PROPOSED VYGENHOEK PLATINUM MINE, MPUMALANGA PROVINCE

VISUAL ASSESSMENT – INPUT FOR SCOPING REPORT

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Lourens du Plessis (t/a LOGIS) is a *Professional Geographical Information Sciences (GISc) Practitioner* registered with The South African Geomatics Council (SAGC), and specialises in Environmental GIS and Visual Impact Assessments (VIA).

Lourens has been involved in the application of Geographical Information Systems (GIS) in Environmental Planning and Management since 1990. He has extensive practical knowledge in spatial analysis, environmental modeling and digital mapping, and applies this knowledge in various scientific fields and disciplines. His GIS expertise are often utilised in Environmental Impact Assessments, Environmental Management Frameworks, State of the Environment Reports, Environmental Management Plans, tourism development and environmental awareness projects.

He holds a BA degree in Geography and Anthropology from the University of Pretoria and worked at the GisLAB (Department of Landscape Architecture) from 1990 to 1997. He later became a member of the GisLAB and in 1997, when Q-Data Consulting acquired the GisLAB, worked for GIS Business Solutions for two years as project manager and senior consultant. In 1999 he joined MetroGIS (Pty) Ltd as director and equal partner until December 2015. From January 2016 he worked for SMEC South Africa (Pty) Ltd as a technical specialist until he went independent and began trading as LOGIS in April 2017.

Lourens has received various awards for his work over the past two decades, including EPPIC Awards for ENPAT, a Q-Data Consulting Performance Award and two ESRI (Environmental Systems Research Institute) awards for *Most Analytical* and *Best Cartographic Maps*, at Annual International ESRI User Conferences. He is a co-author of the ENPAT book and has had several of his maps published in various tourism, educational and environmental publications.

He is familiar with the "Guidelines for Involving Visual and Aesthetic Specialists in EIA Processes" (Provincial Government of the Western Cape: Department of Environmental Affairs and Development Planning) and utilises the principles and recommendations stated therein to successfully undertake visual impact assessments. Although the guidelines have been developed with specific reference to the Western Cape province of South Africa, the core elements are more widely applicable (i.e. within the Mpumalanga Province).

1. INTRODUCTION

Nomamix (Pty) Ltd proposes the establishment of the Vygenhoek Platinum Mine on a site in the Mpumalanga Province bordering the Limpopo Province.

The project is proposed on portions 3 and 7 of the farm Vygenhoek 10 JT, located approximately 28km north-east of Roossenekal and 30km north-west of Lydenburg. The site under investigation has a surface area of approximately 724ha, but the extent of the mining operations is expected to be limited to a semi-circular area adjacent to the western farm boundary.

