Report on the terrestrial ecological assessment for the proposed rock quarry on the farm Vingerfontein 162 situated near Victoria West, Northern Cape Province.

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DECLARATION OF INDEPENDENCE

DPR Ecologists and Environmental Services is an independent company and has no financial, personal or other interest in the proposed project, apart from fair remuneration for work performed in the delivery of ecological services. There are no circumstances that compromise the objectivity of the study.

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Title	**Report on the terrestrial ecological assessment for the proposed rock quarry on the farm Vingerfontein 162 situated near Victoria West, Northern Cape Province.**		
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Executive Summary

The proposed rock quarry, for which a mining permit will be obtained, is situated approximately 30 km west of the small town of Victoria West (Appendix A: Map 1). The site is situated adjacent to the R63 tarred road, while access to it will be obtained via a 1.5 km long new access road. The footprint of the mining area will be 5 hectares in total, consisting of a hard rock quarry (1.5 hectares) and a separate stockpiling/crushing area (2.1 hectares). The site and surroundings still consist of natural vegetation, without any prominent disturbances. The only localised disturbances noted were a small dirt track, artificial impoundment, livestock pens and watering point, though these result in very little disturbance. The site forms part of an arid region and consequently watercourses are limited to a few small, ephemeral drainage lines, which feed into the artificial impoundment in the area.

Tracks and signs of mammals are abundant on and around the site. As indicated (Section 4.1), the area is still largely natural and consequently the mammal population should also largely still be intact. However, the area is utilised for stock farming, which will undoubtedly have an impact on the mammal population in the area. This has, over centuries, resulted in the removal of large ungulates and most carnivores from the area, while the use of jackal-proof fencing and control of smaller carnivores have also modified the mammal population in the area. It may however still be possible for species of conservational importance to be present in the area. The mammal population is therefore anticipated to be modified, with some decrease in the capacity provided by the natural habitat likely, though species of conservation value may still be present. However, the footprint of the proposed mining operations (5 hectares) is not anticipated to have a large impact on the mammal population, when seen in context of the extensive natural areas which are present in the surroundings, providing adequate habitat for the local mammal population. The anticipated impact therefore remains moderate, which is however dependent on mitigation as listed being successfully implemented.

From the description of the vegetation on the site, including the rock quarry, stockpiling area and access road, it consists of natural vegetation which is still in a fairly good condition (Appendix A: Map 1). Areas of disturbance are present but are indicative of only low levels of disturbance. The species diversity is moderate, although the area does contain a significant number of protected plant species which will contribute towards its conservation value (Appendix B). The site therefore still contains elements of significant conservation value, which include protected plant species and drainage lines along the access road (Appendix A: Map 3). Significant mitigation will therefore have to be implemented to ensure the impact on these elements of significant conservation value is decreased. In addition, the vegetation type in this area, Eastern Upper Karoo, is still widespread and listed as being of Least Concern (LC), with a relatively low conservation value, confirmed by the Northern Cape Critical Biodiversity Areas Plan (2024), which regards the area as an Other Natural Area (ONA) (Appendix A: Map 2). The site does however form part of a National Protected Areas Expansion Strategy (NPAES): Focus Area, which due to the limited extent (5 hectares) of the development, is unlikely to be compromised. A moderate sensitivity for the site is therefore maintained and the impact of the loss of vegetation and species diversity is therefore considered to be moderate.

Mitigation as indicated in the previous paragraph should include the following (Appendix A: Map 1 - 3):

- As indicated, several of the succulent and geophytic species occurring on the site are regarded as protected within the Northern Cape Province (Appendix B). Where the

development will affect any of these, the necessary permits will have to be obtained. Many of these species are fairly common, widespread and abundant and, with the necessary permits, can simply be removed. However, several are uncommon, localised species and at least a fair portion of affected plants should be transplanted to adjacent areas where they will remain unaffected. These species include *Albuca crispa, Aloe broomii, Stomatium rouxii, Anacampseros filamentosa, Trichodiadema setulifolium, Crassula deltoidea, Euphorbia caterviflora, Haworthiopsis venosa* subsp. *tessellata, Pachypodium succulentum, Pelargonium obratanifolium, Duvalia corderoyi, Euphorbia arida, Adromischus trigynus* and *Ceropegia filiformis*. These geophytic and succulent species are easily transplanted with a high success rate.

- Several small drainage lines which are likely to be crossed by the proposed access road should be taken into account in order to ensure that the impact on them is kept to a minimum. Protection from erosion will also be particularly relevant at these crossings.

- In addition, the area contains no exotic weeds or invasive species. However, disturbance caused by mining is highly likely to leave disturbed areas vulnerable to infestation, with the invasive *Prosopis glandulosa* tree being of particular concern, as it is well known to be heavily invasive in this region. The proposed mining operations will therefore have to implement a comprehensive monitoring and eradication programme to ensure that invasive plant species (particularly *Prosopis glandulosa*) are removed from the area and prevented from re-establishing.

The impact significance has been determined and should mining take place without mitigation, some impacts may be high, such as the impact of the loss of protected species (Appendix A: Map 1 - 3). The majority of impacts will however be moderate. However, should adequate mitigation be implemented as described, these can all be reduced to moderate impacts. This is however subject to the mining area implementing mitigation to ensure that protected plant species are transplanted, limiting the impact on fauna by implementing suitable mitigation, implementing a comprehensive monitoring and eradication programme to address weeds and invasive species, and undertaking comprehensive rehabilitation.

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Terrestrial ecological and biodiversity assessment

1. INTRODUCTION

1.1 Background

Natural vegetation is an important component of ecosystems. Some of the vegetation units in a region can be more sensitive than others, usually as a result of a variety of environmental factors and species composition. These units are often associated with water bodies, water transferring bodies or moisture sinks. These systems are always connected to each other through a complex pattern. Degradation of a link in this larger system, e.g. tributary, pan or wetland, usually leads to the degradation of the larger system. Therefore, degradation of such a water related system should be prevented.

Though vegetation may seem to be uniform and low in diversity, it may still contain species that are rare and endangered. The occurrence of such a species may render the development unviable. Should such a species be encountered, the development should be moved to another location or cease altogether.

South Africa has a large number of endemic species and in terms of plant diversity ranks third in the world. This has the result that many of the species are rare, highly localised and consequently endangered. It is our duty to protect our diverse natural resources.

South Africa's water resources have become a major concern in recent times. As a water scarce country, we need to manage our water resources sustainably in order to maintain a viable resource for the community as well as to preserve the biodiversity of the system. Thus, it should be clear that we need to protect our water resources so that we may be able to utilise this renewable resource sustainably. Areas that are regarded as crucial to maintain healthy water resources include wetlands, streams, as well as the overall catchment of a river system.

It is well known that quarry mining operations have several detrimental impacts on the environment. These impacts are numerous, but the most pronounced impacts are associated with the clearing of vegetation, excavation of large amounts of earth materials, the storage and disposal thereof and the modification of the environment associated with it.

The proposed rock quarry, for which a mining permit will be obtained, is situated approximately 30 km west of the small town of Victoria West (Appendix A: Map 1). The site is situated adjacent to the R63 tarred road, while access to it will be obtained via a 1.5 km long new access road. The footprint of the mining area will be 5 hectares in total, consisting of a hard rock quarry (1.5 hectares) and a separate stockpiling/crushing area (2.1 hectares). The site and surroundings still consist of natural vegetation, without any prominent disturbances. The only localised disturbances noted were a small dirt track, artificial impoundment, livestock pens and watering point, though these result in very little disturbance. The site forms part of an arid region and consequently watercourses are limited to a few small, ephemeral drainage lines, which feed into the artificial impoundment in the area.

A site visit was conducted on 19 November 2025. The entire footprint of the Mining Permit (MP) and immediate surroundings were surveyed. A detailed survey of the terrestrial vegetation on and around the site which will be affected by the MP was undertaken. The survey was conducted during late spring after recent rainfall and the plant identification on the site was

considered sufficient, though given the arid climate of the region, it is likely that several plant species were overlooked.

For the above reasons it is necessary to conduct an ecological and wetland assessment of the area proposed for the MP.

The report together with its recommendations and mitigation measures should be used to minimise the impact of the proposed development.

1.2 The value of biodiversity

The diversity of life forms and their interaction with each other and the environment has made Earth a uniquely habitable place for humans. Biodiversity sustains human livelihoods and life itself. Although our dependence on biodiversity has become less tangible and apparent, it remains critically important.

The balancing of atmospheric gases through photosynthesis and carbon sequestration is reliant on biodiversity, while an estimated 40% of the global economy is based on biological products and processes.

Biodiversity is the basis of innumerable environmental services that keep us and the natural environment alive. These services range from the provision of clean water and watershed services to the recycling of nutrients and pollution. These ecosystem services include:

- Soil formation and maintenance of soil fertility.
- Primary production through photosynthesis as the supportive foundation for all life.
- Provision of food, fuel and fibre.
- Provision of shelter and building materials.
- Regulation of water flows and the maintenance of water quality.
- Regulation and purification of atmospheric gases.
- Moderation of climate and weather.
- Detoxification and decomposition of wastes.
- Pollination of plants, including many crops.
- Control of pests and diseases.
- Maintenance of genetic resources.

1.3 Details and expertise of specialist

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South African Council for Natural Scientific Professions No. (400284/13) (Ecological Science).

Membership with relevant societies and associations:

- South African Society of Aquatic Scientists (SASAQS0091)
- South African Association of Botanists
- South African Wetlands Society (3SLY4IG4)

Expertise:

- Qualifications: B.Sc. (Hons) Botany (2008), M.Sc. in Vegetation Ecology (2012) with focus on ephemeral watercourses.
- Vegetation ecologist with over 10 years of experience in conducting ecological assessments. Founded DPR Ecologists & Environmental Services (Pty.) Ltd. in 2016.
- Has conducted over 200 ecological and wetland assessments for various developments.
- Regularly attends conferences and courses in order to stay up to date with current methods and trends:

  2017: Kimberley Biodiversity Symposium.
  2018: South African Association of Botanists annual conference.
  2018: National Wetland Indaba Conference.
  2019: SASS5 Aquatic Biomonitoring Training.
  2019: Society for Ecological Restoration World Congress 2019.
  2019: Wetland rehabilitation: SER 2019 training course.
  2020: Tools For Wetlands (TFW) training course.
  2022: National Wetland Indaba Conference.
  2025: National Wetland Indaba Conference.

2. SCOPE AND LIMITATIONS

- To evaluate the present state of the vegetation and ecological functioning of the area proposed for the MP.
- To identify possible negative impacts that could be caused by the proposed clearing of vegetation and construction of the MP.
    - Severity relates to the nature of the event, aspect or impact to the environment and describes how severely the aspects may impact on the ecosystem.
    - Duration refers to the amount of time that the environment will be affected by the event, risk or impact, if no intervention e.g. remedial action takes place.
    - Extent refers to the spatial influence of an impact.
    - Frequency refers to how often the specific activity, related to the event, aspect or impact, is undertaken.
    - Probability refers to how often the activity/event or aspect may have an impact on the environment.

2.1 Vegetation

Aspects of the vegetation that will be assessed include:

- The vegetation types of the region with their relevance to the proposed site.
- The overall status of the vegetation on site.
- Species composition with the emphasis on dominant-, rare- and endangered species.

The amount of disturbance present on the site assessed according to:

- The number of grazing impacts.
- Disturbance caused by human impacts.
- Other disturbances.

2.2 Fauna

Aspects of the fauna that will be assessed include:

- A basic survey of the fauna occurring in the region using visual observations of species, as well as evidence of their occurrence in the region (burrows, excavations, animal tracks, etc.).
- The overall condition of the habitat.
- A list of species that may occur in the region (desktop study).

2.3 Limitations, assumptions, gaps and uncertainties

- Some geophytic or succulent species may have been overlooked due to a specific flowering time or cryptic nature.
- Given the aridity of the region, dormancy in many plant species limits identification and it is possible that species of conservation importance were overlooked or absent at the time of the survey.
- Although a comprehensive survey of the site was done, it is still likely that several species were overlooked.

