

# DPR

**Ecologists & Environmental Services**

## **Report on the ecological assessment for the proposed borrow pit along the R58 Provincial Road between Aliwal North and Lady Grey, Eastern 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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## **Executive Summary**

The proposed borrow pit will be situated on the Remainder of the Farm 210 which is situated adjacent to the R58 Provincial Road (Map 1). The site is situated approximately 20 km to the west of the small town of Lady Grey and approximately 30 km to the east of Aliwal North.

According to Mucina & Rutherford (2006) the area consists of Aliwal North Dry Grassland (Gh 2). The vegetation type is currently listed as being of Least Concern (LC) (Map 2). This will also decrease the conservation value of remaining natural vegetation. In addition, the on-site survey and available aerial images clearly indicate previous transformation of the grass layer as a result of the existing borrow pit and the footprint of the proposed borrow pit, can, for the most part, no longer be regarded as a good representative sample of this vegetation type. The recently published National Biodiversity Assessment (2018) also confirms that the site, at least the portion consisting of the previous borrow pit, no longer consists of natural vegetation (Map 2). The Eastern Cape Biodiversity Conservation Plan (ECBCP – 2007) has been published in order to identify areas which are essential to meeting conservation targets for specific vegetation types, i.e. Critical Biodiversity Areas (CBA). The proposed site does however not fall within a CBA area, indicating a relatively low conservation value (Map 2). As a result of the above, the overall conservation value of the site is therefore relatively low.

The majority of the site has been significantly modified from the natural condition although remnants of the natural grassland is still prominent. A large portion of the site consists of a previous, historical borrow pit which leads to complete transformation of this portion both in terms of topography and vegetation (Map 1). The remainder of the proposed site footprint in the surroundings consists of grassland although the majority of this has also been transformed due to the previous stockpiling and processing activities. Consequently the vegetation composition in these areas are dominated by pioneer species and dwarf karroid shrubs, a clear modification of the natural grassland.

No watercourses or wetlands occur near the site with the nearest watercourse being a small but distinct drainage line to the south (approximately 250 meters) (Map 1). This drainage line flows to the south of the site and is highly unlikely that it will be affected by the development. The site itself does not contain any concentrated runoff patterns, wetlands or watercourses though the existing borrow pit does cause two small portions where ponding occurs and leads to the formation of artificial wetland conditions. However, these do not perform any significant ecological functions, are completely artificial in nature and will therefore not have any significant conservation value.

From the description of the vegetation on the site it is clear that it has mostly been transformed from the natural condition with the existing pit being most affected while the surrounding area also consists of secondary vegetation though less disturbed. The impact of the proposed development will therefore have a relatively low impact. The site also does not contain any protected or Red Listed species and given the disturbed condition is unlikely to contain such species. The pit itself is largely free draining although small patches become inundated where wetland conditions has established. These are however completely artificial and do not provide and ecologically important functions and they therefore have a low conservation value. Therefore, in conclusion, the proposed site footprint for the development does not contain any aspects of significant conservation value and should not result in any high impacts on the vegetation and ecology of the site and immediate surroundings.

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## **Ecological 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, 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 amount 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 borrow pit mining operations has several detrimental impacts on the environment. These impacts are numerous but the most pronounced impacts are associated with the excavation of large amounts of earth materials, the storage and disposal thereof and the sedimentation associated with it, especially where mining takes place near watercourses. This usually causes degradation of waterways due to sedimentation as well as the transformation of the vegetation and ecosystem on the site.

The proposed borrow pit will be situated on the Remainder of the Farm 210 which is situated adjacent to the R58 Provincial Road (Map 1). The site is situated approximately 20 km to the west of the small town of Lady Grey and approximately 30 km to the east of Aliwal North. The proposed site already contains a historical borrow pit and as a result is already degraded by this activity, although the surrounding area still consists of natural vegetation. Although natural grassland is still present in the surroundings it is clear that the area has been subjected to significant transformation by previous land uses. No watercourses or wetlands could be identified on or near the proposed site.

A site visit was conducted on 12 January 2021. The entire footprint of the site was surveyed as well as the immediate surroundings. The site survey was conducted during summer after sufficient rains and the plant identification on the site was considered optimal.

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

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.

## **2. SCOPE AND LIMITATIONS**

- To evaluate the present state of the vegetation and ecological functioning of the area proposed for the development.
- To identify possible negative impacts that could be caused by the proposed development.

### **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 amount 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**

Some geophytic or succulent species may have been overlooked due to a specific flowering time or cryptic nature.

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.**

Vegetation:

Red Data List (Raymondo *et al.* 2009)

Vegetation types (Mucina & Rutherford 2006)

Field guides used for species identification (Bromilow 1995, 2010, Coates-Palgrave 2002, Fish *et al* 2015, Gibbs-Russell *et al* 1990, Manning 2009, Moffett 1997, Pooley 1988, Pooley 2003, Retief & Meyer 2017, Van Oudtshoorn 2004, Van Wyk & Malan 1998, Van Wyk & Van Wyk 1997, Venter & Joubert 1985).

Terrestrial fauna:

Field guides for species identification (Smithers 1986a, Child *et al* 2016, Cillié 2018).

#### **3.2 Survey**

The site was assessed by means of transects and sample plots.

Noted species include rare and dominant species.

The broad vegetation types present on 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.

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.

#### **3.3 Criteria used to assess sites**

Several criteria were used to assess the site and determine the overall status of the environment.

##### **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 nich – 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 on a proposed site plays a large role on the feasibility of a development. Depending on the status and provincial conservation policy, presence of a Red Data species can potentially be a fatal flaw.

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 though, can vary significantly 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.

### **Vegetation condition**

The sites are compared to a benchmark site in a good to excellent condition. Vegetation management practises (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 tree, shrub, 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 shows 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 signs 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.

