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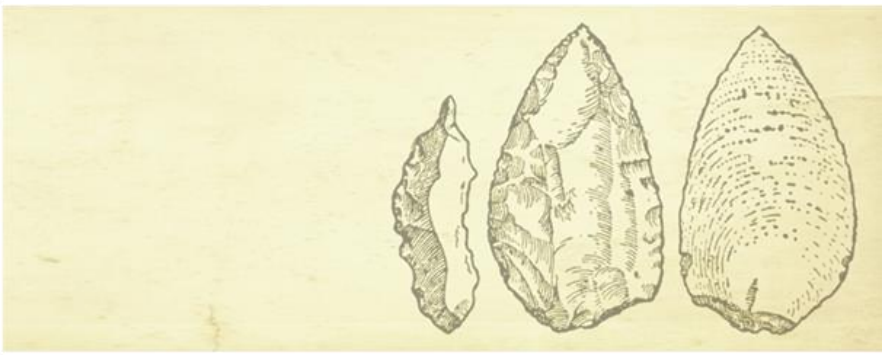

PHASE 1 HIA EV SOLAR CHARGING, AKKERBOOM FARM STALL, N14, FRIER'S DALE, NORTHERN CAPE

PHASE 1 HERITAGE IMPACT ASSESSMENT FOR THE THE PROPOSED ESTABLISHMENT OF AN ELECTRIC VEHICLE CHARGING FACILITY, SOLAR PV PLANT AND ASSOCIATED INFRASTRUCTURE AT AKKERBOOM FARM STALL ALONG THE N14, BETWEEN KAKAMAS AND KEIMOES, ON THE FARM FRIER'S DALE 466, PORTIONS 19 AND 47 KAI !GARIB LOCAL MUNICIPALITY, ZF MGCAWU DISTRICT MUNICIPALITY, NORTHERN CAPE PROVINCE

PREPARED FOR:

ENVIROAFRICA CC

PREPARED BY:

HEIDI FIVAZ & JAN ENGELBRECHT

ELIZE BUTLER & SKY-LEE FAIRHURST-BOOYSE

UBIQUE HERITAGE CONSULTANTS

18 NOVEMBER 2024

REVISED

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Declaration of Independence:

UBIQUE Heritage Consultants hereby, as the appointed independent specialists, declare that:

- We act as independent specialists in this application;
- We 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;
- We regard the information contained in this report as it relates to our specialist input/study to be accurate and correct, and 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 NEMA, the Environmental Impact Assessment Regulations, 2014 (as amended) and any specific Environmental Management Act;
- We declare that there are no circumstances that may compromise my objectivity in performing such work;
- We have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- We will comply with the Act, Regulations and all other applicable legislation;
- We have no, and will not engage in, conflicting interests in the undertaking of the activity;
- We have no vested interest in the proposed activity proceeding;
- We 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;
- We have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- We have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- All the particulars furnished by me in this specialist input/study are true and correct, and
- We realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signed: **Date: 2024-11-18**
J.A.C. Engelbrecht, H. Fivaz & S. Fairhurst-Booyse
UBIQUE Heritage Consultants

SUMMARY OF SPECIALIST EXPERTISE

HEIDI FIVAZ

CRM ARCHAEOLOGIST & OBJECT CONSERVATOR

Heidi Fivaz has been a part of UBIQUE Heritage Consultants since 2016. She holds a B.Tech. Fine Arts degree (2000) from the Tshwane University of Technology, a BA in Culture and Arts Historical Studies degree (2012) from UNISA and received her BA (Hons) in Archaeology in 2015 (UNISA). She has received extensive training in object conservation from the South African Institute of Object Conservation and specialises in glass and ceramics conservation. Ms Fivaz was awarded her MA in Archaeology (with distinction) in 2021 by the University of South Africa (UNISA), focusing on historical and industrial archaeology. She is a professional member of the Association of South African Archaeologists and has worked on numerous archaeological excavation and surveying projects over the past thirteen years. Ms Fivaz is an accredited CRM Field Director.

JAN ENGELBRECHT

CRM ARCHAEOLOGIST

Jan Engelbrecht is accredited by the Cultural Resources Management section of the Association of Southern African Professional Archaeologists (ASAPA) to undertake Phase 1 AIAs and HIAs in South Africa. He is also a member of the Association for Professional Archaeologists (ASAPA). Mr Engelbrecht holds an honours degree in archaeology (specialising in the history of early farmers in southern Africa (Iron Age) and the Colonial period) from the University of South Africa. He has over 12 years of experience in heritage management. Mr Engelbrecht established Ubique Heritage Consultants in 2012. He is currently studying for his MA Degree in Archaeology.

SKY-LEE FAIRHURST-BOOYSE

ARCHAEOLOGIST & ARCHAEOLOGICAL ILLUSTRATOR

Sky-Lee Fairhurst-Booyse has been part of UBIQUE Heritage Consultants since 2019 and became a director in 2023. Mrs Fairhurst-Booyse obtained her BA in Archaeology and Biblical archaeology in 2016 and her BA Hons in Archaeology (cum laude) at the University of South Africa (UNISA) in 2018, focussing on research themes of gender, households and Late Iron Age settlements. She successfully attained her MA in Archaeology from UNISA in 2023. She is skilled at artefacts and archaeological illustrations. Over the past ten years, she has obtained considerable excavation and survey experience and worked on various sites, including Historical, Iron Age, and Palaeontological sites.

ELIZE BUTLER

PALAEONTOLOGIST

Elize Butler has conducted approximately 300 palaeontological impact assessments for developments in the Free State, KwaZulu-Natal, Eastern, Central, Northern Cape, Northwest, Gauteng, Limpopo, and Mpumalanga. She has an MSc in Zoology (*cum laude*) (specialising in Palaeontology) from the University of the Free State, South Africa. Mrs Butler has been working in Palaeontology for more than 29 years. She has experience in locating, collecting and curating fossils. She has been a member of the Palaeontological Society of South Africa (PSSA) since 2006 and has conducted PIAs since 2014.

EXECUTIVE SUMMARY

Project description

UBIQUE Heritage Consultants were appointed by EnviroAfrica cc as independent heritage specialists in accordance with Section 38 of the NHRA and the National Environmental Management Act 107 of 1998 (NEMA) to conduct a cultural heritage assessment to determine the impact of the proposed zero carbon EV solar charging station by ZCC along the N14, Frier's Dale, Kai !Garib Local Municipality, ZF Mgcawu District Municipality, Northern Cape Province, on any sites, features, or objects of cultural heritage significance.

Findings and Impact on Heritage Resources

UBIQUE Heritage Consultants assessed the development footprint on the **24th of August, 2023.** Only seven isolated, low-density occurrences of lithic material were recorded. The finds include late-MSA/early LSA scrapers, flakes and chunks made from Banded Ironstone Formation (BIF). The lithic material shows various degrees of weathering and is without substantial archaeological context or matrix. Therefore, it is deemed minor scientific importance and not conservation-worthy (NCW).

The Keimoes Suite (Namaqua-Natal Metamorphic Province) underlies the study area. According to the PalaeoMap on the South African Heritage Resources Information System (SAHRIS) database, the Palaeontological Sensitivity of the Keimoes Suite is Zero as it is igneous in origin and thus unfossiliferous (Almond et al., 2013; SAHRIS website). The National Environmental Web-based Screening Tool indicates that the development has a Medium Palaeontological Sensitivity. A low Palaeontological Significance has thus been allocated to the proposed development.

Recommendations

Based on the assessment of the potential impact of the development on the identified heritage, the following recommendations are made, taking into consideration any existing or potential sustainable social and economic benefits:

1. The MSA/LSA lithic occurrence within the development footprint is of low significance and is not conservation-worthy, and the impact of the development is negligible. Therefore, no further mitigation is recommended.

2. A low Palaeontological Significance has thus been allocated to the proposed development. It is therefore recommended that no further palaeontological heritage

studies, ground truthing, or specialist mitigation be required pending the discovery of newly discovered fossils. It is considered that the proposed development will not have detrimental impacts on the area's palaeontological resources. (Butler, 2023).

3. Although all possible care has been taken to identify sites of cultural importance during the investigation of study areas, it is always possible that hidden or sub-surface sites could be overlooked during the assessment. If during construction, any evidence of archaeological sites or remains (e.g. remnants of stone-made structures, indigenous ceramics, bones, stone artefacts, ostrich eggshell fragments, charcoal and ash concentrations), fossils or other categories of heritage resources are found during the proposed development, SAHRA APM Unit must be alerted as per section 35(3) of the NHRA. If unmarked human burials are uncovered, the SAHRA Burial Grounds and Graves (BGG) Unit must be alerted immediately as per section 36(6) of the NHRA. Depending on the nature of the finds, a professional archaeologist or palaeontologist must be contacted as soon as possible to inspect the findings. If the newly discovered heritage resources are of archaeological or palaeontological significance, a Phase 2 rescue operation may be required, subject to permits issued by SAHRA. UBIQUE Heritage Consultants and its personnel will not be held liable for such oversights or costs incurred due to such oversights.

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ABBREVIATIONS

AIA:	Archaeological Impact Assessment
ASAPA:	Association of South African Professional Archaeologists
CRM:	Cultural Resource Management
EIA:	Early Iron Age
EMP:	Environmental Management Plan
ESA:	Earlier Stone Age
GPS:	Global Positioning System
HIA:	Heritage Impact Assessment
HWC:	Heritage Western Cape
IA:	Iron Age
IMP:	Integrated Management Plan
LSA:	Later Stone Age
MIA:	Middle Iron Age
MSA:	Middle Stone Age
NBKB:	Ngwao-Boswa Jwa Kapa Bokone (Northern Cape PHRA)
NHRA:	National Heritage Resources Act
PHRA:	Provincial Heritage Resource Agency
SADC:	Southern African Development Community
SAHRA:	South African Heritage Resources Agency
SAHRIS:	South African Heritage Resources Information System

GLOSSARY

Archaeological:	Material remains resulting from human activity in a state of disuse, older than 100 years, including artefacts, human and hominid remains and artificial features and structures.
Historic building:	Structures 60 years and older.
Heritage:	That which is inherited and forms part of the National Estate (historic places, objects, fossils as defined by the National Heritage Resources Act 25 of 1999).
Heritage resources:	Valuable, finite, non-renewable and irreplaceable resources that provide evidence of the origins of South African society

Mitigation:	Anticipating and preventing adverse impacts and risks, then to minimise them, rehabilitate or repair impacts to the extent feasible.
'Public monuments:	All monuments and memorials, erected on land belonging to any branch of central, provincial or local government, or on land belonging to any organisation funded by or established in terms of the legislation of such a branch of government; or – which were paid for by public subscription, government funds, or a public-spirited or military organisation and are on land belonging to any private individual.
'Structures':	Any building, works, device or other facility made by people, and which are fixed to land, and include any fixtures, fittings and equipment associated therewith.

1. INTRODUCTION

1.1 Scope of study

The project involves the proposed establishment of an Electric Vehicle Charging Facility, Solar PV plant and associated infrastructure at Akkerboom Farm Stall along the N14, between Kakamas and Keimoes, on Farm Frier's Dale 466, Portions 19 and 47, Kai !Garib Local Municipality, ZF Mgcawu District Municipality, Northern Cape Province. UBIQUE Heritage Consultants were appointed by EnviroAfrica cc as independent heritage specialists in accordance with the National Environmental Management Act 107 of 1998 (NEMA) and in compliance with Section 38 of the National Heritage Resources Act 25 of 1999 (NHRA) to conduct a cultural heritage assessment (AIA/HIA) of the development area.

The assessment aims to identify and report any heritage resources that may fall within the development footprint; to determine the impact of the proposed development on any sites, features, or objects of cultural heritage significance; to assess the significance of any identified resources; and to assist the developer in managing the documented heritage resources in an accountable manner, within the framework provided by the National Heritage Resources Act (Act 25 of 1999) (NHRA).

South Africa's heritage resources are rich and widely diverse, encompassing sites from all periods of human history. Resources such as buildings and archaeological artefacts may be tangible or intangible, such as landscapes and living heritage. Their significance is based on their aesthetic, architectural, historical, scientific, social, spiritual, linguistic, economic or technological values; their representation of a time or group; their rarity; and their sphere of influence.

Natural (e.g. erosion) and human (e.g. development) activities can jeopardise the integrity and significance of heritage resources. In the case of human activities, a range of legislation exists to ensure the timely and accurate identification and effective management of heritage resources for present and future generations.

The result of this investigation is presented within this heritage impact assessment report. It comprises the recording of heritage resources present/ absent and offers recommendations for managing these resources within the context of the proposed development.

Depending on SAHRA's acceptance of this report, the developer will receive permission to proceed with the proposed development, considering any proposed mitigation measures.

1.2 Assumptions and limitations

It is assumed that the description of the proposed project, as provided by the client, is accurate. Furthermore, it is assumed that the public consultation process undertaken as part of the Environmental Impact Assessment (EIA) is comprehensive and does not have to be repeated as part of the heritage impact assessment.

The significance of the sites, structures, and artefacts is determined by their historical, social, aesthetic, technological, and scientific value in relation to their uniqueness, condition of preservation, and research potential. The various aspects are not mutually exclusive, and any site is evaluated with reference to any number of these aspects. Cultural significance is site-specific and relates to the content and context of the site.

The comprehensive field survey and intensive desktop study have taken all possible care to identify sites of cultural importance within the development areas. However, it is essential to note that some heritage sites may have been missed due to their subterranean nature or dense vegetation cover. No subsurface investigation (i.e. excavations or sampling) was undertaken since a SAHRA permit is required for such activities. Therefore, should any heritage features and/or objects such as architectural features, stone tool scatters, artefacts, human remains, or fossils, be uncovered or observed during construction, operations must be stopped, and a qualified archaeologist must be contacted to assess the find. Observed or located heritage features and/or objects may not be disturbed or removed until the heritage specialist can assess the significance of the site (or material) in question.

2. TERMS OF REFERENCE

2.1 Statutory Requirements

2.1.1 General

The principle is that the environment should be protected for present and future generations by preventing pollution, promoting conservation and practising ecologically sustainable development. With regard to spatial planning and related legislation at national and provincial levels, the following legislation may be relevant:

- Physical Planning Act 125 of 1991
- Municipal Structures Act 117 of 1998
- Municipal Systems Act 32 of 2000
- Development Facilitation Act 67 of 1995 (DFA)

The identification, evaluation and management of heritage resources in South Africa are required and governed by the following legislation:

- National Environmental Management Act 107 of 1998 (NEMA)
- KwaZulu-Natal Heritage Act 4 of 2008 (KZNHA)
- National Heritage Resources Act 25 of 1999 (NHRA)
- Minerals and Petroleum Resources Development Act 28 of 2002 (MPRDA)

2.1.2 National Heritage Resources Act 25 of 1999

The NHRA established the South African Heritage Resources Agency (SAHRA) together with its Council to fulfil the following functions:

- coordinate and promote the management of heritage resources at the national level;
- set norms and maintain essential national standards for the management of heritage resources in the Republic and to protect heritage resources of national significance;
- control the export of nationally significant heritage objects and the import into the Republic of cultural property illegally exported from foreign countries;
- enable the provinces to establish heritage authorities which must adopt powers to protect and manage certain categories of heritage resources; and
- provide for local authorities' protection and management of conservation-worthy places and areas.

2.1.3 Heritage Impact Assessments/Archaeological Impact Assessments

Section 38(1) of the NHRA of 1999 requires **the responsible heritage resources authority to notify the person who intends to undertake a development that fulfils the following criteria to submit an impact assessment report if there is reason to believe that heritage resources will be affected by such event**:

- the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;
- the construction of a bridge or similar structure exceeding 50m in length;
- any development or other activity that will change the character of a site—
    - exceeding 5000m² 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 rezoning of a site exceeding 10 000m² in extent; or
- any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority.

2.1.5 Management of Graves and Burial Grounds

- **Graves younger than 60 years** are protected in terms of Section 2(1) of the Removal of Graves and Dead Bodies Ordinance 7 of 1925 as well as the Human Tissues Act 65 of 1983.

- **Graves older than 60 years, situated outside a formal cemetery administered by a local Authority are** protected in terms of Section 36 of the NHRA as well as the Human Tissues Act of 1983. Accordingly, such graves are the jurisdiction of SAHRA. The procedure for Consultation Regarding Burial Grounds and Graves (Section 36(5) of NHRA) is applicable to graves older than 60 years that are situated outside a formal cemetery administrated by a local authority. Graves in the category located inside a formal cemetery administrated by a local authority will also require the same authorisation as set out for graves younger than 60 years over and above SAHRA authorisation.

The **protocol for the management of graves older than 60 years situated outside a formal cemetery administered by a local authority** is detailed in Section 36 of the NHRA:

> (3) *(a)* No person may, without a permit issued by SAHRA or a provincial heritage resources authority—
>
> *(a)* destroy, damage, alter, exhume or remove from its original position or otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves;
>
> *(b)* destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority; or
>
> *(c)* bring onto or use at a burial ground or grave referred to in paragraph *(a)* or *(b)* any excavation equipment, or any equipment which assists in the detection or recovery of metals.
>
> (4) SAHRA or a provincial heritage resources authority may not issue a permit for the destruction or damage of any burial ground or grave referred to in subsection (3)*(a)* unless it is satisfied that the applicant has made satisfactory arrangements for the exhumation

and re-interment of the contents of such graves, at the cost of the applicant and in accordance with any regulations made by the responsible heritage resources authority.

(5) SAHRA or a provincial heritage resources authority may not issue a permit for any activity under subsection (3)*(b)* unless it is satisfied that the applicant has, in accordance with regulations made by the responsible heritage resources authority—

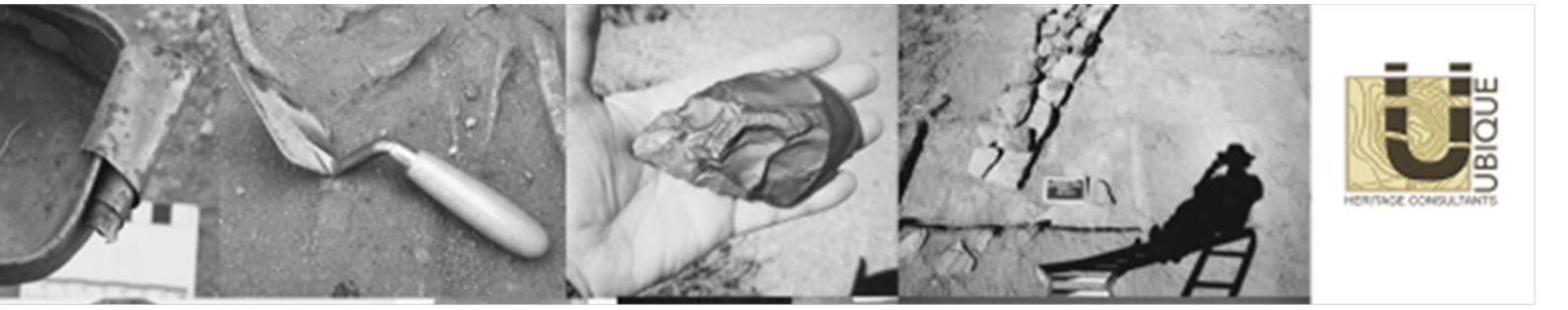
(a) made a concerted effort to contact and consult communities and individuals who by tradition have an interest in such grave or burial ground; and

(b) reached agreements with such communities and individuals regarding the future of such grave or burial ground.

