling of reservoirs, and vibrations produced by blasting for open-pit mining, civil excavation and the disposal of expired munitions). Most earthquakes are induced by deep-level mining for gold and platinum, and thus restricted to the mining districts (refer to **Figure 48**). However, natural earthquakes do take place from time to time. They are driven by various tectonic forces, such as the spreading of the seafloor along the mid-Atlantic and mid-Indian ocean ridges, the propagation of the East African Rift System, and the response of the crust to erosion and uplift (Durrheim & Manzunzu, 2019).

Seismic intensity of the project area

Based on the location of the site, the seismic intensity is (MMS) VI (Council of Geoscience, 2020) and the corresponding liquefaction hazard is “Marginal” with a peak horizontal ground acceleration of between 50 and 100 cm/s2 (refer to **Figure 48**).

Table 18: Summary of seismicity assessment terminology

Magnitude (M)	Magnitude (M) is a measure of the energy released by the earthquake and the amount of slip on the fault. Seismograms recorded by many widely-spread seismograph stations are used to assign a single magnitude to an event. The SANSN uses either the local magnitude scale (ML) or the moment magnitude scale (Mw), which are essentially equivalent for M<6.5. The ML scale uses the maximum amplitude of ground motion recorded at the various local stations, is quick and easy to measure, but saturates above M6.5. The Mw scale takes the entire seismogram into account and is derived from an assessment of the mass of rock moved (or work done, hence the subscript ‘w’) by the earthquake. Mw does not saturate and can be estimated from local, regional or global

	stations. It has been calibrated to match ML for $M<6.5$. Earthquakes are generally divided into the following categories: micro $M<3$, small $3<M<5$, moderate $5<M<7$ and major $M>7$. Natural earthquakes are generally only felt when $M>3$ and only cause significant damage when $M>6$. However, people unaccustomed to earthquakes may be frightened by the shaking that is produced by an M5 event, even though the amplitude of ground motion is only 1/10 that of an M6 event. It should be noted that earthquakes induced by mining or fluid injection may cause damage if $5<M<6$ because they generally occur at much shallower depths than natural events
Intensity (I)	Intensity (I) describes the shaking experienced on the surface of the earth. Intensity generally decreases with distance from the epicentre (the point on the earth's surface above the earthquake source), but is also affected by near-surface geology. Shaking is generally amplified where there is a thick layer of alluvium. Reports by many widespread observers are collated to derive Intensity Data Points (IDPs) and compile an isoseismal map. The SANSN uses the Modified Mercalli Intensity (MMI) scale. The levels of the intensity scale can be roughly related to the Peak Ground Acceleration (PGA), a quantity that is used by engineers to design structures. It is expressed either in terms of gals (cm/s^2) or the acceleration of gravity (g, 9.8 m/s2). To give some examples: an MMI of III (0.001 – 0.002 g) indicates ground motion that is perceptible to people, especially on the upper floors of buildings; VI (0.02 – 0.05 g) is felt by all, many people are frightened and run out of doors, and a few buildings may be slightly damaged; VIII (0.1 – 0.2 g) causes slight damage to earthquake-resistant structures, considerable damage to solid buildings, and great damage to poorly-built buildings; while XII ($>$ 2 g) indicates destruction, with objects thrown into the air. The resonant frequency of structures depends on their height and footprint. Thus engineers make use of estimates of the Peak Spectral Acceleration (PSA), a measure of ground motion at particular frequencies, to determine if structures will respond to an earthquake.

In terms of SABS 0160 (1989) and updated by the CGS (2003) for the design of structures, this is equivalent to a max of 0.1g and represents the lower level above which additional structural elements need to be considered to accommodate any excess movement/vibration due to earthquakes.

Landslides

Comprehensive surveys of the landslide hazards in South Africa have been conducted by Singh et al. (2008, 2011). The landslide susceptibility map is shown in **Figure 46**. [Note that the predominant trigger of landslides is intense rainfall, not earthquakes.]

Landslide susceptibility ranges from very-low to low for the proposed Vygenhoek mine area.

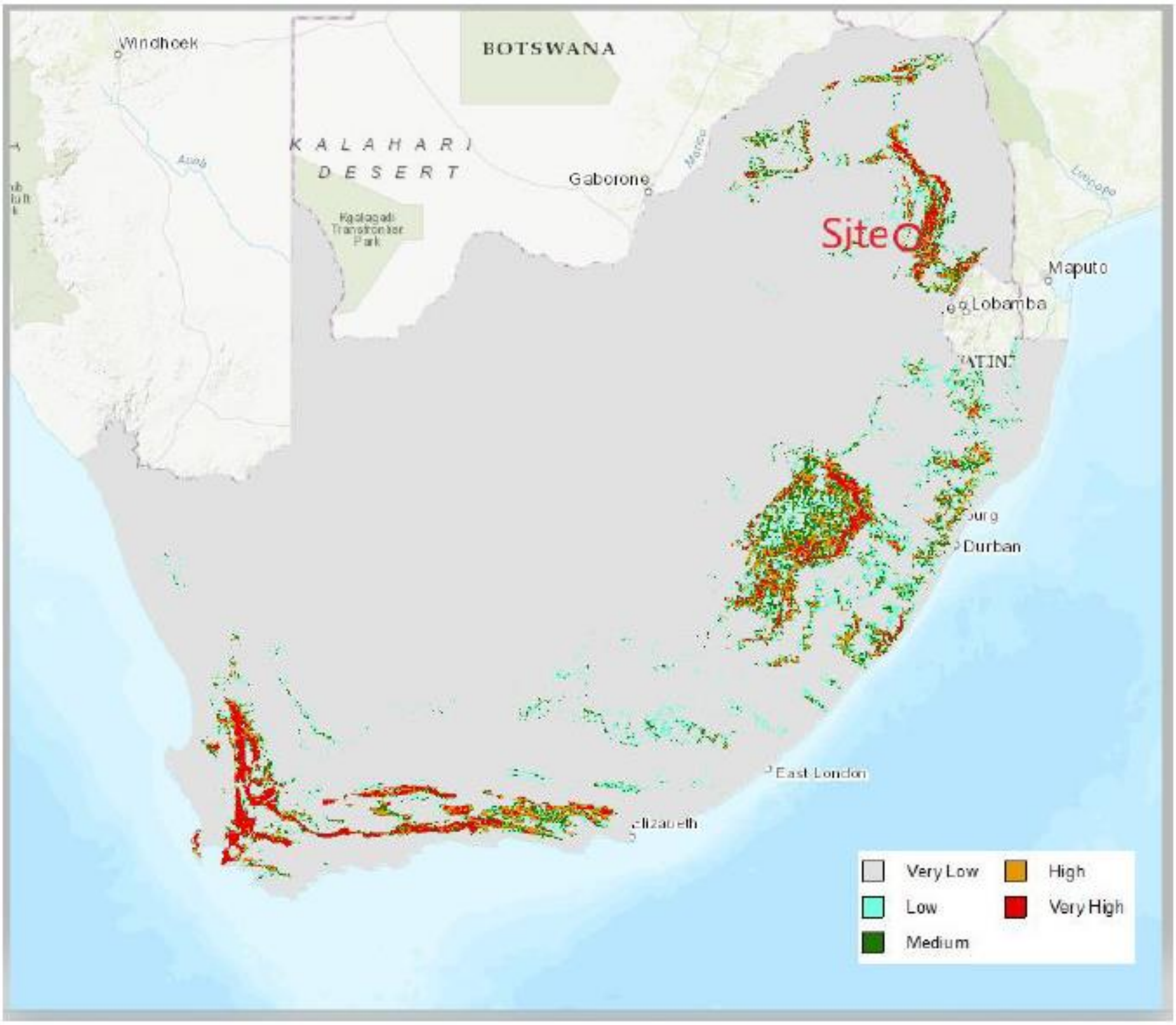


Figure 46: Landslide susceptibility map (Council of Geoscience, 2020)

Collapsible soils

Collapsible soils, also known as metastable soils, are unsaturated soils that undergo a large volume change upon saturation. The sudden and usually large volume change could cause considerable structural damage. The most common types are aeolian soils, typically wind-deposited sands and or silts, such as loess, aeolic beaches, and volcanic dust deposits characterized by showing in-situ high void ratios and low unit weights; and residual soils, which are a product of the in-situ weathering of local parent rocks that leaches out soluble and colloidal materials producing soils with a large range of particle size distribution and large void ratios.

The proposed Vygenhoek mine falls within an area not associated with collapsible soils. Hence, no collapses in soils due to seismic activity is anticipated. Collapsible soils, also known as metastable soils, are unsaturated soils that undergo a large volume change upon saturation. The sudden and usually large volume change could cause considerable structural damage. The most common types are aeolian soils, typically wind-deposited sands and or silts, such as loess, aeolic beaches, and volcanic dust deposits characterized by showing in-situ high void ratios and low unit weights; and residual soils, which are a product of the in-situ weathering of local parent rocks that leaches out soluble and colloidal materials producing soils with a large range of particle size distribution and large void ratios.

The proposed Vygenhoek mine falls within an area not associated with collapsible soils. Hence, no collapses in soils due to seismic activity is anticipated.

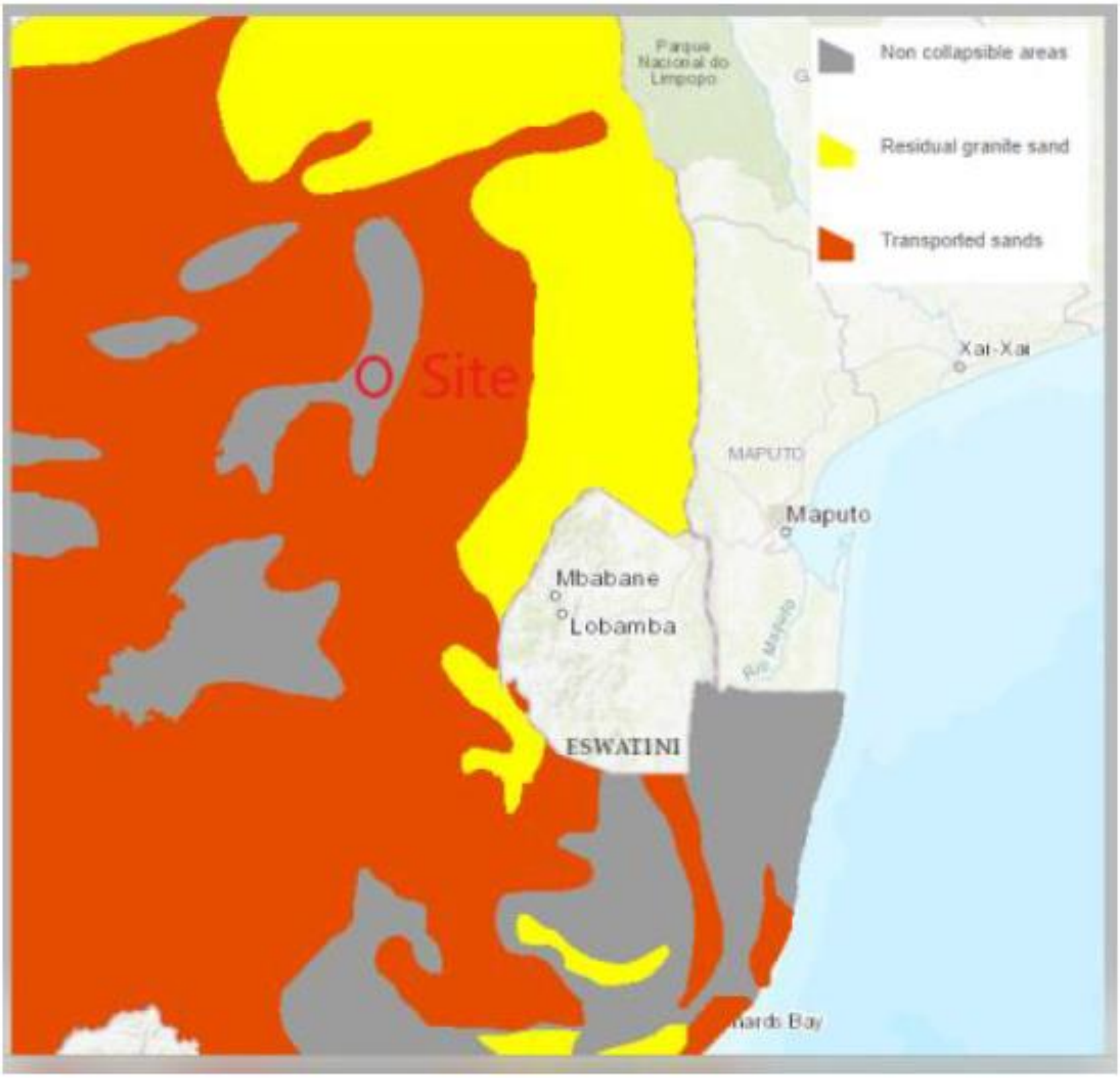


Figure 47: Collapsible soils (Council of Geoscience, 2020)

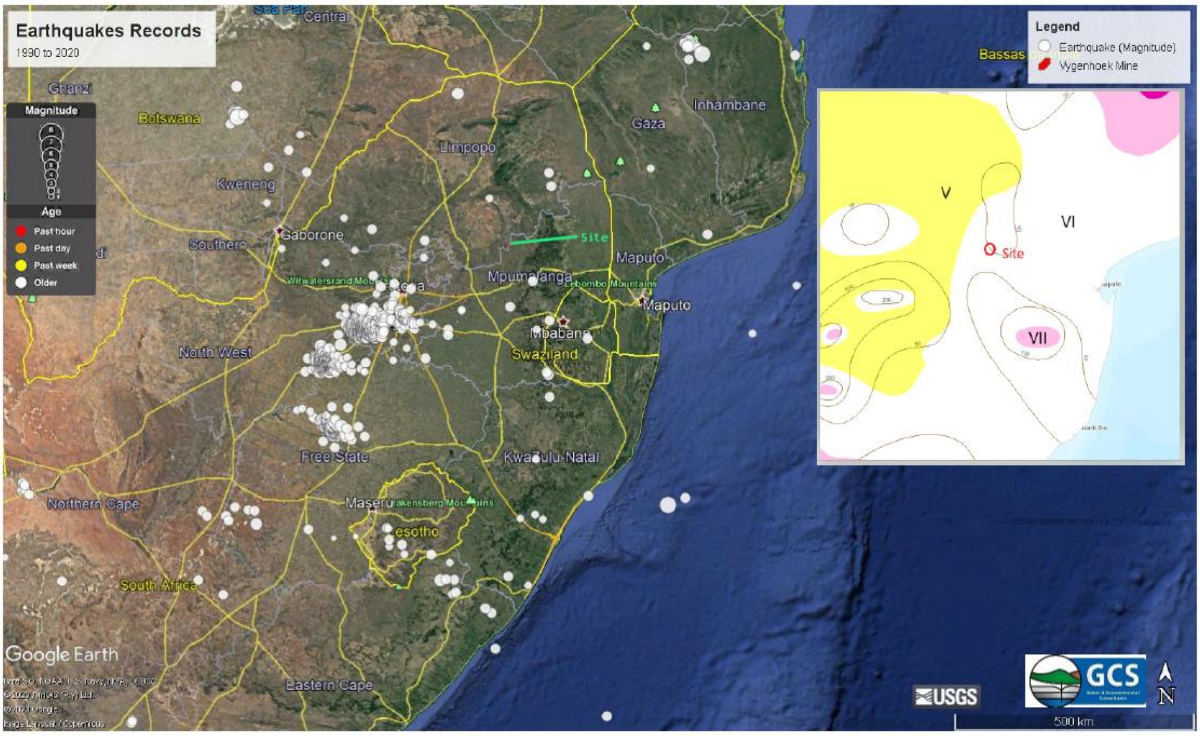


Figure 48: Location of recorded earthquakes in Southern Africa from 1900 – 2020 and MMS

Terms of reference for EIA

Based on the desktop level seismicity assessment undertaken, the following conclusions are drawn:

- The proposed Vygenhoek mine is situated in an area where seismic intensity is low, and the liquefaction hazard is "Marginal".
- The proposed Vygenhoek mine is situated in an area not prone to cause collapsible soils; and
- The proposed Vygenhoek mine is situated in an area with a very low to low probability of causing landslides.

Based on the above no further seismic intrusive work would be required. However, it is recommended that a slope stability assessment be conducted to inform the mine plan as soon as mining starts. The slope stability assessment can help prevent landslides typically associated with high walls and steep-sloped areas.

XIII. Human Health (Adaptera Strategic Support Services, June 2020)

A desktop-based scoping exercise for a Health Impact Assessment (HIA) has been conducted by Adaptera Strategic Support Services in June 2020 for the proposed Vygenhoek Platinum Mine project (see **Appendix N** for the detailed report).

SSSeSee *Scope of HIA*

At this stage, only the scoping phase of the HIA is being conducted via desktop research. Scoping, according to the International Finance Corporation (2009) is a process of outlining the range and types of hazards and beneficial impacts and setting the geographical, timescale and population boundaries to the assessment. This stage of the HIA process also establishes TOR, if needed. The overall types and categories of questions that should be addressed are defined at this stage. And it is essential to develop a description and general knowledge of the project, covering location, size, workforce, surrounding communities, operations, and likely exposures.

Geographical

For the purpose of this report, the scope of the study encompasses the project area (see **Figure 49**) which includes a 10km, 20km and 30km radius around the project, as situated near the main town of Lydenburg (Mashishing), Mpumalanga Province, South Africa.

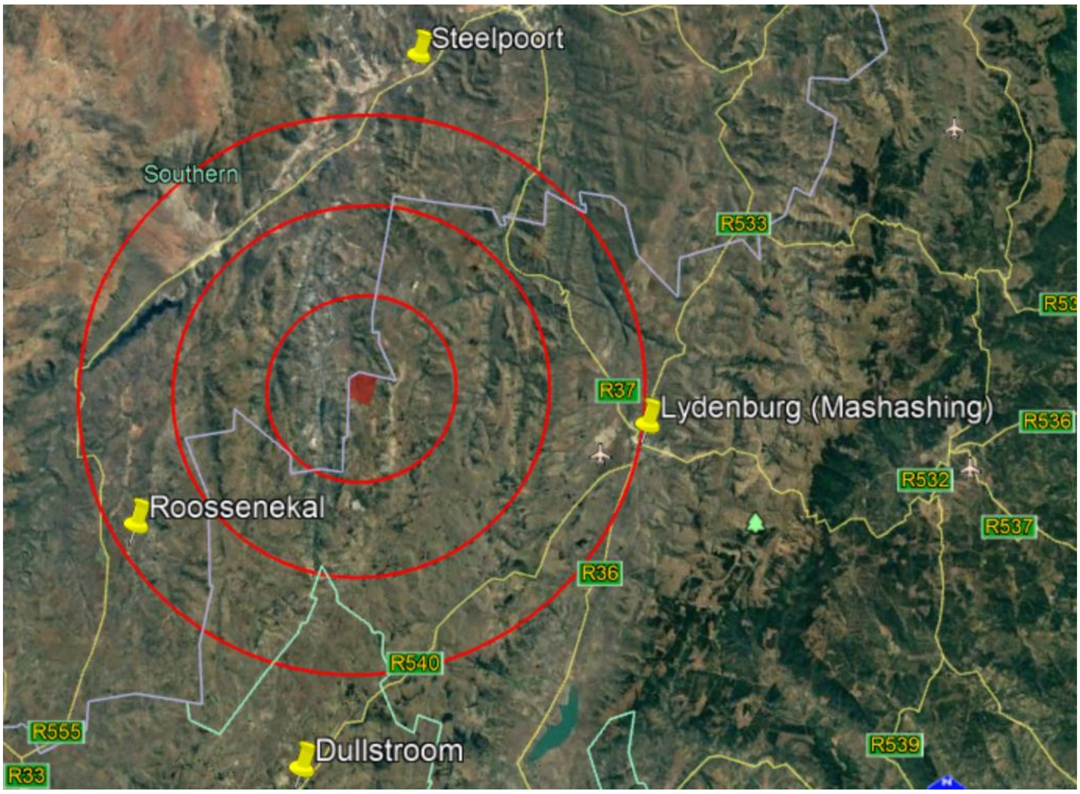


Figure 49: Project location in relation to nearby towns – radius of 10 km, 20 km, and 30 km respectively

Potentially Affected Communities

A Potentially Affected Community (PAC) is a defined community within a clear geographical boundary where project-related health impacts may reasonably be expected to occur. The PACs which have been identified for this project are:

- Farming Communities (agriculture and livestock) = <10km+
- Steelpoort (Ga-Mapodila, Pelaneng, Matholeng, Ga-Matate, Ga-Mampuru, Ga-Masha, Kokwaneng, Mmaphoko) = 20-30km
- Lydenburg (Mashashing) = 30km
- Roossenekal = 30km

- Dullstroom (Sakhelwe) = 40km

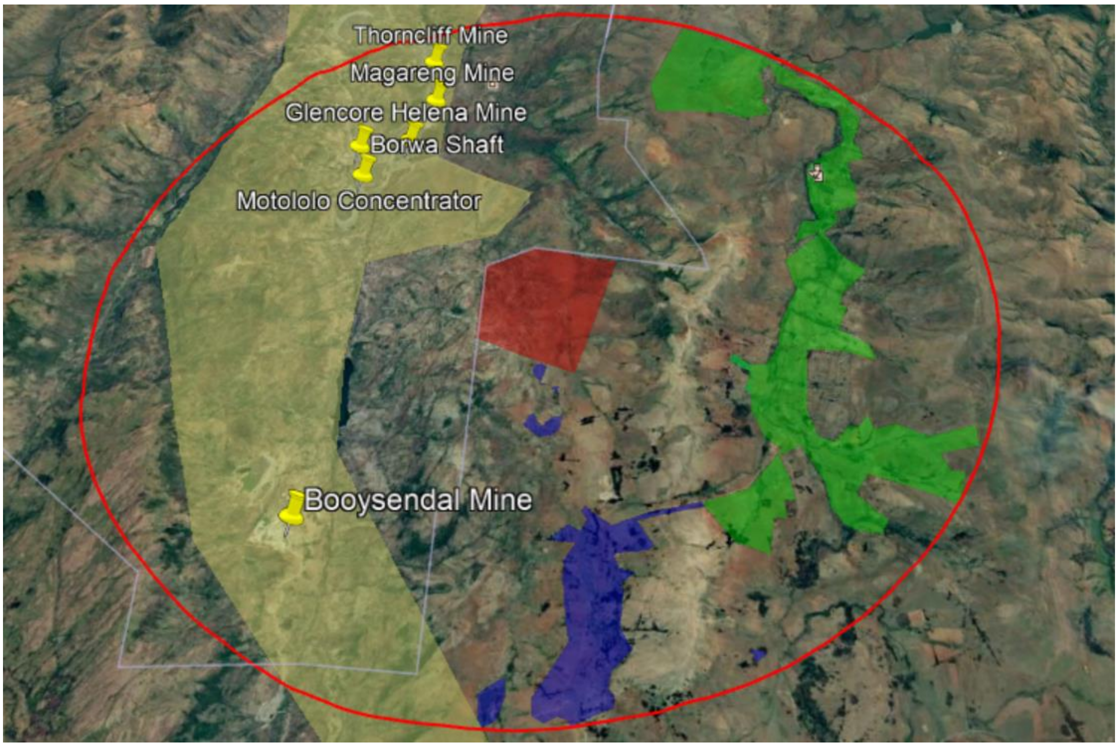


Figure 50: Potentially affected communities within the 10 km radius

Stakeholder engagement

Effective stakeholder engagement is integral to the quality of health impact assessment and to the success of associated mitigation actions (IFC, 2007). Although stakeholder engagement was not included during this reporting process, it is highly recommended as part of the follow-up and HIA process. Key stakeholders to engage with include, but is not limited to:

- The farming community (livestock and agricultural farmers)
- Local communities residing within, adjacent to and potentially impacted by the project footprint
- Local Municipal Health and Labour Departments (Lydenburg/Mashashing)
- Other Mining Operations in the Area
- Any other relevant/key stakeholders who may potentially be impacted upon by the project

Potential Health Impacts

The health and wellbeing impacts described here can occur at any time during the mining and metals lifecycle from exploration and construction to operation and closure.

These impacts can be classified into:

1. Health outcomes

2. Health determinants
3. Health equity/inequality
4. Cumulative impacts

Impacts of mining and metal projects on health outcomes

Health outcomes are measurable changes in the health status of an individual, group or population which are attributable to an intervention or series of interventions. Health outcomes may be intended or unintended and may not become apparent for many years.

The following represents the types of *health outcomes* considered during a HIA:

- Infectious diseases: Malaria, HIV and Influenza, COVID-19
- Chronic diseases: Heart disease, cancer, bronchitis, asthma, silicosis, pneumonocniosis
- Nutritional disorders: Malnutrition, vitamin deficiencies and obesity
- Physical injury: Accidents, heavy metals and chemical poisoning, hearing loss, community unrest often resulting in violence
- Mental health and wellbeing: Suicide, depression, stress, and anxiety

Impacts of mining operations on health determinants

Health determinants (also known as the wider environmental and social determinants of health and wellbeing) are the social, economic, environmental, and cultural factors, the living conditions that indirectly influence health and wellbeing. They include what we eat and drink; where we live and work; and the social relationships and connections we have with other people and organizations. Some determinants such as sex, age, family history of illness is unmodifiable while others are modifiable through community interventions. It is the modifiable determinants that are the focus of HIA.

HIA assesses both the direct physical health impacts on community health, for example traffic injury, emissions into the air, water and soil, and the indirect impacts on health via health determinants. The following sub-sections outline the various ways a mining operations can influence the wider environmental and social determinants of health and wellbeing.

- Employment and economy:
  - Mining operations can bring prosperity and new goods and services to an area and thereby help improve the quality of life and living standards of local people. The increase in income, development of new local businesses linked to the project, access to new markets for local goods and produce and access to new services and amenities can have a significant beneficial effect on individual and community health and wellbeing.
  - However, new goods and services can negatively impact some sectors of the local economy. Employment opportunities in a new project may also preclude people from carrying out other important roles that they previously fulfilled e.g. childcare, food gathering, and leadership roles in the community. The employment of women may have particularly significant effects on family and community social relationships and thus appropriate support mechanisms should be considered. Similarly, an increase in commercial sex workers (CSW) while having short term benefits for clients and CSWs can have significant, long term, negative individual and community health and wellbeing impacts.
  - The potential peaks and troughs in international demand for mined materials and the limited lifespan of such projects (10-20 years) can have significant social, economic, and personal costs. For example, when a mine closes and migrant workers leave, it is not only the mining jobs that are lost, but local businesses, supplying goods and services to the mine and its workers, are also affected in ways that cannot be reversed when the project closes. In such a situation a return to traditional industries (e.g. agriculture) may not be possible if land use has changed and skills have not been passed on from one generation to the next.
  - Good enhancement and mitigation measures with a focus on local recruitment, enhancing local skills and developing plans for what will happen as and when the project closes are likely to minimize the potential negative impacts.
- Housing and shelter:
  - Mining operations can help to support local housing markets by building new accommodation; providing higher employment incomes with which local people can buy land and/or improve their existing homes; and by increasing private sector rental opportunities.
  - Hostel accommodation and camps are commonly constructed to house project workers. This can bring with it a range of risks and opportunities in relation to health and wellbeing (e.g. water supply, sanitary installations, ventilation, and the control of infectious diseases). The influx of unemployed persons seeking work can also create pressures on existing housing leading to higher land and house prices, higher rents, housing shortages for existing residents, land invasions, informal settlements and overcrowding.
  - In addition, existing local housing can be affected physically through vibration effects both during construction and operation that, in severe cases, can lead to subsidence and physical damage. In

some cases, local communities may need to be resettled away from the project site and this too can have negative health impacts from the social, economic, and cultural dislocation that occurs.

- Good planning and close working with local communities and local government can help to reduce the potential negative impacts on local housing.

- Water supply and sanitation:
  - Access to clean water and good sanitation are a fundamental determinant of health and can be positively or negatively affected by mining operations. Projects can be heavy users of local water and can also release materials into existing water sources. Similarly, projects can place pressures on existing sanitation and water supply systems because of the increase in population in the area.
  - A water supply and sanitation plan for workers is vital. This can include separate water supply and sanitation systems and/or social investment in upgrading existing local water supply and sanitation systems. Such enhancement can improve local public health as well as the productivity of workers through reduced sickness absence and reduced demand on both project and community health and social care services.
- Transport and connectivity:
  - Mining operations can lead to the construction of new road, airport, rail and port connections. These can have positive health impacts because they create easier access to public and commercial goods and services (e.g. health care) as well as enabling people to access new economic and educational opportunities in other villages, towns and cities.
  - However, they can have negative health effects through traffic injuries, chemical spillages, air pollution, noise pollution, oil/fuel run offs, and reduced physical activity due to the use of motorised transport in place of walking and cycling. They can also facilitate human and animal pest migration in ways that can increase the transmission of new and existing infectious diseases. Heavily trafficked roads can also become a barrier to the free movement of people within a community (severance) if traffic flows are high, there are few safe crossing points and roads are damaged by heavy lorries.
  - These potential negatives can be minimized through good design, transport planning and appropriate transport mitigation measures.
- Learning and education:
  - Skills learnt in the mining industry, and related businesses, can help to make local people more employable in the other industries. In addition, mining operations may bring wider prosperity that improves local infrastructure such as schools and libraries and increases the educational opportunities and resources that parents can afford for their children.
  - However, as identified earlier, there can be a loss of traditional skills in agriculture and local crafts as young people focus on getting jobs linked to the operation.

  - Support for local schools and for local industries through funding, volunteering, and the teaching of more cost-effective methods for existing activities, can ensure that the diversity of local sources of employment and traditional skills are maintained and enhanced.
- Crime and safety:
  - The increased income and economic opportunities that a mine brings can reduce the potential for crime and enhance community safety as more legitimate economic opportunities develop. However, the influx of new people also has the potential to increase crime and anti-social activities. The mixing of communities from separate ethnic groups and cultures may lead to tensions or the weakening of social controls that have traditionally maintained order in local communities. The project itself, as well as the increase in the local population, may stretch the capacity of local police, fire, and other related services to deal with incidents.
  - Understanding the local context, good communication and working in partnership with local communities and the local police service can ensure that many crime and safety issues are prevented from happening.
- Health, social care, and public services:
  - Mining operations can have a positive impact on health and social care services, whether provided by the public, voluntary or private sectors by identifying existing community health problems and needs, putting additional funding into local services and infrastructure, and working jointly with local health, social care and community development workers to address local needs. Due to increased prosperity and other improvements, the proportion of households requiring assistance may also be reduced.
  - However, mining operations may also place additional pressures on local health, social care and public services (including emergency services) due to the increase in population that they can bring, particularly if they also cause disruption and lead to new, or exacerbate existing, health and social problems.
  - Most mines have their own medical facilities and services available to the workforce. These can be overwhelmed by local people demanding to be treated in them if existing local health services are seen to be inadequate, inaccessible, or expensive.
  - Developing a good baseline profile of the existing health and wellbeing status of local communities and the capacity of local health services is critical in minimizing any potential pressures on local public services. There also needs to be close partnership with local health, social care and NGO welfare services in order to develop a plan to manage demand, enhance service capacity (medical supplies, equipment and personnel), and most importantly, develop and implement preventative public health measures.
  - A health facilities audit can help to get a clear understanding of the capacity of the local health system to deliver health and social care. Such an audit should consider the private as well as the public

health system - in many countries most of the primary and secondary health care may be provided by private specialists who charge a fee. Traditional medical practices and individual and family health seeking behaviours should also be assessed. Traditional practitioners are often important health actors and act as gatekeepers to some community sub-groups.

- Alongside building local health service capacity and funding health promotion and disease prevention programs it is also important to develop effective health information systems and health management systems to help monitor and evaluate the positive and negative health and wellbeing impacts of the project. It may also be useful to allow limited public access to the project's medical services so that capacity building within local health services can take place.

- Commercial goods and services:
  - The increase in access to a wider range of goods and services (e.g. medicines, food and household supplies) that a mining operation can bring could lead to positive health and wellbeing impacts through reducing exposure to risks, enhancing individual and community resilience, speeding up recovery from illnesses and stabilizing existing health problems.
  - However, high demands on existing local goods and services could increase costs for local people. Any price increases for basic items will disproportionately impact on those on low incomes. There is also a risk that 'junk' food, cigarettes, gambling, alcohol, and drugs may become more available and affordable to local communities, thus increasing their risk to new health and social problems. In addition, demand for prostitution may increase, leading to long term psychosocial harm for those forced into the sex industry, as well as increased transmission of sexually transmitted infections and other social harms associated with commercial sex work.
  - Many of these can be mitigated through good planning and working closely with local communities, NGOs, local government and health and social care agencies.
- Social capital and community cohesion:
  - The stimulus that a mining operation can bring to a local economy can help to strengthen and deepen social ties by increasing the prosperity of the community and providing resources for people to take on a wider range of social and community activities.
  - However, community tensions can arise if there is conflict between those who support and those who oppose a proposed project. In addition, the new people who come into the area may further affect the cohesion of local communities. For example, as young people are exposed to new ideas, new ways of doing things and different perspectives they may clash with existing social structures, traditions, and norms. There may also be tensions between skilled and unskilled workers and discrimination against migrants.
  - To deal with these issues effectively there needs to be a detailed understanding of the local social and cultural context and good links with local communities, religious institutions, and local NGOs.
- Spirituality, faith, and traditions:

- Mining operations generally do not have any direct effects on people's spirituality, faith and traditions. However, spiritual, and traditional activities and events (e.g. festivals, religious ceremonies and birth, death and marriage rites) may be disrupted by construction and operation activities. For communities whose spirituality and identity are strongly connected to the land, damage to the landscape caused by a project's activities or loss of access to sacred sites may harm their spiritual wellbeing. In such communities, relocation is likely to be doubly damaging to their sense of self and mental wellbeing.
- Here again good links and communication with local communities, religious institutions and NGOs alongside good training of project staff can help to ensure that sacred places are not inadvertently desecrated and that spiritual customs are respected.

- Arts and cultural activities:
  - Mining operations may expand the audience for local arts and crafts and help to develop commercial markets for traditional arts and culture. Projects may also bring in new forms of art and culture e.g. movies and new forms of dance. Conversely, they may disrupt communal artistic or cultural activities.
  - Good links with local communities and local NGOs can help to ensure that cultural activities are not disrupted, and are even potentially enhanced through support of these activities through money, staff time and other resources e.g. building materials, paints, skills, etc.
- Leisure and recreation:
  - There can also be both positive and negative effects on local leisure and recreational activities because of the changes that a mining operations brings. Of particular interest, from a public health perspective, are changes to levels of physical activity. Small daily changes in walking, cycling or sporting activity can have significant effects on a range of health outcomes including heart disease, certain cancers and mental wellbeing.
  - Good links with local communities and community health and development workers can help to ensure that any such disruption is kept to a minimum.
- Lifestyle and daily routines:
  - There can be temporary or long-term changes to people's lifestyles and daily routines because of mining operations, especially in isolated indigenous communities. Many of these changes have already been discussed and include changes to livelihoods, food supply, access to goods and services, means of transport, faith and traditions, educational opportunities and exposure to chemicals and infectious diseases.
  - The greater the collective incidence of such factors, which interfere with and disrupt lifestyles and everyday routines, the greater the mental, emotional and community nuisance and turmoil that the project is likely to generate. These in turn can manifest in physical and mental ill health, stress, anxiety, and opposition to the project.
  - Developing an integrated approach to mitigation and enhancement and good communication can ensure that disruption is kept to a minimum and is tolerated by local communities.

- Governance and public policy:
  - Large mining operations can have a major influence on national and local governance and public policy. In turn, existing governance structures and public policies can have a significant effect on how a mining operations is implemented, and on the impact the project is likely to have on community health and wellbeing. Strong, stable and transparent local government and other public institutions are more likely to be proactive in developing project partnerships to protect and enhance local communities' health and wellbeing. In contrast, weak, unstable, less participative, and less transparent public institutions can make it harder for projects to work with local agencies.
  - Whatever the local structures, proactive engagement of, and partnership with, local government can help to improve the likely overall benefits of a project for local people - and help to plan once the project ends. In addition, approaches such as having a clear and explicit anti-corruption policy for project workers and partners can also help to reduce individual and institutional corruption.
- Energy and waste:
  - The choice of energy sources used by a mining operation and the project's approach to dealing with waste can have important long term and transgenerational effects on a local community's health and wellbeing. This can occur, for example, through soil and water contamination from landfills affecting local agriculture and fisheries and the depletion of local fossil fuel stocks increasing heating and cooking costs.
  - Projects should, as much as possible, use sustainable energy sources and manage waste in a safe way, using the 3R principles, both to protect local communities and the wider environment.
- Land and spatial:
  - Mining operations can change the quality of local landscapes, soils and waterways both directly through their activities, and indirectly as the project becomes a focal point for the local and regional economies.
  - Land use changes cannot always be easily reversed and, as discussed earlier, can increase insect vectors and overcrowding leading to an increase in infectious diseases. The transmission of disease can be from human to human, insect to human and domestic animals to human as land and spatial changes make some or all these routes more favourable. It also includes emissions of various chemicals, including heavy metals, into the air, water, and soil. Lastly, when a project closes a community may be left with unproductive land.
  - Understanding the implication of land and spatial changes, and the relation of communities to each other and to key resources such as water, fuel, services and employment, can ensure that changes to local land and the spatial configuration of transport connections and settlements do not have negative health and wellbeing impacts. Lastly, a good closure plan, together with the appropriate financial resources to implement it, is important to have in place from the early design stage of a proposed project to ensure that the project leaves a positive and sustainable legacy.

Impacts of mining operations on health equity

Health equity (or health inequality) impacts are the avoidable health differences between different groups within a given population. Health inequalities are largely caused by differential exposure to health risks (e.g. pollution, violence, stress) and unequal access to factors that are associated with good health such as good quality housing, supportive social relationships, adequate and stable income, access to health care, clean water, good nutrition and education.

Most industrial projects can result in marked changes in these factors, both positive and negative. Therefore, one of the most important tasks in HIA is to analyse how the positive and negative health impacts are likely to be distributed within and across local communities.

Often the negative effects of a project, e.g. loss of land, air and water pollution and increased food costs, disproportionately affect those on low incomes, women, children, those with existing disease/disability and the elderly; whereas the positive effects, such as profits, employment opportunities, accrue to groups who are already better off. This leads to greater health inequality, and a wider health equity gap between the 'have' and have nots' within and between communities.

On the positive side, small improvements in health determinants can have significant beneficial effects on vulnerable individuals and groups. For example, immunization programs and disease and vector control programs, when applied across a community, will have significantly greater beneficial effects on these vulnerable individuals and groups. Similarly, investment in female literacy can have a positive effect on the health and wellbeing of the whole community and not just the women who become literate. In contrast, small increases in the prices of local goods, for example, can have significant negative health and wellbeing impacts on vulnerable groups because they are less physically and socially resilient i.e. their bodies are less able to adapt and fight off disease and they have fewer social resources to cushion the negative change.

