Ecological Management Services

BIODIVERSITY ASSESSMENT REPORT FOR OLIE RIVIER FARM IRRIGATION DEVELOPMENT, DOUGLAS NORTHERN CAPE

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For
EIMS

November 2020

DECLARATION OF CONSULTANT

I Natalie Birch declare that I –

- act as the independent specialist in this study;
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2017;
- do not have and will not have any vested interest in the activity proceeding;
- have no, and will not engage in, conflicting interests in the undertaking of the activity;
- undertake to disclose, to the competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the Environmental Impact Assessment Regulations, 2017;
- will provide the competent authority with access to all information at my disposal regarding the study.

Natalie Birch Pr. Sci. Nat 400117/05

November 2020

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ABBREVIATIONS

ADE	Aquifer Dependent Ecosystems
BGIS	Biodiversity Geographical Information System
CBA	Critical Biodiversity Area
CITES	Convention on International Trade in Endangered Species
DAFF	The Department of Agriculture, Forestry and Fisheries
DENC	Department of Environment and Nature Conservation
EIA	Environmental Impact Assessment
ESA	Ecological Support Area
EWT	Endangered Wildlife Trust
FEPA	Freshwater Ecosystem Priority Areas
GPS	Global Positioning System
GWC	Griqualand West Centre of Endemism
IUCN	International Union for Conservation of Nature
NCNCA	Northern Cape Nature Conservation Act
NEM:BA	National Environmental Management: Biodiversity Act
NEMA	National Environmental Management Act
NFEPA	National Freshwater Ecosystem Priority Areas assessment
NPAES	National Protected Areas Expansion Strategy
PESEIS	Present Ecological State, Ecological Importance & Ecological Sensitivity
QDS	Quarter Degree Squares
SABAP	South African Bird Atlas Project
SABIF	South African Biodiversity Information Facility
SANBI	South African National Biodiversity Institute
SARCA	Southern African Reptile Conservation Assessment
SIBIS	SANBI's Integrated Biodiversity Information System
TOPS	Threatened or Protected Species

1.1. INTRODUCTION

The purpose of this project is to develop additional pivots under irrigation. In order to establish the required additional pivots natural vegetation under the pivots will have to be cleared.

An EIA process is required for this development part of this process requires that a specialist fauna and flora assessment of the site is undertaken. This report comprises the specialist biodiversity assessment for the site

The report was complied by Dr N.V. Birch Pr. Sci Nat. (reg no 400117/05). Details of the specialist are attached in Appendix 3.

1.1. TERMS OF REFERENCE & SCOPE OF WORK

Undertake a biodiversity specialist survey and report the findings. This survey included;

- Desktop and field investigations to identify and map different habitats, concentrating on areas proposed for new infrastructure
- Assign species to each habitat through various sampling methods
- Rank each habitat type based on conservation importance (in terms of provincial biodiversity priorities) and ecological sensitivity
- Identify potential impacts (including cumulative) on ecology

The survey has been undertaken according to the protocol for the assessment and reporting of environmental impacts on terrestrial biodiversity (Government Gazette 42451 10 May 2019)

1.2. DATA SOURCING AND REVIEW

The data sources consulted and used where necessary in the study includes the following:
Vegetation:

- Vegetation types and their conservation status were extracted from the South African National Vegetation Map (Mucina and Rutherford 2006) (updated 2018).
- Information on plant and animal species recorded for the Quarter Degree Squares (QDS), was extracted from the SABIF/SIBIS database hosted by SANBI. This is a much larger

extent than the study area, but the data was extracted from a larger area to account for the fact that the area has probably not been well sampled in the past.

- The IUCN conservation status of the species in the list (Table 1.1) was also extracted from the database and is based on the Threatened Species Programme, Red List of South African Plants (2011).
- Threatened Ecosystem data was extracted from the NEM:BA listed ecosystems layer (SANBI 2008).
- Freshwater and wetland information was extracted from the National Freshwater Ecosystem Priority Areas assessment, NFEPA (Nel et al. 2011).
- Information on Critical Biodiversity Areas (CBA) was extracted from the Northern Cape Critical Biodiversity Areas Project 2016.
- Important catchments and protected areas expansion areas were extracted from the National Protected Areas Expansion Strategy 2008 (NPAES).

Fauna

- Lists of mammals, reptiles and amphibians which are likely to occur at the site were derived based on distribution records from the literature and various spatial databases (SANBI's SIBIS and BGIS databases).
- Literature consulted includes Branch (1988) and Alexander and Marais (2007) for reptiles, Du Preez and Carruthers (2009) for amphibians, Friedmann and Daly (2004) and Skinner and Chimimba (2005) for mammals.
- Bird species lists for the area were extracted from the SABAP 1 and SABAP 2 databases and Birdlife South Africa's Important Bird Areas was also consulted to ascertain if the site falls within the range of any range-restricted or globally threatened species.
- The faunal species lists provided are based on species which are known to occur in the broad geographical area, as well as a preliminary assessment of the availability and quality of suitable habitat at the site. For each species, the likelihood that it occurs at the site was rated according to the following scale:
    - **Low:** The available habitat does not appear to be suitable for the species and it is unlikely that the species occurs at the site.
    - **Medium**: The habitat is broadly suitable or marginal and the species may occur at the site.
    - **High:** There is an abundance of suitable habitat at the site and it is highly probable that the species occurs there.
    - **Definite:** Species that were directly or indirectly (scat, characteristic diggings, burrows etc.) observed at the site.

- The conservation status of each species is also listed, based on the IUCN Red List Categories and Criteria version 3.1 (2012) (See Table 1) and where species have not been assessed under these criteria, the CITES status is reported where possible. These lists are adequate for mammals and amphibians, the majority of which have been assessed, however the majority of reptiles have not been assessed and therefore, it is not adequate to assess the potential impact of the development on reptiles, based on those with a listed conservation status alone. In order to address this shortcoming, the distribution of reptiles was also taken into account such that any narrow endemics or species with highly specialized habitat requirements occurring at the site were noted.

Table 1. The IUCN Red List Categories for fauna and flora. Species that fall within the categories in red and orange below are of conservation concern.

IUCN Red List Category
Critically Endangered (CR)
Endangered (EN)
Vulnerable (VU)
Near Threatened (NT)
Critically Rare
Rare
Declining
Data Deficient - Insufficient Information (DDD)
Data Deficient - Taxonomically Problematic (DDT)
Least Concern

The following is provided in Accordance with NEMA Appendix 6,

Section	NEMA 2014 Regs – Appendix 6 (1) Requirement	Position in Report
1	A specialist report prepared in terms of these Regulations must contain—	
(a)	Details of -	
	(i) the specialist who prepared the report; and	Cover page
	(ii) the expertise of that specialist to compile a specialist report including a curriculum vitae;	Appendix 3

(b)	a declaration that the person is independent in a form as may be specified by the competent authority;	Page 2
(c)	an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.1
(d)	the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment; an indication of the quality and age of base data used for the specialist report; a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Section 1.3 & 3 Section 1.3 & 3 Section 6
(e)	a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 1.2 & 3
(f)	Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 4.3, 4.7 and Section 5
(g)	an identification of any areas to be avoided, including buffers;	Section 5
(h)	a map superimposing the activity including the associated structures and infrastructure on the environmental sensitive of the site including areas to be avoided, including buffers;	Section 5
(i)	a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.3
(j)	a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Section 6 and 7
(k)	any mitigation measures for inclusion in the EMPr;	Section 7
(l)	any conditions for inclusion in the environmental authorization;	Section 7

(m)	any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 6 & 7
(n)	a reasoned opinion- (i) whether the proposed activity, activities or portions thereof should be authorized; (ii) regarding the acceptability of the proposed activity or activities; and (iii) if the opinion is that the proposed activity of portion thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 7
(o)	a description of any consultation process that was undertaken during the course of preparing the specialist report;	N/A
(p)	a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A at this stage,
(q)	any other information requested by the competent authority.	N/A at this stage

1.3. LIMITATIONS AND ASSUMPTIONS

The major potential limitation associated with the sampling approach is the narrow temporal window of sampling. Ideally, a site should be visited several times during different seasons to ensure a comprehensive database of plant and animal species are captured. However, this is rarely possible due to time and cost constraints and therefore these surveys usually represent a “moment in time” survey. The original site survey represents the summer/wet season survey as it was conducted in November following a number of seasonal rainfall events. A plant species list was compiled for the site from the site visit, this was augmented by a list of species which are known from other studies to occur in the broad vicinity of the site. The lists of amphibians, reptiles and mammals for the site are based on those observed at the site as well as those likely to occur in the area based on their distribution and habitat preferences. This represents a sufficiently conservative and cautious approach that takes account of the study limitations. Protected tree species which are of concern within this area are easily accounted for as they are highly visible and timing of the survey does not influence the accuracy of their records.

2. REGULATORY AND LEGISLATIVE OVERVIEW

A summary of the relevant portions of the Acts which govern the activities and potential impacts to the environment associated with the development are listed below. Provided that standard mitigation and impact avoidance measures are implemented, not all the activities listed in the Acts below would actually be triggered.

National Environmental Management Act (NEMA) (Act No 107, 1998):

NEMA requires that measures are taken that "prevent pollution and ecological degradation; promote conservation; and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development." In addition:

- That the disturbance of ecosystems and loss of biological diversity are avoided, or where they cannot be altogether avoided, are minimised and remedied:
- That a risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions; and
- Sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure.

National Environmental Management: Biodiversity Act (NEM:BA) (Act 10 of 2004):

The National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEMBA) provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected. The Draft National List of Threatened Ecosystems (Notice 1477 of 2009, Government Gazette No 32689, 6 November 2009) has been gazetted for public comment. The list of threatened terrestrial ecosystems supersedes the information regarding terrestrial ecosystem status in the NSBA 2004. In terms of the EIA regulations, a basic assessment report is required for the transformation or removal of indigenous vegetation in a critically endangered or endangered ecosystem regardless of the extent of transformation that will occur. However, all of the vegetation types within and surrounding the study site are classified as Least Threatened.

NEM:BA also deals with endangered, threatened and otherwise controlled species, under the TOPS Regulations (Threatened or Protected Species Regulations). The Act provides for listing of species as threatened or protected, under one of the following categories:

- **Critically Endangered:** any indigenous species facing an extremely high risk of extinction in the wild in the immediate future.
- **Endangered:** any indigenous species facing a high risk of extinction in the wild in the near future, although it is not a critically endangered species.
- **Vulnerable:** any indigenous species facing an extremely high risk of extinction in the wild in the medium-term future; although it is not a critically endangered species or an endangered species.
- **Protected species:** any species which is of such high conservation value or national importance that it requires national protection. Species listed in this category include, among others, species listed in terms of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

A TOPS permit is required for any activities involving any TOPS listed species.

National Forests Act (No. 84 of 1998):

The National Forests Act provides for the protection of forests as well as specific tree species, quoting directly from the Act: "no *person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a license or exemption granted by the Minister to an applicant and subject to such period and conditions as may be stipulated".* A permit is required for the destruction or transplant or transport of any protected tree species.

National Veld and Forest Fire Act (Act No. 101 of 1998)

The purpose of this Act is to prevent and combat veld, forest and mountain fires. The Act provides for a variety of institutions, methods and practices for achieving the purpose such as the formation of fire protection associations. It also places responsibility on landowners to develop and maintain firebreaks as well as be sufficiently prepared to combat veld fires in terms of equipment as well as suitably trained personnel.

Conservation of Agricultural Resources Act (Act 43 of 1983):

The Conservation of Agricultural Resources Act provides for the regulation of control over the utilisation of the natural agricultural resources in order to promote the conservation of soil, water and vegetation and provides for combating weeds and invader plant species. The Conservation of Agricultural Resources Act defines different categories of alien plants and those listed under Category 1 are prohibited and must be controlled while those listed under Category 2 must be grown within a demarcated area under permit. Category 3 plants includes ornamental plants that

may no longer be planted but existing plants may remain provided that all reasonable steps are taken to prevent the spreading thereof, except within the floodline of water courses and wetlands.

Northern Cape Nature Conservation Act, No. 9 of 2009: (NCNCA)

The Northern Cape Nature Conservation Act provides inter alia for the sustainable utilisation of wild animals, aquatic biota and plants as well as permitting and trade regulations regarding wild fauna and flora within the province. In terms of this act the following section may be relevant with regards to any security fencing the development may require.

Manipulation of boundary fences 19. No Person may –

> *(a) erect, alter remove or partly remove or cause to be erected, altered removed or partly removed, any fence, whether on a common boundary or on such person's own property, in such a manner that any wild animal which as a result thereof gains access or may gain access to the property or a camp on the property, cannot escape or is likely not to be able to escape therefrom;*

The Act also lists protected fauna and flora under 3 schedules ranging from Endangered (Schedule 1), protected (schedule 2) to common (schedule 3). The majority of mammals, reptiles and amphibians are listed under Schedule 2, except for listed species which are under Schedule 1. A permit is required for any activities which involve species listed under schedule 1 or 2. A permit obtainable from the DENC permit office in Kimberly would be required for the site clearing. A permit would also be required to destroy or translocate any nationally or provincially listed species from the site. A single permit, which covers all of these permitting requirements as well as meets TOPS regulations, is used.

3. METHODOLOGY

A site survey, was undertaken during November 2020. During the site visit, the different biodiversity features, habitat, vegetation and landscape units present at the site were identified and mapped in the field. Walk-through-surveys were conducted across the site and all plant and animal species observed were recorded. Active searches for reptiles and amphibians were also conducted within habitats likely to harbor or be important for such species. The presence of sensitive habitats such as wetlands or pans and unique edaphic environments such as rocky outcrops or quartz patches were noted in the field if present and recorded on a GPS and mapped onto satellite imagery of the site.

Flora

Satellite images were used to identify homogenous vegetation/habitat units within the study area. These were then sampled on the ground with the aid of a GPS to navigate in order to characterise the species composition. The following quantitative data was collected:

- species composition,
- cover estimation of each species according to the Braun-Blanquet scale,
- vegetation height,
- amount of bare soil and rock cover,
- slope, aspect
- presence of biotic disturbances, e.g. grazing, animal burrows, etc.

Additional checklists of plant species were compiled by traversing a linear route and recording species as they were encountered. Searches for listed and protected plant species at the site were conducted and all listed plant species observed were recorded.

Fauna

The faunal study was undertaken as a desktop / literature survey combined with a field survey. The tasks included in each are given below.

Desktop/literature survey:

A desktop survey was undertaken to determine the red data reptile, amphibian, mammalian and bird species occurring in the quarter degree square in which the study area falls. The likelihood of red data species occurring on-site has been determined using the i) distribution maps in reference books and ii) a comparison of the habitat described from the field survey.

Field survey:

The habitats on-site were assessed to compare with habitat requirements of red data species determined during the literature survey. During the site visit the presence and identification of bird and mammal species was determined using the following methods / techniques:

- Identification by visual observation.
- Identification of bird and mammal calls.
- Identification of spoor.
- Identification of faeces.
- Presence of burrows and / or nests.

Criteria used in the assessment of impacts

The methodology used in the assessment of the identified impacts is provided in appendix 4

4. DESCRIPTION OF THE AFFECTED ENVIRONMENT

The property under application is described as Remainder extent of the farm Olie Rivier 170. The property is located north east of Douglas within the Frances Baard District. The southern boundary of the property runs along the R357 to Douglas. A secondary gravel road runs north through the property this road connects the R357 to the N8. The property contains some irrigation ground in the form of pivots and a pecan nut orchard. The remainder of the property is fenced to keep an assortment of game species.

The study area falls within the land types Ia and Ae (ARC – Institute for Soil Climate & Water), a land-type being an area that is uniform with respect to terrain form, soil patterns and climate.

The soils within the Ae landtype are AC soils, which are red-yellow well drained soils lacking a strong texture contrast, with a high base status. They are eutrophic soils >= 750 mm deep with < 15% clay. The soils within the Ia landtype are classified as EE soils which are soils with a negligible to weak profile development, usually occurring on recent flood plains. They >= 750 mm deep with < 15% clay.

Figure 4.1. The property of Olie Rivier 170 showing the layout of the existing pivots and the proposed additional pivots.

4.1. BROAD-SCALE VEGETATION PATTERNS

The vegetation within the study area is classified as Kimberley Thornveld and Upper Gariep Alluvial Vegetation (Mucina & Rutherford 2006)

Kimberley Thornveld is described as having a well developed tree layer with *Vachellia erioloba, Vachellia tortilis* and *V. karroo* and *Boscia albitrunca*. The shrub layer is also described as well developed with occasional dense stands of *T. camphoratus* and *S. mellifera*. The grass layer is open with a lot of uncovered soil.

Upper Gariep Alluvial vegetation is found on the flat alluvial terraces supporting a complex of riparian thickets, flooded grasslands, reed beds and ephemeral herb-lands populating mainly sandy banks.

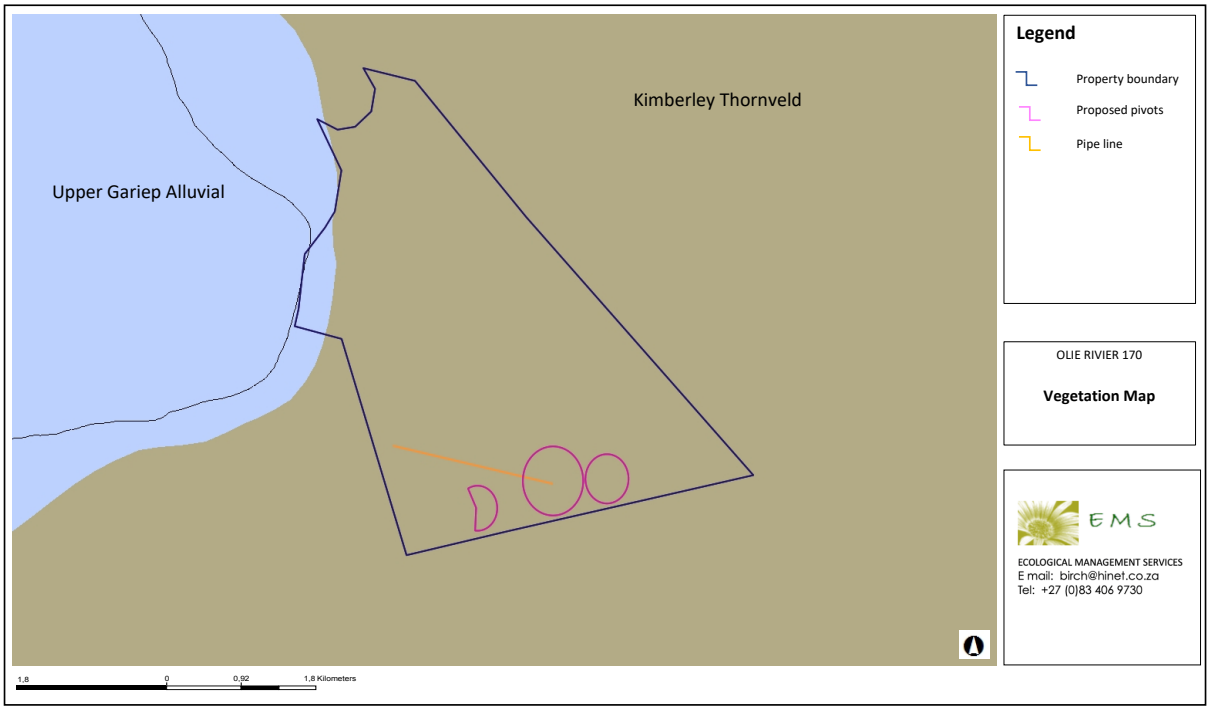

Figure 4.2: The two Vegetation types that occur within the study area.

4.2. PLANT COMMUNITY DESCRIPTION

There are a number of vegetation units which can be identified across the property these are described in more detail below and the extent of these vegetation types in indicated in Figure 4.3.

Figure 4.3: Vegetation type units identified across the property.

VTU 1: Riparian Vegetation

This vegetation type is found along the banks of the river. Common species within this vegetation type include *Vachellia karroo , Salix mucronata, Diospyros lyciodes, Sersia pyroides, Phragmites australis, Asparagus setaceus, A. suaveolens, Lycium arenicola, L. hirsutum* and *Cynodon dactylon*.

Plate 4.1: The riparian vegetation found along the banks of the river

VTU 2: *Senegalia mellifera* scrub.

This vegetation type is found along the alluvial terraces, the drainage lines and the slope of the ridge which occur in the area. The vegetation is dominated by *Senegalia mellifera* although shrubs such as *Ehretia rigida, Gymnosporia buxifolia Tarchonanthus camphoratus*, and *Grewia flava* were recorded. The vegetation type has a very poorly developed grass layer with much of the area not having any grass coverage. The density of the *S. mellifera* also varies throughout the study area, in some sections it forms a dense thicket, in others it is more open with a better developed grass sword. Typically the vegetation, is very sensitive to grazing pressure. It occurs in areas of high runoff, the subsequent moisture content and nutrient concentration result in animals concentrating in these areas which causes over grazing of the limited grass layer.

Plate 4.2: The *Senegalia mellifera* scrub found on the alluvial terrace.

Plate 4.3: The *Senegalia mellifera* scrub found along the rocky ridge

VTU 3: Mixed *Vachellia* Savannah

This vegetation community contains a tree layer which is mainly comprised of *Vachellia erioloba* and *Vachellia tortilis.* Three vegetation strata are evident within this vegetation unit. There is a prominent tree layer between 2.5m – 5m, a shrub layer, between 1.5m – 2.5m and a grass layer with an average height of 50cm. *Vachellia erioloba,* and *Vachellia tortilis* are prominent within this vegetation type. The density of the trees varies across the landscape, with some areas forming a more open savannah, while other areas have dense pockets of trees and shrubs. Other species recorded included, *Asparagus glaucus, Zygophyllum lichtensteinianum, Lycium hirsutum, Helichrysum arenicola, Selago multispicata,* and *Melhania rehmannii*. Grass species within this vegetation community included, *Eragrostis lehmanniana, Schmidtia pappophoroides, Aristida congesta, Centropodia glauca, Enneapogon scoparius, Stipagrostis hirtigluma Stipagrostis uniplumis*, and *Tricholaena monachne*

Plate 4.4: Mixed *Vachellia* savannah in the area of the planned half pivot.

VTU 4: Dams

There are a number of ground dams on the property, these are all man-made features within a drainage area that has allowed the farmer to retain the water from runoff for stock use. Only one of these dams has a cement wall, the other two have a wall made from soil and gravel. The retention of water and seepage has created an artificial wetland in the immediate surrounds of the dams, with species that prefer a moist environment.

Plate 4.5: The wetland environment surrounding a ground dam in the area.

Plate 4.6: The cement dam wall of one the ground dams

VTU 5: Old Lands/Secondary vegetation

There are areas that have been utilized as irrigation lands in the past. The area where the two large pivots are planned, is an old land. The land has not been under irrigation for about 25 years. Remnants of the old pipeline that supplied the lands with water is still evident as well as some ridging from ploughing activity. The area consists mostly of an open grassland savannah, where the *Vachellia erioloba* and *Vachellia tortillis* have re-colonised. The grass layer is fairly well developed and consists predominantly of *Eragrostis lehmanniana,* and *Schmidtia pappophoroide.*

Plate 4.7: The secondary vegetation that has re-colonised an area where irrigations lands were once present. Two of the planned pivots are located in this area.

VUT 6: Existing pivots and irrigation land

The property already has active pivots as well as a section of irrigation land for a pecan nut orchard.

4.3. POPULATIONS OF SENSITIVE AND/OR THREATENED PLANT SPECIES

Historical records of Red List plant species were consulted in order to determine the likelihood of any such species occurring in the study area and these were searched for in the field. Plant species observed as well as a list of threatened plant species previously recorded in the quarter degree grids in which the study area is situated which was obtained from the South African National Biodiversity Institute, are listed in the table below

Table 4.1: Protected species that possibly occur on site.

Species	Legislation	Conservation status	Potential of occurrence on site
Vachellia erioloba	National Forests Act 1998	Protected	Recorded on property and within development footprint
Vachellia haematoxylon	National Forests Act 1998	Protected	Recorded on property but NOT recorded with development footprint
Bosica albitrunca	National Forests Act 1998 NCNCA	Protected Schedule 2	Recorded on property but NOT within development footprint
Titanopsis calcarea	NCNCA	Schedule 2	Not recorded during field survey, **Low** potential of occurrence within development footprint

Plinthus karooicus	NCNCA	Schedule 2	Not recorded during field survey, **Low** potential of occurrence within development footprint
Ruschia ruralis	NCNCA	Schedule 2	Not recorded during field survey, **Low** potential of occurrence within development footprint
Bulbine abyssinica	NCNCA	Schedule 2	Not recorded during field survey, **Low** potential of occurrence within development footprint
Aloe claviflora	NCNCA	Schedule 2	Not recorded during field survey, **Low** potential of occurrence within development footprint
Ornithogalum nanodes	NCNCA	Schedule 2	Not recorded during field survey, **Low** potential of occurrence within development footprint
Nemesia pubescens	NCNCA	Schedule 2	Not recorded during field survey, **Low** potential of occurrence within development footprint

Owing to the narrow temporal window of sampling some species may not have been recorded, this however does not preclude them from occurring within the development site. Species that could possibly occur have been included in the species checklist. It is therefore recommended that prior to clearing an additional walk through is conducted. In order to remove species listed in Schedule 1 & 2 of the NCNCA, during site clearing activities an integrated permit application will have to be made to the DENC to obtain the required permission to remove and/or translocate these species from site. In order to remove the protected trees a license application will have to be made to the Department of Forestry.