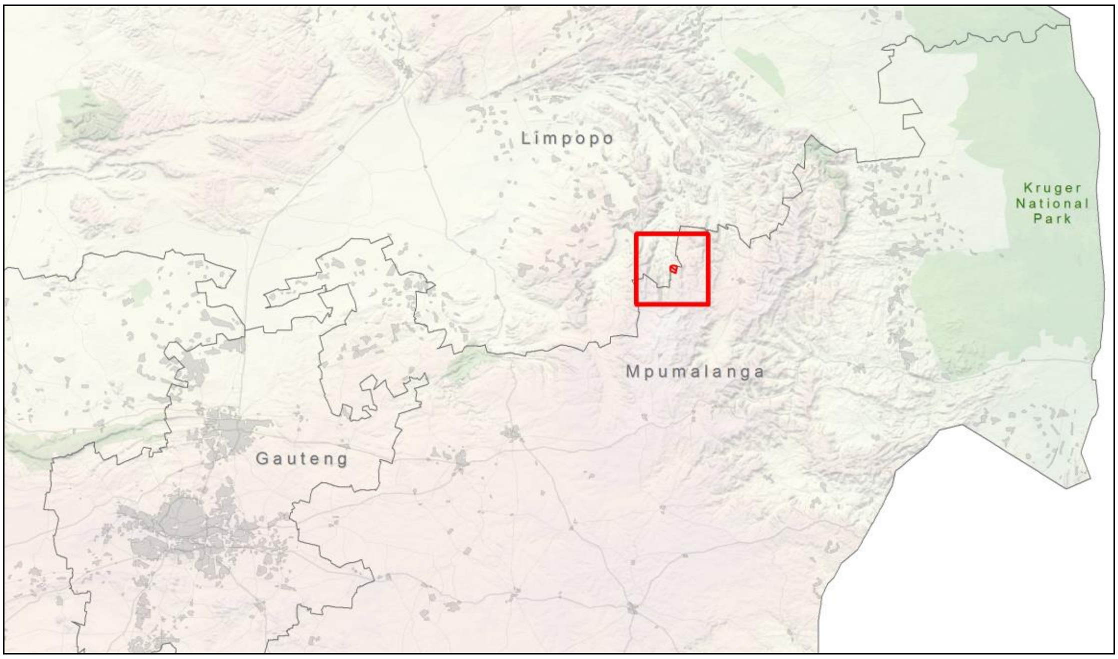


Figure 1: Regional locality of the Vygenhoek Platinum Mine.

The mining footprint is relatively small as it will not support the construction of a processing plant. The ore mined at the site will be stockpiled on a run-of-mine (ROM) pad and transported to an off-site concentrator plant. The mine will initially be an open cast mine supplying up to 15 000 tons of ore to the preferred concentrator, with the potential of substituting the open cast mining methodology with underground mining should it be feasible in the future.

The mine will comprise the following key infrastructure components:

- waste management: temporary handling and storage of general and hazardous waste, on-site change houses/ablution facilities with sewage treatment plant, possible incinerator for treating sewage screenings;

- 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;
- contractor camps;
- medical station; and
- diesel generator

The surface sub-outcrop of the Vygenhoek project 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.
- Drilling and blasting will be required to break the hard overburden.
- The waste will be dumped in the pit behind the advancing face where possible with the remainder placed at the waste dump, separate from the topsoil.
- Drilling and blasting of the ore.
- Loading and hauling of the ore for stockpiling at the ROM pad or for transport to the preferred concentrator.

A portion of the waste will be used in the construction of haul roads. Topsoil will be placed on top of backfill for the purpose of rehabilitation.

The proposed project requires Environmental Authorisation (EA) from the Department of Mineral Resources (DMR) subject to the completion of a full Scoping and Environmental Impact Assessment (EIA) process in terms of Regulation 49 of the Mineral and Petroleum Resources Development Act (Act 28 of 2002).

Figure 2: Aerial view of open cast mining operations.

Figure 3: Ore being loaded on a truck for transportation to the ROM pad.

2. SCOPE OF WORK

The scope of the work includes a scoping level visual assessment of the issues related to the visual impact.

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.

3. 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.

4. 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 4**), 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. Refer to **Map 1** to view the location of the project site and the topography of the study area.