- Some animal species may not have been observed as a result of their nocturnal and/or shy habits.

3. METHODOLOGY

3.1 Several literature works were used for additional information.

General ecology:

- Red Data List (Raymondo *et al.* 2009).
- Vegetation types (Mucina & Rutherford 2006).
- NBA 2018: South African Inventory of Inland Aquatic Ecosystems (SAIIAE).
- NBA 2018 Technical Report: Inland Aquatic (Freshwater) Realm.
- NBA 2018 Technical Report Volume 1: Terrestrial Realm.
- National Freshwater Ecosystem Priority Areas 2011 (NFEPA).
- Strategic Water Source Areas 2018 (SWSA).
- SANBI (2011): List of threatened ecosystems.
- NEM:BA: List of threatened ecosystems and Threatened Or Protected Species (TOPS).
- Northern Cape Nature Conservation Act No. 9 of 2009.
- Northern Cape Critical Biodiversity Areas Plan (2016).
- Northern Cape Biodiversity Spatial Plan (2024).

Vegetation:

- Red Data List (Raymondo *et al.* 2009).
- Vegetation types (Mucina & Rutherford 2006).
- Field guides used for species identification (Adams 1976, Bromilow 1995, 2010, Bruyns 2005, Court 2010, Coates-Palgrave 2002, Fish *et al.* 2015, Gerber *et al.* 2004, Gibbs-Russell *et al.* 1990, Griffiths & Picker 2015, Hartmann 2017, Manning 2009, Moller & Becker 2019, Roberts & Fourie 1975, Shearing & Van Heerden 2008, Smith *et al.* 1998, Smith & Crouch 2009, Smith & Van Wyk 2003, Van Ginkel & Cilliers 2020, Van Ginkel *et al.* 2011, Van Oudtshoorn 2004, Van Rooyen & Van Rooyen 2019).

Terrestrial fauna:

- Field guides for species identification (Smithers 1983, Child *et al.* 2016, Cillié 2018).

3.2 Site Sensitivity Verification

EIA Screening Tool: The EIA Screening Tool which provides a general indication of elements of sensitivity that may occur in a development area was utilised during the assessment for the following aspects:

- Animal species – A high sensitivity for Ludwig's Bustard (*Neotis ludwigii*) is indicated for the site, while a moderate sensitivity is indicated for Karoo Padloper (*Chersobius boulengeri*) and Riverine Rabbit (*Bunolagus monticularis*). Although the habitat is not ideal for Ludwig's Bustard, being higher lying rocky ridges, while the species prefers lower lying alluvial plains, it may still infrequently occur in these habitats and therefore a Moderate sensitivity is considered relevant. The Riverine Rabbit is a very rare species, with exceptionally high conservation value, which also requires highly specialised habitat, being dense riverine scrub, occurring along the floodplain of larger rivers, which is certainly completely absent from the site and immediate surroundings and therefore a Low sensitivity is considered applicable to this species. The Karoo Padloper is also a rare species, with high conservation value and although the habitat

also appears to be more suitable, none were observed in the area and therefore a Moderate sensitivity remains (Refer to Sections 4.1 and 4.2 for a discussion of the habitat conditions and overview of the presence of species of high conservation value).

- Plant species – A low sensitivity is indicated for endangered plant species occurring on the site. The site survey has indicated the presence of numerous protected plant species, with some also clearly being uncommon species, however, none are currently listed as threatened or endangered, consequently a verified low sensitivity is therefore confirmed for the site (See Section 4.1) (Appendix B).

- Terrestrial biodiversity – The development area is listed as having a Very High Sensitivity. The value of Very High Sensitivity consists of the site forming part of a National Protected Areas Expansion Strategy (NPAES): Focus Area, being considered for future expansion of protected areas. The area therefore retains a Very High Sensitivity, though the extent of the development (5 hectares) is unlikely to compromise it and is therefore unlikely to exceed a moderate impact. (See Section 4.1) (Appendix A: Map 1 - 3).

3.3 Survey

The site was assessed by means of transects and sample plots. Observation w.r.t. the general ecology of the area includes:

- Noted species include rare and dominant species.
- The broad vegetation types present at the site were determined.
- The state of the environment was assessed in terms of condition, grazing impacts, disturbance by humans, erosion and presence of invader and exotic species.
- The state of the habitat was also assessed.

Ecological aspects surveyed and recorded include:

- The overall ecology of the area, including the diversity of species, uniformity or diversity of habitats and different vegetation communities.
- Identification and delineation of distinct vegetation communities and habitats and the ecological drivers responsible for these distinct communities, i.e. soil, geology, topography, aspect, etc.
- A comprehensive plant species survey, including the identification of protected, rare or threatened species.
- Any ecological process or function which is important to the ecosystem, including ecological drivers, such as fire, frost, grazing, browsing, etc. and any changes to these processes.

Animal species were also noted, as well as the probability of other species occurring on or near the site according to their distribution areas and habitat requirements.
The state of the habitat was also assessed.

In order to provide a visually representative overview of the results obtained from the survey, site sensitivity mapping will also be done. This should indicate the relative importance of different ecological elements on the site as obtained from the survey. In general, these levels of sensitivity will include:

- Low Sensitivity – normally confined to areas that are completely transformed from the natural condition or degraded to such an extent that they are no longer representative of the natural ecosystem. Such areas will also no longer contain any ecological processes of importance relative to the surrounding areas. However, in some instances, such as watercourses which are completely transformed but still provide important ecological functions, a low level of sensitivity will not apply.

- Moderate Sensitivity – normally applicable to areas that are still natural and therefore do still have some ecological importance, but which do not contain elements of high conservation value and are not essential to the continued functioning of surrounding areas. Areas of Moderate Sensitivity usually require some mitigation but can be developed without resulting in high impacts.

- High Sensitivity – areas of high sensitivity contain one or more ecological elements which are considered of high conservation value. Such areas are normally preferred to be excluded from a development but where this is not possible, will require comprehensive mitigation and are also likely to result in high impacts.

- Very High Sensitivity – these areas are critical to the continued functioning of the ecosystem on and around the site. Development of such areas normally represent a fatal flaw and should be excluded from development. No manner of mitigation is able to decrease the anticipated impact in these areas.

3.4 Criteria used to assess sites

The following criteria are also applied during the site survey to further inform the general sensitivity and conservation value of the site or specific elements on the site. These criteria are used to assess the site and determine the overall status of the environment.

3.4.1 Vegetation characteristics

Characteristics of the vegetation in its current state. The diversity of species, sensitivity of habitats and importance of the ecology as a whole.

Habitat diversity and species richness: normally a function of locality, habitat diversity and climatic conditions.
Scoring: Wide variety of species occupying a variety of niches – 1, Variety of species occupying a single niche – 2, Single species dominance over a large area containing a low diversity of species – 3.

Presence of rare and endangered species: The actual occurrence or potential occurrence of rare or endangered species.
Scoring: Occurrence actual or highly likely – 1, Occurrence possible – 2, Occurrence highly unlikely – 3.

Ecological function: All plant communities play a role in the ecosystem. The ecological importance of all areas can vary significantly though, e.g. wetlands, drainage lines, ecotones, etc.

Scoring: Ecological function critical for greater system – 1, Ecological function of medium importance – 2, No special ecological function (system will not fail if absent) – 3.

Degree of rarity/conservation value:
Scoring: Very rare and/or in pristine condition – 1, Fair to good condition and/or relatively rare – 2, Not rare, degraded and/or poorly conserved – 3.

3.4.2 Vegetation condition

The sites are compared to a benchmark site in a good to excellent condition. Vegetation management practices (e.g. grazing regime, fire, management, etc.) can have a marked impact on the condition of the vegetation.

Percentage ground cover: Ground cover is under normal and natural conditions a function of climate and biophysical characteristics. Under poor grazing management, ground cover is one of the first signs of vegetation degradation.
Scoring: Good to excellent – 1, Fair – 2, Poor – 3.

Vegetation structure: This is the ratio between trees, shrubs, sub-shrubs and grass layers. The ratio could be affected by grazing and browsing by animals.
Scoring: All layers still intact and showing specimens of all age classes – 1, Sub-shrubs and/or grass layers highly grazed, while tree layer still fairly intact (bush partly opened up) – 2, Mono-layered structure often dominated by a few unpalatable species (presence of barren patches notable) – 3.

Infestation with exotic weeds and invader plants or encroachers:
Scoring: No or very slight infestation levels by weeds and invaders – 1, Medium infestation by one or more species – 2, Several weed and invader species present and high occurrence of one or more species – 3.

Degree of grazing/browsing impact:
Scoring: No or very slight notable signs of browsing and/or grazing – 1, Some browse lines evident, shrubs show signs of browsing, grass layer grazed, though still intact – 2, Clear browse line on trees, shrubs heavily pruned and grass layer almost absent – 3.

Signs of erosion: The formation of erosion scars can often give an indication of the severity and/or duration of vegetation degradation.
Scoring: No or very little sign of soil erosion – 1, Small erosion gullies present and/or evidence of slight sheet erosion – 2, Gully erosion well developed (medium to large dongas) and/or sheet erosion removed the topsoil over large areas – 3.

3.4.3 Faunal characteristics

Presence of rare and endangered species: The actual occurrence or potential occurrence of rare or endangered species on a proposed site plays a large role in the feasibility of a development. Depending on the status and provincial conservation policy, presence of a Red Data species or very unique and sensitive habitats can potentially be a fatal flaw.
Scoring: Occurrence actual or highly likely – 1, Occurrence possible – 2, Occurrence highly unlikely – 3.

3.5 Biodiversity sensitivity rating (BSR)

The total scores for the criteria discussed in section 3.3 were used to determine the biodiversity sensitivity ranking for the sites. On a scale of 0 – 30, five different classes are described to assess the biodiversity of the study area. The different classes are described in Table 1:

Table 1: Biodiversity sensitivity ranking

BSR	BSR general floral description	Floral score equating to BSR class
Totally Transformed (5)	Vegetation is totally transformed or in a highly degraded state, generally has a low level of species diversity, no species of concern and/or has a high level of invasive plants. The area has lost its inherent ecological function. The area has no conservation value and potential for successful rehabilitation is very low.	29 – 30
Advanced Degraded (4)	Vegetation is in an advanced state of degradation, has a low level of species diversity, no species of concern and/or has a high level of invasive plants. The area's ecological function is seriously hampered, has a very low conservation value and the potential for successful rehabilitation is low.	26 – 28
Degraded (3)	Vegetation is notably degraded, has a medium level of species diversity although no species of concern are present. Invasive plants are present but are still controllable. The area's ecological function is still intact but may be hampered by the current levels of degradation. Successful rehabilitation of the area is possible. The conservation value is regarded as low.	21 – 25
Good Condition (2)	The area is in a good condition although signs of disturbance are present. Species diversity is high and species of concern may be present. The ecological function is intact and very little rehabilitation is needed. The area is of medium conservation importance.	11 – 20
Sensitive/Pristine (1)	The vegetation is in a pristine or near pristine condition. Very few signs of disturbance other than those needed for successful management are present. The species diversity is very high with several species of concern known to be present. Ecological functioning is intact and the conservation importance is high.	0 - 10

4. ECOLOGICAL OVERVIEW OF THE SITE

4.1 Overview of ecology and vegetation types

Refer to the list of species encountered on the site in Appendix B.

According to Mucina & Rutherford (2006) and utilising current mapping resources (National Biodiversity Assessment 2018), the site falls within Eastern Upper Karoo (NKu 4) (Appendix A: Map 1). This vegetation type contains a varied topography with undulating plains, ridges, hills and uneven, rocky terrain, incised by a high number of small watercourses. This vegetation type is currently listed as being of Least Concern (LC) under the National List of Threatened Ecosystems (Notice 1477 of 2009) (National Environmental Management Biodiversity Act, 2004) (Appendix A: Map 1). The vegetation type is not under sufficient development pressures to be considered a threatened ecosystem. This will also decrease the conservation value of remaining natural vegetation.