4.3. CRITICAL BIODIVERSITY AREAS & BROAD-SCALE PROCESSES

Kimberley Thornveld is classified as Least Threatened only 2% of this vegetation is formerly conserved and 18% is considered transformed, mostly by agricultural cultivation. Threats include bush encroachment by *Senegalia mellifera* owing to overgrazing. The Upper Gariep Alluvial Vegetation is classified as Vulnerable, with only 2% conserved and more than 20% transformed through cultivation. The planned additional pivots fall only within the Kimberley Thornveld.

Focus areas for land-based protected area expansion are large, intact and unfragmented areas of high importance for biodiversity representation and ecological persistence, suitable for the creation or expansion of large protected areas. The focus areas were identified through a systematic biodiversity planning process undertaken as part of the development of the National Protected Area Expansion Strategy 2008 (NPAES). They present the best opportunities for meeting the ecosystem-specific protected area targets set in the NPAES and were designed with strong emphasis on climate change resilience and requirements for freshwater ecosystems. The project area does not fall within a NPAES focus area but is located approximately 25km north west of the

Mokala National Park and its proposed expansion area for the eastern Kalahari bushveld (appendix 2).

The study area is not considered a threatened ecosystem in terms of NEM:BA and does not fall within a within a River FEPA (Fresh Water Ecosystem Priority Area), there are however two identified NFEPA wetlands within the study area, these are in fact the farm ground dams. These dams are located well beyond 500m from the proposed additional pivot development.

The study site and surrounding area does not fall within an Important Bird and Biodiversity Area (IBA). IBAs are sites of international significance for the conservation of the world's birds and other biodiversity.

The study site falls with a Critical Biodiversity Area 2 (CBA2). CBA2 are areas that have been selected as the best option for meeting biodiversity targets, based on complementarity, efficiency, connectivity and/or avoidance of conflict with other land or resources uses (appendix 2).

4.4. ALIEN/INVASIVE SPECIES

The Conservation of Agricultural Resources Act (CARA) regulates and restricts the propagation, harboring and sale of invasive alien plant and weed species listed in a set of Regulations published in terms of the Act. CARA was amended in 2001 and is administered by the National Department of Agriculture.

The National Environmental Management: Biodiversity Act (NEMBA – Act no. 10 of 2004) regulates all invasive organisms in South Africa, including a wide range of fauna and flora. All listed IAPs are divided into four categories in accordance with the Government Gazette Notice No. 40166 of July 2016 as listed below:

- Category 1a (PROHIBITED): Listed Invasive Species

  A person in control of a Category 1a Listed Invasive Species must comply with the provisions of section 73(2) of the Act; immediately take steps to combat or eradicate listed invasive species in compliance with sections 75(1), (2) and (3) of the Act; and allow an authorised official from the Department to enter onto land to monitor, assist with or implement the combatting or eradication of the listed invasive species.

- Category 1b (PROHIBITED / Exempted if in Possession or Under control): Listed Invasive Species

A person in control of a Category 1 b Listed Invasive Species must control the listed invasive species in compliance with sections 75(1), (2) and (3) of the Act. A person contemplated in sub-regulation (2) must allow an authorised official from the Department to enter onto the land to monitor, assist with or implement the control of the listed invasive species, or compliance with the Invasive Species Management Programme contemplated in section 75(4) of the Act.

- **Category 2 (PERMIT REQUIRED): Listed Invasive Species**

  Category 2 Listed Invasive Species are those species listed by notice in terms of section 70(1)(a) of the Act as species which require a permit to carry out a restricted activity within an area specified in the Notice or an area specified in the permit, as the case may be. A landowner on whose land a Category 2 Listed Invasive Species occurs or person in possession of a permit, must ensure that the specimens of the species do not spread outside of the land or the area specified in the Notice or permit. Unless otherwise specified in the Notice, any species listed as a Category 2 Listed Invasive Species that occurs outside the specified area contemplated in sub-regulation (1), must, for purposes of these regulations, be considered to be a Category 1 b Listed Invasive Species and must be managed according to Regulation 3. Notwithstanding the specific exemptions relating to existing plantations in respect of Listed Invasive Plant Species published in Government Gazette No. 37886, Notice 599 of 1 August 2014 (as amended), any person or organ of state must ensure that the specimens of such Listed Invasive Plant Species do not spread outside of the land over which they have control.

- **Category 3 (PROHIBITED): Listed Invasive Species**

  Category 3 Listed Invasive Species are species that are listed by notice in terms of section 70(1)(a) of the Act, as species which are subject to exemptions in terms of section 71(3) and prohibitions in terms of section 71A of the Act, as specified in the Notice. Any plant species identified as a Category 3 Listed Invasive Species that occurs in riparian areas, must, for the purposes of these regulations, be considered to be a Category 1b Listed Invasive Species and must be managed according to regulation 3.

Species		Category
Argemone mexicana	Yellow flowered Mexican Poppy	1b
Prosopis cf. *glandulosa*	Mesquite	3
Opuntia humifusa	Prickly pear	1b
Argemone ochroleuca	White flowered Mexican poppy	1b

Table 4.3: Alien invasive species that occur in and around the property

4.5. POPULATIONS OF SENSITIVE AND/OR THREATENED FAUNAL SPECIES

A section of the property has already been disturbed by agricultural activity which has resulted in some disturbance to the faunal population on site. Disturbances that alter the natural environment have two effects namely, it may cause the loss of certain species due to the destruction of habitat. It may also cause the influx of other species previously unable to colonise an area owing to lack of suitable habitat or because they have been excluded through competition.

It was not possible to compile a complete list of species present on the property during the field survey owing to the limited time frame of the assessment. It is therefore important to note that many species that potentially occur on-site may not have been identified thus emphasis was placed on the habitat in order to determine potential occurrence of species. The potential of occurrence is also assessed for the immediate surrounding area as to establish the possibility of ecological linking corridors for certain species.

Based on the bird species identified while on-site, the proposed development site hosts both grassland and bushveld bird species. The loose sandy soils which occurs over a large portion of the study site, makes these areas suitable for burrowing mammals.

Reptiles Species of Conservation Concern

No red data terrapin, tortoises, snakes or lizards were identified as occurring in the quarter degree square, based on the distribution maps available in the South African Red Data Book for reptiles (Bates *et. al*. 2014) and The Southern African Reptile Conservation Assessment (SARCA). The conservation status was cross checked on the IUCN website to determine most recent status listing for these species.

Amphibians of Conservation Concern

No red data amphibians were identified as occurring in the quarter degree squares, based on the distribution maps available in the South African Red Data Book for amphibians (Minter *et al*., 2004) Du Preez and Carruthers (2009) and the South African Frog Atlas project.

Birds of Conservation Concern

A list of all red data bird species occurring in the quarter degree square, was extracted from the SABAP 1 and SABAP 2 databases and Birdlife South Africa's Important Bird Areas and from the Red Data Book of Birds (Taylor *et al* 2015) with the distribution being confirmed in Roberts – Birds of Southern Africa, 7th edition (Hockey *et al.*, 2005). The IUCN 3.1. status is also presented in the table. Based on an evaluation of the habitat requirements for these red data species, the potential

of these species occurring either on-site or within 500m of the property boundary is provided in Table 4.4 below.

Eight red data bird species have been recorded for the quarter degree square, five have a high potential to occur on site. Most of these species will utilise the site for foraging purposes but they may not be totally dependent on the site.

Common Name	Scientific Name	Conservation Status (*Regional, Global)	Suitable Habitat requirements[1]	Potential for Occurrence On-site and surrounding area
Blue Crane	*Anthropoides paradiseus*	Near Threatened Vulnerable	Grasslands, cultivated lands Karoo scrub and edges of vleis	**Very Low** – Edge of distribution range, vegetation too dense
Kori Bustard	*Ardeotis kori*	Near Threatened Near Threatened	Dry thornveld grassland, arid scrub requires the cover of some trees	**High** – Recorded in the area Suitable habitat occurs on site
Greater Flamingo	*Phoenicopterus ruber*	Near Threatened Least Concerned	Greater Flamingos forage on open shallow eutrophic wetlands, both inland and coastal, with a preference for saline and brackish waters	**Very Low** - No large bodies of open water occur on the proposed development site.
Lanner Falcon	*Falco biarmicus*	Vulnerable Least Concerned	Lanner Falcons are generally a cliff nesting bird, but have adapted to using the disused nests of Black and Pied crows, situated either in trees or on power lines For foraging purposes, Lanner Falcons utilise a wide range of habitats, from semi desert to woodland, agricultural land and also occurs in cities, but appear to prefer open habitats	**High** – Suitable foraging habitat occurs on site
Lesser Flamingo	*Phoenicopterus minor*	Near Threatened Near Threatened	The Lesser Flamingo forages on large brackish or saline, inland and coastal waters, shallow eutrophic wetlands, saltpans and sheltered coastal lagoons This species may use water bodies more saline than those used by the Greater	**Very Low** - no large bodies of open water occur on the proposed development site
Secretary bird	*Asagittarius serpentarius*	Vulnerable Vulnerable	This species shows a preference for open country, mainly savannah, open woodland, grassland, dwarf shrubland, mountain slopes and man-made habitats such as grazing paddocks and fallow fields	**High** – Suitable habitat occurs on site
African White backed Vulture	*Gyps africanus*	Critically endangered Critically endangered	Savannah and bushveld. Nest in tall trees (*Vachellia erioloba).*	**High**-Suitable habitat on the property However no nests were recorded within the planned

[1] Habitat requirements determined using the following reference material: Harrison *et al.*, 1997a; Harrison *et al.*, 1997b; ; Hockey *et al.*, 2005

Common Name	Scientific Name	Conservation Status (*Regional, Global)	Suitable Habitat requirements[1]	Potential for Occurrence On-site and surrounding area
				development area. The fact that the site is located near operating pivots reduces its suitability but does not exclude it as potential habitat
Cape Vulture	*Gyps coprotheres*	Endangered Endangered	Widespread in southern Africa where it can be found in open grasslands and woodlands, from sea level to very high mountains provided there are high cliffs to breed on. They can, however, roost on trees and pylons far away from their breeding sites.	**High**-Suitable habitat on the property. The fact that the site is located near operating pivots reduces its suitability but does not exclude it as potential habitat

Table 4.4: Bird species of conservation concern identified as occurring in and around the quarter degree squares and the potential for occurrence on the site.

Mammals of Conservation Concern

A list of all red data mammal species occurring in the quarter degree squares, was extrapolated from the Red Data Book for Mammals (EWT, 2004) and the MammalMAP, the Mammal Atlas of Africa database. Based on an evaluation of the habitat requirements for these red data species (EWT, 2004; Skinner and Chimimba, 2005), the potential of these species occurring either on-site or within 500m of the property boundary is provided in Table 4.5 below.

COMMON NAME	SCIENTIFIC NAME	CONSERVATION STATUS[2]	SUITABLE HABITAT ON-SITE[3]	POTENTIAL FOR OCCURRENCE ON-SITE AND SURROUNDING AREA
South African hedgehog	*Atelerix frontalis*	Near Threatened	The South African Hedgehog is a nocturnal species that has been recorded to occur in grassland, resting curled up under matted grass, in debris under the shade of bushes or in holes under the ground	**High** – Area has sufficient grassland and bushes thus suitable habitat is present.
Brown hyaena	*Hyaena brunnea*	Near Threatened	They occur in semi-desert scrub, open scrub and open woodland savannah. As they are nocturnal, cover in which to lie in during the day is essential, such as dense shade or holes in the ground. This	**Low** – For the most part, the vegetation cover of the proposed development site is suitable however the substantial amount of agricultural activity and its promiximity to human habitation make it unlikely that this animal will occur in the area

[2] Status based on listing in the National Red List of Mammals 2016

[3] Habitat requirements determined using the following reference material: Skinner and Smithers, 1990; EWT, 2004; Skinner and Chimimba, 2005

COMMON NAME	SCIENTIFIC NAME	CONSERVATION STATUS[2]	SUITABLE HABITAT ON-SITE[3]	POTENTIAL FOR OCCURRENCE ON-SITE AND SURROUNDING AREA
			species has been reported in the general vicinity of the site, and it is possible that this species may currently visit the site as a vagrant when feeding.	
Spotted-necked otter	*Lutra maculicollis*	Vulnerable	Spotted-necked Otters are found in fresh water of large rivers with prominent pools, lakes, dams and well watered swamps. They occur in deeper water than the Cape Clawless Otter, but do not move far from the water margins They are also dependent on adequate cover of dense vegetation or holes in which to hide.	**Low –** Although it is likely that it occurs around the river the proposed development site of the pivots is situated too far from the water margin

Table 4.5: Mammal species of conservation concern identified as occurring in and around the quarter degree squares and the potential for occurrence on the site.

5. SITE SENSITIVITY

The classification of areas into different sensitivity classes is based on information collected at various levels. This includes the national conservation status of the vegetation, the presence of species of special concern and the condition of the vegetation

Vegetation types can be categorised according to their conservation status, which is in turn, assessed according to the degree of the transformation relative to the expected extent of each vegetation type. The status of a habitat or vegetation type is based on how much of its original area still remains intact relative to various thresholds. Sensitivity of habitats and sites within the area can be assessed using a combination of criteria as follows:

	Criterion	Definition
1	Conservation status of untransformed habitats occurring in the study area	The extent of each vegetation type occurring within the study area that is conserved and/or transformed relative to a targeted amount required for conservation
2	Presence and number of Red Data species and other species of special concern	Presence or potential presence of Red Data species within habitats
3	Within-habitat species richness of flora and the between-habitat (beta) diversity of the site	Presence or potential presence of Red Data Species within habitats.
4	The type or nature of topography of the site, ie presence of ridges koppies etc	Steepness and/or nature of topography in the study area.
5	The type and nature of important ecological processes on site, especially hydrological processes, ie wetlands drainage lines etc.	Habitats and/or terrain features that represent ecological processes such as water-flow migration routes etc.

In order to advise the impact assessment and the proposed mitigation, a sensitivity map has been generated for the property using a number of criteria. In order to quantify and detail the sensitive areas in terms of the criteria used to assess sensitivity, the site was demarcated into a number of manageable blocks. A table was created to list each of the sensitivity criteria and a value assigned to each criteria. Each block was then assessed in terms of its relative sensitivity value. This produced a quantifiable sensitivity map. The criteria used to assess the sensitivity included;

Current state of degradation	1 = (80-100% degraded), Very degraded, highly transformed
	2 = (60 -79% degraded), moderately transformed
	3 = (40 – 59%) degraded, some transformation
	4 = (20 -39% degraded, slightly transformed
	5 = (0-19%) degraded Good condition
Slope & drainage	1 = Flat
	2 = Gently undulating
	3 = Slight slope
	4 = Slope less than 5°
	5 = Slope 5° or greater
Potential for erosion	1= Low
	2 = Medium
	3 = High
Presence of Red Data Species	0 = No
	1 = Yes
Suitable habitat for RD species	0 = No
	1 = Yes
Potential habitat fragmentation	1 = Low
	2 = Low – moderate
	3 = Moderate
	4 = Moderate - high
	5 = High
Importance to biodiversity& Ecosystem Functioning	
	1 = Low
	2 = Low – moderate
	3 = Moderate
	4 = Moderate - high
	5 = High

Areas have been classified as follows:

- Low (0-9) sensitivity areas are already highly transformed and/or already contain development. Any development in these areas will not have a significant environmental impact.
- Medium (10-20) sensitivity areas: The vegetation and habitats in these areas have had some disturbance and may include some potential habitat for red data species. Development in these areas, would be subject to strict guidelines and the mitigation measures.
- High (21-25) sensitivity areas included confirmed occurrence of red data species, and ideal red data species habitat. Any development in these areas would have a significant environmental impact. No development should take place in these areas, but it is recognised that in certain exceptional cases, development may need to take place. Under these conditions very strict development guidelines would be required, and only under guarantee that similar areas within the site would be conserved thus reducing the risk of development.

The proposed development footprint falls mostly within an area of low sensitivity, there are however some areas considered to be moderately sensitive that will contain a small amount of development.

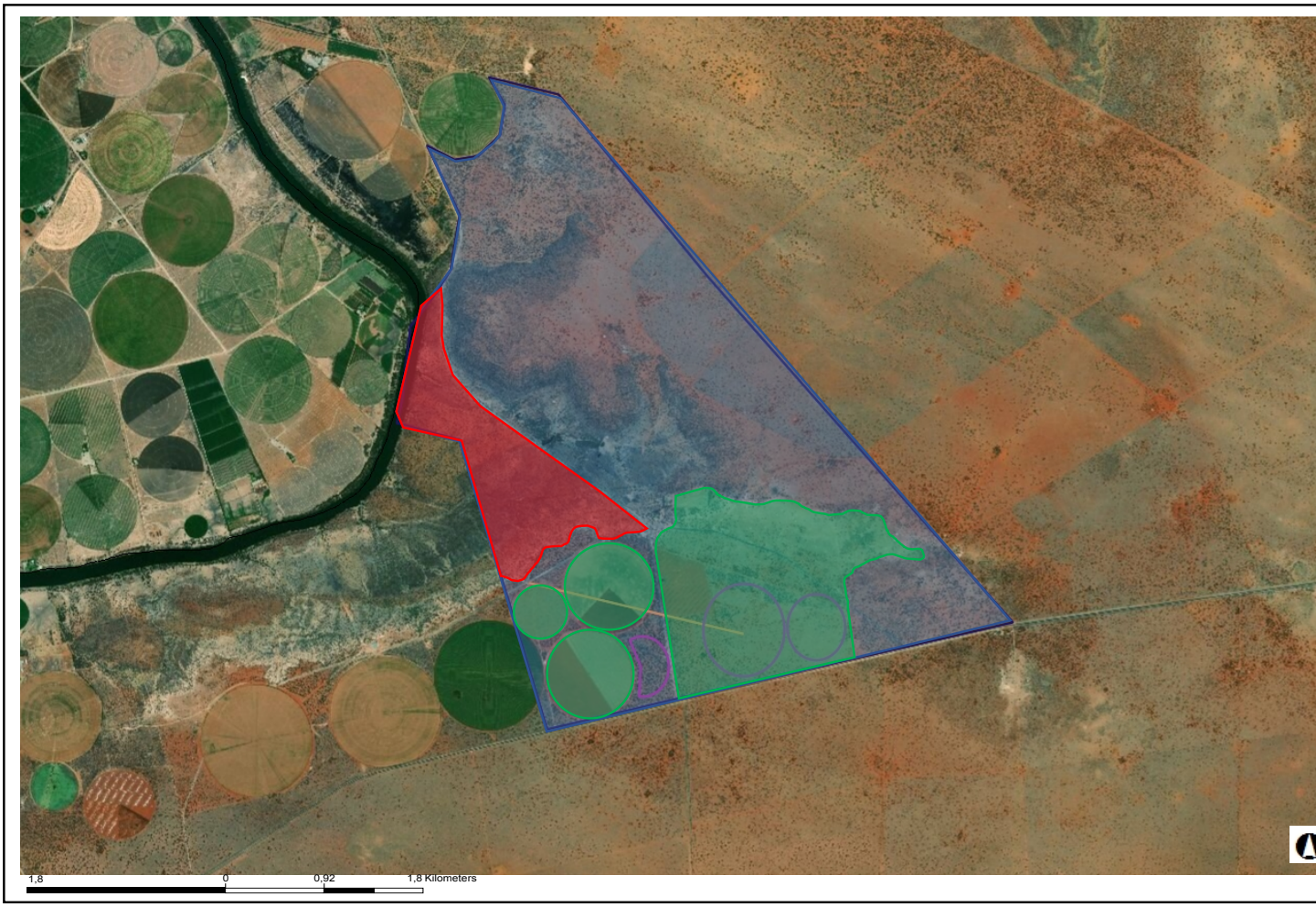

Figure 5.1: Site sensitivity map

6. POTENTIAL IMPACTS

Typically a development is divided into the construction phase and the operational phase. The construction phase usually results in the most significant impacts. It is during this phase that most of the destruction of habitat and microhabitat takes place. For this development the construction of the pivot and the initial preparation of the land can be considered the construction phase. Planting and harvesting the pivots is considered the operational phase. Although the construction phase will entail the initial clearing of the land the disturbance to the biodiversity will be perpetuated throughout the life of the project.

1. Habitat fragmentation, Loss of Natural vegetation and Alien invasion in a CBA 2

Vegetation clearing will occur as a result of the development of irrigation pivots. The two large pivots will be developed in an area that contains secondary vegetation. The area has been fallow for some time which has allowed the natural successional processes to occur and re-establish some of the naturally occurring species, however there are still structural and compositional differences in the secondary vegetation present on site. As primary vegetation is more functional in an ecosystem, the loss of this secondary vegetation is not as severe as the loss of primary vegetation and is unlikely to significantly increase the fragmentation of the habitat within the CBA2.

As with all disturbance, there is an increased risk of alien infestation. Many alien species proliferate in disturbance areas such as the periphery of the irrigation lands. Invasive species affect our natural biodiversity in a number of ways. They may compete directly with natural species for food or space, may compete indirectly by changing the food web or physical environment, or hybridize with indigenous species. Rare species with limited ranges and restricted habitat requirements are often particularly vulnerable to the influence of these alien invaders. Invasive plants have claimed about 8 percent or 10 million hectares of land suitable for agricultural use in South Africa. These invasive alien plants steal about seven percent of South Africa's water bulk every year.

Mitigation:

Vegetation clearing should be restricted to areas of the pivot only. Alien vegetation that has grown as a result of land clearing must be removed by approved methods.

Assessment of Impact:

Impact Name	**Habitat fragmentation, Loss of Natural vegetation and Alien invasion in a CBA 2**				
Alternative	0				
Phase	Construction & Operation				
Environmental Risk					
Attribute	Pre - mitigation	Post - mitigation	Attribute	Pre - mitigation	Post - mitigation
Nature of Impact	-1	-1	Magnitude	2	2
Extent of Impact	1	1	Reversibility	2	2
Duration	4	4	Probability	3	2
Environmental Risk (pre- mitigation)					-6.75
Environmental Risk (post-mitigation)					-4.5
Degree of confidence in impact prediction					HIGH
Cumulative Impacts					1
Degree of Potential irreplaceable loss of resources					1
Prioritisation Factor					1.00
Final Significance					**-4.5**

2. Loss of Species of Conservation Concern

Vegetation will be cleared in the area under the pivots. The area where the two large pivots are planned is comprised of secondary vegetation. The field survey revealed that the loss of floral species of conservation concern is unlikely as it is very unlikely that these species occur within the secondary vegetation. The exception is the protected tree *Vachellia erioloba* which occurs within the development footprint. These trees have re-colonised the area over the last 20 odd years which is evident in terms of population size and structure. The density of these trees is also less than the density in areas of primary vegetation. The half pivot planned does however fall within an area of primary vegetation, thus the likelihood of floral species of conservation concern being affected is higher but is not considered significant. In terms of the loss of faunal species of conservation concern, it is very unlikely that the loss of habitat consisting of secondary vegetation would affect faunal species of conservation concern. The small patch of primary vegetation that will be removed for the half pivot is already very fragmented by the adjacent pivots and the secondary gravel road and it is unlikely that this will result in a loss of faunal species of conservation concern from the area.

Mitigation:

A search and rescue operation should be performed prior to clearing, it is however not a feasible or practical option with regard to the protected trees, so it's important to ensure that trees between the pivots remain undisturbed.

Assessment of Impact:

Impact Name	**Loss of Species of Conservation Concern**				
Alternative	0				
Phase	Construction				
Environmental Risk					
Attribute	Pre - mitigation	Post - mitigation	Attribute	Pre - mitigation	Post - mitigation
Nature of Impact	-1	-1	Magnitude	2	2
Extent of Impact	2	1	Reversibility	2	2
Duration	4	4	Probability	3	3
Environmental Risk (pre- mitigation)					-7.5
Environmental Risk (post-mitigation)					-6.75
Degree of confidence in impact prediction					HIGH
Cumulative Impacts					1
Degree of Potential irreplaceable loss of resources					1
Prioritisation Factor					1.00
Final Significance					**-7.59**

3. Anthropogenic Disturbances, Intentional and/or accidental killing of fauna

Anthropogenic disturbances include aspects such as, vibrations caused by machinery & vehicles. These aspects will impact on invertebrate species more than any other faunal species. These anthropogenic disturbances impact on the way invertebrates forage. For example; some invertebrates use vibrations caused by their prey to locate and catch them. Vibrations caused by construction equipment will make this impossible. Smaller fauna will inevitably be killed during land clearing activities as these activities will destroy their habitat. In addition to unintentional killing of fauna, some faunal species, particularly herpetofaunal species, are often intentionally killed as they are thought to be dangerous.

Mitigation

There is unfortunately no mitigation for the vibrations caused by machinery/vehicles, except perhaps ensuring that activities are kept to a minimum. As the killing of herpetofauna is considered a result of ignorance, this can be ameliorated through education. The labour force involved should be educated regarding the conservation importance of herpetofauna.

