BIODIVERSITY ASSESSMENT

PROPOSED DOLOMITIC LIMESTONE MINE ON PORTION 4 OF FARM WELVERDIEND NO 511, NEAR VANRHYNSDORP

August 2018

View towards the proposed mining site (mid distance) from the N7, with Gifberg in the background.

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1 INTRODUCTION

This report investigates the biodiversity impacts of the proposed extension (30 ha) of an approved limestone mine on Portion 4 of Farm Welverdiend No 511, near Vanrhynsdorp (see Map 1). The proposed mining site is located on a relatively flat plain at the foot of the Matsikamma Mountains. The general area is covered with a mixture of low shrubland and grassland. An existing access road (partially tarred) provides access to the mining site. According to the 2006 Vegetation Map of South Africa, the site is located in Knersvlakte Dolomite Vygieveld and Vanrhynsdorp Gannabosveld. Also found in the general area to the south of the Wiedou River is Klawer Sandy Shrubland and Namaqualand Riviere along the Widou River itself.

Map 1 Satellite photo showing the location of the proposed mining site (red asterisk) between Klawer and Vanrhynsdorp.

Cape Lime (Pty) Ltd, a subsidiary of Afrimat Ltd, currently mine and process limestone and dolomite on the Farm Vaderlandsche Rietkuil, 7 km east of the proposed project. The current activities entail, apart from mining of limestone and dolomite, crushing and screening of all mined material, as well as calcination of limestone in a fluid bed lime kiln. The markets currently served are water treatment, glass industry, aggregates, mineral fillers and chemical industries.

The extent of the current limestone deposit being mined is such that it cannot support the supply of limestone to additional processing facilities without drastically reducing the life of the resource. Expansion in terms of additional capacity on the current site is also limited due to numerous constraints. Cape Lime is confronted on a regular basis with enquiries with regard to supply of high quality white lime products to potential new projects in South Africa, for which Cape Lime does not have the current production capacity.

Cape Lime has been awarded a mining right for the proposed mining activity by the Department of Mineral Resources (DMR) in terms of Section 22 of the Mineral & Petroleum Resources Development Act of 2002. Subsequently, environmental authorisation has been obtained in terms of the NEMA (Act 107 of 1998) related to mining activities on ±5.2 ha. It was followed by a General Authorization in terms of Section 39 of the National Water Act of 1998, as well as authorization by the Matzikama Municipality in terms of the LUPO (No 15 of 1985). The application for the approval of the current EIA is triggered by the enlarged mining area, still well within the approved Mining Right area of 321 ha, and the establishment of lime kilns.

