# ECOLOGICAL, RED DATA AND BIODIVERSITY ASSESSMENT REPORT

**ON FARM ZWARTBERG 72 MR (REMAINING EXTENT & PORTION 1),**

**WITHIN**

## BLOUBERG LOCAL MUNICIPALITY,

## CAPRICORN DISTRICT,

## LIMPOPO PROVINCE

TUA CONSERVA
ENVIRONMENTAL & CONSERVATION SERVICES c.c

February 2022

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**ACRONYMS**

| | |
|---|---|
| **DFFE:** | Department of Forestry, Fisheries and Environment |
| **DM:** | District Municipality |
| **ECO:** | Environmental Control Officer |
| **EIA:** | Environmental Impact Assessment |
| **EMP:** | Environmental Management Plan |
| **LEDET:** | Limpopo Department of Economic Development, Environmental and Tourism |
| **LEMA** | Limpopo Environmental Management Act |
| **LIHRA:** | Limpopo Heritage Resource Agency |
| **NEMA:** | National Environmental Management Act |
| **NPAES** | National Protected Areas Expansion Strategy (for South Africa) |
| **PA** | Protected Areas |
| **WUL:** | Water Use License |
| **IBA** | Important Bird and Biodiversity Area |

Declaration

I, Johannes Claassens, declare that –

- I act as the independent specialist
- I will perform the work relating to the project in an objective manner, even if this results in views and findings that are not favourable to the project proponent
- I declare that there are no circumstances that may compromise my objectivity in performing such work
- I have expertise in conducting the specialist report relevant to this project, including knowledge of the National Environmental Management Act, 1998 (Act No. 107 of 1998; the Act), regulations and any guidelines that have relevance to the proposed activity
- I will comply with the Act, regulations, and all other applicable legislation.
- I will take into account, to the extent possible, the matters listed in Regulation 8
- I have no, and will not engage in, conflicting interests in the undertaking of the activity
- I undertake to disclose to the project proponent and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the project; and - the objectivity of any report, plan, or document to be prepared by myself for submission to the competent authority or project proponent
- All the particulars furnished by me in this document are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of section 24F of the Act.

Johannes Claassens

## NOTATIONS AND TERMS

In this Report, except where the context otherwise indicates or it is otherwise expressly stipulated, the following words and expressions have the respective meanings hereinafter assigned to them and any other word or expression to which a meaning has been assigned in any related legislation shall bear that meaning:

**Agricultural Building:**

A building designed for use in connection with, and which is ordinarily incidental to, or reasonably necessary in connection with the use of the land on which the building is situated as agricultural land and may include a dwelling house.

**Agriculture:**

Means land used or a building designed or used for the purposes such as, but not limited to ploughing, de-pasturing, horticulture, poultry farming, dairy farming, breeding and keeping of livestock, apiaries, forestry, mushroom and vegetable production, flower production, orchards and any other activity commonly connected with farming or associated therewith, and include the sale of own produced goods. It includes only one main dwelling unit and associated farm settlement.

**Agriculture Infrastructure:**

The development and/or erection of gates and fences, farm roads, pipelines and electricity lines for gates, security masts and cameras and for irrigation needs.

**Cadastral Boundary**

A cadastral boundary is any line displayed and wholly described on any Diagram or General Plan approved by the Surveyor General's Office depicting the extents of individual land parcels, servitude areas or lease areas. Cadastral boundaries displayed on diagrams and general plans represent fictitious lines on the ground connecting any set of consecutive beacons that were legally established by a Land Surveyor registered with the South African Council for Professional and Technical Surveyors. Cadastral boundaries can however also follow natural features like middle of rivers and valleys or edges of cliffs.

**Catchment Area:**

The catchment area shall mean the planar region or area enclosed by the watershed divide, draining into a river, river system or other water body.

**Heritage Conservation:**

In relation to heritage resources, includes protection, maintenance, preservation and sustainable use of places or objects to safeguard their cultural significance

**Flood:**

A flood shall mean an overflow of water that submerges land which is usually dry.

**Floodplain:**

Shall mean the area of land adjacent to a watercourse, subject to flooding and inundation up to the 1 in 100-year recurrence interval.

**Property Boundary**

A property boundary is a cadastral boundary depicting the extents on the ground within which full ownership rights can be exercised by the owner of that land parcel.

**Protected Area:**

Means land or an area described in terms of the National Environmental Management: Protected Areas Act (Act No. 57 of 2003) that will substantially promote the preservation of specific ecological processes, natural systems, natural beauty or species of indigenous wildlife or the preservation of biotic diversity in general with the nature primarily orientated to support sustained economic activities. Such area may comprise private, communal, or state land or any combination thereof which is contractually developed and managed with joint resources for conservation, education, recreation, and sustainable resource utilisation purposes.

**RED DATA: Definitions of the national Red List categories**

**Extinct (EX)** A species is Extinct when there is no reasonable doubt that the last individual has died. Species should be classified as Extinct only once exhaustive surveys throughout the species' known range have failed to record an individual.

**Extinct in the Wild (EW)** A species is Extinct in the Wild when it is known to survive only in cultivation or as a naturalized population (or populations) well outside the past range.

**Regionally Extinct (RE)** A species is Regionally Extinct when it is extinct within the region assessed (in this case South Africa), but wild populations can still be found in areas outside the region.

**Critically Endangered, Possibly Extinct (CR PE)** Possibly Extinct is a special tag associated with the category Critically Endangered, indicating species that are highly likely to be extinct, but the exhaustive surveys required for classifying the species as Extinct has not yet been completed. A small chance remains that such species may still be rediscovered.

**Critically Endangered (CR)** A species is Critically Endangered when the best available evidence indicates that it meets at least one of the five IUCN criteria for Critically Endangered, indicating that the species is facing an extremely high risk of extinction.

**Endangered (EN)** A species is Endangered when the best available evidence indicates that it meets at least one of the five IUCN criteria for Endangered, indicating that the species is facing a very high risk of extinction.

**Vulnerable (VU)** A species is Vulnerable when the best available evidence indicates that it meets at least one of the five IUCN criteria for Vulnerable, indicating that the species is facing a high risk of extinction.

**Near Threatened (NT)** A species is Near Threatened when available evidence indicates that it nearly meets any of the IUCN criteria for Vulnerable and is

therefore likely to become at risk of extinction in the near future.

**Critically Rare** A species is Critically Rare when it is known to occur at a single site but is not exposed to any direct or plausible potential threat and does not otherwise qualify for a category of threat according to one of the five IUCN criteria.

**Rare** A species is Rare when it meets at least one of four South African criteria for rarity but is not exposed to any direct or plausible potential threat and does not qualify for a category of threat according to one of the five IUCN criteria. The four criteria are as follows:

- Restricted range: Extent of Occurrence (EOO) <500 $km^2$, OR
- Habitat specialist: Species is restricted to a specialized microhabitat so that it has a very small Area of Occupancy (AOO), typically smaller than 20 $km^2$, OR
- Low densities of individuals: Species always occurs as single individuals or very small subpopulations (typically fewer than 50 mature individuals) scattered over a wide area, OR
- Small global population: Less than 10 000 mature individuals.

**Declining** A species is Declining when it does not meet or nearly meet any of the five IUCN criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened, but there are threatening processes causing a continuing decline of the species.

**Least Concern** A species is Least Concern when it has been evaluated against the IUCN criteria and does not qualify for any of the above categories. Species classified as Least Concern are considered at low risk of extinction. Widespread and abundant species are typically classified in this category.

**Data Deficient - Insufficient Information (DDD)** A species is DDD when there is inadequate information to assess its risk of extinction, but the species is well defined. Listing of species in this category indicates that more information is required, and that future research could show that a threatened classification is appropriate.

**Data Deficient - Taxonomically Problematic (DDT)** A species is DDT when taxonomic problems hinder the distribution range and habitat from being well defined, so that an assessment of risk of extinction is not possible.

**Not Evaluated (NE)** A species is Not Evaluated when it has not been evaluated against the criteria. The national Red List of South African plants is a comprehensive assessment of all South African indigenous plants, and therefore all species are assessed and given a national Red List status.

**Storm Water system:**

Means both the constructed and natural facilities, including roads, pipes, culverts,

watercourses and their associated floodplains, whether over or under public or privately owned land, used or required for the management, collection, conveyance, temporary storage, control, monitoring, treatment, use or disposal of storm water.

**Aquifer dependant ecosystems**- ecosystems which depend on groundwater in, or discharge from, an aquifer. They are distinctive because of their connection to the aquifer and would be fundamentally altered in terms of their structure and functions if groundwater was no longer available.

**Baseflow**- the volume of water in the stream when at its minimum or base level of flow; this is the level to which the stream flow returns between storms; in climates with seasonal rainfall, it is often treated as the dry season flow.

**Geohydrology**- the study of the properties, circulation and distribution of groundwater (McGraw-Hill, 1978); in practice used interchangeably with hydrogeology; but in theory hydrogeology is the study of geology from the perspective of its role and influence in hydrology while geohydrology is the study of hydrology from the perspective of the influence on geology.

**Groundwater Dependent Ecosystems**- an ecosystem which depends on groundwater discharging from or contained within an aquifer and is significantly altered by changes in the groundwater regime.

**Groundwater recharge**- (a) the volume of water added to the zone of saturation (McGraw-Hill, 1978) and (b) those processes leading to the addition of water to the zone of saturation. A recharge area refers to the portion of the catchment where the subsurface **water is recharged.**

**Hydrology-** the study of the occurrence, properties, circulation, and distribution of water on the earth and in the atmosphere.

**Infiltration**- the process through which water filters through the surface of the soil under the influence of gravity and hydraulic forces (Lincoln *et al*., 1983). Having entered the soil, the further movement of water is properly termed percolation. The infiltrating water replenishes soil moisture deficiencies on its downwards path-care should be taken not to confuse and equate infiltration with groundwater recharge.

**Quick flow**- that portion of the increase in stream flow which occurs during or after a storm, synonymous with storm runoff or stormflow.

**Runoff**- the water in a stream after rain. In hydrology this refers to all the surface flow of water from a catchment in a stream or river; sometimes includes the sub-surface runoff. It is usually used to refer to the (volume of) surface water that leaves a catchment in a period of time.

**Seasonal river**- rivers which only flow reliable during specific periods of the year as determined by the seasonal distribution of rainfall; flow generally occurs between 20%-80% of the time; these rivers generally have a limited baseflow component with little or no groundwater discharge.

**Stormflow**- the increased runoff and water flow which is associated directly with a particular (intense) rainfall event or storm. It is the same as the quick flow or direct runoff.

**Watercourse**-a River or spring; a natural channel in which water flows regularly or intermittently; a wetland, lake or dam into which, or from which water flows; and any collection of water which the Minister may, by notice in the Gazette, declare to be a water course.

## 1. ASSIGNMENT

Zwartberg Projek's strategic plan is to develop croplands for rotational use of croplands for sustainable farming. Tua Conserva Environmental & Conservation Services cc undertook the Ecological Assessment, Red Data and Biodiversity surveys on the farm Zwartberg 72 MR as part of the requirements for an environmental assessment application.

The surveys were done in early summer (October, November 2021 and January 2022).

The project footprint for suitable areas was defined by terrain analysis which was refined by soil analysis. The surveys concentrated on the footprints and direct adjoining environment and was mainly dictated by the landscape forms and land-uses encountered.

The Swartwater area was settled on in the 1906 when farming commenced, mainly cattle and crops for own use and trading for commodities (personal comments from Mr. K. Janse van Vuuren, resident farmer, September 2021). The name Swartwater was derived from the high incidents of malaria in the area. Early explorers[1] provide an insight of the natural environment and conditions. Eugene Marais[2] a prominent South African scientist provides an insight of the Waterberg area (circa 1898-1930's).

More resent interpretation was done using monochrome aerial photographs dating back to 1956. The area was then settled on for farming purposes for 40 years and provides a specific reference of the spatial landscape. Later dated monochrome aerial photographs provides the change in landscape. More visual insight in recent changes is made possible by Google Earth.

Using the above historical sequence information, the project areas was visited for physical surveys and to compare the information from the Screening tool. The present biophysical information was assessed in the present setting to interpret the context of information gathered to provide an indication of the influence from the (historical, previous and current) and proposed development.

## 2. REGULATIONS GOVERNING THIS REPORT

### 2.1 National Environmental Management Act, 1998 (Act No. 107 of 1998) - Regulation No. R982

This report was prepared in terms of the National Environmental Management Act, 1998 (Act
No. 107 of 1998) Gazette No. 38282 Government Notice R. 982. Appendix 6 – Specialist reports include a list of requirements to be included in a specialist report:

- A specialist report or a report prepared in terms of these regulations must contain: Details of
    - i. The specialist who prepared the report; and

[1] F. C. Selous: Hunters Wanderings in Africa, 1881. Captain Sir William Cornwallis Harris: Wild Sports of Southern Africa, 1963. R. G. Cumming: Hunters Life in South Africa, 1850.
[2] E. N. Marais: Versamelde Werke, 1984.

ii. The expertise of that specialist to compile a specialist report, including a curriculum vitae

- A declaration that the specialist is independent in a form as may be specified by the competent authority
- An indication of the scope of, and purpose for which, the report was prepared; the date and season of the site investigation and the relevance of the season to the outcome of the assessment
- A description of the methodology adopted in preparing the report or carrying out the specialized process
- The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure
- An identification of any areas to be avoided, including buffers
- A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers
- A description of any assumptions made and any uncertainties or gaps in knowledge
- A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment
- any mitigation measures for inclusion in the EMPr
- any conditions for inclusion in the environmental authorisation
- any monitoring requirements for inclusion in the EMPr or environmental authorisation
- a reasoned opinion –
  - (i) As to whether the proposed activity or portions thereof should be authorised and
  - (ii) If the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr and where applicable, the closure plan
  - (iii) A description of any consultation process that was undertaken during preparing the specialist report
- A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and
- Any other information requested by the competent authority.
- This Act also embraces all three fields of environmental concern namely: resource conservation and exploitation; pollution control and waste management; and land-use planning and development. The environmental management principles include the duty of care for wetlands and special attention is given to management and planning procedures.

### 2.2 National Environmental Management Act, 1998 (Act No. 107 of 1998) - Regulation No. R984

The Environmental Impact Assessment (EIA) Process is a requirement of the National Environmental Management Act, (Act 107 of 1998). The following listed activity under

Regulation R984 of 4 December 2014 (as amended on 7 April 2017) requires a full environmental impact assessment to be conducted and authorization from the Limpopo Department of Economic Development, Environment and Tourism (LEDET).

- Activity 15 - The clearance of an area of 20 hectares or more of indigenous vegetation.

**"indigenous vegetation"** refers to vegetation consisting of indigenous plant species occurring naturally in an area, regardless of the level of alien infestation and where the topsoil has not been lawfully disturbed during the preceding ten years.

**2.3 Conservation of Agricultural Resources Act (Act No. 43 of 1983)**

This Act regulates the utilization and protection of wetlands, soil conservation and all matters relating thereto; control and prevention of veld fires, control of weeds and invader plants, the prevention of water pollution resulting from farming practices and losses in biodiversity.

**2.4 National Environmental Management Biodiversity Act (NEMBA: Act 10 of 2004)**

The following aspects of the NEMBA (2004) are important to consider in the compilation of an ecological report. It must include:

- Listing of ecosystems that are threatened or in need of national protection
- Links to Integrated Environmental Management processes and
- Must be considered in EMF and IDPs
- The Minister may make regulations to reduce the threats to listed ecosystems.

**2.5 The National Forest Act (Act No 84 of 1998)**

The National Forest Act:

- Promotes the sustainable management and development of forests for the benefit of all
- Creates the conditions necessary to restructure forestry in State Forests
- Provide special measures for the protection of certain forests and protected trees
- Promotes the sustainable use of forests for environmental, economic, educational, recreational, cultural, health and spiritual purposes
- Promotes community forestry.

**2.6 Preservation and Development of Agricultural Land Bill. (Gazette No 43723, 18 September 2020)**

To provide for:

- Management of agricultural land.
- Evaluation of agricultural land and evaluation classification.
- Preparation purposes and content of Provincial Agriculture Sector Plans.
- Declaration of Protected Agricultural Aeas.

**2.7 Limpopo Environmental Management Act (Act No 3 of 2004)**

The Limpopo Environmental Management Act (2004) deals with the conservation of wild animals, freshwater fish and the conservation and protection of flora in the Limpopo Province. Animals and plants are both listed in the schedules with different degrees of protection afforded to each.

## 3. TERMS OF REFERENCE

### 3.1 Objectives

- To assess the project areas environmental attributes and identify the ecological functioning to make objective recommendation on the location of the project areas footprint.
- To make informed decisions on how to prevent impacts on the environment that could be harmful and/or to make recommendations to prevent and provide also mitigation measures where necessary.

### 3.2 Scope

(i) Flora Survey
- Vegetation surveys of project area to compile list of species based on information from aerial photos to identify sites
- Identify Red Data species, protected species, encroacher species and exotic species' presence and extend
- Veld Condition Assessment

(ii) Plant Community delamination and description
- Use aerial photos to identify communities, survey area to confirm structure and composition
- Describe the vegetation and habitat it supports
- Describe the vegetation condition for game

(iii) Fauna Survey
- List potential species that occur in the area and in specific, habitat.
- Identify the presence of Red Data and protected species
- Interview farmer(s) on presence of specific species of concern, e.g., African Wild dog (*Lycaon pictus)*, Cheetah *(Acinonyx jubatus)* and Leopard (*Panthera pardus*)
- Assess habitat integrity and functioning for species needs

(iv) Identify wetlands
- Confirm presence of wetlands
- Indicate planning and mitigating measures

(v) Describe biodiversity and its:
- Function on area
- Influence of development

(vi) Identify ecological sensitive areas
- Describe sensitive ecological areas
- Indicate planning and mitigating measures

### 3.3 Limitations and assumptions

(i) Time constraints allowed vegetation surveys to be conducted only in early summer & in the beginning of main summer rainfall. Long-term surveys are not always feasible due to strategic planning of developers. In this case farming where crop planting is, depended on seasonal planning and crop rotation.

(ii) The project area and in specific the development footprint represented vegetation on the study area was homogeneous and representative sample (6) areas were

surveyed. Ecosystems are linked over distance and surveys were only conducted on the project area. Ecosystem identification outside the project boundaries was identified by aerial photos and data from SANBI.

(iii) Change in vegetation over time was also studied by using monochrome aerial photographs which provided an indication in vegetation structure change.

(iv) No wetland type was identified on the project footprint as functioning as part of a larger drainage system linked to the project area. However, watercourses in proximity were mapped and indicated in zoning plan.

## 4. METHODOLOGY

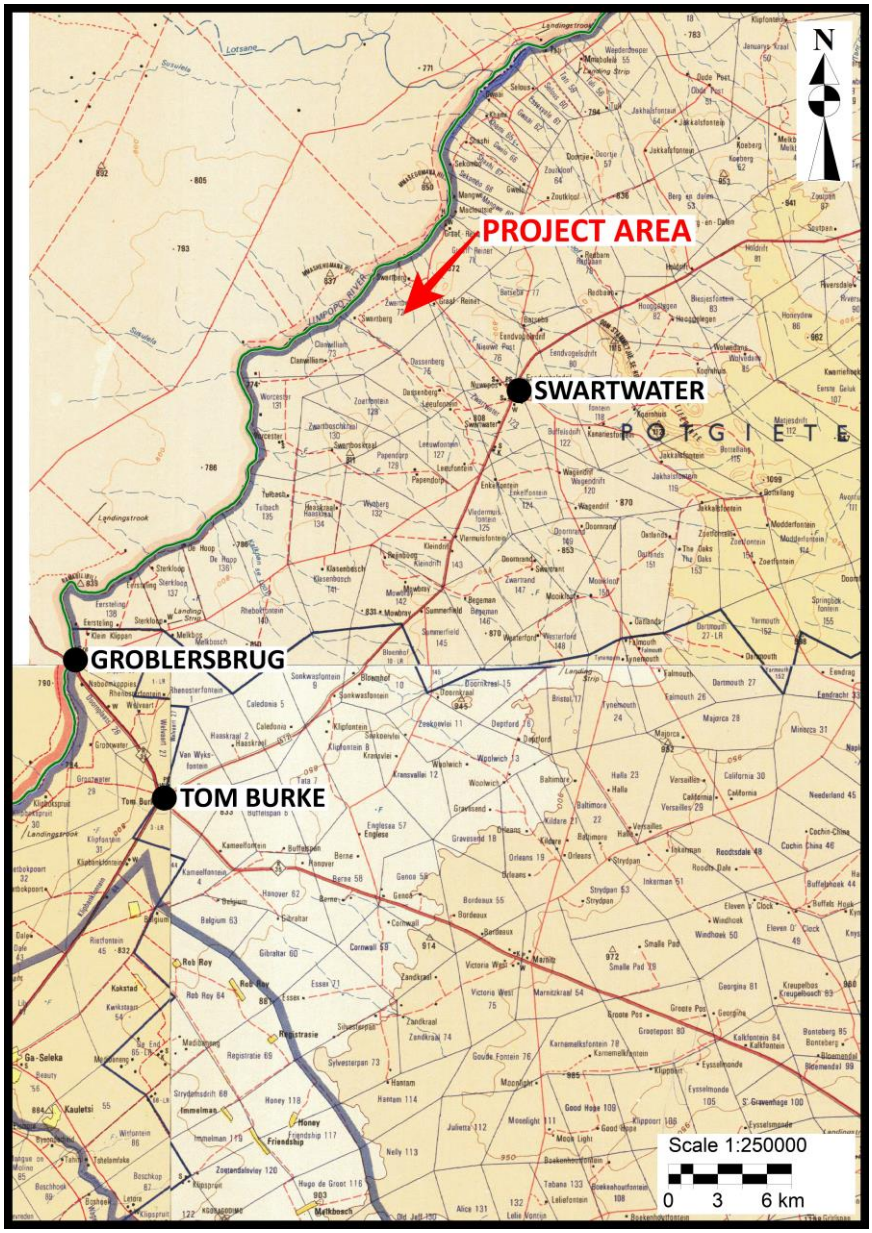
The area was assessed during site visits when surveys during day and night were conducted. The following methods was used during the assessment of the study site:

- Desktop study preceded field surveys to gather information of the receiving environment.
- The study sites were reached by vehicle (point-to-point movement) and surveys conducted on foot.
- Monochrome aerial photographs dated for 1956, 1964, 1970, 1983 and 1999 was used to compare the historical physical development area over time.
- A grid system was used for surveying each area.
- A Nikon D300 was used for site photographs.
- A drone was used for surveys and vertical-and panoramic photography.
- Trail cameras was used for nocturnal photography.
- Interviews with owners was conducted.
- Red Data fauna and flora information was obtained from available sources to identify the likely occurrence of any Red Data flora and fauna species in the area. This included previous surveys conducted by specialists conducting surveys for protected areas in the same veldtype.
- Limpopo Conservation Plan v2: Technical Report dated September 2013 was used for sourcing data.
- Protected flora species were recorded.
- The plant communities were assessed. Survey points was identified and surveyed using a 50x50 meter area. Structure (woody), species (trees, shrubs, grasses and forbes) and density was noted using a prepared checklist. Veld Condition Assessment was also done.
- Tracking and marking was done using a Garmin GPSMap 66s.
- A faunal potential occurrence list was compiled using references and checklist from surveys in the area. Data from the writer as well as personal observations was used. Data from trap cameras was also used. Owner(s) was also consulted. During the day and night surveys all sightings of species was noted. This included physical sightings, spoor, faeces, sound, and trail cameras.
- Identifiable floral and faunal species present were recorded within the proposed footprint(s). The levels of disturbance, species recorded, and species considered likely to occur within this study site were factors used to inform the current ecological status of the assessed area.