(6) Subject to the provision of any other law, any person who in the course of development or any other activity discovers the location of a grave, the existence of which was previously unknown, must immediately cease such activity and report the discovery to the responsible heritage resources authority which must, in cooperation with the South African Police Service and in accordance with regulations of the responsible heritage resources authority—

(a) carry out an investigation for the purpose of obtaining information on whether or not such grave is protected in terms of this Act or is of significance to any community; and

(b) if such grave is protected or is of significance, assist any person who or community which is a direct descendant to make arrangements for the exhumation and re-interment of the contents of such grave or, in the absence of such person or community, make any such arrangements as it deems fit.



3. STUDY APPROACH AND METHODOLOGY

3.1 Desktop study

The first step in the methodology was to conduct a desktop study of the heritage background of the area and the proposed development site. This entailed scoping and scanning historical texts/records, previous heritage studies, and research around the study area.

The study area is contextualised by incorporating data from previous CRM reports in the area and an archival search. The objective is to extract data and information on the area in question, looking at archaeological sites, historical sites and graves.

No archaeological site data was available for the project area. A concise account of the archaeology and history of the broader study area was compiled (sources listed in the bibliography).

3.1.1 Literature review

A literature survey was undertaken to obtain background information regarding the area. Through researching the SAHRA APM Report Mapping Project records and the SAHRIS online database (http://www.sahra.org.za/sahris), it was determined that several other archaeological or historical studies had been performed within the broader vicinity of the study area. Sources consulted in this regard are indicated in the bibliography.

3.2 Field study

Phase 1 (AIA/HIA) requires the completion of a field study to establish and ensure the following:

3.2.1 Systematic survey

A systematic survey of the proposed project area was completed to locate, identify, record, photograph, and describe archaeological, historical or cultural interest sites.

UBIQUE Heritage Consultants inspected the proposed development and surrounding areas on the **24th of August, 2023** and completed a controlled-exclusive, pre-planned pedestrian and vehicular survey. We inspected the ground's surface, wherever the surface was visible. This was done with no substantial attempt to clear brush, sand, deadfall, leaves or other material that may cover the surface. In addition, cut banks and other exposures were fortuitously observed without looking beneath the surface beyond inspecting rodent burrows.

The survey was tracked with a handheld Garmin global positioning unit (Garmin eTrex 10).

3.2.2 Recording significant areas

GPS points of identified significant areas were recorded with a handheld Garmin global positioning unit (Garmin eTrex 10). Photographs were taken with a Canon IXUS 185 20-megapixel camera. Detailed field notes were taken to describe observations. The layout of the area and plotted GPS points, tracks and coordinates were transferred to Google Earth, and QGIS and maps were created.

3.2.3 Definitions of heritage resources

The NHRA defines a heritage resource as any place or object of cultural significance, i.e., aesthetic, architectural, historical, scientific, social, spiritual, linguistic, or technological value or significance. These include, but are not limited to, the following wide range of places and objects:

- living heritage as defined in the National Heritage Council Act No 11 of 1999 (cultural tradition; oral history; performance; ritual; popular memory; skills and techniques; indigenous knowledge systems; and the holistic approach to nature, society and social relationships);
- Ecofacts (non-artefactual organic or environmental remains that may reveal aspects of past human activity; definition used in KwaZulu-Natal Heritage Act 2008);
- places, buildings, structures and equipment;
- places to which oral traditions are attached or which are associated with living heritage;
- historical settlements and townscapes;
- landscapes and natural features;
- geological sites of scientific or cultural importance;
- archaeological and palaeontological sites;
- graves and burial grounds;
- public monuments and memorials;
- sites of significance relating to the history of slavery in South Africa;
- movable objects, but excluding any object made by a living person; and
- battlefields.

3.3 Determining significance

Heritage resources are considered of value if the following criteria apply:

a.	It is important in the community or pattern of South Africa's history;
b.	It has uncommon, rare or endangered aspects of South Africa's natural or cultural heritage;
c.	It has the potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage;

d.	It is vital in demonstrating the principal characteristics of a particular class of South Africa's natural or cultural places or objects;
e.	It exhibits particular aesthetic characteristics valued by a community or cultural group;
f.	It is essential in demonstrating a high degree of creative or technical achievement at a particular period;
g.	It has a strong or unique association with a particular community or cultural group for social, cultural or spiritual reasons;
h.	It has a strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa;
i.	It is of significance relating to the history of slavery in South Africa.

Levels of significance of the various types of heritage resources observed and recorded are determined by the following criteria:

CULTURAL & HERITAGE SIGNIFICANCE	
LOW	A cultural object found out of context, not part of a site or without any related feature/structure in its surroundings.
MEDIUM	Any site, structure or feature is regarded as less important due to several factors, such as date, frequency and uniqueness. Likewise, any important object found out of context.
HIGH	Any site, structure or feature is regarded as important because of its age or uniqueness. Graves are always categorised as of a high importance. Likewise, any important object found within a specific context.

Field Ratings or Gradings are assigned to indicate the level of protection required and who is responsible for national, provincial, or local protection.

FIELD RATINGS & GRADINGS	
National Grade I	Heritage resources with exceptional qualities to the extent that they are of national significance and should therefore be managed as part of the national estate.
Provincial Grade II	Heritage resources with qualities provincial or regional importance, although it may form part of the national estate, it should be managed as part of the provincial estate.
Local Grade IIIA	Heritage resources are of local importance and worthy of conservation. Therefore, it should be included in the heritage register and not be mitigated (high significance).
Local Grade IIIB	

FIELD RATINGS & GRADINGS	
	Heritage resources are of local importance and worthy of conservation. Therefore, it should be included in the heritage register and mitigated (high/ medium significance).
General Protection Grade IVA	The site/resource should be mitigated before destruction (high/ medium significance).
General protection Grade IVB	The site/resource should be recorded before destruction (medium significance).
General protection Grade IVC	Phase 1 is considered as sufficient recording, and it may be demolished (low significance).

3.3.1 Assessment of development impacts

A heritage resource impact may be defined broadly as the net change, either beneficial or adverse, between the integrity of a heritage site with and without the proposed development. Beneficial impacts occur wherever a proposed development actively protects, preserves, or enhances a heritage resource by minimising natural site erosion or facilitating non-destructive public use. More commonly, development impacts are of an adverse nature and can include:

- destruction or alteration of all or part of a heritage site;
- isolation of a site from its natural setting and/or
- introduction of physical, chemical or visual elements out of character with the heritage resource and its setting.

Beneficial and adverse impacts can be direct or indirect and cumulative, as implied by the examples. Although indirect impacts may be more difficult to foresee, assess and quantify, they must form part of the assessment process.

3.3.1 Impact Rating System

Impact assessment must take account of the nature, scale, and duration of impacts on the environment, whether such impacts are positive or negative. Impact assessment is completed according to the project phases:

- planning
- construction
- operation
- decommissioning

Where necessary, the proposal for mitigation or optimisation of an impact is detailed. A brief discussion of the impact and the rationale behind assessing its significance is included. The rating system is applied to the potential impacts on the receiving environment and includes an objective evaluation of the impact mitigation. In assessing the significance of each impact, the following criteria are used:

NATURE		
Loss of Archaeological & Cultural Heritage		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be experienced.		
1	Site	The impact will only affect the site.
2	Local/district	Will affect the local area or district.
3	Province/region	Will affect the entire province or region.
4	International and National	Will affect the entire country.
PROBABILITY		
This describes the chance of occurrence of an impact.		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	The impact will undoubtedly occur (Greater than a 75% chance of occurrence).
DURATION		
This describes the duration of the impacts. Duration indicates the lifetime of the impact as a result of the proposed activity.		
1	Short term	The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development. However, they will be mitigated by direct human action or by natural processes thereafter (10 – 30 years).

4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process, will not occur in such a way or such a period that the impact can be considered indefinite.
INTENSITY/ MAGNITUDE		
Describes the severity of an impact.		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component, but the system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	The impact affects the continued viability of the system/ component, and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease—high costs of rehabilitation and remediation.
4	Very high	The impact affects the continued viability of the system/component, and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired. Rehabilitation and remediation are often impossible. If possible, rehabilitation and remediation are often unfeasible due to extremely high costs.
REVERSIBILITY		
This describes the degree to which an impact can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with the implementation of minor mitigation measures.
2	Partly reversible	The impact is partly reversible, but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible, and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in a marginal loss of resources.
3	Significant loss of resources	The impact will result in a significant loss of resources.
4	Complete loss of resources	The impact results in a complete loss of all resources.
CUMULATIVE EFFECT		

This describes the cumulative effect of the impacts. A cumulative impact is an effect which in itself may not be significant. However, it may become significant if added to other existing or potential impacts emanating from similar or diverse activities due to the project activity in question.

1	Negligible cumulative impact	The impact would result in negligible to no cumulative effects.
2	Low cumulative impact	The impact would result in insignificant cumulative effects.
3	Medium cumulative impact	The impact would result in minor cumulative effects.
4	High cumulative impact	The impact would result in significant cumulative effects.

SIGNIFICANCE

Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale and, therefore, indicates the level of mitigation required. The calculation of the significance of an impact uses the following formula:

(Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.

The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.

POINTS	IMPACT SIGNIFICANCE RATING	DESCRIPTION
6 to 28	Negative low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive medium impact	The anticipated impact will have moderate positive effects.
51 to 73	Negative high impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive high impact	The anticipated impact will have significant positive effects.
74 to 96	Negative very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive very high impact	The anticipated impact will have highly significant positive effects.

3.4 Report

The desktop research and field survey results are compiled in this report. The identified heritage resources and anticipated direct, indirect, and cumulative impacts of the proposed project's development on the identified heritage resources will be presented objectively. Alternatives are offered if any significant sites are impacted adversely by the proposed project. All efforts will be made to ensure that all studies, assessments, and results comply with the relevant legislation, code of ethics, and Association of South African Professional Archaeologists (ASAPA) guidelines. The report aims to assist the developer in managing the documented heritage resources in a responsible manner and protecting, preserving, and developing them within the framework provided by the National Heritage Resources Act of 1999 (Act 25 of 1999).

4. PROJECT OVERVIEW

UBIQUE Heritage Consultants were appointed by EnviroAfrica cc as independent heritage specialists in accordance with Section 38 of the NHRA and the National Environmental Management Act 107 of 1998 (NEMA) to conduct a cultural heritage assessment to determine the impact of the proposed establishment of an Electric Vehicle Charging Facility, Solar PV plant and associated infrastructure at Akkerboom Farm Stall along the N14, between Kakamas and Keimoes, Northern Cape Province, on any sites, features, or objects of cultural heritage significance.

The proponent intends to establish a fully renewable energy-powered electric vehicle (EV) charging facility at the Akkerboom Farm Stall. The project site is situated on Portions 19 & 47 of Farm Frier's Dale, No. 466, along the N14, between Kakamas and Keimoes, in the Northern Cape. The project will encompass the development of a solar photovoltaic (PV) plant, a battery energy storage system (BESS), and associated infrastructure to enable sustainable energy generation to charge EVs efficiently.

Project Components:

1. Solar PV Plant:

The PV plant will consist of an array of solar panels installed in 2 steps: Stage 1 and stages 2-7 (Appendix 12). The development will take place in stages as the demand for electricity increases. The solar panels (of the entire development) are expected to generate an electrical output of approximately 7 megawatts (MW) (approximately 1 MW per ha), which will be transmitted to the battery storage units and the EV charging infrastructure. The solar panels will be strategically placed to optimize energy capture, considering site-specific environmental factors such as solar irradiation levels and shading.

2. Battery Energy Storage System (BESS):

The project will incorporate battery energy storage units that will store the electricity generated by the solar PV plant. These batteries will be housed in secure containers alongside other energy management equipment to ensure optimal efficiency and safety. The storage system will provide consistent power to the EV charging infrastructure, ensuring uninterrupted service even during low solar generation or high demand periods.

3. Electric Vehicle Charging Infrastructure:

The EV charging facility will accommodate approximately six electric vehicles at any given time. This infrastructure will be powered entirely by the solar PV plant and the energy stored in the BESS,

making it a sustainable and eco-friendly solution for travellers and locals using electric vehicles along the N14 corridor. The facility will be equipped with fast-charging stations designed to minimize downtime for EV users.

4. Electricity Transmission Infrastructure:

The electricity transmission infrastructure will connect the solar PV plant and the battery storage units to the EV charging stations. The project's initial stage will involve installing approximately 300 meters of transmission cabling, with additional stages extending the cabling by a further 450 meters to support the expansion (stages 2-7).

5. Development Footprint:

The total development footprint of the project, including the solar PV plant, BESS, and EV charging infrastructure, will cover approximately 7 hectares at the Akkerboom Farm Stall. This footprint includes the installation of necessary utilities, access roads, and support structures, ensuring seamless integration of the renewable energy generation systems with the EV charging facility.

4.1 Technical information

PROJECT DESCRIPTION	
Project name	THE PROPOSED ESTABLISHMENT OF AN ELECTRIC VEHICLE CHARGING FACILITY, SOLAR PV PLANT AND ASSOCIATED INFRASTRUCTURE AT AKKERBOOM FARM STALL (PORTIONS 19 & 47 OF FARM FRIER'S DALE, NO. 466) ALONG THE N14, BETWEEN KAKAMAS AND KEIMOES, NORTHERN CAPE
DEVELOPER	
Zero Carbon Charge	
Development type	Alternative Energy Infrastructure – electricity (generation, transmission & distribution)
CONSULTANTS	
Environmental	EnviroAfrica cc
Heritage and archaeological	UBIQUE Heritage Consultants
Palaeontological	Banzai Environmental
PROPERTY DETAILS	
Province	Northern Cape
District municipality	ZF Mgcawu
Local municipality	Kai !Garib
Topo-cadastral map	1:50 000 2820DB
Farm name	Frier's Dale 466, Portions 19 and 47
Closest town	Kakamas
GPS Co-ordinates	28°40'20.53 S 20°47'32.9 E

	28°44'19.65 S 20°49'29.87 E
EIA FOOTPRINT SIZE	7 ha
ASSESSED FOOTPRINT SIZE	9 ha
LAND USE	
Previous	Agriculture
Current	Agriculture
Rezoning required	Yes
Sub-division of land	No

DEVELOPMENT CRITERIA IN TERMS OF SECTION 38(1) NHRA	YES/NO
Construction of a road, wall, power line, pipeline, canal or other linear forms of development or barrier exceeding 300m in length.	Yes
Construction of bridge or similar structure exceeding 50m in length.	No
Construction exceeding 5000m ².	Yes
Development involving three or more existing erven or subdivisions.	No
Development involving three or more erven or divisions that have been consolidated within the past five years.	No
Rezoning of site exceeding 10 000m ².	Yes
Any other development category, public open space, squares, parks, recreation grounds.	No

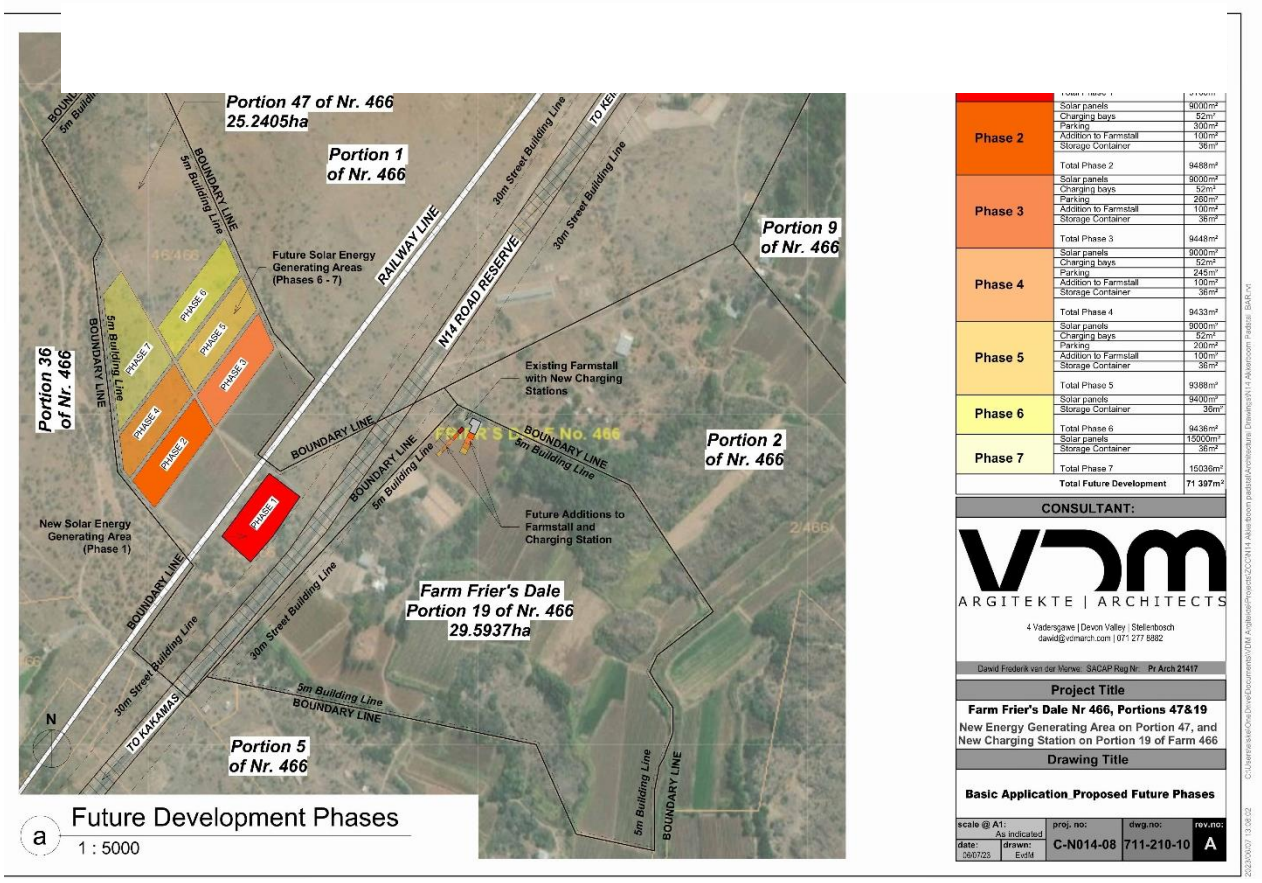


Figure 1 *Proposed zero carbon EV solar charging station by ZCC at Akkerboom farmstall along the N14 on the Farm Frier's Dale 466, Portions 19 and 47. Image provided by: EnviroAfrica cc.*