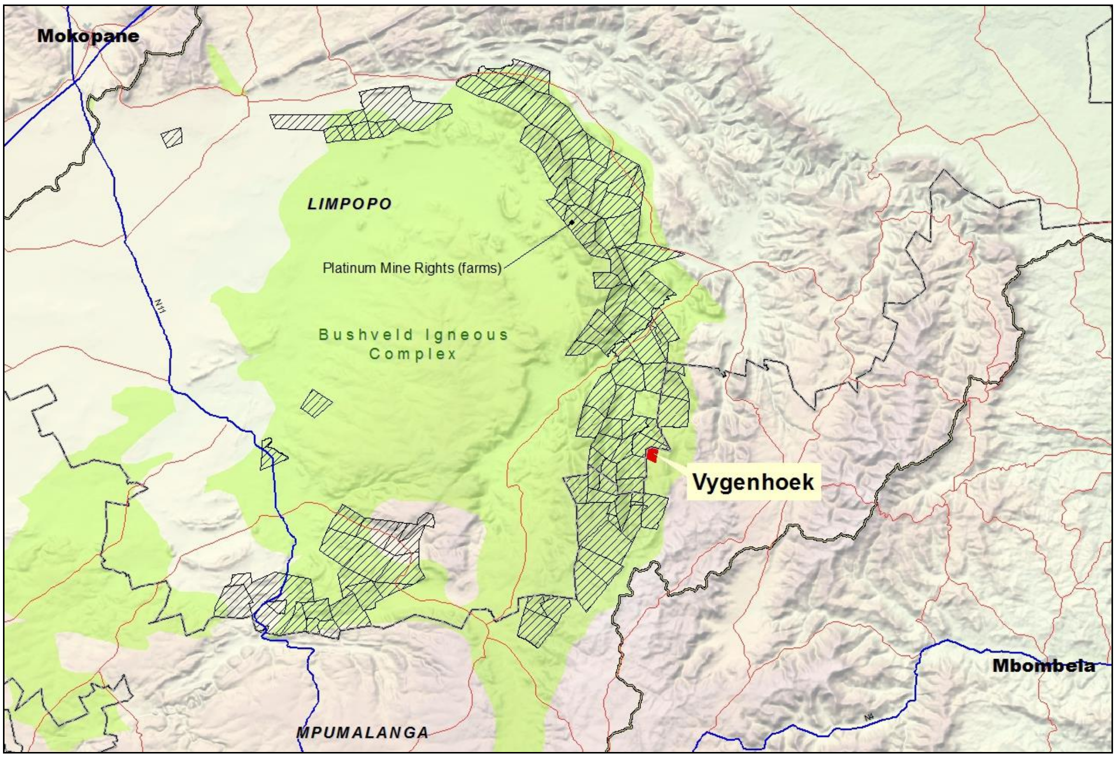


Figure 4: Platinum mining rights within the eastern limb of the Bushveld Igneous Complex.

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 **Map 2** 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

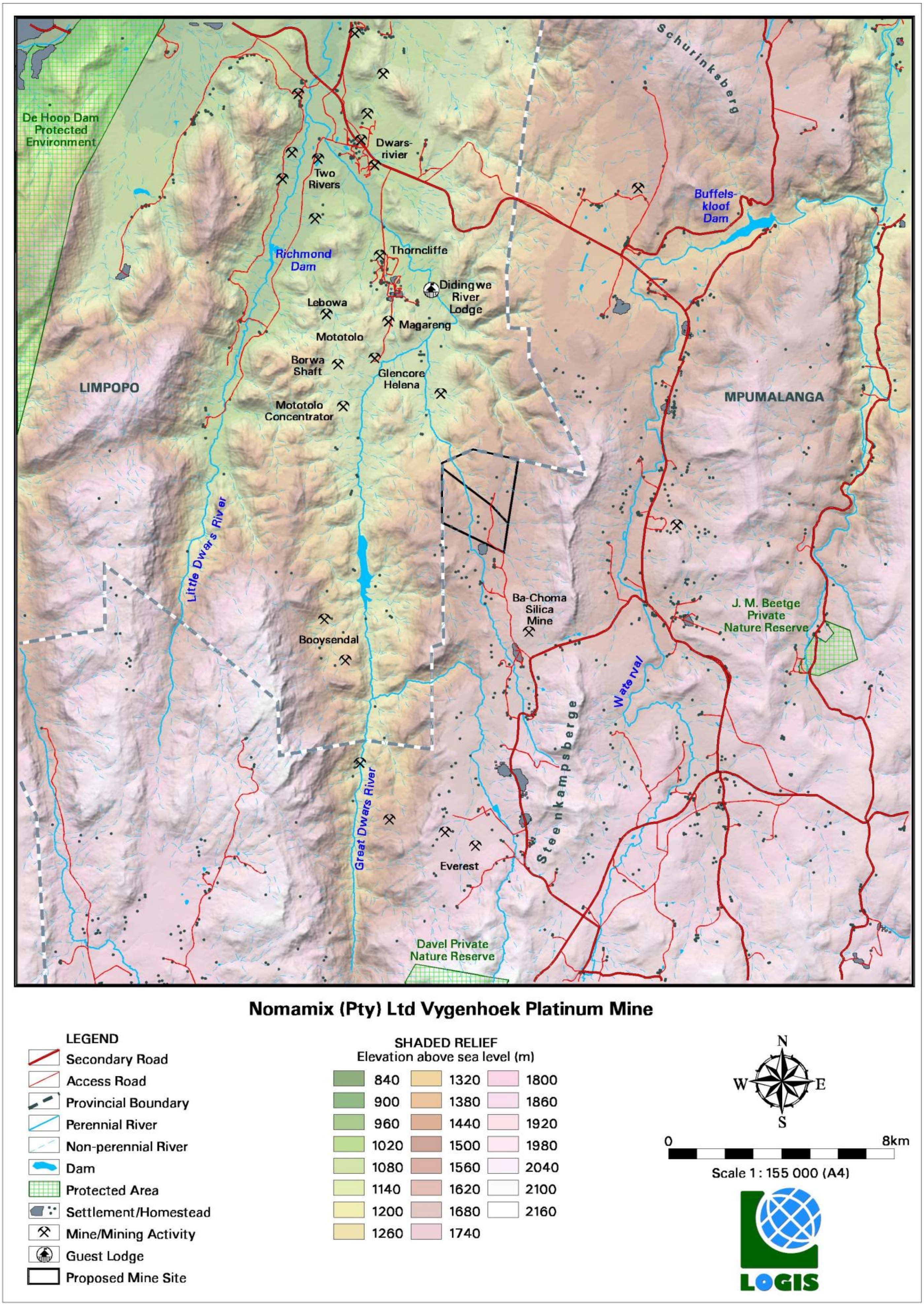
Thorncliffe Guest Farm are located further north along the Great Dwars River. The J.M. Beetge and Davel Private Nature Reserves are located (respectively) 11km and 15km from the Vygenhoek farm (at the closest).