Cumulative impacts of mining operations on health outcomes, determinants, and equity

Cumulative impacts result from the additive or synergistic effects of two or more health impacts, from one or more projects in an area, over the short, medium, or long term and can occur at the local, regional, national, and global level.

These can be very significant impacts and it is important therefore to consider both the cumulative positive impacts and the cumulative negative impacts to gain a more holistic view of the potential impacts of a project.

At the local level, cumulative impacts are the collective set of health impacts that arise from the mining operation, over time, and all the other projects located nearby. For a project, the cumulative health impacts might include the impacts on individuals and groups caused from emissions released into the air, water and soil, and an increased prevalence of malaria mosquitoes and trematode snails due to changes in habitat. While each on their own may pose a low or minor negative health and wellbeing impact together they may have a major adverse effect on individual and community health and wellbeing. Similarly, the provision of local jobs, skills training and improvements to local social infrastructure can have a greater cumulative positive impact than each intervention on its own. The cumulative impacts of a project may be exacerbated by other industrial projects in an area. This can mean, for example, that lorries on roads and road traffic emissions or strains on local goods supply chains from each of the projects give rise to greater traffic injuries, greater malnutrition and greater social unrest than the sum of each of the project on their own.

Examples of local cumulative health impacts:

- Positive Impacts: One or several projects provide jobs, stimulate the creation of new businesses and are customers to other local businesses leading to improved incomes and access to goods and services (e.g. food and medicines leading to improved nutrition, alleviation of acute and chronic diseases).
- Negative Impacts: One or several projects in an area each emitting pollutants into the air, water and soil that individually are not significant but cumulatively have the potential to lead to physical illness and chronic disease.

Environmental Health Areas (EHA's)

The environmental health areas (EHA) framework defines the types of health impacts and provides a structure for organizing and analysing potential project impacts on the community. **Table 19** and **Table 20** presents a list of generic EHAs. The EHAs can be used for both comprehensive and rapid appraisal HIAs (International Finance Corporation, 2009).

Based on experience in analyzing and mitigating the key burden of health impacts (for example, respiratory problems, vector-borne diseases, accidents and injuries, diarrheal diseases, and so on), the HIA should identify the environmental health areas that are likely to broadly capture the vast majority of linkages between project-related activities and community-level impacts.

Potential health impacts are considered in 1) the broad perspective associated with development and mitigation of adverse environmental conditions, and 2) the narrower context of diseases and injuries associated with water, sanitation, solid waste, housing, vector control, and hazardous materials. Thus, the potential linkages between infrastructure-related activities and overall environmental health conditions need to be emphasized. These linkages are useful when considering the range of potential mitigation strategies for project impacts.

World Bank research has demonstrated that a significant percentage (as much as 44% in Sub-Saharan Africa) of the typical burden on health can be mitigated by infrastructure improvements in four sectors: housing, water and sanitation, transportation, and communication.

The project should identify the specific populations affected by each environmental health area. These population categories are designed to be consistent with the age groupings used in common demographic health surveys.

Although not every EHA may be relevant for a given project, experience indicates that the project should consider EHAs while preparing the HIA. The EHA approach also captures some workforce issues that could impact relevant communities, for example, housing and respiratory issues (such as communicable respiratory diseases that could spread from construction camps to local communities), but it primarily focuses on the relationship between potential project impacts and communities. The EHA framework covers a broad view of environmental health, and encompasses a wide spectrum of health determinants, including social and institutional issues.

Table 19: Global environmental health areas

Environmental Health Areas (EHAs) (International Finance Corporation, 2009)	
Vector-Related Diseases	Mosquito, fly, tick, and lice related diseases such as: Malaria, Dengue, Schistosomiasis, Onchocerciasis, Lymphatic Filariasis, Yellow Fever.
Respiratory and Housing Issues	Transmission of communicable diseases such as: Acute Respiratory Infections (bacterial and viral), Pneumonias, Tuberculosis, Meningitis, Plague, Leprosy and Respiratory effects from housing, overcrowding, housing inflation.
Veterinary Medicine and Zoonotic Issues	Diseases affecting animals such as: Bovine Tuberculosis, Swinepox, Avian Influenza; or diseases that can be transmitted from animals to people such as: Brucellosis, Rabies, Bovine TB, Bird Flu.
Sexually Transmitted Infections	Sexually transmitted infections such as: HIV/AIDS, Syphilis, Gonorrhoea, Chlamydia, Hepatitis B.
Soil- and Water-Sanitation-Related Diseases	Diseases that are transmitted directly or indirectly through contaminated water, soil or non-hazardous waste such as: Diarrheal, , Schistosomiasis, Hepatitis A and E, Poliomyelitis, Giardiasis, Worms.
Food- and Nutrition-Related Issues	Adverse health effects such as: Malnutrition, Anaemia (including deficiencies of Folate, Vitamin A, Iron, Iodine), Micronutrient Deficiencies due to changes in agricultural and subsistence practices or food inflation, Gastroenteritis (bacterial and viral), changes in agricultural and subsistence hunting, fishing, and gathering practices.
Accidents and Injuries	Road-traffic related, spills and releases, construction (home- and project-related) and drowning.
Exposure to Potentially Hazardous Materials	This considers the environmental health determinants linked to the project and related activities. Noise, water, and air pollution (indoor and outdoor) as well as visual impacts will be considered in this biophysical category. It can also include exposure to heavy metals and hazardous chemical substances and other compounds, solvents or spills and releases from road traffic and exposure to mal odours. Pesticides, fertilizers, road dust, air pollution (indoor and outdoor, related to vehicles, cooking, heating, or other forms of combustion or incineration), landfill refuse or incineration ash, and any other project-related solvents, paints, oils or cleaning agents, by-products, or release events.

Social Determinants of Health (SDH)	Including psychosocial stress (due to resettlement, overcrowding, political or economic crisis), social production of disease, political economy of health, and eco-social issues such as resettlement or relocation, violence, gender issues, education, income, occupation, social class, race or ethnicity, security concerns, substance misuse (drug, alcohol, smoking), depression and changes to social cohesion.
Cultural Health Practices	Role of traditional medical providers, indigenous medicines, and unique cultural health practices.
Health Services Infrastructure and Capacity	Physical health infrastructure, staffing levels and competencies, technical capabilities of health care facilities at district levels; program management delivery systems; coordination and alignment of the project to existing national- and provincial-level health programs (for example, TB, HIV/AIDS), and future development plans.
Noncommunicable Diseases (NCDs)	Hypertension, diabetes, stroke, cardiovascular disorders, cancer, and mental health.

Table 20: Environmental health impact issues matrix

HEALTH IMPACT ISSUES (International Finance Corporation, 2009)							
Environmental Health Areas	**Influx** *Camp followers job seekers, family, service workers*	**Resettlement / Relocation**	**Water Management** *Including creation of new water bodies, altering existing water bodies & changes in drainage patterns*	**Linear Features** *Roadways, transportation routes, transmission lines*	**Hazardous Materials Control & Disposal** *Including waste containers (drums)*	**Changes in Income & Expenditure Consumption** *Including food/housing inflation*	**Infrastructure / Facilities** *Including onsite housing, catering facilities, housing & laundry, sewerage treatment plants, surface water runoff control, dams & containment facilities*
Vector-Related	Increasing human parasite burdens (e.g. malaria)	Movement to different prevalence area	Creation & movement of breeding grounds	Improper drainage, temporary water pool creation	Creation of breeding sites with drums at household level		Creation & movement of breeding grounds, improper drainage, temporary water pool creation
Respiratory & Housing	Crowded housing, both work camps & community	Number of occupants per room, mix of occupant's children/elderly/adults		Facilitating mixing/interaction of different groups		Housing inflation triggered crowding	Crowded housing in work camps, spread of ectoparasites
Veterinary Medicine	Movement & migration of livestock due to influx of new groups (incl. COVID-19)	Movement & migration of livestock due to influx of new groups (incl. COVID-19)	Creation and/or movement of livestock watering locations		Inadvertent water source contamination of streams/rivers		Changes in movement & migration of livestock
Sexually Transmitted Infections / HIV/AIDS	Mixing of high & low prevalence groups	Mixing of high & low prevalence groups		Facilitating movement of high-risk groups into rural settings		Men with money mixing with vulnerable women	Inappropriate access to project housing by local community members
Soil, Water & Sanitation	Overburdening existing services/systems, explosive food-borne epidemics	Failure to anticipate extended family influx in initial design	Changes in surface water flows/quality, potential groundwater drawdown		Releases into surface water, long-term impacts to groundwater		Releases into surface water from STP, changes in surface water flows, quality, potential groundwater drawdown

Food & Nutrition	Influx of extended family, more mouths to feed	Shift from subsistence to peri-urban living, petty trading	Changes in crop/garden selection & planting cycle	Changes in access to gardens or local markets		Food inflation further marginalisation vulnerable groups	Food inflation, food related illnesses, changes in local dietary habits
Accidents & Injury	Overcrowding, falls, burns, road traffic		Drownings, boats accidents	Road traffic, increased pedestrian activity	Unplanned releases/emissions		Overcrowding, falls, burns, road traffic
Hazardous Materials Exposure	Squatter developments adjacent to industrial facilities with unplanned releases			Movement via trucks of hazardous materials across communities to project areas	Use of project drums & containers for water & food storage, inadequate incinerator design		Release of contaminants into local community streams & rivers
Social Determinants of Health, Psychological, Gender Issues	Cultural shock due to rapid social change	Transformation of rural to peri-urban / urban lifestyle		Greater ease of mixing of different social/ethnic groups		Sudden money influx into a barter-based economic structure	Greater ease of mixing of different social/ethnic groups
Cultural Health Practices	Introduction of new practices &/or elimination of existing practices	Introduction of new practices and/or elimination of existing practices				Shift to western medicine	Introduction of new practices and/or elimination of existing practices
Health Services Infrastructure & Capacity	Increased visits for outpatient and inpatient services	Increased visits for outpatient & inpatient services if access improves				Attraction of additional private providers/increase in insurance enrolment	Changes in access
Noncommunicable Hypertension, Diabetes	Changes in diet	Peri-urban living versus high-intensity subsistence farming				Shift from high physical activity to sedentary lifestyle	Changes in diet

LEGEND	**LOW RISK POTENTIAL**	**MEDIUM RISK POTENTIAL**	**HIGH RISK POTENTIAL**

Fatal Flaws and/or Red Flags:

Through the desktop research, and considering the magnitude of related mining activities in the adjacent area, no fatal flaws are envisaged, although depending on the timing of the project the potential red flags that relate to health include:

- The current global pandemic known as Coronavirus Disease 2019 (COVID-19) may well impact the short-term timeframes including the 6-month site establishment and potentially the operational 8-month ore production milestone and 14-month steady state production milestone.
- The existing local health infrastructure systems may be negatively impacted by the above COVID-19 pandemic which is currently already under strain and may remain under severe strain in the coming months to a year or two. This could result in a medium-term impact to the local health infrastructure depending on the severity of COVID-19 in the local and provincial settings.
- Potential informal settlements (residents) that have apparently taken up occupancy on the proposed land (as per other Specialists site visit), including neighbouring communities which may be directly adjacent to the proposed project and negatively affected in terms of health.

Conclusion

The applicant needs to consider two major factors related to community health.

- The first is the existing health needs of the community. These existing health needs are present regardless of the proposed Project and represent the current health status of the community.
- Second, the proposed Project will need to consider the future health impacts that it may exert on the community.

This HIA (Scoping) has outlined the project context with potential health related impacts (changes) to the status of the local communities that may be caused by the proposed Project. An attempt has been made to give a comprehensive outlook of the baseline health status of the proposed Project area (where possible) and to understand the Projects health impacts, based on the available evidence.

Terms of reference for EIA

- Site Visit – to conduct a physical site visit of the proposed area to verify the information gained through the desktop research and ensure a baseline record is available of key stakeholders and potential health impacts not identified during the desktop research.
- Stakeholder Engagement – to conduct initial stakeholder engagements (possibly together, or in conjunction with the social impact assessment) to introduce the project and receive valuable input from key stakeholders as to the potential health impacts envisaged from their perspective.
- Risk Assessment – to assess, rank and prioritise the various health impacts that were identified during both the desktop research and site visit.

- Health Action Plan – to develop a Health Action Management Plan that includes the mitigation and management measures needed for implementation. This plan will need stakeholder review and input and should also include the following aspects:
  - Implementation and Monitoring – to identify and include the roles and responsibilities of the various parties involved and establish an action framework and allocation of resources as well as the design of a monitoring system (including key performance indicators) to ensure that mitigation progress is satisfactory.
- Evaluation & Verification of Performance & Effectiveness – to be implemented during the project lifecycle to ensure that implementation of the Health Action Plan has been accomplished and is achieving the intended results.

XIV. Socio-economic (Envital, July 2020)

Envital (Pty) Ltd conducted the baseline assessment in July 2020. Find **Appendix O** for the detailed report.

Regional overview

The proposed project site is located within the Thaba Chweu Local Municipality, which forms part of Ehlanzeni District Municipality in Mpumalanga Province. Mpumalanga is located in the northeast of South Africa, on the border of Mozambique (to the east) and eSwatini (to the south). The Ehlanzeni is one of three district municipalities in Mpumalanga, and comprises four local municipalities namely: Thaba Chweu, City of Mbombela, Nkomazi, and Bushbuckridge.

The total population of the Ehlanzeni is approximately 1.8 million, with a population density of 63 people per square kilometre (Statistics SA, 2016 in Ehlanzeni, 2020). The bulk (40%) of the Ehlanzeni's population is located in Mbombela Local Municipality, while Thaba Chweu Local Municipality has the lowest population with only 5% (Statistics SA, 2016 in Ehlanzeni, 2020).

The main urban areas in the Ehlanzeni are: Mbombela, Hazyview, Malelane, Mashishing (Lydenburg), Barberton, Sabie, and Komatipoort. The capital city of the province, Mbombela (formerly Nelspruit), is the economic hub of the province and is located in the south of the Ehlanzeni. The City of Mbombela has the highest population growth rate compared to other other local municipalities, as immigrants from other municipalities and from outside the province and country are attracted to this area for employment (Ehlanzeni, 2020).

Land use and settlement patterns within Ehlanzeni are influenced by a range of factors, including topography, climate, and availability of natural resources (including water, soil types, minerals, and biodiversity). The subtropical climate and varied and dramatic topography gives Ehlanzeni an aesthetically beautiful environment that is well suited to agricultural and tourism. The majority of the land use within Ehlanzeni is rural and considered either natural (83%) or agricultural (16%), with only 1% under urban or mining use (Laduma Tapp, 2010).

Demographics

The age profile of Ehlanzeni is slightly younger than the provincial and national profiles (**Figure 51**), with 35% considered children (0-14 years) and 38% considered youth (15 – 34 years) (Statistics SA, 2012). There is generally a higher number of women to men throughout Ehlanzeni (**Figure 52**), which could be a result of out-migration of men in search of employment. Thaba Chweu Local Municipality is the exception, as the number of men is higher. This is likely to be due to the many mining operations located in and around Thaba Chweu. The most spoken language in Ehlanzeni is SiSwati (54%), followed by Xitonga (22%) and Sepedi (10%) (Statistics SA, 2012) (**Figure 53**).

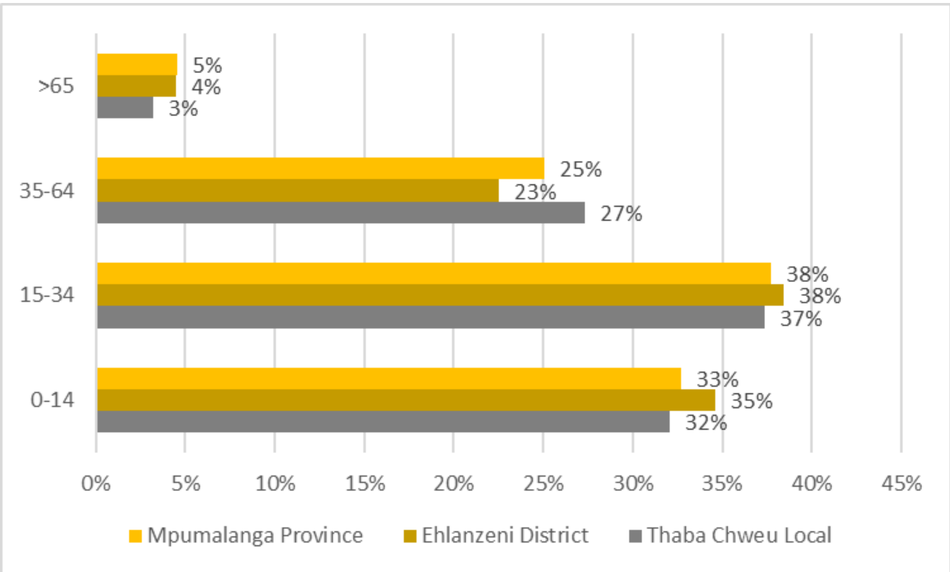


Figure 51: Age profile comparing district, province and national (Statistics SA, 2012)

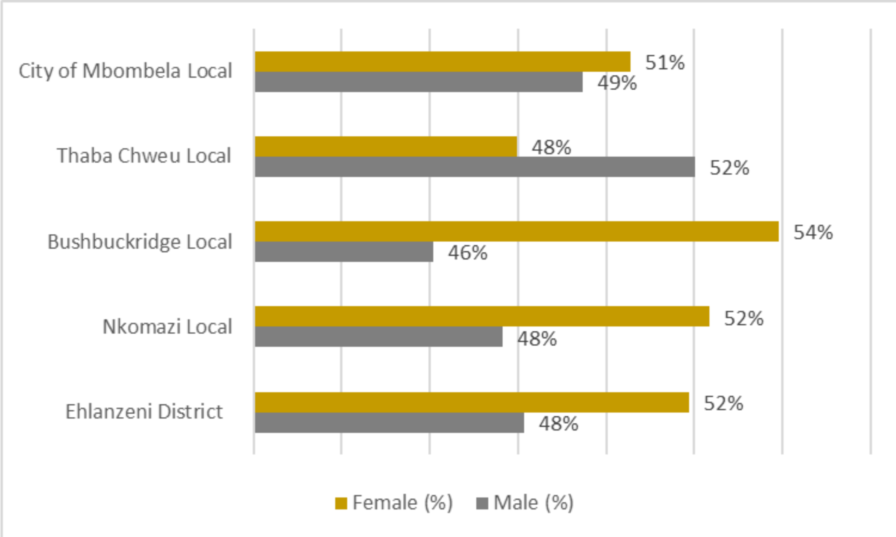


Figure 52: Gender profile comparing district and local municipalities (Statistics SA, 2012)

The education levels within the District are low, but similar to Mpumalanga, with 10% having no formal schooling, 40% having less than Grade 10 and only 6% having tertiary education (**Figure 54**). In 2011 the Ehlanzeni District had an unemployment of 30%, with Bushbuck Ridge Local Municipality having the highest unemployment at 52% and Thaba Chweu Local Municipality the lowest (20%) (Statistics SA, 2012).

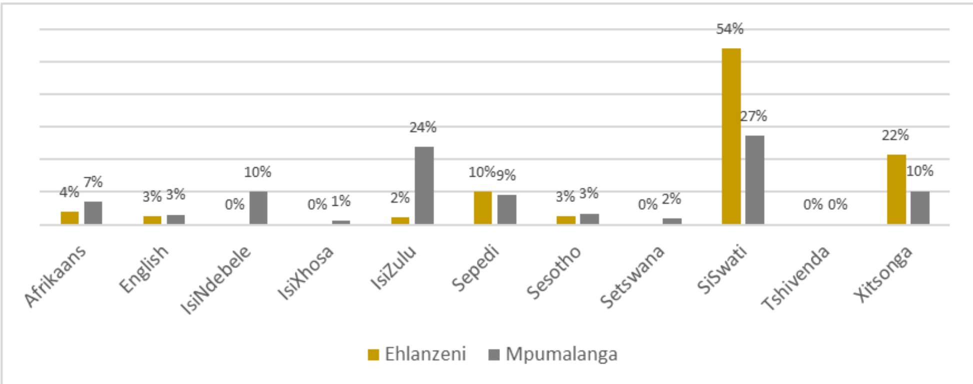


Figure 53: Languages spoken in Ehlanzeni District Municipality (Statistics SA, 2012)

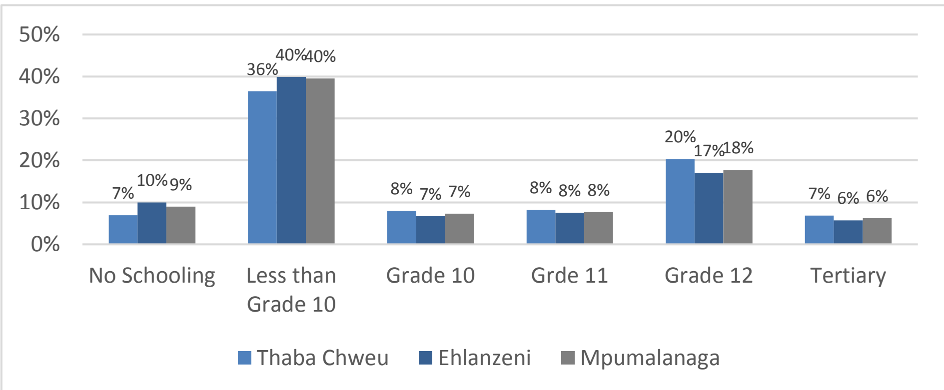


Figure 54: Highest education for Thaba Chweu, Ehlanzeni and Mpumalanga (Statistis SA, 2012)

Economic Environment overview

Mpumalanga relies on the diverse natural resources found within the province to support the local economy, including mineral and ecological. Mpumalanga is not a major economic centre within South Africa but contributes considerably to the country's tourism, agricultural and mining.

The major contributors to the Mpumalanga economy are mining (25.2%) and manufacturing (19.3%), however the main economic contributors within Ehlanzeni are community, social and personal services (45.2%), wholesale and retail trade (47%), construction (42.8%), finance (34.6%), transport (39.7%) and agriculture (33%) (Ehlanzeni, 2020). According to the Ehlanzeni Integrated Development Plan (IDP), there are indications that the local economy has been shifting from primary sector towards tertiary sector activities over the past two decades, however limited direct investment and low skills levels in the region means economic growth has been restricted and unemployment remains high (Ehlanzeni, 2020). Ehlanzeni therefore continues to rely on agriculture, construction, mining, and tourism to provide employment for unskilled labourers (Ehlanzeni, 2020). Tourism is a key source of local and foreign revenue for Ehlanzeni, with internationally recognised attractions such as the Motlatse (Blyde River) Canyon Game Reserve and the Kruger National Park within its borders. In addition, there are numerous smaller reserves, sites of natural beauty and cultural attractions which contribute to the tourism development in the district (Laduma Tapp, 2010).

Agriculture within the district is dominated by the cultivation of subtropical, citrus, and deciduous fruits, as well as other crops, such as nuts, tobacco, wheat, sugarcane, and vegetables (Ehlanzeni, 2020). Forestry competes with crop cultivation for land and other resources and is one of the dominant land uses in Ehlanzeni (Ehlanzeni, 2020).

Ehlanzeni also has access to one of the key transport and logistics corridors in the region, namely the Maputo Development Corridor. This inter-country economic development corridor connects the industrial, agricultural, and mining areas of Gauteng, Limpopo, Mpumalanga and eSwatini with the ports in Mozambique. The spinoffs from this corridor development include direct investment in economic activities and infrastructure in the area, allowing for easier access to ports for raw materials and products from the region.

Mining

Mining has contributed between 17 and 26% of the provincial Gross Domestic Product (GDP) over the past decade (Ehlanzeni, 2020). Most of the benefits, however, are only recognised outside of the region, such as through export. Opportunities within the regional mining sector include (Ehlanzeni, 2020):

- Growing demand on the global market for commodities (including platinum);
- Beneficiation of minerals (e.g. jewellery making);

- Platinum Group Metals mining along the eastern limb of the Bushveld Complex;
- New entrants to mainstream industry for Black Economic Empowerment (Mpumalanga Mining Energy Preferential Procurement Initiative);
- Small Scale mining; and
- Strategic alliances for share acquisition through Broad Based Black Economic Empowerment.

Key opportunities for local economic development through mining initiatives include local investment, skills development, infrastructure, and technology development and broadening of the supplier base (Ehlanzeni, 2020). The proposed project is likely to contribute towards the regional economy through direct investment and developing the mining sector.

Local Municipality overview

The proposed project site is located in Ward 5 of the Thaba Chweu Local Municipality, approximately 30 km west northwest of Mashishing (formerly Lydenburg) (the closet urban centre) and almost 100 km northwest of Mbombela.

The main economic sectors in Thaba Chweu are forestry, agriculture, mining, business services and tourism (Thaba Chweu, 2017). The landscape is dominated by commercial agriculture and forestry, with the western portion (near Mashishing) dominated by agriculture and scatter mining activities, and he eastern side (near Sabie), dominated by forestry (Thaba Chweu, 2017). Employment within Thaba Chweu comes primarily from the mining sector, followed by community services and then agriculture (Thaba Chweu, 2017).

Many of the large towns within Thaba Chweu depend mainly on tourism as their main economic driver, with the exception of Mashishing, which has received a boost from mining activities in the western parts (Thaba Chweu, 2017). The proposed project is, therefore, likely to contribute towards local economic development through employment, local investment and procurement, and skills development.

Demographics

The population of Ward 5 is 12 406, with a population density of 9.9 people per square kilometre (Statistics SA, 2012). This is 13% of the total population of Thaba Chweu Local Municipality and only 0.8% of Ehlanzeni District Municipality.

The population of Ward 5 is fairly young, with 69% being below the age of 35, and 41 % below the age of 15 (Figure 55) (Statistics SA, 2012). The dependency ratio is 54%, which is relatively low compared to Mpumalanga (59%) and the national ratio of 56% (Statistics SA, 2012). The majority (90%) of the population is Back African, followed by Coloured (6%) and White (4%) (Statistics SA, 2012). The most spoken language is Sepedi (47%), followed by SiSwati (13%), and isiZulu and Afrikaans (each 9%) (Statistics SA, 2012).

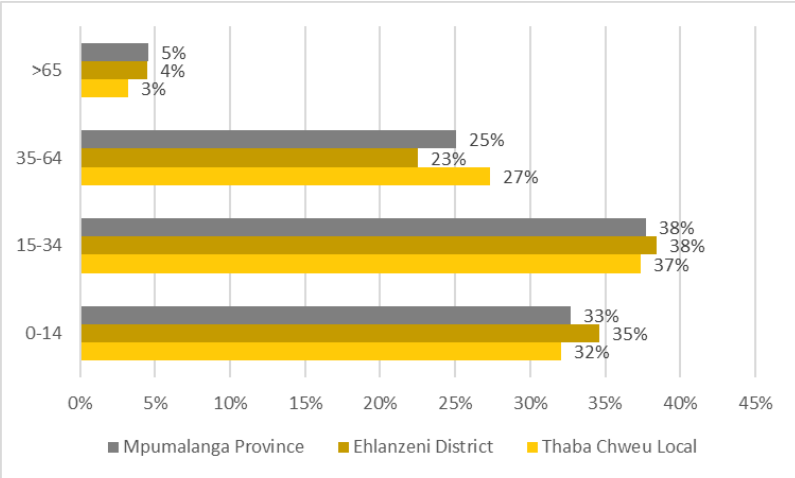


Figure 55:Age profile for Ward 5, Thaba Chweu Local Municipality and Ehlanzeni Local Municipaility (Statistics SA, 2012)

The highest level of education attained by individuals 18 and over in Ward 5 is relatively low with 10% having no schooling, 45% less than Grade 10, 13% have a grade 12 and only 2% having tertiary education (Statistics SA, 2012). This is similar to the local and district municipality (**Figure 54**).

The poverty rate in Thaba Chweu in 2015 was 21.5% and the unemployment rate was 20.5% in 2011 (Thaba Chweu, 2017). Both of these aspects are low compared with other local municipalities within the Ehlanzeni District Municipality (25% - 52%) and the national average (27%) (Statistics SA, 2012). Employment within Ward 5 is relatively high at 70% of the working-age population being employed and 25% unemployed in 2011 (5% discouraged work seekers), compared to 58% and 30% for Ehlanzeni District and 62% and 29% for Mpumalanga respectively (Statistics SA, 2012).

Approximately 17% of the Thaba Chweu population relies on social grants, with 51% of these individuals (8059 people) receiving child grants, 15% (2409 people) receiving disability grants and 29% (4626) receiving old age grants (Stats SA, 2012 in Thaba Chweu, 2017).

There are total of 4 208 households within Ward 5. Household income within Ward 5 is predominantly low, with 12% having no income, and 25% considered low income (Statistics SA, 2012) (**Figure 56**). The majority (67%) of houses within Ward 5 are formal, 2% informal and 32% farm dwellings (Statistics SA, 2012). Household size varies but is characteristic of rural household sizes, with the majority having one or two people, (**Figure 57**) (Statistics SA, 2012). Land tenure security is limited, with 50% of households being rented, 17% occupied rent-free (likely to be on farm tenants), and only 20% being owned and fully paid off (Statistics SA, 2012).

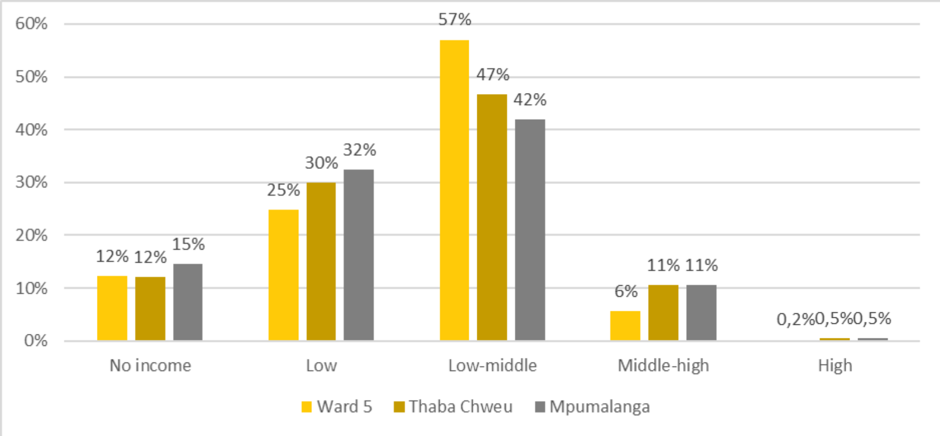


Figure 56: Household income for Ward 5, Thaba Chweu and Mpumalanga (Statistics SA, 2012)

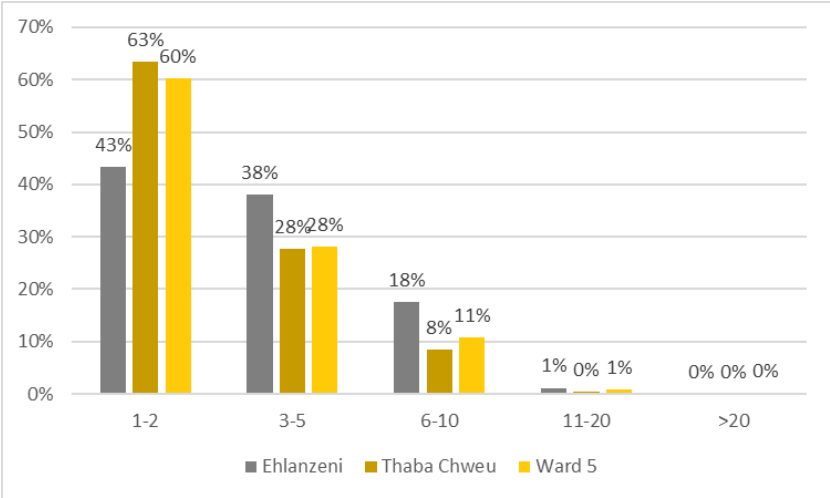


Figure 57: Household size for Ward 5, Thaba Chweu and Ehlanzeni

Formal basic services within Ward 5 are similar to that of Thaba Chweu , but slightly lower than Mpumalanga (**Table 21**). This is likely to be due to the rural nature of the area. Only 67% receive water through a regional water scheme, and 10% obtain water from boreholes and 10% from rivers and streams (Statistics SA, 2012). Only 65% of households have access to water-bourne sewage, 17% have access to pit latrines, and 8% do not have access to formal sanitation (Statistics SA, 2012). Refuse collection is received by 63% of households, and 25% have their own refuse dumps, while 7% have no means of formal refuse disposal (Statistics SA, 2012). 68% of households have access to electricity, but just 63% use it for cooking, and 59% for heating (Statistics SA, 2012). There is a heavy reliance on wood for heating and cooking (approximately 25%), and paraffin (up to 10% of households) (Statistics SA, 2012).

Table 21: Key basic household services – Ward 5, Thaba Chweu and Mpumalanga (Statistics SA, 2012)

Services	**Description**	**Ward 5**	**Thaba Chweu**	**Mpumalanga**
Water Source	Regional/local water scheme	**67%**	**70%**	**74%**
	Borehole	10%	12%	8%

	River/stream	10%	8%	4%
	Water tanker/vendor	7%	6%	12%
	Other	6%	4%	9%
Sanitation Facilities	None	8%	3%	6%
	Flush toilet (connected to sewerage system)	**65%**	**63%**	**42%**
	Pit latrine	17%	26%	45%
	Other	6%	3%	4%
Refuse	No rubbish disposal	7%	5%	8%
	Removed by local authority	**63%**	**63%**	**44%**
	Own refuse dump	25%	28%	45%
	Other	5%	4%	3%
Energy – Lighting	Electricity	**68%**	**83%**	**86%**
	Paraffin	2%	2%	1%
	Candles	27%	14%	12%
	Other	3%	1%	1%
Energy – Cooking	Electricity	**63%**	**71%**	**69%**
	Paraffin	10%	5%	6%
	Wood	24%	20%	17%
	Other	3%	4%	8%
Energy - Heating	Electricity	**59%**	**61%**	**57%**
	Paraffin	4%	2%	2%
	Wood	26%	21%	15%
	None	8%	13%	14%
	Other	3%	3%	12%

Proposed mine site details

Land use

The area within and surrounding the proposed project site is rural in nature and appears to be characterised by a mix of agricultural and mining activities. Agriculture appears to be a mix of subsistence and commercial farming, including crops and livestock. The site appears to be mostly fallow or used for extensive grazing, with a small area cultivated for subsistence crops. Information from a past study indicates that the site is used for subsistence farming, including stock grazing (Digby Well, 2012).

There are several mines in the broader area, from as close as two kilometres from the site. This mining is mainly for Platinum Group Metals which are being extracted along the remainder of the eastern limb of the Bushveld Complex, extending bother south and north of the site. These activities include extraction pits, waste dams, processing plants, and associated housing.

Settlements

There is evidence of informal houses or farm tenants within the property of the proposed project, as well as immediately south of the property on adjoining land. According to a study conducted in 2012 for a similar mine at the same site, this community is comprised of the Pakaneng community (Digby Wells, 2012). The study also indicated that the Pakaneng Choma Community Trust (which were the current residents/land occupants – the Pakaneng/Vygenhoek community – are a part of) had a land claim on the site of the proposed project. It was noted, however, that there were also new in-migrants settling informally in the area who had no relationship or ties to the Pakaneng and Choma Clans. Other settlements in the broader area appear to include formal farming settlements (western style farmhouse and associated buildings), small informal settlements, small traditional rural family settlements, and formal settlements relating to mining activities.

infrastructure

There is little formal public infrastructure, other than roads, within the local area. Most occupants and businesses are likely to rely on private or communal resources for basic services (e.g. boreholes and rivers, generators, and foraged wood). There is little evidence of formal shops or other trading infrastructure in the area, with the exception of the South Africa Police Station at Maartenshoop several kilometres to the northeast of the site, as well as a pharmacy, farm shops and guest lodges south of Maartenshoop and along the secondary road to the east. There is no evidence of clinics or other public health facilities, but a mobile clinic is sometimes available (Digby Wells, 2012). There are also no schools within the immediate area, with the closest primary school over 10 km from the site, and the closest secondary school in Ladenburg (Digby Wells, 2012).

Social and political Structures

There are three tribal areas within the Thaba Chweu Local Municipality (Thaba Chweu, 2012), Mogan, Mashile, and Mohlala Traditional Authority (Digby Wells, 2012). These were part of the former Lebowa government and are situated on the far northern part of the municipality and none of the communities or households near to the proposed project site form part of these traditional authorities (Digby Wells, 2012). The only formal authority in this region is therefore the regulated municipal structure, which means that a Ward Councillor and Ward Committee is responsible for representing and engaging with the local communities.

Potential receptors

The potential social and socio-economic receptors are likely to vary depending on the impacts of the proposed project on the local receiving environment. Several aspects will need to be considered, including:

- Proximity of settlements to the operational site;
- Vulnerability of households within proximity to the operational site;
- Biophysical environmental impacts, including air quality, noise, and vibration;
- Degree to which the proposed project will change the local environment, e.g. traffic, influx of people and aesthetics;
- Number, value and sourcing of employment and procurement opportunities during all phases; and
- Value and implementation of local social and economic development initiatives.

Primary receptors

There are several houses within two kilometres of the proposed project operational site that may be directly or indirectly affected by the proposed project. **Figure 58** provides an overview of identified settlements within two kilometres of the proposed project site. Satellite images indicate that there are at least two houses within the proposed project property boundary, and a group of approximately 25 and 30 houses immediately south of the property boundary (Google Earth Pro, 2020).

These houses appear to be characteristic of farm tenants and are likely to be comprise a mixture of brick houses, as well as more informal corrugated iron and wooden buildings. According to a previous study the in the immediate area of the site is owned either privately or by the state and leased to these residents (details for these agreements are unknown) (Digby Wells, 2012).

The livelihoods of the households closest to the proposed project site, including access to resources such as water and grazing land, may be affected during all phases. The detailed socio-economic assessment will consider the need to relocate any houses or off-set loss of livelihoods as a result of the proposed project.

