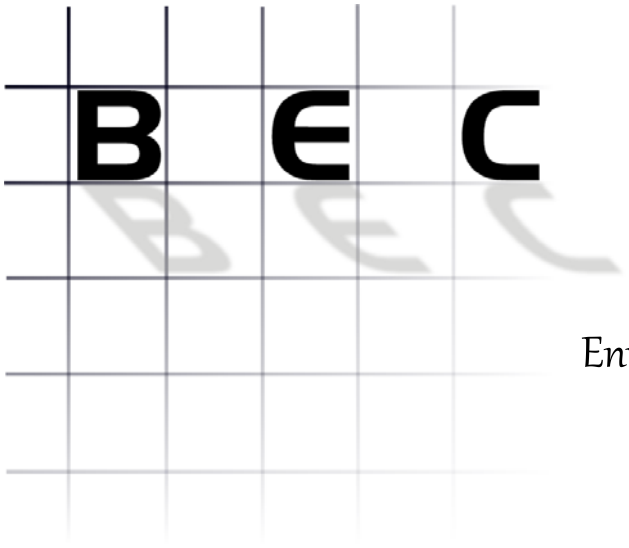
Project code: SVE – RM2 - 2011/18

# Strategic Biodiversity Basic Assessment

# for the proposed RUSTM02 PV Plant on remaining extent of Portion 24 of the farm Spruitfontein 341, North-West Province

compiled by




Bathusi Environmental Consulting

June 2011

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# I PROJECT DETAILS

| | |
|---|---|
| **Client:** | Savannah Environmental (Pty) Ltd |
| **Report name:** | Strategic Biodiversity Basic Assessment for the proposed RustMo2 PV Plant on remaining extent of Portion 24 of the farm Spruitfontein 341, North-West Province |
| **Report type:** | Biodiversity Basic Assessment Report |
| **BEC Project number:** | SVE - MME – 2011/18 |
| **Authority Reference:** | (National DEA) 12/12/20/2283 |
| **Compiled by:** | Riaan A. J. Robbeson (Pr.Sci.Nat.), Bathusi Environmental Consulting |

# II RESERVED COPYRIGHT



# III SPECIALIST INVESTIGATORS

The Natural Scientific Professions Act of 2003 aims to '*provide for the establishment of the South African Council of Natural Scientific Professions (SACNASP), and for the registration of professional, candidate and certified natural scientists; and to provide for matters connected therewith'.*

Quoting the Natural Scientific Professions Act of 2003: '*Only a registered person may practice in a consulting capacity*' (20(1) – pg 14).

**Table 1: Biodiversity Specialists for this project**

| **Floristic Investigator:** | **Riaan Robbeson (Pr.Sci.Nat.)** |
|---|---|
| Qualification: | M.Sc. (Botany), UP |
| Affiliation: | South African Council for Natural Scientific Professions |
| Fields of Expertise: | Botanical Scientist & Ecological Scientist |
| *Registration Number:* | *400005/03* |
| Affiliation: | Grassland Society of Southern Africa |
| Membership Status: | Professional Member |
| *Membership Number:* | *667.08/08* |
| | |
| **Investigator:** | **Dewald Kamffer (Pr.Sci.Nat.)** |
| Qualification: | M.Sc. (Conservation Biology), UP |
| Affiliation: | South African Council for Natural Scientific Professions |
| Fields of expertise: | Ecological Scientist & Zoological Scientist |
| *Registration number:* | *400204/05* |

## IV DECLARATION OF INDEPENDENCE

All specialist investigators, project investigators and members of companies employed for conducting this biodiversity investigation declare that:

- We act as independent ecologists compiling this report
- We consider ourselves bound to the rules and ethics of the south african council for natural scientific professions;
- At the time of completing this report, we did not have any interest, hidden or otherwise, in the proposed development or activity as outlined in this document, other than financial compensation for work performed in a professional capacity in terms of the environmental impacts assessment regulations, 2005;
- We will not be affected in any manner by the outcome of the environmental process of which this report forms part of, other than being part of the general public;
- We do not have any influence over decisions made by the governing authorities;
- Undertake to disclose, to the competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the environmental impact assessment regulations, 2005;
- Will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not;
- We do not necessarily object to or endorse the proposed development, but aim to present facts and recommendations based on scientific data and relevant professional experience; and
- Should we consider ourselves to be in conflict with any of the above declarations, we shall formally submit a Notice of Withdrawal to all relevant parties and register as an Interested and Affected Party.

*Signature of principal ecologist:*

**Bathusi Environmental Consulting cc (CK1999/052182/23)**

*Name of company:*

**21st June 2011**

*Date:*

## V SURVEY DETAILS

Field surveys were conducted on the 10th June 2011.

## VI LEGISLATION

Compliance with provincial, national and international legislative aspects is strongly advised during the planning, assessment, authorisation and execution of this particular project. Legislative aspects taken cognisance of during the compilation of this report included the following, but may not necessarily be limited to:

| Table 2: Legislative guidance for this project | |
|---|---|
| **Biodiversity Act (No. 10 of 2004)** | To provide for the management and conservation of South Africa's biodiversity within the framework of the National Environmental Management Act 1998; the protection of species and ecosystems that warrant national protection; the sustainable use of indigenous biological resources; the fair and equitable sharing of benefits arising from bioprospecting involving indigenous biological resources; the establishment and functions of a South African National Biodiversity Institute; and for matters connected therewith. |
| **Conservation of Agricultural Resources Act 43 of 1983** | The conservation of soil, water resources and vegetation is promoted. Management plans to eradicate weeds and invader plants must be established to benefit the integrity of indigenous life. |
| **Constitution of the Republic of South Africa (Act 108 of 1996)** | The Bill of Rights, in the Constitution of South Africa (No. 108 of 1996), states that everyone has a right to a non-threatening environment and requires that reasonable measures are applied to protect the environment. This protection encompasses preventing pollution and promoting conservation and environmentally sustainable development. These principles are embraced in NEMA and given further expression. |
| **Convention on Biological Diversity, 1995** | International legally binding treaty with three main goals; conserve biological diversity (or biodiversity); ensure sustainable use of its components and the fair and equitable sharing of benefits arising from genetic resources. |
| **Convention on International Trade in Endangered Species of Wild Life and Fauna** | International agreement between governments, drafted as a result of a resolution adopted in 1963 at a meeting of members of the International Union for Conservation of Nature (IUCN). Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival and it accords varying degrees of protection to more than 33,000 species of animals and plants. |
| **Environmental Conservation Act (No. 73 of 1989)** | To provide for the effective protection and controlled utilization of the environment and for matters incidental thereto. |
| **National Environmental Management Act (No. 107 of 1998)** | Requires adherence to the principles of Integrated Environmental Management (IEA) in order to ensure sustainable development, which, in turn, aims to ensure that environmental consequences of development proposals be understood and adequately considered during all stages of the project cycle and that negative aspects be resolved or mitigated and positive aspects enhanced. |
| **National Environmental Management Act (No 10 of 2004)** | Restriction of activities involving alien species, restricted activities involving certain alien species totally prohibited and duty care relating to listed invasive species. |
| **National Forest Act, 1998 (No 84 of 1998)** | Cutting, disturbing, damaging or destroying any indigenous, living tree in a natural forest, except in terms of a licence issued under section 7(4) or section 23; or an exemption from the provisions of the subsection published by the Minister in the Gazette. The sections include protected tree species, a particular tree, a group of trees or particular woodland to be a protected tree, group of trees, woodland or species. In terms of |

| Table 2: Legislative guidance for this project | |
|---|---|
| | section 15, no person may cut, disturb, damage, destroy or remove any protected tree; or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire of dispose of any protected tree, except under a licence granted by the Minister. |
| **Protected Areas Act (No. 57 of 2003)** | To provide for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes; for the establishment of a national register of all national, provincial and local protected areas; for the management of those areas in accordance with national norms and standards; for intergovernmental co-operation and public consultation in matters concerning protected areas; and for matters in connection therewith. |

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# 1 EXECUTIVE SUMMARY

Momentous Energy, as an independent power producer, has identified a site for the proposed establishment of a photovoltaic (PV) plant in the North-West Province. The site is located adjacent to the Marikana Platinum Mine, approximately 20km east of Rustenburg. This report aims to provide a brief description of the affected biological (flora and fauna) environment, highlighting potentially sensitive aspects as well as providing some mitigation measures to curb significant as well as general impacts.

## 1.1 Biophysical Environment

The study area is situated within the Limpopo River Catchment Area. A non-perennial tributary of the Brakspruit is present in the southern part of the site. Visual observations revealed that the status of the stream is relatively degraded because of some erosion within the study area, which resulted in extensive widening of the flow regime of the stream. No major dams are situated within the immediate vicinity of the study area.

The general region comprises extensively transformed habitat that resulted mainly from agriculture and mining. The high transformation factor of the region renders remaining habitat fragmented and isolated. Some natural woodland habitat remains in the area, particularly to the south in the Magaliesberg Nature Area. Extensive mining areas are located to the east and north of the study area. Agricultural activities have resulted in land transformation on the site as well as to the west.

The topography of the region falls into the categories of 'Slightly Undulating Plains' and the general altitude is approximately 1,200 meters above sea level. No significant slopes are present within the study area, but important ridges and hills are present to the south (Magaliesberg) of the study area. These areas are unlikely to be affected by the proposed development.

The study area is situated within the Savanna Biome, specifically within the Marikana Thornveld (Endangered Status) and Moot Plains Bushveld (Vulnerable Status) vegetation types, situated within the Savanna Biome. The Magaliesberg Nature Area is located approximately 3.5km to the south of the study area. The buffer zone of this nature area is located approximately 500m to the south and east of the site. It is however unlikely that these areas will be directly affected by the proposed development.

On a greater scale, the region is highly fragmented by a well-developed road and railway infrastructure. Remaining pockets of natural habitat in the immediate vicinity of the site is largely isolated from natural and uninterrupted habitat of the Magaliesberg Nature Area towards the south of the site. However, this Nature Area represents only the mountainous habitat of the region, while the plains and flatter parts of the region have been extensively transformed. Areas surrounding the study site exhibit a history of prolonged and severe

impact on the status of natural habitat, rendering remaining natural habitat relatively low in terms of conservation potential, but high in terms of conservation importance.

### 1.2 Flora

The study area is situated within the 2527CB ¼-degree grid. SANBI information indicates the known presence of 234 plant species within this grid (POSA, 2009). The site investigation revealed the presence of approximately 91 plant species on the site. The diversity of this portion of land, in spite of the moderately degraded status of extensive parts of the site, is regarded as diverse, reflecting not only on the species richness of the regional vegetation, but also the effect of transformation and the influx of plant species not normally associated with the region.

The savanna physiognomy of the area is indicated by the presence of several woody species in areas of natural vegetation. These woody species comprise a relative large proportion of diversity and their dominance in certain areas, particularly in wetter and untransformed parts of the study area, is noted. Grasses, forbs and trees comprise a high percentage of the species diversity. The degraded nature of parts of the site is firstly indicated by the presence of numerous weeds and alien invasive species, secondly by the absence of species associated with the natural regional vegetation types and lastly the unnatural prominence of species associated with the area. It is estimated that approximately 31.9% of the species comprise plants of an undesirable nature. The effect of these species is enhanced by their dominance in certain parts. A total of 37 plant families are represented by the floristic diversity of the site, dominated by Poaceae (29 species, 31.9%).

SANBI records for the region indicate the presence of two Red Data species in this ¼-degree grid. While conditions were not conducive for locating or identifying Red Data species during the site investigation, it is regarded highly unlikely that any of these Red Data flora species would occur on this site, as available habitat does not correspond to the habitat required by any of these species. A number of invasive and weed species were noted on the study site.

A single individual of the protected tree species (*Sclerocarya birrea* subsp. *birrea*, Marula) is present on the site. It is situated in the immediate vicinity of the old homestead and is assumed to have been planted by early inhabitants of the property. An application for a permit for the removal/ damage/ cutting or pruning of protected tree species as per National Forest Act, 1998 (No 84 of 1998) need to be applied for from the relevant authority prior to the commencement of construction activities.

Results of the photo analysis and site investigations revealed the presence of the following habitat types:

- Agricultural Fields (Low floristic sensitivity);
- Drainage Line/ Eroded Woodland (Medium-high floristic sensitivity);

- Grassland Seepage (Medium-high floristic sensitivity);
- Homestead (Medium-low floristic sensitivity);
- Natural Woodland/ Savanna (Medium-high floristic sensitivity); and
- Reverted Woodland (Medium-low floristic sensitivity).

A relatively large portion of the proposed site exhibits attributes of medium-high floristic sensitivity, which is attributed to the Endangered and Vulnerable status ascribed to the regional vegetation types and not the specific result of particularly pristine vegetation present within the study area. However, these habitat types are moderately degraded, displaying the effects of surrounding land uses and erosion, rendering the remaining parts of natural vegetation isolated in a highly transformed and degraded environment. In addition, areas of medium-high floristic sensitivity within the study area are relative small when considered on a regional scale.

Ultimately, the relatively small size of the remaining pockets of natural vegetation renders the actual conservation potential relatively low; it is estimated that the current size of natural vegetation within the study site (including the immediate surrounds) is below the critical threshold where the natural ecology of the region can effectively be conserved. However, the role that these small islands of natural vegetation plays as 'stepping stones' between larger areas of potentially richer and more effectively conserved ecology (such as the nearby Magaliesberg Nature Area), cannot be underestimated, hence the medium-high floristic sensitivity ascribed to these parts.

Considering the proposed project, it is regarded unlikely that the loss of terrestrial habitat types (excluding wetland related habitat types) will result in significant impacts on a local or regional scale. When considered in light of the existing mines and proposed developments adjacent to this property, the effect on a local scale might be of moderate significance, on a regional scale it is however regarded negligent. The increase in habitat transformation on a regional scale is not expected to result in significant increases of habitat fragmentation and isolation on a regional scale. Wetland related habitat, because of a moderate connectivity to downstream habitat, should be excluded from the proposed development. The implementation of site-specific mitigation measures are recommended in order to control construction and operational activities from affecting these areas adversely.

### 1.3 Fauna

Only specific faunal groups are used during the species-specific element of this faunal assessment because of restrictions concerning database availability. Data on the Q-degree level is available for the following faunal groups:

- Invertebrates: Butterflies (South African Butterfly Conservation Assessment – http://sabca.adu.org.za)
- Amphibians: Frogs (Atlas and Red Data Book of the South Africa, Lesotho and Swaziland)

- Reptiles: Snakes and other Reptiles (South African Reptile Conservation Assessment - http://sarca.adu.org.za)
- Mammals: Terrestrial Mammals (Red Data Book of the Mammals of South Africa: A Conservation Assessment.)

A total of 592 animal species (124 families, 33 orders and 5 classes - Insecta, Amphibia, Reptilia, Aves and Mammalia) are known from the region of the study area. This includes 46 Red Data species.

The presence of 24 animal species on this particular site was confirmed during the site investigation. Signs, or individuals, of two butterflies, one reptile, sixteen birds and five mammals were confirmed; this includes the Red Data mammal *Mellivora capensis* (Honey Badger, NT). These animals are regarded typical of the study area, taking into consideration the size and location in the Marikana Thornveld and Moot Plains Bushveld as well as the mixture of habitat types present in the study area. It must be noted that a study during the raining period (i.e. in the warm, wet season) would likely reveal other species that are unlikely to be found during the cold, dry season; such as migrant birds, summer-active invertebrates, amphibians and reptiles.

A total of 81 Red Data animals is known to occur in the North-West Province (for mammals, reptiles, amphibians and invertebrates) and the Q-grid 2527CB (for avifauna). Another 16 Red Data species known from the region are considered at least moderately likely to be present in the study area, as either permanent residents, or at least migrating through the study area periodically. It is estimated that 48 of the listed 81 animals have a low probability of occurring in the study area, 16 species have a moderate-low probability and 16 have a moderate probability of occurring. Most of the species are considered to have either a low or a moderate-low likelihood of occurring in the study area.

During the field assessment, the study area was investigated and the following faunal sensitivities were ascribed to habitat types:

- Agricultural Fields (Low faunal sensitivity);
- Drainage Line/ Eroded Woodland (Medium-high faunal sensitivity);
- Grassland Seepage (Medium-high faunal sensitivity);
- Homestead (Low faunal sensitivity);
- Natural Woodland/ Savanna (Medium faunal sensitivity); and
- Reverted Woodland (Medium faunal sensitivity).

The study area represents a relatively small, isolated fragment of moderately transformed faunal habitat situated within a matrix of crop agriculture and mining infrastructure on local and regional scale. Faunal species observed in the study area are mostly widespread and common and are not restricted in range or habitat requirements. Evidence of one Red Data species was observed in the study area, observed in the southern section of the study area (Wetland habitat).

The study area does not exhibit any significantly sensitive faunal habitat or –communities and it is not likely that the proposed project will impact significantly on any animal species, assemblage or community on a local or regional scale. It is however recommended that the wetland related habitat types be excluded from the proposed development.

### 1.4 Impact Assessment

Results of the floristic and faunal investigations were interpreted holistically in order to assess the potential impact on the ecological environment. The impact assessment is aimed at presenting a description of the nature, extent significance and potential mitigation of identified impacts on the biological environment. Only habitat types that exhibit attributes of Medium-High sensitivity were evaluated. Impacts in areas of Medium or lower categories are regarded acceptable and the implementation of generic mitigation measures is expected to result in minimising potential impacts within these areas. Habitat types that are evaluated in the following section include:

- Drainage Lines/ Eroded Woodland Medium-high Sensitivity;
- Grassland Seepage Medium-high Sensitivity; and
- Natural Woodland/ Savanna Medium-high Sensitivity.

No impacts were identified that could lead to a beneficial impact on the ecological environment of the study area since the proposed development is largely destructive as it involves the alteration of natural habitat or further degradation of habitat that is currently in a sub-climax status. The following impacts are relevant to the propose development:

- Destruction of threatened and protected flora species;
- Destruction of sensitive/ pristine habitat types;
- Direct impacts on threatened fauna species;
- Direct impacts on common fauna species;
- Floristic species changes subsequent to development;
- Faunal interactions with structures, servitudes and personnel; and
- Impacts on SA's conservation obligations & targets (VEGMAP vegetation types).

Results of the impact assessment indicate impacts of a high or medium significance within areas of wetland related habitat types, mainly because of the effect that impacts high up in a catchment area will have on downstream areas. Impacts of medium and lower significance are estimated for the terrestrial habitat types. When considering cumulative impacts, it has to be accepted that the study area is small, as well as situated within a highly transformed and degraded region that resulted from agriculture and mining. The contribution that this development will have to habitat transformation, -fragmentation and –isolation on a regional scale is regarded small. On a local scale, however, the effect might be of a moderate significance.

Ultimately, the conservation potential of these areas is regarded low since rehabilitation of degraded areas and reclamation of transformed habitat will be extremely costly while the

actual contribution to provincial and regional conservation objectives will be low. The loss of the terrestrial habitat types, taking cognisance of the presence of extensive mining and agricultural areas in the immediate surrounds, as well as the planned development on the adjacent property, is not expected to result in significant impacts on the biological environment. The implementation of generic mitigation measures is regarded sufficient to prevent impacts resulting from construction and operational activities from spreading beyond the site, or into more important habitat.

The exclusion of wetland related areas from the proposed development is recommended. These areas, although only moderately pristine at best, do play a role in the ecology of the region, particularly in downstream habitat. It is recommended that a wetland specialist be consulted in order to delineate the boundaries of wetland related habitat types on the site, also applying relevant buffer zones to the development. The implementation of generic mitigation measures, which should mostly be aimed at avoiding any impact within these parts, is regarded sufficient to protect this habitat type and biodiversity attributes associated with the area.

Remaining areas were estimated to exhibit attributes of low and medium-low ecological sensitivity; impacts of development within these areas are not expected to affect biodiversity attributes on a local or regional scale. The implementation of generic mitigation measures are nonetheless recommended to ensure environmentally responsible development.

## 2 TERMS OF REFERENCE

The major objectives of this Biodiversity Basic Assessment are to establish the presence/absence of ecologically sensitive areas or species within the proposed project area, briefly assess the potential impacts of the proposed development on the natural environment and make pertinent development recommendations based on results of the field assessments and available desktop knowledge.

**The Terms of Reference for the floristic assessment are as follows:**

- Obtain all relevant Précis and Red Data flora information;
- Conduct a photo analysis of the proposed area;
- Identify preliminary floristic variations;
- Survey preliminary habitat types to obtain a broad understanding of the floristic diversity;
- Assess the potential presence of Red List flora species according to information obtained from SANBI;
- Incorporate existing knowledge of the region into the assessment;
- Describe broad habitat variations present in the study area in terms of biophysical attributes and phytosociological characteristics;
- Compile a floristic sensitivity analysis;
- Incorporate results into the Biodiversity Impact Evaluation;
- Map all relevant aspects;
- Provide pertinent recommendations; and
- Present all results in a suitable format.