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[1].

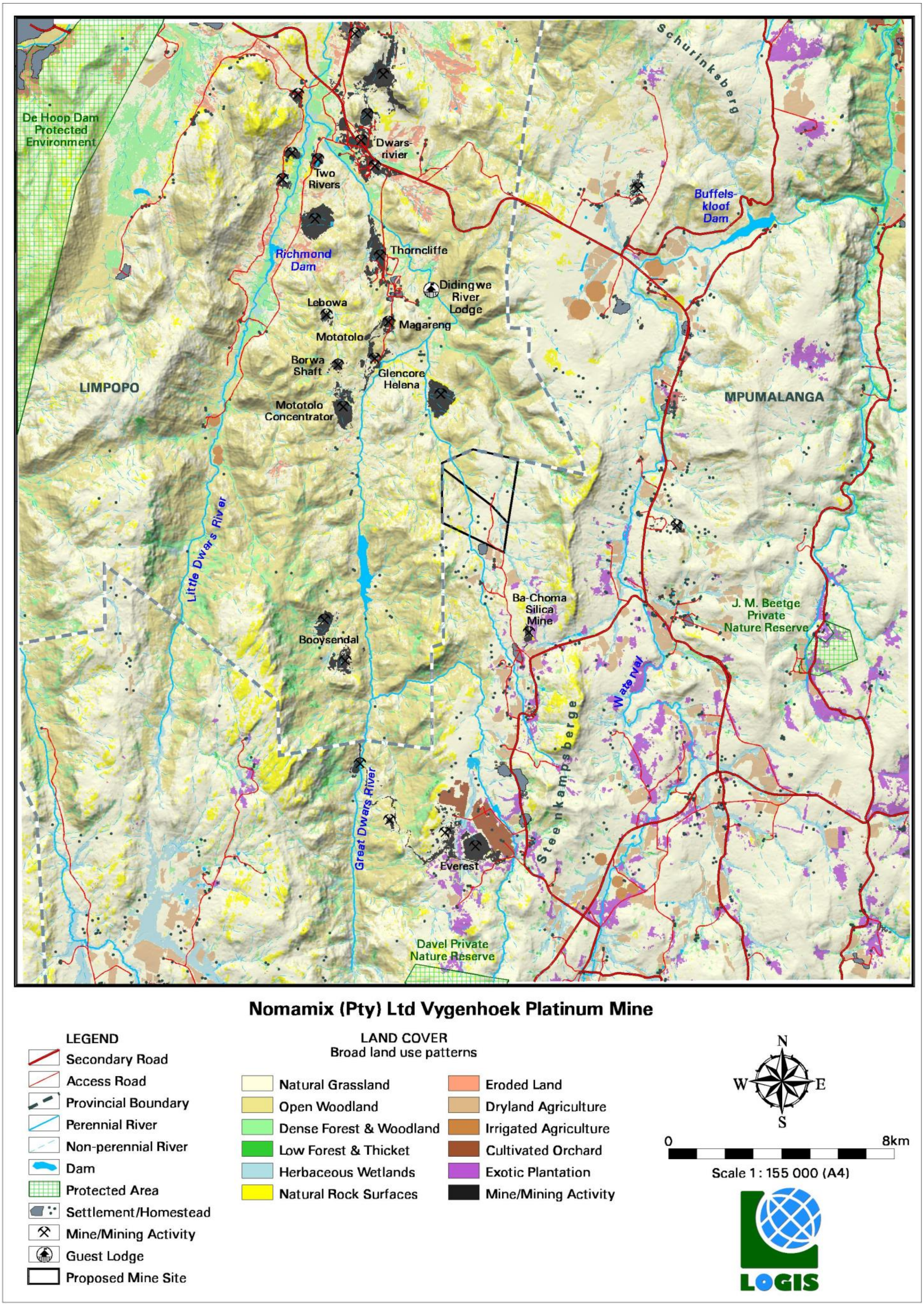
Figure 5: View of the Great Dwars River. (*Photo credit: Google Earth, Herman Freysen*).