Assessment of Impact:

Impact Name	**Anthropogenic Disturbances, Intentional and/or accidental killing of fauna**				
Alternative	0				
Phase	Construction & Operation				
Environmental Risk					
Attribute	Pre - mitigation	Post - mitigation	Attribute	Pre - mitigation	Post - mitigation
Nature of Impact	-1	-1	Magnitude	1	1
Extent of Impact	1	1	Reversibility	2	2
Duration	3	3	Probability	2	1
Environmental Risk (pre- mitigation)					-4
Environmental Risk (post-mitigation)					-1.75
Degree of confidence in impact prediction					MEDIUM
Cumulative Impacts					2
Degree of Potential irreplaceable loss of resources					1
Prioritisation Factor					1.13
Final Significance					**-1.97**

7. RECOMMENDATIONS AND CONCLUSION

The area of the proposed development footprint consists of both primary and secondary vegetation. The proposed development site has already been subjected to some disturbance and fragmentation and most of the proposed development footprint falls within a low sensitivity area, i.e. an area where development will not have a significant environmental impact.

With respect to the sensitivity of the region where the development is planned, the project site falls within a CBA2. In terms of the Technical Guidelines for CBA Maps (June 2017), dryland and irrigated crop cultivation should not be allowed within a CBA2 area. To understand the sensitivity of the area it is important to investigate why and how the area has been classified. The Northern Cape CBA map has been drawn up by means of a dual analysis which included a systematic target-based assessment using the actual extent of biodiversity features and a MARXAN analysis to identify areas of the landscape for meeting targets for broader features most efficiently.

The primary biodiversity features included in the MARXAN analysis were terrestrial vegetation types, however four additional criteria were applied when defining CBAs, namely ecosystem threat status (Critically Endangered and Endangered types), rarity, endemism and ecosystem process importance. The Upper Gariep Alluvial vegetation type is classified as vulnerable but has been prioritised in the ecosystem process importance category as evidence gathered by DENC suggests that degradation of this vegetation type is just as intense as the Lower Gariep Alluvial (which is classified as endangered) and it is deemed to have significant process value for the maintenance of hydrological processes.

During the CBA mapping process, biodiversity features that needed to be included in the CBA map that were already precisely mapped were included as their actual extent (e.g. a wetland and its buffer) as a unit of assessment and a planning unit, however where these features were not available (i.e. had not been previously mapped or identified on the ground) a set of province-wide planning units were developed based on a hexagon grid, landcover and Protected Areas. The hexagons used were approximately 1600 ha in extent and had a 2.5km side. One of the reasons that such a large scale was used was because these larger units aimed to identify connected landscapes to secure areas for both fine-scale features such as wetlands, and broad units such as terrestrial ecosystem types. The large scale however can result in an inaccurate demarcation of an area, and thus some ground truthing operations are required to clarify the boundaries and validate these classifications of the CBA map in certain areas.

According to the available literature the classification of this CBA2 is attributed to the presence of a threatened vegetation type (the Upper Gariep Alluvial vegetation type), its landscape connectivity and the buffer zone around protected areas and national protected areas expansion priorities, namely the Mokala National Park.

The Upper Gareip Alluvial vegetation will not be impacted by this development. As the areas is already mostly secondary in nature and has already been disturbed by development, the additional development will not significantly alter landscape connectivity for the area. The Northern Cape CBA technical guidelines states that the buffer zone around National Parks for inclusion in a CBA2 is 10km. The study area falls outside of this 10km buffer zone as it is located more than 20km away from the Park.

The impact of the proposed development on the biodiversity is considered to be low and as such the development should be able to proceed as long as the mitigations measures are adhered to and that best practice measures for the operation are implemented. The planned development will not alter the biodiversity and habitat significantly from the status quo.

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APPENDIX 1

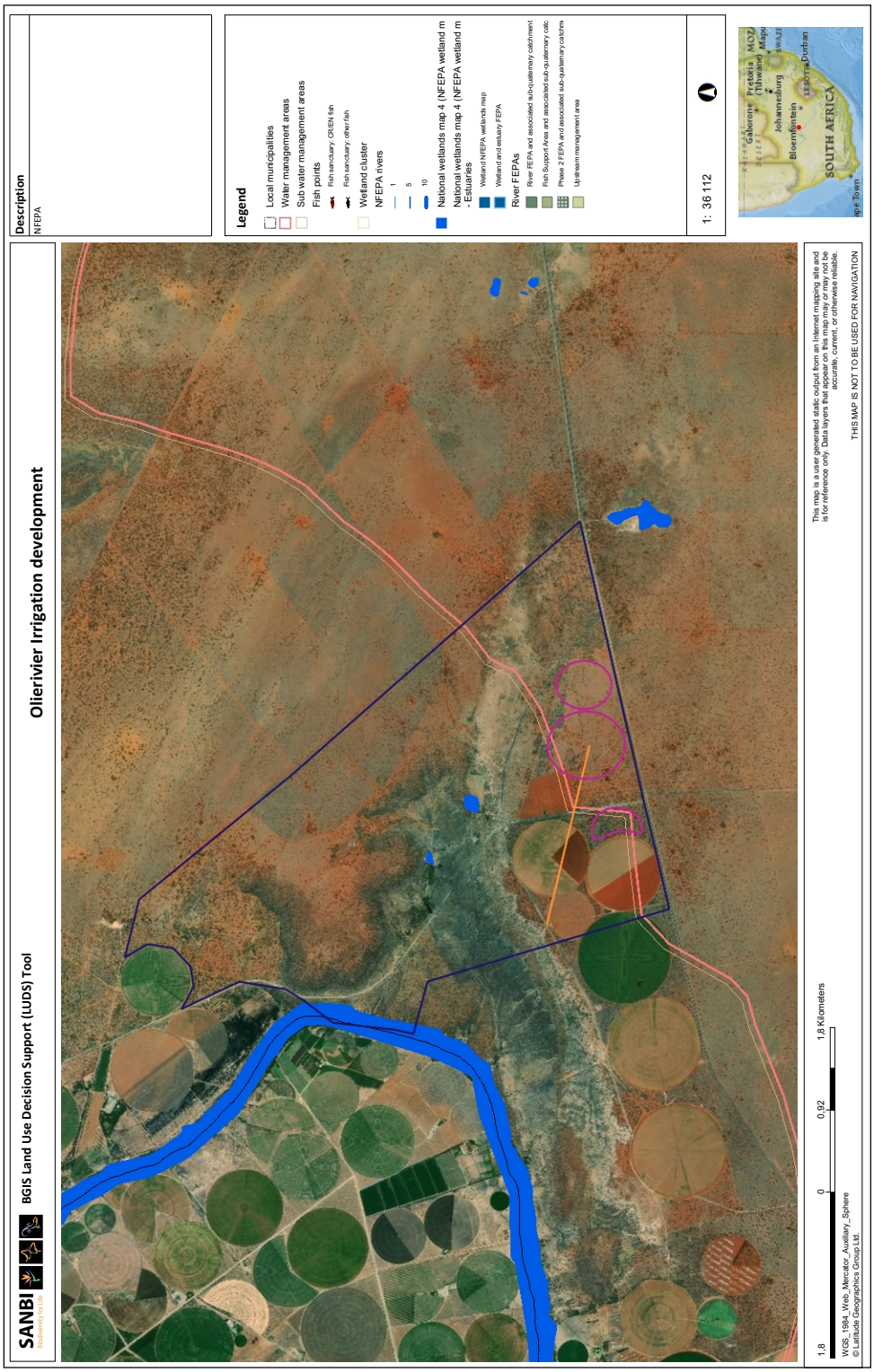
SPECIES LISTS

PLANT SPECIES CHECK LIST

Family		Ecology	IUCN	NCNCA	Forest Act
Aizoaceae	*Titanopsis calcarea (Marloth) Schwantes*	Indigenous; Endemic	LC	Schedule 2	
Aizoaceae	*Ruschia sp.*			Schedule 2	
Aizoaceae	*Plinthus karooicus I.Verd.*	Indigenous	LC	Schedule 2	
Aizoaceae	*Ruschia ruralis (N.E.Br.) Schwantes*	Indigenous; Endemic	LC	Schedule 2	
Amaranthaceae	*Salsola microtricha Botsch.*	Indigenous; Endemic	LC		
Anacardiaceae	*Searsia pyroides (Burch.) Moffett var. gracilis (Engl.) Moffett*		LC		
Asparagaceae	*Asparagus glaucus Kies*	Indigenous	LC		
Asparagaceae	*Asparagus setaceus (Kunth) Jessop*		LC		
Asparagaceae	*Asparagus suaveolens Burch.*		LC		
Asphodelaceae	*Bulbine abyssinica A.Rich.*	Indigenous	LC	Schedule 2	
Asphodelaceae	*Aloe claviflora Burch.*	Indigenous	LC	Schedule 2	
Asteraceae	*Chrysocoma ciliata L.*	Indigenous	LC		
Asteraceae	*Helichrysum arenicola M.D.Hend.*	Indigenous	LC		
Asteraceae	*Euryops asparagoides (Licht. ex Less.) DC.*	Indigenous	LC		
Asteraceae	*Nolletia chrysocomoides (Desf.) Cass. ex Less.*	Indigenous	LC		
Asteraceae	*Tarchonanthus camphoratus L.*		LC		
Brassicaceae	*Lepidium africanum (Burm.f.) DC.*	Indigenous	LC		
Brassicaceae	*Heliophila minima (Stephens) Marais*	Indigenous	LC		
Boraginaceae	*Ehretia rigida (Thunb.) Druce subsp. nervifolia Retief & A.E.van Wyk*		LC		
Capparaceae	*Boscia albitrunca (Burch.) Gilg & Gilg-Ben.*	Indigenous	LC	Schedule 2	Protected
Cactaceae	*Opuntia humifusa (Raf.) Raf*				
Celastraceae	*Gymnosporia buxifolia (L.) Szyszyl.*				
Cleomaceae	*Cleome rubella Burch.*	Indigenous	LC		
Convolvulaceae	*Cuscuta appendiculata Engelm.*	Indigenous; Endemic	LC		
Cucurbitaceae	*Kedrostis crassirostrata Bremek.*	Indigenous	LC		

Cucurbitaceae	*Acanthosicyos naudinianus (Sond.) C.Jeffrey*	Indigenous	LC		
Cyperaceae	*Pseudoschoenus inanis (Thunb.) Oteng-Yeb.*	Indigenous	LC		
Ebenaceae	*Diospyros lycioides Desf.*	Indigenous	LC		
Fabaceae	*Vachellia erioloba (E.Mey.) P.J.H.Hurter*	Indigenous	LC		Protected
Fabaceae	*Vachellia haematoxylon (Willd.) Seigler & Ebinger*	Indigenous	LC		Protected
Fabaceae	*Vachellia karroo (Hayne) Banfi & Gallaso*		LC		
Fabaceae	*Vachellia tortilis (Forssk.) Gallaso & Banfi*				
Fabaceae	*Pomaria burchellii (DC.) B.B.Simpson & G.P.Lewis*	Indigenous	LC		
Fabaceae	*Senegalia mellifera (Vahl) Seigler & Ebinger subsp. detinens (Burch.) Kyal. & Boatwr.*	Indigenous	LC		
Fabaceae	*Prosopis glandulosa Torr. var. glandulosa*				
Gisekiaceae	*Gisekia pharnaceoides L.*	Indigenous	LC		
Hyacinthaceae	*Albuca sp.*				
Hyacinthaceae	*Albuca prasina (Ker Gawl.) J.C.Manning & Goldblatt*	Indigenous			
Hyacinthaceae	*Ornithogalum nanodes F.M.Leight.*	Indigenous	LC	Schedule 2	
Malvaceae	*Hermannia bryoniifolia Burch.*	Indigenous; Endemic	LC		
Malvaceae	*Melhania rehmannii Szyszyl.*	Indigenous	LC		
Malvaceae	*Hermannia pulchella L.f.*	Indigenous	LC		
Malvaceae	*Grewia flava DC.*		LC		
Menispermaceae	*Antizoma angustifolia (Burch.) Miers ex Harv.*	Indigenous	LC		
Ophioglossaceae	*Ophioglossum reticulatum L.*	Indigenous	LC		
Ophioglossaceae	*Ophioglossum polyphyllum A.Braun*	Indigenous	LC		
Papaveraceae	*Argemone mexicana L. forma mexicana*	Naturalised			

Papaveraceae	*Argemone ochroleuca Sweet subsp. ochroleuca*	Naturalised		
Poaceae	*Eragrostis curvula (Schrad.) Nees*	Indigenous	LC	
Poaceae	*Centropodia glauca (Nees) Cope*	Indigenous	LC	
Poaceae	*Aristida congesta Roem. & Schult.*	Indigenous	LC	
Poaceae	*Stipagrostis uniplumis (Licht.) De Winter*	Indigenous	LC	
Poaceae	*Stipagrostis hirtigluma (Steud.) De Winter*	Indigenous	LC	
Poaceae	*Tricholaena monachne (Trin.) Stapf & C.E.Hubb.*	Indigenous	LC	
Poaceae	*Enneapogon scoparius Stapf*	Indigenous	LC	
Poaceae	*Aristida stipitata Hack.*	Indigenous	LC	
Poaceae	*Eragrostis pseudobtusa De Winter*	Indigenous; Endemic	NE	
Poaceae	*Eragrostis lehmanniana Nees var. lehmanniana*		LC	
Poaceae	*Phragmites australis (Cav.) Steu*		LC	
Poaceae	*Cynodon dactylon (L.) Pers.*		LC	
Poaceae	*Schmidtia pappophoroides Steud.*		LC	
Polygalaceae	*Polygala seminuda Harv.*	Indigenous	LC	
Ruscaceae	*Sansevieria aethiopica Thunb.*	Indigenous	LC	
Saliacea	*Salix mucronata Thunb. subsp. mucronata*		LC	
Scrophulariaceae	*Nemesia pubescens Benth.*	Indigenous		Schedule 2
Scrophulariaceae	*Selago mixta Hilliard*	Indigenous; Endemic	LC	
Scrophulariaceae	*Selago multispicata Hilliard*		LC	
Solanaceae	*Lycium pilifolium C.H.Wright*	Indigenous	LC	
Solanaceae	*Lycium hirsutum Dunal*	Indigenous	LC	
Solanaceae	*Lycium arenicola Miers*	Indigenous	LC	
Thymelaeaceae	*Lasiosiphon polycephalus (E.Mey. ex Meisn.) H.Pearson*		LC	
Zygophyllaceae	*Roepera lichtensteiniana (Cham.) Beier & Thulin*	Indigenous		
Zygophyllaceae	*Zygophyllum lichtensteinianum Cham. & Schltdl.*		LC	


SANBI
Biodiversity for Life
BGIS Land Use Decision Support (LUDS) Tool
Olierivier Irrigation development
Description
NFEPA
Legend
Local municipalities
Water management areas
Sub water management areas
Fish points
Fish sanctuary: CRAEN fish
Fish sanctuary: other fish
Wetland cluster
NFEPA rivers
1
5
10
National wetlands map 4 (NFEPA wetland m
National wetlands map 4 (NFEPA wetland m - Estuaries
Wetland NFEPA wetlands map
Wetland and estuary FEPA
River FEPAs
River FEPA and associated sub-quaternary catchment
Fish Support Area and associated sub-quaternary catc
Phase 2 FEPA and associated sub-quaternary catchm
Upstream management area
1: 36 112
Gaborone
Pretoria (Tshwane)
Johannesburg
Bloemfontein
Durban
SOUTH AFRICA
Cape Town
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0,92
1,8 Kilometers
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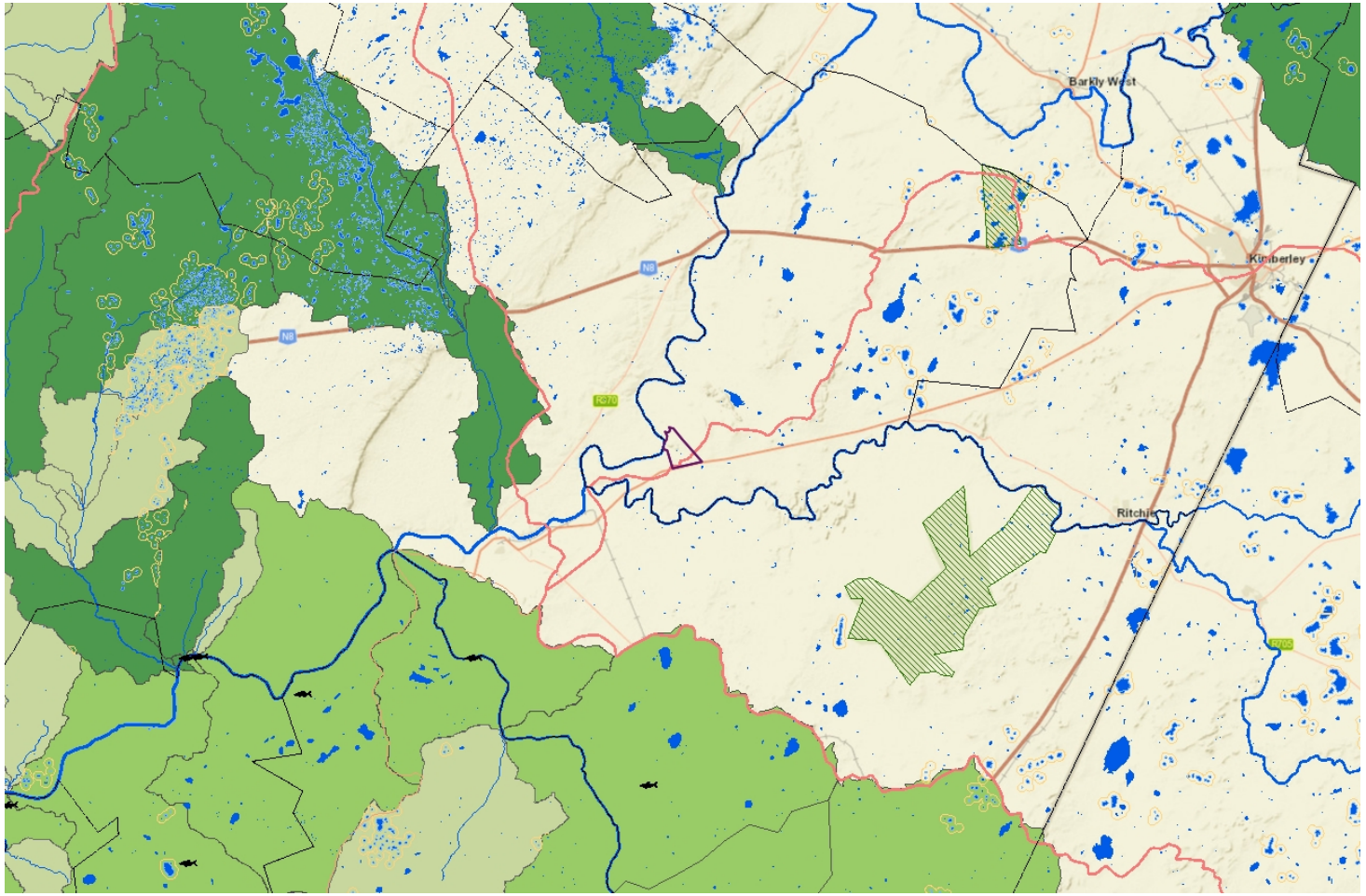
SANBI Biodiversity for Life

BGIS Land Use Decision Support (LUDS) Tool

NFEPA



Description

Olierivier Irrigation Project

Legend

- Local municipalities
- Water management areas
- Sub water management areas
- Fish points
  - Fish sanctuary: CR/EN fish
  - Fish sanctuary: other fish
- Wetland cluster
- NFEPA rivers
  - 1
  - 5
  - 10
- Formal land-based (NBA 2011)
- Informal land-based (NPAES)
- Marine - MPA (NBA 2011)
- National wetlands map 4 (NFEPA wetland m
- National wetlands map 4 (NFEPA wetland m - Estuaries
  - Wetland NFEPA wetlands map
  - Wetland and estuary FEPA
- River FEPAs
  - River FEPA and associated sub-quaternary catchment
  - Fish Support Area and associated sub-quaternary catc
  - Phase 2 FEPA and associated sub-quaternary catchm
  - Upstream management area
- World Street Map

1: 577 791

29,4 0 14,68 29,4 Kilometers

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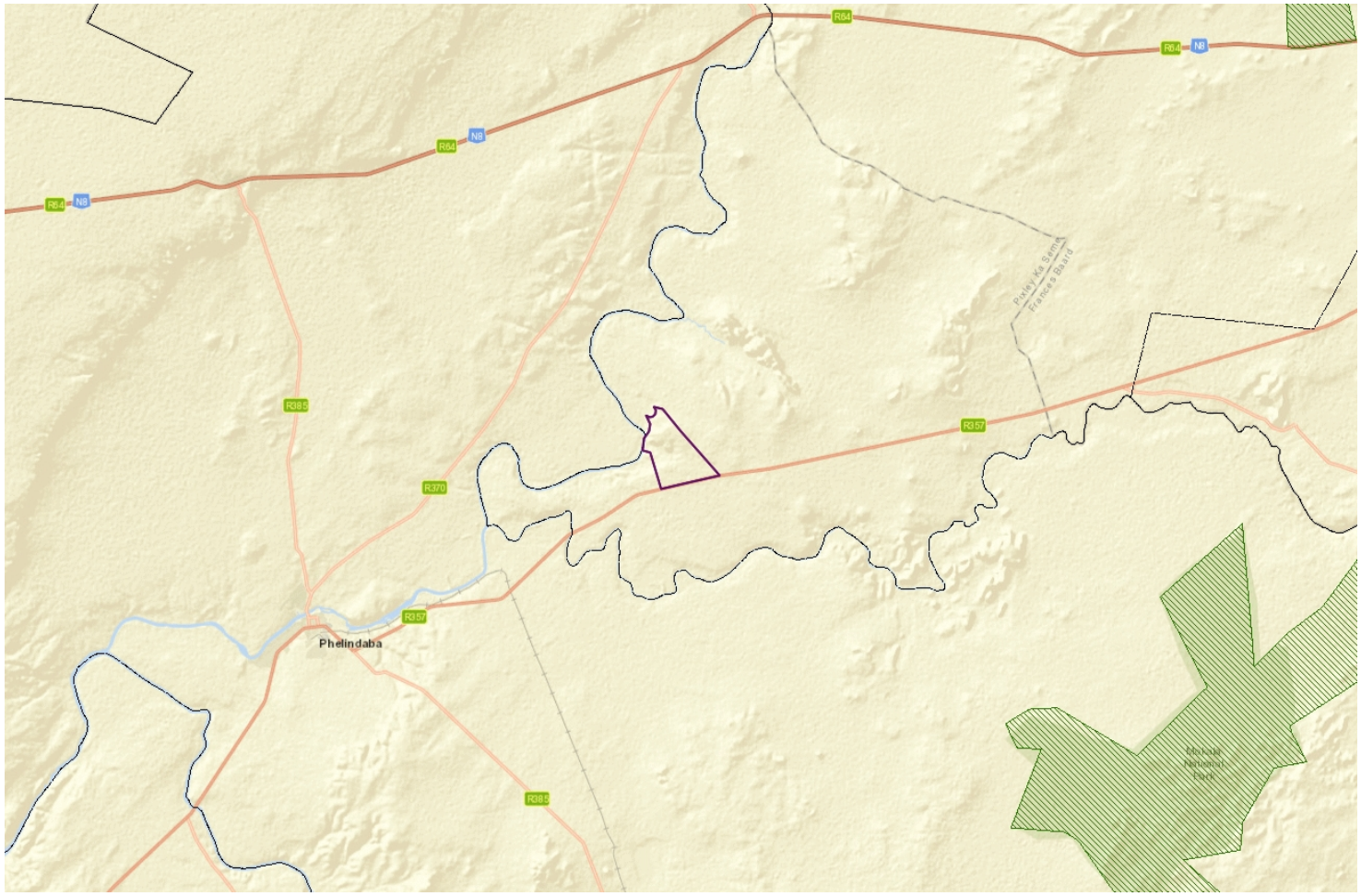
SANBI Biodiversity for Life

BGIS Land Use Decision Support (LUDS) Tool

Olierivier



Description

IBA and protected area

Legend

- Important Bird Areas
  - Fully
  - Partially
  - Unprotected
- South African municipal boundaries 2009
- Formal protected areas (NBA 2011)
- Informal protected areas (NPAES)
- Marine Protected Areas MPAs (NBA 2011)
- World Street Map