- The ecological sensitivity of the site envisaged impacts of the development and recommendations regarding mitigation measures have been provided.
- The CBA's presence was compared with field survey data and the Conservation Value calculated.

## 5. STUDY AREA LOCATION

The farm Zwartberg 72 MR (Portion 1 and Restant) is in Capricorn District. The farm is bordering onto the Limpopo River with existing farming development mainly along the river, outside the riparian zone. The new areas identified is terrestrial and inland on the farm and will be adjoining onto existing developed areas, with some areas being in-filling where undeveloped "gaps" were left due to infrastructure. Portion 1 and Restant is divided by an electrified game fence. The owner indicated that the fence will be removed. Spatially the project area is hemmed in by a District Road, Zwartberg mountain, adjoining farms (crop, cattle and game) and existing croplands. It is further isolated mainly by electrified game fences. In depth it is isolated by the various farming activities on adjoining farms (in depth) and the international border with Botswana.




**Map 1: Geographic location**

## 6. PROJECT DESCRIPTION OF ACTIVITY

The proposed project is for new croplands and according to the strategic planning of Zwartberg Projek for rotational irrigation farming. The identified area of approximately 955 ha as initial footprint will be surveyed from which recommendations will be made. Soil analysis will also be used in the survey process. Water is from an existing legal water use.

This report is to describe, assess and make recommendation for the environmental application and environmental impact report (EIA) which will be conducted for the following listed activity in terms of the National Environmental Management Act (Act No 107 of 1998):

- Regulation 983, 4 December 2014. Listing Notice 1:
  - Activity no 13; The development of facilities for off-stream storage of water, including dams and reservoirs, with a combined capacity of 50 000 cubic meters or more.
- Regulation 984, 4 December 2014. Listing Notice 2:
  - Activity no 13: The physical alteration of virgin soil to agriculture.

- Activity no 15: The clearance of an area of 20 hectares or more of indigenous vegetation.
- Activity no 16: The development of a dam where the highest part of the dam wall, as measured from the outside toe of the wall to the highest part of the wall, is 5 meters or higher or where the high-water mark of the dam covers an area of 10 hectares or more.

## 7. DESCRIPTION OF THE AFFECTED ENVIRONMENT

### 7.1 Climate

The project area is situated in a semi-arid zone with a mean annual rainfall ranging from 300-500 mm. Rainfall is predominantly during summer. Below average rainfall occurs with flooding irregular events (figure 1).

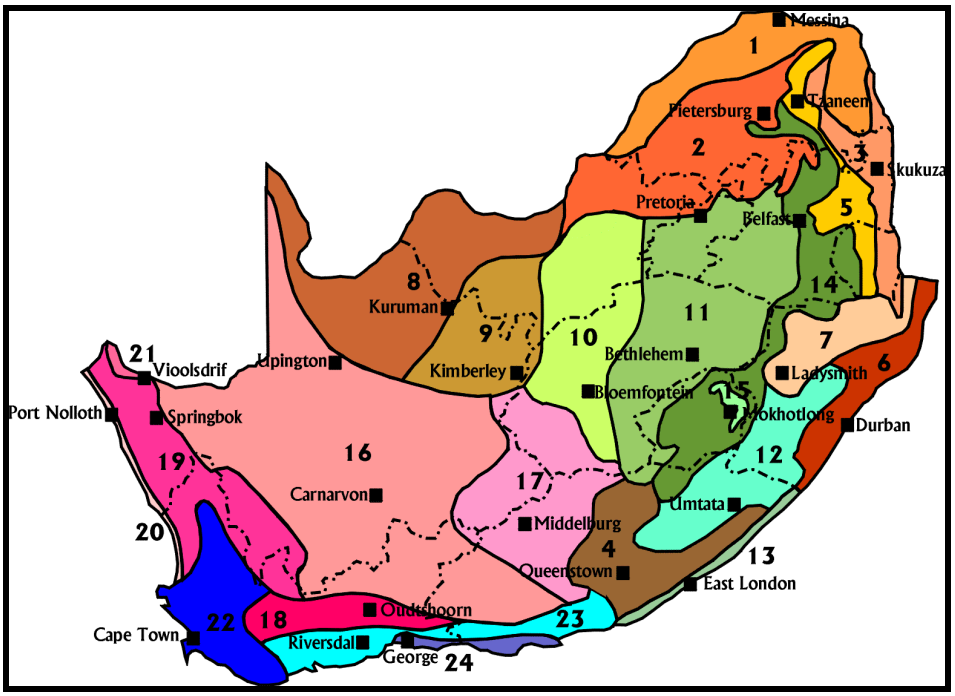



**Figure 1: Climatic Regions for South Africa**

| Region | Climatic properties | Locality | Vegetation | Economic Uses |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| **1. Northern Arid Bushveld** | **Lower than average (300 – 500 mm p.a.) and somewhat erratic precipitation for the Savanna type regions, with semi-arid and hot conditions in the Limpopo and Olifants River basins. Rainy season lasts from about Nov to Mar, with the peak falling in Jan. Winds are light to moderate and blow mostly from the north-eastern sector. Almost frost free.** | **Northern and north-western parts of Limpopo Province.** | **Dominated by stunted shrubby growth with mostly *Acacia* species (*Vachellia)* and Baobab *Adansonia digitata*, Shepherd's Tree *Boscia albitrunca*, Grasslayer includes *Stipagrostis uniplumis* (Silky Bushman's Grass), Common Nine-awn grass (*Enneapogon cenchroides)*, Guinea Grass (*Panicum maximum)* and Tassel Three-awn (*Aristida congesta)*.** | **Ecotourism, cattle and game farming, citrus and vegetables (mainly through irrigation).** |

The area is suitable for various crops produced during the favourable winter dry climate zone for the markets. Frost occurs infrequent but can be catastrophic. Temperatures mean monthly maximum and minimum average for Lephalale are between 38.2° (December) and 2.1°C (June).

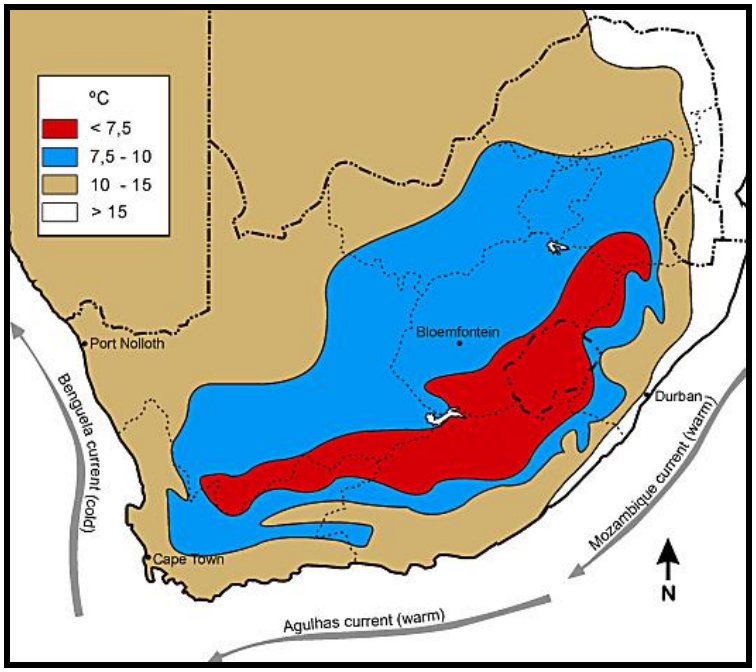



**Figure 2: Four minimum climate zones for South Africa**

## 7.2 Geology and soil types

The area is underlain by Sandstone and Shales of the Karoo Supergroup into which some diabase dykes, quarts and pegmatite veins have intruded. Geology is directly related to soil types and plant communities that may occur in a specific area (Van Rooyen & Theron, 1996). Soils in these areas vary from sandier in the north, east and west to shallow and calcareous in areas adjoining to east and west with loamy soils in the north nearer to the river.

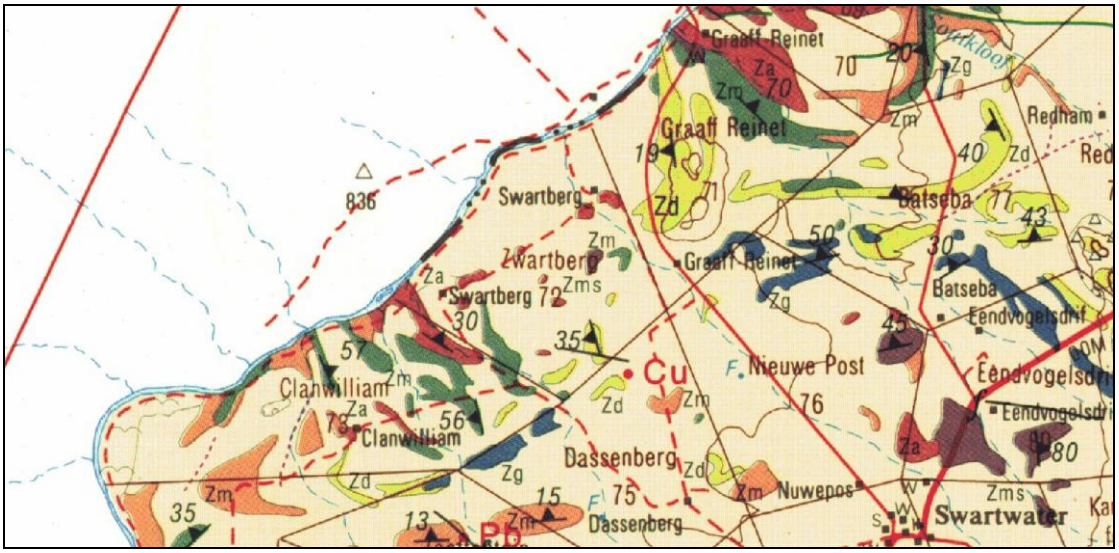
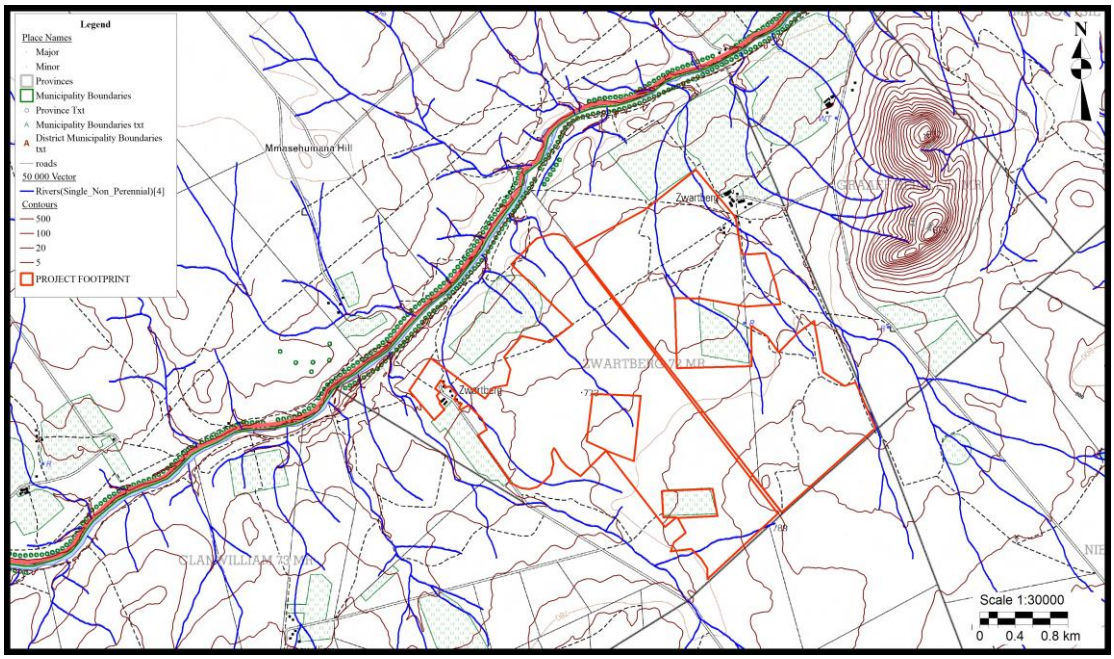



**Figure 3: Geology of area**

Soil types are mainly Covelley (63%), Coega (15%), Hutton (12%) and Glenrosa (9%) with a loamy-sand structure and a 5-10% clay content.

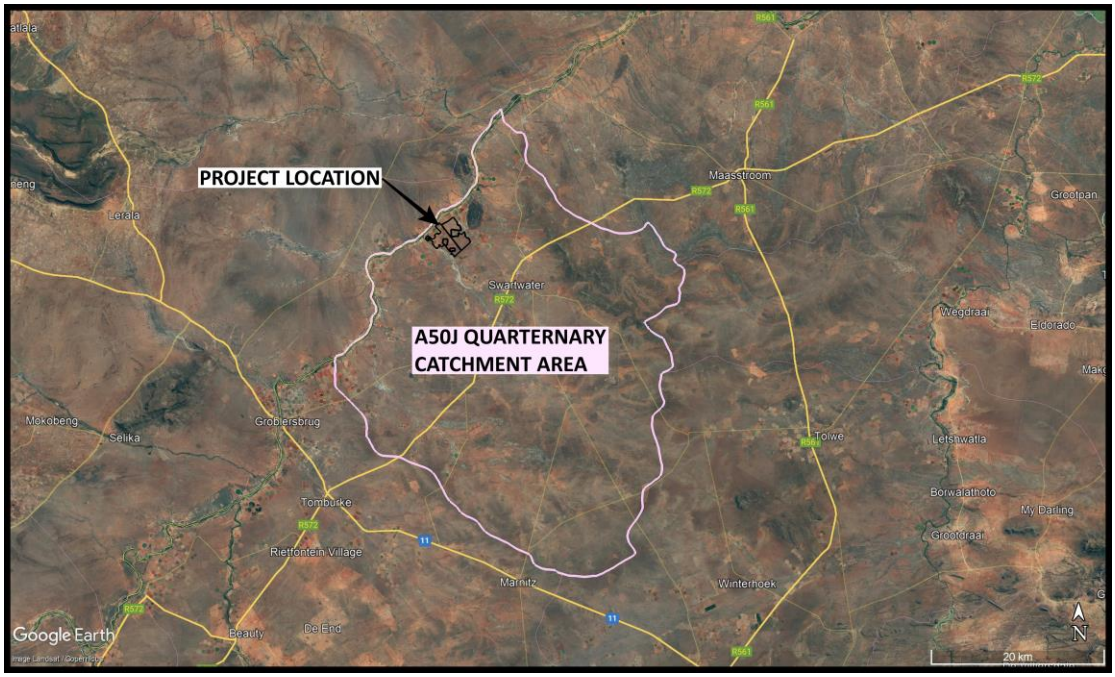
## 7.3 Topography and drainage

The project is situated in the Western Limpopo River Valley with associated inland plains with larger and lesser drainage lines. The project area ranges between the highest at 790 meters above sea level and lowest 770 meters above sea level. Drainage direction NW.




**Map 2: Contour and drainage**

The project areas drain through surface flow collecting into ephemeral watercourses towards the Limpopo River north of the site.
The Eco-region is Limpopo Plain.
It is in Quaternary Catchment Area: A50J of the Limpopo Water Management Area.
Freshwater Ecosystem Priority Area is rated as Category A or B (Good condition).




**Map 3: Quarterly Catchment Area (A50J)**

### 7.4 Sense of place and Land use

Deep rural and exclusively for agriculture (which includes game farming and eco-tourism).

## 8. ECOLOGICAL ASSESSMENT

The ecological assessment will focus on the vegetation environment, the faunal component and the habitat it provides together with the aquatic (if any) present. This will provide an understanding of the ecological functioning at macro-and micro level and the role in biodiversity support.

### 8.1 Vegetation Description

#### 8.1.1 <u>Biome: Savannah</u>

A biome is a broad ecological unit that represents a major life zone extending over a large natural area (Rutherford & Westfall 1994), defined mainly by vegetation structure and climate. It is the largest land community unit recognised at a continental or sub continental level and map able at a scale no larger than about 1:10 million (Rutherford & Westfall 1994). The vegetation of the study area belongs to the broad vegetation group of the Savannah Biome (Low and Rebelo 1996). The Savannah Biome is the largest Biome in Southern Africa, occupying 46% of its area, and over one-third the area of South Africa. It is well developed over the northern-, eastern-and north-western part of the country. A grassy ground layer and a distinct upper layer of woody plants (trees and shrubs) are characteristic of the Savannah Biome. Where this upper layer is near the ground (low growing) the vegetation may be referred to as Shrubveld, where it is tall and dense, as Woodland, and the intermediate stages are locally known as Bushveld.