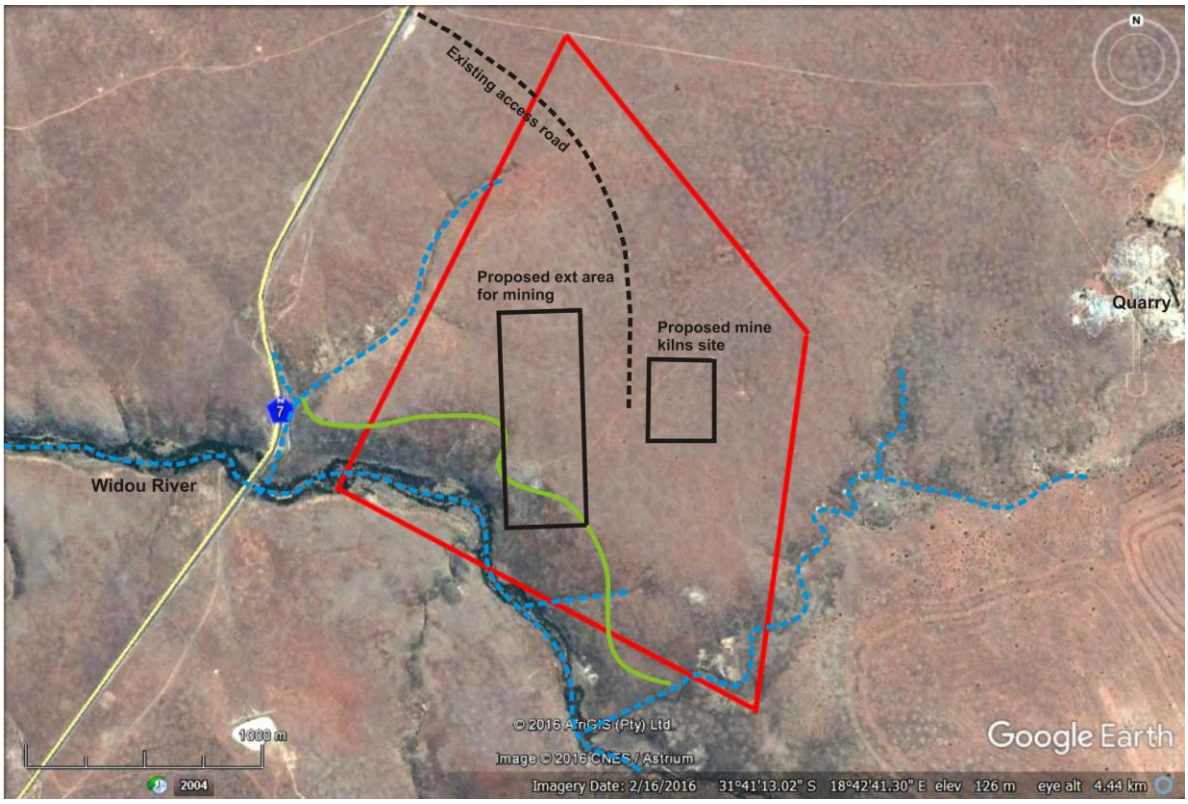
2 PROJECT DESCRIPTION

The proposed mining project entails the clearing of ±30 ha of undeveloped land for the prospect of mining limestone deposits, the erection of a crushing plant, four fluid bed lime calciners and associated infrastructure. The layout will be planned to allow the phasing in of the four kilns to the process line as and when required. It will also include related logistical facilities, workshops and an office complex. Access roads to the facilities will be extended from the existing tarred access road from the N7. The total footprint of the project on the subject property will be ±30 ha and the process plant and logistical facilities will have a maximum footprint of ±9 ha (see Map 2 below).

Mining will be done by removal of overburden to expose the underlying limestone. Overburden thickness varies from virtually none on the southern end of the deposit to ±10 m on the northern side. This allows strip mining to be done by drilling and blasting ±30 m wide and 50 m long strips on the shallow end of the deposit. This will facilitate backfilling of the southern end of the excavation to commence relatively early (±3 years after the start of operations), thereby minimising the need for overburden stockpiles. This will assist in minimising the visual impact of the operation and expedite rehabilitation of backfilled slopes. Excavation of blasted limestone will be done by an excavator and trucks will haul the limestone to the crushing plant.

Crushing will consist of a three stage crushing operation to reduce the limestone to <6 mm particle size. Co-products in the crushing and screening process will be <1 mm material,

which will be supplied to customers in the glass and industrial minerals industry. The <6 mm material will be stockpiled for use as feed to the lime kilns. The latter will be fed by a limestone feed conveyor. The coal to be used as fuel in the kilns will also be fed from a coal stockpile, via a coal conveyor. Lime produced will be stored in silos before being dispatched to various clients. Support infrastructure to be provided, include workshops, a laboratory for quality control test work, administrative offices and a weighbridge.



Map 2 Google Earth photo showing the position of the proposed mining extension area and mine kilns site (outlined in black). The mining rights area is outlined in red. The green line indicates the boundary between the good quality vygieveld on the steeper slope above the Widou River and the grassy area to the north. The blue lines indicate watercourses.

3 TERMS OF REFERENCE

The terms of reference for this study are as follows:

- To determine if vegetation of high conservation value will be affected by the project. Reference will be made to its conservation value and potential impact on ecological linkages, CBA's, etc.
- To determine if any rare and threatened (Species of Conservation Concern) plant species will be affected.
- To assess the impacts on flora and vegetation.
- To propose mitigation measures to be included in method statements to ensure that

the impact on biodiversity is minimised.

4 METHODOLOGY

A biodiversity survey of the site was undertaken on 14-15 November 2016, and a follow-up survey on 6 August 2018. A qualitative assessment of the type and condition of the affected vegetation, disturbance and presence of alien species and Species of Conservation Concern was carried out. Plant species not identified in the field, were collected or photographed and identified at the Compton (Kirstenbosch) Herbarium. John Manning (Compton Herb), Dee Snijman and Cornelia Klak (Bolus Herb) kindly assisted with the identification of a few of the bulbs and vygies. Mucina & Rutherford's (2006) vegetation map and the latest floristic taxonomic literature and reference books were used for the purpose of this specialist study. Any plants classified as rare or endangered in the Red List of South African Plants online database are highlighted. The assessment follows Brownlie's (2005), CapeNature and other relevant guidelines for biodiversity assessments.

The following information was recorded during the site visit:

1. The condition of the vegetation. Is the vegetation either disturbed or degraded? A disturbed or degraded area could range from old/existing agricultural fields (fallow land), or areas previously disturbed by construction activities, to an area that has been severely eroded or degraded as a result of bad land management.
2. The species diversity. This refers to the numbers of different indigenous plant and animal species occurring on site.
3. Species of Conservation Concern occurring on site. This would include rare, vulnerable, endangered or critically endangered plants and animals (where possible).
4. Fatal flaws. These would include finding large numbers of threatened plants or local endemics that would be negatively impacted upon if project was allowed to continue.
5. Identification of the vegetation type(s) on the site. This would include trying to establish the known range of a vegetation type and whether or not this vegetation type is vulnerable (VU), endangered (EN) or critically endangered (CR).