### **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 on 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.

### 3.4 Biodiversity sensitivity rating (BSR)

The total scores for the criteria above were used to determine the biodiversity sensitivity ranking for the sites. On a scale of 0 – 30, six different classes are described to assess the suitability of the sites to be developed. The different classes are described in the table below:

Table 1: Biodiversity sensitivity ranking

BSR	BSR general floral description	Floral score equating to BSR class
Ideal (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. The site is ideal for the proposed development.	29 – 30
Preferred (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. The area is preferred for the proposed development.	26 – 28
Acceptable (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. The area is acceptable for the proposed development.	21 – 25
Not preferred (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. The area is not preferred for the proposed development.	11 – 20
Sensitive (1)	The vegetation is in a pristine or near pristine condition. Very little 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. The area is regarded as sensitive and not suitable for the proposed development.	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 and surroundings in Appendix B.

According to Mucina & Rutherford (2006) the area consists of Aliwal North Dry Grassland (Gh 2). The 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) (Map 2). The vegetation type, though being affected by dryland crop cultivation, is not under sufficient development pressures to be considered a threatened ecosystem. This will also decrease the conservation value of remaining natural vegetation. In addition, the on-site survey and available aerial images clearly indicate previous transformation of the grass layer as a result of the existing borrow pit and the footprint of the proposed borrow pit, can, for the most part, no longer be regarded as a good representative sample of this vegetation type.

The Eastern Cape Biodiversity Conservation Plan (ECBCP – 2007) has been published in order to identify areas which are essential to meeting conservation targets for specific vegetation types, i.e. Critical Biodiversity Areas (CBA). The proposed site does however not fall within a CBA area, indicating a relatively low conservation value (Map 2). However, from an aquatic perspective, the area does fall within a CBA 2 due to its importance as a catchment for surrounding watercourses. The proposed development should however not have any significant impact on this function as long as adequate storm water management is implemented.

The proposed borrow pit will be situated on the Remainder of the Farm 210 which is situated adjacent to the R58 Provincial Road (Map 1). The site is situated approximately 20 km to the west of the small town of Lady Grey and approximately 30 km to the east of Aliwal North. The proposed site already contains a historical borrow pit and as a result is already degraded by this activity, although the surrounding area still consists of natural vegetation. Although natural grassland is still present in the surroundings it is clear that the area has been subjected to significant transformation by previous land uses. No watercourses or wetlands could be identified on or near the proposed site.

The majority of the site has been significantly modified from the natural condition although remnants of the natural grassland is still prominent. A large portion of the site consists of a previous, historical borrow pit which leads to complete transformation of this portion both in terms of topography and vegetation (Map 1). This consists of a large, linear excavation which is largely free draining, although two small areas of ponding were noted where artificial wetland conditions has formed. These are however completely artificial, does not perform any significant ecological function and is therefore not of any significant conservation value. This historical borrow pit has consequently completely and irreversibly transformed the vegetation in and around it. The remainder of the proposed site footprint in the surroundings consists of grassland although the majority of this has also been transformed due to the previous stockpiling and processing activities. Consequently the vegetation composition in these areas are dominated by pioneer species and dwarf karroid shrubs, a clear modification of the natural grassland. The current vegetation layer is therefore of secondary establishment which is also clearly reflected in the species composition and vegetation structure. Patches of climax grasses and a more natural species composition is present along the periphery and toward the south

west of the site but does not significantly contribute toward an increased conservation value for the site.



Figure 1: Aerial view of the proposed site (Google Earth 2020). Note the historical borrow pit on the site is clearly visible which causes transformation of the natural vegetation. Though not clearly apparent previous disturbance has also affected the immediately adjacent grassland.



Figure 2: Panorama of the existing borrow pit on the site which has clearly caused transformation of the natural vegetation.



Figure 3: Another view of the existing borrow pit. Although the natural vegetation has clearly been transformed, a significant pioneer vegetation layer has subsequently been able to re-establish.

The topography of the site is dominated by an undulating plain with the site itself located on a low rise which has a gentle but visible slope from south east to north west. The topography on the site has however been altered significantly by the excavation caused by the previous borrow pit. No watercourses or wetlands occur near the site with the nearest watercourse being a small but distinct drainage line to the south (approximately 250 meters) (Map 1). This drainage line flows to the south of the site and is highly unlikely that it will be affected by the development. Furthermore, since the site slopes generally in a north western direction, runoff generated on the site will also drain away from the drainage line and will therefore clearly not have an influence on it. This drainage line will therefore not form part of this study. The site itself has an elevation of 1461 m along the north eastern border, decreasing to 1456 m along the western border and clearly indicated that the site has a gentle slope from east to west. The site itself does not contain any concentrated runoff patterns, wetlands or watercourses though the existing borrow pit does cause two small portions where ponding occurs and leads to the formation of artificial wetland conditions. However, these do not perform any significant ecological functions, are completely artificial in nature and will therefore not have any significant conservation value. Despite the absence of any watercourses or wetlands, the proposed borrow pit will still need to divert clean runoff around the site which should be easily attainable by implementing a low berm around the perimeter.





Figure 4: The existing borrow pit is not completely free draining and where inundation occurs, artificial wetland patches has formed (red).



Figure 5: The drainage line to the south of the site is clearly quite small, not located near the site or fed by runoff from it and should therefore remain unaffected.

The geology of the site is dominated by dolerite with sandstone outcrops occurring along the perimeter. The region is dominated by layers of sandstone and mudstone of the Tarkastad Subgroup within the undulating terrain, of which the sandstone layer is prominent on the site. Dolerite intrusions into these layers are present, though not abundant, as is the case on the site. Rainfall in the region ranges from 500 to 600 mm per year, falling mostly in summer. The climate is temperate but with cold winters and frost occurring in excess of 50 days (Mucina & Rutherford 2006).

The following description of the vegetation on the site should give a good indication of the condition of the ecology on it.