**The Terms of Reference for the faunal assessment are as follows:**

- Obtain available faunal distribution records and Red Data faunal information
- Survey the site to obtain a broad overview of available faunal habitat types;
- Assess the potential presence of Red Data fauna species;
- Incorporate existing knowledge of the region;
- Describe the status of available habitat in terms of faunal attributes, preferences and conservation potential;
- Compile a faunal sensitivity analysis;
- Incorporate results into the Biodiversity Impact Evaluation;
- Map all relevant aspects; and
- Present all results in a suitable format.

# 3 INTRODUCTION

Destructive activities in a natural environment require vigilance to ensure that the biological and cultural heritage of future generations is not adversely affected by activities of today. Concern is growing about the consequences of biodiversity losses, for ecosystem functioning, for the provision of ecosystem services and for human well being.

Why is Biodiversity Conservation Important? Biodiversity sustains life on earth. An estimated 40 percent of the global economy is based on biological products and processes. Biodiversity has allowed massive increases in the production of food and other natural materials, which in turn have fed the (uncontrolled) growth and development of human societies. Biodiversity is also the basis of innumerable environmental services that keep humans and the natural environment alive; from the provision of clean water and watershed services to the recycling of nutrients and pollination.

Current pressures on and losses of biodiversity are unfortunately threatening to undermine the functionality of natural ecological processes and adaptive responses of the environment. The last few centuries have witnessed brutal increases in the rate at which biodiversity is being altered by humanity. With uncontrolled growth of human population, consumption needs have increased exponentially as well as the drive to extract more economically valuable resources at ever-faster rates. Natural habitats that harbour some of the world's most valuable biodiversity are being lost at increasingly faster and over progressively wider areas, while managed lands are undergoing increasing simplification. Adopting 'biodiversity friendly' practices remains challenging within the entire developmental sphere, especially for smaller companies and peripheral players. This is partly because governments, while perhaps committed on paper to biodiversity, have found it difficult to create the right incentives and apply the necessary regulations in a way that could encourage all players to conserve biodiversity.

Humanity faces the challenge of supporting the needs of growing populations from a rapidly shrinking natural resource base. Achieving a balance while doing this will require a better understanding and recognition of conservation and development imperatives and this is only a step towards more strategic and integrated approach to land use planning and management that helps societies make better-informed decisions. Evidence illustrate how management tools, rehabilitation and restoration processes, together with improved scientific knowledge, can help conserve biodiversity; also highlighting that mutual benefits can result from stronger collaboration between the mining and conservation sectors. Good practice, collaboration and innovative thinking can advance biodiversity conservation worldwide while ensuring that the minerals and products that society needs are produced responsibly.

In 1992, the Convention of Biological Diversity, a landmark convention, was signed by more than 90 % of all members of the United Nations. The enactment of the National

Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004), together with the abovementioned treaty, focuses on the preservation of all biological diversity in its totality, including genetic variability, natural populations, communities, ecosystems up to the scale of landscapes. Hence, the local and global focus changed to the sustainable utilisation of biological diversity.

Savannah Environmental has appointed by Momentous Energy as an independent Environmental Assessment Practitioner (EAP), to undertake the necessary environmental studies to identify and assess all potential environmental impacts associated with the proposed project. Bathusi Environmental Consultants (BEC) has been appointed as independent ecological specialists to conduct a strategic biodiversity impact evaluation of the biological environment that will be affected by this proposed development. Dewald Kamffer (FSI) conducted the faunal assessment; Riaan Robbeson (BEC) conducted the floristic assessment, provided the ecological interpretation and compiled the ecological sensitivity analysis.

## 4 LIMITATIONS OF THIS INVESTIGATION

Although care was taken to ensure the proper investigation the study area, it is only reasonable to expect that not all areas could be investigated in detail and not all species could be located or identified during a single survey that was conducted during the winter period. Because rare and endemic species normally do not occur in great densities and because of customary limitations in the search and identification of Red Listed species, the detailed investigation of these species was not possible and results are ultimately based on estimations.

Results presented in this report are based on a snapshot investigation of the study area and not on detailed and long-term investigations of all environmental attributes and the varying degrees of biological diversity that may be present in the study area. No concrete conclusions may therefore be drawn concerning biological diversity or conservation strategies as far as this study area is concerned.

It is emphasised that information, as presented in this document, only have bearing on the site as indicated on accompanying maps. This information cannot be applied to any other area, however similar in appearance or any other aspect, without proper investigation.

Furthermore, additional information may become known during a later stage of the process or development. This company, the consultants and/or specialist investigators do not accept any responsibility for conclusions, suggestions, limitations and recommendations made in good faith, based on the information presented to them, obtained from the surveys or requests made to them at the time of this report.

# 5 PROJECT BACKGROUND

The use of solar energy for power generation can be described as a non-consumptive use of natural resources that emits zero greenhouse gas emissions. The generation of renewable energy contributes to South Africa's electricity generating market, which has to date been dominated by coal-based power generation.

Momentous Energy, as an independent power producer, has identified this site for the proposed establishment of a solar photovoltaic (PV) plant. The site is located approximately 20km east of Rustenburg. The proposed project will be referred to as RustMo2 and will have maximum generating capacity of 10MW, which will be evacuated into the national electricity grid as part of a power purchase agreement with Eskom and the South African Treasury.

This proposed facility is to be the second phase of RustMo1 (adjacent proposed facility, DEA reference N. 12/12/20/2145). Therefore, the facility is proposed to link to the first phase of the development and connect to the grid via the same power line. No feasible site alternatives have therefore been identified for invesitigation within this Basic Assessment process. The solar energy facility is proposed to accommodate an array of photovoltaic (PV) panels with a generating capacity of up to 10MW. A broader study area of approximately 18.3ha is being considered within which the facility is to be constructed, although the actual development footprint of the proposed facility would be smaller in extent. Therefore, the PV panels and the associated infrastructure can be appropriately placed within the boundaries of the broader site to avoid any identified environmental sensitivities.

Infrastructure assicuiated wit the facility will include:

- Photovoltaic solar panels with a generating capacity of up to 10MW;
- Inverterns to convert the electricity to Direct Current (DC);
- Cabling between the project components, to be laid underground where practical;
- Internal access roads; and
- Standalone water taps.

In terms of the EIA Regulations published in terms of Section 24(5) of the National Environmental Management Act (NEMA, Act No. 107 of 1998), Momentous Energy requires authorisation from the National Department of Environmental Affairs (DEA) (in consultation with the North West Department of Agriculture, Conservation, Environment, and Rural Development), for the construction and operation of the proposed PV plant. In terms of sections 24 and 24D of NEMA, as read with the EIA Regulations of GNR 543; GNR544; GNR545; and GNR546, a Basic Assessment process needs to be undertaken for the proposed project. Momentus Energy has appointed Savannah Environmental, as independent environmental consultants, to undertake the required Basic Assessment process to identify and assess potential environmental impacts associated with the proposed project, and proposed appropriate mitigation and management measures as part of an

Environmental Management Programme. Bathusi Environmental Consulting was appointed as independent ecologists to assess the terrestrial biodiversity component.

## 6 APPROACH TO THIS ASSESSMENT

While a proper knowledge of the biodiversity of the region is not negotiable to the ultimate success of this project, an attempt was made to remove any subjective opinions that might be held on any part of the study area as far as possible. Inherent characteristics of a project of this nature implies that no method will be foolproof, mainly as a result of shortcomings in available databases and lack of site specific detail that could be obtained from limited detailed site investigations conducted over a short period of time. It is an unfortunate fact that inherent sensitivities within certain areas are likely to exist that could not be captured or illustrated during the process. This is a limitation of every scientific study; it simply is not possible to know everything or to consider aspects to a level of molecular detail. However, the approach followed in this study is considered effective in presenting objective comments on the comparison of biodiversity sensitivity of parts in the study area.

In order to present an objective opinion of the biodiversity sensitivity of the study area and how this relates to the suitability/ unsuitability of any area within the site in terms of the proposed development, all opinions and statements presented in this document are based on the following aspects, namely:

- A desk-top assessment of all available biological and biophysical data;
- Augmentation of existing knowledge by means of site specific and detailed field surveys;
- Specialist interpretation of available data, or known sensitivities of certain regional attributes; and
- An objective impact assessment, estimating potential impacts on biological and biophysical attributes.

## 6.1 Background Information

The overall goal of this section of the biodiversity investigation is to establish a reference point for the biophysical and biological sensitivities of the study area by means of the Ecosystem Approach or Landscape Ecology. The Ecosystem Approach is advocated by the Convention on Biological Diversity. It recognizes that people and biodiversity are part of the broader ecosystems on which they depend, and that it should thus be assessed in an integrated way. Principles of the Ecosystem Approach include the following:

- The objectives of ecosystem management are a matter of societal choice;
- Ecosystem managers should consider the effects of their activities on adjacent and other systems;
- Conservation of ecosystem structure and functioning, to maintain ecosystem services, should be a priority target;
- Ecosystems must be managed within the limits of their functioning;
- The approach must be undertaken at appropriate spatial and temporal scales;
- Objectives for ecosystem management should be set for the long-term;
- Management must recognise that change is inevitable;
- The approach should seek an appropriate balance between, and integration of, conservation and use of biodiversity;
- All forms of relevant information should be considered; and
- All relevant sectors of society and scientific disciplines should be involved.

For the purpose of this particular study, a local scale was selected as suitable in terms of the size of the study area. The approach of Landscape Ecology includes the assessment of biophysical and societal causes, consequences of landscape heterogeneity and factors that causes disturbance to these attributes. In nonprofessionals' terms, it implies that if sensitive habitat types/ ecosystems (frequently associated with biodiversity elements of high sensitivity or conservation importance) are protected, species that are highly sensitive to changes in the environment will ultimately be protected. Species conservation is therefore largely replaced by the concept of habitat conservation. This approach is regarded effective since the protection of sensitive ecosystems will ultimately filter down to species level.

It is inevitable that the Landscape Ecology Approach will not function effectively in all cases since extremely localised and small areas of sensitivity do occur scattered in the study area, which cannot always be captured on available databases or might have been missed during the site investigations. In addition to the compilation of basic species lists and the identification and description of localised ecological habitat, it was also regarded important to identify areas of sensitivity on a local scale and, where possible, communities or species that are considered sensitive to impacts arising from the proposed development.

This investigation therefore aims to:

- Determine the biological sensitivity of the receiving natural environment as it relates to the construction and operation of the plant and associated infrastructure in a natural environment;
- Highlight the known level of biodiversity;
- Highlight flora and fauna species of conservation importance that are likely to occur within the study area;
- Estimate the level of potential impacts of the construction and operation of proposed power lines on the biological resources of the study area;
- Apply the Precautionary Principal throughout the assessment[1].

Available databases of biophysical attributes are implemented to identify regional areas of importance as it relates to biodiversity. Biophysical attributes that are known to be associated with biodiversity aspects of importance, conservation potential or natural status of the environment were implemented to compile the ecological sensitivity analysis of the study area. These attributes include the following:

- Areas of known biological importance (ENPAT);
- Geology and soil types;
- Areas of surface water (ENPAT);
- Degradation classes (ENPAT Land Cover Classes);
- Regional vegetation types (VEGMAP);
- Land cover categories (ENPAT);
- Regional conservation (Mpumalanga Biodiversity Conservation Plan); and
- Ridges and outcrops.

## 6.2 Floristic Assessment

The floristic assessment was conducted by R. A. J. Robbeson (Pr.Sci.Nat.).

### *6.2.1 General Floristic Attributes*

The vegetation investigation is based on a variation of the Braun-Blanquet method whereby vegetation is stratified on aerial images with physiognomic[2] characteristics as a first approximation. These initial stratifications are then surveyed for floristic and environmental diversity during a site investigation and ultimately subjected to a desktop analysis to establish differences/ similarities between observed units.

In preparation for the site survey, physiognomic homogenous units are identified and delineated on digital aerial photos, using standard aerial photo techniques (downloaded

[1] (www.pprinciple.net/the_precautionary_principle.html).

[2] Physiognomy refers to the visual appearance of vegetation in terms of different growth classes, biomass, height, etc.

from www.googleearth.com and georectified on Arcview 3.2). A site visit was conducted to examine the general floristic attributes and -diversity of the study area. Because of the seasonality of the surveys, only qualitative observations were made at sample points with limited floristic diversity noted.

A desktop analysis of sample data was conducted to establish differences/ similarities between delineated vegetation units, which were subsequently described in terms of species composition and dominance as well as driving (developmental) environmental parameters. Preliminary results and species lists that are provided should be interpreted with normal liabilities in mind.

### *6.2.2 Red Data Flora*

Red Listed flora information, as presented by SANBI was used as a point of departure for this assessment. Since a snapshot investigation of an area, such as this particular investigation, represents a severe limitation in terms of locating and identification potential Red Listed flora species, particular emphasis was placed on the identification of habitat deemed suitable for the possible presence of Red Listed plant species and associating the suitability of the habitat to known habitat types of Red Listed flora species.

### *6.2.3 Floristic Sensitivity*

The aim of this exercise is to determine the inherent sensitivity of vegetation communities by means of the comparison of weighted floristic attributes. Results of this exercise are not 'stand-alone' and will eventually be presented in conjunction with results obtained from the faunal investigation.

Each vegetation unit is subjectively rated on a scale of 1 to 10 (**Sensitivity Values**) in terms of the influence that the particular Sensitivity Criterion has on the floristic status of the plant community. Separate Values are multiplied with the specific Criteria Weighting, which emphasises the importance/ triviality that the individual Sensitivity Criteria have on the status of each community. **Ranked Values** are then added and expressed as a percentage of the maximum possible value (**Floristic Sensitivity Value**) and placed in a particular class, namely:

| | |
|---|---|
| **High** | 80% – 100% |
| **Medium – high** | 60% – 80% |
| **Medium** | 40% – 60% |
| **Medium – low** | 20% – 40% |
| **Low** | 0% – 20% |

This method is considered effective in highlighting sensitive areas, based on observed floristic attributes rated across the spectrum of communities. Phytosociological attributes (species diversity, presence of exotic species, etc.) and physical characteristics, e.g. human

impacts, size, fragmentation are important in assessing the status of the various communities.

High Sensitivity Index Values indicate areas that are considered pristine, unaffected by human influences or generally managed in an ecological effective manner. These areas can be compared to nature reserves and even well managed farm areas. Low Sensitivity Index Values indicate areas of lower ecological status or importance in terms of vegetation attributes, or areas that have been negatively affected by human impacts or poor management. Sensitivity Criteria employed in assessing the floristic sensitivity of separate units may vary between different areas, depending on location, type of habitat, size, etc.

## 6.3 Faunal Assessment

The faunal assessment was conducted by D. Kamffer (Pr.Sci.Nat.). This faunal assessment included qualitative surveys across major habitat types observed in the study areas.

### *6.3.1 Data analysis*

- All GPS acquired data is converted from text to shapefiles to allow GIS analyses.
- Shapefiles of environmental attributes such as geology, soil, hydrology and vegetation are incorporated in the analyses of available faunal habitats.
- Sensitivity maps are compiled, where relevant, subsequent to data analyses.
- Species lists are compiled for relevant taxa using fieldwork data, literature and data supplied by various other institutions and specialists.

### *6.3.2 Red Listed fauna Probabilities*

Three parameters are used to assess the Probability of Occurrence of each Red Listed species:

- Habitat requirements (HR) - Red Listed animals have specific habitat requirements and the presence of these habitat characteristics in the study area is evaluated.
- Habitat status (HS) - The status or ecological condition of available habitat in the study area is assessed. Often, a high level of degradation of a specific habitat type will negate the potential presence of Red Listed species (especially wetland-related habitats where water quality plays a major role); and
- Habitat linkage (HL) - Movement between areas used for breeding and feeding purposes forms an essential part of ecological existence of many species. The connectivity of the study area to surrounding habitats and adequacy of these linkages are evaluated for the ecological functioning of Red Listed species within the study area.

The estimated Probability of Occurrence for Red Data fauna species is presented in five categories, namely:

- Very low;
- Low;
- Moderate;
- High; and
- Very high.

### *6.3.3 Faunal Habitat Sensitivities*

Faunal habitat sensitivities are subjectively estimated based on the following criteria:

- Habitat status;
- Connectivity;
- Observed species composition & RD Probabilities; and
- Functionality.

And is place in one of the following classes:

- High;
- Medium-high
- Medium;
- Medium-low; or
- Low.

## 6.4 Impact Evaluation

### *6.4.1 Extent of the Impact*

The extent of the impact was assessed accordingly:

**(1)** Site only;
**(2)** Site and immediate surrounds;
**(3)** Local area;
**(4)** Regional area; or
**(5)** Beyond regional.

### *6.4.2 Duration of the Impact*

The lifespan of the impact was assessed to be:

**(1)** Very short duration (< 1 year);
**(2)** Short duration (2 to 5 years);
**(3)** Medium term (5 to 15 years);
**(4)** Long term (> 15 years); or
**(5)** Permanent.

### 6.4.3 Magnitude of the Impact

The magnitude or severity of the impacts is indicated as either:

**(0)** Small (where the aspect will have no impact on the environment);
**(2)** Minor (where the impact affects the environment in such a way that natural, cultural and social functions and processes are not affected;
**(4)** Low (where the impact affects the environment in such a way that natural, cultural and social functions and processes are slightly affected);
**(6)** Moderate (where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way);
**(8)** High (where natural, cultural or social functions or processes are altered to the extent that it will temporarily cease); or
**(10)** Very high / don't know (where natural, cultural or social functions or processes are altered to the extent that it will permanently cease).

### 6.4.4 Probability of Occurrence

The likelihood of the impact actually occurring was indicated as either:

**(1)** Very improbable (the possibility of the impact materializing is very low as a result of design, historic experience or implementation of adequate mitigation measures);
**(2)** Improbable (some possibility, but low likelihood);
**(3)** Probable (distinct possibility);
**(4)** Highly probable (most likely); or
**(5)** Definite / do not know (the impact will occur regardless of the implementation of any prevention or corrective actions).

### 6.4.5 Status of the Impact

The impacts are assessed as either having a:

- Negative effect (i.e. at a cost to the environment);
- Positive effect (i.e. at a benefit to the environment); or
- Neutral effect on the environment.

### 6.4.6 Accumulative Impact

The impact of the development is considered together with additional developments of the same or similar nature and magnitude. The combined impacts may be:

- Negligible – i.e. the net effect is the same as the single development;
- Marginal – i.e. the impact of two developments of a similar nature is less than twice the impact of a single development. This implies it is better to place the two developments in the same environment rather than in separate environments; or

- Compounding – i.e. the impact of two developments is more than twice the impact of two single - developments. This implies that it is better to split the two developments into separate environments.

### *6.4.7 Significance of the Impact*

Based on a synthesis of the information contained in the points above, the potential impacts were assigned a significance weighting (S). The weighting is formulated by adding the sum of the numbers assigned to extent (E), duration (D) and magnitude (M) and multiplying this sum by the probability (P) of the impact hence:

$$S = (E+D+M)*P$$

- Negligible: 0 (There is no impact);
- Low: 1-30 (Impact is of a low order, mitigation measures are easy and simple or not required);
- Medium: 31-60 (The impact could influence the decision to develop in the rea unless it is effectively mitigated); and
- High: >60 (Where the impact must have an influence in the decision to develop in the area)

# 7 THE BIOPHYSICAL ENVIRONMENT

## 7.1 Location

The proposed solar PV facility will be situated on approximately 18.3ha of the remaining extent of Portion 24 of the farm Spruitfontein 341, located in the North-West Province. It is situated to the west of the Marikana Platinum Mine and is bordered by the N4 highway to the south. Marikana is situated approximately 8km northeast of the site and Rustenburg 20km to the west. The regional location of the study area is illustrated in Figure 1. A Google Earth image of the immediate surrounds is presented in Figure 2.

## 7.2 Surface Water

The study area is situated within the Limpopo River Catchment Area. A non-perennial tributary of the Brakspruit (Figure 3) is present in the southern section of the site. Visual observations made during the site investigation revealed that the status of the stream is relative degraded as a result of some erosion within the study area, which resulted in extensive widening of the flow regime of the stream. The extent of surface water during periods of flooding will therefore be significantly wider than indicated on Figure 3. No major dams are situated within the immediate vicinity of the study area.

Areas of surface water generally contribute significantly towards the local and regional biodiversity of any area due to the atypical nature of the ecotonal areas on the fringes of aquatic habitat types. Ecotones (areas or zones of transition between aquatic and terrestrial habitat types) are frequently occupied by species that occupy both habitat types. Many flora and fauna species are adapted to exploit these temporal or seasonal fluctuations in moisture levels in these areas and exhibits extremely narrow habitat variation tolerance levels. These areas comprise high biodiversity numbers in relative small areas and are furthermore frequently traversed by terrestrial animals that utilise the water sources on a frequent basis. However, due to the extreme perennial nature of the rivers and streams in the study area, their contribution to biodiversity is not as significant as in cases where frequent flow patterns are noted in the western, wetter parts of the country. Ecotonal interface areas form narrow bands around areas of surface water and they constitute extremely small portions when calculated on a purely mathematical basis. However, considering richness, these areas are extremely important on a local and regional scale. Rivers also represent important linear migration routes for a number of fauna species as well as a distribution method for plant seeds. All areas of surface water are therefore regarded important in terms of biodiversity attributes.