The Northern Cape Critical Biodiversity Areas Plan (2024) has recently been published and has identified areas which are essential to meeting conservation targets for specific vegetation types, i.e., Critical Biodiversity Areas. The site and surroundings are not considered essential to meeting conservation targets and are listed as Other Natural Areas (ONA) (Appendix A: Map 2). The site is therefore not considered as essential to meeting conservation targets for the area and therefore has a fairly low default conservation value. Areas to the east and west (4 km to either side) are listed as Critical Biodiversity Areas (CBA) 1 and 2, providing habitat to threatened bird and mammal species, further substantiating that the site is not considered suitable habitat for threatened fauna (this is most relevant to the Ludwig's Bustard and Riverine Rabbit, See Section 4.2).

The proposed rock quarry, for which a mining permit will be obtained, is situated approximately 30 km west of the small town of Victoria West (Appendix A: Map 1). The site is situated adjacent to the R63 tarred road, while access to it will be obtained via a 1.5 km long new access road. The footprint of the mining area will be 5 hectares in total, consisting of a hard rock quarry (1.5 hectares) and a separate stockpiling/crushing area (2.1 hectares). The site and surroundings still consist of natural vegetation, without any prominent disturbances. The only localised disturbances noted were a small dirt track, artificial impoundment, livestock pens and watering point, though these result in very little disturbance. The site forms part of an arid region and consequently watercourses are limited to a few small, ephemeral drainage lines, which feed into the artificial impoundment in the area.

Figure 1: View of the proposed Mining Permit (MP) indicated in red (Google Earth 2023). This consists of an access road, stockpile area and hard rock quarry. The area clearly consists of natural vegetation, without any significant transformation present.

The footprint of the proposed MP is clearly completely natural, with very few disturbances present. This has also been confirmed by the current survey, as well as the National Biodiversity Assessment (2018), which indicates natural vegetation, in a good condition and without any exotic weeds or invasive species (Appendix A: Map 1). The area is dominated by low ridges and hills, draining toward a lower lying plain to the north, which also contains several small drainage lines transecting it. This results in a moderate diversity of habitat which includes low ridges, rocky and sandy habitats and drainage lines supporting a low but dense riparian vegetation layer. As a result of the moderate habitat diversity, the area also contains a moderate species diversity, which includes scant dwarf karroid shrubs, grasses, succulents and geophytic species.

Figure 2: The landscape is dominated by a sparse grass layer and dwarf karroid vegetation which is still largely natural on the site and surroundings.

As indicated, the site and surroundings are still completely natural, though a few localised disturbances are present. These modifications and disturbances include:

- The R63 tarred road to the north of the site results in localised transformation, which will also affect surface water drainage patterns and the movement of fauna.
- A small dirt track is present on the site and will have a limited, localised impact in terms of disturbance.
- A watering point with livestock pens is situated near the access road and will only have a limited impact and localised disturbance.
- An artificial impoundment to the north of the site, which is a man-made structure, now forms part of the natural drainage systems in the area.
- Grazing by domestic livestock is present, but not considered to exceed moderate values and will also have a limited impact in terms of trampling and overgrazing.

Figure 3: A small dirt track results in limited, localised disturbances.

Figure 4: An artificial impoundment to the north of the site, which is a man-made structure, now forms part of the natural drainage systems in the area.

As previously indicated, the topography of the site consists of low rocky ridges and hills and a few small drainage lines draining from these, with gentle to moderate slopes toward the lower lying plains situated to the north of the site. The slopes are generally gentle, but can contain

steeper drops along the edges of hills and ridges, sloping to the north. The gentle slope of the site also generates a significant runoff, which leads to the formation of several drainage lines, draining from the ridges and hills to the lower lying plains. None of these drainage lines form part of either the rock quarry or stockpiling area, but will be crossed at several points, by the proposed new access road (Appendix A: Map 1). These drainage lines incised into the landscape also contribute toward the diversity of topography and habitats. The topography of the site is considered to be natural, without significant modifications, but will be modified as a result of the proposed quarry.

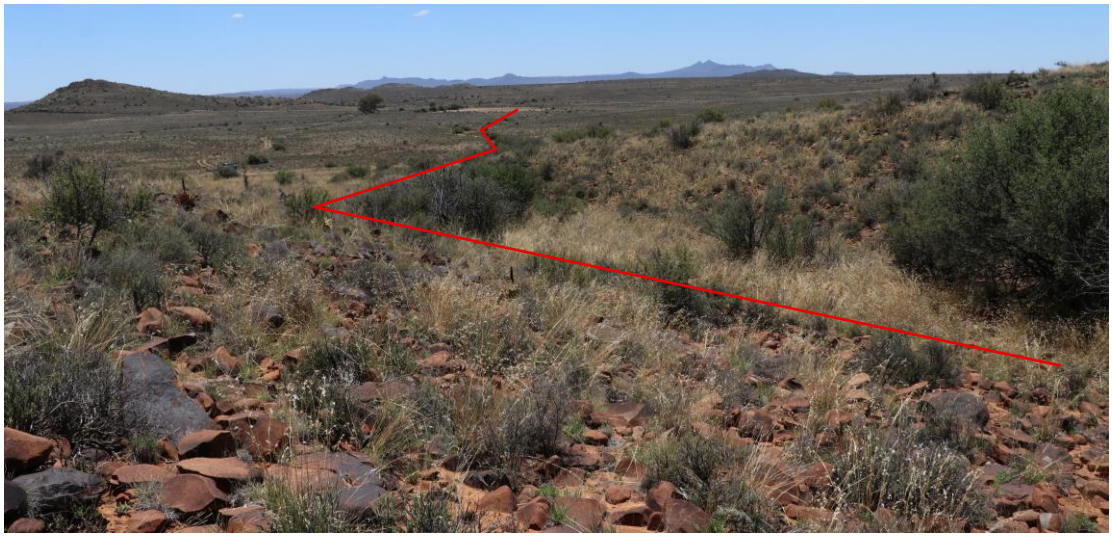

Figure 5: Topography of the area which consists of low ridges and hills, sloping to the north, also resulting in the formation of numerous small drainage lines (red).

The region is characterised by an arid climate and receives on average 200 mm annual rainfall with mean annual rainfall for Victoria West being 240 mm. The average annual, daily temperature given for Victoria West is 16°C. The highest average daily temperature occurs during January with an average of 24°C and the lowest average occurs during July with an average of 8°C.

The site lies within the Karoo Basin where geology is dominated by mudstone and sandstone rocks derived from marine sediments. These relatively soft sediments weather to form stony plains and flat or rounded hills. The site itself is situated on the higher lying ridges and hills dominated by rocky soils, often overlying dolerite bedrock. The surrounding landscape also includes dolerite capped ridges and mesas, with the site also containing a dolerite sill. The landscape thus comprises abrupt ridges and conical hills scattered across extensive sandy and silty plains. Vegetation in this landscape can be divided into montane shrubland on the dolerite capped hills and ridges, while the vast plains consist of dwarf shrubland, grassy dwarf shrubland and patches of succulent dwarf shrubland.

Figure 6: The landscape is dominated by vast plains with prominent mesas. The area can be regarded as a typical inselberg landscape.

In order to provide an overall description of the proposed MP site, a detailed description of the vegetation will be provided. This will also aim to provide the condition of the terrestrial ecology at the site, while also indicating the presence of elements of conservation value where this will be relevant to the proposed MP (Appendix A: Map 1 - 3).

The development will consist of a hard rock quarry site, a stockpiling and crushing area and a new access road connecting these areas to the R63 tarred road. The vegetation communities in these areas are all fairly similar, being dominated by a sparse grass layer and abundance of dwarf karroid shrubs, though some differences are evident and will be indicated in the discussion below. The access road and stockpile area are most similar, being situated on the lower lying ridges and plains sloping to the north. Here the habitat is dominated by shale and sandstone, rocky soils, which are generally shallow, but increasing somewhat in depth toward the lower lying areas. The rock quarry is situated on top of a low hill, which is dominated by a dolerite sill, shallow soils and high degree of surface rock. Here the grass component is somewhat more prominent, with shrubs also being present. The grass layer, in all habitats is dominated by *Aristida congesta, Fingerhuthia africana, Eragrostis obtusa* and *Eragrostis lehmanniana*. Where the surface rock increases, from the stockpile site and toward the rock quarry, the grass species increase in diversity and prominence and species such as *Themeda triandra, Digitaria eriantha, Tragus koelerioides, Eragrostis trichophora, Heteropogon contortus, Aristida diffusa* and *Sporobolus fimbriatus* occur. In areas with much shallower, rocky soils, other grass species adapted to these arid habitats include *Oropetium capense, Enneapogon desvauxii* and *Eragrostis nindensis*. There is therefore a distinction in terms of the grass species between rocky habitats (Stockpile area and quarry) and the lower lying areas toward the north (access road). The dwarf karroid shrub component is dominant throughout the area and is diagnostic for this vegetation type. Such species include *Eriocephalus ericoides, Aptosimum spinescens, Rosenia oppositifolia, Pteronia ciliata, Pteronia glauca, Pentzia incana, Indigofera sessilifolia, Salsola aphylla, Lycium cinerium, Asparagus suaveolens, Hermannia pfeilii, Hermannia filifolia, Amphiglossa triflora, Wahlenbergia nodosa* and *Chrysocoma ciliata*. This is only a portion of the dwarf shrubs (shorter than 40 cm) present on the site and represents a significant species diversity (Appendix B). Towards the higher lying ridges and hills (stockpile area and quarry), taller shrubs are also being prominent, but remain scattered. These shrubs include *Searsia burchellii, Lacomucinea lineata* and *Rhigozum obovatum*. Species diversity on the site is significant due to a variety of micro-habitats, though is still

considered as moderate. As a result, a variety of different growth forms are present, which include herbaceous species such as *Aptosimum indivisum, Chaenostoma caeruleum, Hermannia coccocarpa, Chascanum pinnatifidum* and *Lotononis sp.* while geophytic species (plants with underground storage organs) are also abundant and include *Drimia elata, Dipcadi ciliare, Moraea polystachya, Ledebouria apertifolia, Albuca crispa, Drimia vermiformis* and *Drimia calcarata.* Several of these geophytic species are also listed as protected and have a significant conservation value. Given the arid climate, shallow soils and surface rock, succulent species are also abundant and include *Ruschia intricata, Aloe broomii, Stomatium rouxii, Anacampseros filamentosa, Curio radicans, Bulbine frutescens, Crassula capitella* subsp. *thyrsiflora, Trichodiadema setulifolium, Monsonia salmoniflorum, Crassula deltoidea, Delosperma multiflorum, Crassula muscosa, Euphorbia caterviflora, Haworthiopsis venosa* subsp. *tessellata, Pachypodium succulentum, Crassula coralina, Pelargonium obratanifolium, Duvalia corderoyi, Euphorbia arida, Crassula subaphylla, Adromischus trigynus* and *Ceropegia filiformis*. The majority of these are listed as protected within the Northern Cape, while some are also considered to be uncommon, and these therefore also hold a high conservation value which will require significant mitigation.

As indicated, several of the succulent and geophytic species occurring on the site are regarded as protected within the Northern Cape Province (Appendix B). These include *Moraea polystachya, Albuca crispa, Ruschia intricata, Aloe broomii, Stomatium rouxii, Anacampseros filamentosa, Crassula capitella* subsp. *thyrsiflora, Trichodiadema setulifolium, Crassula deltoidea, Delosperma multiflorum, Crassula muscosa, Euphorbia caterviflora, Haworthiopsis venosa* subsp. *tessellata, Pachypodium succulentum, Crassula coralina, Pelargonium obratanifolium, Duvalia corderoyi, Euphorbia arida, Crassula subaphylla, Adromischus trigynus* and *Ceropegia filiformis*. In addition, the species *Pelargonium obratanifolium* is listed as a specially protected species, thus also being of high conservation value. Where the development will affect any of these, the necessary permits will have to be obtained. Many of these species are fairly common, widespread and abundant and, with the necessary permits, can simply be removed. However, several are uncommon, localised species and at least a fair portion of affected plants should be transplanted to adjacent areas where they will remain unaffected. These species include *Albuca crispa, Aloe broomii, Stomatium rouxii, Anacampseros filamentosa, Trichodiadema setulifolium, Crassula deltoidea, Euphorbia caterviflora, Haworthiopsis venosa* subsp. *tessellata, Pachypodium succulentum, Pelargonium obratanifolium, Duvalia corderoyi, Euphorbia arida, Adromischus trigynus* and *Ceropegia filiformis*. These geophytic and succulent species are easily transplanted with a high success rate. Though these are all listed as protected, are uncommon and considered of high conservation value, none are listed as threatened or endangered and therefore do not entail a fatal flaw for the development.