5 LIMITATIONS TO THE STUDY

Since fieldwork was carried out during the beginning and after the spring season, flowering plants that only flower at other times of the year (e.g. autumn to early winter) may have been missed. The findings are supplemented with the findings of other botanical studies undertaken in the area for previous mining applications. The overall confidence in the completeness and accuracy of the botanical findings is therefore considered to be moderate to good.

6 LOCALITY & BRIEF SITE DESCRIPTION

The study site is located in the Knersvlakte, a topographically uniform area or plain that stretches from Klawer in the south to Kliprand in the north (see Map 1). The surrounding area comprises a relatively flat area that dips gently down towards the Widou River on the southern boundary of the Mining Right area (see Photo 1). The Gifberg forms a dramatic backdrop 7 km to the east. The underlying geology comprises Namibian Gariep Supergroup metasediments, in particular dolomite-rich sediments (Mucina & Rutherford 2006). Limestone is exposed on the steeper slopes above the Widou River (see Photo 2). The surrounding area is mostly untransformed and used for grazing (sheep farming). The Olifants River Valley, 15 km west of the site, supports wine farming as the main agricultural activity in the area.

Photo 1 Typical view across the northern portion of proposed mining site, looking southwards towards the Matsikamma Mountains. *Stipa capensis* is the dominant grass cover. *Salsola zeyheri* and *Atriplex lindleyi* subsp *inflata* are also common. Insert: Early spring view of northern portion.

7 BIOGEOGRAPHICAL CONTEXT

Being located in the north-western corner of the Western Cape interior, the site lies inside the Succulent Karoo Biome evidenced by a prominence of succulent shrubs, such as vygies, *Aloe falcata*, *Tylecodon wallichii* and *Euphorbia mauritanica*. Grasses are dominant in the disturbed

or overgrazed areas. The Vegetation Map of South Africa (Mucina & Rutherford 2006) classifies the main vegetation types found on site as Vanrhynsdorp Gannabosveld (SKk5) and Knersvlakte Dolomite Vygieveld (SKk6) (see Map 3). Klawer Sandy Shrubland (SKs13) and Namaqualand Riviere are located outside the proposed mining area to the south. Vanrhynsdorp Gannabosveld is found in the southern Knersvlakte between Vredendal and Vanrhynsdorp at the foot of the Matsikamma and Gifberg Mountains, as well as northeast of Vanrhynsdorp (Mucina & Rutherford 2006). The landscape is mainly flat or slightly undulating, supporting succulent shrubland dominated by *Salsola*, vygies and *Galenia* species (Mucina & Rutherford 2006). In the south, the plains can acquire a grassland appearance through seasonal dominance of certain grass species, such as *Bromus pectinatus* and *Stipa capensis* (Mucina & Rutherford 2006).