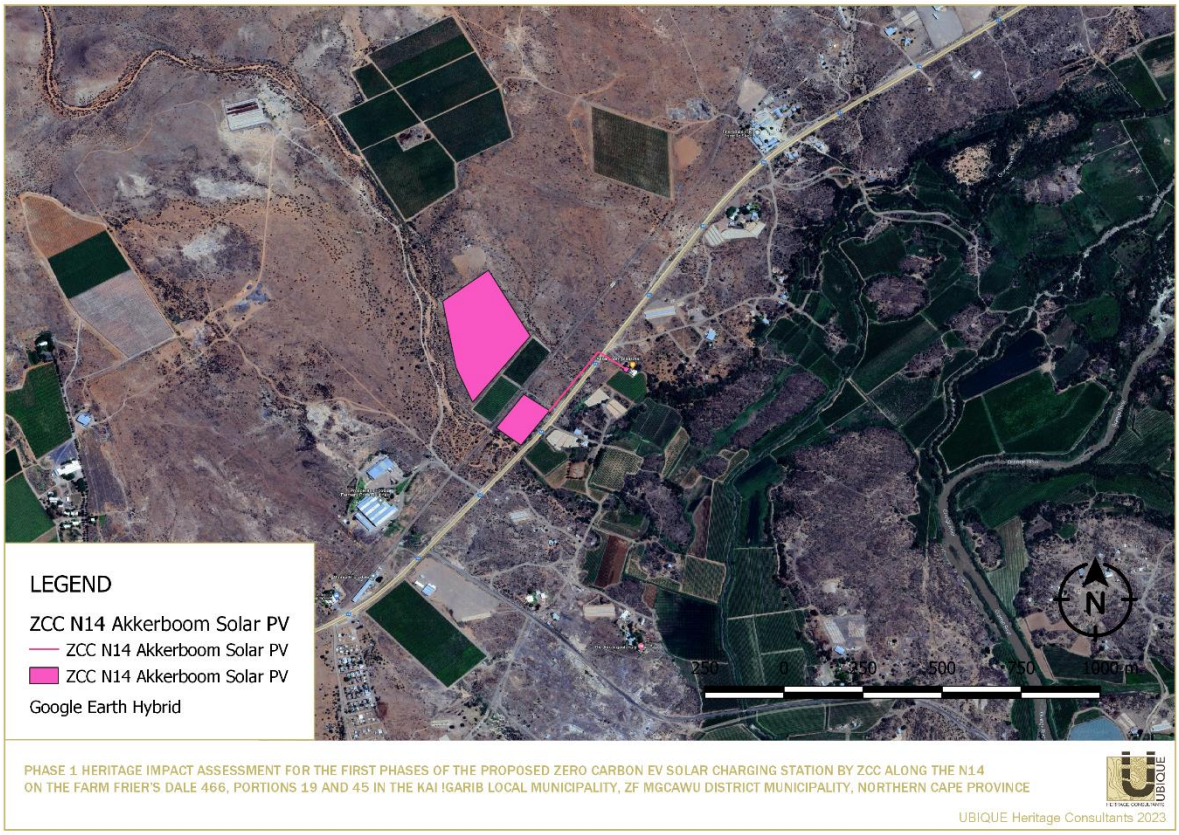


Figure 2 *Regional locality of the development footprint, indicated on Google Earth Satellite imagery.*

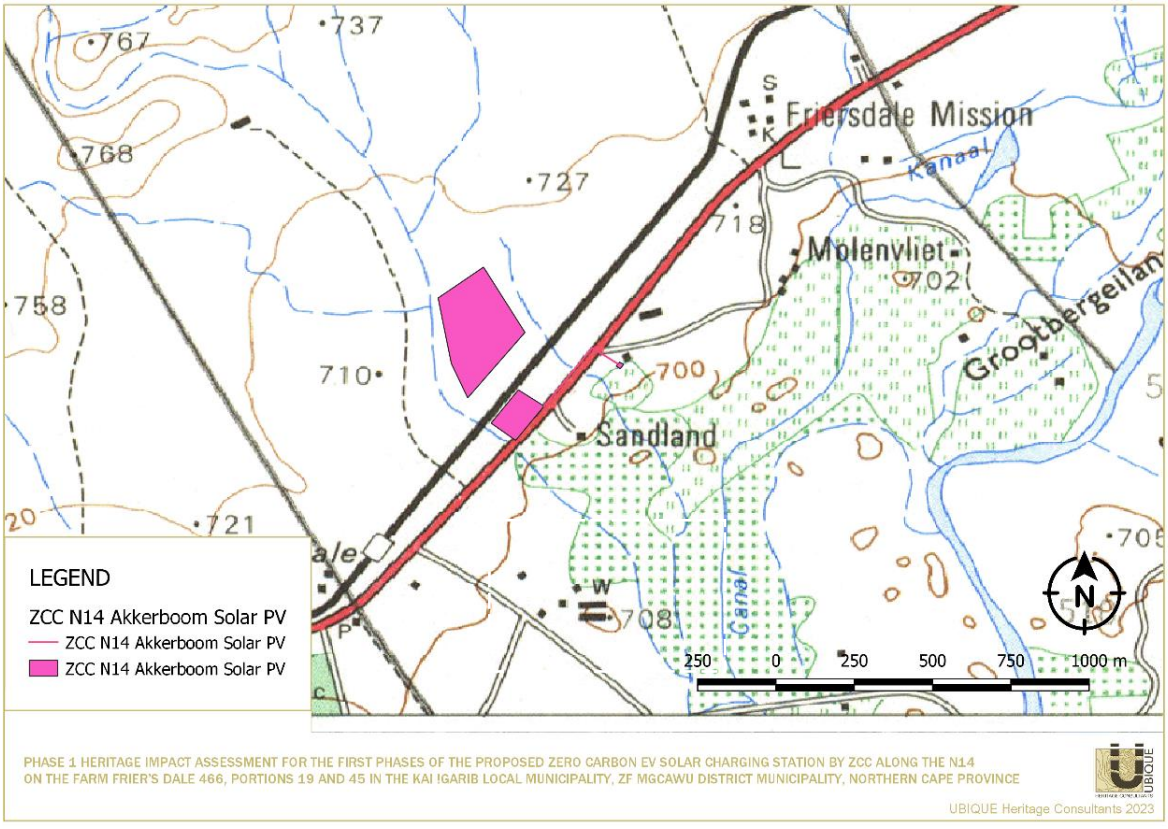


Figure 3 *Locality of the development footprint, indicated on 1: 50 000 2820DB map.*

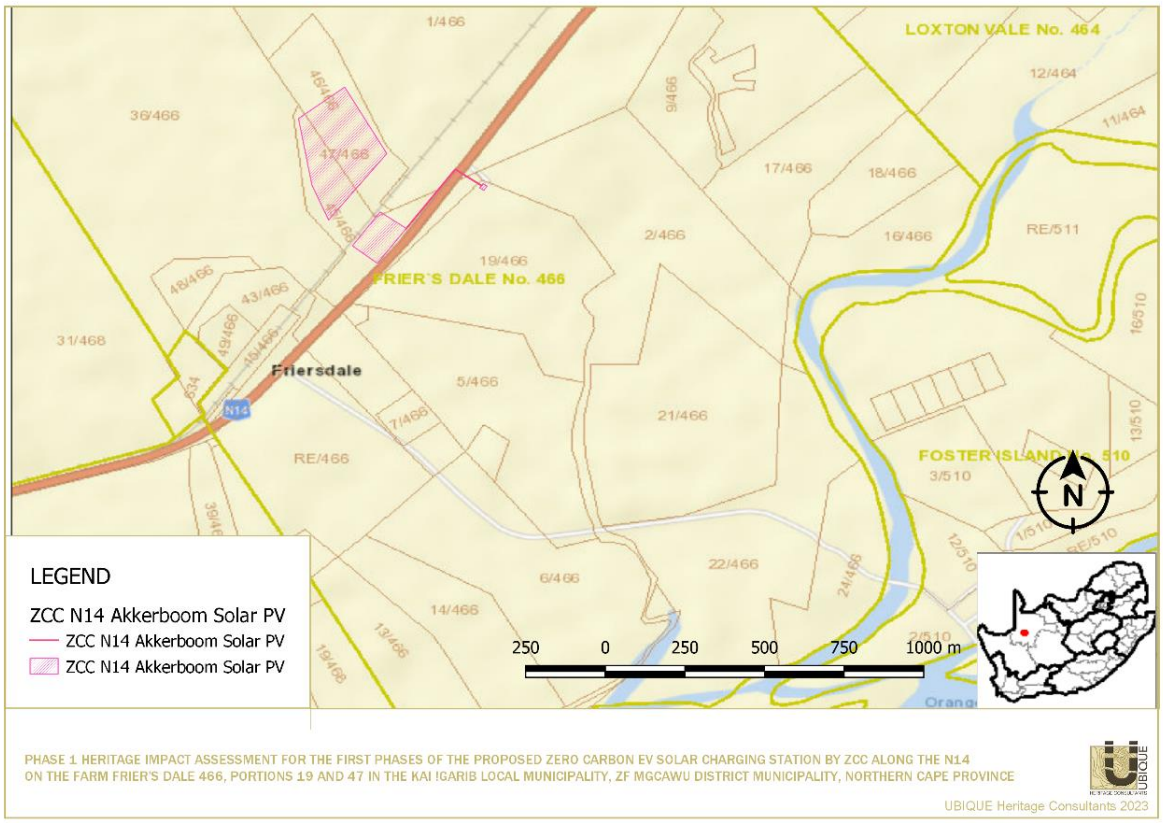


Figure 4 *Locality of development footprint indicated on Chief-Surveyor-General ArcGIS Web Map (https://csggis.drdlr.gov.za/psv/)*

5. HISTORICAL AND ARCHAEOLOGICAL BACKGROUND

5.1 Region: Northern Cape

South Africa has a long and varied history of human occupation (Deacon & Deacon 1999). This occupation dates to approximately 2 mya (million years ago) (Mitchell 2002). Briefly, the archaeology of South Africa can be divided into three "major" periods: the Stone Age, the Iron Age and the Historical period. In addition, various archaeological and historical sites have been identified and documented throughout South Africa, including the Northern Cape province.

5.1.1 Stone Age

The history of the Northern Cape is reflected in a rich archaeological landscape with a wealth of pre-colonial archaeological sites. Numerous sites have been identified and documented across the region. These sites date back to the Early, Middle and Later Stone Ages.

In southern Africa, the Stone Age can be divided into three periods. It is, however, critical to note that dates are relative and only provide a broad framework for interpretation. The division of the Stone Age, according to Lombard et al. (2012), is as follows:

- Earlier Stone Age (ESA): >2 000 000 - >200 000 years ago
- Middle Stone Age (MSA): <300 000 - >20 000 years ago
- Later Stone Age (LSA): <40 000 - until the historical period

In short, the Stone Age refers to humans mainly utilising stone as a technological marker. Each sub-division is formed by industries where the assemblages share attributes or common traditions (Lombard et al. 2012). The ESA is characterised by flakes and percussive tools produced from pebbles and cobbles, as well as objects created later during this period, such as large hand axes, cleavers and other bifacial tools (Klein 2000). The MSA is associated with small flakes, blades and points. The aforementioned is generally suggested to have been made and utilised for hunting activities and had numerous functions (Wurz 2013).

Furthermore, the LSA is characterised by microlithic stone tools, scrapers and flakes (Binneman 1995; Lombard et al. 2012). The LSA is also associated with rock art. Numerous LSA rock art sites, mainly rock engravings and paintings, have been identified in the Northern Cape (Beaumont 2008c; Kruger 2018; Morris 1988). These sites are commonly found on slopes, hilltops, rocky outcrops and occasionally in river beds (Kruger 2018). Banded ironstone occurs on several sites throughout the Northern Cape. Due to its superior flaking qualities, it would appear to have been a favoured raw material for making stone tools (Kaplan 2012b). Beaumont et al. (1995) state, regarding the LSA, that "virtually all the 'Bushmanland' sites so far located appear to be ephemeral

occupation by small groups in the hinterland on both sides of the [Orange] river". This contrasts sharply with the substantial herder encampments along the Orange River floodplain (Morris 2013a, b, c, d, e, & f). It has been noted by Beaumont et al. (1995:240-241) that a widespread low density of stone artefacts scatters from the Pleistocene age appears across areas of 'Bushmanland' to the south. Here, raw materials, mainly quartzite cobbles, were derived from the Dwyka glacial (Morris 2013a, b, c, d, e, & f). Morris (2013b & c) states that substantial MSA sites are uncommon in Bushmanland. However, several sites were recorded, but small samples were yielded.

Although humans sparsely populated the Northern Cape region in the past (Kruger 2015a and b), the archaeological sites in this landscape are not scattered randomly (Kruger 2018). Previously conducted surveys have revealed signs of human occupation "mainly in the shelter of granite inselbergs (koppies) on red dunes which provided clean sand for sleeping, or around the seasonal pans" (Beaumont et al. 1995:264). Archaeological sites and MSA and LSA scatters and quarries frequently occur in low-lying areas on plains between dune straights and outcrops along the Orange River; in other words, near water. They can likewise be found close to local sources of highly-prized raw materials such as banded iron formations (BIF), jaspilite, and specularite (Morris 2012; Kruger 2015; 2018).

Most studies and surveys conducted throughout the Northern Cape have recorded Stone Age sites and surface scatters of Stone Age artefacts (ranging from the ESA, MSA and LSA) throughout the Northern Cape. These include the districts of Groblershoop, Griekwastad, Hotazel, Kenhardt, Pofadder, Marydale, and Upington (Dreyer 2006, 2008a, 2012; Engelbrecht & Fivaz 2019; Kaplan 2008, 2012, 2013 a & b; Kruger 2015; Morris 2012, 2013; Rossouw 2013; Van Ryneveld 2007; Van Vollenhoven 2014 and Webley 2013). Large rubbing stones, Acheulean hand axes (with secondary retouch) and scatters of core flakes have been found during previous investigations throughout the broader region (Dreyer 2008b, 2013 Revised, 2014). Van Ryneveld (2007) documented low densities of MSA artefact scatters at several Quartz outcrops on the farm Boksputs 118. An ancient specularite working site was recorded on the eastern side of Postmasburg, Doornfontein (Van Vollenhoven 2014). Associated Ceramic Later Stone Age material and older transitional ESA/MSA Fauresmith sites were documented at Lyly Feld, King, Mashwening, Demaneng, Rus & Vrede, Gloucester, Paling and Mount Huxley (Engelbrecht & Fivaz 2019). Moreover, MSA and LSA tools and rock engraving were found at Putsonderwater, Beeshoek and Bruce (Engelbrecht & Fivaz 2019). In addition, numerous Stone Age sites have been identified, documented and excavated in the surrounding areas near Kathu, the Doornlaagte ESA site, and the Wonderwerk Caves (Van Vollenhoven 2014; Dreyer 2015). The Stone Age sites and artefacts found and documented near the Kathu pans represent one of the most extended preserved Stone Age sequences in South Africa. They yield artefacts and sites from the ESA, MSA and LSA with evidence of 500,000-year-old hafted stone points (Engelbrecht & Fivaz 2019).

5.1.2 Iron Age

The Iron Age (IA) is characterised by the use of metal (Coertze & Coertze 1996: 346). There is some controversy about the periods within the IA. Van der Ryst & Meyer (1999) have suggested that there are two phases within the IA, namely:

- Early Iron Age (EIA) 200 – 1000 A.D
- Late Iron Age (LIA) 1000 – 1850 A.D

However, Huffman (2007) suggests instead that there are three periods within the Iron Age these periods are:

- Early Iron Age (EIA) 250 – 900 A.D
- Middle Iron Age (MIA) 900 – 1300 A.D
- Late Iron Age (LIA) 1300 – 1840 A.D

Thomas Huffman believes that the Middle Iron Age should be included within this period; his dates have been widely accepted in the IA field of archaeology.

The South African Iron Age is generally characterised by farming communities with domesticated animals, cultivated plants, manufactured and used ceramics and beads, and smelted iron for weapons and manufactured tools (Hall 1987). Iron Age people were often mixed farmers/agropastoralists. These agropastoralists generally lived in areas with sufficient water for domestic use and arable soil that could be cultivated with an iron hoe. Most Iron Age (IA) settlements built by agropastoralists were permanent settlements (with a few exceptions). They comprised houses, raised grain bins, storage pits and animal kraals/byres, contrasting with pastoralists' and hunter-gatherers' temporary camps (Huffman 2007). It is evident in the archaeological record that IA groups had migrated with their material culture (Huffman 2002).

Most IA groups in southern Africa preferred to occupy southern African central and eastern parts from about 200 AD. The San and Khoi remained in the western and southern parts (Huffman 2007; Van Vollenhoven 2014); it is, thus, very rare, but not uncommon, to find IA sites in the Northern Cape.

The later phase (the LIA) was accompanied by extensive stone-walled settlements, such as the Thlaping capital, Dithakong, approximately 40 km north of Kuruman (De Jong 2010). The Sotho-Tswana and Nguni-speaking societies are the descendants of the LIA mixed farming communities. They found that the region was already sparsely inhabited by LSA Khoisan groups (the "first people"). De Jong (2010) comments that many of them were eventually assimilated by LIA communities. Only a few had managed to survive. Some of the surviving groups included the Korana and the Griqua. However, it should be mentioned that this contact period has often been referred to as the Ceramic LSA. It is often represented by sites such as the earlier mentioned Blinkklipkop specularite mine near Postmasburg and found cultural material at the Kathu Pan (De Jong 2010).

IA sites have been recorded in the northeastern part of the province. However, according to Kruger (2018), environmental factors delegated that the spread of IA farming westwards from the 17th century was constrained mainly to the areas east of the Langeberg Mountains. Nevertheless, there has been evidence of an IA presence in the Upington area in the 18th century (Kruger 2018). LIA people had briefly utilised the area close to the Orange River, as they had mined copper in the Northern Cape (Van Vollenhoven 2014).

5.1.3 Historical period

The Historical/Colonial period generally refers to the last 500 years when European settlers and colonialism entered southern Africa (Binneman et al., 2011). During the colonial frontier period, place names started becoming fixed on maps and farm names, specifically in a cadastral sense. Numerous names have Khoekhoegowab origin and, as Morris (2017a) states, encapsulate vestiges of pre-colonial/indigenous social geography. Morris (2017a) also states that genocide against the Indigenous people is documented in the wider area. Historical literature confirms that San hunter-gatherers occupied Bushmanland early in the 19th century. During the 19th century, People of mixed descent lived around the salt pans in Bushmanland. They were, however, driven away from the land as the farms were surveyed and made available to European farmers (Webley & Halkett 2012). In the late 18th and early 19th centuries, with the introduction and implementation of the commando system, the Karoo 'Bushmen' were eventually destroyed or indentured into farm labour (ACRM 2015). Certain mountainous areas (e.g. Gamsberg near Aggeneys and Namies) are known massacre sites (Morris 2017a).

