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Report on the biodiversity and ecological assessment of the proposed establishment of an urban development on the Remainder of Erf 22011, Bloemfontein, Free State Province.

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DECLARATION OF INDEPENDENCE

EKO Environmental 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 site consists predominately of natural vegetation although in a significantly degraded condition. The site is currently utilised as grazing for horses and other domestic stock. Due to the small size of the site and the overstocking by livestock the grazing pressure is exceptionally high. The site has notably also been degraded by past land uses and small dilapidated buildings and rubble is present on the site.

Anticipated impacts which the development will have is primarily concerned with the loss of vegetation, habitat and the water systems including the drainage area, impoundment and wetland area. Due to the already disturbed condition of the site, relatively low diversity and surrounding urban areas, the loss of vegetation, habitat and diversity is anticipated to remain relatively low. The vegetation type on the site is also not currently under significant threat and is considered as being of Least Concern (LC) (Map 2).

Three protected species occur on the site (Appendix C). The loss of the few protected Wild Olives on the site is also not considered a high impact as these species are widespread and the specimens on the site is not of significant size or age. The bulb species on the site are of higher conservation value but as long as they are transplanted this impact is also anticipated to remain low.

The Dam van Trane is artificial in nature and therefore has a relatively low conservation value (Map 1 & 2). It does however have a relatively high historical value. The wetland area in the north-eastern corner of the site is also highly degraded and transformed and also has a relatively low conservation value (Map 1 & 2). It is however recommended that both these areas be excluded from development which will render the impact on them negligible.

The loss of the drainage line on the site is considered a moderate impact. It forms part of Bloemspruit which is a canalised and highly transformed system and the loss of the drainage line will not have a high impact on this system (Map 1). The drainage line should however still be accommodated in the development in terms of storm water management.

The development is likely to cause conditions susceptible to the establishment of weeds and the eradication on the site should be done during the construction phase (Appendix D).

The loss of habitat on the site is not anticipated to have a high impact on the faunal population as the site is currently not able to sustain a healthy faunal population and the loss thereof would therefore not be high.

The impact significance has been determined and it is clear that the impacts the development will have can only be considered as low to moderate. This is largely due to the current degraded condition of the site and the site being surrounded by urban areas.

In conclusion, the site consists of natural grassland which has however been degraded and transformed to some extent by sustained overgrazing. The vegetation type is not of significant conservation value and this area does not contain a significant species or habitat diversity. The area is also surrounded by existing urban areas which isolates it from extensive natural areas further decreasing its conservation value. The plains portion is therefore not considered to have any significant ecological aspects worthy of conservation and this area can be developed. A protected tree species and two protected bulb species occur which are of some conservation

value (Appendix C). It is recommended that permits be obtained to remove the *O. europaea* subsp. *africana* (Wild Olives) trees present on the site and permits be obtained to transplant the *Brunsvigia radulosa* and *Eucomis autumnalis* bulbs and utilise them in the landscaping of the development. The Dam van Trane is an artificial impoundment supporting an artificial wetland with relatively low conservation value in terms of ecology (Map 1 & 2). However, it still has some ecological value and especially in terms of historical value has a high conservation value. It is therefore recommended that the dam and associated wetland be excluded from development. The wetland area occurring in the north-eastern corner of the site is highly degraded and forms part of the origin of the Bloemspruit (Map 1 & 2). In ecological terms it has a relatively low conservation value although it still provides several services to the urban area. Furthermore, development in this wetland area will be problematic due to flooding and the swelling and shrinking properties of wetland soils. It is therefore recommended that this area be excluded from development. Should it not be possible to exclude this area the required authorizations should be obtained from the Department of Water and Sanitation (DWS) and additional specialist studies conducted. The small drainage line/area transecting the site from east to west does not contain any riparian vegetation or distinct channel (Map 1). It is not considered to be of significant conservation value and it is therefore recommended that it be formalised and incorporated into the development. The storm water and water transporting function should be retained and accommodated within the development in order to ensure that runoff still enters the Bloemspruit system. As stipulated by the National Water Act, 1998 (Act 36 of 1998) any construction taking place within 100 meters of a watercourse or within 500 meters of a wetland area requires authorisation from the Department of Water Sanitation (DWS). This is specifically relevant to the Dam van Trane and wetland area in the north-west corner of the site.

Table of contents

Vegetation and ecological assessment.

Declaration of Independence

Executive Summary

1. Introduction	6
1.1 Background	
1.2 The value of biodiversity	
2. Scope and limitations	8
2.1 Vegetation	
2.2 Fauna	
2.3 Limitations	
3. Methodology	9
3.1 Desktop study	
3.2 Survey	
3.3 Criteria used to assess sites	
3.4 Biodiversity sensitivity rating (BSR)	
4. Ecological overview of the site	12
4.1 Overview of vegetation	
4.2 Overview of fauna	
5. Anticipated impacts	16
5. Site specific results	18
6. Biodiversity sensitivity rating (BSR) interpretation	19
7. Discussion and conclusions	20
8. Recommendations	22
9. References	23
Annexure A: Maps and Site photos	25
Annexure B: Species list	31
Annexure C: Protected species on the site	34
Annexure D: Likely weed species	36
Annexure E: Impact methodology	38

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.

South Africa has a large amount of endemic species and in terms of biological 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.

Development around cities and towns are necessary to accommodate an ever growing population. 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 urban development will occur on the remainder of Erf 22011 (Map 1 & 2). The site is situated adjacent to the Tempe Military Base and is currently utilised as natural grazing although heavily overutilized. The extent of the site to be developed is approximately 23.5 hectares.

