Terrestrial Ecology Screening:

Ilima Coal Mine

Carolina, Mpumalanga Province

November 2018

Prepared for: ABS Africa
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Declaration of Independence

We declare that we have been appointed as independent consulting ecologists with no affiliation with or vested financial interests in the proponent, other than remuneration for work performed. We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. Remuneration for our services by the proponent is not linked to approval by any decision-making authority responsible for authorising this development.

W.L.McCleland *15 November 2018*

1. INTRODUCTION

1.1. BACKGROUND

Ilima Coal Company (Pty) Ltd. (Ilima) has been granted a Prospecting Right (MP30/5/1/2/2/102PR) for the the Kranspan Prospecting Right area. Ilima intends to develop a coal mine on the site and have appointed ABS Africa to undertake the Environmental and Social Impact Assessment (ESIA) as part of pre-feasibility and detailed feasibility assessments. This specialist report forms part of the ESIA, and concerns the terrestrial ecosystems that may be impacted by the proposed mine. This report is based on a desktop review of available data only, and will be updated by a field survey to be undertaken by ECOREX in January / February 2018.

1.2 PROJECT DESCRIPTION

A full project description is given in the main body of the ESIA.

1.3 AIMS OF THIS REPORT

The aims of this report were:

- *Review*: To collate and review relevant and available ecological information for the study area, and to identify data gaps, as well as propose a fieldwork strategy to fill these gaps;

- *Baseline Conditions*: To summarise the baseline ecological conditions in the Study Area, based on a desktop review, including ecosystem classification, assessment of conservation importance and biodiversity value, and existing threats to biodiversity;

- *Key Issues*: To identify and assess key issues related to potential impacts of the proposed development on terrestrial ecosystems.

1.4 STUDY TEAM

Warren McCleland – Terrestrial Ecologist. Warren is the owner and director of ECOREX Consulting Ecologists CC, a consultancy of flora and vertebrate fauna specialists based in Mpumalanga, South Africa. He has been involved in specialist biodiversity assessments for a wide range of developments, particularly mining, throughout sub-Saharan Africa over the past 15 years. Countries of work experience outside of South Africa include Democratic Republic of the Congo, Republic of Guinea, Sierra Leone, Liberia, Mali, Tanzania, Kenya, Zambia, Malawi, Mozambique, Namibia and Swaziland. Warren is the co-author of the "Field Guide to the Trees & Shrubs of Mpumalanga & Kruger National Park" published in 2002, and is currently working on a field guide to the Wildflowers of the Kruger National Park.

Duncan McKenzie – Terrestrial Ecologist. Duncan has been involved in biodiversity assessments for ECOREX for ten years and countries of work experience include Lesotho, Swaziland, Mali, Mozambique, Guinea, Sierra Leone, South Africa, Tanzania and Democratic Republic of the Congo. Duncan has previously worked as a Regional Coordinator for the Mondi Wetlands Project and lectures on many aspects of conservation in Mbombela and the Kruger National Park. He is currently the Regional Co-ordinator for the South African Bird Atlas Project, sits on the KZN Bird Rarities Committee and is a co-author on the Wildflowers of the Kruger National Park project.

Linda McKenzie – GIS. Linda is a GIS Specialist/GIS Analyst with over 13 years' experience in the industry. For the last six years she has operated her own GIS Consultancy called Digital Earth. She has extensive experience in both the private and public sector, and has worked on a wide variety of projects and GIS applications. Most recently, these include vegetation and sensitivity mapping, landcover data capture, municipal roads master planning, hydroelectric scheme and wind farm feasibility mapping and town planning, land surveyor and engineering support services. Linda currently serves as Vice Chairperson and Treasurer for GISSA Mpumalanga and is a registered Professional GISc Practitioner (PGP0170).

2. DETAILED TERMS OF REFERENCE

- Review relevant available information to understand the regional biodiversity setting and develop a list of species of conservation significance potentially present on the site.
- Analyse aerial or satellite imagery and prepare a preliminary map of vegetation communities within the study area.
- Prepare survey protocol for a rapid assessment of the study area during the wet season to ground truth the preliminary map and investigate the following:
    - types and condition of terrestrial habitats present within the study area (including an understanding of their vulnerability in relation to current threats and their uniqueness);
    - indications of the species richness within the terrestrial habitats (including key floral and faunal groups, dominant species, endemic species, threatened species, and alien invasive species);
    - indications of vegetation community structure and composition (using timed-meander transects where appropriate) at representative locations;
    - presence of sensitive habitats and landscapes.
- Assess the potential biodiversity value of the different habitats represented.
- Identify potential key impacts of the project on biodiversity.

3. STUDY AREA

The Ilima Coal Project is located approximately 13 km south-west of the town of Carolina in Albert Luthuli Local Municipality, Mpumalanga Province (Figure 1). The study area covers 3383 hectares and comprises nine portions of the farm Kranspan 49-IT. Ilima Coal has been granted a Prospecting Right for this area (No. 44/2016 (PR) [MP30/5/1/2/2/102PR]), which expires in March 2019.

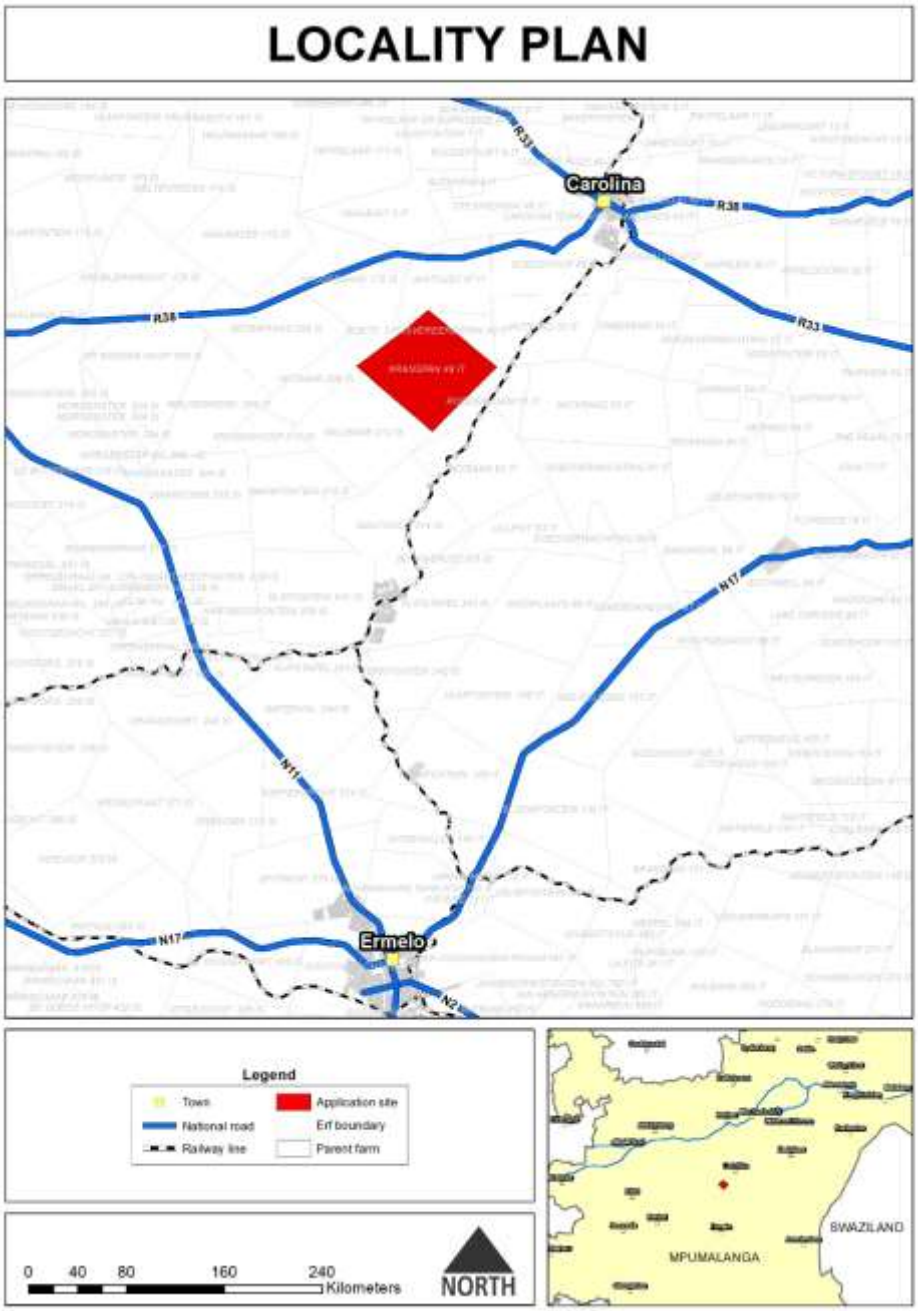

Figure 1. Location of the Ilima Coal Study Area

4. METHODS

4.1 FLORA

The Botanical Database of Southern Africa (BODATSA), which is curated by the South African National Biodiversity Institute (SANBI), was queried for a list of plant species that have been recorded from a 20 km radius of the study area. BODATSA contains records from the National Herbarium in Pretoria (PRE), the Compton Herbarium in Cape Town (NBG & SAM) and the KwaZulu-Natal Herbarium in Durban (NH).

Version 2017.1 of the Red List of South African plants (http://redlist.sanbi.org/index.php), which is managed as part of SANBI's Threatened Species Programme, was consulted for the current conservation status of each species in the above list. The term "Species of Conservation Concern" (SCC) as defined by Raimondo *et al*. (2009) was followed in this report, namely all species classified as threatened (Critically Endangered, Endangered and Vulnerable), as well as species classified as Data Deficient, Near Threatened, Critically Rare, Rare and Declining.

Mucina & Rutherford (2006) was the primary reference for determining the regional context of the vegetation occurring in the vicinity of the study area.

A broad-scale landcover map was compiled by Digital Earth using satellite imagery. This will provide for the first level of habitat differentiation into Modified and Natural Habitat following the definitions in the International Finance Corporation's Performance Standard 6 (Biodiversity Conservation and Sustainable Management of Living) (IFC, 2012). These categories will be refined once wet season fieldwork has been completed.

4.2 TERRESTRIAL FAUNA

Mammals

Friedmann & Daly (2004) and the Virtual Museum of African Mammals (MammalMAP, 2017) were used to prepare a list of mammal species that have been confirmed to occur within 2922CD as well as adjacent QDSs. Conservation status assessments for each species were obtained from Friedmann & Daly (2004) and online updates on the Endangered Wildlife Trust's Mammal Red List (https://www.ewt.org.za/Reddata/reddata.html).

Birds

The online database of the Southern African Bird Atlas Project (SABAP2) was queried for a list of bird species confirmed to occur in the relevant QDSs that the study area is located in, namely 2629BB and 2630AA[1][2]. At a finer mapping scale, lists of bird species recorded during SABAP2 in the the four pentads (mapping units) in which the study area is located (2610_3000, 2605_3000, 2610_2955 and 2605_2955) were downloaded and are included in Appendix 3. Taylor *et al.* (2016) was consulted for the most current conservation status of each species of conservation concern on the above lists.

Herpetofauna

The primary reference for compiling a list of potentially occurring reptiles was Bates *et al*. (2016), and Du Preez & Carruthers (2009) and Minter *et al.* (2004) for a list of potentially occurring amphibians. The Reptile Atlas of Southern Africa (ReptileMAP, 2017)[3] and Frog Atlas of Southern Africa (FrogMAP, 2017)[4], which are continuously updated online databases that reflect the most current distribution data for reptiles and amphibians in South Africa, were used to supplement the data from the above references and to indicate the most current taxonomy.

4.3 ECOLOGICAL SENSITIVITY

For the purposes of this study, Ecological Sensitivity (ES) is considered to be a function of Conservation Value (CV) of the receptor (e.g. habitat unit) and its sensitivity to impacts or Receptor Sensitivity Index (RSI). CV is assessed according to presence of populations of SCC as well as suitability of habitat for supporting populations of SCC. RSI is calculated as a function of Vulnerability to impacts and Resilience, i.e. capacity to be restored to original state with limited human intervention.

Ecological Sensitivity is calculated as follows:

ES = CV + RSI, where

RSI = V + R

[1] http://sabap2.adu.org.za/gap_analysis.php?DGC=SE2629#content_90perc
[2] http://sabap2.adu.org.za/gap_analysis.php?DGC=SE2630#content_90perc
[3] http://vmus.adu.org.za/, formerly SARCA

[4] http://vmus.adu.org.za/, formerly SAFAP

Table 1 indicates how ES is interpreted in relation to these variables.

Table 1. Ecological Sensitivity Matrix

Receptor Sensitivity Index		Resilience				
		Very Low	Low	Medium	High	Very High
Vulnerability	Very High	Very High	High	Med-High	Medium	Medium
	High	High	Med-High	Medium	Medium	Low
	Medium	Med-High	Medium	Medium	Low	Low
	Low	Medium	Low	Low	Low	Low
	Very Low	Low	Low	Low	Low	Low

Ecological Sensitivity		Conservation Value				
		Very High	High	Med-High	Medium	Low
Receptor Sensitivity Index	Very High	Very High	Very High	High	Med-High	Medium
	High	Very High	High	Med-High	Medium	Medium
	Med-High	High	Med-High	Medium	Medium	Low
	Medium	Med-High	Medium	Medium	Low	Low
	Low	Medium	Medium	Low	Low	Low

4.4 ASSUMPTIONS AND LIMITATIONS

- The description of the baseline terrestrial ecology and potential impacts on terrestrial ecosystems in this report is based on a desktop study only and should be considered incomplete until data specific to the study area have been collected during summer fieldwork.
- While the potential impacts on terrestrial ecosystems are briefly described in this report, the significance of impacts was not assessed at this stage since no primary data have yet been collected. Impacts will be assessed in the updated report following wet season fieldwork.

5. BIODIVERSITY BASELINE DESCRIPTION

5.1 FLORA

5.1.1 Regional Context

5.1.1.1 National Vegetation Types

The study area is situated within the Grassland Biome, which dominates the high central and eastern plateau of South Africa (Highveld), as well as the mountainous region of Mpumalanga, western KZN and the Eastern Cape (Drakensberg). This area is characterised by summer rainfall and winter drought, and regular frost in winter (Mucina & Rutherford, 2006). Local plant species richness is high in the Grassland Biome and five centres of plant endemism have been described within the biome. Four geographically distinct bioregions are present within this biome, namely Drakensberg Grassland, Dry Highveld Grassland, Mesic Highveld Grassland and Sub-escarpment Grassland. The study area is situated within the Mesic Highveld Grassland Bioregion within the Eastern Highveld Grassland national vegetation type (Gm12), which is described in more detail below (following Mucina & Rutherford, 2006):

Eastern Highveld Grassland

This vegetation type is endemic to Gauteng and Mpumalanga provinces, occurring from the East Rand in the west to Belfast in the east, and extending as far south as Bethal, Ermelo and Piet Retief. Terrain comprises slightly to moderately undulating plains with scattered rocky outcrops and pan depressions. Soils are mostly red to yellow sandy soils on shale and sandstone of the Madzaringwe Formation (Karoo Supergroup). Mean annual precipitation varies from 650 to 900 mm, of which almost all occurs in summer, and frost incidence varies from 13-42 days per year. Floristic composition and important taxa are indicated in

Table 2 below. Eastern Highveld Grassland has a conservation status of Endangered because of a very high level of habitat loss (44%) and very low level of protection.

Table 2. Floristic composition and important taxa in Eastern Highveld Grassland

Important Taxa	
Dominant Grasses	*Aristida aequiglumis, A. congesta, A. junciformis, Brachiaria serrata, Cynodon dactylon, Digitaria monodactyla, D. tricholaenoides, Elionurus muticus, Eragrostis chloromelas, E. curvula, E. plana, E. racemosa, E. sclerantha, Heteropogon contortus, Loudetia simplex, Microchloa caffra, Monocymbium ceresiiforme, Setaria sphacelata, Sporobolus africanus, S. pectinatus, Themeda triandra, Trachypogon spicatus, Tristachya leucothrix.*
Herbaceous Plants	*Berkheya setifera (dominant), Haplocarpha scaposa (dominant), Justicia anagalloides (dominant), Pelargonium luridum (dominant), Acalypha angustata, Dicoma anomala, Helichrysum aureonitens, H. callicomum, H. oreophilum, Pentanisia prunelloides, Senecio coronatus, Hilliardiella oligocephala, Wahlenbergia undulata.*
Geophytes	*Gladiolus crassifolius, Haemanthus humilis subsp. hirsutus, Hypocis rigidula, Ledebouria ovatifolia.*
Succulents	*Aloe ecklonis.*
Low Shrubs	*Anthospermum rigidum, Stoebe plumosa.*

An azonal national vegetation type that is embedded throughout Eastern Highveld Grassland and is relevant to the study area is Eastern Temperate Freshwater Wetlands (AZf3). This is a widespread vegetation type occurring in Northern Cape, Eastern Cape, Free State, North-West, Gauteng, Mpumalanga and KwaZulu-Natal, and is associated with shallow stagnant or slow-moving waterbodies such as pans, seasonally flooded vleis and sluggish rivers.

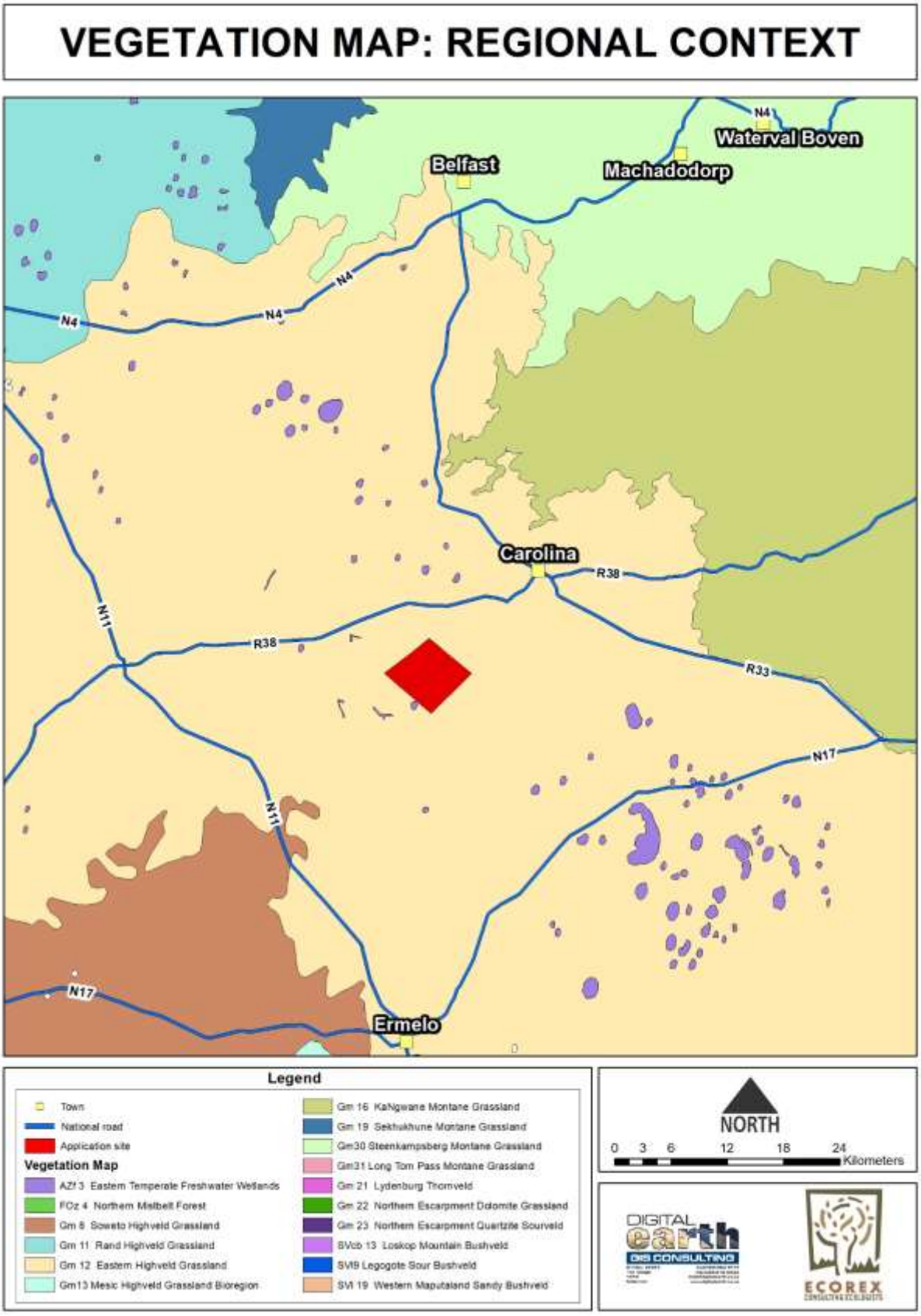

Figure 2. National Vegetation Types represented in the Study Area

5.1.1.2 Centres of Plant Endemism

The study area is not situated within any centres of plant endemism as defined by Van Wyk & Smith (2001).

5.1.1.3 Threatened Ecosystems

Eastern Highveld Grassland is a listed Threatened Ecosystem (Vulnerable) under Notice 1002 of Government Gazette 34809, 9 December 2011.

5.1.2 Local Context – Vegetation Assemblages

The Botanical Database of Southern Africa (BODATSA), which is curated by SANBI, lists 401 plant species from 74 families for a 20 km radius of the study area (Appendix 1). The dominant plant families in the flora are the Asteraceae (54 spp), Poaceae (45 spp), Fabaceae (29 spp), Cyperaceae (23 spp) and Apocynaceae (20 spp). This is likely to be significantly higher plant species diversity than that which is in the study area as the data search parameters included a larger area with a greater variety of habitats. However, it does give an indication of the dominant families and provides a list of species to expect during summer fieldwork. A full list of plant species confirmed to occur in the study area will be provided subsequent to summer fieldwork.

The description of broad-scale vegetation assemblages below is based primarily on analysis of high-resolution satellite imagery and has not been verified yet by fieldwork data. An updated report will be submitted subsequent to completion of summer fieldwork, which will contain information regarding the dominant and diagnostic species per vegetation assemblage.

Two broad-scale vegetation communities have been identified within the study area as representing Natural Habitat as defined by IFC (2012), namely Untransformed Grassland and Wetlands, while waterbodies such as Endorheic Pans are considered part of the Wetland community. An overview of all Natural Habitat is given below. Each of these vegetation communities will be described in detail once fieldwork has taken place. Areas that can be classified as Modified Habitat, such as cultivated lands, buildings and tree plantations, cover 1575 ha (47%) of the study area. These areas are not dealt with in the descriptions below.

5.1.2.1 Untransformed Grassland

Approximately 1450 ha of the study area (43%) still comprises Untransformed Grassland that is most likely representative of Eastern Highveld Grassland, although possibly overgrazed and

lower in species composition than undisturbed grassland (Figure 3). This is the vegetation assemblage in which most plant species of conservation concern are likely to be found and is the habitat that is most likely to support populations of fauna species of conservation concern.