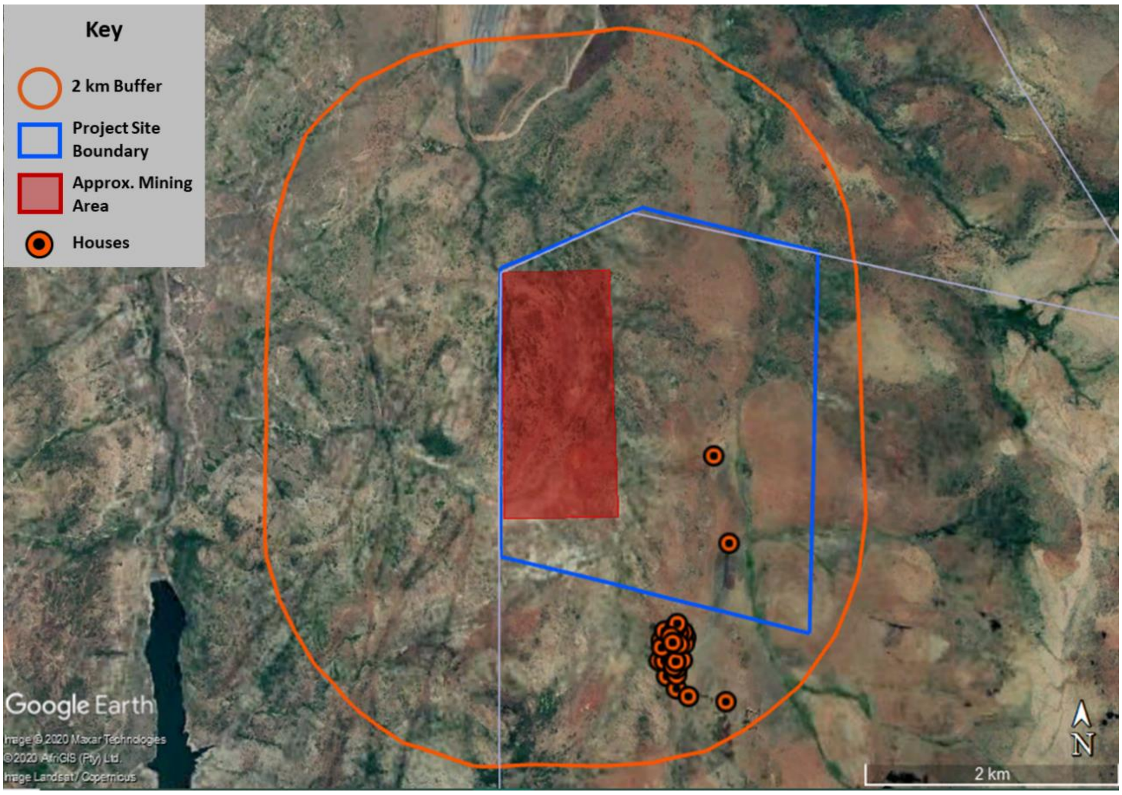


Figure 58: Potential social receptors within 2 km from proposed operational mining area

Secondary receptors

There are also likely to be a larger population who may be indirectly impacted by the proposed project in the 5 to 10 km radius of the proposed project site. These may include:

- Commercial farms and associated settlements and activities;
- Formal farm tenants;
- Rural traditional settlements;
- Informal settlements; and
- Mining settlements.

Figure 59 provides a preliminary overview of the activities and settlements in the broader region of the proposed project, based on satellite imagery.

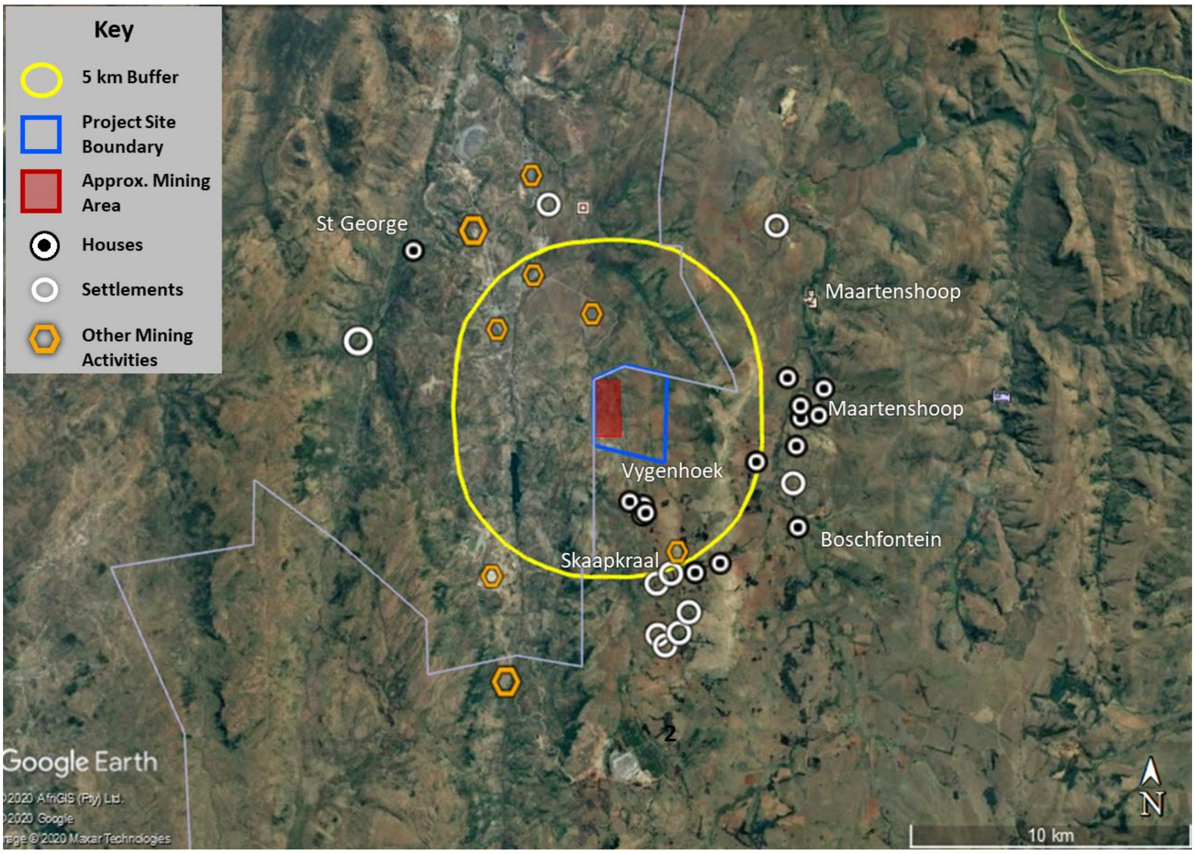


Figure 59: Broader activities, communities and settlements surrounding the site

Socio-economic impacts

The following potential socio-economic impacts have been provided as a preliminary assessment based on a desktop assessment of the proposed project and socio-economic receiving environment.

<u>*Construction phase*</u>

- Reduced access to livelihood resources – Construction activities my require the securing of certain portions of the site, which may be used by local communities to support their subsistence livelihoods, including collection of firewood and herbal medicines, and grazing.
- Increased temporary local employment opportunities – A number (unknown) of temporary employment opportunities may be generated during the construction phase, which would benefit local unemployed individuals. The benefits may impact beyond the local area – i.e. to the regional or national level – as many of these opportunities may be skilled or professional and so are unlikely to be sourced locally.

- Increased local economic development opportunities – The local procurement of materials and services could benefit local businesses and indirectly provide employment and improved local spending in the short-term. As the types of services required during construction is unlikely to exist locally, these benefits may be realised on a regional or national level, however the procurement of materials and services such as security and cleaning could be sourced locally.
- Change in sense of place - Construction activities could change the nature of the local area with increased traffic, influx of people, and presence of machinery and activities in the area.

Operational phase

- Reduced access to livelihood resources – The operational phase may see the reduced access to livelihood resources (wood, grazing land, water) could be further restricted.
- Indirect damage to/loss of assets – The operation of the proposed mine could result in indirect economic impacts on local households, such as damage to buildings through blasting, and increased crime and theft of stock or goods.
- Direct and indirect employment opportunities – It is anticipated that the operational phase will see the employment of approximately 44 people for the ten-year duration for the operational phase, creating direct employment for the region. In addition, the sourcing of materials and services could develop indirect employment opportunities.
- Growth and diversification of local economy - Local businesses could also see growth and diversification through the provision of services and materials to the operation, thus encouraging diversification within the local economy.
- Increase in social ills – As with any large-scale development in a rural area, there is likely to be an influx of people (both employees and jobseekers) that could change the local social dynamic and structure. This could result in increased social ills, such as drug and alcohol abuse, gender-based violence, and increased social conflict.
- Increased nuisance and changed sense of place - Mining activities could negatively impact the physical environment, including reduced air quality, noise emissions, and increased traffic. These aspects could cause a nuisance to local residents, and potentially change the sense of place.
- Increased pressure on resources – the influx of people to the area could result in the development of informal settlements, and place additional strain on natural and public resources, which are scare in this area already. This could have a severe impact on existing poor communities and households.
- Reduced public health and safety – The influx of employees and jobseekers, the increase in traffic and reduced natural resources (air, water), could impact negatively on existing

communities through reduced environmental health (respiratory), spread of communicable diseases, and increased crime and violence (outside people and competition for resources).

Decommissioning phase

- Loss of permanent jobs - The employment during operational phase is likely to be phased out during decommissioning, resulting in a loss employment locally and regionally.
- Increase temporary employment – Limited temporary employment opportunities would be generated, which could benefit local communities.
- Increased local procurement - The decommissioning phase may see the need for local procurement of goods and services

Socio-economic feasibility

The socio-economic scoping assessment was based on desktop review of exiting information. Based on this review and a preliminary assessment of potential socio-economic impacts of the proposed project, there are no immediate fatal flaws identified. The following key “red flags” have, however, been identified:

Impact on livelihoods

There is the potential for the livelihoods of people living on and near to the proposed project site to be severely affected. Based on previous studies for the site, given the likely nature of the households (i.e. low-income and vulnerable), and information from other specialist studies, the two houses on the project property and the 25 to 30 houses immediately south of the project site are likely to use the proposed project land to support their livelihoods, such as for grazing livestock, and collecting fire wood, water and other natural resources. The use of the land for mining and associated activities (e.g. roads and waste rock stockpiles) could prevent or reduce access to these resources. The degree to which this will affect their livelihoods will need to be assessed further in the EIA phase.

Loss of economic and cultural assets

The mining activities could potentially impact the physical assets of the households within close proximity to the proposed project operations. This loss could include damage to houses or other material possessions, as well as social or cultural assets such as loss of access or damage to graves and change in nature of the area (e.g. increased traffic). The degree to which this will affect the socio-economic stability of these households or communities will need to be assessed further in the EIA phase.

The above aspects are not considered fatal flaws, and it is not anticipated that houses will need to be relocated at this stage, as there are no houses within the operational or working area of the mine.

However, should the EIA phase determine the impact on the above aspects to be too high, then relocation, compensation or other mitigation may be required.

Plan of study for EIA phase

The aim of the socio-economic impact assessment (SIA) will be to determine the potential positive and negative impacts of the proposed Vygenhoek Project and the potential alternatives, including no-go alternative, on the local and regional socio-economic landscape. The study will consider the direct, indirect, and cumulative impacts of the proposed project in relation to current and proposed activities within the local area, and the people and activities on and around the proposed projects property.

The objectives of the SIA will be to:

- Develop a social profile for the proposed project area through the description of the social receiving environment that may be affected by the proposed activity;
- Undertake the field work to determine the current settlement patterns and activities on and adjacent to the proposed project site;
- Identify, describe, and assess the potential positive and negative socio-economic impacts associated with the proposed project; and
- Provide mitigation measures and recommendations to enhance the socio-economic sustainability of the proposed project.

<u>Proposed scope of work</u>

Desktop review

The socio-economic impact assessment (SIA) will build on the scoping assessment to further develop a baseline of the socio-economic receiving environment associated with the project. This will include a review of existing data and information including geographical, demographic, socio-economic, institutional, and sociocultural. Other key sources of information may include project documentation, studies for similar projects, and relevant policy and planning information. The desktop review will aim to contextualise the proposed development and provide insight into potential impacts.

Field work

It is anticipated that field work will be required to establish the current settlement patterns and number and type houses, families, and communities on and adjacent to the proposed project site. It is anticipated that the fieldwork will take place over at least five days. During this time, observational data will be obtained, as well as interviews with key stakeholders and community representatives. At this time, it is not anticipated that detailed investigations, such as household surveys will be required, as relocation may not be required, or will be done as part of the resettlement planning process.

Review of other specialists

The SIA process will include a review of the other specialist studies, including ecological, air quality, ground and surface water, blast and vibration, visual, and noise impact assessments. The specialist will engage with each report and specialist to determining the extent and significance to which the biophysical impacts may affect the local social and socio-economic environment.

Reporting

A SIA report will be compiled in line with the requirements Appendix 6 to the 2014 EIA Regulations (GN R 982). The report will contain a description of the socio-economic receiving environment, potential positive and negative socio-economic impacts, qualitative impact assessment, and recommended management and mitigation measures to be included in the Environmental Management Programme and/or the Environmental Authorisation.

XV. Heritage and Palaeontology (HCAC, July 2020)

HCAC Consultants conducted the baseline assessment in July 2020. Find **Appendix P** for the detailed report.

In anticipation of other mining activities in the greater study area, archaeologists have completed numerous heritage surveys (e.g., Huffman & Schoeman 2001, 2002 a and b; van Schalkwyk 2005; Roodt 2003a, 2003b, 2003c, 2005, 2008a, 2008b; Van der Walt & Fourie 2006; Van der Walt & Celliers 2009; Van der Walt 2009; 2016 and Pistorius 2007, 2010, 2011) for various Environmental Impact Assessment Reports (EIAs) and Environmental Management Programmes (EMPs). These studies provide a good understanding of the archaeology of the area and use of the wider landscape. Since 2001, heritage surveys have recorded more than 240 sites in the greater study area, ranging from the Middle Stone Age to recent households of farm labourers and tenants. A Heritage assessment by Du Piesanie and Higgitt (2012) recorded 50 features in the Vygenhoek project area. Based on these studies it is clear that the area under investigation has a wealth of heritage sites and a cultural layering dating to the following periods:

- Stone Age sites;
- Iron Age sites;
- Historical features and;
- Graves and burial sites can be expected anywhere on the landscape.

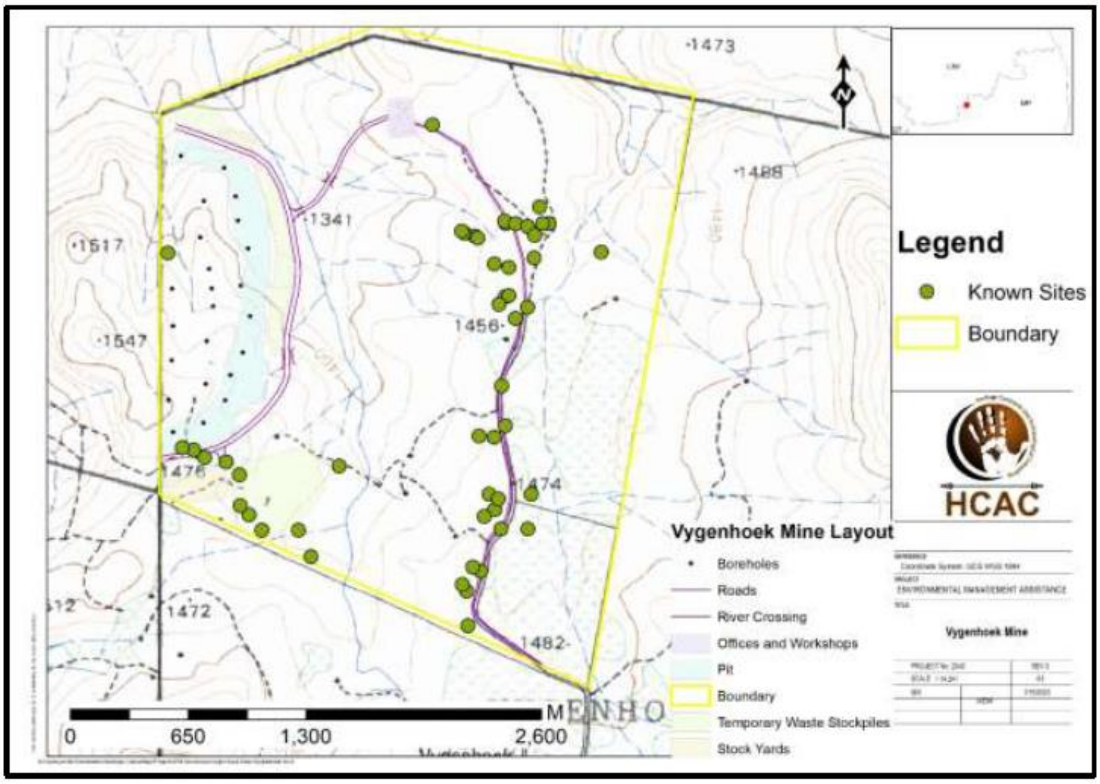


Figure 60: Known sites in relation to the project layout

Graves are of high social significance and are the most sensitive from a heritage perspective. The Dwars River Valley has been the location of numerous mining projects and the various projects have a cumulative negative and permanent impact on the heritage resources of the area. Based on the current information obtained for the area at a desktop level it is anticipated that any sites that occur within the proposed development area will have a Generally Protected B (GP.B) or lower field rating apart from graves that could have a Generally Protected A (GP.A) field rating.

The study area is of low and insignificant paleontological sensitivity according to the SAHRIS palaeontological sensitivity map and no further studies are required in this regard.

Terms of reference for EIA

With cognisance of the recorded archaeological sites in the area and in order to comply with the National Heritage Resources Act (Act 25 of 1999) it is recommended that a field-based impact assessment should be conducted of the mine layout. During this study known sites of archaeological, historical or places of cultural interest must be verified, recorded, photographed and described. The extent of the sites determined and mitigation proposed should any significant sites be impacted upon, ensuring that all the requirements of the SAHRA are met.

If the recommendations in the detailed scoping report are adhered to, HCAC is of the opinion that the impact of the development on heritage resources can be mitigated. This will be confirmed through the

Heritage Impact Assessment to be undertaken. If during the pre-construction phase or during construction, any archaeological finds are made (e.g. graves, stone tools, and skeletal material), the operations must be stopped, and the archaeologist must be contacted for an assessment of the finds. Due to the subsurface nature of archaeological material and graves the possibility of the occurrence of unmarked or informal graves and subsurface finds cannot be excluded.

XVI. Traffic

Siyazi Limpopo Consulting Services (Pty) Ltd conducted the baseline assessment in July 2020. Find **Appendix Q** for the detailed report.

Existing road characteristics and modal distribution

Table 22 contains information related to the existing intersections under investigation.

Table 23 provides information concerning the relevant road sections under investigation and includes the following:

- Relevant road section;
- Picture of road section;
- Existing class of road;
- Proposed class of road;
- Road reserve widths;
- Lane widths; and
- Median widths (If applicable).

Figure 61 and **Figure 62** provide a graphical presentation of the existing road network layout for the area under investigation.

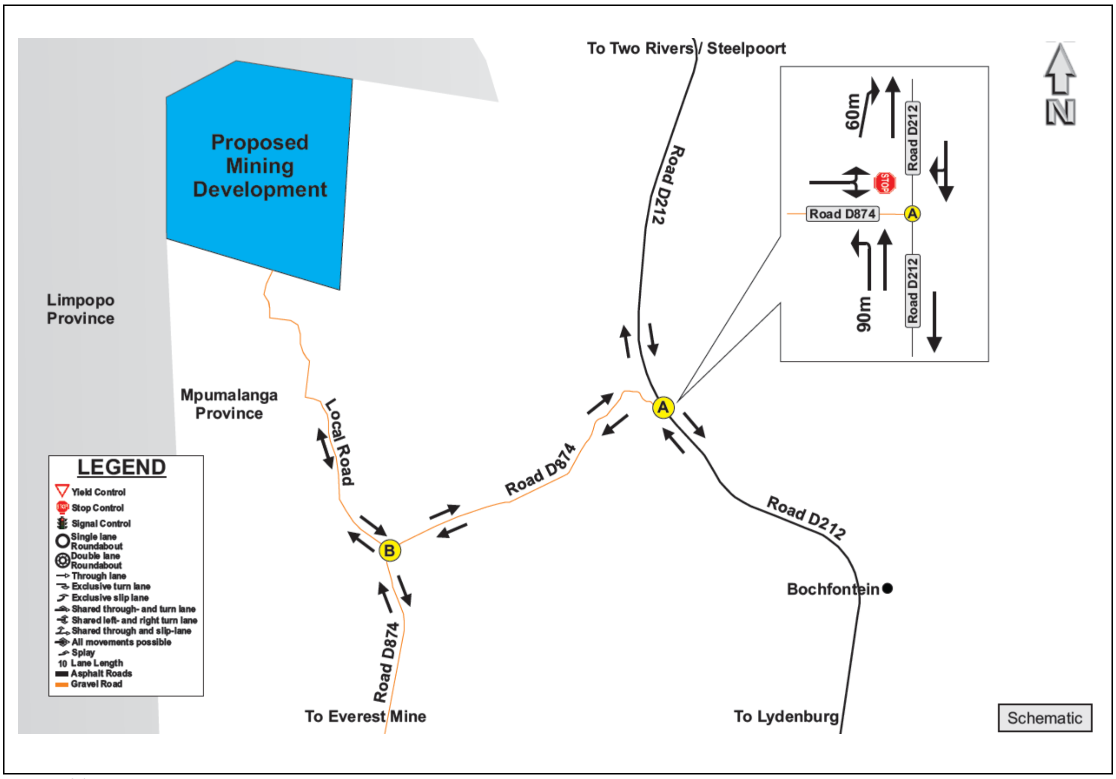


Figure 61: Existing road network layout

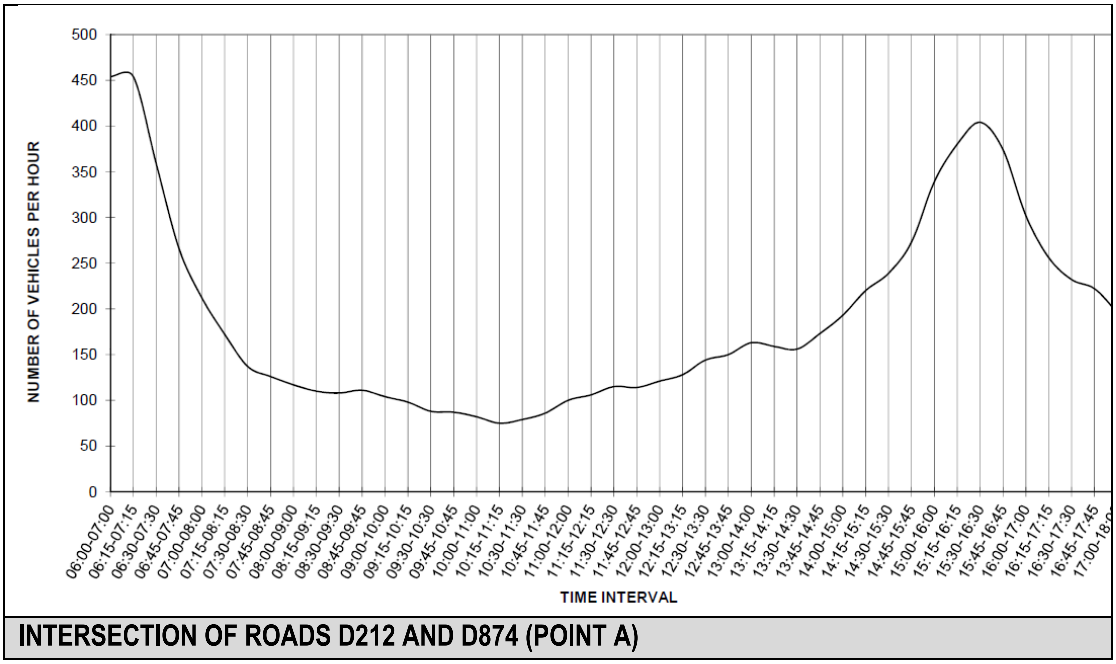


Figure 62: Hourlt traffic pattern per 15 – minute interval for all modes of vehicles (06:00 to 18:00) at relevant intersections

Table 22: Summary of intersection control at existing intersections under investigation

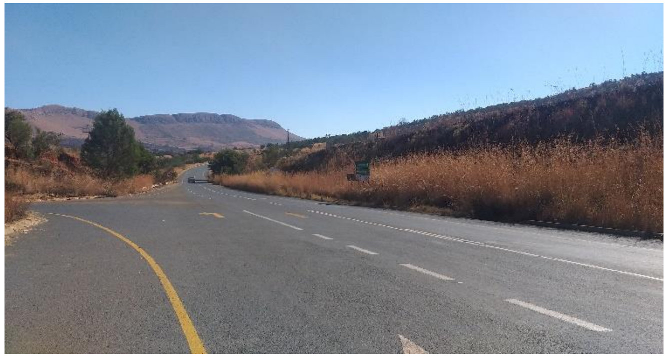
POINT	DESCRIPTION	INTERSECTION CONTROL	PEDESTRIAN ACTIVITIES	INTERSECTION PHOTO
A	Roads D212 and D874	Free-flow on Road D212	No Pedestrian activity observed during surveys	
B	Road D874 and Local Road	Free-flow on Road D874	No Pedestrian activity observed during surveys	

Table 23: Summary of road characteristics

RELEVANT ROAD SECTION	PICTURE OF ROAD SECTION	ASSUMED EXISTING CLASS OF ROAD			POSSIBLE FUTURE CLASS OF ROAD			Road Authority	Road Reserve (M)	Number of Lanes	Lane Width	Type of Surface	Median	Anticipated Traffic Growth per Annum over 10 Years	Speed Limit
		Primary Function: Activity and Access			**Proposed Function:** Activity and Access										
		Class	**Class No.**	**Route No.**	**Class**	**Class No.**	**Route No.**								
		Collector	R4	D	Collector	R4	D								
		Description: Collector road			**Description:** Collector road										
Road Section 1 **Road D212** Road link between Road R555 to Steelpoort and Road R577 to Lydenburg		**Spacing between Intersections:** 600 - 800m			**Spacing between Intersections:** 600 - 800m			Mpumalanga Department of Public Works, Roads and Transport	±40m	One lane per direction	3.7m wide with 2.0m paved shoulder	Asphalt	None.	4%	60 km/h for relevant sections.

<table>
<tr><td rowspan="5"><u>Road Section 2</u>
Road D874

Providing access to local communities and farms from and to Road D212</td><td rowspan="5"></td><td colspan="3"><u>Primary Function:</u>
N/a</td><td colspan="3"><u>Primary Function:</u>
N/a</td><td rowspan="5">Mpumalanga Department of Public Works, Roads and Transport</td><td rowspan="5">±30m</td><td rowspan="5">One lane per direction</td><td rowspan="5">3.5m wide</td><td rowspan="5">Gravel</td><td rowspan="5">None.</td><td rowspan="5">N/a</td><td rowspan="5">40 km/h</td></tr>
<tr><td>Class</td><td>Class No.</td><td>Route No.</td><td>Class</td><td>Class No.</td><td>Route No.</td></tr>
<tr><td>Collector</td><td>R4</td><td>D</td><td>Collector</td><td>R4</td><td>D</td></tr>
<tr><td colspan="3"><u>Description:</u> Collector road</td><td colspan="3"><u>Description:</u> Collector road</td></tr>
<tr><td colspan="3"><u>Spacing between Intersections:</u>
600 - 800m</td><td colspan="3"><u>Spacing between Intersections:</u>
600 - 800m</td></tr>
</table>

RELEVANT ROAD SECTION	PICTURE OF ROAD SECTION	ASSUMED EXISTING CLASS OF ROAD			POSSIBLE FUTURE CLASS OF ROAD			Road Authority	Road Reserve (M)	Number of Lanes	Lane Width	Type of Surface	Median	Anticipated Traffic Growth per Annum over 10 Years	Speed Limit
Road Section 3 **Local Road** Township access to Road D874		**Primary Function:** Activity / Access			**Proposed Function:** Activity / Access			Thaba Chweu Local Municipality	±20m	Single lane for most of road	3.7m wide	Gravel	None.	3%	40km/h
		Class	**Class No.**	**Route No.**	**Class**	**Class No.**	**Route No.**								
		Local Road	R5	N/a	Local Road	R5	N/a								
		Description: Access road			**Description:** Access road										
		Spacing between Intersections: 450 - 600m			**Spacing between Intersections:** 450 - 600m										

Traffic counts as basis for making traffic-engineering calculations

In order to gain a better understanding of the existing traffic patterns and movements adjacent to the proposed mining development, 12-hour manual traffic counts were conducted at existing intersections that could potentially be affected by the proposed mining development.

It is standard traffic engineering practice to conduct at least 12-hour manual traffic counts, as close as possible to a month-end Friday when traffic movement is expected to be at its highest. The relevant 12-hour manual traffic counts were conducted on Friday 3 July 2020 at the intersection of Roads D212 and D874 (**Point A**).

Due to a very low vehicle volumes along Road D874 it was not deemed necessary to include vehicle traffic counts at the intersection of Road D874 and the Local Road (**Point B**).

The respective peak-hour flows for the traffic count at the relevant intersection was identified as indicated in **Table 24** below.

Table 24: Peak hour periods at relevant intersections

TABLE 2.5: PEAK HOUR PERIODS AT THE RELEVANT INTERSECTION					
POINT	INTERSECTION	AM PEAK		PM PEAK	
		TIME INTERVAL	NUMBER OF VEHICLES	TIME INTERVAL	NUMBER OF VEHICLES
A	Roads D212 and D874	06:15 to 07:15	454	15:30 to 16:30	404

Figure 62 indicates the hourly traffic pattern, per 15-minute interval, for all modes of vehicles at the relevant intersection between 06:00 and 18:00 on Friday 3 July 2020.

Future land use information, including existing and proposed approved developments in the area

At the time of conducting this study, there were no known approved latent developments within the area under investigation that would have a significant impact on the relevant road network adjacent to proposed mining development.

Determination of the vehicle trips anticipated to be generated due to the proposed mine development

As part of the proposed mining development an increase in vehicle traffic volumes is expected due to the transportation of staff, delivery of operational consumables and production. The detailed vehicle trip generation anticipated due to the proposed mining development is not part of the baseline study and would be conducted as part of the full traffic impact assessment.

Determination of the levels of service at the relevant intersections

Table 25 provides a summary of the available reserve capacity on the various sections of roads that had been investigated. The assumed free-flow capacity of individual lanes is relevant provided that the relevant intersections have reserve capacity available for the relevant lanes of the intersections.

Existing access to and from the proposed mining development site

Vehicle access to and from the proposed mining development site is currently by means of a local gravel road which intersects with Road D874 (**Point B**). Broader access to Road D874 is mainly obtained from Road D212 which provides access from the north (Road R555 - Steelpoort) and the south (Road R577 - Lydenburg).

The local road is a two lane gravel road (one lane per direction) for the first 460 meters from the intersection with Road D874 (**Point B**) and then narrows to a single lane gravel road for most of the road section up to the proposed mining development site . This section of the Local Road is shared by vehicle traffic in both directions, has limited passing opportunities on most sections and in general is suitable for light vehicle traffic only.

Key findings

Based on the investigations conducted as part of this study, the following findings were concluded:

- The existing roads network investigated as part of this study is currently operating at acceptable levels of service from a road capacity point of view.
- The existing access road (Local Road) that provides access to the proposed mining development site from Road D874 is mostly a single lane gravel road that is shared by vehicle traffic in both directions, has limited passing opportunities on most sections, and in general is suitable for light vehicle traffic only and is therefore deemed to not be suitable for mine related vehicle traffic with specific reference to heavy vehicles.
- Housing and a small informal settlement along the Local Gravel road are present and should be avoided by mine related heavy vehicles as far as practically possible from a road and community safety perspective.
- Vehicles turning right from the north at the intersection of Roads D212 and D874 (**Point A**), specifically heavy vehicles in the future as part of the proposed mining development, does so by means of a single lane sharing through and right-turning movements which could lead to

accidents due to vehicles waiting to turn right and no passing lanes for the through movement.

- No reflective road studs are installed at Point A.
- The relevant section of Road D874 under investigation (currently a gravel road) between **Points A** and **B** which is approximately 5 kilometres apart and provides broader access from and to Road D212 is in need of some rehabilitation of some sections due to water erosion;
- A single lane stream crossing along Road D874 near **Point A** would require investigation in order to determine whether the crossing would be able to accommodate an increase in mine related heavy vehicle traffic for the long-term.

Recommendations

The following recommendations are made from a traffic engineering point of view:

- Alternative road access to the proposed mining development should be investigated since the existing Local Road that provides access from Road D874 is deemed to not be suitable for mine related vehicle traffic with specific reference to heavy vehicles.
- Geometric improvements in terms of road safety at the intersection of Roads D212 and D874 (**Point A**) would be required as part of the proposed mining development by means of Construct a dedicated right-turn lane on the northern approach of Road D212.
- Reflective road studs should be installed at Point A in order to ensure visibility of the intersection geometry to road users at night time.
- Rehabilitation of some sections of Road D874 would be required to ensure that workers, consumable deliveries and mine product could be transported at all times to and from the proposed mining development.
- Further investigation with regards to a single lane stream crossing on Road D874 near **Point A** should be conducted in order to determine whether this crossing would be suitable for an increase in heavy vehicle traffic in the long-term.

Table 25: Available reserve capacity for relevant road section

Point	Intersection	Direction of Road Section	Capacity per Lane	Number of Lanes	Total Capacity	Actual Number of Vehicles		Reserve Capacity Available	
						2020		2020	
						AM	PM	AM	PM
A	Roads D212 and D874	North (Road D212)	900	1	900	399	52	501	848
		South (Road D212)	900	1	900	55	348	845	552
		West (Road D874)	400	1	400	0	4	400	396

Table 26: Summary of other traffic-related matters

Item	Description of Element	General Comments	Specific Issues	Actions Required
1.	**ACCESS - RELATED MATTERS**			
1.1	**Access from and to Road D212 (Point A)**			
1.1.1	**Point of Access-related matters**	a) Broader access from and to Road D874 is mainly gained via an existing intersection with Road D212 (**Point A**). b) **Point A** is in an acceptable condition in terms of road markings and road traffic signs.	a) Vehicles turning right at the intersection from the north on Road D212, specifically heavy vehicles in the future as part of the proposed mining development, does so by means of a single lane sharing through and right-turning vehicles which could lead to accidents from vehicles waiting to turn right. b) No reflective road studs are installed.	a) Construct a dedicated right-turn lane on the northern approach of Road D212 as part of the proposed mining development. b) Reflective road studs should be installed at Point A in order to ensure visibility of the intersection geometry to road users at night time.
1.1.2	**Sight distances**	a) Sight distances along Road D212 were inspected visually and were determined to have sufficient sight distance to the northern and southern directions. The current speed limit along Road D212 at the intersection is 60 km/h.	a) None	a) None

<table>
<tr><th>Item</th><th>Description of Element</th><th colspan="3">General Comments</th><th colspan="2">Specific Issues</th><th colspan="3">Actions Required</th></tr>
<tr><td rowspan="5"></td><td rowspan="5"></td><td colspan="4"></td><td colspan="4"></td></tr>
<tr><td colspan="2">Required</td><td colspan="2">Available</td><td colspan="2">Required</td><td colspan="2">Available</td></tr>
<tr><td>Intersection Sight Distance</td><td>225m</td><td>Intersection Sight Distance</td><td>300m</td><td>Intersection Sight Distance</td><td>225m</td><td>Intersection Sight Distance</td><td>250m</td></tr>
<tr><td>Stopping Sight Distance</td><td>90m</td><td>Stopping Sight Distance</td><td>300m</td><td>Stopping Sight Distance</td><td>90m</td><td>Stopping Sight Distance</td><td>200m</td></tr>
<tr><td colspan="4">ROAD D212 NORTHBOUND / NORTHERN APPROACH</td><td colspan="4">ROAD D212 SOUTHBOUND / SOUTHERN APPROACH</td></tr>
<tr><td>1.1.3</td><td>Intersection spacing</td><td colspan="3">a) All intersections are existing intersections and deemed to comply with the required intersection spacing standards.</td><td colspan="2">a) None</td><td colspan="3">a) None</td></tr>
<tr><td>1.2</td><td colspan="9">Traffic Calming along Road D212 at Point A</td></tr>
</table>

Item	Description of Element	General Comments	Specific Issues	Actions Required
1.2.1	**Traffic calming along Road D212**	a) Traffic calming along Road D212 at the intersection of Roads D212 and D874 is already implemented by means of speed bumps.	a) None.	a) None.

XVII. Visual Assessment (Logis, July 2020)

LOGIS (Pty) Ltd conducted the baseline assessment in July 2020. Find **Appendix R** for the detailed report.

The study area for the visual assessment encompasses a geographical area of 1,071km² (the extent of the full page maps displayed in this report) and includes a minimum 10km buffer zone (area of potential visual influence) from the mining footprint. The study area does not include any major roads or towns, and is located within a relatively remote area along the border between the Mpumalanga and Limpopo Provinces.

Methodology

The study was undertaken using Geographical Information Systems (GIS) software as a tool to generate viewshed analyses and to apply relevant spatial criteria to the proposed facility. A detailed Digital Terrain Model (DTM) for the study area was created from topographical data provided by NASA in the form of a 30m SRTM (Shuttle Radar Topography Mission) elevation model.

The methodology utilised to identify issues related to the visual impact included the following activities:

- The creation of a detailed digital terrain model of the potentially affected environment.
- The sourcing of relevant spatial data. This included cadastral features, vegetation types, land use activities, topographical features, site placement, etc.
- The identification of sensitive environments upon which the proposed facility could have a potential impact.
- The creation of viewshed analyses from the proposed project site in order to determine the visual exposure and the topography's potential to absorb the potential visual impact. The viewshed analyses take into account the dimensions of the proposed structures and activities.

This report (scoping report) sets out to identify the possible visual impacts related to the proposed Vygenhoek Platinum Mine from a desktop level.

The affected environment

The project is proposed on portions 3 and 7 of the farm Vygenhoek 10 JT, located within the Thaba Chweu Local Municipality, in the Ehlanzeni District Municipality of the Mpumalanga Province.

The project site falls within the Steenkampsberge and is relatively remote and not easily accessible from any major roads within the region. The Steenkampsberge fall within the eastern limb of the Bushveld Igneous Complex (refer to **Figure 63**), a geological system that contains 85% of the world's platinum group elements.

The physical geography is characterised by low mountains and parallel hills with incised river valleys separating the mountains. The surface elevation of the study area ranges from 811m above sea level in the north-west to 2,913m to the south.