The development of a rich colonial frontier can be seen in the archaeological record (Kruger 2018). However, it was not until relatively recently (because of its distance from the Cape Colony) that this arid part of South Africa's interior was colonised. The Historical period of the Northern Cape coincides with the incursion of white traders, hunters, explorers, and missionaries into the interior of South Africa (Engelbrecht & Fivaz 2019). The historical period started with the first recorded oral histories (Van Vollenhoven 2014). The documented records of this region dating from the 18th- and 1- centuries mainly pertain to areas south of and along the Orange River (Morris 2018a, b & c). Hendrick Wikar and Robert Gordon, who, according to Morris (2018a, b & c) and Morris & Beaumont (1991), were two of the earliest travellers, had followed the river as far as and beyond the region during the 1770s. Wikar and Gordon provided descriptions of the terrain and the communities living along the river (Morris 2018a, b & c; Morris & Beaumont 1991). Some other early travellers, traders, and missionaries who arrived in the region during the 19th century include PJ Truter, William Somerville, Cowan, Donovan, Burchell and Campbell (De Jong 2010). The London Mission Society (LMS) station near Kuruman was established in 1817 by James Read (De Jong 2010; Van Vollenhoven 2014). Various buildings and structures that have been documented and recorded can be associated with early travellers, traders, and missionaries. There is also evidence of the settlements of the first white farmers and towns in the Northern Cape. These historical buildings and structures have been captured on the SAHRIS database in areas such as Kakamas, Kenhardt, Keimoes and Upington.

De Jong (2010) classifies the cultural landscape along the Gariep/Orange River as predominantly historic farmland. From the 1880s onwards, irrigation of the Orange River played a central role in the area's economy in the vicinity of Upington (Legassick 1996). Hunter-gatherers shared the river's resources (Morris 1992). The beginning of irrigation in this area has been attributed to the *Basters*. By the 18th century, the Basters had focused on the Orange River (and Namaqualand) as a sanctuary from colonial rule (Mlilo 2019; Van der Walt 2015). They were regarded as "primitive pastoral people" who had "crude" ways to divert the river to their "little gardens" (Van der Walt 2015). The term "Basters" characterises a group of people of mixed percentage (white and Khoekhoe or slave and Khoekhoe). According to Van der Walt (2015), the term also implies an economic category that implies possessing property and being culturally European.

The surveying, division and transference of Government-owned land to farmers mark the initial distribution of land to colonial farmers from the 1880s onward (De Jong 2010). It is believed that most farms were still government farms and were leased to farmers in 1875. The farms were later sold to individuals (Van Vollenhoven 2014). The introduction of the windpump to South Africa in the 1870s made the arid lands accessible and suitable for grazing (Webley & Halkett 2012).

During the late 1920s, more permanent and large-scale settlements and possibly some of the first farmsteads started to appear in the region, and the first great influx of people began in the 1930s. Extensive irrigation networks and channels supplied water for the development of vineyards and other cash crops (e.g. grain crops), cultivated in a narrow band along the Orange River leading to the region known as the Green Kalahari. Van Schalkwyk (2019) comments that this has resulted in numerous smaller hamlets and villages. These hamlets/villages had churches, cemeteries and shops.

The region has been the backdrop to various incidents of conflict. Numerous factors such as population growth, increasing pressure on natural resources, the emergence of power blocs' attempts to control trade, the emergence of the Griquas, and penetration of the Korana and early white communities from the southwest resulted in a period of instability in South Africa. Furthermore, with the introduction of loan farms in the second half of the 18th century, an influx of newcomers such as trekboers, European game hunters and livestock thieves contributed to the region's volatility and sociocultural stress and transformation (Mlilo 2019).

The period known as the Difaqane/Mfecane began in the late 18th century and effectively ended with the settlement of white farmers in the interior (De Jong 2010; Mlilo 2019). The Difaqane/Mfecane period also affected the Northern Cape Province around the 1820s, relatively later than the rest of southern Africa (De Jong 2010). This period was prompted by the incursion of displaced refugees associated with the Fokeng, Tlokwa, Hlakwana and Phuting groups (De Jong 2010). Between 1879 and 1880, the region was caught up in the Koranna War. With the arrival of the Dutch settlers in the Cape in the mid-17th century, clashes between the Europeans and Khoi tribes in the Cape Peninsula resulted in the Goringhaiqua and Goraxouqua migrating north towards the Gariep/Orange River in 1680. These tribes became known as the Korannas, living as small

tribal entities in separate areas (Penn 2005). It is believed that any military settlement related to the Koranna Wars would have been closer to the Orange River (Webley & Halkett 2014).

Further military activity in the area included the rise of the 'rebels' during the Anglo-Boer War and again in 1915 with the incursion of German troops (Morris 2018a, b & c). Numerous graves can be linked to the battles fought during the 1914 Rebellion (Engelbrecht & Fivaz 2019).

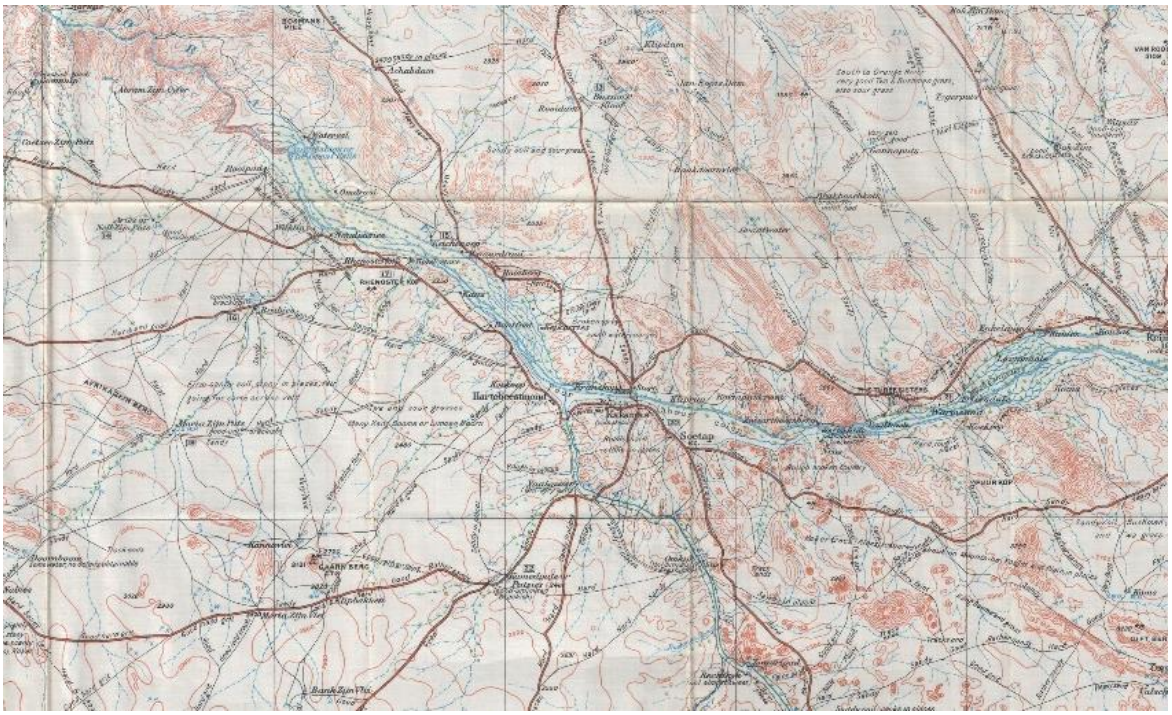


Figure 5 *Imperial Map of Kakamas and surrounds. Image from UCT digital collections, https://digitalcollections.lib.uct.ac.za/*

5.2 Local: Kakamas

De Jong (2010) classifies the cultural landscape of Kakamas as predominantly historic farmland. The affected area comprises working (operating) irrigation and grazing farms in a typical Lower Orange River environment. These farms display heritage features typically occurring in the district, such as the large size, irrigation furrows and pipelines, fences, tracks, farmsteads, and irrigated fields. In addition, farmsteads are clustered close to rivers and primary roads (De Jong 2010). According to De Jong (2010), this landscape class is of relatively low heritage sensitivity because it can absorb the adverse effects of new development through some mitigation.

In 1882, the first 81 farms to be given out to the north of the Orange River from Kheis (opposite the present Groblershoop) to the Augrabies Falls were allocated almost exclusively to Basters (Morris 1992). The further division of these farms commenced when the irrigation canal was

completed. These farms were divided into "water-erven" for irrigation and "dry-erven" for establishing buildings (Van der Walt 2015). More white settlers moved to the Gordonia region in the late 19th century. By the turn of the century, approximately 13 Afrikaner families had settled at Keimoes (De Beer 1992; Van der Walt 2015). Many farmers moved to new areas due to the aftermath of the scorched earth policy of the Anglo-Boer War. These farmers searched for greener pastures. Settlements next to the Gariep/Orange River provided adequate irrigation for crops (Engelbrecht & Fivaz 2020). By 1910, Keimoes had its hotel, prison, court and police service (De Beer, 1992). It attained municipal status in 1949, and 1951, Keimoes opened its own power station, and electricity replaced candlelight (De Beer 1992; Van der Walt 2015). In 1995, only three Baster landowner families were remaining in the Keimoes area, namely the Jansen family, the Loxtons and the Spangenbergs. The commercialisation of agricultural farming during the 20th century and the state's support for the capitalisation of white farmers in the area probably contributed to many of the *Basters*' decision to sell their farms to emerging white farmers (Legassick 1996; Van der Walt 2015).

Kakamas town originated from an irrigation scheme established by the community in 1898 for farmers left destitute by severe drought (1895-1897). The irrigation scheme was led by Rev. Schroder, a Dutch Reformed Church (DRC) missionary and Special Magistrate for the Northern Border, which included canals dug by hand, beginning at the upper end of Neus Island (Hopkins 1978; Van Vuuren 2011). The construction and development of canal systems were vital for the irrigation of extensive vineyards and orchards and the expansion of major agricultural enterprises in the region (Engelbrecht & Fivaz 2018). By the time Schröder came to Upington in July 1883. There were people already living in the area of Keimoes who had planted fields and utilised irrigation. The irrigation scheme of the Basters can be attributed to Abraham September. Abraham September was born in slavery and found freedom as a Baster. Interestingly, Schröder and Scott had begun the canal from where Abraham September had selected. Legassick (1996) commented that "the small, white-painted, stone house where Abraham September lived when he undertook this work survives to this day, though the house and the land upon which it stands have long passed from the hands of the September family".

The Kakamas area's water-related infrastructure was essential for agricultural development. Several water wheels, excavated tunnels, and irrigation furrows have been declared Provincial Heritage Sites. The Kakamas settlement is also known for its pioneering development of a hydroelectric power generator, brought into operation in 1924 (Hopkins 1978). The building, which housed the old transformer in Voortrekker Street, was earmarked as a museum (SAHRA database).

The town of Kakamas was laid out in 1931 and attained full municipal status in 1964 (Van Schalkwyk 2013). The name Kakamas originated with the Einiqua. However, there are several theories about the meaning of the word:

- *Bad Grazing:* before the canals and irrigation schemes were developed, the area was notorious for its poor grazing pastures.

- *Angry/Charging Cow/Chasing Cows:* this may derive from the Korana word kagamas, which could have become associated with the place because the river banks nearby had sloping banks, making it an easy crossing place for cattle herds. Most herds were reluctant to enter the river and would turn on their herders.

- *Thakemas, meaning drink place.* This would refer to the ease with which livestock could be herded to the area to drink.

- *Swimming water:* Possibly the San word given to the place because it was possible to swim across the river at this point (De Jong 2010).

Keimoes translates from the Khoekhoe language as "large eye" or “big eye”. This might refer to the natural water fountain called Big Eye or Keimoes situated at the Roman Catholic Mission Station in the town or to the vast views seen from the Tierberg, a small mountain outside the town. A second account for the town’s name is said to originate from the Khoemana leader, Klaas Lucas, who in the 1860s named the place Keimoes or “mouse nest” in the Khoemana language, denoting the colonies of mice living there (Raper *et al.* 2014).

6. HERITAGE SENSITIVITY

The Heritage Screening tool (https://screening.environment.gov.za/) shows Low significance with locations of High to Very High sensitivity towards the northwest and southwest of the proposed project area (Figure 6).

Our findings confirm the Low Heritage Sensitivity indicated on the DFFE Screening Tool.

Figure 6 *The Project area indicated on the Heritage Screening tool (https://screening.environment.gov.za/)*

6.1 Summary of Local Heritage Resources

The desktop study revealed that Impact Assessments had been done in the Kakamas/Keimoes region. Some of the assessments reported on cultural material and features relating to the Stone Age and the Historical/Colonial era (e.g. ACRM 2016; 2017; Beaumont 2008a & b; Engelbrecht & Fivaz 2018; 2019a; Fivaz & Engelbrecht 2019; 2021a & b; Kaplan 2012a; 2016; 2017; Morris 2010; 2017b; Orton 2013; Rossouw 2021; Van Schalkwyk 2011; 2013; 2014).

6.1.1 Stone Age

Numerous studies in and around the current study area have reported on lithics, dating from the ESA, MSA and LSA. Rossouw (2013) found occasional occurrences of lithics made from brown jasper present as isolated surface occurrences in Section A-B on the farm Blaauwskop 36. Rossouw (2013) speculated that these lithics can be attributed to the LSA. Irregular flakes and chips represent the lithics; they also appear fresh with little sign of intentional faceting or formal preparation. Kruger (2015) identified and recorded scatters of MSA stone tools, such as blades, points, scrapers and one adze at Eenduin farm near Keimoes. Engelbrecht (2015) recorded similar stone tools at the Blaauwskop settlement, approximately 15 km northeast of Keimoes.

Near Lennertsville, approximately 10 km from the farm Kousas and 18-20 km from Blaauwskop, Kaplan (2018) documented a large silcrete core, an LSA silcrete retouched flake, and one quartzite flake was documented along with several flaked stone tools. Kaplan (2008) noted that specific flake tools have been utilized or retouched. Some other finds include flakes of various sizes, bladelets and blades (e.g., backed pieces and points), fine punch-struck flakes, and small round cores. Kaplan (2008) also documented four convex scrapers, three side scrapers, an adze, a large ESA core, and weathered, retouched MSA flakes. He stated most of the tools are LSA in character, possibly from the 'Wilton Complex' (Kaplan 2008).

Other traces left on the landscape by prehistoric people include grinding grooves in the bedrock exposures at Dyason's Klip, 16.1 km northeast of Keimoes (Morris 2013). There are about five grinding surfaces and a small number of stone tools in the locale. Morris (2013) also recorded lower grindstones adjacent to localized bedrock exposure, with a surface scatter of LSA flakes.

To the west of the study area on agricultural lot 2371 Kakamas South Settlement, Morris (2017b) reports the unexpected occurrence of a rock gong on a rocky granite-gneiss outcrop. Rock gongs (or lithophones) are rocks that ring when struck and are characterised by beating marks that reflect ancient use (Morris 2017b). According to Morris (2017b), the find is significant as it is the first rock gong to be identified from this part of the Northern Cape and on granite-gneiss. Often associated with rock art, they are a feature of the LSA, with alleged ritual connotations (Morris 2017b).

Another interesting prehistoric find in the greater vicinity is two kite-like features 22 km north of Keimoes (Van der Walt & Lombard 2018). The prominent funnel-shaped features of undetermined age were constructed and shaped by organising local dolerite stones, sometimes incorporating in-situ dolerite outcrops/boulders. Kites are widely accepted as hunting traps (Holzer *et al.* 2010 in Van der Walt & Lombard 2018). The ethnohistorical records documented various hunting traps used by San hunter-gatherers. However, the use of these funnel-shaped stone features by Stone Age herding communities (who also hunted) cannot be conclusively discounted (Van der Walt & Lombard 2018).

Furthermore, Morris (2014; Morris & Beaumont 1991) hypothesizes that the archaeological footprint of substantial herder and short-term hunter-gatherer encampments along the floodplain of the Orange River may have been disrupted and destroyed by intensive farming alongside the river since colonial settlement.

6.1.2 Rock Art

Several rock art sites have been documented on the SAHRA Database in the Northern Cape Province. No sites have, however, been recorded in the Kakamas region. Instead, rock art sites have been recorded at Augrabies. The closest rock art sites are located (approximately 45km) northwest of the proposed development area.

HERITAGE SITES IN AND AROUND BLOEMFONTEIN DOCUMENTED ON THE SAHRA DATABASE:

Site/Object Name	Coordinates	Site type	Site Reference	Site ID
Augrabies sites RVM19 historical engravings.	-28.464711, 20.287494	Rock Art	RVM19	93896
Augrabies sites RVM3 LSA engravings	-28.395425, 20.386838	Rock Art	RVM3	93893

6.1.3 Iron Age

No Iron Age Sites were reported in the consulted HIA/AIAs.

6.1.4 Historical/Colonial Period

Very few Impact Assessments reported on cultural material and sites associated with the Historical/Colonial Period. This is because the cultural landscape of Kakamas and Keimoes is predominantly historic farmland.

HISTORICAL PERIOD RESOURCES RECORDED IN 50 KM RADIUS

HIA/AIA	SITE	COORDINATES	HERITAGE RESOURCES
Engelbrecht & Fivaz 2019 a	Plot 2372: 4	28° 48.236' S 20° 32.957' E	1850 – 1920: Surface scatter Hole-in-cap tin lid with lead solder

HISTORICAL PERIOD RESOURCES RECORDED IN 50 KM RADIUS

HIA/AIA	SITE	COORDINATES	HERITAGE RESOURCES
Engelbrecht & Fivaz 2019 a	Plot 2372: 5	28° 47.781' S 20° 32.440' E	1850 – 1920: Surface scatters: Tin can with folded/ crimped hand-soldered seam (1850-the 1880s) and cast-iron potsherds, one piece with a leg.
Engelbrecht & Fivaz 2019 a	Plot 1763: 12	28° 49.031' S 20° 33.759' E	Historical: Surface scatter Cast iron pot sherd.
Engelbrecht & Fivaz 2019 a	Plot 1763: 13	28° 49.026' S 20° 33.699' E	Surface scatter Broken horseshoe, green and weathered clear glass, whiteware ceramics, tin can with folded/ crimped hand soldered seam (1850-the 1880s).
Engelbrecht & Fivaz 2019 a	Plot 1763: 14	28° 49.055' S 20° 33.776' E	Undetermined: High-density surface scatter. Glass, green and weathered clear
Morris 2010	Zwartbooisberg farm	28.76717° S 20.73735° E, 28.76691° S 20.73866° E	Earlier twentieth-century glass
Morris 2010	Zwartbooisberg farm		Cement and packed stone strengthened the old canal. At one point, the initials and date "AJK 19-2-1941" are inscribed on the cement.
Morris 2010	Zwartbooisberg farm	General area: 28.77057° S 20.72835° E	A foundation of cement, either relating to the canal itself or some farming activity, is estimated to be of mid-twentieth-century age. The material found near a midden, such as metal and bone
Fivaz & Engelbrecht 2019	RZB006	29° 03' 44.8" S 20° 50'46.7" E	1905-1920 Interlocking machine soldered tin with trademarks (Bourneville Cadbury's England)
Fivaz & Engelbrecht 2019	RZB007	29° 03' 43.9" S 20° 50'44.5" E	ca. early 1900s Historical fuel/oil tin with machine soldered seems with trademarks
Fivaz & Engelbrecht 2019	RZB008	29° 03' 43.7" S 20° 50'44.3" E	ca 1860-1900s Historical green liquor bottle, the partial base of the bottle
Fivaz & Engelbrecht 2019	RZB012	29° 03' 43.7" S 20° 50'44.3" E	ca. 1880> Historical fired shotgun cartridge, a metal casing 12 BR.