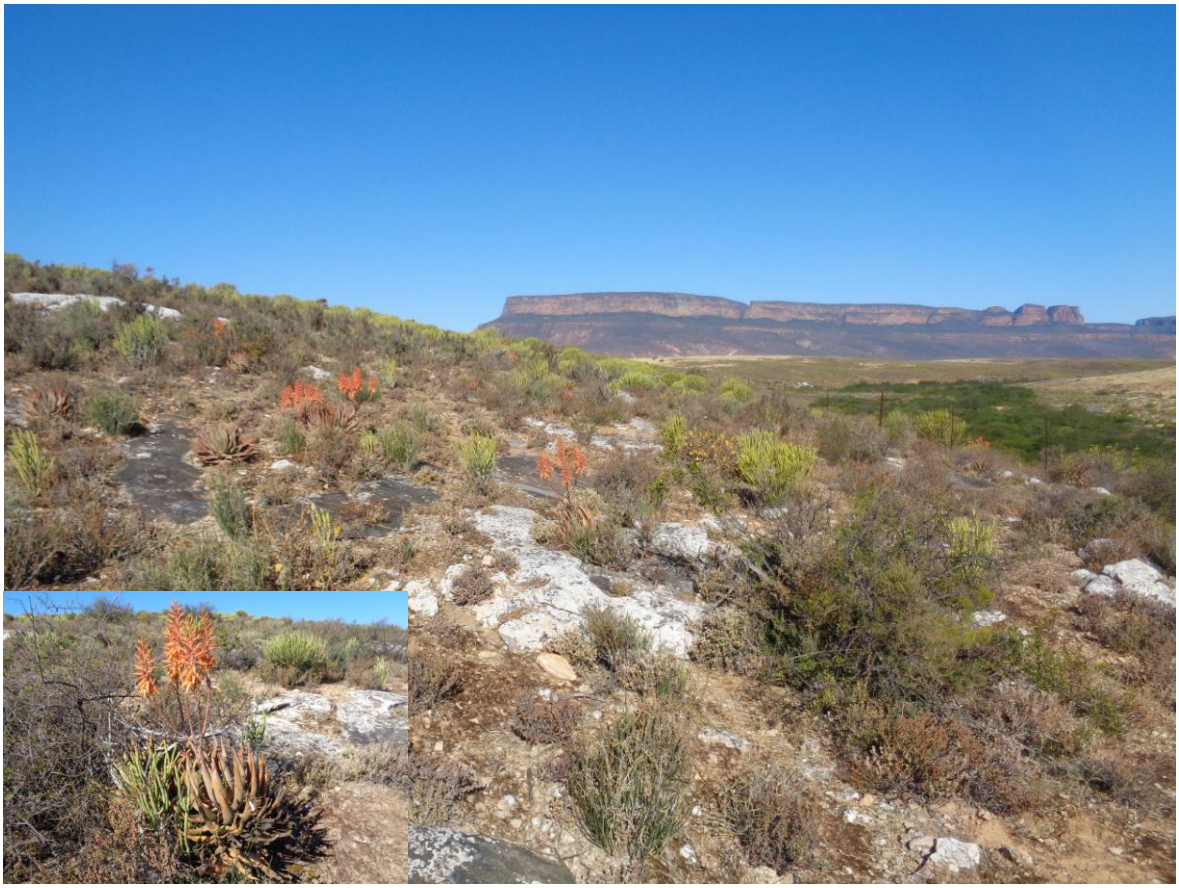
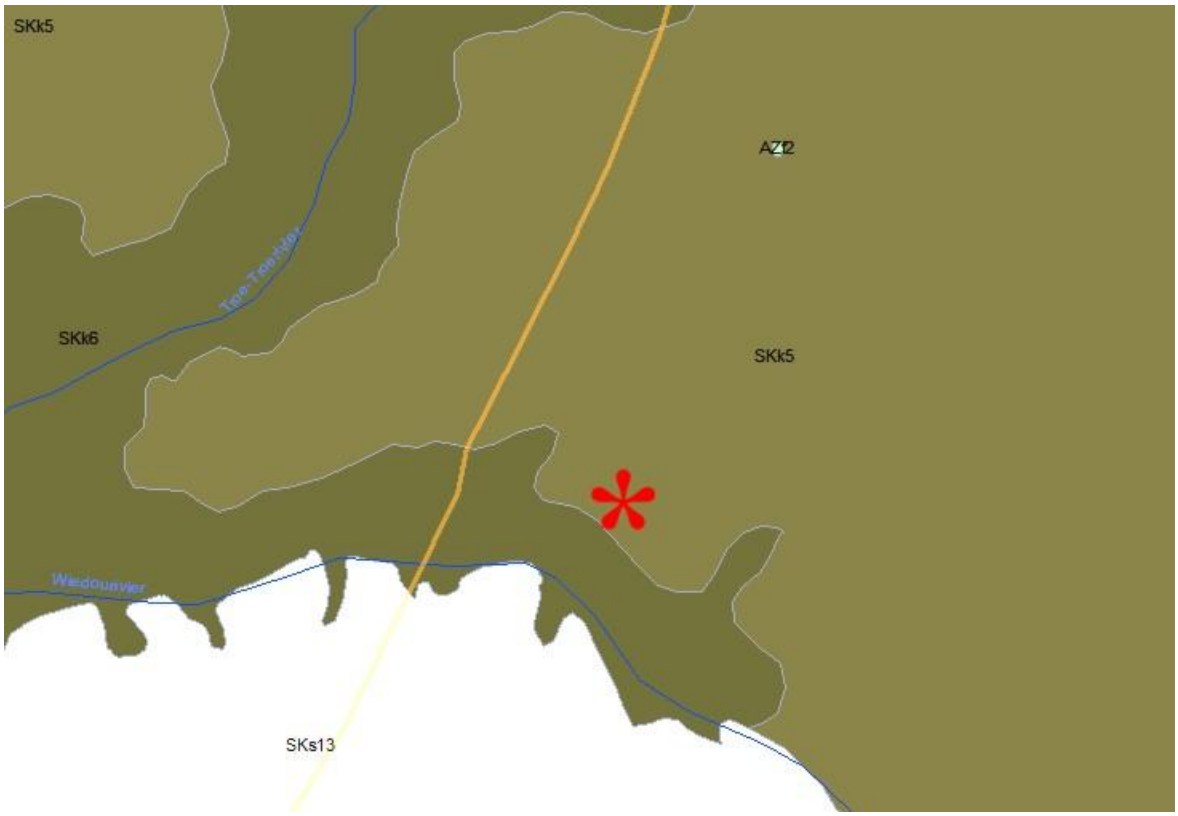


Photo 2 Knersvlakte Dolomite Vygieveld with exposed limestone. Insert: *Aloe falcata*.