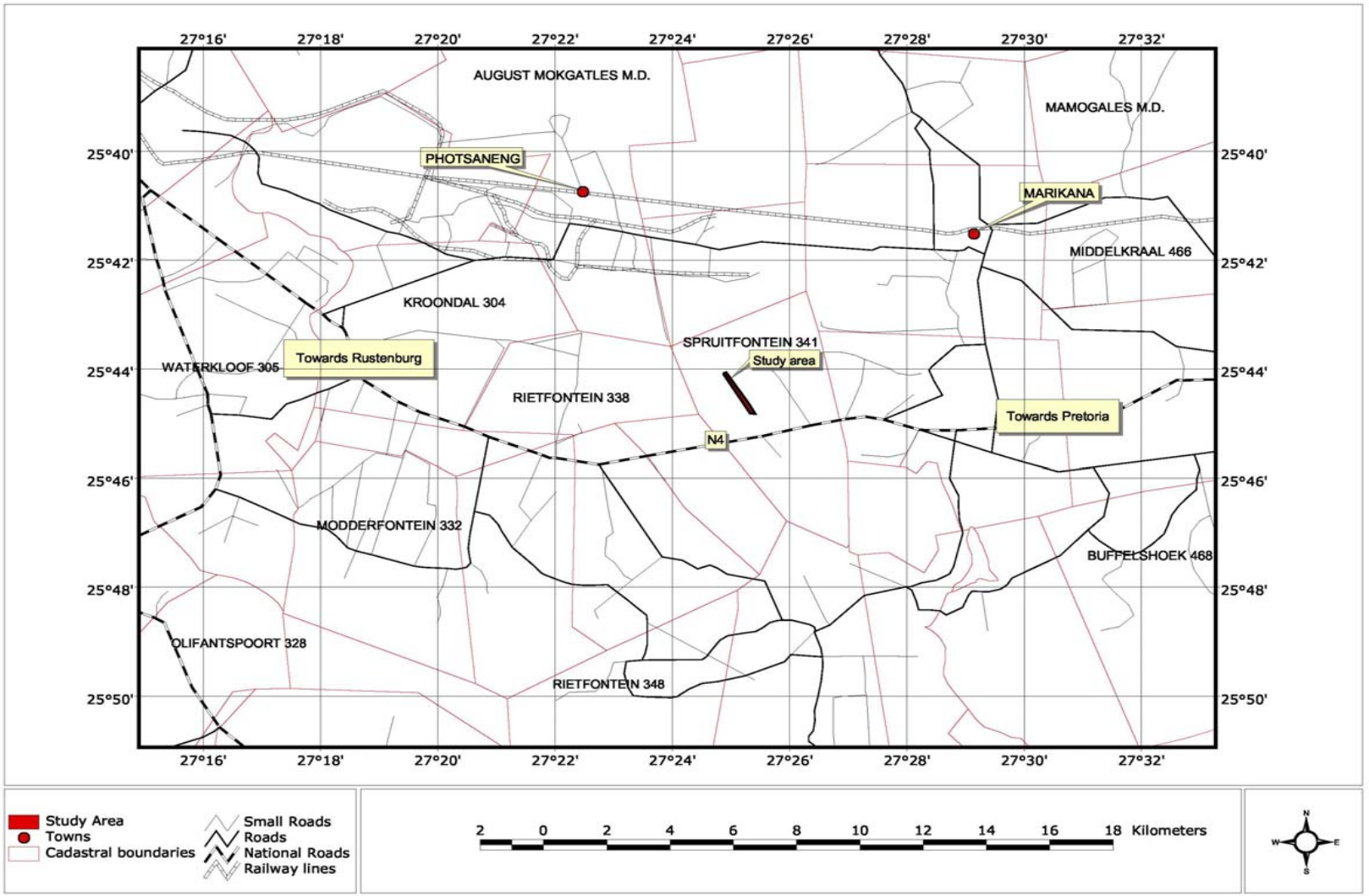


**Figure 1: Regional setting of the study area**


**Figure 2: Google Earth image of the general region**

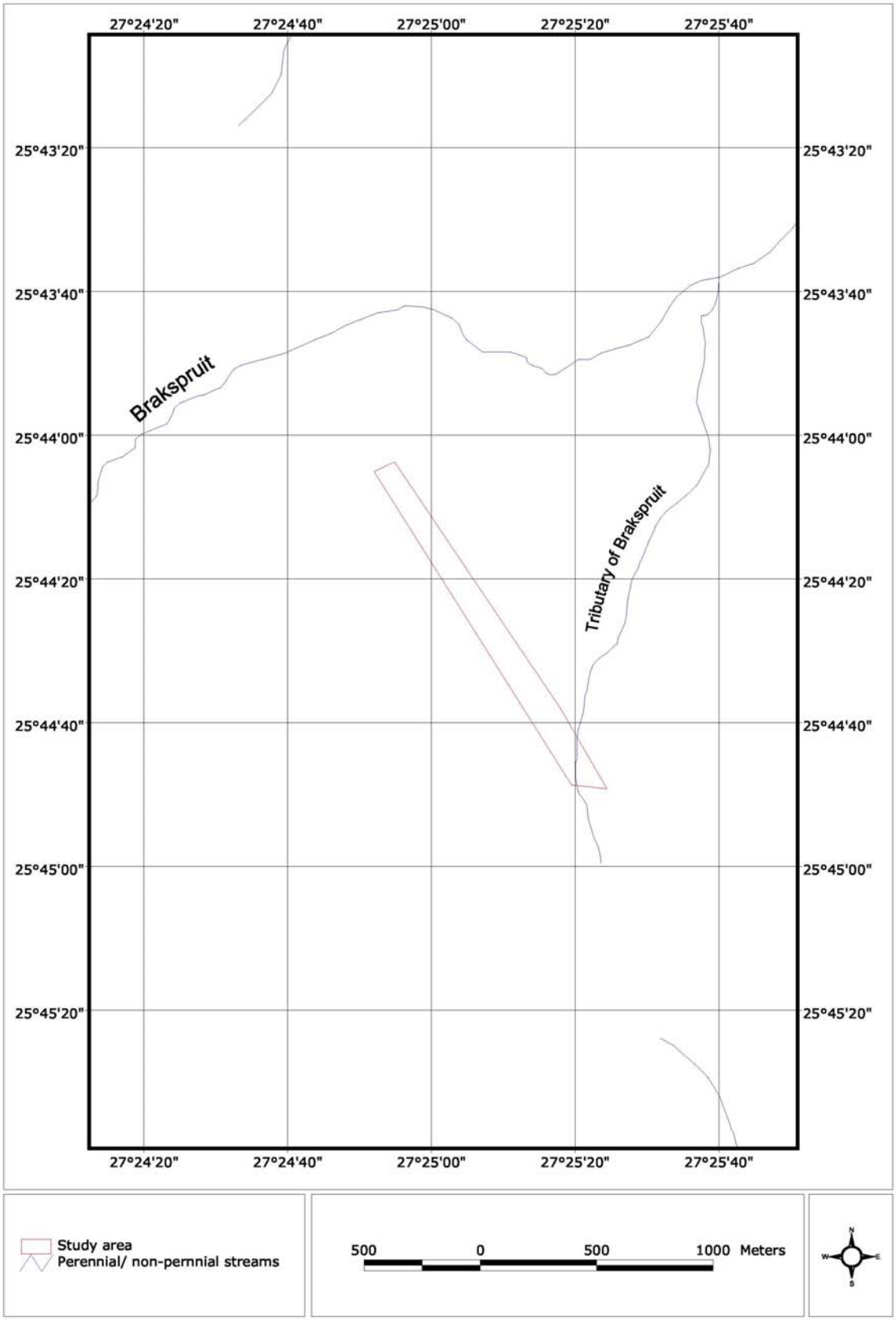


**Figure 3: Areas of surface water in the region**

## 7.3 Land Cover & Land Use of the Region

*The existing database (ENPAT) was found inadequate to illustrate the current land cover status of the immediate region. Visual observations are therefore presented in this report in order to provide a broad overview of the land use and land cover of the immediate region.*

For the purpose of this assessment, land cover are loosely categorised into classes that represent natural habitat and categories that contribute to habitat degradation and transformation on a local or regional scale. In terms of the importance for biodiversity, the assumption is made that landscapes that exhibit high levels of transformation are normally occupied by plant communities and faunal assemblages that do not reflect the original or pristine status of an area or region. This is particularly important in the case of Red Data species as these plants and animals have extremely low tolerances levels to any disturbance, which is one of the main reasons for being threatened. Significant changes to the status of habitat available to these species are therefore likely to result in severe impacts on these species and their conservation status.

The study area is located in a region comprising extensive transformed habitat that resulted mainly from agriculture and mining. The high transformation factor of the region renders remaining habitat fragmented and isolated. Some natural woodland habitat remains in the area, particularly to the south in the Magaliesberg Nature Area. Extensive mining areas are located to the east and north of the study area. Agricultural activities have resulted in land transformation on the site as well as to the west.

Three aspects are associated with habitat changes that accompany certain land uses. Permanent transformation of natural habitat by land uses such as agriculture, mining and urbanisation results in the permanent decimation of available habitat for flora and fauna species as these areas will not return to the original pristine status. Habitat transformation or degradation also affects species directly; a change in species composition of an area results from an exodus of some species that are no longer able to exist in changed habitat conditions. Furthermore, a decrease in abundance of certain species might result from decreased habitat or an influx of species that are not normally associated with the original or pristine habitat, but are suitably adapted to the changed environment. While some, or most, species that occupy these changed habitat conditions might be indigenous to a region, they are not necessarily endemic to the region. Lastly, a larger threat to the natural biodiversity of a region is represented by the influx of invasive exotic species and weeds that can effectively sterilise large tracts of remaining natural habitat.

## 7.4 Ridges & Topography

The topography of the region falls into the categories of 'Slightly Undulating Plains' and the general altitude are approximately 1,200 meter above sea level. No significant slopes are present within the study area, but important ridges and hills are present to the south (Magaliesberg) of the study area. These areas are unlikely to be affected by the proposed development.

## 7.5 Regional Vegetation - VEGMAP

The study area is situated within the Savanna Biome, specifically within the Marikana Thornveld and Moot Plains Bushveld vegetation types (Figure 4), located within the Savanna Biome.

### *7.5.1 Background to the Savanna Biome*

The Savanna Biome is known to support more than 5,700 plant species, exceed only by the Fynbos Ecoregion in species richness. Most savanna types have an herbaceous layer usually dominated by grass species and a discontinuous to sometimes very open tree layer. The woody component often forms an irregular series of interlocking, often low, canopies with openings and sometimes little distinction can be made between tall shrubs and small trees. 'Savanna grasslands' may grade into 'Tree savanna', 'Shrub savanna', Savanna woodland' or 'Savanna parkland'. Structure of the woody component of savanna is important to animals – for example tree height, which determines the available browse, dense woody entanglements forming impenetrably barriers, availability of shade and protection against predators or scavengers, etc.

Floristically similar vegetation can be structurally different, but there is often an excellent correlation between vegetation patterns and soil types, with much floristic variation along rainfall gradients, even with similar substrates. In addition, there are most often major differences in the herbaceous layer under canopies and areas between tree canopies; woody plants can serve as sites of protection for certain grass species. Soil nutrient enrichments and increase soil organic matter is found underneath trees, especially large ones, due to various mechanisms including leaf litter, stem flow and throughfall of rain and N-fixation under leguminous trees. Thinning or even total removal of savanna trees is a common practice to counter the apparent suppression of herbaceous plants to improve grazing. In bottomland *Acacia* communities in the Pilanesberg Game Reserve, spatial analysis suggested competition among trees as a mechanism controlling their size and density.

### 7.5.2 Marikana Thornveld

This ecological type is structurally similar to open *Acacia* savanna woodland, occurring in valleys, slightly undulating plains and some lowland hills. Shrubs are denser along drainage lines, on termitaria and rocky outcrop or in other habitat protected from fire. The Marikana Thornveld is a threatened ("Endangered") vegetation type of which less than 1% is formally conserved within reserves and is mainly threatened by cultivation and urbanisation (48%). Alien invasive plants occur localised in high densities, especially along the drainage lines. The following species are regarded representative of the Marikana Thornveld vegetation type.

- **Tall Tree**

*Acacia burkei*

- **Small Trees**

*Acacia caffra*, *A. gerrardii*, *A. karroo*, *Combretum molle*, *Searsia lancea*, *Ziziphus mucronata*, *Acacia nilotica*, *A. tortilis* subsp. *heteracantha*, *Celtis africana*, *Dombeya rotundifolia*, *Pappea capensis*, *Peltophorum africanum* and *Terminalia sericea*.

- **Tall Shrubs**

*Euclea crispa* subsp. *crispa*, *Olea europaea* subsp. *africana*, *Searsia pyroides* var. *pyroides*, *Diospyros lycioides* subsp. *guerkei*, *Ehretia rigida* subsp. *rigida*, *Euclea undulata*, *Grewia flava* and *Pavetta gardeniifolia*.

- **Low Shrubs**

*Asparagus cooperi*, *Rhynchosia nitens*, *Indigofera zeyheri* and *Justicia flava*.

- **Woody Climbers**

*Clematis brachiata* and *Helinus integrifolius*.

- **Herbaceous Climbers**

*Pentarrhinum insipidum* and *Cyphostemma cirrhosum*.

- **Graminoids**

*Elionurus muticus*, *Eragrostis lehmanniana*, *Setaria sphacelata*, *Themeda triandra*, *Aristida scabrivalvis* subsp. *scabrivalvis*, *Fingerhuthia africana*, *Heteropogon contortus*, *Hyperthelia dissoluta*, *Melinis nerviglumis* and *Pogonarthria squarrosa*.

- **Herbs**

*Hermannia depressa*, *Ipomoea obscura*, *Barleria macrostegia*, *Dianthus mooiensis* subsp. *mooiensis*, *Ipomoea oblongata* and *Vernonia oligocephala*.

- **Geophytic Herbs**

*Ledebouria revoluta, Ornithogalum tenuifolium* and *Sansevieria aethiopica.*

### *7.5.3 Moot Plains Bushveld*

The main belt of this vegetation type occurs immediately to the south of Magaliesberg from the Selons River Valley in the west through Maanhaarrand, filling the valley bottom of the Magalies River, proceeding east of the Hartebeestpoort Dam between the Magaliesberg and Daspooort mountain ranges to Pretoria. The vegetation consists of an open to closed, low, often thorny *Acacia* savanna in the bottomlands and plains as well as woodlands of varying height and density on the lower hillsides. This vegetation type is Vulnerable of which only 13% is conserved, mainly in the Magaliesberg Nature Area. About 28% is transformed mainly by cultivation, mining and urban and built-up areas. Very scattered occurrences to sometimes dense patches in places of various alien plains occur, including *Cereus jamacuru, Eucalyptus* species, *Jacaranda mimosifolia, Lantana camara, Melia azedarach* and *Schinus molle.* The following species are regarded representative of the Moot Plains Bushveld vegetation type.

- **Small Trees**

*Acacia nilotica, A. tortilis* subsp. *heteracantha* and *Searsia lancea*.

- **Shrubs**

*Buddleja saligna, Euclea undulata, Olea europaea* subsp. *africana, Grewia occidentalis, Gymnosporia polyacantha, Mystroxylon aethiopicum* subsp. *burkeanum, Aptosimum elongatum, Felicia fascicularis, Lantana rugosa* and *Teucrium trifidum.*

- **Succulent Shrub**

*Kalanchoe paniculata*

- **Woody Climber**

*Jasminum breviflorum*

- **Herbaceous Climber**

*Lotononis bainesii*

- **Graminoids**

*Heteropogon contortus, Setaria sphacelata, Themeda triandra, Aristida congesta, Chloris virgata, Cynodon dactylon, Sporobolus nitens* and *Tragus racemosus.*

- **Herbs**

*Achyropsis avicularis, Corchorus asplenifolius, Evolvulus alsinoides, Helichrysum nudifolium, H. undulatum, Hermannia depressa, Osteospermum muricatum* and *Phyllanthus maderaspatensis.*

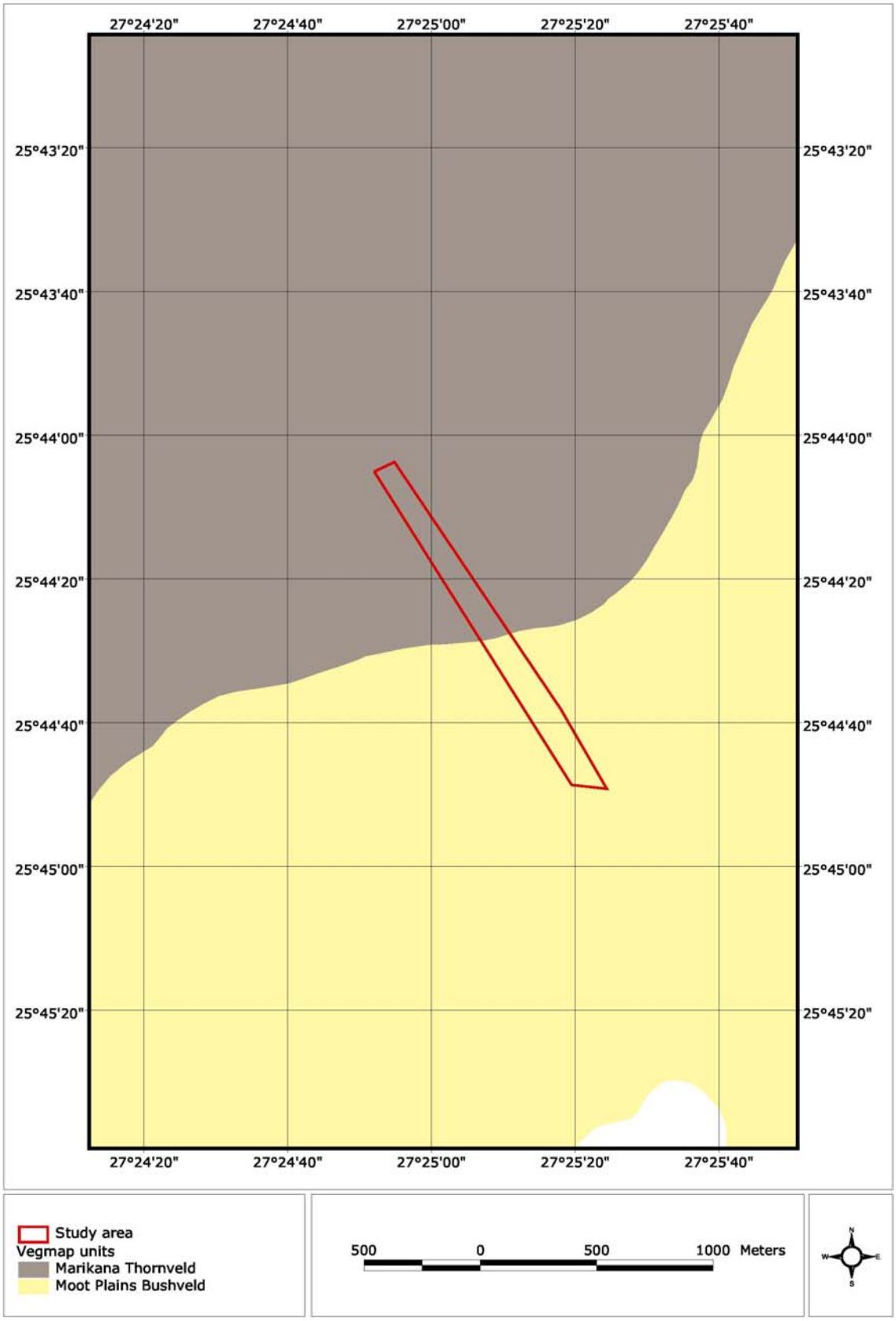


**Figure 4: VEGMAP vegetation types of the region**

### 7.6 Areas of Conservation

The Magaliesberg Nature Area is located approximately 3.5km to the south of the study area. The buffer zone of this nature area is located approximately 500m to the south and east. It is unlikely that these areas will be directly affected by the proposed development (Figure 5).

### 7.7 Geology & Land Types

The study area comprises Pyroxenite of the Bushveld Complex. In places, some quartzite and hornfels of the Magaliesberg and Rayton Formations are present. Rocks are usually covered by thick sandy piedmont deposits derived from Magaliesberg quartzite. Norite, gabbro, pyroxenite and anorthosite of the Bushveld Complex and occasional dykes of syenite and diabase also occur.

The following land type units are encountered in the proposed corridors (Figure 6):

- Bc8; and
- Ea3.