5.1.2.2 Wetlands

At least three wetland types are represented in the study area, namely Endorheic Pans, Valley-bottom Wetlands and Hillslope Seeps, covering approximately 330 ha (Figure 3). Satellite imagery indicates several circular to sub-circular permanent or seasonal pans in the study area, of which Kranspan is the most significant, covering approximately 125 ha. Kranspan and another pan to the north-east are likely to support significant numbers of congregatory waterbirds at certain times of the year. While wetlands typically have lower species diversity than adjacent undisturbed grassland, a high proportion of habitat specialist plants are usually present and likelihood of fauna species of conservation concern being present is moderate to high.

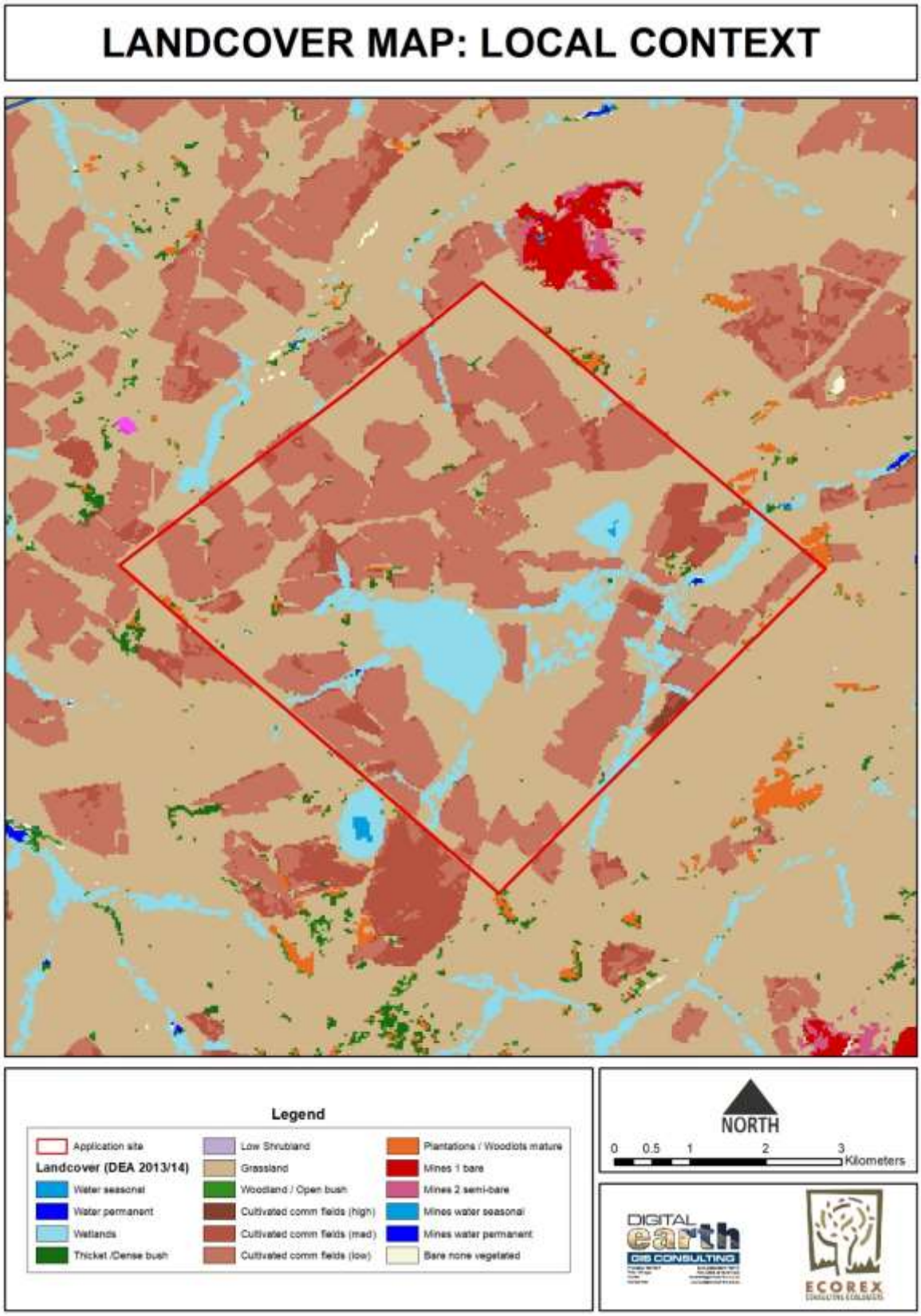

Figure 3. Natural and Modified Habitat represented in the study area

5.1.3 Species of Conservation Concern

Thirteen Species of Conservation Concern (SCC) have been recorded from the two quarter-degree grids that the study area is situated in (2629BB, 2630AA) (Appendix 2). Sixteen of these are classified as threatened (Critically Endangered, Endangered or Vulnerable), although most of these have a low likelihood of occurrence because of a lack of suitable habitat and / or altitude. Three species have a high likelihood of occurring and are dealt with in more detail below.

Alepidea longeciliata

This small herb is endemic to Highveld Grassland in Mpumalanga, occurring in a small area between Breyten, Lothair, Middelburg and Stoffberg, although the records from Middelburg and Stoffberg are putative and its distribution seems to be centred on the Carolina area (De Castro & McCleland, 2015). *Alepidea longeciliata* occurs in grassland overlaying Karoo sandstone and is specifically associated with seasonally wet soils on hillslope seeps in hygrophilous grassland. It is threatened primarily by habitat loss to agriculture and mining, particularly coal mining, and has been assessed as **Endangered** (von Staden et al., 2009). A population is known from a property adjacent to Kranspan 49-IT (De Castro & McCleland, 2015) and it thus has a high likelihood of being present in the study area.

Khadia carolinensis

This small succulent is also endemic to Mpumalanga, occurring in Highveld grassland between Belfast and south of Carolina. It is associated with exposed rocky outcrops, especially sandstone sheetrock, usually on well-drained, sandy loam soils (Lötter et al., 2007). Much of the global population of this species is located over extensive coal reserves for which mining rights have been applied for, and the primary future threat to this species is open-cast coal mining, resulting in a conservation status of **Vulnerable** (Lötter et al., 2007). A population has been confirmed on a property adjacent to Kranspan 49-IT (De Castro & McCleland, 2015) and it thus has a high likelihood of being present in the study area.

Aspidoglossum xanthosphaerum

This species is a slender herb that is nearly endemic to Mpumalanga, occurring in grassland above 1600 masl. Specific habitat requirements are poorly known, but specimens collected from near Breyten were located in short grassland on gentle hillslopes, habitat that is present in the study area (De Castro, 2006). It is thus considered to have a moderate likelihood of occurring, even though there are no records from adjacent properties. Even though *Aspidoglossum xanthosphaerum* is currently only known from four widely separated areas

between Breyten and Wakkerstroom, it is very easily overlooked and is likely to be present on more localites than those currently known. It has been assessed as **Vulnerable** by Nicholas & Victor (2006).

All three of the above species flower from October to November, which would be the optimal time for a survey to confirm the presence or absence of these species in the study area.

5.1.4 Endemic Species

Even though the study area is not situated within any centres of plant endemism as defined by Van Wyk & Smith (2001), eleven range-restricted species that are endemic to Mpumalanga are known to occur in the quarter-degree grids that the study area is situated in (Appendix 2). Most of these species have a low likelihood of occurring on Kranskop 49-IT, apart from *Khadia carolinensis, Aspidoglossum xanthosphaerum* and *Alepidea longeciliata*. Each of these species is discussed in section 5.1.3.

5.1.5 Protected Species

Thirty-seven plant species occurring in the general vicinity of the study area are protected under Schedule 11 of the Mpumalanga Nature Conservation Act No. 10 (1998) (Appendix 2). An updated list of protected species confirmed to occur in the study area will be provided once summer fieldwork has been completed.

5.2 TERRESTRIAL FAUNA

5.2.1 Mammals

Regional Context

The study area is situated within the Grassland biome, which is confined to the cool, high-lying plateau of eastern South Africa, Swaziland and Lesotho, as described by Mucina & Rutherford (2006). A number of small mammal species are endemic to this biome, of which only two have been confirmed to occur within the general vicinity of the study area (Friedman & Daly, 2004): Hottentot's Golden Mole (*Amblysomus hottentotus*) and Highveld Golden Mole (*A. septentrionalis*).

Species Richness

A list of 33 mammal species that have been recorded in the QDSs in which the study area is situated in is presented in Appendix 3. A list of confirmed mammal species will be provided once summer fieldwork has been completed.

Species of Conservation Concern

Ten species of conservation concern occur on the Highveld in the general vicinity of the study area (Appendix 6), of which eight have been recorded in the quarter-degree grids in which the study area is situated. Five of these have a moderate to high likelihood of occurring in the study area, all of which are classified as NT (Appendix 1). Two additional species for which there are no records in the vicinity of the study area, but which have a moderate likelihood of occurring are one VU species (Spotted-necked Otter *Hydrictis maculicollis*) and one NT species (African Clawless Otter *Aonyx capensis*). Dedicated searches for the species covered above will take place during summer fieldwork and will include the use of motion-triggered Bushnell Trailcam cameras.

5.2.2 Birds

Regional Context

The study area is situated within the Afrotropical Highlands biome as defined by Fishpool & Evans (2001). This biome is located in fragmented patches throughout the Afromontane belt of Africa and corresponds to the Grassland Biome in South Africa. Twenty-four species occurring in South Africa are listed by Barnes (1998) as being endemic to the biome, i.e. not occurring outside of the biome. Many of these are forest species that will not occur in the study area, and only one biome-restricted endemic (Southern Bald Ibis *Geronticus calvus*) has been

confirmed to occur in the same quarter-degree grids in which the study area is situated during the current Southern African Bird Atlas Project (SABAP2).

Kranskop 49-IT is situated along the eastern boundary of the Amersfoort – Bethal – Carolina District Important Bird Area (IBA) and the Chrissie Pans IBA is located to the south-east of the study area (Marnewick et al., 2015).

Species Richness

The quarter-degree grids 2629BB and 2630AA, in which the study area falls, currently have a combined list of 212 bird species recorded during the ongoing second Southern African Bird Atlas Project (SABAP2)[5], a total probably approaching true species diversity for the district. SABAP2 data also indicate that 134 bird species have been recorded from the four pentads (mapping units) in which the study area is situated (2610_3000, 2605_3000, 2610_2955, 2605_2955) (Appendix 4). A pentad is a much smaller mapping unit than a quarter-degree grid, measuring approximately 77 km^2, and is thus a better indication of which species are likely to occur in the study area. However, none of the pentads listed above have been surveyed more than three times during SABAP2 and are thus significantly undersampled and likely to support more species than is currently indicated. Summer fieldwork will give a better indication of avian species richness within the study area. It is likely that at least three bird assemblages are present, namely a Grassland assemblage, Open Water assemblage and a Transformed (Cultivated Lands) assemblage. These assemblages will be described in more detail once summer fieldwork has been undertaken.

Species of Conservation Concern

Eight threatened bird species have been recorded in the quarter-degree grids in which the study area is situated, namely one CR species (Wattled Crane *Grus carunculatus*), two EN species (Grey Crowned Crane *Balearica regulorum*, Cape Vulture *Gyps coprotheres*) and five VU species (Southern Bald Ibis, Secretarybird *Sagittarius serpentarius*, White-bellied Korhaan *Eupodotis senegalensis*, Denham's Bustard *Neotis denhami* and African Grass Owl *Tyto capensis*). Five of these species have a moderate likelihood of occurring in the study area (Appendix 6) and will be searched for during summer fieldwork.

Five NT species have been recorded in the quarter-degree grids in which the study area is situated and have a moderate to high likelihood of being present in the study area (Appendix 6). Three of these are only likely to be recorded in open water habitat at Kranspan, namely

[5] http://sabap2.adu.org.za/ Accessed 13 November 2018

Maccoa Duck (*Oxyura maccoa*), Lesser Flamingo (*Phoeniconaias minor*) and Greater Flamingo (*Phoenicopterus roseus*), while two species are most likely to occur in untransformed grassland habitat, namely Blue Crane (*Grus paradiseus*) and Blue Korhaan (*Eupodotis caerulescens*).

Four additional species for which there are no records in the vicinity of the study area have a moderate likelihood of occurring (Appendix 6). One of these is classified as VU (Lanner Falcon *Falco biarmicus*), while the other three are NT (Chestnut-banded Plover *Charadrius pallidus*, Pallid Harrier *Circus macrourus*, Black-winged Pratincole *Glareola nordmanni*). A more thorough field analysis of habitat suitability will be undertaken during the wet season survey and each species will be dealt with in more detail in the updated report.

5.2.3 Herpetofauna (Reptiles and Amphibians)

Regional Context

The study area is situated within the Grassland biome, which is confined to the cool, high-lying plateau of eastern South Africa, Swaziland and Lesotho, as described by Mucina & Rutherford (2006). Numerous reptile and amphibian taxa are endemic to this biome, although the study area is situated in an area of moderate to low endemism, with 3 endemic reptile species per QDS (Bates et al., 2014) and 4-6 endemic frog species per QDS (Minter et al., 2004).

Species Richness

Thirty reptile species and 14 amphibian species have been recorded from the two QDSs in which the study area is located, with a mean of 20 reptile species and 12 amphibian species per QDS (Appendix 5). Given the relatively small size of the study area and low habitat heterogeneity, it is unlikely that this full list of species will be present in the study area. A more accurate estimate of species richness will be made after summer fieldwork has been completed.

Species of Conservation Concern

No reptile species of conservation concern as assessed by Bates et al. (2014) have been observed within the vicinity of the study area, while one species that has been regionally assessed by the MTPA as NT (Spotted Harlequin Snake *Homoroselaps lacteus*) has been recorded in 2629BB (Appendix 5). Three additional NT reptiles have been recorded in other QDSs in the general vicinity of the study area (Coppery Grass Lizard *Chamaesaura aenea*, Large-scaled Grass Lizard *C. macrolepis*, Striped Harlequin Snake *Homoroselaps dorsalis*), but these have a low likelihood of being present in the study area (Appendix 6).

No amphibian species of conservation concern have been recorded from the vicinity of the study area, although one species has a low likelihood of occurring, namely Giant Bullfrog (*Pyxicephalus adspersus*), which has been classified as NT and is a protected species under NEMBA (2004). This species breeds in shallow temporary pans which are present within the study area and adjacent properties, but is very rare on the eastern Highveld and there are no recent records from the relevant QDSs.

5.3 ECOLOGICAL SENSITIVITY ANALYSIS

A full sensitivity analysis of each of the vegetation communities represented in the study area will be presented once fieldwork has been completed. This will be done using the methodology described in section 4. Conservation Value (CV), which is an important component of the ES analysis, can only be calculated once field data have been collected and habitat state assessed. In the interim, the classification of land units in the Mpumalanga Biodiversity Sector Plan (MBSP) (Lötter *et al.*, 2014) will used as a surrogate for ES. Figure 4 shows the MBSP classification of land units within the study area.

All of the Natural Habitat (untransformed vegetation) within the study area falls within Critical Biodiversity Areas (CBAs) according to the MBSP (Lötter *et. al,* 2014)**.** Just over half of the untransformed grassland in the study area (736 ha) has been classified as **CBA: Irreplaceable**, while the pans, riparian wetlands and other grassland have been classified as **CBA: Optimal**. These are the most sensitive habitats in the study area and represent the areas where impacts on ecology would be most significant.

All the transformed areas, such as cultivated lands, are classified as either Heavily Modified or Moderately Modified: Old Lands.

Critical Biodiversity Areas are areas that are essential for meeting biodiversity targets for species, ecosystems or ecological processes. The desired management objectives for CBAs are that they be **kept in a natural or near-natural state, with no further loss of habitat or species**. Only low-impact, biodiversity-sensitive land-uses such as low-intensity livestock grazing are considered appropriate, while land-uses such as any form of mining or prospecting, conversion of natural habitat for agriculture or plantation forestry, expansion of existing settlements or infrastructure, and the building of new infrastructure or linear developments such as roads, railways, pipelines, etc., **are considered inappropriate**. Areas falling within the Modified category are the preferred areas for a wide variety of land-use types, which includes mining development.

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Figure 4. MBSP Classification of land units within and adjacent to the study area

6. KEY POTENTIAL IMPACTS

6.1 FLORA

During the preparation and construction phases it is possible that areas of natural habitat will be cleared during the creation of open-cast pits, creating or widening of access roads to the infrastructure, etc. Habitat loss is also likely to take place during operation of the open pit.

The following key impacts to flora have been identified:

6.1.1 Disturbance or loss of an Endangered vegetation type and listed Threatened Ecosystem as well as associated populations of Species of Conservation Concern

Parts of the study area that comprise undisturbed Natural Habitat, i.e. untransformed grassland and wetlands, are likely to be lost with the development of open cast pits and associated infrastructure. These are the habitats in which species of conservation concern are most likely to occur and thus populations of these species are likely to also be impacted. The location of infrastructure and open pits within these habitats will significantly increase the severity of this impact.

6.1.2 Introduction/proliferation of alien invasive species

Areas of exposed soil created through construction activities could provide a platform for alien invasive species to become established. This is specifically relevant along cleared road verges. From the preparation phase, through construction and operation, the various vehicles and equipment entering the site will enhance the risk of these alien species being introduced to the project area.

6.1.3 Illegal utilisation of flora resources

It is likely that a number of traditional medicinal plants occur in Ntaural habitat in the study area. The influx of labour teams during the construction phase could result in an increase in illegal harvesting of medicinal plants by contractors. It is assumed that any labour teams will be accommodated in nearby towns and not on site, which would lower this risk considerably.

6.2 FAUNA

The following key impacts to fauna have been identified:

6.2.1 Disturbance/loss of threatened faunal habitat and associated Species of Conservation Concern

Over 50% of the study area comprises Natural Habitat that is regarded as threatened, and this habitat is likely to support faunal assemblages with populations of species of conservation concern. The development of open cast pits and associated infrastructure could result in some loss of this habitat and displacement or even mortalities of some faunal species of conservation concern. The location of infrastructure within Natural Habitat will significantly increase the severity of this impact.

6.2.2 Illegal utilisation of faunal resources

The presence of a labour force within the study area will increase the risk of illegal utilisation of fauna resources, such as hunting of small antelope and trapping of small mammals. The frequency of the disturbing activities will be throughout the life of the operation. It is assumed that any labour teams will be accommodated in nearby towns and not on site, which would lower this risk considerably.

7. RECOMMENDATIONS – FIELDWORK PHASE

The need for biodiversity data collection within the study area has been highlighted throughout this report. This should ideally take place in the summer, during the peak rainfall period (Feb-Apr), although a follow up survey to confirm the presence or absence of plant species of conservation concern will be need from October to November 2019 and will fulfil the MTPA minimum requirements for specialist surveys in sensitive habitats. The following fieldwork methods will be followed during the fieldwork phase:

7.1 FLORA

The primary field survey method for the floristic biodiversity study will be Timed-meander Transects, a semi-quantitative method that focused on the location of plant species of conservation concern (Goff *et al*., 1982; Huebner, 2007). The method has been shown to be highly effective and time efficient in detecting rare species and documenting α-diversity (Huebner, 2007). Approximately 20 minutes will be spent searching all available habitats at each site, although highly diverse habitats will occasionally require more time while sites situated in transformed habitats with secondary vegetation will require less time. Inventories of identifiable vascular plants will be made at each of the sites visited, recording presence/absence, as well as estimating dominance/cover-abundance according to Braun-Blanquet cover scales (Kent & Coker, 1992). Where plants cannot be identified in the field, specimens will be collected and dried in a plant press for later identification.

7.2 MAMMALS

Standard small mammal survey techniques will be employed for surveying rodents. At each site, traps will be set along a transect (trapline) and will be left out for several consecutive nights. Locations of traplines will be selected to cover as many different microhabitats as possible. Traplines will consist of 10 trap stations, with one Sherman live trap per station; trap stations will be approximately 5 m apart. Traps will be baited in the late afternoon and will be checked shortly after sunrise each morning. Motion-triggered Bushnell TrailCam cameras will be installed at sites of focused large mammal activity, such as paths, waterholes and saltlicks. These sites will be baited with small amounts of canned pilchards.

7.3 BIRDS

The MacKinnon list method as recommended by O'Dea *et al.* (2004) will be used to survey bird populations. This is a rapid assessment technique in which all species seen or heard are grouped into consecutive lists of equal length and a species accumulation curve is generated by plotting cumulative species totals against number of lists. Ten-species lists will be used, which Herzog *et al*. (2002) considered to be the best compromise between stable richness estimation curves and robust sample size. Birds will be searched for by walking slowly through vegetation and recording all species seen or heard. Care will be taken to remain at any point of bird activity and record all the species present, particularly mixed species flocks. Vocalizations of cryptic species will be recorded and played back using a smartphone in order to lure those species into view and confirm identification. Surveys will be focussed on the first five hours of daylight (approximately 6am-11am), with incidental observations recorded throughout the day.

7.4 HERPETOFAUNA

The primary survey technique for herpetofauna will be active searching of suitable habitat while conducting bird surveys. Active searching will involve photographing reptiles that are sunning themselves on exposed sites, as well as lifting up and searching under rocks or logs, and catching any frogs viewed during the day along wetland transects. Nocturnal audio point counts will be done at sites of frog activity; where necessary, frog calls will be recorded with a smartphone and identification confirmed with existing recordings and consultation with other herpetologists.