As previously discussed, the site already contains a previous borrow pit excavation (Map 1). Here the vegetation has been removed though a sparse grass layer has been able to re-establish. This layer is however dominated by pioneer and weedy species and is not representative of the natural grassland. Pioneer grasses adapted to rocky areas with shallow soils (a consequence of the excavated pit) are abundant in the pit and include *Aristida diffusa*,

*A. congesta* and *Heteropogon contortus*. Other pioneer grasses which are also notable in the pit include *Eleonurus muticus*, *Cymbopogon pospischillii* and *Eragrostis gummiflua*. Several dwarf karroid shrubs are also prominent inside the pit and include *Chrysocoma ciliata*, *Amphiglossa triflora*, *Lycium horridum*, *Melolobium candicans* and *Pentzia incana*. Where these occur in abundance they are a clear indicator of disturbance. Other pioneer and weedy herbaceous species which further indicate the disturbance associated with the pit include *Oenothera sp.*, *Salvia stenophylla*, *Gazania krebsiana* and *Berkheya onopordifolia*. As previously indicated, small patches at the bottom of the pit becomes inundated and here wetland conditions has formed. The vegetation in these patches is also indicative of saturated soil conditions and includes the sedge, *Schoenoplectus decipiens*, Aquatic fern, *Marsilea sp.* and the semi-aquatic *Limosella major*. Exotic weeds and pioneers such as *Conyza bonariensis* and *Pseudognaphalium luteo-album* are also abundant and an indicator of the artificial nature of these inundated patches. Overall the vegetation within the existing borrow pit is clearly transformed and not representative of the surrounding natural grassland. However, a significant pioneer vegetation layer has become established, without any severe infestation by exotic species and therefore indicates that through adequate rehabilitation it will be possible to rehabilitate the proposed borrow pit to such an extent that it contains a vegetation layer which stabilises the pit, prevents erosion and allows for the site to blend to some extent with the surrounding vegetation.

The area around the existing borrow pit, especially to the west, which was previously utilised for stockpiling/processing has re-established a predominately indigenous vegetation layer but which is significantly different from the surrounding grassland in terms of species composition and vegetation structure. The vegetation of the surrounding areas are dominated by several climax grass species while the vegetation around the pit contains much less climax grasses while pioneer grasses and especially dwarf karroid shrubs are dominant. Dominant dwarf karroid shrubs include *Pentzia incana*, *Chrysocoma ciliata*, *Lycium horridum*, *Felicia muricata*, *Euryops oligoglossus* and *Helichrysum dregeanum*. Though present in natural grassland they occur only in low abundances and where disturbance is evident, as on the site, they become abundant. Other pioneer herbaceous species which also indicate the degraded condition of the vegetation include *Solanum supinum*, *Senecio consanguineus*, *S. isatideus*, *Tribulus terrestris*, *Commelina africana* and *Geigeria fillifolia*. Although infestations of exotic weeds and invaders are absent, scattered clumps of the invasive succulents, *Opuntia ficus-indica* and *O. engelmannii* are a concern. Other exotic weeds present in low abundance include *Chenopodium murale*, *Argemone ochroleuca* and *Physalis viscosa*. Other herbaceous species which are present but are also a component of the surrounding natural grassland indicate that though disturbed, this portion of the site may rehabilitate through time to a close to natural condition. These species include *Hermannia coccocarpa*, *H. depressa*, *Chaenostoma patrioticum*, *Hypoxis angustifolia* and *Oxalis depressa*. As indicated, climax grasses and pioneer grasses being diagnostic of the surrounding natural grassland are present but not abundant and include *Themeda triandra*, *Cymbopogon pospischillii*, *Sporobolus fimbriatus*, *Eragrostis curvula* and *Digitaria eriantha*. However, pioneer grasses are still dominant and is still indicative of previous disturbances. These include *Cynodon dactylon*, *Eragrostis lehmanniana*, *Chloris virgata*, *Tragus keolerioides*, *Melica decumbens*, *Setaria sphacelata* and *Sporobolus discosporus*.



Figure 6: Although the existing borrow pit entails the highest impact on the site, the adjacent portions had clearly also been transformed by previous mining activities. These areas are clearly visible where dwarf karroid shrubs dominate and grasses are sparse and short.



Figure 7: When compared to those portions affected by previous mining activities, the surrounding natural grassland is clearly different, being dominated by a dense grass layer with dwarf karroid shrubs being largely absent.





Figure 8: When viewed side-by-side the previously disturbed and surrounding natural areas are quite clearly discernible. The proposed development footprint was therefore confirmed to be largely confined to those areas previously being transformed. This will significantly reduce the anticipated impacts of the development.

The surrounding natural grassland which is large situated outside the footprint of the proposed borrow pit is dominated by climax grasses with dwarf karroid shrubs being largely absent. This is considered the natural condition of the vegetation type and can be used to indicate the relative disturbance on the site itself. Climax grasses include *Themeda triandra*, *Cymbopogon pospischillii*, *Sporobolus fimbriatus*, *Eragrostis curvula*, *E. capensis* and *Digitaria eriantha*. Other herbaceous species observed which forms part of the natural grassland includes *Polygala amatymbica*, *Ophioglossum sp.*, *Wahlenbergia denticulata*, *Eriospermum porphyrium* and *Senecio discodregeanus*.

Protected and Red Listed species are absent from the site and also considered unlikely to occur due to previous clearing of the natural grass layer associated with the existing borrow pit on the site. Protected and Red Listed plants are normally only able to establish in natural vegetation and are therefore unlikely to occur on the site which is dominated by secondary vegetation with notable disturbance present. Specimens of the protected *Aloe broomii* and *Nananthus gerstneri* were noted in surrounding areas but are not located near the site and will therefore not be affected by the development.

From the description of the vegetation on the site it is clear that it has mostly been transformed from the natural condition with the existing pit being most affected while the surrounding area also consists of secondary vegetation though less disturbed. The surrounding natural grassland is dominated by a dense grass layer with dwarf karroid shrub being almost absent. Such natural grassland will largely be avoided by the proposed development footprint though a small section in the south west still contains natural grassland and will likely be affected. The pit itself and previous stockpile/processing areas consists of pioneer, secondary vegetation and does therefore not have a high conservation value. The impact of the proposed development will

therefore have a relatively low impact. The site also does not contain any protected or Red Listed species and given the disturbed condition is unlikely to contain such species. The pit itself is largely free draining although small patches become inundated where wetland conditions has established. These are however completely artificial and do not provide any ecologically important functions and they therefore have a low conservation value.