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

Figure 6: Thorncliffe Guest Farm. (*Photo credit: Google Earth, Jiří Paclt*).



Map 1: Shaded relief map of the study area.



Map 2: Land cover and broad land use patterns.

5. VISUAL EXPOSURE/VISIBILITY

The result of the preliminary viewshed analysis for the proposed facility is shown on **Map 3**. 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. Refer to **Figure 7** below.

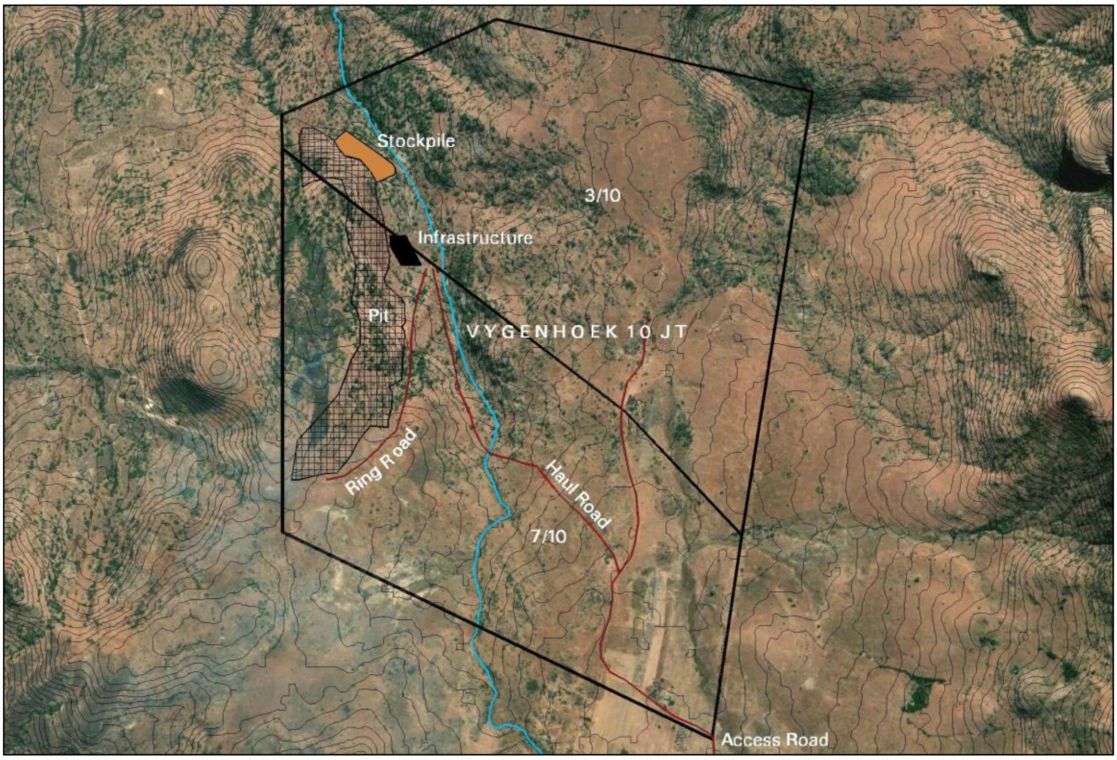


Figure 7: Preliminary mine layout.

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.