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9. APPENDICES

APPENDIX 1. LIST OF PLANTS RECORDED FROM A 20KM RADIUS OF THE STUDY AREA (BODATSA)

Taxa	Red Data	Provincial Endemic	Protected
Family Acanthaceae			
Crossandra greenstockii S.Moore			
Justicia anagalloides (Nees) T.Anderson			
Thunbergia atriplicifolia E.Mey. ex Nees			
Family Agavaceae			
Chlorophytum bowkeri Baker			
Chlorophytum cooperi (Baker) Nordal			
Family Aizoaceae			
Delosperma sp.			
Khadia carolinensis (L.Bolus) L.Bolus	VU	x	
Ruschia sp.			
Family Alliaceae			
Tulbaghia acutiloba Harv.			
Tulbaghia ludwigiana Harv.			
Family Amaranthaceae			
Hermbstaedtia odorata (Burch.) T.Cooke var. *odorata*			
Family Amaryllidaceae			
Boophone disticha (L.f.) Herb.			MNCA
Brunsvigia radulosa Herb.			MNCA
Crinum macowanii Baker			MNCA
Crinum bulbispermum (Burm.f.) Milne-Redh. & Schweick.			MNCA
Cyrtanthus breviflorus Harv.			MNCA
Cyrtanthus tuckii Baker var. *transvaalensis* I.Verd.			MNCA
Cyrtanthus tuckii Baker var. *tuckii*			MNCA
Haemanthus humilis Jacq. subsp. *hirsutus* (Baker) Snijman			MNCA
Scadoxus puniceus (L.) Friis & Nordal			MNCA
Family Anacardiaceae			
Searsia discolor (E.Mey. ex Sond.) Moffett			
Searsia magalismontana (Sond.) Moffett subsp. *magalismontana*			
Searsia tumulicola (S.Moore) Moffett var. *meeuseana* (R.Fern. & A.Fern.) Moffett forma *pumila* (Moffett) Moffett			
Family Apiaceae			
Afrosciadium magalismontanum (Sond.) P.J.D.Winter			
Alepidea longeciliata Schinz ex Dummer	EN	x	
Family Apocynaceae			
Ancylobotrys capensis (Oliv.) Pichon			
Asclepias multicaulis (E.Mey.) Schltr.			
Asclepias eminens (Harv.) Schltr.			
Asclepias dissona N.E.Br.	CE (PE)	x	
Asclepias adscendens (Schltr.) Schltr.			
Asclepias albens (E.Mey.) Schltr.			
Asclepias aurea (Schltr.) Schltr.			
Asclepias cucullata (Schltr.) Schltr. subsp. cucullata			

Asclepias stellifera Schltr.			
Aspidoglossum biflorum E.Mey.			
Aspidoglossum ovalifolium (Schltr.) Kupicha			
Aspidoglossum glabrescens (Schltr.) Kupicha			
Aspidoglossum xanthosphaerum Hilliard	VU	x	
Brachystelma angustum Peckover	VU	x	MNCA
Gomphocarpus rivularis Schltr.			
Gomphocarpus physocarpus E.Mey.			
Huernia loeseneriana Schltr.			MNCA
Pachycarpus concolor E.Mey. subsp. *transvaalensis* (Schltr.) Goyder			
Pachycarpus suaveolens (Schltr.) Nicholas & Goyder	VU	x	
Raphionacme hirsuta (E.Mey.) R.A.Dyer			
Riocreuxia aberrans R.A.Dyer	NT	x	
Schizoglossum periglossoides Schltr.			
Schizoglossum nitidum Schltr.			
Xysmalobium undulatum (L.) Aiton f. var. *undulatum*			
Family Aponogetonaceae			
Aponogeton natalensis Oliv.			
Family Araceae			
Zantedeschia albomaculata (Hook.) Baill. subsp. *macrocarpa* (Engl.) Letty			
Family Asparagaceae			
Asparagus fractiflexus (Oberm.) Fellingham & N.L.Mey.	EN	x	
Family Asphodelaceae			
Aloe greatheadii Schonland var. *davyana* (Schonland) Glen & D.S.Hardy			MNCA
Bulbine capitata Poelln.			
Bulbine inflata Oberm.			
Kniphofia triangularis Kunth subsp. *obtusiloba* (A.Berger) Codd	Rare		
Kniphofia porphyrantha Baker			MNCA
Kniphofia multiflora J.M.Wood & M.S.Evans			MNCA
Trachyandra saltii (Baker) Oberm. var. *saltii*			
Trachyandra asperata Kunth var. *carolinensis* Oberm.		x	
Trachyandra asperata Kunth var. *nataglencoensis* (Kuntze) Oberm.			
Trachyandra asperata Kunth var. *macowanii* (Baker) Oberm.			
Family Asteraceae			
Afroaster serrulatus (Harv.) J.C.Manning & Goldblatt			
Berkheya zeyheri Oliv. & Hiern subsp. *zeyheri*			
Berkheya setifera DC.			
Callilepis leptophylla Harv.			
Callilepis salicifolia Oliv.			
Cyanthillium wollastonii (S.Moore) H.Rob., Skvarla & V.A.Funk			
Denekia capensis Thunb.			
Dimorphotheca jucunda E.Phillips			
Dimorphotheca caulescens Harv.			
Dimorphotheca spectabilis Schltr.			
Euryops transvaalensis Klatt subsp. *transvaalensis*			
Euryops laxus (Harv.) Burtt Davy			
Euryops gilfillanii Bolus			
Felicia mossamedensis (Hiern) Mendonça			
Gerbera aurantiaca Sch.Bip.	EN		
Gazania krebsiana Less. subsp. *serrulata* (DC.) Roessler			
Geigeria burkei Harv. subsp. *burkei* var. burkei			
Gerbera ambigua (Cass.) Sch.Bip.			
Gnaphalium filagopsis Hilliard & B.L.Burtt			
Haplocarpha sp.			
Haplocarpha scaposa Harv.			
Helichrysum aureonitens Sch.Bip.			
Helichrysum lepidissimum S.Moore			

Helichrysum griseum Sond. *Helichrysum nudifolium* (L.) Less. var. *nudifolium* *Helichrysum adenocarpum* DC. subsp. *adenocarpum* *Helichrysum oreophilum* Klatt *Helichrysum miconiifolium* DC. *Helichrysum rugulosum* Less. *Helichrysum cephaloideum* DC. *Helichrysum chionosphaerum* DC. *Helichrysum argyrolepis* MacOwan *Helichrysum pallidum* DC. *Helichrysum caespititium* (DC.) Harv. *Hilliardiella hirsuta* (DC.) H.Rob. *Hypochaeris radicata* L. *Macledium zeyheri* (Sond.) S.Ortiz subsp. *zeyheri* *Nidorella anomala* Steetz *Nolletia rarifolia* (Turcz.) Steetz *Oncosiphon piluliferus* (L.f.) Kallersjo *Othonna natalensis* Sch.Bip. *Pegolettia lanceolata* Harv. *Philyrophyllum schinzii* O.Hoffm. *Phymaspermum athanasioides* (S.Moore) Kallersjo *Pseudognaphalium luteoalbum* (L.) Hilliard & B.L.Burtt *Pseudopegolettia tenella* (DC.) H.Rob., Skvarla & V.A.Funk *Senecio scitus* Hutch. & Burtt Davy *Senecio polyodon* DC. var. polyodon *Senecio bupleuroides* DC. *Senecio discodregeanus* Hilliard & B.L.Burtt *Senecio othonniflorus* DC. *Senecio erubescens* Aiton var. *erubescens* *Seriphium plumosum* L. *Ursinia montana* DC. subsp. *montana* *Ursinia nana* DC.			
Family Boraginaceae *Cynoglossum austroafricanum* Hilliard & B.L.Burtt *Cynoglossum lanceolatum* Forssk. *Myosotis afropalustris* C.H.Wright			
Family Brassicaceae *Heliophila rigidiuscula* Sond.			
Family Campanulaceae *Wahlenbergia denticulata* (Burch.) A.DC. var. *transvaalensis* (Adamson) W.G.Welman *Wahlenbergia undulata* (L.f.) A.DC.			
Family Capparaceae *Maerua cafra* (DC.) Pax			
Family Caryophyllaceae *Cerastium arabidis* E.Mey. ex Fenzl *Cerastium capense* Sond. *Dianthus mooiensis* F.N.Williams subsp. *mooiensis* var. *dentatus* Burtt Davy *Dianthus transvaalensis* Burtt Davy *Silene burchellii* Otth subsp. *modesta* J.C.Manning & Goldblatt *Silene burchellii* Otth subsp. *pilosellifolia* (Cham. & Schltdl.) J.C.Manning & Goldblatt			
Family Colchicaceae *Colchicum striatum* (Hochst. ex A.Rich.) J.C.Manning & Vinn.			
Family Commelinaceae *Commelina africana* L. var. *africana* *Commelina africana* L. var. *krebsiana* (Kunth) C.B.Clarke *Cyanotis speciosa* (L.f.) Hassk.			

Family Convolvulaceae *Convolvulus natalensis* Bernh. ex Krauss *Convolvulus thunbergii* Roem. & Schult. *Falkia oblonga* Bernh. ex C.Krauss *Ipomoea crassipes* Hook. var. *crassipes* *Ipomoea ommanneyi* Rendle *Ipomoea bathycolpos* Hallier f. *Ipomoea oblongata* E.Mey. ex Choisy			
Family Crassulaceae *Cotyledon orbiculata* L. var. *oblonga* (Haw.) DC. *Crassula alba* Forssk. var. alba			
Family Cucurbitaceae *Cucumis hirsutus* Sond. *Trochomeria hookeri* Harv.			
Family Cyperaceae *Abildgaardia ovata* (Burm.f.) Kral *Ascolepis capensis* (Kunth) Ridl. *Bulbostylis humilis* (Kunth) C.B.Clarke *Bulbostylis schoenoides* (Kunth) C.B.Clarke *Bulbostylis* sp. *Cyperus sphaerospermus* Schrad. *Cyperus parvinux* C.B.Clarke *Cyperus obtusiflorus* Vahl var. *flavissimus* (Schrad.) Boeck. *Cyperus obtusiflorus* Vahl var. *obtusiflorus* *Cyperus tenax* Boeck. *Dracoscirpoides surculosa* Muasya, Reynders & Goetgh. *Fuirena pubescens* (Poir.) Kunth var. *pubescens* *Isolepis fluitans* (L.) R.Br. var. *fluitans* *Isolepis costata* Hochst. ex A.Rich. *Kyllinga melanosperma* Nees *Kyllinga pulchella* Kunth *Pycreus macranthus* (Boeck.) C.B.Clarke *Pycreus* sp. *Rhynchospora brownii* Roem. & Schult. *Schoenoplectus decipiens* (Nees) J.Raynal *Schoenoplectus corymbosus* (Roth ex Roem. & Schult.) J.Raynal *Scirpoides burkei* (C.B.Clarke) Goetgh., Muasya & D.A.Simpson *Scleria woodii* C.B.Clarke			
Family Dipsacaceae *Scabiosa columbaria* L.			
Family Droseraceae *Drosera burkeana* Planch.			
Family Dryopteridaceae *Dryopteris athamantica* (Kunze) Kuntze			
Family Ebenaceae *Diospyros lycioides* Desf. subsp. *guerkei* (Kuntze) De Winter			
Family Ericaceae *Erica oatesii* Rolfe var. *oatesii* *Erica cerinthoides* L. var. *cerinthoides*			
Family Eriocaulaceae *Eriocaulon hydrophilum* Markotter			
Family Euphorbiaceae *Acalypha caperonioides* Baill. var. *caperonioides* *Clutia natalensis* Bernh. *Euphorbia gueinzii* Boiss. *Euphorbia clavarioides* Boiss.			
Family Fabaceae			

Aeschynomene rehmannii Schinz var. *leptobotrya* (Harms ex Baker f.) J.B.Gillett			
Argyrolobium tuberosum Eckl. & Zeyh.			
Crotalaria globifera E.Mey.			
Dichilus lebeckioides DC.			
Elephantorrhiza elephantina (Burch.) Skeels			
Eriosema simulans C.H.Stirt.			
Erythrina zeyheri Harv.			
Indigastrum fastigiatum (E.Mey.) Schrire			
Indigofera rostrata Bolus			
Indigofera hilaris Eckl. & Zeyh. var. *hilaris*			
Indigofera dimidiata Vogel ex Walp.			
Indigofera hedyantha Eckl. & Zeyh.			
Leobordea carinata (E.Mey.) B.-E.van Wyk & Boatwr.			
Leobordea mucronata (Conrath) B.-E.van Wyk & Boatwr.			
Leobordea corymbosa (E.Mey.) B.-E.van Wyk & Boatwr.			
Leobordea foliosa (Bolus) B.-E.van Wyk & Boatwr.			
Listia solitudinis (Dummer) B.-E.van Wyk & Boatwr.			
Mundulea sericea (Willd.) A.Chev. subsp. *sericea*			
Neorautanenia ficifolia (Benth. ex Harv.) C.A.Sm.			
Rhynchosia reptabunda N.E.Br.			
Rhynchosia nervosa Benth. ex Harv. var. *nervosa*			
Rhynchosia totta (Thunb.) DC. var. *totta*			
Rhynchosia adenodes Eckl. & Zeyh.			
Senna italica Mill. subsp. *arachoides* (Burch.) Lock			
Senna bicapsularis (L.) Roxb.			
Tephrosia elongata E.Mey. var. *elongata*			
Trifolium africanum Ser. var. *lydenburgense* J.B.Gillett			
Vicia sativa L. subsp. *sativa*			
Vigna unguiculata (L.) Walp. subsp. *unguiculata* var. *unguiculata*			
Family Gentianaceae			
Chironia purpurascens (E.Mey.) Benth. & Hook.f. subsp. *humilis* (Gilg) I.Verd.			
Chironia palustris Burch. subsp. *transvaalensis* (Gilg) I.Verd.			
Sebaea leiostyla Gilg			
Family Geraniaceae			
Geranium multisectum N.E.Br.			
Monsonia angustifolia E.Mey. ex A.Rich.			
Pelargonium luridum (Andrews) Sweet			
Family Gesneriaceae			
Streptocarpus pentherianus Fritsch			
Family Hyacinthaceae			
Albuca setosa Jacq.			
Albuca virens (Ker Gawl.) J.C.Manning & Goldblatt subsp. *virens*			
Drimia sp.			
Drimia depressa (Baker) Jessop			
Drimia calcarata (Baker) Stedje			
Ledebouria undulata (Jacq.) Jessop			
Ledebouria ovatifolia (Baker) Jessop			
Ledebouria cooperi (Hook.f.) Jessop			
Merwilla plumbea (Lindl.) Speta	NT		
Family Hypericaceae			
Hypericum aethiopicum Thunb. subsp. *sonderi* (Bredell) N.Robson			
Hypericum lalandii Choisy			
Family Hypoxidaceae			
Empodium elongatum (Nel) B.L.Burtt			
Hypoxis iridifolia Baker			
Hypoxis rigidula Baker var. *rigidula*			
Hypoxis filiformis Baker			

Family Iridaceae			
Aristea torulosa Klatt			
Dierama mobile Hilliard			
Dierama insigne N.E.Br.			
Gladiolus crassifolius Baker			MNCA
Gladiolus longicollis Baker subsp. *platypetalus* (Baker) Goldblatt & J.C.Manning			MNCA
Gladiolus malvinus Goldblatt & J.C.Manning	VU	x	MNCA
Gladiolus woodii Baker			MNCA
Gladiolus paludosus Baker	VU	x	MNCA
Gladiolus papilio Hook.f.			MNCA
Gladiolus dalenii Van Geel subsp. *dalenii*			MNCA
Hesperantha candida Baker			MNCA
Moraea stricta Baker			
Moraea pallida (Baker) Goldblatt			
Watsonia latifolia N.E.Br. ex Oberm.			MNCA
Family Juncaceae			
Juncus oxycarpus E.Mey. ex Kunth			
Juncus effusus L.			
Juncus dregeanus Kunth subsp. *dregeanus*			
Family Lamiaceae			
Acrotome hispida Benth.			
Mentha longifolia (L.) Huds. subsp. *polyadena* (Briq.) Briq.			
Rotheca hirsuta (Hochst.) R.Fern.			
Salvia runcinata L.f.			
Salvia stenophylla Burch. ex Benth.			
Stachys erectiuscula Gurke			
*Stachys natalens*is Hochst. var. *galpinii* (Briq.) Codd			
Stachys hyssopoides Burch. ex Benth.			
Stachys simplex Schltr.			
Syncolostemon pretoriae (Gurke) D.F.Otieno			
Family Lentibulariaceae			
Utricularia sp.			
Family Linaceae			
Linum thunbergii Eckl. & Zeyh.			
Family Linderniaceae			
Craterostigma wilmsii Engl. ex Diels			
Family Lobeliaceae			
*Lobelia erinu*s L.			
Monopsis decipiens (Sond.) Thulin			
Family Malvaceae			
Corchorus confusus Wild			
Hermannia cristata Bolus			
Hermannia sp.			
Hermannia lancifolia Szyszyl.			
Hibiscus trionum L.			
Hibiscus microcarpus Garcke			
Hibiscus aethiopicus L. var. *ovatus* Harv.			
Family Menyanthaceae			
Nymphoides thunbergiana (Griseb.) Kuntze			
Family Molluginaceae			
Psammotropha mucronata (Thunb.) Fenzl var. *foliosa* Adamson			
Psammotropha myriantha Sond.			
Family Myrtaceae			
Leptospermum laevigatum (Gaertn.) F.Muell.			
Family Ochnaceae			
Ochna natalitia (Meisn.) Walp.			
Family Oleaceae			

Jasminum quinatum Schinz			
Family Onagraceae			
Ludwigia palustris (L.) Elliott			
Family Orchidaceae			
Brownleea parviflora Harv. ex Lindl.			MNCA
Disa baurii Bolus			MNCA
Disa cooperi Rchb.f.			MNCA
Disa versicolor Rchb.f.			MNCA
Eulophia ovalis Lindl. var. *ovalis*			MNCA
Eulophia hians Spreng. var. *hians*			MNCA
Eulophia streptopetala Lindl.			MNCA
Eulophia ovalis Lindl. var. *bainesii* (Rolfe) P.J.Cribb & la Croix			MNCA
Eulophia cooperi Rchb.f.			MNCA
Habenaria dregeana Lindl.			MNCA
Habenaria dives Rchb.f.			MNCA
Orthochilus leontoglossus (Rchb.f.) Bytebier			MNCA
Orthochilus vinosus (McMurtry & McDonald) Bytebier			MNCA
Satyrium parviflorum Sw.			MNCA
Family Orobanchaceae			
Alectra capensis Thunb.			
Buchnera sp.			
Buchnera simplex (Thunb.) Druce			
Sopubia cana Harv. var. *cana*			
Striga elegans Benth.			
Striga bilabiata (Thunb.) Kuntze subsp. *bilabiata*			
Family Oxalidaceae			
Oxalis smithiana Eckl. & Zeyh.			
Oxalis corniculata L.			
Oxalis obliquifolia Steud. ex A.Rich.			
Family Papaveraceae			
Papaver aculeatum Thunb.			
Phrymaceae			
Mimulus gracilis R.Br.			
Family Phytolaccaceae			
Phytolacca heptandra Retz.			
Family Plantaginaceae			
Linaria vulgaris Mill.			
Family Poaceae			
Agrostis lachnantha Nees var. *lachnantha*			
Alloteropsis semialata (R.Br.) Hitchc. subsp. *semialata*			
Alloteropsis semialata (R.Br.) Hitchc. subsp. *eckloniana* (Nees) Gibbs Russ.			
Andropogon appendiculatus Nees			
Andropogon schirensis Hochst. ex A.Rich.			
Aristida sciurus Stapf			
Arundinella nepalensis Trin.			
Brachiaria serrata (Thunb.) Stapf			
Ctenium concinnum Nees			
Cynodon hirsutus Stent			
Digitaria tricholaenoides Stapf			
Diheteropogon filifolius (Nees) Clayton			
Elionurus muticus (Spreng.) Kunth			
Eragrostis plana Nees			
Eragrostis curvula (Schrad.) Nees			
Eragrostis capensis (Thunb.) Trin.			
Eragrostis racemosa (Thunb.) Steud.			
Festuca caprina Nees			
Hemarthria altissima (Poir.) Stapf & C.E.Hubb.			

Heteropogon contortus (L.) Roem. & Schult. *Holcus lanatus* L. *Koeleria capensis* (Steud.) Nees *Loudetia simplex* (Nees) C.E.Hubb. *Melinis nerviglumis* (Franch.) Zizka *Microchloa caffra* Nees *Monocymbium ceresiiforme* (Nees) Stapf *Odontelytrum abyssinicum* Hack. *Panicum hygrocharis* Steud. *Panicum schinzii* Hack. *Paspalum dilatatum* Poir. *Pennisetum sphacelatum* (Nees) T.Durand & Schinz *Pennisetum thunbergii* Kunth *Pogonarthria squarrosa* (Roem. & Schult.) Pilg. *Rendlia altera* (Rendle) Chiov. *Setaria nigrirostris* (Nees) T.Durand & Schinz *Setaria sphacelata* (Schumach.) Stapf & C.E.Hubb. ex M.B.Moss var. *torta* (Stapf) Clayton *Sorghum* sp. *Sporobolus pectinatus* Hack. *Sporobolus* sp. *Stiburus conrathii* Hack. *Stipagrostis zeyheri* (Nees) De Winter subsp. *sericans* (Hack.) De Winter *Themeda triandra* Forssk. *Trachypogon spicatus* (L.f.) Kuntze *Tristachya leucothrix* Trin. ex Nees *Tristachya* sp.			
Family Polygalaceae *Polygala gracilenta* Burtt Davy *Polygala rehmannii* Chodat *Polygala gerrardii* Chodat *Polygala uncinata* E.Mey. ex Meisn. *Polygala leendertziae* Burtt Davy			
Family Polygonaceae *Oxygonum dregeanum* Meisn. subsp. *canescens* (Sond.) Germish. var. *canescens* *Persicaria lapathifolia* (L.) Gray *Rumex dregeanus* Meisn. subsp. *montanus* B.L.Burtt *Rumex acetosella* L. subsp. *angiocarpus* (Murb.) Murb. *Rumex woodii* N.E.Br.			
Family Pteridaceae *Actiniopteris radiata* (J.Konig ex Sw.) Link *Cheilanthes hirta* Sw. var. *brevipilosa* W.Jacobsen & N.Jacobsen forma *brevipilosa* *Cheilanthes multifida* (Sw.) Sw. subsp. *lacerata* N.C.Anthony & Schelpe *Cheilanthes hirta* Sw. var. *hyaloglandulosa* (W.Jacobsen & N.Jacobsen) J.E.Burrows			
Family Ranunculaceae *Ranunculus multifidus* Forssk. *Ranunculus dregei* J.C.Manning & Goldblatt			
Family Rhamnaceae *Ziziphus zeyheriana* Sond.			
Family Rosaceae *Alchemilla woodii* Kuntze *Cliffortia linearifolia* Eckl. & Zeyh.			
Family Rubiaceae *Anthospermum rigidum* Eckl. & Zeyh. subsp. *pumilum* (Sond.) Puff *Anthospermum rigidum* Eckl. & Zeyh. subsp. *rigidum*			

Galium capense Thunb. subsp. *capense*			
Kohautia amatymbica Eckl. & Zeyh.			
Pachystigma thamnus Robyns			
Pachystigma pygmaeum (Schltr.) Robyns			
Pavetta sp.			
Pentanisia prunelloides (Klotzsch ex Eckl. & Zeyh.) Walp. subsp. *prunelloides*			
Pentanisia angustifolia (Hochst.) Hochst.			
Pygmaeothamnus chamaedendrum (Kuntze) Robyns var. *chamaedendrum*			
Spermacoce natalensis Hochst.			
Family Ruscaceae			
Eriospermum cooperi Baker var. *cooperi*			
Eriospermum mackenii (Hook.f.) Baker subsp. *mackenii*			
Family Santalaceae			
Thesium exile N.E.Br.			
Family Scrophulariaceae			
Chaenostoma neglectum J.M.Wood & M.S.Evans			
Chaenostoma polelense (Hiern) Kornhall subsp. *fraterna* (Hilliard) Kornhall			
Diclis rotundifolia (Hiern) Hilliard & B.L.Burtt			
Hebenstretia comosa Hochst.			
Hebenstretia oatesii Rolfe subsp. *oatesii*			
Jamesbrittenia sp.			
Jamesbrittenia aurantiaca (Burch.) Hilliard			
Manulea rhodantha Hilliard subsp. *aurantiaca* Hilliard			
Melanospermum transvaalense (Hiern) Hilliard			
Nemesia fruticans (Thunb.) Benth.			
Selago sp.			
Selago welwitschii Rolfe var. *holubii* (Rolfe) Brenan			
Selago densiflora Rolfe			
Selago capitellata Schltr.			
Zaluzianskya elongata Hilliard & B.L.Burtt			
Zaluzianskya pulvinata Killick			
Zaluzianskya spathacea (Benth.) Walp.			
Family Solanaceae			
Solanum capense L.			
Solanum retroflexum Dunal			
Withania somnifera (L.) Dunal			
Family Thymelaeaceae			
Gnidia fastigiata Rendle			
Gnidia gymnostachya (C.A.Mey.) Gilg			
Gnidia sp.			
Lasiosiphon caffer Meisn.			
Lasiosiphon microcephalus (Meisn.) J.C.Manning & Magee			
Lasiosiphon kraussianus (Meisn.) Meisn.			
Family Valerianaceae			
Valeriana capensis Thunb. var. *capensis*			
	13	**11**	**37**