A site visit was conducted on 16 February 2017. The entire footprint of the hospital development was surveyed over the period of one day. The time of the survey is considered optimal in terms of species identification.

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.

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

Certain bulbous which have finished flowering and are therefore not readily identifiable may have been overlooked.

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

Due to high levels of overgrazing some grass species may have been overlooked as no vegetative portions or inflorescences are present.

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, Manning 2009, Moffett 1997, Van Oudtshoorn 2004, 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 niche – 2, Single species dominance over a large area containing a low diversity of species – 3.

Presence of rare and endangered species: The actual occurrence or potential occurrence of rare or endangered species 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 (Mucina & Rutherford 2006)

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

According to Mucina & Rutherford (2006) the area consists of Winburg Grassy Shrubland (Gh 7) (Map 2). This vegetation type is currently listed as being of Least Concern (LC) under the National List of Threatened Ecosystems (Notice 1477 of 2009)(National Environmental Management Biodiversity Act, 2004) (Map 2). The vegetation type is therefore not currently subjected to any pronounced development pressures.

The site consists predominately of natural vegetation although in a significantly degraded condition. The site is currently utilised as grazing for horses and other domestic stock. Due to the small size of the site and the overstocking by livestock the grazing pressure is exceptionally high. The site has notably also been degraded by past land uses and small dilapidated buildings and rubble is present on the site.

The proposed urban development will occur on the remainder of Erf 22011 (Map 1 & 2). The site is situated adjacent to the Tempe Military Base and is currently utilised as natural grazing although heavily overutilized. The extent of the site to be developed is approximately 23.5 hectares. The site is situated within the grassland biome and the vegetation therefore consists of grassland with scattered shrubs and trees which is natural to the Winburg Grassy Shrubland vegetation type. Several exotic tree species are also present on the site and these alter the vegetation structure to some extent. This also includes two significant windrows of the exotic *Eucalyptus camaldulensis* (Bluegum).

The topography of the site consists of a plain sloping gently from east to west. The Dam van Trane (an artificial water body) is situated in the north-western corner of the site (Map 1 & 2). It does not drain into any defined watercourse but seeps from the dam in an eastern direction. This results in a small drainage line without any distinct channel draining from east to west across the site and forms areas of elevated moisture (Map 1). No clearly defined ponding could be identified. The north-eastern corner of the site contains wetland condition associated with the origin of the Bloemspruit, a watercourse flowing through the city (Map 1 & 2). The elevation of the site varies from 1443 m to 1433 m, also indicating the gentle slope of the site.

The vegetation on the site consists of a well-defined low grass layer with a few scattered trees. Two windrows consisting of exotic *Eucalyptus camaldulensis* trees also alter the vegetation structure to some extent. The scattered trees on the site consist of *Searsia lancea*, *Vachellia karroo*, *Olea europaea* subsp. *africana* and *Diospyros lycioides*. These are all widespread although the *O. europaea* subsp. *africana* is a protected species in the Free State Province (Appendix C). Only a few specimens occur on the site and are not of significant size or age. They are consequently not considered of significant conservation value but are nonetheless protected and permits should be obtained to remove the specimens on the site. The shrub, *Asparagus larcinus*, is also common under trees. Exotic tree species on the site consists of *Eucalyptus camaldulensis* (Bluegum) and *Fraxinus americana*. These species should preferably be removed prior to construction. Some of the Bluegum trees are of considerable size and likely quite old. They are however not listed as Champion Trees (Declared List of Champion Trees 2016, Individual Trees and Groups of Trees Declared as Protected Under Section 12 of the National Forests Act of 1998 by the Department of Agriculture, Forestry and

Fisheries). They are therefore not of any significant ecological value and as exotic species should preferably be removed from the site. It is not known if these are of significant historical value, which should be determined a qualified archaeologist.

The dominant grass layer consists of *Eragrostis lehmanniana*, *E. superba*, *E. obtusa*, *Cymbopogon pospischillii*, *Tragus koelerioides*, *T. berteronianus*, *Heteropogon contortus*, *Hyparrhenia hirta*, *Themeda triandra*, *Digitaria eriantha*, *Sporobolus fimbriatus*, *Fingerhuthia africana* and *Aristida congesta*. This species composition consists of several climax grass species but with a significant component of pioneer grasses which indicates a natural grass layer which is being degraded to a significant extent. In addition, and a much more prominent indicator of disturbance is the decrease in percentage cover of the grasses and a significant increase in the pioneer, indigenous weed, *Nidorella resediflora*, which clearly indicates a significant amount of disturbance on the site. This is most likely as a result of sustained overgrazing by domestic stock. Several herbs and dwarf shrubs also occur on the site and the most abundant species include *Sutera caerulea*, *Ruschia hamata*, *Hermannia coccocarpa*, *Ipomoea oenotheroides*, *Salvia verbenaca*, *Felicia muricata*, *Berkheya onopordifolia*, *Senecio inaequidens*, *Geigeria filifolia*, *Nenax microphylla* and *Pentzia incana*. Several of these are also indicators of disturbance where they are abundant. Numerous exotic species also occur within the grass layer. Two protected bulb species identified on the site are *Brunsvigia radulosa* and *Eucomis autumnalis* (Appendix C). These are widespread and not of significant rarity but are nonetheless protected and therefore of some conservation value. Both of these easily transplant and are of some aesthetic value and they can therefore be transplanted and utilised in the landscaping of the development. Permits should be obtained to transplant these and a designated nursery area should be created on the site where these can be temporarily cultivated until they can be placed in landscaping areas.