In addition to the previous paragraph, the recently published National Biodiversity Assessment (2018) also confirms that the site, at least the portion consisting of the previous borrow pit, no longer consists of natural vegetation (Map 2). The natural vegetation type in the area, Aliwal North Dry Grassland is also not currently considered to be of high conservation concern and is listed as being of Least Concern (LC) (Map 2). The Eastern Cape Biodiversity Conservation Plan (ECBCP – 2007) also does not consider the site or surroundings to form part of a Critical Biodiversity Area (CBA) and confirms it as having a lower conservation value (Map 2). Therefore, in conclusion, the proposed site footprint for the development does not contain any aspects of significant conservation value and should not result in any high impacts on the vegetation and ecology of the site and immediate surroundings.

#### **4.2 Overview of terrestrial fauna (actual & possible)**

Tracks and signs of mammals are common on the site but will be somewhat modified from the natural condition due to the transformed nature of the natural grassland on the site. As the grass layer is modified, so the habitat is modified and in turn the mammal population is modified. However, large areas of natural grassland occur all around the site and the mammal population will still be largely natural here. Mammal species which are rare and endangered are often habitat specific and sensitive to habitat change. It is therefore considered unlikely that such species would occur on the site. It is also considered likely that the site will also contain several other mammal species but these were not observed on the site.

Mammal observations on the site include scat of a Porcupine (*Hystrix africaeaustralis*), burrows of Aardvark (*Orycteropus afer*) and soil mounds of the Common mole rat (*Cryptomys hottentotus*). These species identified are all relatively widespread and common and therefore not of high conservation significance. They do however indicate a substantial mammal population in the area.

The most significant impact on mammals anticipated on the site itself is primarily concerned with the loss and fragmentation of available habitat due to the development of the borrow pit. Transformation of the natural vegetation on the site will result in a decrease in the population size as available habitat decreases. However, the survey has indicated that the available habitat has already been transformed to a large extent and this function would therefore already be compromised. The anticipated impact can therefore not be regarded as significant. Furthermore, large natural areas occur around the site and any mammals on the site are likely to vacate the site into these adjacent areas should development take place.

In order to ensure no direct impact on the mammals on the site the hunting, capturing or trapping of mammals on the site should be strictly prohibited during operation of the borrow pit. In addition, extra care will have to be taken to ensure that animals inhabiting the site are not buried alive, this is specially relevant to the Antbear burrows in existing pit area.



Table 2: Red Listed mammals likely to occur in the study area (Child *et al* 2016).

Common name	Scientific name	Status
SA hedgehog	<i>Erinaceus frontalis</i>	Near Threatened
Striped Weasel	<i>Poecilogale albinucha</i>	Near Threatened
White-tailed mouse	<i>Mastomys albicaudatus</i>	Vulnerable
Small spotted cat	<i>Felis nigripes</i>	Vulnerable
Vaal Rhebok	<i>Pelea capreolus</i>	Near Threatened
Serval	<i>Leptailurus serval</i>	Near Threatened
Brown Hyena	<i>Hyaena brunnea</i>	Near Threatened
Southern African Vlei Rat	<i>Otomys auratus</i>	Near Threatened
African Clawless Otter	<i>Aonyx capensis</i>	Near Threatened

The likelihood that one or several of these endangered species may occur on the site is considered highly unlikely.



Figure 9: Tracks and signs of mammals on the site include clockwise from top left; burrow of an Aardvark (*Orycteropus afer*), scat from a Porcupine (*Hystrix africaeaustralis*) and soil mounds of the Common mole rat (*Cryptomys hottentotus*).

## 5. ANTICIPATED IMPACTS

Anticipated impacts that the development will have is primarily concerned with the loss of habitat and species diversity.

As previously discussed, the vegetation on the site and immediate surroundings has, for the most part, already previously been transformed by the existing borrow pit excavation and associated stockpile/processing area. In addition, the natural vegetation type, Aliwal North Dry Grassland (Gh 2), is also not currently considered to be of high conservation concern and is listed as being of Least Concern (LC) (Map 2). The Eastern Cape Biodiversity Conservation Plan (ECBCP – 2007) also does not consider the site or surroundings to form part of a Critical Biodiversity Area (CBA) and confirms it as having a lower conservation value (Map 2). Consequently the conservation value of the habitat or vegetation on the site is relatively low and the species diversity is also relatively low. As a result of the above, the loss of the vegetation and species diversity cannot be regarded as a high impact. The current condition of the site also indicates that it should be possible to re-instate a semi-natural vegetation layer after mining has been completed.

Due to the largely modified and transformed nature of the vegetation on the site no protected or Red Listed species were observed and it is considered unlikely that such a species would occur. Protected and Red Listed plants are normally only able to establish in natural vegetation and are therefore unlikely to occur on the site which is dominated by secondary vegetation with notable disturbance present. Specimens of the protected *Aloe broomii* and *Nananthus gerstneri* were noted in surrounding areas but are not located near the site and will therefore not be affected by the development. The anticipated impact is therefore considered to be zero.

The site does not contain any watercourses, including drainage lines or wetlands and the impact on these would therefore be negligible (Map 1 & 2). The existing borrow pit excavation does form small patches which become inundated and form wetland conditions though these are completely artificial and perform no significant ecological function. The impact of the removal of these would not result in any significant impact and it is also likely that after mining has completed such inundated patches will again be formed. The excavations formed by borrow pit are seldom able to be free draining and almost all rehabilitated borrow pits will contain some water or saturated soils. The nearest watercourse is a small but distinct drainage line to the south (approximately 250 meters) (Map 1). This drainage line flows to the south of the site and is highly unlikely that it will be affected by the development. Furthermore, since the site slopes generally in a north western direction, runoff generated on the site will also drain away from the drainage line and will therefore clearly not have an influence on it. However, runoff from the surroundings should still be kept separate from the proposed borrow pit and will need to divert clean runoff around the site which should be easily attainable by implementing a low berm around the perimeter.