HISTORICAL PERIOD RESOURCES RECORDED IN 50 KM RADIUS			
HIA/AIA	SITE	COORDINATES	HERITAGE RESOURCES
Orton 2013	003	S 28 45 52.8 E 20 44 04.1	Small-scale quarry into bedrock of unknown (but almost certainly 20th century) age. One part has an informal drystone wall to hold up the sediments, and several piles of river pebbles occur around the excavations.

Just outside the town of Kakamas North on Lot 189 is a monument commemorating First World War German troops killed in a battle against South African Union forces on the 4th of February 1915. Union troops assembled near Upington to launch an attack on German South West Africa while the German forces prepared an attack on Kakamas. A heavy battle ensued between two unevenly matched forces at Kakamas, resulting in seven dead, six wounded and sixteen prisoners of war amongst the Germans. The '*Volksbund Deutschen Kriegs-graberfflrsorge*' erected the memorial (SAHRA database).

The Kakamas area has numerous National and provincial Monuments, ranging from buildings, battlefields, monuments, memorials, and burial grounds, all of which are listed in this table below, which can also be found on the SAHRA Database:

HERITAGE SITES IN AND AROUND KAKAMAAS ARE DOCUMENTED ON THE SAHRA DATABASE:						
Site/Object Name	Coordinates	Archive Status	Declaration Type	Site type	Site Reference	Site ID
North Furrow, Kakamas, Gordonia District	-28.785592 20.639647	National monument	Provincial Heritage Site	Building	9/2/032/0005	28797
Battlefield, Kakamas, Gordonia District	-28.742640 20.635730	National monument	Provincial Heritage Site	Battlefield	9/2/032/0006	28798
Water wheel, near DR Church Parsonage, South Furrow, Kakamas	-28.772950 20.622203	National monument	Provincial Heritage Site	Building	9/2/032/0008	28799
Water wheel No. 2, Plot 103, South Furrow, Kakamas	-28.783353 20.635208	National monument	Provincial Heritage Site	Building	9/2/032/0009/ 001	28793

HERITAGE SITES IN AND AROUND KAKAMAAS ARE DOCUMENTED ON THE SAHRA DATABASE:						
Site/Object Name	Coordinates	Archive Status	Declaration Type	Site type	Site Reference	Site ID
Water Wheel No. 1, Plot 103, South Furrow, Kakamas	-28.783504 20.635524	National monument	Provincial Heritage Site	Building	9/2/032/0009/004	28794
Water wheel, Plot 1057, North Furrow, Kakamas	-28.785597 20.640039	National monument	Provincial Heritage Site	Building	9/2/032/0009/005	28792
Water wheel, Plot 68, North Furrow, Kakamas	-28.785335 20.638437	National monument	Provincial Heritage Site	Building	9/2/032/0009/006	28791
Water Wheel, Plot 1467, South Furrow, Kakamas	-28.783988 20.636358	National monument	Provincial Heritage Site	Building	9/2/032/0009/009	28788
Kakamas Museum, Voortrekker Street, Kakamas	-28.770215 20.617134	National monument	Provincial Heritage Site	Building	9/2/032/0010	28789
Kakamas Memorial, Kakamas Battlefield, Kakamas	-28.743329, 20.635730			Monuments & Memorials, Burial Grounds & Graves	DC8/NAMM/0010	137912
Kakamas Perskeboom Monument, Kakamas Library, Kakamas	-28.773816, 20.622187			Monuments & Memorials	DC8/NAMM/0011	136310
Kakamas Suid 01	-28.762890, 20.535580			Burial Grounds & Graves	KAKA01	44550
Kakamas Suid 02	-28.762510, 20.538010			Burial Grounds & Graves	KAKA02	44551

6.1.5 Graves/Burials

Several graves were recorded in the area around the development footprint.

GRAVES/BURIALS RECORDED IN 10 KM RADIUS			
HIA/AIA	SITE	COORDINATES	HERITAGE RESOURCES
Van Schalkwyk 2013a	Kakamas Suid 28	28°45'46.40"S 20°32'8.09"E 28°45'45.04"S 20°32'16.84"E	Two large community cemeteries

GRAVES/BURIALS RECORDED IN 10 KM RADIUS

HIA/AIA	SITE	COORDINATES	HERITAGE RESOURCES
Rossouw 2021	Lutzburg cemetery	28°44'36.31"S 20°38'8.55"E	Small military graveyard and declared heritage site: commemorates several German soldiers who were killed in a battle against a force of the Union of South Africa, which took place here on the 4th February 1915
Beaumont 2008a		28° 30' 21.5" S, 20° 10' 45.9" E	Graveyard with approximately 50-60 burials
ACRM 2016	891	S28° 40.726' E20° 27.130'	Grave

7. IDENTIFIED RESOURCES AND HERITAGE ASSESSMENT

7.1 Surveyed area

The area surveyed for the impact assessment was dictated by the Google Earth map of the development footprints provided by the client. The proposed development area was surveyed by vehicle and on foot. The pedestrian survey was conducted in predominantly 30-50 m transects. **Seasonality has no bearing on the study, and fieldwork is deemed sufficient for the nature of the project.**

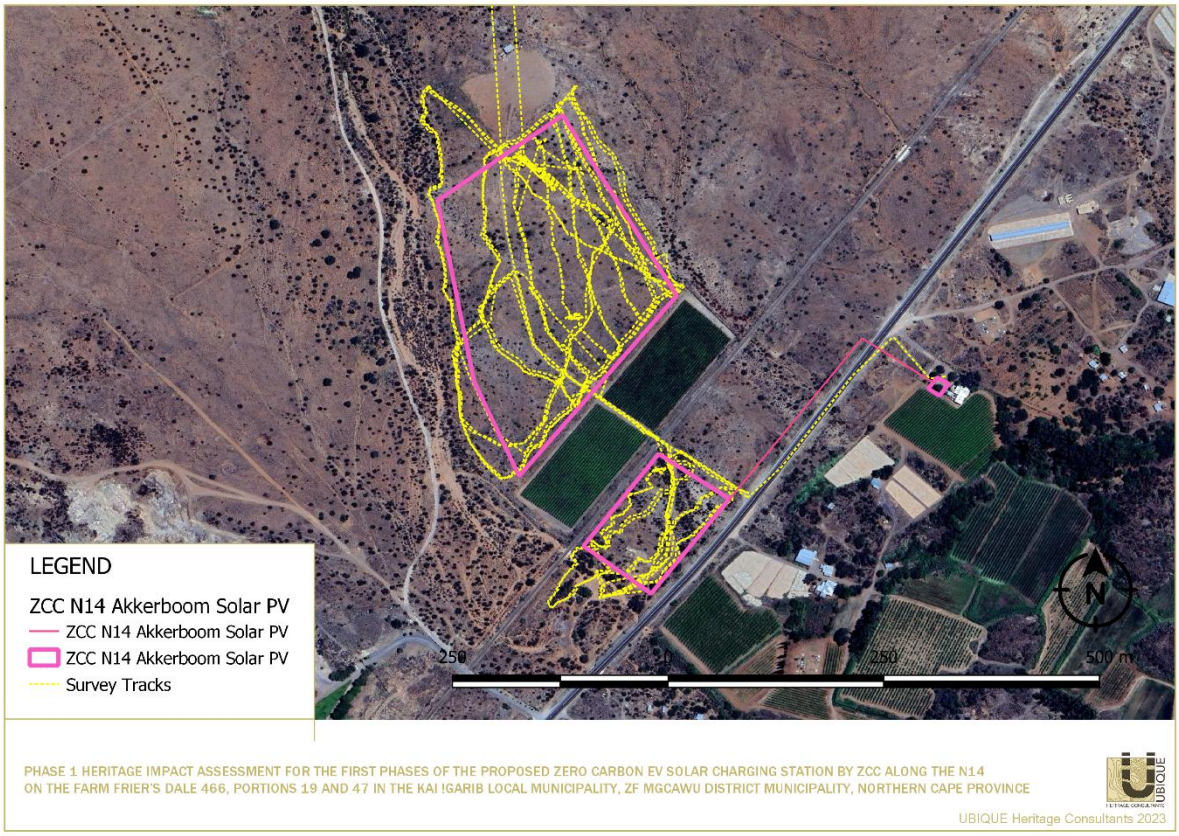


Figure 7 *Survey tracks across the development footprint.*

7.2 Description of the affected environment

The development area falls within the Bushmanland Arid Grassland vegetation type. Irregular plains characterise the Bushmanland Arid Grassland with slightly sloping plateaus sparsely vegetated by grassland dominated by white grasses (*Stipagrostis* species). This gives the

vegetation type the appearance of a semidesert steppe. The vegetation structure is also often altered in places where low shrubs of Salsola are present (Mucina & Rutherford 2006).

The study terrain is predominantly flat and rocky with sandy areas and a slight slope towards the south and southeast. Certain areas were previously disturbed by agricultural and road construction activities. A few two-track gravel roads are crossing the site. Rocky outcrops are present throughout the site. The N14 National Road runs east and southeast of the sites. The adjacent terrain is agricultural, mainly crop production and livestock farming.

The vegetation noted includes *Acacia erioloba* (Camelthorn), *Acacia mellifera* (Black thorn acacia), *Aizoon schellenbergii* (Skaapbossie), *Aloe argenticauda*, *Boscia albitrunca* (Grootwitgatboom), *Boscia foetida* (Stinkwitgat), *Enneapogon cenchroides* (Vaalsuurgras), *Rhigozum trichotomum* (Three-thorn), *Stipagrostis ciliate* (Tall bushman grass), *Stipagrostis namaquensis* (River bushman grass), *Eragrostis chloromelas* (Curly leaf). In addition, calcrete/Limestone, Banded Ironstone Formation (BIF), a few Dolorite patches, Quartz, shale, Quartzite, and Granite patches are visible within the footprint. One natural waterway was identified west of the footprints just outside the western boundary of the site footprints, flowing from north to south.

Figure 8 *Views of the affected development area.*

7.3 Identified heritage resources

7.3.1. Stone Age Identified

STONE AGE RESOURCES IDENTIFIED					
SITE ID #	DESCRIPTION		PERIOD	LOCATION	FIELD RATING/ SIGNIFICANCE/ RECOMMENDED MITIGATION
466/47-001	Type lithic/s	Blade or scraper	MSA/LSA	28º 44' 19.7" S 20º 49' 30.9" E	Field Rating IVC Low significance
	Raw material	BIF			
	N in m².	1/10m²			
	Context	No context. Open scatter			
	Additional	No context			
466/47-002	Type lithic/s	Chunk	MSA/LSA	28º 44' 15.7" S 20º 49' 29.8" E	Field Rating IVC Low significance
	Raw material	BIF			
	N in m².	1/10m²			
	Context	No context. Open scatter			
	Additional	No context			
466/47-003	Type lithic/s	Chunk and scraper	MSA/LSA	28º 44' 09.5" S 20º 49' 30.0" E	Field Rating IVC Low significance
	Raw material	BIF			
	N in m².	2/10m²			
	Context	No context. Open scatter			
	Additional	No context			
466/47-004	Type lithic/s	Chunk,flakes and scraper	MSA/LSA	28º 44' 16.8" S 20º 49' 31.6" E	Field Rating IVC Low significance
	Raw material	BIF			
	N in m².	5/50m²			
	Context	No context. Open scatter			
	Additional	No context			
466/47-005	Type lithic/s	Flake	MSA/LSA	28º 44' 10.6" S 20º 49' 31.7" E	Field Rating IVC Low significance
	Raw material	BIF			
	N in m².	1/10m²			
	Context	No context. Open scatter			
	Additional	No context			
466/47-006	Type lithic/s	Chunks	MSA/LSA	28º 44' 11.6" S 20º 49' 33.3" E	Field Rating IVC Low significance
	Raw material	BIF			
	N in m².	2/50m²			
	Context	No context. Open scatter			
	Additional	No context			
466/47-007	Type lithic/s	Chunks and flakes	MSA/LSA	28º 44' 23.5" S 20º 49' 35.1" E	Field Rating IVC Low significance
	Raw material	BIF			
	N in m².	4/20m²			
	Context	Alluvial-deposit			
	Additional	No context			

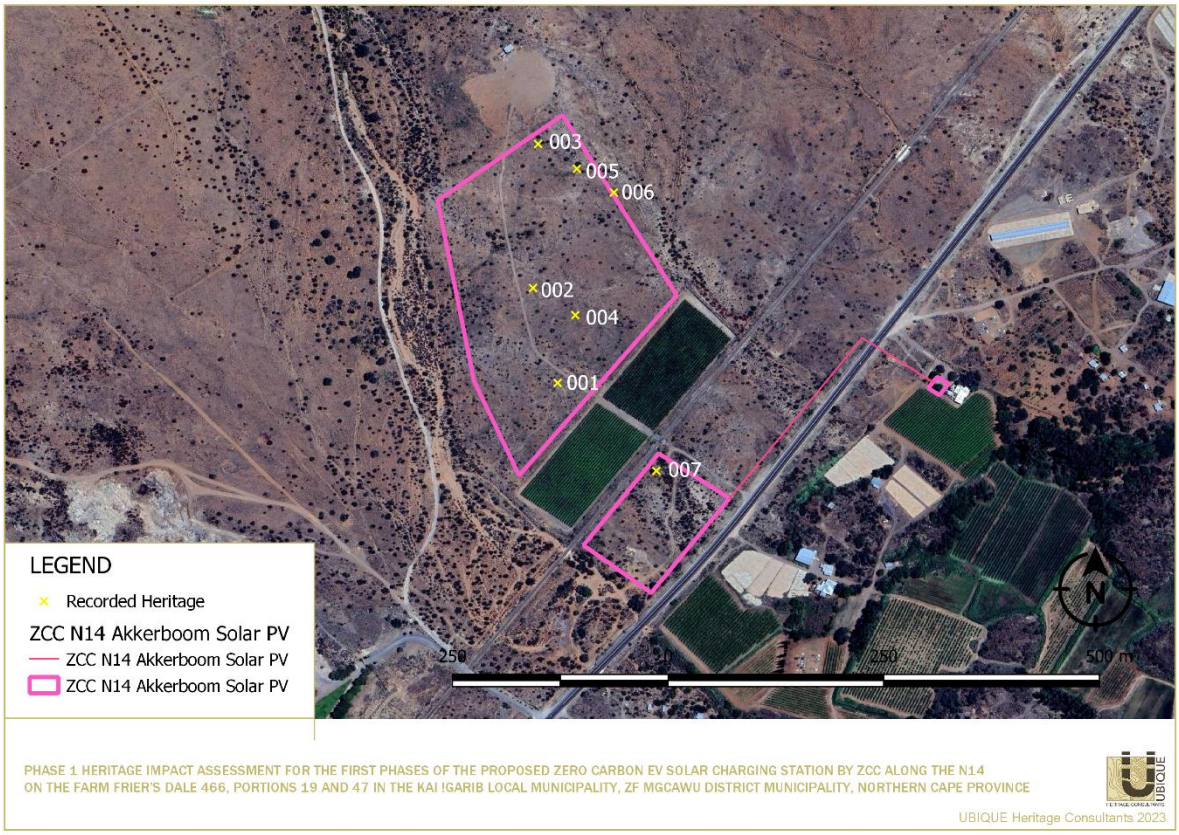


Figure 9 *Distribution of identified heritage resources on and around the development footprints*

7.4 Discussion

7.4.1. Archaeological features

7.4.1.1. Prehistorical

Only seven isolated, low-density occurrences of lithic material were recorded. The finds include late-MSA/early LSA scrapers, flakes and chunks made from Banded Ironstone Formation (BIF).

The lithic material shows various degrees of weathering and is without substantial archaeological context or matrix. Therefore, it is deemed minor scientific importance and not conservation-worthy (NCW).

The material is given a 'General' Protection C (Field Rating IV C). This means that it has been sufficiently recorded (in Phase 1). Therefore, it requires no further action.

4466/47/001

466/47/002

466/47/003

466/47/004

466/47/005

466/47/006

466/47/007

Figure 10 *The lithic material recorded on and around the study footprint.*

7.4.2. Palaeontological resources

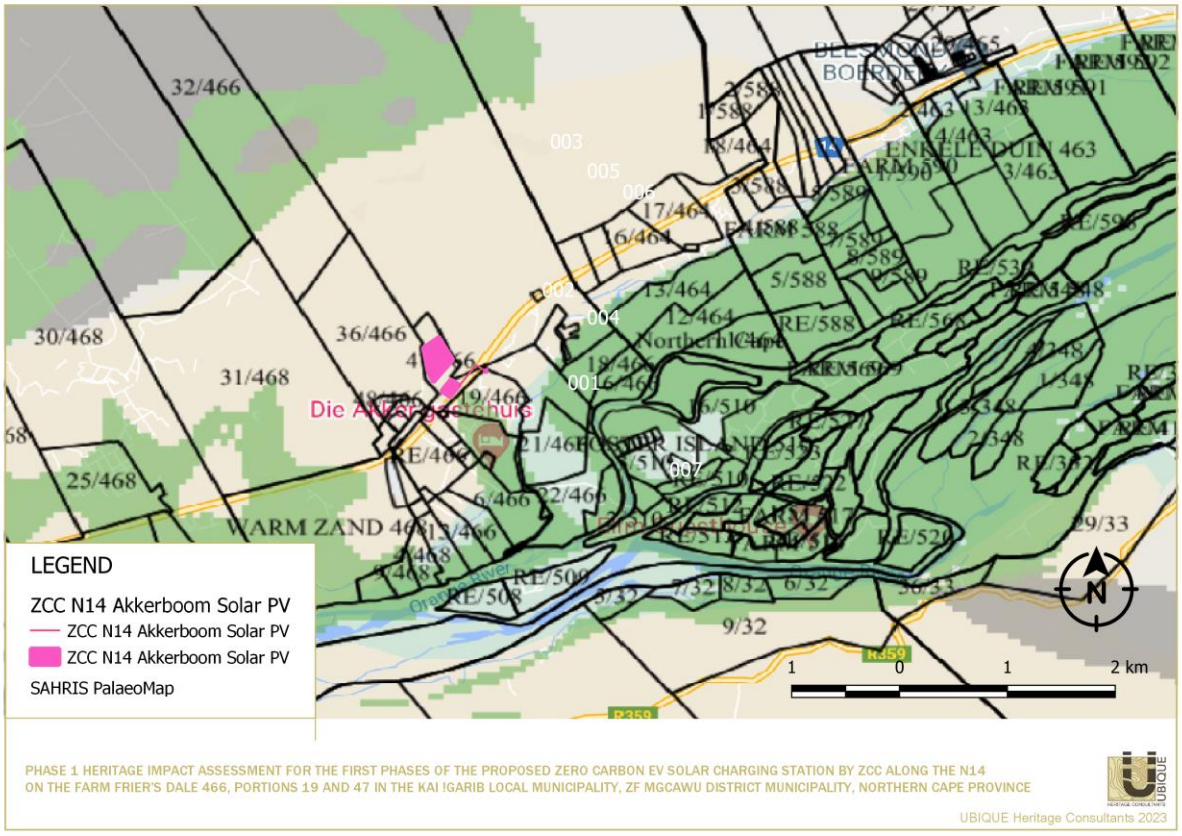


Figure 11 *The SAHRIS PalaeoSensitivity Map, indicating Unknown (clear), Insignificant/Zero (grey), and moderate (green) palaeontological significance in the study area, (https://sahris.sahra.org.za/map/palaeo).*

Elize Butler from Banzai Environmental conducted a palaeontological desktop assessment for the development footprint (see Appendix A). She determined that the Keimoes Suite (Namaqua-Natal

Metamorphic Province) underlies the study area. According to the PalaeoMap on the South African Heritage Resources Information System (SAHRIS) database, the Palaeontological Sensitivity of the Keimoes Suite is Zero as it is igneous in origin and thus unfossiliferous (Almond et al., 2013; SAHRIS website). The National Environmental Web-based Screening Tool indicates that the development has a Medium Palaeontological Sensitivity.