The plains portion of the site as discussed above consists of natural grassland which has been degraded and transformed to some extent. The vegetation type is not of significant conservation value and this area does not contain a significant species or habitat diversity. The area is also surrounded by existing urban areas which isolates it from extensive natural areas further decreasing its conservation value. The plains portion is therefore not considered to have any significant ecological aspects worthy of conservation and this area can be developed. The few specimens of *O. europaea* subsp. *africana* (Wild Olives) are protected but is a widespread species and are not of significant size or age (Appendix C). They are consequently not considered of significant conservation value but are nonetheless protected and permits should be obtained to remove the specimens on the site. The two protected bulb species, *Brunsvigia radulosa* and *Eucomis autumnalis*, are widespread and not of significant rarity but are nonetheless protected and therefore of some conservation value (Appendix C). Both of these easily transplant and are of some aesthetic value and they can therefore be transplanted and utilised in the landscaping of the development. Permits should be obtained to transplant these and a designated nursery area should be created on the site where these can be temporarily cultivated until they can be placed in landscaping areas.

The Dam van Trane is an artificial impoundment with significant historical value and is older than a century (Map 1 & 2). It is associated with an artificial wetland community. The dam wall faces east and seepage also occurs from the dam in this direction. The vegetation associated with the dam consists of a grass and sedge layer with a few trees on the dam wall. Dominant grasses consist of *Setaria sphacelata*, *Cynodon dactylon*, *Paspalum distichum* and *Leptochloa fusca*. Of these, *P. distichum* and *L. fusca*, are obligate wetland species growing in shallow water. Several sedge species also confirm the presence of wetland conditions associated with

the dam and surrounding seepage area. These include *Cyperus longus*, *C. eragrostis*, *C. marginatus* and *Eleocharis limosa*. Other aquatic species associated with the area include *Conyza podocephala*, *Marsilea sp.*, *Alternanthera sessilis* and *Persicaria lapathifolia*. The ecological function of the dam serves as an artificial water body which captures surface runoff and seeps as surface and groundwater flow from the dam. The functioning of the dam is therefore not vital to continued functioning of surrounding areas or an important and significant function. It does however still provide wetland habitat, albeit artificial, and has a significant historical value. It is recommended that the dam and immediate surrounding wetland areas be excluded from development.

A wetland area forming part of the origin of the Bloemspruit is located in the north-eastern corner of the site (Map 1 & 2). The Bloemspruit is a significant river flowing through the city from east to west and confluences with the Renosterspruit to the west of the city. It is a significant watercourse providing several services to this urban area but has been intensely degraded and transformed. Its conservation value in terms of ecology is therefore relatively low although the services it provides are essential and the conservation of this wetland area is therefore recommended. The vegetation within this wetland area is dominated by several obligate wetland species which include the sedges *Cyperus eragrostis* and *C. marginatus*, the rush *Juncus rigidus* and Bulrush, *Typha capensis*. Several facultative wetland grasses include *Setaria sphacelata* and *Paspalum dilatatum*. The area therefore undoubtedly consists of wetland conditions although only the western fringe of the wetland is situated within the site boundary and the main channel is situated to the north and east of the site. The wetland area is highly degraded and as a result numerous exotic species has established including *Oenothera rosea*, *Conyza bonariensis*, *Verbena officinale*, *Cirsium vulgare*, *Xanthium strumarium*, *Cestrum laevigatum*, *Sphaeralcea bonariensis* and *Fraxinus americana*.

In conclusion, this wetland area occurs on the border of the site with the majority of the wetland situated outside the site. The area is heavily degraded and transformed and in ecological terms is of relatively low conservation value. It does however form part of the Bloemspruit which provides several services to the urban area. Furthermore, development in this wetland area will be problematic due to flooding and the swelling and shrinking properties of wetland soils. It is therefore recommended that this area be excluded from development. Should it not be possible to exclude this area the required authorizations should be obtained from the Department of Water and Sanitation (DWS) and additional specialist studies conducted.

A small drainage line/area transects the site from east to west (Map 1). It originates as seepage from the Dam van Trane and then occurs as surface runoff or groundwater flow without any distinct channel. It does not contain any riparian vegetation which would indicate high flow volumes. It does however still function as water transporting body. The drainage line forms part of the Bloemspruit which flows through the Tempe Military Base where after it is canalised and flows through urban areas (Map 1). The drainage line is therefore not considered to play a vital ecological function as it forms part of the canalised Bloemspruit. It is therefore recommended that it be formalised and incorporated into the development. The storm water and water transporting function should be retained and accommodated within the development in order to ensure that runoff still enters the Bloemspruit system.

In conclusion, the site consists of natural grassland which has however been degraded and transformed to some extent by sustained overgrazing. The vegetation type is not of significant conservation value and this area does not contain a significant species or habitat diversity. The area is also surrounded by existing urban areas which isolates it from extensive natural areas

further decreasing its conservation value. The plains portion is therefore not considered to have any significant ecological aspects worthy of conservation and this area can be developed. A protected tree species and two protected bulb species occur which are of some conservation value. It is recommended that permits be obtained to remove the *O. europaea* subsp. *africana* (Wild Olives) trees present on the site and permits be obtained to transplant the *Brunsvigia radulosa* and *Eucomis autumnalis* bulbs and utilise them in the landscaping of the development (Appendix C). The Dam van Trane is an artificial impoundment supporting an artificial wetland with relatively low conservation value in terms of ecology (Map 1 & 2). However, it still has some ecological value and especially in terms of historical value has a high conservation value. It is therefore recommended that the dam and associated wetland be excluded from development. The wetland area occurring in the north-eastern corner of the site is highly degraded and forms part of the origin of the Bloemspruit (Map 1 & 2). In ecological terms it has a relatively low conservation value although it still provides several services to the urban area. Furthermore, development in this wetland area will be problematic due to flooding and the swelling and shrinking properties of wetland soils. It is therefore recommended that this area be excluded from development. Should it not be possible to exclude this area the required authorizations should be obtained from the Department of Water and Sanitation (DWS) and additional specialist studies conducted. The small drainage line/area transecting the site from east to west does not contain any riparian vegetation or distinct channel (Map 1). It is not considered to be of significant conservation value and it is therefore recommended that it be formalised and incorporated into the development. The storm water and water transporting function should be retained and accommodated within the development in order to ensure that runoff still enters the Bloemspruit system. As stipulated by the National Water Act, 1998 (Act 36 of 1998) any construction taking place within 100 meters of a watercourse or within 500 meters of a wetland area requires authorisation from the Department of Water Sanitation (DWS). This is specifically relevant to the Dam van Trane and wetland area in the north-west corner of the site.

