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EKO•ENVIRONMENTAL

Report on the floristic and ecological assessment of the proposed establishment of a service/delivery access road adjacent to the Northridge Mall, Bloemfontein, Free State Province.

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Vegetation and 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.

It is inevitable that developments will occur around large cities as the necessity exists to provide housing, energy, food and waste management to the large population these areas house. Where such developments occur in the rural periphery of cities the site should be chosen so that areas of higher disturbance are preferred over pristine natural vegetation. Areas along the boundaries of cities and towns are usually in a degraded state due to the impact of the large population these areas house. Though this may be the case in most situations there may still be areas that consist of sensitive habitats such as water courses, wetlands or rare vegetation types that need to be conserved. These areas may also contain endangered fauna and flora.

The proposed access road is situated adjacent to the Northridge Mall in Bloemfontein and is adjacent to a residential area. It is situated on Park Erf 30476, Extension 213. The extent and length of the road of the road is approximated at 200 m in length and 12 m in width. The coordinates for the site is S 29.071959˚, E 26.231090˚ (Map 1).

For the above reasons it is necessary to conduct a vegetation and 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.

A site assessment was conducted on 8 September 2016.

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 access road.
- To identify possible negative impacts that could be caused by the proposed construction of an access road.

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

Due to high levels of historical disturbance and human activity on the site large portions are devoid of natural vegetation.
Bulbous and herbaceous species may have been overlooked due to time of year, the current drought as well as the amount of disturbance on the site.
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, Court 2010, Hartmann 2001, Manning 2009 Van Oudtshoorn 2004, Smith *et al* 1998, Smith & Crouch 2009, Smith & Van Wyk 2003, Van Wyk & Malan 1998, Van Wyk & Van Wyk 1997, Venter & Joubert 1985)

Terrestrial fauna:
Field guides for species identification (Smithers 1986a).

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

The vegetation in the study area consists of Bloemfontein Karroid Shrubland (Gh 8). The vegetation type is currently listed as being of Least Concern under the National List of Threatened Ecosystems (Notice 1477 of 2009)(National Environmental Management Biodiversity Act, 2004) (Map 2). However, according to Brown & Du Preez (2014), the vegetation type must be regarded as endemic to the Free State Province and must be afforded a high conservation status and must be included as a Threatened Ecosystem. In this area it is under pressure for residential development. The area proposed for the road is however also degraded due to its proximity to current land use surrounding it.

The topography of the site consists of a plateau/ridge of higher elevation and slopes toward the north. The vegetation on the site consists of dwarf shrubs, shrubs and grassland and forms mosaic pattern of vegetation structure. The area is disturbed and contains a dirt track utilised for servicing the powerline on the site where vegetation is largely absent (Map 1). Natural vegetation still remains on the site although it is notably degraded and not of as high a diversity as portions of the surrounding vegetation type in natural condition. As mentioned a powerline also occurs on the site which has also contributed to degradation of the vegetation. Soils on the site is relatively shallow as is characteristic of this vegetation type. No discernible watercourse or wetland occurs on or near the site and runoff occurs primarily as sheetflow.

No current land use occurs on the site other than the power line and associated dirt track (Map 1). No other structures or buildings occur on the site. Littering on the site is common. Grazing and browsing of the vegetation is absent due to the site being isolated by urban areas and not forming part of any farming area. The mammal populations on the site will also be diminished due to the condition of the site, isolation from surrounding natural areas and proximity of urban areas.