From the description of the vegetation composition, the proposed site, including rock quarry, stockpile area and access road still consists of natural vegetation, in good condition with a significant species diversity, including protected plant species of significant conservation value (Appendix A: Map 1). Only limited disturbances are present and not considered sufficient to affect the vegetation composition or the condition of the habitat. The species diversity is moderate, although the area does contain a significant number of protected plant species which will contribute towards its conservation value (Appendix B). However, no threatened or endangered species are present, while the vegetation type is also widespread, and no unique habitats are present on the site. The site would therefore still entail at least a Moderate Sensitivity (Appendix A: Map 3).

Figure 7: The rock quarry site will be situated on a higher lying, low hill, where surface dolerite boulders dominate. The vegetation is dominated by dwarf karroid, but note also a prominent, but sparse grass component and taller, scattered shrubs.

Figure 8: The stockpile area will be situated lower down, but also on a low rocky ridge, with a high percentage of surface rock. Note that the dwarf karroid shrubs still dominate, though the grass component is less prominent, while larger shrubs are completely absent.

Figure 9: The proposed access road will traverse all habitats as described, including the lower lying plain, where surface rock is less prominent, with deeper soils. The vegetation remains dominated by dwarf karroid shrubs.

Figure 10: Protected species occurring on the site which are considered to have a higher conservation value include, clockwise from top left: *Adromischus trigynus, ALbuca crispa, Aloe broomii, Crassula deltoidea, Stomatium rouxii, Haworthiopsis venosa* subsp. *tessellata, Euphorbia arida, Anacampseros filamentosa, Ceropegia filiformis.*

Conclusions

From the description of the vegetation on the site, including the rock quarry, stockpiling area and access road, it consists of natural vegetation which is still in a fairly good condition (Appendix A: Map 1). Areas of disturbance are present but are indicative of only low levels of disturbance. The species diversity is moderate, although the area does contain a significant number of protected plant species which will contribute towards its conservation value (Appendix B). The site therefore still contains elements of significant conservation value, which include protected plant species and drainage lines along the access road (Appendix A: Map 3). Significant mitigation will therefore have to be implemented to ensure that the impact on these elements of significant conservation value is decreased.

Mitigation as indicated in the previous paragraph should include the following (Appendix A: Map 1 - 3):

- As indicated, several of the succulent and geophytic species occurring on the site are regarded as protected within the Northern Cape Province (Appendix B). Where the development will affect any of these, the necessary permits will have to be obtained. Many of these species are fairly common, widespread and abundant and, with the necessary permits, can simply be removed. However, several are uncommon, localised species and at least a fair portion of affected plants should be transplanted to adjacent areas where they will remain unaffected. These species include *Albuca crispa, Aloe broomii, Stomatium rouxii, Anacampseros filamentosa, Trichodiadema setulifolium, Crassula deltoidea, Euphorbia caterviflora, Haworthiopsis venosa* subsp. *tessellata, Pachypodium succulentum, Pelargonium obratanifolium, Duvalia corderoyi, Euphorbia arida, Adromischus trigynus* and *Ceropegia filiformis*. These geophytic and succulent species are easily transplanted with a high success rate.

- Several small drainage lines are likely to be crossed by the proposed access road and they should also be taken into account in order to ensure the impact on them is kept to a minimum. Protection from erosion will also be particularly relevant at these crossings.

- In addition, the area contains no exotic weeds or invasive species. However, disturbance caused by mining is highly likely to leave disturbed areas vulnerable to infestation, with the invasive *Prosopis glandulosa* tree being of particular concern, as it is well known to be heavily invasive in this region. The proposed mining operations will therefore have to implement a comprehensive monitoring and eradication programme to ensure that invasive plant species (particularly *Prosopis glandulosa*) are removed from the area and prevented from re-establishing.

4.2 Overview of terrestrial fauna (actual & possible)

Tracks and signs of mammals are abundant on and around the site. As indicated (Section 4.1), the area is still largely natural and consequently the mammal population should also largely still be intact. However, the area is utilised for stock farming, which will undoubtedly have an impact on the mammal population in the area. This has, over centuries, resulted in the removal of large ungulates and most carnivores from the area, while the use of jackal-proof fencing and control of smaller carnivores have also modified the mammal population in the area. It may however still be possible for species of conservational importance to be present in the area. The mammal population is therefore anticipated to be modified, with some decrease in the capacity provided by the natural habitat likely, though species of conservation value may still be present. However, the footprint of the proposed mining operations (5 hectares) is not anticipated to have a large impact on the mammal population, when seen in context of the extensive natural areas which are present in the surroundings, providing adequate habitat for the local mammal population thus resulting in the anticipated impact remaining moderate.

The mammal and faunal survey of the site was conducted by means of active searching and recording any tracks or signs of mammals, other faunal species and actual observations of fauna. It is also considered likely that the area will contain several other faunal species, but these were not observed on the site. From the survey the following actual observations of mammals and other fauna were recorded:

- droppings of a small antelope, most likely Steenbok (*Raphicerus campestris*) or Klipspinger (*Oreotragus oreotragus*) were observed on the site. These are small antelope, that are common in natural areas and not dependent on pristine habitat.
- Porcupine (*Hystrix africaeaustralis*) are common on the site and visible through scat and excavations. It is a very common species anticipated to occur in this region.
- Common Molerat (*Cryptomys hottentottus*) are abundant on the site. This is a common species, well adapted to any type of habitat, even occurring in urban environments.
- Scat of a small insectivore, with an abundance of beetle remains, thus considered possibly that of the Hedgehog (*Atelerix frontalis*), a species listed as Near Threatened and therefore of higher conservation value.
- Reptiles are also common in the area, which include remains of the Leopard Tortoise (*Stigmochelys pardalis*) and Rock Monitor (*Varanus albigularis*), both which are widespread and common and anticipated to occur in this area.

These species identified on the site indicate a significant diversity, which although dominated by widespread and generalist species, also contains species of higher conservation value. This also indicates that although the mammal population will be somewhat modified, it remains likely that other species of high conservation value will still be present.

It is also considered likely that several mammal species were overlooked during the survey, and it may also be likely that other rare and endangered species may be present in the area.

Mammal species likely to occur on the site have been determined by means of FitzPatrick Institute of African Ornithology (2021).

Table 2: Red Listed mammals previously recorded in the surrounding region (Child *et al.* 2016).

Scientific name	Common name	Status
Pelea capreolus	Vaal Rhebok	**Near Threatened**
Equus quagga	Plains Zebra	**Near Threatened**
Atelerix frontalis	Southern African Hedgehog	**Near Threatened**
Bunolagus monticularis	Riverine Rabbit	**Critically Endangered**
Hyaena brunnea	Brown Hyena	**Near Threatened**
Parotomys littledalei	Littledale's Whistling Rat	**Near Threatened**
Felis nigripes	Black-footed Cat	**Vulnerable**

The survey and available literature (Table 3) have indicated that the mammal population in the area will consist largely of widespread, generalist species. There is however still some likelihood that species of conservation value may occur in the surroundings. Especially smaller mammals (Black-footed Cat, Hedgehog, Riverine Rabbit) and far roaming mammals (Brown Hyena, Vaal Rhebok) are still likely to be present. Habitat suitability excludes the possibility of the Riverine Rabbit occurring here, though the others mentioned may possibly use the area as habitat. The extent of the proposed development (5 hectares) seen in context of the extensive natural areas, will limit the anticipated impact to a moderate impact.

A note should also be made of the following faunal species of high conservation value which are known to occur in the region and may be affected by the proposed development:

- Riverine Rabbit (*Bunolagus monticularis*), possibly the most endangered mammal in the country, is known to occur in the area, but is a habitat specialist, completely confined to dense riparian vegetation occurring along the larger rivers in the area. This

habitat type is completely absent from the site and immediate surroundings and the species is therefore not anticipated to occur near or be affected by the development.

- Ludwig's Bustard (*Leonotis ludwigii*), which is a large terrestrial bird of high conservation value. The species may sporadically occur in the area, but is usually found in the lower lying plains and alluvial habitats and therefore a moderate likelihood is considered applicable to this species occurring on the site. Impacts which are more relevant to this species include large-scale developments (renewable energies developments) resulting in habitat loss or overhead powerlines, both which are not associated with the proposed mining permit and therefore any impacts on this species should remain low.

- Karoo Padloper (*Chersobius boulengeri*) is a rare and endangered tortoise associated with rocky ridges and hills and is known to occur in this region. It is therefore possible that the species may occur in this area, but was not recorded during the survey. Should the species indeed occur in the area, the impact of the proposed development is not anticipated to exceed moderate values. This is due to the extent of the development remaining small (5 hectares), which when considered in comparison to the extensive natural surroundings, cannot be considered as significant in terms of the loss of habitat. Any subsequent direct impacts on the species can be limited by implementing adequate rehabilitation.

The impact that the proposed development will have, is mainly concerned with the loss of habitat and fragmentation of available habitat due to the development. Transformation of the natural vegetation on the site will result in a decrease in the population size as available habitat decreases. However, extensive natural areas still occur in the surrounding area and any fauna on the site are likely to vacate the site into these adjacent areas, should development take place. The site was also found to contain no obvious mammal burrows, probably a consequence of shallow soils, which will further decrease the direct impact. Furthermore, the extent of the proposed development is small and the associated impact that it would have on fauna would accordingly also be relatively low. The anticipated impact is therefore not anticipated to exceed a moderate value, but is however dependent on the following mitigation being successfully implemented:

- In order to ensure no direct impact on the fauna on the site occurs, the hunting, capturing or trapping of fauna on the site should be strictly prohibited during operation of the mining development. This includes, but is not limited to, mammals, reptiles and birds.
- Open excavations may act as pitfall traps to mammals, reptiles and amphibians and trenches should be monitored daily for trapped animals which should promptly be removed.
- In the event of poisonous snakes or other dangerous animals encountered on the site, an experienced and certified snake handler or zoologist must remove these animals from the site and re-locate them to a suitable area.
- After cessation of mining activities, the area should be completely rehabilitated, which is particularly applicable to the stockpile area and rock quarry. The rock quarry should be rehabilitated to such an extent that it contains no sheer drops or cliffs, so that any fauna entering it should be able to freely leave the quarry and so that no fauna falling into the quarry are injured due to sheer drops (this is also particularly applicable to tortoises).

Table 3: Likely mammal species in the region (Mammalmap 2023).