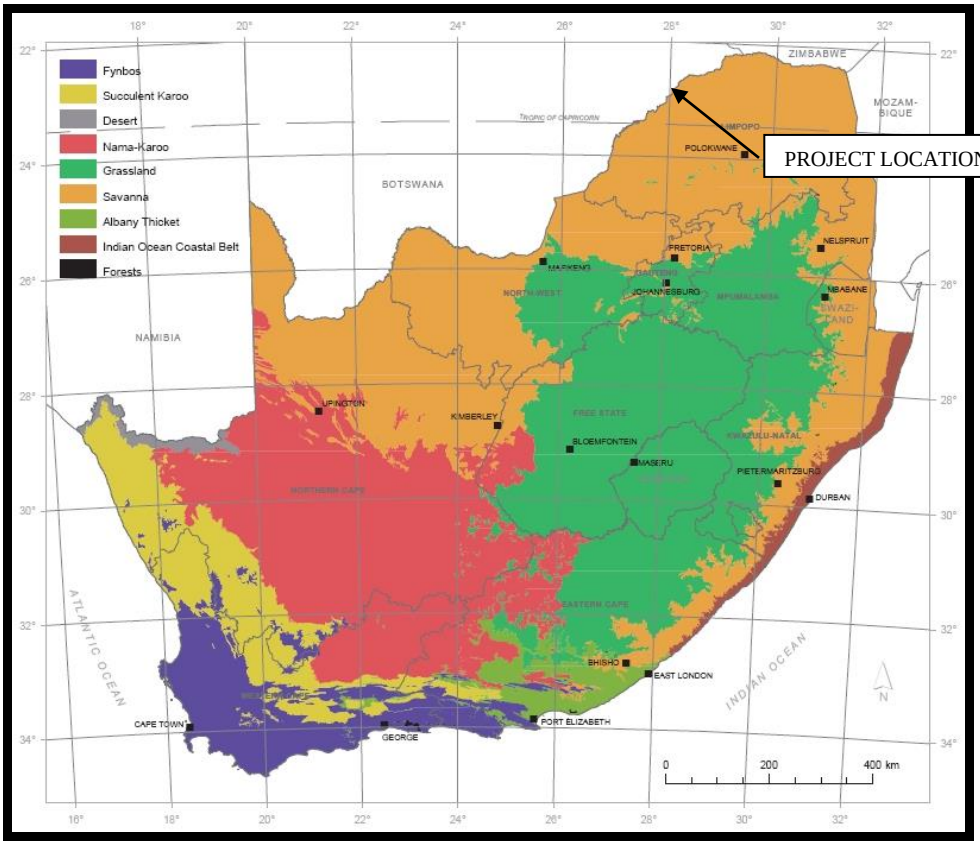
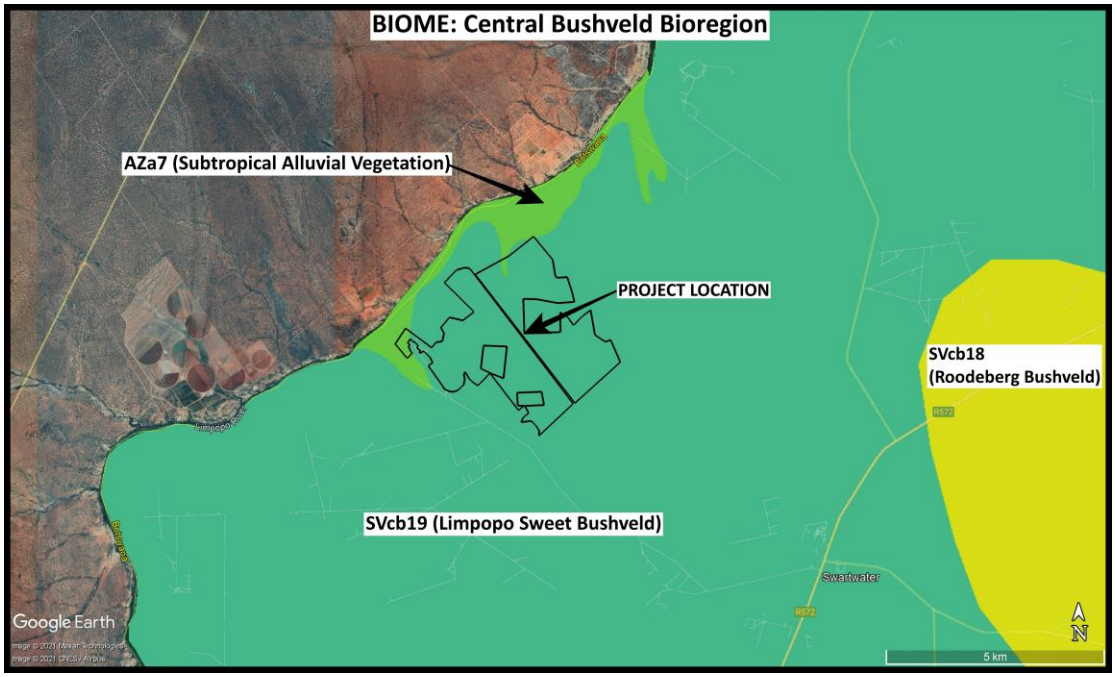



**Figure 4: Biomes of South Africa**

The environmental factors delimiting the biome are complex and include (Low and Rebelo 1996); altitude ranges from sea level to 2 000m; rainfall varies from 235 to 1 000 mm per year; frost may occur from 0 to 120 days per year; and almost every major geological and soil type occurs within the biome. Representation of the Savannah Biome in conservation areas in South Africa, Limpopo Province is good in general, mainly due to the presence of the Kruger-, Marekele- and Mapungubwe National Parks as well as the provincial nature reserves e.g., Blouberg-, Langjan-, Musina-, Nwanedi-, Makuya-, Manyeleti-, Letaba Ranch and Hans Merensky Provincial Nature Reserves within the biome in Limpopo province. Most of the area from the Soutpansberg and Blouberg towards the Limpopo River is used for game farming and can thus be considered moderately preserved, provided that sustainable stocking rates and sound environmental practices are maintained, which unfortunately is not always true. The importance of tourism and game hunting in the conservation land use of the area must also not be underestimated especially in the Limpopo province. The irrigation farming nodes are located along the Limpopo River. Geographically the same type of savannah is found in Botswana directly to the north and will have a role in the spatial functioning of connectivity and corridors.

### 8.1.2 Veldtypes (Vegetation types)

According to Acock's (1975) classification of the vegetation of South Africa, the study area falls within Veld Type 14, (Arid Sweet Bushveld). According to the classification of Low and Rebelo (1996), there is one veld type present, namely Veld Type 17, (Sweet Bushveld). According to Mucina & Rutherford (2006), the study area is situated in the Central Bushveld Bioregion with veldtypes Limpopo Sweet Bushveld (SVcb 19). It has an Ecosystem Status of Least Concern with an extent of 1, 200, 516 hectares (Limpopo Conservation Plan V2, 2013).




**Map 4: Vegetation units**

The project area is situated south of the Limpopo River in a terrestrial landscape. The veldtype is well conserved in the Provincial Nature Reserves, as well as private nature reserves and game farms. Effectiveness of conservation of veld in the private conservation areas is however determined by the level of ecologically sound management that is applied. Very high summer temperatures occur, and temperatures range from 1.5°C 0 42.5°C, with an average of 22°C. Therefore, evaporation rates are very high. Frost occurs very seldom and is, for all practical consideration, regarded as absent with no influence on the vegetation, although when it occurs it is catastrophic. The tree layer is characterized by sparse to dense growth of Acacia[3] species of which *Acacia nigrescens* (Knobthorn) and *Acacia burkei* (Black Monkey Thorn), *Adansonia digitata* (Baobab), *Terminalia prunoides* (Lowveld cluster-leaf), *Commiphora* spp. (Corkwood spp.), *Boscia albitrunca* (Shepherd's Tree), *B. foetida* (Stink Shepherd's Tree), *Kirkia acuminate* (White Seringa), and *Acacia tortilis* (Umbrella Thorn) is most prominent. The shrub layer is moderately developed and individuals of *Grewia* spp. (Raisin bush spp), *Ochna inermis* (Stunted Plane), and *Dichrostachys cineria* (Sickle Bush) occur. The grass layer is poorly developed, with grasses such as *Enneapogon cenchroides* (Nine-awned Grass), *Cenhrus ciliaris* (Blue Buffalo Grass), *Stipagrostis uniplumis* (Silky Bushman Grass), *Aristida congesta* (Tassel Three-awn) and *Schmidtia pappophoroides* (Sand Quick). *A. congesta, E. cenchroides* and herbs are common in overgrazed and degraded areas. Rainfall and especially fire resulting in grazing pressure have always been important driving forces in this vegetation type, and certain changes in the vegetation composition and structure can be expected (and was found) if these driving forces change. The position in the landscape (crest, scarp, mid slope, valley floor) generally strongly influences the qualities of the soil and therefore the characteristics of the vegetation as well as the species composition

[3] Name change of the African Genus *Acacia.* Refer to Field Guide to the Acacia of South Africa, by Nico Smit, 2008. Pages 5-6: "…*ICBN does not prescribe what classification system to use, hence the end-users of plant names now have a choice as to whether they want to use the name* ***Acacia*** *in a strict or wide sense. The consensus in South Africa is overwhelmingly for the continued use of the name* ***Acacia*** *for the African species of the genus".*

thereof. The position of the project is on flat plains. Currently the most common economic uses for this veld type are a combination of game- and cattle farming as well as ecotourism with agriculture irrigation activities localized on the inland terrestrial plains. In the study site, especially along the Limpopo River situated in the valley floor, agriculture (vegetables, citrus, cotton etc.) is the most important land use.

### 8.1.3 Vegetation Units (Communities)

Different plant communities develop because of differences in geology, topography, rockiness, drainage, soil texture, soil depth, slope, and historic management. Each plant community usually represents a different habitat, has its own inherent grazing and browsing capacity and represents a specific habitat for certain types of fauna species. The study area is dominated by tree and shrub forms of *Acacia burkei, A. nigrescens, Boscia albitrunca, Adansonia digitata, Combretum imberbe, Terminalia prunoides, Commiphora* species*, Grewia* species and the grasses *Aristida. Congesta* and *Enneapogon cenchroides.* A comprehensive species list of forbs, climbers, bulbous plants, succulents, dwarf shrubs, parasites and epiphytes, was not deemed necessary to be compiled. The publication by Me. R van der Walt the author of *Wildflowers of the Limpopo Valley* (2009) was used as reference. 'Forbs", is the riches component of the flora biodiversity in this arid area. It is also an important food source for game, especially in the dry season and in drought periods when the grass layer is depleted. Many of these plants are annuals and do not appear every season. Two plant communities were identified on the footprint area:

**Plant community 1:** *Acacia nigrescens-Boscia albitrunca-Terminalia prunioides-Commiphora* and *Grewia species* woodland.

**Plant community 2:** *Acacia burkei, Boscia albitrunca, Commiphora gladulosa,* and *Sesamothamnus lugardii* woodland**.**

**Photo 1: Plant community 1(a)**

| Vegetation Type: Limpopo Sweet Bushveld No 17 (SVcb19) and Acocks (Arid Sweet Bushveld: A 14) | | | |
|---|---|---|---|
| No | Plant community | Botanical name | Common name |
| 1a | *Sweet Bushveld on deep sandy-loam soils: Mostly Acacia/Sclerocarya/Grewia*<br>**Woody Structure**<br>Highest trees: 11 m<br>Average height trees: 6.5 m<br>Density trees: 10 - 15 %<br>Average height shrubs: 3.5 m<br>Density *shrubs: 15- 25 %*<br><br>**Herbaceous Structure:**<br>• Grasses:<br>Average height: 1 m<br>Ground cover: 60 - 80 %<br>• Forbes:<br>Average height: 0.4 m<br>Ground cover: 1 % | *Acacia burkei* | Black Monkey Thorn |
| | | *Acacia caffra* | Common hook-thorn |
| | | *Acacia erubescens* | Blue thorn |
| | | *Acacia mellifera* | Black Thorn |
| | | *Acacia nigrescens* | Knob Thorn |
| | | *Acacia nilotica* | Scented-pod Thorn |
| | | *Acacia senegal var. leiorhachis* | Slender Three-hook Thorn |
| | | *Acacia tortilis supsp. heteracantha* | Umbrella Thorn |
| | | *Adansonia digitata* | Baobab |
| | | *Burkea africana* | Wild seringa |
| | | *Albizia anthelmintica* | Worm-bark False-thorn |
| | | *Terminalia prunioides* | Lowveld cluster-leaf |
| | | *Boscia albitrunca* | Shepherd's Tree |
| | | *Boscia foetida subs. rehmanniana* | Stink shepherd's tree |
| | | *Catophractes alexandri* | Trumpet thorn |
| | | *Commiphora africana* | Hairy corkwood |
| | | *Commiphora edulis* | Rough-leaved corkwood |
| | | *Commiphora neglecta* | *Green-stemmed corkwood* |
| | | *Commiphora schimperi* | *Glossy-leaved corkwood* |
| | | *Commiphora glandulosa* | *Tall common corkwood* |
| | | *Commiphora pyracanthoides* | Common corkwood |
| | | *Commiphora mollis* | Velvet Corkwood |
| | | *Dichrostachys cinerea* | Sickle Bush |
| | | *Sclerocarya birrea* subsp. *caffra* | Marula |
| | | *Ficus abutilifolia* | Large-leaved rock fig |
| | | *Grewia bicolour* | White Raisin |
| | | *Grewia monticola* | Silver Raisin |

| | | | |
|---|---|---|---|
| | | *Grewia tenax* | Small-leaved cross-berry |
| | | *Grewia flavescens* | Sandpaper Raisin |
| | | *Catophractes alexandri* | Trumpet thorn |
| | | **Grasses** | |
| | | *Aristida congesta* subsp. *barbicolis* | Spreading Three-awn |
| | | *Aristida adscensionis* | Annual Three-awn |
| | | *Brachiaria deflexa* | False Signal Grass |
| | | *Digitaria eriantha* | Finger Grass |
| | | *Digitaria velutina* | Flaccid Finger Grass |
| | | *Enneapogon cenchroides* | Nine-awned Grass |
| | | *Eragrostis biflora* | Shade Eragrostis |
| | | *Eragrostis lehmanniana* | Lehmann's Love Grass |
| | | *Eragrostis pallens* | Broom Love Grass |
| | | *Eragrosti rigidior* | Broad -leaved Curly Leaf |
| | | *Melinis repens* | Natal Red Top |
| | | *Stipagrostis uniplumis* | Silky Bushman Grass |
| | | *Panicum maximum* | Guinea Grass |
| | | *Pogonarthria squarrosa* | Herringbone Grass |
| | | *Cenchrus ciliaris* | Blue Buffalo Grass |
| | | *Schmidtia pappophoroides* | Sand Quick |
| | | *Solanum gigantium* | Goat bitter apple |
| | | *Tragus berteronianus* | Common Carrot-seed Grass |
| | | *Urochloa mosambicensis* | Bushveld Signal Grass |

**Photo 2: Plant community 1b**

| No | Plant community | Botanical name | Common name |
|---|---|---|---|
| 1b | *Sweet Bushveld on shallower sandy soils with calcrete intrusions:* Mostly *Acacia burkei-Terminalia prunioides-Boscia albitrunca-Sesamothamnus lugardii woodland*<br>**Woody Structure**<br>Highest trees: 8 m<br>Average height: 5.3 m<br>Density trees: 10 - 15 %<br>Average height shrubs: 3.5 m<br>Density shrubs: 15- 20 %<br>**Herbaceous Structure:**<br>• Grasses:<br>Average height: 0.5m<br>Ground cover: 60 - 85 %<br>• Forbes:<br>Average height: 0.5 m<br>Ground cover: 1 % | *Acacia mellifera* | Black Thorn |
| | | *Acacia nigrescens* | Knob Thorn |
| | | *Acacia nilotica* | Scented-pod Thorn |
| | | *Acacia tortilis supsp. heteracantha* | Umbrella Thorn |
| | | *Albezia harveyi* | Bushveld False-thorn |
| | | *Albezia anthelmintica* | Worm-bark False-thorn |
| | | *Terminalia prunoides* | Lowveld cluster-leaf |
| | | *Boscia albitrunca* | Shepherd's Tree |
| | | *Boscia foetida subs. rehmanniana* | Stink Shepherd's Tree |
| | | *Commiphora edulis* | Rough-leaved corkwood |
| | | *Commiphora marlothii* | Paper-bared corkwood |
| | | *Commiphora africana* | *Hairy corkwood* |
| | | *Commiphora glandulosa* | *Tall common corkwood* |
| | | *Commiphora pyracanthoides* | Common corkwood |
| | | *Dichrostachys cinerea* | Sickle Bush |
| | | *Sclerocarya birrea* subsp. *caffra* | Marula |
| | | *Grewia bicolour* | White Raisin |
| | | *Grewia monticola* | Silver Raisin |

| | | | |
|---|---|---|---|
| | | *Grewia flavescens* | Sandpaper Raisin |
| | | *Sesamnotamnus lugardii* | Transvaal Sesame Bush |
| | | *Aristida congesta* subsp. *barbicolis* | Spreading Three-awn |
| | | *Enneapogon cenchroides* | Nine-awned Grass |
| | | *Brachiaria deflexa* | False Signal Grass |
| | | *Stipagrostis uniplumis* | Silky Bushman Grass |
| | | *Panicum maximum* | Guinea Grass |
| | | *Cenchrus ciliaris* | Blue Buffalo Grass |
| | | *Aristida adscensionis* | Annual Three-awn |
| | | *Solanum gigantium* | Goat bitter apple |
| | | *Tragus berteronianus* | Common Carrot-seed Grass |
| | | *Eragrostis lehmanniana* | Lehman's Love Grass |
| | | *Microchloa caffra* | Pinchushion Grass |

### 8.1.4 Protected Plants (DAFF & LEMA)

Protected trees and plants were identified, e.g. Baobab, Shepherd's Tree, Leadwood, Apple Leaf and Marula on the farm and in surrounding areas of the proposed development areas. The Shepherd's Tree had an abundant distribution throughout the landscape, they were not individually recorded.

The baobab and marula trees have a prominent role in the environment and serve as specific nish habitat for species. Only the smaller baobab can be potentially replanted. Larger trees should be incorporated in the lay-out as done elsewhere on the farms. Both species are not in abundance with only one baobab found.

### 8.1.5 Problem Plants

The problem plants include alien (exotic) invaders and weed species that have been classified as alien weeds or invasive plants by NEMBA regulations. Refer to table below for the list of plants with potential to be present.

Table 1: List of foreign problem plants

| Species | Vernacular (English) | Priority | Present |
|---|---|---|---|
| *Achyranthes aspera* | Burweed | Low | No |
| *Agave sisalana* | Sisal | Medium | Yes |
| *Argemone ochroleuca* subsp. *ochroleuca* | White flowered Mexican poppy | Very low | No |
| *Aristolochia elegans* | Dutchman's pipe / calico flower | | No |
| *Arundo donax* | Giant reed, Spanish reed | Medium | No |
| *Azolla filiculoides* | Red water fern | Very low | No |
| *Cardiospermum grandiflorum* | Balloon vine, heart pea vine | Medium | No |
| *Catharanthus roseaus* | Graveyard flower, Madagascar periwinkle | Very low | No |
| *Cereus jamacaru* | Queen of the night | Medium | No |

| | | | |
|---|---|---|---|
| *Cinnamomum camphora* | Camphor tree | Low | No |
| *Cuscuta campestris* | Common dodder | Low | No |
| *Cylindropuntia fulgida var. mamillata* | Rosea cactus | | No |
| *Datura ferox* | Large thorn apple | Low | No |
| *Datura inoxia* | Downy thorn apple | Low | No |
| *Datura stramonium* | Common thorn apple | Low | No |
| *Flaveria bidentis* | Smelter's bush | Low | No |
| *Hedychium spp.* | Ginger lily | Low | No |
| *Macfadyena unguiscati* | Cat's claw creeper | High | No |
| *Nicotiana glauca* | Brazilian tree tobacco, wild tobacco | Low | No |
| *Ricinus communis* | Castor oil plant | Low | No |
| *Xanthium spinosum* | Spiny cocklebur, burweed | Low | No |
| *Xanthium strumarium* | Large cocklebur | Low | No |

The level of infestation by foreign problem plants can be described as non-existent to low. The same situation prevails on the remaining areas of the farm. Species (indigenous) that can have an effect due to their ability to encroach is also listed according to the Conservation of Agriculture Resources, 1983 (Act No 43 of 1983). These species are:

- *Acacia erubescens*
- *Acacia tortillis*
- *Acacia mellifera*
- *Dichrostachys cinerea*
- *Grewia bicolour*
- *Grewia flavescens*

## 8.2 Fauna Survey

### 8.2.1 Mammals

Signs were present for various large, medium, and small mammal species including rodents, hare and small antelope. The study area border onto various land uses, e.g. crop-, cattle and game farming as the most prominent.

**Photo 3: Small steenbok next to rockpile removed from exiting croplands**

Active movement of smaller wildlife between properties is active, although the fences are electrified. Movement is also possible from the Limpopo River inland and vice versa. Table 2 below provides a list of animals positively identified by the writer as well as species that were confirmed in their occurrence with the farming personnel on the project area, the remainder of the farm and adjoining farms. Where no positive information was obtained the writers' knowledge based on 44 years' experience of the area as well as checklist on species for (5) provincial reserves in the area was used as control. In Table 4 under column PRESENT the presence or occurrence of species is indicated by:

- Y= positive identification by writer either by a sighting* (which include trap cameras), spoor** or scats***.
- N= no possibility of occurrence, due to management or financial constrains as well as isolation of the area.
- P= strong possibility of occurrence.
- H= historically present.
- New= New distribution

Many of the smaller mammals, e.g., mongooses etc. we're not listed although mentioned where necessary in discussions.