1: 288 895

14,7 0 7,34 14,7 Kilometers

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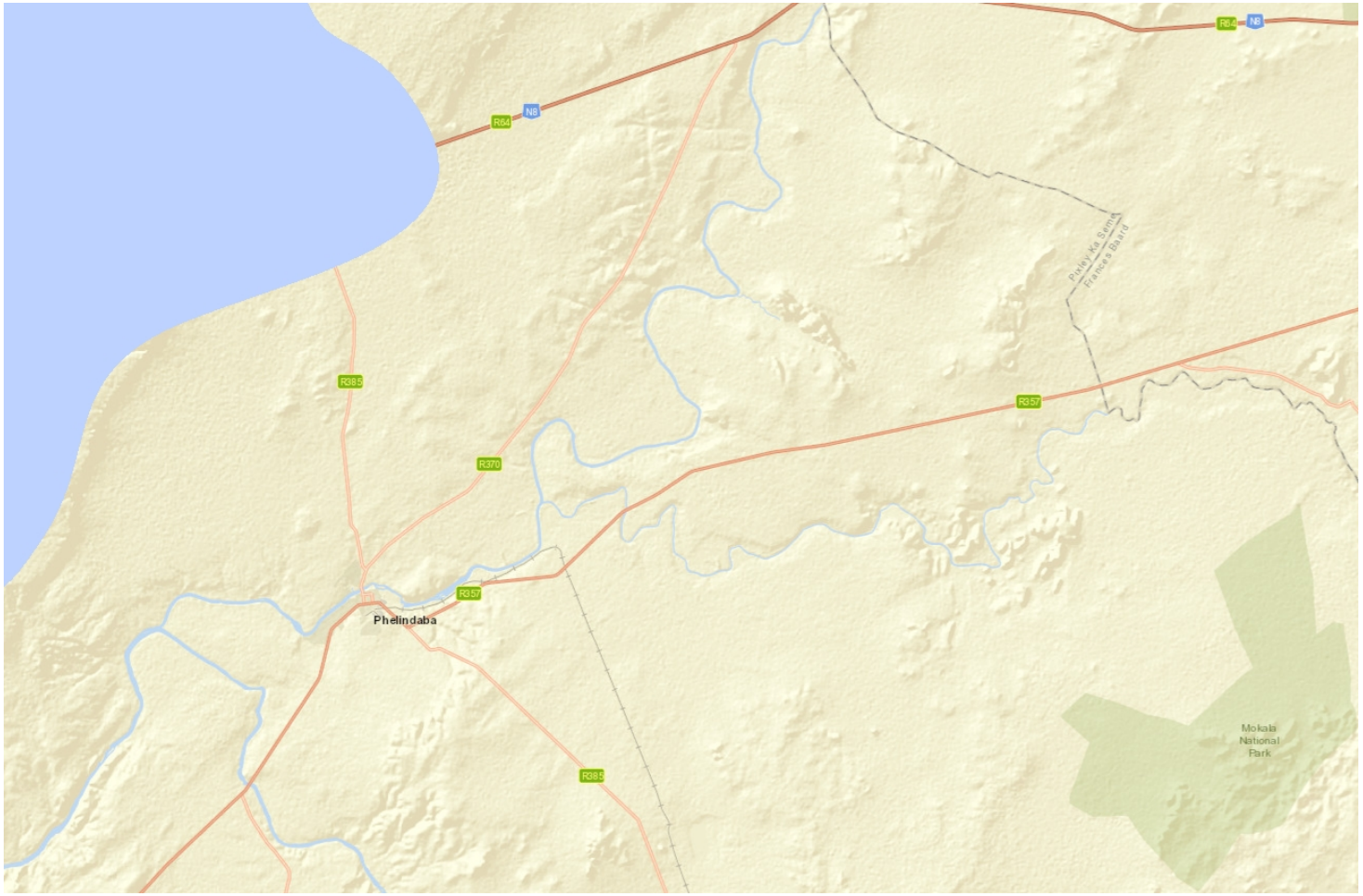
BGIS Land Use Decision Support (LUDS) Tool

Olierivier



Description

Strategic water source area

Legend

SWSA_geo
- Ground water
- Surface water
- Overlap between GW and SW

World Street Map
- Addo Biodiversity Conservation Plan
- Cape Winelands DMA Biodiversity Assessm
- Cape Town Biodiversity Network
- Centralkaroo Biodiversity Assessment
- Eastern Cape Biodiversity Conservation Plar
- FSP Bergrivier
- FSP Breede Valley
- FSP Cederberg
- FSP Hessequa
- FSP Langeberg
- FSP Matzikama
- FSP Mossel Bay
- FSP Saldanha Bay
- FSP Witzenberg
- Garden Route Biodiversity Sector Plan
- Gauteng C Plan
- KwaZulu-Natal Systematic conservation Plar
- Little Karoo Biodiversity Assessment
- Mpumalanga Biodiversity Conservation Plan
- Municipal Summaries Free State
- Municipal Summaries Limpopo

1: 288 895

14,7 0 7,34 14,7 Kilometers

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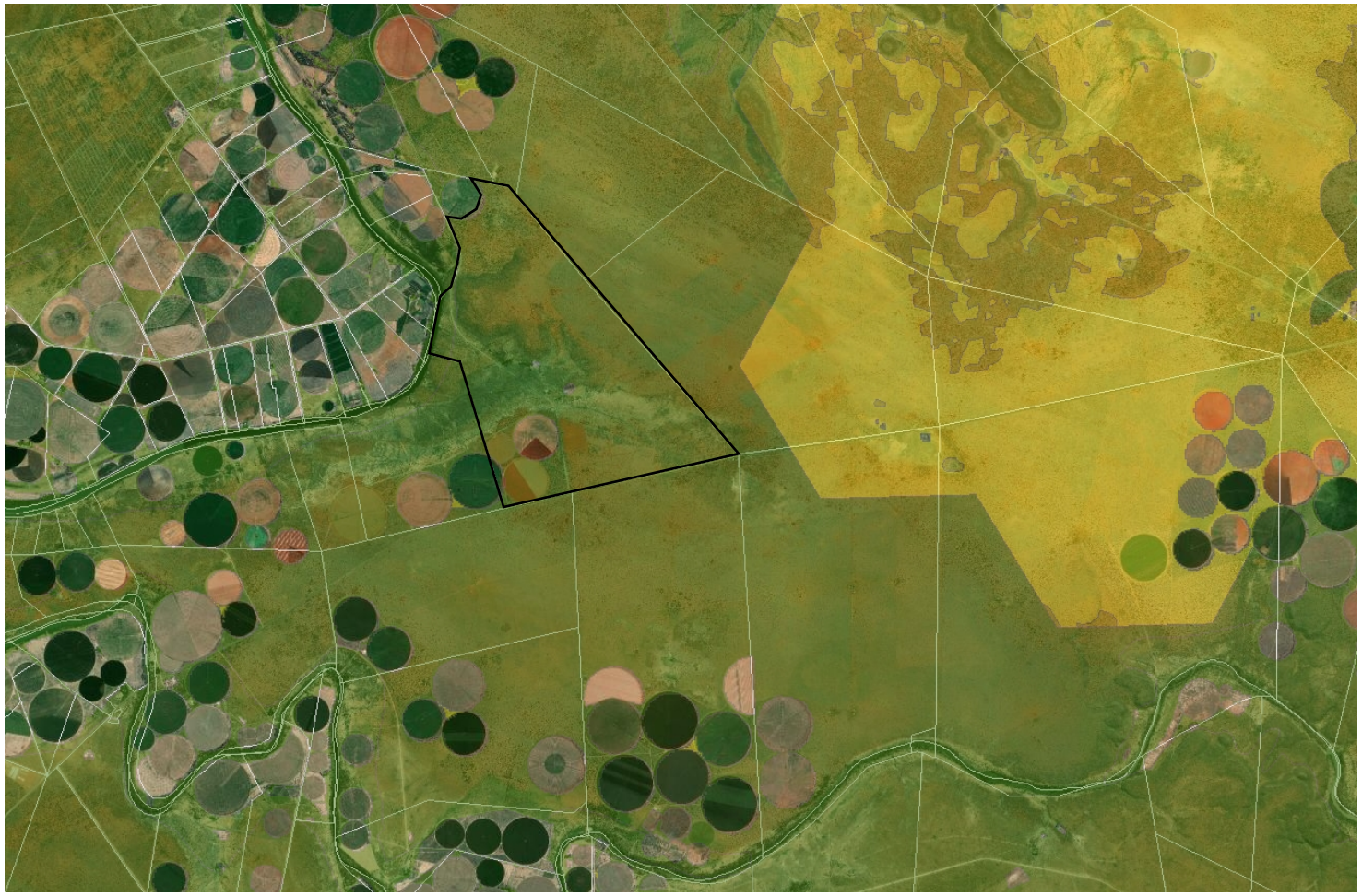
SANBI Biodiversity for Life

BGIS Land Use Decision Support (LUDS) Tool

Olierivier



Description

CBA map

Legend

Northern Cape Critical Biodiversity Areas 20
- Critical Biodiversity Area One
- Critical Biodiversity Area Two
- Ecological Support Area
- Other Natural Areas
- Protected Area

- South African parent farm cadaster
- Formal protected areas (NBA 2011)
- Informal protected areas (NPAES)
- Marine Protected Areas MPAs (NBA 2011)
- Addo Biodiversity Conservation Plan
- Cape Winelands DMA Biodiversity Assessm
- Cape Town Biodiversity Network
- Centralkaroo Biodiversity Assessment
- Eastern Cape Biodiversity Conservation Plar
- FSP Bergrivier
- FSP Breede Valley
- FSP Cederberg
- FSP Hessequa
- FSP Langeberg
- FSP Matzikama
- FSP Mossel Bay
- FSP Saldanha Bay
- FSP Witzenberg
- Garden Route Biodiversity Sector Plan
- Gauteng C Plan

1: 72 224

3,7 0 1,83 3,7 Kilometers

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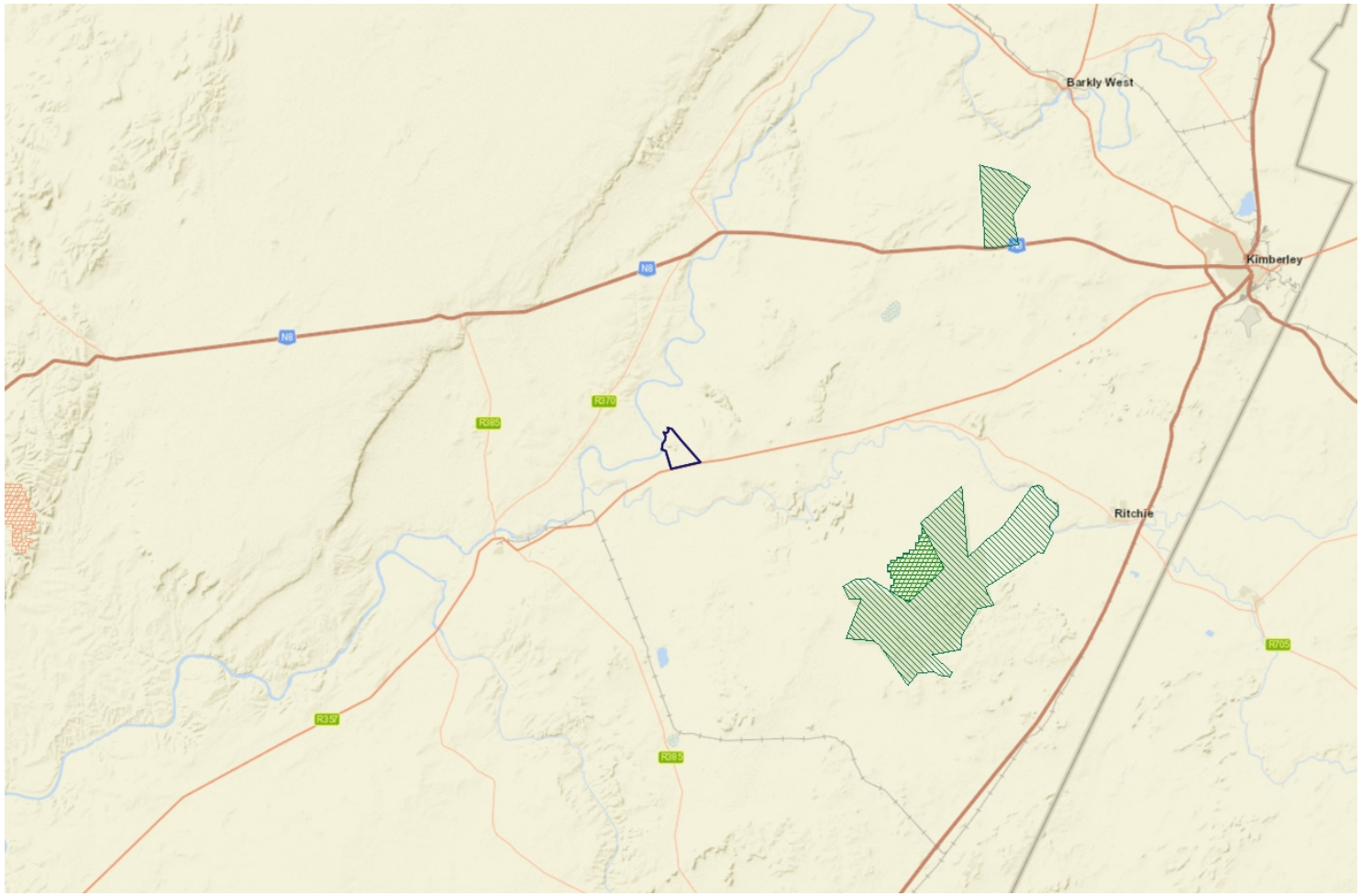
SANBI Biodiversity for Life

BGIS Land Use Decision Support (LUDS) Tool

Protected and Focus Areas



Description

OlieRivier Irrigation Development

Legend

- National parks (NBA 2011)

NPAES focus areas

- <all other values>
- Agulhas
- Amathole Tarkastad
- Baviaans-Addo
- Bhisho Kei
- Blouberg Langjan
- Boland Koggelberg
- Camdeboo Escarpment
- Canca Limestone Fynbos
- Drakensberg and midlands
- Eastern Kalahari Bushveld
- Eastern Valley Bushveld
- Freestate Highveld Grasslands
- Garden Route
- Gariep
- Kamiesberg Bushmanland Augrabies
- Karoo Escarpment Grassland
- Kgalaghadi National Park
- Knersvlakte Hantam
- Kruger Lowveld
- Langeberg and Robertson
- Limpopo Central Bushveld
- Lower Karoo
- Maluti Grasslands

1: 577 791

29,4 0 14,68 29,4 Kilometers

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APPENDIX 3

DETAILS OF SPECIALIST

ABRIDGED CURRICULUM VITA

NATALIE VIVIENNE BIRCH

Date of birth: 21 August 1972

QUALIFICATIONS

BSc (Rhodes University) – Botany and Zoology

BSc (Hons) Wildlife Management, Pretoria University

PhD (Rhodes University)

PHD DISSERTATION

Vegetation potential of natural rangelands in the mid Fish River Valley. Towards a sustainable and acceptable management system.

RESEARCH INTERESTS

My academic interests cover various areas dealing with ecological functioning, and wildlife management, with a special interest in the functioning and management of arid and semi arid rangelands.

ACADEMIC AWARD

Awarded a medal in 2001 by the Grassland Society of Southern Africa for: Outstanding Student in Range and Forage Science

PROFESSIONAL EXPERIENCE

1999 – 2000	Eastern Cape Parks Board	Ecologist
2000 -2002	Coastal & Environmental Services	Consultant
2003 – present	Ecological Management Services	Owner/Consultant

I am a founding member of Ecological Management Services, which is based in Kimberley, and we specialise in ecological management and impact assessment. Although we are based in Kimberley we cover most of South Africa and have projects in the Eastern Cape, Free State, North West Province, Northern Cape and Gauteng. We have undertaken impact assessments for various types of developments including urban and rural developments, agricultural developments, as well as

developments within the mining sector. We also provide specialist input to various types of projects and have formulated biodiversity offset studies required to off set impacts from large developments.

A selection of recent work is as follows:

- Department of Agriculture Northern Cape—Hopetown Piggery
- Department of Agriculture Northern Cape—Phillipstown Piggery
- Department of Agriculture Northern Cape—Chikiana Piggery
- Department of Agriculture Northern Cape—De Aar Hydroponics
- Sidi Parani—Fertilizer granulation plant in Christiana
- Tiva Enviro Services - Biodiversity study for De Aar Hospital
- Ghaap Ostrich Abattoir—Biodiversity Study
- Amakhala Nature Reserve—Development of lodge facilities
- IG van der Merwe Trust—Residential development, Douglas
- Valrena Trust—Residential development along Vaal River
- Idstone Pty Ltd—Development of irrigation ground for seed potatoes production
- Tiaan Trust—Development of irrigation ground
- C F Scholtz & Seuns - Development of irrigation ground for growing of crops
- Kosie Smith Trust - Development of irrigation ground for growing seed potatoes
- Bakgat Trust—Development of irrigation ground for growing of crops
- Mount Carmel (pty) Ltd—Development of irrigation ground for growing of crops
- Koppieskraal Plase Rietrivier Beperk—Development of irrigation ground for seed potatoes production
- Genade Boerdery (PTY) Ltd—Development of irrigation ground for growing of crops
- Santarose Investments (Pty) Ltd - Development of irrigation ground for seed potatoes production
- Valrena Trust—Development of irrigation ground for growing of crops
- Middledrift Dairy Trust—Establishment of Dairy
- Eliweni Wildlife (Pty) Ltd - Lodge Development on Amakhala Nature Reserve
- Idstone Pty Ltd—Development of irrigation ground for the growing of seed potatoes
- Trisa Trust—Development of irrigation ground for the growing of seed potatoes
- GWK Pty Ltd—Development of irrigation pivots and vineyards
- Blair Athol Golf course development
- Rolfontein Nature Reserve lodge development
- SLR—Ecological Specialist survey for Kudumane Mine
- Biodiversity offset plan—UMK mine
- Biodiversity Action Plan for UMK mine
- Biodiversity offset Kudumane Mine
- IDC—Ecological Management & Business Plan: Siyancuma Women in Game Initiative
- Swanvest 123 Pty Ltd—Wolverfontein Breeding Facility
- De Beers—Ecological Evaluation and Management Plan for Kleinsee Game Farm
- Kalahari Oryx Game Reserve—Risk Assessment introduction of Lion
- Department of Land Affairs—Ecological Management and Business plan for Thwane Commonage
- Mauricedale Game Ranch—Paardefontein Specialist Vegetation Survey
- Santrosa Investments Pty Ltd—Olie Rivier Game Farm HA

- Manzi Safaris Habitat Assessment
- Thuru Lodge—Risk Assessment & Habitat Analysis
- Dugmore brothers—Habitat assessment Hartebeesthoek
- Schutte Boerdery Trust—Habitat Assessment Glenfrere
- F G. Taljaard—Habitat Assessment Namakwari Game Reserve
- Rivierfront Wild - Doornfontein Habitat Assessment
- Sjibbolet Trust—Hartsvalley Habitat Assessment
- Raltefontein Habitat Assessment
- Kalahari Oryx Game Reserve—Specialist Vegetation survey

PROFESSIONAL ASSOCIATIONS

Grassland Society of Southern Africa

South African Council for Natural scientific Professions Registration number 400117/05

RESEARCH PUBLICATIONS

Evans, N.V., Avis, A.M. and Palmer, A.R. 1997. Changes to the vegetation of the mid-Fish River valley, Eastern Cape South Africa, in response to land-use, as revealed by a direct gradient analysis. *African Journal of Range & Forage science*, **14**(2): 68-74.

Birch N.V., Avis, A.M. and Palmer, A.R. (1999) The Effect Of Land-Use On The Vegetation Communities Along A Topo-Moisture Gradient In The Mid-Fish River Valley, South Africa. *African Journal of Range & Forage science*, **16**(1): 1-8

Birch, N.V., Avis, A.M. and Palmer, A.R. 1999. Changes to the vegetation communities of natural rangelands in response to land-use in the mid-Fish River valley, South Africa. *People and Rangelands Building the Future* (Eds D. Eldridge & D. Freudenberger) pp.319-320 vol 1. Proceeding of the VI International Rangeland Congress, Townsville, Queensland, Australia

APPENDIX 4

IMPACT ASSESSMENT METHODOLOGY

THE PROPOSED NEW CULTIVATION (PIVOT) AREAS ON THE REMAINDER OF THE FARM OLIE RIVIER 170, DOUGLAS, SOL PLAATJE LOCAL MUNICIPALITY, FRANCES BAARD DISTRICT MUNICIPALITY, NORTHERN CAPE PROVINCE

Heritage Impact Assessment

Issue Date: 7 December 2020
Revision No.: 0.1
Project No.: 498HIA

PGS HERITAGE
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Offices in South Africa, Kingdom of Lesotho and Mozambique

Head Office:
906 Bergarend Streets
Waverley, Pretoria,
South Africa

Directors: HS Steyn, PD Birkholtz, W Fourie

Declaration of Independence

I, Wouter Fourie, declare that –

General declaration:

- I act as the independent heritage practitioner in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting heritage impact assessments, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I will take into account, to the extent possible, the matters listed in section 38 of the NHRA when preparing the application and any report relating to the application;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not
- All the particulars furnished by me in this form are true and correct;
- I will perform all other obligations as expected from a heritage practitioner in terms of the Act and the constitutions of my affiliated professional bodies; and
- I realise that a false declaration is an offence in terms of regulation 71 of the Regulations and is punishable in terms of section 24F of the NEMA.

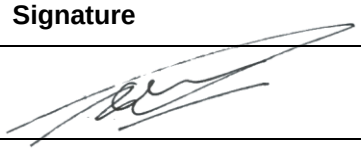
Disclosure of Vested Interest

- I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Regulations;

HERITAGE CONSULTANT: PGS Heritage (Pty) Ltd
CONTACT PERSON: Wouter Fourie
Tel: +27 (0) 12 332 5305
Email: wouter@pgsheritage.com

SIGNATURE: 

ACKNOWLEDGEMENT OF RECEIPT

Report Title	***THE PROPOSED NEW CULTIVATION (PIVOT) AREAS ON THE REMAINDER OF THE FARM OLIE RIVIER 170, DOUGLAS, SOL PLAATJE LOCAL MUNICIPALITY, FRANCES BAARD DISTRICT MUNICIPALITY, NORTHERN CAPE PROVINCE***		
Control	**Name**	**Signature**	**Designation**
Author	**Wouter Fourie**		**Archaeologist/ PGS Heritage**
Reviewed			

CLIENT: Environmental Impact Management Services (Pty) Ltd

CONTACT PERSON:

Tel:

E-mail:

SIGNATURE: _____

EXECUTIVE SUMMARY

PGS Heritage (Pty) Ltd (PGS) was appointed by Environmental Impact Management Services (Pty) Ltd (EIMS) to undertake a Heritage Impact Assessment (HIA) which will serve to inform the Environmental Impact Assessment Report (EIA) and Environmental Management Programme (EMPr) for the proposed new Cultivation (Pivot) Areas on the Remainder of the farm Olie Rivier 170, Douglas, Sol Plaatje Local Municipality, Frances Baard District Municipality, Northern Cape Province

This report focusses on the three (3) areas proposed for the development of irrigation areas and an irrigation pipeline.

Heritage resources are unique and non-renewable and as such, any impact on such resources must be seen as significant. The HIA has shown that the study area and surrounding area has some heritage resources situated within the proposed development boundaries. Through data analysis and a site investigation, the following issues were identified from a heritage perspective.

Heritage Sites

Intensive field surveys of the study area were undertaken on foot by comprising one field archaeologist and a technician on 28 November 2020. No archaeological sites or burial grounds and graves were identified during the fieldwork.

Impact Assessment

Despite an intensive walkthrough of the project area, no evidence for any archaeological or heritage sites could be identified. As a result, low to no impact is expected from the proposed development on heritage.

Mitigation Measures

With no impact expected on heritage, no further mitigation is required. Refer Chapter 8 of this report.

General

It is the author's considered opinion that the overall impact on heritage resources is Low. Provided that the recommended mitigation measures are implemented, the impact would be acceptably Low or could be totally mitigated to the degree that the project could be approved from a heritage perspective.

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List of Figures

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TERMINOLOGY AND ABBREVIATIONS

Archaeological resources

This includes:

- material remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years including artefacts, human and hominid remains and artificial features and structures;
- rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and which is older than 100 years, including any area within 10m of such representation;
- wrecks, being any vessel or aircraft, or any part thereof, which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the republic as defined in the Maritimes Zones Act, and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which SAHRA considers to be worthy of conservation; and
- features, structures and artefacts associated with military history which are older than 75 years and the site on which they are found.

Cultural significance

This means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance.

Development

This means any physical intervention, excavation, or action, other than those caused by natural forces, which may in the opinion of the heritage authority in any way result in a change to the nature, appearance or physical nature of a place or influence its stability and future well-being, including:

- construction, alteration, demolition, removal or change in use of a place or a structure at a place;
- carrying out any works on or over or under a place;
- subdivision or consolidation of land comprising a place, including the structures or airspace of a place;
- constructing or putting up for display signs or boards;
- any change to the natural or existing condition or topography of land; and
- any removal or destruction of trees, or removal of vegetation or topsoil

Early Stone Age

The archaeology of the Stone Age between 700 000 and 3 300 000 years ago.

Fossil

Mineralised bones of animals, shellfish, plants and marine animals. A trace fossil is the track or footprint of a fossil animal that is preserved in stone or consolidated sediment.

Heritage

That which is inherited and forms part of the National Estate (historical places, objects, fossils as defined by the National Heritage Resources Act 25 of 1999).

Heritage resources

This means any place or object of cultural significance and can include (but not limited to) as stated under Section 3 of the NHRA,

- places, buildings, structures and equipment of cultural significance;
- places to which oral traditions are attached or which are associated with living heritage;
- historical settlements and townscapes;
- landscapes and natural features of cultural significance;
- geological sites of scientific or cultural importance;
- archaeological and palaeontological sites;
- graves and burial grounds, and
- sites of significance relating to the history of slavery in South Africa;

Holocene

The most recent geological time period which commenced 10 000 years ago.