4.2 Overview of terrestrial fauna (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	<i>Manis teminckii</i>
South African Hedgehog	<i>Atelerix frontalis</i>
Aardwolf	<i>Proteles cristatus</i>
African Wild Cat	<i>Felis lybica</i>
Small-Spotted Cat	<i>Felis nigripes</i>
Bat-Eared Fox	<i>Otocyon megalotis</i>
Striped Weasel	<i>Poecilogale albinucha</i>

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

5. ANTICIPATED IMPACTS

Anticipated impacts which the development will have is primarily concerned with the loss of vegetation, habitat and the water systems including the drainage area, impoundment and wetland area. Due to the already disturbed condition of the site, relatively low diversity and surrounding urban areas, the loss of vegetation, habitat and diversity is anticipated to remain relatively low. The vegetation type on the site is also not currently under significant threat and is considered as being of Least Concern (LC) (Map 2). The surrounding area also consists primarily of urban and built-up areas and the site therefore does not provide significant habitat to fauna.

Three protected species occur on the site (Appendix C). The loss of the few protected Wild Olives on the site is also not considered a high impact as these species are widespread and the specimens on the site is not of significant size or age. The bulb species on the site are of higher conservation value but as long as they are transplanted this impact is also anticipated to remain low. Due to the degraded condition of the site it is also highly unlikely that rare or endangered species will occur on the site.

The Dam van Trane is artificial in nature and therefore has a relatively low conservation value (Map 1 & 2). It does however have a relatively high historical value. The wetland area in the north-eastern corner of the site is also highly degraded and transformed and also has a relatively low conservation value (Map 1 & 2). It is however recommended that both these areas be excluded from development which will render the impact on them negligible.

The loss of the drainage line on the site is considered a moderate impact. It forms part of Bloemspruit which is a canalised and highly transformed system and the loss of the drainage line will not have a high impact on this system (Map 1). The drainage line should however still be accommodated in the development in terms of storm water management.

The development is likely to cause conditions susceptible to the establishment of weeds and the eradication of weeds on the site should be done prior and during the construction phase (Appendix D).

The loss of habitat on the site is not anticipated to have a high impact on the faunal population as the site is currently not able to sustain a healthy faunal population and the loss thereof would therefore not be high.

The impact significance has been determined and it is clear that the impacts the development will have can only be considered as low to moderate. This is largely due to the current degraded condition of the site and the site being surrounded by urban areas.

Please refer to Appendix E for the impact methodology.

Significance of the impact:

Impact	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Loss of vegetation type and clearing of vegetation	2	5	2	3	4	2	3	9
Loss of protected species	2	3	2	2.3	4	1	2.5	5.75
Loss of watercourses	2	5	2	3	5	2	3.5	10.5
Infestation with weeds and invaders	2	3	1	2	4	2	3	6
Impact on Terrestrial fauna	2	5	1	2.6	5	2	3.5	9.1

6. SITE SPECIFIC RESULTS

Habitat diversity and species richness:

Habitat diversity is considered as relatively low. The tree and grass layers are degraded and this causes a degraded habitat. Due to the degraded condition the diversity of species is also considered as relatively low.

Presence of rare and endangered species:

No rare or endangered species occur on the site and the likelihood that any such species would occur is considered highly unlikely due to the degraded condition of the site. Several specimens of the protected Wild Olive (*Olea europaea* subsp. *africana*) occur on the site but this species is however widespread and the specimens on the site are not of significant size or age and they are therefore not considered of significant conservation value. Permits will still have to be obtained to remove them (Appendix C). The two protected bulb species, *Brunsvigia radulosa* and *Eucomis autumnalis*, are widespread and not of significant rarity but are nonetheless protected and therefore of some conservation value (Appendix C). Permits should be obtained to transplant these and a designated nursery area should be created on the site where these can be temporarily cultivated until they can be placed in landscaping areas.

Ecological function:

The ecological function of the site has been impaired to some degree. The site is surrounded by urban areas and the habitat function it provides is therefore degraded (Map 1). The Dam van Trane is artificial and has a limited ecological function as wetland habitat (Map 1 & 2). The wetland area in the north-eastern corner of the site is highly degraded and transformed and its ecological function is also impaired to a large degree (Map 1 & 2). The drainage line on the site provides an ecological function as water transporting body (Map 1). However, it forms part of the Bloemspruit system which is canalised and the functioning of the drainage line on the site is therefore not vital to the continued functioning of downstream areas.

Degree of rarity/conservation value:

The site consists of Winburg Grassy Shrubland (Gh 7) which is not currently subjected to any pronounced development pressures and is consequently listed as being of Least Concern (LC) (Map 2).