**Table 2: List of mammals identified**

| SCIENTIFIC NAME | COMMON NAME | PRESENT |
|---|---|---|
| *Pappio ursinus* | Baboon | Y* |
| *Tragelaphus scriptus* | Bushbuck | P |
| *Cencerus caffra* | Buffalo | H |
| *Potamochoerus larvatus* | Bushpig | Y* |
| *Sylvicapra grimmia* | Common Duiker | Y* |
| *Acinonyx jubatis* | Cheetah | N |
| *Tragelaphus oryx livingstonii* | Eland | Y* |
| *Loxodonta africana* | Elephant | H |

| | | |
|---|---|---|
| *africana* | | |
| *Oryx gazella* | Gemsbok | Y* |
| *Camelopardus giraffe* | Giraffe | Y* |
| *Crocodillus niloticus* | Crocodile | Y* |
| *Hippopotamus amphibius* | Hippopotamus | Y* |
| *Aepyceros melampus* | Impala | Y* |
| *Oreotragus oreotragus* | Klipspringer | N |
| *Tragelaphus strepsiceros* | Kudu | Y* |
| *Panthera pardalus* | Leopard | P |
| *Panthera leo* | Lion Free roaming | H/N |
| *Cercopithecus aethiops* | Monkey Vervet | Y* |
| *Tragelaphus angasi* | Nyala | N |
| *Struthio camelus* | Ostrich | N |
| *Alcelaphus bucelaphus* | Red Hartebeest | Y* |
| *Redunca arundinum* | Reedbuck Common | P |
| *Redunca fulvorufula* | Reedbuck Mountain | N |
| *Raphicerus sharpie* | Sharp's Grysbok | N |
| *Hippotragus equinus* | Roan | N |
| *Ceratotherium simum* | Rhinoceros White | H/N |
| *Hippotragus niger* | Sable | P |
| *Raphicerus campestris* | Steenbok | Y* |
| *Damaliscus lunatus* | Tsessebe | P |
| *Phacochoerus africanus* | Warthog | Y* |
| *Kobus ellipsiprymnus* | Waterbuck | Y* |
| *Connochaetus taurinus* | Wildebeest Blue | Y* |
| *Equus burchellii* | Zebra | Y* |
| *Manis temminckii* | Pangolin | P |
| *Orycteropus afer* | Aardvark | P |
| *Mellivora capensis* | Badger | P |
| *Canis mesomelas* | Black-backed Jackal | Y** |
| *Otocyon megalotis* | Bat-eared Fox | P |
| *Lycaon pictus* | African Wild dog | H/P |
| *Crocuta crocuta* | Spotted hyena | H/P |
| *Crocuta brunnea* | Brown hyena | Y*** |
| *Felis serval* | Serval | Y*** |
| *Felis caracal* | Caracal | P*** |
| *Proteles cristalus* | Aardwolf | Y* |
| *Felis lybica* | African Wild Cat | P |
| *Genetta genetta* | Small-spotted Genet | P |
| *Genetta tigrina* | Large-spotted Genet | P* |
| *Mungos mongo* | Banded mongoose | Y* |
| *Ichneumia albicauda* | White-tailed mongoose | New |
| *Galago senegalensis* | Bushbaby | P |
| *Otolemur crassicaudatus* | Thick-tailed Galago | N |

*Ichneumia albicauda* was observed by neighbouring farmer Mr. J. Du Preez (personal comment to writer). This is a new distribution record. The Regional Red Data Status is Least Concerned.

**Photo 4: White-tailed mongoose (*Ichneumia albicauda)***

### 8.2.2 Red Data Species

**Mammals**

In Table 5 below a list of mammals is supplied as identified in the surveys on using available literature and references. Potential Red Data mammals of the study area are listed below. SARDB / IUCN (World Conservation Union): CR = Critically Endangered, E = Endangered, VU = Vulnerable, NT = Lower Risk near threatened, LC= Least Concerned, DD = Data Deficient

Table 3: Potential Red Data mammal's occurrence

| SCIENTIFIC NAMES | COMMON NAMES | SARDB | ENDEM | Does suitable habitat occur on Site? | Probability of the species occurring on site. (High/Medium/Low) |
|---|---|---|---|---|---|
| **ORDER ARTIODACTYLA/PERISSODACTYLA/PROBOSCIDE** | | | | | |
| *Raphicerus sharpie* | Sharp's Grysbok | NT | No | Yes | Low |
| **ORDER VIVERRIDAE** | | | | | |
| *Ichneumia albicauda* | White-tailed mongoose | LC | No | Yes | High (Positive) |
| **ORDER CARNIVORA** | | | | | |
| *Hyaena brunnea* | Brown hyena | NT | No | Yes | Low |
| *Crocuta crocuta* | Spotted hyena | NT | No | Yes | Medium (migrant from Botswana) |
| *Leptailurus serval* | Serval | NT | No | No | Medium |

| | | | | | |
|---|---|---|---|---|---|
| *Mellivora capensis* | Honey badger | NT | No | Yes | Medium |
| *Felis sylvestris* | African wildcat | LC | No | Yes | Medium |
| *Lycaon pictus* | Wild dog | E | No | Yes | Low |
| *Acinonyx jubatis* | Cheetah | VU | No | Yes | Low |
| *Pantera leo* | Lion | VU | No | Yes | Low |
| *Panthera pardus* | Leopard | LC | No | Yes | Medium |
| *Proteles cristatus* | Aardwolf | LC | No | Yes | High |
| *Otocyon mega lotis* | Bat-eared fox | LC | No | Yes | High |
| **ORDER HYRACOIDEA** | | | | | |
| *Crocidura hirta* | Lesser Red Musk Shrew | DD | No | No | Low |
| **ORDER INSECTIVORA** | | | | | |
| *Atelerix frontalis* | South African hedgehog | NT | No | Grassland and open thornveld | Low |
| **ORDER LAGOMORPHA** | | | | | |
| *Pronolagus randensis* | Jameson's Red Rock Rabbit | LC | No | No | Low |
| **ORDER MACROSCELIDEA/PHOLIDOTA/TUBULIDENTATA** | | | | | |
| *Manis temminckii* | Pangolin | VU | No | Yes | Low |
| *Orycteropus afer* | Aardvark | LC | No | Yes | Low |
| **ORDER PRIMATA** | | | | | |
| *Cercopithecus aethiops pygerythrus* | Vervet monkey | LC | No | Yes | High (Positive) |
| *Galaogo moholi* | Southern Lesser Galago | LC | No | Yes | High |
| *Otolemur crassicaudatus* | Thick-tailed Bushbaby | LC | No | Yes | Low |
| *Papio ursinus* | Chacma baboon | LC | No | Yes | High (Positive) |
| **ORDER RODENTIA** | | | | | |
| *Dasymys incomtus* | Water rat | NT | No | No | Low |

The possibility of the carnivore mammal species to use the area in their range movements (new ranges for younger animals or even drought conditions) is possible as there is still free-roaming species movement from Botswana (spotted hyena as an example as confirmed with farmer) in the north as well as from inland (south). Electrified fences however have an influence on their rangeland movement, which will mostly be from SSW and SSE. The high presence of human activity deters the specie to use the area for hunting, resting and rangeland due to surrounding activities in-depth. The likelihood of lion, cheetah and African Wild dog visiting the area is highly unlikely.

**Birds**

The types of habitats found on the project have big trees vegetation and deciduous wooded savanna. No nests were seen during surveys. This can also be ascribed to high human movement and farming activities. The main part of the project area can be described as

moderately suitable habitat for birds. While no detailed bird assessment was conducted for the site, notes were made during the various site visits (day and night) of birds seen.

Important bird information for Limpopo Province

| | |
|---|---|
| Southern African BIRDS | - 887 species |
| Limpopo | - 587 species = 66% of SA birds |
| Southern African endemics | - 149 species |
| Only Limpopo in SA | - 20 species |
| SA RED DATA | - 125 species |
| Limpopo RED DATA | - 74 of the 125 species |
| | |
| SA Critically endangered | - 5 species |
| Limpopo | - 3 of the 5 species |
| Endangered in SA | - 11 species |
| Endangered in Limpopo | - 3 of 11 species |
| Vulnerable in SA | - 43 species |
| Endangered in Limpopo | - 22 of 43 species |
| Near threatened in SA | - 64 species |
| Endangered in Limpopo | - 39 of 64 species |

Table 4: Important Birding Areas in Limpopo Province

| NUMBER | NAME | SIZE = Ha | COORDINATES SOUTH | COORDINATES EAST | PROTECTION STATUS |
|---|---|---|---|---|---|
| SA001 | Mapungubwe NP | 2500 | 22º13’ | 29º19’ | Fully |
| SA002 | Kruger Park NP & Adjacent areas | 2 142 528 | 22º23’-26º | 30º50’- 32º 02’ | Fully |
| SA003 | Soutpansberg | 260 000 | 22º 57’ | 29º 20’ – 30º 30’ | Partially |
| SA004 | Blouberg | 30 000 | 23º 07’ | 28º 52’ – 29º 03’ | Partially |
| SA005 | Wolkberg | 65 000 | 23º 38’ | 29º 50’ – 30º 15’ | Partially |
| SA006 | Pietersburg Nat. Reserve | 3 200 | 23º 56’ | 29º 30’ | Fully |
| SA007 | Waterberg System | 375 000 | 24º 10’ – 24º 25’ | 27º 30’ – 28º 40’ | Partially |
| SA008 | Nylriver & Floodplain | 16 000 | 24º 39’ | 28º 42’ | Partially |
| SA009 | Northern Turf Thornveld | 50 000 | 24º 43’ – 24º 56’ | 27º 10’ – 27º 30’ | Unprotected |

Of the nine IBA’s in Limpopo province, four areas, namely SA003, SA004 (at 93 km the nearest), SA007 and SA009 are not in near proximity to the project area. The Limpopo River can be considered as important on its own as well as the artificial habitat created by

irrigation dams inland from the river. The permanent open water which has been created by the weirs can be considered as important to the birdlife population and in specific species associated with permanent water. These impoundments supply the water needed by birds not being able to survive along the Limpopo River as it did not have permanently flowing water throughout the winter and early summer.

Species Status quo

Several common bird species were observed during those visits to the project area, such as Helmeted guineafowl (*Numida meleagris),* Lilac breasted Roller (*Coracias caudata),* European bee-eater (*Merops apiaster),* Diederick cuckoo (*Chrysococyx caprius),* Redchested Cuckoo, *(Cuculus solitarius)* Greyheaded bush shrike (*Malaconotus blanchoti),* Wattled Starling (*Creatophora cinerea),* Klaas's Cuckoo (*Chrysococcyx klaas),* Spotted Sandgrouse *(Pterocles burchelli)* and Kori Bustard (*Ardeotis kori*).

The Lilac breasted Roller and Wattled Starlings were observed actively hunting in cropland areas which implicates presence of insects which in-turn implicates low chemical-and pesticide use. The Kori Bustard was also found in croplands. This observation of the specie was also found on surrounding farms in the area and further east near Beitbridge on the farm River 141 MS. What is important is that both sexes were observed together which implicates active breeding pairs.

**Figure 5: Kori Bustard**

Exotic species (mynah and mallard) most found in Limpopo province was not encountered in the area.

Red Data Species

Potential Red Data Birds of the study area are listed below.

SARDB / IUCN (World Conservation Union):

CR = Critically Endangered,

E = Endangered,

VU = Vulnerable,

NT = Lower Risk near threatened,

DD = Data Deficient

The list of Red Data birds recorded in or around the project area. An indication is provided if suitable habitat occurs on the site. The possibility for their occurrence in the future should the project proceed is also mentioned.

Table 5: Potential Red Data birds identified

| SCIENTIFIC NAMES | COMMON NAMES | ENDEM | Does suitable habitat occur on Site? | Probability of the species occurring on site? (High/Medium/Low |
|---|---|---|---|---|
| **ENDANGERED** | | | | |
| *Epphippiorhynchus senegalensis* | Saddlebilled Stork | N | N | Low |
| **VULNERABLE** | | | | |
| *Polemaetus belicosus* | Martial Eagle | N | N | Low |
| *Circus ranivorus* | African marsh Harrier | N | N | Low |
| *Polemaetus belicosus* | Martial Eagle | N | N | Low |
| *Aquila rapax* | Tawny Eagle | N | N | Low |
| *Gyps coprotheres* | Cape Vulture | N | N | Low |
| *Torgos tracheliotus* | Lappetfaced vulture | N | N | Low |
| *Trigonoceps occipitalis* | Whiteheaded Vulture | N | N | Low |
| *Polemaetus bellicosus* | Martial Eagle | N | N | Low |
| *Terathopius ecaudatus* | Bateleur | N | N | Low |
| *Ardeotis kori* | Kori Bustard | N | Y | High (Positive) |
| *Bucorvus leadbeateri* | Ground Hornbill | N | N | Low |
| *Buphagus africanus* | Yellowbilled Oxpecker | N | N | Low |
| *Gorsachius leuconotus* | White-Backed Night Heron | N | N | Low |
| *Circus ranivorus* | African Marsh Harrier | N | N | Low |
| *Schotopelia peli* | Pel's Fishing Owl | N | N | Low |
| **NEAR THREATENED** | | | | |
| *Leptoptilos crumeniferus* | Marabou Stork | N | N | Low |
| *Hieraaetus ayresii* | Ayre's Eagle | N | N | Low |
| *Circus pygargus* | Pallid Harrier | N | N | Low |
| *Sagittarius serpentarius* | Secretary Bird | N | Y | Medium |
| *Buphagus erythrorhyncus* | Redbilled oxpecker | N | Y | Medium |
| *Ciconia nigra* | Black Stork | N | Y | Low |
| *Dissoura episcopus* | Woolly-necked Stork | N | N | Low |

| | | | | |
|---|---|---|---|---|
| *Anastomus lamelligerus* | Openbill | N | N | Low |
| *Ibis ibis* | Yellowbilled Stork | N | N | Low |
| *Nettapus auritus* | African Pygmy-Goose | N | N | Low |
| **LEAST CONCERNED** | | | | |
| *Ciconia cicona* | WhiteStork | N | N | Low |

The Kori Bustard was seen in cropland that is in a rotation "rest", its presence indicates that conservation farming practices and chemical use for pest control is within limits for food sources of the species.

Habitat description

One habitat is present:

- Savannah Woodland

The type of habitat found include medium and big trees in arid wooded savannah. The main part of the area can be described as homogeneous terrestrial habitat. The Limpopo River and the Zwartberg mountain (NE) are near the project area and is a suitable habitat for various species associated with the area's habitat. Thus, species associated with the project area can find refuge there. What should also be considered is the "agriculture habitat" created, the Kori Bustard is an example for sightings made on re-grassed lands placed on "rest" phase.

Habitat assessment

The human interference and presence on the project area act as daily disturbance. The area, in which the project is situated, is not considered as an Important Birding Area (refer to Table 11). With nearby food sources, the Limpopo River and mountain vegetation contributes to the habitat and presence of representing species for this arid area (and providing more suitable nesting sites). The savannah is rated as third most important vegetation type for threatened species (Barnes, p11; 2000).

Habitat after construction

What can be expected is that the croplands (those in rotation phase and planted with grass) will serve as food reservoir in the late winter and early summer when trophic bottlenecks occur. Connectivity between the Limpopo River and terrestrial vegetation, via the croplands, will still be able to function for arboreal movement.

The cropland habitat, consisting of planted areas and areas in a rotation rest phase, can contribute to the presence and supporting birdlife. The project will contribute to maintaining birding potential of the area.

**Herpetological survey**

The terrestrial habitat including cover and a small isolated rocky outcrop available for reptiles. A number of common reptile species, can be expected to occur on the footprint, including Puff adders *(Bitis arietans),* Rhombic night adders (*Causus rhombeatus),* Brown house snake (*Lamprophis fuliginosus),* Ground agama (*Agama aculeate),* Leopard tortoise (*Geochelone pardalis),* Flap-neck chameleon *(Chamaeleo dilepis)* and Striped skinks (*Trachylepis striata).* An isolated population of Giant Plated Lizard (*Gerrhosaurus v. validus*) was found on the rocky outcrop, it is a common species and not threatened. A Mopane Snake (*Hemirhagerrhis nototaenia*) was also sighted, it is not a well-known snake and seldom seen.

**Photo 5: Mopane snake**

**Species Status Quo**

Reptile lists provided are for the species most likely to occur in the study site using alternative habitats as indicators for reptile fauna present on the site. As control the reptile list for the Messina-, Langjan Provincial nature Reserves and Mapungubwe National Park (formerly the Vhembe Provincial Nature Reserve) were used.

Table 6: Herpetofauna checklist

| **Table 11: Herpetofaunal checklist compiled from control lists for three provincial reserves within 90 km radius (Messina Nature Reserve, Langjan Nature Reserve and Mapungubwe National Park.** | | |
|---|---|---|
| **TORTOISES AND TERRAPINS** | | |
| NO | SCIENTIFIC NAMES | **COMMON NAMES** |
| 1 | *Geochelone pardalis* | Leopard Tortoise |
| 2 | *Kinixys spekii* | Bell's Hinged Tortoise |
| 3 | *Pelomedusa subrufa* | African Helmeted Terrappin |
| **LIZARDS** | | |
| 1 | *Afroedura t. transvaalica* | Transvaal Gecko |
| 2 | *Hemidactylus mabouia* | Moreau's Tropical House Gecko |
| 3 | *Lygodactylus c. capensis* | Cape Dwarf Gecko |
| 4 | *L. stevensoni* | Stevenson's DwarF Gecko |
| 5 | *L. bradfieldi* | Bradfield's Dwarf Gecko |
| 6 | *Ptenopus g. garrulus* | Barking Gecko |

| | | |
|---|---|---|
| 7 | *Pachydactylus punctatus* | Speckled Gecko |
| 8 | *Pachydactylus tigrinus* | Tiger Gecko |
| 9 | *P. c. capensis* | Cape Gecko |
| 10 | *P. bibronii* | Bibron's Gecko |
| 11 | *Agama atricollis* | Tree Agama |
| 12 | *A. armata* | Not available |
| 13 | *Chamaeleo d. dilepis* | Flap-necked Chameleon |
| 14 | *Scelotus limpopoensis albiventris* | Limpopo Dwarf Burroughing Skink |
| 15 | *Mabuya quinquetaeniata margaritifer* | Rainbow Skink |
| 16 | *Mabuya capensis* | Cape Skink |
| 17 | *Mabuya variegata punctulata* | Speckled Skink |
| 18 | *M. varia* | Variable Skink |
| 19 | *M.s. striata* | Striped Skink |
| 20 | *Lygosoma s. sundavallii* | Sundevall's Writhing Skink |
| 21 | *Panaspis wahlbergii* | Wahlberg's Snake-eyed skink |
| 22 | *Acontias percivalli occidentalis* | Percival's Legless Skink |
| 23 | *Nucras caesicaudata* | Blue-Tailed Sandveld Lizard |
| 24 | *Nucras taeniolata holubi* | Ornate Longtailed Lizard |
| 25 | *N. intertexta* | Spotted Longtailed Lizard |
| 26 | *Heliobolus lugubris* | Bushveld Lizard |
| 28 | *Ichnotropis squamulosa* | Common Rough-scaled Lizard |
| 29 | *Cordylus tropidosternum jonesi* | Tropical Girdled Lizard |
| 30 | *Platysaurus intermedius rhodesians* | Common Flat Lizard |
| 31 | *Platysaurus i. Intermedius* | Common Flat Lizard |
| 32 | *Gerrhosaurus v. validus* | Giant Plated Lizard |
| 33 | *G. flavigularis* | Yellow-throated Plated Lizard |
| 34 | *G. nigrolineatus* | Black-striped Plated Lizard |
| 35 | *Varanus albigularis* | Rock or white-throated Monitor |
| 36 | *V.n. niloticus* | Nile or Water Monitor |
| 37 | *Monopeltis s. sphenorhynchus* | Slender Spade-snouted Worm Lizard |
| **SNAKES** | | |
| **NO** | **SCIENTIFIC NAMES** | **COMMON NAMES** |
| 1 | *T. s. schlegelii* | Schlegels' Blind Snake |
| 2 | *Leptotyphlops longicaudus* | Long-tailed Thread Snake |
| 3 | *Python sebae natalensis* | African Rock Python |
| 4 | *Lamprophis fuliginosus* | Brown House Snake |
| 5 | *Lycophidion c. capense* | Cape Wolf snake |
| 6 | *Mehelya capensis* | Cape File Snake |
| 7 | *M. nyassae* | Black File Snake |
| 8 | *Psammophylax tritaeniatus* | Striped Skaapsteker |
| 9 | *Rhamphiophis oxyrhynchus* | Rufous Beaked Snake |

| | | |
|---|---|---|
| | *rostratus* | |
| 11 | *Psammophis s. subtaeniatus* | Stripe-bellied Sand Snake |
| 12 | *P. angolensis* | Dwarf Sand Snake |
| 13 | *P. jallae* | Jalla's Sand Snake |
| 14 | *Aparallactus capensis* | Cape Centipede Eater |
| 15 | *Atractaspis bibronii* | Southern or Bibron's Burrowing Asp |
| 16 | *Philothamnus s. semivariegatus* | Spotted Bush Snake |
| 17 | *Crotaphopeltis hotamboeia* | Herald or Red-lipped Snake |
| 18 | *Telescopus s. semiannulatus* | Eastern Tiger Snake |
| 19 | *Dispholidus t. typus* | Boomslang |
| 20 | *Thelotornis c. capensis* | Bird or Twigg Snake |
| 21 | *Dasypeltis scabra* | Commong or Rhombic Egg Eater |
| 22 | *Elapsoidea sundevallii longicauda* | Sundevall's Garter Snake |
| 23 | *Aspidelaps s. scutatus* | Shield-nose Snake |
| 24 | *Naja haje annulifera* | Snouted Cobra |
| 25 | *N. mossambica* | Mozambique Spitting Cobra |
| 26 | *Dendroaspis polylepsis* | Black Mamba |
| 27 | *Causus rhombeatus* | Common Night Adder |
| 28 | *Bitis caudalis* | Horned Adder |
| 29 | *Bitis a. arietans* | Puff Adder |

**Red Data Reptile Species**

Red Data Species as listed by McLachlan (1978) indicates that the following species occur.

Table 7: Herpetofauna Red Data Species

| SCIENTIFIC NAMES | COMMON NAMES | PRESENCE |
|---|---|---|
| **VULNERABLE** | | |
| *Python sebae* | African Rock Python | Possible |
| *Varanus exanthhematicus* | Veld Monitor | Possible |
| *Varanus niloticus* | Water Monitor | Not found |

None of the three vulnerable species were identified. The habitat is suitable for all three species due to the water habitat created by water drainage from croplands and storage dams.