A low Palaeontological Significance has thus been allocated to the proposed development. It is therefore recommended that no further palaeontological heritage studies, ground truthing, or specialist mitigation be required pending the discovery of newly discovered fossils. It is considered that the proposed development will not have detrimental impacts on the area's palaeontological resources.

8. ASSESSMENT OF THE IMPACT OF THE DEVELOPMENT

ARCHAEOLOGICAL, HISTORICAL, & CULTURAL

NATURE	HERITAGE AND CULTURAL RESOURCES IDENTIFIED SITE(S): **LOW SIGNIFICANCE** Field Rating Field Rating IV C							
DEVELOPMENT PHASE	DEVELOPMENT IMPACT			IMPACT RATING		RECOMMENDED MITIGATION	IS IMPACT ACCEPTABLE?	
	CRITERIA	*BM	**AM	BEFORE MITIGATION	AFTER MITIGATION		*BM	**AM
PLANNING PHASE	Extent	2	2	Positive low impact	Positive low impact	NONE	YES	YES
	Probability	1	1					
	Reversibility	1	1					
	Irreplaceability	1	1					
	Duration	1	1					
	Cumulative Effect	1	1					
	Magnitude	1	1					
	Impact Significance	7	7					
CONSTRUCTION PHASE	Extent	2	1	Negative low impact	Negative low impact	NONE	YES	YES
	Probability	1	1					
	Reversibility	2	1					
	Irreplaceability	3	1					
	Duration	3	1					
	Cumulative Effect	2	2					
	Magnitude	2	1					
	Impact Significance	26	7					
OPERATIONAL PHASE	Extent	2	1	Negative low impact	Negative low impact	NONE	YES	YES
	Probability	1	1					
	Reversibility	2	1					
	Irreplaceability	3	1					
	Duration	3	1					
	Cumulative Effect	2	2					
	Magnitude	2	1					
	Impact Significance	26	7					
DECOMMISSIONING PHASE	Extent	2	1	Negative low impact	Negative low impact	NONE	YES	YES
	Probability	1	1					
	Reversibility	2	1					
	Irreplaceability	3	1					
	Duration	3	1					
	Cumulative Effect	2	2					
	Magnitude	2	1					
	Impact Significance	26	7					

IMPACT: The material recorded within the development footprint on Farm Frier's Dale 466 Portion 47 has no archaeological context with low historical or scientific value. The development impact is therefore considered negligible. The impact is considered as NEGATIVE LOW before mitigation and NEGATIVE LOW after mitigation during the construction, operational, and decommissioning phases.

MITIGATION: No mitigation is recommended.

PALAEONTOLOGY								
NATURE	FOSSILS AND PALAEONTOLOGICAL HERITAGE							
DEVELOPMENT PHASE	DEVELOPMENT IMPACT			IMPACT RATING		RECOMMENDED MITIGATION	IS IMPACT ACCEPTABLE?	
	CRITERIA	*BM	**AM	BEFORE MITIGATION	AFTER MITIGATION		*BM	**AM
CONSTRUCTION PHASE	Extent		1	Negative Medium impact	Negative low impact	NONE	YES	YES
	Probability		3					
	Reversibility		4					
	Irreplaceability		4					
	Duration		4					
	Cumulative Effect		2					
	Magnitude							
	Impact Significance		17					

IMPACT: Regarding the impact on palaeontological resources, an overall Zero Palaeontological Sensitivity is allocated to the development footprint. Thus, the development may be authorised to its whole extent, as the development footprint is not considered sensitive regarding palaeontological resources (Butler, 2023). Loss of fossil heritage will have a negative impact. Only the site will be affected by the proposed development. The expected duration of the impact is assessed as potentially permanent too long term. In the absence of mitigation procedures, the damage or destruction of any palaeontological materials will be permanent. Impacts on palaeontological heritage during the construction phase could potentially occur and are regarded as having a medium probability. As fossil heritage will be destroyed, the impact is irreversible. The significance of the impact occurring will be medium pre-mitigation and low post-mitigation.

MITIGATION: No mitigation is recommended.

8.1 Cumulative Impact

The term "Cumulative Effect" has, for the purpose of this report, been defined as the summation of effects over time which can be attributed to the operation of the project itself and the overall effects on the heritage significance of the site and within a 30 km radius, that can be attributed to the project and other existing and planned future projects. The Cumulative Impact of this project is considered to be Negative Low.

9. RECOMMENDATIONS

Based on the assessment of the potential impact of the development on the identified heritage, the following recommendations are made, taking into consideration any existing or potential sustainable social and economic benefits:

1. The MSA/LSA lithic occurrence within the development footprint is of low significance and is not conservation-worthy, and the impact of the development is negligible. Therefore, no further mitigation is recommended.

2. A low Palaeontological Significance has thus been allocated to the proposed development. It is therefore recommended that no further palaeontological heritage studies, ground truthing, or specialist mitigation be required pending the discovery of newly discovered fossils. It is considered that the proposed development will not have detrimental impacts on the palaeontological resources of the area. (Butler, 2023).

3. Although all possible care has been taken to identify sites of cultural importance during the investigation of study areas, it is always possible that hidden or sub-surface sites could be overlooked during the assessment. If during construction, any evidence of archaeological sites or remains (e.g. remnants of stone-made structures, indigenous ceramics, bones, stone artefacts, ostrich eggshell fragments, charcoal and ash concentrations), fossils or other categories of heritage resources are found during the proposed development, SAHRA APM Unit must be alerted as per section 35(3) of the NHRA. If unmarked human burials are uncovered, the SAHRA Burial Grounds and Graves (BGG) Unit must be alerted immediately as per section 36(6) of the NHRA. Depending on the nature of the finds, a professional archaeologist or palaeontologist must be contacted as soon as possible to inspect the findings. If the newly discovered heritage resources are of archaeological or palaeontological significance, a Phase 2 rescue operation may be required, subject to permits issued by SAHRA. UBIQUE Heritage Consultants and its personnel will not be held liable for such oversights or costs incurred due to such oversights.

10. CONCLUSION

Heritage resources on Farm Frier's Dale 466, Portions 19 and 47, Kai !Garib Local Municipality, ZF Mgcawu District Municipality, Northern Cape Province, will be negatively impacted by the proposed development. However, the impact will be low, negative and acceptable. Therefore, the proposed project can continue with regards to heritage.

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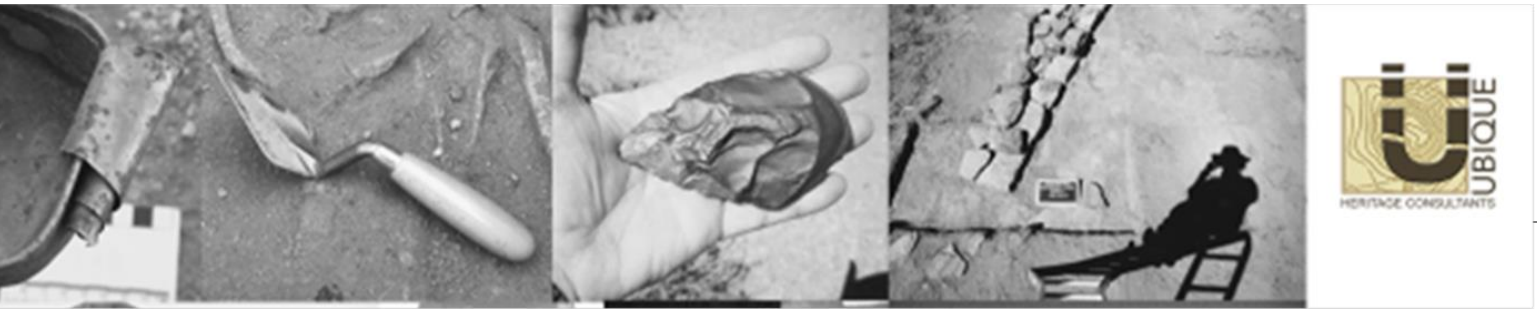

APPENDIX A

PALAEONTOLOGICAL IMPACT ASSESSMENT ZCC - RENEWABLE ELECTRICAL VEHICLE CHARGING FACILITY NEAR KAKAMAS AND KEIMOES, NORTHERN CAPE PROVINCE

BANZAI ENVIRONMENTAL

PALAEONTOLOGICAL IMPACT ASSESSMENT

ZCC - RENEWABLE ELECTRICAL VEHICLE CHARGING FACILITY NEAR KAKAMAS AND KEIMOES, NORTHERN CAPE PROVINCE

September 2023

(Revised November 2024)

Compiled for UBIQUE Heritage Consultants

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 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 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 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 of 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 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.

PALAEONTOLOGICAL CONSULTANT: Banzai Environmental (Pty) Ltd
CONTACT PERSON: Elize Butler
Tel: +27 844478759
Email: info@banzai-group.com

SIGNATURE: 

This Palaeontological Impact Assessment report (as part of the Heritage Impact Assessment) 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: Checklist for Specialist studies conformance with Appendix 6 of the EIA Regulations of 2014 (as amended).

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	The relevant section in the 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 vita	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 – Methods and TOR	-
(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 8	-
(d) The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 1; & 8	
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process, inclusive of equipment and modelling used	Section 4 Approach and Methodology	-

Table 1: Checklist for Specialist studies conformance with Appendix 6 of the EIA Regulations of 2014 (as amended).		
Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	The relevant section in the report	Comment where not applicable.
(f) details of an assessment of the specifically 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 1; & 8	
(g) An identification of any areas to be avoided, including buffers	Section 1 & 8	
(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 4.1 – Assumptions and Limitations	-
(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 & 8	
(k) Any mitigation measures for inclusion in the EMPr	Section 1 & 8	
(l) Any conditions for inclusion in the environmental authorisation	Section 1 & 8	
(m) Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 1 & 8	
(n)(i) A reasoned opinion as to whether the proposed activity, activities or portions thereof should be authorised and	Section 1 & 8	
(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 1 & 8	-

Table 1: Checklist for Specialist studies conformance with Appendix 6 of the EIA Regulations of 2014 (as amended).		
Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	The relevant section in the report	Comment where not applicable.
(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 was handled as part of the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) process.
(p) A summary and copies of any comments that were received during any consultation process	N/A	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.	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 Ubique Heritage Consultants to conduct the Palaeontological Desktop Assessment (PDA) to assess the proposed establishment of an Electric Vehicle Charging Facility, Solar Pv Plant and associated infrastructure at Akkerboom Farm Stall (Portions 19 & 47 of Farm Frier's Dale, No. 466) along the N14, between Kakamas and Keimoes, Northern Cape. In accordance with the National Environmental Management Act 107 of 1998 (NEMA) and to comply with the National Heritage Resources Act (No 25 of 1999, section 38) (NHRA), this PIA is necessary to confirm if fossil material could potentially be present in the planned development area, to evaluate the potential impact of the proposed development on the Palaeontological Heritage and to mitigate possible damage to fossil resources.

The study area is underlain by the Keimoes Suite (Namaqua-Natal Metamorphic Province). According to the PalaeoMap on the South African Heritage Resources Information System (SAHRIS) database, the Palaeontological Sensitivity of the Keimoes Suite is Zero as it is igneous in origin and thus unfossiliferous (Almond et al., 2013; SAHRIS website). The National Environmental Web-based Screening Tool indicates that the development has a Medium Palaeontological Sensitivity.

A low Palaeontological Significance has thus been allocated to the proposed development. It is therefore recommended that no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required pending the discovery of newly discovered fossils. It is considered that the development of the proposed development will not lead to detrimental impacts on the palaeontological resources of the area.

If fossil remains are discovered during any phase of construction, either on the surface or below, the ECO in charge of these developments must be alerted immediately. These discoveries should be protected (if possible, *in situ*), and the ECO must report to SAHRA so that appropriate mitigation can be carried out by a professional palaeontologist. SAHRA Contact details: South African Heritage Resources Agency, 111 Harrington Street, PO Box 4637, Cape Town 8000, South Africa. Email: Phone: +27 (0)21 462 4502. Fax: +27 (0)21 462 4509 Web: www.sahra.org.za)
Preceding any collection of fossil material, the specialist would need to apply for a collection permit from SAHRA. Fossil material must be housed in an approved collection (museum or university), and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA.

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Appendix A: Curriculum Vitae

1 INTRODUCTION

South Africa has pledged to reduce greenhouse gas emissions (GHG) to 398-510 MtCO2e by 2025 and 350-420 MtCO2e by 2030 in accordance with the Paris Agreement. In response to the mission, the government created the Green Transport Strategy for South Africa (2018-2050). South Africa intends to widely adopt the use of electric vehicles (EVs) in its vehicle population as part of its commitment to reduce emissions from the transportation sector, which accounts for 10.8% of total GHG emissions in the country.

In South Africa, EVs now have a limited market share (about 2300 vehicles), and if we want this figure to grow exponentially, the government must carefully evaluate the availability and accessibility of EV charging infrastructure. While the drive to electrify the automotive sector is well advanced in urban and suburban areas, the same cannot be said for rural South Africa, where a lack of rural charging infrastructure remains the most significant barrier to large-scale EV adoption. Because EV owners can charge their vehicles overnight at home and easily accomplish most home-based trips (home to work, home to school, home to groceries) on a single charge, range anxiety is eliminated. When EV owners want more dependable charging infrastructure for long-distance travel, the problem arises. Due to a lack of chargers in rural areas and slow charging periods, EV users are more likely to be stranded without recharging capabilities.

Given the current situation in South Africa, where the market share of EVs is still relatively small, it is essential to address the lack of reliable chargers, especially in rural areas, in order to support the exponential growth of EV adoption. The crucial question that follows is how to properly handle this problem and guarantee the availability of reliable charging infrastructure, particularly in rural South Africa. We can create a network of accessible and sustainable electric transit that benefits every South African, regardless of location, by tackling this issue head-on.

Deloitte's 2023 Global Automotive Consumer Study indicates that SA is moving towards an electric mobility future as demand for petrol and diesel vehicles drops. The preference for gasoline/diesel fell by 74% in the 2023 poll from 84% in 2022. Although EVs are much more environmentally friendly, lower fuel prices are the main driver of EV adoption. According to market research, lower petrol prices continue to be the key justification for buying an EV.

Even though more South Africans are buying electric cars, many people are still sceptical about them. According to 53% of those surveyed, the biggest problem with EVs is the absence of charging infrastructure nationwide. Deloitte claims this emphasizes how critical collaboration between the public and commercial sectors is to solving the problem.

The transport sector is South Africa's second-largest source of CO2 emissions after the electricity sector. Road transport alone is responsible for 91.2% of this sector's emissions, accounting for 13% of all emissions in the nation. Considering that the road transport sector is responsible for 16% of global emissions, electric vehicles (EVs) have become a crucial technology for decarbonizing it.

Zero Carbon Charge (ZCC) is developing a network of ultra-fast electric vehicle (EV) charging facilities/stations powered by renewable energy, allowing South African drivers to travel across the country with the knowledge that charging stations are located every 150 kilometres along all major roads in South Africa. Charging stations will be built with existing infrastructure, such as farm stalls, businesses, and guest homes along South African national and provincial roadways.

The proponent intends to establish a fully renewable energy-powered electric vehicle (EV) charging facility at the Akkerboom Farm Stall. The project site is situated on Portions 19 & 47 of Farm Frier's Dale, No. 466, along the N14, between Kakamas and Keimoes, in the Northern Cape. The project will encompass the development of a solar photovoltaic (PV) plant, a battery energy storage system (BESS), and associated infrastructure to enable sustainable energy generation in order to efficiently charge EV's.

1.1 Charging technology

Project Components:

1. Solar PV Plant:

The PV plant will consist of an array of solar panels installed in 2 steps: Stage 1 and stages 2-7 (Appendix 12). The development will take place in stages as the demand for electricity increases. The solar panels (of the entire development) are expected to generate an electrical output of approximately 7 megawatts (MW) (approximately 1 MW per ha), which will be transmitted to the battery storage units and the EV charging infrastructure. The solar panels will be strategically placed to optimize energy capture, considering site-specific environmental factors such as solar irradiation levels and shading.

2. Battery Energy Storage System (BESS):

The project will incorporate battery energy storage units that will store the electricity generated by the solar PV plant. These batteries will be housed in secure containers alongside other energy management equipment to ensure optimal efficiency and safety. The storage system will provide consistent power to the EV charging infrastructure, ensuring uninterrupted service even during low solar generation or high demand periods.

3. Electric Vehicle Charging Infrastructure:

The EV charging facility will accommodate approximately six electric vehicles at any given time. This infrastructure will be powered entirely by the solar PV plant and the energy stored in the BESS, making it a sustainable and eco-friendly solution for travellers and locals using electric vehicles along the N14 corridor. The facility will be equipped with fast-charging stations, designed to minimize downtime for EV users.

4. Electricity Transmission Infrastructure:

The electricity transmission infrastructure will connect the solar PV plant and the battery storage units to the EV charging stations. The initial stage of the project will involve the installation of approximately 300 meters of transmission cabling, with additional stages extending the cabling by a further 450 meters to support the expansion (stages 2-7).

5. Development Footprint:

The total development footprint of the project, including the solar PV plant, BESS, and EV charging infrastructure, will cover approximately 7 hectares at the Akkerboom Farm Stall. This footprint includes the installation of necessary utilities, access roads, and support structures, ensuring seamless integration of the renewable energy generation systems with the EV charging facility.