The Dam van Trane is an artificial impoundment with relatively low conservation value although the historical value is significant (Map 1 & 2). The wetland in the north-eastern corner is heavily degraded and transformed and in ecological terms is of relatively low conservation value (Map 1 & 2). It does however form part of the Bloemspruit which provides several services to the urban area. The drainage line on the site forms part of the Bloemspruit canalised system and is subsequently not considered to have a high conservation value (Map 1).

Percentage ground cover:

Due to the recent drought conditions and heavy overgrazing of the grassland on the site the percentage ground cover is relatively low.

Vegetation structure:

The vegetation structure on the site is transformed to some degree. Exotic tree species alter the tree layer and heavy overgrazing of the site decreases grass cover and increases dwarf shrub and herb cover.

Infestation with exotic weeds and invader plants:

Several exotic species occur on the site but are not dominant.

Degree of grazing/browsing impact:

Grazing by domestic stock is sustained and high and has degraded the grassland layer on the site.

Signs of erosion:

Erosion is moderate in the form of sheet erosion.

Terrestrial animals:

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.

Table 2: Biodiversity Sensitivity Rating for the proposed urban development.

	Low (3)	Medium (2)	High (1)
Vegetation characteristics			
Habitat diversity & Species richness	3		
Presence of rare and endangered species		2	
Ecological function		2	
Uniqueness/conservation value		2	
Vegetation condition			
Percentage ground cover	3		
Vegetation structure	3		
Infestation with exotic weeds and invader plants or encroachers		2	
Degree of grazing/browsing impact	3		
Signs of erosion		2	
Terrestrial animal characteristics			
Presence of rare and endangered species	3		
Sub total	15	10	0
Total		25	

7. BIODIVERSITY SENSITIVITY RATING (BSR) INTERPRETATION

Table 3: Interpretation of Biodiversity Sensitivity Rating.

Site	Score	Site Preference Rating	Value
urban development	25	Acceptable	3

8. DISCUSSION AND CONCLUSION

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

According to Mucina & Rutherford (2006) the area consists of Winburg Grassy Shrubland (Gh 7) (Map 2). This vegetation type is currently listed as being of Least Concern (LC) under the National List of Threatened Ecosystems (Notice 1477 of 2009)(National Environmental Management Biodiversity Act, 2004) (Map 2). The vegetation type is therefore not currently subjected to any pronounced development pressures.

The site consists predominately of natural vegetation although in a significantly degraded condition. The site is currently utilised as grazing for horses and other domestic stock. Due to the small size of the site and the overstocking by livestock the grazing pressure is exceptionally high. The site has notably also been degraded by past land uses and small dilapidated buildings and rubble is present on the site.

The proposed urban development will occur on the remainder of Erf 22011 (Map 1 & 2). The site is situated adjacent to the Tempe Military Base and is currently utilised as natural grazing although heavily overutilized. The extent of the site to be developed is approximately 23.5 hectares. The site is situated within the grassland biome and the vegetation therefore consists of grassland with scattered shrubs and trees which is natural to the Winburg Grassy Shrubland vegetation type. Several exotic tree species are also present on the site and these alter the vegetation structure to some extent.

The topography of the site consists of a plain sloping gently from east to west. The Dam van Trane (an artificial water body) is situated in the north-western corner of the site (Map 1 & 2). It does not drain into any defined watercourse but seeps from the dam in an eastern direction. This results in a small drainage line without any distinct channel draining from east to west across the site and forms areas of elevated moisture (Map 1). No clearly defined ponding could be identified. The north-eastern corner of the site contains wetland condition associated with the origin of the Bloemspruit, a watercourse flowing through the city (Map 1 & 2).

Anticipated impacts which the development will have is primarily concerned with the loss of vegetation, habitat and the water systems including the drainage area, impoundment and wetland area. Due to the already disturbed condition of the site, relatively low diversity and surrounding urban areas, the loss of vegetation, habitat and diversity is anticipated to remain relatively low. The vegetation type on the site is also not currently under significant threat and is considered as being of Least Concern (LC) (Map 2).

Three protected species occur on the site (Appendix C). The loss of the few protected Wild Olives on the site is also not considered a high impact as these species are widespread and the specimens on the site is not of significant size or age. The bulb species on the site are of higher conservation value but as long as they are transplanted this impact is also anticipated to remain low.

The Dam van Trane is artificial in nature and therefore has a relatively low conservation value (Map 1 & 2). It does however have a relatively high historical value. The wetland area in the north-eastern corner of the site is also highly degraded and transformed and also has a

relatively low conservation value (Map 1 & 2). It is however recommended that both these areas be excluded from development which will render the impact on them negligible.

The loss of the drainage line on the site is considered a moderate impact. It forms part of Bloemspruit which is a canalised and highly transformed system and the loss of the drainage line will not have a high impact on this system (Map 1). The drainage line should however still be accommodated in the development in terms of storm water management.

The development is likely to cause conditions susceptible to the establishment of weeds and the eradication on the site should be done during the construction phase (Appendix D).

The loss of habitat on the site is not anticipated to have a high impact on the faunal population as the site is currently not able to sustain a healthy faunal population and the loss thereof would therefore not be high.

The impact significance has been determined and it is clear that the impacts the development will have can only be considered as low to moderate. This is largely due to the current degraded condition of the site and the site being surrounded by urban areas.