Habitat description

Natural terrestrial habitat consisting mainly of semi-arid savannah is found outside the proposed development footprints. The Limpopo River and Zwartberg mountain is nearby as more specialised habitat reservoir for species.

Habitat assessment

The rocky outcrop on the project area provides suitable refuge and permanent habitat for species.

**Photo 6: Giant Plated Lizard**

Habitat after construction

Influence by the development will be low as the areas is mostly semi-arid savannah. After completion it can be expected that the permanent water (seepage) will create new opportunities for reptiles.

## Amphibian's survey

Breeding of African frogs is strongly dependant on rain, especially in the drier parts of the country where surface water only remains for a short period. The species which will occur will be mostly tropical savannah species. The combination of rainfall, temperature and humidity is particularly conducive to frog life. Most frog species in the drier regions of Limpopo province are classified as explosive breeders. Pans provide habitat for short periods when filled with water. No species were found during surveys (undertaken from October-, December 2021 and January 2022). Another important role that surveying of amphibians provide is the "health quality" of water sources and water seepage areas. Due to the sensitivity of amphibians to the quality of water they serve as an indicator of pollution which was used in this survey as an indicator of excessive pesticide and herbicide applications.

Species Status Quo

The list below provided are for the species most likely to occur on the study site using alternative habitats as indicators. As control the amphibian list for the Messina-, Langjan Provincial nature Reserves and Mapungubwe National Park (formerly the Vhembe Provincial Nature Reserve) were used.

Table 8: Amphibian list that can occur on project area

| **Scientific name** | **Common name** | **Conservation Status** |
|---|---|---|
| **Family: Artholeptidea** | | |
| **Genus: Bufo** | **Toads** | |
| *Bufo fenoulheti* | Northern Pygmy Toad | Least Concern |

| | | |
|---|---|---|
| *Bufo garmani* | Eastern olive Toad | Least Concern |
| *Bufo gutturalis* | Guttural Toad | Least Concern |
| *Bufo maculatus* | Flat-backed Toad | Least Concern |
| *Bufo poweri* | Western Olive Toad | Least Concern |
| **Family: Hemisotidea** | | |
| **Genus: Hemisis** | | |
| *Hemisis marmoratus* | Mottled Shovel-nosed Frog | Least Concern |
| **Family: Hyperoliidae** | | |
| **Genus: Hyperolius** | | |
| *Hyporelius marmoratus* | Painted Reed Frog | Least Concern |
| *Hyporelius pusillus* | Water Lily Frog | Least Concern |
| **Genus: Kassina** | | |
| *Kassina maculata* | Red-legged Kassina | Least Concern |
| *Kassina senegalensis* | Bubbling Kassina | Least Concern |
| **Genus: Leptopelis** | | |
| *Leptopelis mossambicus* | Brown-backed Tree Frog | Least Concern |
| **Family: Microhylidea** | | |
| **Genus: Breviseps** | | |
| *Breviseps aspersus* | Bushveld Rain Frog | Least Concern |
| **Genus: Phrynomantis** | | |
| *Phyronomantis annectens* | Banded Rubber Frog | Least Concern |
| **Family: Petropedetidea** | | |
| **Genus: Cacosternum** | | |
| *Cacosternum boettgeri* | Boettger's Caco | Least Concern |
| **Genus: Phrynobatrachus** | | |
| *Phrynobatrachus mababiensis* | Dwarf Puddle Frog | Least Concern |
| *Phrynobatrachus natalensis* | Snoring Puddle Frog | Least Concern |
| **Family: Ranidae** | | |
| **Genus: Afrana** | | |
| *Afrana angolensis* | Common River Frog | Least Concern |
| **Genus: Ptychadena** | | |
| *Ptychadena mossambica* | Broad-banded Grass Frog | Least Concern |
| *Ptychadena porosissima* | Striped Grass frog | Least Concern |
| *Ptychadena uzungwensis* | Udzungwa Grass frog | Least Concern |
| **Genus: Pyxicephalus** | | |
| *Pyxicephalus adspersus* | Giant Bullfrog | Threatened |
| *Pyxicephalus edulis* | Edible Bullfrog | Least Concern |
| **Genus: Tomopterna** | | |
| *Tomopterna cryptonis* | Tremelo Sand Frog | Least Concern |
| *Tomopterna delandii* | Cape Sand Frog | Least Concern |
| *Tomopterna marmorata* | Russet-backed Sand Frog | Least Concern |
| **Family: Ranidae** | | |

| | | |
|---|---|---|
| **Genus: Chiromantis** | | |
| *Chiromantis xerampelina* | Foam Nest Frog | Least Concern |

Red Data Species

No Red Data Species were identified that could possibly occur on the project area.

Habitat Description

Suitable habitat consists of the pans (outside footprint and adjoining farms) and terrestrial habitats (semi-arid). The rainy period plays an important role in species presence and is functional for short periods.

Habitat Assessment

The habitat potential for the project area at present is limited to the rainy period and is also influenced by the amount it rains and the subsequent follow-up rains to ensure that species complete their life cycle. The endorheic pans provide temporary habitat when filled, they will remain unchanged. Seepage from storage dams will provide year-round habitat for species that will colonise over time.

## 8.3 Wetland and Watercourses Assessment

AQUATIC SENSITIVE AREAS AND SYSTEMS

Consideration to the receiving environment and in specific aquatic sensitive areas and systems (wetlands and riparian vegetation) has indicated that none is found on the project area or influenced by the project.

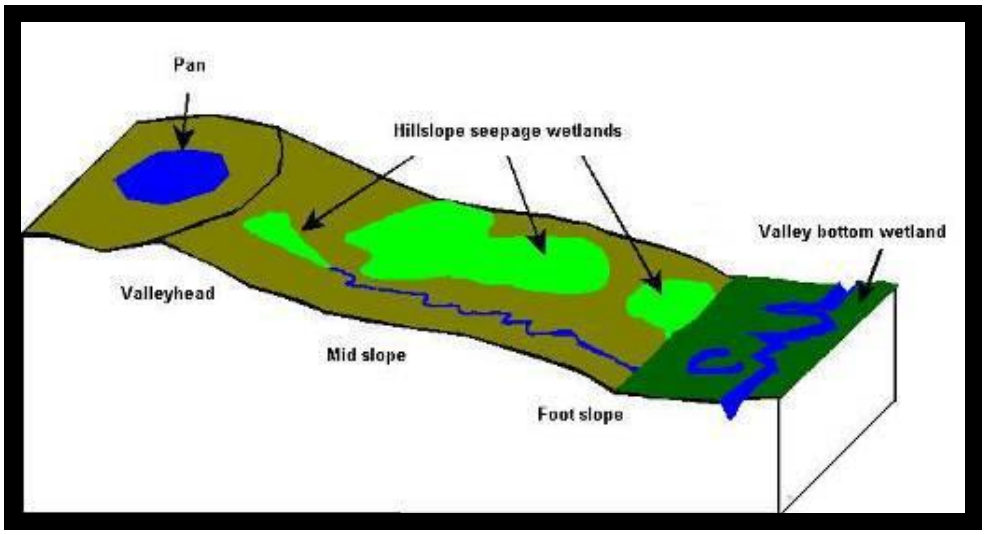



**Figure 6: Diagram illustrating position of various wetland types within the landscape**

The National Water Act (Act No 36 of 1998) defines wetlands as those ecosystems where:

> *"Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil."*

No wetlands are found on the project area.

The National Water Act defines a riparian habitat as follows:

> *"Riparian habitat includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterized by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas"*

No riparian vegetation is found on the project area.

The project also is situated outside the flood line-and riparian zone of the Limpopo River.

The watercourse west and east the proposed croplands will not be affected and is located outside the footprint. The pans are located outside the footprints of the development areas and should be indicated for purposes of planning as no-go areas during development in a zoning plan.

## 9 POTENTIAL IMPACTS

### 9.1 Habitat Destruction

Historical perspective

Although the existing human activity on the project is clearly visible, the more recent presence of other human interference such as impacts (direct or in-directly) on vegetation and fauna by fencing and roads in the area was found in-situ on an intense scale. Mostly terrestrial medium-and large mammal species (which has a low presence currently) are already being impacted on by restricting their movement, arboreal species were not influenced as severely. On the other hand, the question of what impact the development will have on the current species, this can partly describe due to the experience and observations on developments in the area. Normally it is found that species will disperse to surrounding areas and adapt to new patterns. What was also evident was the presence of specific species inside the existing fenced croplands or directly adjoining. Species presence and/or signs found indicate that the remaining mammals, birds and reptiles are established and survive. The presence of migrating birds and other non-endemic species found supports the aforementioned. The habitat has been used over nearly 120 years (starting 1906 with settlement by trek-farmers) with the last 70 years for farming activities initially consisting mainly for cattle and dryland croplands with a shift to extensive irrigation croplands and game production.

The aerial (circa 28 September 1956) photography shows various croplands, not seen unless enlarged are the fencing for grazing camps.

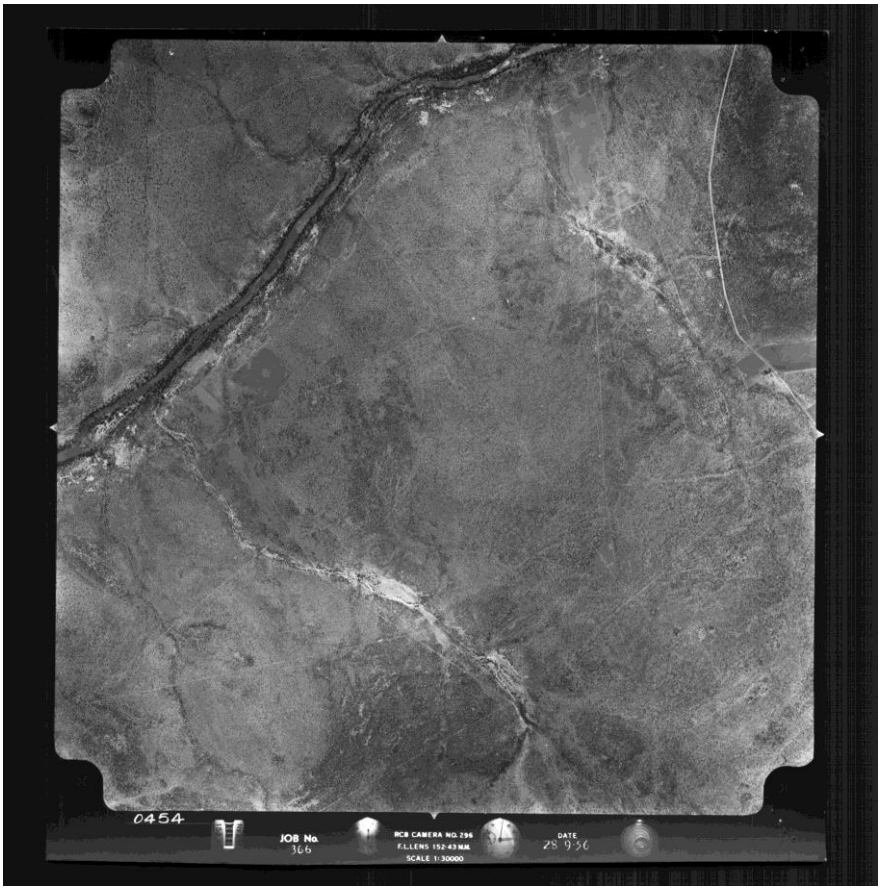



**Figure 7: 1956 Monochrome aerial photo**

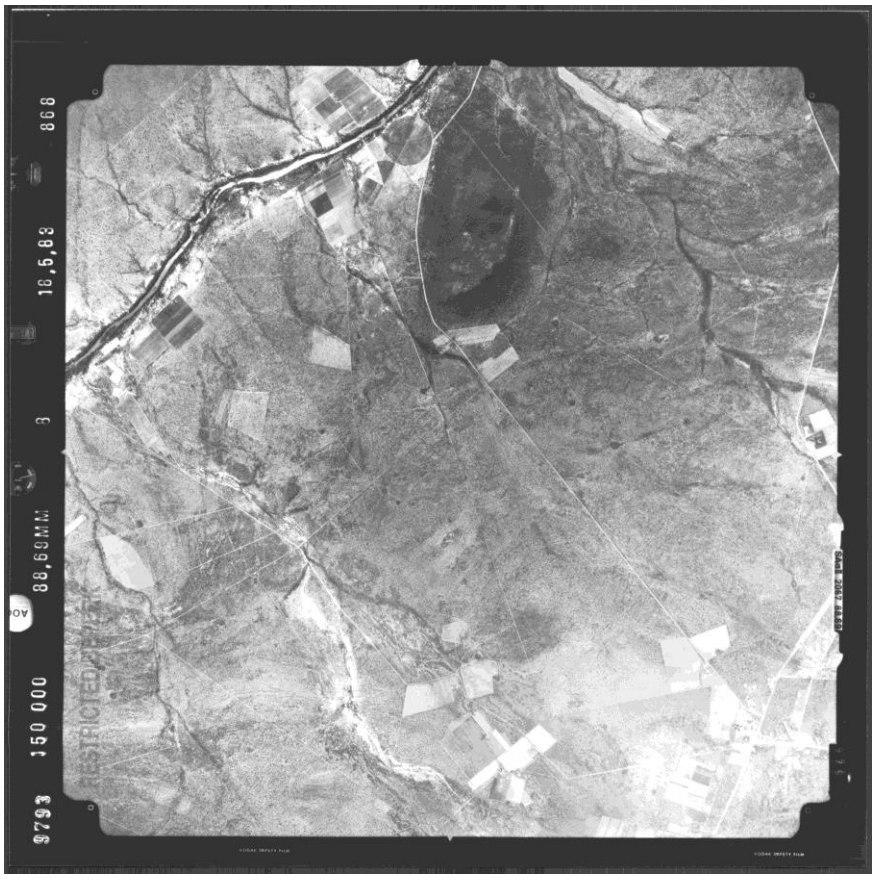



**Figure 8: Aerial monochrome dated 1983 for project-and surrounding area**

Since the mid-1980 the area has been placed increasingly under further farming development. The location is exclusively terrestrial. Foliage is sparse in general during wintertime necessitating larger game species to roam further afield (if they are overstocked). Terrestrial species is driven mostly by the need of water and large ranging areas for food in this arid landscape. The rangeland for larger mammals and large predators was further restricted by removing natural prey in earlier farming activities. Predation on cattle also resulted in extermination by farmers. This changed in the mid-1970's when game was recognised as a specific financial commodity for hunting and ecotourism. A change in legislation also allowed for ownership of game on farms adequately fenced and issued and exemption permit. Farm were game fenced and electrified. In 2010 a new trend in intensive breeding programs for colour and horn size developed and resulted in fences upgraded with mesh and even more intensely electrified. This resulted in a total barrier block of medium and larger mammal movement. Thus, corridors were severed for landbound movement and migration disrupted for large and medium mammal species.

Cumulatively the above changed the habitat connectivity and migration before the implementation of LEDET's guidelines on Critical Biodiversity Areas and Ecological Support Areas. The timeline of events described above was not fully assessed or taken into consideration for the CBA delineation. Observations during surveys revealed that cropland development in the past were not in proximity of drainage lines into which water collected from surface flow, aerial photographs confirm this issue. Common sense prevailed (by the farmers) and development mostly left watercourses intact.

Habitat destruction by development of croplands

Removing vegetation from an area effectively removes many forms of natural habitat occupied by various life forms of mammals, birds, reptiles, amphibians, and insects. Larger trees such as *Vachellia (Acacia) nigrescens* could be used for nesting by the larger birds of prey. Smaller less agile species is more prone to be affected by habitat loss. It can be expected that reptiles will be the component most affected due to their mobility. Mammals (those found to be currently present) and birds are more agile and can move quicker away from disturbances. Most species affected would be able to move as soon as disturbances occur by bush-clearing activities to surrounding areas.

Construction Phase

The largest portion of vegetation that will be removed is dominated by *Acacia species*. Two (un-named) Woodland Drainage Lines outside the footprint will not be directly affected. The remaining woodland will to a lesser extent function ecologically. It will be replaced by an agriculture ecosystem (croplands) which will function as minor ecosystem in the larger ecosystem context.

Various large trees, e.g., Black Monkey Thorn, Apple-Leaf, Knob-Thorn, Baobab (single specimen), Shepard's trees being the most prominent large trees with medium size trees consisting of *Acacia-, Commiphora-and Terminalia species* with *Grewia species* as shrub stratum. Existing large trees found outside the footprint can provide specific habitat for nesting-and roosting sites for birds. The project is situated outside of the 1:20-year flood line of the Limpopo River. Protected tree species included Leadwood, Apple leaf, Shepherd's Tree, Marula, and a Baobab.

Operational Phase

After construction no more trees will be removed outside of the footprint areas, the cropland areas will be fenced to prevent damage by wildlife and will create a physical barrier that will help in spill-over damage from farming activities. What can be expected is that the remaining vegetation will remain and will be maintained by seepage from the croplands as well as from stormwater outlet in dry periods. The vegetation will however mostly be dependent on annual rainfall.

**Identified impacts**

The following impacts have been identified:

- Removal of natural vegetation and in effect habitat.
- Removal of protected tree species.
- Destruction portions of one specific vegetation community.
- Altering carrying capacity for grazers and browser species habitat.

**(i) Removal of natural vegetation**

The removal of vegetation will be on ± 955 hectares. The removal will add to the ever-increasing loss of vegetation and could also result in fragmentation thereof if corridors were not possible. Cropland farming could be the main culprits of destruction of sensitive vegetation at the farming nodes along the Limpopo River if incorrectly planned and executed.

The location of the new-and existing footprints will allow movement of wildlife species along natural vegetated corridor areas. The areas cleared of natural vegetation will be replaced by croplands. It can be expected that the carbon cycle of the natural vegetation will be partly compensated for by the croplands. The rotation croplands will be planted with grass which will also contribute to carbon cycle.

Past impacts consisted of infrastructure development for farming activities, mostly fences (with cut lines), roads, housing, packing warehouses and pipelines.

Past overgrazing and impacts by drought (and fire) have left the area with dense patches of encroached herbaceous cover. The woody component is well established.

The combined surface areas of the farm Zwartberg 75 MR (portion 1 and Restant) are 1954 hectares (area of influence). The two areas are divided by an electrified game fence, this fence will be removed (comment by applicant) and is supported and enhance connectivity and corridors. Areas not suitable for development surrounds the existing and proposed croplands and can function as natural habitat. The combined footprints of the areas are approximately 955 hectares and represents ±48% of terrestrial vegetation, no sensitive vegetated areas are directly affected.

**(ii) Removal of protected species**

Tree species that are considered protected in accordance with the National Forest Act 1998 (Act No 84 of 1998) were recorded. These species were:

- Leadwood (*Combretum imberbe*).
- Shepherd's tree (*Boscia albitrunca)*.
- Apple leaf (*Philenoptera violacea)* previously (*Longocarpus capassa)*.
- Marula (*Sclerocarya birrea*)
- Baobab (*Adansonia digitata*).

Species that can influence Red Data species, and other species, due to their ability to encroach is also listed according to the Conservation of Agriculture Resources, 1983 (Act No 43 of 1983). These species are:

- *Acacia species*
- *Dichrostachys cinerea*
- *Grewia bicolour*
- *Grewia flavescens*

Temperature and rainfall are important climatological parameters in sustaining the physical environment and plays a significant role in determining the biotic environment of a specific area. Temperature and precipitation data are included for a better understanding and interpretation of the natural environment as found in the general area.

Van der Walt (2009) is quite correct in her mentioning that information on the occurrence and distribution of threatened and endemic species in the Limpopo Valley region are limited.

The following species is listed in the Interim Red List, March 2006, as compiled by the Threatened Species Programme (Van der Walt, 2009).

**Table 9: Interim Flora Red Data List for threatened species**

| No | Botanical name | Common name |
|---|---|---|
| **ENDANGERED** | | |
| 1 | *Plinthus rehmannii* | Not available |
| **RARE** | | |
| 2 | *Otholobium polyphyllum* | Not available |
| 3 | *Peristrophe cliffordi* | Not available |
| 4 | *Peristrophe decorticans* | Not available |
| 5 | *Peristrophe gillilandiorum* | Not available |
| **LEAST CONCERNED** | | |
| 5 | *Barleria holubii* | Small-leaved Barleria |
| 6 | *Hermbstaedtia capitata* | Not available |
| 7 | *Hibiscus waterbergensis* | Not available |
| 8 | *Hoodii currorii subsp. Tugardii* | Ghaap |
| 9 | *Psoralea repens* | Not available |

The habitat requirements and distribution of these species were scrutinized during surveys to establish and confirm the presence on the site. None was found on footprints. Species protected under the Limpopo Environmental Management Act, 2003 (Act No.107 of 2003) such as *Orbea carnosa, O. rogersii* and *Tavaresia barklyi* was not found in the project area.

The drought (and subsequent heavy grazing and fire) could have a significant influence on presence of species.

**(iii) Destruction portions of a specific vegetation units (community)**

Woodland with its larger trees serves many purposes in the ecology of the area with the highest diversity of vegetation found along rivers, terrestrial drainage lines, mountains, and rocky ridges in the semi-arid landscape.
This area had a Poor conservation value with poor species richness and low presence of exotic species and human related disturbances.