According to the Vegetation Map of South Africa, Knersvlakte Dolomite Vygieveld follows the main river courses (Troe-troe and Wiedou Rivers) between Vanrhynsdorp and Vredendal. It is described as a sparse, succulent shrubland dominated by erect shrubs lower than 0.3 m with succulent leaves. Klawer Sandy Shrubland is restricted to the area south of the Troe-troe and Wiedou Rivers, and east of the Olifants River. It extends past Klawer southwards. It is also found on a slightly undulating landscape and foothills covered with medium dense, tall

shrubland. A narrow strip of Namaqualand Riviere vegetation is found along the Wiedou River where thickets of *Vachellia karroo* dominate on alluvial deposits.



Map 3 Extract of the SA Vegetation Map (Mucina & Rutherford 2006), showing the position of the study site (red asterisk) within Vanrhynsdorp Gannabosveld (SKk5) and Knersvlakte Dolomite Vygieveld (SKk6). Also found in the area to the south of the site are Klawer Sandy Shrubland (SKs13) and Namaqualand Riviere (along the Wiedou River).

8 VEGETATION, FLORA & FAUNA

The area proposed for the limestone mine comprises mainly a low grassland, dominated by *Stipa capensis*. *Salsola zeyheri* (vaalganna), *Atriplex lindleyi* subsp *inflata*, *A. vestita*, *Psilocaulon junceum*, *Asparagus capensis*, *Justicia cuneata*, *Hoplophyllum spinosum*, *Trachyandra falcata* and *Brunsvigia bosmaniae* (Maartblom) are also common (see Photo 1). The latter is especially plentiful on the eastern side of the site. The dominance of *Stipa capensis* indicates to disturbance or severe overgrazing. The increase in cover of *Stipa capensis* also reduces grazing potential for sheep due to wool damage by seeds.

Succulent shrubs are dominant on the steeper limestone slopes directly above the Widou River where a low, open shrubland prevails (see Photo 2). *Euphorbia mauritanica* (dominant), *Tylecodon wallichii*, *Mesembryanthemum nitidum*, *M. guerichianum*, *Ruschia cf. bolusiae*, *R. leucosperma*, *R. comptonii*, *Drosanthemum cf. deciduum*, *Aloe falcata*, *Didelta carnosa*, *D.*

spinosa, *Eriocephalus microphyllus*, *Pteronia succulenta*, *Elytropappus rhinocerotis, Berkheya fruticosa*, *Cotula microglossa, Gorteria diffusa, Asparagus retrofractus*, *Cyphia crenata*, *Roepera morgsana*, *R. cordifolia*, *Lessertia frutescens*, *Hermannia* sp, *Galenia africana*, *Searsia undulata* and *Atriplex semibaccata* were recorded on the limestone slopes. A single occurrence of *Quaqua* sp (not in flower; 31° 41' 16.5"S, 18° 42' 27.4"E) was also recorded in the good quality vygieveld directly west of the proposed mining site. Unfortunately this plant could not be found during the follow-up survey to determine its species.

The Widou River (seasonal) to the south of the site supports *Vachellia karroo* thicket (see Photo 3). The latter has been invaded with *Prosopis glandulosa* and *Nerium oleander*. From a distance it is impossible to distinguish between the *V. karroo* and *P. glandulosa* due to their similar growth form and armed branches. It is understood that the riverine area will not be affected by mining activities. Erosion does not seem to be a problem in the area (due to low rainfall), although signs of minor sheet and gully erosion were noted on the southern side (left bank) of the Widou River.

Photo 3 Widou River, with *Vachellia karroo* and *Prosopis glandulosa*. Insert: *Brunsvigia bosmaniae*

Bulb species recorded include *Trachyandra falcata*, *T. revoluta, T. tortilis*, *Brunsvigia bosmaniae, Haemanthus coccineus, Ammocharis longifolia, Lachenalia unifolia, L. marginata,*

Drimia elata, Massonia depressa, Albuca canadensis, *Gladiolus scullyi*, *Moraea lewisiae* subsp. *secunda*, *Lapeirousia pyramidalis*, *Eriospermum* sp, *Cyanella orchidiformis*, *Oxalis pes-caprae* and *O. purpurea*. Alien species recorded include *Limonium sinuatum* (alien weed), *Prosopis glandulosa* and *Nerium oleander. Prosopis glandulosa* is a declared alien invader under the Conservation of Agricultural Resources Act (Act 43 of 1983). It is considered the most important woody invader species in Namaqualand (Mucina & Rutherford 2006). *Galenia africana* can also become invasive along watercourses.

CapeNature mentioned in their comment letter (dated 27 Feb 2017) of the occurrence of a sizeable population of *Haemanthus lanceifolius* on the adjacent site. This species is listed as Vulnerable (see Red List of South African Plants online database). The survey on 6 August 2018 did not reveal any of this species on site, although *Haemanthus coccineus* is present in low numbers. Pictures taken of the leaves of several *Haemanthus* plants on and off the proposed mining site were that of *H. coccineus* as confirmed by Dee Snijman, an amaryllid specialist. Other Species of Conservation Concern[1] recorded in the area by Simon Todd in an earlier study (Todd 2014), include *Gethyllis gregoriana* (Rare), *Quaqua framesii* (VU), *Eriospermum calcareum* (EN) and *Oxalis blastorrhiza* (EN). Todd noted that very few of these species were observed, mostly single plants. He presumably recorded *H. lanceifolius* in the area directly west of the southern half of the site.