In conclusion, the site consists of natural grassland which has however been degraded and transformed to some extent by sustained overgrazing. The vegetation type is not of significant conservation value and this area does not contain a significant species or habitat diversity. The area is also surrounded by existing urban areas which isolates it from extensive natural areas further decreasing its conservation value. The plains portion is therefore not considered to have any significant ecological aspects worthy of conservation and this area can be developed. A protected tree species and two protected bulb species occur which are of some conservation value (Appendix C). It is recommended that permits be obtained to remove the *O. europaea* subsp. *africana* (Wild Olives) trees present on the site and permits be obtained to transplant the *Brunsvigia radulosa* and *Eucomis autumnalis* bulbs and utilise them in the landscaping of the development. The Dam van Trane is an artificial impoundment supporting an artificial wetland with relatively low conservation value in terms of ecology (Map 1 & 2). However, it still has some ecological value and especially in terms of historical value has a high conservation value. It is therefore recommended that the dam and associated wetland be excluded from development. The wetland area occurring in the north-eastern corner of the site is highly degraded and forms part of the origin of the Bloemspruit (Map 1 & 2). In ecological terms it has a relatively low conservation value although it still provides several services to the urban area. Furthermore, development in this wetland area will be problematic due to flooding and the swelling and shrinking properties of wetland soils. It is therefore recommended that this area be excluded from development. Should it not be possible to exclude this area the required authorizations should be obtained from the Department of Water and Sanitation (DWS) and additional specialist studies conducted. The small drainage line/area transecting the site from east to west does not contain any riparian vegetation or distinct channel (Map 1). It is not considered to be of significant conservation value and it is therefore recommended that it be formalised and incorporated into the development. The storm water and water transporting function should be retained and accommodated within the development in order to ensure that runoff still enters the Bloemspruit system. As stipulated by the National Water Act, 1998 (Act 36 of 1998) any construction taking place within 100 meters of a watercourse or within 500 meters of a wetland area requires authorisation from the Department of Water Sanitation (DWS). This is specifically relevant to the Dam van Trane and wetland area in the north-west corner of the site.

9. RECOMMENDATIONS

- The protected Wild Olive (*Olea europaea* subsp. *africana*) occurring on the site is not of significant size or age and are therefore not considered of conservation significance. However, permits will still have to be obtained to remove them from the site (Appendix C).
- Two protected bulb species on the site, *Brunsvigia radulosa* and *Eucomis autumnalis*, transplant easily and are of some aesthetic value and they should therefore be transplanted and utilised in the landscaping of the development (Appendix C). Permits should be obtained to transplant these and a designated nursery area should be created on the site where these can be temporarily cultivated until they can be placed in landscaping areas.
- The process of transplanting protected species should be undertaken and overseen by a suitably qualified person, preferably a botanist or ecologist. This should be undertaken during the rainy season when deciduous bulbs will be visible. The designated nursery area should also be constructed, overseen and maintained by a suitably qualified person.
- The Dam van Trane is an artificial impoundment supporting an artificial wetland and largely as a result of its historical value it is recommended that the dam and associated wetland be excluded from development (Map 1 & 2).
- The wetland area occurring in the north-eastern corner of the site is highly degraded although it still provides several services to the urban area (Map 1 & 2). It is recommended that this area be excluded from development. Should it not be possible to exclude this area the required authorizations should be obtained from the Department of Water and Sanitation (DWS) and additional specialist studies conducted.
- The small drainage line on the site forms part of the canalised Bloemspruit system and is therefore not of vital importance to the functioning of downstream areas (Map 1). It should however still be accommodated within the development in terms of storm water management.
- As stipulated by the National Water Act, 1998 (Act 36 of 1998) any construction taking place within 100 meters of a watercourse or within 500 meters of a wetland area requires authorisation from the Department of Water Sanitation (DWS). This is specifically relevant to the Dam van Trane and wetland area in the north-east corner of the site.
- Alien weeds and invaders occurring on the site should be removed and monitored for re-establishment (Appendix D).
- The hunting, capturing and trapping of fauna should be prevented by making this a punishable offense during the construction phase.
- After construction has ceased all construction materials should be removed from the area.