Map 3 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

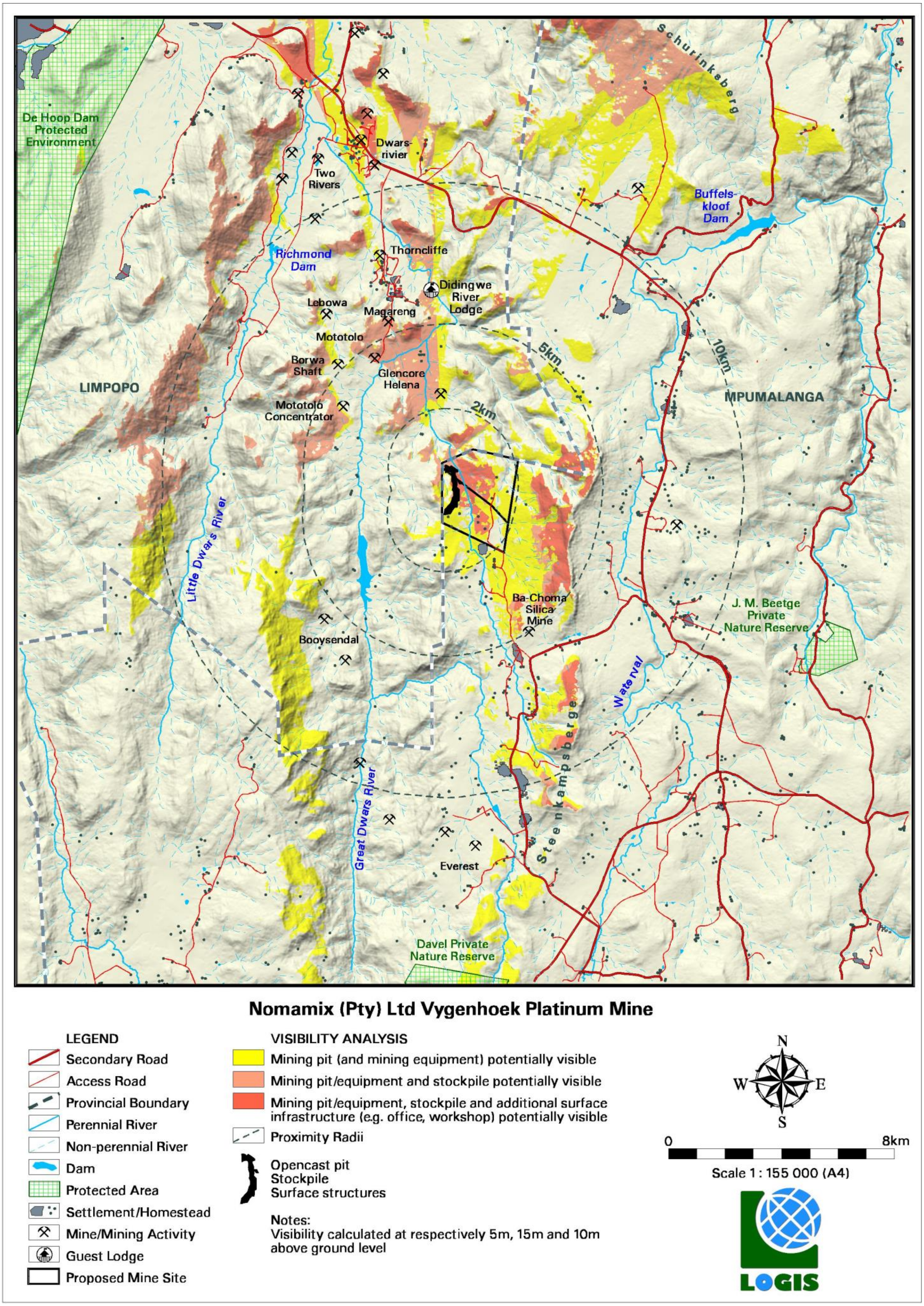
It is clear that the Vygenhoek mine may have a fairly contained area of potential visual exposure in spite of its relatively elevated position within the landscape. The rocky sub-outcrop is the most elevated part of the mining site and it stands to reason that mining activity (e.g. drilling and blasting 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.



Map 3: Map indicating the potential (preliminary) visual exposure of the proposed Vygenhoek Platinum Mine.

6. 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 1: Impact table summarising the potential primary visual impacts associated with the Vygenhoek Platinum Mine.

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)

Issue	Nature of Impact	Extent of Impact	No-Go Areas
The viewing of the mining infrastructure and activities	The potential negative experience of viewing the mining infra-structure and activities within a predominantly natural setting	Primarily observers situated within a 2-5km radius of the mine	N.A.

Description of expected significance of impact

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.

7. CONCLUSION AND RECOMMENDATIONS

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.

8. REFERENCES/DATA SOURCES

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