NT = Near Threatened
VU = Vulnerable
EN = Endangered
CE PE - Critically Endangered (Presumed Extinct)
MNCA = Mpumalanga Nature Conservation Act No. 10 (1998)

APPENDIX 2. POTENTIALLY OCCURRING PLANT SPECIES OF CONSERVATION CONCERN

Species	Family	Red Data Status	Habitat	Likelihood	Reason
Khadia carolinensis	Aizoaceae	VU	Well-drained, sandy loam soils among rocky outcrops, or at the edges of sandstone sheets, Highveld Grassland	High	Confirmed in 2630AA (Carolina Town and Townlands 43 IT, Groenvallei 40 IT, Jagtlust 47 IT)
Alepidea longeciliata	Apiaceae	EN	Highveld grassland, may be associated with pans	High	Confirmed in 2629BB (Bankfontein 215 IS, Jagtlust 47 IT)
Asclepias dissona	Apocynaceae	CE (PE)	Damp grassland	Low	Confirmed in 2630AA (Boesmanspruit 9 IT) but last recorded in 1932. Possibly extinct
Aspidoglossum xanthosphaerum	Apocynaceae	VU	Montane grassland, Highveld grassland, marshy sites	Moderate	Some suitable habitat present
Brachystelma angustum	Apocynaceae	VU	Pockets of shallow, humic soils on white quartzitic ridges	Low	Only known from north of Carolina
Riocreuxia aberrans	Apocynaceae	NT	Wedged in cracks among rocks on exposed quartzite ridges	Low	Unsuitable habitat present
Pachycarpus suaveolens	Apocynaceae	VU	Short or annually burnt grasslands, 1400-2000 mamsl	Low	Although historically recorded from the Carolina district, it is a very rare species and only known from eight localities
Asparagus fractiflexus	Asparagaceae	EN	High altitude, open grasslands, on rocky outcrops or among boulders	Low	Although historically recorded from the Carolina district, it is a very rare species and only known from four localities

Kniphofia triangularis subsp. obtusiloba	Asphodelaceae	Rare	Quartzitic rocky outcrops in montane grasslands	Low	Confirmed in 2630AA (near Slaaihoek), but in high-lying wetter areas of the Escarpment
Gerbera aurantiaca	Asteraceae	EN	Mistbelt grassland, well-drained doleritic areas	Low	Unsuitable habitat present
Merwilla plumbea	Hyacinthaceae	NT	Montane mistbelt and Ngongoni grassland, rocky areas on steep, well drained slopes	Low	Unsuitable habitat present
Gladiolus malvinus	Iridaceae	VU	Dolerite outcrops in grassland, around 2000 m	Low	Unsuitable geology and habitat present
Gladiolus paludosus	Iridaceae	VU	Wetlands or marshes in high altitude grassland that remain wet throughout the year or dry out for only a short period	Low	Rare and localised species

NT = Near Threatened
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CE - Critically Endangered
PE = Presumed Extinct

APPENDIX 3. LIST OF MAMMALS RECORDED FROM THE VICINITY OF THE STUDY AREA

Common Name	Scientific Name	Red Data	Provincial Endemic	Protected - NEMBA ToPS	Protected - MNCA	QDS	
						2629BB	2630AA
ORDER: AFROSORICIDA							
Family Chrysochloridae (golden moles)							
Hottentot's Golden Mole	*Amblysomus hottentotus*						X
Highveld Golden Mole	*Amblysomus septentrionalis*	NT					X
ORDER: EULIPOTYPHLA							
Family Erinaceidae (hedgehogs)							
Southern African Hedgehog	*Atelerix frontalis*	NT		PR			X
Family Soricidae (shrews)							
Swamp Musk Shrew	*Crocidura mariquensis*	NT				X	
Forest Shrew	*Myosorex varius*						X
ORDER: LAGOMORPHA							
Family Leporidae (rabbits and hares)							
Cape Hare	*Lepus capensis*						X
Scrub Hare	*Lepus saxatilis*						X
ORDER: RODENTIA							
Family Hystricidae (Old World porcupines)							
Cape Porcupine	*Hystrix africaeaustralis*						X
ORDER: CARNIVORA							
Family Canidae (dogs, jackals & allies)							
Black-backed Jackal	*Canis mesomelas*						X
Bat-eared Fox	*Otocyon megalotis*			PR			X
Cape Fox	*Vulpes chama*			PR		X	
Family Mustelidae (otters, badgers & allies)							
Striped Polecat	*Ictonyx striatus*						X
Family Herpestidae (mongooses)							
Yellow Mongoose	*Cynictis penicillata*					X	X
Slender Mongoose	*Herpestes sanguineus*						X
Suricate	*Suricata suricatta*					X	
Family Hyaenidae (hyaenas)							
Brown Hyaena	*Parahyaena brunnea*	NT		PR	MNCA		X
Aardwolf	*Proteles cristatus*				MNCA		X
Family Felidae (cats)							
Serval	*Leptailurus serval*	NT		PR			X
ORDER: TUBULIDENTATA							
Family Orycteropodidae (Aardvark)							
Aardvark	*Orycteropus afer*			PR	MNCA		X
ORDER: PERRISODACTYLA							
Family Equidae (horses)							
Plains (Burchell's) Zebra	*Equus quagga burchellii*			PR			X
ORDER: CETARTIODACTYLA							
Family Suidae (pigs)							

Bushpig	*Potamochoerus larvatus*						X
Family Bovidae (cattle & antilopes)							
Red Hartebeest	*Alcelaphus buselaphus caama*			PR			X
Springbok	*Antidorcas marsupialis*						X
Black Wildebeest	*Connochaetes gnou*			PR	MNCA		X
Blesbok	*Damaliscus pygargus phillipsi*			PR			X
Oribi	*Ourebia ourebi ourebi*	EN		EN	MNCA		X
Grey Rhebok	*Pelea capreolus*	NT			MNCA		X
Steenbok	*Raphicerus campestris*				MNCA		X
Southern Reedbuck	*Redunca arundinum*				MNCA		X
Southern Mountain Reedbuck	*Redunca fulvorufula fulvorufula*	EN			MNCA		X
Common Duiker	*Sylvicapra grimmia*					X	X
Eland	*Tragelaphus oryx*				MNCA		X
Family Cervidae (deer)							
Persian Fallow Deer	*Dama dama*						X
TOTAL	**33**	**8**	**0**	**11**	**10**	**5**	**30**

NT = Near Threatened
VU = Vulnerable
EN = Endangered
E = Endemic to South Africa, Lesotho & Swaziland
Q!DS = Quarter Degree Square
NEMBA ToPS = National Environmental Management: Biodiversity Act: Threatened or Protected Species
PR = Protected
MNCA = Mpumalanga Nature Conservation Act

APPENDIX 4. LIST OF BIRDS RECORDED FROM THE VICINITY OF THE STUDY AREA (SABAP2)

Common Name	Scientific Name	Red Data	Biome-[illegible]	Protected - [illegible]	2610_3000	2605_3000	2610_2955	2605_2955	2629BB	2630AA
ORDER: ANSERIFORMES										
Family Anatidae (ducks, geese and swans)										
Egyptian Goose	*Alopochen aegyptiaca*				X	X	X	X		
Red-billed Teal	*Anas erythrorhyncha*					X				
Cape Shoveler	*Anas smithii*				X	X	X			
Yellow-billed Duck	*Anas undulata*				X	X	X	X		
Southern Pochard	*Netta erythrophthalma*				X	X	X			
Maccoa Duck	*Oxyura maccoa*	NT					X		X	X
Spur-winged Goose	*Plectropterus gambensis*				X	X	X	X		
South African Shelduck	*Tadorna cana*						X			
White-backed Duck	*Thalassornis leuconotus*						X			
ORDER: GALLIFORMES										
Family Numididae (guineafowl)										
Helmeted Guineafowl	*Numida meleagris*				X	X	X	X		
Family Phasianidae (pheasants, fowl and allies)										
Common Quail	*Coturnix coturnix*				X	X	X			
Natal Spurfowl	*Pternistis natalensis*						X	X		
Swainson's Spurfowl	*Pternistis swainsonii*				X	X	X	X		
Grey-winged Francolin	*Scleroptila africana*					X				
Red-winged Francolin	*Scleroptila levaillantii*					X	X			
ORDER: PODICIPEDIFORMES										
Family Podicipedidae (grebes)										
Little Grebe	*Tachybaptus ruficollis*				X	X	X	X		
ORDER: PHOENICOPTERIFORMES										
Family Phoenicopteridae (flamingos)										
Lesser Flamingo	*Phoeniconaias minor*	NT								X
Greater Flamingo	*Phoenicopterus roseus*	NT					X		X	
ORDER: CICONIIFORMES										
Family Ciconiidae (storks)										
White Stork	*Ciconia ciconia*				X					
ORDER: PELECANIFORMES										
Family Threskiornithidae (ibises and spoonbills)										
Hadeda Ibis	*Bostrychia hagedash*				X	X	X	X		
Southern Bald Ibis	*Geronticus calvus*	VU	x	VU	X			X		X
Glossy Ibis	*Plegadis falcinellus*					X	X			
African Sacred Ibis	*Threskiornis aethiopicus*				X	X				
African Spoonbill	*Platalea alba*				X	X				
Family Ardeidae (herons and bitterns)										
Great Egret	*Ardea alba*				X	X				
Grey Heron	*Ardea cinerea*				X	X	X			

Goliath Heron	*Ardea goliath*				X	X				
Black-headed Heron	*Ardea melanocephala*				X	X	X	X		
Western Cattle Egret	*Bubulcus ibis*				X	X	X			
Little Egret	*Egretta garzetta*					X	X			
Yellow-billed Egret	*Egretta intermedia*				X	X	X	X		
Little Bittern	*Ixobrychus minutus*					X				
Family Scopidae (Hamerkop)										
Hamerkop	*Scopus umbretta*					X				
ORDER: SULIFORMES										
Family Phalacrocoracidae (cormorants and shags)										
Reed Cormorant	*Microcarbo africanus*				X	X	X	X		
White-breasted Cormorant	*Phalacrocorax lucidus*				X		X			
ORDER: ACCIPITRIFORMES										
Family Sagittariidae (Secretarybird)										
Secretarybird	*Sagittarius serpentarius*	VU			X					X
Family Accipitridae (kites, hawks and eagles)										
Common Buzzard	*Buteo buteo*				X	X	X			
Jackal Buzzard	*Buteo rufofuscus*						X			
Black-shouldered Kite	*Elanus caeruleus*				X	X	X	X		
Cape Vulture	*Gyps coprotheres*	EN		EN						X
African Harrier-Hawk	*Polyboroides typus*				X					
ORDER: OTIDIFORMES										
Family Otididae (bustards)										
Blue Korhaan	*Eupodotis caerulescens*	NT*			X					
White-bellied Korhaan	*Eupodotis senegalensis*	VU							X	
Denham's Bustard	*Neotis denhami*	VU		VU						X
ORDER: GRUIFORMES										
Family Rallidae (rails, crakes and coots)										
Black Crake	*Amaurornis flavirostra*					X				
Red-knobbed Coot	*Fulica cristata*				X	X	X	X		
Common Moorhen	*Gallinula chloropus*				X	X	X			
African Swamphen	*Porphyrio madagascariensis*					X				
African Rail	*Rallus caerulescens*				X	X				
Family Gruidae (cranes)										
Grey Crowned Crane	*Balearica regulorum*	EN		ENPRCR						X
Blue Crane	*Grus paradiseus*	NT							X	X
Wattled Crane	*Grus carunculatus*	CR							X	X
ORDER: CHARADRIIFORMES										
Family Burhinidae (thick-knees)										
Spotted Thick-knee	*Burhinus capensis*					X				
Family Recurvirostridae (stilts and avocets)										
Black-winged Stilt	*Himantopus himantopus*				X		X			
Pied Avocet	*Recurvirostra avosetta*				X		X			
Family Charadriidae (plovers)										
Kittlitz's Plover	*Charadrius pecuarius*				X					
Three-banded Plover	*Charadrius tricollaris*				X		X			
Blacksmith Lapwing	*Vanellus armatus*				X	X	X	X		

Crowned Lapwing	*Vanellus coronatus*				X	X	X	X		
African Wattled Lapwing	*Vanellus senegallus*				X	X	X	X		
Family Scolopacidae (sandpipers and snipes)										
African Snipe	*Gallinago nigripennis*				X	X	X	X		
Family Laridae (gulls, terns and skimmers)										
Whiskered Tern	*Chlidonias hybrida*				X	X		X		
White-winged Tern	*Chlidonias leucopterus*				X	X				
Grey-headed Gull	*Chroicocephalus cirrocephalus*				X	X				
ORDER: COLUMBIFORMES										
Family Columbidae (pigeons and doves)										
Speckled Pigeon	*Columba guinea*					X	X	X		
Rock Dove	*Columba livia*						X			
Namaqua Dove	*Oena capensis*							X		
Laughing Dove	*Spilopelia senegalensis*				X	X	X	X		
Cape Turtle Dove	*Streptopelia capicola*				X	X	X	X		
Red-eyed Dove	*Streptopelia semitorquata*				X	X	X	X		
ORDER: CUCULIFORMES										
Family Cuculidae (cuckoos)										
Diederik Cuckoo	*Chrysococcyx caprius*				X	X	X			
ORDER: STRIGIFORMES										
Family Tytonidae (barn owls)										
African Grass Owl	*Tyto capensis*	VU								X
Family Strigidae (owls)										
Marsh Owl	*Asio capensis*					X				
ORDER: APODIFORMES										
Family Apodidae (swifts)										
Little Swift	*Apus affinis*					X				
White-rumped Swift	*Apus caffer*				X	X	X			
ORDER: COLIIFORMES										
Family Coliidae (mousebirds)										
Speckled Mousebird	*Colius striatus*						X			
ORDER: CORACIIFORMES										
Family Alcedinidae (kingfishers)										
Pied Kingfisher	*Ceryle rudis*					X				
Giant Kingfisher	*Megaceryle maxima*					X				
ORDER: BUCEROTIFORMES										
Family Upupidae (hoopoes)										
African Hoopoe	*Upupa africana*					X				
ORDER: PICIFORMES										
Family Lybiidae (African barbets)										
Black-collared Barbet	*Lybius torquatus*						X			
Family Picidae (woodpeckers)										
Red-throated Wryneck	*Jynx ruficollis*					X	X			
ORDER: FALCONIFORMES										
Family Falconidae (caracaras and falcons)										
Amur Falcon	*Falco amurensis*				X	X	X	X		
ORDER: PASSERIFORMES										
Family Malaconotidae (bushshrikes)										
Bokmakierie	*Telophorus zeylonus*				X	X	X			
Family Laniidae (shrikes)										
Southern Fiscal	*Lanius collaris*				X	X	X	X		
Family Alaudidae (larks)										

Red-capped Lark	*Calandrella cinerea*					X	X	X			
Spike-heeled Lark	*Chersomanes albofasciata*					X					
Rufous-naped Lark	*Mirafra africana*							X			
Family Pycnonotidae (bulbuls)											
Dark-capped Bulbul	*Pycnonotus tricolor*				X	X	X				
Family Hirundinidae (swallows and martins)											
Greater Striped Swallow	*Cecropis cucullata*				X	X	X				
White-throated Swallow	*Hirundo albigularis*				X	X					
Barn Swallow	*Hirundo rustica*				X	X	X	X			
South African Cliff Swallow	*Petrochelidon spilodera*					X					
Rock Martin	*Ptyonoprogne fuligula*					X					
Banded Martin	*Riparia cincta*					X	X				
Brown-throated Martin	*Riparia paludicola*					X	X				
Family Acrocephalidae (reed warblers and allies)											
African Reed Warbler	*Acrocephalus baeticatus*					X					
Lesser Swamp Warbler	*Acrocephalus gracilirostris*					X					
Family Locustellidae (grassbirds and allies)											
Little Rush Warbler	*Bradypterus baboecala*					X					
Family Cisticolidae (cisticolas and allies)											
Wing-snapping Cisticola	*Cisticola ayresii*				X	X	X				
Pale-crowned Cisticola	*Cisticola cinnamomeus*				X						
Neddicky	*Cisticola fulvicapilla*						X				
Zitting Cisticola	*Cisticola juncidis*				X	X	X				
Cloud Cisticola	*Cisticola textrix*				X	X					
Levaillant's Cisticola	*Cisticola tinniens*				X	X	X	X			
Black-chested Prinia	*Prinia flavicans*					X					
Tawny-flanked Prinia	*Prinia subflava*				X						
Family Sturnidae (starlings)											
Common Myna	*Acridotheres tristis*						X	X			
Pied Starling	*Lamprotornis bicolor*				X	X	X	X			
Family Muscicapidae (chats and Old World flycatchers)											
Cape Robin-Chat	*Cossypha caffra*				X	X					
Ant-eating Chat	*Myrmecocichla formicivora*				X	X	X	X			
Mountain Wheatear	*Myrmecocichla monticola*					X	X				
Capped Wheatear	*Oenanthe pileata*					X	X				
African Stonechat	*Saxicola torquatus*				X	X	X	X			
Family Passeridae (Old World sparrows)											
Southern Grey-headed Sparrow	*Passer diffusus*						X	X			
House Sparrow	*Passer domesticus*					X	X	X			
Cape Sparrow	*Passer melanurus*				X	X	X	X			
Family Ploceidae (weavers and widowbirds)											
Yellow-crowned Bishop	*Euplectes afer*				X	X	X	X			
Red-collared Widowbird	*Euplectes ardens*							X			
Fan-tailed Widowbird	*Euplectes axillaris*				X	X	X	X			
Southern Red Bishop	*Euplectes orix*				X	X	X	X			
Long-tailed Widowbird	*Euplectes progne*				X	X	X	X			
Cape Weaver	*Ploceus capensis*					X					
Southern Masked Weaver	*Ploceus velatus*				X	X	X	X			

Red-billed Quelea	*Quelea quelea*				X	X		X		
Family Estrildidae (waxbills, munias and allies)										
Red-headed Finch	*Amadina erythrocephala*							X		
Common Waxbill	*Estrilda astrild*				X	X	X	X		
Quail-Finch	*Ortygospiza fuscocrissa*				X	X	X			
Family Viduidae (indigobirds and whydahs)										
Pin-tailed Whydah	*Vidua macroura*				X	X				
Family Motacillidae (wagtails and pipits)										
African Pipit	*Anthus cinnamomeus*				X	X	X			
Cape Longclaw	*Macronyx capensis*				X	X	X	X		
Cape Wagtail	*Motacilla capensis*				X	X	X	X		
Family Fringillidae (finches and canaries)										
Black-throated Canary	*Crithagra atrogularis*				X	X	X	X		
Cape Canary	*Serinus canicollis*				X	X	X	X		
Family Emberizidae (buntings and New World sparrows)										
Golden-breasted Bunting	*Emberiza flaviventris*							X		
TOTAL	**134**	**13**	**1**	**6**	**78**	**97**	**80**	**51**	**5**	**10**

NT = Near Threatened
VU = Vulnerable
EN = Endangered
CR = Critically Endangered
NEMBA ToPS = National Environmental Management: Biodiversity Act: Threatened or Protected Species
PR = Protected

APPENDIX 5. LIST OF HERPETOFAUNA OCCURRING IN THE VICINITY OF THE STUDY AREA

Common Name	Scientific Name	Red Data	QDS	
			2629BB	2630AA
REPTILES				
Family Cordylidae (girdled lizards)				
Common Girdled Lizard	*Cordylus vittifer*			X
Common Crag Lizard	*Pseudocordylus melanotus melanotus*		X	X
Family Gerrhosauridae (plated lizards)				
Yellow-throated Plated Lizard	*Gerrhosaurus flavigularis*			X
Family Scincidae (skinks)				
Thin-tailed Legless Skink	*Acontias gracilicauda*			X
Wahlberg's Snake-eyed Skink	*Panaspis wahlbergii*			X
Cape Skink	*Trachylepis capensis*		X	
Speckled Rock Skink	*Trachylepis punctatissima*		X	X
Variable Skink	*Trachylepis varia*		X	X
Family Chamaeleonidae (chameleons)				
Common Flap-neck Chameleon	*Chamaeleo dilepis dilepis*			X
Family Agamidae (agamas)				
Distant's Ground Agama	*Agama aculeata distanti*			X
Southern Rock Agama	*Agama atra*		X	X
Family Typhlopidae (blind snakes)				
Bibron's Blind Snake	*Afrotyphlops bibronii*			X
Delalande's Beaked Blind Snake	*Rhinotyphlops lalandei*			X
Family Leptotyphlopidae (thread snakes)				
Eastern Thread Snake	*Leptotyphlops scutifrons conjunctus*		X	
Family Viperidae (vipers)				
Puff Adder	*Bitis arietans arietans*			X
Snouted Night Adder	*Causus defilippii*			X
Rhombic Night Adder	*Causus rhombeatus*		X	
Family Lamprophiidae (African snakes)				
Black-headed Centipede-eater	*Aparallactus capensis*		X	X
Spotted Harlequin Snake	*Homoroselaps lacteus*	NT*	X	
Dusky-bellied Water Snake	*Lycodonomorphus laevissimus*			X
Brown Water Snake	*Lycodonomorphus rufulus*			X
Cross-marked Grass Snake	*Psammophis crucifer*			X
Western Yellow-bellied Sand Snake	*Psammophis subtaeniatus*		X	
Spotted Grass Snake	*Psammophylax rhombeatus rhombeatus*		X	X
Mole Snake	*Pseudaspis cana*		X	X
Family Elapidae (cobras, mambas & allies)				
Sundevall's Garter Snake	*Elapsoidea sundevallii sundevallii*			X
Rinkhals	*Hemachatus haemachatus*		X	X
Family Colubridae (colubrids)				
Red-lipped Snake	*Crotaphopeltis hotamboeia*		X	X
Rhombic Egg-eater	*Dasypeltis scabra*		X	X
Spotted Bush Snake	*Philothamnus semivariegatus*			X
TOTAL	**30**	**1**	**15**	**25**
AMPHIBIANS				
Family Bufonidae (toads)				
Raucous Toad	*Sclerophrys capensis*		X	X
Guttural Toad	*Sclerophrys gutturalis*		X	X

Family Hyperoliidae (sedge and bush frogs)				
Bubbling Kassina	*Kassina senegalensis*		X	X
Rattling Frog	*Semnodactylus wealii*		X	X
Family Pipidae (clawed frogs)				
Common Platanna	*Xenopus laevis*			X
Family Ptychadenidae (grass frogs)				
Striped Grass Frog	*Ptychadena porosissima*			X
Family Pyxicephalidae (sand frogs)				
Delalande's River Frog	*Amietia delalandii*		X	X
Cape River Frog	*Amietia fuscigula*		X	X
Common Caco	*Cacosternum boettgeri*		X	X
Striped Stream Frog	*Strongylopus fasciatus*		X	X
Clicking Stream Frog	*Strongylopus grayii*		X	X
Tremelo Sand Frog	*Tomopterna cryptotis*		X	X
Natal Sand Frog	*Tomopterna natalensis*		X	
Tandy's Sand Frog	*Tomopterna tandyi*		X	
TOTAL	**14**	**0**	**12**	**12**

NT* = Near Threatened (Provincial Assessment)

APPENDIX 6. POTENTIALLY OCCURRING FAUNA SPECIES OF CONSERVATION CONCERN

Species	Scientific Name	Red Data	Habitat	SABAP2 Reporting Rate for 2629BB	SABAP2 Reporting Rate for 2630AA	Likelihood	Reason
Mammals							
Highveld Golden Mole	*Amblysomus septentrionalis*	NT	Highveld grassland			Moderate	Suitable habitat present
African Clawless Otter	*Aonyx capensis*	NT	Rivers and streams			Moderate	Suitable habitat present
Southern African Hedgehog	*Atelerix frontalis*	NT	Savanna, grassland			High	Recorded on an adjacent farm in 2015 (pers.obs.)
Swamp Musk Shrew	*Crocidura mariquensis*	NT	Wetlands in savanna biome			Moderate	Suitable habitat present
Spotted-necked Otter	*Hydrictis maculicollis*	VU	Rivers and streams			Moderate	Suitable habitat present
Serval	*Leptailurus serval*	NT	Grassland, wetlands			Moderate	Suitable habitat present
Oribi	*Ourebia ourebi ourebi*	EN	Grassland			Low	Although suitable habitat is present, there are no nearby records
Brown Hyaena	*Parahyaena brunnea*	NT	Wide variety of habitats bu prefers more arid regions			Moderate	Suitable habitat present
Grey Rhebok	*Pelea capreolus*	NT	High-altitude grassland			Low	Requires large tracts of natural grassland
Southern Mountain Reedbuck	*Redunca fulvorufula fulvorufula*	EN	High-altitude grassland			Low	Requires large tracts of natural grassland
Subtotal	10	10					
Birds							
Grey Crowned Crane	*Balearica regulorum*	EN	Wetland and grassland	-	5.3%	Moderate	Suitable habitat present
Chestnut-banded Plover	*Charadrius pallidus*	NT	Saline pans, shorelines	-	-	Low	Very rare in the general area, one record from near Chrissiesmeer
Pallid Harrier	*Circus macrourus*	NT	Dry grasslands	-	-	Moderate	Suitable habitat present
Blue Korhaan	*Eupodotis caerulescens*	NT*	Highveld grassland	8.0%	7.9%	High	Suitable habitat present and recorded from adjacent properties (pers.obs.)