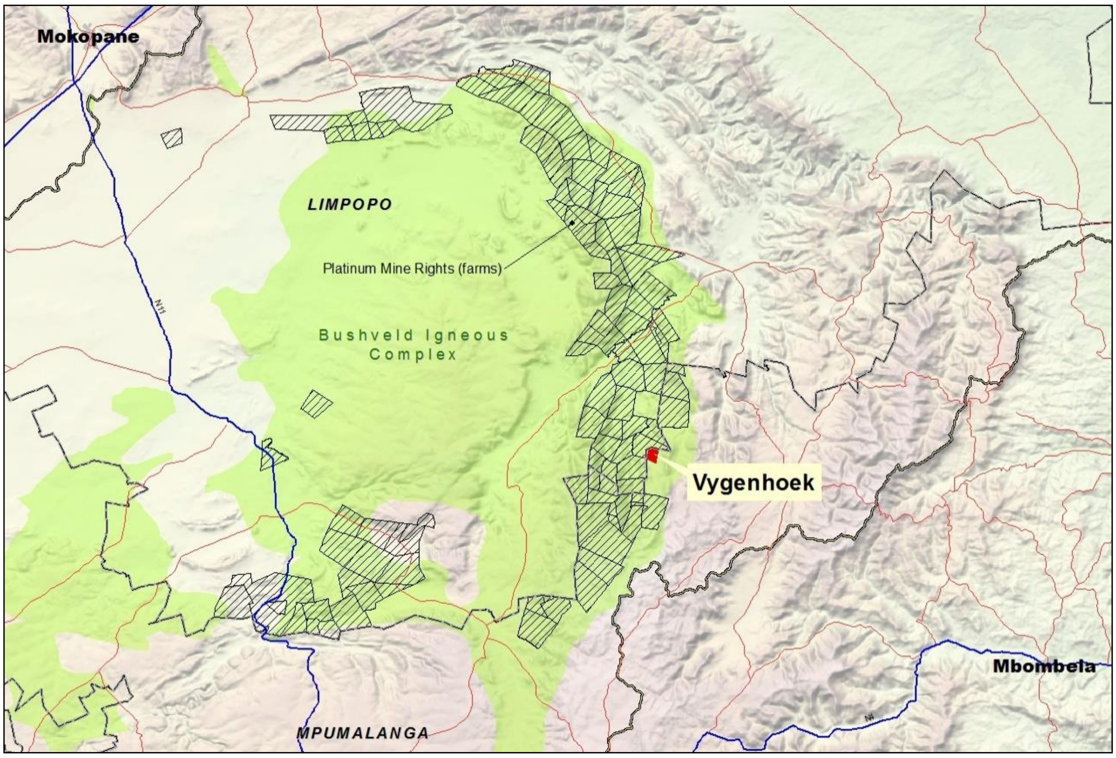


Figure 63:Platinum mining right within the eastern limb of the Bushveld Igneous Complex

The project site is located within the upper reaches of the Olifants River primary catchment, in a valley between the Waterval and Great Dwars Rivers. These rivers are tributaries of the Spekboom River, which flows into the Steelpoort River, and ultimately confluences with the Olifants River. An unnamed perennial river traverses the project site before flowing into the Great Dwars River. There are a number of man-made dams within the study area; amongst them are the Buffelskloof and Richmond Dams.

The study area has a rural and predominantly natural character and has, due to the steep slopes and shallow soils of the region, largely been unsuitable for agriculture. Some dryland and irrigated agriculture occur on the more even slopes within the Waterval River valley, but is overall fairly limited within the study area. The predominant natural land cover types are grassland, open woodland and dense forest and woodland (along the steeper slopes). The study area spans across two bioregions, namely the Central Bushveld Bioregion to the west (in the mountains) and the Mesic Highveld Grassland Bioregion to the east. The Bushveld Bioregion comprises Sekhukhune Mountain Bushveld vegetation and the Grassland Bioregion consists of Sekhukhune and Lydenburg Montane Grassland. See **Figure 67** for the broad land cover types map of the study area.

Besides the limited agricultural and forestry activities in the study area, there are a considerable number of active mines located within the region. Some of these include the Ba-Choma Silica Mine, the

Booysendal Mine, the Mototolo Mine, Everest Platinum Mine, Thorncliffe Mine and Dwarsrivier Mine. The establishment of mines in this area correlates with the high concentration of mineral resources associated with the eastern limb of the Bushveld Igneous Complex and the mining rights allocated within this area.

Settlements and homesteads dot the landscape at irregular intervals, but other than the mining and agricultural activities, there are limited additional land uses (such as tourism) within the study area. The Didingwe River Lodge and Thorncliffe Guest Farm are located further north along the Great Dwars River. The J.M. Beetge and Davel Private Nature Reserves are located (respectively) 11km and 15km from the Vygenhoek farm (at the closest).

The majority of the study area is sparsely populated (less than 10 people per km^2) and is generally considered to have a high scenic quality due to the mountainous terrain and undeveloped nature of the region. This scenic quality is however expected to come under increasing pressure from mining activities due to the abundance of mineral resources and platinum mining rights allocated along the entire length of the eastern limb of the Bushveld Igneous Complex[2].

Figure 64: View of the Great Dwars River (Photo credit: Google Earth, Herman Freysen)

[2] Sources: DEAT (ENPAT Limpopo/Mpumalanga), NBI (Vegetation Map of South Africa, Lesotho and Swaziland), NLC2018 (ARC/CSIR) and OLEMF.

Figure 65: Thorncliffe Guest Farm (Photo credit: Google Eart, Jiri Paclt)

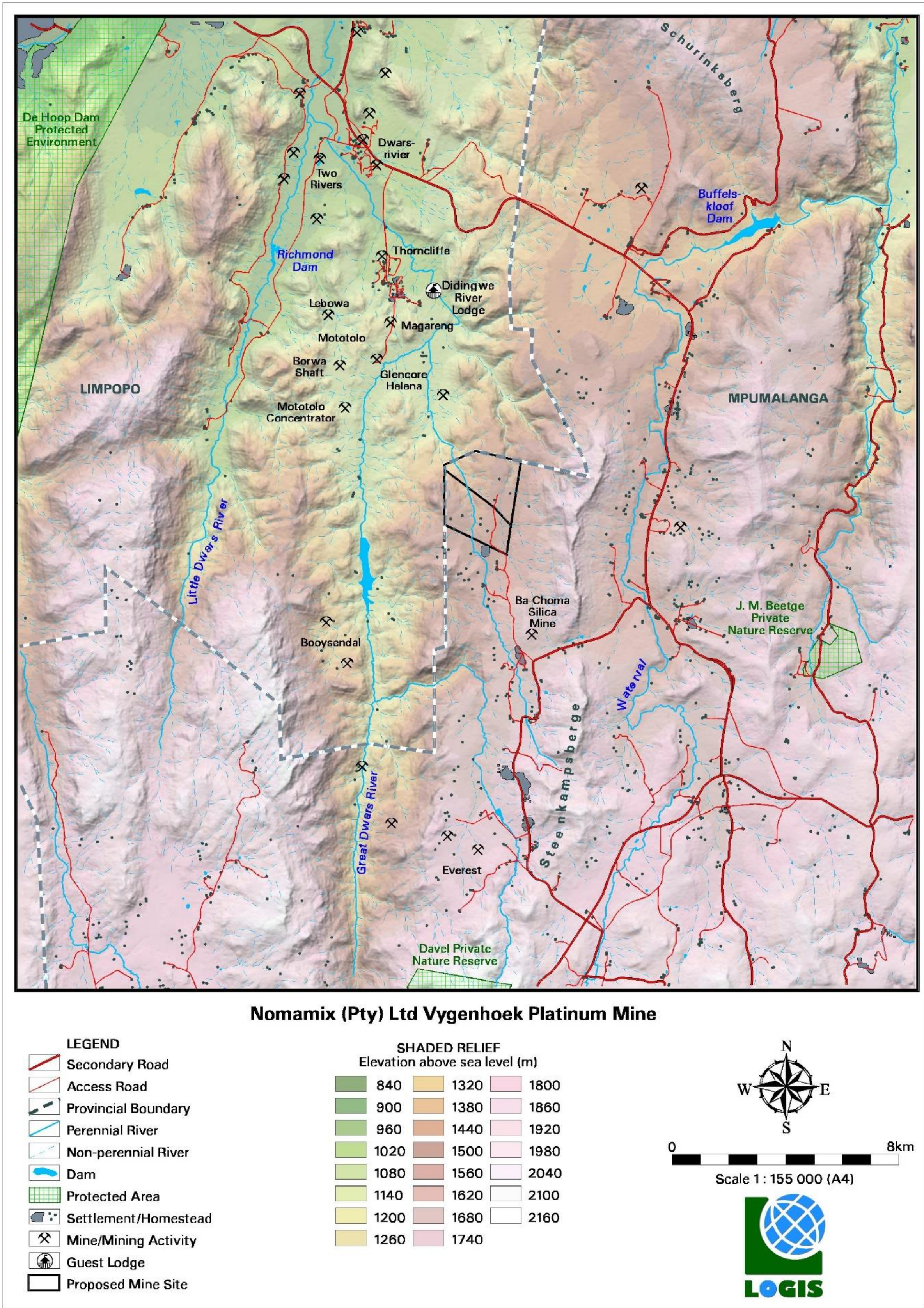


Figure 66: Shaded relief map of the study area

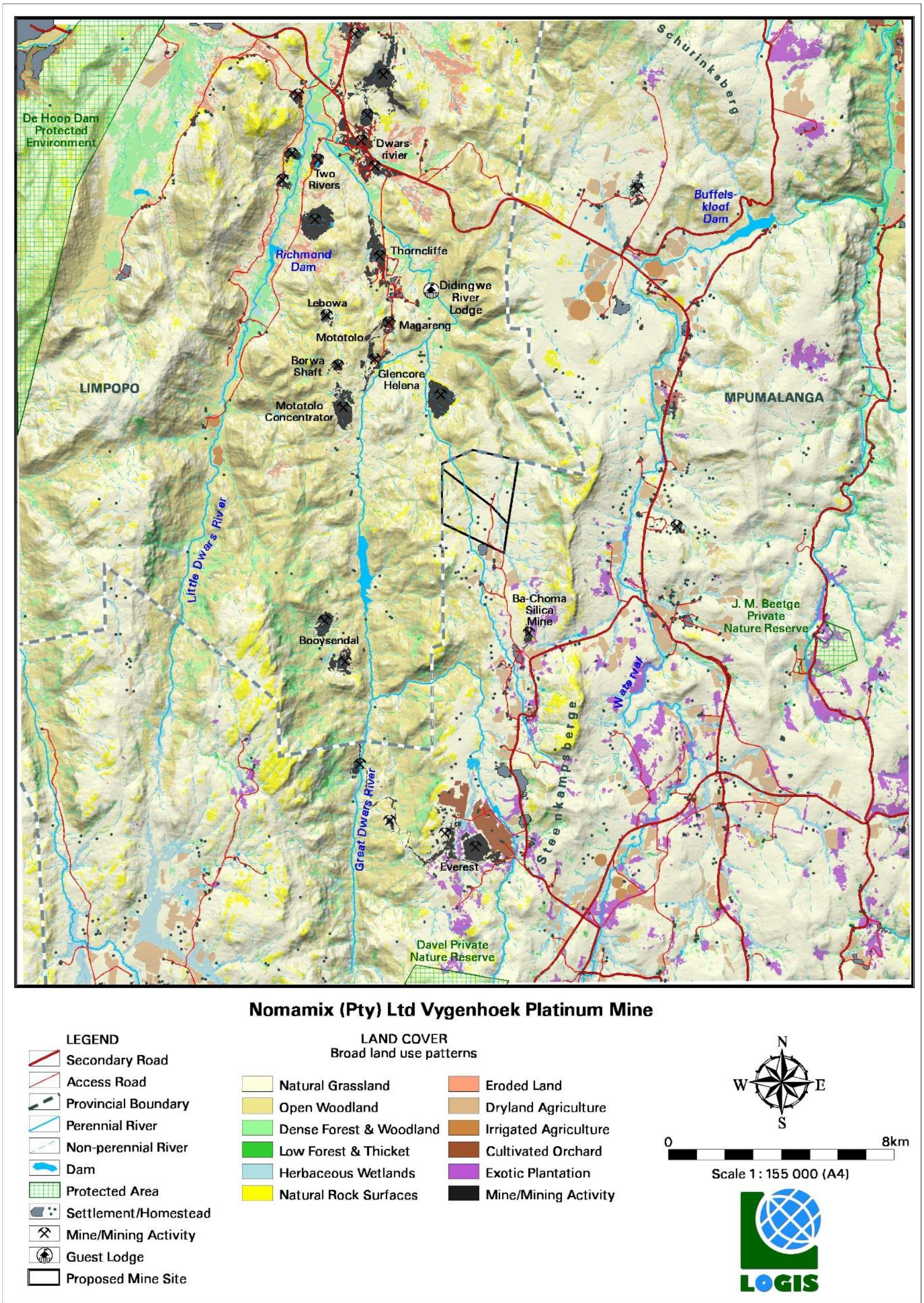


Figure 67: Land cover and broad land use patterns

Visual exposure/visibility

The result of the preliminary viewshed analysis for the proposed facility is shown on **Figure 68**. The initial viewshed analyses were undertaken from the open cast pit area (rock sub-outcrop), the stockpile and the associated surface infrastructure. The vantage points utilised were placed at respectively 5m, 15m and 10m above ground level in order to simulate the infrastructure and activities. This was done in order to determine the general visual exposure (visibility) of the area under investigation, simulating the maximum height of the proposed structures and mining activities associated with the mine.

The viewshed analysis will be further refined once a preliminary and/or final mine layout is completed and will be regenerated for the actual position of the infrastructure on the site and actual proposed infrastructure during the EIA phase of the project.

Figure 68 also indicates proximity radii from the footprint of the proposed structures/activities in order to show the viewing distance (scale of observation) of the facility in relation to its surrounds.

The viewshed analysis does not include the effect of vegetation cover or existing structures on the exposure of the proposed mine, therefore signifying a worst-case scenario.

Results

It is clear that the proposed Vygenhoek mine may have a fairly contained area of potential visual exposure in spite of its relatively elevated position within the landscape. The rocky sub-outcrop is the most elevated part of the mining site and it stands to reason that mining activity (e.g. drilling and blasting of the hard overburden, and loading and hauling of the ore) and mining equipment (e.g. haul trucks and excavators) may be most exposed. However, the location of the mining site within a valley, flanked by mountains on both the western and eastern sides, contains the immediate visual exposure to the valley itself.

Longer distance visual exposure is largely limited to the peaks and elevated side slopes of surrounding mountains. Additional (yet limited) visual exposure is also possible further north, down the Great Dwars River valley towards the Glencore Helena mine. The Didingwe River Lodge may also theoretically be exposed, although it is highly unlikely due to the vegetation cover present at the lodge.

The stockpile and ancillary surface infrastructure is expected to be less visually intrusive than the mining pit and activities, due to their locations lower down in the valley.

Conclusion

Notwithstanding the fact that the proposed Vygenhoek Platinum Mine may have a fairly limited area of potential visual exposure, the mine and mining activities, where visible from shorter distances (e.g. within a 2-5km radius), may constitute a high visual prominence, potentially resulting in a high visual impact.

This may become evident should potential sensitive visual receptors be identified within this zone during the EIA phase of the project.

Anticipated issues related to the visual impact

Anticipated issues related to the potential visual impact of the proposed Vygenhoek Platinum Mine include the following:

- An investigation into the visibility of the mine to, and potential visual impact on visitors to the Didingwe River Lodge and (potentially) residents of farm residences located within close proximity to the site.
- Potential cumulative visual impacts (or alternately, consolidation of visual impacts) with specific reference to the location of the Vygenhoek Platinum Mine within an area with existing mining activity.
- The potential visual impact of operational, safety and security lighting of the facility at night on observers residing in close proximity to the facility.
- The visual absorption capacity of natural or planted vegetation (if applicable).
- The potential to mitigate visual impacts.

It is envisaged that the issues listed above may potentially constitute a significant visual impact at a local and/or regional scale. These need to be assessed in greater detail during the EIA phase of the project.

Table 27: Impact table summarising the potential primary visual impacts associated with the proposed Vygenhoek Mine

<table>
<tr><td colspan="4">Impact

Visual impact of the mine on observers in close proximity to the proposed mining infrastructure and activities. Potential sensitive visual receptors include:

• Visitors to the Didingwe River Lodge
• Residents of homesteads and farm dwellings (if present in close proximity to the facility)</td></tr>
<tr><th>Issue</th><th>Nature of Impact</th><th>Extent of Impact</th><th>No-Go Areas</th></tr>
<tr><td>The viewing of the mining infrastructure and activities</td><td>The potential negative experience of viewing the mining infra-structure and activities within a predominantly natural setting</td><td>Primarily observers situated within a 2-5km radius of the mine</td><td>N.A.</td></tr>
<tr><td colspan="4">Description of expected significance of impact</td></tr>
</table>

Extent: Local Duration: Long term Magnitude: Moderate to High Probability: Probable Significance: Moderate to High Status (positive, neutral or negative): Negative Reversibility: Recoverable Irreplaceable loss of resources: No Can impacts be mitigated: Yes
Gaps in knowledge & recommendations for further study A finalised layout of the mine and ancillary infrastructure are required for further analysis. This includes the provision of the dimensions of mining structures and equipment. Additional spatial analyses are required in order to create a visual impact index that will include the following criteria: • Visual exposure • Visual distance/observer proximity to the structures/activities • Viewer incidence/viewer perception (sensitive visual receptors) • Visual absorption capacity of the environment surrounding the mining infrastructure and activities Additional activities: • Identify potential cumulative visual impacts • Undertake a site visit • Recommend mitigation measures and/or infrastructure placement alternatives Refer to the Plan of Study for the EIA phase of the project below.

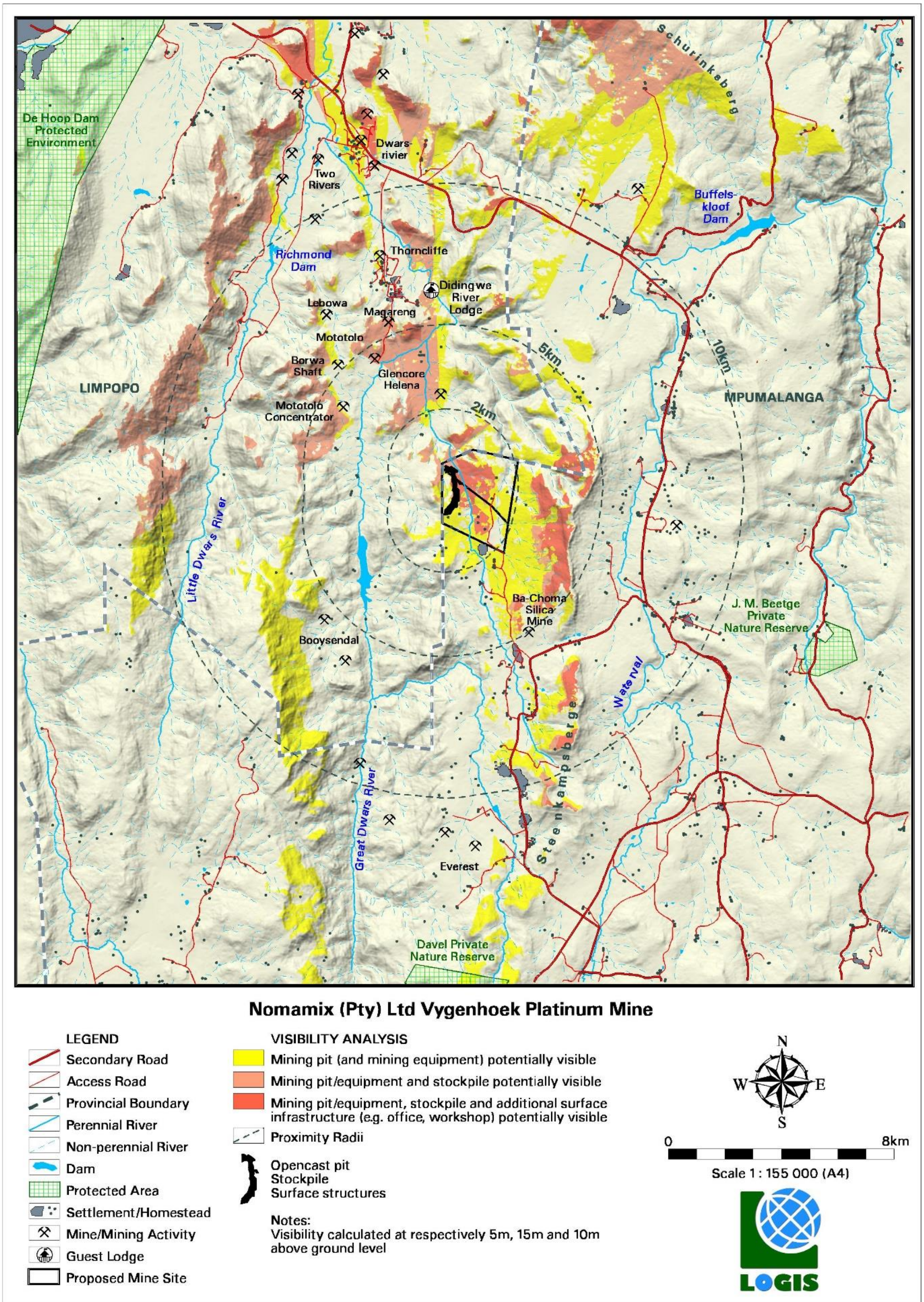


Figure 68: Map indicating the potential (preliminary) visual exposure of the proposed Vygenhoek

Terms of reference for EIA

The fact that some components of the proposed mine may be visible does not necessarily imply a high visual impact. Sensitive visual receptors within (but not restricted to) a 2-5km buffer zone from the mine need to be identified and the severity of the visual impact assessed within the EIA phase of the project.

It is recommended that additional spatial analyses be undertaken in order to create a visual impact index that will further aid in determining potential areas of visual impact. This exercise should be undertaken for the open cast pit as well as for the ancillary infrastructure, as these structures (e.g. the stockpile and mine structures) are envisaged to have varying levels of visual impact at a more localised scale. The site-specific issues (as mentioned earlier in the report) and potential sensitive visual receptors should be measured against this visual impact index and be addressed individually in terms of nature, extent, duration, probability, severity and significance of visual impact.

This recommended work must be undertaken during the Environmental Impact Assessment (EIA) Phase of reporting for this proposed project. In this respect, the Plan of Study for the EIA is as follows:

- Determine potential visual exposure

The visibility or visual exposure of any structure or activity is the point of departure for the visual impact assessment. It stands to reason that if the proposed mining facility and associated infrastructure were not visible, no impact would occur.

Viewshed analyses of the proposed facility and the related infrastructure, based on a 20m (or 5m) contour interval digital terrain model of the study area, indicate the potential visibility.

The first step in determining the visual impact of the proposed facility is to identify the areas from which the structures would be visible. The type of structures, the dimensions, the extent of operations and their support infrastructure are taken into account.

Features such as vegetation, man-made topographical features and other existing structures (that make up the visual absorption capacity of the environment surrounding the proposed development) that might shield the facility are built into the model to ensure that the result of the visibility analysis is as accurate as possible.

- Determine visual distance/observer proximity to the facility

In order to refine the visual exposure of the facility on surrounding areas/receptors, the principle of reduced impact over distance is applied in order to determine the core area of visual influence for each type of structure.

Proximity radii for the proposed mining site are created in order to indicate the scale and viewing distance of the facility and to determine the prominence of the structures in relation to their environment.

The visual distance theory and the observer's proximity to the facility are closely related, and especially relevant, when considered from areas with a high viewer incidence and a predominantly negative visual perception of the proposed facility.

- Determine viewer incidence/viewer perception (sensitive visual receptors)

The next layer of information is the identification of areas of high viewer incidence (i.e. main roads, residential areas, settlements, etc.) that would be exposed to the project infrastructure.

This is done in order to focus attention on areas were the perceived visual impact of the facility will be the highest and where the perception of affected observers will be negative.

Related to this data set, is a land use character map, that further aids in identifying sensitive areas and possible critical features (i.e. tourist facilities, national parks, residential areas, etc.), that should be addressed.

- Determine the visual absorption capacity of the landscape

This is the capacity of the receiving environment to absorb the potential visual impact of the proposed facility. The VAC is primarily a function of the vegetation, and will be high if the vegetation is tall, dense and continuous. Conversely, low growing sparse and patchy vegetation will have a low VAC.

The VAC would also be high where the environment can readily absorb the structure in terms of texture, colour, form and light / shade characteristics of the structure. On the other hand, the VAC for a structure contrasting markedly with one or more of the characteristics of the environment would be low.

The VAC also generally increases with distance, where discernable detail in visual characteristics of both environment and structure decreases.

- Calculate the visual impact index

The results of the above analyses are merged in order to determine the areas of likely visual impact and where the viewer perception would be negative. An area with short distance visual exposure to the proposed infrastructure, a high viewer incidence and a predominantly negative perception would therefore have a higher value (greater impact) on the index. This focusses the attention to the critical areas of potential impact and determines the potential **magnitude** of the visual impact.

Geographical Information Systems (GIS) software will be used to perform the analyses and to overlay relevant geographical data sets in order to generate a visual impact index.

- Determine impact significance

The potential visual impacts are quantified in their respective geographical locations in order to determine the significance of the anticipated impact on identified receptors. Significance is determined as a function of extent, duration, magnitude (derived from the visual impact index) and probability. Potential cumulative and residual visual impacts are also addressed. The results of this section is displayed in impact tables and summarised in an impact statement.

- Propose mitigation measures

The preferred layout alternative (or a possible permutation of the alternatives) will be based on its potential to reduce the visual impact. Additional general mitigation measures will be proposed in terms of the planning, construction, operation and decommissioning phases of the project.

- Reporting and map display

All the data categories, used to calculate the visual impact index, and the results of the analyses will be displayed as maps in the accompanying report. The methodology of the analyses, the results of the visual impact assessment and the conclusion of the assessment will be addressed in the VIA report.

- Site visit

Undertake a site visit in order to verify the results of the spatial analyses and to identify any additional site specific issues that may need to be addressed in the VIA report.

(b) Description of current land uses

Land use can be defined as the arrangements, activities and inputs people undertake in a certain land cover type to produce, change or maintain, *i.e.* the human use of land. Land use involves the management and modification of natural environment or wilderness into built environment such as settlements and semi-natural habitats such as dams, infrastructure, natural veld, pans, ploughed land, settlements, wetlands, pastures, and managed woods.

Land capability classification shows the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management.

Table 28: Criteria for determination of land capability

Summarised description of land capability criteria	
Wetlands, Pans, Drainage Lines	Land with organic soils or supporting hygrophilous vegetation where soil and vegetation processes are water determined.
Arable (>600mm)	Land that does not qualify as wetland. Soil is readily permeable to depth of 750mm. Soil has pH value between 4 and 8.4. Soil has low salinity and SAR. Soil has less than 10% (by volume) rocks or pedocrete fragments larger than 100mm in the upper 750mm. Has a slope (%) and erodibility factor (k) such that their product is <2.0. Occurs under a climate of crop yields that are at least equal to the current national average for these crops.

Grazing (250 – 600mm)	Land which does not qualify as wetland or arable land. Has soil, or soil-like material, permeable to roots of native plants, that is more than 250mm thick and contains less than 50% by volume of rocks or pedocrete fragments larger than 100mm. Supports, or is capable of supporting a stand of native or introduced grass species or other forage plants used by domesticated livestock or game animals on a commercial basis.
Wilderness (<250mm)	Land which does not qualify as wetland, arable or grazing land.

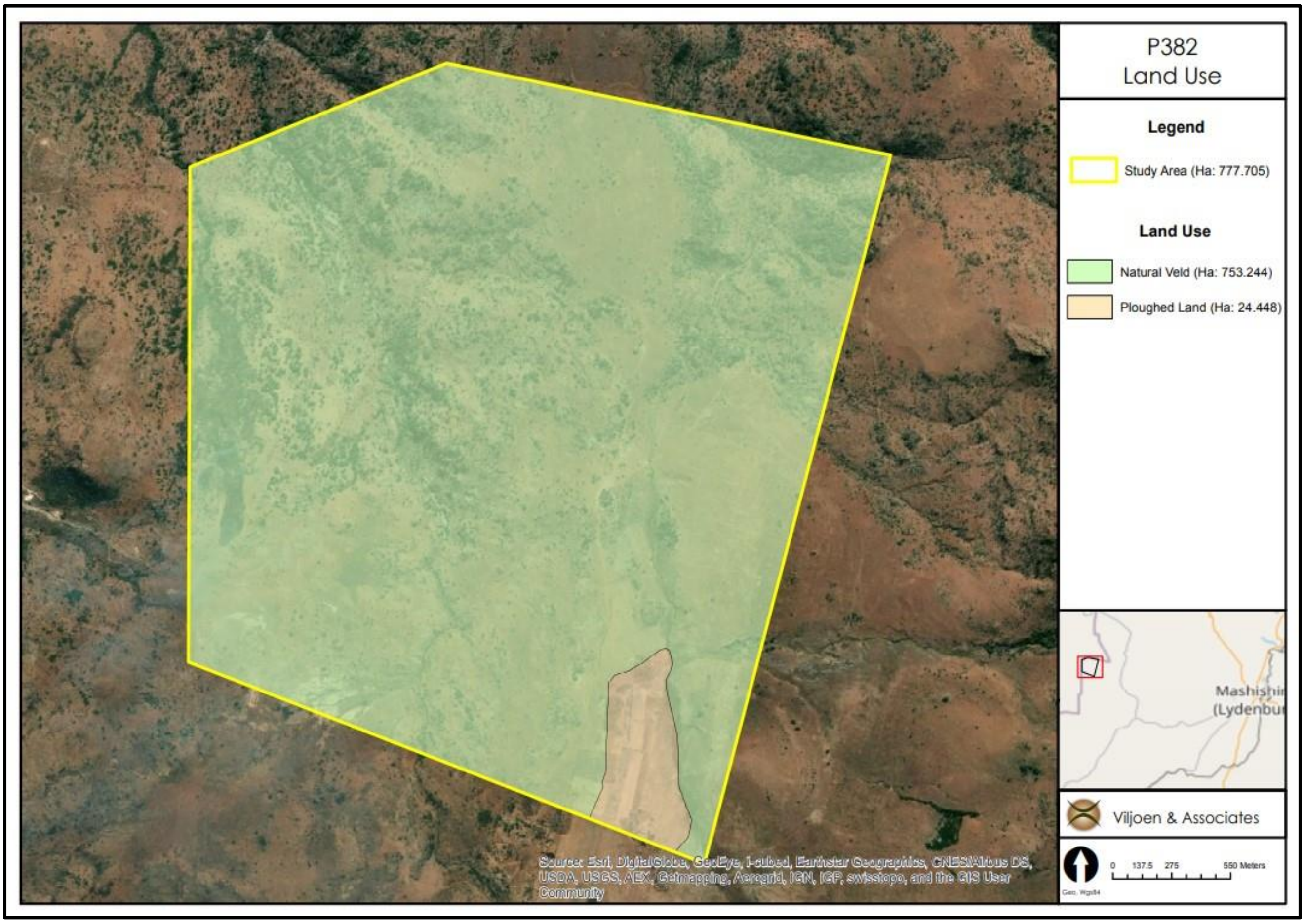


Figure 69: Land use of the proposed Vygenhoek Platinum Mine

Table 29 summarises the *land use* (**Figure 72**) of the area investigated:

Table 29: Land use of the proposed Vygenhoek Platinum Mine

Area	Land Use	Surface Area (ha)	% of Total
Portions 3 and 7 Farm Vygenhoek	Natural Veld	753,24	96,86
	Ploughed Land	24,44	3,14
	Total	**777,68**	**100**

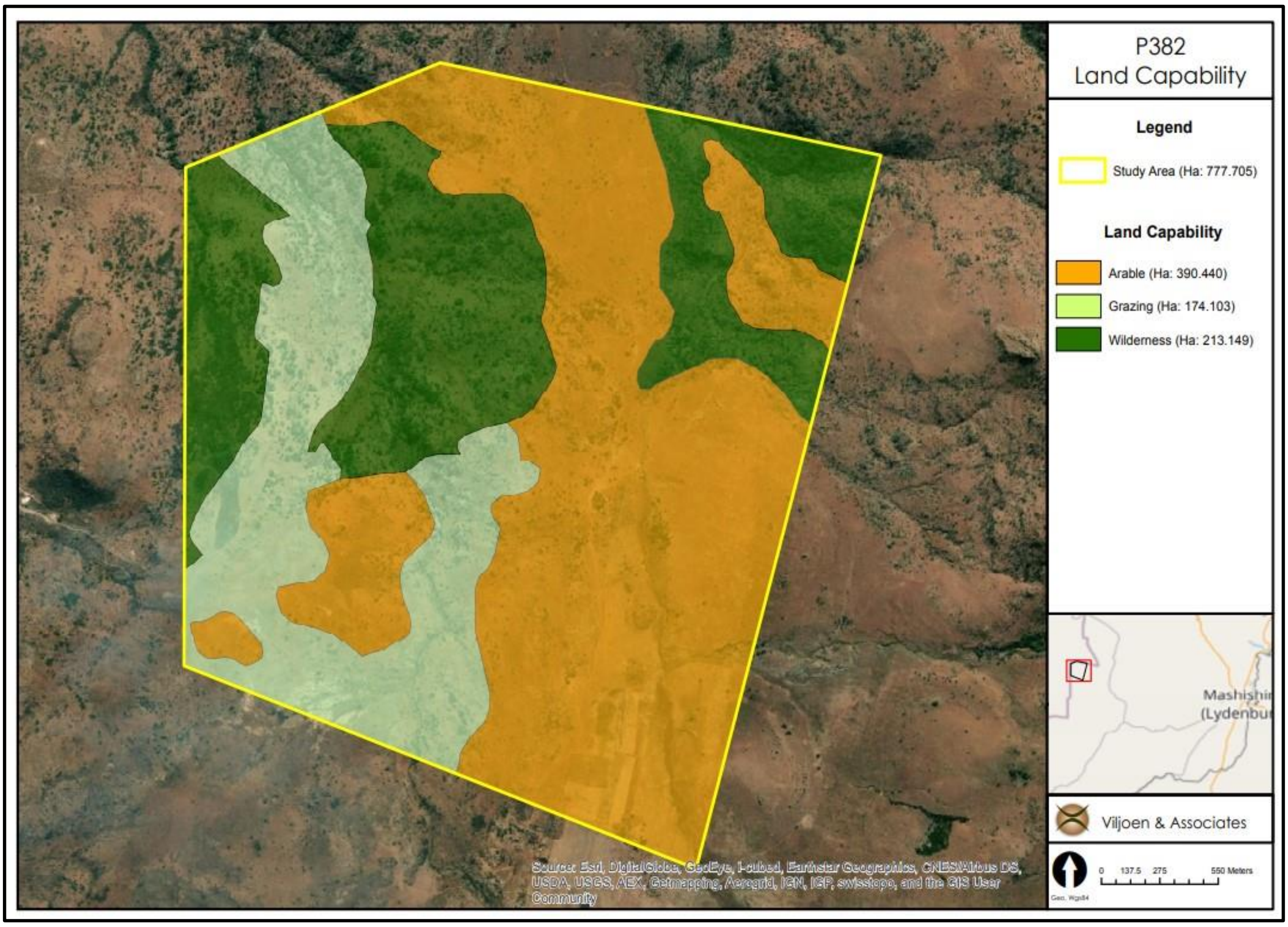


Figure 70: Land capability of the proposed Vygenhoek Platinum Mine

Table 30 summarises the *land capability* (**Figure 73**) of the area investigated:

Table 30: Land capability of the proposed Vygenhoek Platinum Mine

Area	Land Capability	Surface Area (ha)	% of Total
Portions 3 and 7 Farm Vygenhoek	Arable	390,44	50,21
	Grazing	174,10	22,39
	Wilderness	213,14	27,41
	Total	**777,68**	**100**

(c) Description of specific environmental features and infrastructure on site

Throughout the process of determination the potential environmental impacts, the site layout for the proposed activities were considered.

Infrastructures associated to the proposed Vygenhoek Platinum Mine are as follows:

- Waste management: temporary handling and storage of general and hazardous waste, on-site change houses/ablution facilities with conservancy tank and chemical toilets;
- Surface Water Management: water supply dams, mine residue facility return water dams, pollution control dams, clean and dirty storm water controls, river crossings;
- Storage and handling of hazardous substances: fuel, lubricants, various process input chemicals, raw material stockpiles/bunkers, gas, burning oils, explosives;
- Security and access control;
- Lay down and storage yard areas;
- Workshops and wash bays;
- Offices;
- RoM and product stockpile lay down areas;
- Screening lay down areas;
- Vehicle/Equipment/Plant parking bay;
- Residue stockpile areas;
- Contractor camps;
- Medical station; and
- Diesel Generator.

Apart from the infrastructures associated to the mining development, a number of environmentally and socially sensitive receptors were identified. **Appendix S** provides the detailed site lay out plan in relation to the sensitive receptors.

(d) Environmental and current land use map

(Show all environmental and current land use features)

Find **Appendix S**.

v) Impacts identified

(Provide a list of the potential impacts identified of the activities described in the initial site layout that will be undertaken, as informed by both the typical known impacts of such activities, and as informed by the consultations with affected parties together with the significance, probability and duration of the impacts)

This section summarises the potential impacts associated to the three different phases of the proposed mining activities. The potential impacts and risks are explored by investigating each aspect (i.e. air quality, soil quality, water quality etc.) associated to the proposed activities.

For the purpose of this section, the mitigation measures recommended will only summarise the approach taken to manage each risk. A detailed mitigation plan will form part of the final EIR and EMPr.