The vegetation structure on the site is comprised of a grass, dwarf shrub and shrub layers and a significant succulent/bulb element in shallow soils or where rock sheets occur. Although degraded the vegetation structure still resembles the natural condition. The dominant grass species on the site include *Enneapogon cenchroides, Eragrostis lehmanniana, Aristida congesta, Themeda triandra, Heteropogon contortus* and *Digitaria eriantha*. Dominant shrubs and dwarf shrubs include *Diospyros austro-africana, Euryops empetrifolius, Searsia ciliata, Felicia muricata, Gymnosporia polycantha* and *Olea europaea* subsp. *africana*. The last also being a protected species. The Wild Olive (*O. europaea* subsp. *africana*) is the provincial tree of the Free State and a protected species (Appendix B). It is widespread and common and the specimens on the site is not of exceptional size or age and is therefore not of significant conservation value. Permits will however still have to be obtained to remove them from the site. Other herbs common on the site include *Heliophila suavissima* and *Dicoma macrocephala*. Succulent and bulb species occurring on the site include *Euphorbia mauritanica, Crassula nudicaulis, Albuca setosa, Chasmatophyllum muscullinum, Ruschia intricata, R. unidens, Stapelia grandiflora* and *Aloe grandidentata*. Of these the following are also listed as being protected: *E. mauritanica, S. grandiflora* and *A. grandidentata* (Appendix B). These are all widespread and relatively common. As protected species they retain a conservation value and due to their ease of establishment it is recommended that permits be obtain to transplant these to an area on or adjacent to the site where they will not be affected.

In conclusion the area is considered to have significant conservation value as the vegetation in the area is considered to be unique and containing a high species diversity. However, the specific site proposed for the access road has been degraded and the diversity of species is relatively low with areas of the site transformed from the natural condition. The site is isolated from surrounding natural areas and is not considered to represent a conservable portion of the vegetation type. However, the site still contains a few species which are protected (Appendix B). Protected succulent species should be transplanted to adjacent areas where they will not be affected by construction and permits should be obtained to remove the few specimens of Wild Olive on the site. It should be kept in mind that ongoing development within this vegetation type will contribute to the cumulative impact of decreasing this vegetation type and as a result continued development within the vegetation type will have to be done with increased care and sensitivity.

4.2 Overview of terrestrial mammals (actual & possible)

Due to the degraded condition of the site as well as the urban proximity of dwellings it is considered unlikely that any species of concern will occur on the site. The mammal population on the site is likely to be diminished from the natural condition.

List of some Red Data terrestrial mammals that could occur in the region:

Pangolin	*Manis temminckii*
South African Hedgehog	*Atelerix frontalis*
Aardwolf	*Proteles cristatus*
African Wild Cat	*Felis lybica*
Small-Spotted Cat	*Felis nigripes*
Bat-Eared Fox	*Otocyon megalotis*
Striped Weasel	*Poecilogale albinucha*

It is considered highly unlikely that any these species would occur in the vicinity.

5. Site specific results

Habitat diversity and species richness:
Habitat diversity on the site is moderate and degraded. As a result the species diversity is also moderate in contrast to the natural condition where it should have been relatively high. The habitat consists of dwarf karroid shrubland with a mosaic vegetation pattern of grass, dwarf shrubs and shrubs.

Presence of rare and endangered species:
No rare or endangered species occur on the site although a few protected species were noted to occur (Appendix B). These are the succulent species *E. mauritanica, S. grandiflora*, *A. grandidentata* and the tree species *Olea europaea* subsp. *africana* (Wild Olive). All the above species are relatively widespread and common and are therefore not of significant conservation concern. However, the succulent species are easily transplanted and permits should be obtained to transplant them to adjacent areas where they will not be affected by construction. The Wild Olives trees are present on the site as juvenile shrubs and are therefore not of significant size or age. Permits should be obtained to remove these.

Ecological function:
The ecological function of the site is largely intact although degraded to some extent. The habitat provided by the site is degraded and due to the proximity and isolation from natural areas its function as habitat for fauna will be decreased. The functioning as part of the catchment and providing runoff will have to be accommodated by the access road in the form of storm water drainage.