Order	Scientific name	Common name	Status
Bovidae	*Antidorcas marsupialis*	Springbok	Least Concern
	Damaliscus pygargus phillipsi	Blesbok	Least Concern
	Oryx gazella	Gemsbok	Least Concern
	Pelea capreolus	Vaal Rhebok	Near Threatened
	Raphicerus campestris	Steenbok	Least Concern
Canidae	*Canis mesomelas*	Black-backed Jackal	Least Concern
	Otocyon megalotis	Bat-eared Fox	Least Concern
Cercopithecidae	*Papio ursinus*	Chacma Baboon	Least Concern
Equidae	*Equus quagga*	Plains Zebra	Near Threatened
Felidae	*Caracal caracal*	Caracal	Least Concern
	Felis nigripes	Black-footed Cat	Vulnerable
	Felis silvestris	Wildcat	Least Concern
Herpestidae	*Cynictis penicillata*	Yellow Mongoose	Least Concern
	Herpestes pulverulentus	Cape Gray Mongoose	Least Concern
	Suricata suricatta	Meerkat	Least Concern
Hyaenidae	*Hyaena brunnea*	Brown Hyena	Near Threatened
	Proteles cristata	Aardwolf	Least Concern
Leporidae	*Lepus saxatilis*	Scrub Hare	Least Concern
	Pronolagus rupestris	Smith's Red Rock Hare	Least Concern
Macroscelididae	*Elephantulus edwardii*	Cape Elephant Shrew	Least Concern
	Elephantulus rupestris	Western Rock Elephant Shrew	Least Concern
	Macroscelides proboscideus	Short-eared Elephant Shrew	Least Concern
Muridae	*Aethomys granti*	Grant's Rock Mouse	Least Concern
	Aethomys namaquensis	Namaqua Rock Mouse	Least Concern
	Otomys unisulcatus	Karoo Bush Rat	Least Concern
	Parotomys littledalei	Littledale's Whistling Rat	Near Threatened
	Rhabdomys pumilio	Xeric Four-striped Grass Rat	Least Concern
Mustelidae	*Ictonyx striatus*	Striped Polecat	Least Concern
Orycteropodidae	*Orycteropus afer*	Aardvark	Least Concern
Procaviidae	*Procavia capensis capensis*	Cape Rock Hyrax	Least Concern
Sciuridae	*Sciurus carolinensis*	Eastern Grey Squirrel	Least Concern
	Xerus inauris	South African Ground	Least Concern

		Squirrel	
Soricidae	*Crocidura sp.*	Shrews	
Viverridae	*Genetta genetta*	Common Genet	Least Concern

Figure 11: Tracks and signs of fauna identified on and around the site include, clockwise from top left: scat of Porcupine (*Hystrix africaeaustralis*), droppings of a small antelope, soil mounds of Common Molerat (*Cryptomys hottentottus*), remains of a Rock Monitor (*Varanus albigularis*), remains of a Leopard Tortoise (*Stigmochelys pardalis*) and dropping of a small insectivore, possibly a Hedgehog (*Atelerix frontalis*).

5. ANTICIPATED IMPACTS

Anticipated impacts that the development will have, are primarily concerned with the loss of habitat and species diversity on and adjacent to the site (Appendix A: Map 1 - 3). The development consists of the proposed mining permit, including hard rock quarry, stockpiling/crushing area and access road, and it is therefore anticipated that impacts will be similar during both the construction and operational phases.

The following impacts on the ecosystem, ecology and biodiversity will be assessed:

- Loss of vegetation and consequently habitat and species diversity as a result.
- Loss of protected, rare or threatened plant species.
- Impacts on watercourses, wetlands or the general catchment.
- The impact that the development will have on exotic weeds and invasive species, both current and anticipated conditions.
- Impacts resulting on the faunal population on and around the site.
- Any significant cumulative impacts that the development will contribute towards.

As indicated in previous sections, the proposed site completely consists of natural vegetation in a good condition and with limited disturbances present (Appendix A: Map 1). The proposed development will therefore result in the loss of habitat and vegetation. In terms of species diversity, species composition and uniqueness of the habitat, the site is considered to have a moderate conservation value. The overall loss of these aspects is therefore expected to have moderate values.

Loss of vegetation, habitat and species diversity

From the description of the vegetation on the site, including the rock quarry, stockpiling area and access road, it consists of natural vegetation which is still in a fairly good condition (Appendix A: Map 1). Areas of disturbance are present but are indicative of only low levels of disturbance. The species diversity is moderate, although the area does contain a significant number of protected plant species which will contribute towards its conservation value (Appendix B). The site therefore still contains elements of significant conservation value, which include protected plant species and drainage lines along the access road (Appendix A: Map 3). Significant mitigation will therefore have to be implemented to ensure the impact on these elements of significant conservation value is decreased. In addition, the vegetation type in this area, Eastern Upper Karoo, is still widespread and listed as being of Least Concern (LC), with a relatively low conservation value confirmed by the Northern Cape Critical Biodiversity Areas Plan (2024), which regards the area as an Other Natural Area (ONA) (Appendix A: Map 2). The site does however form part of a National Protected Areas Expansion Strategy (NPAES): Focus Area, which, due to the limited extent (5 hectares) of the development, is unlikely to be compromised. A moderate sensitivity for the site is therefore maintained and the impact of the loss of vegetation and species diversity is therefore considered to be moderate.

Loss of protected plant species

As indicated, several of the succulent and geophytic species occurring on the site are regarded as protected within the Northern Cape Province (Appendix B). These include *Moraea polystachya, Albuca crispa, Ruschia intricata, Aloe broomii, Stomatium rouxii, Anacampseros*

filamentosa, Crassula capitella subsp. *thyrsiflora, Trichodiadema setulifolium, Crassula deltoidea, Delosperma multiflorum, Crassula muscosa, Euphorbia caterviflora, Haworthiopsis venosa* subsp. *tessellata, Pachypodium succulentum, Crassula coralina, Pelargonium obratanifolium, Duvalia corderoyi, Euphorbia arida, Crassula subaphylla, Adromischus trigynus* and *Ceropegia filiformis*. In addition, the species *Pelargonium obratanifolium* is listed as a specially protected species, thus also being of high conservation value. Where the development will affect any of these, the necessary permits will have to be obtained. Many of these species are fairly common, widespread and abundant and, with the necessary permits, can simply be removed. However, several are uncommon, localised species and at least a fair portion of affected plants should be transplanted to adjacent areas where they will remain unaffected. These species include *Albuca crispa, Aloe broomii, Stomatium rouxii, Anacampseros filamentosa, Trichodiadema setulifolium, Crassula deltoidea, Euphorbia caterviflora, Haworthiopsis venosa* subsp. *tessellata, Pachypodium succulentum, Pelargonium obratanifolium, Duvalia corderoyi, Euphorbia arida, Adromischus trigynus* and *Ceropegia filiformis*. These geophytic and succulent species are easily transplanted with a high success rate. Though these are all listed as protected, are uncommon and considered of high conservation value, none are listed as threatened or endangered and therefore do not entail a fatal flaw for the development. Significant mitigation will therefore have to be implemented to ensure the impact on these elements of significant conservation value is decreased. The impact of the loss of vegetation and species diversity is therefore considered to be moderate.

Impacts on drainage systems and watercourses

No drainage lines form part of either the rock quarry or stockpiling area, but a few will be crossed by the proposed new access road (Appendix A: Map 1). These drainage lines are very small, but form defined watercourses and any direct impacts on them should therefore still be taken into account by the development in order to ensure the impact on them is kept to a minimum. Protection from erosion will also be particularly relevant at these crossings.

Impact of increased weed and invasive species establishment

Due to the removal of vegetation and disturbance of the soil surface, the proposed mining operations will further increase the susceptibility to the establishment of weeds and invasive species. The area contains no exotic weeds or invasive species. However, disturbance caused by mining is highly likely to leave disturbed areas vulnerable to infestation, with the invasive *Prosopis glandulosa* tree being of particular concern, as it is well known to be heavily invasive in this region. The proposed mining operations will therefore have to implement a comprehensive monitoring and eradication programme to ensure that invasive plant species (particularly *Prosopis glandulosa*) are removed from the area and prevented from re-establishing. Monitoring of weed establishment should form a prominent part of management of the mining operations. Where category 1 and 2 weeds occur, they require removal by the property owner according to the Conservation of Agricultural Resources Act, No. 43 of 1983 and National Environmental Management: Biodiversity Act, No. 10 of 2004. Unmitigated this is anticipated to be at least a moderate impact, though should be easily decreased through adequate weed control.

Impact on mammal population

The impact that the proposed development will have, is mainly concerned with the loss of habitat and fragmentation of available habitat due to the development. Transformation of the

natural vegetation on the site will result in a decrease in the population size as available habitat decreases. However, extensive natural areas still occur in the surrounding area and any fauna on the site are likely to vacate the site into these adjacent areas, should development take place. The site was also found to contain no obvious mammal burrows, probably a consequence of shallow soils, which will further decrease the direct impact. Furthermore, the extent of the proposed development is small and the associated impact that it would have on fauna would accordingly also be relatively low. The anticipated impact is therefore not anticipated to exceed a moderate value, but is however dependent on mitigation being successfully implemented.

Cumulative Impact

As previously indicated, the proposed mining permit development will be situated in an area that is currently still natural, containing extensive natural vegetation. The cumulative impact of the proposed mining permit (5 hectares) would therefore seem to be fairly low. However, the area has increasingly become exposed to development pressures, mostly due to wind farm developments and potential shale fracking exploration (unknown for the immediate area) and taking this into account, the cumulative impact of the development is considered to be moderate. This cumulative impact can be marginally decreased if comprehensive and successful rehabilitation of the site is undertaken after mining, enabling the site to be re-integrated into the surroundings to some degree.

Conclusion

The impact significance has been determined and should mining take place without mitigation, some impacts may be high, such as the impact of the loss of protected species (Appendix A: Map 1 - 3). The majority of impacts will however be moderate. However, should adequate mitigation be implemented as described, these can all be reduced to moderate impacts. This is however subject to the mining area implementing mitigation to ensure that protected plant species are transplanted, limiting the impact on fauna by implementing suitable mitigation, implementing a comprehensive monitoring and eradication programme to address weeds and invasive species and undertaking comprehensive rehabilitation.

Please refer to Appendix C for the impact methodology.

Significance of the impact:

Impact	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Before Mitigation								
Loss of vegetation type and clearing of vegetation	3	5	2	3.3	5	3	4	13.2
Loss of protected species	4	5	2	3.6	5	4	4.5	16.2
Impact on watercourses	3	5	3	3.6	4	3	3.5	12.6
Infestation with weeds and invaders	3	4	3	3.3	5	3	4	13.2
Impact on terrestrial	4	4	2	3.6	4	3	3.5	12.6

fauna								
Cumulative impact	3	4	2	3	4	3	3.5	10.5
After Mitigation								
Loss of vegetation type and clearing of vegetation	3	5	2	3.3	5	3	4	13.2
Loss of protected species	2	5	2	3	4	3	3.5	10.5
Impact on watercourses	3	5	3	3.6	4	3	3.5	12.6
Infestation with weeds and invaders	2	4	2	2.6	3	3	3	7.8
Impact on terrestrial fauna	4	4	2	3.6	4	3	3.5	12.6
Cumulative impact	2	4	2	2.6	4	3	3.5	9.1

6. BIODIVERSITY SENSITIVITY RATING (BSR)

Habitat diversity and species richness:
Habitat diversity at and around the site can be considered as moderate. The area is dominated by low ridges and hills, draining toward a lower lying plain to the north, which also contains several small drainage lines transecting it. This results in a moderate diversity of habitat which includes low ridges, rocky and sandy habitats and drainage lines supporting a low but dense riparian vegetation layer. As a result of the moderate habitat diversity, the area also contains a moderate species diversity, which includes scant dwarf karroid shrubs, grasses, succulents and geophytic species.

Presence of rare and endangered species:
The site and surroundings contain a high number of protected species with several also being considered uncommon and of high conservation value. Several of the succulent and geophytic species occurring on the site are also regarded as protected within the Northern Cape Province (Appendix B). These include *Moraea polystachya, Albuca crispa, Ruschia intricata, Aloe broomii, Stomatium rouxii, Anacampseros filamentosa, Crassula capitella* subsp. *thyrsiflora, Trichodiadema setulifolium, Crassula deltoidea, Delosperma multiflorum, Crassula muscosa, Euphorbia caterviflora, Haworthiopsis venosa* subsp. *tessellata, Pachypodium succulentum, Crassula coralina, Pelargonium obratanifolium, Duvalia corderoyi, Euphorbia arida, Crassula subaphylla, Adromischus trigynus* and *Ceropegia filiformis*. In addition, the species *Pelargonium obratanifolium* is listed as a specially protected species, thus also of high conservation value.

Ecological function:
The site functions as habitat for a variety of fauna, supports a specific vegetation type and also functions as part of the catchment of several small drainage systems. As indicated in previous descriptions (See Section 4.1), the site and surroundings are still intact, natural and in fairly good condition and as a result, all of these ecological functions are still intact.