White-bellied Korhaan	*Eupodotis senegalensis*	VU	Open woodland and grassland	4.0%	-	Low	Although suitable habitat is present, there are no nearby records
Lanner Falcon	*Falco biarmicus*	VU	Wide variety of habitats	-	5.3%	Moderate	Suitable foraging habitat present only
Southern Bald Ibis	*Geronticus calvus*	VU	Montane grassland, ploughed lands	12.0%	18.4%	Moderate	Suitable foraging habitat present only
Black-winged Pratincole	*Glareola nordmanni*	NT	Highveld grassland, wetland	4.0%	-	High	Suitable habitat present and recorded from adjacent properties (pers.obs.)
Wattled Crane	*Grus carunculatus*	CR	Undisturbed wetland and grassland	4.0%	-	Moderate	Suitable foraging habitat present only
Blue Crane	*Grus paradiseus*	NT	Undisturbed grassland in Mpumalanga	4.0%	-	Moderate	Suitable habitat present
Cape Vulture	*Gyps coprotheres*	EN	Wide variety of habitats, cliff nesting	-	-	Low	Although suitable habitat is present, there are no recent records
Denham's Bustard	*Neotis denhami*	VU	Fairly undisturbed grassland	4.0%	2.6%	Low	Suitable habitat present, but requires large tracts of natural grassland
Maccoa Duck	*Oxyura maccoa*	NT	Pans, dams, wetlands	20.0%	5.3%	Moderate	Suitable habitat present
Lesser Flamingo	*Phoeniconaias minor*	NT	Saline pans	-	-	Moderate	Suitable habitat present
Greater Flamingo	*Phoenicopterus roseus*	NT	Saline pans	20.0%	-	Moderate	Suitable habitat present
Secretarybird	*Sagittarius serpentarius*	VU	Open woodland, grassland	-	13.1%	Moderate	Suitable habitat present
Botha's Lark	*Spizocorys fringillaris*	EN	Short, montane grassland	-	-	Low	Formerly recorded in 2629BB (SABAP1) but no recent records. May be locally extinct
African Grass Owl	*Tyto capensis*	VU	Grassland	-	-	Moderate	Suitable habitat present
Subtotal	18	18					
Reptiles							
Coppery Grass Lizard	*Chamaesaura aenea*	NT	Highveld and Escarpement grasslands			Low	Rare in the general area, poorly known species
Large-scaled Grass Lizard	*Chamaesaura macrolepis*	NT	Grassland and open woodland			Low	Rare in the general area, poorly known species

Striped Harlequin Snake	*Homoroselaps dorsalis*	NT	Mostly high altitude Escaprment grasslands in Mpumalanga			Low	No suitable habitat present
Spotted Harlequin Snake	*Homoroselaps lacteus*	NT#	Wide variety of habitats			Low	Rare in the general area, poorly known species
Subtotal	4	4					
Frogs							
Giant Bull Frog	*Pyxicephalus adspersus*	NT	Pans in arid savanna and grassland			Low	Very rare in Mpumalanga, no recent records near the study area
Subtotal	1	1					
TOTAL	**33**	**33**					

NT = Near-threatened
VU = Vulnerable
EN = Endangered
CR = Critically Endangered
E = Endemic to South Africa, Lesotho and Swaziland
MNCA = Mpumalanga Nature Conservation Act
NEMBA = National Environmental Management: Biodiversity Act
= Provincial assessment
* = IUCN assessment

APPENDIX 7. CV OF REPORT AUTHOR

Name	:	**Warren Lee McCleland**
Profession	:	Terrestrial Ecologist
Date of Birth	:	7 Sep 1972
Name of Firm	:	ECOREX Consulting Ecologists cc
Position in Firm	:	Sole Member
Years with firm	:	11
Nationality	:	South African

Qualifications :

- N.Dip. [Nature Conservation] Cape Peninsula University of Technology 1993

Membership in Professional Societies:

- South African Association of Botanists
- International Association for Impact Assessment (SA)

Languages :

	Speaking	Reading	Writing
English (home):	Excellent	Excellent	Excellent
Afrikaans:	Good	Good	Good
isiZulu:	Good	Fair	Fair
siSwati:	Fair	Poor	Poor

Countries of Work Experience **:** Angola**,** Botswana**,** Democratic Republic of the Congo**,** Kenya Lesotho, Liberia, Malawi, Mali, Mozambique, Namibia, Republic of Guinea, Sierra Leone, South Africa, Swaziland, Tanzania, Zambia, Zimbabwe.

OVERVIEW OF EXPERIENCE

- 15 years experience in conducting baseline surveys, data analysis and report writing in various biomes in southern and tropical Africa, particularly savannah, forest and grassland biomes.
- 5 years experience game reserve management (KwaZulu-Natal, Mpumalanga)
- **Co-author of acclaimed Field Guide to Trees and Woody Shrubs of Mpumalanga & Kruger National Park, Jacana Publishers, 2002.**
- Specialist knowledge of identification of plants, mammals, birds, reptiles and frogs.
- Experience in reporting according to IFC Performance Standards for numerous international projects in Sierra Leone, Angola, Democratic Republic of the Congo, Republic of Guinea, Tanzania, Malawi, Mali, Mozambique and Zambia.
- Accredited with the discovery of a number of new plant species, most notably *Gladiolus diluvialis* Goldblatt & Manning (Fish River Canyon, Namibia), *Streptocarpus sekhukhuniensis* ms (Stoffberg, Mpumalanga – manuscript currently being edited) and *Barleria lebomboensis* Darbyshire, McCleland & Froneman (Lebombo Mts, Swaziland).
- **2014 Recipient of the Marloth Medal** from the Botanical Society of South Africa for co-authoring the Kruger tree field guide.

Employment Record:

2005 - present	ECOREX Consulting Ecologists CC	Ecologist; Sole Member
2001 - 2005	Lawson's Birding Tours	Specialist Guide
2000 - 2001	Escarpment Ecological Consultants cc	Founder Director
1996 – 2000	Crystal Springs Game Reserve	Reserve Manager
1995	Mutemwa Lodge, western Zambia	Lodge manager, guide
1993 - 1994	Natal Parks Board	Cadet field ranger

SELECTED RECENT PROJECTS & EXPERIENCE

West Africa			
Mali	**2014**	Biodiversity Baseline Study and Impact Assessment for Kalana Gold Mine, Yanfolila	Epoch Resources – Fanie Coetzee (fanie@epochresources.co.za)
	2013	Biodiversity Baseline Study and Impact Assessment for Fekola Gold Mine, Fedougou	Epoch Resources – Fanie Coetzee (fanie@epochresources.co.za)
Republic of Guinea	**2012**	Review of Specialist Studies conducted for an EIA for an aluminium mine near Bel-Air, in Bofa Prefecture.	Epoch Resources – Fanie Coetzee (fanie@epochresources.co.za)
Sierra Leone	**2011**	Biodiversity Baseline Study and Impact Assessment for Marampa Iron Ore Mine, Lunsar	SRK (U.K.) - Nicola Rump (nrump@srk.co.uk)
East Africa			
Tanzania	**2011**	Biodiversity Baseline Study and Impact Assessment for Mkuju River Uranium Project, Selous Game Reserve, Songea	Epoch Resources – Fanie Coetzee (fanie@epochresources.co.za)
Southern and South-central Africa			
Angola	**2013**	Biodiversity Management Plan for the raising of the Cambambe Dam wall, Kwanza River, Dondo	ERM – Jessica Hughes (jessica.hughes@erm.com)
Democratic Republic of the Congo	**2014**	Biodiversity Baseline Study and Impact Assessment for Pumpi Copper Mine, Kolwezi	Epoch Resources – Fanie Coetzee (fanie@epochresources.co.za)
	2013	Biodiversity Assessment of selected wetland habitats, Kamoa Copper Mine, Kolwezi	Wetland Consulting Services – Gary Marneweck (GaryM@wetcs.co.za)
	2009-2011	Biodiversity Baseline Study and Impact Assessment for Kinsevere Copper Mine, Lubumbashi	Knight Piesold - Amelia Briel (abriel@knightpiesold.com)
	2008	Biodiversity Baseline Study for Ulindi Hydropower Scheme, Itombwe Mts, Kivu South	Knight Piesold - Amelia Briel (abriel@knightpiesold.com)
Malawi	**2015**	Terrestrial Ecology Survey of sugar mill site, Ethco, Dwangwa	ERM - Rachel Conti (Rachel.Conti@erm.com)
	2010	Terrestrial Ecology Survey of Kanyika Uranium Mine, Kasungu	Synergistics - Bronwyn Williams (bronwyn@synergistics.co.za)
Mozambique	**2016**	Biodiversity Baseline Study and Impact Assessment for an onshore gas pipeline, Inhassoro, Inhambane province	ERM – Jessica Hughes (jessica.hughes@erm.com)
	2015	Critical Habitat Assessment for coastal dry forest in Palma District, Cabo Delgado province	Enviro-Insight - Luke Verburgt (luke@enviro-insight.co.za)
	2015	Biodiversity Baseline Study for a Regional ESIA of Seismic Exploration blocks, SASOL, Inhassoro	Golder - Warren Aken (waken@golder.co.za)
	2014	Biodiversity Baseline Study and Impact Assessment for a coastal road between Pemba and Palma, Cabo Delgado province	ERM – Jessica Hughes (jessica.hughes@erm.com)
	2013	Biodiversity Monitoring Plan for Benga Coal Mine, Moatize	Rio Tinto - Isaac Ndlovu (Isaac.ndlovu@riotinto.com)
	2012	Biodiversity Baseline Study and Action Plan for the Muanza Quarry, Gorongosa NP, Sofala province	Nepid Consultants – Dr Rob Palmer rob@nepid.co.za)
	2011	Terrestrial Ecology component of the Biodiversity Study for the Four Dams Project (Corumana Dam, Gorongosa Dam, Metuchira Weir, Ressano Weir), Maputo and Sofala provinces	Austral-Cowi - Jacob Ulrich (jacob.ulrich@australcowi.co.mz)
Namibia	**2009**	Biodiversity Baseline Study and Impact Assessment for Neckartal Dam, Keetmanshoop	Knight Piesold - Amelia Briel (abriel@knightpiesold.com)
South Africa	**2013**	Faunal Baseline Study and Impact Assessment for Riemvasmaak Hydro-electric Scheme, Augrabies Falls NP	Aurecon - Nelis Bezuidenhout (Nelis.Bezuidenhout@aurecongroup.com)
	2010	Biodiversity Baseline Study and Impact Assessment for Hoogland Chrome Mine, Steenkampsberg Mts, Mpumalanga	Metago Environmental Engineers - Hylton Allison (hallison@slrconsulting.com)
	2010	Assessment of the status of *Pelargonium sidoides* and harvesting potential in Lesotho and South Africa	South African National Biodiversity Institute - Domitilla Raimondo (Raimondo@sanbi.org)
Swaziland	**2014**	Biodiversity Baseline Study and Impact Assessment for Ethemba Dam, Hlatikulu	Knight Piesold - Neal Neervoort (nneervoort@knightpiesold.com)
		Biodiversity Value Assessment for the Mhlumeni Community Conservation land, Siteki	Rod de Vletter (devletter@gmail.com)
Zambia	**2015**	Botanical survey for ESIA for Ngonye Falls Hydropower Project, Zambezi River, Senanga	Ecotone - Michiel Jonker (michiel@ecotone-sa.co.za)
	2013	Biodiversity Baseline Study and Impact Assessment for Mulungushi Hydropower Project, Kabwe	ERM – Zoe Daniels (Zoe.Daniel@erm.com)
	2008	Biodiversity Baseline Study and Impact Assessment for Lumwana Copper Mine, Solwezi	Knight Piesold - Amelia Briel (abriel@knightpiesold.com)
Zimbabwe	**2011**	Biodiversity Baseline Study and Impact Assessment for Bokai Platinum Mine, Gweru	Epoch Resources - Fanie Coetzee (fanie.coetzee@epochresources.co.za)

PUBLICATIONS

Books

Schmidt, E., Lötter, M.C. & McCleland, W.L. 2002. *Field Guide to Trees and Woody Shrubs of Mpumalanga & Kruger National Park*. Jacana Publishers, Houghton.

Peer-reviewed Journals

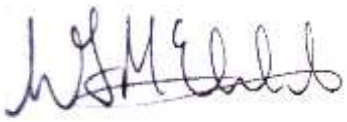
Darbyshire, I., McCleland, W.L. & Froneman, W. 2017. *Barleria lebomboensis* (Acanthaceae), an endangered new species from the Lebombo Mountains of Swaziland. *Phytotaxa* 323(2):173-181.

Cheek, M., Lawrence, P. & McCleland, W.L. 2018. *Cola dorrii* sp. nov. (Sterculiaceae) a threatened Maputaland Forest endemic of South Africa. *Kew Bulletin* 73(2).

McCleland, W.L. & Massingue, A. 2018. New populations and a conservation assessment of *Ecbolium hastatum* Vollesen. *Bothalia* 48(1).

DECLARATION

I declare that the particulars above are accurate and true to the best of my knowledge and belief.

SIGNATURE:  DATE: 16 November 2018

HERITAGE SCOPING REPORT

FOR THE PROPOSED KRANSPAN COLLIERY, MPUMALANGA PROVINCE

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ABS Africa (Pty) Ltd

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Project Reference:

2181106

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Archaeological Scoping Report

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Amendments on document

Date	Report Reference Number	Description of Amendment

Indemnity and Conditions Relating to this Report

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. The report is based on assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken and Heritage Contracts and Archaeological Consulting (HCAC) CC and its staff reserve the right to modify aspects of the report including the recommendations if and when new information becomes available from ongoing research or further work in this field, or pertaining to this investigation.

Although all possible care is taken to identify sites of cultural importance during the investigation of study areas, it is always possible that hidden or sub-surface sites could be overlooked during the study. HCAC CC and its personnel will not be held liable for such oversights or for costs incurred as a result of such oversights.

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EXECUTIVE SUMMARY

Site name and location: The Kranspan Project covers the Kranspan Prospect Area, located in the Mpumalanga Province of South Africa, some 13 kilometres (km) south-west of Carolina by road. The Project area can be reached via the R36 Provincial Road travelling southwest from the town of Carolina (Figure 1).

1: 50 000 Topographic Map: 2630 AA & 2629 BB.

EIA Consultant: ABS Africa (Pty) Ltd.

Developer: ILIMA Coal Company (Pty) Ltd

Heritage Consultant: Heritage Contracts and Archaeological Consulting CC (HCAC).
Contact person: Jaco van der Walt, Tel: +27 82 373 8491, Email: jaco.heritage@gmail.com.

Date of Report: 15 November 2018.

Findings of the Assessment:

The scope of work comprises a heritage scoping report for the Kranspan Colliery Project. This report was conducted based on a desktop study of available data regarding cultural heritage resources of the area and will be followed by a field-based assessment in the EIA phase. Previously recorded heritage sites in the larger project area indicate the range of cultural resources that can be expected in the study area. Large portions of the study area have previously been disturbed by agricultural activities, and this would have impacted on surface indicators of heritage resources. In terms of the NHRA and based on available information on the area the following features can be expected in the area:

- Later Stone Age
- Later Iron Age
- Several buildings occur on site, and based on the history of the area these structures could be older than 60 years. The presence of structures older than 60 years will be confirmed during the EIA phase.
- Graves and Cemeteries

The study area is of very high paleontological sensitivity and according to the SAHRIS palaeontological sensitivity map must be subjected to a field based palaeontological assessment in the impact assessment phase. From a heritage point of view, the proposed project is considered to be viable, and no fatal flaws are expected.

Contents

Figures

ABBREVIATIONS

AIA: Archaeological Impact Assessment
ASAPA: Association of South African Professional Archaeologists
BIA: Basic Impact Assessment
CRM: Cultural Resource Management
EAP: Environmental Assessment Practitioner
ECO: Environmental Control Officer
EIA: Environmental Impact Assessment*
EIA: Early Iron Age*
EMP: Environmental Management Plan
ESA: Early Stone Age
GPS: Global Positioning System
HIA: Heritage Impact Assessment
LIA: Late Iron Age
LSA: Late Stone Age
MEC: Member of the Executive Council
MIA: Middle Iron Age
MPRDA: Mineral and Petroleum Resources Development Act
MSA: Middle Stone Age
NEMA: National Environmental Management Act
PRHA: Provincial Heritage Resource Agency
SADC: Southern African Development Community
SAHRA: South African Heritage Resources Agency
SAHRIS: South African Heritage Resources Information System

**Although EIA refers to both Environmental Impact Assessment and the Early Iron Age both are internationally accepted abbreviations and must be read and interpreted in the context it is used.*

GLOSSARY

Archaeological site (remains of human activity over 100 years old)

Early Stone Age (2 million to 300 000 years ago)

Middle Stone Age (300 000 to 30 000 years ago)

Late Stone Age (30 000 years ago until recent)

Historic (approximately AD 1840 to 1950)

Historic building (over 60 years old)

Lithics: Stone Age artefacts

1. INTRODUCTION

HCAC was contracted by ABS Africa (Pty) Ltd to conduct a heritage scoping study for the proposed Kranspan Colliery Project. A Heritage Impact Assessment report will follow the heritage scoping report.

The scoping report aims to conduct a desktop study to identify possible heritage resources within the project site. The study furthermore aims to assess the impact of the proposed project on non - renewable heritage resources, and to submit appropriate recommendations with regards to responsible cultural resources management measures. This will assist the developer in managing the discovered heritage resources in a responsible manner, to protect, preserve and develop them within the framework provided by Heritage legislation.

This report outlines the approach and methodology utilised for the scoping phase of the project. The report includes information collected from various sources and consultations. Possible impacts are identified, and mitigation measures are proposed in the following report. It is important to note that no fieldwork was conducted as part of the scoping phase but will be conducted as part of the impact assessment phase.

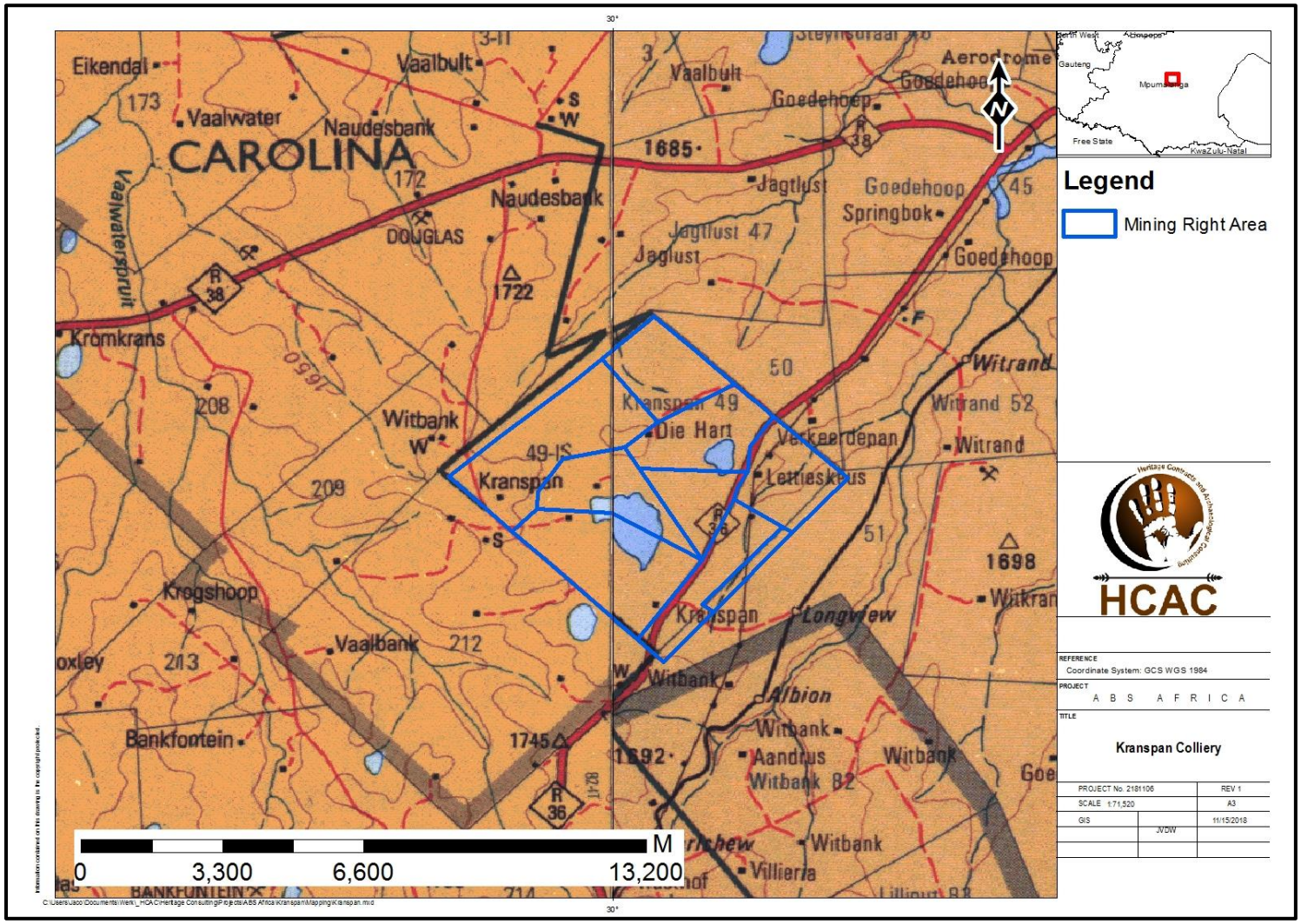

Figure 1. Regional Locality map of the site under investigation indicated in blue.