Degree of rarity/conservation value:
The vegetation in the study area consists of Bloemfontein Karroid Shrubland (Gh 8). The vegetation type is currently listed as being of Least Concern under the National List of Threatened Ecosystems (Notice 1477 of 2009)(National Environmental Management Biodiversity Act, 2004) (Map 2). However, according to Brown & Du Preez (2014), the vegetation type must be regarded as endemic to the Free State Province and must be afforded a high conservation status and must be included as a Threatened Ecosystem. In this area it is under pressure for residential development. The area proposed for the road is however also degraded due to its proximity to current land use surrounding it. Its conservation value is therefore decreased and considered only moderate.

The Free State Biodiversity Plan indicates the site to form part of an Ecological Support Area 1 which functions in maintaining the integrity of Critical Biodiversity Areas.

A rough estimate of the percentage of vegetation condition on the site is considered as 20% near natural, 60% degraded and 20% transformed vegetation in comparison to natural vegetation of the region in pristine condition with no impacts.

Percentage ground cover:
The percentage ground cover is considered as low. The natural condition is only considered moderate due to the arid habitat conditions created by shallow soils. However, degradation on the site has caused the percentage ground cover to be decreased.

Vegetation structure:
The vegetation structure is largely natural consisting of a dwarf karroid shrub layer, grass and shrub layers.

Infestation with exotic weeds and invader plants:
The site contains only limited exotics although it is considered likely that annual weed species establish annually after rains.

Degree of grazing/browsing impact:
Grazing by domestic stock is absent from the site.

Signs of erosion:
Erosion is considered as moderate due to clearing of vegetation along the dirt track.

Terrestrial animals:
Due to the degraded condition of the site as well as the urban surroundings and proximity of dwellings it is considered unlikely that any species of concern will occur on the site. The mammal population on the site is likely to be diminished from the natural condition.

Table 2: Biodiversity Sensitivity Rating for the proposed access road.

	Low (3)	Medium (2)	High (1)
Vegetation characteristics			
Habitat diversity & Species richness		2	
Presence of rare and endangered species		2	
Ecological function		2	
Uniqueness/conservation value		2	
Vegetation condition			
Percentage ground cover	3		
Vegetation structure		2	
Infestation with exotic weeds and invader plants or encroachers		2	
Degree of grazing/browsing impact			1
Signs of erosion		2	
Terrestrial animal characteristics			
Presence of rare and endangered species	3		
Sub total	6	14	1
Total		21	

6. Biodiversity sensitivity rating (BSR) interpretation

Table 3: Interpretation of Biodiversity Sensitivity Rating.

Site	Score	Site Preference Rating	Value
Proposed access road	21	Acceptable	3

7. Discussion and conclusions

The site proposed for the access road has been rated as being acceptable for the development.

The vegetation in the study area consists of Bloemfontein Karroid Shrubland (Gh 8). The vegetation type is currently listed as being of Least Concern under the National List of Threatened Ecosystems (Notice 1477 of 2009)(National Environmental Management Biodiversity Act, 2004) (Map 2). However, according to Brown & Du Preez (2014), the vegetation type must be regarded as endemic to the Free State Province and must be afforded a high conservation status and must be included as a Threatened Ecosystem. In this area it is under pressure for residential development. The area proposed for the road is however also degraded due to its proximity to current land use surrounding it.

No current land use occurs on the site other than the power line and associated dirt track (Map 1). No other structures or buildings occur on the site. Littering on the site is common. Grazing and browsing of the vegetation is absent due to the site being isolated by urban areas and not forming part of any farming area. The mammal populations on the site will also be diminished due to the condition of the site, isolation from surrounding natural areas and proximity of urban areas. No discernible watercourse or wetland occurs on or near the site and runoff occurs primarily as sheetflow.

Due to the degraded condition of the site as well as the urban proximity of dwellings it is considered unlikely that any species of concern will occur on the site. The mammal population on the site is likely to be diminished from the natural condition.