The site contains several exotic weeds, though they do not yet form significant infestations, however, a few are considered problematic (Appendix B). Operational activities will also increase disturbance and therefore increase the susceptibility for the establishment of weeds and their spread into the surroundings. Monitoring of weed establishment and eradication should form a prominent part of management of the development. 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 most significant impact on mammals anticipated on the site itself is primarily concerned with the loss and fragmentation of available habitat due to the development of the borrow pit. Transformation of the natural vegetation on the site will result in a decrease in the population size as available habitat decreases. However, the survey has indicated that the available habitat has already been transformed to a large extent and this function would therefore already be compromised. The anticipated impact can therefore not be regarded as significant. Furthermore, large natural areas occur around the site and any mammals on the site are likely to vacate the site into these adjacent areas should development take place. In order to ensure no direct impact on the mammals on the site the hunting, capturing or trapping of mammals on the site should be strictly prohibited during operation of the borrow pit. In addition, extra care will have to be taken to ensure that animals inhabiting the site are not buried alive, this is specially relevant to the Antbear burrows in the existing pit area.

The impact significance has been determined and it is clear that the proposed development is not anticipated to have significant impacts in terms of the ecology. This is mostly the result of the existing disturbance and transformation of the site and the absence of any ecologically significant features. Prior to mitigation most impacts will be low-moderate although there is a moderate impact anticipated for the likely spread of exotic weeds. However, with adequate mitigation it can easily be reduced to a low impact.

Please refer to Appendix C for the impact methodology.

### Significance of the impact:

Impact	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
<b>Before Mitigation</b>								
Loss of vegetation type and clearing of vegetation	2	4	2	2.6	3	3	3	7.8
Loss of protected species	1	5	1	2.3	1	1	1	2.3
Impact on watercourses	1	5	1	2.3	1	2	1.5	3.4
Infestation with weeds and invaders	3	4	2	3	4	3	3.5	10.5
Impact on Terrestrial fauna	2	4	1	2.3	3	3	3	6.9
<b>After Mitigation</b>								
Loss of vegetation type and clearing of vegetation	2	4	2	2.6	3	3	3	7.8
Loss of protected species	1	5	1	2.3	1	1	1	2.3
Impact on watercourses	1	4	1	2	1	2	1.5	3
Infestation with weeds and invaders	2	2	1	1.6	3	2	2.5	4
Impact on Terrestrial fauna	1	4	1	2	3	3	3	6

## 6. SITE SPECIFIC RESULTS

### **Habitat diversity and species richness:**

The proposed site is quite small with a uniform topography and as a result, under natural conditions, it would also not have a significant habitat diversity. In addition, the topography has been modified by the existing borrow pit excavation and species diversity significantly decreased due to previous mining activities. As a result, habitat and species diversity is relatively low.

### **Presence of rare and endangered species:**

Due to the largely modified and transformed nature of the vegetation on the site no Red Listed, rare, protected or threatened species were observed and it is considered unlikely that such a species would occur. Specimens of the protected *Aloe broomii* and *Nananthus gerstneri* were noted in surrounding areas but are not located near the site and will therefore not be affected by the development.

### **Ecological function:**

The ecological function of the site has been modified to a large degree. The site functions as habitat for fauna, sustains a specific vegetation type, i.e. Aliwal North Dry Grassland and also forms part of the catchment of surrounding watercourses (Map 1 & 2). The natural vegetation on the site has clearly been significantly modified due to the previous borrow pit and associated activities. This in turn degrades the habitat available to fauna. Due to the alteration to the topography caused by the existing borrow pit excavation this also influences the natural drainage pattern and will influence its functioning as part of the catchment. Furthermore, the function of the site is not paramount to the continued functioning of the surrounding natural areas. In other words, development of the site should not impair the functioning of the surrounding area to a large extent.

### **Degree of rarity/conservation value:**

According to Mucina & Rutherford (2006) the area consists of Aliwal North Dry Grassland (Gh 2). The 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) (Map 2). This will also decrease the conservation value of remaining natural vegetation. In addition, the on-site survey and available aerial images clearly indicate previous transformation of the grass layer as a result of the existing borrow pit and the footprint of the proposed borrow pit, can, for the most part, no longer be regarded as a good representative sample of this vegetation type. This is also substantiated by the Eastern Cape Biodiversity Conservation Plan (ECBCP – 2007) which does not regard the site or surroundings as a Critical Biodiversity Areas (CBA) (Map 2). The overall conservation value of the site is therefore relatively low.

### **Percentage ground cover:**

The percentage ground cover is moderate to low. The grass layer density would under natural conditions be considerably higher. This is due to the previous borrow pit and associated activities which has considerably decreased the vegetation, especially within the pit, but also the immediate surroundings. The modification of the percentage ground cover is therefore regarded as at least moderate overall.

**Vegetation structure:**

Naturally the vegetation structure should consist of a dense grass cover with a prominent herbaceous component and almost no dwarf shrubs. These are both still present though their percentage cover has been decreased considerably. The dwarf karroid shrub component has become dominant in some areas, especially where previous disturbance has been highest. Overall the vegetation structure is therefore considered to be moderately modified.

**Infestation with exotic weeds and invader plants:**

The site contains several exotic weeds, though they do not yet form significant infestations, however, a few are considered problematic (Appendix B). These include the succulent invasive species noted on the site, *Opuntia ficus-indica* and *O. engelmannii*. Overall the presence of exotic weeds and invasive species are therefore considered moderate.

**Degree of grazing/browsing impact:**

The area is utilised as grazing for domestic livestock although this is only regarded as having a moderate impact.

**Signs of erosion:**

Although signs of erosion are not prominent, the decrease in vegetation cover, disturbance of the soil surface and grazing by domestic stock will cause at least a moderate level of sheet erosion.