A large part of the South African interior is occupied by a catena which in its perfect form is represented by (in order from highest to lowest in the upland landscape) Hutton, Bainsvlei, Avalon and Longlands forms. The valley bottoms are occupied by one or other gley soil (e.g. Rensburg, Willowbrook, Katspruit, Champagne forms). In addition to these, Glencoe, Wasbank, Westleigh, Kroonstad, Pinedene and Tambankulu (rare) forms, and Klipfontein and (occasional) Hillside soil series are found. Soils with hard plinthite are particularly common over sandstones in the moist climate zones in the eastern parts of the country. Depending on the extent to which tater tables have been operative over a landscape, Longlands and Avalon and related grey and yellow soils may predominate, even to the exclusion of red soils. Where water tables have not extended far beyond the valley bottoms, red soils may predominate with plinthic soils restricted to narrow strips of land around valley bottoms or pans. However, plinthic soils must cover more than 10% of the area for to qualify for inclusion in units Ba to Bd. Upland margalitic soils are absent or occupy less than 10% in units Ba to Bd. Bc comprises a plinthic catena with eutrophic, red soils that are rare, widespread and upland duplex and margalitic soils. The Hutton soil form predominates in the footslopes with Rensburg, Dundee, Arcadia and Kroonstad formations occurring in the valley bottoms.

E land types indicate land with high base status, dark coloured and/ or red soils, usually clayey, associated with basic parent materials. A land type more than half of which is covered by soil forms with vertic, melanic and red structured diagnostic horizons qualifies for inclusion in unit Ea, provided it does not qualify for inclusion in units A, B or C. Ea3 (footslopes) are dominated by the Rensburg, Arcadia and Dundee soil forms.

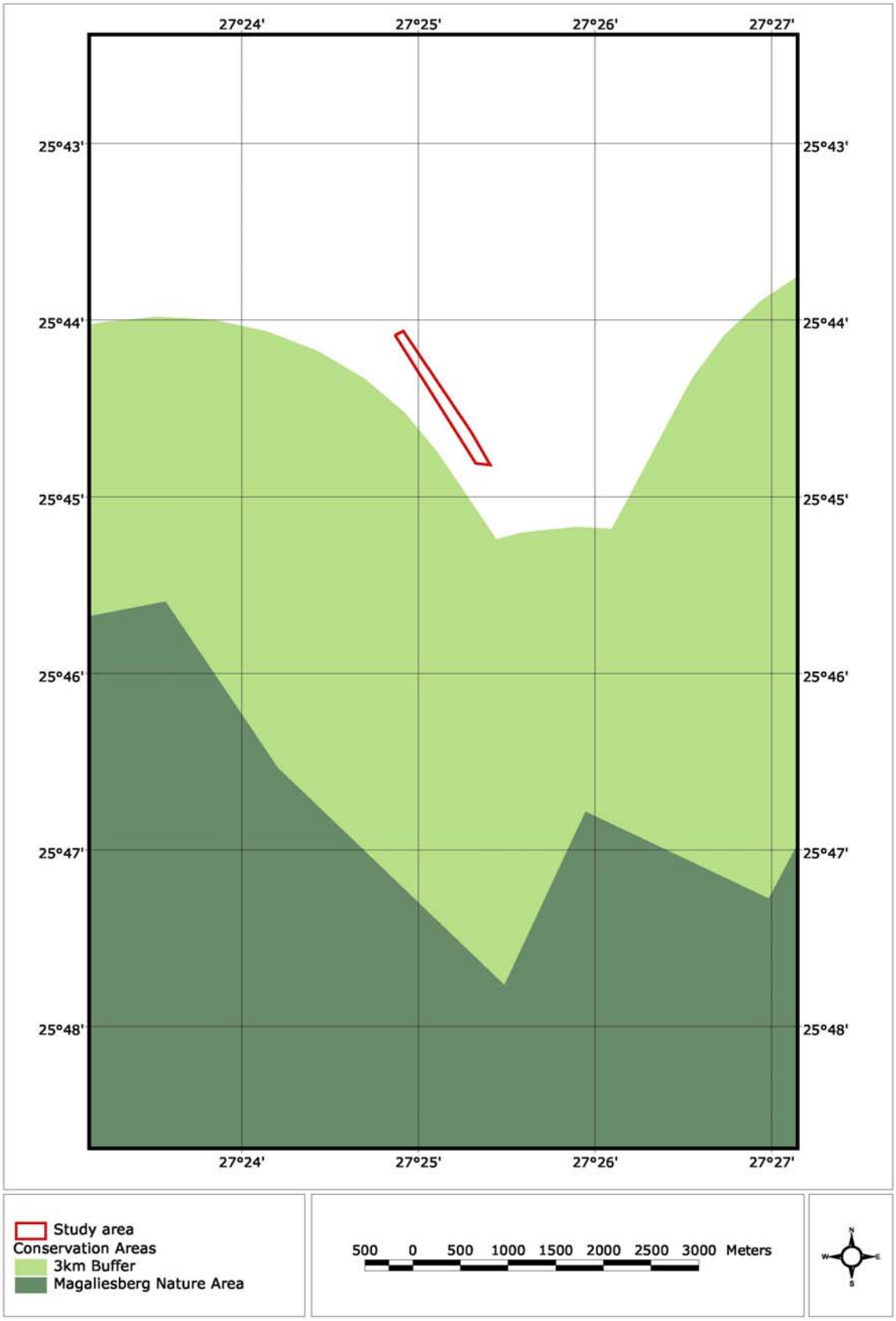


**Figure 5: Conservation areas within the general region**

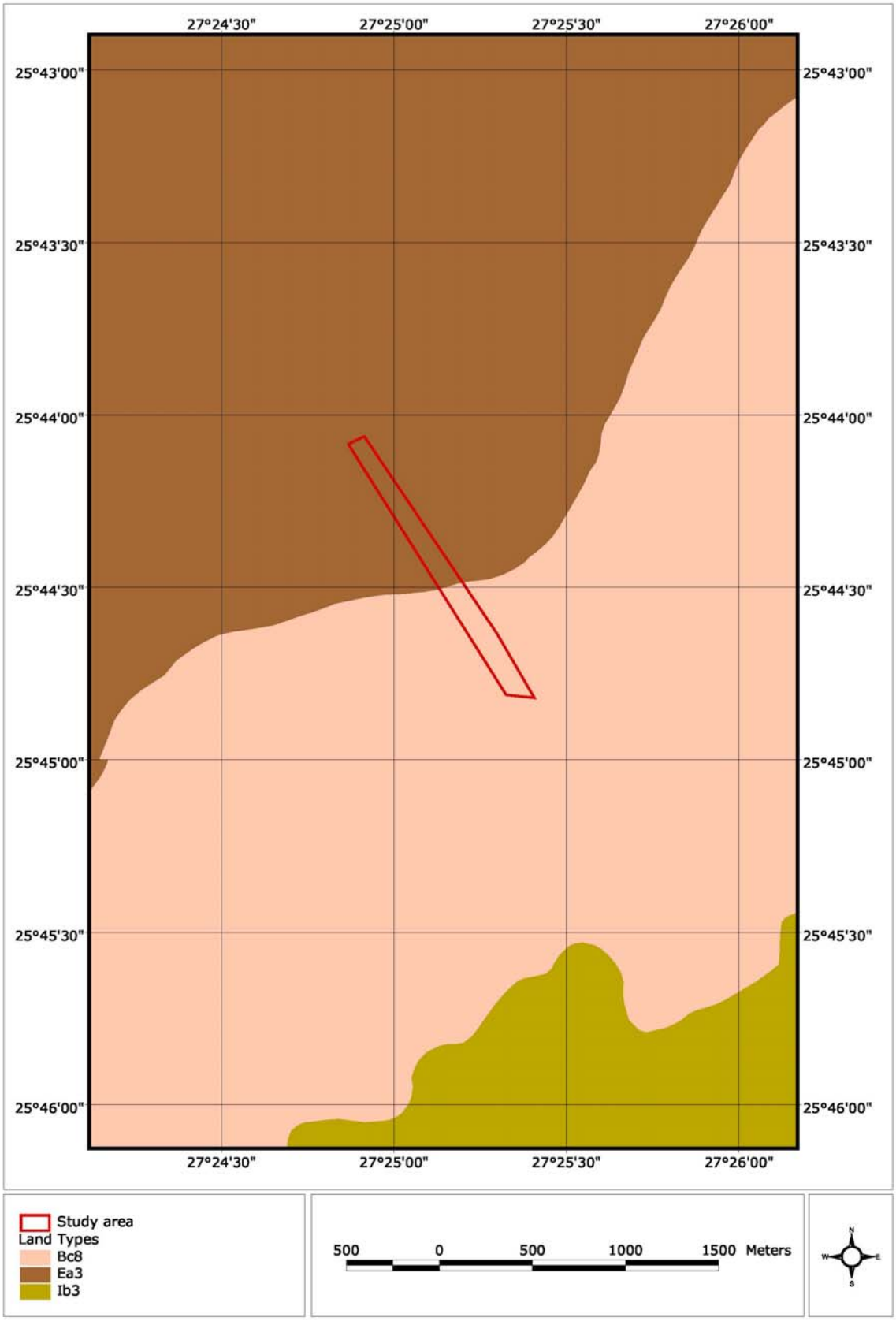


**Figure 6: Land types (soils) within the study area**

## 7.8 Surrounding Local and Regional Impacts on Biodiversity

The region in which the study area is situated is characterised by a high degree of transformation and habitat destruction that resulted mainly from agriculture, but also from recent mining activities. Areas located to the immediate west of the study area comprise extensive agricultural fields, while the Marikana Mine is situated immediately to the east and north. On a greater scale, the region is highly fragmented by a well-developed road and railway infrastructure. The effect is that remaining pockets of natural habitat in the immediate vicinity of the site is largely isolated from similar habitat. The Magaliesberg Nature Area is located to the south of the site, representing a relative large and uninterrupted natural habitat. However, this Nature Area represents only the mountainous habitat of the region, while the plains and flatter parts of the region have been extensively transformed. Areas surrounding the study site indicate a history of prolonged and severe impact on the status of natural habitat, rendering remaining natural habitat relative low in terms of conservation potential, but high in terms of conservation importance.

Larger, uninterrupted areas of natural habitat are important in terms of biodiversity attributes and conservation purposes. High levels of transformation and habitat isolation are known to have an adverse impact on the status of natural habitat and the biodiversity in the immediate region while 'normal' impacts on the remaining pockets of natural vegetation exponentially increase as their size and availability decrease. Ultimately, these areas are rendered sterile in terms of normal species presence, -dominance, and their value in terms of conservation potential and efficacy to operate normally as a complete ecological unit lessens over time as the size decreases below the critical thresholds values.

Another important aspect is that the effect of surrounding land uses, such as agriculture and mining also affects the perimeter of these isolated parcels (edge effects), characterised by species changes (infestation of weeds and aliens), changes in water regime and flow of non-perennial streams, influx of chemicals used in agriculture and mining (wind and water spread), etc.

# 8 FLORA OF THE STUDY AREA

## 8.1 Regional Diversity

The study area is situated within the 2527CB ¼-degree grid. Available SANBI information indicates the known presence of 234 plant species within this grid (POSA, 2009). As a rule, it is estimated that any grid where less than 300 species are known to occur is regarded a result of undersampling and does not reflect the floristic diversity of the particular area. The existing database is therefore not regarded an accurate reflection of the true floristic diversity of the region.

Notwithstanding the relative poor floristic knowledge of the region, the species composition of the area adequately displays the woodland nature of the area (Table 3) with 46 shrub species (19.7%) and 42 tree species (17.9%). The diverse nature of the herbaceous stratum is indicated by 67 forb species (28.6%); together with 20 geophyte species (8.5%) and 23 grass species (9.8%).

**Table 3: Growth forms of the region**

| Growth Form | Number | Percentage |
|---|---|---|
| Bryophyte | 5 | 2.1% |
| Carnivore | 1 | 0.4% |
| Climber | 16 | 6.8% |
| Creeper | 1 | 0.4% |
| Cyperoid | 9 | 3.8% |
| Forb | 67 | 28.6% |
| Geophyte | 20 | 8.5% |
| Graminoid | 23 | 9.8% |
| Helophyte | 2 | 0.9% |
| Parasite | 2 | 0.9% |
| Shrub | 46 | 19.7% |
| Tree | 42 | 17.9% |
| **Total** | **234** | |

## 8.2 Floristic Diversity of the Site

The species list and dissemination of the plants observed in the study area is included as Appendix 1.

The site investigation revealed the presence of approximately 91 plant species on the site (Table 20). The diversity of this portion of land, in spite of the moderately degraded status of extensive parts of the site, is regarded diverse, reflecting not only on the species richness of the regional vegetation types, but also the effect of transformation and the influx of plant species not normally associated with the region.

The savanna physiognomy of the area is indicated by the presence of several woody species in areas of relative natural vegetation. These woody species comprisde a relative large proportion of diversity and their dominance in certain areas, particularly in wetter and untransformed parts of the study area, is noted. Grasses (29 species, 31.9%), forbs (21 species, 23.1%) and trees (20 species, 2.0%) comprise a high percentage of the species diversity (Table 21). The degraded nature of parts of the site is firstly indicated by the presence of numerous weeds and alien invasive species, secondly by the absence of species associated with the natural regional vegetation types and lastly the unnatural prominence of species associated with the area. It is estimated that approximately 31.9% of the species comprise plants of an undesirable nature. The effect of these species is enhanced by their dominance in certain parts.

A total of 37 plant families are represented by the floristic diversity of the site, dominated by Poaceae (29 species, 31.9%) (Table 22).

It should be noted that the survey was conducted during the winter period and while the most of the plants on site was still in a suitable condition for identification purposes, a summer survey is likely to reveal additional flowering species that are not generally observed during the winter period. A case in point is the relative low number noted within the Asteraceae family.

### 8.3 Flora species of Conservation Importance

- A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered and it is therefore considered to be facing a very high risk of extinction in the wild.
- Rare taxa are taxa with small populations that are not classified as Endangered or Vulnerable, but are at risk as an unexpected threat may cause a decline in the population.

SANBI records for the region indicate the presence of two Red Data species in this particular ¼-degree grid (Table 4). While conditions were not conducive for identifying Red Data species during the site investigation, it is regarded highly unlikely that any of these Red Data flora species would occur on this site, as available habitat does not correspond to the habitat required by any of these species.

**Table 4: Red Data flora species of the region**

| Taxon | Family | Status |
|---|---|---|
| *Aloe peglerae* | Asphodelaceae | Endangered |
| *Frithia pulchra* | Mesembryanthemaceae | Rare |

### 8.4 Alien & Invasive Plant Species

The following invasive and weed species were noted on the study site (Table 5).

**Table 5: Invasive and weed plant species of the study area**

| Species Name | Growth Form | Family | Status / Uses |
|---|---|---|---|
| *Achyranthes aspera* | Forb | Amaranthaceae | Declared Invader - Category 1 |
| *Cereus jamacuru* | Succulent | Cactaceae | Declared Invader - Category 1 |
| *Conyza bonariensis* | Forb | Asteraceae | Weed, indicator of disturbed areas |
| *Cynodon dactylon* | Grass | Poaceae | Indicator of disturbed areas, grazing potential |
| *Dichrostachys cinerea* | Shrub | Mimosaceae | Invader, medicinal properties, traditional uses, firewood, weaving |
| *Gomphrena celosioides* | Forb | Amaranthaceae | Weed |
| *Jacaranda mimosifolia* | Tree | Bignoniaceae | Declared Invader - Category 3 |
| *Opuntia ficus-indica* | Succulent | Cactaceae | Declared Invader - Category 1 |
| *Pennisetum setaceum* | Grass | Poaceae | Declared Invader - Category 1 |
| *Pseudognaphalium luteo-album* | Forb | Asteraceae | Weed (Europe) |
| *Schkuhria pinnata* | Forb | Asteraceae | Medicinal uses, weed (S. America) |
| *Solanum panduriforme* | Forb | Solanaceae | Weed |
| *Tithonia rotundifolia* | Forb | Asteraceae | Declared Invader - Category 1 |
| *Verbena bonariensis* | Forb | Verbenaceae | Weed (S. America) |
| *Verbena tenuisecta* | Forb | Verbenaceae | Weed (S. America) |

### 8.5 Protected Tree Species

A single individual of the protected tree species (*Sclerocarya birrea* subsp. *birrea*, Marula) is present on the site. It is situated in the immediate vicinity of the old homestead and is assumed to have been planted by early inhabitants of the property. An application for a permits for the removal/ damage/ cutting or pruning of protected tree species as per National Forest Act, 1998 (No 84 of 1998) need to be submitted to the relevant authority prior to the commencement of construction activities.

## 8.6 Floristic Habitat types

Due to the relative high levels of transformation as well as low utilisation levels and the effect of frequent burning noted across most of the site, vegetation within the study area was found to be relatively degraded, albeit in a well-developed status. Because of intensive human activities, remaining natural vegetation within the study area is not regarded entirely representative of the regional vegetation type, i.e. pristine. Results of the photo analysis and site investigations revealed the presence of the following habitat types (Figure 7):

- Agricultural Fields;
- Drainage Line/ Eroded Woodland;
- Grassland Seepage;
- Homestead;
- Natural Woodland/ Savanna; and
- Reverted Woodland.

### *8.6.1 Agricultural Fields*

The northern part of the study area comprises agricultural fields of approximately 3.9ha. The natural vegetation has been removed and pioneer species has colonised the area since cultivation has ceased. The dominant species in this area include the shrubs *Dichrostachy cinerea*, *Acacia karroo*, *Gomphocarpus fruticosus*, the forbs *Schkhuria pinnata*, *Tagetes minuta*, *Thitonia rotundifolia*, *Verbena bonariensis*, *Cucumis zeyheri*, *Vernonia* species and *Gladiolus* species. The grasses *Sorghum bicolor*, *Cynodon dactylon* and *Eragrostis curvula* indicate the degraded nature of this area, while the presence of *Brachiaria eruciformis*, *Aristida bipartitia* and *Bothriochloa insculpta* the clayey soil conditions indicate.

This habitat is located within the Ea3 land type, comprising relative deep, clayey soils that are conducive to agriculture.

The likelihood of encountering Red Data flora species within this unit is regarded low and, due to the transformed nature of the vegetation, a low floristic sensitivity is ascribed to these parts.

### *8.6.2 Drainage Line / Eroded Woodland*

The southern section of the study area comprises a wetland related habitat type (approximately 2.8ha). This area is wide, more typical of eroded areas than of a drainage line, hence the assumption that erosion is one of the driving forces behind the development of this habitat.drainage line. The nature of the erosion is not obvious and could be a result of historic excavation activities. Islands created by singular trees with high banks and areas of open soils inbetween characterises this habitat. Originally, the vegetation might have conformed to dense woodland, as can be observed in the northwestern corner of this particular habitat. Low-lying areas exhibit attributes of frequent flowing and is dominated

by grasses and forbs. Higher areas are characterised by stands of trees with associated shrubs and forbs.

Species that are frequently encountered in this area include the trees *Dombeya rotundifolia*, *Searsia pyroides*, *S. leptodictya*, *Euclea crispa*, *Gymnosporia buxifolia*, *Ziziphus mucronata*, *Combretum zeyheri*, *C molle*, *Pappea capensis*, *Berchemia zeyheri* and *Euphorbia ingens*. It is obvious that broadleafed species tends to dominate within this habitat, while *Acacia caffra*, *A. karroo*, *A. robusta*, and *Dichrostachys cinerea* occur at much lower densities.

The herbaceous layer is not particularly well developed, mainly because of the poor soil conditions within the open areas and the shaded conditions within the wooded parts. Species that were encountered include the grasses *Hyparrhenia hirta*, *Eragrostis rigidior*, *Heteropogon contortus*, *Cynodon dactylon*, *Sporobolus africanus*, *Melinis nerviglumis*, *Themeda triandra*, *Eragrostis gummiflua* and *Digitaria eriantha*. Forbs and shrubs that occur in this area include Aloe greatheadii, Asparagus species, Gomphocarpus fruticosus, Dodonea angustifolia, Sarcostemma viminale, Achyranthes aspera and *Rhoicissus tridentata*.

Due to the association with wetland habitat type, this area is regarded medium-high in floristic sensitivity; a major contribution towards the sensitivity is made by the presence of numerous indigenous tree species that are representative of the regional vegetation type. Some degradation is noted (erosion), but the functionality of the larger habitat type is only slightly affected. The presence of weeds and alien species, such as *Cereus jamacuru* and *Jacaranda mimosifolia* is noted. The likelihood of encountering Red Data species within this habitat type is regarded medium-low.

### *8.6.3 Grassland Seepage*

This vegetation type is generally termed 'Hydromorphic Grasslands' and constitutes grassland that occur in-between terrestrial and aquatic systems, usually situated on terrain type 4 and 5 (footslopes) in close vicinity to valley bottoms (drainage lines, streams, rivers). Soil conditions indicate temporary inundation during times of high rain, but are generally dry for the longest part of the year. This hydromorphic grassland comprises small grassland seepage in the southern part of the study area that drains towards the drainage line located immediately to the north. The extent of this habitat captured within the study area is approximately 0.3ha. It forms part of a larger grassladnd seepage located to the east of the study area. Since this habitat type mostly occurs in close vicinity to riparian systems, they are generally regarded as sensitive.