Habitat diversity on the site is moderate and degraded. As a result the species diversity is also moderate in contrast to the natural condition where it should have been relatively high. The habitat consists of dwarf karroid shrubland with a mosaic vegetation pattern of grass, dwarf shrubs and shrubs.

The Free State Biodiversity Plan indicates the site to form part of an Ecological Support Area 1 which functions in maintaining the integrity of Critical Biodiversity Areas.

No rare or endangered species occur on the site although a few protected species were noted to occur (Appendix B). These are the succulent species *E. mauritanica, S. grandiflora*, *A. grandidentata* and the tree species *Olea europaea* subsp. *africana* (Wild Olive). All the above species are relatively widespread and common and are therefore not of significant conservation concern. However, the succulent species are easily transplanted and permits should be obtained to transplant them to adjacent areas where they will not be affected by construction. The Wild Olives trees are present on the site as juvenile shrubs and are therefore not of significant size or age. Permits should be obtained to remove these.

In conclusion the area is considered to have significant conservation value as the vegetation in the area is considered to be unique and containing a high species diversity. However, the specific site proposed for the access road has been degraded and the diversity of species is relatively low with areas of the site transformed from the natural condition. The site is isolated from surrounding natural areas and is not considered to represent a conservable portion of the vegetation type. However, the site still contains a few species which are protected (Appendix B). Protected succulent species should be transplanted to adjacent areas where they will not

be affected by construction and permits should be obtained to remove the few specimens of Wild Olive on the site. It should be kept in mind that ongoing development within this vegetation type will contribute to the cumulative impact of decreasing this vegetation type and as a result continued development within the vegetation type will have to be done with increased care and sensitivity.

8. Recommendations

- Weed eradication should be done during construction (Appendix C).

- After construction has ceased all construction materials should be removed from the area and no dumping of rubble or waste may occur on or around the site.

- Protected succulent species occurring on the site are *E. mauritanica, S. grandiflora* and *A. grandidentata*. As protected species they retain a conservation value and due to their ease of establishment it is recommended that permits be obtain to transplant these to an area on or adjacent to the site where they will not be affected.

- A few juvenile specimens of the protected Wild Olive (*O. europaea* subsp. *africana*) occur on the site. Permits must be obtained to remove them from the site.

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Annexure A: Maps and Site photos

Locality map for the proposed establishment of a service/delivery access road adjacent to the Northridge Mall, District Bloemfontein, Free State Province.

Preparred for:
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9 Barnes Street
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Legend:

- Site boundary
- Dirt track
- Power line
- Kenneth Kaunda Rd

Map Information

Spheroid: WGS 84

Scale:

0 93 186 279
Scale (m)