2 QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

Mrs. Elize Butler carried out the current study. For projects in the Free State, KwaZulu-Natal, Eastern, Central, and Northern Cape, Northwest, Gauteng, Limpopo, and Mpumalanga, she has completed almost 500 palaeontological impact assessments. She has more than 30 years of experience in the field and an MSc (cum laude) in Zoology from the University of the Free State in South Africa with a focus in Palaeontology. She is adept at locating, collecting, and storing fossils. In 2006, she became a member of the Palaeontological Society of South Africa (PSSA), and in 2014, she began performing PIAs.

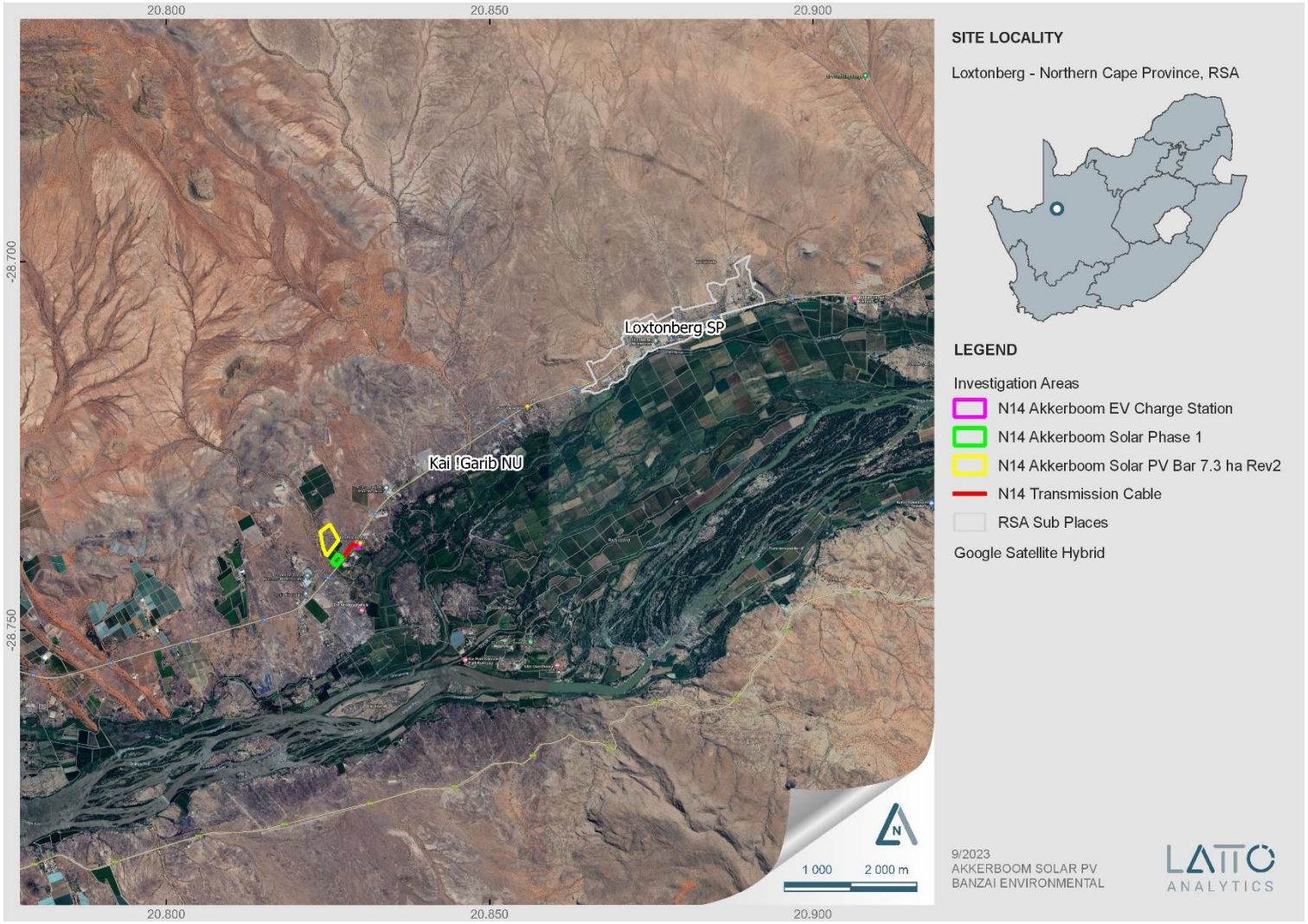

***Figure 1**: Regional locality of the proposed ZCC EV Akkerboom Charging Facility on Portion 47 of Farm Frier's Dale No. 466 between Kakamas and Keimoes in the Northern Cape Province.*

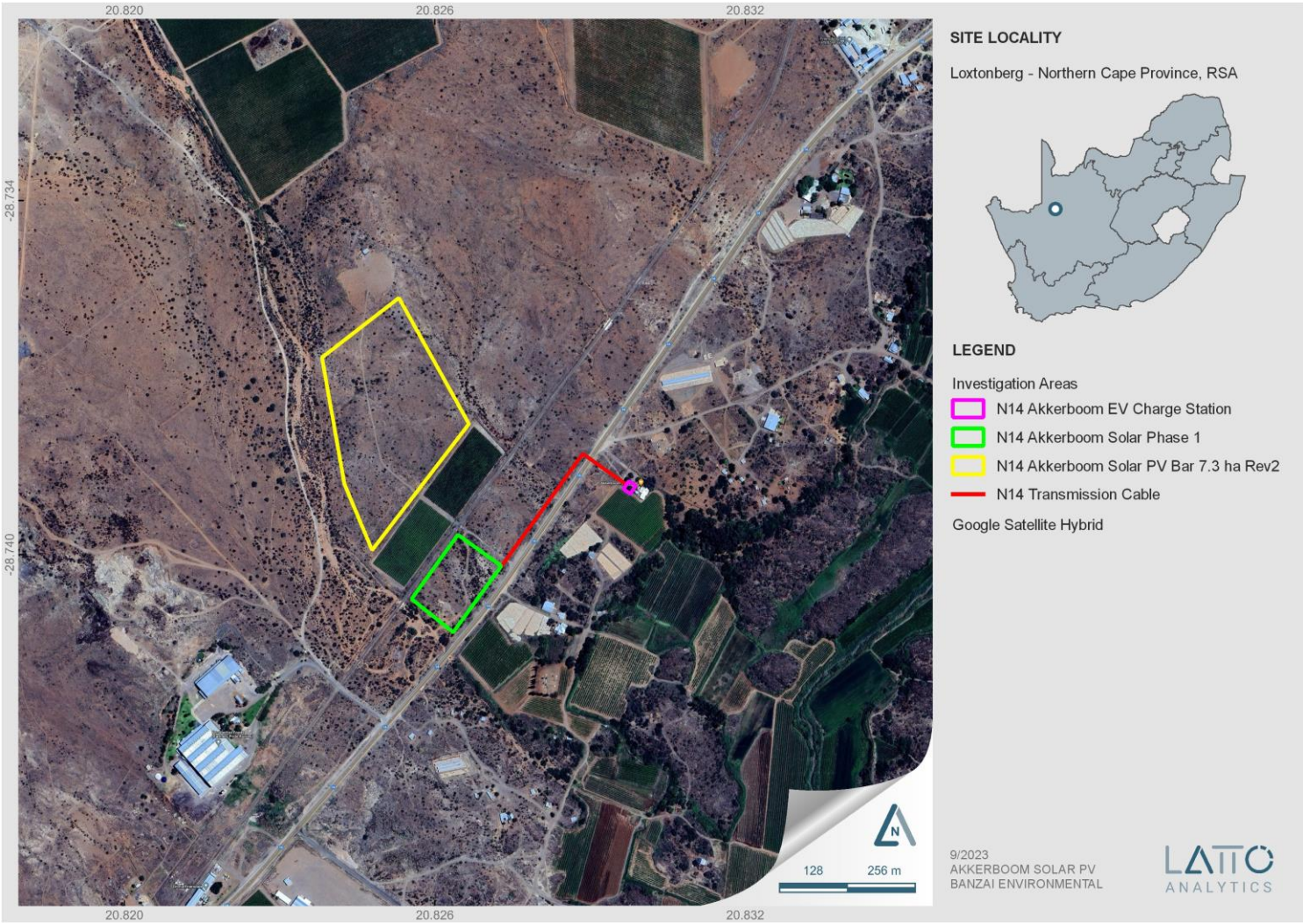

***Figure 2**: Locality Map of the proposed ZCC EV Akkerboom Charging Facility on Portion 47 of Farm Frier's Dale No. 466 between Kakamas and Keimoes in the Northern Cape Province.*

3 NATIONAL HERITAGE RESOURCES ACT (25 OF 1999)

Cultural Heritage in South Africa, including 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".

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

- National Environmental Management Act (NEMA) Act 107 of 1998
- National Heritage Resources Act (NHRA) Act 25 of 1999
- Minerals and Petroleum Resources Development Act (MPRDA) Act 28 of 2002
- Notice 648 of the Government Gazette 45421- general requirements for undertaking an initial site sensitivity verification where no specific assessment protocol has been identified.

The next section in each Act is directly applicable to the identification, assessment, and evaluation of cultural heritage resources.

GNR 982 (Government Gazette 38282, 14 December 2014) promulgated under the National Environmental Management Act (NEMA) Act 107 of 1998

- Basic Assessment Report (BAR) – Regulations 19 and 23
- Environmental Impacts Assessment (EIA) – Regulation 23
- Environmental Scoping Report (ESR) – Regulation 21
- Environmental Management Programme (EMPr) – Regulations 19 and 23

National Heritage Resources Act (NHRA) Act 25 of 1999

- Protection of Heritage Resources – Sections 34 to 36
- Heritage Resources Management – Section 38

MPRDA Regulations of 2014

Environmental reports to be compiled for application of mining right – Regulation 48

- Contents of scoping report – Regulation 49
- Contents of environmental impact assessment report – Regulation 50
- Environmental management programme – Regulation 51
- Environmental management plan – Regulation 52

The NEMA (No 107 of 1998) states that an integrated EMP should (23:2 (b)) "*…identify, predict and*

evaluate the actual and potential impact on the environment, socio-economic conditions and cultural heritage".

In agreement with legislative requirements, EIA rating standards as well as SAHRA policies, the following comprehensive and legally compatible PIA report have been compiled.

Palaeontological heritage is exceptional and non-renewable and is protected by the NHRA. Palaeontological resources 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 adheres 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 by regulations by SAHRA or a Provincial Heritage Resources Authority.

4 METHODS AND TERMS OF REFERENCE

This PDA assesses the development's potential impact on the fossil heritage. This Palaeontological Assessment is part of the HIA Report. The PIA's goals are to 1) identify the palaeontological significance of the rock formations in the footprint; 2) evaluate the palaeontological magnitude of the formations; 3) clarify the impact on fossil heritage; and 4) make recommendations for how the developer might protect and minimize potential harm to fossil heritage, according to the "SAHRA APM Guidelines: Minimum Standards for the Archaeological and Palaeontological Components of Impact Assessment Reports".

Calculations of the palaeontological state of each rock segment and the potential impact of development on fossil history take into account the palaeontological status of the rocks, the type of development, and the amount of bedrock removed.

The Provisional DFFE Screening Tool, the SAHRIS Palaeosensitivity map, all Palaeontological Impact Assessment reports for the same area, Google Earth images, topographical and geological maps, as well as academic articles about specimens from the development area and Assemblage Zones, are all used to create scoping reports.
A field-based assessment is necessary when the development footprint has a moderate to high palaeontological sensitivity. A desktop or field assessment of the exposed rock is used to evaluate the significance of the proposed development's impact, and recommendations for more research or mitigation are made. Excavations for the project often only take place during the building phase, changing the terrain and destroying or permanently encasing fossils at or below the ground surface. Then, access to Fossil Heritage will no longer be available for academic study.

When doing a site investigation, a palaeontologist examines the local development as well as the quantity and variety of fossils found there. This can be demonstrated by looking at representative fossiliferous rock exposures (most igneous and metamorphic rocks are not fossiliferous, whereas sedimentary rocks contain fossil heritage). Examined rock exposures frequently contain a sizeable portion of the stratigraphic unit, primarily composed of recently exposed (unweathered) rock. These exposures may be man-made (such as quarries, open building excavations, and even railway and road cuttings) or natural (such as cliffs and dongas as well as rocky outcrops along streams or riverbanks). It is usual practice for palaeontologists to record well-preserved fossils (GPS, and stratigraphic data) during field assessment examinations.

Although mitigation is often done before construction, it may occur if potentially fossiliferous bedrock is revealed. Fossil collection and documentation are examples of mitigation. A permit from SAHRA must be obtained before beginning any fossil excavation, and the material must be stored at an authorized facility. When mitigation is properly used, it is possible to have a positive impact by raising awareness of the palaeontological past of the area.

By physically evaluating bedrock outcrops to determine their lithology and fossil richness and crisscrossing the development footprint, one can assess an area's fossil potential. Because the presence of fossils at the surface is so unexpected, an average sample size of the region is investigated. To be clear, however, the lack of fossils in a development footprint does not automatically suggest that there is no palaeontologically important material present on the site (on or below the ground surface).

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;
- Describe the proposed project and provide information regarding the developer and consultant who commissioned the study;
- Describe the location of the proposed development and provide geological and topographical maps
- Provide palaeontological and geological history of the affected area;
- Identify sensitive areas to be avoided (providing shapefiles/kmls) in the proposed development;
- Evaluate 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 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 are impacts that 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
- Detail the implications of specialist findings for the proposed development (such as permits, licenses, etc.).

4.1 Assumptions and Limitations

The geology of the area is the focal point of geological maps, and the sheet explanations of the Geological Maps were not intended to focus on palaeontological heritage. Many inaccessible areas of South Africa have never been examined by palaeontologists, and data is typically dependent solely on aerial pictures. Locality and geological information in museums and university databases are out of date, and data acquired in the past is not always adequately documented.

Comparable Assemblage Zones in other places are also used to provide information on the existence of fossils in areas that have not before been recorded. When similar Assemblage Zones and geological

formations are used for Desktop studies, it is commonly assumed that exposed fossil exists within the footprint. As a result, a field assessment will improve the accuracy of the desktop evaluation.

5 GEOLOGICAL AND PALAEONTOLOGICAL HISTORY

The ZCC EV Charging Facility near Keimoes and Kakamas in the Northern Cape Province is depicted on the 1:250 000 Upington 2820 (1988) Geological Map (Council for Geosciences, Pretoria). This geological map (Figure 3, Table 2) indicates that the study area is underlain by the Friersdale Charnockite of the Keimoes Suite (Mf, Namaqua Natal Province). The updated Geology (Figure 4) (Council for Geosciences, Pretoria) only indicates that the EV Charging Facility is underlain by the Keimoes Suite (stk, Namaqua Natal Province).). According to the PalaeoMap (Figure 5, Table 3) on the South African Heritage Resources Information System (SAHRIS) database, the Palaeontological Sensitivity of the Keimoes Suite is Zero (grey) as it is igneous in origin and thus unfossiliferous (Almond et al., 2013; SAHRIS website). The National Environmental Web-bases Screening Tool indicates that the development has a Medium (yellow) Palaeontological Sensitivity (Figure 6).

Namaqua-Natal Province comprised of igneous and metamorphic rocks (e.g., gneisses, schists, quartzites, amphibolites) plus major granitic and gabbroic (norite) intrusions), that were formed during the Namaqua Orogeny about 1200 to 1000 Ma (million years ago). These rocks form outcrops in the Northern Cape as well as in KwaZulu Natal. Research has found that these rocks form part of an uninterrupted, 400-km wide and 1400-km-long arced orogenic belt that underlies the Phanerozoic Karoo Supergroup (Cornell et al., 2006). The Namaqua-Natal Metamorphic Province comprises metasediments that are unfossiliferous. This bedrock is exposed in places where the sedimentary deposits of the Kalahari Group have been eroded away. These superficial sands (Kalahari Group) are not indicated on the 1:250 000 scale map but are present in the development area. The Kalahari Group sedimentary deposits on the edge of the Kalahari Basin are thin. The basal pebbly sands (Eden Formation) that were deposited in braided streams (Haddon, 2000) may overly be bedrock. Calcretes present in the Mokalanen Formation have formed in several sediments, e.g., colluvium, windblown sands, as well as ephemeral streams and pans. Sometimes, these calcretes may attain considerable thickness and represent polyphase development during the last 5Ma (late Miocene/Pliocene). The calcretes are overlain by red aeolian sands (Gordonia Formation) of the Kalahari. Calcrete deposits may accumulate in pans beneath the aeolian sands. Radiometric dating could thus far not establish a precise boundary between the Quaternary and Tertiary (Kent,1980). The Gordonia Formation (Kalahari Group) 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).

According to Cornell et al. (2006) and Moen (2007), the ancient Keimoes Suite is a component of the Precambrian basement rocks that make up the Namaqua-Natal Province of the Mid Proterozoic

(Mokolian) era. Keimoes Suite consists of dark grey to leucocratic, grandiorite, charnockite and minor diorite granite. Sands from porous dunes are typically not good for preserving fossils. However, the mummification of soft tissues might be at play in this situation, and migrating lime-rich groundwaters from the underlying bedrocks (such, for instance, dolerite) might cause the rapid concretization of organic structures like burrows and root casts. This unit may occasionally contain terrestrial fossil remnants, such as calcretized rhizoliths (root castings), termitaria (such as Hodotermes, the harvester termite), ostrich egg shells (Struthio), and land snail shells (such as Trigonephrus).

Other fossil groups, such as freshwater bivalves and gastropods (such as Corbula, Unio), snails, ostracods (seed shrimps), charophytes (stonewort algae), diatoms (microscopic algae inside siliceous shells), and stromatolites (laminated microbial limestones), are associated with the nearby watercourses and pans. Diatoms and other microfossils can be blown onto the neighbouring sand dunes by the wind. Since these Kalahari fossils (or subfossils) are expected to exist intermittently but broadly, it is anticipated to have poor overall palaeontological sensitivity.