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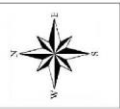
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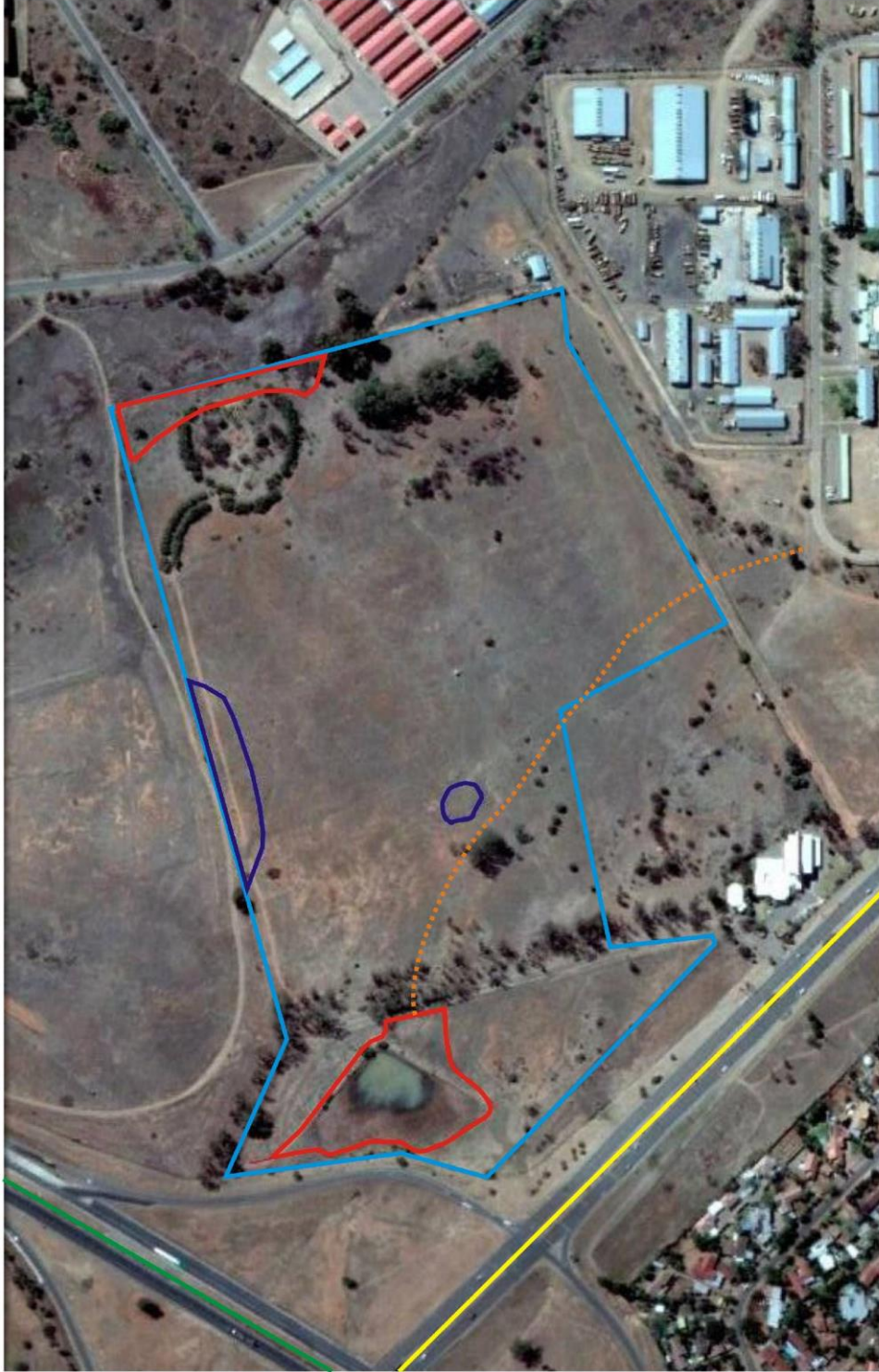
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Annexure A: Maps and Site photos



Locality map for the proposed urban development on the Remainder of Erf 22011, Bloemfontein, Free State Province.









Map 1: Locality map of the proposed urban development on the Remainder of Erf 22011, Bloemfontein. The site boundary and sensitive features are also indicated. Also note the surrounding urban areas.



Prepared for:
Spatial Solutions Inc.
P.O. Box 28046
Danhof
9310

Legend:

-  Site boundary
-  N8 National Road
-  N1 National Road
-  Drainage line
-  Protected species
-  Wetland areas

Map Information

Spheroid: WGS 84



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General ecology map for the proposed urbandevelopment on the Remainder of Erf 22011, Bloemfontein, Free State Province.



Map 2: General ecology map of the proposed hospital development on Erf 1/22011, Bloemfontein. Sensitive areas on the site is indicated.



Prepared for:
Spatial Solutions Inc.
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Danhof
9310

Legend:

- Site boundary
- Property boundaries
- Prominent roads
- Watercourses
- Winburg Grassy Shrubland
- Bloemspruit wetland
- Dam van Trane
- Protected species

Map Information

Spheroid: WGS 84

Scale: 1:10 000

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Figure 1: Panorama of the Dam van Trane in the north-eastern corner of the site.



Figure 2: Panorama of the wetland areas surrounding the Dam van Trane. These wetlands are caused by seepage from the dam walls to the surrounding area.



Figure 3: Panorama of the site from the north to the south. The two windrows of exotic Bluegum Trees (*Eucalyptus camaldulensis*) is indicated (red).



Figure 4: Panorama of the site from the east toward the west.



Figure 5: Close-up view of the plain area which illustrates the dominance of the pioneer herb, *Nidorella resedifolia*, which considerably decreases the grass layer.



Figure 6: View of the Bron van Herinnering, a monument in the north-eastern corner of the site. A planted lane of Karree (*Searsia lancea*) has been planted here.



Figure 7: View of the wetland area in the north-eastern corner of the site forming part of the Bloemspruit.



Figure 8: Another view of the wetland area. The majority of the wetland area is situated outside the site boundary (red).



Figure 9: Some of the Bluegum Trees (*Eucalyptus camaldulensis*) are of significant size and age but as exotic trees they are considered to be of low conservation value and should preferably be removed. It is unknown if they have any significant historical value.



Figure 10: View of the drainage line/area on the site (red). No identifiable riparian vegetation or definable channel is present.

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>Bidens pinnata</i>	Herb
* <i>Cestrum laevigatum</i>	Shrub
* <i>Cirsium vulgare</i>	Herb
* <i>Conyza bonariensis</i>	Herb
* <i>Cuscutta campestris</i>	Parasite
* <i>Eucalyptus camaldulensis</i>	Tree
* <i>Fraxinus americana</i>	Tree
* <i>Oenothera rosea</i>	Herb
* <i>Opuntia engelmannii</i>	Succulent
* <i>Opuntia ficus-indica</i>	Succulent
* <i>Schkuhria pinata</i>	Herb
* <i>Sphaeralcea bonariensis</i>	Shrub
* <i>Tagetes minuta</i>	Herb
* <i>Verbena bonariensis</i>	Herb
* <i>Verbena officinale</i>	Herb
* <i>Xanthium strumarium</i>	Herb
<i>Alternanthera sessilis</i>	Herb
<i>Aristida congesta</i>	Grass
<i>Aristida diffusa</i>	Grass
<i>Asparagus larcinus</i>	Shrub/climber
<i>Barleria macrostegia</i>	Herb
<i>Berkheya macrocephala</i>	Herb
<i>Berkheya onopordifolia</i>	Herb
<i>Brunsvigia radulosa</i>	Geophyte
<i>Chasmatophyllum mustellinum</i>	Succulent
<i>Chloris virgata</i>	Grass
<i>Commelina africana</i>	Herb
<i>Conyza podocephala</i>	Herb
<i>Crabbea acaulis</i>	Herb
<i>Crassula lanceolata</i>	Succulent
<i>Cymbopogon pospischillii</i>	Grass
<i>Cynodon dactylon</i>	Grass
<i>Cyperus eragrostis</i>	Sedge
<i>Cyperus longus</i>	Sedge
<i>Cyperus marginatus</i>	Sedge
<i>Cyperus usitatus</i>	Sedge
<i>Delosperma sp.</i>	Succulent
<i>Digitaria eriantha</i>	Grass
<i>Diospyros lycioides</i>	Tree