**Terrestrial animals:**

Tracks and signs of mammals are common on the site but will be somewhat modified from the natural condition due to the transformed nature of the natural grassland on the site. As the grass layer is modified, so the habitat is modified and in turn the mammal population is modified. However, large areas of natural grassland occur all around the site and the mammal population will still be largely natural here. Mammal species which are rare and endangered are often habitat specific and sensitive to habitat change. It is therefore considered unlikely that such species would occur on the site. It is also considered likely that the site will also contain several other mammal species but these were not observed on the site. Overall the mammal population is therefore regarded as at least moderately modified.



Table 3: Biodiversity Sensitivity Rating for the proposed borrow pit development.

	Low (3)	Medium (2)	High (1)
Vegetation characteristics			
Habitat diversity & Species richness	3		
Presence of rare and endangered species	3		
Ecological function	3		
Uniqueness/conservation value	3		
Vegetation condition			
Percentage ground cover		2	
Vegetation structure		2	
Infestation with exotic weeds and invader plants or encroachers		2	
Degree of grazing/browsing impact		2	
Signs of erosion		2	
Terrestrial animal characteristics			
Presence of rare and endangered species		2	
Sub total	12	12	0
Total		24	

## 7. BIODIVERSITY SENSITIVITY RATING (BSR) INTERPRETATION

Table 4: Interpretation of Biodiversity Sensitivity Rating.

Site	Score	Site Preference Rating	Value
Aliwal North Borrow Pit	24	Acceptable	3

## 8. DISCUSSION AND CONCLUSION

The proposed site has been rated as being acceptable for the borrow pit development mostly as a result of the already degraded condition of the vegetation, the small extent of the site, absence of any ecological sensitive aspects and previous borrow pit on the site.

The proposed borrow pit will be situated on the Remainder of the Farm 210 which is situated adjacent to the R58 Provincial Road (Map 1). The site is situated approximately 20 km to the west of the small town of Lady Grey and approximately 30 km to the east of Aliwal North. The proposed site already contains a historical borrow pit and as a result is already degraded by this activity, although the surrounding area still consists of natural vegetation. Although natural grassland is still present in the surroundings it is clear that the area has been subjected to significant transformation by previous land uses. No watercourses or wetlands could be identified on or near the proposed site.

According to Mucina & Rutherford (2006) the area consists of Aliwal North Dry Grassland (Gh 2). The 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) (Map 2). This will also decrease the conservation value of remaining natural vegetation. In addition, the on-site survey and available aerial images clearly indicate previous transformation of the grass layer as a result of the existing borrow pit and the footprint of the proposed borrow pit, can, for the most part, no longer be regarded as a good representative sample of this vegetation type. The recently published National Biodiversity Assessment (2018) also confirms that the site, at least the portion consisting of the previous borrow pit, no longer consists of natural vegetation (Map 2). The Eastern Cape Biodiversity Conservation Plan (ECBCP – 2007) has been published in order to identify areas which are essential to meeting conservation targets for specific vegetation types, i.e. Critical Biodiversity Areas (CBA). The proposed site does however not fall within a CBA area, indicating a relatively low conservation value (Map 2). As a result of the above, the overall conservation value of the site is therefore relatively low.

The majority of the site has been significantly modified from the natural condition although remnants of the natural grassland is still prominent. A large portion of the site consists of a previous, historical borrow pit which leads to complete transformation of this portion both in terms of topography and vegetation (Map 1). This consists of a large, linear excavation which is largely free draining, although two small areas of ponding were noted where artificial wetland conditions has formed. These are however completely artificial, does not perform any significant ecological function and is therefore not of any significant conservation value. This historical borrow pit has consequently completely and irreversibly transformed the vegetation in and around it. The remainder of the proposed site footprint in the surroundings consists of grassland although the majority of this has also been transformed due to the previous stockpiling and processing activities. Consequently the vegetation composition in these areas are dominated by pioneer species and dwarf karroid shrubs, a clear modification of the natural grassland. The current vegetation layer is therefore of secondary establishment which is also clearly reflected in the species composition and vegetation structure. Patches of climax grasses and a more natural species composition is present along the periphery and toward the south west of the site but does not significantly contribute toward an increased conservation value for the site.

The topography of the site is dominated by an undulating plain with the site itself located on a low rise which has a gentle but visible slope from south east to north west. The topography on the site has however been altered significantly by the excavation caused by the previous borrow pit. No watercourses or wetlands occur near the site with the nearest watercourse being a small but distinct drainage line to the south (approximately 250 meters) (Map 1). This drainage line flows to the south of the site and is highly unlikely that it will be affected by the development. Furthermore, since the site slopes generally in a north western direction, runoff generated on the site will also drain away from the drainage line and will therefore clearly not have an influence on it. This drainage line will therefore not form part of this study. The site itself does not contain any concentrated runoff patterns, wetlands or watercourses though the existing borrow pit does cause two small portions where ponding occurs and leads to the formation of artificial wetland conditions. However, these do not perform any significant ecological functions, are completely artificial in nature and will therefore not have any significant conservation value. Despite the absence of any watercourses or wetlands, the proposed borrow pit will still need to divert clean runoff around the site which should be easily attainable by implementing a low berm around the perimeter.

Due to the largely modified and transformed nature of the vegetation on the site no Red Listed, rare, protected or threatened species were observed and it is considered unlikely that such a species would occur. Specimens of the protected *Aloe broomii* and *Nananthus gerstneri* were noted in surrounding areas but are not located near the site and will therefore not be affected by the development.