With regards to the presence of mammal fauna, only aardvark (see Photo 4), porcupine and mole or molerat activity was noted on site. Antelope species that may frequent the area include the common duiker, steenbok and grysbok. Rock hyrax and an angulate tortoise were recorded in the limestone area next to the N7. Termite (snout harvester termite mounds) and cocktail ant (*Crematogaster* sp) nests were also noted. The farm was utilised as a sheep farm until recently. The sheep was removed at the beginning of 2016.

9 CONSERVATION STATUS & BIODIVERSITY NETWORK

Knersvlakte Dolomite Vygieveld is the best represented vegetation unit, with less than 5% transformed (Mucina & Rutherford 2006). Vanrhynsdorp Gannabosveld is the most transformed unit, with 79.5% remaining according to Mucina & Rutherford (2006). None of the vegetation types appear on the national list of threatened ecosystems (DEA 2011). However, CapeNature commented (27 Feb 2017) that Vanrhynsdorp Gannabosveld is under threat from mining and agriculture and is poorly protected. They further commented that Knersvlakte Dolomite Vygieveld has a very limited range with no formal protection. In the larger area, both

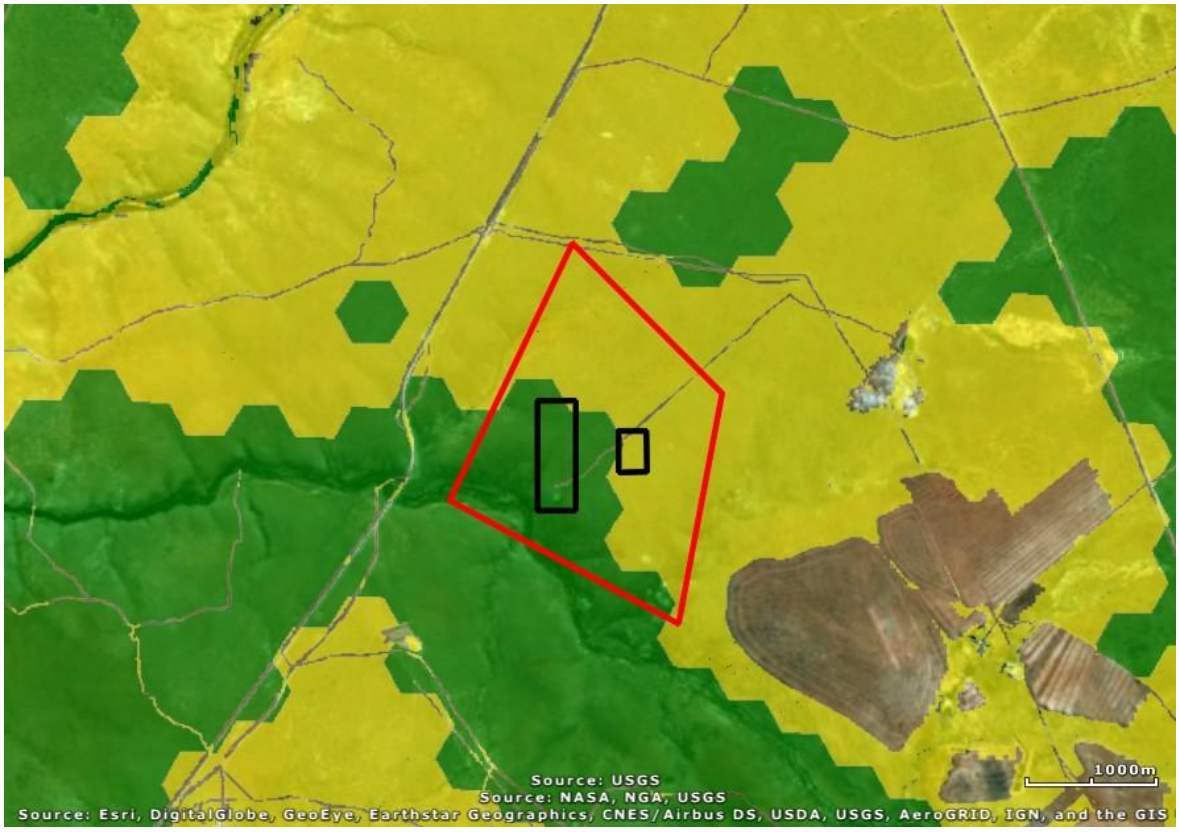
vegetation units are being threatened by overgrazing, cultivation (limited mainly to the Olifants River valley), mining activities and road construction. Mucina & Rutherford (2006) noted that "rehabilitation (of Vanrhynsdorp Gannabosveld) after open-cast mining is very limited due to lack of viable topsoil to cover the rehabilitated fields".