Table 31: Explanation of colour indicator

Colour	Significance Points	Explanation
	≤ 30	**LOW** environmental significance
	31 - 60	**MODERATE** environmental significance
	> 60	**HIGH** environmental significance

Table 32: Possible impacts identified as part of the scoping phase

ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	DESCRIPTION OF ENVIRONMENTAL RISK (DIRECT AND INDIRECT IMPACT)	PHASE	Duration	Extent	Magnitude	Probability	SIGNIFICANCE (Pre-Mitigation)	Mitigation Type	Duration	Extent	Magnitude	Probability	SIGNIFICANCE (Post-Mitigation)
Construction															
Air Quality Management															
Access and hauling along roads i.e. during the construction of roads	Fugitive and ambient dust generation	Air Quality	**Direct Impact:** Road construction involves the removal of rock and earth by grading or digging during construction. Vegetation is removed, grading and paving takes place using a range of road construction equipment. This often leads to the generation of fugitive dust comprising TSP, PM10 and PM2.5 from the dirt roads.	Construction & Operational	1	2	6	5	45	Control	1	1	2	3	12
Site clearing and topsoil stripping for lay down area of approximately 47ha and all related mining infrastructure			**Direct Impact:** Vegetation is removed, grading and paving to prepare the lay down areas takes place using a range of construction equipment. This often leads to the generation of fugitive dust comprising PM10 and PM2.5. The generation of dust during these activities will affect the visual environment negatively.		1	2	6	5	45		1	1	2	3	12
Construction of training centres, offices, ablution facilities and kitchen facilities			**Direct Impact:** During the construction of infrastructures areas are to be cleared of vegetation. This often leads to the generation of fugitive dust comprising TSP, PM10 and PM2.5.		1	2	6	5	45		1	1	2	3	12
Construction of Pollution Control Dams (PCD's)			**Direct Impact:** Continuous use of haul road often leads to the generation of fugitive dust comprising TSP, PM10 and PM2.5 from the dirt roads. The generation of dust during these activities will affect the visual environment negatively.		1	2	6	5	45		1	1	2	3	12
Transport of construction material, mobile plant and equipment to the site			**Indirect Impact:** Continuous exposure to high levels of dust fallout may lead to unhealthy environment for employees and surrounding communities.		2	3	6	5	55		2	2	2	3	18
Access and hauling along roads i.e. during the construction of roads	GHG emissions (direct and indirect)	Air Quality & Climate	**Direct Impact:** The usage of diesel operated mobile equipment being used during the construction and operational activities contributes directly to Nomamix (Pty) Ltd carbon footprint.	Construction & Operational	1	4	4	4	36	Control	1	3	2	3	18
Site clearing and topsoil stripping for lay down area of approximately 47 ha and all related mining infrastructure			**Indirect Impact:** During the construction phase, it is expected that some clearing of land may be required in terms of removing vegetation. This will result in the loss of carbon sink capacity due to vegetation not being available to convert the CO2 emitted to oxygen. Fossil fuel combustion is a major source of CO2 emissions. CH4 and N2O are related to vehicle km travelled rather than fuel		1	4	4	4	36		1	3	2	3	18

Stores, workshops &wash bays			consumption and account for 5% of diesel engine emissions in terms of CO2 equivalent (Amoako, et al. 2018). **Cumulative Impact:** Changing climatic conditions will have both direct (operational and performance-based) and indirect (securing of supplies and rising energy costs) impacts on the mining sector. These include but are not limited to water-related impacts (droughts, floods, storms, etc); heat-related impacts (bush fires and heat strokes); and sea level rise.		2	4	4	4	40		2	3	2	3	21
Fuel operating power generators					2	4	4	4	40		2	3	2	3	21
Transport of construction material, mobile plant, and equipment to the site					2	4	4	4	40		2	3	2	3	21
Onsite Clinic	Electricity usage	GHG emissions	**Direct Impact**: Contributing factor the BCR Minerals (Pty) Ltd carbon footprint. **Indirect Impact:** The proposed mine will have 2 stationary generators (with 1 being a back-up generator). The proposed mine expects to consume about 4 000 litres of diesel per month in these generators, which it is assumed will be used to electrify the infrastructure (workshop, administration office, weighbridge, and additional lighting of the stockpile area). Fossil fuel combustion is a major source of CO2 emissions. CH4 and N2O are related to vehicle km travelled rather than fuel consumption and account for 5% of diesel engine emissions in terms of CO2 equivalent (Amoako, et al. 2018). **Cumulative Impact:** Changing climatic conditions will have both direct (operational and performance-based) and indirect (securing of supplies and rising energy costs) impacts on the mining sector. These include but are not limited to water-related impacts (droughts, floods, storms, etc); heat-related impacts (bush fires and heat strokes); and sea level rise.	Operational	3	4	4	4	44	Control	3	3	2	3	24
Construction of training centres, offices, ablution facilities and kitchen facilities					1	4	4	4	36		1	3	2	3	18

Fauna and Flora															
Access and hauling along roads i.e. during the construction of roads	Vegetation and habitat loss	Macro and Micro organisms	**Direct Impact:** Clearing the area to construct the access roads leads to the loss of vegetation and habitats of macro and micro-organisms. The loss of vegetation also affects the surrounding Fauna and Flora. Increased human-animal conflict, accidental killings	Construction	5	3	10	5	90	Remedy	3	1	6	5	50
Site clearing and topsoil stripping for lay down area of approximately 47 ha and all related mining infrastructure															

Storm water runoff management features		Fauna and Flora	**Direct Impact:** Clearing of site and stripping of topsoil during the construction of storm water runoff management features poses a risk to the loss of vegetation and habitats of macro and micro-organisms. The loss of vegetation also affects the habitat of surrounding Fauna and Flora. **Indirect Impact:** If areas surrounding the storm water features are not rehabilitated properly or features installed are not constructed according to the storm water management model, these areas are prone to erosion.		5	3	10	5	90		3	1	6	5	50
Access and hauling along roads i.e. during the construction of roads	Influx of alien invasive vegetation	Fauna and Flora micro and macro ecosystems	**Direct Impact:** Site clearing for roads, lay down areas, and mining area exposes the un-vegetated area to the influx of alien invasive vegetation causing Irreversible damage to the native fauna and flora species and loss of habitats. Increased human-animal conflict, accidental killings	Construction	5	3	10	5	90	Control	3	2	6	4	44
Site clearing and topsoil stripping for lay down area of approximately 47 ha and all related mining infrastructure					5	3	10	5	90		3	2	6	4	44
Construction of training centres, offices, ablution facilities and kitchen facilities					5	3	10	5	90		3	2	6	4	44
Stores, workshops &wash bays	Spread of chemical fires	Fauna and flora micro and macro ecosystems	**Direct Impact:** The improper storage of hazardous substances poses a risk of chemical fires. In the event of a chemical fire the impact to the surrounding environment is significant. Fires may lead to the loss of ecosystems, damage to properties and fatalities. Altered ecological regimes (fire), ecological processes, contamination of nearby sensitive (wetland) habitat.	Construction & Operational	5	3	10	2	36	Avoid	1	1	0	1	2
Fuel operating power generators					5	3	10	2	36		1	1	0	1	2
Fuel storage					5	3	10	2	36		1	1	0	1	2

Aquatic ecology															
Access and hauling along roads i.e. during the construction of roads	Sedimentation and siltation of watercourses	Wetland and aquatic ecology	**Direct Impact:** Constructing access roads through drainage lines may cause sedimentation and siltation of watercourses if not managed properly. **Indirect Impact:** While the placement of various infrastructure associated with the propose mine may not result in the direct loss of wetland habitat, activities associated with the establishment of the mine is likely to impact the adjacent and downstream watercourses through the clearing of natural vegetation, altered overland flow and	Construction and Operations	2	3	8	5	65	Avoid	2	1	4	3	21

Site clearing and topsoil stripping for lay down area of approximately 47 ha and all related mining infrastructure			sediment transport. Further, the use of heavy machinery within the construction footprint will lead to soil compaction, which increases the runoff of water over the topsoil and the reduction in stormwater infiltration into the soil profile, therefore increasing the likelihood of erosion gully formation and the deposition of sediment within associated watercourses. In addition, the presence of bare soil associated with stockpiles during mining activities will result in a change in the stormwater runoff volume and velocity entering adjacent wetland systems.		2	3	8	5	65		2	1	4	3	21
Transport of construction material, mobile plant, and equipment to the site					2	3	8	5	65		2	1	4	3	21
Storm water runoff management features			**Direct Impact:** Improper or ineffective storm water runoff management features poses a risk of contributing to the sedimentation and siltation of watercourses.		5	3	8	5	80		5	1	4	2	20
Access and hauling along roads i.e. during the construction of roads	Alteration of drainage patterns	Wetland and aquatic ecology	**Indirect Impact:** Alteration of the drainage patterns may lead to the degradation of downstream or surrounding Wetlands which in its turn may affect the aquatic micro and macro ecology. **Direct Impact**: The construction of access roads through drainage lines may lead to the siltation of streams as well as lead to erosion along the riverbanks that will affect the surface water quality negatively.	Construction and Operations	5	3	8	5	80	Remedy	3	1	4	4	32
Site clearing and topsoil stripping for lay down area of approximately 47 ha and all related mining infrastructure					5	3	8	5	80		3	1	4	4	32
Storm water runoff management features					5	3	8	5	80		3	1	4	4	32

Site clearing and topsoil stripping for lay down area of approximately 47 ha and all related mining infrastructure	Destruction of wetlands	Wetland and aquatic ecology	**<u>Direct Impact:</u>** Site clearing and topsoil stripping in Wetlands will cause the loss of micro and macro aquatic species. The potential presence of wetland features with the proposed mining area is likely to result in the direct loss of potential wetland features present. **<u>Indirect Impacts:</u>** The proposed activity is further expected to result in impacts to drivers of wetland features adjacent to and/or downstream of the proposed mining areas, resulting in the degradation and loss of ecosystem services provided by wetlands.	Construction	5	3	8	5	80	Remedy	3	1	4	4	32
Pollution Control Dams (PCD's) i.e. Construction and operation	Contamination of water resources	Wetland and aquatic ecology	**<u>Direct Impact:</u>** If PCD's are not constructed in a way to avoid seepage to the surrounding environment or if not maintained, it poses a risk of contaminating water resources within proximity to the facility.	Construction & Operational	4	3	6	5	65	Control	2	2	4	4	32
Stores, workshops &wash bays			**<u>Direct Impact:</u>** Improper management of effluent from store, workshops, and wash bays poses a high risk to contaminating water resources. **<u>Indirect Impact:</u>** Over an extended period, the exposure to contamination will cause the degradation of fauna and flora habitats as well as affect the surface and sub-surface water quality. **<u>Cumulative Impacts:</u>** Mismanagement of mine-generated waste and pollutants (including hydrocarbons, construction waste, hazardous chemicals, etc.) is likely to result in these substances or their derivatives entering and polluting the sensitive aquatic environments either directly through surface runoff during rainfall events, or subsurface water movement. An increase in pollutants will lead to changes in the water quality of the wetlands and watercourses, affecting their ability to act as ecological corridors within the development landscape. The linked nature of the wetland systems to downstream water resources will result in pollutants being carried downstream from the mine construction site having consequences on further downstream users.		4	3	6	5	65		2	2	4	4	32
Ablutions & change house with sewage treatment plant			**<u>Direct Impact:</u>** Improper management of effluent from ablution facilities, change houses, and sewage treatment plant poses a high risk to contaminating water resources. **<u>Indirect Impact:</u>** Over an extended period, the exposure to contamination will cause the degradation of fauna and flora habitats as well as affect the surface and sub-surface water quality.		4	3	6	5	65		2	2	4	4	32
Fuel operating power generators			**<u>Direct Impact:</u>** The construction of improper generator facilities poses a risk of the surrounding environment to be exposes to continuous leaking of hydrocarbons leading possibly contaminating both surface and sub-surface water sources as well as the soils surrounding the facility.		4	3	6	5	65		2	2	4	4	32
Fuel storage			**<u>Direct Impact:</u>** The construction of improper storage facilities poses a risk of the surrounding environment to be exposes to continuous leaking of hydrocarbons leading possibly contaminating both surface and sub-surface water sources as well as the soils surrounding the facility.		4	3	6	5	65		2	2	4	4	32

Site clearing and topsoil stripping for lay down area of approximately 47 ha and all related mining infrastructure	Hydrocarbon contamination	Wetland and aquatic ecology	**Direct Impact:** Throughout the construction phase construction equipment are used. This poses a risk of hydrocarbon spills if equipment is not maintained. Depending on the size of the spill the level of contamination may vary from insignificant to significant and may affect the surrounding water quality (both surface and sub-surface) as well as the soil quality. Mismanagement of mine-generated waste and pollutants (including hydrocarbons, construction waste, hazardous chemicals, etc.) is likely to result in these substances or their derivatives entering and polluting the sensitive aquatic environments either directly through surface runoff during rainfall events, or subsurface water movement. An increase in pollutants will lead to changes in the water quality of the wetlands and watercourses, affecting their ability to act as ecological corridors within the development landscape. The linked nature of the wetland systems to downstream water resources will result in pollutants being carried downstream from the mine construction site having consequences on further downstream users.	Construction & Operational	4	1	4	4	36	Control	1	1	0	3	6
Storm water runoff management features			**Direct Impact:** Storm water from dirty areas such as the mining area, lay down areas, workshops, stores, wash bays etc. poses a risk to hydrocarbon containing effluent to contaminate water resources. Depending on the level of contamination the risk may vary from insignificant to significant and may affect the surrounding water quality (both surface and sub-surface) as well as the soil quality.		4	2	6	4	48		1	1	0	3	6
Access and hauling along roads i.e. during the construction of roads	Destruction of upstream tributaries and reduction in water in the catchment	Wetland and aquatic ecology	**Indirect Impact:** Alteration of the upstream drainage lines may lead to the degradation of downstream or surrounding Wetlands which in its turn may affect the aquatic micro and macro ecology. **Direct Impact:** The destruction of tributaries may lead to a limited volume of water available to the downstream users. The reduction in water in the catchment may cause the degradation of surface water quality.	Construction and Operations	5	3	8	5	80	Avoid	3	1	4	4	32

Soil																
Access and hauling along roads i.e. during the construction of roads	Degradation of soil resources	Soil quality	**Direct Impact:** As part of the construction activity related to roads, valuable topsoil's will be removed. Improper management of topsoil or fertile soil may cause the loss of flora micro-ecosystems and cause the degradation of soil quality.	Construction & Operational	5	1	10	5	80	Remedy	2	1	6	4	36
Site clearing and topsoil stripping for lay down area of approximately 47 ha and all related mining infrastructure			**Direct Impact:** If not managed properly, fertile soil will be lost during site clearance and topsoil striping. Loss of fertile soil will cause the degradation of habitat for flora micro- and macro organisms.		5	1	10	5	80		2	1	6	4	36

Stores, workshops &wash bays			**Direct Impact:** The continuous spills of hydrocarbons and hazardous substances poses an environmental risk to the surrounding soil quality. The degradation of the soil quality will cause the loss of habitat or healthy environment for micro ecosystems.		5	1	10	5	80		2	1	2	3	15
Ablutions & change house with sewage treatment plant			**Direct Impact:** Continuous leaking or lack of maintenance poses a risk to contaminating the surrounding soils and degrading the soil quality. This will affect the micro-ecosystems in a negative manner.		5	1	10	5	80		2	1	2	3	15
Fuel operating power generators			**Direct Impact:** Continuous exposure to hydrocarbon leaks poses a risk to the degradation of the surrounding soil resources.		5	1	10	5	80		2	1	0	3	9
Fuel storage					5	1	10	5	80		2	1	0	3	9
Access and hauling along roads i.e. during the construction of roads	Hydrocarbon Contamination	Soil quality	**Direct Impact:** Throughout the construction phase construction equipment are used. This poses a risk of hydrocarbon spills if equipment is not maintained. Depending on the size of the spill the level of contamination may vary from insignificant to significant and may affect the surrounding water quality (both surface and sub-surface) as well as the soil quality.	Construction & Operational	2	1	8	3	33	Control	1	1	0	2	4
Transport of construction material, mobile plant, and equipment to the site					2	2	8	3	36		1	1	0	2	4
Stores, workshops &wash bays			**Direct Impact:** Throughout the construction & operation phase equipment and plant are used. This poses a risk of hydrocarbon spills if equipment/plant are not maintained. Depending on the size of the spill the level of contamination may vary from insignificant to significant and may affect the surrounding water quality (both surface and sub-surface) as well as the soil quality. The improper management of oil separators/sumps may also lead to the contamination of the surrounding environment.		2	1	8	4	44		1	1	2	3	12
Fuel operating power generators			**Direct Impact:** The construction of improper generator facilities poses a risk of the surrounding environment to be exposes to continuous leaking of hydrocarbons leading possibly contaminating both surface and sub-surface water sources as well as the soils surrounding the facility.		2	1	8	4	44		1	1	2	3	12
Fuel storage			**Direct Impact:** The construction of improper storage facilities poses a risk of the surrounding environment to be exposes to continuous leaking of hydrocarbons leading possibly contaminating both surface and sub-surface water sources as well as the soils surrounding the facility.		2	1	8	4	44		1	1	2	3	12

Access and hauling along roads i.e. during the construction of roads	Erosion	Loss of fertile soil	**Indirect Impact:** Improper management of storm water may lead to erosion along the access routes. This may lead to the loss of fertile soil and in its turn effect the micro-ecosystems of the surrounding environment.	Construction & Operational	5	2	10	4	68	Avoid	1	1	2	3	12
Site clearing and topsoil stripping for lay down area of approximately 47 ha and all related mining infrastructure			**Direct Impact:** Un-vegetated areas exposed to weathering for an extended period will lead to erosion. Erosion prone areas has a high risk of losing fertile soil caused by flash floods. The loss of fertile soil will result in the loss of important micro ecosystems.		5	2	10	5	85		2	1	4	3	21
Storm water runoff management features			**Direct Impact:** Improper management of storm water runoff poses a high risk to erosion. Un-vegetated or degraded areas exposed to weathering for an extended period are a contributing factor. Erosion prone areas has a high risk of losing fertile soil caused by flash floods. The loss of fertile soil will result in the loss of important micro ecosystems.		5	3	10	3	54		2	1	4	3	21
Transport of construction material, mobile plant, and equipment to the site					5	2	10	3	51		1	1	2	3	12

Mining offices i.e. operation of training centres, offices, and kitchen facilities	General waste generation & Littering	Soils quality due to leachates	**Direct Impact:** Littering throughout the construction and operational phase poses the risk of the visual environment to be affected negatively. The storing of waste onsite for an extended time may cause the formation of leachate that will affect the soil and water quality of the surrounding environment in a negative way. **Indirect Impact:** Exposure of leachate to the natural environment poses a health risk to the surrounding fauna and flora habitats as well as human health.	Construction & Operational	3	1	2	4	24	Control	1	1	0	3	6

Water resources															
Access and hauling along roads i.e. during the construction of roads	Hydrocarbon Contamination	Surface Water quality	**Direct Impact:** Throughout the construction phase construction equipment are used. This poses a risk of hydrocarbon spills if equipment is not maintained. Depending on the size of the spill the level of contamination may vary from insignificant to significant and may affect the surrounding water quality (both surface and sub-surface) as well as the soil quality. The improper management of oil separators/sumps may also lead to the contamination of the surrounding environment.	Construction & Operational	3	3	8	3	42	Control	1	1	2	3	12
Site clearing and topsoil stripping for lay down area of approximately 47 ha and all related mining infrastructure					4	3	8	4	60		1	1	4	3	18
Weigh bridge					3	3	8	3	42		1	1	0	3	6
Stores, workshops &wash bays					3	3	8	4	56		1	1	2	3	12

Fuel operating power generators		Groundwater quality			3	3	8	3	42		1	1	2	3	12
Fuel storage					3	3	8	3	42		1	1	2	3	12
Transport of construction material, mobile plant, and equipment to the site					3	3	8	3	42		1	1	2	3	12
Storm water runoff management features			**Direct Impact:** Storm water from dirty areas such as the mining area, lay down areas, workshops, stores, wash bays etc. poses a risk to hydrocarbon containing effluent to contaminate water resources. Depending on the level of contamination the risk may vary from insignificant to significant and may affect the surrounding water quality (both surface and sub-surface) as well as the soil quality.		4	3	8	3	45		1	1	2	3	12
Pollution Control Dams (PCD's) i.e. Construction and operation			**Direct Impact:** The lack of inspections or regular maintenance of facilities such as water pumps poses a risk to contaminating the surface and sub-surface water resource.		4	3	8	4	60		1	1	4	3	18
Access and hauling along roads i.e. during the construction of roads	Sedimentation and siltation of watercourses	Surface Water	**Direct Impact:** Constructing access roads through drainage lines may cause sedimentation and siltation of watercourses if not managed properly. Indirect Impact: Storm water runoff of dirt roads may cause sedimentation and siltation of nearby watercourses.	Construction & Operational	3	3	8	4	56	Control	1	1	2	3	12
Site clearing and topsoil stripping for lay down area of approximately 47 ha and all related mining infrastructure					3	3	8	4	56		2	1	2	3	15
Transport of construction material, mobile plant, and equipment to the site					3	3	8	4	56		1	1	2	3	12
Storm water runoff management features			**Direct Impact:** Improper or ineffective storm water runoff management features poses a risk of contributing to the sedimentation and siltation of watercourses.		3	3	8	4	56		2	1	2	3	15
Access and hauling along roads i.e. during the construction of roads	Alteration of drainage patterns	Surface Water quality	**Indirect Impact:** Alteration of the drainage patterns may lead to the degradation of downstream or surrounding Wetlands which in its turn may affect the aquatic micro and macro ecology. **Direct Impact:** The construction of access roads through drainage lines may lead to the siltation of streams as well as	Construction & Operational	5	3	10	5	90	Remedy	3	2	6	3	33

Site clearing and topsoil stripping for lay down area of approximately 47 ha and all related mining infrastructure			lead to erosion along the riverbanks that will affect the surface water quality negatively.		5	3	10	5	90		3	2	8	5	65
Storm water runoff management features					5	3	10	4	72		3	2	6	3	33
Access and hauling along roads i.e. during the construction of roads	Destruction of upstream tributaries and reduction in water in the catchment	Downstream water users	**Indirect Impact:** Alteration of the upstream drainage lines may lead to the degradation of downstream or surrounding Wetlands which in its turn may affect the aquatic micro and macro ecology.	Construction & Operational	4	3	8	4	60	Control	2	1	2	3	15
		Surface Water quality	**Direct Impact:** The destruction of tributaries may lead to a limited volume of water available to the downstream users. The reduction in water in the catchment may cause the degradation of surface water quality.		4	3	8	4	60		2	1	2	3	15
Access and hauling along roads i.e. during the construction of roads	Water usage for dust suppression	Wastage of water resource	**Direct Impact:** Improper management of the water used during dust suppression may lead to the wastage of the available water resource.	Construction & Operational	3	1	6	4	40	Control	1	1	0	3	6
Site clearing and topsoil stripping for lay down area of approximately 47 ha and all related mining infrastructure	Water level reduction and contamination	Groundwater quality	**Direct Impact:** The reduction in water levels as well as contamination of the water resource that may be caused by alternating the topography during site clearing and topsoil stripping poses a risk to affecting the surface and sub-surface water quality as well as the downstream users.	Construction & Operational	3	2	6	4	44	Control	1	1	2	3	12
		Downstream water users			3	2	6	4	44		1	1	2	3	12

Use of existing drilled / new boreholes		Surface Water quality	**Direct Impact**: Improper management of boreholes i.e. Pumping rates exceeding yield thresholds poses a risk to boreholes being pumped dry. **Indirect Impact:** Exposed boreholes may result in both sub-surface and surface water quality to be affected. Overexposing for an extended time may lead to water shortages and poses a negative effect to the downstream users.		3	2	6	4	44		1	1	2	3	12
Onsite Clinic	Domestic water usage	Wastage of water resource	**Direct Impact:** The lack of water management and maintenance of taps, toilets, basins etc. poses a risk to wastage of water.	Construction & Operational	3	1	4	3	24	Control	1	1	0	2	4
Mining offices i.e. operation of training centres, offices, and kitchen facilities					3	1	4	3	24		1	1	0	2	4
Mining offices i.e. operation of training centres, offices, and kitchen facilities	General waste generation & Littering	Surface Water quality due to leachates	**Direct Impact:** Littering throughout the construction and operational phase poses the risk of the visual environment to be affected negatively. The storing of waste onsite for an extended time may cause the formation of leachate that will affect the soil and water quality of the surrounding environment in a negative way. **Indirect Impact:** Exposure of leachate to the natural environment poses a health risk to the surrounding fauna and flora habitats as well as human health.	Construction & Operational	3	1	4	4	32	Control	1	1	0	3	6
Water storage facilities	Improper water storage management	Wastage of water resource	**Direct Impact:** Improper management of water storage facilities i.e. Not inspecting or regularly maintaining the storage tanks poses a risk of leaks and contamination.	Construction & Operational	3	1	4	3	24	Control	1	1	0	2	4
		Water contamination			3	1	4	3	24		1	1	0	2	4
Pollution Control Dams (PCD's) i.e. Construction and operation	Contamination of water resources	Surface Water quality	**Direct Impact:** If PCD's are not constructed in a way to avoid seepage to the surrounding environment or if not maintained, it poses a risk of contaminating water resources within proximity to the facility.	Construction & Operational	3	2	6	3	33	Control	1	1	2	3	12

Stores, workshops &wash bays			**Direct Impact:** Improper management of effluent from store, workshops, and wash bays poses a high risk to contaminating water resources. **Indirect Impact:** Over an extended period, the exposure to contamination will cause the degradation of fauna and flora habitats as well as affect the surface and sub-surface water quality.		3	2	6	4	44		1	1	2	3	12
Ablutions & change house with sewage treatment plant		Groundwater quality	**Direct Impact:** Improper management of effluent from ablution facilities, change houses, and sewage treatment plant poses a high risk to contaminating water resources. **Indirect Impact:** Over an extended period, the exposure to contamination will cause the degradation of fauna and flora habitats as well as affect the surface and sub-surface water quality.		3	2	6	4	44		1	1	2	3	12
Fuel operating power generators			**Direct Impact:** The construction of improper generator facilities poses a risk of the surrounding environment to be exposes to continuous leaking of hydrocarbons leading possibly contaminating both surface and sub-surface water sources as well as the soils surrounding the facility.		3	2	6	4	44		1	1	2	3	12
Fuel storage			**Direct Impact:** The construction of improper storage facilities poses a risk of the surrounding environment to be exposes to continuous leaking of hydrocarbons leading possibly contaminating both surface and sub-surface water sources as well as the soils surrounding the facility.		3	2	6	4	44		1	1	2	3	12

Topography and Visual																
Access and hauling along roads i.e. during the construction of roads	Dust generation	Topography and Visual Environment	**Direct Impact:** Road construction involves the removal of rock and earth by grading or digging during construction. Vegetation is removed, grading and paving takes place using a range of road construction equipment. This often leads to the generation of fugitive dust comprising TSP, PM10 and PM2.5 from the dirt roads.	Construction, Operational & Decommissioning	3	2	6	4	44	Control	3	1	2	3	18
Site clearing and topsoil stripping for lay down area of approximately 47 ha and all related mining infrastructure			**Direct Impact:** Vegetation is removed, grading and paving to prepare the lay down areas takes place using a range of construction equipment. This often leads to the generation of fugitive dust comprising TSP, PM10 and PM2.5. The generation of dust during these activities will affect the visual environment negatively.		3	2	6	4	44		3	1	2	3	18

Transport of construction material, mobile plant, and equipment to the site			**Direct Impact:** Continuous use of haul road often leads to the generation of fugitive dust comprising TSP, PM10 and PM2.5 from the dirt roads. The generation of dust during these activities will affect the visual environment negatively. **Indirect Impact:** Continuous exposure to high levels of dust fallout may lead to unhealthy environment for employees and surrounding communities.		3	2	6	4	44		3	1	2	3	18
Site clearing and topsoil stripping for lay down area of approximately 47 ha and all related mining infrastructure	Topography and visual alteration	Topography and Visual Environment	**Direct Impact:** Vegetation stripping during site clearing and topsoil removal activities will alter the visual environment and topography.	Construction, Operational & Decommissioning	3	2	6	5	55	Remedy	2	1	2	3	15
Mining offices i.e. operation of training centres, offices, and kitchen facilities			**Direct Impact:** Construction of mining facilities will alter the topography and visual environment.		3	2	6	5	55		2	1	2	3	15
Pollution Control Dams (PCD's) i.e. Construction and operation			**Direct Impact:** Construction of PCD's will alter the topography and visual environment.		3	2	6	5	55		2	1	2	3	15
Mining offices i.e. operation of training centres, offices, and kitchen facilities	General waste generation & Littering	Visual Environment	**Direct Impact:** Littering throughout the construction and operational phase poses the risk of the visual environment to be affected negatively. The storing of waste onsite for an extended time may cause the formation of leachate that will affect the soil and water quality of the surrounding environment in a negative way. **Indirect Impact:** Exposure of leachate to the natural environment poses a health risk to the surrounding fauna and flora habitats as well as human health.	Construction & Operational	2	1	2	4	20	Control	1	1	0	1	2

Noise

Access and hauling along roads i.e. during the construction of roads	Noise generation	Surrounding noise quality	**Direct Impact:** Increased noise levels at potentially sensitive receptors exceeding criteria of the Noise Control Regulations legislation (NCR) and SANS guidelines; Changing ambient sound levels could change the acceptable land use capability; Changing ambient sound levels could increase annoyance and potential complaints; and Disturbing character of sound.	Construction & Operational	2	2	6	5	50	Control	2	1	2	3	15
Site clearing and topsoil stripping for lay down area of approximately 47 ha and all related mining infrastructure			**Direct Impact:** The use of construction equipment during site clearing and topsoil stripping may cause noise during the construction phase. If equipment is not maintained and serviced regularly high levels of noise may result throughout the construction and operational phase.		2	2	6	5	50		2	1	2	3	15
Mining offices i.e. operation of training centres, offices, and kitchen facilities					2	2	6	5	50		2	1	2	3	15

Heritage and Palaeontology															
Site clearing and topsoil stripping for lay down area of approximately 47 ha and all related mining infrastructure	Destruction of graves	Loss of heritage resources	**Direct Impact:** Proposed activities near identified graves poses the risk of destructing graves of great cultural and heritage importance. **Indirect Impact:** Loss of heritage and history for the future generation of the affected community.	Construction	5	1	10	4	64	Avoid	5	1	2	4	32

	Degradation of cultural significance heritage sites		**Direct Impact:** Proposed mining activities near cultural significant heritage sites poses the risk of degrading or loss of these sites. **Indirect Impact:** Loss of heritage and history for the future generation of the affected community.		5	1	10	4	64		5	1	2	4	32

Health and Safety															
Employment of workers and procurement of construction materials.	Health and Safety of employees	Human health and safety environment	**Direct Impact:** Increased demand for labour and employees from different cultures may pose the risk to the lack of knowledge and skills on health and safety in the workplace. Different human behaviours deal with different situations and if there is not a simplified system of managing health and safety risk, situations resulting loss or injury of human life may be a result.	Construction & Operational	4	1	6	5	55	**Control**	4	1	6	3	33

Socio-economic															
Employment of workers and procurement of construction materials.	Loss of farm labour	Socio-economic	**Direct Impact:** Increased demand of labour force poses a risk of the local farmers losing farm labour due to competing financial income.	Construction & Operational	2	2	4	5	40	**Control**	2	2	2	4	24
	Population Influx – Pressure on Resources	Socio-economic	**Direct Impact:** Increased demand for labour force poses a risk of a population influx in the local district municipality. The increasing population will put pressure on the local municipality to provide services such as sewage, drinking water, waste management, electricity etc.	Construction & Operational	2	2	4	5	40	**Control**	2	2	2	4	24

	Population Influx – Social Pathologies	Socio-economic	**Direct Impact:** Increased demand for labour force poses a risk of a population influx. The increased population influx may lead to conflicting social pathologies in the surrounding local community.	Construction & Operational	2	2	4	5	40	**Control**	2	2	2	4	24
	Population Influx – Community Conflict	Socio-economic	**Direct Impact:** Increased demand for labour force poses a risk of a population influx. The increased population influx may lead to community conflicts in the surrounding local community.	Construction & Operational	2	3	6	5	55	**Control**	2	2	2	4	24
	Job Creation and Skills Training	Socio-economic	**Direct Impact:** As positive, local employed labour force will form part of a skills and training development programme. The proposed mining operation will create a job opportunity for at least a total of 60 people.	Construction & Operational	2	2	0	4	16	**Control**	2	2	0	4	16
	Job Creation (Multiplier Effect) and Population Influx	Socio-economic	**Indirect Impact:** Social projects forming part of the proposed mining project will create additional job opportunities for the local communities. A number (unknown) of temporary employment opportunities may be generated during the construction phase, which would benefit local unemployed individuals. The benefits may impact beyond the local area – i.e. to the regional or national level – as many of these opportunities may be skilled or professional and so are unlikely to be sourced locally.	Construction & Operational	2	3	0	5	25	**Control**	2	2	0	4	16
	Increased local economic development opportunities	Socio-economic	**Direct impact:** The local procurement of materials and services could benefit local businesses and indirectly provide employment and improved local spending in the short-term. As the types of services required during construction is unlikely to exist locally, these benefits may be realised on a regional or national level, however the procurement of materials and services such as security and cleaning could be sourced locally.	Construction & Operational	2	3	0	4	20	**Control**	2	2	0	3	12

	Reduced access to livelihood resources	Socio-economic	**Indirect Impact:** Construction activities my require the securing of certain portions of the site, which may be used by local communities to support their subsistence livelihoods, including collection of firewood and herbal medicines, and grazing.	Construction & Operational	2	3	6	4	44	**Control**	2	2	4	3	24
	Change in sense of place	Socio-economic	**Direct and indirect impact:** Construction activities could change the nature of the local area with increased traffic, influx of people, and presence of machinery and activities in the area.	Construction & Operational	2	3	6	4	44	**Control**	2	2	4	3	24

Operational															
Air Quality Management															
Topsoil and subsoil stripping & stockpiling for mining operation area	Fugitive and ambient dust generation	Air Quality	**Direct Impact:** Clearing of vegetation for topsoil and subsoil stripping exposes the mining operation area to dust generation. High levels of dust fallout will affect the overall air quality. The generation of dust during these activities will affect the visual environment negatively. **Indirect Impact:** Continuous exposure to high levels of dust fallout may lead to unhealthy environment for employees and surrounding communities.	Operational	3	2	6	5	55	Control	3	1	4	3	24
Opencast mining excavations			**Direct Impact:** Exposed un-vegetated mining areas may lead to high levels of dust fallout and will affect the overall air quality. The generation of dust during these activities will affect the visual environment negatively. **Indirect Impact:** Continuous exposure to high levels of dust fallout may lead to unhealthy environment for employees and surrounding communities.		3	2	6	5	55		3	1	4	3	24
Drilling & Blasting			**Direct Impact:** Dust being generated form drilling and blasting activities poses the risk of affecting the ambient air quality. This also affects the visual environment. **Indirect Impact:** Continuous exposure to high levels of dust fallout may lead to unhealthy environment for employees and surrounding communities.		3	3	8	5	70		3	1	2	3	18
RoM & product stockpiling			**Direct Impact:** Continuous use of haul road often leads to the generation of fugitive dust comprising TSP, PM10 and PM2.5 from the dirt roads. Stockpiled RoM, residue and product are continuously exposed to weathering leading the generation of fine dust particles. The generation of dust during these activities will affect the visual environment negatively. **Indirect Impact:** Continuous exposure to high levels of dust fallout may lead to unhealthy environment for employees and surrounding communities.		3	2	6	5	55		3	1	2	3	18
Residue stockpiles					4	3	8	5	75		3	1	4	3	24
Screening Operations			**Direct Impact:** Screening operations poses a high risk to the generation of fugitive dust comprising TSP, PM10 and PM2.5. The generation of dust during these activities effects the visual environment negatively.		3	3	6	5	60		3	1	2	3	18

Discard disposal (backfilling of mining area)			**Direct Impact:** Continuous use of haul roads and backfilling of material often leads to the generation of fugitive dust comprising TSP, PM10 and PM2.5 from the dirt roads. Un-vegetated area is continuously exposed to weathering leading the generation of fine dust particles. Backfilling of material in windy conditions also contribute to dust generation. The generation of dust during these activities will affect the visual environment negatively. **Indirect Impact:** Continuous exposure to high levels of dust fallout may lead to unhealthy environment for employees and surrounding communities.		3	2	6	5	55		3	1	2	3	18
Vehicular activity on haul roads; and operation of mining equipment					3	2	6	4	44		3	1	2	3	18
Bulk transporting of Ore to market on Public roads			**Direct Impact:** Continuous use of haul road often leads to the generation of fugitive dust comprising TSP, PM10 and PM2.5 from the dirt roads. The generation of dust during these activities will affect the visual environment negatively. **Indirect Impact:** Continuous exposure to high levels of dust fallout may lead to unhealthy environment for employees and surrounding communities.		3	2	6	4	44		3	1	2	3	18
Topsoil and subsoil stripping & stockpiling for mining operation area	CO_2 emissions (direct and indirect)	Air Quality & Climate	**Direct Impact:** The use of diesel operated hauling equipment and power generators will cause a contributing factor the Nomamix (Pty) Ltd carbon footprint. **Indirect Impact:** It is expected that some clearing of land may be required in terms of removing vegetation. This will result in the loss of carbon sink capacity due to vegetation not being available to convert the CO2 emitted to oxygen. Fossil fuel combustion is a major source of CO2 emissions. CH4 and N2O are related to vehicle km travelled rather than fuel consumption and account for 5% of diesel engine emissions in terms of CO2 equivalent (Amoako, et al. 2018).	Operational	3	4	6	3	39	Control	3	3	2	2	16
Drilling & Blasting			**Indirect Impact:** According to Goswami & Brent (n.d.), GHG emissions from the detonation of explosives are of the order of 1 tonne of CO2 for every 5 tonnes of explosives consumed. However, upstream emissions from the manufacture of ammonium nitrate can range from the equivalent of 1 to 4 tonnes of CO2 for every tonne of explosives. In terms of the direct detonation of the explosives at the proposed mine, it can be estimated, based on a maximum usage of 1.2 kg of explosives used per m3 of hard overburden, and the calculation of '1 tonne of CO2 for every 5 tonnes of explosives consumed' that CO2 emissions would be around 1 319.434 tonnes of CO2 from the 6 597.17 tonnes of explosives used.		3	4	6	3	39		3	3	2	2	16
Opencast mining excavations			**Cumulative Impact:** Although the ore will be processed by a concentrator not owned and managed by The applicant, the proposed mine is in part responsible for the GHG emissions generated by the concentrator, due to the role they play in feeding the concentrator with the raw materials needed to undertake their own processes.		3	4	6	3	39		3	3	2	2	16
Waste generation, storage and disposal			**Cumulative Impact:** CH4 emissions from waste stored temporarily onsite are not expected to generate any significant GHG emissions. CH4 is generated as a result of degradation of organic material under anaerobic conditions, therefore it is only the total mass of decomposing material currently in the solid waste disposal site (SWDS) that matters, and not what (and how much) waste was deposited in that year. CH4 emissions can however be calculated once the projected amount of waste (waste composition) to be deposited annually at the SWDS is known.		3	4	6	3	39		3	3	2	2	16
RoM & product stockpiling			**Direct Impact:** It is expected that some clearing of land may be required in terms of removing vegetation. This will result in the loss of carbon sink capacity due to vegetation not being available to convert the CO2 emitted to oxygen. Fossil fuel combustion is a major source of CO2 emissions. CH4		3	4	6	3	39		3	3	2	2	16