The site contains several exotic weeds, though they do not yet form significant infestations, however, a few are considered problematic (Appendix B). These include the succulent invasive species noted on the site, *Opuntia ficus-indica* and *O. engelmannii*. Operational activities will also increase disturbance and therefore increase the susceptibility for the establishment of weeds and their spread into the surroundings. Monitoring of weed establishment and eradication should form a prominent part of management of the development. 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 impact significance has been determined and it is clear that the proposed development is not anticipated to have significant impacts in terms of the ecology. This is mostly the result of the existing disturbance and transformation of the site and the absence of any ecologically significant features. Prior to mitigation most impacts will be low-moderate although there is a moderate impact anticipated for the likely spread of exotic weeds. However, with adequate mitigation it can easily be reduced to a low impact.

From the description of the vegetation on the site it is clear that it has mostly been transformed from the natural condition with the existing pit being most affected while the surrounding area also consists of secondary vegetation though less disturbed. The surrounding natural grassland is dominated by a dense grass layer with dwarf karroid shrub being almost absent. Such natural grassland will largely be avoided by the proposed development footprint though a small section in the south west still contains natural grassland and will likely be affected. The pit itself and previous stockpile/processing areas consists of pioneer, secondary vegetation and does therefore not have a high conservation value. The impact of the proposed development will therefore have a relatively low impact. The site also does not contain any protected or Red Listed species and given the disturbed condition is unlikely to contain such species. The pit

itself is largely free draining although small patches become inundated where wetland conditions has established. These are however completely artificial and do not provide and ecologically important functions and they therefore have a low conservation value. Therefore, in conclusion, the proposed site footprint for the development does not contain any aspects of significant conservation value and should not result in any high impacts on the vegetation and ecology of the site and immediate surroundings.

## 9. RECOMMENDATIONS

- Despite the absence of any watercourses or wetlands, the proposed borrow pit will still need to divert clean runoff around the site which should be easily attainable by implementing a low berm around the perimeter.
- The hunting, capturing or trapping of fauna, including mammals, reptiles, birds and amphibians, on the site should be strictly prohibited during operation of the borrow pit. In addition, extra care will have to be taken to ensure that animals inhabiting the site are not buried alive, this is specially relevant to the Antbear burrows in existing pit area.
- Adequate monitoring of weed establishment and their 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.
- Monitoring of mining operations including weed establishment and erosion should take place.
- Rehabilitation of the mining area should be adequate and should include the following:
  - Overburden and tailings resulting from the mining operations should be returned to excavations in order to aid in re-establishing a more natural topography.
  - The topography of the site should be re-instated as far as possible.
  - Eradication and monitoring of weed establishment should take place and should be extended after cessation of mining (Appendix B).
  - Topsoil should be removed prior to mining where still present, protected from wind erosion and weed establishment and replaced on the site during rehabilitation.
  - Adequate monitoring of rehabilitation success should be done and remedial action taken where required.
  - After mining has ceased all manmade materials should be removed from the site, i.e. structures, concrete, waste, etc.

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## Annexure A: Maps





## Layout map of a proposed borrow pit along the R58 Provincial Roads between Aliwal North and Lady Grey, Eastern Cape Province.






Map 1: Layout map of the proposed borrow pit adjacent to the R58 Provincial Road. The proposed development footprint and access road is indicated. Note that an existing road will be utilised. The existing borrow pit excavation is clearly visible. The surrounding area consists of extensive natural grassland. Note the small drainage line to the south of the proposed borrow pit. It is however not located near the site and prevalent runoff patterns should prevent the development from having any significant impacts on it.



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### Legend:

-  Site location
-  Road network
-  Watercourses
-  Wetlands and impoundments

### Map Information

Spheroid: WGS 84

Quantum GIS

Scale: 1:7 500

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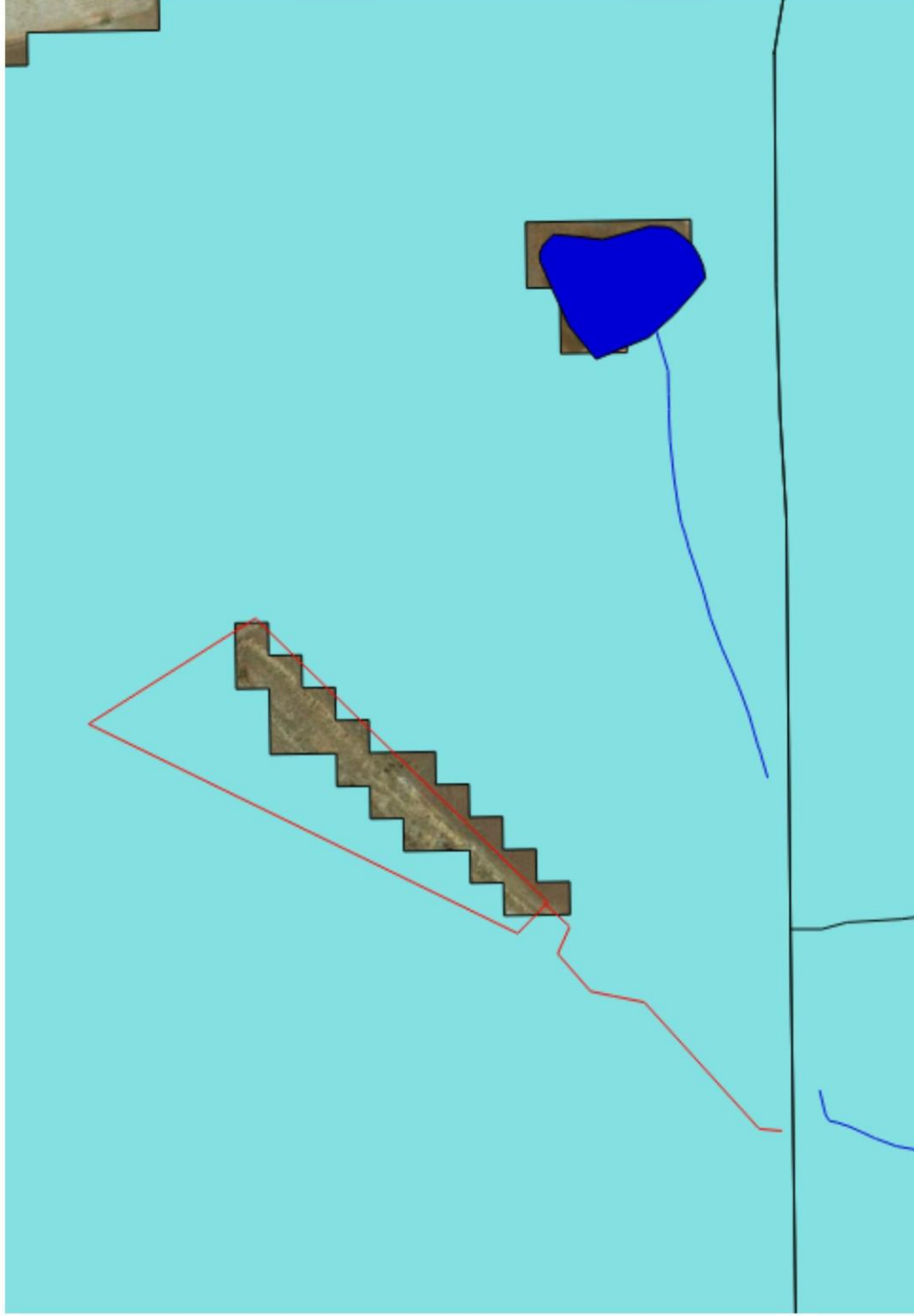
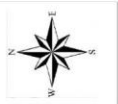
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## General ecology map of a proposed borrow pit along the R58 Provincial Roas between Aliwal North and Lady Grey, Eastern Cape Province.