**(iv) Altering carrying capacity for grazers and browser species**

The clearing of vegetation will effectively remove grazing and browsing from the carrying capacity of game. The impact of overgrazing can be managed by adapting game numbers. During surveys the field conditions was assessed by using a practical method for veld condition assessment.

## 9.2 Impacts on the vegetation

State of vegetation (plant communities found)
Vegetation type: Limpopo Sweet Bushveld No 17 (SVcb19) and Acocks (Arid Sweet Bushveld: A 14)
Two plant communities were identified and is discussed below.
**Plant community 1:** *Acacia nigrescens-Boscia albitrunca-Terminalia prunioides-Commiphora* and *Grewia species* woodland. (Photo 1)
This vegetation unit occurs over the largest portion of the project area. It is located between the Zwartberg mountain to the north-east and has two drainage lines located outside the footprint area which drains towards the Limpopo River. An isolated dolerite outcrop on a calcrete ridge is found on the southern side of the farm, it does not form part of the proposed cropland area. The area has been settled on since 1903 with early cropland farming visible on arial photographs dated 1956 and shows a progressive expansion from that period. Cattle farming was historically present and also present to date which resulted in overgrazing and subsequent bush encroachment consisting mainly of *Acacia species*, *Commiphora pyracanthoides* and *Grewia species*. *Acacia nigrescens* and *Boscia albitrunca* is the dominant tree species. Signs of human activities was found throughout the survey areas. The area has been mapped for soil characteristics and properties for croplands.

**Photo 7: Aerial view from 85m**

| | |
|---|---|
| State of vegetation | Natural |
| Conservation priority | Medium |
| Characteristics description | Structure: This vegetation unit is characterized by a woody layer mostly dominated by medium-large sized trees and medium shrubs that form an open to medium dense structure. The woody species is dominated by Knob Torn, Marula, Shepherd's Tree, Lowveld cluster leaf, *Commiphora* and *Grewia* species throughout its distribution in the local context. Substrate is shallow calcareous soils derived from limestone.<br>Drainage is by surface flow.<br>Soils: Mostly deep sandy-loam soil which drains freely on flat landscape. Calcareous soils derived from limestone also found where topography change. |
| Trees | Highest height: 11m<br>Average height: 6.5m<br>Density: 10-15% |
| Shrubs | Average height: 3m<br>Density: 20-30% |
| Herbaceous | Grasses average height: 0.8-1.2m<br>Grasses basal cover: Moderate<br>Forbes average height: 0.8m<br>Forbes basal cover: Low |
| Sensitivity | Moderate – indigenous woodland with a widespread status |

| | |
|---|---|
| Protected Trees | *Sclerocarya birrea* (Marula)<br>*Boscia albitrunca* (Shepherd's tree) |
| Red Data species | None observed |
| Current land use | Grazing: cattle and game. |
| Veld condition | Fair |

The following specific recommendations for the vegetation unit regarding the proposed development should be adhered to:

- The vegetation unit is classified as least concerned and has a wide distribution.
- The layout should not infringe outside the recommended development footprint for croplands.
- Protected trees should be incorporated in the layout of croplands, where not possible destruction permits should be applied for from DFFE.
- The development of croplands is considered as highly suitable in this area.

**Plant community 2:** *Boscia albitrunca, Commiphora gladulosa, Acacia mellifera* and *Sesamothamnus lugardii* woodland**.** (Photo 2)

This vegetation unit occurs in the north-eastern part of the proposed croplands site. The substrate forms medium depth red, yellow apedal soils derived from limestone, isolated shallower areas where calcrete shows are present. The deeper sandy-loam soils are indicated by the presence of medium tree species such as black monkey thorn and corkwood while the shrub layer is characterized by the dominance of *Commiphora pyracanthoides* and *Grewia bicolor*. The woody structure is open woodland with a low-developed shrub layer. Photo 2 indicates the state of the woody and herbaceous layer. The area has been mapped for soil characteristics and properties for croplands.

**Table 10: Botanical analysis and characteristics of Plant Community 2**

| | |
|---|---|
| State of vegetation | Natural |
| Conservation priority | Medium |
| Characteristics description | Structure: This vegetation unit is characterized by a woody layer mostly dominated by medium sized trees and medium shrubs that form an open structure. The woody species is dominated by Black Monkey Thorn, Tall common corkwood, Shepherd's Tree, Lowveld cluster leaf and the shrub layer by *Commiphora, Grewia* species and the distinct *Sesamnotamnus lugardii* throughout its distribution in the local context.<br>No drainage lines, drainage by surface flow.<br>Soils: Mostly medium-deep sandy-loam soil which drains freely on flat landscape. Calcareous soils derived from limestone intrusions also found. |
| Trees | Highest height: 9m<br>Average height: 5.5m<br>Density: 5-10% |
| Shrubs | Average height: 3m<br>Density: 15-20% |
| Herbaceous | Grasses average height: 0.8-1m |

| | |
|---|---|
| | Grasses basal cover: Moderate<br>Forbes average height: 0.6m<br>Forbes basal cover: Low |
| Sensitivity | Moderate – indigenous woodland with a widespread status |
| Protected Trees | Boscia albitrunca (Shepherd's tree) |
| Red Data species | None observed |
| Current land use | Grazing: cattle and game. |
| Veld condition | Fair |

The following specific recommendations for the vegetation unit regarding the proposed development should be adhered to:

- The vegetation unit is classified as having a low sensitivity due its widespread occurrence in the Savanna Biome;
- The eradication of protected trees would need a permit from DFFE.
- The development of croplands is considered suitable in this area, provided that the soil depth is confirmed as suitable for crop cultivation under irrigation as per soil surveys conducted.

## 9.3 Faunal Findings

### 9.3.1 Habitat assessment

The habitat surrounding the project areas of the two farms is used for crop and game farming with ecotourism and has been altered moderately before this survey. Fauna species have various levels of mobility and presence is also dependant on seasonal change. Human interference and activities also have a marked influence.

**Habitat after construction**

In the literature studies it was evident that species associated with the typical terrestrial Limpopo Sweet Bushveld was historically distributed in the region, this can be confirmed by the author who has worked in the region and along the Limpopo River since 1975 as a nature conservator. Smithers (1983) provides distribution descriptions and maps for species mentioned in Table 3.

The habitat remaining after development will be able to support most of the species currently present. Corridors along terrestrial ephemeral watercourses is open from terrestrial landscape to Limpopo River. Corridors are also created by cropland layout, also channelling movement to the river or inland.

**Habitat on adjoining areas**

The habitat of the project areas should not be considered in isolation as it would be unwise if adjoining land uses to the adjoining land-uses are available for ecological processes. Movement of larger mammal game species will however be restricted by the game fences with movement possible for medium and smaller mammals. Connectivity between habitats is along corridors and has an influence on the survival of species and faunal communities. Taken into consideration the size of properties representing faunal species and

communities, they can still function albeit with supporting management input from farmers, and this they do as the game is an economic asset.

### 9.3.2 Impact on species

Direct impacts on survival of species indicated that the proposed extension configuration will moderately influence species' movement. The carrying capacity of the area will not be able to be sustainable for the existing numbers of game. The game numbers will have to be adapted downward. The prominent game species found were duiker, Steenbuck, impala, kudu, eland, warthog, gemsbok, waterbuck, and giraffe. The only predators were caracal. The landowners mentioned the presence of leopard, but no signs were found during surveys.

Indicator species were observed in the croplands and directly on proposed footprints. These species' importance is that they survive in the altered environment with the new ecotone created. Civet was found in the croplands and Steenbuck and Banded mongooses were found both in the croplands and in adjoining areas. The croplands created a new trophic area for omnivores such as the Civet and Mongooses. This is indicative that the use of chemicals and pesticides is at such levels that insects as food source are not toxic to these two species. The crops eaten by civets are pumpkin, watermelon and potatoes which do not seem to influence the species. Their presence indicate that farming practices is within prescribed chemical and pesticide specifications for toxic levels.

## 10 BIODIVERSITY INTEGRITY (BI)

The Convention on Biological Diversity (CBD) defines biodiversity as "***the variability among living organisms from all sources including,*** **inter alia,** ***terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.****"* It is the variety of life on earth at all levels, from genes to worldwide populations of the same species; from communities of species sharing the same small area of habitat to worldwide ecosystems.

**Levels of biodiversity**

- *Ecosystems* containing rich biodiversity, large numbers of threatened or endemic species, that are important for migrating species; have social, economic, cultural or scientific significance or support key processes.
- *Species* and communities of species that are threatened, related to domesticated or cultivated species, have medicinal, agricultural, or other economic, social, cultural, or scientific significance and indicator species.
- *Genotypes* with social, scientific or economic significance.

To provide an understanding of how biodiversity is likely to respond to a proposed activity; impacts at **each level** of diversity can be best assessed in terms of:

- *Composition:* what biological units are present and how abundant they are.
- *Structure* (or pattern): how biological units are organized in time and space.
- *Function:* the role different biological units play in maintaining natural processes and dynamics.

There are several planning guide documents produced by SANBI for South Africa as a whole, as well as the Conservation Plan for Limpopo (2013) by LEDET on provincial levels that allow

for conservation planning as well as meeting biodiversity targets for the country's variety of ecosystems. These guides are essential to source for desktop studies for proposed development projects. The information from said guides together with the onsite surveys and subsequent reports form an important part of the sensitivity analysis. In addition, sensitivity analysis during field surveys provides finer scale data to be used to ground truth the larger scale assessments and put it into a more localised context. The sensitivity for a proposed project area should be seen in context of the total surrounding area to be able to properly understand the sensitivity issues and to place them in context.

**Biodiversity Important Areas**

These are the areas that has a regional influence on the biodiversity and is entrenched in legislation and planning guidelines according to the NEMA: Biodiversity legislation. The proposed development is considered in relation to its influence on these areas.

(i) CBA's and ESA's
(ii) Protected Areas
(iii) Protected Areas' Buffers
(iv) Priority Areas for Protected Areas Expansion
(v) Surface Strategic Water Source Areas: Terrestrial
(vi) Indigenous Forests

## 10.1 Critical Biodiversity-and Ecological Support Areas

The purpose of the Limpopo Conservation Plan version 2 (LCPv2) is to develop the spatial component of a bioregional plan. The Limpopo Conservation Plan categories for the proposed croplands are presented in Figure 8.

When compared to the conditions on site it does not correlate.

The Screening Tool indicate the area as Very High Potential Agriculture area.

In the Waterberg Spatial Development Framework (9 July 2021) the area is indicated as Protected Agriculture Areas (DAFF, 2021, Figure 51 on page 136), although the project is in Capricorn District the zoning crosses the administrative boundary.

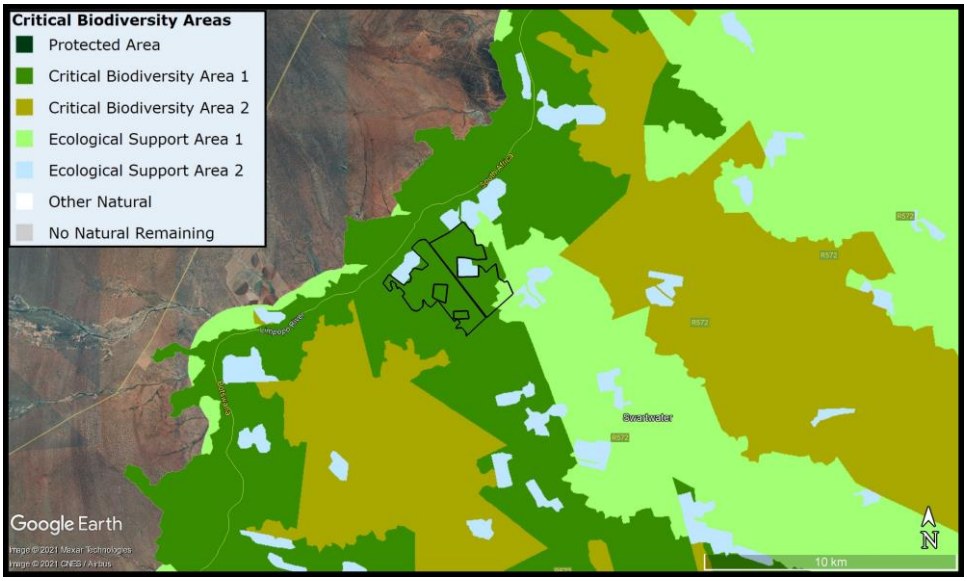



**Figure 9 : CBA for area**

### 10.2 Protected Areas

No areas in radius of 70 km.

### 10.3 Protected Areas Buffer

No areas in radius of 70 km.

### 10.4 Priority Areas for Protected Areas Expansion

None.

### 10.5 Surface Strategic Water Source Areas: Terrestrial

None.

### 10.6 Surface Strategic Water Source Areas: Aquatic

None

### 10.7 Indigenous Forests

None.

### 10.8 Important Birding Areas

None. Refer to Table 4.

**Table 11: Biodiversity Sensitivity**

| Biodiversity Important Areas | Sensitivity Rating (Very High/Low) | Verification: describe |
|---|---|---|
| CBA,s and ESA's | Low | ESA 2 verification recommended<br>Area has been mostly transformed by agriculture |
| Protected Areas | Low | None in 70 km radius |
| Protected Areas Buffers | Low | None |
| Priority Areas for Protected Areas Expansion | Low | None |
| Surface Strategic Water Source Areas: Terrestrial | Low | No watercourse is affected by project. |
| Surface Strategic Water Source Areas: Aquatic | Low | Limpopo river or Riparian Zone affected |
| Indigenous Forests | Low | None |
| Important Birding Areas | Low | None |

## 11 ECOLOGICAL EVALUATION

### 11.1 Habitat Integrity (HI)

A stable habitat provides a template for a certain level of biotic integrity to be realised. Habitat integrity is linked to Biodiversity Integrity; it is the supporting structure in nature. To determine the HI the elements of habitat must be in balance. They are:

**Habitat: Vegetation**

Vegetation forms the main component of habitat. It will have a specific characteristic for an area that supports the biotic life-forms. Vegetation is static and has specific characteristics and structure for specific areas called bioregions. It is also the primary food producer. The surveys indicated that the remaining vegetation will still support some ecological functions, although at a lower intensity. Over time these ecological functions will stabilise at new levels of functioning. The vegetation will benefit from irrigation seepage water from croplands in the drier seasonal periods.

**Habitat: Water and food sources**

Water is a primary part of any biotic life-form with availability as a driver in organisms (mainly plant-and wildlife) found in an area. Wildlife as secondary food source or producers needs water and forms part of the food cycle. The croplands not only produce a crop product, but it also creates a new agriculture ecosystem. Medium-and small mammals can enter through fences and forage for insects and worms, also can they have their "share" of the crop. It is not uncommon to use damaged crop products as food for wildlife to support them in the dry season. Two bird species noted (in time more species will be discovered) has also adapted to the agriculture ecosystem by foraging and static hunting in both planted lands and rotation lands planted with grass. The Kori Bustard also breeds in the grassland created and have a positive contribution to the population. This is due to the electrification of fences which prevent small predators to enter.

**Habitat: Location and Space**

Biotic life-forms need space and in some instances are space specific in the habitat. Depending on a species' needs and social needs the locations and space varies in size. As mentioned above the Kori Bustard uses the location of rotation croplands in rest which also creates space for the area and regional population to forage and breed in the agriculture ecosystem. The undeveloped vegetated areas surrounding the croplands are included in the forage and range use of the species.

**Habitat: Availability**

To survive seasonal change (droughts and/or floods) life-forms have specific needs to survive, mate, reproduce and interact in social behaviour with other life-forms in an area. The natural woodland ecosystem and the agriculture ecosystem have a distinct ecotone. It is artificial in the form of an electric fence. The needs of species adapted to the change, and they utilise the "opportunity" that was created. It can, however, not accommodate all the species. Species are opportunistic and due to their presence, the level of tolerance in croplands can be measured in the level of destructive feeding habits. A Civet does not waste food by unnecessary damage to watermelon whereas a porcupine will "test" a couple of fruit, the same is applicable to baboons and warthogs which have a "destructive" feeding behaviour.

Habitat loss

Loss of natural habitat occurs with most forms of development and is also the case with this proposed development. It is sometimes referred to as habitat transformation. Habitat loss (**conversion**) may be irreversible, meaning that biodiversity patterns and processes can never be restored e.g., such as human settlements and most forms of mining for the study areas. In other instances, habitat loss (**degradation**) is reversible, meaning that local

biodiversity features may be restored to some extent, e.g., croplands. For example, overgrazed veld in some ecosystems can recover if the grazers are reduced and managed. Habitat loss (**fragmentation)** through sub-dividing landscapes by international borders and/or disease control fences of larger areas (and between countries) affect areas on a large scale, whereas human development affect it on a smaller scale. Habitat loss in South Africa, as well as world-wide, is the single biggest cause of biodiversity loss. Halting biodiversity loss depends on avoiding habitat loss in areas that are important for achieving biodiversity targets and slowing the rate of loss in adjoining and supporting other areas. Habitat loss creates "islands" of remaining habitat supported by systems to maintain the "islands". The more interference on the systems and habitats the higher the impact on ecological integrity.
One of the systems is a corridor. Corridors play an important role in the functioning of supporting of an area's vegetation, habitat and subsequent wildlife in an intricate pattern of seasonal movement. Two main physical landscape characteristics (secondary physical terrestrial landscapes serve as links between them) are found in nature that supports corridors. This includes mountain ranges and drainage lines (including perennial rivers and streams, non-perennial rivers and ephemeral rivers and large water courses). Drainage lines, watercourses and streams that cannot be described as rivers also play a role as corridors, especially those that drain directly into the Limpopo River. Man-made dams also fit into the natural pattern in nature, albeit over time. Any spatial component of an ecological process that may occur on site or location or in its vicinity (i.e., corridors such as watercourses, upland-lowland gradients, migration routes, and vegetation boundaries such as edaphic interfaces, upland-lowland interfaces, or biome boundaries) are considered.

## 11.2 Corridor's description

### Types of corridors

Corridors are diverse with the two main corridors for the project being terrestrial and arboreal corridors. Ecosystems in the riparian zone depend on water, sediment and nutrients carried by the stream. The riparian zone can be found along the banks of a river and watercourses and can include some form of floodplain. Corridors for ecological processes include an endless list of natural cause-and-effect relationships. Examples include pollination, migration, soil erosion, water purification and climate regulation. Such processes are complex and often poorly understood. They are also difficult to measure (usually conducted over longer periods) or to manage and plan for. **Few can be represented spatially on a map**. But ecological processes are as important to the persistence of biodiversity as the biological feature i.e., species, itself.
The **protected area conservation system** seeks to protect a representative sample of species, communities and ecosystems. Although many ecological processes will be conserved along with the protected biota, there are some that are not. The most obvious are those involving species movement and connectivity, i.e., those that are thwarted by habitat fragmentation. These processes were spatially represented and are incorporated into LEDET as ecological corridors in their "Conservation Plan". To be effective they must provide relatively uninterrupted strips of natural habitat in perpetuity, ultimately with special measures provided to encourage biological movement along their full length. Unfortunately, the CBA's and ESA's maps were found not to be reliable and placed unrealistic "pressure" on landowners, most of them being farmers. Conflicting with this is

the Protection of Important Agricultural Areas in which the project area is located. This application is by a farmer whose primary activity is crop-and cattle farming with game farming as secondary, but not less important, farming activity. Species which were historically present such as sable and buffalo has been reintroduced.

**Corridors found**

The most prominent corridors found are firstly the terrestrial biota, secondly the arboreal biota and thirdly the aquatic biota; the latter two biota focuses around and along the terrestrial dry watercourses. The corridors function mostly laterally along watercourses or along fence lines and roads as well as cross-sectional outward to the terrestrial area. It must be understood that the mentioned corridors function in the Limpopo Valley Physiological Region either inland from both banks, thus from the South African and Botswana sides of the Limpopo River (to the terrestrial zones) and up-or downstream. Thus, the Limpopo River is the main corridor for supporting various ecosystems. The "depth" to which this support functions depends on the condition of the receiving environment and the human activities that restrict, hamper or direct a specific species movement.

The terrestrial corridors are used mostly by mammals and birds. Influence on animal movement is mostly by man-made activities, thus artificial influences. In this project the terrestrial movement is mostly influenced by game fencing (around farms and croplands) as well as the human development (roads) inland from the Limpopo River.

The same phenomena were found when the first game fences were erected and later electrified on inland game farms. What can be said is that aggressive small breachers of fences such as warthogs and porcupines breached fences randomly when no special measures were taken. The primates, birds and bats are the prominent species that are not adversely influenced. Fences have a minimum influence on the birds and bats' movement. It is when the large trees are removed along the length of the watercourses that flows into the Limpopo River that serious impact on the nish habitats for those species are influenced. The project serves as an ecological corridor and more specific as ecological connectivity zone on an extensive geographical scale due to its location along the Limpopo River and in line between Blouberg Mountain (80km) and Tswapong Hills/Palapye Mountain (38km) in Botswana.