Screening Operations			and N2O are related to vehicle km travelled rather than fuel consumption and account for 5% of diesel engine emissions in terms of CO2 equivalent (Amoako, et al. 2018). **Cumulative Impact:** The impacts of climate change pose serious risks for the mining sector. "The mining sector is extremely energy-intensive and one of the major emitters of greenhouse gases. Total CO2 emissions vary across the industry, largely depending upon the type of resource proposed mined as well as the design and nature of the mining process. It is widely recognised that available mining deposits are increasingly deeper and of declining ore grade. This will lead to growing demands for water as well as greater proposed mine waste, thereby raising energy consumption, and increasing the industry's climate footprint" (Ruttinger, 2016).		3	4	6	3	39		3	3	2	2	16
Vehicular activity on haul roads; and operation of mining equipment			**Cumulative Impact:** Fossil fuel combustion is a major source of CO2 emissions. CH4 and N2O are related to vehicle km travelled rather than fuel consumption and account for 5% of diesel engine emissions in terms of CO2 equivalent (Amoako, et al. 2018). Diesel would mostly be used in mobile sources on the proposed mine.		3	4	6	3	39		3	3	2	2	16
Bulk transporting of Ore to market on Public roads					3	4	6	3	39		3	3	2	2	16

Fauna and Flora															
Topsoil and subsoil stripping & stockpiling for mining operation area	Vegetation and habitat loss	Macro and micro organisms	**Direct Impact:** Clearing of site and stripping of topsoil leads to the loss of vegetation and habitats of macro and micro-organisms. The loss of vegetation also affects the habitat of surrounding Fauna and Flora. Direct impacts on species of conservation consideration and habitat associated with these species, increased human-animal conflict situations, harvesting of species. Increased disturbance factor for sensitive animals	Construction & Operational	5	2	10	5	85	Remedy	3	1	6	5	50
Opencast mining excavations					5	2	10	5	85		3	1	6	5	50
RoM & product stockpiling		Fauna and flora			5	2	10	5	85		3	1	6	5	50
Residue stockpiles					5	2	10	5	85		3	1	6	5	50
Topsoil and subsoil stripping & stockpiling for mining operation area	Influx of alien invasive vegetation	Fauna and flora micro and macro ecosystems	**Direct Impact:** Site clearing for roads, lay down areas, and mining area exposes the un-vegetated area to the influx of alien invasive vegetation causing Irreversible damage to the native fauna and flora species and loss of habitats notably also with reference to surrounding areas of natural vegetation, importantly downstream of the site.	Construction & Operational	5	3	10	5	90	Control	3	2	6	4	44
Opencast mining excavations					5	3	10	5	90		3	2	6	4	44

RoM & product stockpiling					5	3	10	5	90		3	2	6	4	44
Residue stockpiles					5	3	10	5	90		3	2	6	4	44
Topsoil and subsoil stripping & stockpiling for mining operation area	Impacts on species of conservation consideration, local diversity patterns and ecological patterns	Fauna and flora micro and macro ecosystems	**<u>Indirect Impacts</u>:** Deterioration of habitat adjacent to mining site, indirect impacts on habitat status of conservation important taxa, loss of general biodiversity, changed ecological patterns and migratory routes of animals, altered fire regime.	Construction & Operational	5	3	10	5	90	Control	3	2	6	4	44
Opencast mining excavations					5	3	10	5	90		3	2	6	4	44
RoM & product stockpiling					5	3	10	5	90		3	2	6	4	44
Residue stockpiles					5	3	10	5	90		3	2	6	4	44
Residual stockpiles	Impacts on habitat types that exhibit unperturbed status, local and regional conservation efforts, anthropogenic encroachment, and human-nature conflict	Macro ecological systems and infrastructure	**<u>Cumulative Impacts:</u>** Cumulative losses of remaining natural habitat on a regional scale due to exacerbated mining activities in the region, exacerbated human encroachment and associated impacts caused by human-animal conflict and exacerbated use of natural resources	Construction & Operational	5	3	6	5	70	Control	3	2	6	4	44
Increase in human persistence and associated activities					5	3	8	5	80		3	2	6	4	44
Exacerbated habitat fragmentation and isolation					5	5	8	5	90		3	5	6	4	56

Continued increase in mining activities in the region					5	6	6	5	85		3	6	6	4	60

Aquatic ecology															
Topsoil and subsoil stripping & stockpiling for mining operation area	Sedimentation and siltation of watercourses	Wetlands and aquatic ecology	**Direct Impact:** Stripping topsoil and subsoil or stockpiling material through or near drainage lines may cause sedimentation and siltation of watercourses if not managed properly. **Indirect Impact:** Storm water runoff of dirt roads and un-vegetated areas may cause sedimentation and siltation of nearby watercourses.	Construction & Operational	4	3	8	5	75	Avoid	3	1	4	4	32
Opencast mining excavations			**Direct Impact:** Stockpiling excavated material through or near drainage lines may cause sedimentation and siltation of watercourses if not managed properly. **Indirect Impact:** Storm water runoff of dirt roads and un-vegetated areas may cause sedimentation and siltation of nearby watercourses.		4	3	8	5	75		3	1	4	4	32
RoM & product stockpiling			**Direct Impact:** Stockpiling RoM and product material through or near drainage lines may cause sedimentation and siltation of watercourses if not managed properly. **Indirect Impact:** Storm water runoff of dirt roads and un-vegetated areas may cause sedimentation and siltation of nearby watercourses.		4	3	8	5	75		3	1	4	4	32
Residue stockpiles			**Direct Impact:** Stockpiling screened material through or near drainage lines may cause sedimentation and siltation of watercourses if not managed properly. Various stockpiles will be likely be located within the area, including overburden, topsoil, throw out and emergency stockpiles, and will be characterised by bare soil and steep side slopes that generate significant surface run-off. Run-off from these stockpiles is likely to be sediment rich, while carbonaceous stockpiles (if any) might also generate acid rock drainage as pyrites in the overburden are exposed to oxygen. Where run-off from these stockpiles enters adjacent wetlands, water quality deterioration is likely to result, including increases in turbidity, sulphates, and metal concentrations (e.g. aluminium and Iron), and a drop in pH. **Indirect Impact**: Storm water runoff of dirt roads and un-vegetated areas may cause sedimentation and siltation of nearby watercourses.		4	3	8	5	75		3	1	4	4	32
Screening Operations					4	3	8	5	75		3	1	4	4	32
Discard disposal (backfilling of mining area)			**Direct Impact:** Backfilling material through or near drainage lines may cause sedimentation and siltation of watercourses if not managed properly. Indirect Impact: Storm water runoff of dirt roads and un-vegetated areas may cause sedimentation and siltation of nearby watercourses.		4	3	8	5	75		3	1	4	4	32
River crossings			**Direct Impact**: Excavating, stockpiling and transport of material through or near drainage lines may cause sedimentation and siltation of watercourses if not managed properly. **Indirect Impact:** Storm water runoff of dirt roads and un-vegetated areas may cause sedimentation and siltation of nearby watercourses.		4	3	8	5	75		3	1	4	4	32
Vehicular activity on haul roads; and operation of			**Direct Impact:** Constructing access roads through drainage lines may cause sedimentation and siltation of watercourses if not managed properly.		4	3	8	5	75		3	1	4	4	32

mining equipment			**Indirect Impact:** Storm water runoff of dirt roads may cause sedimentation and siltation of nearby watercourses.												
Water Management			**Direct Impact:** Runoff from lay down areas, construction areas, mining areas, stockpile areas, roads etc. potentially contains sediment and silt that poses a risk of affecting surrounding water courses and drainage lines.		5	3	8	5	80		3	1	4	4	32
Topsoil and subsoil stripping & stockpiling for mining operation area	Alteration of drainage patterns	Wetland and aquatic ecology	**Indirect Impact:** Alteration of the drainage patterns may lead to the degradation of downstream or surrounding Wetlands which in its turn may affect the aquatic micro and macro ecology. **Direct Impact:** Site clearing and topsoil stripping through drainage lines may lead to the siltation of streams as well as lead to erosion along the riverbanks that will affect the surface water quality negatively. Various stockpiles will be likely be located within the area, including overburden, topsoil, throw out and emergency stockpiles, and will be characterised by bare soil and steep side slopes that generate significant surface run-off. Run-off from these stockpiles is likely to be sediment rich, while carbonaceous stockpiles (if any) might also generate acid rock drainage as pyrites in the overburden are exposed to oxygen. Where run-off from these stockpiles enters adjacent wetlands, water quality deterioration is likely to result, including increases in turbidity, sulphates, and metal concentrations (e.g. aluminium and Iron), and a drop in pH.	Construction & Operational	5	3	10	5	90	Remedy	3	2	6	5	55
Opencast mining excavations					5	3	10	5	90		3	2	6	5	55
Residue stockpiles					5	3	10	5	90		3	2	6	5	55
River crossings					5	3	8	5	80		3	2	6	5	55
Water Management					5	3	8	5	80		1	1	2	2	8

Topsoil and subsoil stripping & stockpiling for mining operation area	Destruction of wetlands	Wetland and aquatic ecology	**Direct Impact**: Site clearing and topsoil stripping in Wetlands will cause the loss of micro and macro aquatic species. Various stockpiles will be likely be located within the area, including overburden, topsoil, throw out and emergency stockpiles, and will be characterised by bare soil and steep side slopes that generate significant surface run-off. Run-off from these stockpiles is likely to be sediment rich, while carbonaceous stockpiles (if any) might also generate acid rock drainage as pyrites in the overburden are exposed to oxygen. Where run-off from these stockpiles enters adjacent wetlands, water quality deterioration is likely to result, including increases in turbidity, sulphates, and metal concentrations (e.g. aluminium and Iron), and a drop in pH. **Indirect impacts:** Alien invasive trees and shrubs are expected to increase within the area as the tend to invade areas that have been disturbed (e.g. on stockpiles and excavated or eroded areas). Such disturbed areas are likely to act as seed areas that will ultimately facilitate the invasion of associated watercourses and riparian areas. Alien species generally out-compete indigenous species for water, light, space and nutrients as they are adaptable to changing conditions and are able to easily invade a wide range of ecological niches, posing an ecological threat as they alter habitat structure, lower biodiversity (both number and "quality" of species), change nutrient cycling and productivity, and modify food webs. **Cumulative Impacts:** Alien invasive trees and shrubs are expected to increase within the area as the tend to invade areas that have been disturbed (e.g. on stockpiles and excavated or eroded areas). Such disturbed areas are likely to act as seed areas that will ultimately facilitate the invasion of associated watercourses and riparian areas. Alien species generally out-compete indigenous species for water, light, space and nutrients as they are adaptable to changing conditions and are able to easily invade a wide range of ecological niches, posing an ecological threat as they alter habitat structure, lower biodiversity (both number and "quality" of species), change nutrient cycling and productivity, and modify food webs.	Construction & Operational	5	3	10	5	90	Remedy	3	1	6	5	50
Opencast mining excavations	Contamination of water resources	Wetland and aquatic ecology	**Direct Impact:** Throughout the operational phase of the mining operations, potential pollutants are used such as high levels of nitrates. Improper management of potential pollutants may lead to the degradation of water quality (both surface and sub-surface). Polluted water resources may affect the aquatic environment in a detrimental manner. Various stockpiles will be likely be located within the area, including overburden, topsoil, throw out and emergency stockpiles, and will be characterised by bare soil and steep side slopes that generate significant surface run-off. Run-off from these stockpiles is likely to be sediment rich, while carbonaceous stockpiles (if any) might also generate acid rock drainage as pyrites in the overburden are exposed to oxygen. Where run-off from these stockpiles enters adjacent wetlands, water quality deterioration is likely to result, including increases in turbidity, sulphates, and metal concentrations (e.g. aluminium and Iron), and a drop in pH.	Construction & Operational	3	3	6	4	48	Avoid	2	1	2	3	15
RoM & product stockpiling					4	3	6	5	65		2	1	2	3	15
Residue stockpiles					5	3	8	5	80		3	1	4	4	32
Discard disposal (backfilling of mining area)					3	3	8	4	56		2	1	2	3	15
Screening Operations			**Direct Impact:** Water seeping from stockpiles poses a risk of leading to elevated concentrations of heavy metals and other elements in the groundwater environment and can potentially be acidic. When this water reaches surface water bodies or the groundwater it can negatively affect the water quality. **Indirect Impact:** Alteration to the conditions of the water resources may negatively affect the aquatic ecology.		3	3	6	4	48		1	1	2	2	8

Drilling & Blasting			**Direct Impact:** Improper management of blasting activities poses the risk of contaminating water resources with pollutants such as high content of Nitrates. The presence of pollutants in the water resources poses a risk of degrading the conditions for the aquatic ecology to thrive.		3	3	8	4	56		2	1	2	3	15
Waste generation, storage and disposal			**Direct Impact:** These storage of large amounts of waste over an extended time in a area not lined or bunded poses a risk of forming potentially hazardous leachates. **Indirect Impact:** The hazardous leachate from the waste storage facilities poses a risk of contaminating both surface and sub-surface water resources. This may lead to the degradation of conditions for the aquatic ecology to thrive. **Cumulative Impact:** Mismanagement of mine-generated waste and pollutants (including hydrocarbons, construction waste, hazardous chemicals, etc.) is likely to result in these substances or their derivatives entering and polluting the sensitive aquatic environments either directly through surface runoff during rainfall events, or subsurface water movement. An increase in pollutants will lead to changes in the water quality of the wetlands and watercourses, affecting their ability to act as ecological corridors within the development landscape. The linked nature of the wetland systems to downstream water resources will result in pollutants being carried downstream from the mine construction site having consequences on further downstream users.		3	3	6	4	48		1	1	0	2	4
Chemical Toilets			**Direct Impact:** Improper management of effluent from chemical toilets poses a high risk to contaminating water resources. **Indirect Impact:** Over an extended period the exposure to contamination will cause the degradation of fauna and flora habitats as well as affect the surface and sub-surface water quality.		2	3	6	4	44		1	1	0	2	4
River crossings			**Direct Impact:** Storm water run-off from river crossing structures containing pollutants poses a risk in contaminating the surrounding water resources. **Indirect Impact:** Pollutants poses a risk in altering the conditions of the aquatic ecology to thrive.		3	3	6	4	48		2	1	0	2	6
Water supply (potable & process)			**Direct Impact:** Leaks and breaks of water supply infrastructure poses a risk of contaminating water resources. **Indirect Impact:** Pollutants poses a risk in altering the conditions of the aquatic ecology to thrive.		4	3	6	4	52		1	1	0	2	4
Storage of fuel and lubricants in temporary facilities			**Direct Impact:** The use of improper storage facilities poses a risk of the surrounding environment to be exposes to continuous leaking of hydrocarbons leading possibly contaminating both surface and sub-surface water sources as well as the soils surrounding the facility.		3	3	6	4	48		1	1	0	2	4
Water Management			**Direct Impact:** The poor management of onsite water i.e. Storm water, process water, effluent, potable water etc. may lead to the contamination of water resources.		4	3	6	4	52		2	1	2	2	10
Topsoil and subsoil stripping & stockpiling for mining operation area	Hydrocarbon contamination	Wetland and aquatic ecology	**Direct Impact:** Throughout the operational phase construction equipment are used. This poses a risk of hydrocarbon spills if equipment is not maintained. Depending on the size of the spill the level of contamination may vary from insignificant to significant and may affect the surrounding water quality (both surface and sub-surface) as well as the soil quality.	Construction & Operational	3	1	4	4	32	Control	1	1	0	3	6

Vehicular activity on haul roads; and operation of mining equipment					3	1	4	4	32		1	1	0	3	6
Storage of fuel and lubricants in temporary facilities					3	1	6	4	40		1	1	0	3	6
Topsoil and subsoil stripping & stockpiling for mining operation area	Destruction of upstream tributaries and reduction in water in the catchment	Wetland and aquatic ecology	**Indirect Impact:** Alteration of the upstream drainage lines may lead to the degradation of downstream or surrounding Wetlands which in its turn may affect the aquatic micro and macro ecology. **Direct Impact:** The destruction of tributaries may lead to a limited volume of water available to the downstream users. The reduction in water in the catchment may cause the degradation of surface water quality.	Construction & Operational	5	3	10	5	90	Remedy	3	2	6	5	55
Opencast mining excavations					5	3	10	5	90		3	2	6	5	55
Water Management					3	3	6	3	36		1	1	2	1	4
Residue stockpiles	Hazardous Leachate	Aquatic ecology	**Direct Impact:** Potential pollutant in the residue material resulting from mining operation may lead to the formation of leachate. The leachate may contain toxins that is hazardous to the aquatic ecology and water resources.	Construction, Operational & Decommissioning	5	3	8	4	64	Avoid	3	2	6	3	33
Waste generation, storage, and disposal			**Direct Impact:** The hazardous leachate from the waste storage facilities poses a risk of contaminating both surface and sub-surface water as well as soil resources. This may lead to the degradation of conditions for the aquatic ecology to thrive.		3	2	6	3	33		1	1	0	1	2
Drilling & Blasting	Noise generation	Aquatic ecology	**Direct and indirect Impact:** Mining activities, including blasting, is expected to result in the loss of biodiversity features within the immediate area, as result in a depauperate aquatic biodiversity assemblage downstream of the proposed mining activities. This impact is of particular relevance given that currently undescribed fish species of conservation concern are known to be present within the watercourses downstream of the study area and may utilise the watercourses associated with the proposed mine for spawning or breeding purposes. The blasting associated with mining therefore has the potential to disrupt spawning or breeding behaviour through generation of vibrations and movement of aquatic habitat. Noise generated through mining activities is further expected to result in a localised decrease in amphibian species because of decreased mate attraction during breeding periods.	Operational	3	2	8	5	65	Control	3	1	6	4	40

Soil															
Topsoil and subsoil stripping & stockpiling for mining operation area	Degradation of soil	Soil quality	**Direct Impact:** If not managed properly, fertile soil will be lost during site clearance, topsoil striping and stockpiling. Loss of fertile soil will cause the degradation of habitat for flora micro- and macro organisms.	Operational	5	1	10	5	80	Remedy	3	1	6	4	40

RoM & product stockpiling					5	1	10	5	80		3	1	6	4	40
Residue stockpiles					5	1	10	5	80		3	1	6	4	40
Opencast mining excavations					5	1	10	5	80		3	1	6	4	40
Drilling & Blasting			**Direct Impact:** Improper management of blasting activities poses the risk of contaminating soil resources with pollutants such as a high content of Nitrates. The presence of pollutant in the soils results in the degradation of the quality. **Indirect Impact:** The degradation of soil quality poses the risk of degrading the conditions for flora and fauna micro ecosystems.		4	1	8	4	52		2	1	4	3	21
Screening Operations			**Direct Impact:** Improper management of stockpile area i.e. mixing of topsoil and fertile soils with subsoil or RoM product poses a risk of degrading of soil quality. **Indirect Impact:** The degradation of soil quality poses the risk of degrading the conditions for flora micro-organism to thrive.		4	1	8	4	52		2	1	4	3	21
Discard disposal (backfilling of mining area)			**Direct Impact:** Backfilling of soil layers will impact on the land capability by restoring the land capability to some extent because vegetation will be supported and therefore returned to the planned post mining land capability such as arable and or grazing. However, if not done incorrectly, the conditions for fauna and flora to reinstate the area will be negatively affected.		4	1	8	4	52		2	1	4	3	21
Waste generation, storage, and disposal			**Direct Impact:** These storage of large amounts of waste over an extended time in an area not lined or bunded poses a risk of forming potentially hazardous leachates. **Indirect Impact:** The hazardous leachate potentially poses a risk in contaminating the soil causing the degradation of conditions for flora micro-organisms to thrive.		4	1	8	4	52		2	1	4	3	21
Chemical Toilets			**Direct Impact:** Continuous leaking, spills or lack of maintenance poses a risk to contaminating the surrounding soils and degrading the soil quality. This will affect the micro-ecosystems in a negative manner.		4	1	8	4	52		2	1	4	3	21
Storage of fuel and lubricants in temporary facilities			**Direct Impact:** Continuous exposure to hydrocarbon leaks poses a risk to the degradation of the surrounding soil resources.		4	1	8	4	52		2	1	4	3	21
Vehicular activity on haul roads; and operation of mining equipment			**Direct Impact:** As part of the maintenance related to roads, valuable topsoil's may be removed. Improper management of topsoil or fertile soil may cause the loss of flora micro-ecosystems and cause the degradation of soil quality.		4	1	8	4	52		2	1	4	3	21
Opencast mining excavations	Hydrocarbon Contamination	Soil quality	**Direct Impact:** Throughout the operational phase construction equipment are used. This poses a risk of hydrocarbon spills if equipment is not maintained. Depending on the size of the spill the level of contamination may vary from insignificant to significant and may affect the surrounding water quality (both surface and sub-surface) as well as the soil quality.	Operational	3	1	1	4	20	Control	1	1	0	3	6
RoM & product stockpiling					3	1	4	4	32		1	1	0	3	6
Drilling & Blasting			**Direct Impact:** The use of drill Riggs poses a high risk of hydrocarbon spills. Depending on the size of the spill the level of contamination may vary from insignificant to significant and may affect the surrounding water quality (both surface and sub-surface) as well as the soil quality.		3	1	4	4	32		1	1	2	3	12
Screening Operations			**Direct Impact:** Hydrocarbon spills can occur where heavy machinery such as the screening plant and hauling vehicles are parked because they contain large volumes of lubricating oils, hydraulic oils, and diesel to run. This poses a risk of hydrocarbon spills if equipment is not maintained. Depending on the size of the spill the level of contamination		3	1	4	4	32		1	1	0	3	6

			may vary from insignificant to significant and may affect the surrounding water quality (both surface and sub-surface) as well as the soil quality.	Construction & Operational						Avoid					
Discard disposal (backfilling of mining area)			**Direct Impact:** During backfilling activities equipment and plant are used. This poses a risk of hydrocarbon spills if equipment is not maintained. Depending on the size of the spill the level of contamination may vary from insignificant to significant and may affect the surrounding water quality (both surface and sub-surface) as well as the soil quality. Indirect Impact: The degradation of water quality and soil quality poses a risk of negatively affecting the conditions for micro and macro organisms to thrive.		3	1	4	4	32		1	1	0	3	6
River crossings			**Direct Impact:** Throughout the construction and operational phase construction equipment are used. This poses a risk of hydrocarbon spills if equipment is not maintained. Depending on the size of the spill the level of contamination may vary from insignificant to significant and may affect the surrounding water quality (both surface and sub-surface) as well as the soil quality.		3	1	4	3	24		1	1	0	3	6
Storage of fuel and lubricants in temporary facilities			**Direct Impact:** The construction of improper storage facilities poses a risk of the surrounding environment to be exposes to continuous leaking of hydrocarbons leading possibly contaminating both surface and sub-surface water sources as well as the soils surrounding the facility.		3	1	4	4	32		1	1	2	3	12
Vehicular activity on haul roads; and operation of mining equipment			**Direct Impact:** The use of vehicles on haul roads throughout the operational phase poses a risk of hydrocarbon spills if equipment is not maintained. Depending on the size of the spill the level of contamination may vary from insignificant to significant and may affect the surrounding water quality (both surface and sub-surface) as well as the soil quality.		3	1	4	3	24		1	1	0	3	6
Topsoil and subsoil stripping & stockpiling for mining operation area	Erosion	Loss of fertile soil	**Direct Impact**: Un-vegetated areas exposed to weathering for an extended period will lead to erosion. Erosion prone areas has a high risk of losing fertile soil caused by flash floods. The loss of fertile soil will result in the loss of important micro ecosystems.		5	2	10	5	85		3	1	4	3	24
Opencast mining excavations					5	2	10	5	85		3	1	4	3	24
RoM & product stockpiling					5	2	10	5	85		3	1	4	3	24
Discard disposal (backfilling of mining area)					5	2	10	5	85		3	1	4	3	24
River crossings			**Direct Impact:** Improper installation of river crossing infrastructure poses the risk of contributing to the conditions causing erosion i.e. Un-vegetated and exposed river/watercourse banks. **Indirect Impact:** Erosion poses a risk of contributing to sedimentation and siltation of rivers/watercourses. Pollutants may affect the conditions for the aquatic ecology to thrive.		5	2	8	4	60		3	1	2	3	18
Vehicular activity on haul roads; and operation of mining equipment			**Indirect Impact:** Improper management of storm water may lead to erosion along the access routes. This may lead to the loss of fertile soil and in its turn effect the micro-ecosystems of the surrounding environment.		4	2	8	4	56		3	1	2	3	18

Water Management			**Direct Impact:** Poor management of storm water throughout the construction, operational, and decommissioning phase poses a high risk for erosion. This may lead to the loss of fertile soil and in its turn effect the micro-ecosystems of the surrounding environment.		5	2	8	4	60		3	1	2	3	18
Waste generation, storage, and disposal	Illegal dumping	Soil Contamination	**Direct Impact:** Dumping of generated water in areas other than is approved by the authorisation or EMP poses a high risk of polluting numerous sources i.e. Water and soil. The dumping of general waste poses a choking risk to grazing animals. Hazardous Leachates from illegal dumps also poses a risk to the health of surrounding communities. **Indirect Impact:** The hazardous leachate from the waste storage facilities poses a risk of contaminating both surface and sub-surface water as well as soil resources. This may lead to the degradation of conditions for the aquatic ecology to thrive.	Operational	3	1	4	4	32	Control	1	1	2	3	12

Water resources																
Topsoil and subsoil stripping & stockpiling for mining operation area	Hydrocarbon Contamination	Surface Water quality	**Direct Impact:** Throughout the operational phase construction equipment are used. This poses a risk of hydrocarbon spills if equipment is not maintained. Depending on the size of the spill the level of contamination may vary from insignificant to significant and may affect the surrounding water quality (both surface and sub-surface) as well as the soil quality.	Operational	3	2	4	4	36	Avoid	1	1	0	3	6
Opencast mining excavations					3	2	4	4	36		1	1	0	3	6
RoM & product stockpiling			**Direct Impact:** Throughout the operational phase equipment and plant are used to transport and stockpile RoM and product. This poses a risk of hydrocarbon spills if equipment is not maintained. Depending on the size of the spill the level of contamination may vary from insignificant to significant and may affect the surrounding water quality (both surface and sub-surface) as well as the soil quality.		3	2	4	4	36		1	1	0	3	6

Drilling & Blasting			**Direct Impact:** The use of drill Riggs poses a high risk of hydrocarbon spills. Depending on the size of the spill the level of contamination may vary from insignificant to significant and may affect the surrounding water quality (both surface and sub-surface) as well as the soil quality.		3	2	4	4	36		1	1	0	3	6
Screening Operations			**Direct Impact:** Hydrocarbon spills can occur where heavy machinery such as the screening plant and hauling vehicles are parked because they contain large volumes of lubricating oils, hydraulic oils, and diesel to run. This poses a risk of hydrocarbon spills if equipment is not maintained. Depending on the size of the spill the level of contamination may vary from insignificant to significant and may affect the surrounding water quality (both surface and sub-surface) as well as the soil quality.		3	2	4	4	36		1	1	0	3	6
Discard disposal (backfilling of mining area)			**Direct Impact**: During backfilling activities equipment and plant are used. This poses a risk of hydrocarbon spills if equipment is not maintained. Depending on the size of the spill the level of contamination may vary from insignificant to significant and may affect the surrounding water quality (both surface and sub-surface) as well as the soil quality. **Indirect Impact**: The degradation of water quality and soil quality poses a risk of negatively affecting the conditions for micro and macro organisms to thrive.		3	2	4	4	36		1	1	0	3	6
River crossings		Groundwater quality	**Direct Impact:** Throughout the construction and operational phase construction equipment are used. This poses a risk of hydrocarbon spills if equipment is not maintained. Depending on the size of the spill the level of contamination may vary from insignificant to significant and may affect the surrounding water quality (both surface and sub-surface) as well as the soil quality.		3	2	4	4	36		1	1	0	3	6
Storage of fuel and lubricants in temporary facilities			**Direct Impact:** The construction of improper storage facilities poses a risk of the surrounding environment to be exposes to continuous leaking of hydrocarbons leading possibly contaminating both surface and sub-surface water sources as well as the soils surrounding the facility.		3	2	4	4	36		1	1	0	3	6
Vehicular activity on haul roads; and operation of mining equipment			**Direct Impact:** The use of vehicles on haul roads throughout the operational phase poses a risk of hydrocarbon spills if equipment is not maintained. Depending on the size of the spill the level of contamination may vary from insignificant to significant and may affect the surrounding water quality (both surface and sub-surface) as well as the soil quality.		3	2	4	4	36		1	1	0	3	6
Topsoil and subsoil stripping & stockpiling for mining operation area	Sedimentation and siltation of watercourses	Surface Water	**Direct Impact:** Stripping topsoil and subsoil or stockpiling material through or near drainage lines may cause sedimentation and siltation of watercourses if not managed properly. **Indirect Impact:** Storm water runoff of dirt roads and un-vegetated areas may cause sedimentation and siltation of nearby watercourses.	Operational	3	2	6	4	44	Control	2	1	4	3	21
Opencast mining excavations			**Direct Impact:** Stockpiling excavated material through or near drainage lines may cause sedimentation and siltation of watercourses if not managed properly. **Indirect Impact:** Storm water runoff of dirt roads and un-vegetated areas may cause sedimentation and siltation of nearby watercourses.		3	2	6	4	44		2	1	4	3	21
RoM & product stockpiling			**Direct Impact:** Stockpiling RoM and product material through or near drainage lines may cause sedimentation and siltation of watercourses if not managed properly. **Indirect Impact:** Storm water runoff of dirt roads and un-vegetated areas may cause sedimentation and siltation of nearby watercourses.		3	2	6	4	44		2	1	4	3	21
Residue stockpiles			**Direct Impact:** Stockpiling residue material through or near drainage lines may cause sedimentation and siltation of watercourses if not managed properly. **Indirect Impact:** Storm water runoff of dirt roads and un-vegetated areas may cause sedimentation and siltation of nearby watercourses.		3	2	6	4	44		2	1	4	3	21

Screening Operations			**<u>Direct Impact:</u>** Stockpiling screened material through or near drainage lines may cause sedimentation and siltation of watercourses if not managed properly. **<u>Indirect Impact:</u>** Storm water runoff of dirt roads and un-vegetated areas may cause sedimentation and siltation of nearby watercourses.		3	2	6	4	44		2	1	4	3	21
Discard disposal (backfilling of mining area)			**<u>Direct Impact:</u>** Backfilling material through or near drainage lines may cause sedimentation and siltation of watercourses if not managed properly. **<u>Indirect Impact:</u>** Storm water runoff of dirt roads and un-vegetated areas may cause sedimentation and siltation of nearby watercourses.		3	2	6	4	44		2	1	4	3	21
River crossings			**<u>Direct Impact:</u>** Excavating, stockpiling and transport of material through or near drainage lines may cause sedimentation and siltation of watercourses if not managed properly. **<u>Indirect Impact:</u>** Storm water runoff of dirt roads and un-vegetated areas may cause sedimentation and siltation of nearby watercourses.		3	2	6	4	44		2	1	2	3	15
Vehicular activity on haul roads; and operation of mining equipment			**<u>Direct Impact:</u>** Constructing access roads through drainage lines may cause sedimentation and siltation of watercourses if not managed properly. **<u>Indirect Impact:</u>** Storm water runoff of dirt roads may cause sedimentation and siltation of nearby watercourses.		3	2	6	4	44		2	1	2	3	15
Water Management			**<u>Direct Impact:</u>** Runoff from lay down areas, construction areas, mining areas, stockpile areas, roads etc. potentially contains sediment and silt that poses a risk of affecting surrounding water courses and drainage lines.		3	2	6	4	44		2	1	2	3	15
Topsoil and subsoil stripping & stockpiling for mining operation area	Alteration of drainage patterns	Surface Water quality	**<u>Indirect Impact:</u>** Alteration of the drainage patterns may lead to the degradation of downstream or surrounding Wetlands which in its turn may affect the aquatic micro and macro ecology. **<u>Direct Impact:</u>** Site clearing and topsoil stripping through drainage lines may lead to the siltation of streams as well as lead to erosion along the riverbanks that will affect the surface water quality negatively.	Construction & Operational	5	2	10	5	85	Remedy	5	1	6	5	60
Opencast mining excavations			**<u>Indirect Impact:</u>** Alteration of the drainage patterns may lead to the degradation of downstream or surrounding Wetlands which in its turn may affect the aquatic micro and macro ecology. **<u>Direct Impact:</u>** Site clearing and topsoil stripping through drainage lines may lead to the siltation of streams as well as lead to erosion along the riverbanks that will affect the surface water quality negatively.		5	2	10	5	85		5	1	6	5	60
Residue stockpiles			**<u>Indirect Impact:</u>** Alteration of the drainage patterns may lead to the degradation of downstream or surrounding Wetlands which in its turn may affect the aquatic micro and macro ecology. **<u>Direct Impact:</u>** Site clearing and topsoil stripping through drainage lines may lead to the siltation of streams as well as lead to erosion along the riverbanks that will affect the surface water quality negatively.		5	2	10	5	85		5	1	6	5	60
River crossings			**<u>Direct Impact:</u>** Excavating, stockpiling and transport of material through or near drainage lines may cause sedimentation and siltation of watercourses if not managed properly. **<u>Indirect Impact:</u>** Storm water runoff of dirt roads and un-vegetated areas may cause sedimentation and siltation of nearby watercourses.		5	2	8	5	75		5	1	4	5	50

Water Management			**Indirect Impact:** Alteration of the drainage patterns may lead to the degradation of downstream or surrounding Wetlands which in its turn may affect the aquatic micro and macro ecology. **Direct Impact:** Site clearing and topsoil stripping through drainage lines may lead to the siltation of streams as well as lead to erosion along the riverbanks that will affect the surface water quality negatively.		5	2	8	5	75		3	1	2	1	6
Topsoil and subsoil stripping & stockpiling for mining operation area	Destruction of upstream tributaries and reduction in water in the catchment	Downstream water users	**Indirect Impact:** Alteration of the upstream drainage lines may lead to the degradation of downstream or surrounding Wetlands which in its turn may affect the aquatic micro and macro ecology. **Direct Impact:** The destruction of tributaries may lead to a limited volume of water available to the downstream users. The reduction in water in the catchment may cause the degradation of surface water quality.	Construction & Operational	5	2	10	5	85	Remedy	5	1	6	5	60
Opencast mining excavations		Surface Water quality			5	2	10	5	85		5	1	6	5	60
Water Management					4	2	8	4	56		1	1	2	3	12
Topsoil and subsoil stripping & stockpiling for mining operation area	Water level reduction and contamination	Groundwater quality	**Direct Impact:** The reduction in water levels as well as contamination of the water resource that may be caused by alternating the topography during site clearing and topsoil stripping poses a risk to affecting the surface and sub-surface water quality as well as the downstream users.	Operational	3	2	6	4	44	Control	1	1	2	3	12
River crossings		Downstream water users	**Direct Impact:** Improper installation of river crossing infrastructures poses a risk in water level reduction and contamination of downstream water users i.e. through blocking of the natural flow of streams/rivers. **Indirect Impact:** The reduction of water levels of rivers/watercourses poses a risk of affecting both surface and sub-surface water resources.		3	2	4	3	27		1	1	0	3	6
Water supply (potable & process)			**Direct Impact:** Water wastage and over exploitation of water resources poses a risk in water level reduction. **Indirect Impact:** The reduction of water levels of rivers/watercourses/underground water tables poses a risk of affecting both surface and sub-surface water resources.		3	2	4	3	27		1	1	0	3	6
Water Management		Surface Water quality	**Direct Impact:** Improper management of water usage and installation of improper storm water features and infrastructure poses a risk of reducing the water levels for downstream users. **Indirect Impact:** The reduction of water levels of rivers/watercourses/underground water tables poses a risk of affecting both surface and sub-surface water resources.		3	2	6	3	33		1	1	2	3	12
Opencast mining excavations	Contamination of water resources	Surface Water quality	**Direct Impact:** Throughout the operational phase of the mining operations, potential pollutants are used such as high levels of nitrates. Improper management of potential pollutants may lead to the degradation of water quality (both surface and sub-surface). Polluted water resources may affect the aquatic environment in a detrimental manner.	Construction & Operational	3	2	6	4	44	Avoid	2	1	4	3	21
Drilling & Blasting		Surface Water quality	**Direct Impact:** Improper management of blasting activities poses the risk of contaminating water resources with pollutants such as high content of Nitrates. The presence of pollutants in the water resources poses a risk of degrading the conditions for the aquatic ecology to thrive.		3	2	6	4	44		1	1	4	3	18

RoM & product stockpiling			**<u>Direct Impact:</u>** Throughout the operational phase of the mining operations, potential pollutants are used such as high levels of nitrates. Improper management of potential pollutants may lead to the degradation of water quality (both surface and sub-surface). Polluted water resources may affect the aquatic environment in a detrimental manner. **<u>Indirect Impact:</u>** Sub-surface material and ore exposed to weathering may release pollutants to the water resources.		3	2	6	4	44		2	1	4	3	21
Residue stockpiles					5	2	8	4	60		3	1	6	3	30
Screening Operations			**<u>Direct Impact:</u>** Water seeping from stockpiles poses a risk of leading to elevated concentrations of heavy metals and other elements in the groundwater environment and can potentially be acidic. When this water reaches surface water bodies or the groundwater it can negatively affect the water quality. **<u>Indirect Impact:</u>** Alteration to the conditions of the water resources may negatively affect the aquatic ecology.		3	2	6	4	44		1	1	2	3	12
Discard disposal (backfilling of mining area)		Groundwater quality	**<u>Direct Impact:</u>** Throughout the operational phase of the mining operations, potential pollutants are used such as high levels of nitrates. Improper management of potential pollutants may lead to the degradation of water quality (both surface and sub-surface). Polluted water resources may affect the aquatic environment in a detrimental manner. Indirect Impact: Sub-surface material and ore exposed to weathering may release pollutants to the water resources.		3	2	6	4	44		1	1	2	3	12
Waste generation, storage, and disposal			**<u>Direct Impact:</u>** These storage of large amounts of waste over an extended time in a area not lined or bunded poses a risk of forming potentially hazardous leachates. **<u>Indirect Impact:</u>** The hazardous leachate from the waste storage facilities poses a risk of contaminating both surface and sub-surface water resources. This may lead to the degradation of conditions for the aquatic ecology to thrive.		3	2	6	4	44		1	1	2	3	12
Chemical Toilets			**<u>Direct Impact:</u>** Improper management of effluent from chemical toilets poses a high risk to contaminating water resources. **<u>Indirect Impact:</u>** Over an extended period, the exposure to contamination will cause the degradation of fauna and flora habitats as well as affect the surface and sub-surface water quality.		2	1	4	3	21		1	1	2	3	12
River crossings			**<u>Direct Impact:</u>** Storm water run-off from river crossing structures containing pollutants poses a risk in contaminating the surrounding water resources. **<u>Indirect Impact:</u>** Pollutants poses a risk in altering the conditions of the aquatic ecology to thrive.		2	1	4	3	21		1	1	2	3	12
Water supply (potable & process)			**<u>Direct Impact:</u>** Leaks and breaks of water supply infrastructure poses a risk of contaminating water resources. **<u>Indirect Impact:</u>** Pollutants poses a risk in altering the conditions of the aquatic ecology to thrive.		2	1	4	3	21		1	1	2	3	12
Storage of fuel and lubricants in temporary facilities			**<u>Direct Impact:</u>** The use of improper storage facilities poses a risk of the surrounding environment to be exposes to continuous leaking of hydrocarbons leading possibly contaminating both surface and sub-surface water sources as well as the soils surrounding the facility.		3	2	6	4	44		1	1	2	3	12
Water Management			**<u>Direct Impact:</u>** The poor management of onsite water i.e. Storm water, process water, effluent, potable water etc. may lead to the contamination of water resources.		3	2	6	4	44		1	1	2	3	12
Residue stockpiles	Hazardous Leachate	Groundwater quality	**<u>Direct Impact:</u>** Potential pollutant in the residue material resulting from mining operation may lead to the formation of leachate. The leachate may contain toxins that is hazardous to the aquatic ecology and water resources.	Construction & Operational	5	2	8	5	75	Remedy	3	1	6	3	30