Degree of rarity/conservation value:
From the description of the vegetation on the site, including the rock quarry, stockpiling area and access road, it consists of natural vegetation which is still in a fairly good condition (Appendix A: Map 1). Areas of disturbance are present but are indicative of only low levels of disturbance. The species diversity is moderate, although the area does contain a significant number of protected plant species which will contribute towards its conservation value (Appendix B). The site therefore still contains elements of significant conservation value, which include protected plant species and drainage lines along the access road (Appendix A: Map 3). Significant mitigation will therefore have to be implemented to ensure the impact on these elements of significant conservation value is decreased. In addition, the vegetation type in this area, Eastern Upper Karoo, is still widespread and listed as being of Least Concern (LC), with a relatively low conservation value confirmed by the Northern Cape Critical Biodiversity Areas Plan (2024), which regards the area as an Other Natural Area (ONA) (Appendix A: Map 2). The site does however form part of a National Protected Areas Expansion Strategy (NPAES): Focus Area, which, due to the limited extent (5 hectares) of the development, is unlikely to be compromised. A moderate sensitivity for the site is therefore maintained.

Percentage ground cover:
Percentage ground cover is low, which is natural for this arid region and is therefore considered as unmodified and intact.

Vegetation structure:
The vegetation communities in these areas are all fairly similar, being dominated by a sparse grass layer and abundance of dwarf karroid shrubs. The vegetation structure may vary to some degree, depending on the habitat, including the lower lying plains and ridges, dominated by shale and sandstone and rocky soils, while the rock quarry will be situated on top of a low hill, which is dominated by a dolerite sill, shallow soils and a high degree of surface rock. Here the grass component is somewhat more prominent, with shrubs also being present. The mining permit footprint consists of natural vegetation, with low levels of disturbance and being intact, the vegetation is therefore considered as unmodified to a significant degree.

Infestation with exotic weeds and invader plants:
Given the natural condition of the site and surroundings, it does not yet contain any exotic weeds or invasive species (Appendix B).

Degree of grazing/browsing impact:
The site is being utilised for grazing by domestic livestock, which is still regarded to only result in a moderate degree of overgrazing and trampling.

Signs of erosion:
Due to the slope and moderate overgrazing of the area, some erosion is present, especially along dirt tracks, but is still considered to be moderate.

Terrestrial animals:
Tracks and signs of mammals are abundant on and around the site. As indicated (Section 4.1), the area is still largely natural and consequently the mammal population should also largely still be intact. However, the area is utilised for stock farming, which will undoubtedly have an impact on the mammal population in the area. This has, over centuries, resulted in the removal of large ungulates and most carnivores from the area, while the use of jackal-proof fencing and control of smaller carnivores have also modified the mammal population in the area. It may however still be possible for species of conservational importance to be present in the area. The mammal population is therefore anticipated to be modified, with some decrease in the capacity provided by the natural habitat likely, though species of conservation value may still be present. However, the footprint of the proposed mining operations (5 hectares) is not anticipated to have a large impact on the mammal population, when seen in context of the extensive natural areas which are present in the surroundings, providing adequate habitat for the local mammal population, thus resulting in the anticipated impact remaining moderate.

Table 4: Biodiversity Sensitivity Rating for the proposed mining permit development.

	Low (3)	Medium (2)	High (1)
Vegetation characteristics			
Habitat diversity & Species richness		2	
Presence of rare and endangered species			1
Ecological function			1
Uniqueness/conservation value		2	
Vegetation condition			
Percentage ground cover			1
Vegetation structure			1
Infestation with exotic weeds and invader plants or encroachers			1
Degree of grazing/browsing impact		2	
Signs of erosion		2	
Terrestrial animal characteristics			
Presence of rare and endangered species		2	
Subtotal	0	10	5
Total		15	

7. BIODIVERSITY SENSITIVITY RATING (BSR) INTERPRETATION

Table 5: Interpretation of Biodiversity Sensitivity Rating.

Site	Score	Site Preference Rating	Value
Vingerfontein mining permit	15	Good Condition	2

8. DISCUSSION AND CONCLUSION (Appendix A: Map 1 - 3)

The proposed mining permit area is considered to be in a Good Condition (See Section 7). The site consists of natural vegetation, with few impacts and disturbances and therefore regarded to be in a good condition. However, although some elements of significant conservation value (protected plant species, fauna of conservation value) are present on the site, no elements, species or habitats or species of exceptional conservation value are present (endangered vegetation or fauna), which would then have entailed a pristine condition.

The proposed rock quarry, for which a mining permit will be obtained, is situated approximately 30 km west of the small town of Victoria West (Appendix A: Map 1). The site is situated adjacent to the R63 tarred road, while access to it will be obtained via a 1.5 km long new access road. The footprint of the mining area will be 5 hectares in total, consisting of a hard rock quarry (1.5 hectares) and a separate stockpiling/crushing area (2.1 hectares). The site and surroundings still consist of natural vegetation, without any prominent disturbances. The only localised disturbances noted were a small dirt track, artificial impoundment, livestock pens and watering point, though these result in very little disturbance. The site forms part of an arid region and consequently watercourses are limited to a few small, ephemeral drainage lines, which feed into the artificial impoundment in the area.

According to Mucina & Rutherford (2006) and utilising current mapping resources (National Biodiversity Assessment 2018), the site falls within Eastern Upper Karoo (NKu 4) (Appendix A: Map 1). This vegetation type contains a varied topography with undulating plains, ridges, hills and uneven, rocky terrain, incised by a high number of small watercourses. This vegetation type is currently listed as being of Least Concern (LC) under the National List of Threatened Ecosystems (Notice 1477 of 2009) (National Environmental Management Biodiversity Act, 2004) (Appendix A: Map 1). The vegetation type is not under sufficient development pressures to be considered a threatened ecosystem. This will also decrease the conservation value of remaining natural vegetation.

The Northern Cape Critical Biodiversity Areas Plan (2024) has recently been published and has identified areas which are essential to meeting conservation targets for specific vegetation types, i.e., Critical Biodiversity Areas. The site and surroundings are not considered essential to meeting conservation targets and are listed as Other Natural Areas (ONA) (Appendix A: Map 2). The site is therefore not considered as essential to meeting conservation targets for the area and therefore has a fairly low default conservation value. Areas to the east and west (4 km to either side) are listed as Critical Biodiversity Areas (CBA) 1 and 2, providing habitat to threatened bird and mammal species, further substantiating that the site is not considered suitable habitat for threatened fauna (this is most relevant to the Ludwig's Bustard and Riverine Rabbit, See Section 4.2).

The footprint of the proposed MP is clearly completely natural, with very few disturbances present. This has also been confirmed by the current survey as well as the National Biodiversity Assessment (2018), which indicates natural vegetation, in a good condition and without any exotic weeds or invasive species (Appendix A: Map 1). The area is dominated by low ridges and hills, draining toward a lower lying plain to the north, which also contains several small drainage lines transecting it. This results in a moderate diversity of habitat which includes low ridges, rocky and sandy habitats and drainage lines supporting a low but dense riparian vegetation layer. As a result of the moderate habitat diversity, the area also contains a

moderate species diversity which includes scant dwarf karroid shrubs, grasses, succulents and geophytic species.

Tracks and signs of mammals are abundant on and around the site. As indicated (Section 4.1), the area is still largely natural and consequently the mammal population should also largely still be intact. However, the area is utilised for stock farming, which will undoubtedly have an impact on the mammal population in the area. This has, over centuries, resulted in the removal of large ungulates and most carnivores from the area, while the use of jackal-proof fencing and control of smaller carnivores have also modified the mammal population in the area. It may however still be possible for species of conservational importance to be present in the area. The mammal population is therefore anticipated to be modified, l with some decrease in the capacity provided by the natural habitat likely, though species of conservation value may still be present. However, the footprint of the proposed mining operations (5 hectares) is not anticipated to have a large impact on the mammal population, when seen in context of the extensive natural areas which are present in the surroundings, providing adequate habitat for the local mammal population, thus resulting in the anticipated impact remaining moderate, which is however dependent on mitigation as listed being successfully implemented.

From the description of the vegetation on the site, including the rock quarry, stockpiling area and access road, it consists of natural vegetation which is still in a fairly good condition (Appendix A: Map 1). Areas of disturbance are present but are indicative of only low levels of disturbance. The species diversity is moderate, although the area does contain a significant number of protected plant species which will contribute towards its conservation value (Appendix B). The site therefore still contains elements of significant conservation value, which include protected plant species and drainage lines along the access road (Appendix A: Map 3). Significant mitigation will therefore have to be implemented to ensure the impact on these elements of significant conservation value is decreased. In addition, the vegetation type in this area, Eastern Upper Karoo, is widespread and listed as being of Least Concern (LC), with a relatively low conservation value confirmed by the Northern Cape Critical Biodiversity Areas Plan (2024), which regards the area as an Other Natural Area (ONA) (Appendix A: Map 2). The site does however form part of a National Protected Areas Expansion Strategy (NPAES): Focus Area, which, due to the limited extent (5 hectares) of the development, is unlikely to be compromised. A moderate sensitivity for the site is therefore maintained and the impact of the loss of vegetation and species diversity is therefore considered to be moderate.

Mitigation as indicated in the previous paragraph should include the following (Appendix A: Map 1 - 3):

- As indicated, several of the succulent and geophytic species occurring on the site are regarded as protected within the Northern Cape Province (Appendix B). Where the development will affect any of these, the necessary permits will have to be obtained. Many of these species are fairly common, widespread and abundant and, with the necessary permits, can simply be removed. However, several are uncommon, localised species and at least a fair portion of affected plants should be transplanted to adjacent areas where they will remain unaffected. These species include *Albuca crispa, Aloe broomii, Stomatium rouxii, Anacampseros filamentosa, Trichodiadema setulifolium, Crassula deltoidea, Euphorbia caterviflora, Haworthiopsis venosa* subsp. *tessellata, Pachypodium succulentum, Pelargonium obratanifolium, Duvalia corderoyi, Euphorbia arida, Adromischus trigynus* and *Ceropegia filiformis*. These geophytic and succulent species are easily transplanted with a high success rate.

- Several small drainage lines are likely to be crossed by the proposed access road and they should also be taken into account in order to ensure the impact on them is kept to a minimum. Protection from erosion will also be particularly relevant at these crossings.

- In addition, the area contains no exotic weeds or invasive species. However, disturbance caused by mining is highly likely to leave disturbed areas vulnerable to infestation, with the invasive *Prosopis glandulosa* tree being of particular concern, as it is well known to be heavily invasive in this region. The proposed mining operations will therefore have to implement a comprehensive monitoring and eradication programme to ensure that invasive plant species (particularly *Prosopis glandulosa*) are removed from the area and prevented from re-establishing.

The impact significance has been determined and should mining take place without mitigation, some impacts may be high, such as the impact of the loss of protected species (Appendix A: Map 1 - 3). The majority of impacts will however be moderate. However, should adequate mitigation be implemented as described, these can all be reduced to moderate impacts. This is however subject to the mining area implementing mitigation to ensure that protected plant species are transplanted, limiting the impact on fauna by implementing suitable mitigation, implementing a comprehensive monitoring and eradication programme to address weeds and invasive species and undertaking comprehensive rehabilitation.

9. RECOMMENDATIONS

- Where mining operations occur, it is important that comprehensive rehabilitation and monitoring of the rehabilitation take place.

- Correct topsoil and seedbank management will be paramount to successful rehabilitation. Where disturbance or excavation will occur, the upper 30 cm, or topsoil, should be removed, together with the vegetation, and stored on the site. Even where very shallow soils occur and topsoil may be perceived to be absent, the soil surface, including any residual soils, stone and gravel, will contain a seedbank, together with any vegetation material, which will be crucial to rehabilitation. The topsoil, together with the seedbank and any vegetation material, should then be placed on top of the rehabilitated soil surface. Subsoil should be used as backfilling and not as top dressing. Only removed topsoil should be utilised to rehabilitate the disturbed surface. The rehabilitated quarry and stockpile areas should be incorporated into the surrounding landscape as far as possible.

- Rehabilitation of the quarry should aim to establish a free draining pit, without any sheer drops or cliffs and sloping sides, while endeavouring to integrate it into the surrounding topography as well as is feasible.

- The proposed quarry should incorporate adequate storm water management principles, divert clean runoff around the site and retain dirty storm water within it.

- Monitoring of erosion should take place and should any erosion be noted, this must be remedied.