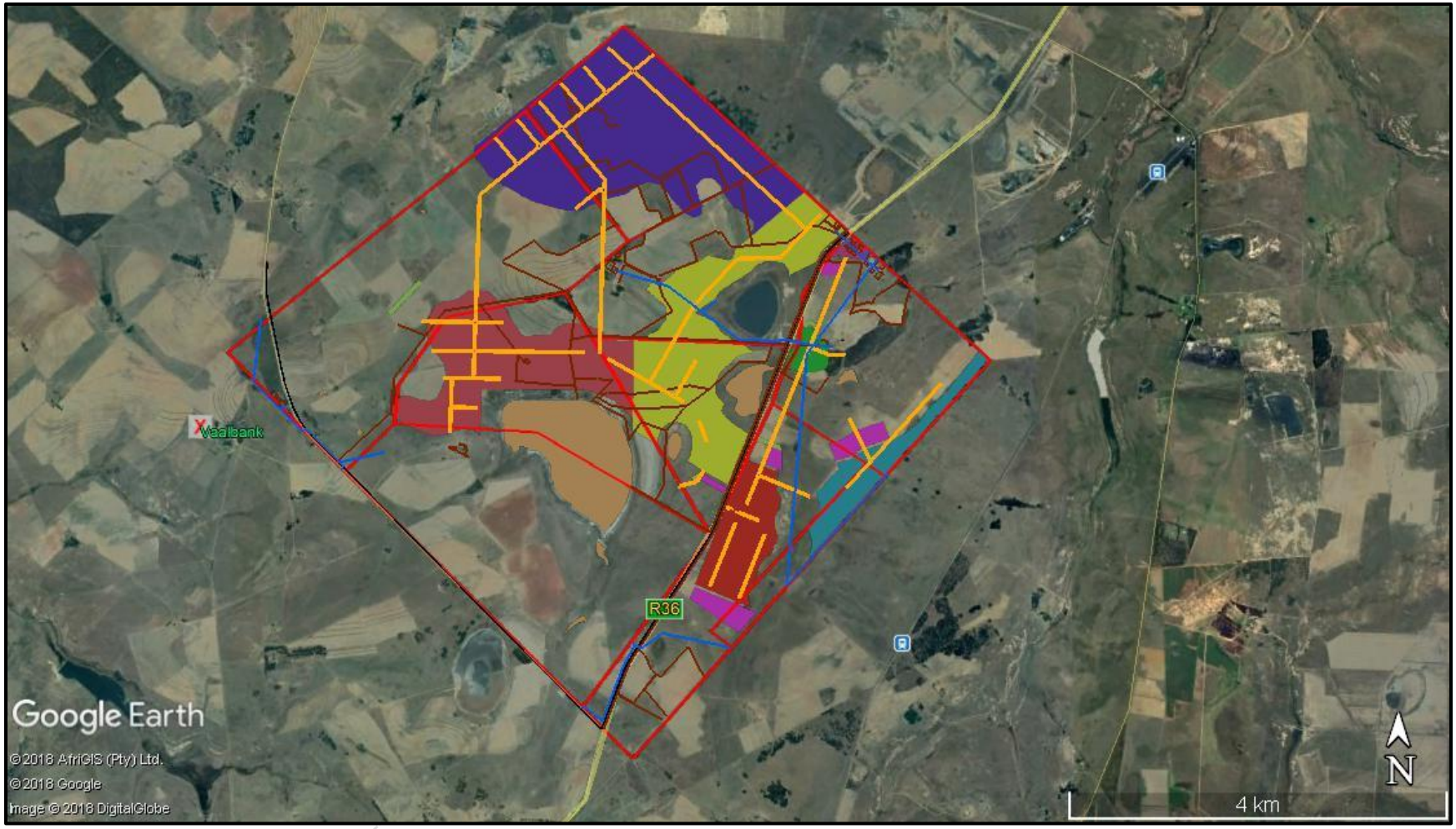

Figure 2. 2018 Google Earth image showing the surface infrastructure. (Google Earth 2018

1.1 Terms of Reference

The main aim of this scoping report is to determine if any known heritage resources occur within the project site. The objectives of the scoping report were to:

- Conduct a desktop study:
  - Review available literature, previous heritage studies and other relevant information sources to obtain a thorough understanding of the archaeological and cultural heritage conditions of the area;
  - Identify known and recorded archaeological and cultural sites; and
  - Determine whether the area is renowned for any cultural and heritage resources, such as Stone Age sites, Iron Age sites, informal graveyards or historical homesteads.
- Compile a specialist Heritage Scoping Report in line with the requirements of the EIA Regulations, 2014, as amended on 07 April 2017.

The reporting of the scoping component is based on the results and findings of a desktop study, wherein potential issues associated with the proposed project will be identified, and those issues requiring further investigation through the IA Phase highlighted. Reporting will aim to identify the anticipated impacts, as well as cumulative impacts, of the operational units of the proposed project activity on the identified heritage resources for all 3 development stages of the project, i.e. construction, operation and decommissioning. Reporting will also consider alternatives should any significant sites be impacted on by the proposed project. This is done to assist the developer in managing the discovered heritage resources in a responsible manner, in order to protect, preserve and develop them within the framework provided by Heritage Legislation.

During the EIA phase, the following terms apply:

Field study
Conduct a field study to (a) locate, identify, record, photograph and describe sites of archaeological, historical or cultural interest; b) record GPS points of sites/areas identified as significant areas; c) determine the levels of significance of the various types of heritage resources affected by the proposed development

Reporting
Report on the identification of anticipated and cumulative impacts the operational units of the proposed project activity may have on the identified heritage resources for all 3 phases of the project; i.e., construction, operation and decommissioning phases. Consider alternatives, should any significant sites be impacted adversely by the proposed project. Ensure that all studies and results comply with the relevant legislation, SAHRA minimum standards and the code of ethics and guidelines of ASAPA.

To assist the developer in managing the discovered heritage resources in a responsible manner, and to protect, preserve, and develop them within the framework provided by the National Heritage Resources Act of 1999 (Act No 25 of 1999).

1.2 Nature of the development

Ilima Coal Company (Ilima) is the holder of a prospecting right for coal minerals over nine (9) portions of the Farm Kranspan 49IT. The latter is situated in the Mpumalanga Province, approximately 13 km south-west of the town of Carolina (Figure 1).
Following the successful completion of prospecting activities, Ilima now intends to apply for a mining right in terms of Section 22 of the Minerals and Petroleum Resources Development Act 28 of 2002. The planned operations entail both surface and underground mining as well as the establishment of various mine support infrastructure within the proposed mining right area.

Ilima has advised as follows:

1. There will be both opencast (roll over) and underground (bord & pillar) mining operations on the project area. The attached plan defines the areas.
2. At this stage, only the E-Seam will be mined. There are some localised areas where the B Seam and CU and CL are present, however they appear to be uneconomic.
3. The underground conceptual design is being conducted and will be incorporated into the MWP once completed.
4. We have applied a 100m stand-off from known wetlands/water courses etc.
5. Mining will commence with opencast areas and underground operations will be started later.
6. The draft MWP makes provision for a beneficiation plant, (this is not confirmed)
7. If the wash plant is excluded the mine will either dry crush and screening the ROM or transport it to Ilima or another wash plant in the area

The mine infrastructure will be situated in the south-eastern portion of the farm Kranspan 49IT and will consist of the following:

- Opencast mining areas with contractor's camp.
- Haulroads to access the mining areas.
- Adits from opencast highwalls to provide access to the underground mining.
- ROM stockpile areas.
- Upcast ventilation shaft with the main fan situated on this shaft.
- Offices, stores, workshop, change house, and lamp room, all prefabricated structures that allows for easy removal and rehabilitation of the site.
- Parking area.
- Diesel Tanks
- Crushing and Screening Plant (Raw)
- Dense Medium beneficiation plant
- Product stockpiles and loading area.
- Discard/Tailings
- Onsite laboratory
- Weighbridges
- An access road to the shaft that will be constructed along the overland conveyor route and in the same servitude.

1.3 The receiving environment

The Project covers the Kranspan Prospecting Right area and is located in the Mpumalanga Province of South Africa, some 13 km southwest of Carolina. The Project can be accessed via the R36 paved provincial road if travelling from the north or the south.

The nearest sizeable towns are Carolina, 13 km to the northeast. The nearest accessible railway siding is at Witrand, ~ 6 km north. There are numerous farm homesteads situated within the Project Area. The land is currently mainly used for maize, cattle and sheep farming. The surface topography is undulating, with gradual rises and falls over the area with the highest elevations towards the central portion of the Project area. The farms covered by Kranspan is 3383.42 hectares (ha) in extent, is held under a Prospecting Right (PR) (No. 44/2016 (PR) [MP30/5/1/2/2/102PR]); granted to Ilima Coal Company, which expires in 02 March 2019. The boreholes drilled in the Prospecting Area indicate that the area of interest lies on all the farms covered by the Kranspan Prospecting Right area. The boundaries of the Target Area, which is the same as the Prospecting Right Area. The vegetation of the general area and the proposed site consists of Eastern Highveld Grassland (Mucina & Rutherford 2006) and is characterised by ankle- high grass cover

2. APPROACH AND METHODOLOGY

The assessment is to be undertaken in two phases, a desktop study as part of the Scoping phase and a Heritage Impact Assessment as part of the EIA phase. This report concerns the scoping phase. The aim of the scoping phase is to cover available data regarding archaeological and cultural heritage to compile a background history of the study area in order to identify possible heritage issues or fatal flaws that could possibly be associated with the project and should be avoided during development.

This was accomplished by means of the following phases (the results are represented in section 4 of this report):

2.1 Literature review

A review was conducted utilising data for information gathering from a range of sources on the archaeology and history of the area. The aim of this is to extract data and information on the area in question, looking at archaeological sites, historical sites and graves of the area.

2.2 Information collection

The South African Heritage Resources Information System (SAHRIS) was consulted to collect further data from CRM practitioners who undertook work in the area to provide the most comprehensive account of the history of the area where possible. In addition, the archaeological database housed at the University of the Witwatersrand was consulted.

2.3 Public consultation

No public consultation was conducted during this phase by the author.

2.4 Google Earth and mapping survey

Google Earth and 1:50 000 maps of the area were utilised to identify possible places where archaeological sites might be located.

2.5 Genealogical Society of South Africa

The database of the genealogical society was consulted to collect data on any known graves in the area.

2.6. Restrictions

This study did not assess the impact on intangible resources or the palaeontological component of the project. Based on available data and resources as outlined in the report additional information that becomes available at a later stage might change the outcome of the assessment.

3. LEGISLATION

For this project, the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA) is of importance and the following sites and features are protected:

a. Archaeological artefacts, structures and sites older than 100 years;
b. Ethnographic art objects (e.g. prehistoric rock art) and ethnography;
c. Objects of decorative and visual arts;
d. Military objects, structures and sites older than 75 years;
e. Historical objects, structures and sites older than 60 years;
f. Proclaimed heritage sites;
g. Grave yards and graves older than 60 years;
h. Meteorites and fossils; and
i. Objects, structures and sites or scientific or technological value.

The national estate includes the following:

a. Places, buildings, structures and equipment of cultural significance;
b. Places to which oral traditions are attached or which are associated with living heritage;
c. Historical settlements and townscapes;
d. Landscapes and features of cultural significance;
e. Geological sites of scientific or cultural importance;
f. Archaeological and palaeontological importance;
g. Graves and burial grounds;
h. Sites of significance relating to the history of slavery; and
i. Movable objects (e.g. archaeological, palaeontological, meteorites, geological specimens, military, ethnographic, books etc.).

Section 34 (1) of the Act deals with structures that are older than 60 years. Section 35(4) of this Act deals with archaeology, palaeontology and meteorites. Section 36(3) of the Act, deals with human remains older than 60 years. Unidentified/unknown graves are also handled as older than 60 years until proven otherwise.

3.1 Heritage Site Significance and Mitigation Measures

The presence and distribution of heritage resources define a Heritage Landscape. In this landscape, every site is relevant. In addition, because heritage resources are non-renewable, heritage surveys need to investigate an entire project area. In all initial investigations, however, the specialists are responsible only for the identification of resources visible on the surface.

This section describes the evaluation criteria used for determining the significance of archaeological and heritage sites. National and Provincial Monuments are recognised for conservation purposes. The following interrelated criteria were used to establish site significance:

- The unique nature of a site;
- The integrity of the archaeological/cultural heritage deposit;
- The wider historic, archaeological and geographic context of the site;
- The location of the site in relation to other similar sites or features;
- The depth of the archaeological deposit (when it can be determined or is known);
- The preservation condition of the site; and
- Potential to answer present research questions.

The criteria above will be used to place identified sites within the South African Heritage Resources Agency's (SAHRA's) (2006) system of grading of places and objects that form part of the national estate. This system is approved by the Association of South African Professional Archaeologists (ASAPA) for the Southern African Development Community (SADC) region. The recommendations for each site should be read in conjunction with Section 10 of this report.

FIELD RATING	***GRADE***	***SIGNIFICANCE***	***RECOMMENDED MITIGATION***
National Significance (NS)	Grade 1	-	Conservation; national site nomination
Provincial Significance (PS)	Grade 2	-	Conservation; provincial site nomination
Local Significance (LS)	Grade 3A	High significance	Conservation; mitigation not advised
Local Significance (LS)	Grade 3B	High significance	Mitigation (part of site should be retained)
Generally Protected A (GP.A)	-	High/medium significance	Mitigation before destruction
Generally Protected B (GP.B)	-	Medium significance	Recording before destruction
Generally Protected C (GP.C)	-	Low significance	Destruction

4. REGIONAL OVERVIEW

4.1 General Information

4.1.1. Database search

The following CRM studies were consulted for this report.

Author	Year	Project	Findings
Van Schalkwyk, J.	2003	Archaeological Survey of a Section of The Secunda-Mozambique Gas Pipeline, Carolina District, Mpumalanga	Cemeteries
Pistorius, JCC.	2007	A Phase I Heritage Impact Assessment (HIA) Study for The Upgrading of Eskom's Nooitgedacht Substation on The Farm Wintershoek 451 Near Carolina In the Mpumalanga Province of South Africa	No sites were recorded.
Van Schalkwyk, J. A.	2007	Heritage Impact Assessment for The Planned Development on The Farms Hebron 421JT And Twyfelaar 11 IT, Carolina Municipal District, Mpumalanga Province	Iron Age, Historical Sites and Cemeteries were recorded.
Van Schalkwyk, J.A.	2007	Heritage Impact Scoping Report for The Planned Hendrina-Marathon Powerline, Mpumalanga Province	Settlements to initiation sites, industrial and farming related sites as well as cemeteries were noted in the area.
Pelser, A and Van der Walt, J.	2008	A Report on A Heritage Impact Assessment for Proposed Opencast Coal Mining Operations For The Klippan Colliery On The Farm Klippan 452 JS (Emachibini), Wonderfontein, Mpumalanga	Graves were recorded.
Pelser, A.	2012	A Report on a Heritage Impact Assessment (HIA) For the Proposed Motshaotshele Colliery Project, Close to Hendrina, Mpumalanga Province	Cemeteries

4.1 2. Public consultation

No public consultation was conducted by the heritage consultant during the scoping phase.

4.1.3. Google Earth and mapping survey

Google Earth and 1:50 000 maps of the area were utilised to identify possible places where archaeological sites might be located.

4.1.4. Genealogical Society of South Africa

No gravesites are on record for the study area.

5. BACKGROUND INFORMATION FOR THE STUDY AREA

5.1. Archaeology of the area

5.1.1. Stone Age

South Africa has a long and complex Stone Age sequence of more than 2 million years. The broad sequence includes the Later Stone Age, the Middle Stone Age and the Earlier Stone Age. Each of these phases contains sub-phases or industrial complexes, and within these, we can expect regional variation regarding characteristics and time ranges. For Cultural Resources Management (CRM) purposes it is often only expected/ possible to identify the presence of the three main phases. Yet sometimes the recognition of cultural groups, affinities or trends in technology and/or subsistence practices, as represented by the sub-phases or industrial complexes, is achievable (Lombard et al. 2012). The three main phases can be divided as follows;

- Later Stone Age; associated with Khoi and San societies and their immediate predecessors. Recently to ~30 thousand years ago
- Middle Stone Age; associated with Homo sapiens and archaic modern humans. 30-300 thousand years ago.
- Earlier Stone Age; associated with early Homo groups such as Homo habilis and Homo erectus. 400 000-> 2 million years ago.

Early Stone Age:

The Early Stone Age in southern Africa is defined by the Oldowan complex, primarily found at the sites Sterkfontein, Swartkrans and Kromdraai, situated within the Cradle of Humankind, just outside Johannesburg (Kuman, 1998). Within this complex, tools are more casual and expediently made, and tools consist of rough cobble cores and simple flakes. The flakes were used for such activities as skinning and cutting meat from scavenged animals. This industry is unlikely to occur in the study area.

The second complex is that of the more common Acheulean, defined by large handaxes and cleavers produced by hominids at about 1.4 million years ago (Deacon & Deacon, 1999). Among other things, these Acheulian tools were probably used to butcher large animals such as elephants, rhinoceros and hippopotamus that had died from natural causes. Acheulian artefacts are usually found near the raw material from where they were quarried, at butchering sites, or as isolated finds. No Acheulian sites are on record near the project area, but isolated finds are possible. However, isolated finds have little value.

Middle Stone Age:

During the Middle Stone Age, significant changes start to occur in the evolution of the human species. These changes manifest themselves in the complexity of the stone tools created, as seen in the diversity of tools, the standardisation of these tools over a widespread area, the introduction of blade technology, and the development of ornaments and art. What these concepts ultimately attest to is an increase or development of abstract thinking. By the beginning of the Middle Stone Age (MSA), toolkits included prepared cores, parallel-sided blades and triangular points hafted to make spears (Volman, 1984). MSA people had become accomplished hunters by this time, especially of large grazing animals such as wildebeest, hartebeest and eland.

These hunters are classified as early humans, but by 100,000 years ago, they were anatomically fully modern. The oldest evidence for this change has been found in South Africa, and it is an important point in debates about the origins of modern humanity. In particular, the degree to which behaviour was fully modern is still a matter of debate. The repeated use of caves indicates that MSA people had developed the concept of a home base and that they could make fire. These were two important steps in cultural evolution (Deacon & Deacon, 1999). Accordingly, if there are caves in the study area, they may be sites of archaeological significance. MSA artefacts are common throughout southern Africa, but unless they occur in undisturbed deposits, they have little significance.

Later Stone Age:

The Later phases of the Stone Age began at around 20 000 years BP (Before Present). This period was marked by numerous technological innovations and social transformations within these early hunter-gatherer societies. Hunting tools now included the bow and arrow. More particularly, the link-shaft arrow which comprises a poisoned bone tip loosely linked to a shaft which fell away when an animal was shot and left the arrow tip embedded in the prey animal. Other innovations included bored stones used as digging –stick weights to help with the uprooting of tubers and roots, small stone tools, normally less than 25mm long, which was used for cutting meat and scraping hides. There were also polished bone needles, twine made from plant fibres, tortoiseshell bowls, fishing equipment including bone hooks and stone sinkers, ostrich eggshell beads and other decorative artwork (Delius, 2007).

These people may be regarded as the first modern inhabitants of Mpumalanga, known as the San or Bushmen. They were a nomadic people who lived together in small family groups and relied on hunting and gathering of food for survival. Evidence of their existence is to be found in numerous rock shelters throughout the Eastern Mpumalanga where some of their rock paintings are still visible. A number of these shelters have been documented throughout the Province (Bornman, 1995; Schoonraad in Barnard, 1975; Delius, 2007). These include areas such as Witbank, Ermelo, Barberton, Nelspruit, White River, Lydenburg and Ohrigstad.

At Honingklip near Badplaas in the Carolina District, two LSA rock shelters with four panels of rock art was discovered and archaeologically investigated. The site was used between 4870 BP and as recently as 200 BP. Stone walls at both sites date to the last 250 years of hunter-gatherer occupation and they may have served as protection against intruders and predators. Pieces of clay ceramic and iron beads found at the site indicate that there was an early social interaction between the hunter-gatherer (San) communities and the first farmers who moved into this area at around 500 AD.

Three late Stone Age sites are on record in the greater area. The sites are Welgelegen Skuiling close to Ermelo, Chrissiesmeer (also known for rock art) and lastly Groenvlei close to Carolina; this area is also known for rock art (Bergh 1999).

5.1.2. Iron Age

The Iron Age as a whole represents the spread of Bantu speaking people and includes both the pre-Historic and Historic periods. It can be divided into three distinct periods:

- The Early Iron Age: Most of the first millennium AD.
- The Middle Iron Age: 10th to 13th centuries AD
- The Late Iron Age: 14th century to the colonial period.

The Iron Age is characterised by the ability of these early people to manipulate and work Iron ore into implements that assisted them in creating a favourable environment to make a better living.