This habitat type is characterised by relative flat grassland on sandy substrate where grey soils predominate (possibly an E horizon). The physiognomy is moist grassland, dominated by the herbaceous (grass) layer. Because of the leached soil horizons, the vegetation is not particularly palatable and is therefore not grazed extensively. Thet species composition is

dominated by grasses, including *Sporobolus africanus, Eragrostis* species, *Hyperthelia dissoluta, Pogonarthria squarrosa, Eragrostis gummiflua*. The likelihood of encountering Red Data species within this type of habitat is regarded medium. A medium-high floristic sensitivity is ascribed to this area.

### *8.6.4 Homestead*

This habitat represents a small section of the central part of the study site where remnants of the original homestead are present, comprising approximately 0.3ha. Although the vegetatioin is relatively degraded, original impacts were relatively localised and the vegetation has recovered to some extent. An important aspect to note in this area is the presence of rock sheets and small portions of shallow, rocky soils in the immediate vicinity, giving rise to a small variation in the vegetation, particularly forbs and grasses. This is visually observed to be the highest part of the study area. The presence of trees that were planted by the original inhabitants was also noted, including indigenous and exotic species.

Species that were observed include *Themeda triandra, Setaria nigrirostris, Acacia caffra, Jacaranda mimosifolia, Tipuana tipu, Bothriochloa insculpta, Lantana rugosa, Sorghum bicolor, Pseudognaphalium luteo-album, Xerophyta retinervis, Heteropogon contortus, Gomphrena celocioides, Combretum molle, Vitex zeyheri, Aloe greatheadii, Duvalia politia, Eragrostis rigidior, Dichrostachys cinerea, Monsonia angustifolia, Searsia leptodictya, Ximenia americana, Asparagus species, Pennisetum setaceus, Schkhuria pinnata, Vangueria infausta, Pogonarthria squarossa, Commelina africana, Pellaea calomelanos, Sclerocarrya birrea, Waltheria indica, Pappea capensis, Euclea crispa* and *Melinis repens.*

In spite of the relatively degraded status of the vegetation, a high diversity is noted with a relative unique species composition representative of variations of the regional vegetation type that is frequently associated with rocky outcrops. The isolated nature of this portion, however, renders it low in conservation potential. Although the likelihood of encountering Red Data flora species within this area is regarded low, the presence of the protected tree species *Sclerocarya birrea* (Marula) is noted. It is assumed that early inhabitants of the farmstead have planted this tree since this species is not associated with the region. A medium-low floristic status is ascribed to this portion.

### *8.6.5 Natural Woodland / Savanna*

The central part of the study area comprises an open savanna of approximately 6.5ha, dominated by *Acacia* species. The status of this part of the study area is not pristine due to poor management, frequent fires, absence of grazing, infestation by invasive shrubs, etc., but the vegetation is still representative of the regional vegetation type (Marikana Thornveld). Due to the winter survey period, the forbaceous component of the area could not be sampled adequately and relatively few forbs were noted. A summer survey will most likely reveal a more diverse herbaceous component.

The physiognomy of this habitat is described as open *Acacia* savanna, with a well-developed grass layer. The woody component is dominated by *Acacia caffra, A. karroo, A. robusta, A. nilotica, A. tortilus, Searsia pyroides, S. lancea, Ziziphus mucronata* and *Euclea crispa.* The shrub component is dominated by the invasive *Dichrostachys cinerea,* occurring together with *Lantana rugosa.* The grass component is dominated by *Themeda triandra, Heteropogon contortus, Eragrostis rigidior, Eragrostis chloromelas, Hyparrhenia hirta, Hyperthelia dissoluta, Aristida congesta* subsp. *barbicollis, Cynodon dactylon, Bothriochloa insculpta, Themeda triandra, Elionurus muticus, Panicum maximum* and *Melinis repens.* Forbs that were noted include *Xerophyta retinervis, Aloe greastheadii, Monsonia angustifolia, Commelina africana, Waltheria indica, Vernonia oligocephala, Gladiolus* species, *Crinum* species, *Crabbea angustifolia, Ledebouria* species, *Hermannia depressa* and *Raphionachme hirsuta.*

This habitat type is representative of the natural regional vegetation, of which little remains in the region. Although no Red Data species are likely to be present within these areas, a medium-high floristic sensitivity is ascribed to these parts, particularly because of the Endangered status of the regional vegetation type.

### *8.6.6 Reverted Woodland*

This habitat type represents areas of natural woodland where historic activities has resulted in degradation of the natural woodland, which has subsequent to the cessation of impacts reverted back to an open savanna status, comprising approximately 3.6ha of the study area. The nature of the activities was not so severe to result in irreversible transformation of the vegetation, as in the case of ploughing. More likely, trees were removed and evidence of grass mowing can be observed on aerial images. Subsequent to this, the woody component has recovered to some extent, currently comprising *Acacia* species similar to that of the Natural Woodland/ Savanna habitat. The dominance of *Dichrostachys cinerea* provides further evidence of historic impacts as well as other current impacts such as frequent fires and periodic intensive grazing.

Because of historic impacts, the herbaceous layer is dominant, comprising mostly grasses such as *Dichrostachys cinerea Hyperthelia dissoluta, Aristida canescens, A. congesta* subsp. *barbicollis, Eragrostis chloromelas, Cymbopogon plurinodis* and *Elionurus muticus.*

Because the likelihood of encountering Red Data flora species within these areas are low as well as the degraded nature of the woodland, a medium-low floristic sensitivity is ascribed to these parts of the study area.

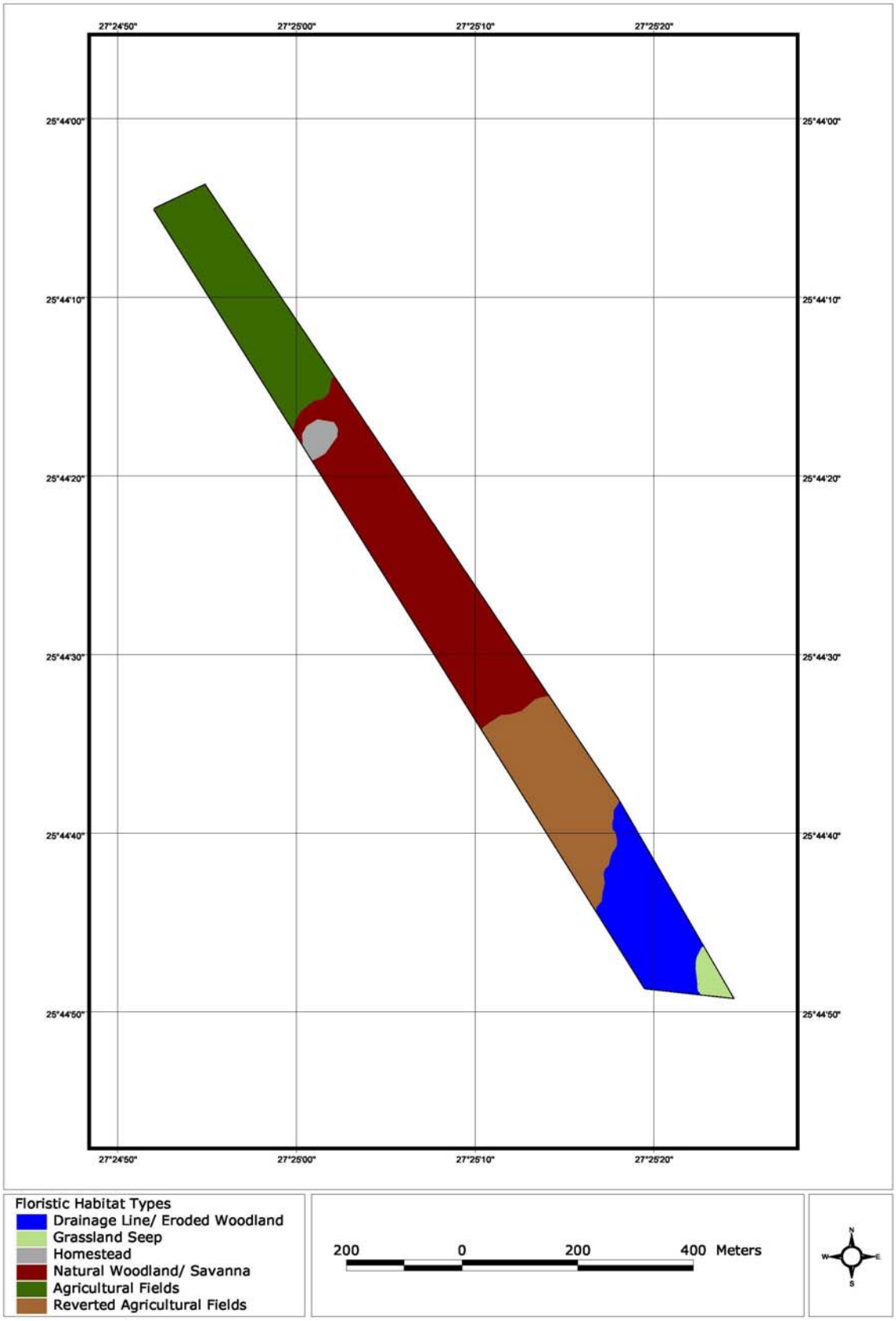


**Figure 7: Floristic habitat types of the study area**

## 8.7 Floristic Sensitivity

Floristic sensitivity calculations are presented in Table 6 and illustrated in Figure 8.

**Table 6: Floristic sensitivity estimations for the respective habitat types**

| Criteria | RD species | Landscape sensitivity | Status | Species diversity | Functionality / fragmentation | TOTAL | SENSITIVITY INDEX | SENSITIVITY CLASS |
|---|---|---|---|---|---|---|---|---|
| **Community** | **Criteria Ranking** | | | | | | | |
| Agricultural Fields | 1 | 2 | 2 | 2 | 2 | 54 | 17% | Low |
| Drainage Line/ Eroded Woodland | 2 | 9 | 7 | 7 | 9 | 196 | 61% | Medium-high |
| Grassland Seepage | 3 | 9 | 8 | 8 | 9 | 217 | 68% | Medium-high |
| Homestead | 1 | 2 | 2 | 4 | 6 | 88 | 28% | Medium-low |
| Natural Woodland/ Savanna | 2 | 9 | 8 | 7 | 8 | 199 | 62% | Medium-high |
| Reverted Woodland | 1 | 4 | 4 | 4 | 6 | 104 | 33% | Medium-low |

The extent of habitat sensitivities within the respective alternatives is presented in Table 7.

**Table 7: Extent of habitat sensitivities within the study area**

| Sensitivity | Extent | Percentage |
|---|---|---|
| Low | 3.9ha | 22.41% |
| Medium-low | 3.9ha | 22.41% |
| Medium-high | 9.6ha | 55.17% |

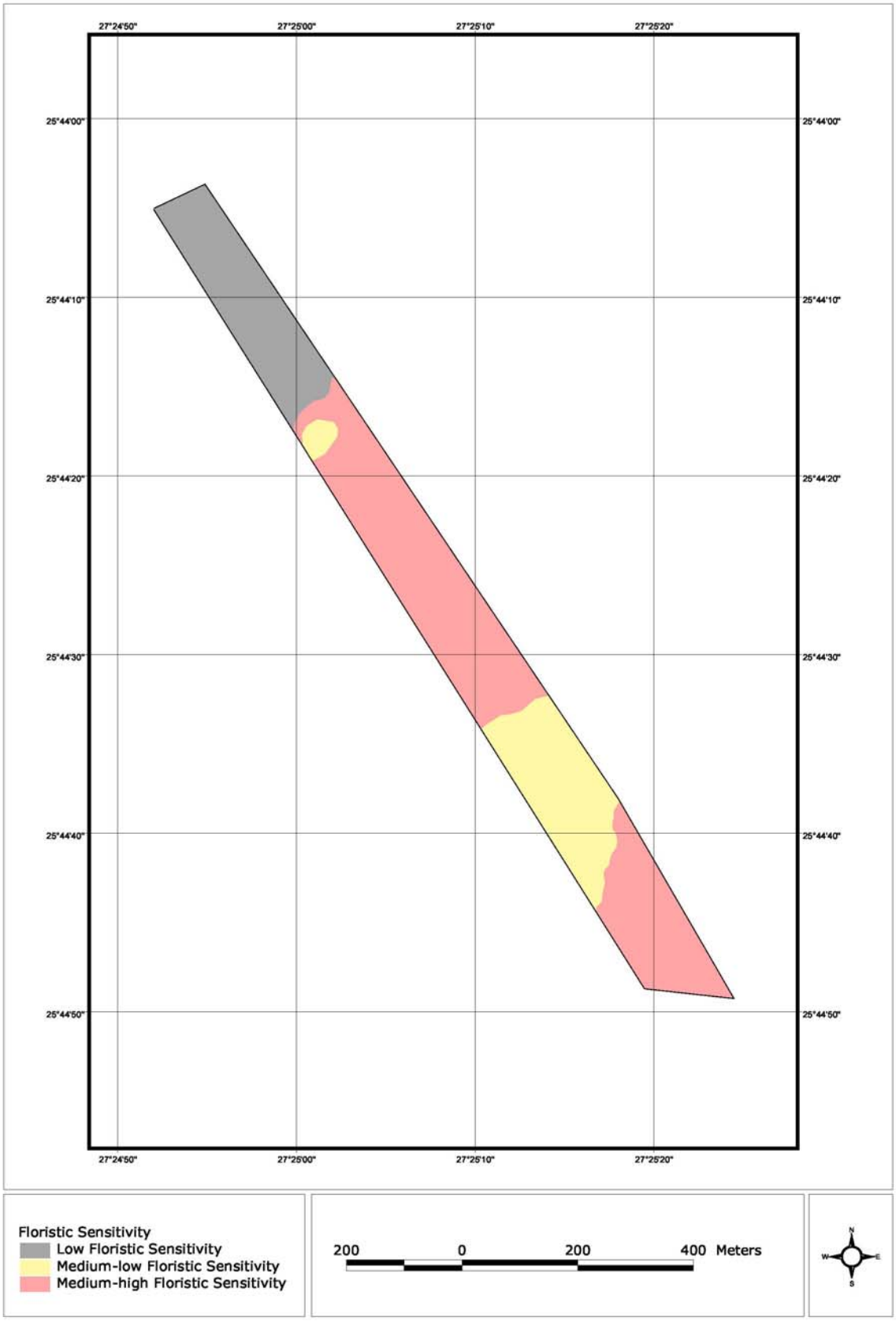


**Figure 8: Flora habitat sensitivities of the study area**

## 8.8 Discussion

A relatively large portion of the proposed site exhibits attributes of medium-high floristic sensitivity, including wetland related habitat and natural woodland areas. This is mainly the result of the Endangered and Vulnerable status ascribed to the regional vegetation types and not the because of the presence of particularly pristine vegetation present within the study area. These areas were however found to be moderately degraded in most parts, exhibiting effects of surrounding land uses and erosion; this ultimately rendered remaining natural vegetation highly isolated in a fragmented environment of extremely high environmental impacts. Furthermore, areas of medium-high floristic sensitivity within the study area are relative small when considered on a regional scale.

Ultimately, the relatively small size of the remaining pockets of natural vegetation renders the actual conservation potential relative low; it is estimated that the current size of natural vegetation within the study site (including the immediate surrounds) are below the critical threshold where the natural ecology of the region can effectively be conserved. However, the role that these small islands of natural vegetation plays as 'stepping stones' between larger areas of potentially richer and more effectively conserved ecology (such as the nearby Magaliesberg Nature Area), cannot be underestimated, hence the medium-high floristic sensitivity ascribed to these parts.

Considering the proposed project, it is regarded unlikely that the loss of portions of natural terrestrial vegetation (excluding wetland related habitat types) will result in significant impacts on a local or regional scale. Wetland related habitat, because of a moderate connectivity to downstream habitat, should be excluded from the proposed development. The implementation of site-specific mitigation measures is recommended in order to control construction and operational activities from affecting these areas adversely.

# 9 FAUNA OF THE STUDY AREA

## 9.1 Regional Faunal Diversity

Only specific faunal groups are used during the species-specific element of this faunal assessment because of restrictions concerning database availability. Data on the Q-degree level is available for the following faunal groups:

- Invertebrates: Butterflies (South African Butterfly Conservation Assessment – http://sabca.adu.org.za)
- Amphibians: Frogs (Atlas and Red Data Book of the South Africa, Lesotho and Swaziland)
- Reptiles: Snakes and other Reptiles (South African Reptile Conservation Assessment - http://sarca.adu.org.za)
- Mammals: Terrestrial Mammals (Red Data Book of the Mammals of South Africa: A Conservation Assessment.)

Animals known to be present in the Q-grids of the study area were considered potential inhabitants of the study area (all species known from the North West Province were included to minimize the effect of sampling bias). The likelihood of each species' presence in the study areas was estimated based on known ecological requirements of species; these requirements were compared to the ecological conditions found in the study area and surrounding faunal habitat.

A total of 592 animal species (124 families, 33 orders and 5 classes - Insecta, Amphibia, Reptilia, Aves and Mammalia) are known from the region of the study area. This includes 46 Red Data species.

## 9.2 Faunal Diversity of the Site

The presence of 24 animal species on this particular site was confirmed during the site investigation (Table 23). Signs of, or individuals of, two butterflies, one reptile, sixteen birds and five mammals were confirmed for the study area. This includes the Red Data mammal *Mellivora capensis* (Honey Badger, NT).

The twenty-four animals confirmed for the study area are regarded as typical of the study area, taking into consideration the size and location in the Marikana Thornveld and Moot Plains Bushveld as well as the mixture of habitat types present in the study area. It must be noted that a study during the raining period (i.e. in the warm, wet season) would likely reveal other species that are unlikely to be found during the cold, dry season; such as migrant birds, summer-active invertebrates, amphibians and reptiles. It is also regarded likely that additional Red Data species might be present.

## 9.3 Red Data Fauna Assessment

A total of 81 Red Data animals are known to occur in the North-West Province (for mammals, reptiles, amphibians and invertebrates) and the Q-grid 2527CB (for avifauna). This includes 15 listed as Data Deficient (DD), 31 as Near Threatened (NT), 28 as Vulnerable (VU), 4 as Endangered (EN) and 3 as Critically Endangered (CR). Another sixteen Red Data species known from the region are considered at least moderately likely to be present in the study area; either as permanent residents, or at least migrating through the study area periodically.

It is estimated that 48 of the listed 81 animals have a low probability of occurring in the study area, 16 species have a moderate-low probability and 16 have a moderate probability of occurring. Most of the species are considered to have either a low or a moderate-low likelihood of occurring in the study area. This assessment is based on:

- the small size of the study area;
- the isolated nature of the study area due to the surrounding land uses of crop agriculture and mining; and
- the lack of significantly unique habitat characteristics such as those associated with wetlands and outcrops.

Signs (tracts) of the Red Data *Mellivora capensis* (Honey Badger) were observed within the study area.

**The Honey Badger (*Mellivora capensis*) -** is found throughout Africa south of the Sahara, across the middle-east to India. The species inhabit diverse habitats including deep forests, subtropical dry evergreen forests, tropical thorn forests, open woodlands and open riparian habitat. The diet of the Honey Badger includes mammals, insects, amphibians, reptiles and birds as well as roots, berries and fruit. They are primarily nocturnal animals although diurnal observations are commonplace. Although classified as Near Threatened for South Africa, the species is globally classified as Least Threatened in the IUCN Red List. Honey Badgers do not occur at high densities and are considered uncommon throughout their range.

It should be noted that only a few indications (tracts) were observed in the study area. No signs of utilising the habitat for breeding or habitation were observed. It is likely that either infrequent foraging is conducted or that the area is traversed on an infrequent basis.

## 9.4 Faunal Habitat Types

The close relationship between vegetation units and specific faunal composition has been noted in several scientific studies. For the purpose of this investigation, floristic units are therefore considered representative of the faunal habitat types (Refer Figure 9).

## 9.5 Faunal Habitat Sensitivity Assessment

During the field assessment, the study area was investigated and assessed in terms of the following biodiversity elements:

- Habitat status: level of habitat transformation and degradation vs. pristine faunal habitat;
- Habitat diversity: the number of different faunal habitat types (both on micro- and macro-scale) found within the proposed site and bordering areas;
- Habitat linkage: the degree to which the faunal habitat of the proposed site is linked to other natural areas enabling movement of animals to and from the habitat found on site;
- Red Data species: the degree to which suitable habitat for the red data species likely to be found in the study area (larger study area) is located on each site; and
- Sensitive faunal habitat: the relative presence of faunal sensitive habitat type elements such as surface rock associated with outcrops and hills as well as wetland elements.

**Table 8: Faunal Habitat Sensitivities for the study area**

| Community | Status | Diversity | Linkage | RD Likelihood | Habitat Sensitivity | Average | Sensitivity Class |
|---|---|---|---|---|---|---|---|
| Agricultural Fields | 2 | 2 | 2 | 1 | 1 | 16% | Low |
| Drainage Line/ Eroded Woodland | 6 | 7 | 7 | 9 | 10 | 78% | Medium-high |
| Grassland Seepage | 7 | 7 | 7 | 8 | 9 | 76% | Medium-high |
| Homestead | 1 | 2 | 1 | 1 | 1 | 12% | Low |
| Natural Woodland/ Savanna | 8 | 8 | 4 | 4 | 5 | 58% | Medium |
| Reverted Woodland | 6 | 7 | 4 | 2 | 4 | 46% | Medium |

The extent of habitat sensitivities within respective corridor alternatives is presented in Table 9.