Map 2: General ecology map of the proposed borrow pit adjacent to the R58 Provincial Road. The area consists exclusively of Aliwal North Dry Grassland which is neither listed as a Threatened Ecosystem, Critical Biodiversity Area or National Protected Areas Expansion Strategy (NPAES) Focus Area. The National Biodiversity Assessment (NBA 2018) also indicates a portion of the site no longer consists of natural vegetation, note however that this is coarsely delineated with the on-site survey confirming that the borrow pit and surroundings are no longer representative of the natural vegetation type.



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**Legend:**

-  Site location
-  Road network
-  Watercourses
-  Wetlands and impoundments
-  Aliwal North Dry Grassland
-  Critical Biodiversity Area 1
-  Critical Biodiversity Area 2
-  NPAES Focus Areas
-  Threatened Ecosystems

**Map Information**

**Spheroid:** WGS 84

Quantum GIS

**Scale:** 1:7 500

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## Appendix B: Species list

Species indicated with an \* are exotic.

Protected species are coloured orange and Red Listed species red.

Species	Growth form
* <i>Argemone ochroleuca</i>	Herb
* <i>Chenopodium murale</i>	Herb
* <i>Conyza bonariensis</i>	Herb
* <i>Oenothera sp.</i>	Herb
* <i>Opuntia engelmannii</i>	Succulent
* <i>Opuntia ficus-indica</i>	Succulent
* <i>Physalis viscosa</i>	Herb
<i>Aloe broomii</i>	Succulent
<i>Amphiglossa triflora</i>	Dwarf shrub
<i>Aristida congesta</i>	Grass
<i>Aristida diffusa</i>	Grass
<i>Berkheya onopordifolia</i>	Herb
<i>Chaenostoma patrioticum</i>	Herb
<i>Chasmatophyllum muscullinum</i>	Succulent
<i>Chloris virgata</i>	Grass
<i>Chrysocoma ciliata</i>	Dwarf shrub
<i>Commelina africana</i>	Herb
<i>Cymbopogon pospischillii</i>	Grass
<i>Cynodon dactylon</i>	Grass
<i>Cyperus rupestris</i>	Sedge
<i>Digitaria eriantha</i>	Grass
<i>Eleonurus muticus</i>	Grass
<i>Eragrostis capensis</i>	Grass
<i>Eragrostis curvula</i>	Grass
<i>Eragrostis gummiflua</i>	Grass
<i>Eragrostis lehmanniana</i>	Grass
<i>Eriospermum porphyrium</i>	Geophyte
<i>Euryops oligoglossus</i>	Dwarf shrub
<i>Felicia muricata</i>	Dwarf shrub
<i>Galium capense</i>	Herb
<i>Gazania krebsiana</i>	Herb
<i>Geigeria fillifolia</i>	Herb
<i>Helichrysum dregeanum</i>	Dwarf shrub
<i>Hermannia coccocarpa</i>	Herb
<i>Hermannia depressa</i>	Herb
<i>Heteropogon contortus</i>	Grass
<i>Hypoxis angustifolia</i>	Geophyte
<i>Limosella major</i>	Aquatic Herb
<i>Lycium horridum</i>	Dwarf shrub
<i>Marsilea sp.</i>	Aquatic fern

<i>Melica decumbens</i>	Grass
<i>Melolobium candicans</i>	Dwarf shrub
<i>Microchloa caffra</i>	Grass
<i>Nananthus gerstneri</i>	Succulent
<i>Ophioglossum sp.</i>	Fern
<i>Oxalis depressa</i>	Geophyte
<i>Pentzia incana</i>	Dwarf shrub
<i>Polygala amatymbica</i>	Herb
<i>Pseudognaphalium luteo-album</i>	Herb
<i>Salvia stenophylla</i>	Herb
<i>Schoenoplectus decipiens</i>	Sedge
<i>Senecio consanguineus</i>	Herb
<i>Senecio discodregeanus</i>	Herb
<i>Senecio isatideus</i>	Herb
<i>Setaria sphacelata</i>	Grass
<i>Solanum supinum</i>	Herb
<i>Sporobolus discosporus</i>	Grass
<i>Sporobolus fimbriatus</i>	Grass
<i>Stoebe plumosa</i>	Dwarf shrub
<i>Themeda triandra</i>	Grass
<i>Tragus koelerioides</i>	Grass
<i>Tribulus terrestris</i>	Herb
<i>Wahlenbergia denticulata</i>	Herb



## 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 severe the aspects 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 refer to 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 has 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, 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. Pose 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.