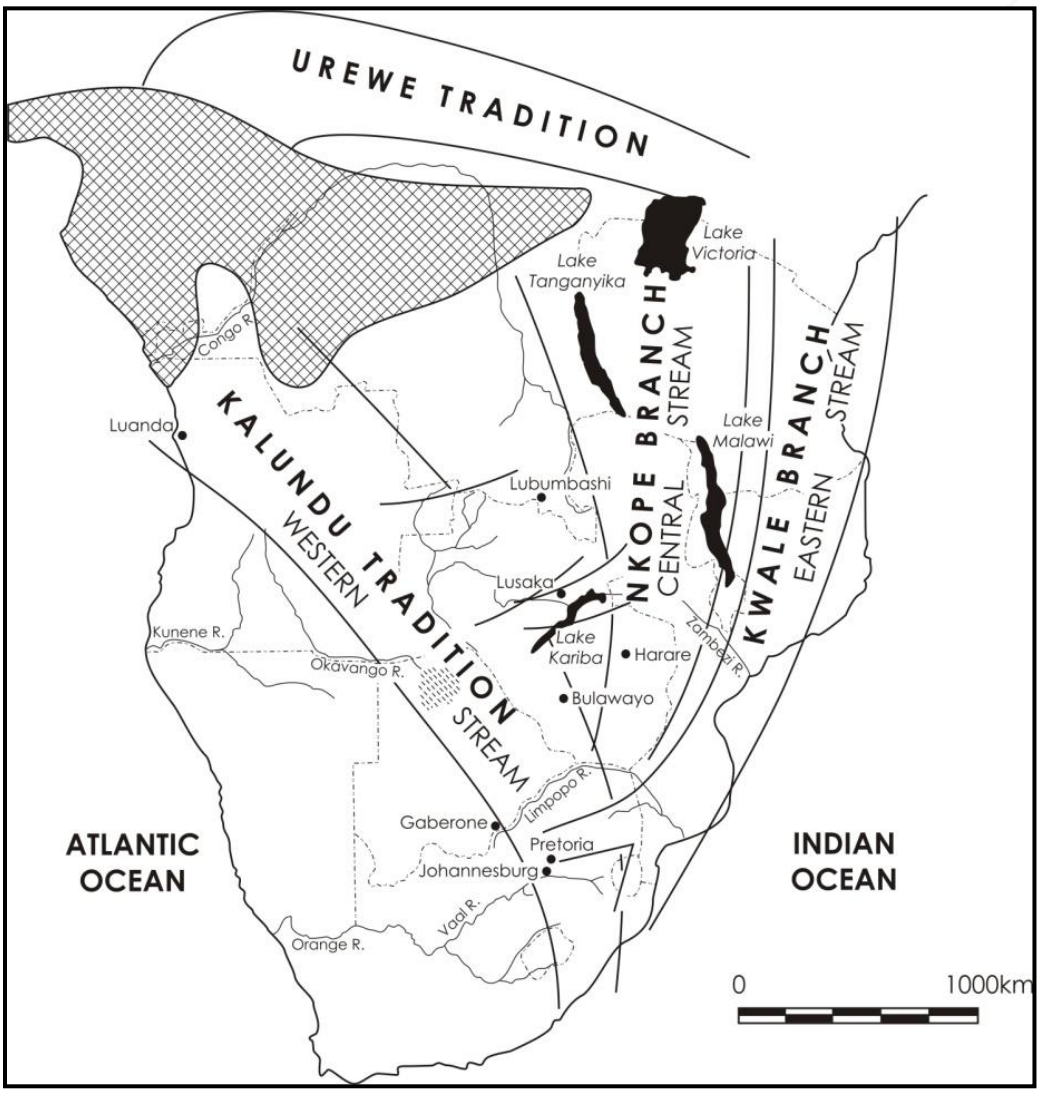

Figure 3. Movement of Bantu speaking farmers (Huffman 2007)

Early and Middle Iron Age

No sites dating to this period are on record close to the study area.

Late Iron Age

Stonewalled settlements are well known around the Watervalboven and Machadodorp area to the north of the study area, in fact, these settlements are found all along the Mpumalanga escarpment, from Ohrigstad in the north, all the way to Carolina in the south (Maggs 2007). These settlements consist of roughly circular homesteads linked by walled roads or cattle tracks associated with agricultural terraces. These complexes sometimes extend over several square kilometres, and some researchers claim that these settlements are the most prominent footprint on the landscape of any pre-colonial society in South Africa and compare this complex agricultural system to the internationally renowned terraced settlements of Nyanga in eastern Zimbabwe (Delius et al. 2012).

5.1.3. Anglo-Boer War

Figure 4. The Witkloof Monument (http://www.boerenbrit.com)

The Witkloof Monument stands testament to an interesting battle that took place in the larger area. According to the Canadian War Museum, the following events took place:

In the morning of 6 November, a British column left the town of Belfast and rode south to disperse a large Boer commando camping about thirty kilometres to the south near the Komati River. The force included the Canadian Mounted Rifles, the Royal Canadian Dragoons, and one section of "D" Battery, Royal Canadian Field Artillery, with two 12-pounder guns. After forcing the commando back across the river, the column camped for the night near a farm named Leliefontein. Boer resistance had been stronger than expected, and the British commander expected them to be reinforced during the night. He issued orders to return to Belfast in the morning. The Boer commander brought up reinforcements and thought that the British would continue their advance. The Boers prepared to meet them on the road heading south in the morning.

The British commander detailed the Royal Canadian Dragoons and the two 12-pounder field guns of "D" Battery as his rear-guard, all under the command of Lieutenant-Colonel François-Louis Lessard of the Dragoons. The Dragoons had only around one hundred men and a horse-drawn Colt machine gun. However, the Canadian horsemen and artillerymen were experienced and had worked together long enough to operate as a team. The Dragoons deployed in line four or five kilometres across covering the rear of the departing British column with the guns and the machine gun in the centre. The Boers realized that the British were retiring and began to press the Canadian rear-guard. During the morning, the Boers mounted a series of strong attacks along the Canadian line. These attacks culminated in a charge by two hundred mounted Boers firing from the saddle that threatened to break the Canadian line and capture the two field guns. The charge was only beaten off by the gallantry of a small party of Dragoons and the fire of the machine gun, which killed the two Boer commanders (J.C Fourie and H.F. Prinsloo).

Leliefontein was the most desperate situation faced by Canadians during the war. Awarded decorations, including Victoria Crosses to Lieutenants H.Z. C. Cockburn, R.E.W. Turner and Sergeant E.J. Holland, all of the Royal Canadian Dragoons, attest to the intensity of this battle. (http://www.warmuseum.ca/cwm/exhibitions/boer/battleleliefontein_e.shtml).

This battle is considered a defeat for the British, but http://www.canadahistory.com reports that “the considered actions of the Canadians made the loss one that was bearable and productive of building moral for the Empire's troop”s.

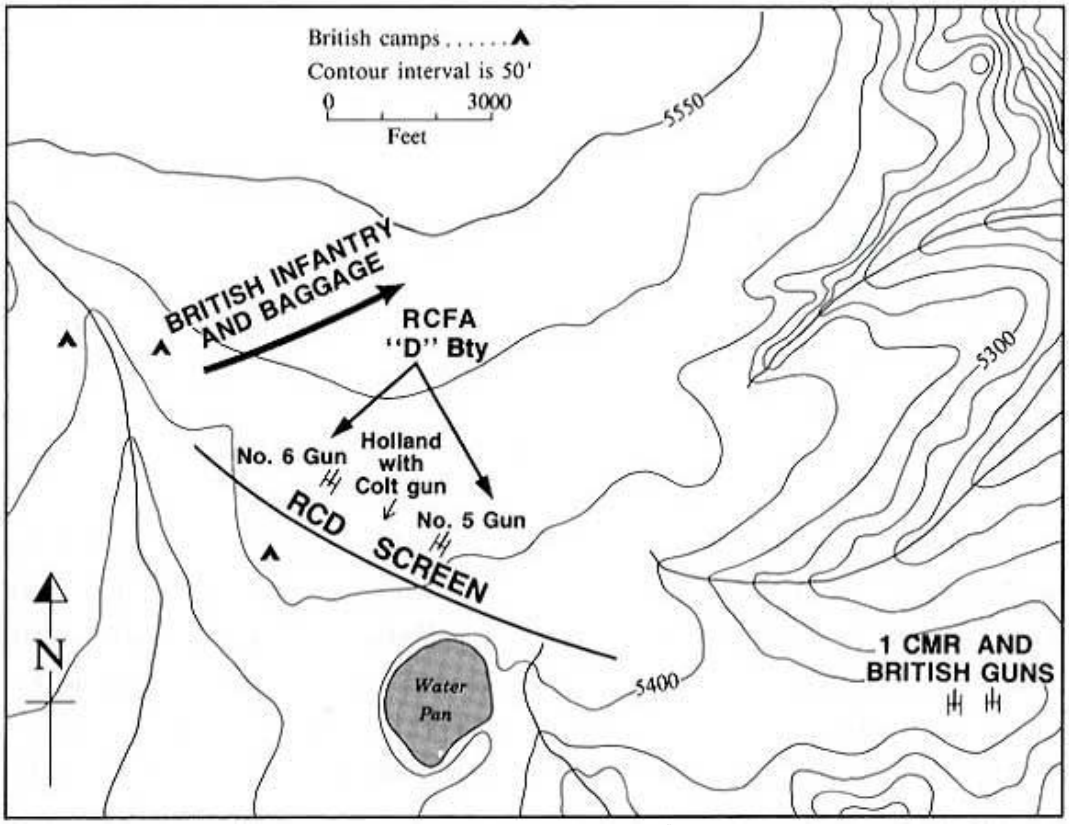

Figure 5. Map of the Battle of Leliefontein, 9 a.m., 7 November 1900 (http://www.warmuseum.ca)

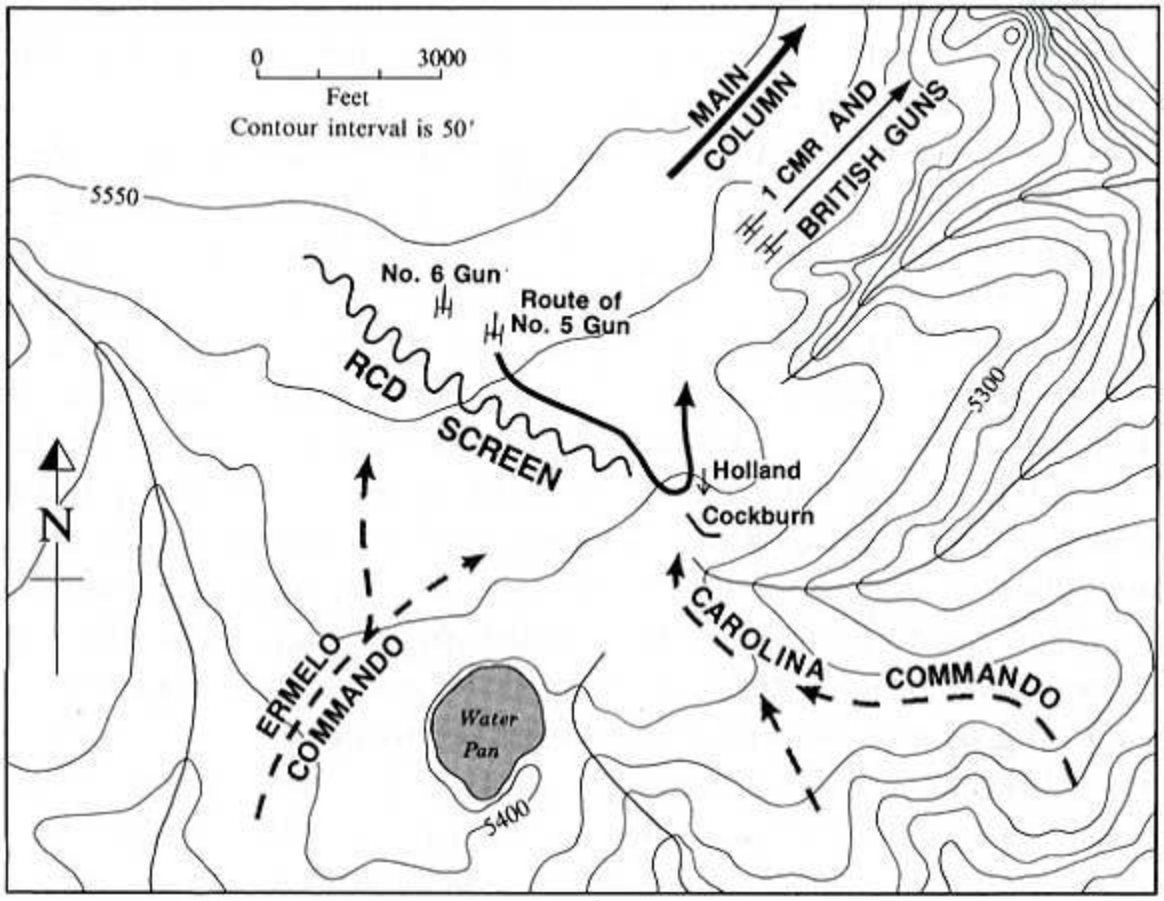

Figure 6. Map of the Battle of Leliefontein, 11 a.m., 11 November 1900 (http://www.warmuseum.ca)

According to the map (fig. 9) from J.S. Bergh, (red), Geskiedenisatlas van Suid-Afrika, Die vier noordelike provinsies, p. 54, there were two concentration camps located to the north of the study area close to Belfast.

Figure 7. Concentration camps represented by red dots and railway stations with grey squares (Bergh 1999).

5.1.4. Cultural landscape

The site under investigation is located on both sides of the R36, about 10 kilometres north of Breyten and 12 kilometres south-west of Carolina in Mpumalanga Province.

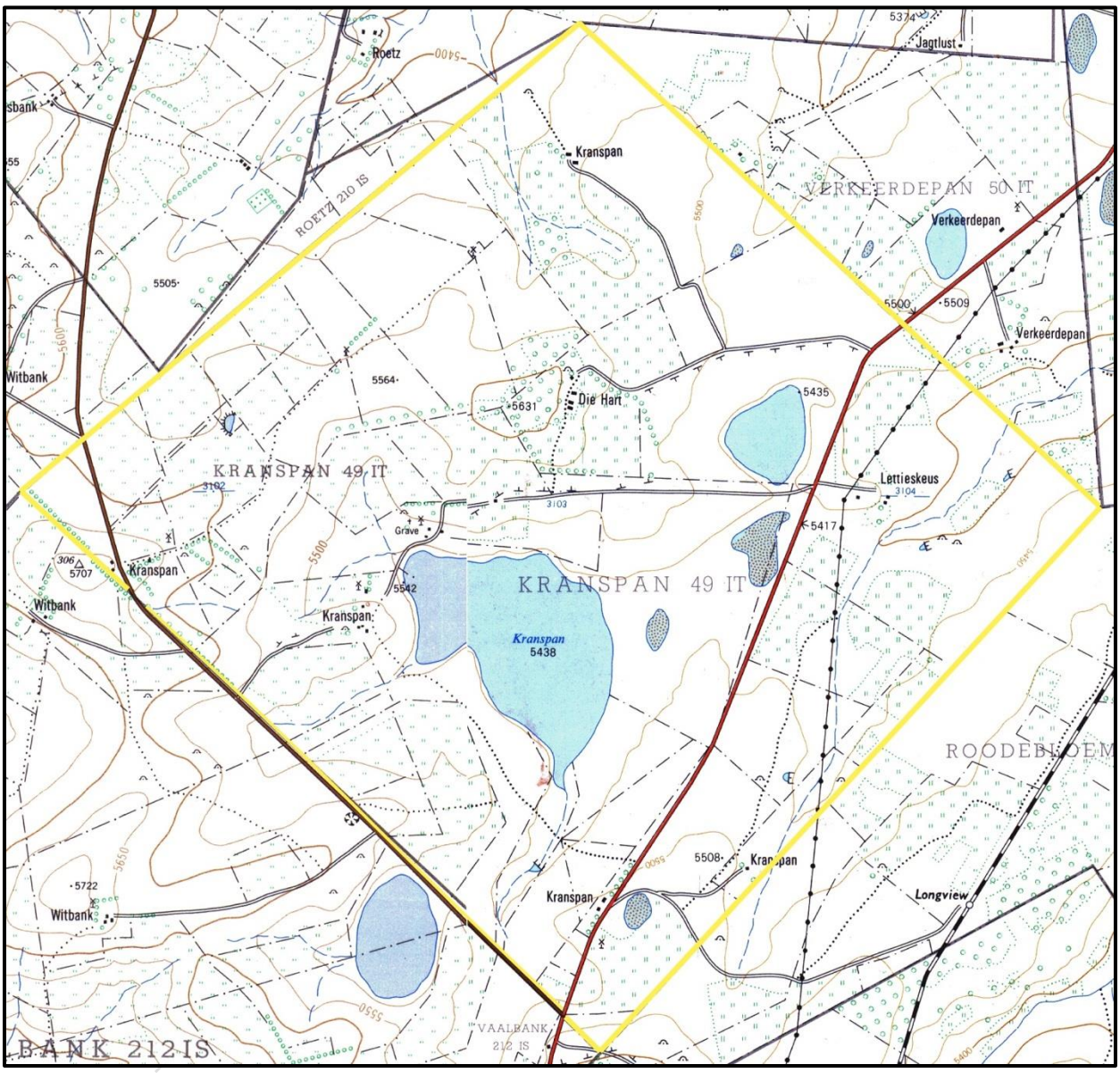

Figure 8. 1966-1968 Topographical map of the site under investigation.A main road went through the farm, and a secondary road ran along its southwestern boundary. Three minor roads and a number of tracks / footpaths went through the property. About half of the farm was used as cultivated lands (this includes orchards). The Kranspan Dam, as well as four medium-sized dams and six small dams, can be seen. A number of settlement sites are visible. Individual buildings, huts and windmills can be seen in various places. A power line went through the eastern part of the study area. (Topographical Map 1966; Topographical Map 1968)

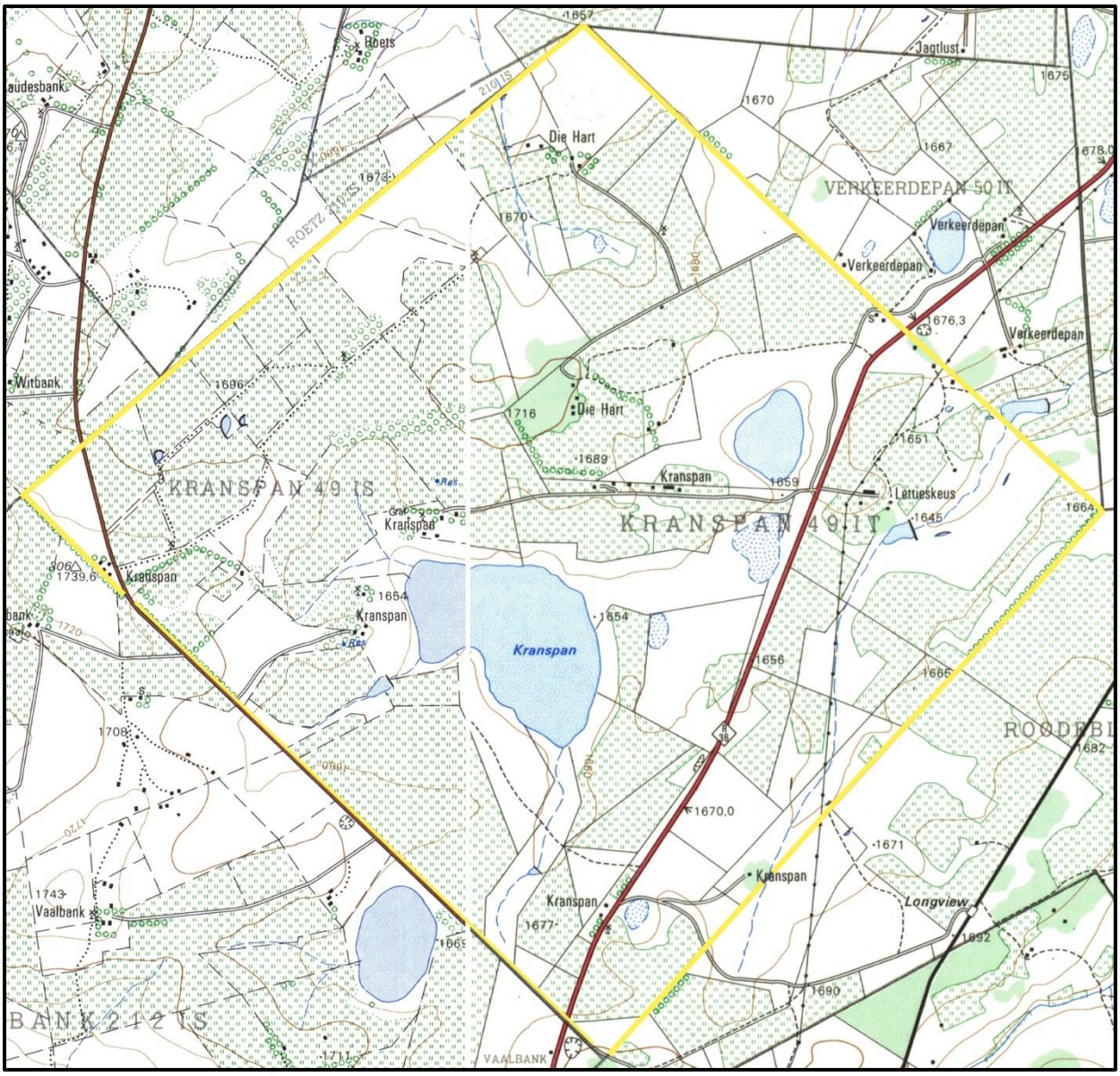

Figure 9. 1984-1985 Topographical map of the site under investigation. The study area is indicated with a yellow border. A main road went through the farm and a secondary road ran along its southwestern boundary. A number of minor roads and tracks / footpaths went through the farm. About two- thirds of the property was used as cultivated lands. The Kranspan Dam, as well as two medium-sized dams and 13 small dams can be seen. A number of settlement sites are visible. Individual buildings and windmills can be seen in various places. A power line went through the eastern part of the study area. (Topographical Map 1983; Topographical Map 1985)

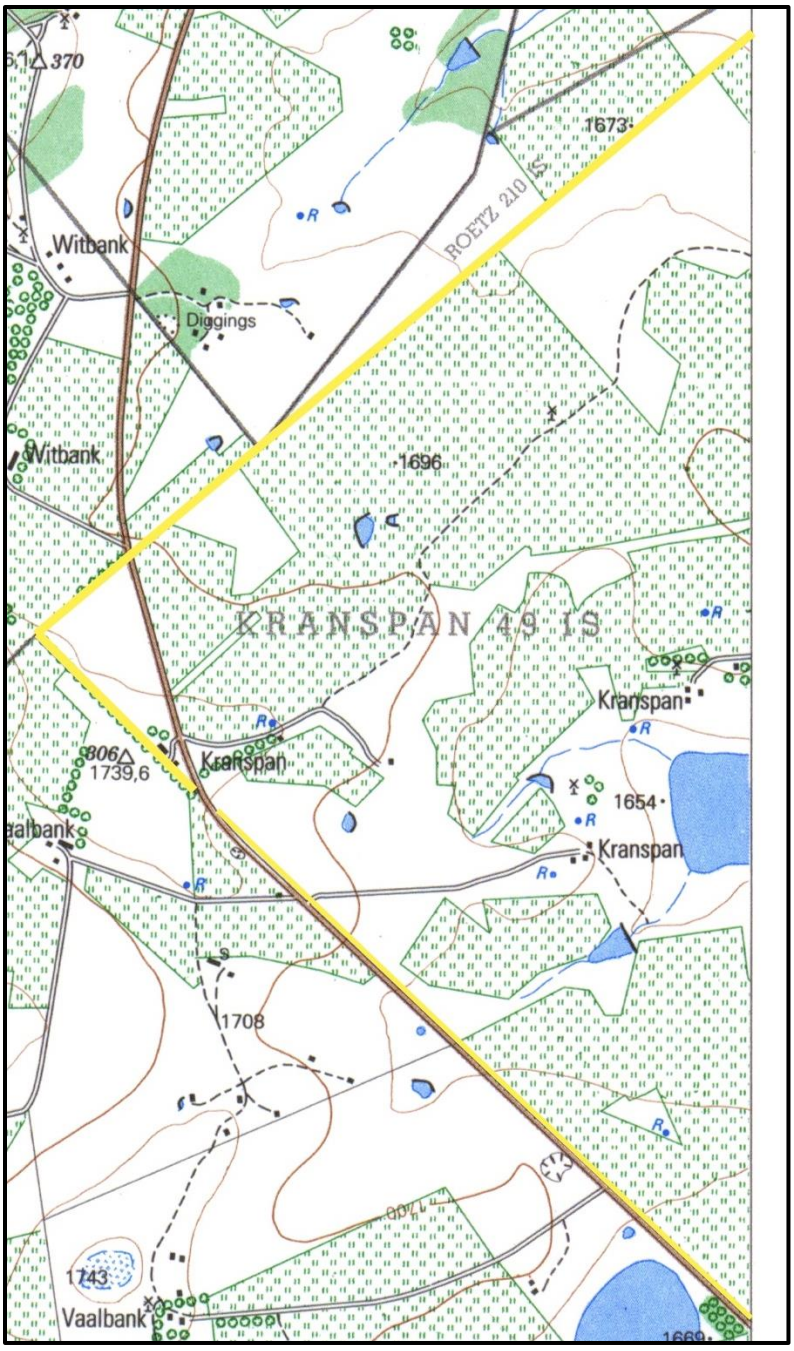

Figure 10. 1996 Topographical map of a western part of the site under investigation. The study area is indicated with a yellow border. More than half of this section of Kranspan was used as cultivated lands. A secondary road ran along the southwestern boundary of the study area. Two minor roads and a track / footpath went through the site. A part of the Kranspan Dam and five small dams can be seen. Six water reservoirs are also visible. One can see three settlement sites with two, three and three buildings respectively. Two windmills are visible. (Topographical 1996)