Photo 4 An aardvark burrow. These burrows may also be occupied by aardwolf, bat-eared fox, Cape fox and black-backed jackal. Insert: termite mound.

The study area falls within the Matzikama Biodiversity Network. Map 4 below shows that the proposed mining site protrudes significantly into a mapped critical biodiversity area (CBA), while the kilns site is located inside an ecological support area (ESA). The CBA comprises a wide east-west linking ecological corridor associated with the Widou River. CBA's are defined as areas in a natural condition that are required to meet biodiversity targets, for species, ecosystems or ecological processes and infrastructure (Pool-Stanvliet *et al.* 2017). ESA's, on the other hand, are not essential for meeting biodiversity targets, but play an important role in supporting the functioning of protected areas or CBA's, and are often vital for delivering ecosystem services. These sites are selected for meeting national targets for species, habitats and ecological processes (Pool-Stanvliet *et al.* 2017). Many of these areas support known

[1] The Red List of South African Plants (Raimondo *et al*. 2009) has assessed all plant species in South Africa, and all indigenous species are now technically Red Data Book species, and thus it is preferable to use the term Species of Conservation Concern to refer to species that are listed as either Threatened or Rare.

occurrences of threatened plant species, and/or may be essential elements of designated ecological corridors. They should be considered as essential regional priorities for conservation, and must be considered in all land-use planning initiatives (Pool-Stanvliet *et al.* 2017). Loss of designated CBA's is therefore not recommended.



Map 4 Biodiversity network map (produced by CapeNature) with the mining rights area outlined in red and the proposed mining extension areas outlined in black. Green = critical biodiversity area (CBA); yellow = ecological support area (ESA).

10 IMPACT OF THE PROPOSED MINING OPERATION

The proposed mining site is located inside a largely untransformed, but severely degraded or overgrazed shrubland, classified as Knersvlakte Dolomite Vygieveld and Vanrhynsdorp Gannabosveld. The largest portion of the mining site intrudes into the latter, while less than a quarter intrudes into Knersvlakte Dolomite Vygieveld. None of the vegetation types are currently considered as threatened. Being well represented and not threatened, the impact on vegetation type *per se* will be of low significance, with mitigation (Table 1 below summarises the impact). The impact is expected to be long term to permanent, depending on rehabilitation success after the completion of mining activities. In the long term, the mining site will require a sustained management effort to control the aliens and allow indigenous species to re-establish during the rehabilitation phase.

Table 1 Impact on vegetation type.

Mitigation	Extent	Duration	Intensity	Probability of occurrence	Significance	Status	Confidence
Without mitigation	Limited to site & surroundings	Long term - permanent	Med	Probable	Med	-	Med-high
With mitigation	Limited to site & surroundings	Long term - permanent	Med	Probable	Low	-	Med-high

The southern portion of the proposed mining site (area south of the green line on Map 2), being located inside Knersvlakte Dolomite Vygieveld and encroaching onto the Widou River, poses the greatest impact as this area is more species rich and potentially more sensitive to erosion (steeper). This area should rather be excluded from mining in order to avoid species loss and minimising erosion. Apparently the southernmost part of the mining site has already been approved for mining. The impact on ecological linkage is also likely to have significance, due to the mining site's protrusion into a CBA associated with the Wiedou River (see Table 2). This impact can be lessened by moving mining activities slightly further away (northwards) from the Widou River. The shrubland around the southern portion of the mining site will assumably remain intact. There will be no impact on any known Species of Conservation Concern.

Table 2 Impact on biological linkage and CBA's.

Mitigation	Extent	Duration	Intensity	Probability of occurrence	Significance	Status	Confidence
Without mitigation	Limited to site & surroundings	Long term - permanent	Med	Probable	Med-high	-	Med-high
With mitigation	Limited to site & surroundings	Long term - permanent	Med	Probable	Low-med	-	Med-high

As an indirect impact, soil disturbance caused by opencast mining activities will provide ideal conditions for the establishment of alien invasive vegetation. However, it is unlikely that any woody aliens, such as *Prosopis glandulosa*, will become a serious problem. *Prosopis glandulosa* and *Nerium oleander* are largely confined to the Widouw River streambed. Weedy pioneer species, such as *Atriplex* species, *Stipa capensis* and *Bromus pectinatus*, will probably be the first to establish and prevail. These will be difficult to control, but the impact is not considered significant, given the already degraded condition of the veld.

Impact on fauna will be of low to medium significance, without mitigation. Since the Widouw River will not be directly affected by mining activities, mammals visiting the river will not be interfered with. Residing mammals on the proposed mining site, such as aardvark and porcupines, will be directly affected. It must be noted that sheep farming has probably displaced most of the indigenous mammal fauna. One can expect that all large fauna will move away with the commencement of mining activities. Insect fauna, such as termite and cocktail ant nests, will be eliminated. It is uncertain (unlikely) whether rehabilitation of the mining site will create a suitable habitat for indigenous fauna post mining.