**Table 9: Extent of habitat sensitivities within the respective habitat types**

| Habitat Sensitivity | Extent | Percentage |
|---|---|---|
| Low | 4.2ha | 24.14% |
| Medium | 10.1ha | 58.05% |
| Medium-high | 3.1ha | 17.82% |

## 9.6 Discussion

The study area represents a relatively small, isolated fragment of moderately transformed faunal habitat situated within a matrix of crop agriculture and mining infrastructure on local and regional scale. Parts of the natural habitat of the study area have been degraded and transformed, while approximately half of the study area comprises moderately natural woodland/ savanna and wetland habitat. Fauna species observed in the study area are mostly widespread and common and are not restricted in range or habitat requirements. Evidence of one Red Data species was observed in the study area, observed in the southern section of the study area (Wetland habitat).

Although both regional vegetation communities found in the study area (Moot Plains Bushveld - Vulnerable and Marikana Thornveld - Endangered) are listed as threatened plant communities, only token elements of these communities are present in the study area and little important faunal habitat is present.

In conclusion, the study area does not exhibit any significantly sensitive faunal habitat or –communities and it is not likely that the proposed project (proposed RUSTMO2 PV Plant) will affect significantly on any animal species, assemblage or community on a local or regional scale. It is however recommended that the wetland related habitat types be excluded from the proposed development.

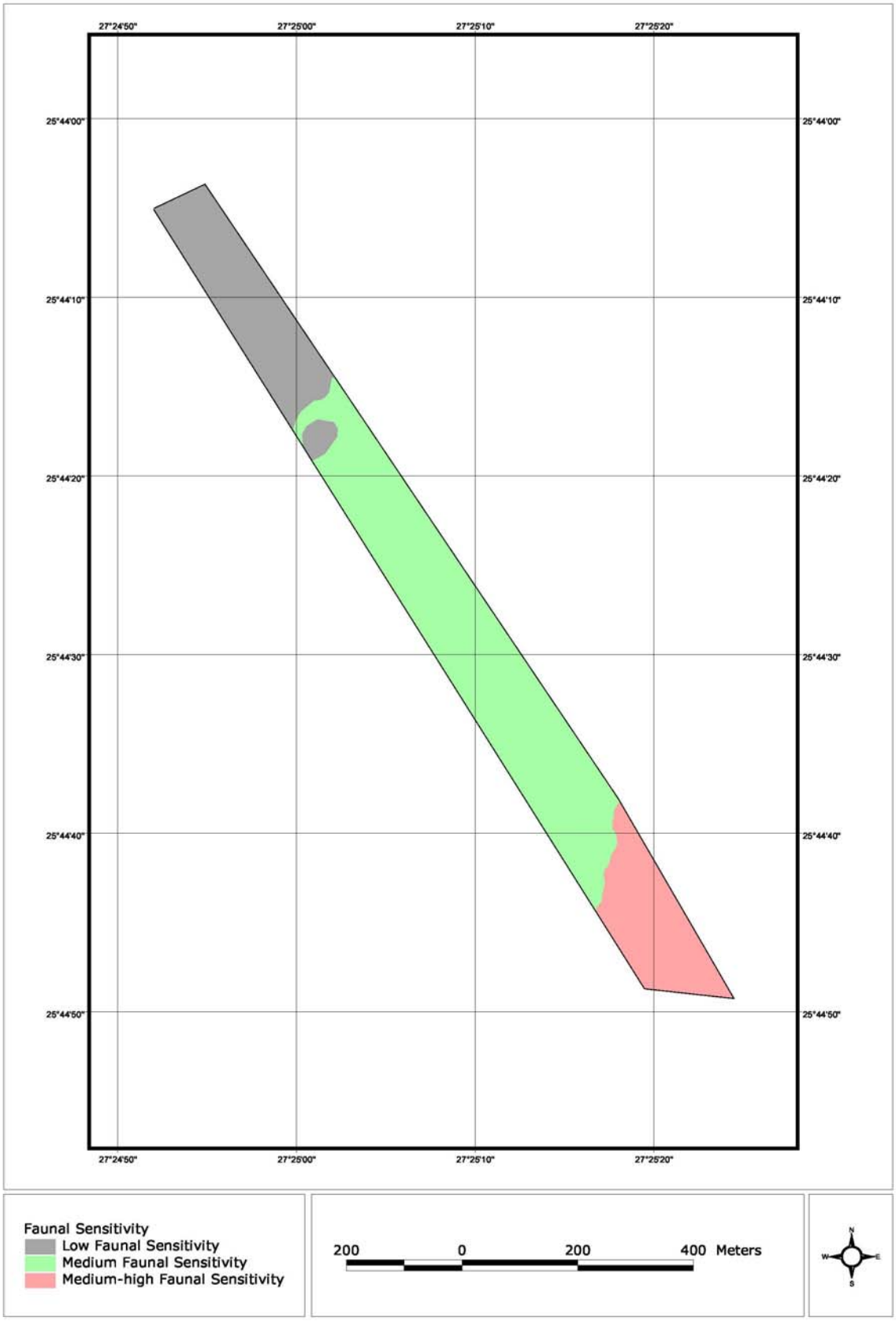


**Figure 9: Faunal habitat sensitivities of the study area**

## 10 ECOLOGICAL INTERPRETATION

Results of the respective floristic- and faunal habitat sensitivity assessments are interpreted to present an estimation (Table 10) that would reflect the expected impact of the construction and operation of the proposed line and substations on the biological environment. While the estimations of habitat sensitivity, as presented in preceding chapters do provide an indication in terms of the extent and locality of important habitat, an interpretation of the surrounding habitat sensitivity is also implemented in these estimations.

**Table 10: Ecological Sensitivity of the study area**

| Community | Floristic Sensitivity | Faunal Sensitivity | Ecological Sensitivity |
|---|---|---|---|
| Agricultural Fields | Low | Low | Low |
| Drainage Line/ Eroded Woodland | Medium-high | Medium-high | Medium-high |
| Grassland Seepage | Medium-high | Medium-high | Medium-high |
| Homestead | Medium-low | Low | Medium-low |
| Natural Woodland/ Savanna | Medium-high | Medium | Medium-high |
| Reverted Woodland | Medium-low | Medium | Medium |

Floristic and faunal sensitivity analysis indicates the high sensitivity of areas associated with wetland regimes; these areas are regarded unsuitable for development purposes. It is imperative that a wetland specialist be consulted in order to determine the boundaries of these habitat types. The status of these areas is moderately pristine and is regarded likely to exhibit high biodiversity attributes with a moderate likelihood of Red Data species being present. Unfortunately, these areas are relatively small and are not well represented in the general region, ultimately reducing the conservation potential of these areas on a local and regional scale.

The largest extent of the study area exhibits attributes of medium-high or medium ecological sensitivity. These areas are however relatively small when considered on a regional scale and the conservation of these parts is therefore not regarded as feasible. The proposed activity is not expected to result in significant impacts when considered on a local or regional scale. It should be noted that impacts associated with the construction and operation of a development of this nature within this environment is regarded as negligent in relation to impacts resulting from agriculture and mining.

Both the floristic and faunal assessments indicated the medium-high sensitivity of the southern part of the study area, i.e. wetland related habitat. It is recommended that this area be excluded from the proposed development. A wetland specialist should be consulted in order to delineate the boundaries of this habitat since this assessment is based on visual observations.

# 11 BIODIVERSITY IMPACT ASSESSMENT

Results of the floristic and faunal investigations were interpreted holistically in order to assess the potential impact on the ecological environment. The impact assessment is aimed at presenting a description of the nature, extent, significance and potential mitigation of identified impacts on the biological environment. These tabular assessments are presented in Section 11.4 in the form of Impact Rating Matrix for each identified impact within the respective habitat types.

Please note that only habitat types that exhibit attributes of Medium-High sensitivity will be evaluated in this section. Impacts in areas of Medium or lower categories are regarded acceptable and the implementation of generic mitigation measures is expected to result in minimising potential impacts within these areas. Habitat types that are evaluated in the following section include:

- Drainage Lines/ Eroded Woodland Medium-high Sensitivity;
- Grassland Seepage Medium-high Sensitivity; and
- Natural Woodland/ Savanna Medium-high Sensitivity.

## 11.1 Identification of Impacts

No impacts were identified that could lead to a beneficial impact on the ecological environment of the study area since the proposed development is largely destructive as it involves the alteration of natural habitat or further degradation of habitat that is currently in a sub-climax status.

Impacts resulting from the proposed development on ecological attributes of the study area are largely restricted to the physical impacts on biota or the habitat in which they occur. Direct impacts, such as habitat destruction and modifications, are regarded immediate, long-term and of high significance. These impacts are mostly measurable and easy to assess, as the effects thereof is immediately visible and can be determined to an acceptable level of certainty. In contrast, indirect impacts are not immediately evident and can consequently not be measured immediately. A measure of estimation is therefore necessary in order to evaluate these impacts. Lastly, impacts of a cumulative nature places direct and indirect impacts of this projects into a regional and national context, particularly in view of similar or resultant developments and activities.

Ten impacts were identified that are of relevance to any development in a natural environment. Not all of these impacts might occur, or the extent of impact might be limited; the relevance of these impacts is therefore determined in Section 11.2 prior to being implemented in the Impact Assessment.

Impacts were placed in three categories, namely:

- **Direct impacts:**
  - Destruction of threatened and protected flora species;
  - Destruction of sensitive/ pristine habitat types;
  - Direct impacts on threatened fauna species;
  - Direct impacts on common fauna species;
- **Indirect Impacts:**
  - Floristic species changes subsequent to development;
  - Faunal interactions with structures, servitudes and personnel;
  - Impacts on surrounding habitat/ species;
- **Cumulative Impacts:**
  - Impacts on SA's conservation obligations & targets (VEGMAP vegetation types);
  - Increase in local and regional fragmentation/ isolation of habitat; and
  - Increase in environmental degradation.

Other, more subtle impacts on biological components, such as changes in local, regional and global climate, effects of noise pollution on fauna species, increase in acid rain, ground water deterioration, etc., are impacts that cannot be quantified to an acceptable level of certainty and is mostly subjective in nature as either little literature is available on the topic or contradictory information exist. These impacts are therefore omitted from this assessment.

## 11.2 Nature of Impacts

### *11.2.1 Destruction of Threatened & Protected Flora Species*

This impact is regarded as a direct impact as it results in the physical damage or destruction of Red Data or Protected species or areas that are suitable for these species, representing a significant impact on the biodiversity of a region. Threatened species, in most cases, do not contribute significantly to the biodiversity of an area in terms of sheer numbers as there are generally few of them, but a high ecological value is placed on the presence of such species in an area as they generally present an indication of pristine habitat conditions. Conversely, the presence of pristine habitat conditions can frequently be accepted as an indication of the potential presence of species of conservation importance, particularly in moist habitat conditions.

Red Data species are particularly sensitive to changes in their environment, having adapted to a narrow range of specific habitat requirements. Habitat changes, mostly a result of human interferences and activities, are one of the greatest reasons for these species having a threatened status. Surface transformation/ degradation activities within habitat types that are occupied by flora species of conservation importance will ultimately result in significant impacts on these species and their population dynamics. Effects of this impact are usually permanent and recovery or mitigation is generally not perceived as possible.

One of the greatest limitations in terms of mitigating or preventing this particular impact, is that extremely little information is generally available in terms of the presence, distribution patterns, population dynamics and habitat requirements of Red Data flora species. To allow for an accurate assessment, it will be necessary to assess the presence/ distribution, habitats requirements, etc. associated with these species in detail and over prolonged periods; something that is generally not possible during EIA investigation such as this. However, by applying ecosystem conservation principles to this impact assessment and subsequent planning and development phases, resultant impacts will be limited largely.

**The likelihood of Red Data flora species occurring within parts of the study area is regarded highly unlikely as no areas were found to be suitable for these species. However, a single individual of protected tree species is present within the site and specific comments need to be made about this. This impact is therefore included in this Impact Assessment.**

### *11.2.2 Direct Impacts on Threatened Fauna Species*

Due to the confirmed presence of a Red Data mammal species, the likelihood exists that attributes of the study area that are utilised by this species will be affected adversely. Aspects that could potentially be affected include migration patterns and suitable habitat for breeding and foraging purposes.

**The presence of Red Data fauna species within the study area is confirmed and this impact is therefore included in this Impact Assessment.**

### *11.2.3 Destruction/ Alteration of Sensitive/ Pristine Habitat Types*

The loss/ change of pristine habitat types or habitat that are regarded sensitive as a result of restricted presence in the larger region (atypical habitat) represents a potential loss of habitat and biodiversity on a local and regional scale. Sensitive habitat types include mountains, ridges, koppies, wetlands, rivers, streams and localised habitat types of significant physiognomic variation and unique species composition. These areas represent centres of atypical habitat and contain biological attributes that are not frequently encountered in the greater surrounds. A high conservation value is generally ascribed to floristic communities and faunal assemblages that occupy these areas as they contribute significantly to the biodiversity of a region.

Furthermore, these habitat types are generally isolated and are frequently linear in nature, such as rivers and ridges. Any impact that disrupts this continuous linear nature will risk fragmentation and isolation of existing ecological units, affecting the migration potential of some fauna species adversely, pollinator species in particular.

**Relatively small parts of the study area are regarded as being moderately sensitive. The likelihood of this impact occurring is therefore regarded as moderate and will therefore be included as part of the Impact Assessment.**

### *11.2.4 Direct Impacts on Common Fauna Species*

The likelihood of this direct impact occurring is relatively low because of the ability of animal species to migrate away from impacts. The presence of a relatively diverse faunal species composition on this property has been established. Taking the levels of transformation and degradation of the surrounding region into consideration, remaining areas of natural habitat should be considered islands of faunal refugia. While the tolerance levels of common animal species is generally of such a nature that surrounding areas will suffice in habitat requirements of species forced to move from areas of impact, limited such habitat remains on a local and regional scale. It is regarded highly unlikely that the conservation status of common animal species will be affected because of direct and indirect impacts of the proposed development on these species and their habitat.

**The nature of the development is expected to result in some direct impacts on common fauna species because of the ability of most animals to avoid direct contact in a fragmented habitat. This impact is therefore included in the Impact Assessment.**

### *11.2.5 Floristic Species Changes Subsequent to Development*

This impact represents an indirect impact. The transformation of natural habitat during the construction process will inevitably result in the establishment of pioneer or sub-climax habitat types that are not considered representative of the region. While impacts are generally regarded to be of low severity, impacted areas are frequently invaded by species not normally associated with the region (exotic and invasive species). In addition, many species that are not necessarily abundant in the region will increase in abundance because of more favourable habitat conditions being created because of habitat manipulation activities (encroacher species). This effect is more pronounced in the floristic component, but changed habitat conditions in the habitat will inevitably imply minor changes in the faunal component that occupies the habitat.

Micro-habitat conditions are changed as a result of the removal of the vegetation layer, affecting shade conditions, habitat competition, germination success of the herbaceous layer, etc. and is likely to result in the establishment of a species composition that is entirely different than original conditions and the immediate surrounds, in many cases also comprising species of an invasive nature, particularly shrubs.

If left unmitigated, this risk could result in decreased habitat, increased competition and lower numbers of endemic biota, the genetic pool of species might eventually be influenced by the introduction of non-endemic species. Different faunal assemblages and plant

communities have developed separate gene structures as a result of habitat selection and geographical separation and the introduction of individuals of the same species that might be genetically dissimilar to the endemic species might lead to different genetic selection structures, eventually affecting the genetic structure of current populations and assemblages.

**Construction activities are regarded likely to result in changes to the status of existing habitat types. Although much of the study area is regarded as being sub-climax, some areas of natural habitat will also be altered and it is likely that the area will become infested with weeds and invasive species during the operational phase should no maintenance procedures be put into place. This impact is therefore included in the Impact Assessment.**

### *11.2.6 Faunal Interactions with Structures, Servitudes & Personnel*

It should be noted that animals generally avoid contact with human structures, but do grow accustomed to structures after a period. While the structures are usually visible, injuries and death of animals could potentially occur. An aspect that is of concern is the presence of vehicles on access and infrastructure roads, leading to road kills, particularly amongst nocturnal animals that abound in the study area.

The presence of personnel within the development area during construction and maintenance periods will inevitably result in some, but normally limited, contact with animals. While most of the larger animal species are likely to move away from human contact, encounters with snakes and scorpions remain likely. Similarly, the presence of humans within areas of natural habitat could potentially result in killing of animals by means of snaring, poaching, poisoning, trapping, etc.

**The nature of the proposed development is expected to result in limited indirect impacts on the fauna species. This impact is included in the Impact Assessment.**

### *11.2.7 Impacts on Surrounding Habitat / Species*

Surrounding areas and species present in the direct vicinity of the study area could potentially be affected by indirect impacts resulting from construction and operation activities. This indirect impact could potentially include all of the above impacts, depending on the sensitivity and status of surrounding habitat and species as well as the extent of impact activities. However, surrounding areas are characterised by high levels of transformation and human activities, including mining, road infrastructure and agriculture. These areas therefore represent areas of low ecological sensitivity and are unlikely to be affected by the proposed development.

**The nature of this impact dictates that potential impacts are unlikely to spread from the development area into bordering areas of high sensitivity. This impact is therefore unlikely to occur and is therefore excluded from the Impact Assessment.**

### *11.2.8 Impacts on SA's Conservation Obligations & Targets*

This impact is regarded as a cumulative impact since it affects the status of conservation strategies and targets on a local as well as national level and is viewed in conjunction with other types of local and regional impacts that affects conservation areas. The importance of habitat types is based on the conservation status ascribed to regional vegetation types, including both Vulnerable and Endangered vegetation types; any impact that could result in decimation of remaining areas of natural regional vegetation types, are therefore regarded significant. No declared area of conservation will be affected directly by the proposed development. The study site is located outside the buffer zone of the Magaliesberg Nature Area.

**Loss of parts of the natural vegetation is expected to result in an insignificant, indirect impact on the conservation status of the regional vegetation types; which is regarded Endangered and Vulnerable. Although of a small extent, this impact is relevant and is included in the Impact Assessment. Furthermore, taking into consideration that a similar project is planned for the adjacent property, as well as the presence of extensive mining areas further to the east, the cumulative impact of this development on the local scale might be of moderate signigificance, on a regional scale it will however be of low significance.**

### *11.2.9 Increase in Local & Regional Fragmentation / Isolation of Habitat*

Uninterrupted habitat is a precious commodity for biological attributes in modern times, particularly in areas that are characterised by moderate and high levels of transformation. The loss of natural habitat, even small areas, implies that biological attributes have permanently lost that ability of occupying that space, effectively meaning that a higher premium is placed on available food, water and habitat resources in the immediate surrounds. This, in some instances might mean that the viable population of plants or animals in a region will decrease proportionally with the loss of habitat, eventually decreasing beyond a viable population size.

The danger in this type of cumulative impact is that effects are not known or is not visible with immediate effect and normally when these effects become visible, they are beyond repair. Impacts on linear areas of natural habitat affect the migratory success of animals in particular.

**The general region is characterised by extremely high levels of transformation and habitat fragmentation. Cumulative impacts from the proposed development, when considered in conjunction with development of the adjacent property as well as**

**mining and agricultural practices on a local and regional scale, are unlikely to increase regional or local levels of fragmentation and habitat isolation. This particular impact is therefore excluded from the Impact Assessment.**

#### *11.2.10 Increase in Environmental Degradation*

Cumulative impacts associated with this type of development could lead to initial, incremental or augmentation of existing types of environmental degradation, including impacts on the air, soil and water present within available habitat. Pollution of these elements might not always be immediately visible or readily quantifiable, but incremental or fractional increases might rise to levels where biological attributes could be affected adversely on a local or regional scale. In most cases, these effects are not bound and are dispersed or diluted over an area that is much larger than the actual footprint of the causal factor.

Similarly, developments in untransformed and pristine areas are usually not characterised by visibly significant environmental degradation and these impacts are usually most prevalent in areas where continuous and long-term impacts have been experienced.

**The nature of the proposed development dictates that the biological environment is unlikely to be affected since no effluents, spillages or chemicals are likely to be produced or transported. In comparison with existing levels of environmental degradation that have resulted from mining and agriculture, this impact is highly unlikely to exacerbate existing levels and is therefore excluded from the Impact Assessment.**

### 11.3 Probable Impacts on the Biological Environment

Based on the above, it is expected that the probable impacts on the environment, because of the project, could include:

- Destruction of threatened and protected flora species;
- Destruction of sensitive/ pristine habitat types;
- Direct impacts on threatened fauna species;
- Direct impacts on common fauna species;
- Floristic species changes subsequent to development;
- Faunal interactions with structures, servitudes and personnel; and
- Impacts on SA's conservation obligations & targets (VEGMAP vegetation types).

### 11.4 Assessment of Impacts

In estimating the significance and likelihood of impacts of the proposed development on the biological environment, cognisance is taken of all biophysical, floristic and faunal attributes that characterise the study area as well as the immediate region.