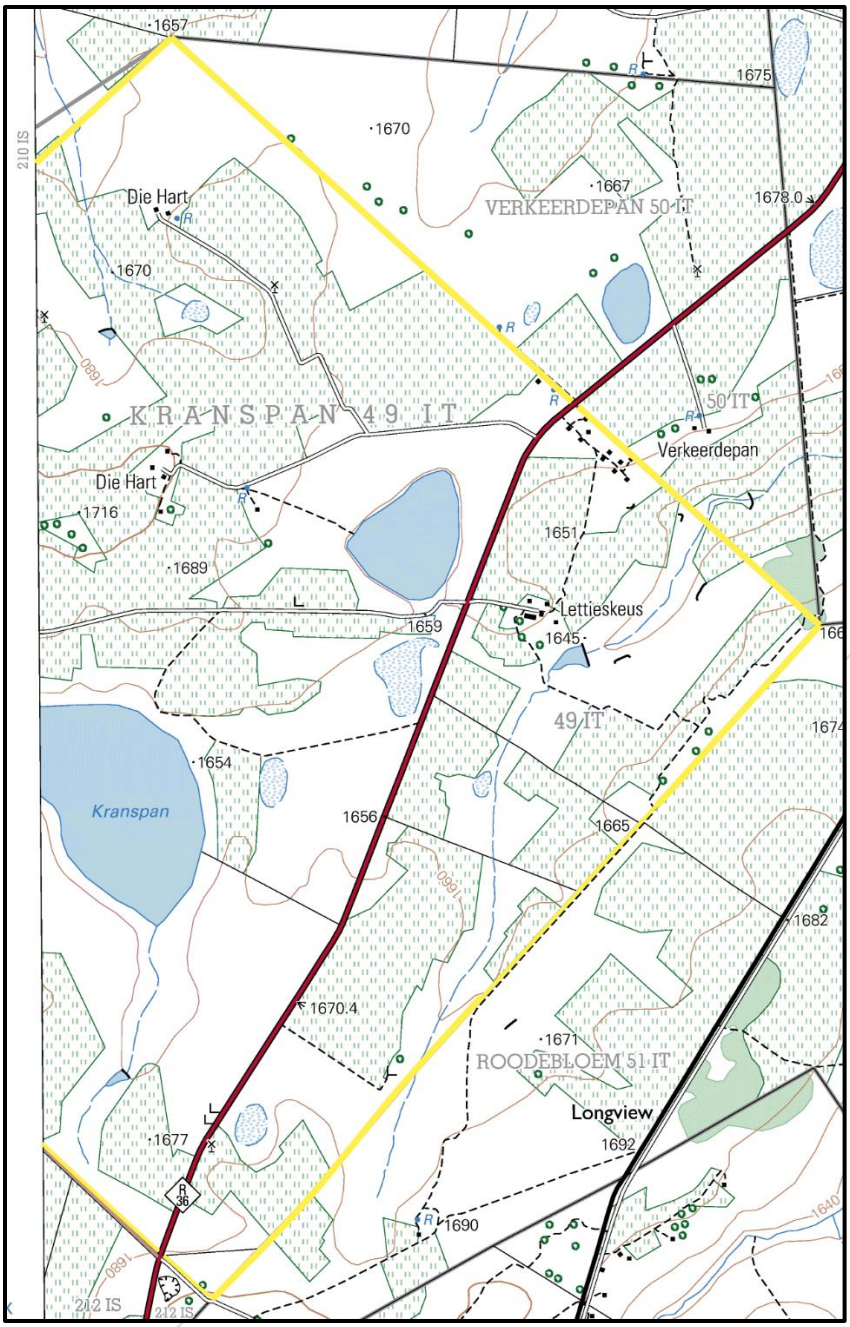

Figure 11. 2009 Topographical map of an eastern part of the site under investigation. The study area is indicated with a yellow border. The R36 main road went through the property, and a number of minor roads and tracks / footpaths are visible. Two large dams, including the Kranspan Dam and eight smaller dams are visible. Two buildings and a water reservoir can be seen at Die Hart (north); four buildings and a reservoir can be seen at the second Die Hart site (south of the latter site); five buildings are visible at Lettieskeus and 10 more at a site to the north thereof. Some individual buildings, windmills and ruins can be seen at various places on the property. (Topographical 2009)

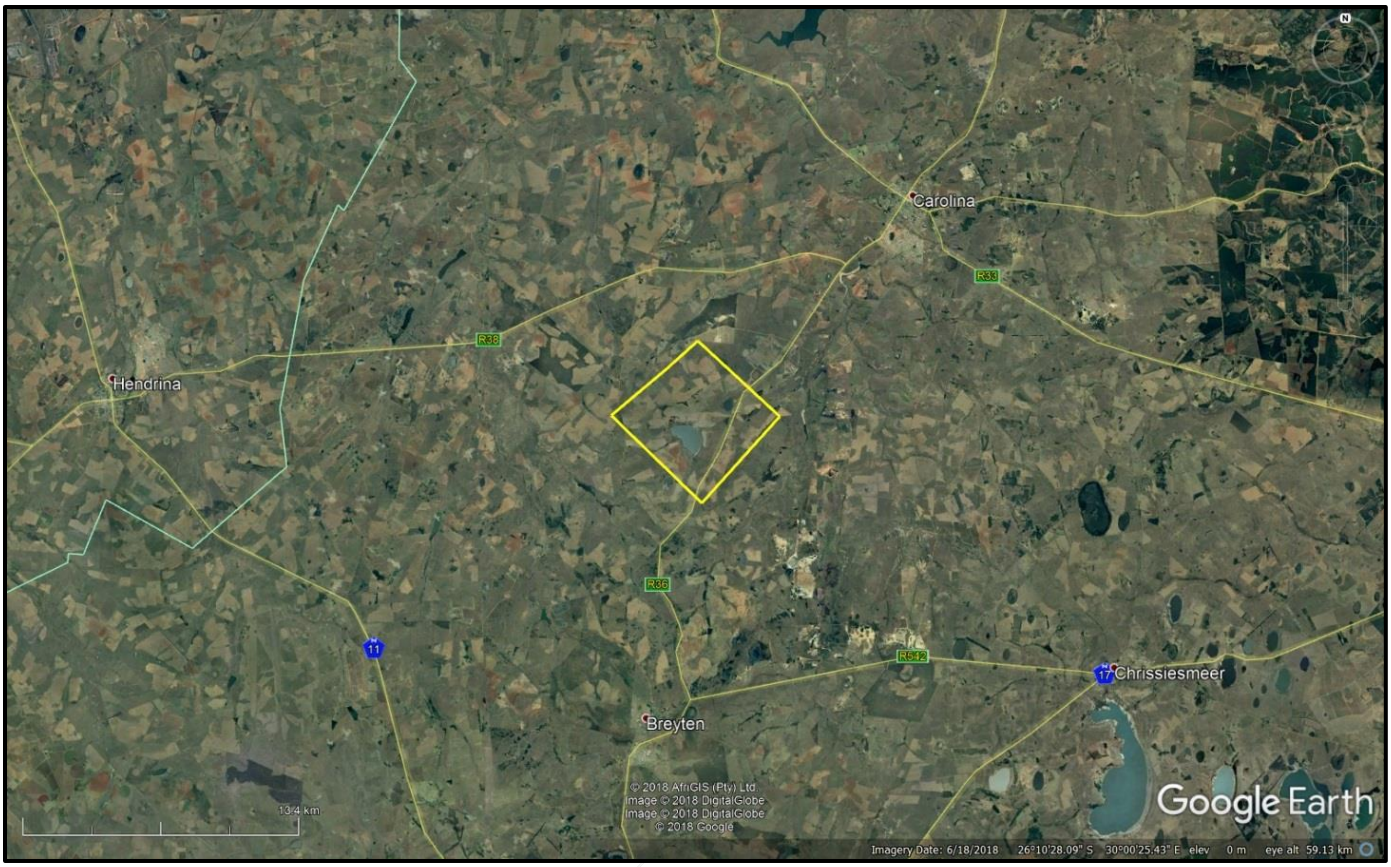

Figure 12. 2018 Google Earth image showing the study area in relation to the R36, Breyten, Carolina, Chrissiesmeer and other sites. (Google Earth 2018)

5.2. Palaeontology

Based on the SAHRA paleontological sensitivity map the area is of very high sensitivity and will require a palaeontological study prior to development

Colour	Sensitivity	Required Action
RED	VERY HIGH	Field assessment and protocol for finds is required
ORANGE/YELLOW	HIGH	Desktop study is required and based on the outcome of the desktop study, a field assessment is likely
GREEN	MODERATE	Desktop study is required
BLUE	LOW	No palaeontological studies are required however a protocol for finds is required
GREY	INSIGNIFICANT/ZERO	No palaeontological studies are required
WHITE/CLEAR	UNKNOWN	These areas will require a minimum of a desktop study. As more information comes to light, SAHRA will continue to populate the map.

Figure 13. SAHRA Paleontological Sensitivity map indicating the approximate location of the study area (blue star) as of very high paleontological sensitivity.

6. PROBABILITY OF OCCURRENCE OF SITES

Based on the above information, it is possible to determine the probability of finding archaeological and cultural heritage sites within the study area to a certain degree. For the purposes of this section of the report the following terms are used – low, medium and high probability. Low probability indicates that no known occurrences of sites have been found previously in the general study area. Medium probability indicates some known occurrences in the general study area are documented and can, therefore, be expected in the study area. A high probability indicates that occurrences have been documented close to or in the study area and that the environment of the study area has a high degree of probability for the occurrence of sites.

» Archaeological and Cultural Heritage Landscape

NOTE: *Archaeology is the study of human material and remains (by definition) and is not restricted in any formal way as being below the ground surface*.

*Archaeologica*l remains dating to the following periods can be expected within the study areas:

» Stone Age finds
ESA: Low *Probability*
MSA*: Low Probability*
LSA: High Probability
LSA –Herder: Low Probability

» Iron Age finds
EIA: *Low Probability*
MIA*: Low Probability*
LIA: Medium - High Probability

» Historical finds
Historical period: *Medium Probability*
Historical dumps: *Medium Probability*
Structural remains: *Medium to high Probability*

» Living Heritage
For example, rainmaking sites: *Low Probability*

» Burial/Cemeteries
Burials over 100 years: *High Probability*
Burials younger than 60 years*: High Probability*

Subsurface excavations including ground levelling, landscaping, and foundation preparation can expose any number of these resources.

7. ASSUMPTIONS AND LIMITATIONS

The study area was not subjected to a field survey at this stage in the environmental process; this will be done during the impact assessment phase. It is assumed that information obtained for the wider area is applicable to the study area. Additional information could become available in future that could change the results of this report. It is assumed that the EAP will upload all relevant documents to the SAHRIS.

8. FINDINGS

Based on the databases consulted no known heritage sites occur within the study area although a single grave site located at 30.0330571765, -26.16513 is on record (Figure 14). Based on historic maps structures older than 60 years are also likely to occur in the study area (Figure 8). The lack of sites on record can be attributed to a lack of systematic research in the study area and does not mean that there are no heritage sites in the project area.

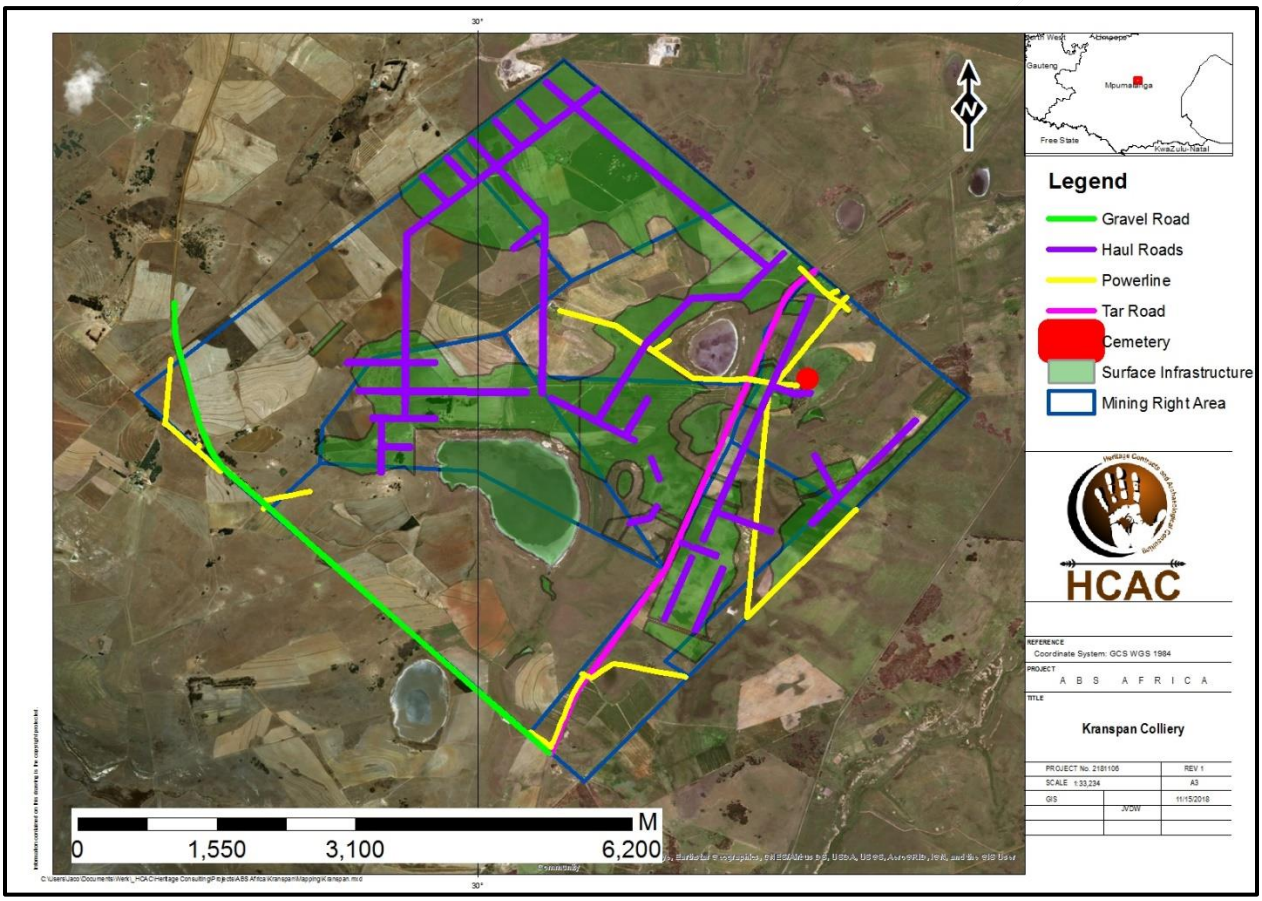

Figure 14. Known sites that occur in the study area.

8.1. Archaeology
8.2. Historical period

8.2.1 Historical finds:
Historical finds include middens, structural remains and cultural landscape features that can be expected in the study area, since the area has been developed and cultivated from prior to the 1960's. Impacts to heritage resources will occur primarily during the construction phase, and no impacts are expected during the operation and decommissioning phase.

8.2.2 Nature of Impact
Due to the development of the study area and surrounds no impacts of any magnitude are expected as the proposed development is in line with the surrounding land use.

8.2.3 Extent of impact
The construction of the project could have a low impact on a local scale.

8.3. Burials and Cemeteries

8.3.1 Burials and Cemeteries

Graves and informal cemeteries can be expected anywhere on the landscape and studies in the surrounding areas recorded informal graves, and unmarked graves can be expected throughout the study area.

8.3.2 Nature of Impact

The construction and operation of the proposed project could directly impact on marked and unmarked graves.

8.3.3 Extent of impact

The project could have a low to medium impact on a local scale.

Impact on Heritage resources

The construction of the proposed project could directly impact on graves, archaeological sites and historical sites.

Issue	Nature of Impact	Extent of Impact	No-Go Areas
Disturbance and destruction of archaeological sites, historical sites and graves.	Construction activities could cause irreversible damage or destroy heritage resources and depletion of the archaeological record of the area.	Low to Medium on a local scale.	TBC after field work

Description of the expected significance of impacts

The significance of sites, mitigation and significance of possible impact can only be determined after the fieldwork has been conducted, but based on previous work in the area Stone Age, Iron Age and grave sites can be expected.

Gaps in knowledge & recommendations for further study

The study area has not been subjected to a heritage resource survey, and it is assumed that information obtained for the wider region is applicable to the study area. To address these gaps, it is recommended that a field study should be conducted to confirm the presence of heritage resources after which mitigation measures will be recommended (if needed).

9. POTENTIAL SIGNIFICANCE OF HERITAGE RESOURCES

Based on the current information obtained for the area at a desktop level it is anticipated that any sites that occur within the proposed development area will have a Generally Protected A (GP.A) or lower field rating and all sites should be mitigatable. No red flags have been identified.

10. CONCLUSIONS AND RECOMMENDATIONS

This brief background study indicates that the general area under investigation can contain heritage sites and a cultural layering dating to the following periods:

» Paleontological Sensitivity

The study area is of very high paleontological sensitivity and according to the SAHRIS palaeontological sensitivity map must be subjected to a desktop palaeontological assessment in the impact assessment phase.

» Archaeological sites

Based on research conducted in the area Stone Age scatters as well as Iron Age sites can be expected in the larger study area. The extensive agricultural activities in the study area would have impacted on surface indicators of heritage sites and apart from pans and ridges that would have been focal points in antiquity few sites of significance are expected, but this will have to be verified during a field-based study. If any sites of significance are found these sites could be mitigated either in the form of conservation of the sites within the development or by a Phase 2 study where the sites will be recorded and sampled before the client can apply for a destruction permit for these sites prior to development.

» Historical finds and Cultural landscape

Some structures do occur on site and could be older than 60 years and therefore protected by the NHRA. This will be verified during the Impact Assessment phase.

» Burials and cemeteries

Formal and informal cemeteries, as well as pre-colonial graves, occur widely across Southern Africa and a grave site is known to exist in the project area. It is generally recommended that these sites are preserved *in situ* and within a development. These sites can, however, be relocated if conservation is not possible, but this option must be seen as a last resort and is not advisable. The presence of grave sites must be confirmed during the field survey and the public consultation process.

» General

From a heritage viewpoint, the proposed project is considered to be viable. This will, however, be confirmed through the Heritage Impact Assessment to be undertaken in the EIA Phase.

11. PLAN OF STUDY

The development triggers the NHRA in the following areas, and therefore a Phase 1 Heritage Impact Assessment (HIA) is recommended:

Action Trigger	Yes/No	Description
Construction of a road, wall, power line, pipeline, canal or other linear form of development or barrier exceeding 300 m in length.	Yes	Access and Haul roads
Construction of a bridge or similar structure exceeding 50 m in length.	No	
Development exceeding 5000 m²	Yes	Footprint of impact area exceeds 5000m²
Development involving more than 3 erven or sub divisions	No	
Development involving more than 3 erven or sub divisions that have been consolidated in the past 5 years	No	
Re-zoning of site exceeding 10 000 m²	Yes	Unknown
Any other development category, public open space, squares, parks or recreational grounds	No	

With cognisance of the recorded archaeological sites in the wider area and in order to comply with the National Heritage Resources Act (Act 25 of 1999), it is recommended that a Phase 1 HIA must be undertaken. During this study sites of archaeological, historical or places of cultural interest must be located, identified, recorded, photographed and described. During this study, the levels of significance of recorded heritage resources must be determined, and mitigation proposed should any significant sites be impacted upon, ensuring that all the requirements of the SAHRA are met.

11.1 Reasoned Opinion

If the above recommendations are adhered to, HCAC is of the opinion that the impact of the development on heritage resources can be mitigated. This will be confirmed through the Heritage Impact Assessment to be undertaken in the EIA Phase.

If during the pre-construction phase or during construction, any archaeological finds are made (e.g. graves, stone tools, and skeletal material), the operations must be stopped, and the archaeologist must be contacted for an assessment of the finds. Due to the subsurface nature of archaeological material and graves, the possibility of the occurrence of unmarked or informal graves and subsurface finds cannot be excluded.

12. LIST OF PREPARERS

Jaco van der Walt (Archaeologist and project manager).

13. STATEMENT OF COMPETENCY

The author of the report is a member of the Association of Southern African Professional Archaeologists and is also accredited in the following fields of the Cultural Resource Management (CRM) Section, member number 159: Iron Age Archaeology, Colonial Period Archaeology, Stone Age Archaeology and Grave Relocation. Jaco is also an accredited CRM Archaeologist with SAHRA and AMAFA.

Jaco has been involved in research and contract work in South Africa, Botswana, Mozambique, Zimbabwe, Tanzania and the DRC and conducted well over 300 AIAs since he started his career in CRM in 2000. This involved several mining operations, Eskom transmission and distribution projects and infrastructure developments. The results of several of these projects were presented at international and local conferences.

14. STATEMENT OF INDEPENDENCE

I, Jaco van der Walt as duly authorised representative of Heritage Contracts and Archaeological Consulting CC, hereby confirm my independence as a specialist and declare that neither I nor the Heritage Contracts and Archaeological Consulting CC have any interest, be it business, financial, personal or other, in any proposed activity, application or appeal in respect of which the client was appointed as Environmental Assessment practitioner, other than fair remuneration for work performed on this project.

SIGNATURE: _____

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