Table 3 Impact on fauna.

Mitigation	Extent	Duration	Intensity	Probability of occurrence	Significance	Status	Confidence
Without mitigation	Limited to site & surroundings	Long term - permanent	Med	Probable	Low-med	-	Med-high
With mitigation	Limited to site & surroundings	Long term - permanent	Med	Probable	Low	-	Med-high

11 CONCLUSION & MITIGATION MEASURES

The proposed mining site is located inside a largely untransformed, but severely degraded or overgrazed shrubland, classified as Knersvlakte Dolomite Vygieveld and Vanrhynsdorp Gannabosveld. The largest portion of the mining site lies inside the latter. None of the vegetation types are currently listed as threatened. However, CapeNature commented that Vanrhynsdorp Gannabosveld is under threat from mining and agriculture, while Knersvlakte Dolomite Vygieveld has a very limited range with no formal protection.

The southern portion of the proposed mining site, being located inside Knersvlakte Dolomite Vygieveld and encroaching onto the Widou River, poses the greatest impact as this area is more species rich and potentially more sensitive to erosion. This area should rather be avoided. The impact on ecological linkage is also likely to have some significance, due to the mining area extending into a CBA associated with the Wiedou River. Alien infestation and the impact on indigenous fauna will be of a lesser concern.

The impact is expected to be long term to permanent, depending on rehabilitation success after the completion of mining activities. It is recommended that the mining application be approved if the following mitigation options are adhered to:

- The impact on Knersvlakte Dolomite Vygieveld, the Widou River and associated CBA

can be lessened by moving mining activities slightly further away (northwards) from the Widou River. A buffer of 250 m between the river and mining activities should be maintained.

- The mining area must be properly demarcated prior to the start of any mining activities, and no disturbance may occur outside this area. Fencing or coloured steel droppers could be used for this purpose. They must not be moved during mining.
- It is recommended that a search and rescue of succulents and bulbs be undertaken ahead of mining activities. These plants must be properly bagged and transplanted in the vygieveld adjacent to the mining site, a safe distance away from the mining area. Search and rescue and relocation of the bulbs should be undertaken early in spring at the beginning of the flowering season. An experienced contractor should be appointed to undertake search and rescue.
- Topsoil salvage and replacement would be critical for rehabilitation. Where possible, topsoil, containing indigenous plant seeds, should be pushed aside and protected from compacting/trampling. Topsoil stockpiles must not exceed 0.5 m in height.
- Mining should be phased, starting at the lowest point (closest point to the Wiedou River). Backfilling and rehabilitation of a mined out area should be undertaken immediately after mining has been completed in that area. The primary means of rehabilitation should involve the replacement of topsoil and hydro-seeding with an indigenous grass seed mixture at the start of the rainfall season (June). A suitably experienced landscaping contractor should be appointed to undertake rehabilitation.
- In order to control or prevent erosion, it is recommended that runoff cut-off trenches and detention ponds be established on the down-slope side of mine.
- All erosion damage, such as erosion channels and runnels, must be backfilled and rehabilitated.
- Regular follow-up clearing of aliens may also be required in order to achieve rehabilitation successfully.

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PERSONAL COMMUNICATION

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CURRICULUM VITAE

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CAREER SUMMARY: **1997-2005:** Employed as an environmental specialist at **Planning Partners**, a multi-disciplinary consultancy specialising in town and regional planning, environmental planning and landscape architecture.
Started **Mark Berry Environmental Consultants** in **June 2005**.

EXPERIENCE: **Environmental Impact Assessments (EIA's)** for residential, commercial, industrial, agricultural and civil engineering projects. EIA applications include the upgrading of Murray's Bay Harbour at Robben Island; an abalone farm near Saldanha; several bulk sewer and stormwater pipelines; the upgrading of access to and restoration of an archaeological site (Klipgat Cave) near De Kelders; the rehabilitation of the flood-damaged Koringlands River in Swellendam; a regional shopping mall in Hawston; low-cost housing projects; and cell phone masts in the Mossel Bay area.

With a PhD in the botanical field, I regularly undertake **biodiversity assessments** of fynbos, strandveld, renosterveld, thicket and karoo vegetation types as part of the EIA application process. For my PhD I have assessed the impact of informal settlement on the coastal vegetation and flora of the south-eastern Cape coastal zone.

Environmental Management Plans (EMP's) for a wide range of activities, including golf estates, residential and commercial developments, wineries, bulk municipal infrastructure, a harbour and several borrow-pits/quarries.

Environmental Control Officer (ECO) on construction sites, including residential and commercial developments, the upgrading of a harbour and other civil engineering projects.

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EXAMINER:

Between 2000 and 2006 I have acted as examiner for the Board of Control for Landscape Architects (BOCLA), responsible for the setting up and marking of the Environmental Planning Section of exam paper.

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