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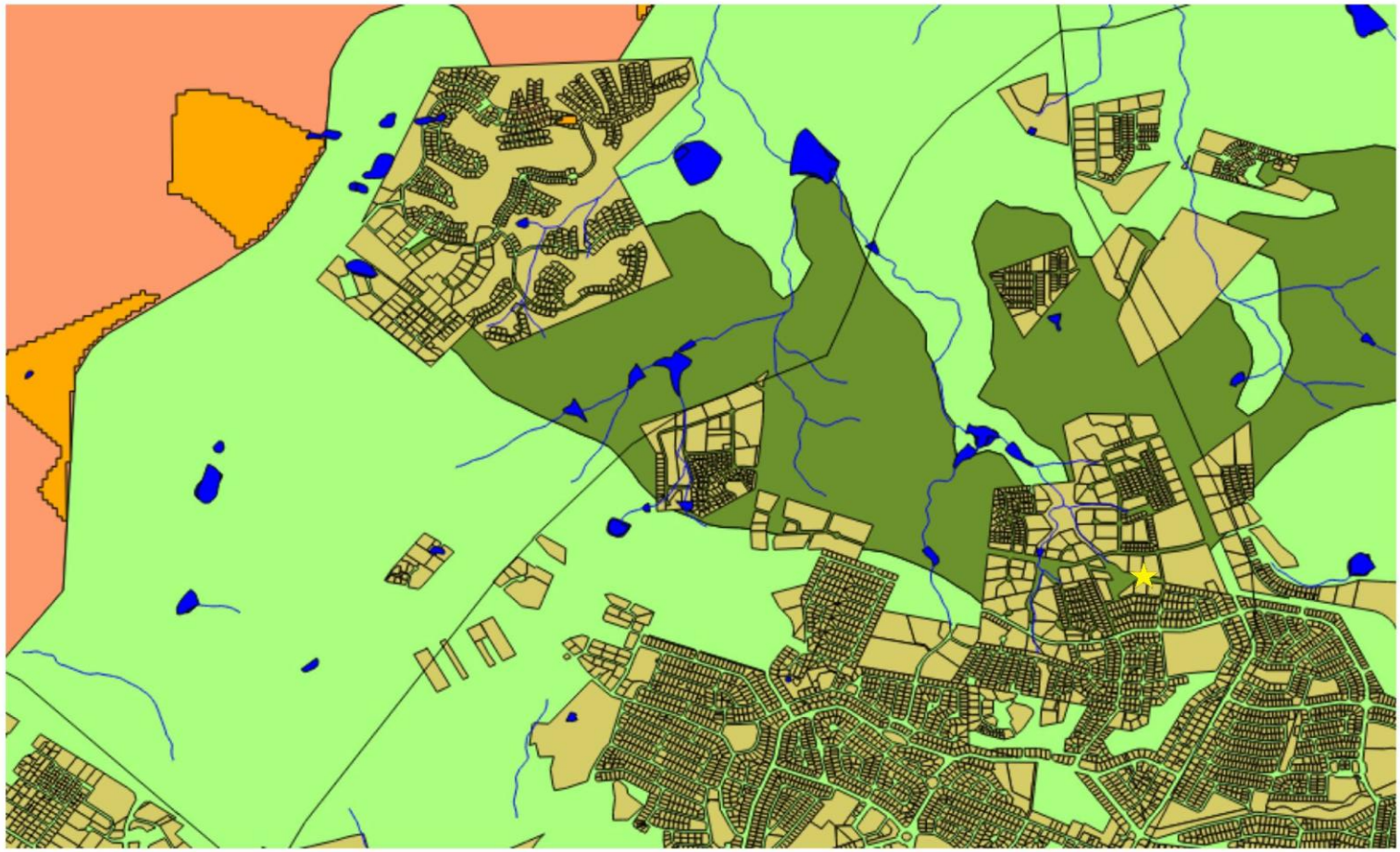
Map 1: Location of the proposed establishment of an access road adjacent to the Northridge Mall. The dirt track and power line causing degradation of the site is also indicated. Note also the surrounding construction and urban areas.

General ecology of the proposed establishment of a service/delivery access road adjacent to the Northridge Mall, District Bloemfontein, Free State Province.



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Legend:

- Road network
- Watercourses
- Winburg Grassy Shrubland
- Bloemfontein Karroid Shrub
- Bloemfontein Dry Grassland
- Threatened ecosystems
- Erven
- Wetlands and waterbodies

Map Information

Spheroid: WGS 84

Scale: 1:30 000

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Map 2: General ecology of the proposed establishment of an access road adjacent to the Northridge Mall. Note that the site is surrounded by urban areas. Also note that no watercourses or wetlands is located near the site.

Figure 1: View of the eastern end of the propose road.

Figure 2: View of the proposed road from the east toward the west. The overhead powerline and dirt track is indicated.

Figure 3: View of the site. Note areas devoid of vegetation. Although the vegetation type contains rock sheets where cover is low this area is not of this type and has been degraded.

Appendix B: Protected species on the site

Protected species on the site may not be limited to these species but these species have identified on and around the site. Additional sources should be consulted to confirm the presence of protected species.