<i>Dipcadi ciliare</i>	Geophyte
<i>Dipcadi viride</i>	Geophyte
<i>Eleocharis limosa</i>	Sedge
<i>Eragrostis lehmanniana</i>	Grass
<i>Eragrostis obtusa</i>	Grass
<i>Eragrostis superba</i>	Grass
<i>Eucomis autumnalis</i>	Geophyte
<i>Felicia muricata</i>	Dwarf shrub
<i>Fingerhuthia africana</i>	Grass
<i>Geigeria filifolia</i>	Herb
<i>Gomphocarpus fruticosus</i>	Shrub
<i>Helichrysum dregeanum</i>	Dwarf shrub
<i>Hermannia coccocarpa</i>	Herb
<i>Hermannia depressa</i>	Herb
<i>Heteropogon contortus</i>	Grass
<i>Hibiscus pusillus</i>	Herb
<i>Hyparrhenia hirta</i>	Grass
<i>Hypoxis hemerocallidae</i>	Geophyte
<i>Indigofera alternans</i>	Herb
<i>Ipomoea oenotheroides</i>	Herb
<i>Juncus rigidus</i>	Rush
<i>Ledebouria luteola</i>	Geophyte
<i>Leptochloa fusca</i>	Grass
<i>Lycium horridum</i>	Dwarf shrub
<i>Marsilea sp.</i>	Fern
<i>Monsonia angustifolia</i>	Herb
<i>Moraea pallida</i>	Geophyte
<i>Nenax microphylla</i>	Dwarf shrub
<i>Nidorella resedifolia</i>	Herb
<i>Nolletia ciliaris</i>	Dwarf shrub
<i>Olea europaea subsp. africana</i>	Tree
<i>Oxalis obliquifolia</i>	Geophyte
<i>Paspalum dilatatum</i>	Grass
<i>Paspalum distichum</i>	Grass
<i>Pentzia incana</i>	Dwarf shrub
<i>Persicaria lapathifolia</i>	Herb
<i>Portulaca oleracea</i>	Succulent
<i>Pycreus sp.</i>	Sedge
<i>Ranunculus multifidus</i>	Herb
<i>Rosenia humilis</i>	Dwarf shrub
<i>Ruschia hamata</i>	Succulent
<i>Salvia verbanaca</i>	Herb
<i>Scabiosa columbaria</i>	Herb
<i>Searsia lancea</i>	Tree
<i>Seddera capensis</i>	Herb
<i>Selago densiflora</i>	Herb

<i>Senecio consanguineus</i>	Herb
<i>Senecio inaequidens</i>	Herb
<i>Setaria sphacelata</i>	Grass
<i>Sporobolus fimbriatus</i>	Grass
<i>Sutera caerulea</i>	Herb
<i>Talinum cafferum</i>	Geophyte
<i>Themeda triandra</i>	Grass
<i>Tragus berteronianus</i>	Grass
<i>Tragus koelerioides</i>	Grass
<i>Typha capensis</i>	Bulrush
<i>Vachellia karroo</i>	Tree

Appendix C: 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.



Olea europaea subsp. africana
Wild Olive/Olienhout

Protected in the Free State Province

National Red List Status: **Least Concern**

Method: **A few small specimens on the site. Permits should be obtained to remove them.**



Brunsvigia radulosa
Kandelaar Lelie/Candelabra Lily

Protected in the Free State Province

National Red List Status: **Least Concern**

Method: **Few scattered specimens in north of the site. Should be transplanted and incorporated into the landscaping of the development. Transplants easily. Will not be visible during winter months.**



Eucomis autumnalis
Pineapple Flower/Wildepynappel

Protected in the Free State Province

National Red List Status: **Least Concern**

Method: **Small colony in central portion of the site. Should be transplanted and incorporated into the landscaping of the development. Transplants easily. Will not be visible during winter months.**

Appendix D: 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 strumarium
Large cocklebur/Kankerroos

Type: Weed
Category: 1

Mechanical removal by hand is effective to control this weed. Cutting is not recommended as this leads to re-sprouting.

Several chemicals have also been registered for control: bromoxynil, metribuzin, cyanazine/atrazine, bendioxide, MCPB, MCPA-K and 2,4-D(A), (T), (I).



Opuntia spp.
Prickly Pear

Type: Weed
Category: 1

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

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



Cestrum laevigatum
Inkberry/Inkbessie

Type: Invader
Category: 1

Chemical control is most effective with a herbicide such as triclopyr or imazapyr being painted on stems or cut stumps.



Eucalyptus camaldulensis
Bluegum Tree/Bloekomboom

Type: Invader
Category: 2

Trees should be cut down and stumps treated with a suitable herbicide.

Appendix E: 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.

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