**Findings:**

**Terrestrial species**

Most of the game farmers implemented their own fences (some with electrification) for complying with game laws and for security purposes. In time the species came to accept the "barrier" and do not continuously force the "barrier". This is in line with what has been experienced on fenced game farms to keep in game. Little impact is expected by larger types of game species as they adapted to on-site conditions. Some medium and smaller species still breach the fence by digging and crawling. This can be controlled by inspections.

Arboreal species

The arboreal species will be impacted on when vegetation, especially large trees, are removed. Trees will remain on undeveloped areas.

Cumulative impacts from the removal of large trees on destruction of habitat (nesting-and roosting sites) for bird species such as:

Species with vulnerable conservation status which is indicated in the distribution range:

- Hooded vulture

- African white backed vulture
- Lappet faced vulture
- White-headed vulture
- Tawny Eagle
- Martial Eagle
- Bateleur

Near threatened conservation status:

- Secretary bird
- Bat hawk
- Ayre's eagle
- Crowned eagle.

The above list are species found in a larger range zone and includes other ecosystems. The consequences of removal of large trees should thus be placed in context in a larger range context (including Botswana which has a low human development influence). The project area and past-and-present farming activities would be a disturbance factor for species' nesting. Most of the species will prefer the undeveloped adjoining areas further inland or in Botswana.

Mitigating measures

(i) By keeping to the footprints, the impacts on terrestrial species can be kept to a minimum.
(ii) The areas between croplands and fencing of natural grass (considered as agricultural ecosystem) creates an ecotone from croplands to natural habitat.
(iii) The ecotone must be strengthened horizontally, vertically, and linearly to accommodate various species. This can be achieved by planting more "ecotone" friendly trees (providing shade and food for different species) as well as planting poles for birds, hawks, and eagles to rest on while they hunt for food in the croplands; planting pol-nest boxes for owls and bats around and near the croplands and also to establish beehives to support bees as part of the pollination process.
(iv) Not removing large trees on the remaining areas of the farm can still provide habitat for species.
(v) Fencing the new crop areas will also help and prevent "spill-over" vegetation damage.

**Conclusion**

(i) Large-, medium and small mammal species can adapt to the situation.
(ii) Game specie numbers will have to be adapted downwards.
(iii) Habitat will be lost and have a low significance on movement of species.

### 11.3 Connectivity description

Connectivity refers to the ecological connectedness of the pattern of habitats and distribution of species within a particular area. High connectivity facilitates the free movement of individuals and species. Habitats that are fragmented by development, present obstacles to biological movement and reduced connectivity in proportion to the intensity and type of development. Connectivity is either by land, water or arboreal and can be vertical or horizontal. Both landscapes, terrain forms and vegetation play a role. Habitats in isolation can be seen as "biodiversity islands" and is referred to as the "Island Biographical

Theory"[4]. The linear movement of land-based species along existing corridors has already been partly severed; movement will still be possible using the remaining corridors mostly by smaller mammals and birds. Larger mammals are fenced "in".

### 11.4 Pollution

11.4.1 Background

Pollution is a direct contributor to habitat loss and includes waste that is generated by farming, construction, human settlement, and crop farming by means of indiscrete use of fertilisers, chemical compounds, and pesticides. There are three forms of waste, firstly domestic waste (which includes damaged crop products), secondly general waste (which includes construction waste and can include rocks and stone removed form croplands) and thirdly hazardous waste (which includes fertilisers, pesticides, and chemicals). Other forms of pollution include noise, light and dust commonly found during construction and operational phases of development of new croplands, this will however be transient.

11.4.2 Situation

The level of pollution is localised and will be mostly dust and noise during the construction phase. Fertilisers, chemical compounds, and pesticide's pollution can occur on the new (and existing) croplands. Surveys indicated that this is not at present occurring based on the presence of various biota. It is therefore prudent that a monitoring plan is compiled to source data over time. This monitoring should be directly linked to the water quality as required by DWS in the WUL and chemical soil analysis conducted yearly. In the operational phase no pollution is expected to occur and is based on the observation of indicator wildlife species on and around the croplands. The "safety net" is a due-diligence monitoring plan.

11.4.3 Summary

(i) No signs of pollution were found.
(ii) There is remaining habitat surrounding the proposed development area.
(iii) The existing terrestrial ecosystem will adapt to new development and will still function. With mitigation and can provide habitat for various biota.
(iv) The level of pollution can be expected to be low.
(v) The monitoring currently conducted can be adapted to include mitigation.
(vi) There is a no probability of risk of infecting wildlife with illnesses.
(vii) There is a low probability of endangering the life of wildlife.
(viii) No Red Data species was identified, and none found during surveys.
(ix) Protected trees will be destroyed, identified specimens will be included in the layout of final footprint and other can be transplanted.
(x) There is a high risk of malaria with ponding stagnant open water.

## 12 ECOLOGICAL SENSITIVITY ANALYSIS

The Biodiversity Act provides for listing threatened and protected ecosystems as follows:
52 (1) (a) The Minister may . . . publish a national list of threatened ecosystems in need of protection.
(b) An MEC for environmental affairs may . . . similarly publish a provincial list of threatened ecosystems.

[4] Implications of Island Biography for Ecosystem Conservation. South African National Scientific Programmes Report No 61. September 1982.

52 (2) The following categories of threatened ecosystems may be listed in terms of subsection (1):

- 'Critically endangered' ecosystems – that have undergone severe ecological degradation and are at an extremely high risk of irreversible transformation.
- 'Endangered', or 'vulnerable' ecosystems – being categories of reduced degradation and risk, each less than the previous category above.
- 'Protected' ecosystems – being ecosystems that are not threatened but nevertheless, are worthy of special protection.

**Note:**

The project area **has not been published** as a threatened ecosystem.

**Ecological Integrity (EI)**

EI consists of Habitat Integrity and Biodiversity Integrity and the combined result is EI, any change in either HI or BI will influence EI.

Therefore, HI and BI should be able to provide an indication of an area EI. Any change in either HI or BI will alter EI.

It is the sum-total of all the systems and processes that are found in the specific ecosystem that provides an EI. The "cause-and-effect" determine the EI.

For this project the features mentioned above is valued to provide an indication of **Ecological Sensitivity (ES)** which in turn provides the EI. ES is the identification of the drivers for an ecosystem that is prone to be influenced and result in impacts.

**Terrestrial Ecological Sensitivity**

The sensitivity is measured by listing the aspects found to be most prevalent on the study area and the surrounding areas. They were identified during surveys.

Aspects for consideration:

- Ecological drivers: unique
- Ecological processes: complex
- Ecological functioning complex and interlinked
- Ecological corridors for communities/individuals
- Distinct landscape features
  - Wetlands
  - Pans/springs
  - Alluvial areas
  - Erosion
  - Old lands
  - Current agricultural areas
  - Ridges/mountains
- Specific biodiversity features or threatened ecosystem on site
- Special vegetation features
- Limited distribution of species
- Important and/or fine-scale habitats present
- Ecological connectivity of importance
- Corridors for Species of Conservation Concern

**Sensitivity Rating:**

- High Sensitivity = HS

- Medium Sensitivity = MS
- Low Sensitivity = LS

**Table 12: Ecological Sensitivity Rating**

| Sensitivity Rating | Sensitivity Aspect | Present (Yes) Not present (No) | Reason for sensitivity |
|---|---|---|---|
| L | Ecological drivers present (unique/specialist) | No | Homogenous arid environment |
| L | Ecological processes: complex | No | Homogenous arid environment |
| L | Ecological functioning complex and interlinked | No | No specialised habitats or ecotones present |
| L | Ecological corridors for communities/individuals | Yes | Two ephemeral watercourses and one mountain found outside the footprint area. Fences and roads also created corridors |
| L | Distinct landscape features | Yes | Endorheic Pans distributed on landscape Protected trees found on site |
| L | Specific biodiversity features or threatened ecosystem on site | Yes | Endorheic Pans. Excluded form development footprint. Can benefit from seepage and channelled water |
| L | Special vegetation features (Red Data- and Protected species) | Yes | Protected trees, limited number on project area due to suitable conditions. Same species are commonly found in surrounding area. No red Data species |
| L | Limited distribution of species | No | Species found are common in area and Veld Type |
| L | Important and/or fine-scale habitats present | Yes | Rocky outcrop (quartzite). Which is isolated by croplands, roads and fences. Area already developed as croplands. |
| L | Ecological connectivity of importance | Yes | Remaining habitat, in specific the large trees and pans with associated trees. |
| L | Corridors for Species of Conservation Concern | No | *Lycaon pictus and Acinonyx jubatus* did not use area in last four decades. Indication by Screening Tool incorrect as |

| | | | |
|---|---|---|---|
| | | | well as CBA map. |

**Rating**: Low sensitivity

**Comments and interpretation**

- The proposed new croplands will be located directly adjoining onto existing croplands.
- The two portions of the farm are currently divided by a fence. This fence will be removed. This will provide better access and flow in the area towards and along corridors.
- Corridors found in proximity of the footprints are two minor drainage lines which allows migration at a specific seasonal period towards the Limpopo River. Mostly used by medium to small mammal species. The Limpopo River is a Mega corridor that bisects various ecosystems up-and-downstream, and access is possible both outside the project area influence area.
- The EI of the area has undergone a change; this can be expected. To include it in CBA1 and ESA1 is however incorrect. The past developments created new agriculture ecosystems that co-exist with the remaining ecosystem on the farm. Fences and farming activities (game) that developed inhibited the free-roaming populations of cheetah and African Wild dogs. Leopards are the apex mammal predator in the area.
- Farming activities does have an influence on biodiversity. What was found on site during surveys on existing croplands indicated that a co-existence has developed between "*pure natura and pure agriculture*". The presence of indicator species is proof of the on-site situation.
- Pollution "hot-spots" by agriculture practices was not found on the farm.
- Mitigation can help to provide a healthy co-existence and maintaining natural processes.

## 13 CONSERVATION VALUE

The quality of the Conservation Value of the vegetation is described in Table 12 as very good, good, moderate, poor, and very poor according to the following criteria.

**Table 13: Conservation Value**

| **Conservation Value criteria used for evaluation** | |
|---|---|
| Very good | High species richness as compared to other similar vegetation types and units, no exotic vegetation, no human related disturbances, no invasive weedy vegetation.<br>A specific Red Data plant occurs here.<br>A plant/eco-system occurs here, which plays an important role in the survival of any Red Data faunal species. |
| Good | High species richness as compared to other similar vegetation types and units, low number of exotic vegetation, low human related disturbances, low number of invasive weedy vegetation |
| Moderate | Average species richness as compared to other similar vegetation types and units, exotic vegetation evident, human related disturbances observe, invasive weedy vegetation obvious |
| Poor | Poor species richness as compared to other similar vegetation types and |

| | |
|---|---|
| | units, low presence of exotic vegetation evident, substantial human related disturbances observed, invasive weedy vegetation obvious |
| Very poor | Very poor species richness as compared to other similar vegetation types and units, extensive exotic vegetation evident, extensive human related disturbances observed, extensive invasive weedy vegetation obvious |

**Conservation Value:**

- Before development: Poor
- After development: Poor

Conservation value is all inclusive of biodiversity, ecosystems, habitat, and sensitivity. It provides a site-specific assessment of the past, present, and future role in preservation and conservation of the biotic and abiotic elements. Change in conservation value is not only agricultural development and this should be understood. Medupi Power station, upper catchments, bordering country activities, human settlements, cultural aspects and much more have an influence on the conservation. The "art" of conservation is to understand the workings on ground level by on-site conditions and the exterior influences surrounding the development area at a larger scale.

Rational:

(i) Human disturbance was found throughout the project area over a considerate period.

(ii) The vegetation is spatially isolated by roads, electrified game fences and adjoining crop farming.

(iii) The project area has two supporting vegetation types within 500-1000 meters from the farm. They are the Limpopo Riparian vegetation and Zwartberg mountain.

## 14 IMPACTS ASSESSMENTS

### Methods

The methods and format of the impact tables used in this chapter are in accordance with the requirements of the 2014 Regulations.

- The **nature,** which shall include a description of what causes the effect, what will be affected and how it will be affected.
- The **probability (P)** *of occurrence,* which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale of 1-5, where 1 is very improbable (probably will not happen), 2 is improbable (some possibility, but low likelihood), 3 is probable (distinct possibility), 4 is highly probable (most likely) and 5 is define (impact will occur regardless of any prevention measures).
- The **duration (D),** wherein it will be indicated whether:
  - the lifetime of the impact will be of a very short duration (0-1 years) – assigned a score of 1;
  - the lifetime of the impact will be of a short duration (2-5 years) – assigned a score of 2;
  - medium-term (5-15 years) – assigned a score of 3;
  - long term (>15 years) – assigned a score of 4; or
  - permanent – assigned a score of 5;

- The **extent (E),** wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 will be assigned as appropriate (with 1 being low and 5 being high);
- The **magnitude (M),** quantified on a scale from 0-10, where 0 is small and will have no effect on the environment, 2 is minor and will not result in an impact on processes, 4 is low and will cause a slight impact on processes, 5 is moderate and will result in processes continuing but in a modified way, 8 is high (processes are altered to the extent that they temporarily cease), and 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
- The **significance (S),** which shall be determined through a synthesis of the characteristic described above and can be assessed as low, medium or high;
    - The significance rating is calculated by the following formula:
      **S (significance) = (D + E + M) xx (P)**
- The **status,** which will be described as either positive, negative, or neutral.
- The degree to which the impact can be reversed.
- The degree to which the impact may cause irreplaceable loss of resources.
- The degree to which the impact can be *mitigated.*

Impact should be identified for the construction and operational phases of the proposed development. Proposed mitigation measures should be practical and feasible such that they can be realistically implemented by the applicant.

### 17.1 Impact on Vegetation assessment

The footprint is in a flat homogenous terrestrial landscape.
In summary the impact of the project on the available habitat will be of Local extent, Permanent duration, Medium intensity and Medium probability. The significance of the loss of habitat will be Medium without mitigation and Low with mitigation during the construction phase. During the operational phase, impacts will be Low with or without mitigation.
Table 14: Vegetation impact

| Loss of indigenous vegetation or indigenous plant species due to clearing of areas of the specific veldtype.<br>Nature: Total clearing will take place. Protected trees are found in footprint areas. Vegetation is the main component of habitat for fauna and flora species. | | | | |
|---|---|---|---|---|
| | **Without Mitigation** | | **With Mitigation** | |
| CONSTRUCTION PHASE | | | | |
| Probability | Definite | 5 | Definite | 5 |
| Duration | Permanent | 5 | Permanent | 5 |
| Extent | Local | 1 | Local | 1 |
| Magnitude | Moderate | 6 | Low | 4 |
| Significance | **Medium** | **60** | **Medium** | **50** |
| Status (positive or negative) | Negative | | Negative | |
| OPERATIONAL PHASE | | | | |
| Probability | Improbable | 2 | Improbable | 1 |

| | | | | |
|---|---|---|---|---|
| Duration | Permanent | 5 | Permanent | 5 |
| Extent | Local | 1 | Local | 1 |
| Magnitude | Low | 4 | Minor | 2 |
| Significance | **Low** | **20** | **Low** | **16** |
| Status (positive or negative) | Negative | | Negative | |
| | | | | |
| Reversibility | Low | | Medium | |
| Irreplaceable loss of resources? | Low | | Low | |
| Can impacts be mitigated? | Yes | | | |
| Mitigation:<br>(i) Areas to be cleared must be delineated before clearing commence.<br>(ii) Large baobab trees will be left in-situ and should be incorporated in the lay-out.<br>(iii) A minimum buffer zone of not less than 8 meters should be left around each tree. This area is a no-go zone for any form of development and/or agriculture activity.<br>(iv) Destruction permits be sourced from DFFE.<br>(v) No infringing on the buffer zones of 32 meters along the water courses as prescribed by legislation.<br>(vi) Areas in "rest" (croplands in rotation program) is planted to provide cover, produce organic material for A-horizon of soil, which also benefit soil micro-organisms, prevent erosion, provide grass-veld habitat, allow better water penetration and retention of water. | | | | |
| Cumulative impacts: Expected that very little accumulative effects will occur for vegetation. Similar habitat is available on farm and surrounding areas for fauna. | | | | |

### 17.2 Impact on Fauna assessment

For the mammals no endangered species was identified with probability of occurring, three (3) vulnerable species with only the Pangolin a Medium probability of occurring, eight (8) near threatened species with the Honey Badger the only high probability with two (2) medium probability and three (3) low probability. For the least concerned species six (6) is rated as high probability and three (3) as low probability. One (1) species is listed as least concerned with a high probability of occurrence. Additionally, one (1) was positively identified. Three (3) Red Listed reptile species were likely to occur on the site, none of which was confirmed. Most of the species would be associated with natural woodlands while only a few would utilise the ridges that will provide habitat in the form of shelter, roosting sites for terrestrial and bird species.

Table 15: Faunal assessment

| |
|---|
| Mammal-, bird-, amphibian-, reptile and insects will be killed or prevented to survive the development.<br>Nature: Total clearing will take place and faunal live forms will be killed in the processes of development and operational phases. The areas have already been fenced to prevent conflict with wildlife. |

| | **Without Mitigation** | | **With Mitigation** | |
|---|---|---|---|---|
| CONSTRUCTION PHASE | | | | |
| Probability | Probable | 3 | Improbable | 2 |
| Duration | Permanent | 5 | Permanent | 5 |
| Extent | Local | 1 | Local | 1 |
| Magnitude | Moderate | 6 | Low | 4 |
| Significance | **Medium** | **36** | **Low** | **20** |
| Status (positive or negative) | Negative | | Negative | |
| OPERATIONAL PHASE | | | | |
| Probability | Improbable | 2 | Improbable | 1 |
| Duration | Permanent | 5 | Permanent | 5 |
| Extent | Local | 1 | Local | 1 |
| Magnitude | Low | 4 | Minor | 2 |
| Significance | **Low** | **20** | **Low** | **16** |
| Status (positive or negative) | Negative | | Negative | |
| | | | | |
| Reversibility | Low | | Low | |
| Irreplaceable loss of resources? | Low | | Low | |
| Can impacts be mitigated? | Yes | | | |

Mitigation:

1. Movement for large mammal species should be restricted by fences. Problem causing species such as primates, warthog and porcupines are restricted by electric barriers. Most are mobile and move away from high impact farming areas.
2. Smaller mammal species was observed in abundance.
3. Less mobile species such as tortoises should be collected and released in the no-development zone. Records should be kept.

Cumulative impacts: Expected that very little accumulative effects will occur as the existing wildlife is stable and adapted to conditions.

### 17.3 Impact on habitat assessment

Connectivity is not good for large animal species. The Limpopo River provides lateral connectivity up-or-down stream with limited movement along the various watercourses inland to the terrestrial zone which provides a sheltered corridor for smaller species into the terrestrial landscape.

The impact of the development on connectivity is likely to be of regional extent, long duration, medium intensity and medium probability. The significance of the loss in connectivity will be Medium without mitigation and Medium with mitigation during the construction phase. During the operation phase the significance will be Medium without mitigation and Low with mitigation. The significance of the impacts during the operation phase will be high (positive) with or without mitigation.

Table 16: Habitat assessment

| |
|---|
| Terrestrial habitat will be destroyed<br>Nature: Total transformation of habitat on an area of 955 hectares of the combined |

area of 1954 hectares on the remaining areas of the farm Zwartberg; thus, leaving remaining terrestrial habitat to function naturally.
The croplands that are "rested" in the rotation plan is planted with natural grass which provides habitat for various species. The planted croplands created an agriculture ecosystem. There is a transition from the agriculture ecosystem to the "rested" croplands that serve as ecotone to the remaining natural areas.

| | **Without Mitigation** | | **With Mitigation** | |
|---|---|---|---|---|
| CONSTRUCTION PHASE | | | | |
| Probability | Definite | 5 | Definite | 5 |
| Duration | Permanent | 5 | Permanent | 5 |
| Extent | Local | 1 | Local | 1 |
| Magnitude | Moderate | 6 | Low | 4 |
| Significance | **Medium** | **60** | **Low** | **25** |
| Status (positive or negative) | Negative | | Negative | |
| OPERATIONAL PHASE | | | | |
| Probability | Improbable | 2 | Improbable | 1 |
| Duration | Permanent | 5 | Permanent | 5 |
| Extent | Local | 1 | Local | 1 |
| Magnitude | Low | 4 | Minor | 2 |
| Significance | **Low** | **20** | **Low** | **16** |
| Status (positive or negative) | Negative | | Negative | |
| | | | | |
| Reversibility | Low | | Low | |
| Irreplaceable loss of resources? | Low | | Low | |
| Can impacts be mitigated? | Yes | | | |

Mitigation:

1. The crop lands will create an agriculture ecosystem, with "rested" croplands serving as ecotone to the adjoining natural areas as habitat for species.
2. The croplands can still function as ecological support areas.
3. The four natural cycles of nitrogen, water, carbon and oxygen can function on the developed areas.

Cumulative impacts: Expected that positive accumulative effects for species will occur. Red Data species, especially birds, will benefit in the winter-and early summer period when food and water is low.

### 17.4 Impacts on sensitive systems assessment

Construction activities will affect present habitat and species compositions directly through the alteration and disturbance of habitat, the displacement and probable destruction of species through negligence. Secondary impacts, such as the generation of noise and dust, are likely to displace some faunal species temporarily (particularly common bird species). Mitigation measures to minimise the impact on species and

their habitats, as listed under Mitigation Measures, must be implemented during this phase.