- The exotic species occurring on the site must be eradicated as mining progresses (Appendix B). It is also recommended that the eradication of exotic species be rigidly maintained and form part of the management of the mining process.

- Adequate monitoring of weed establishment and its continued eradication must be maintained (Appendix B). Where category 1 and 2 weeds occur, they require removal by the property owner according to the Conservation of Agricultural Resources Act, No. 43 of 1983 and National Environmental Management: Biodiversity Act, No. 10 of 2004.

- The area proposed for the mining operations contains numerous protected species which have significant conservation value and will require mitigation (Appendix B):
    - Many of the affected protected species are cryptic and inconspicuous and it is recommended that a walkthrough survey be conducted prior to the site being cleared. This should include identification and marking of all protected plants on the site and should be performed by an ecologist or botanist.
    - These protected species include *Moraea polystachya, Albuca crispa, Ruschia intricata, Aloe broomii, Stomatium rouxii, Anacampseros filamentosa, Crassula capitella* subsp. *thyrsiflora, Trichodiadema setulifolium, Crassula deltoidea, Delosperma multiflorum, Crassula muscosa, Euphorbia caterviflora, Haworthiopsis venosa* subsp. *tessellata, Pachypodium succulentum, Crassula coralina, Pelargonium obratanifolium, Duvalia corderoyi, Euphorbia arida, Crassula subaphylla, Adromischus trigynus* and *Ceropegia filiformis*. In addition, the species *Pelargonium obratanifolium* is listed as a specially protected

species, thus also of high conservation value. Where the development will affect any of these, the necessary permits will have to be obtained.

- Many of these species are fairly common, widespread and abundant and, with the necessary permits, can simply be removed.
- However, several are uncommon, localised species and at least a fair portion of affected plants should be transplanted to adjacent areas where they will remain unaffected. These species include *Albuca crispa, Aloe broomii, Stomatium rouxii, Anacampseros filamentosa, Trichodiadema setulifolium, Crassula deltoidea, Euphorbia caterviflora, Haworthiopsis venosa* subsp. *tessellata, Pachypodium succulentum, Pelargonium obratanifolium, Duvalia corderoyi, Euphorbia arida, Adromischus trigynus* and *Ceropegia filiformis*. These geophytic and succulent species are easily transplanted with a high success rate.
- Protected plants occurring on the site are listed as such under the Northern Cape Nature Conservation Act No. 9 of 2009.

- Mining activities may affect the faunal population and care should therefore be taken to ensure none of the faunal species on site are harmed. The following mitigation should be implemented to reduce the anticipated impact on fauna:
  - In order to ensure no direct impact on the fauna on the site occurs, the hunting, capturing or trapping of fauna on the site should be strictly prohibited during operation of the mining development. This includes, but is not limited to, mammals, reptiles and birds.
  - Open excavations may act as pitfall traps to mammals, reptiles and amphibians and trenches should be monitored daily for trapped animals which should promptly be removed.
  - In the event of poisonous snakes or other dangerous animals encountered on the site, an experienced and certified snake handler or zoologist must remove these animals from the site and re-locate them to a suitable area.
  - After cessation of mining activities, the area should be completely rehabilitated, which is particularly applicable to the stockpile area and rock quarry. The rock quarry should be rehabilitated to such an extent that it contains no sheer drops or cliffs, so that any fauna entering it should be able to freely leave the quarry and so that no fauna falling into the quarry are injured due to sheer drops (this is also particularly applicable to tortoises).
  - No overhead powerlines are currently associated with the development, however, should this be considered for the development, additional avifaunal assessment will be required.

- No littering must be allowed and all litter must be removed from the site.

- Monitoring of mining operations and compliance with recommended mitigation measures must take place.

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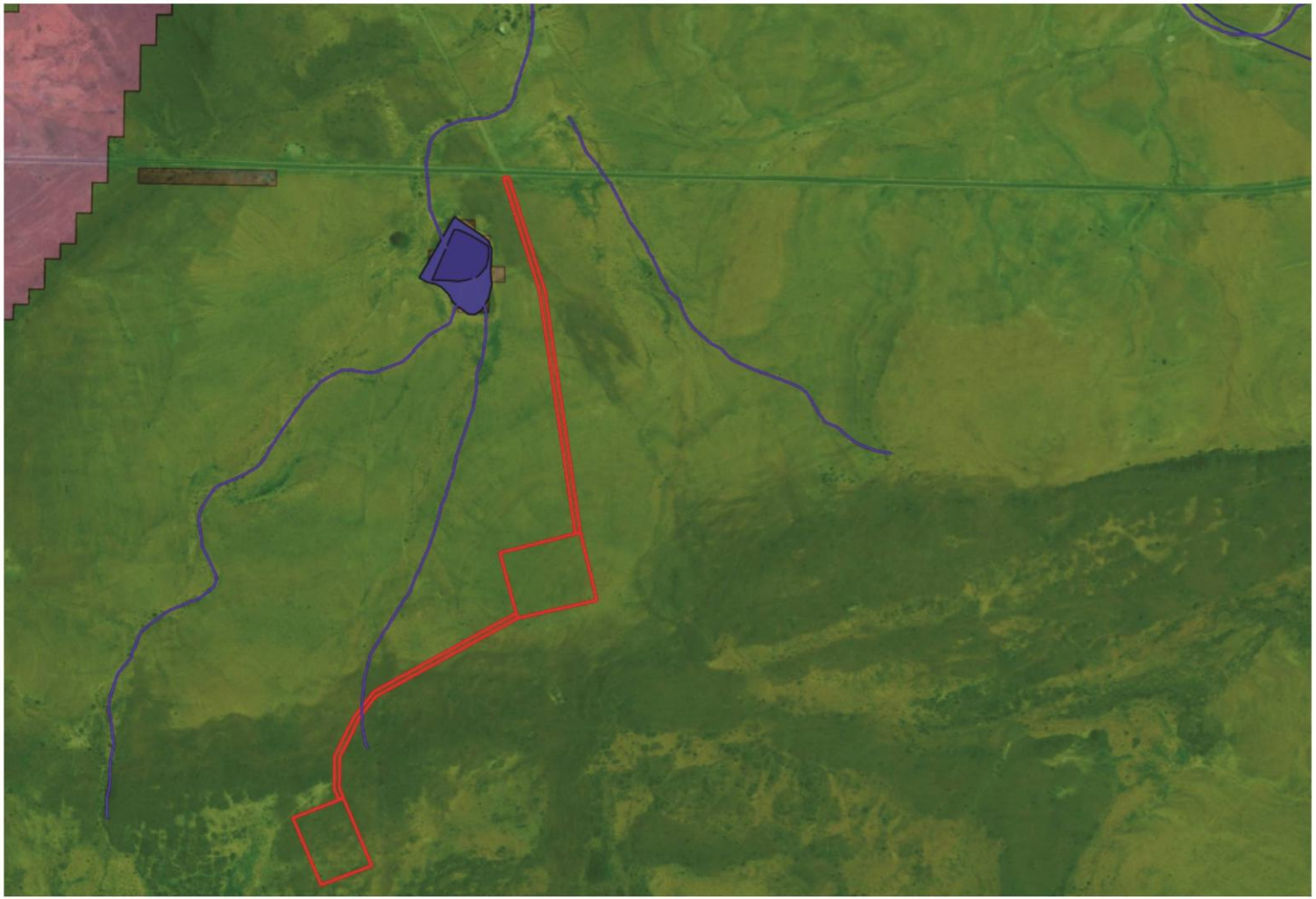
Appendix A: Maps

Locality and general ecology map for the proposed rock quarry on the farm Vingerfontein 162 situated near Victoria West, Northern Cape Province.



Preparred for:
Greenmined Environmental
De Beers Avenue
Somerset West
7130

Legend:

- Study area
- Watercourses
- Wetlands and impoundments
- Eastern Upper Karoo
- Upper Karoo Hardeveld

Map Information

Spheroid: WGS 84

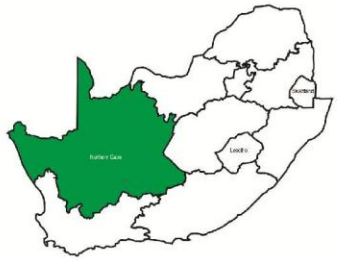
Quantum GIS

Scale: 1:12 000

DPR Ecologists
Contact Darius van Rensburg at:
darius@dprecologists.co.za
P.O. Box 12726, Brandhof, 9324
Tel: 083 410 0770

Map 1: Locality and general ecology map of the proposed rock quarry on the farm Vingerfontein 162 situated near Victoria West. Remaining natural vegetation in the area is indicated, which confirms the area containing extensive natural vegetation, with very little transformation having occurred. The development will consist of a new access road, upper quarry area and lower stockpile/crushing area. Note also the presence of several small drainage lines in the area, draining from the higher lying hills and ridges and into an artificial impoundment.

Northern Cape Biodiversity Spatial Plan map for the proposed rock quarry on the farm Vingerfontein 162 situated near Victoria West, Northern Cape Province.



Preparred for:
Greenmined Environmental
De Beers Avenue
Somerset West
7130

Legend:

- Study area
- Watercourses
- Wetlands and impoundments
- Critical Biodiversity Area 1
- Critical Biodiversity Area 2
- Ecological Support Area
- Other Natural Area

Map Information

Spheroid: WGS 84

Quantum GIS

Scale: 1:12 000

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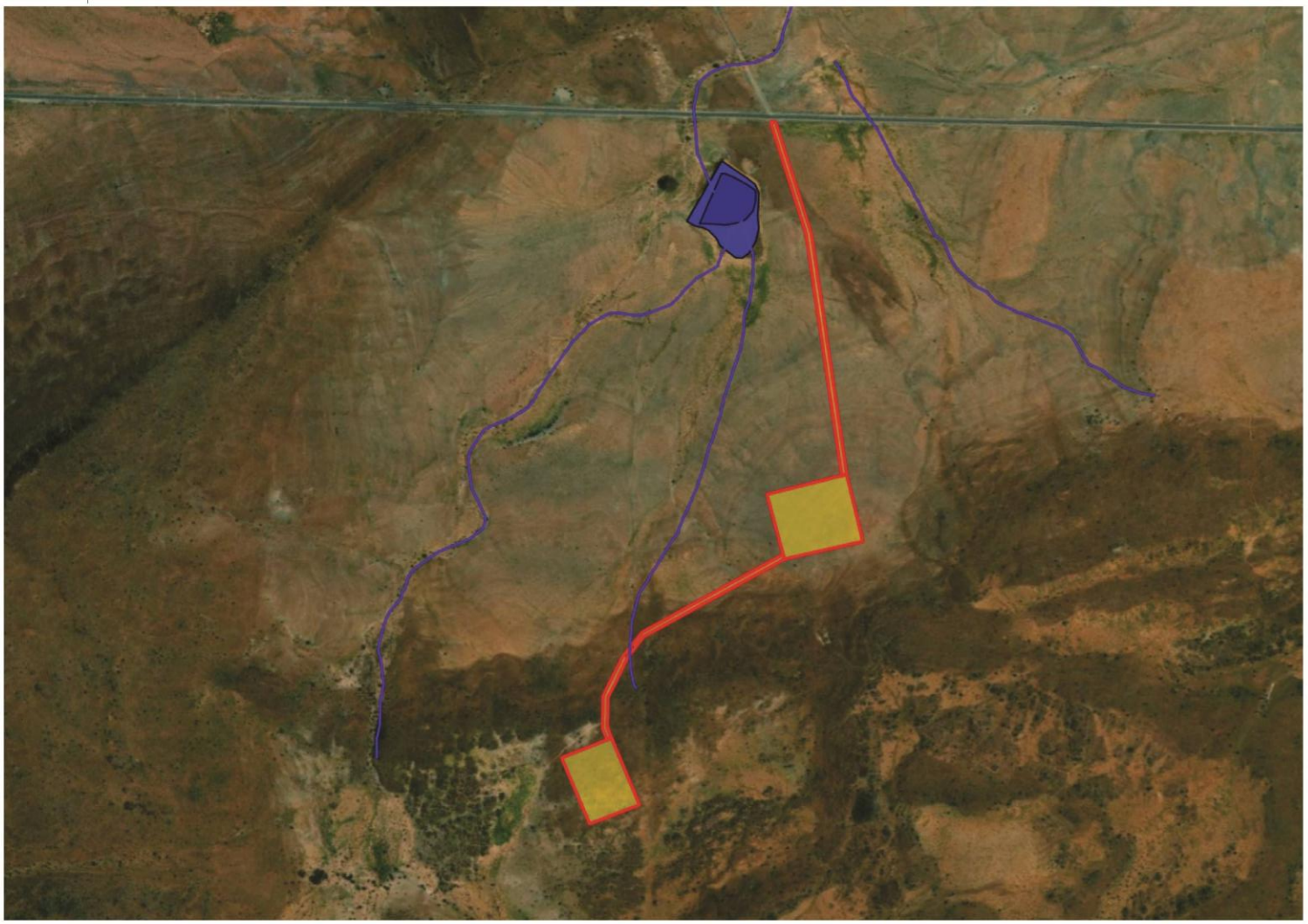
Map 2: Northern Cape Biodiversity Spatial Plan map of the proposed rock quarry on the farm Vingerfontein 162 situated near Victoria West. The site and surroundings are all regarded as Other Natural Areas (ONA), indicating that it is not considered essential for meeting conservation targets and thus decreasing its conservation value to some degree. Areas os transformation (notable the R63 tarred road), are considered as transformed and not included in the map. Larger watercourses are regarded as Ecological Support Areas (North East of the site), also indicating the imnportance of watercourses in the landscape, also being relevant to the smaller drainage lines on the site.