Late Stone Age

The archaeology of the last 30 000 years associated with fully modern people.

Late Iron Age (Early Farming Communities)

The archaeology of the last 1000 years up to the 1800's, associated with iron-working and farming activities such as herding and agriculture.

Middle Iron Age

The archaeology of the period between 900-1300AD, associated with the development of the Zimbabwe culture, defined by class distinction and sacred leadership.

Middle Stone Age

The archaeology of the Stone Age between 30 000-300 000 years ago, associated with early modern humans.

Palaeontology

Any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace.

Table 1 – List of abbreviations used in this report

Abbreviations	Description
AIA	Archaeological Impact Assessment
APHP	Association of Professional Heritage Practitioners
ASAPA	Association of South African Professional Archaeologists
CRM	Cultural Resource Management
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
EIAs practitioner	Environmental Impact Assessment Practitioner
ESA	Earlier Stone Age
GAE	GA Environmental (Pty) Ltd
GN	Government Notice
GPS	Global Positioning System
HIA	Heritage Impact Assessment
IAIASA	International Association for Impact Assessment South Africa
I&AP	Interested & Affected Party
LIA	Late Iron Age
LSA	Late Stone Age
MIA	Middle Iron Age
MSA	Middle Stone Age
NEMA	National Environmental Management Act, 1998 (Act No 107 of 1998)
NHRA	National Heritage Resources Act, 1999 (Act No 25 of 1999)
NCW	Not Conservation Worthy
PDA	Palaeontological Desktop Assessment
PGS	PGS Heritage (Pty) Ltd
PHRA	Provincial Heritage Resources Authority
SADC	Southern African Development Community
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System

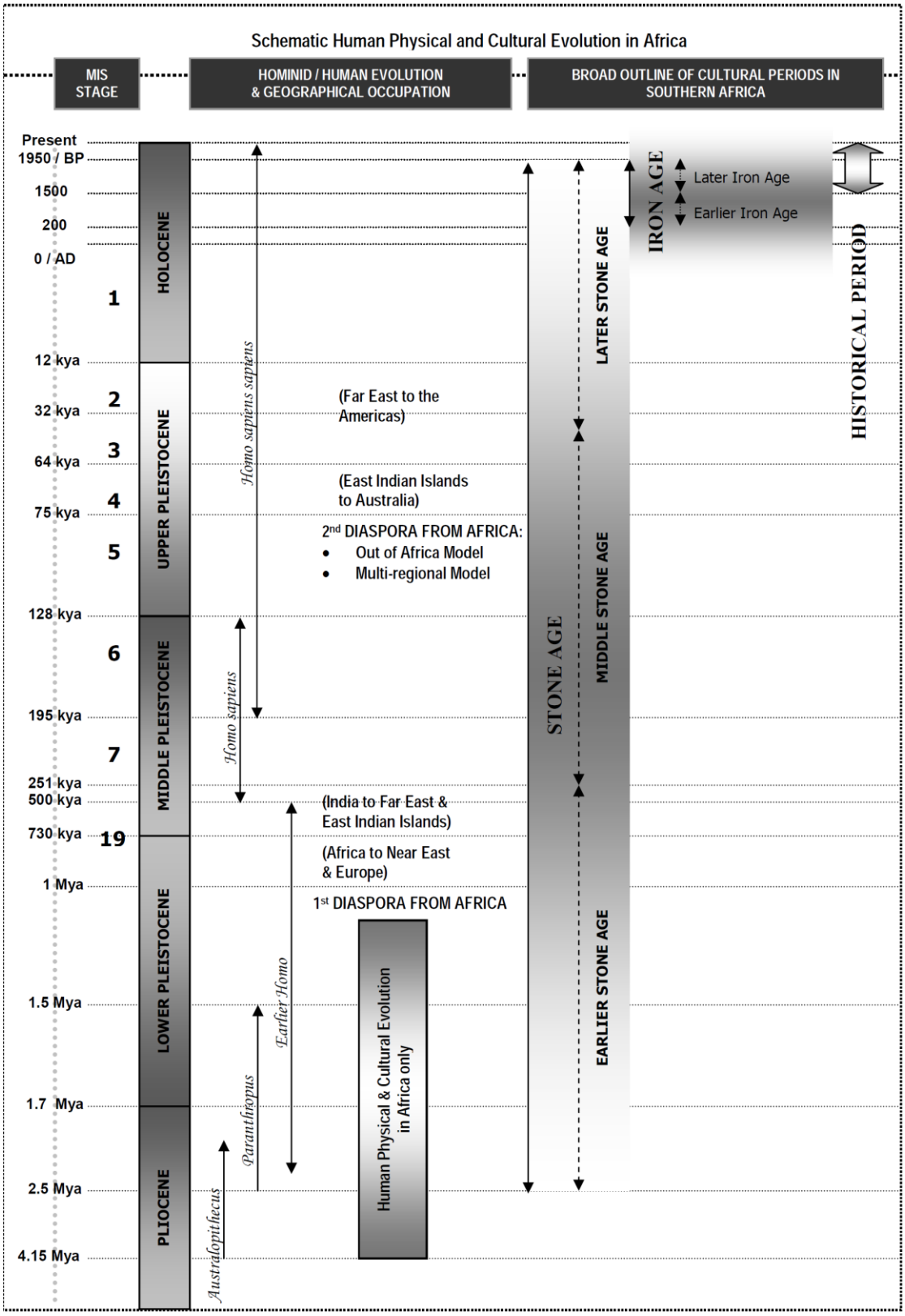

Figure 1 – Human and Cultural Timeline in Africa

1 INTRODUCTION

PGS Heritage (Pty) Ltd (PGS) was appointed by Environmental Impact Management Services (Pty) Ltd (EIMS) to undertake a Heritage Impact Assessment (HIA) which will serve to inform the Environmental Impact Assessment Report (EIA) and Environmental Management Programme (EMPr) for the proposed new Cultivation (Pivot) Areas on the Remainder of the farm Olie Rivier 170, Douglas, Sol Plaatje Local Municipality, Frances Baard District Municipality, Northern Cape Province.

1.1 SCOPE OF THE STUDY

The aim of the study is to identify possible heritage sites and finds that may occur in the proposed development area. The HIA aims to inform the EIA in the development of a comprehensive EMPr to assist the project applicant in responsibly managing the identified heritage resources in order to protect, preserve, and develop them within the framework provided by the National Heritage Resources Act (Act 25 of 1999) (NHRA).

1.2 SPECIALIST QUALIFICATIONS

This HIA was compiled by PGS.

The staff at PGS have a combined experience of nearly 90 years in the heritage consulting industry. PGS and its staff have extensive experience in managing HIA processes. PGS will only undertake heritage assessment work where they have the relevant expertise and experience to undertake that work competently.

Wouter Fourie, the Project Coordinator, is registered with the Association of Southern African Professional Archaeologists (ASAPA) as a Professional Archaeologist and is accredited as a Principal Investigator; he is further an Accredited Professional Heritage Practitioner with the Association of Professional Heritage Practitioners (APHP).

1.3 ASSUMPTIONS AND LIMITATIONS

Not detracting in any way from the comprehensiveness of the research undertaken, it is necessary to realise that the heritage resources located during the desktop research and fieldwork do not necessarily represent all the possible heritage resources present within the area.

Such observed or located heritage features and/or objects may not be disturbed or removed in any way until such time that the heritage specialist has been able to make an assessment as to the significance of the site (or material) in question. This applies to graves and cemeteries as well.

1.4 LEGISLATIVE CONTEXT

The identification, evaluation and assessment of any cultural heritage site, artefact or find in the South African context is required and governed by the following legislation:

- Notice 648 of the Government Gazette 45421- general requirements for undertaking an initial site sensitivity verification where no specific assessment protocol has been identified
- National Environmental Management Act (NEMA), Act 107 of 1998 – Appendix 6
- National Heritage Resources Act (NHRA), Act 25 of 1999

1.4.1 NOTICE 648 OF THE GOVERNMENT GAZETTE 45421

Although minimum standards for archaeological (2007) and palaeontological (2012) assessments were published by SAHRA, GN.648 requires sensitivity verification for a site selected on the national web-based environmental screening tool for which no specific assessment protocol related to any theme has been identified. The requirements for this Government Notice (GN) are listed in **Table 2** and the applicable section in this report noted.

Table 2 - Reporting requirements for GN648

GN 648	Relevant section in report	Where not applicable in this report
2.2 (a) a desktop analysis, using satellite imagery;	section 4.3	
2.2 (b) a preliminary on-site inspection to identify if there are any discrepancies with the current use of land and environmental status quo versus the environmental sensitivity as identified on the national web-based environmental screening tool, such as new developments, infrastructure, indigenous/pristine vegetation, etc.	section 4.1	-
2.3(a) confirms or disputes the current use of the land and environmental sensitivity as identified by the national web-based environmental screening tool;	section 4.1	-
2.3(b) contains motivation and evidence (e.g. photographs) of either the verified or different use of the land and environmental sensitivity;	section 4.1	-

1.4.2 NEMA – APPENDIX 6 REQUIREMENTS

The HIA report has been compiled considering the NEMA Appendix 6 requirements for specialist reports as indicated in the table below. For ease of reference, the table below provides cross-references to the report sections where these requirements have been addressed. It is important to note, that where something is not applicable to this HIA, this has been indicated in the table below.

Table 3 - Reporting requirements as per NEMA Appendix 6 for specialist reports

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	Relevant section in report	Comment where not applicable.
1.(1) (a) (i) Details of the specialist who prepared the report	Page 2 of Report – Contact details and company	-
(ii) The expertise of that person to compile a specialist report including a curriculum vita	Section 1.2 – refer to **Appendix B**	-
(b) A declaration that the person is independent in a form as may be specified by the competent authority	Page ii of the report	-
(c) An indication of the scope of, and the purpose for which, the report was prepared	Section 2.1	-
(cA) An indication of the quality and age of base data used for the specialist report	Section 3	-
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 6	-
(d) The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 3	-
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Section 3	-
(f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 5	
(g) An identification of any areas to be avoided, including buffers	Section 4.6	
(h) A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Figure 8	
(i) A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.3	-
(j) A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Section 7	
(k) Any mitigation measures for inclusion in the EMPr	Section 6.6	
(l) Any conditions for inclusion in the environmental authorisation		None required
(m) Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 6.6	
(n)(i) A reasoned opinion as to whether the proposed activity, activities or portions thereof should be authorised and	Section 7	
(n)(iA) A reasoned opinion regarding the acceptability of the proposed activity or activities; and		
(n)(ii) If the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Section 7	-
(o) A description of any consultation process that was undertaken during the course of carrying out the study		Not applicable. A public consultation process was

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	Relevant section in report	Comment where not applicable.
		handled as part of the EIA and EMP process.
(p) A summary and copies if any comments that were received during any consultation process		Not applicable. To date no comments regarding heritage resources that require input from a specialist have been raised.
(q) Any other information requested by the competent authority.		Not applicable.
(2) Where a government notice by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	NEMA Appendix 6 and GN648	

1.4.3 THE NATIONAL HERITAGE RESOURCES ACT

- NHRA Act 25 of 1999
  - Protection of Heritage Resources – Sections 34 to 36; and
  - Heritage Resources Management – Section 38

The NHRA is utilized as the basis for the identification, evaluation and management of heritage resources and in the case of Cultural Resource Management (CRM) those resources specifically impacted on by development as stipulated in Section 38 of NHRA. This study falls under s38(8) and requires comment from the relevant heritage resources authority.

2 SITE LOCATION AND DESCRIPTION

2.1 LOCALITY AND SITE DESCRIPTION (PROVIDED BY EIMS)

The Oierivier Irrigation project is located approximately 24km east of the town of Douglas, within the Sol Plaatje Local Municipality, Frances Baard District Municipality, Northern Cape Province (**Figure 2**).

Study Area central Coordinate	E24.01770 S28.97173
Location	The study area is located within the Sol Plaatje Local Municipality, Frances Baard District Municipality, Northern Cape Province
Property	Remainder of Olie Rivier 170

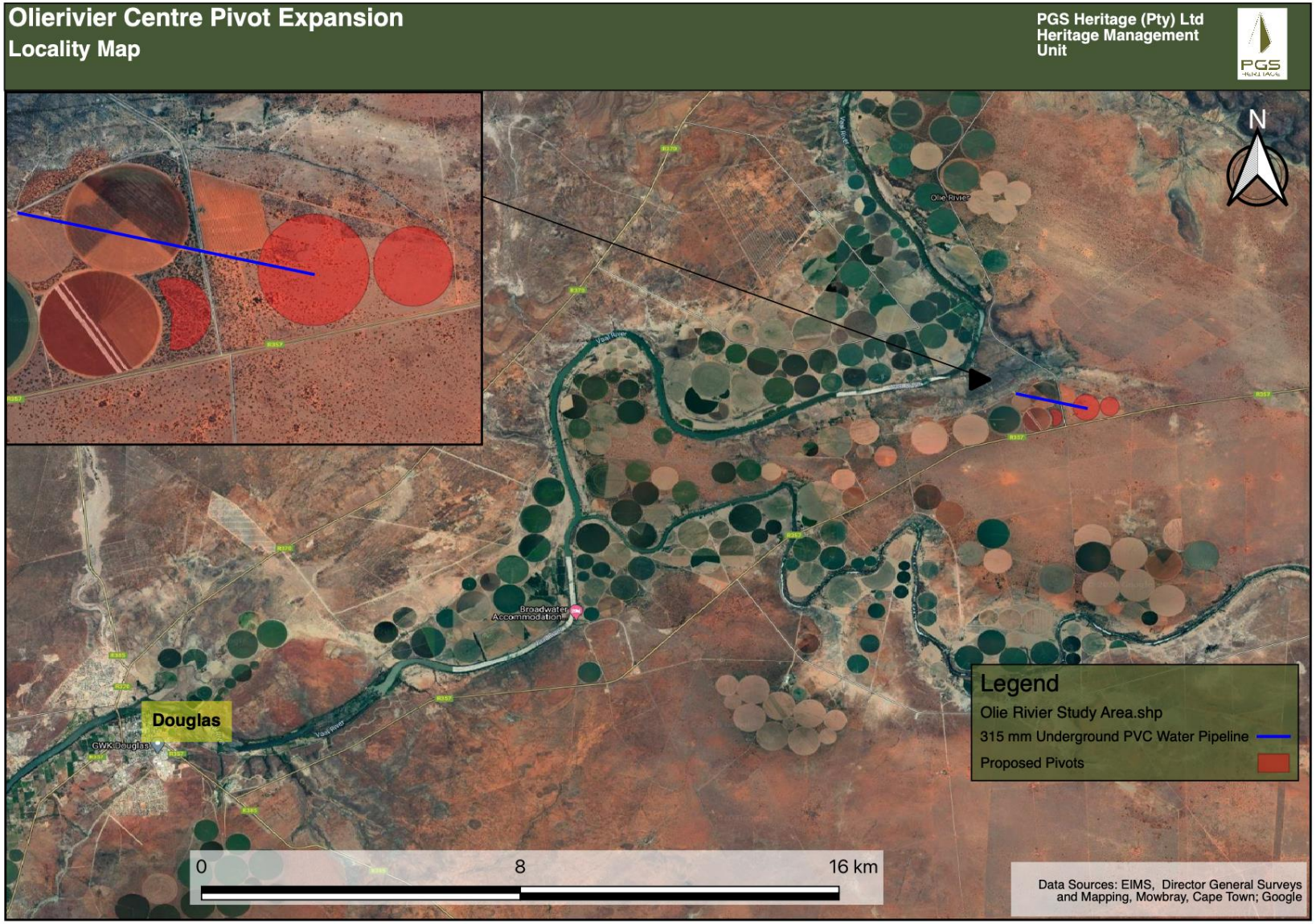

Figure 2 - Locality map showing proposed development

2.2 PROJECT DESCRIPTION (PROVIDED BY EIMS)

The proposed project involves the clearance of approximately 70 hectares of indigenous vegetation for the purposes of creating new cultivation (pivot) areas (**Figure 2**).

3 METHODOLOGY

The applicable maps, tables and figures, are included as stipulated in the NHRA (no 25 of 1999), the NEMA (no 107 of 1998). The HIA process consisted of three steps:

Step I – Literature Review and sensitivity analysis[1]: The background information to the field survey relies greatly on previous studies completed for the project to determine known sensitivities, as well as the heritage background research completed for this report.

Step II – Physical Survey: A physical survey was conducted by vehicle through the proposed project area by a qualified heritage specialist. The survey was conducted on 28 November 2020, aimed at locating and documenting sites falling within and adjacent to the proposed development footprint.

Step III – The final step involved the recording and documentation of relevant archaeological resources, the assessment of resources in terms of the HIA criteria and report writing, as well as mapping and constructive recommendations.

3.1 SITE SIGNIFICANCE

Site significance classification standards use is based on the heritage classification of s3 in the NHRA and developed for implementation keeping in mind the grading system approved by SAHRA for archaeological impact assessments. An update classification and rating system as developed by Heritage Western Cape (2016) is implemented in this report.

Site significance classification standards prescribed by the Heritage Western Cape Guideline (2016) based on SAHRA guidelines, were used for the purpose of this report (**Table 4** and **Table 5**).

Table 4 - Rating system for archaeological resources

Grading	Description of Resource	Examples of Possible Management Strategies	Heritage Significance
I	Heritage resources with qualities so exceptional that they are of special national significance. Current examples: Langebaanweg (West Coast Fossil Park), Cradle of Humankind	May be declared as a National Heritage Site managed by SAHRA. Specific mitigation and scientific investigation can be permitted in certain circumstances with sufficient motivation.	Highest Significance
II	Heritage resources with special qualities which make them significant, but do not fulfil the criteria for Grade I status. Current examples: Blombos, Paternoster Midden.	May be declared as a Provincial Heritage Site managed by HWC. Specific mitigation and scientific investigation can be permitted in certain circumstances with sufficient motivation.	Exceptionally High Significance
III	Heritage resources that contribute to the environmental quality or cultural significance of a larger area and fulfils one of the criteria set out in section 3(3) of the Act but that does not		

[1] *According to Notice 648 of the Government Gazette 45421*

Grading	Description of Resource	Examples of Possible Management Strategies	Heritage Significance
	fulfil the criteria for Grade II status. Grade III sites may be formally protected by placement on the Heritage Register.		
IIIA	Such a resource must be an excellent example of its kind or must be sufficiently rare. Current examples: Varschedrift; Peers Cave; Brobartia Road Midden at Bettys Bay	Resource must be retained. Specific mitigation and scientific investigation can be permitted in certain circumstances with sufficient motivation.	High Significance
IIIB	Such a resource might have similar significances to those of a Grade III A resource, but to a lesser degree.	Resource must be retained where possible where not possible it must be fully investigated and/or mitigated.	Medium Significance
IIIC	Such a resource is of contributing significance.	Resource must be satisfactorily studied before impact. If the recording already done (such as in an HIA or permit application) is not sufficient, further recording or even mitigation may be required.	Low Significance
NCW	A resource that, after appropriate investigation, has been determined to not have enough heritage significance to be retained as part of the National Estate.	No further actions under the NHRA are required. This must be motivated by the applicant or the consultant and approved by the authority.	No research potential or other cultural significance

Table 5 - Rating system for built environment resources

Grading	Description of Resource	Examples of Possible Management Strategies	Heritage Significance
I	Heritage resources with qualities so exceptional that they are of special national significance. Current examples: Robben Island	May be declared as a National Heritage Site managed by SAHRA.	Highest Significance
II	Heritage resources with special qualities which make them significant in the context of a province or region, but do not fulfil the criteria for Grade I status. Current examples: St George's Cathedral, Community House	May be declared as a Provincial Heritage Site managed by HWC.	Exceptionally High Significance
II	Such a resource contributes to the environmental quality or cultural significance of a larger area and fulfils one of the criteria set out in section 3(3) of the Act but that does not fulfil the criteria for Grade II status. Grade III sites may be formally protected by placement on the Heritage Register.		
IIIA	Such a resource must be an excellent example of its kind or must be sufficiently rare. These are heritage resources which are significant in the context of an area.	This grading is applied to buildings and sites that have sufficient intrinsic significance to be regarded as local heritage resources; and are significant enough to warrant that any alteration, both internal and external, is regulated. Such buildings and sites may be representative, being excellent examples of their kind, or may be rare. In either case, they	High Significance

Grading	Description of Resource	Examples of Possible Management Strategies	Heritage Significance
		should receive maximum protection at local level.	
IIIB	Such a resource might have similar significances to those of a Grade III A resource, but to a lesser degree. These are heritage resources which are significant in the context of a townscape, neighbourhood, settlement or community.	Like Grade IIIA buildings and sites, such buildings and sites may be representative, being excellent examples of their kind, or may be rare, but less so than Grade IIIA examples. They would receive less stringent protection than Grade IIIA buildings and sites at local level.	Medium Significance
IIIC	Such a resource is of contributing significance to the environs. These are heritage resources which are significant in the context of a streetscape or direct neighbourhood.	This grading is applied to buildings and/or sites whose significance is contextual, i.e. in large part due to its contribution to the character or significance of the environs. These buildings and sites should, as a consequence, only be regulated if the significance of the environs is sufficient to warrant protective measures, regardless of whether the site falls within a Conservation or Heritage Area. Internal alterations should not necessarily be regulated.	Low Significance
NCW	A resource that, after appropriate investigation, has been determined to not have enough heritage significance to be retained as part of the National Estate.	No further actions under the NHRA are required. This must be motivated by the applicant and approved by the authority. Section 34 can even be lifted by HWC for structures in this category if they are older than 60 years.	No research potential or other cultural significance

4 CURRENT STATUS QUO

4.1 SITE DESCRIPTION

4.1.1 GENERAL SITE

The study area is a portion of the Olie Rivier farm situated about 24km east of Douglas along the R357. The study area is situated on an extremely flat environment that is almost completely devoid of any changes of elevation such as small hills and ridges. The area is mostly categorised by a thick layer of red sand that covers the entire landscape.

The vegetation across the landscape is completely dominated by a patched layer of grass growing on the sandy layer with scattered thorn trees dispersed across the area. Visibility on site was very high due to the dispersed nature of the present vegetation as well as the flat topography of the landscape.

The study area is mainly being used as grazing field for wildlife.

Figure 3 – General view of the study area with sparse grass land

Figure 4 – View of the western most pivot area with previous bush clearing evident

Figure 5 – View of western pivot area

4.2 ARCHAEOLOGICAL BACKGROUND TO THE STUDY AREA AND SURROUNDINGS

The archival research focused on available information sources (published literature and historical maps) that were used to compile a background history of the study area and surrounds. This data then informed the possible heritage resources to be expected during the initial field surveying.

Table 6: Summary of archival data found on the area in general

DATE	DESCRIPTION
2.5 million to 250 000 years ago	The Earlier Stone Age is the first and oldest phase identified in South Africa's archaeological history and comprises two technological phases. The earliest of these technological phases is known as the Oldowan, which is associated with crude flakes and hammer stones and dates to approximately 2 million years ago. Examples of such tools have been excavated from the sites of Wonderwerk Cave in Kuruman and Canteen Kopje in Barkly West, near Kimberley. The second technological phase in the earlier stone age of Southern Africa is known as the Acheulian and comprises more refined and better made stone artefacts such as the cleaver and bifacial hand axe. The Acheulian dates back to approximately 1.5 million years ago and examples of this phase have been found at Wonderwerk Cave (Berna et al. 2012). This site is of particular importance because its excavations have provided some of the first evidence of the controlled use of fire by hominins dating to approximately 1 million years ago (Berna et al. 2012). Other archaeological sites associated with the Earlier Stone Age from the general vicinity of the study area, is Canteen Kopje, Kathu Pan and Rooidam which has yielded many invaluable artefacts primarily associated with the Acheulian, this particular period of Earlier Stone Age (Herries, 2011).
250 000 to 40 000 years ago	The Middle Stone Age is the second oldest phase identified in South Africa's archaeological history. This phase is associated with flakes, points and blades manufactured by means of the so-called 'prepared core' technique. Examples of such artefacts have been found at the Bundu Farm, Kathu Pan and Wonderwerk Cave sites (Lombard et al. 2012). It is also widely argued that this time period saw the advent of "modern human behaviour".
40 000 years ago to the historic past	The Later Stone Age is the third oldest phase identified in South Africa's archaeological history. This phase in human history is associated with an abundance of very small stone artefacts known as microliths and is characterised by a hunter-gatherer way of life. Other types of heritage associated with this time period and therefore hunter-gatherers are OES (ostrich eggshell) beads, thin-walled ceramics, bone implements and rock art (painted and engraved) (Forssman et al. 2010). A large number of Later Stone Age sites are known in the Northern Cape Province. Some of these include those sites found in the Seacow Valley (Sampson, 1988) and Little Witkrans, Powerhouse Cave, and Blinkklipkop (Humphreys & Thackeray, 1983). And the more famous sites such as Wonderwerk Cave in Kuruman and Canteen Kopje in Barkley West, near Kimberley (Forssman et al. 2010). Canteen Kopje exhibits evidence of a very rich cultural history in the later periods of the Later Stone Age where the hunter-gatherers would interact with Khoekhoe herders that moved into the region, which we can tell from excavated domesticated animal remains such as sheep and goats (Forssman et al. 2010). These communities even entered a network of cultural exchange within the last 2000 years. Similar evidence has also been recovered from Wonderwerk Cave (Forssman et al. 2010). *Nooitgedacht Rock Art Site*

	This National Monument is situated on the farm Nooitgedacht adjacent to the farm Droogfontein and contains 3 sections of glaciated pavement with over 250 Bushman and Khoe rock engravings (**Figure 6**)  *Figure 6 - (Khoi)San Engraving of and Eland on glacial pavement at Nooitgedacht* (http://commons.wikimedia.org/wiki/File:Rock_Art_at_Nooitgedacht.jpg)
AD 1650 – AD 1700	Historical records combined with 'Type Z' walling and archaeological evidence from Postmasburg show that Bantu-speaking farmers occupied the area from around AD 1650 to AD 1700. The typical archaeology that is associated with these Iron Age farmers are the well-known stone-walled settlements (or 'Kraals') and their thick-walled, decorated ceramics. However there is not much evidence of farmers or herders South and to the West of this area, with the evidence showing that most of this land was left unoccupied possibly because of its characteristically arid conditions (Forssman et al. 2010).
AD 1700 - AD 1850	Hearsay and eyewitness accounts have placed Tswana (more specifically Tshlaping) farming settlements North of present-day Kuruman however, a lack of archaeological evidence from the area as well as what we know about the lack of rainfall in the area, corroborates the previous point that this point of South Africa was not well inhabited by Iron Age farmers (Humphreys, 1976). The 18th century is also characterised by the conflict between the Griqua, Korana and white settlers who were competing for availability of land, which gave rise to the occurrence of the *Mfecane* as a direct result of the influx of all these different peoples (Becker, 2013)
1899 - 1902	A series of fortifications and encampments can still be found today surrounding Kimberley as a result of the siege of Kimberley between 1899 and 1900, during the Anglo-Boer War (Becker, 2013). The Kimberley area was also privy to the "Western Campaign" during the war, with regards to the Battles of Belmont, Graspan, Modder River and Magersfontein (Morris 2000). It also saw the base of operations for the subsequent incursions into the Cape Colony by De Wet, Hertzog and Naude, as well as the development of British military bases and hospitals (Morris 2000).