Waste generation, storage, and disposal			**Direct Impact:** The hazardous leachate from the waste storage facilities poses a risk of contaminating both surface and sub-surface water as well as soil resources. This may lead to the degradation of conditions for the aquatic ecology to thrive.		3	1	4	3	24		1	1	0	1	2
Waste generation, storage, and disposal	Illegal dumping	Surface water contamination	**Direct Impact:** Dumping of generated water in areas other than is approved by the authorisation or EMP poses a high risk of polluting numerous sources i.e. Water and soil. The dumping of general waste poses a choking risk to grazing animals. Hazardous Leachates from illegal dumps also poses a risk to the health of surrounding communities. **Indirect Impact:** The hazardous leachate from the waste storage facilities poses a risk of contaminating both surface and sub-surface water as well as soil resources. This may lead to the degradation of conditions for the aquatic ecology to thrive.	Operational	3	1	4	3	24	Control	1	1	0	2	4

Topography and Visual															
Topsoil and subsoil stripping & stockpiling for mining operation area	Dust generation	Topography and Visual Environment	**Direct Impact:** Clearing of vegetation for topsoil and subsoil stripping exposes the mining operation area to dust generation. High levels of dust fallout will affect the overall air quality. The generation of dust during these activities will affect the visual environment negatively. **Indirect Impact:** Continuous exposure to high levels of dust fallout may lead to unhealthy environment for employees and surrounding communities.	Operational & Decommissioning	3	2	8	5	65	Remedy	2	1	4	4	28
Opencast mining excavations			**Direct Impact:** Exposed un-vegetated mining areas may lead to high levels of dust fallout and will affect the overall air quality. The generation of dust during these activities will affect the visual environment negatively. **Indirect Impact:** Continuous exposure to high levels of dust fallout may lead to unhealthy environment for employees and surrounding communities.		3	2	8	5	65		2	1	4	4	28
Drilling & Blasting			**Direct Impact:** Dust being generated form drilling and blasting activities poses the risk of affecting the ambient air quality. This also affects the visual environment. **Indirect Impact:** Continuous exposure to high levels of dust fallout may lead to unhealthy environment for employees and surrounding communities.		3	2	6	5	55		1	1	2	3	12
RoM & product stockpiling			**Direct Impact:** Continuous use of haul road often leads to the generation of fugitive dust comprising TSP, PM10 and PM2.5 from the dirt roads. Stockpiled RoM and product are continuously exposed to weathering leading the generation of fine dust particles. The generation of dust during these activities will affect the visual environment negatively. **Indirect Impact:** Continuous exposure to high levels of dust fallout may lead to unhealthy environment for employees and surrounding communities.		3	2	8	5	65		2	1	4	4	28
Residue stockpiles					5	2	8	5	75		3	1	4	4	32
Discard disposal (backfilling of mining area)					3	2	8	5	65		2	1	4	4	28
Vehicular activity on haul roads; and operation of mining equipment					3	2	6	4	44		1	1	2	3	12

Bulk transporting of Ore to market on Public roads					3	2	6	4	44		1	1	2	3	12
Screening Operations			**Direct Impact:** Screening operations poses a high risk to the generation of fugitive dust comprising TSP, PM10 and PM2.5. The generation of dust during these activities effects the visual environment negatively.		3	2	6	4	44		1	1	2	3	12
Topsoil and subsoil stripping & stockpiling for mining operation area	Topography and visual alteration	Topography and Visual Environment	**Direct Impact:** Topsoil and subsoil stripping will alter the topography and visual environment throughout the mining operation.	Operational & Decommissioning	5	2	8	5	75	Remedy	3	1	4	4	32
Opencast mining excavations			**Direct Impact:** Open cast mining will alter the topography and visual environment throughout the mining operation in a significant way.		5	2	8	5	75		3	1	4	4	32
Residue stockpiles			**Direct Impact:** Stockpiles of residue material over an extended time potentially alters the topography and visual environment.		5	2	10	5	85		5	1	4	5	50

Noise															
Topsoil and subsoil stripping & stockpiling for mining operation area	Noise generation	Surrounding noise quality	**Direct Impact:** The use of construction equipment during site clearing and topsoil stripping may cause noise during the construction phase. If equipment is not maintained and serviced regularly high levels of noise may result throughout the construction and operational phase.	Operational	3	2	6	5	55	Control	3	1	4	3	24
Opencast mining excavations					3	2	6	5	55		3	1	4	3	24
Drilling & Blasting					3	2	6	5	55		3	1	4	3	24
RoM & product stockpiling					3	2	6	5	55		3	1	4	3	24
Screening Operations					3	2	6	5	55		3	1	4	3	24

Discard disposal (backfilling of mining area)					3	2	6	5	55		3	1	4	3	24
Vehicular activity on haul roads; and operation of mining equipment					3	2	6	5	55		3	1	4	3	24

Heritage and Palaeontology															
Topsoil and subsoil stripping & stockpiling for mining operation area	Destruction of graves	Loss of heritage resources	**<u>Direct Impact:</u>** Proposed activities near identified graves poses the risk of destructing graves of great cultural and heritage importance. **<u>Indirect Impact:</u>** Loss of heritage and history for the future generation of the affected community.	Operational	5	1	10	4	64	Avoid	1	1	4	3	18
	Degradation of cultural significance heritage sites		**<u>Direct Impact:</u>** Proposed mining activities near cultural significant heritage sites poses the risk of degrading or loss of these sites. **<u>Indirect Impact:</u>** Loss of heritage and history for the future generation of the affected community.		5	1	10	4	64		1	1	4	3	18

Health and Safety

Employment of workers	Health and Safety of employees	Human health and safety environment	**Direct Impact:** Increased demand for labour and employees from different cultures may pose the risk to the lack of knowledge and skills on health and safety in the workplace. Different human behaviours deals with different situations and if there is not a simplified system of managing health and safety risk, situations resulting loss or injury of human life may be an end result.	Construction & Operational	4	1	6	5	55	**Control**	4	1	6	3	33

Socio-economic																
Employment of workers	Loss of farm labour	Socio-economic	**Direct Impact:** Increased demand of labour force poses a risk of the local farmers losing farm labour due to competing financial income.	Construction & Operational	3	3	4	5	50	**Control**	3	2	2	3	21
	Population Influx – Pressure on Resources	Socio-economic	**Direct Impact:** Increased demand for labour force poses a risk of a population influx in the local district municipality. The increasing population will put pressure on the local municipality to provide services such as sewage, drinking water, waste management, electricity etc.	Construction & Operational	3	2	4	5	45	**Control**	3	2	2	3	21
	Population Influx – Social Pathologies	Socio-economic	**Direct Impact:** Increased demand for labour force poses a risk of a population influx. The increased population influx may lead to conflicting social pathologies in the surrounding local community.	Construction & Operational	3	2	4	4	36	**Control**	3	2	2	3	21
	Population Influx – Community Conflict	Socio-economic	**Direct Impact:** Increased demand for labour force poses a risk of a population influx. The increased population influx may lead to community conflicts in the surrounding local community.	Construction & Operational	3	3	6	5	60	**Control**	3	2	2	3	21
	Reduced access to livelihood resources	Socio-economic	**Direct impact**: The operational phase may see the reduced access to livelihood resources (wood, grazing land, water) could be further restricted.	Construction & Operational	3	3	6		0	**Control**	3	2	2	3	21

	Direct and indirect employment opportunities	Socio-economic	**Direct impact:** It is anticipated that the operational phase will see the employment of approximately 44 people for the ten-year duration for the operational phase, creating direct employment for the region. In addition, the sourcing of materials and services could develop indirect employment opportunities.	Construction & Operational	3	3	2	3	24	**Control**	3	2	0	1	5
	Growth and diversification of local economy	Socio-economic	**Direct impact:** Local businesses could also see growth and diversification through the provision of services and materials to the operation, thus encouraging diversification within the local economy.	Construction & Operational	3	3	2	3	24	**Control**	3	2	0	1	5
	Increase in social ills	Socio-economic	**Direct impact:** As with any large-scale development in a rural area, there is likely to be an influx of people (both employees and jobseekers) that could change the local social dynamic and structure. This could result in increased social ills, such as drug and alcohol abuse, gender-based violence, and increased social conflict.	Construction & Operational	3	3	2	3	24	**Control**	3	2	0	1	5
	Increased nuisance and changed sense of place	Socio-economic	**Direct impact:** Mining activities could negatively impact the physical environment, including reduced air quality, noise emissions, and increased traffic. These aspects could cause a nuisance to residents, and potentially change the sense of place.	Construction & Operational	3	3	6	4	48	**Control**	3	2	2	3	21
	Indirect damage to/loss of assets	Socio-economic	**Direct impact:** The operation of the proposed mine could result in indirect economic impacts on local households, such as damage to buildings through blasting, and increased crime and theft of stock or goods.	Construction & Operational	3	3	6	4	48	**Control**	3	2	2	3	21
	Reduced public health and safety	Socio-economic	**Direct impact:** The influx of employees and jobseekers, the increase in traffic and reduced natural resources (air, water), could impact negatively on existing communities through reduced environmental health (respiratory), spread of communicable diseases, and increased crime and violence (outside people and competition for resources).	Construction & Operational	3	3	6	4	48	**Control**	3	2	2	3	21

	Increased local economic development opportunities	Socio-economic	**Direct impact:** The local procurement of materials and services could benefit local businesses and indirectly provide employment and improved local spending in the short-term. As the types of services required during construction is unlikely to exist locally, these benefits may be realised on a regional or national level, however the procurement of materials and services such as security and cleaning could be sourced locally.	Construction & Operational	3	3	2	5	40	**Control**	3	2	0	1	5
	Job Creation and Skills Training	Socio-economic	**Direct Impact:** As positive, local employed labour force will form part of a skills and training development programme. The proposed mining operation will create a job opportunity for at least a total of 60 people.	Construction & Operational	3	3	0	5	30	**Control**	3	2	0	1	5
Bulk transporting of Ore to market on Public roads	Pressure on public transport infrastructure	Socio-economic	**Direct Impact:** Influx of bulk transporting vehicles puts pressure on the public transport infrastructures. During the life cycle of the proposed activity an increase in vehicle movement in the area will be expected. This poses a potential increase in vehicle, pedestrian, and livestock accidents.	Construction & Operational	4	3	6	5	65	**Control**	4	2	4	5	50
Decommissioning															
Air Quality Management															
Demolition / removal of portable and related infrastructure	Fugitive and ambient dust generation	Air Quality	**Direct Impact:** Dismantling and demolition of existing infrastructure, transporting, and handling of topsoil on unpaved roads to bring the site to state suitable for alternative land uses poses potential impacts on the atmospheric environment. Demolition and removal of all infrastructures will cause fugitive dust emissions. Any implication this activity will have on ambient air quality will be short-term and localised. **Indirect Impact:** Continuous exposure to high levels of dust fallout may lead to unhealthy environment for employees and surrounding communities.	Decommissioning	2	2	4	5	40	Control	2	1	2	3	15
Vehicular activity: removal of mobile plant / equipment and vehicles			**Direct Impact:** Transportation of mobile plants / equipment and other materials from site can lead to the generation of fugitive dust comprising TSP, PM10 and PM2.5. This activity will be short-term, localised, and will have low impacts on the atmospheric environment once the demolition ceases. **Indirect Impact:** Continuous exposure to high levels of dust fallout may lead to unhealthy environment for employees and surrounding communities.		2	3	4	5	45		2	1	2	3	15
Rehabilitation of the lay down areas			**Direct Impact:** Re-vegetation of the remaining footprint of the mine must be done after the reclamation. The impacts on the atmospheric environment during rehabilitation will be limited to the vehicular activity, spreading of soil and profiling/contouring. The impact will be medium-term, extremely limited on spatial scale, with limited implication on ambient air quality.		2	2	4	5	40		2	1	2	3	15

Demolition of PCD's			**Direct Impact:** Dismantling and demolition of existing infrastructure, transporting, and handling of topsoil on unpaved roads to bring the site to state suitable for alternative land uses poses potential impacts on the atmospheric environment. Demolition and removal of all infrastructures will cause fugitive dust emissions. Any implication this activity will have on ambient air quality will be short-term and localised. **Indirect Impact:** Continuous exposure to high levels of dust fallout may lead to unhealthy environment for employees and surrounding communities.		2	2	4	5	40		2	1	2	3	15
Demolition of workshops, waste storage facilities, fuel storage facilities etc.					2	2	4	5	40		2	1	2	3	15

Fauna and Flora															
Rehabilitation of mining areas	Vegetation and habitat loss	Macro and Micro organisms	**Direct Impact:** Improper rehabilitation measures implemented poses a risk of vegetation and habitat loss. The conditions for macro and micro-organisms need to be suitable for reinstatement of the ecosystem.	Decommissioning	2	1	6	5	45	Remedy	1	1	2	3	12
Rehabilitation of the lay down areas		Fauna and Flora			3	1	6	5	50		1	1	2	3	12
Rehabilitation of mining areas	Influx of alien invasive vegetation	Fauna and Flora micro and macro ecosystems	**Direct Impact:** Site clearing for roads, lay down areas, and mining area exposes the un-vegetated area to the influx of alien invasive vegetation causing Irreversible damage to the native fauna and flora species and loss of habitats, notably along wetlands and drainage lines.	Decommissioning	5	2	8	5	75	Control	3	2	3	4	32
Rehabilitation of the lay down areas					5	2	8	5	75		3	2	3	4	32

Aquatic ecology															
Rehabilitation of mining areas	Sediment ation and	Wetlands and	**Direct Impact:** Runoff from exposed un-vegetated areas poses a risk in contaminating nearby streams, rivers, and drainage lines.	Decommissio ning	2	3	6	4	44	Control	1	1	2	3	12

Vehicular activity: removal of mobile plant / equipment and vehicles			**Direct Impact:** Constructing and the use of access roads through drainage lines may cause sedimentation and siltation of watercourses if not managed properly. **Indirect Impact:** Storm water runoff of dirt roads may cause sedimentation and siltation of nearby watercourses.		2	3	6	4	44		1	1	2	3	12
Rehabilitation of the lay down areas			**Direct Impact:** If areas remain un-vegetated and exposed run-off from these areas may contain sediment and silt posing the risk of contaminating watercourses/rivers in proximity.		2	3	6	4	44		1	1	2	3	12
Demolition of PCD's	Contamination of water resources	Wetland and aquatic ecology	**Direct Impact:** Discharge, spills and leakage of effluent containing pollutants poses a risk of contaminating water resources within proximity. **Indirect Impact:** Pollutants poses a risk in altering the conditions of the aquatic ecology to thrive.	Decommissioning	2	3	6	4	44	Control	1	1	4	3	18
Demolition of workshops, waste storage facilities, fuel storage facilities etc.				Decommissioning	2	3	6	3	33		1	1	4	3	18

Soil															
Rehabilitation of mining areas	Degradation of soil resources	Soil quality	**Direct Impact:** Poor management of topsoil and subsoil poses a risk to degradation of soil resources.	Decommissioning	5	1	8	5	70	Remedy	2	1	2	3	15
Demolition / removal of portable and related infrastructure					3	1	6	4	40		1	1	2	1	4
Rehabilitation of the lay down areas					5	1	8	5	70		2	1	2	3	15
Demolition of PCD's					3	1	6	4	40		1	1	2	1	4
Demolition of workshops, waste storage facilities, fuel storage facilities etc.			**Direct Impact:** Poor management of topsoil and subsoil poses a risk to degradation of soil resources. Spills or leaks of effluent may contain possible pollutants that poses a risk of further degradation of soil resources. Workshop floors, waste storage facilities and fuel storage facilities are exposed to hydrocarbons throughout construction, operation, and decommissioning. Improper disposal method or remediation poses a risk of polluting the surrounding water and soil resources. **Indirect Impact:** Degradation of soil resources poses a risk in altering the conditions for micro-organisms to thrive in.		3	1	6	4	40		1	1	2	1	4
Rehabilitation of mining areas	Hydrocarbon	Soil quality	**Direct Impact:** The potential impact will arise during demolition of infrastructure, where mobilisation of contaminants such as fuels containing hydrocarbons, waste, explosives, PCD material to the surface water resources resulting in the contamination of those resources.	Decommissioning	3	1	6	3	30	Control	1	1	0	3	6

Vehicular activity: removal of mobile plant / equipment and vehicles			**Direct Impact:** Heavy vehicle activity used during the decommissioning phase is poses a risk of leaking or spilling contaminants such as fuels containing hydrocarbons, waste, explosives, PCD material to the surface water resources resulting in the contamination of those resources.		3	1	6	3	30		1	1	0	3	6
Demolition of PCD's					3	1	6	3	30		1	1	0	3	6
Demolition of workshops, waste storage facilities, fuel storage facilities etc.			**Direct Impact:** Heavy vehicle activity used during the decommissioning phase is poses a risk of leaking or spilling contaminants such as fuels containing hydrocarbons, waste, explosives, to the surface water resources resulting in the contamination of those resources. If the effluent are not treated or disposed of at a registered facility, the leakage or spillage of the contaminated water may lead to the degradation of water and soil resources. Workshop floors, waste storage facilities and fuel storage facilities are exposed to hydrocarbons throughout construction, operation, and decommissioning. Improper disposal method or remediation poses a risk of polluting the surrounding water and soil resources.		3	1	6	3	30		1	1	0	3	6
Rehabilitation of mining areas	Erosion	Loss of fertile soil	**Direct Impact:** Exposed un-vegetated rehabilitated areas poses a high risk of erosion. This may lead to the loss of fertile soil and in its turn effect the micro-ecosystems of the surrounding environment.	Decommissioning	5	2	8	4	60	Avoid	2	1	4	3	21
Demolition / removal of portable and related infrastructure	Erosion	Loss of fertile soil		Decommissioning	3	1	6	4	40	Avoid	1	1	2	3	12
Vehicular activity: removal of mobile plant / equipment and vehicles	Erosion	Loss of fertile soil		Decommissioning	3	1	6	4	40	Avoid	1	1	2	3	12
Rehabilitation of the lay down areas	Erosion	Loss of fertile soil		Decommissioning	5	2	8	4	60	Avoid	2	1	4	3	21
Demolition of PCD's	Erosion	Loss of fertile soil		Decommissioning	3	1	6	4	40	Avoid	1	1	2	3	12
Demolition of workshops, waste storage facilities, fuel storage facilities etc.	Erosion	Loss of fertile soil		Decommissioning	3	1	6	4	40	Avoid	1	1	2	3	12

Demolition / removal of portable and related infrastructure	General waste generation & Littering	Soils quality due to leachates	**<u>Direct Impact:</u>** Throughout the decommissioning phase of the project large amounts of waste (general and hazardous waste) will be generated putting strain on local landfill sites. The storage of large amounts of waste over an extended time in a area not lined or bunded poses a risk of forming potentially hazardous leachates. **<u>Indirect Impact:</u>** The hazardous leachate from the waste storage facilities poses a risk of contaminating both surface and sub-surface water resources. This may lead to the degradation of conditions for the aquatic ecology to thrive. Pressure on the local or national landfills poses the risk of land degradation and requires more space in terms of the IDP of the local municipality.	Decommissioning	1	1	8	5	50	Control	1	1	4	3	18
Demolition of PCD's					1	1	8	5	50		1	1	4	3	18
Demolition of workshops, waste storage facilities, fuel storage facilities etc.					1	1	8	5	50		1	1	4	3	18
Water resources															
Demolition / removal of portable and related infrastructure	Hydrocarbon Contamination	Surface Water quality	**<u>Direct Impact:</u>** The potential impact will arise during demolition of infrastructure, where mobilisation of contaminants such as fuels containing hydrocarbons, waste, explosives, PCD material to the surface water resources resulting in the contamination of those resources.	Decommissioning	2	2	6	4	40	Control	1	1	2	3	12
Vehicular activity: removal of mobile plant / equipment and vehicles			**<u>Direct Impact:</u>** Heavy vehicle activity used during the decommissioning phase is poses a risk of leaking or spilling contaminants such as fuels containing hydrocarbons, waste, explosives, PCD material to the surface water resources resulting in the contamination of those resources.		2	2	6	4	40		1	1	2	3	12
Demolition of PCD's		Groundwater quality	**<u>Direct Impact:</u>** Heavy vehicle activity used during the decommissioning phase is poses a risk of leaking or spilling contaminants such as fuels containing hydrocarbons, waste, explosives, PCD material to the surface water resources resulting in the contamination of those resources. If the contend of the PCD's are not treated or disposed of at a registered facility, the leakage or spillage of the contaminated water may lead to the degradation of water and soil resources.		2	2	6	4	40		1	1	2	3	12

Demolition of workshops, waste storage facilities, fuel storage facilities etc.			**Direct Impact:** Heavy vehicle activity used during the decommissioning phase is poses a risk of leaking or spilling contaminants such as fuels containing hydrocarbons, waste, explosives, to the surface water resources resulting in the contamination of those resources. If the effluent is not treated or disposed of at a registered facility, the leakage or spillage of the contaminated water may lead to the degradation of water and soil resources. Workshop floors, waste storage facilities and fuel storage facilities are exposed to hydrocarbons throughout construction, operation, and decommissioning. Improper disposal method or remediation poses a risk of polluting the surrounding water and soil resources.		2	2	6	4	40		1	1	2	3	12
Rehabilitation of mining areas	Sedimentation and siltation of watercourses	Surface Water quality	**Direct Impact:** Runoff from exposed un-vegetated areas poses a risk in contaminating nearby streams, rivers, and drainage lines.	Decommissioning	5	2	8	5	75	Control	2	1	4	3	21
Vehicular activity: removal of mobile plant / equipment and vehicles			**Direct Impact:** If areas remain un-vegetated and exposed run-off from these areas may contain sediment and silt posing the risk of contaminating watercourses/rivers in proximity.		2	1	4	3	21		1	1	0	3	6
Rehabilitation of the lay down areas			**Direct Impact:** If areas remain un-vegetated and exposed run-off from these areas may contain sediment and silt posing the risk of contaminating watercourses/rivers in proximity.		5	2	8	5	75		2	1	4	3	21
Demolition / removal of portable and related infrastructure	General waste generation & Littering	Surface Water quality due to leachates	**Direct Impact:** Throughout the decommissioning phase of the project large amounts of waste (general and hazardous waste) will be generated putting strain on local landfill sites. The storage of large amounts of waste over an extended time in an area not lined or bunded poses a risk of forming potentially hazardous leachates. **Indirect Impact:** The hazardous leachate from the waste storage facilities poses a risk of contaminating both surface and sub-surface water resources. This may lead to the degradation of conditions for the aquatic ecology to thrive.	Decommissioning	2	1	4	4	28	Control	1	1	0	3	6
Demolition of PCD's					2	1	4	4	28		1	1	0	3	6
Demolition of workshops, waste storage facilities, fuel storage facilities etc.					2	1	4	4	28		1	1	0	3	6
Demolition of PCD's	Contamination of water resources	Surface Water quality	**Direct Impact:** Discharge, spills and leakage of effluent containing pollutants poses a risk of contaminating water resources within proximity. **Indirect Impact:** Pollutants poses a risk in altering the conditions of the aquatic ecology to thrive.	Decommissioning	3	2	8	4	52	Avoid	1	1	4	3	18

Demolition of workshops, waste storage facilities, fuel storage facilities etc.		Groundwater quality			3	2	6	4	44		1	1	2	2	8

Topography and Visual															
Demolition / removal of portable and related infrastructure	Dust generation	Topography and Visual Environment	**<u>Direct Impact:</u>** Dismantling and demolition of existing infrastructure, transporting, and handling of topsoil on unpaved roads to bring the site to state suitable for alternative land uses poses potential impacts on the atmospheric environment. Demolition and removal of all infrastructures will cause fugitive dust emissions. Any implication this activity will have on ambient air quality will be short-term and localised. **<u>Indirect Impact:</u>** Continuous exposure to high levels of dust fallout may lead to unhealthy environment for employees and surrounding communities.	Decommissioning	1	1	2	3	12	Control	1	1	0	1	2
Vehicular activity: removal of mobile plant / equipment and vehicles			**<u>Direct Impact:</u>** Transportation of mobile plants / equipment and other materials from site can lead to the generation of fugitive dust comprising TSP, PM10 and PM2.5. This activity will be short-term, localised, and will have low impacts on the atmospheric environment once the demolition ceases. **<u>Indirect Impact:</u>** Continuous exposure to high levels of dust fallout may lead to unhealthy environment for employees and surrounding communities.		1	1	2	3	12		1	1	0	1	2
Rehabilitation of the lay down areas			**<u>Direct Impact:</u>** Re-vegetation of the remaining footprint of the mine must be done after the reclamation. The impacts on the atmospheric environment during rehabilitation will be limited to the vehicular activity, spreading of soil and profiling/contouring. The impact will be medium-term, extremely limited on spatial scale, with limited implication on ambient air quality.		5	2	6	5	65		3	2	2	3	21
Demolition of PCD's			**<u>Direct Impact:</u>** Dismantling and demolition of existing infrastructure, transporting, and handling of topsoil on unpaved roads to bring the site to state suitable for alternative land uses poses potential impacts on the atmospheric environment. Demolition and removal of all infrastructures will cause fugitive dust emissions. Any implication this activity will have on ambient air quality will be short-term and localised. **<u>Indirect Impact:</u>** Continuous exposure to high levels of dust fallout may lead to unhealthy environment for employees and surrounding communities.		1	1	2	3	12		1	1	0	1	2
Demolition of workshops, waste storage facilities, fuel storage facilities etc.			**<u>Direct Impact:</u>** Dismantling and demolition of existing infrastructure, transporting, and handling of topsoil on unpaved roads to bring the site to state suitable for alternative land uses poses potential impacts on the atmospheric environment. Demolition and removal of all infrastructures will cause fugitive dust emissions. Any implication this activity will have on ambient air quality will be short-term and localised. **<u>Indirect Impact:</u>** Continuous exposure to high levels of dust fallout may lead to unhealthy environment for employees and surrounding communities.		1	1	2	3	12		1	1	0	1	2

Demolition / removal of portable and related infrastructure	General waste generation & Littering	Topography and Visual Environment	**Direct Impact:** Throughout the decommissioning phase of the project large amounts of waste (general and hazardous waste) will be generated putting strain on local landfill sites. The storage of large amounts of waste over an extended time in an area not lined or bunded poses a risk of forming potentially hazardous leachates. **Indirect Impact:** The hazardous leachate from the waste storage facilities poses a risk of contaminating both surface and sub-surface water resources. This may lead to the degradation of conditions for the aquatic ecology to thrive.	Decommissioning	2	1	4	5	35	Control	1	1	2	3	12
Demolition of PCD's					2	1	8	5	55		1	1	4	3	18
Demolition of workshops, waste storage facilities, fuel storage facilities etc.					2	1	4	5	35		1	1	2	3	12

Noise															
Rehabilitation of mining areas	Noise generation	Surrounding noise quality	**Direct Impact:** The use of unmaintained equipment and plant throughout the rehabilitation phase poses a risk of generating noise.	Decommissioning	3	2	8	5	65	Control	2	1	4	3	21
Demolition / removal of portable and related infrastructure					1	1	4	5	30		1	1	0	3	6
Vehicular activity: removal of mobile plant / equipment and vehicles					1	1	4	5	30		1	1	0	3	6

Demolition of PCD's					1	1	4	5	30		1	1	0	3	6
Demolition of workshops, waste storage facilities, fuel storage facilities etc.					1	1	4	5	30		1	1	0	3	6

Socio-economic																
Employment of workers	Loss of permanent jobs	Socio-economic	**Direct Impact:** The employment during operational phase is likely to be phased out during decommissioning, resulting in a loss employment locally and regionally.	Construction & Operational	2	3	6	4	44	**Control**	2	2	2	3	18
	Increase temporary employment	Socio-economic	**Direct Impact:** Limited temporary employment opportunities would be generated, which could benefit local communities.	Construction & Operational	2	2	2	3	18	**Control**	2	1	0	1	3
	Increased local procurement	Socio-economic	**Direct Impact:** The decommissioning phase may see the need for local procurement of goods and services	Construction & Operational	2	2	2	3	18	**Control**	2	1	0	1	3

Methodology used in determining the significance of environmental impacts

(Describe how the significance, probability, and duration of the aforesaid identified impacts that were identified through the consultation process was determined in order to decide the extent to which the initial site layout needs revision)

The significance (quantification) of potential environmental impacts identified during the preliminary assessment have been determined using a ranking scale, based on the following (terminology has been taken from the Guideline Documentation on EIA Regulations, of the Department of Environmental Affairs and Tourism, April 1998):

Occurrence

- Probability of occurrence (how likely is it that the impact may occur?)
- Duration of occurrence (how long may it last?)

Severity

- Magnitude (severity) of impact (will the impact be of high, moderate or low severity?)
- Scale/extent of impact (will the impact affect the national, regional or local environment, or only that of the site?)

Each of these factors has been assessed for each potential impact using the ranking scales represented by **Table 33**.

Table 33: Ranking scale of the four factors considered to determine significance rating

Probability	Duration
1 - very improbable (probably will not happen 2 - improbable (some possibility, but low likelihood) 3 - probable (distinct possibility) 4 - highly probable (most likely) 5 - definite (impact will occur regardless of any prevention measures)	1 - of a very short duration (0–1 years) 2 - of a short duration (2-5 years) 3 - medium-term (5–15 years) 4 - long term (> 15 years) 5 - permanent
Extent	**Magnitude**
1 - limited to the site 2 - limited to the local area 3 - limited to the region 4 - will be national 5 - will be international	0 - small and will have no effect on the environment 2 - minor and will not result in an impact on processes 4 - low and will cause a slight impact on processes 6 - moderate and will result in processes continuing but in a modified way 8 - high (processes are altered to the extent that they temporarily cease) 10 - very high and results in complete destruction of patterns and permanent cessation of processes

The environmental significance of each potential impact is assessed using the following formula:

Significance Points (SP) = (Magnitude + Duration + Extent) x Probability

The maximum value is 100 Significance Points (SP). Potential environmental impacts were rated as high, moderate or low significance on the following basis:

- < 30 significance points = **LOW** environmental significance.
- 31- 60 significance points = **MODERATE** environmental significance
- 60 significance points = **HIGH** environmental significance

vi) Positive and negative impacts that the proposed activity (in terms of the initial site layout) and alternatives will have on the environment and the community that may be affected

(Provide a discussion in terms of advantages and disadvantages of the initial site layout compared to alternative layout options to accommodate concerns raised by affected parties)

The possible positive and negative impacts that the proposed Vygenhoek Platinum Mine may pose was discussed in detail in section v).

Recommendations was made by the specialist to conduct further investigations that will include field work that was not conducted as part of the desktop-scoping review process. See section i) iii) **Table 34** for the specialist recommendations.

vii) Possible mitigation measures that could be applied and the level of risk

(With regard to the issues and concerns raised by affected parties provide a list of the issues raised and an assessment/ discussion of the mitigations or site layout alternatives available to accommodate or address their concerns, together with an assessment of the impacts or risks associated with the mitigation or alternatives considered)

During the EIR and EMPr preparation a detailed management plan of each impact and risks identified in section **v)**. The management plan addresses mitigation measures in detail.

All concerns raised by the I&AP as part of the PPP listed in the previous section will be incorporated and addressed and will form part of the consideration of mitigation measures.

viii) The outcome of the site selection Matrix (Final Site Layout Plan)

(Provide a final site layout plan as informed by the process of consultation with interested and affected parties)

Find attached as **Appendix C** the final site layout plan.

ix) Motivation where no alternative sites were considered

As discussed in section (***h)*** of this report, no property alternatives have been considered as the proposed activities will occur on properties forming part of where previous prospecting rights was issued. However, a number of alternatives regarding the placement of infrastructure within the property boundaries have been considered during the scoping process and will be further investigated during the EIA phase.

The current site layout (**Appendix C**) has been determined by considering both environmental and social sensitive receptors as well as considering operational feasibility.

At the time of submitting this report to the competent authority the following infrastructures did not form part of the site layout:

- Storm water infrastructure; and
- Location of PCD's.

It is therefore recommended that before authorising the activity a detailed site layout plan is submitted indicating the details of all infrastructures associated to the proposed mining development.

x) Statement motivating the alternative development location within the overall site

(Provide a statement motivating the final site layout that is proposed)

As discussed in the previous sections, both environmental and social sensitive receptors where considered in the site layout attached as **Appendix C**.

In terms of the actual mining areas, there are no alternative sections to be mined as the prospecting results indicated that these areas would be most feasible. However, as indicated previously, all alternatives as highlighted in section h) i) of this report, will be further assessed during the EIA process. The site layout (**Appendix C**) indicates the proposed infrastructure taking into consideration the desktop studies that took place as part of the scoping phase.

i) Plan of study for the Environmental Impact Assessment process

The section to follow describes how the EIA process will be approach in the development of the EIR and EMPr.

i) Description of alternatives to be considered including the option of not going ahead with the activity

As discussed in section ***(h) and (i)*** of this report, no property alternatives will be considered as the proposed activities will occur on properties forming part of the existing prospecting rights. However, a number of alternatives regarding the placement of infrastructure within the property boundaries will be considered throughout this process. The placing of RoM and product stockpiles as well as the residue deposits/stockpiles will be assessed and placed accordingly. In addition, all infrastructures such as an alternative access road will be further assessed during the EIA phase.

ii) Description of the aspects to be assessed as part of the environmental impact assessment process

(The EAP must undertake to assess the aspects affected by each individual mining activity whether listed or not, including activities such as blasting, Loading, hauling and transport, and mining activities such as Excavations, stockpiles, discard dumps or dams, water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors, etc…etc…etc.).

In section ***(v)*** possible impacts and aspects associated to the proposed Vygenhoek Platinum Mine have been predetermined. As part of the EIR and EMPr these impacts and aspects will be explored further and mitigation and management measures will be developed to control reduce and or eliminate possible environmental impacts.

iii) Description of aspects to be assessed by specialist

As part of the desktop studies undertaken by the appointed specialist, several aspects have been identified that will need to be assessed during the EIA phase. **Table 34** highlight the aspects identified.

Table 34: Aspects to be assessed by the appointed specialists

Appointed specialist	Aspects to be considered
Air Quality	The anticipated impact of activities at the proposed Vygenhoek Platinum Mine will be quantitatively assessed through dispersion modelling using AERMOD and presented in the final Level 2 Air Quality Impact Assessment (AQIA) report. It is expected that emissions from activities at the proposed mine will most likely result in air quality impacts in terms of dust-fall, PM_{10} and $PM_{2.5}$,. However, a detailed emissions inventory will be compiled for the proposed Vygenhoek Platinum Mine operations as part of the AQIA.
Climate Change Impact Assessment	GHG calculations and a detailed climate change impact assessment report have not been compiled as part of the scoping phase. It is recommended that a full climate change impact assessment be undertaken as part of the EIA phase to fully assess the potential impact of the project on climate change. This would require a thorough calculation of all potential GHG emissions for the life of the proposed mine.
Noise	Due to the risk of the noise impact, it is recommended that the proposed mining activity be evaluated in detail using a noise propagation model considering: • the actual mining layout and the proposed mining activities (equipment and the average use of these equipment); • the topography and surface characteristics of the surrounding area; and actual ambient sound levels (requiring a future site visit and ambient sound level measurements).
Terrestrial biodiversity	The following schedule and time allowance is suggested: • EIA Austral Summer/Wet Season Surveys - preferably 2 surveys during the height of the growing season, which is typically between November and March (preferably November and December. Consideration for multiple surveys is suggested to allow for univoltine[3] butterfly activity. • Red Data distribution and geo-location survey – a single survey to determine the relative abundance and geo-location of specific animal species for permitting requirements and/or determining the extent of occurrence of sub-populations of confirmed species. This survey should

[3] Producing a single generation per year, and especially a single brood of eggs capable of hibernating

	ideally be conducted prior to the submission of the EIA application to inform decision making and to highlight project liabilities.
Aquatic biodiversity	Based on the results obtained during the scoping phase, it was determined that both aquatic and wetland specialist studies will be required to inform the Environmental Impact Assessment. In this regard, all aquatic and wetland studies are to ensure compliance with the procedures for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the National Environmental Management Act (Act 107 of 1998) and Water Use Licence Application process. Given the high sensitivities of the freshwater ecosystem associated with the proposed mine, it was further determined that such specialist studies are to be conducted at a detailed level, and that an aquatic and/or wetland compliance statement are not deemed to be applicable on the basis of the sensitivities identified during the present exercise. A detailed Terms of Reference for the aquatic and wetland assessments is provided below, and should be ready together with the minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the National Environmental Management Act (Act 107 of 1998), as well as the Natural Scientific Professions Act (Act 27 of 2003). *Aquatic specialist assessment* In addition to the general requirements for specialist studies, the following are deemed applicable to aquatic specialist assessments: • Ideally, two seasonal aquatic studies are to be conducted for the purpose of establishing a baseline for the associated aquatic ecosystem and to inform a monitoring approach to be undertaken should the proposed mine receive authorisation. Where the aquatic assessment is to be conducted during a single season only, a single comprehensive aquatic ecosystem assessment is to be conducted following sufficient summer rainfall and inundation of the associated watercourses for a period of at least six (6) weeks prior to the study commencing. As such, it is expected that unless significant early summer rainfall occurs within the upper catchment, studies of the associated aquatic ecosystem are expected to take place within the middle part of the summer period (i.e. December to February); • Aquatic macroinvertebrates sampled within the study area, specifically Mollusca and Odonata, are to be identified to the lowest possible taxonomic level (i.e. lower than Family level) in order to determine the possible presence of species of conservation concern; • An assessment of the adult Odonata associated with the study area is to be undertaken; • A detailed ichthyofaunal assessment is to be undertaken within the watercourses adjacent to and downstream of the proposed mining area. During the assessment, the relative density and diversity of fish species is to be investigated for each site, with specific attention given to the presence of species of conservation concern and as-yet undescribed species; • All aquatic data collection is to be done in a manner that is non-destructive, unless the relevant permits are obtained from the Mpumalanga Tourism and Parks Agency. Any samples collected on-site are to be lodged with the South African Institute for Aquatic Biodiversity (SAIAB); • Potential spawning habitat for identified species of conservation concern, Protected and/or endemic species is to be identified, and the potential impact of blasting activities thereon determined;

- Determination of the Present Ecological State of the associated watercourses is to be determined by the EcoStatus approach (i.e. by means of the Macro-Invertebrate Response Assessment Index, Fish Response Assessment Index, etc.);
- A detailed monitoring programme is to be developed as part of the assessment, that will take effect immediately upon authorisation so as to allow for collection of suitable pre-mining data that will inform the monitoring of potential impacts;
- The aquatic specialist must provide input into a biodiversity management plan to be developed for the mine, with specific consideration given to the identified sensitivities;
- The identified aquatic specialist who is to conduct the aquatic assessment is to have expertise in aquatic macroinvertebrate identification below family level, have expertise in fish taxonomy and identification, and have expertise in the application of the EcoStatus suite of indices.
- Ideally, the identified aquatic specialist is to have >10 years' experience in conducting aquatic assessments. Where this is not possible, the specialist is to have at least 5 years' experience in conducting specialist aquatic assessments, with proven competence in freshwater fish assessments.