Terrestrial ecological sensitivity map for the proposed rock quarry on the farm Vingerfontein 162 situated near Victoria West, Northern Cape Province.



Preparred for:
Greenmined Environmental
De Beers Avenue
Somerset West
7130

Legend:

- Study area
- Watercourses
- Wetlands and impoundments
- Very High Sensitivity
- High Sensitivity
- Moderate Sensitivity
- Low Sensitivity

Map Information

Spheroid: WGS 84

Quantum GIS

Scale: 1:12 000

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Map 3: Terrestrial ecological sensitivity map of the proposed rock quarry on the farm Vingerfontein 162 situated near Victoria West. All the components of the site consist of natural vegetation in relatively good condition and therefore not be regarded as being of low sensitivity. However, the vegetation type is still widespread, while the site is also not considered essential to meet conservation targets (See Map 2) and does not contain elements of very high conservation value (endangered species or unique habitats) and as a result is considered to have a Moderate Sensitivity overall. The smaller drainage lines in the area does not form part of the site, but may be crossed by the access road and these are considered to be of High Sensitivity.

Appendix B: Species list

Species indicated with an * are exotic.

Protected species are coloured orange and Red Listed species red.

Species	Growth form
Adromischus trigynus	Succulent
Albuca crispa	Geophyte
Aloe broomii	Succulent
Amphiglossa triflora	Dwarf shrub
Anacampseros filamentosa	Succulent
Aptosimum indivisum	Herb
Aptosimum sp.	Dwarf shrub
Aptosimum spinescens	Dwarf shrub
Aristida congesta	Grass
Aristida diffusa	Grass
Asparagus mucronatus	Dwarf shrub
Asparagus suaveolens	Dwarf shrub
Bulbine frutescens	Succulent
Ceropegia filiformis	Geophyte
Chaenostoma caeruleum	Herb
Chascanum pinnatifidum	Herb
Cheilanthes eckloniana	Fern
Chrysocoma ciliata	Dwarf shrub
Crassula capitella subsp. *thyrsiflora*	Succulent
Crassula deltoidea	Succulent
Crassula muscosa	Succulent
Crassula subaphylla	Succulent
Curio radicans	Succulent
Delosperma multiflorum	Succulent
Digitaria eriantha	Grass
Dipcadi ciliare	Geophyte
Drimia calcarata	Geophyte
Drimia elata	Geophyte
Drimia vermiformis	Geophyte
Duvalia corderoyi	Succulent
Enneapogon desvauxii	Grass
Eragrostis lehmanniana	Grass
Eragrostis nindensis	Grass
Eragrostis nindensis	Grass
Eragrostis obtusa	Grass
Eragrostis trichophora	Grass
Eriocephalus ericoides	Dwarf shrub
Euphorbia arida	Succulent
Euphorbia caterviflora	Succulent

Felicia muricata	Herb
Fingerhuthia africana	Grass
Gazania krebsiana	Herb
Gnidia polycephala	Dwarf shrub
Gomphocarpus filiformus	Herb
Haworthiopsis venosa subsp. *tessellata*	Succulent
Helichrysum lucilioides	Dwarf shrub
Hermannia coccocarpa	Herb
Hermannia filifolia	Dwarf shrub
Hermannia pfeilii	Dwarf shrub
Heteropogon contortus	Grass
Indigofera sessilifolia	Dwarf shrub
Jamesbrittenia pinnatifida	Dwarf shrub
Lacomucinea lineata	Shrub
Ledebouria aprtiflora	Geophyte
Limeum aehtiopicum	Herb
Lotononis sp.	Herb
Lycium cinerium	Dwarf shrub
Melolobium candicans	Dwarf shrub
Monsonia salmoniflorum	Succulent
Moraea polystachya	Geophyte
Nenax microphylla	Dwarf shrub
Ophioglossum sp.	Fern
Oropetium capense	Grass
Pachypodium succulentum	Succulent
Pelargonium abrotanifolium	Dwarf shrub
Pentzia incana	Dwarf shrub
Pteronia ciliata	Dwarf shrub
Pteronia glauca	Dwarf shrub
Rhigozum obovatum	Shrub
Rosenia oppostifolia	Dwarf shrub
Ruschia intricata	Succulent
Salsola aphylla	Dwarf shrub
Searsia burchellii	Shrub
Solanum tomentosum	Herb
Sporobolus fimbriatus	Grass
Stomatium rouxii	Succulent
Themeda triandra	Grass
Tragus koelerioides	Grass
Trichodiadema setuliferum	Succulent
Wahlenbergia nodosa	Dwarf shrub

Appendix C: Impact methodology

The environmental significance assessment methodology is based on the following determination:
Environmental Significance = Overall Consequence x Overall Likelihood

Determination of Consequence

Consequence analysis is a mixture of quantitative and qualitative information, and the outcome can be positive or negative. Several factors can be used to determine consequence. For the purpose of determining the environmental significance in terms of consequence, the following factors were chosen: **Severity/Intensity, Duration and Extent/Spatial Scale.** Each factor is assigned a rating of 1 to 5, as described below and in tables 6, 7, 9 and 10.

Determination of Severity

Severity relates to the nature of the event, aspect or impact to the environment and describes how severely the aspects may impact on the biophysical and socio-economic environment.
Table 7 will be used to obtain an overall rating for severity, taking into consideration the various criteria.

Table 7: Rating of severity

Type of criteria	**Rating**				
	1	**2**	**3**	**4**	**5**
Quantitative	0-20%	21-40%	41-60%	61-80%	81-100%
Qualitative	Insignificant / Non-harmful	Small / Potentially harmful	Significant / Harmful	Great / Very harmful	Disastrous Extremely harmful
Social/ Community response	Acceptable / I&AP satisfied	Slightly tolerable / Possible objections	Intolerable/ Sporadic complaints	Unacceptable / Widespread complaints	Totally unacceptable / Possible legal action
Irreversibility	Very low cost to mitigate/ High potential to mitigate impacts to level of insignificance / Easily reversible	Low cost to mitigate	Substantial cost to mitigate / Potential to mitigate impacts / Potential to reverse impact	High cost to mitigate	Prohibitive cost to mitigate / Little or no mechanism to mitigate impact/ Irreversible
Biophysical (Air quality, water quantity and quality, waste production, fauna and flora)	Insignificant change / deterioration or disturbance	Moderate change / deterioration or disturbance	Significant change / deterioration or disturbance	Very significant change / deterioration or disturbance	Disastrous change / deterioration or disturbance

Determination of Duration
Duration refers to the amount of time that the environment will be affected by the event, risk or impact, if no intervention e.g. remedial action takes place.

Table 8: Rating of Duration

Rating	Description
1: Low	Almost never / almost impossible
2: Low-Medium	Very seldom / highly unlikely
3: Medium	Infrequent / unlikely / seldom
4: Medium-High	Often / regularly / likely / possible
5: High	Daily / highly likely / definitely

Determination of Extent/Spatial Scale
Extent refers to whether the spatial influence of an impact be local (extending only as far as the activity, or will be limited to the site and its immediate surroundings), regional (will have an impact on the region), national (will have an impact on a national scale) or international (impact across international borders).

Table 9: Rating of Extent / Spatial Scale

Rating	Description
1: Low	Immediate, fully contained area
2: Low-Medium	Surrounding area
3: Medium	Within Business Unit area of responsibility
4: Medium-High	Within Mining Boundary area
5: High	Regional, National, International

Determination of Overall Consequence
Overall consequence is determined by adding the factors determined above and summarised below, and then dividing the sum by 4.

Table 10: Example of calculating Overall Consequence

Consequence	Rating
Severity	Example 4
Duration	Example 2
Extent	Example 4
SUBTOTAL	10
TOTAL CONSEQUENCE:(Subtotal divided by 4)	3.3

Likelihood
The determination of likelihood is a combination of Frequency and Probability. Each factor is assigned a rating of 1 to 5, as described below and in Table 11 and Table 12.

Determination of Frequency
Frequency refers to how often the specific activity, related to the event, aspect or impact, is undertaken.

Table 11: Rating of frequency

Rating	Description
1: Low	Once a year or once/more during operation/LOM
2: Low-Medium	Once/more in 6 Months
3: Medium	Once/more a Month
4: Medium-High	Once/more a Week
5: High	Daily

Determination of Probability

Probability refers to how often the activity/event or aspect will have an impact on the environment.

Table 12: Rating of probability

Rating	Description
1: Low	Almost never / almost impossible
2: Low-Medium	Very seldom / highly unlikely
3: Medium	Infrequent / unlikely / seldom
4: Medium-High	Often / regularly / likely / possible
5: High	Daily / highly likely / definitely

Overall Likelihood

Overall likelihood is calculated by adding the factors determined above and summarised below, and then dividing the sum by 2.

Table 13: Example of calculating the overall likelihood

Consequence	Rating
Frequency	Example 4
Probability	Example 2
SUBTOTAL	6
TOTAL LIKELIHOOD (Subtotal divided by 2)	3

Determination of Overall Environmental Significance

The multiplication of overall consequence with overall likelihood will provide the environmental significance, which is a number that will then fall into a range of LOW, LOW-MEDIUM, MEDIUM, MEDIUM-HIGH or HIGH, as shown in the table below.

Table 14: Determination of overall environmental significance

Significance or Risk	Low	Low-Moderate	Moderate	Moderate-High	High
Overall Consequence X Overall Likelihood	1 - 4.9	5 - 9.9	10 - 14.9	15 – 19.9	20 - 25

Qualitative description or magnitude of Environmental Significance

This description is qualitative and is an indication of the nature or magnitude of the Environmental Significance. It also guides the prioritisations and decision making process associated with this event, aspect or impact.

Table 15: Description of the environmental significance and the related action required.

Significance	Low	Low-Moderate	Moderate	Moderate-High	High
Impact Magnitude	Impact is of very low order and therefore likely to have very little real effect. Acceptable.	Impact is of low order and therefore likely to have little real effect. Acceptable.	Impact is real, and potentially substantial in relation to other impacts. Can pose a risk to the company.	Impact is real and substantial in relation to other impacts. Poses a risk to the company. Unacceptable.	Impact is of the highest order possible. Unacceptable. Fatal flaw.
Action Required	Maintain current management measures. Where possible, improve.	Maintain current management measures. Implement monitoring and evaluate to determine potential increase in risk. Where possible, improve.	Implement monitoring. Investigate mitigation measures and improve management measures to reduce risk, where possible.	Improve management measures to reduce risk.	Implement significant mitigation measures or implement alternatives.