4.3 PREVIOUS ARCHAEOLOGICAL AND HERITAGE STUDIES IN AND AROUND THE STUDY AREA

A scan of the SAHRIS database has revealed the following studies conducted in and around the study area of this report. These studies are summarised below in ascending date order:

- Beaumont, P. B. 2012. Phase 1 Archaeological Impact Assessment Report on mining zones 0-24 and abutting areas on the remaining extent of farm Schmitdsdrift 248, Pixley Ka Seme District Municipaity, Northern Cape. **The large-scale survey identified 45 burial grounds, 32 stone walled sites all recent historic. 16 artefact sites ranging from MSA to LSA.**
- MIllo, Trust. 2019. Phase 1 Archaeological Impact Assessment report for mining right of Maxwill Opencast Alluvial Diamond Mine and associated infrastructure, Northern Cape Province under the jurisdiction of Pixely Ka Seme District Municipality in the Northern Cape Province**. The field survey identified scatters of Middle Stone Age (MSA) and Later Stone Age (LSA) stone/lithic artefacts, scatters of glass, porcelain, metal knife, metal hook, terracing platforms and house platforms. But the MSA and LSA stone tools are a secondary deposition because they could be as a result of flooding.**
- Kruger, Nelius. 2018. Heritage Scoping Study (HS) for the proposed At Last Prospecting Project on a portion of the farm At Last 232 in the Frances Baard District Municipality, Northern Cape Province. **The study identified that draining lines holds significance for lithic material finds, while slopes are associated with Iron Age settlements.**
- MIllo, Trust. 2018. Phase 1 Archaeological Impact Assessment report for mining right MIllo, Trust. 2019. Phase 1 Archaeological Impact Assessment report for mining right of Maxwill Opencast Alluvial Diamond Mine and associated infrastructure, Northern Cape Province under the jurisdiction of Pixely Ka Seme District Municipality in the Northern Cape Province. **No major finds were identified.**
- Van Ryneveld, K. 2005. Cultural Resources Management Impact Assessment. Portions of Leeuwpoort 161, Kimberley District, Northern Cape .**Finds included historical burial grounds and lithics artefacts on a basal layered shale deposit.**
- Rossouw. L. 2017. Phase 1 Heritage Impact Assessment of proposed installation of new irrigation pivots and associated infrastructure on the farm Zulani 167 near Douglas, Northern Cape Province. **The terrain as a whole is capped by a thick mantle of aeolian sand that appears to be superficially sterile in terms of Stone Age cultural remains with no perceived impact.**
- Rossouw, L. 2017. Phase 1 Heritage Impact Assessment of proposed installation of new irrigation pivots and associated infrastructure on the farm Banks Drift 163 near Douglas, Northern Cape Province. **The terrain as a whole is capped by a thick mantle of aeolian sand that appears to be superficially sterile in terms of Stone Age cultural remains with no perceived impact.**
- Morris, D. 2007. Archaeological Impact Assessment at Taaiboschfontein near Plooysburg, Northern Cape. **A low density scatter of lithics at the base of the soil unit over laying calcrete was identified.**

- Morris, D. 2005. Archaeological Impact Assessment at Abrahamoosfontein near Plooysburg, Northern Cape. **No heritage features identified.**

4.4 ARCHIVAL/HISTORICAL MAPS

The examination of historical data and cartographic resources represents a critical tool for locating and identifying heritage resources and in determining the historical and cultural context of the study area. Relevant topographic maps and satellite imagery were studied to identify structures, possible burial grounds or archaeological sites present in the footprint area.

Topographic maps (1:50 000) for various years (1969) were assessed to observe the development of the area, as well as the location of possible historical structures and burial grounds. The maps were also used to assess the possible age of structures located, to determine whether they could be considered as heritage sites. Map overlays were created showing the possible heritage sites identified within the areas of concern, as can be seen below (**Figure 7**).

The relevant topographical maps include:

- First Edition 2824CC Uitkyk Topographic Sheet surveyed in 1969 and drawn in 1971 by the Trigonometrical Survey Office. Published by the Government Printer in 1971.

It can be seen that all the map sheets consulted depict the project area with no infrastructure in the footprint area.

4.5 FINDINGS OF THE HISTORICAL DESKTOP STUDY

4.5.1 HERITAGE SCREENING

A Heritage Screening Report was compiled using the Department of Environment, Forestry and Fisheries National Web-based Environmental Screening Tool as required by Regulation 16(1)(v) of the Environmental Impact Assessment Regulations 2014, as amended . According to the Heritage screening report, the directly affected area has no archaeological and cultural heritage sensitivity.

This has been confirmed by the field work that identified no heritage resources.

4.5.2 HERITAGE SENSITIVITY

The sensitivity maps were produced by overlying:

- Satellite Imagery;
- Current Topographical Maps; and
- First edition Topographical Maps dating to 1968-70.

By superimposition and analysis, it was possible to rate these structure/areas according to age and thus their level of protection under the NHRA. Note that these structures refer to possible tangible heritage sites as listed in ***Table 7***.

Table 7 -Tangible heritage sites in the study area

Name	Description	Legislative protection
Archaeology - Iron Age Sites	Older than 100 years	NHRA Sect 3 and 35
Architectural Structures	Possibly older than 60 years	NHRA Sect 3 and 34
Graves and Burial Grounds	60 years or older	NHRA Sect 3 and 36

Additionally, evaluation of satellite imagery has indicated the following areas that may be sensitive from a heritage perspective. The analysis of the studies conducted in the area assisted in the development of the following landform type to heritage find matrix in **Table 8**.

Table 8 - Landform type to heritage find matrix

LANDFORM TYPE	HERITAGE TYPE
Crest and foot hill	LSA and MSA scatters, LIA settlements
Crest of small hills	Small LSA sites – scatters of stone artefacts, ostrich eggshell, pottery and beads
Watering holes/pans/rivers	ESA, MSA and LSA sites, LIA settlements
Farmsteads	Historical archaeological material
Ridges and drainage lines	LSA sites, LIA settlements

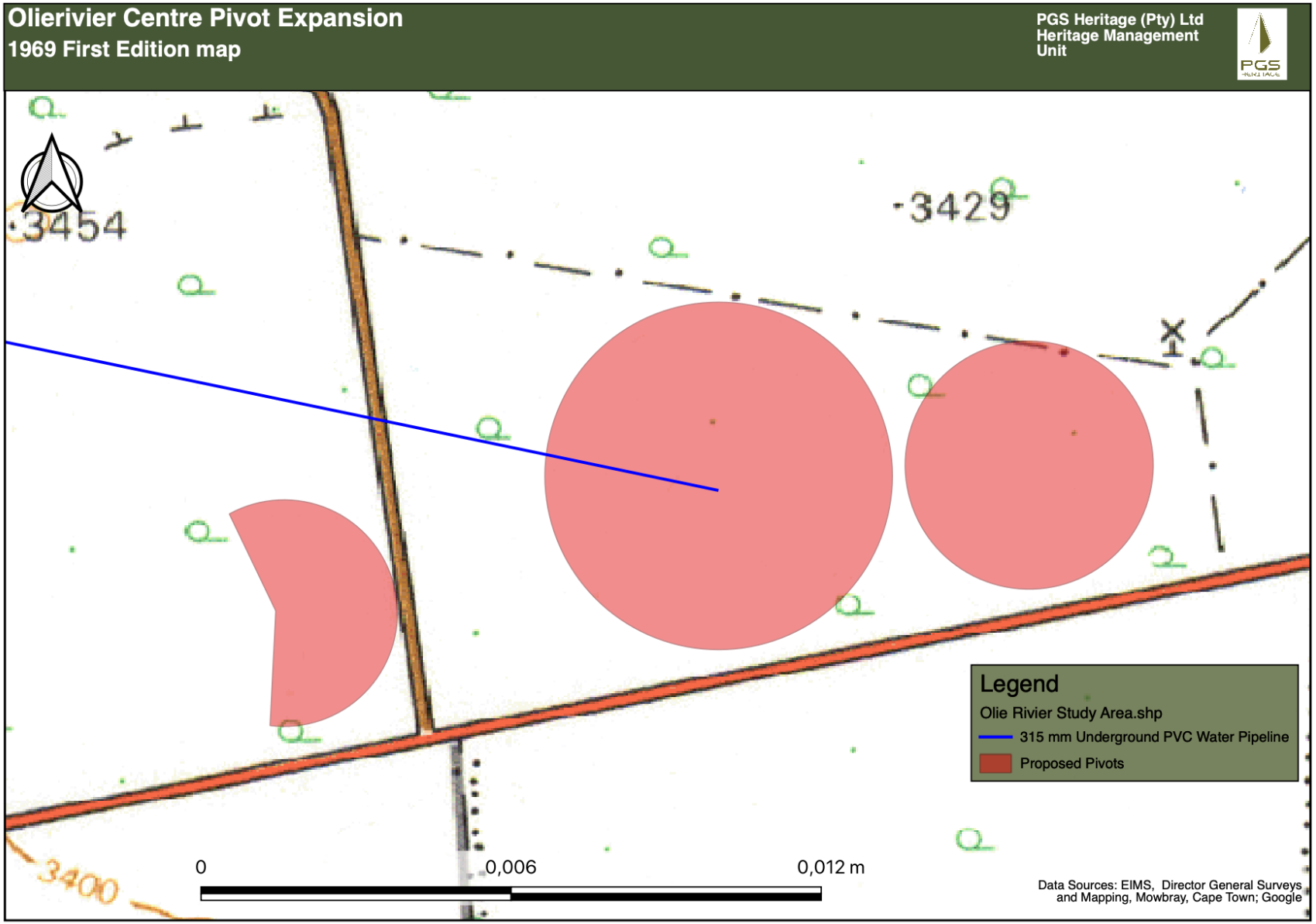

Figure 7 - First Edition 2824CC Topographic Sheet dating to 1969 showing the study area

5 FIELDWORK AND FINDINGS

A controlled surface survey was conducted on foot and by a vehicle by an archaeologist from PGS. The fieldwork was conducted between 28 November 2020. During the fieldwork, hand-held GPS devices were used to record tracklogs. These recorded track logs show the routes followed by the fieldwork team on site. The tracklogs (in yellow) for the survey are indicated in **Figure 8**.

No heritage artefacts or resources were identified.

5.1 SENSITIVITY ASSESSMENT OUTCOME

No other heritage sites were identified during the survey of the project area.

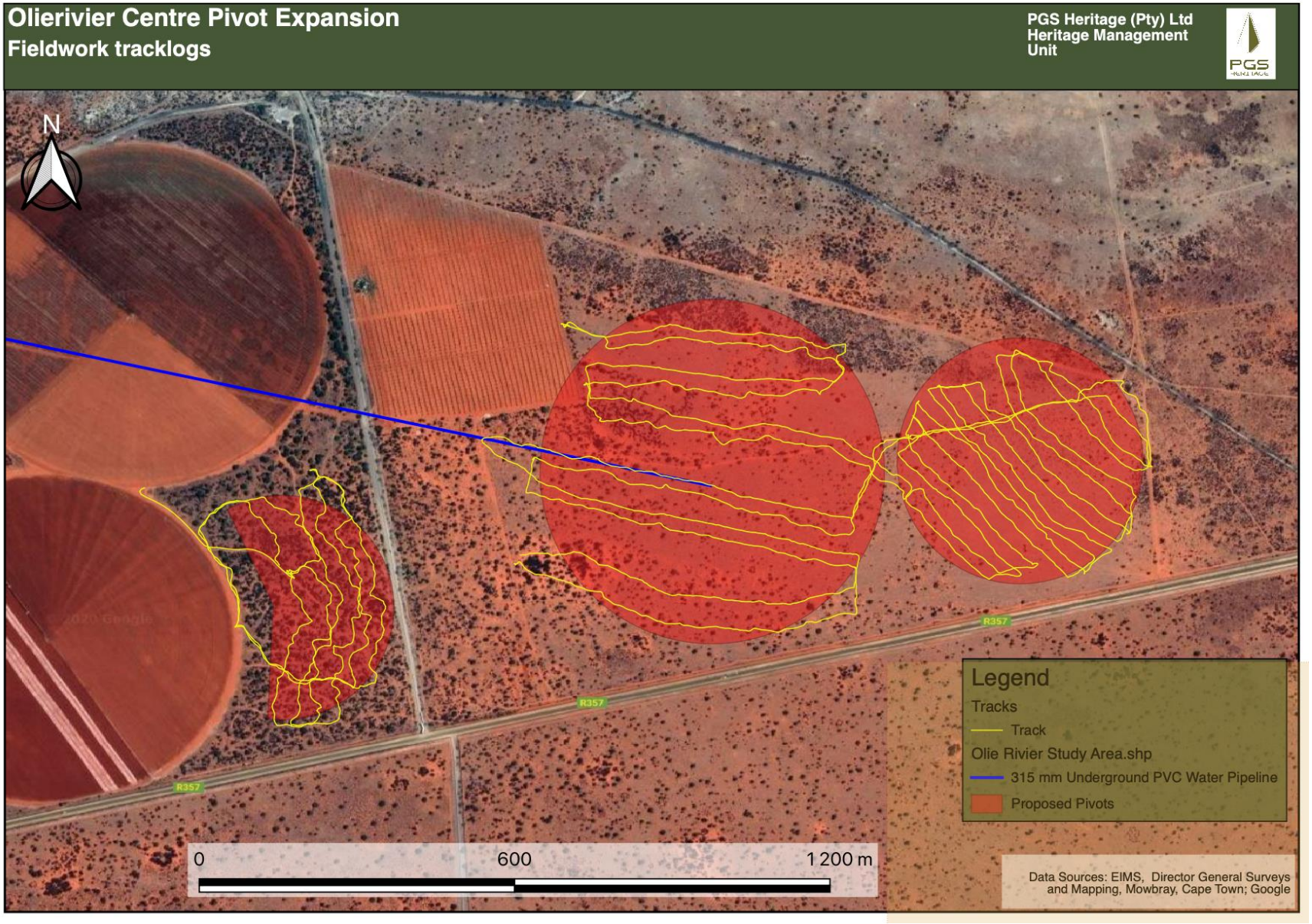

Figure 8 - Fieldwork tracklogs

6 IMPACT ASSESSMENT

The impact significance rating methodology, as provided by EIMS, is guided by the requirements of the NEMA EIA Regulations 2014 (as amended). The broad approach to the significance rating methodology is to determine the environmental risk (ER) by considering the consequence (C) of each impact (comprising Nature, Extent, Duration, Magnitude, and Reversibility) and relate this to the probability/ likelihood (P) of the impact occurring. This determines the environmental risk. In addition, other factors, including cumulative impacts and potential for irreplaceable loss of resources, are used to determine a prioritisation factor (PF) which is applied to the ER to determine the overall significance (S). The impact assessment will be applied to all identified alternatives. Where possible, mitigation measures will be recommended for the impacts identified.

6.1 DETERMINATION OF ENVIRONMENTAL RISK

The significance (S) of an impact is determined by applying a prioritisation factor (PF) to the environmental risk (ER). The environmental risk is dependent on the consequence (C) of the particular impact and the probability (P) of the impact occurring. The consequence is determined through the consideration of the Nature (N), Extent (E), Duration (D), Magnitude (M), and reversibility (R) applicable to the specific impact.

For the purpose of this methodology, the consequence of the impact is represented by:

$$\boldsymbol{C = \frac{(E+D+M+R) \times N}{4}}$$

Each individual aspect in the determination of the consequence is represented by a rating scale as defined in **Table 9** below.

Table 9 - Criteria for Determining Impact Consequence

Aspect	Score	Definition
Nature	- 1	Likely to result in a negative/ detrimental impact
	+1	Likely to result in a positive/ beneficial impact
Extent	1	Activity (i.e. limited to the area applicable to the specific activity)
	2	Site (i.e. within the development property boundary),
	3	Local (i.e. the area within 5 km of the site),
	4	Regional (i.e. extends between 5 and 50 km from the site
	5	Provincial / National (i.e. extends beyond 50 km from the site)
Duration	1	Immediate (<1 year)
	2	Short term (1-5 years),
	3	Medium term (6-15 years),
	4	Long term (the impact will cease after the operational life span of the project),
	5	Permanent (no mitigation measure of natural process will reduce the impact after construction).

Aspect	Score	Definition
Magnitude/ Intensity	1	Minor (where the impact affects the environment in such a way that natural, cultural and social functions and processes are not affected),
	2	Low (where the impact affects the environment in such a way that natural, cultural and social functions and processes are slightly affected),
	3	Moderate (where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way),
	4	High (where natural, cultural or social functions or processes are altered to the extent that it will temporarily cease), or
	5	Very high / don't know (where natural, cultural or social functions or processes are altered to the extent that it will permanently cease).
Reversibility	1	Impact is reversible without any time and cost.
	2	Impact is reversible without incurring significant time and cost.
	3	Impact is reversible only by incurring significant time and cost.
	4	Impact is reversible only by incurring prohibitively high time and cost.
	5	Irreversible Impact

Once the C has been determined, the ER is determined in accordance with the standard risk assessment relationship by multiplying the C and the P. Probability is rated/ scored as per Error! Reference source not found.**9**.

Table 10 - Probability Scoring

Probability	1	Improbable (the possibility of the impact materialising is very low as a result of design, historic experience, or implementation of adequate corrective actions; <25%),
	2	Low probability (there is a possibility that the impact will occur; >25% and <50%),
	3	Medium probability (the impact may occur; >50% and <75%),
	4	High probability (it is most likely that the impact will occur- > 75% probability), or
	5	Definite (the impact will occur)

The result is a qualitative representation of relative ER associated with the impact. ER is therefore calculated as follows:

ER= C x P

Table 11 - Determination of Environmental Risk

Cons	5	5	10	15	20	25

	4	4	8	12	16	20
	3	3	6	9	12	15
	2	2	4	6	8	10
	1	1	2	3	4	5
	0	1	2	3	4	5
	Probability					

The outcome of the environmental risk assessment will result in a range of scores, ranging from 1 through to 25. These ER scores are then grouped into respective classes as described in **Table 12**.

Table 12 - Significance Classes

Environmental Risk Score	
Value	**Description**
< 9	Low (i.e. where this impact is unlikely to be a significant environmental risk).
≥9 - <17	Medium (i.e. where the impact could have a significant environmental risk),
≥17	High (i.e. where the impact will have a significant environmental risk).

The impact ER will be determined for each impact without relevant management and mitigation measures (pre-mitigation), as well as post-implementation of relevant management and mitigation measures (post-mitigation). This allows for a prediction in the degree to which the impact can be managed/mitigated.

6.2 IMPACT PRIORITISATION

Further to the assessment criteria presented in the section above, it is necessary to assess each potentially significant impact in terms of:

1. Cumulative impacts; and
2. The degree to which the impact may cause irreplaceable loss of resources.

To ensure that these factors are considered, an impact prioritisation factor (PF) will be applied to each impact ER (post-mitigation). This prioritisation factor does not aim to detract from the risk ratings but rather to focus the attention of the decision-making authority on the higher priority/significance issues and impacts. The PF will be applied to the ER score based on the assumption that relevant suggested management/mitigation impacts are implemented.

Table 13 - Criteria for Determining Prioritisation

Cumulative Impact (CI)	Low (1)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely

		that the impact will result in spatial and temporal cumulative change.
	Medium (2)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.
	High (3)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/ definite that the impact will result in spatial and temporal cumulative change.
Irreplaceable Loss of Resources (LR)	Low (1)	Where the impact is unlikely to result in irreplaceable loss of resources.
	Medium (2)	Where the impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.
	High (3)	Where the impact may result in the irreplaceable loss of resources of high value (services and/or functions).

The value for the final impact priority is represented as a single consolidated priority, determined as the sum of each individual criteria represented in Table 5. The impact priority is therefore determined as follows:

Priority = CI + LR

The result is a priority score which ranges from 3 to 9 and a consequent PF ranging from 1 to 2 (Refer to **Table 14**).

Table 14 - Determination of Prioritisation Factor

Priority	Ranking	Prioritisation Factor
2	Low	**1**
3	Medium	**1.125**
4	Medium	**1.25**
5	Medium	**1.375**
6	High	**1.5**

In order to determine the final impact significance, the PF is multiplied by the ER of the post-mitigation scoring. The ultimate aim of the PF is an attempt to increase the post-mitigation environmental risk rating by a full ranking class if all the priority attributes are high (i.e. if an impact comes out with a medium environmental risk after the conventional impact rating, but there is significant cumulative impact potential and significant potential for irreplaceable loss of resources, then the net result would be to upscale the impact to a high significance).

Table 15 - Final Environmental Significance Rating

Environmental Significance Rating	
Value	**Description**
≤ -20	High negative (i.e. where the impact must have an influence on the decision process to develop in the area).
> -20 ≤ -10	Medium negative (i.e. where the impact could influence the decision to develop in the area).
> -10	Low negative (i.e. where this impact would not have a direct influence on the decision to develop in the area).
0	No impact
<10	Low positive (i.e. where this impact would not have a direct influence on the decision to develop in the area).
≥ 10 < 20	Medium positive (i.e. where the impact could influence the decision to develop in the area).
≥ 20	High positive (i.e. where the impact must have an influence on the decision process to develop in the area).

The significance ratings and additional considerations applied to each impact will be used to provide a quantitative comparative assessment of the alternatives being considered. In addition, professional expertise and opinion of the specialists and the environmental consultants will be applied to provide a qualitative comparison of the alternatives under consideration. This process will identify the best alternative for the proposed project.

6.3 HERITAGE IMPACTS

Despite an intensive walkthrough of the footprint area, no evidence for any significant archaeological or heritage sites could be identified. As a result, a low impact is expected from the proposed development on heritage. Refer to **Table 16**.

Table 16 - Impact rating for heritage resources

IMPACT DESCRIPTION				Pre-Mitigation							Post Mitigation								Priority Factor Criteria			
Identifier	Impact	Alternative	Phase	Nature	Extent	Duration	Magnitude	Reversibility	Probability	Pre-mitigation ER	Nature	Extent	Duration	Magnitude	Reversibility	Probability	Post-mitigation ER	Confidence	Cumulative Impact	Irreplaceable loss	Priority Factor	Final score
10.1.1	Impact on heritage resources		Construction	-1	1	5	2	5	2	-6,5	-1	1	5	1	1	1	-2	High	1	1	1,00	-2

6.4 MANAGEMENT RECOMMENDATIONS AND GUIDELINES

6.4.1 CONSTRUCTION PHASE

The project will encompass the removal of vegetation and the digging of trenches for the establishment of the irrigation pivots.

It is possible that cultural material will be exposed during construction and may be recoverable, keeping in mind delays can be costly during construction and as such must be minimised. Development surrounding infrastructure and construction of facilities results in significant disturbance, however, foundation holes do offer a window into the past and it thus may be possible to rescue some of the data and materials. It is also possible that substantial alterations will be implemented during this phase of the project and these must be catered for.

During the construction phase, it is important to recognize any significant material being unearthed, making the correct judgment on which actions should be taken. It is recommended that the following chance find procedure should be implemented.