Wetland specialist assessment

In addition to the general requirements for specialist studies, the following are deemed applicable to wetland specialist assessments:

- Wetland within the study area as well as within 1km of the study area are to be delineated using the guidelines as published by the DWAF (2005) entitled "A Practical Field Procedure for Identification and Delineation of Wetlands and Riparian Areas". However, a pragmatic approach should be taken if any problematic soil types are encountered, and the delineated of wetlands in such soil types supported;
- The wetland delineation component of the specialist report should include the following information as a minimum:
    - A description of how and when the delineation was done;
    - A description of the catchment, landscape, landscape position, topography (slopes – concave, convex, flat etc., and slope changes), vegetation, soils and hydrological conditions including a summary of the available information used to determine the extent of wetland habitat;
    - Review of historical imagery and anecdotal evidence;
    - Where appropriate, the incorporation of field datasheets as appendices which should include a description of site conditions of representative sample points that adequately describe the delineation. In some cases, particularly for difficult sites, the sample points should be described from both inside and outside the delineated wetland boundary;
    - Site maps identifying the boundary of the wetland within the study area, plus an indication if the wetland extends outside the site boundary, albeit only at a desktop level if access is restricted or difficult in those areas, and the location of all data collection points recorded during the study. This should also include Information on the type and date of imagery used to support the delineation;
    - All sample points used by the delineator to determine the boundary of the wetland must be recorded using a Global Positioning System (GPS). The GPS used during

	the study and the accuracy of the GPS should be stipulated in the reporting to highlight potential inaccuracies in the boundaries presented on the map; • All delineated wetlands are to be classified according to Ollis et al. (2013); • All delineated wetlands to be assessed in terms of health and functionality (hydrological, ecological and ecosystem services) using recognised tools (e.g. Wet-Health, Wet-EcoServices, Wet-IHI, etc.), taking cognisance of recent findings regarding the limitations of such tools on certain hydrogeomorphic types. Where wetlands are transformed, the assessment needs to include potential levels of functionality that could be expected with iterative levels of rehabilitation; • Consideration should at all times be given to the drivers and responses of wetland formation/support for delineated wetlands when considering potential impacts associated with the proposed activity. In this regard, the wetland specialist is to take cognisance of the findings obtained from the hydropedological assessment of the site in determining the potential impact on landscape-level wetland drivers; • The wetland specialist must provide input into a biodiversity management plan to be developed for the mine, with specific consideration given to the identified sensitivities; Ideally, the identified wetland specialist conducting the assessment is to have >10 years' experience in conducting aquatic assessments. Where this is not possible, the specialist is to have at least 5 years' experience in conducting specialist wetland assessments. Additional expertise in soil science is mandatory given the potential for problematic soils to be present within the study area.
Soil	It is recommended to conduct ground truthing of the Desktop Scoping Soil Specialist Assessment of Portions 3 and 7 Farm Vygenhoek 777ha. Extrapolation from aerial photo interpretation, i.e. mainly Google images combined with site visit and previous data from similar projects in close proximity still leaves a gap in terms of the confidence levels of the estimated data. A survey grid is required to confirm soil types that will yield more accurate data in terms of effective depth, land use & land capability, agricultural potential and suitability of soils for rehabilitation. More accurate soil management plan can be recalibrated from this data, as well as soil sample analyses data characterising soil chemistry and physics. It will enable identifying a potential fatal flaw to assess if soils are prone to erosion due to dispersion anomalies. The refinement of data can be conducted once site selection has been confirmed.
Hydrology	It is recommended that during the detailed hydrological investigation and EIA, the following items are addressed, with mitigation measures recommended where applicable: • Floodline modelling and stream buffers • Conceptual Storm Water Management • Mean Annual Runoff Assessment • Static Water Balance • Water Quality Monitoring • Hydrological Impact Assessment
Geo-hydrology	• It is recommended that a follow-up hydrological assessment be undertaken before mining: - A geophysical assessment of the mining areas should be undertaken as soon as the areas are cleared for mining. It is important to map preferential groundwater flow paths towards the receiving environment and to update the groundwater risk

	- assessment. Subsequently, dedicated groundwater monitoring boreholes should be drilled in these preferential flow path areas to update and improve the proposed monitoring network. - At least three (3) constant rate pump tests should be undertaken (once-off) as part of the monitoring programme, to update aquifer hydraulic parameters and the site conceptual models. - A geochemical assessment including geochemical testing of ore and overburden rock is recommended to update the source terms for the mine. • Develop a numerical groundwater flow and transport model to: - Evaluate preferential flow paths and groundwater migration velocities. - Evaluate long term and post-closure transport movement into the surrounding aquifer; - Track preferential flow paths and changes to groundwater flow; - Ensure no monitoring network gaps exist (i.e. check if the monitoring network is representative of the site); and - Update the numerical groundwater model annually. • Undertake baseline water quality sampling and a hydrocensus to verify existing groundwater users in the study area; and baseline water quality (ambient water quality). • A groundwater management and acid mine drainage (AMD) management plan should be formulated to ensure the impact on the groundwater environment is limited and mitigated.
Seismicity assessment	Based on the above no further seismic intrusive work would be required. However, it is recommended that a slope stability assessment be conducted to inform the mine plan as soon as mining starts. The slope stability assessment can help prevent landslides typically associated with high walls and steep-sloped areas.
Human Health	The HIA should continue as part of the EIA phase and must include the following: • Site Visit – to conduct a physical site visit of the proposed area to verify the information gained through the desktop research and ensure a baseline record is available of key stakeholders and potential health impacts not identified during the desktop research. • Stakeholder Engagement – to conduct initial stakeholder engagements (possibly together, or in conjunction with the social impact assessment) to introduce the project and receive valuable input from key stakeholders as to the potential health impacts envisaged from their perspective. • Risk Assessment – to assess, rank and prioritise the various health impacts that were identified during both the desktop research and site visit. • Health Action Plan – to develop a Health Action Management Plan that includes the mitigation and management measures needed for implementation. This plan will need stakeholder review and input and should also include the following aspects: - Implementation and Monitoring – to identify and include the roles and responsibilities of the various parties involved and establish an action framework and allocation of resources as well as the design of a monitoring system (including key performance indicators) to ensure that mitigation progress is satisfactory. Evaluation & Verification of Performance & Effectiveness – to be implemented during the project lifecycle to ensure that implementation of the Health Action Plan has been accomplished and is achieving the intended results.

Socio-economic	The aim of the socio-economic impact assessment (SIA) will be to determine the potential positive and negative impacts of the proposed Vygenhoek Project and the potential alternatives, including no-go alternative, on the local and regional socio-economic landscape. The study will consider the direct, indirect, and cumulative impacts of the proposed project in relation to current and proposed activities within the local area, and the people and activities on and around the proposed projects property. The objectives of the SIA will be to: • Develop a social profile for the proposed project area through the description of the social receiving environment that may be affected by the proposed activity; • Undertake the field work to determine the current settlement patterns and activities on and adjacent to the proposed project site; • Identify, describe, and assess the potential positive and negative socio-economic impacts associated with the proposed project; and • Provide mitigation measures and recommendations to enhance the socio-economic sustainability of the proposed project. *Proposed scope of work* *Desktop review* The socio-economic impact assessment (SIA) will build on the scoping assessment to further develop a baseline of the socio-economic receiving environment associated with the project. This will include a review of existing data and information including geographical, demographic, socio-economic, institutional, and sociocultural. Other key sources of information may include project documentation, studies for similar projects, and relevant policy and planning information. The desktop review will aim to contextualise the proposed development and provide insight into potential impacts. *Field work* It is anticipated that field work will be required to establish the current settlement patterns and number and type houses, families, and communities on and adjacent to the proposed project site. It is anticipated that the fieldwork will take place over at least five days. During this time, observational data will be obtained, as well as interviews with key stakeholders and community representatives. At this time, it is not anticipated that detailed investigations, such as household surveys will be required, as relocation may not be required, or will be done as part of the resettlement planning process. *Review of other specialists* The SIA process will include a review of the other specialist studies, including ecological, air quality, ground and surface water, blast and vibration, visual, and noise impact assessments. The specialist will engage with each report and specialist to determining the extent and significance to which the biophysical impacts may affect the local social and socio-economic environment.

	Reporting A SIA report will be compiled in line with the requirements Appendix 6 to the 2014 EIA Regulations (GN R 982). The report will contain a description of the socio-economic receiving environment, potential positive and negative socio-economic impacts, qualitative impact assessment, and recommended management and mitigation measures to be included in the Environmental Management Programme and/or the Environmental Authorisation.
Heritage & Palaeontology	With cognisance of the recorded archaeological sites in the area and in order to comply with the National Heritage Resources Act (Act 25 of 1999) it is recommended that a field-based impact assessment should be conducted of the mine layout. During this study known sites of archaeological, historical or places of cultural interest must be verified, recorded, photographed and described. The extent of the sites determined and mitigation proposed should any significant sites be impacted upon, ensuring that all the requirements of the SAHRA are met. If the recommendations in the detailed scoping report are adhered to, HCAC is of the opinion that the impact of the development on heritage resources can be mitigated. This will be confirmed through the Heritage Impact Assessment to be undertaken. If during the pre-construction phase or during construction, any archaeological finds are made (e.g. graves, stone tools, and skeletal material), the operations must be stopped, and the archaeologist must be contacted for an assessment of the finds. Due to the subsurface nature of archaeological material and graves the possibility of the occurrence of unmarked or informal graves and subsurface finds cannot be excluded.
Traffic	The following recommendations are made from a traffic engineering point of view: • Alternative road access to the proposed mining development should be investigated since the existing Local Road that provides access from Road D874 is deemed to not be suitable for mine related vehicle traffic with specific reference to heavy vehicles. • Geometric improvements in terms of road safety at the intersection of Roads D212 and D874 (Point A) would be required as part of the proposed mining development by means of Construct a dedicated right-turn lane on the northern approach of Road D212. • Reflective road studs should be installed at Point A in order to ensure visibility of the intersection geometry to road users at night time. • Rehabilitation of some sections of Road D874 would be required to ensure that workers, consumable deliveries and mine product could be transported at all times to and from the proposed mining development. • Further investigation with regards to a single lane stream crossing on Road D874 near Point A should be conducted in order to determine whether this crossing would be suitable for an increase in heavy vehicle traffic in the long-term.
Visual assessment	It is recommended that additional spatial analyses be undertaken in order to create a visual impact index that will further aid in determining potential areas of visual impact. This exercise should be undertaken for the open cast pit as well as for the ancillary infrastructure, as these structures (e.g. the stockpile and mine structures) are envisaged to have varying levels of visual impact at a more localised scale. The site-specific

	issues (as mentioned earlier in the report) and potential sensitive visual receptors should be measured against this visual impact index and be addressed individually in terms of nature, extent, duration, probability, severity and significance of visual impact. This recommended work must be undertaken during the Environmental Impact Assessment (EIA) Phase of reporting for this proposed project. In this respect, the Plan of Study for the EIA is as follows: • Determine potential visual exposure • Determine visual distance/observer proximity to the facility • Determine viewer incidence/viewer perception (sensitive visual receptors) • Determine the visual absorption capacity of the landscape • Calculate the visual impact index • Determine impact significance • Propose mitigation measures • Reporting and map display • Site visit

Proposed method of assessing the environmental aspects including the proposed method of assessing alternativesEnvironmental Management Assistance (Pty) Ltd as the appointed EAP took an [4]Integrated Environmental Management (IEM) approach. However, the adoption of an IEM approach should not be interpreted as an Environmental Impact Assessment (EIA) in its self. It should rather be seen as an underlying philosophy and set of principles, supported by an EIA and management tools that are aimed at promoting sustainability (DEAT, 2004).

Together with the requirements stipulated in GN R. 982 (2014 EIA regulations) the principles set out in the IEM Guideline series published by the Department of Environmental Affairs (DEA, 1992) were considered throughout the assessment process.

The impact assessment will provide a full description of all environmental issues and risks identified during the EIA process. Secondly it will provide the assessment of the significance (as summarised in section **v)** of this report) of each issue and risk according to the methodology discussed in section **vi)** of this report. Lastly, it will provide with an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures.

[4] Definition of IEM according to DEAT (2004): *IEM provides a holistic framework that can be embraced by all sectors of society for the assessment and management of environmental impacts and aspects associated with an activity for each stage of the activity life cycle, taking into consideration a broad definition of environment and with the overall aim of promoting sustainable development.*

iv) The proposed method of assessing duration significance

The same approach as described in section **vi)** will be used to assess the duration significance.

v) The stages at which the competent authority will be consulted

The competent authority will be consulted throughout the EIR and EMPr process. All correspondence from and to the registered I&AP will be forwarded to the authority.

vi) Particulars of the public participation process with regard to the impact Assessment process that will be conducted

The process as outlined in section (**h) and (ii)** will be conducted during the Impact Assessment process.

1. Steps to be taken to notify interested and affected parties

(These steps must include the steps that will be taken to ensure consultation with the affected parties identified in (h) (ii) herein).

As discussed in section (**h) and (ii)**.

2. Details of the engagement process to be followed

(Describe the process to be undertaken to consult interested and affected parties including public meetings and one on one consultation. NB the affected parties must be specifically consulted regardless of whether or not they attended public meetings and records of such consultation will be required in the EIA at a later stage)

As discussed in section **h)ii)**.

3. Description of the information to be provided to Interested and Affected Parties

(Information to be provided must include the initial site plan and sufficient detail of the intended operation and the typical impacts of each activity, to enable them to assess what impact the activities will have on them or on the use of their land)

As discussed in section **h)ii)**.

vii) Description of the tasks that will be undertaken during the environmental impact assessment process

As discussed in the previous sections in this report, all possible impacts and aspects will be assessed associated to the waste management activities.

Mitigation and management measures will be developed to reduce, avoid, and remedy all potential environmental impacts.

These findings will be discussed in the final EIR and EMPr that will be exposed to the required 30 days public comment period. Any comments received from the registered I&AP will be included in the final EIR and EMPr and be submitted to the competent authority for a decision to be made.

viii) Measures to avoid, reverse, mitigate, or manage identified impacts and to determine the extent of the residual risks that need to be managed and monitored

The following table summarises the cumulative residual risks for the identified impacts:

ACTIVITY	POTENTIAL IMPACT	MITIGATION TYPE (modify, remedy, control, or stop)	POTENTIAL FOR RESIDUAL RISK
Construction			
Air Quality Management			
Access and hauling along roads i.e. during the construction of roads Site clearing and topsoil stripping for lay down area of approximately 47ha and all related mining infrastructure Construction of training centres, offices, ablution facilities and kitchen facilities Construction of Pollution Control Dams (PCD's) Transport of construction material, mobile plant, and equipment to the site	Fugitive and ambient dust generation	Control	Low
Access and hauling along roads i.e. during the construction of roads Site clearing and topsoil stripping for lay down area of approximately 47 ha and all related mining infrastructure Stores, workshops &wash bays Fuel operating power generators Transport of construction material, mobile plant, and equipment to the site	GHG emissions (direct and indirect)	Control	Low
Onsite Clinic Construction of training centres, offices, ablution facilities and kitchen facilities	Electricity usage	Control	Low
Fauna and Flora			
Access and hauling along roads i.e. during the construction of roads Site clearing and topsoil stripping for lay down area of approximately 47 ha and all related mining infrastructure Storm water runoff management features	Vegetation and habitat loss	Remedy	Medium
Access and hauling along roads i.e. during the construction of roads Site clearing and topsoil stripping for lay down area of approximately 47 ha and all related mining infrastructure Construction of training centres, offices, ablution facilities and kitchen facilities	Influx of alien invasive vegetation	Control	Medium
Stores, workshops &wash bays Fuel operating power generators Fuel storage	Spread of chemical fires	Avoid	Low
Aquatic ecology			
Access and hauling along roads i.e. during the construction of roads Site clearing and topsoil stripping for lay down area of approximately 47 ha and all related mining infrastructure Transport of construction material, mobile plant, and equipment to the site Storm water runoff management features	Sedimentation and siltation of watercourses	Avoid	Medium
Access and hauling along roads i.e. during the construction of roads Site clearing and topsoil stripping for lay down area of approximately 47 ha and all related mining infrastructure Storm water runoff management features	Alteration of drainage patterns	Remedy	Medium

Site clearing and topsoil stripping for lay down area of approximately 47 ha and all related mining infrastructure	Destruction of wetlands	Remedy	Medium
Pollution Control Dams (PCD's) i.e. Construction and operation Stores, workshops &wash bays Ablutions & change house with sewage treatment plant Fuel operating power generators Fuel storage	Contamination of water resources	Control	Medium
Site clearing and topsoil stripping for lay down area of approximately 47 ha and all related mining infrastructure Storm water runoff management features	Hydrocarbon contamination	Control	Low
Access and hauling along roads i.e. during the construction of roads	Destruction of upstream tributaries and reduction in water in the catchment	Avoid	Medium
Soil			
Access and hauling along roads i.e. during the construction of roads Site clearing and topsoil stripping for lay down area of approximately 47 ha and all related mining infrastructure Stores, workshops &wash bays Ablutions & change house with sewage treatment plant Fuel operating power generators Fuel storage	Degradation of soil resources	Remedy	Low
Access and hauling along roads i.e. during the construction of roads Transport of construction material, mobile plant, and equipment to the site Stores, workshops &wash bays Fuel operating power generators Fuel storage	Hydrocarbon Contamination	Control	Low
Access and hauling along roads i.e. during the construction of roads Site clearing and topsoil stripping for lay down area of approximately 47 ha and all related mining infrastructure Storm water runoff management features Transport of construction material, mobile plant, and equipment to the site	Erosion	Avoid	Low
Mining offices i.e. operation of training centres, offices, and kitchen facilities	General waste generation & Littering	Control	Low
Water resources			
Access and hauling along roads i.e. during the construction of roads Site clearing and topsoil stripping for lay down area of approximately 47 ha and all related mining infrastructure Weigh bridge Stores, workshops &wash bays Fuel operating power generators Fuel storage Transport of construction material, mobile plant, and equipment to the site Storm water runoff management features Pollution Control Dams (PCD's) i.e. Construction and operation	Hydrocarbon Contamination	Control	Low
Access and hauling along roads i.e. during the construction of roads Site clearing and topsoil stripping for lay down area of approximately 47 ha and all related mining infrastructure Transport of construction material, mobile plant, and equipment to the site Storm water runoff management features	Sedimentation and siltation of watercourses	Control	Medium
Access and hauling along roads i.e. during the construction of roads	Alteration of drainage patterns	Remedy	Medium

Site clearing and topsoil stripping for lay down area of approximately 47 ha and all related mining infrastructure Storm water runoff management features			
Access and hauling along roads i.e. during the construction of roads	Destruction of upstream tributaries and reduction in water in the catchment	Control	Medium
Access and hauling along roads i.e. during the construction of roads	Water usage for dust suppression	Control	Low
Site clearing and topsoil stripping for lay down area of approximately 47 ha and all related mining infrastructure Use of existing drilled / new boreholes	Water level reduction and contamination	Control	Medium
Onsite Clinic Mining offices i.e. operation of training centres, offices, and kitchen facilities	Domestic water usage	Control	Low
Mining offices i.e. operation of training centres, offices, and kitchen facilities	General waste generation & Littering	Contr ol	Low
Water storage facilities	Improper water storage management	Control	Low
Pollution Control Dams (PCD's) i.e. Construction and operation Stores, workshops &wash bays Ablutions & change house with sewage treatment plant Fuel operating power generators Fuel storage	Contamination of water resources	Control	Low
Topography and Visual			
Access and hauling along roads i.e. during the construction of roads Site clearing and topsoil stripping for lay down area of approximately 47 ha and all related mining infrastructure Transport of construction material, mobile plant, and equipment to the site	Dust generation	Control	Low
Site clearing and topsoil stripping for lay down area of approximately 47 ha and all related mining infrastructure Mining offices i.e. operation of training centres, offices and kitchen facilities Pollution Control Dams (PCD's) i.e. Construction and operation	Topography and visual alteration	Remedy	Medium
Mining offices i.e. operation of training centres, offices and kitchen facilities	General waste generation & Littering	Control	Low
Noise			
Access and hauling along roads i.e. during the construction of roads Site clearing and topsoil stripping for lay down area of approximately 47 ha and all related mining infrastructure Mining offices i.e. operation of training centres, offices, and kitchen facilities	Noise generation	Control	Low
Heritage and Palaeontology			
Site clearing and topsoil stripping for lay down area of approximately 47 ha and all related mining infrastructure	Destruction of graves Degradation of cultural significance heritage sites	Avoid	Medium
Health and Safety			
Employment of workers and procurement of construction materials.	Health and Safety of employees	Control	Low
Socio-economic			
Employment of workers and procurement of construction materials.	Loss of farm labour	Control	Low
	Population Influx – Pressure on Resources	Control	Low
	Population Influx – Social Pathologies	Control	Low
	Population Influx – Community Conflict	Control	Low

	Job Creation and Skills Training	Control	Medium
	Job Creation (Multiplier Effect) and Population Influx	Control	Medium
	Increased local economic development opportunities	Control	Medium
	Reduced access to livelihood resources	Control	Medium
	Change in sense of place	Control	Medium
Operational			
Air Quality Management			
Topsoil and subsoil stripping & stockpiling for mining operation area Opencast mining excavations Drilling & Blasting RoM & product stockpiling Residue stockpiles Screening Operations Discard disposal (backfilling of mining area) Vehicular activity on haul roads; and operation of mining equipment Bulk transporting of Ore to market on Public roads	Fugitive and ambient dust generation	Control	Low
Topsoil and subsoil stripping & stockpiling for mining operation area Drilling & Blasting Opencast mining excavations Waste generation, storage, and disposal RoM & product stockpiling Screening Operations Vehicular activity on haul roads; and operation of mining equipment Bulk transporting of Ore to market on Public roads	CO_2 emissions (direct and indirect)	Control	Low
Fauna and Flora			
Topsoil and subsoil stripping & stockpiling for mining operation area Opencast mining excavations RoM & product stockpiling Residue stockpiles	Vegetation and habitat loss	Remedy	Medium
Topsoil and subsoil stripping & stockpiling for mining operation area Opencast mining excavations RoM & product stockpiling Residue stockpiles	Influx of alien invasive vegetation	Control	Medium
Topsoil and subsoil stripping & stockpiling for mining operation area Opencast mining excavations RoM & product stockpiling Residue stockpiles	Impacts on species of conservation consideration, local diversity patterns and ecological patterns	Control	High
Residual stockpiles Increase in human persistence and associated activities Exacerbated habitat fragmentation and isolation Continued increase in mining activities in the region	Impacts on habitat types that exhibit unperturbed status, local and regional conservation efforts, anthropogenic encroachment, and human-nature conflict	Control	High
Aquatic ecology			
Topsoil and subsoil stripping & stockpiling for mining operation area Opencast mining excavations RoM & product stockpiling Residue stockpiles Screening Operations Discard disposal (backfilling of mining area) River crossings Vehicular activity on haul roads; and operation of mining equipment Water Management	Sedimentation and siltation of watercourses	Avoid	Medium
Topsoil and subsoil stripping & stockpiling for mining operation area Opencast mining excavations Residue stockpiles	Alteration of drainage patterns	Remedy	High

River crossings Water Management			
Topsoil and subsoil stripping & stockpiling for mining operation area	Destruction of wetlands	Remedy	Medium
Opencast mining excavations RoM & product stockpiling Residue stockpiles Discard disposal (backfilling of mining area) Screening Operations Drilling & Blasting Waste generation, storage and disposal Chemical Toilets River crossings Water supply (potable & process) Storage of fuel and lubricants in temporary facilities Water Management	Contamination of water resources	Avoid	Medium
Topsoil and subsoil stripping & stockpiling for mining operation area Vehicular activity on haul roads; and operation of mining equipment Storage of fuel and lubricants in temporary facilities	Hydrocarbon contamination	Control	Low
Topsoil and subsoil stripping & stockpiling for mining operation area Opencast mining excavations Water Management	Destruction of upstream tributaries and reduction in water in the catchment	Remedy	Medium
Residue stockpiles Waste generation, storage and disposal	Hazardous Leachate	Avoid	Medium
Drilling & Blasting	Noise generation	Control	Medium
Soil			
Topsoil and subsoil stripping & stockpiling for mining operation area RoM & product stockpiling Residue stockpiles Opencast mining excavations Drilling & Blasting Screening Operations Discard disposal (backfilling of mining area) Waste generation, storage and disposal Chemical Toilets Storage of fuel and lubricants in temporary facilities Vehicular activity on haul roads; and operation of mining equipment	Degradation of soil resources	Remedy	Medium
Opencast mining excavations RoM & product stockpiling Drilling & Blasting Screening Operations Discard disposal (backfilling of mining area) River crossings Storage of fuel and lubricants in temporary facilities Vehicular activity on haul roads; and operation of mining equipment	Hydrocarbon Contamination	Control	Low
Topsoil and subsoil stripping & stockpiling for mining operation area Opencast mining excavations RoM & product stockpiling Discard disposal (backfilling of mining area) River crossings Vehicular activity on haul roads; and operation of mining equipment Water Management	Erosion	Avoid	Medium
Waste generation, storage and disposal	Illegal dumping	Control	Low
Water resources			
Topsoil and subsoil stripping & stockpiling for mining operation area	Hydrocarbon Contamination	Avoid	Low

Opencast mining excavations RoM & product stockpiling Drilling & Blasting Screening Operations Discard disposal (backfilling of mining area) River crossings Storage of fuel and lubricants in temporary facilities Vehicular activity on haul roads; and operation of mining equipment			
Topsoil and subsoil stripping & stockpiling for mining operation area Opencast mining excavations RoM & product stockpiling Residue stockpiles Screening Operations Discard disposal (backfilling of mining area) River crossings Vehicular activity on haul roads; and operation of mining equipment Water Management	Sedimentation and siltation of watercourses	Control	Medium
Topsoil and subsoil stripping & stockpiling for mining operation area Opencast mining excavations Residue stockpiles River crossings Water Management	Alteration of drainage patterns	Remedy	High
Topsoil and subsoil stripping & stockpiling for mining operation area Opencast mining excavations Water Management	Destruction of upstream tributaries and reduction in water in the catchment	Remedy	High
Topsoil and subsoil stripping & stockpiling for mining operation area River crossings Water supply (potable & process) Water Management	Water level reduction and contamination	Control	Medium
Opencast mining excavations Drilling & Blasting RoM & product stockpiling Residue stockpiles Screening Operations Discard disposal (backfilling of mining area) Waste generation, storage and disposal Chemical Toilets River crossings Water supply (potable & process) Storage of fuel and lubricants in temporary facilities Water Management	Contamination of water resources	Avoid	Low
Residue stockpiles Waste generation, storage and disposal	Hazardous Leachate	Remedy	Medium
Waste generation, storage and disposal	Illegal dumping	Contr ol	Low
Water Management	Improper water storage management	Control	Low
Topography and Visual			
Topsoil and subsoil stripping & stockpiling for mining operation area Opencast mining excavations Drilling & Blasting RoM & product stockpiling Residue stockpiles Discard disposal (backfilling of mining area) Vehicular activity on haul roads; and operation of mining equipment Bulk transporting of Ore to market on Public roads Screening Operations	Dust generation	Remedy	Low
Topsoil and subsoil stripping & stockpiling for mining operation area Opencast mining excavations	Topography and visual alteration		Medium

Residue stockpiles			
Noise			
Topsoil and subsoil stripping & stockpiling for mining operation area Opencast mining excavations Drilling & Blasting RoM & product stockpiling Screening Operations Discard disposal (backfilling of mining area) Vehicular activity on haul roads; and operation of mining equipment	Noise generation	Control	Low
Heritage and Palaeontology			
Topsoil and subsoil stripping & stockpiling for mining operation area	Destruction of graves Degradation of cultural significance heritage sites	Avoid	Medium
Health and Safety			
Employment of workers	Health and Safety of employees	Control	Low
Socio-economic			
Employment of workers	Loss of farm labour	Control	Low
	Population Influx – Pressure on Resources	Control	Medium
	Population Influx – Social Pathologies	Control	Medium
	Population Influx – Community Conflict	Control	Medium
	Reduced access to livelihood resources	Control	Medium
	Direct and indirect employment opportunities	Control	Medium
	Growth and diversification of local economy	Control	Medium
	Increase in social ills	Control	Medium
	Increased nuisance and changed sense of place	Control	Medium
	Indirect damage to/loss of assets	Control	Medium
	Reduced public health and safety	Control	Medium
	Increased local economic development opportunities	Control	Medium
	Job Creation and Skills Training	Control	Medium
Bulk transporting of Ore to market on Public roads	Pressure on public transport infrastructure	Control	High
Decommissioning			
Air Quality Management			
Demolition / removal of portable and related infrastructure Vehicular activity: removal of mobile plant / equipment and vehicles Rehabilitation of the lay down areas Demolition of PCD's Demolition of workshops, waste storage facilities, fuel storage facilities etc.	Fugitive and ambient dust generation	Control	Low
Fauna and Flora			
Rehabilitation of mining areas Rehabilitation of the lay down areas	Vegetation and habitat loss	Remedy	Low
Rehabilitation of mining areas Rehabilitation of the lay down areas	Influx of alien invasive vegetation	Control	Medium
Aquatic ecology			
Rehabilitation of mining areas Vehicular activity: removal of mobile plant / equipment and vehicles Rehabilitation of the lay down areas	Sedimentation and siltation of watercourses	Control	Medium
Demolition of PCD's Demolition of workshops, waste storage facilities, fuel storage facilities etc.	Contamination of water resources	Control	Low
Soil			

Rehabilitation of mining areas Demolition / removal of portable and related infrastructure Rehabilitation of the lay down areas Demolition of PCD's Demolition of workshops, waste storage facilities, fuel storage facilities etc.	Degradation of soil resources	Remedy	Low
Rehabilitation of mining areas Vehicular activity: removal of mobile plant / equipment and vehicles Demolition of PCD's Demolition of workshops, waste storage facilities, fuel storage facilities etc.	Hydrocarbon Contamination	Control	Low
Rehabilitation of mining areas Demolition / removal of portable and related infrastructure Vehicular activity: removal of mobile plant / equipment and vehicles Rehabilitation of the lay down areas Demolition of PCD's Demolition of workshops, waste storage facilities, fuel storage facilities etc.	Erosion	Avoid	Medium
Demolition / removal of portable and related infrastructure Demolition of PCD's Demolition of workshops, waste storage facilities, fuel storage facilities etc.	General waste generation & Littering	Control	Low
Water resources			
Demolition / removal of portable and related infrastructure Vehicular activity: removal of mobile plant / equipment and vehicles Demolition of PCD's Demolition of workshops, waste storage facilities, fuel storage facilities etc.	Hydrocarbon Contamination	Control	Low
Rehabilitation of mining areas Vehicular activity: removal of mobile plant / equipment and vehicles Rehabilitation of the lay down areas	Sedimentation and siltation of watercourses	Control	Low
Demolition / removal of portable and related infrastructure Demolition of PCD's Demolition of workshops, waste storage facilities, fuel storage facilities etc.	General waste generation & Littering	Control	Low
Demolition of PCD's Demolition of workshops, waste storage facilities, fuel storage facilities etc.	Contamination of water resources	Avoid	Low
Topography and Visual			
Demolition / removal of portable and related infrastructure Vehicular activity: removal of mobile plant / equipment and vehicles Rehabilitation of the lay down areas Demolition of PCD's Demolition of workshops, waste storage facilities, fuel storage facilities etc.	Dust generation	Control	Low
Demolition / removal of portable and related infrastructure Demolition of PCD's Demolition of workshops, waste storage facilities, fuel storage facilities etc.	General waste generation & Littering	Control	Low
Noise			
Rehabilitation of mining areas Demolition / removal of portable and related infrastructure Vehicular activity: removal of mobile plant / equipment and vehicles Demolition of PCD's Demolition of workshops, waste storage facilities, fuel storage facilities etc.	Noise generation	Control	Low

Socio-economic			
Employment of workers	Loss of permanent jobs	Control	High
	Increase temporary employment	Control	Low
	Increased local procurement	Control	Low

l) Other information required by the competent Authority

At the time of finalising this report for public comment, no specific information was requested by the competent authority.

i) Compliance with the provisions of sections 24 (4)(a) and (b) read with section 24 (3)(a) and (7) of NEMA

Section 24 (4)(a) and (b) of NEMA states the following:

"Procedures for the investigation, assessment and communication of the potential consequences or impacts of the activities on the environment – (a) must ensure, with respect to every application for an environmental authorisation –

- *(i) Coordination and cooperation between organs of state in the consideration of assessments where an activity falls under the jurisdiction of more than one organ of state;*
- *(ii) that the findings and recommendations flowing from an investigation, the general objectives of integrated environmental management laid down in this Act and the principles of environmental management set out in section 2 are taken into account in any decision made by an organ of state in relation to any proposed policy, programme, process, plan or project;*
- *(iii) that a description of the environment likely to be significantly affected by the proposed activity is contained in such application;*
- *(iv) investigation of the potential consequences for or impacts on the environment of the activity and assessment of the significance of those potential consequences or impacts; and*
- *(v) public information and participation procedures which provide all interested and affected parties, including all organs of state in all spheres of government that may have jurisdiction over any aspect of the activity, with a reasonable opportunity to participate in those information and participation procedures; and*

(b) must include, with respect to every application for an environmental authorisation and where applicable –

- *(i) investigation of the potential consequences or impacts of the alternatives to the activity on the environment and assessment of the significance of those potential consequences or impacts, including the option of not implementing the activity;*
- *(ii) investigation of mitigation measures to keep adverse consequences or impacts to a minimum;*
- *(iii) investigation, assessment and evaluation of the impact of any proposed listed or specified activity on any national estate referred to in section 3(2) of the National Heritage Resources Act, 1999*

(Act No. 25 of 1999), excluding the national estate contemplated in section 3(2)(i)(vi) and (vii) of that Act;

(iv) reporting on gaps in knowledge, the adequacy of predictive methods and underlying assumptions, and uncertainties encountered in compiling the required information;

(v) investigation and formulation of arrangements for the monitoring and management of consequences for or impacts on the environment, and the assessment of the effectiveness of such arrangements after their implementation;

(vi) consideration of environmental attributes identified in the compilation of information and maps contemplated in subsection (3); and

(vii) provision for the adherence to requirements that are prescribed in a specific environmental management Act relevant to the listed or specified activity in question."

Section 24 (3)(a) and (7) of NEMA states the following:

"24 (3) The Minister, or an MEC with the concurrence of the Minister, may compile information and maps that specify the attributes of the environment in particular geographical areas, including the sensitivity, extent, interrelationship and significance of such attributes which must be taken into account by every competent authority."

"24 (7) Compliance with the procedures laid down by the Minister or an MEC in terms of subsection (4) does not absolve a person from complying with any other statutory requirement to obtain authorization from any organ of state charged by law with authorising, permitting or otherwise allowing the implementation of the activity in question."

The EIR and EMPr that will follow this report will fulfil the requirements stipulated in section 24 of NEMA. This report resulted with the outcomes of the detailed impact assessment carried out and provides recommendations from a broad spectrum of expertise.

(1) Impact on the socio-economic conditions of any affected persons

(Provide the results of Investigation, assessment, and evaluation of the impact of the mining, bulk sampling or alluvial diamond prospecting on any directly affected person including the landowner, lawful occupier, or, where applicable, potential beneficiaries of any land restitution claim, attach the investigation report as Appendix 2.19.1 and confirm that the applicable mitigation is reflected in 2.5.3; 2.11.6.and 2.12.herein)

As part of the scoping phase the following studies took place:

- Socio-economic assessment (**Appendix O**); and
- Health Impact assessment (**Appendix N**).

The applicant also compiled a Social and Labour plan (**Appendix D**) for the proposed mine.

The impacts of the said studies were described in section ***1) (a) XII*** and ***XIV*** of this report.

(2) Impact on any national estate referred to in section (3)2 of the National Heritage Resource act

(Provide the results of Investigation, assessment, and evaluation of the impact of the mining, bulk sampling or alluvial diamond prospecting on any national estate referred to in section 3(2) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) with the exception of the national estate contemplated in section 3(2)(i)(vi) and (vii) of that Act, attach the investigation report as Appendix 2.19.2 and confirm that the applicable mitigation is reflected in 2.5.3; 2.11.6.and 2.12.herein)

A detailed Heritage Impact Assessment is attached as **Appendix P** Section ***1)(a)XV*** summarises the findings and recommendations made by the specialist investigation.

m) Other matters required in terms of sections 24(4)(a) and (b) of the Act

(the EAP managing the application must provide the competent authority with detailed, written proof of an investigation as required by section 24(4)(b)(i) of the Act and motivation if no reasonable or feasible alternatives, as contemplated in sub-regulation 22(2)(h), exist. The EAP must attach such motivation as Appendix 4).

As discussed in previous sections in this report, no alternatives in terms of property were considered. The proposed Vygenhoek Platinum Project is located within the Nomamix (Pty) Ltd applied mining right area and the surrounding area is currently used for mining related activities. The Mining Right area can only be located within areas where a Prospecting Right was issued previously.

j) UNDERTAKING REGARDING CORRECTNESS OF INFORMATION

I, **Anandi Alers**, herewith undertake that the information provided in the foregoing report is correct, and that the comments and inputs from stakeholders and Interested and Affected parties have been correctly recorded in the report.

Signature of the EAP
DATE:

k) UNDERTAKING REGARDING LEVEL OF AGREEMENT

I, **Anandi Alers**, herewith undertake that the information provided in the foregoing report is correct, and that the level of agreement with interested and Affected Parties and stakeholders has been correctly recorded and reported herein.

Signature of the EAP
DATE:

-END-