Table 17: Sensitive systems assessment

| Sensitive systems<br>Nature: The proposed development will transform part of the terrestrial ecosystem<br>No sensitive system is present. The terrestrial ecosystem is the largest in the province. | | | | |
|---|---|---|---|---|
| | **Without Mitigation** | | **With Mitigation** | |
| CONSTRUCTION PHASE | | | | |
| Probability | Definite | 5 | Definite | 5 |
| Duration | Permanent | 5 | Permanent | 5 |
| Extent | Local | 1 | Local | 1 |
| Magnitude | Moderate | 6 | Low | 4 |
| Significance | **Medium** | **60** | **Low** | **25** |
| Status (positive or negative) | Negative | | Negative | |
| OPERATIONAL PHASE | | | | |
| Probability | Improbable | 2 | Improbable | 1 |
| Duration | Permanent | 5 | Permanent | 5 |
| Extent | Local | 1 | Local | 1 |
| Magnitude | Low | 4 | Minor | 2 |
| Significance | **Low** | **20** | **Low** | **16** |
| Status (positive or negative) | Negative | | Negative | |
| | | | | |
| Reversibility | Low | | Low | |
| Irreplaceable loss of resources? | Low | | Low | |
| Can impacts be mitigated? | Yes | | | |
| Mitigation:<br>1. No further damage should be allowed to watercourses found outside of the development footprint.<br>2. Water quality from boreholes should be monitored to assess the quality draining as seepage form croplands receiving environment.<br>3. The four main ecological cycles found in nature will still function.<br>4. Monitoring of soil and water quality should be conducted quarterly.<br>5. The ecotone zone between rested croplands and natural veld can be supported by planting of trees that will support and enhance the ecotone zone.<br>6. The identified ecotone trees should be planted in sterilised areas between croplands, around dams, warehouses, and previously disturbed areas. A map is supplied. | | | | |
| Cumulative impacts: Pollution from inappropriate farming techniques and where no monitoring is conducted. | | | | |

### 17.5 Impact on biodiversity assessment

Biodiversity supports various lives and livelihoods. It does this by providing essential services.

Biodiversity is:

- A source of harvestable goods including food, medicines and building materials.
- Essential for regulation of natural processes and the earth's life support system, e.g., carbon sequestration, soil formation, and purification of water.
- Essential for pollination of commercially valuable crops and biological control of pests and diseases.
- A source of spiritual and religious enrichment and well-being.

Perhaps most important of all, biodiversity is the basis for evolution and adaption to changing environment, making it essential for survival of life. The following issues and aspects were considered:

At the gene level, to what extent will the proposal have significant effects on

- Genetic diversity of species, particularly rare and declining species and those with identified as priorities in NBSAPs and/or sub-national biodiversity plans?
- Opportunities for species populations to interact, e.g., by increasing habitat fragmentation and isolation?
- Risk of extinction?
- Persistence of locally adapted populations?

At the species level, to what extent will the proposal:

- Alter the species-richness or species-composition of habitats in the study area?
- Alter the species-composition of communities?
- Cause some species to be lost from the area?
- Affect species identified as priorities in NBSAPs and/or sub-national biodiversity plans?
- Increase the risk of invasion by alien species?

At the ecosystem level, to what extent will the proposal:

- Change the amount, quality, or spatial organization of habitat?
- Affect plans to enhance habitat availability or quality?
- Damage ecosystem processes and services, particularly those on which local communities rely?

Table 18: Biodiversity at gene level

| Biodiversity: At gene level<br>Genetic diversity of species, particularly rare and declining species, and those with identified as priorities in NBSAPs and/or sub-national biodiversity plans | | | | |
|---|---|---|---|---|
| | **Without Mitigation** | | **With Mitigation** | |
| CONSTRUCTION PHASE | | | | |
| Probability | Definite | 5 | Probable | 3 |
| Duration | Permanent | 5 | Permanent | 5 |
| Extent | Local | 1 | Local | 1 |
| Magnitude | Moderate | 6 | Low | 4 |

| | | | | |
|---|---|---|---|---|
| Significance | **Medium** | **60** | **Medium** | **30** |
| Status (positive or negative) | - | | + | |
| OPERATIONAL PHASE | | | | |
| Probability | Probable | 2 | Probable | 2 |
| Duration | Permanent | 5 | Permanent | 4 |
| Extent | Local | 1 | Local | 1 |
| Magnitude | Low | 4 | Minor | 2 |
| Significance | **Low** | **20** | **Low** | **14** |
| Status (positive or negative) | - | | + | |
| | | | | |
| Reversibility | Low | | Low | |
| Irreplaceable loss of resources? | Low | | Low | |
| Can impacts be mitigated? | Yes | | | |
| Mitigation:<br>1. No further damage should be allowed to the watercourse (located outside the footprint) and quartzite rocky outcrops and remaining terrestrial habitat.<br>2. Water quality for existing and new agriculture developed areas should be monitored to assess the quality released downstream onto the vegetation and receiving environment.<br>3. The buffer zones along cropland edges and fences will also be able to function as ecotone suitable habitat for species survival. | | | | |
| Cumulative impacts: Expected that positive accumulative effects for small mammal and bird species will occur. Red Data species, especially birds, will benefit in the winter-and early summer period. Other wildlife will also benefit from permanent grazing of croplands in rotation "rest" phase. | | | | |
| Biodiversity: At gene level<br>Opportunities for species populations to interact, e.g. by increasing habitat fragmentation and isolation | | | | |
| | **Without Mitigation** | | **With Mitigation** | |
| CONSTRUCTION PHASE | | | | |
| Probability | Definite | 3 | Probable | 3 |
| Duration | Permanent | 5 | Permanent | 5 |
| Extent | Local | 1 | Local | 1 |
| Magnitude | Moderate | 6 | Low | 4 |
| Significance | **Moderate** | **36** | **Moderate** | **30** |
| Status (positive or negative) | Negative | | Positive | |
| OPERATIONAL PHASE | | | | |
| Probability | Probable | 3 | Probable | 3 |
| Duration | Permanent | 5 | Permanent | 5 |
| Extent | Local | 1 | Local | 1 |

| | | | | |
|---|---|---|---|---|
| Magnitude | Low | 4 | Minor | 2 |
| Significance | **Moderate** | **30** | **Moderate** | **24** |
| Status (positive or negative) | Negative | | Positive | |
| | | | | |
| Reversibility | Low | | Low | |
| Irreplaceable loss of resources? | Low | | Low | |
| Can impacts be mitigated? | Yes | | | |
| Mitigation:<br>1. Damage should not be allowed to the remaining landscape, quartzite rocky outcrops and remaining terrestrial habitat.<br>2. The buffer zones along the cropland edges and fences will also be able to function as ecotone as suitable habitat for species survival.<br>3. Watercourses outside the development footprint remain unchanged and can act as corridors for small mammal species. | | | | |
| Cumulative impacts: Expected that positive accumulative effects for small mammal species will occur. Red Data species, especially birds, will benefit in the winter-and early summer period when area is dry and food and water availability low.<br>Species such as Cori Bustard can breed in croplands in rotation rest phase which provide food, breeding location and safety from predators (the croplands is fenced and electrified that prevent predation). | | | | |
| Biodiversity: At gene level<br>Risk of extinction | | | | |
| | **Without Mitigation** | | **With Mitigation** | |
| CONSTRUCTION PHASE | | | | |
| Probability | Distinct possibility | 3 | Probable | 3 |
| Duration | Medium-term | 3 | Short duration | 2 |
| Extent | Local | 1 | Local | 1 |
| Magnitude | Moderate | 4 | Low | 4 |
| Significance | **Medium** | **24** | **Medium** | **21** |
| Status (positive or negative) | - | | + | |
| OPERATIONAL PHASE | | | | |
| Probability | Probable | 3 | Improbable | 2 |
| Duration | Medium-term | 3 | Short | 2 |
| Extent | Local | 1 | Local | 1 |
| Magnitude | Low | 4 | Minor | 2 |
| Significance | **Medium** | **24** | **Low** | **10** |
| Status (positive or negative) | - | | + | |
| | | | | |

| | | | | |
|---|---|---|---|---|
| Reversibility | Low | | Low | |
| Irreplaceable loss of resources? | Low | | Low | |
| Can impacts be mitigated? | Yes | | | |
| Mitigation:<br>1. No further damage should be allowed to the remaining landscape the remaining watercourse, quartzite rocky outcrops and remaining terrestrial habitat for species use and process functioning.<br>2. Smaller mammal species can move freely in-and-out of fenced croplands that serve as feeding nish areas.<br>3. Birds and smaller mammals also use the croplands rested in the rotation program for breeding.<br>4. The surrounding woodland vegetation will receive seepage water which will benefit the trees along the cropland edges watercourse and subsequent supply habitat for the species. The trees will flourish even in the winter temperatures with the constant seepage water supply, providing nish habitats.<br>5. Buffer zones will restore and function of providing breeding and survival. | | | | |
| Cumulative impacts: Expected that positive accumulative effects for small mammal species will occur. Red Data species, especially birds, will benefit in the winter-and early summer period. Species along the drainage line woodland vegetation will also benefit by the seepage water. | | | | |
| Biodiversity: At gene level<br>Persistence of locally adapted populations | | | | |
| | **Without Mitigation** | | **With Mitigation** | |
| CONSTRUCTION PHASE | | | | |
| Probability | Probable | 3 | Definite | 5 |
| Duration | Short | 2 | Permanent | 5 |
| Extent | Local | 1 | Local | 1 |
| Magnitude | Moderate | 6 | Minor | 2 |
| Significance | **Medium** | **27** | **Moderate** | **40** |
| Status (positive or negative) | - | | + | |
| OPERATIONAL PHASE | | | | |
| Probability | Distinct possibility | 3 | Definite | 5 |
| Duration | Permanent | 5 | Permanent | 5 |
| Extent | Local | 1 | Surrounding Area | 3 |
| Magnitude | Low | 4 | Minor | 2 |
| Significance | **Low** | **30** | **Low** | **50** |
| Status (positive or negative) | + | | + | |
| | | | | |
| Reversibility | Low | | Moderate | |

| | | |
|---|---|---|
| Irreplaceable loss of resources? | Low | Low |
| Can impacts be mitigated? | Yes | |
| Mitigation:<br>1. Remaining terrestrial and watercourse habitats will be preserved.<br>2. A Water quality monitoring plan to detect pollution can serve as early warning of possible build-up of pesticides.<br>3. Proper control during construction. | | |
| Cumulative impacts: Expected that positive accumulative effects for water small mammal species will continue. Red Data species, especially birds, will benefit in the winter-and early summer period when the area has little to no surface water. Species along the woodland vegetation will also benefit by the seepage water. Browsing capacity, nesting sites and general habitat will benefit. | | |

Table 19: Biodiversity at species level

Biodiversity: At species level, to what extent will the proposal:

- Alter the species-richness or species-composition of habitats in the study area?
- Alter the species-composition of communities? Conservation Value: **Low**
- Cause some species to be lost from the area? **Low**
- Affect species identified as priorities in NBSAPs and/or sub-national biodiversity plans? **Low**
- Increase the risk of invasion by alien species? **Low.**

| | **Without Mitigation** | | **With Mitigation** | |
|---|---|---|---|---|
| CONSTRUCTION PHASE | | | | |
| Probability | Improbable | 2 | Very improbable | 1 |
| Duration | Very short | 1 | Very short | 1 |
| Extent | Local | 1 | Local | 1 |
| Magnitude | Low | 4 | Minor | 2 |
| Significance | **Low** | **12** | **Low** | **4** |
| Status (positive or negative) | - | | + | |
| OPERATIONAL PHASE | | | | |
| Probability | Improbable | 2 | Very improbable | 1 |
| Duration | Very short | 1 | Very short | 1 |
| Extent | Local | 1 | Local | 1 |
| Magnitude | Low | 4 | Minor | 2 |
| Significance | **Low** | **12** | **Low** | **4** |
| Status (positive or negative) | - | | + | |
| | | | | |
| Reversibility | Yes | | Yes | |

| | | |
|---|---|---|
| Irreplaceable loss of resources? | Low | Low |
| Can impacts be mitigated? | Yes | |
| Mitigation:<br>1. Identified protected plants can be removed and re-planted; implement buffer zones be implemented on larger baobab trees.<br>2. Buffer zones must be left intact between croplands.<br>3. ECO implement due diligence training and auditing.<br>4. Lower game numbers to a number that reflect 50% of grazer capacity and 75% for browsers. | | |
| Cumulative impacts:<br>The area has a low number of large and medium size herbivores. The species richness is low and does not reflect the expected historical species richness due to continuous farming and human development activities. The species present will however be able to function naturally on the remaining farm area. | | |

Table 20: Biodiversity at ecosystem level

Biodiversity: At the ecosystem level, to what extent will the proposal:

- Change the amount, quality, or spatial organization of habitat?
- Affect plans to enhance habitat availability or quality?
- Damage ecosystem processes and services, particularly those on which local communities rely?

| | **Without Mitigation** | | **With Mitigation** | |
|---|---|---|---|---|
| CONSTRUCTION PHASE | | | | |
| Probability | Improbable | 2 | Very improbable | 1 |
| Duration | Very short | 1 | Very short | 1 |
| Extent | Local | 1 | Local | 1 |
| Magnitude | Low | 4 | Minor | 2 |
| Significance | **Low** | **12** | **Low** | **4** |
| Status (positive or negative) | - | | + | |
| OPERATIONAL PHASE | | | | |
| Probability | Improbable | 2 | Very improbable | 1 |
| Duration | Very short | 1 | Very short | 1 |
| Extent | Local | 1 | Local | 1 |
| Magnitude | Low | 4 | Minor | 2 |
| Significance | **Low** | **12** | **Low** | **4** |
| Status (positive or negative) | - | | + | |
| | | | | |
| Reversibility | Yes | | Yes | |

| | | |
|---|---|---|
| Irreplaceable loss of resources? | Low | Low |
| Can impacts be mitigated? | Yes | |
| Mitigation:<br>1. The remaining habitat can function naturally, although at a lower intensity, due to size on the farm. It can still function as a collectively whole with the adjoining areas for natural processes spatially. It should be managed by a management plan.<br>2. The terrestrial-, watercourse-and rocky outcrops habitat outside the footprint will not be developed further and used as corridors and reserves.<br>3. Fire must not be allowed in remaining landscape of farm.<br>4. ECO implement due diligence training and auditing.<br>5. Lower game numbers to a number that reflect 50% of grazer capacity and 75% for browsers.<br>6. Monitoring plans must be compulsory for soil-water quality be conducted seasonally. | | |
| Cumulative impacts: The main driver for the area is the Limpopo River Ecosystem as the primary habitat with highest biodiversity. The terrestrial landscape and ecosystem can be seen as inter-dependant on the river. Without water both ecosystems will progressively deteriorate as it will not be able to maintain its equilibrium of survival without water from yearly rainfall in the catchment. The changing climate conditions, droughts, human settlements (and associated erosion in those areas), water users along the upper reaches of the river's catchment and the local farming activities of the farming nodes all contribute to the "stress" placed on the ecosystems and the communities it supports. This is only the South African perspective. The same considerations have also to be taken into consideration for Botswana. Adapting to conservation farming practices, better irrigation options and integrating croplands into being "utilised" by wildlife can support the survival of species and communities. Cumulative monitoring should be considered as an integrated planned option for farming and ecosystem stability. | | |

## 15 MITIGATION MEASURES

15.1 Impact on Vegetation

15.1.1 Trees, shrubs, and forbs should be protected during construction and incorporated into the system. Such as:

(i) Large baobab tree(s) in new crop areas should not be removed but incorporated in the lay-out plans.
(ii) Smaller baobab trees should be replanted.
(iii) Buffer area around quartzite outcrop.
(iv) Watercourse outside development footprint should be maintained as corridor.
(v) No fires must be allowed in remaining areas of farm.

15.1.2 The "island" zones must be left intact, they are:

(i) Pans and drainage lines outside development footprint.

(ii) Quartzite rocky outcrop.

15.1.3 Trees must be planted on the inside of the fences that encloses the croplands. These are specific identified trees that will serve as ecotone transition barrier for species and will also serve as habitat for birds, reptiles, and insects. The trees will also serve as visual and climate (wind/shade) barriers. It will support connectivity and corridors for migration.

15.1.4 Permits for destruction of protected trees must be applied for.

15.1.5 Permit for cultivation of virgin soil must be applied for.

15.2 Impact on Fauna

15.2.1 The number of large game species should be adapted downwards to prevent trophic stress and impact on vegetation and resultant erosion.

15.2.2 The crop areas should be game fenced to prevent conflict with damage causing animals such as primates, warthog, and porcupines.

15.2.3 Beehives should be incorporated in “created” ecotone areas.

15.2.4 Bat-houses can also be erected to help with insect control.

15.2.5 Poles of 6 meters and higher can be planted in the sterilized areas in the croplands which is not planted serving as perches for smaller falcons.

15.3 Impact on Habitat

15.3.1 The connectivity and corridors for larger mammals has already been interrupted by previous development. For medium and small species, it will re-establish after completion of works and the corridors created.

15.3.2 Numbers for larger game species should be adapted downwards.

15.3.3 The crop lands “rested” should be used as habitat for small mammals and birds.

15.3.4 An inclusive monitoring plan to maintain the ecological and conservation integrity of the area and to measure pollution is necessary. This must form part of the Global-Gap Program.

## 16 Summary of Findings

16.1 Zwartberg farm has been occupied for a century and two decades. This left the farm with a moderately changed environment. From open woodland savanna to closed savanna. Roads, fences, preventing fires and overgrazing resulted in the changed vegetation structure and presence of encroacher species.

16.2 Change in the receiving environment was historically linked to human presence, change in farming activities, change in farming technology, change in farming practices (conservation farming), changes in market needs for products. Each influenced the receiving environment.

16.3 The Veldtype is classified as Least Concerned and is the largest in the Limpopo Province.

16.4 No Red Data species are found permanently on the farm.

16.5 No protected species as listed in LEMA was found.

16.6 The biodiversity category is more correctly representing Supporting Ecosystem 2.

16.7 Corridors are present and will continue to develop and function during the operational phase.

16.8 Grassland habitat created by rotation crop farming favor various wildlife species. As example is Kori Bustard that breed and raise chicks. They are in a protected area inside a fenced area

where the main predators for the species black-backed jackal and primates can't impact on the nest or chicks.

16.9 The development will create an agriculture ecosystem linked by a changed natural area as an ecotone zone linking with the remaining natural habitat on the farm. This can be enhanced by the planting of an ecotone tree line as described in paragraph 15.1.3 above.

16.10 Soil analysis monitoring reports indicate a "healthy" soil structure.

16.11 No pollution was found.

16.12 Indicator wildlife species were found throughout the farm and on croplands and areas adjoining. The farm provides habitat for species which is not a complete list of species for the region but when listed collectively with the adjoining farms provides a "broader" list of species as indication of the functioning of populations.

## 17 CONCLUSION

The project area has been progressively altered by past human activities. The Conservation Value of the area is that of Low with average species richness as compared to other similar vegetation types and units, low presence of exotic vegetation was found but evidence of human related disturbances observed. Habitat was altered by overgrazing, fire, and croplands. It should be placed in context to the region (including Botswana) to interpret the level of change on the effect thereof on biodiversity. The remaining area of the farm can still function as part of the ecosystem.

The availability of similar habitats under conservation (private initiative) protection in the immediate surrounds was used in consideration of assessments in this report.

The biodiversity on the farm will not have an irreparable influence on the terrestrial ecosystem which can still function and support- and being supported by the agriculture ecosystem created as an Ecological Support Area 2.

The species richness will not be affected and/or specific communities adversely effectuated in such a manner that they will lead to their demise.

A habitat assessment and literature assessment allowed for the listing of no red data fauna and flora species that could potentially occur on the site, although none of the species were found it is still mandatory to ensure that a knowledgeable environmental-and conservation person with experience is used on the project as environmental control officer. This is during the construction phase as well as the operational phase.

## 18 RECOMMENDATIONS

It is recommended that the following is incorporated in the EIR:

14.1 That the mitigation measures in this report is incorporated in the environmental impact assessment report.

14.2 As safeguard it is recommended that monitoring for soil "health" and water quality is conducted every year for pollution detection and assessment.

14.3 That an independent environmental assessment practitioner is appointed as environmental control officer (ECO) to monitor the receiving environment during construction and to implement the EMP.

14.4 That all mitigated and other issues are incorporated and implemented through an environmental management plan.

14.5 That the recommendation in this and other specialist reports is implemented.

14.6 That the environmental management plan is implemented and updated with such information as deemed necessary during the operational phase.

14.7 That the ECO is appointed until such time as all the mitigating measures has been implemented and activated and the final ECO report has been submitted to LEDET: Compliance Monitoring and a completion certificate has been issued.

14.8 Planting of local indigenous trees to serve as windbreakers and shade but most importantly habitat for insects and birds can make a significant positive impact on the ecotone between croplands and remaining natural vegetation.

14.9 A Conservation and Farming Ecotone Monitoring Plan must be compiled by a conservation specialist and should be updated every year to incorporated new farming activities and techniques. This will serve as support document for the preservation and promotion of Biodiversity.

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