### 11.4.1 Impacts within the Drainage Line Habitat Type

| Table 11: Impacts within the Drainage Line / Eroded Woodland Habitat | | |
|---|---|---|
| **Nature of Impact: Direct impacts on Threatened & Protected Flora** | | |
| | **Without mitigation** | **With mitigation** |
| Extent | 2 (Site & Surrounds) | 1 (Site only) |
| Duration | 5 (Permanent) | 1 (Very short term) |
| Magnitude | 4 (Low) | 2 (Minor) |
| Probability | 2 (Improbable) | 1 (Very improbable) |
| Significance | 22 (Low) | 4 (Low) |
| Status (positive or negative) | Negative | Negative |
| Reversibility | Low | Low |
| Irreplaceable loss of resources? | Moderate | Low |
| Can impacts be mitigated? | High | |
| **Nature of Impact: Destruction of sensitive / pristine habitat** | | |
| | **Without mitigation** | **With mitigation** |
| Extent | 3 (Local area) | 1 (Site only) |
| Duration | 5 (Permanent) | 4 (Long term) |
| Magnitude | 8 (High) | 2 (Minor) |
| Probability | 4 (Highly probable) | 2 (Improbable) |
| Significance | 64 (High) | 14 (Low) |
| Status (positive or negative) | Negative | Negative |
| Reversibility | Low | Moderate |
| Irreplaceable loss of resources? | Moderate | Low |
| Can impacts be mitigated? | Moderate | |
| **Nature of Impact: Direct impacts on Threatened fauna species** | | |
| | **Without mitigation** | **With mitigation** |
| Extent | 3 (Local area) | 1 (Site only) |
| Duration | 5 (Permanent) | 2 (Short duration) |
| Magnitude | 10 (Very high) | 4 (Low) |
| Probability | 2 (Improbable) | 1 (Very improbable) |
| Significance | 36 (Medium) | 7 (Low) |
| Status (positive or negative) | Negative | Negative |
| Reversibility | Low | Low |
| Irreplaceable loss of resources? | Moderate | Moderate |
| Can impacts be mitigated? | High | |
| **Nature of Impact: Direct impacts on common fauna species** | | |
| | **Without mitigation** | **With mitigation** |
| Extent | 1 (Site only) | 1 (Site only) |
| Duration | 5 (Permanent) | 2 (Short duration) |
| Magnitude | 6 (Moderate) | 2 (Minor) |
| Probability | 4 (Highly probable) | 2 (Improbable) |
| Significance | 48 (Medium) | 10 (Low) |
| Status (positive or negative) | Negative | Negative |
| Reversibility | Low | Low |
| Irreplaceable loss of resources? | Moderate | Moderate |
| Can impacts be mitigated? | High | |

| Nature of Impact: Floristic species changes subsequent to development | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| Extent | 2 (Site & Surrounds) | 1 (Site only) |
| Duration | 4 (Long term) | 2 (Short duration) |
| Magnitude | 6 (Moderate) | 4 (Low) |
| Probability | 4 (Highly probable) | 2 (Improbable) |
| Significance | 48 (High) | 14 (Low) |
| Status (positive or negative) | Low | Low |
| Reversibility | High | High |
| Irreplaceable loss of resources? | Low | Low |
| Can impacts be mitigated? | High | |

| Nature of Impact: Faunal interactions with structures, personnel, etc. | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| Extent | 1 (Site only) | 1 (Site only) |
| Duration | 4 (Long term) | 4 (Long term) |
| Magnitude | 4 (Low) | 2 (Minor) |
| Probability | 3 (Probable) | 2 (Improbable) |
| Significance | 27 (Low) | 14 (Low) |
| Status (positive or negative) | Negative | Negative |
| Reversibility | Moderate | Moderate |
| Irreplaceable loss of resources? | Low | Low |
| Can impacts be mitigated? | Moderate | |

| Nature of Impact: Impacts on SA conservation obligations | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| Extent | 1 (Site only) | 1 (Site only) |
| Duration | 5 (Permanent) | 2 (Short duration) |
| Magnitude | 4 (Low) | 2 (Minor) |
| Probability | 3 (Probable) | 2 (Improbable) |
| Significance | 30 (Low) | 10 (Low) |
| Status (positive or negative) | Negative | Negative |
| Reversibility | Low | Low |
| Irreplaceable loss of resources? | Yes | Yes |
| Can impacts be mitigated? | High | |

### 11.4.2 Impacts within the Grassland Seepage Habitat Type

| Table 12: Impacts within the Grassland Seepage Habitat Type | | |
|---|---|---|
| **Nature of Impact: Direct impacts on Threatened & Protected Flora** | | |
| | **Without mitigation** | **With mitigation** |
| Extent | 2 (Site & Surrounds) | 1 (Site only) |
| Duration | 5 (Permanent) | 1 (Very short term) |
| Magnitude | 4 (Low) | 2 (Minor) |
| Probability | 2 (Improbable) | 1 (Very improbable) |
| Significance | 22 (Low) | 4 (Low) |
| Status (positive or negative) | Negative | Negative |
| Reversibility | Low | Low |
| Irreplaceable loss of resources? | Moderate | Low |
| Can impacts be mitigated? | Moderate | |
| **Nature of Impact: Destruction of sensitive/ pristine habitat** | | |
| | **Without mitigation** | **With mitigation** |
| Extent | 1 (Site only) | 1 (Site only) |
| Duration | 5 (Permanent) | 4 (Long term) |
| Magnitude | 8 (High) | 4 (Low) |
| Probability | 4 (Highly probable) | 2 (Improbable) |
| Significance | 56 (Medium) | 18 (Low) |
| Status (positive or negative) | Negative | Negative |
| Reversibility | Low | Low |
| Irreplaceable loss of resources? | Yes | Yes |
| Can impacts be mitigated? | Moderate | |
| **Nature of Impact: Direct impacts on Threatened fauna species** | | |
| | **Without mitigation** | **With mitigation** |
| Extent | 2 (Site & Surrounds) | 1 (Site only) |
| Duration | 5 (Permanent) | 2 (Short duration) |
| Magnitude | 10 (Very high) | 4 (Low) |
| Probability | 2 (Improbable) | 1 (Very improbable) |
| Significance | 34 (Medium) | 7 (Low) |
| Status (positive or negative) | Negative | Negative |
| Reversibility | Low | Low |
| Irreplaceable loss of resources? | Yes | Yes |
| Can impacts be mitigated? | Moderate | |
| **Nature of Impact: Direct impacts on common fauna species** | | |
| | **Without mitigation** | **With mitigation** |
| Extent | 1 (Site only) | 1 (Site only) |
| Duration | 5 (Permanent) | 2 (Short duration) |
| Magnitude | 6 (Moderate) | 2 (Minor) |
| Probability | 4 (Highly probable) | 2 (Improbable) |
| Significance | 48 (Medium) | 10 (Low) |
| Status (positive or negative) | Negative | Negative |
| Reversibility | Low | Low |
| Irreplaceable loss of resources? | Yes | Yes |
| Can impacts be mitigated? | Moderate | |

| Nature of Impact: Floristic species changes subsequent to development | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| Extent | 2 (Site & Surrounds) | 1 (Site only) |
| Duration | 4 (Long term) | 2 (Short duration) |
| Magnitude | 6 (Moderate) | 4 (Low) |
| Probability | 3 (Probable) | 2 (Improbable) |
| Significance | 36 (Medium) | 14 (Low) |
| Status (positive or negative) | Negative | Negative |
| Reversibility | Low | Low |
| Irreplaceable loss of resources? | High | High |
| Can impacts be mitigated? | Moderate | |

| Nature of Impact: Faunal interactions with structures, personnel, etc. | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| Extent | 1 (Site only) | 1 (Site only) |
| Duration | 4 (Long term) | 4 (Long term) |
| Magnitude | 4 (Low) | 2 (Minor) |
| Probability | 3 (Probable) | 2 (Improbable) |
| Significance | 27 (Low) | 14 (Low) |
| Status (positive or negative) | Negative | Negative |
| Reversibility | Moderate | Moderate |
| Irreplaceable loss of resources? | Low | Low |
| Can impacts be mitigated? | Moderate | |

| Nature of Impact: Impacts on SA conservation obligations | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| Extent | 1 (Site only) | 1 (Site only) |
| Duration | 5 (Permanent) | 2 (Short duration) |
| Magnitude | 4 (Low) | 2 (Minor) |
| Probability | 3 (Probable) | 2 (Improbable) |
| Significance | 30 (Low) | 10 (Low) |
| Status (positive or negative) | Negative | Negative |
| Reversibility | Low | Moderate |
| Irreplaceable loss of resources? | Yes | Yes |
| Can impacts be mitigated? | Moderate | |

### 11.4.3 Impacts within the Natural Woodland Habitat Type

| Table 13: Impacts within the Natural Woodland / Savanna Habitat Type | | |
|---|---|---|
| **Nature of Impact: Direct impacts on Threatened & Protected Flora** | | |
| | **Without mitigation** | **With mitigation** |
| Extent | 2 (Site & Surrounds) | 1 (Site only) |
| Duration | 5 (Permanent) | 1 (Very short term) |
| Magnitude | 4 (Low) | 2 (Minor) |
| Probability | 2 (Improbable) | 1 (Very improbable) |
| Significance | 22 (Low) | 4 (Low) |
| Status (positive or negative) | Negative | Negative |
| Reversibility | Low | Low |
| Irreplaceable loss of resources? | Moderate | Low |
| Can impacts be mitigated? | High | |
| **Nature of Impact: Destruction of sensitive / pristine habitat** | | |
| | **Without mitigation** | **With mitigation** |
| Extent | 1 (Site only) | 1 (Site only) |
| Duration | 5 (Permanent) | 5 (Permanent) |
| Magnitude | 6 (Moderate) | 4 (Low) |
| Probability | 2 (Improbable) | 1 (Very improbable) |
| Significance | 24 (Low) | 10 (Low) |
| Status (positive or negative) | Negative | Negative |
| Reversibility | Low | Low |
| Irreplaceable loss of resources? | Low | Low |
| Can impacts be mitigated? | Moderate | |
| **Nature of Impact: Direct impacts on Threatened fauna species** | | |
| | **Without mitigation** | **With mitigation** |
| Extent | 3 (Local area) | 2 (Site & Surrounds) |
| Duration | 5 (Permanent) | 4 (Long term) |
| Magnitude | 10 (Very high) | 10 (Very high) |
| Probability | 2 (Improbable) | 2 (Improbable) |
| Significance | 36 (Medium) | 32 (Medium) |
| Status (positive or negative) | Negative | Negative |
| Reversibility | High | High |
| Irreplaceable loss of resources? | Low | Low |
| Can impacts be mitigated? | High | |
| **Nature of Impact: Direct impacts on common fauna species** | | |
| | **Without mitigation** | **With mitigation** |
| Extent | 1 (Site only) | 1 (Site only) |
| Duration | 4 (Long term) | 3 (Medium term) |
| Magnitude | 4 (Low) | 2 (Minor) |
| Probability | 2 (Improbable) | 1 (Very improbable) |
| Significance | 18 (Low) | 6 (Low) |
| Status (positive or negative) | Negative | Negative |
| Reversibility | High | High |
| Irreplaceable loss of resources? | Low | Low |
| Can impacts be mitigated? | High | |

| Nature of Impact: Floristic species changes subsequent to development | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| Extent | 1 (Site only) | 1 (Site only) |
| Duration | 4 (Long term) | 4 (Long term) |
| Magnitude | 4 (Low) | 2 (Minor) |
| Probability | 3 (Probable) | 2 (Improbable) |
| Significance | 27 (Low) | 14 (Low) |
| Status (positive or negative) | Negative | Negative |
| Reversibility | High | High |
| Irreplaceable loss of resources? | Low | Low |
| Can impacts be mitigated? | High | |

| Nature of Impact: Faunal interactions with structures, personnel, etc. | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| Extent | 1 (Site only) | 1 (Site only) |
| Duration | 4 (Long term) | 4 (Long term) |
| Magnitude | 4 (Low) | 2 (Minor) |
| Probability | 3 (Probable) | 2 (Improbable) |
| Significance | 27 (Low) | 14 (Low) |
| Status (positive or negative) | Negative | Negative |
| Reversibility | High | High |
| Irreplaceable loss of resources? | Low | Low |
| Can impacts be mitigated? | High | |

| Nature of Impact: Impacts on SA conservation obligations | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| Extent | 1 (Site only) | 1 (Site only) |
| Duration | 5 (Permanent) | 4 (Long term) |
| Magnitude | 4 (Low) | 2 (Minor) |
| Probability | 2 (Improbable) | 1 (Very improbable) |
| Significance | 20 (Low) | 7 (Low) |
| Status (positive or negative) | Negative | Negative |
| Reversibility | High | High |
| Irreplaceable loss of resources? | Low | Low |
| Can impacts be mitigated? | High | |

## 11.5 Discussion

Results of the impact assessment indicate impacts of a high or medium significance within areas of wetland related habitat types, mainly because of the effect that impacts high up in a catchment area will have on downstream areas. Impacts of medium and lower significance are estimated for the terrestrial habitat types. When considering cumulative impacts, it has to be accepted that the study area is small, as well as situated within a highly transformed and degraded region that resulted from agriculture and mining. The contribution that this development will have to habitat transformation, -fragmentation and –isolation on a regional scale is regarded small. On a local scale, however, the effect might be of a moderate significance.

Ultimately, the conservation potential of these areas is regarded low since rehabilitation of degraded areas and reclamation of transformed habitat will be extremely costly while the actual contribution to provincial and regional conservation objectives will be low. The loss of the terrestrial habitat types, taking cognisance of the presence of extensive mining and agricultural areas in the immediate surrounds, as well as the planned development on the adjacent property, is not expected to result in significant impacts on the biological environment. The implementation of generic mitigation measures is regarded sufficient to prevent impacts resulting from construction and operational activities from spreading beyond the site, or into more important habitat.

The exclusion of wetland related areas from the proposed development is recommended. These areas, although only moderately pristine at best, do play a role in the ecology of the region. Since the aim of this assessment did not include the accurate delineation of wetlands, it is recommended that a wetland specialist be consulted in order to determine the boundaries of wetland related habitat types on the site, also applying relevant buffer zones to the development. The implementation of generic mitigation measures, which should mostly be aimed at avoiding any impact within these parts, is regarded sufficient to protect this habitat type and biodiversity attributes associated with the area.

Remaining areas were estimated to exhibit attributes of low and medium-low ecological sensitivity; impacts of development within these areas are not expected to affect biodiversity attributes on a local or regional scale. The implementation of generic mitigation measures are nonetheless recommended to ensure environmentally responsible development.

## 12 RECOMMENDED MITIGATION MEASURES

| Table 14: Aims & objectives of mitigation measures in areas of medium-high sensitivity | |
|---|---|
| **Objectives** | Implement site specific mitigation measures in specific areas of the proposed development area |
| **Project components** | Photo voltaic plant – construction & operational phases |
| **Potential impact** | Irreversible habitat alteration of areas of medium-high ecological sensitivity, impacting on species of conservation importance, unique habitat |
| **Activity/ risk source** | Construction activities, access roads, maintenance activities |
| **Mitigation: Target/ Objective** | Preventing irreversible impacts within areas of medium-high ecological sensitivity. |

| Table 15: Mitigation measures to curb impacts in areas of medium-high sensitivity | | |
|---|---|---|
| **Mitigation: Action/ control** | **Responsibility** | **Timeframe** |
| Exclude areas of wetland related habitat from the proposed development | Contractor, Environmental Consultant | Planning phase |
| Appoint Environmental Control Officer (ECO) | Contractor | Planning phase |
| Establish the Terms of Reference for the ECO prior to the onset of the construction phase | Contractor | Planning phase |
| Compile and implement a monitoring programme for a minimum of three years subsequent to decomissioing during which all objectives of rehabililtiation will be assessed and addressed | ECO, Ecologist, Contractor | Planning phase |
| Demarcate all areas where no impacts will be allowed, clearly marking these areas with high visibility signs, inform all contractors and construction workers to refrain from entering/ impacting these areas | ECO | Construction, Operational phases |
| Construction of new/ temporary bridges across non-perennial streams and larger rivers is regarded a prohibited activity, use should be made of existing crossings, ensuring proper maintenance/ upgrade | ECO, Contractor, Contractor | Planning, Construction, Operational phases |
| Prevent impacts on any surface water as a result of hazardous materials, contamination, unnecessary crossing by vehicles or personnel, extraction, drinking or other human uses, construction and maintenance activities | ECO, Contractor, Contractor | Construction, Operational phases |
| Implement a weed monitoring and control programme | ECO, Contractor | |
| All declared aliens must be identified and managed in accordance with the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (see Appendix 3), the implementation of a monitoring programme in this regard is recommended | ECO, Contractor | Construction, Operational phases |

| Table 16: Performance indicators within medium-high sensitivity areas | |
|---|---|
| **Performance Indicator** | The continued presence of wetland related habitat within the development area and the absence of surface impacts within these parts. The current biodiversity status will be used as a benchmark for future reference |
| **Monitoring** | Implement a monitoring programme of which the aims and objectives should be to monitor:<br>• General compliance to the approved EMP;<br>• Status of invasive species on site;<br>• Status of impacts within sensitive areas;<br>• Seasonal biodiversity (species richness) surveys; |

| Table 17: Aims & objectives of mitigation measures in general areas | |
|---|---|
| **Objectives** | Implement site generic mitigation measures in the development areas |
| **Project components** | Photo voltaic plant – construction & operational phases |
| **Potential impact** | Spread of impacts resulting from development and operational activities to surrounding areas of sensitivity |
| **Activity / risk source** | Construction activities, access roads, maintenance activities |
| **Mitigation: Target / Objective** | Implement generic mitigation measures in order to prevent the spread of impacts from the development area into adjacent areas of sensitivity |

| Table 18: Generic mitigation measures in general areas | | |
|---|---|---|
| **Mitigation: Action / control** | **Responsibility** | **Timeframe** |
| Submit an application to remove protected tree species, if necessary, as per National Forest Act, 1998 (No 84 of 1998) prior to commencement of construction activities | Contractor, ECO | Prior to construction |
| Ensure compliance to EMP | ECO, Contractor | Construction, operational phases |
| Demarcate development areas by means of semi-permanent demarcation methods | ECO | Construction phase |
| Ensure that all construction and development activities are contained within the development area, preventing any impact within areas of sensitivity | ECO, Contractor | Construction, operational phases |
| The removal or picking of any protected or unprotected plants shall not be permitted and no horticultural specimens (even within the demarcated working area) shall be removed, damaged or tampered with unless agreed to by the ECO | ECO, Contractor | Construction, operational phases |
| No painting or marking of rocks or vegetation to identify locality or other information shall be allowed, as it will disfigure the natural setting. Marking shall be done by steel stakes with tags, if required | ECO, Contractor | Construction, operational phases |
| Make use of existing access roads, ensuring proper upgrade/ construction/ maintenance in order to limit erosion, proliferation of weeds | Contractor | Construction, operational phases |
| Use of branches of trees and shrubs for fire making purposes is strictly prohibited | ECO, Contractor | Construction, operational phases |
| Prevent open fires, provide demarcated fire-safe zones, facilities and fire control measures | ECO, Contractor | Construction, operational phases |
| Fire fighting equipment shall be made available on all vehicles and at various suitable points within the development site | ECO, Contractor | Construction, operational phases |
| No animal may be hunted, trapped or killed for any purpose whatsoever | ECO, Contractor | Construction, operational phases |
| In the event that animals are present that may pose a risk to human safety, a suitable animal handler must be requested to removed the animal in an environmentally responsible manner. This specifically refers to snakes and scorpions | ECO, Contractor | Construction, operational phases |
| Identify areas where surface disturbances will occur and remove topsoil to a depth of approximately 0.75m | Contractor | Construction phase |
| Limit construction, maintenance and inspection activities to dry periods in order to curb occurrence/ augmentation of erosion in areas of existing erosion, destabilizing of substrate in areas of high slopes, riparian zones, etc | Contractor | Construction phase |
| Prevent open fires, provide demarcated fire-safe zones, facilities and fire control measures | Contractor | Construction phase |
| Develop emergency maintenance operational plan to deal with any event of contamination, pollution or spillages, particularly in riparian areas | Contractor | Construction phase |
| Provide temporary on-site sanitation, litter and waste management | Contractor | Construction phase |

| | | |
|---|---|---|
| and hazardous materials management facilities | | |
| Compile and implement a rehabilitation programme | Ecologist, ECO | Construction phase |
| Use only local indigenous species in the rehabilitation/ revegetation process | ECO, contractor | Rehabilitation phase |
| Implement an alien plant monitoring and control programme | ECO, contractor | Construction, operational phases |
| Ensure immediate surface restoration and resloping in order to prevent erosion, taking cognisance of local contours and landscaping | ECO, contractor | Construction phase |
| Implement a monitoring programme for a minimum of three years during which all objectives of closure will be assessed and addressed | ECO, contractor | Construction phase |

| **Table 19: Performance indicators within general development area** | |
|---|---|
| **Performance Indicator** | Preventing the spread of impacts from development areas into adjacent areas of sensitivity. The current biodiversity status will be used as an benchmark for future reference |
| **Monitoring** | Implement a monitoring programme of which the aims and objectives should be to monitor:<br>• General compliance to the approved EMP;<br>• Status of invasive species on site;<br>• Status of impacts within sensitive areas;<br>• Seasonal biodiversity (species richness) surveys; |

## 13 PHOTOGRAPHIC RECORDS

Photo 1: Example of the Agricultural fields habitat type.