Aloe grandidentata
Bont Aalwyn

Protected in the Free State Province

National Red List Status: **Least Concern**

Method: **Scattered on the site. Should be transplanted to areas where they will not be affected by the development. May also be incorporated in landscaping. Transplants easily.**

Euphorbia mauritanica
Milk Bush/Geelmelkbos

Protected in the Free State Province.

National Red List Status: **Least Concern**

Method: **Common on the site. Should be transplanted to areas where they will not be affected by the development. May also be incorporated in landscaping. Transplants easily.**

Olea europaea* subsp. *africana
Wild Olive/Olienhout

Protected in the Free State Province.

National Red List Status: **Least Concern**

Method: **Scattered on the site. Permits must obtained to remove species that will be affected by construction. Transplanting this species is not feasible.**

Stapelia grandiflora* var. *grandiflora
Bobbejaankambroo

Protected in the Free State Province.

National Red List Status: **Least Concern**

Method: **Scattered on the site. Should be transplanted to areas where they will not be affected by the development. May also be incorporated in landscaping. Transplants easily.**

Appendix C: Likely invader weed species

Invader weed species on the site may not be limited to these species but these are considered to be the most likely and significant invaders to occur. Additional sources should be consulted to confirm invader weed species as well as the best method to eradicate them.

According to the Conservation of Agricultural Resources Act, No. 43 of 1983 any Category 1 declared plants must be controlled by the land user on whose land such plants are growing.

Cirsium vulgare
Scotch Thistle/Skotse Dissel

Type: Weed
Category: 1

Mechanical removal is effective to control this weed. Cutting should be done below soil level and no leaves should remain.

Xanthium spinosum
Spiny Cocklebur/Boetebos

Type: Weed
Category: 1

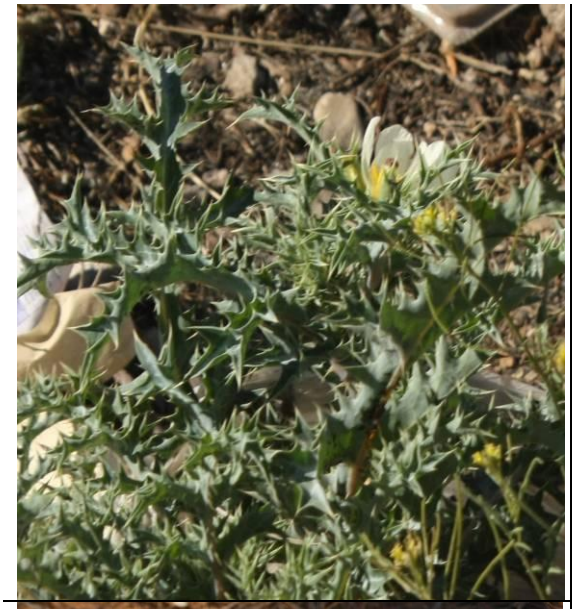
Mechanical removal by hand is effective to control this weed.

Several chemicals have also been registered for control: amitrole/simazine, bromoxynil, metribuzin, MCPA-K and 2,4-D(A).

Datura ferox
Large thorn-apple/Grootstinkblaar

Type: Weed
Category: 1

Mechanical removal by hand is effective for this weed.



Argemone ochroleuca
Mexican Poppy

Type: Weed
Category: 1

Mechanical removal by hand is effective against this weed.

Several chemicals have also been registered for control: 2, 4-D, 2, 4-DB, dicamba, diuron, fluroxypyr, hexazinone, isoproturon, karbutilate, MCPA, picloram and terbutryn.

Opuntia humifusa
Devil's Tongue Fig/Creeping Prickly Pear

Type: Invader
Category: 1

Mechanical control is effective for single specimens. All parts of the plant must be removed and burned.

Chemical control is most effective control method. Monosodium methanearsonate (MSMA) and glyphosate must be injected into the stem as concentrated solutions.

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