6.4.2 CHANCE FIND PROCEDURE

- An appropriately qualified heritage practitioner/archaeologist must be identified to be called upon in the event that any possible heritage resources or artefacts are identified.
- Should an archaeological site or cultural material be discovered during construction (or operation), the area should be demarcated, and construction activities halted.
- The qualified heritage practitioner/archaeologist will then need to come out to the site and evaluate the Heritage resources and make the necessary recommendations for mitigating the find and the impact on the heritage resource.
- The contractor therefore should have some sort of contingency plan so that operations could move elsewhere temporarily while the materials and data are recovered.
- Construction can commence as soon as the site has been cleared and signed off by the heritage practitioner/archaeologist.

6.4.3 POSSIBLE FINDS DURING CONSTRUCTION

The study area occurs within a greater historical and the archaeological site as identified during the desktop and fieldwork phase. Soil clearance for infrastructure as well as the proposed reclamation activities could uncover the following:

- High-density concentrations of a stone artefact
- unmarked graves

6.5 TIMEFRAMES

It must be kept in mind that mitigation and monitoring of heritage resources discovered during construction activity will require permitting for collection or excavation of heritage resources and lead times must be worked into the construction time frames. **Table 17** gives guidelines for lead times on permitting.

Table 17 - Lead times for permitting and mobilisation

Action	Responsibility	Timeframe
Preparation for field monitoring and finalisation of contracts	The contractor and service provider	1 month
Application for permits to do necessary mitigation work	Service provider – Archaeologist and SAHRA	3 months
Documentation, excavation and archaeological report on the relevant site	Service provider – Archaeologist	3 months
Handling of chance finds – Graves/Human Remains	Service provider – Archaeologist and SAHRA	2 weeks
Relocation of burial grounds or graves in the way of construction	Service provider – Archaeologist, SAHRA, local government and provincial government	6 months

6.6 HERITAGE MANAGEMENT PLAN FOR EMPR IMPLEMENTATION

Table 18 - Heritage Management Plan for EMPr implementation

Area and site no.	Mitigation measures	Phase	Timeframe	The responsible party for implementation	Monitoring Party (frequency)	Target	Performance indicators (monitoring tool)
General project area	Implement chance find procedures in case where possible heritage finds are uncovered.	Construction and operation	During construction and operation	Applicant ECO Heritage Specialist	ECO (monthly / as or when required)	Ensure compliance with relevant legislation and recommendations from SAHRA under Section 34-36 and 38 of NHRA	ECO Monthly Checklist/Report

7 CONCLUSIONS

PGS was appointed by EIMS to undertake a HIA for the proposed new Cultivation (Pivot) Areas on the Remainder of the farm Olie Rivier 170, Douglas, Sol Plaatje Local Municipality, Frances Baard District Municipality, Northern Cape Province.

Heritage resources are unique and non-renewable and as such, any impact on such resources must be seen as significant. The HIA has shown that the study area and surrounding area has some heritage resources situated within the proposed development boundaries. Through data analysis and a site investigation, the following issues were identified from a heritage perspective.

7.1 HERITAGE SITES

Intensive field surveys of the study area were undertaken on foot by comprising two field archaeologist on 20-22 September 2020. No archaeological sites or burial grounds and graves were identified during the fieldwork.

7.2 IMPACT ASSESSMENT

Despite an intensive walkthrough of the project area, no evidence for any archaeological or heritage sites could be identified. As a result, low to no impact is expected from the proposed development on heritage.

7.3 MITIGATION MEASURES

With no impact expected on heritage, no further mitigation is required. Refer Chapter 6 of this report.

7.4 GENERAL

It is the author's considered opinion that the overall impact on heritage resources is Low. Provided that the recommended mitigation measures are implemented, the impact would be acceptably Low or could be totally mitigated to the degree that the project could be approved from a heritage perspective.

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APPENDIX A

Project team CV's

WOUTER FOURIE

Professional Heritage Specialist and Professional Archaeologist and Director PGS Heritage

Summary of Experience

Specialised expertise in Archaeological Mitigation and excavations, Cultural Resource Management and Heritage Impact Assessment Management, Archaeology, Anthropology, Applicable survey methods, Fieldwork and project management, Geographic Information Systems, including *inter alia* -

Involvement in various grave relocation projects (some of which relocated up to 1000 graves) and grave "rescue" excavations in the various provinces of South Africa

Involvement with various Heritage Impact Assessments, within South Africa, including -

- Archaeological Walkdowns for various projects
- Phase 2 Heritage Impact Assessments and EMPs for various projects
- Heritage Impact Assessments for various projects
    - Iron Age Mitigation Work for various projects, including archaeological excavations and monitoring
    - Involvement with various Heritage Impact Assessments, outside South Africa, including -
- Archaeological Studies in Democratic Republic of Congo
- Heritage Impact Assessments in Mozambique, Botswana and DRC
- Grave Relocation project in DRC

Key Qualifications

BA [Hons] (Cum laude) - Archaeology and Geography - 1997

BA - Archaeology, Geography and Anthropology - 1996

Professional Archaeologist - Association of Southern African Professional Archaeologists (ASAPA) - Professional Member

Accredited Professional Heritage Specialist – Association of Professional Heritage Practitioners (APHP)

CRM Accreditation (ASAPA) -

- Principal Investigator - Grave Relocations
- Field Director – Iron Age
- Field Supervisor – Colonial Period and Stone Age
- Accredited with Amafa KZN

Key Work Experience

2003- current - Director – Professional Grave Solutions (Pty) Ltd

2007 – 2008 - Project Manager – Matakoma-ARM, Heritage Contracts Unit, University of the Witwatersrand

2005-2007 - Director – Matakoma Heritage Consultants (Pty) Ltd

2000-2004 - CEO– Matakoma Consultants

1998-2000 - Environmental Coordinator – Randfontein Estates Limited. Randfontein, Gauteng

1997-1998 - Environmental Officer – Department of Minerals and Energy. Johannesburg, Gauteng

Worked on various heritage projects in the SADC region including, Botswana, Mozambique, Malawi, Mauritius, Zimbabwe and the Democratic Republic of the Congo

PALAEONTOLOGICAL DESKTOP ASSESSMENT FOR THE PROPOSED PIVOT IRRIGATION EXPANSION ON OLIE RIVIER 170 NEAR DOUGLAS, NORTHERN CAPE

Issue Date:	**11 December 2020**
Revision No.:	v0.1
Client:	EIMS
PGS Project No:	495HIA

PGS HERITAGE

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Directors: HS Steyn, PD Birkholtz, W Fourie

Declaration of Independence

I, Elize Butler, declare that –

General declaration:

- I act as the independent palaeontological specialist in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favorable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting palaeontological impact assessments, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I will take into account, to the extent possible, the matters listed in section 38 of the NHRA when preparing the application and any report relating to the application;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favorable to the applicant or not
- All the particulars furnished by me in this form are true and correct;
- I will perform all other obligations as expected a palaeontological specialist in terms of the Act and the constitutions of my affiliated professional bodies; and
- I realize that a false declaration is an offense in terms of regulation 71 of the Regulations and is punishable in terms of section 24F of the NEMA.

Disclosure of Vested Interest

I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Regulations;

PALAEONTOLOGICAL CONSULTANT: Banzai Environmental (Pty) Ltd

CONTACT PERSON: Elize Butler

Tel: +27 844478759

Email: elizebutler002@gmail.com

SIGNATURE: _____

ACKNOWLEDGEMENT OF RECEIPT

Report Title	**PALAEONTOLOGICAL DESKTOP ASSESSMENT FOR THE PROPOSED PIVOT IRRIGATION EXPANSION ON OLIE RIVIER 170 NEAR DOUGLAS, NORTHERN CAPE**		
Control	**Name**	**Signature**	**Designation**
Author	**Elize Butler**		**Palaeontologist**
Reviewed	**Wouter Fourie**		**Principal Heritage Specialist**

CLIENT:

CONTACT PERSON:

SIGNATURE: _____

This Palaeontological Impact Assessment report has been compiled considering the National Environmental Management Act 1998 (NEMA) and Environmental Impact Regulations 2014 as amended, requirements for specialist reports, Appendix 6, as indicated in the table below.

Table 1 - NEMA Table

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	**Relevant section in report**	**Comment where not applicable.**
1.(1) (a) (i) Details of the specialist who prepared the report	Page ii and Section 2 of Report – Contact details and company and Appendix A	-
(ii) The expertise of that person to compile a specialist report including a curriculum vitae	Section 2 – refer to **Appendix A**	-
(b) A declaration that the person is independent in a form as may be specified by the competent authority	Page ii of the report	-
(c) An indication of the scope of, and the purpose for which, the report was prepared	Section 4 – Objective	-
(cA) An indication of the quality and age of base data used for the specialist report	Section 5 – Geological and Palaeontological history	-
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 10	-
(d) The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 1 and 11	
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Section 7 Approach and Methodology	-
(f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or	Section 1 and 11	

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	Relevant section in report	Comment where not applicable.
activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;		
(g) An identification of any areas to be avoided, including buffers	Section 5	No buffers or areas of sensitivity identified
(h) A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 5 – Geological and Palaeontological history	
(i) A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 7.1 – Assumptions and Limitation	-
(j) A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Section 1 and 11	
(k) Any mitigation measures for inclusion in the EMPr	Section 12	Chance find Protocol
(l) Any conditions for inclusion in the environmental authorisation	Section 12	
(m) Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 12	
(n)(i) A reasoned opinion as to whether the proposed activity, activities or portions thereof should be authorised and	Section 1 and 11	
(n)(iA) A reasoned opinion regarding the acceptability of the proposed activity or activities; and		
(n)(ii) If the opinion is that the proposed activity, activities or portions thereof should be authorised, any	Section 1 and 11	-

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	Relevant section in report	Comment where not applicable.
avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan		
(o) A description of any consultation process that was undertaken during the course of carrying out the study	N/A	Not applicable. A public consultation process will be conducted as part of the EIA and EMPr process.
(p) A summary and copies if any comments that were received during any consultation process	N/A	
(q) Any other information requested by the competent authority.	N/A	Not applicable.
(2) Where a government notice by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	Section 3 compliance with SAHRA guidelines	

EXECUTIVE SUMMARY

Banzai Environmental was appointed by PGS Heritage (Pty) Ltd to conduct the **Palaeontological Desktop Assessment** (PDA) to assess the proposed pivot irrigation expansion on the farm Olie Rivier 170 near Douglas, Northern Cape. The National Heritage Resources Act (No 25 of 1999, section 38) (NHRA), states that a Palaeontological Desktop Assessment (PDA) is necessary to identify if fossils are present in the planned development. This PDA is thus necessary to evaluate the effect of the construction on the palaeontological resources.

The proposed pivot irrigation expansion is mantled by Late Caenozoic Superficial Sediments. According to the South African Heritage Resources Information System, the Palaeontological Sensitivity of the Late Caenozoic Superficial Sediments is low but locally high. It is therefore considered that the extension of the pivot irrigation on Olie Rivier 170 farm is deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological resources of the area. Thus, the construction and operation of the facility may be authorised as the whole extent of the development footprint is not considered sensitive in terms of palaeontological resources.

It is consequently recommended that no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required pending the discovery of newly discovered fossils. If fossil remains are discovered during any phase of construction, either on the surface or exposed by excavations the **Chance Find Protocol** must be implemented by the Environmental Control Officer (ECO) in charge of these developments. These discoveries ought to be protected (if possible, *in situ*) and the ECO must report to SAHRA (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za) so that correct mitigation (recording and collection) can be carry out by a paleontologist.

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Appendix A: CV

TERMINOLOGY AND ABBREVIATIONS

Cultural significance

This means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance

Development

This means any physical intervention, excavation, or action, other than those caused by natural forces, which may in the opinion of the heritage authority in any way result in a change to the nature, appearance or physical nature of a place or influences its stability and future well-being, including:

- construction, alteration, demolition, removal or change in use of a place or a structure at a place;
- carrying out any works on or over or under a place;
- subdivision or consolidation of land comprising a place, including the structures or airspace of a place;
- constructing or putting up for display signs or boards;
- any change to the natural or existing condition or topography of land; and
- any removal or destruction of trees, or removal of vegetation or topsoil

Fossil

Mineralized bones of animals, shellfish, plants, and marine animals. A trace fossil is the track or footprint of a fossil animal that is preserved in stone or consolidated sediment.

Heritage

That which is inherited and forms part of the National Estate (historical places, objects, fossils as defined by the National Heritage Resources Act 25 of 1999).

Heritage resources

This means any place or object of cultural significance and can include (but not limited to) as stated under Section 3 of the NHRA,

- places, buildings, structures, and equipment of cultural significance;
- places to which oral traditions are attached or which are associated with living heritage;
- historical settlements and townscapes;
- landscapes and natural features of cultural significance;
- geological sites of scientific or cultural importance;
- archaeological and palaeontological sites;
- graves and burial grounds, and
- sites of significance relating to the history of slavery in South Africa;

Palaeontology

Any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace.

Table 2: Abbreviations

Abbreviations	**Description**
ASAP	Association of South African Professional Archaeologists
CRM	Cultural Resource Management
DEFF	Department of Environmental Department of Environment, Forestry and Fisheries
ECO	Environmental Control Officer
EIA practitioner	Environmental Impact Assessment Practitioner
EIA	Environmental Impact Assessment
ESA	Early Stone Age
GPS	Global Positioning System
HIA	Heritage Impact Assessment
I&AP	Interested & Affected Party
LSA	Late Stone Age
LIA	Late Iron Age
MSA	Middle Stone Age
MIA	Middle Iron Age
NECSA	Nuclear Energy Corporation of South Africa
NEMA	National Environmental Management Act
NHRA	National Heritage Resources Act
PDA	Palaeontological Desktop Assessment
PIA	Palaeontological Impact Assessment
PHRA	Provincial Heritage Resources Authority
PSSA	Palaeontological Society of South Africa
SADC	Southern African Development Community
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System

1 INTRODUCTION

The owner of Olie Rivier 170, near Douglas in the Northern Cape, proposes to expand the pivot irrigation on the farm. The proposed irrigation expansion will comprise of vegetation clearance for 3 new pivot areas of approximately 10, 20 and 40 ha respectively (Figure1-2).

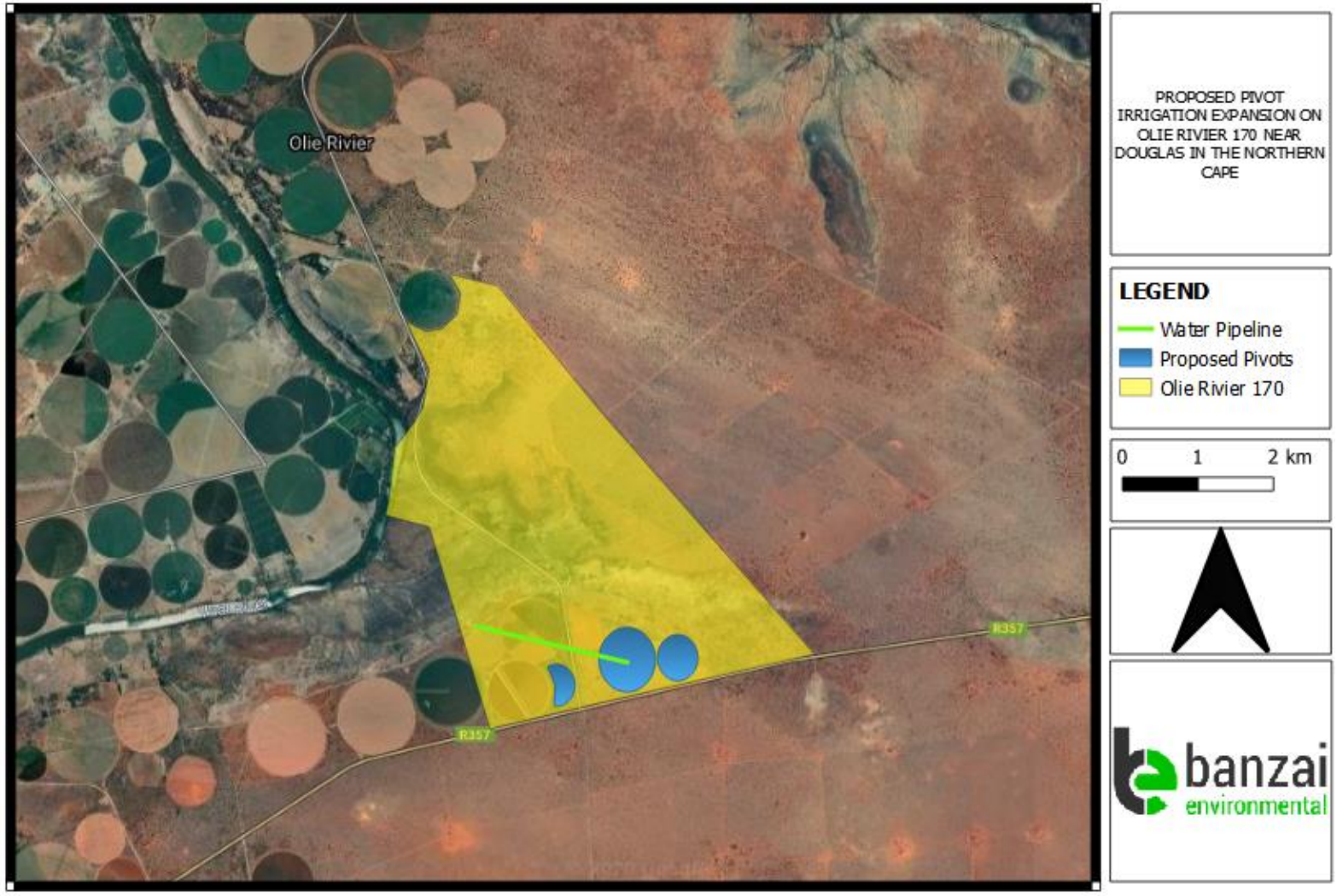

Figure 1: *Google Earth (2020) Image of the proposed pivot irrigation expansion on Olie Rivier 170 near Douglas in the Northern Cape*

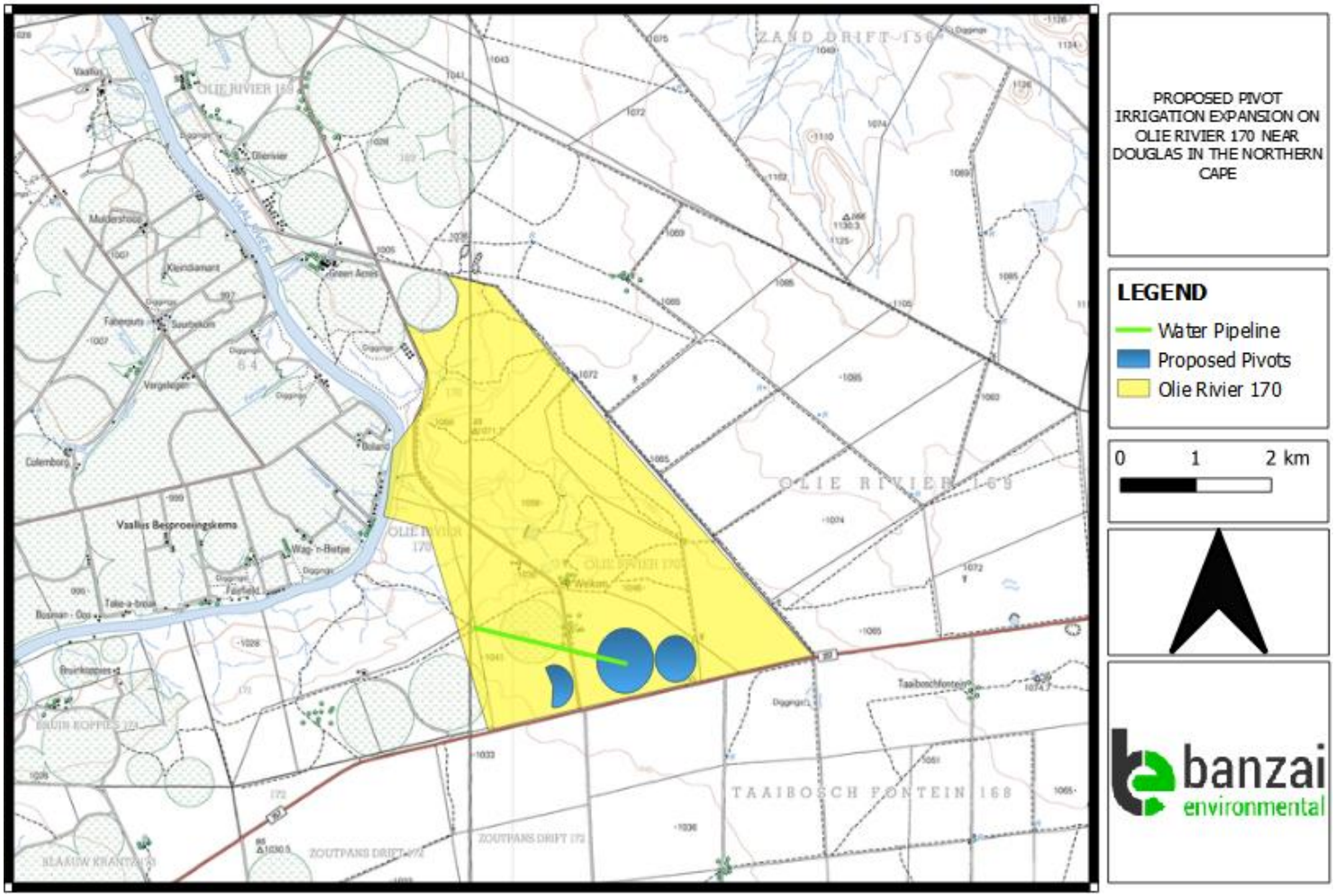

Figure 2*: Extract of the 1: 50 000 topographical map indicating the locality of the proposed pivot irrigation expansion on Olie Rivier 170, near Douglas, Northern Cape Province*.

2 QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

This present study has been conducted by Mrs Elize Butler. She has conducted approximately 300 palaeontological impact assessments for developments in the Free State, KwaZulu-Natal, Eastern, Central, and Northern Cape, Northwest, Gauteng, Limpopo, and Mpumalanga. She has an MSc (*cum laude*) in Zoology (specializing in Palaeontology) from the University of the Free State, South Africa and has been working in Palaeontology for more than twenty-five years. She has experience in locating, collecting, and curating fossils, including exploration field trips in search of new localities in the Karoo Basin. She has been a member of the Palaeontological Society of South Africa (PSSA) since 2006 and has been conducting PIAs since 2014.

3 LEGISLATION

3.1 National Heritage Resources Act (25 of 1999)

Cultural Heritage in South Africa, includes all heritage resources, is protected by the National Heritage Resources Act (Act 25 of 1999) (NHRA). Heritage resources as defined in Section 3 of the Act include **"all objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens**".

Palaeontological heritage is exceptional and non-renewable and is protected by the NHRA. Palaeontological resources and may not be unearthed, broken moved, or destroyed by any development without prior assessment and without a permit from the relevant heritage resources authority as per section 35 of the NHRA.

This Palaeontological Impact assessment forms part of the Heritage Impact Assessment (HIA) and adhere to the conditions of the Act. According to **Section 38 (1)**, an HIA is required to assess any potential impacts to palaeontological heritage within the development footprint where:

- the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length;
- the construction of a bridge or similar structure exceeding 50 m in length;
- any development or other activity which will change the character of a site—
- (exceeding 5 000 m^2 in extent; or
- involving three or more existing erven or subdivisions thereof; or
- involving three or more erven or divisions thereof which have been consolidated within the past five years; or

- the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority
- the re-zoning of a site exceeding 10 000 m² in extent;
- or any other category of development provided for in regulations by SAHRA or a Provincial heritage resources authority.

4 OBJECTIVE

The aim of a Palaeontological Impact Assessment (PIA) is to decrease the effect of the development on potential fossils at the development site.

According to the "SAHRA APM Guidelines: Minimum Standards for the Archaeological and Palaeontological Components of Impact Assessment Reports" the purpose of the PIA are: 1) to **identify** the palaeontological importance of the rock formations in the footprint; 2) to evaluate the palaeontological magnitude of the formations; 3) to determine the **impact** on fossil heritage; and 4) to **recommend** how the property developer should guard against and lessen damage to fossil heritage.

The terms of reference of a PIA are as follows:

General Requirements:

- Adherence to the content requirements for specialist reports in accordance with Appendix 6 of the EIA Regulations 2014, as amended.
- Adherence to all applicable best practice recommendations, appropriate legislation and authority requirements.
- Submit a comprehensive overview of all appropriate legislation, guidelines.
- Description of the proposed project and provide information regarding the developer and consultant who commissioned the study.
- Description and location of the proposed development and provide geological and topographical maps.
- Provide Palaeontological and geological history of the affected area.
- Identification sensitive areas to be avoided (providing shapefiles/kml's) in the proposed development.
- Evaluation of the significance of the planned development during the Pre-construction, Construction, Operation, Decommissioning Phases and Cumulative impacts. Potential impacts should be rated in terms of the direct, indirect and cumulative:
    a. **Direct impacts** are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity.

b. **Indirect impacts** of an activity are indirect or induced changes that may occur as a result of the activity.

c. Cumulative impacts result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities.