Photo 2: Example of the Natural Woodland/ Savanna habitat type.

Photo 3: Example of the Reverted Grassland habitat type.

Photo 4: Example of the Drainage Line/ Eroded Woodland habitat type


Photo 5: Transvaal Thick-toed Gecko (*Pachydactylus affinis*)


Photo 6: Tracts of Honey Badger (*Mellivora capensis*)

Photo 67: Example of Gassland seepage habitat type (on adjacent property)

# 14 APPENDIX 1: FLORISTIC DIVERSITY DETAIL

**Table 20: Flora species of the study area**

| Species Name | Growth Form | Family | Status/ Uses |
|---|---|---|---|
| *Acacia caffra* | Tree | Fabaceae | Dyes & tans |
| *Acacia karroo* | Tree | Fabaceae | Edible parts, dyes and tans, medicinal uses, firewood |
| *Acacia nilotica* | Tree | Fabaceae | Dyes and tans |
| *Acacia robusta* | Tree | Fabaceae | None |
| *Acacia tortilis* | Tree | Fabaceae | None |
| *Achyranthes aspera* | Forb | Amaranthaceae | Declared Invader - Category 1 |
| *Aloe greatheadii* | Succulent | Liliaceae | None |
| *Aristida bipartita* | Grass | Poaceae | Unpalatable, indicator of degraded veld |
| *Aristida canescens* | Grass | Poaceae | Unpalatable, Increaser II |
| *Aristida congesta* subsp. *barbicollis* | Grass | Poaceae | None |
| *Asparagus* species | Shrub | Liliaceae | None |
| *Berchemia zeyheri* | Tree | Rhamnaceae | Edible parts, timber |
| *Bothriochloa insculpta* | Grass | Poaceae | None |
| *Brachiaria eruciformis* | Grass | Poaceae | Indicator of clayey soils, pioneer species, unpalatable |
| *Brachiaria serrata* | Grass | Poaceae | None |
| *Carissa bispinosa* | Shrub | Apocynaceae | Edible parts, medicinal uses |
| *Cereus jamacuru* | Succulent | Cactaceae | Declared Invader - Category 1 |
| *Chloris virgata* | Grass | Poaceae | None |
| *Combretum molle* | Tree | Combretaceae | Medicinal properties, traditional uses |
| *Combretum zeyheri* | Tree | Combretaceae | None |
| *Commelina africana* | Forb | Commelinaceae | Medicinal properties |
| *Conyza bonariensis* | Forb | Asteraceae | Weed, indicator of disturbed areas |
| *Crabbea angustifolia* | Forb | Acanthaceae | None |
| *Crinum* species | Geophyte | Amaryllidaceae | None |
| *Cucumis zeyheri* | Forb | Cucurbitaceae | Edible parts |
| *Cymbopogon plurinodis* | Grass | Poaceae | Unpalatable grazing |
| *Cynodon dactylon* | Grass | Poaceae | Indicator of disturbed areas, grazing potential |
| *Dichanthium annulatum* | Grass | Poaceae | Moderately palatable graze species |
| *Dichrostachys cinerea* | Shrub | Mimosaceae | Invader, medicinal properties, traditional uses, firewood, weaving |
| *Digitaria eriantha* | Grass | Poaceae | Weaving, palatable |
| *Dodonaea angustifolia* | Shrub | Sapindaceae | Medicinal properties |
| *Dombeya rotundifolia* | Tree | Sterculiaceae | None |
| *Duvalia politia* | Succulent | Apocynaceae | Alternative source of water |
| *Ehretia rigida* | Shrub | Ehretiaceae | None |
| *Elionurus muticus* | Grass | Poaceae | None, unpalatable |
| *Eragrostis chloromelas* | Grass | Poaceae | Edible parts |
| *Eragrostis curvula* | Grass | Poaceae | Edible parts, indicator of degraded areas |
| *Eragrostis gummiflua* | Grass | Poaceae | Unpalatable, low grazing potential |
| *Eragrostis lehmanniana* | Grass | Poaceae | Weaving |
| *Eragrostis racemosa* | Grass | Poaceae | Palatable grazing |
| *Eragrostis rigidior* | Grass | Poaceae | None |

| Table 20: Flora species of the study area | | | |
|---|---|---|---|
| **Species Name** | **Growth Form** | **Family** | **Status/ Uses** |
| *Euclea crispa* | Shrub | Ebenaceae | Medicinal uses |
| *Euphorbia ingens* | Succulent | Euphorbiaceae | None |
| *Gladiolus* species | Geophyte | Iridaceae | None |
| *Gomphocarpus fruticosus* | Shrub | Asclepiadaceae | Medicinal uses |
| *Gomphrena celosioides* | Forb | Amaranthaceae | Weed |
| *Grewia flava* | Shrub | Tiliaceae | Edible parts, weaving |
| *Gymnosporia buxifolia* | Tree | Celastraceae | None |
| *Hermannia depressa* | Forb | Sterculiaceae | Medicinal uses |
| *Heteropogon contortus* | Grass | Poaceae | None |
| *Hyparrhenia hirta* | Grass | Poaceae | Thatching & weaving |
| *Hyperthelia dissoluta* | Grass | Poaceae | Thatching |
| *Jacaranda mimosifolia* | Tree | Bignoniaceae | Declared Invader - Category 3 |
| *Lantana rugosa* | Shrub | Verbenaceae | None |
| *Ledebouria* species | Geophyte | Liliaceae | None |
| *Melinis nerviglumis* | Grass | Poaceae | Increaser I |
| *Monsonia angustifolia* | Forb | Geraniaceae | None |
| *Opuntia ficus-indica* | Succulent | Cactaceae | Declared Invader - Category 1 |
| *Panicum maximum* | Grass | Poaceae | None |
| *Pappea capensis* | Tree | Sapindaceae | Edible parts |
| *Pellaea calomelanos* | Fern | Adianthaceae | Medicinal properties |
| *Pennisetum setaceum* | Grass | Poaceae | Declared Invader - Category 1 |
| *Pogonarthria squarrosa* | Grass | Poaceae | Unpalatable, indicator of poor habitat conditions |
| *Pseudognaphalium luteo-album* | Forb | Asteraceae | Weed (Europe) |
| *Raphionachme hirsuta* | Forb | Peripoplacaceae | Edible parts |
| *Rhoicissus tridentata* | Climber | Vitaceae | Medicinal properties |
| *Rhynchosia* species | Forb | Fabaceae | None |
| *Rorippa nudiuscula* | Forb | Brassicaceae | None |
| *Sarcostemma viminale* | Climber | Asclepiadaceae | Medicinal uses |
| *Schkuhria pinnata* | Forb | Asteraceae | Medicinal uses, weed (S. America) |
| *Sclerocarya birrea* | Tree | Anacardiaceae | Protected Tree (National Forest Act, 1998), edible parts, traditional uses |
| *Searsia lancea* | Tree | Anacardiaceae | Edible parts, tanning |
| *Searsia leptodictya* | Tree | Anacardiaceae | None |
| *Searsia pyroides* | Tree | Anacardiaceae | None |
| *Setaria nigrirostris* | Grass | Poaceae | Indicator of moist conditions, clayey soils, palatable |
| *Solanum panduriforme* | Forb | Solanaceae | Weed |
| *Sorghum bicolor* | Grass | Poaceae | Palatable graze species |
| *Sporobolus africanus* | Grass | Poaceae | Palatable, indicator of degraded areas |
| *Tagetes minuta* | Forb | Asteraceae | Essential oils, colours & dyes |
| *Themeda triandra* | Grass | Poaceae | Palatable grazing |
| *Tithonia rotundifolia* | Forb | Asteraceae | Declared Invader - Category 1 |
| *Vangueria infausta* | Tree | Rubiaceae | Edible parts |
| *Verbena bonariensis* | Forb | Verbenaceae | Weed (S. America) |
| *Verbena tenuisecta* | Forb | Verbenaceae | Weed (S. America) |
| *Vernonia oligocephala* | Forb | Asteraceae | Medicinal uses |
| *Vernonia* species | Forb | Asteraceae | None |

| Table 20: Flora species of the study area | | | |
|---|---|---|---|
| **Species Name** | **Growth Form** | **Family** | **Status/ Uses** |
| *Vitex zeyheri* | Shrub | Verbenaceae | None |
| *Waltheria indica* | Forb | Sterculiaceae | None |
| *Xerophyta retinervis* | Geophyte | Velloziaceae | None |
| *Ximenia americana* | Tree | Olacaceae | Medicinal uses |
| *Ziziphus mucronata* | Tree | Rhamnaceae | Edible parts, medicinal uses |

| Table 21: Growth forms for the study area | | |
|---|---|---|
| **Growth Form** | **Count** | **Percentage** |
| Climber | 2 | 2.2% |
| Fern | 1 | 1.1% |
| Forb | 21 | 23.1% |
| Geophyte | 4 | 4.4% |
| Grass | 29 | 31.9% |
| Shrub | 9 | 9.9% |
| Succulent | 5 | 5.5% |
| Tree | 20 | 22.0% |
| **Total** | **91** | |

| Table 22: Plant families of the study area | | |
|---|---|---|
| **Family** | **Count** | **Percentage** |
| Acanthaceae | 1 | 1.1% |
| Adianthaceae | 1 | 1.1% |
| Alternative water source | 1 | 1.1% |
| Amaranthaceae | 2 | 2.2% |
| Amaryllidaceae | 1 | 1.1% |
| Anacardiaceae | 4 | 4.4% |
| Apocynaceae | 1 | 1.1% |
| Asclepiadaceae | 2 | 2.2% |
| Asteraceae | 7 | 7.7% |
| Bignoniaceae | 1 | 1.1% |
| Brassicaceae | 1 | 1.1% |
| Cactaceae | 2 | 2.2% |
| Celastraceae | 1 | 1.1% |
| Combretaceae | 2 | 2.2% |
| Commelinaceae | 1 | 1.1% |
| Cucurbitaceae | 1 | 1.1% |
| Ebenaceae | 1 | 1.1% |
| Ehretiaceae | 1 | 1.1% |
| Euphorbiaceae | 1 | 1.1% |
| Fabaceae | 6 | 6.6% |
| Geraniaceae | 1 | 1.1% |
| Iridaceae | 1 | 1.1% |
| Liliaceae | 3 | 3.3% |
| Mimosaceae | 1 | 1.1% |

| Table 22: Plant families of the study area | | |
|---|---|---|
| **Family** | **Count** | **Percentage** |
| Olacaceae | 1 | 1.1% |
| Peripoplacaceae | 1 | 1.1% |
| Poaceae | 29 | 31.9% |
| Rhamnaceae | 2 | 2.2% |
| Rubiaceae | 1 | 1.1% |
| Rutaceae | 1 | 1.1% |
| Sapindaceae | 2 | 2.2% |
| Solanaceae | 1 | 1.1% |
| Sterculiaceae | 3 | 3.3% |
| Tiliaceae | 1 | 1.1% |
| Velloziaceae | 1 | 1.1% |
| Verbenaceae | 3 | 3.3% |
| Vitaceae | 1 | 1.1% |

## 15 APPENDIX 2: FAUNA DIVERSITY DETAIL

| Table 23: Observed aminal species in the study area | | | | |
|---|---|---|---|---|
| **Class** | **Order** | **Family** | **Genus-Species** | **English name** |
| Insecta | Lepidoptera | Nymphalidae | Danaus chryssipus | African Monarch |
| | | Pieridae | Eurema brigitta | Broad-bordered Grass Yellow |
| Reptilia | Squamata | Gekkonidae | Pachydactylus affinis | Transvaal Thick-toed Gecko |
| Aves | Falconiformes | Accipitridae | Circaetus cinereus | Brown Snake-Eagle |
| | Galliformes | Numididae | Numida meleagris | Helmeted Guineafowl |
| | Columbiformes | Columbidae | Columba guinea | Speckled Pigeon |
| | | | Streptopelia semitorquata | Red-eyed Dove |
| | | | Streptopelia capicola | Cape Turtle-Dove |
| | | | Streptopelia senegalensis | Laughing Dove |
| | Strigiformes | Strigidae | Asio capensis | Marsh Owl |
| | Coliiformes | Coliidae | Urocolius indicus | Red-faced Mousebird |
| | Passeriformes | Hirundinidae | Hirundo rustica | Barn Swallow |
| | | Corvidae | Corvus albus | Pied Crow |
| | | Pycnonotidae | Pycnonotus tricolor | Dark-capped Bulbul |
| | | Cisticolidae | Cisticola aridulus | Desert Cisticola |
| | | Laniidae | Lanius collaris | Common Fiscal |
| | | Nectariniidae | Cinnyris talatala | White-bellied Sunbird |
| | | Estrildidae | Uraeginthus angolensis | Blue Waxbill |
| | | Fringillidae | Emberiza flaviventris | Golden-breasted Bunting |
| Mammalia | Lagomorpha | Leporidae | Lepus saxatilis | Scrub Hare |
| | Carnivora | Canidae | Canis mesomelas | Black-backed Jackal |
| | | Viverridae | Galerella sanguinea | Slender Mongoose |
| | | Mustelidae | Mellivora capensis | Honey Badger |
| | Artiodactyla | Bovidae | Raphicerus campestris | Steenbok |

| Table 24: Red Data Assessment for the study area, based on regional occurrences | | | |
|---|---|---|---|
| **Biological Name** | **English Name** | **Status** | **Probability** |
| **Butterflies** | | | |
| *Metisella meninx* | Marsh Sylph | Vulnerable | moderate-low |
| *Platylesches dolomitica* | Hilltop Hopper | Vulnerable | low |
| *Aloeides dentatis* | Roodepoort Copper | Vulnerable | low |
| *Chrysoritis aureus* | Golden Opal | Near Threatened | low |
| *Lepidochrysops praeterita* | Highveld Blue | Vulnerable | low |
| *Orachrysops mijburghi* | Mijburgh's Blue | Vulnerable | low |
| **Amphibians** | | | |
| *Pyxicephalus adspersus* | Giant Bullfrog | Near Threatened | moderate |
| REPTILES | | | |
| *Cordylus giganteus* | Giant Girdled Lizard | Vulnerable | low |
| **Birds** | | | |
| *Pelecanus onocrotalus* | Great White Pelican | Near Threatened | low |
| *Pelecanus rufescens* | Pink-backed Pelican | Vulnerable | low |
| *Gorsachius leuconotus* | White-backed Night-Heron | Vulnerable | low |
| *Botaurus stellaris* | Eurasian Bittern | Critically Rare | low |
| *Ciconia nigra* | Black Stork | Near Threatened | low |
| *Leptoptilos crumeniferus* | Marabou Stork | Near Threatened | low |
| *Mycteria ibis* | Yellow-billed Stork | Near Threatened | low |
| *Phoenicopterus ruber* | Greater Flamingo | Near Threatened | low |
| *Phoenicopterus minor* | Lesser Flamingo | Near Threatened | low |
| *Sagittarius serpentarius* | Secretarybird | Near Threatened | moderate-low |

| Table 24: Red Data Assessment for the study area, based on regional occurrences | | | |
|---|---|---|---|
| **Biological Name** | **English Name** | **Status** | **Probability** |
| *Gyps coprotheres* | Cape Vulture | Vulnerable | moderate |
| *Gyps africanus* | White-backed Vulture | Vulnerable | moderate-low |
| *Torgos tracheliotus* | Lappet-faced Vulture | Vulnerable | moderate-low |
| *Hieraaetus ayresii* | Ayres's Hawk-Eagle | Near Threatened | low |
| *Polemaetus bellicosus* | Martial Eagle | Vulnerable | moderate-low |
| *Circus ranivorus* | African Marsh-Harrier | Vulnerable | low |
| *Circus macrourus* | Pallid Harrier | Near Threatened | moderate |
| *Circus maurus* | Black Harrier | Vulnerable | low |
| *Falco peregrinus* | Peregrine Falcon | Near Threatened | moderate-low |
| *Falco biarmicus* | Lanner Falcon | Near Threatened | low |
| *Falco naumanni* | Lesser Kestrel | Vulnerable | moderate |
| *Anthropoides paradisea* | Blue Crane | Vulnerable | low |
| *Crex crex* | Corn Crake | Vulnerable | moderate |
| *Podica senegalensis* | African Finfoot | Vulnerable | low |
| *Eupodotis barrowii* | Barrow's Korhaan | Vulnerable | low |
| *Rostratula benghalensis* | Greater Painted-snipe | Near Threatened | low |
| *Charadrius pallidus* | Chestnut-banded Plover | Near Threatened | low |
| *Glareola nordmanni* | Black-winged Pratincole | Near Threatened | low |
| *Rynchops flavirostris* | African Skimmer | Near Threatened | low |
| *Pterocles gutturalis* | Yellow-throated Sandgrouse | Near Threatened | low |
| *Tyto capensis* | African Grass-Owl | Vulnerable | low |
| *Alcedo semitorquata* | Half-collared Kingfisher | Near Threatened | low |
| *Mirafra cheniana* | Melodious Lark | Near Threatened | moderate-low |
| *Buphagus erythrorhynchus* | Red-billed Oxpecker | Near Threatened | low |
| **Mammals** | | | |
| *Acinonyx jubatus* | Cheetah | Vulnerable | low |
| *Atelerix frontalis* | South African Hedgehog | Near Threatened | moderate |
| *Cloeotis percivali* | Short-eared Trident Bat | Critically Rare | moderate-low |
| *Crocidura cyanea* | Reddish-grey Musk Shrew | Data Deficient | moderate |
| *Crocidura fuscomurina* | Tiny Musk Shrew | Data Deficient | moderate-low |
| *Crocidura hirta* | Lesser Red Musk Shrew | Data Deficient | moderate |
| *Crocidura maquassiensis* | Maquassie Musk Shrew | Vulnerable | low |
| *Crocidura mariquensis* | Swamp Musk Shrew | Data Deficient | moderate-low |
| *Crocidura silacea* | Lesser Grey-brown Musk Shrew | Data Deficient | moderate |
| *Crocuta crocuta* | Spotted Hyaena | Near Threatened | low |
| *Damaliscus lunatus lunatus* | Tsessebe | Endangered | low |
| *Diceros bicornis bicornis* | Black Rhinoceros - arid ecotype | Critically Rare | low |
| *Diceros bicornis minor* | Black Rhinoceros | Vulnerable | low |
| *Elephantulus brachyrhynchus* | Short-snouted Elephant-shrew | Data Deficient | low |
| *Elephantulus intufi* | Bushveld Elephant-shrew | Data Deficient | low |
| *Graphiurus platyops* | Rock Dormouse | Data Deficient | low |
| *Hipposideros caffer* | Sundevall's Leaf-nosed Bat | Data Deficient | moderate |
| *Hippotragus equinus* | Roan Antelope | Vulnerable | low |
| *Hippotragus niger niger* | Sable Antelope | Vulnerable | low |
| *Hyaena brunnea* | Brown Hyaena | Near Threatened | moderate |
| *Lemniscomys rosalia* | Single-striped Mouse | Data Deficient | moderate |
| *Leptailurus serval* | Serval | Near Threatened | moderate |
| *Lutra maculicollis* | Spotted-necked Otter | Near Threatened | low |
| *Lycaon pictus* | African Wild Dog | Endangered | low |
| *Manis temminckii* | Pangolin | Vulnerable | low |
| *Mellivora capensis* | Honey Badger | Near Threatened | confirmed |
| *Miniopterus schreibersii* | Schreiber's Long-fingered Bat | Near Threatened | moderate |
| *Myosorex varius* | Forest Shrew | Data Deficient | moderate-low |
| *Mystromys albicaudatus* | White-tailed Rat | Endangered | low |
| *Ourebia ourebi* | Oribi | Endangered | low |

| Table 24: Red Data Assessment for the study area, based on regional occurrences | | | |
|---|---|---|---|
| **Biological Name** | **English Name** | **Status** | **Probability** |
| *Panthera leo* | Lion | Vulnerable | low |
| *Pipistrellus rusticus* | Rusty Bat | Near Threatened | moderate-low |
| *Poecilogale albinucha* | African Weasel | Data Deficient | moderate |
| *Rhinolophus blasii* | Peak-saddle Horseshoe Bat | Vulnerable | moderate |
| *Rhinolophus clivosus* | Geoffroy's Horseshoe Bat | Near Threatened | moderate-low |
| *Rhinolophus darlingi* | Darling's Horseshoe Bat | Near Threatened | moderate-low |
| *Suncus infinitesimus* | Least Dwarf Shrew | Data Deficient | low |
| *Suncus varilla* | Lesser Dwarf Shrew | Data Deficient | moderate-low |
| *Tatera leucogaster* | Bushveld Gerbil | Data Deficient | moderate-low |

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