- Fair assessment of alternatives (infrastructure alternatives have been provided):
- Recommend mitigation measures to minimise the impact of the proposed development; and

Implications of specialist findings for the proposed development (such as permits, licenses etc).

5 GEOLOGICAL AND PALAEONTOLOGICAL HISTORY

The 2824 Kimberley Geological Map indicates that the proposed development footprint is covered by Late Cenozoic Superficial Sediments (Figure 3). According to the PalaeoMap of South African Heritage Resources Information System the Palaeontological Sensitivity of the Late Cenozoic Superficial Sediments is Low (Figure 4).

The Superficial deposits in the Douglas area consists of alluvial gravels, aeolan sands, calcretes of the Quaternary Gordonia Formation that overlies the older sediments. The Cenozoic Kalahari Group is the most widespread body of terrestrial sediments in southern Africa. The sands and calcretes of the Kalahari Group range in thickness from a few metres to more than 180m (Partridge et al., 2006). The pan sediments of the area originated from the Gordonia Formation and contains white to brown fine-grained silts, sands and clays. Some of the pans consist of clayey material mixed with evaporates that shows seasonal effects of shallow saline groundwaters.

The Gordonia dune sands are dated as Late Pliocene/Early Pleistocene to Recent times by the Middle to Later Stone Age stone tools recovered from them (Dingle et al, 1983). The boundary of the Pliocene-Pleistocene has been extended back from 1.8 Ma to 2.588 Ma placing the Gordonia Formation almost entirely within the Pleistocene Epoch.

The fossil assemblages of the Kalahari are generally low in diversity and occur over a wide range but has a high Paleontologically Sensitivity. These fossils represent terrestrial plants and animals with a close resemblance to living forms. Fossil assemblages include bivalves, diatoms, gastropod shells, ostracods and trace fossils. The palaeontology of the Quaternary superficial deposits has been relatively neglected in the past. Late Cenozoic calcrete may comprise of bones, horn corns as well as mammalian teeth. Tortoise remains have also been uncovered as well as trace fossils which includes termite and insect's burrows and mammalian trackways. Amphibian and crocodile skeletons have been uncovered where the depositional settings in the past were wetter.

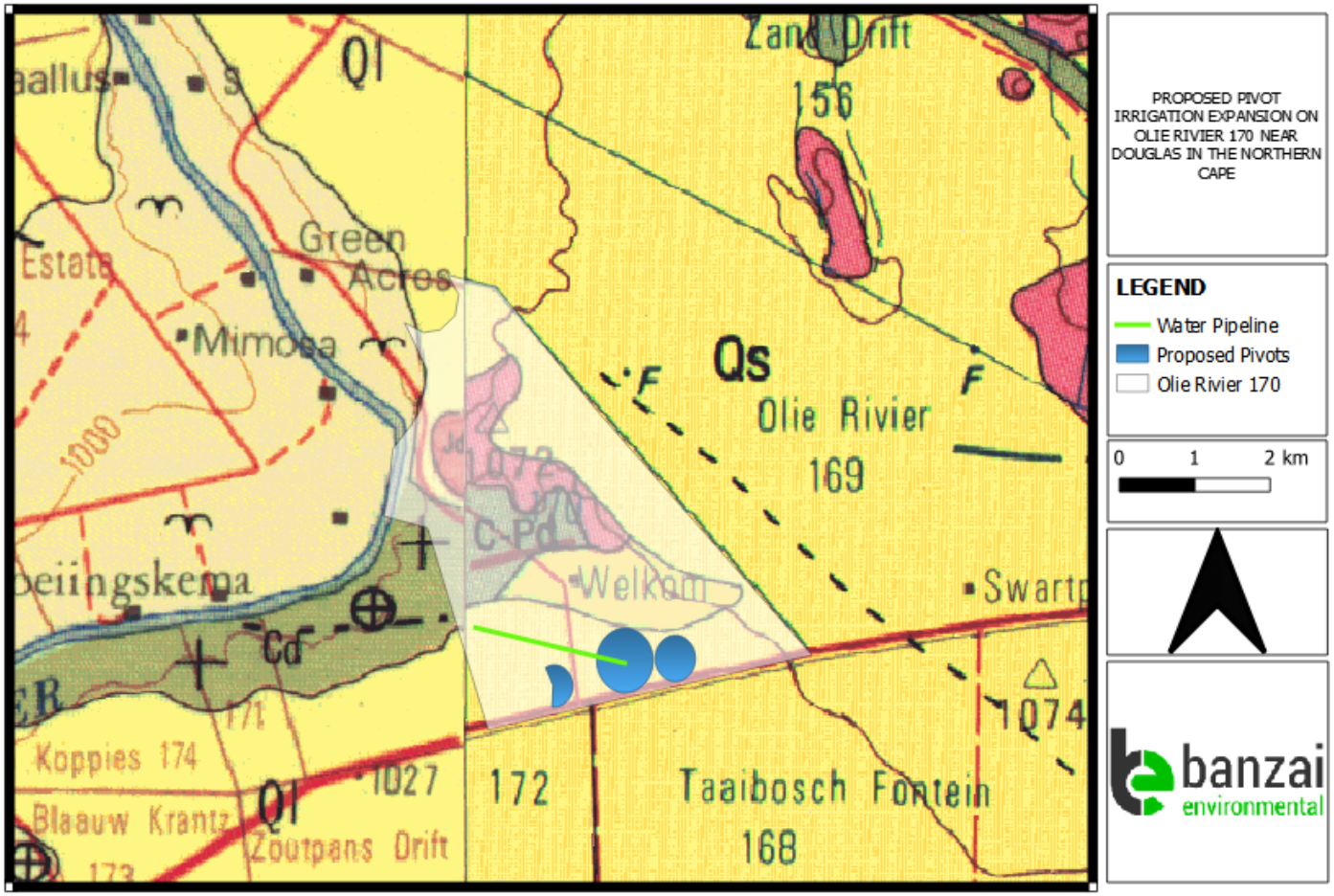

Figure 3: Extract of the 2824 Kimberley Geological Map (Council of Geoscience) indicating the surface geology of the proposed development.

Legend: Qs- Late Cenozoic Superficial Sediments -Sand; Qc- Quaternary Calcretes; Jd- Jurassic Dolerite-Igneous rocks; C-Pd-Dwyka Group, (Karoo Supergroup).

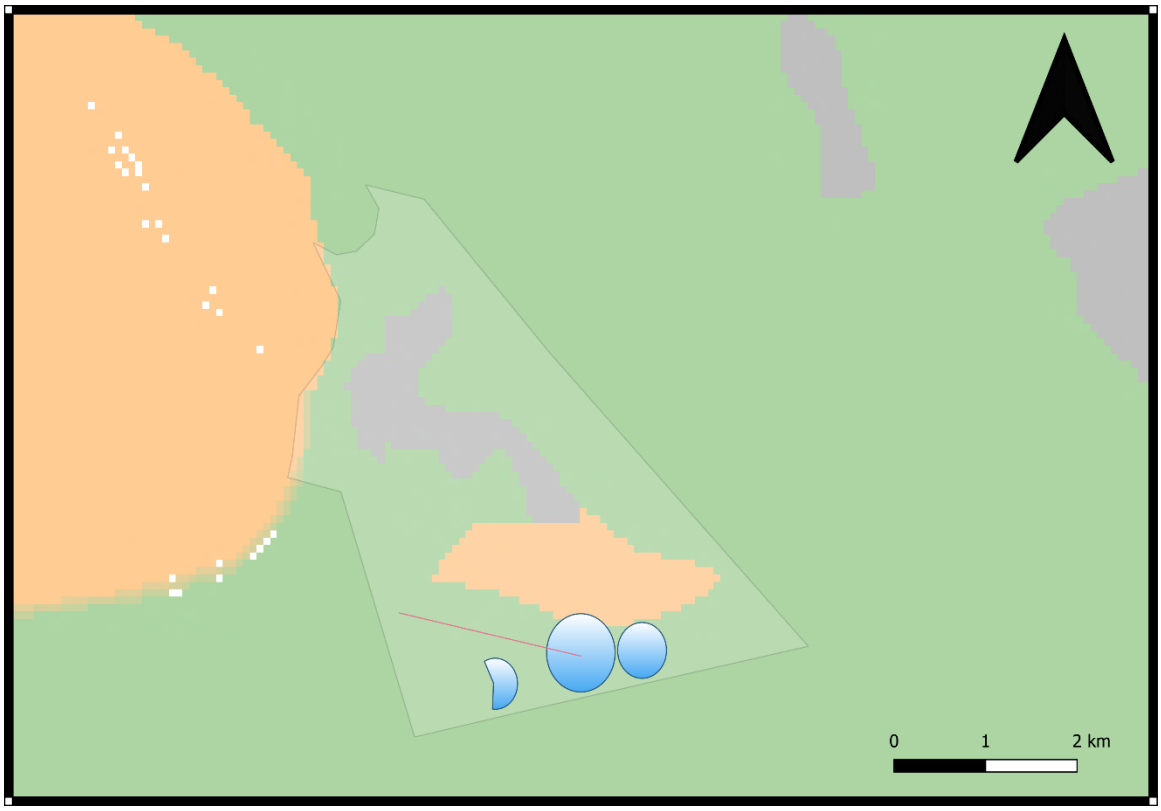

Figure 4: Extract of the 1 in 250 000 SAHRIS PalaeoMap map (Council of Geosciences) indicating the proposed development in graded colours.

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.

According to the SAHRIS Palaeo Sensitivity map (Figure 44) there is a moderate chance of finding fossils in the green area (the orange colour indicates high chance of finding fossils).

6 GEOGRAPHICAL LOCATION OF THE SITE

The proposed pivot irrigation is located on the farm Olie Rivier 170, approximately 30 km north-east of Douglas. The farm is accessible via the R357.

7 METHODS

The aim of a desktop study is to evaluate the risk to palaeontological heritage in the proposed development. This includes all trace fossils and fossils. All available information is consulted to compile a desktop study and includes: Palaeontological impact assessment reports in the same area; aerial photos and Google Earth images, topographical as well as geological maps.

7.1 Assumptions and Limitations

When conducting a PIA several factors can affect the accuracy of the assessment. The focal point of geological maps is the geology of the area and the sheet explanations were not meant to focus on palaeontological heritage. Many inaccessible regions of South Africa have not been reviewed by palaeontologists and data is generally based on aerial photographs. Locality and geological information of museums and universities databases have not been kept up to date or data collected in the past have not always been accurately documented.

Comparable Assemblage Zones in other areas is used to provide information on the existence of fossils in an area which was not yet been documented. When similar Assemblage Zones and geological formations for Desktop studies is used it is generally **assumed** that exposed fossil heritage is present within the footprint.

8 ADDITIONAL INFORMATION CONSULTED

In compiling this report the following sources were consulted:

- Geological map 1:100 000, Geology of the Republic of South Africa (Visser 1984)
- 1: 250 000 2824 Kimberley Geological Map (Council of Geoscience)
- A Google Earth map with polygons of the proposed development was obtained from PGS Consultants.

9 IMPACT ASSESSMENT METHODOLOGY

9.1 Introduction

The impact significance rating methodology, as provided by EIMS, is guided by the requirements of the NEMA EIA Regulations 2014 (as amended). The broad approach to the significance rating

methodology is to determine the environmental risk (ER) by considering the consequence (C) of each impact (comprising Nature, Extent, Duration, Magnitude, and Reversibility) and relate this to the probability/ likelihood (P) of the impact occurring. This determines the environmental risk. In addition, other factors, including cumulative impacts and potential for irreplaceable loss of resources, are used to determine a prioritisation factor (PF) which is applied to the ER to determine the overall significance (S). The impact assessment will be applied to all identified alternatives. Where possible, mitigation measures will be recommended for impacts identified.

Determination of environmental risk

The significance (S) of an impact is determined by applying a prioritisation factor (PF) to the environmental risk (ER). The environmental risk is dependent on the consequence (C) of the particular impact and the probability (P) of the impact occurring. Consequence is determined through the consideration of the Nature (N), Extent (E), Duration (D), Magnitude (M), and reversibility (R) applicable to the specific impact.

For the purpose of this methodology the consequence of the impact is represented by:

$$\boldsymbol{C = \frac{(E + D + M + R) * N}{4}}$$

Each individual aspect in the determination of the consequence is represented by a rating scale as defined Table below.

Table 3: Criteria for Determining Impact Consequence

Aspect	Score	Definition
Nature	- 1	Likely to result in a negative/ detrimental impact
	+1	Likely to result in a positive/ beneficial impact
Extent	1	Activity (i.e. limited to the area applicable to the specific activity)
	2	Site (i.e. within the development property boundary),
	3	Local (i.e. the area within 5 km of the site),
	4	Regional (i.e. extends between 5 and 50 km from the site
	5	Provincial / National (i.e. extends beyond 50 km from the site)
Duration	1	Immediate (<1 year)
	2	Short term (1-5 years),
	3	Medium term (6-15 years),

Aspect	Score	Definition
	4	Long term (the impact will cease after the operational life span of the project),
	5	Permanent (no mitigation measure of natural process will reduce the impact after construction).
Magnitude/ Intensity	1	Minor (where the impact affects the environment in such a way that natural, cultural and social functions and processes are not affected),
	2	Low (where the impact affects the environment in such a way that natural, cultural and social functions and processes are slightly affected),
	3	Moderate (where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way),
	4	High (where natural, cultural or social functions or processes are altered to the extent that it will temporarily cease), or
	5	Very high / don't know (where natural, cultural or social functions or processes are altered to the extent that it will permanently cease).
Reversibility	1	Impact is reversible without any time and cost.
	2	Impact is reversible without incurring significant time and cost.
	3	Impact is reversible only by incurring significant time and cost.
	4	Impact is reversible only by incurring prohibitively high time and cost.
	5	Irreversible Impact

Once the C has been determined the ER is determined in accordance with the standard risk assessment relationship by multiplying the C and the P. Probability is rated/ scored as per Table below.

Table 4: Probability Scoring

Probability	1	Improbable (the possibility of the impact materialising is very low as a result of design, historic experience, or implementation of adequate corrective actions; <25%),

	2	Low probability (there is a possibility that the impact will occur; >25% and <50%),
	3	Medium probability (the impact may occur; >50% and <75%),
	4	High probability (it is most likely that the impact will occur- > 75% probability), or
	5	Definite (the impact will occur),

The result is a qualitative representation of relative ER associated with the impact. ER is therefore calculated as follows:

ER= C x P

Table 5: Determination of Environmental Risk

Consequence	5	5	10	15	20	25
	4	4	8	12	16	20
	3	3	6	9	12	15
	2	2	4	6	8	10
	1	1	2	3	4	5
		1	2	3	4	5
	Probability					

The outcome of the environmental risk assessment will result in a range of scores, ranging from 1 through to 25. These ER scores are then grouped into respective classes as described in Table below.

Table 6: Significance Classes

Environmental Risk Score	
Value	Description
< 9	Low (i.e. where this impact is unlikely to be a significant environmental risk).
≥9 - <17	Medium (i.e. where the impact could have a significant environmental risk),
≥17	High (i.e. where the impact will have a significant environmental risk).

The impact ER will be determined for each impact without relevant management and mitigation measures (pre-mitigation), as well as post implementation of relevant management and mitigation measures (post-mitigation). This allows for a prediction in the degree to which the impact can be managed/mitigated.

Impact Prioritisation

Further to the assessment criteria presented in the section above, it is necessary to assess each potentially significant impact in terms of:

1. Cumulative impacts; and
2. The degree to which the impact may cause irreplaceable loss of resources.

To ensure that these factors are considered, an impact prioritisation factor (PF) will be applied to each impact ER (post-mitigation). This prioritisation factor does not aim to detract from the risk ratings but rather to focus the attention of the decision-making authority on the higher priority/significance issues and impacts. The PF will be applied to the ER score based on the assumption that relevant suggested management/mitigation impacts are implemented.

Table 7: Criteria for Determining Prioritisation

Cumulative Impact (CI)	Low (1)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.
	Medium (2)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.
	High (3)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/ definite that the impact will result in spatial and temporal cumulative change.
Irreplaceable Loss of Resources (LR)	Low (1)	Where the impact is unlikely to result in irreplaceable loss of resources.
	Medium (2)	Where the impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.
	High (3)	Where the impact may result in the irreplaceable loss of resources of high value (services and/or functions).

The value for the final impact priority is represented as a single consolidated priority, determined as the sum of each individual criteria represented in Table 7. The impact priority is therefore determined as follows:

Priority = CI + LR

The result is a priority score which ranges from 3 to 9 and a consequent PF ranging from 1 to 2 (Refer to Table below.)

Table 8: Determination of Prioritisation Factor

Priority	Ranking	Prioritisation Factor
2	Low	**1**
3	Medium	**1.125**
4	Medium	**1.25**
5	Medium	**1.375**
6	High	**1.5**

In order to determine the final impact significance, the PF is multiplied by the ER of the post mitigation scoring. The ultimate aim of the PF is an attempt to increase the post mitigation environmental risk rating by a full ranking class, if all the priority attributes are high (i.e. if an impact comes out with a medium environmental risk after the conventional impact rating, but there is significant cumulative impact potential and significant potential for irreplaceable loss of resources, then the net result would be to upscale the impact to a high significance).

Table 9: Final Environmental Significance Rating

Environmental Significance Rating	
Value	Description
≤ -20	High negative (i.e. where the impact must have an influence on the decision process to develop in the area).
> -20 ≤ -10	Medium negative (i.e. where the impact could influence the decision to develop in the area).
> -10	Low negative (i.e. where this impact would not have a direct influence on the decision to develop in the area).
0	No impact
<10	Low positive (i.e. where this impact would not have a direct influence on the decision to develop in the area).

Environmental Significance Rating	
≥ 10 < 20	Medium positive (i.e. where the impact could influence the decision to develop in the area).
≥ 20	High positive (i.e. where the impact must have an influence on the decision process to develop in the area).

The significance ratings and additional considerations applied to each impact will be used to provide a quantitative comparative assessment of the alternatives being considered. In addition, professional expertise and opinion of the specialists and the environmental consultants will be applied to provide a qualitative comparison of the alternatives under consideration. This process will identify the best alternative for the proposed project.

9.2 Planning Phase Impacts

No Impacts will occur during the Planning Phase

9.3 Construction Phase Impacts

9.3.1 Impact 1

- *The impact*
  Destroy fossil heritage or permanently seal-in fossils at or below the ground surface. These fossils will then be unavailable for research.
- *Activities that can potentially contribute to the impact*
  The site clearance and excavations of the development will include diggings into the sediment cover. The excavations will change the topography of the development site. According to the Geology of the project site there is a moderate possibility of finding fossils.

9.4 Mitigation measures

Chance find Protocol

9.5 Cumulative impacts

The proposed pivot irrigation expansion is mantled by Late Caenozoic Superficial Sediments. According to the South African Heritage Resources Information System, the Palaeontological Sensitivity of the Late Caenozoic Superficial Sediments is low but locally high.

9.6 Irreplaceable loss of Resources

Impacts on fossil heritage are irreversible. Scientifically, all well-documented reports of fossils uncovered during construction would be a positive impact. A negative impact can be limited by the application of adequate mitigation measures. If mitigation is properly undertaken the project will fall within the beneficial category.

9.7 Operational Phase Impacts

No Impacts will occur during the Operational Phase

9.8 Decommissioning Phase Impacts

No Impacts will occur during the Decommissioning Phase

9.9 Rehabilitation and Closure Phase Impacts

No Impacts will occur during the Rehabilitation and Closure phases

9.10 SUMMARY OF IMPACT TABLES

9.11 Summary of Impact Tables

The proposed pivot irrigation expansion is mantled by Late Caenozoic Superficial Sediments. According to the South African Heritage Resources Information System, the Palaeontological Sensitivity of the Late Caenozoic Superficial Sediments is low but locally high. It is therefore considered that the extension of the pivot irrigation on Olie Rivier 170 farm is deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological resources of the area. Thus, the construction and operation of the facility may be authorised as the whole extent of the development footprint is not considered sensitive in terms of palaeontological resources.

Only the site will be affected by the proposed development. The expected duration of the impact is assessed as potentially permanent to long term. The impact is highly destructive, although **the possibility of the impact occurring is probable**. The significance of the impact occurring will be LOW. As fossil heritage will be destroyed the impact is irreversible but the degree to which the impact can cause irreplaceable loss of resources is low. **The cumulative impact will be low because the area is not highly fossiliferous and thus the impacts on fossil heritage in the area will be low**.

10 FINDINGS AND RECOMMENDATIONS

The proposed pivot irrigation expansion is mantled by Late Caenozoic Superficial Sediments. According to the South African Heritage Resources Information System, the Palaeontological Sensitivity of the Late Caenozoic Superficial Sediments is low but locally high. It is therefore considered that the extension of the pivot irrigation on Olie Rivier 170 farm is deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological resources of the area. Thus, the construction and operation of the facility may be authorised as the whole extent of the development footprint is not considered sensitive in terms of palaeontological resources.

It is consequently recommended that no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required pending the discovery of newly discovered fossils. If fossil remains are discovered during any phase of construction, either on the surface or exposed by excavations the **Chance Find Protocol** must be implemented by the Environmental Control Officer (ECO) in charge of these developments. These discoveries ought to be protected (if possible, *in situ*) and the ECO must report to SAHRA (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za) so that correct mitigation (recording and collection) can be carry out by a paleontologist.

11 CHANCE FINDS PROTOCOL

A following procedure will only be followed if fossils are uncovered during excavation.

11.1 Legislation

Cultural Heritage in South Africa (includes all heritage resources) is protected by the **National Heritage Resources Act (Act 25 of 1999) (NHRA).** According to Section 3 of the Act, all Heritage resources include **"all objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens**".

Palaeontological heritage is unique and non-renewable and is protected by the NHRA and are the property of the State. It is thus the responsibility of the State to manage and conserve fossils on behalf of the citizens of South Africa. Palaeontological resources may not be excavated, broken, moved, or destroyed by any development without prior assessment and without a permit from the relevant heritage resources authority as per section 35 of the NHRA.

11.2 Background

A fossil is the naturally preserved remains (or traces) of plants or animals embedded in rock. These plants and animals lived in the geologic past millions of years ago. Fossils are extremely rare and irreplaceable. By studying fossils, it is possible to determine the environmental conditions that existed in a specific geographical area millions of years ago.

11.3 Introduction

This informational document is intended for workmen and foremen on construction sites. It describes the actions to be taken when mining or construction activities accidentally uncovers fossil material.

It is the responsibility of the Environmental Site Officer (ESO) or site manager of the project to train the workmen and foremen in the procedure to follow when a fossil is accidentally uncovered. In the absence of the ESO, a member of the staff must be appointed to be responsible for the proper implementation of the chance find protocol as not to compromise the conservation of fossil material.

11.4 Chance Find Procedure

- If a chance find is made the person responsible for the find must immediately **stop working** and all work that could impact that finding must cease in the immediate vicinity of the find.
- The person who made the find must immediately **report** the find to his/her direct supervisor which in turn must report the find to his/her manager and the ESO or site manager. The ESO or site manager must report the find to the relevant Heritage Agency (South African Heritage Research Agency, SAHRA). (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za). The information to the Heritage Agency must include photographs of the find, from various angles, as well as the GPS co-ordinates.
- A preliminary report must be submitted to the Heritage Agency within **24 hours** of the find and must include the following: 1) date of the find; 2) a description of the discovery and a 3) description of the fossil and its context (depth and position of the fossil), GPS co-ordinates.
- Photographs (the more the better) of the discovery must be of high quality, in focus, accompanied by a scale. It is also important to have photographs of the vertical section (side) where the fossil was found.

Upon receipt of the preliminary report, the Heritage Agency will inform the ESO (or site manager) whether a rescue excavation or rescue collection by a palaeontologist is necessary.

- The site must be secured to protect it from any further damage. **No attempt** should be made to remove material from their environment. The exposed finds must be stabilized and covered by a plastic sheet or sand bags. The Heritage agency will also be able to advise on the most suitable method of protection of the find.
- In the event that the fossil cannot be stabilized the fossil may be collected with extreme care by the ESO (site manager). Fossils finds must be stored in tissue paper and in an appropriate box while due care must be taken to remove all fossil material from the rescue site.
- Once Heritage Agency has issued the written authorization, the developer may continue with the development on the affected area.

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APPENDIX A – ELIZE BUTLER CV

ELIZE BUTLER

PROFESSION:	Palaeontologist
YEARS' EXPERIENCE:	26 years in Palaeontology

EDUCATION:	B.Sc Botany and Zoology, 1988 University of the Orange Free State
	B.Sc (Hons) Zoology, 1991 University of the Orange Free State
	Management Course, 1991 University of the Orange Free State
	M. Sc. *Cum laude* (Zoology), 2009 University of the Free State

Dissertation title: The postcranial skeleton of the Early Triassic non-mammalian Cynodont *Galesaurus planiceps*: implications for biology and lifestyle

MEMBERSHIP

Palaeontological Society of South Africa (PSSA)	2006-currently

EMPLOYMENT HISTORY

Part time Laboratory assistant	Department of Zoology & Entomology University of the Free State Zoology 1989-1992
Part time laboratory assistant	Department of Virology University of the Free State Zoology 1992
Research Assistant	National Museum, Bloemfontein 1993 – 1997
Principal Research Assistant and Collection Manager	National Museum, Bloemfontein 1998–currently

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