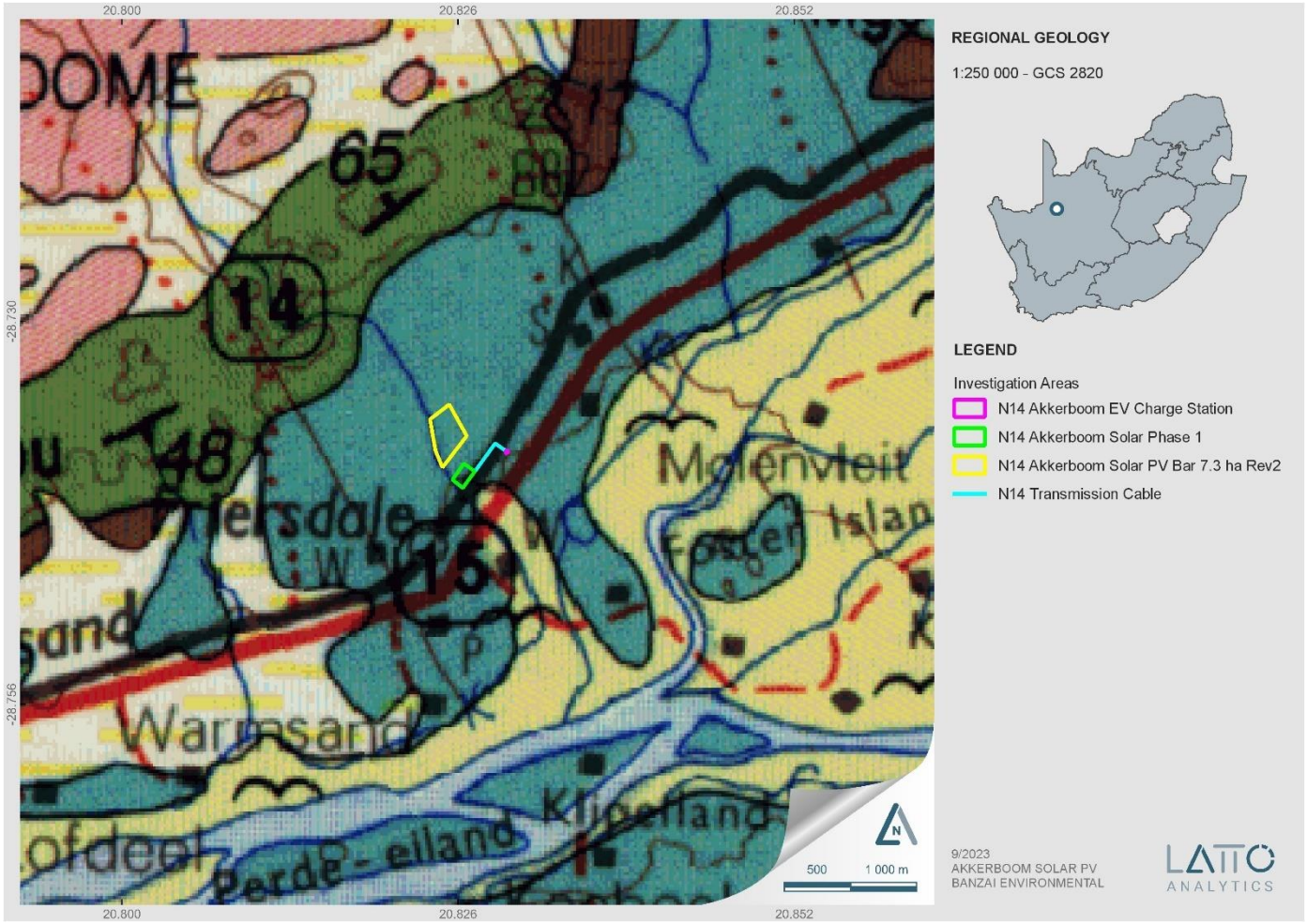

***Figure 3**. Extract of the 1:250 000* Upington 2820 (1988) *Geological Map (Council for Geosciences, Pretoria) indicating that the study area is underlain by the* Friersdale Charnockite of the Keimoes Suite (Mf, Namaqua Natal Province).

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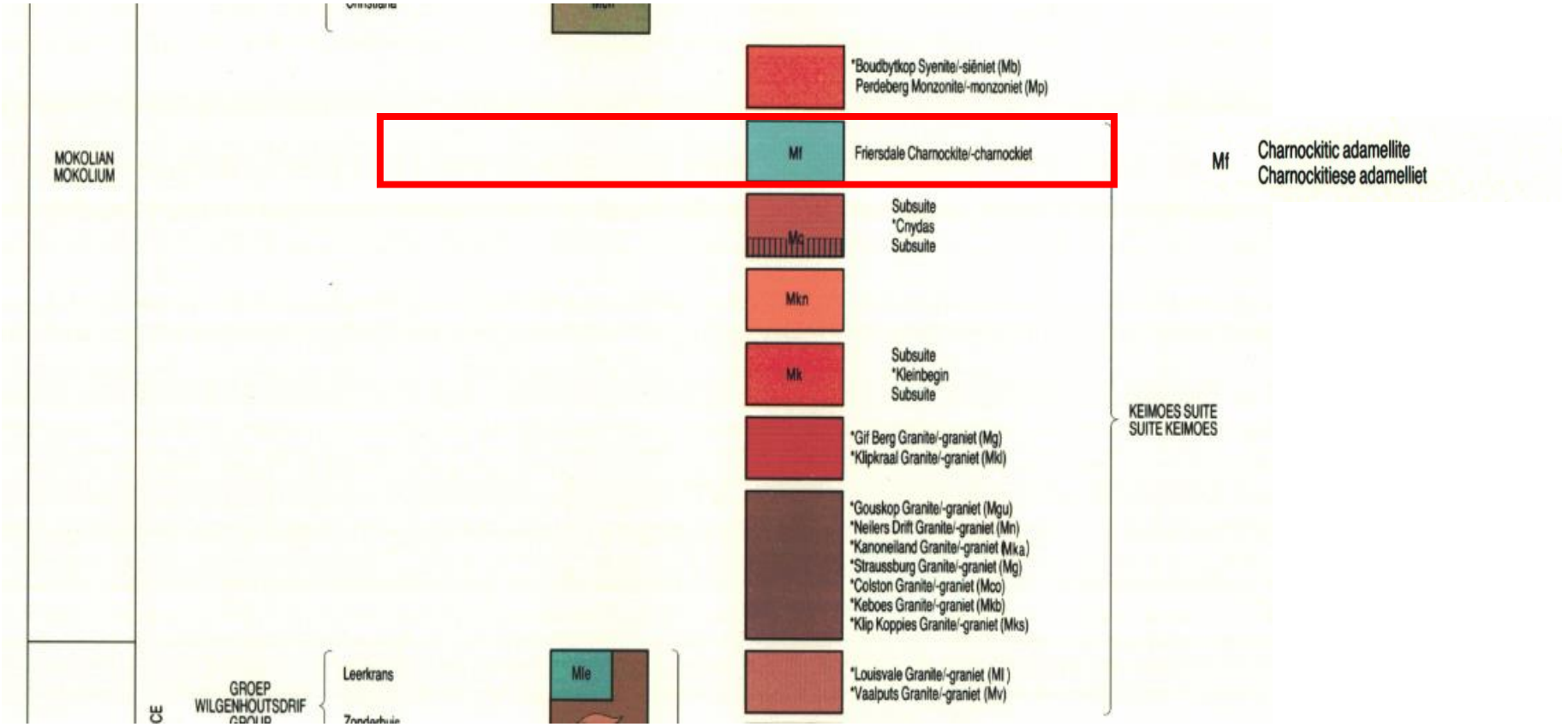
Table 2: Legend of the 1:250 000 Upington *2820 (1988) Geological Map* Geological Map (Council for Geosciences, Pretoria).



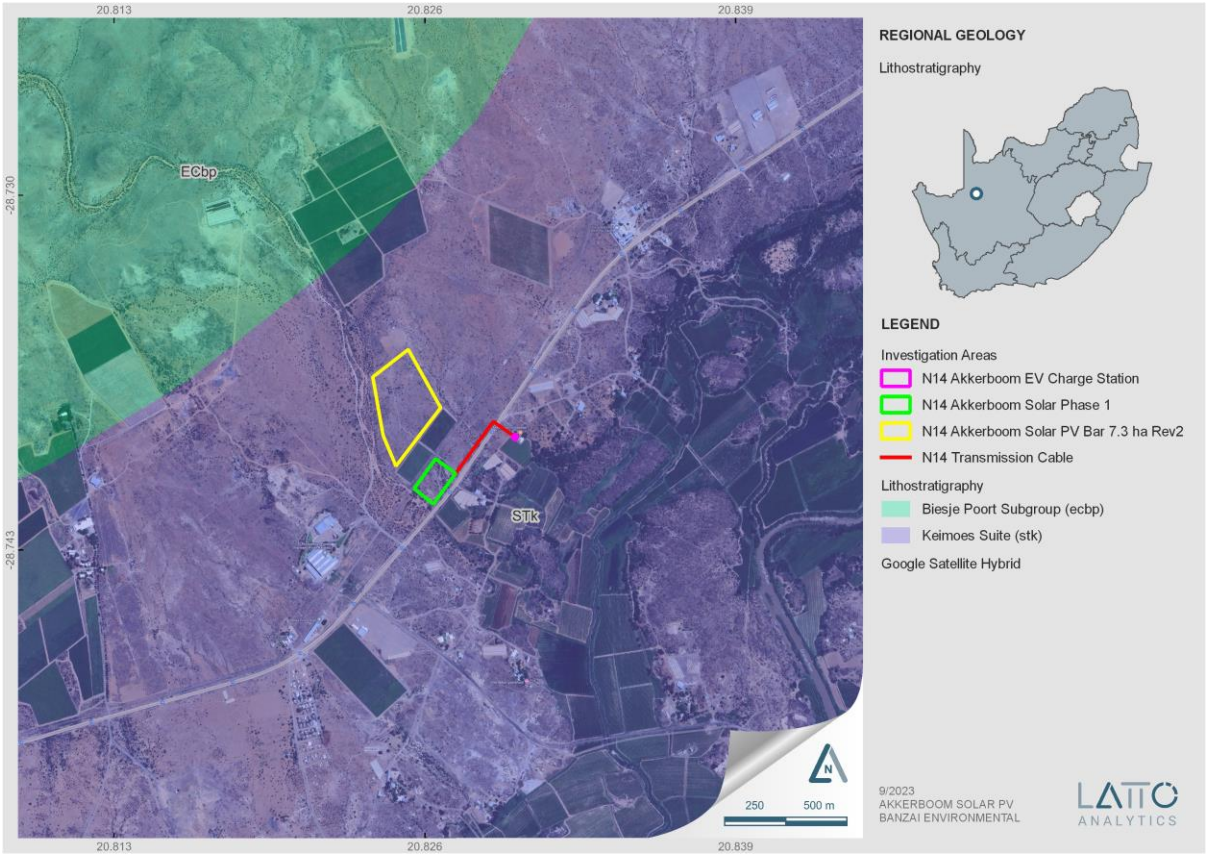


***Figure 4**: Updated geology (Council for Geosciences, Pretoria) indicates that the ZCC EV Charging Facility near Kakamas and Keimoes, in the Northern Cape Province is underlain by the unfossiliferous Keimoes Suite (stk, Namaqua Natal Province).*

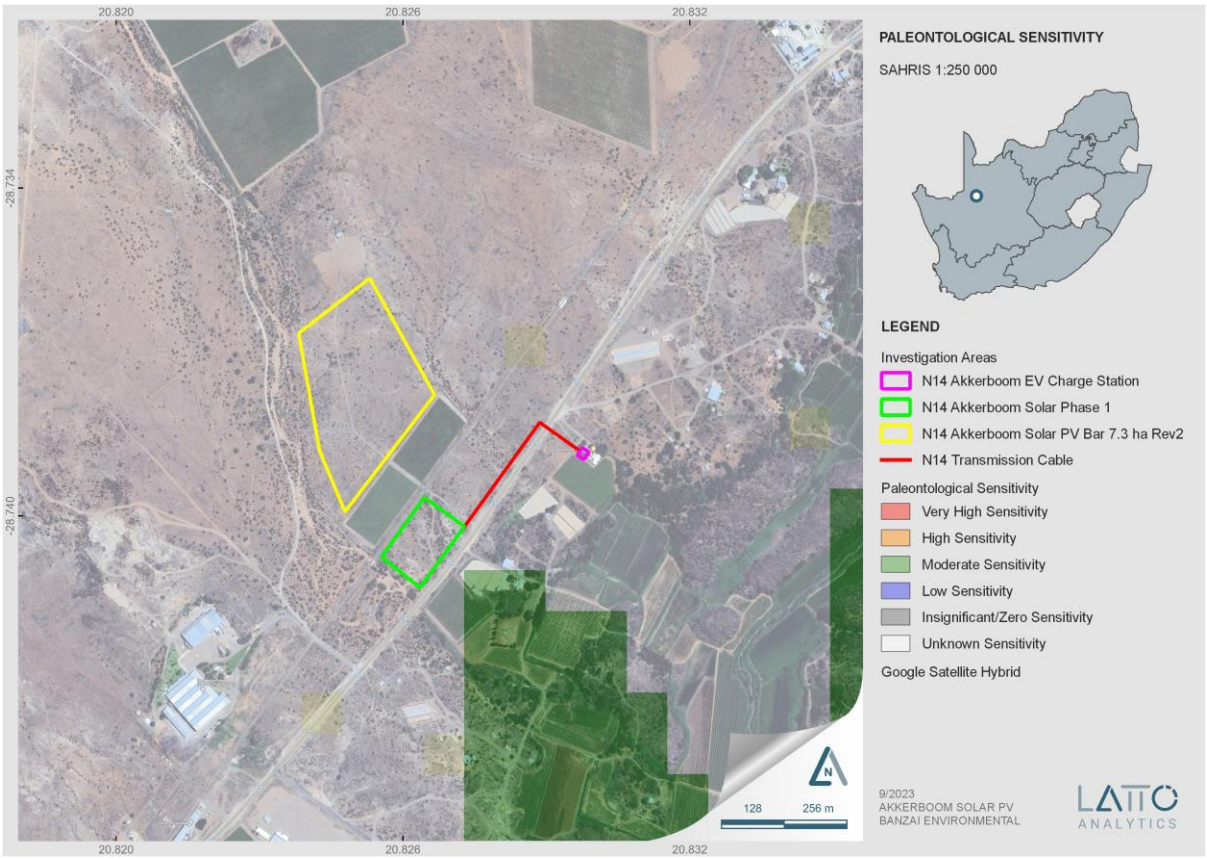
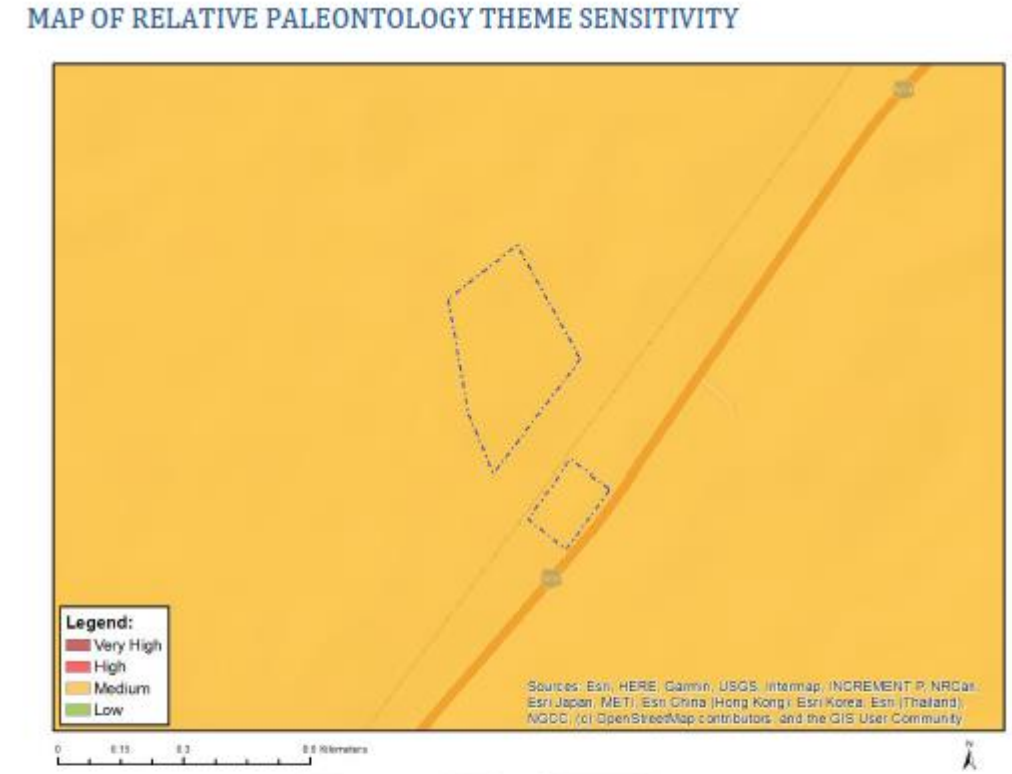


***Figure 5**: Extract of the 1 in 250 000 SAHRIS PalaeoMap map (Council of Geosciences) indicating that the development is underlain by sediments with a Zero Palaeontological Sensitivity.*

The colours on the PalaeoMap indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

Table 3:Palaeontological Sensitivity according to the SAHRIS PalaeoMap (Almond et al., 2013; SAHRIS website).

Colour	**Sensitivity**	**Required Action**
RED	VERY HIGH	Field assessment and protocol for finds are required
ORANGE/YELLOW	HIGH	A 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.



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
		x	

Sensitivity Features:

Sensitivity	Feature(s)
Medium	Features with a Medium paleontological sensitivity

***Figure 6**: Palaeontological Sensitivity of Study site by the National Environmental Web-bases Screening Tool.*

The National Environmental Web-based Screening Tool indicates that the Palaeontological Sensitivity of the development is Medium (yellow).

6 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)
- Palaeosensitivity map on SAHRIS (South African Heritage Resources Information System) website

- A Google Earth kmz file, background information, and a screening report of the proposed development were obtained from Ubique Heritage Consultants.
- Google Earth© satellite imagery.
- 1:250 000 Upington 2820 (1988) Geological Map (Council for Geosciences, Pretoria),

7 ASSESSMENT METHODOLOGY

7.1 Method of Environmental Assessment

Impact assessment must take account of the nature, scale, and duration of impacts on the environment, whether such impacts are positive or negative. Each impact is also assessed according to the following project phases:

- Construction.
- Operation; and
- Decommissioning.

Where necessary, the proposal for mitigation or optimisation of an impact should be detailed. A brief discussion of the impact and the rationale behind the assessment of its significance should also be included. The rating system is applied to the potential impacts on the receiving environment and includes an objective evaluation of the mitigation of the impact. In assessing the significance of each impact, the following criteria are used:

Table 4: The rating system

NATURE		
The Nature of the Impact is the possible destruction of fossil heritage		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be experienced.		
1	Site	The impact will only affect the site.
2	Local/district	Will affect the local area or district.
3	Province/region	Will affect the entire province or region.
4	International and National	Will affect the entire country.
PROBABILITY		
This describes the chance of occurrence of an impact.		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).

DURATION		
This describes the duration of the impacts. Duration indicates the lifetime of the impact as a result of the proposed activity.		
1	Short term	The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 30 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered indefinite.
INTENSITY/ MAGNITUDE		
Describes the severity of an impact.		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component, but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/ component, and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component, and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired. Rehabilitation and remediation are often impossible. If possible

		rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.
REVERSIBILITY		
This describes the degree to which an impact can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures.
2	Partly reversible	The impact is partly reversible, but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible, and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact results in a complete loss of all resources.
CUMULATIVE EFFECT		
This describes the cumulative effect of the impacts. A cumulative impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		
1	Negligible cumulative impact	The impact would result in negligible to no cumulative effects.
2	Low cumulative impact	The impact would result in insignificant cumulative effects.
3	Medium cumulative impact	The impact would result in minor cumulative effects.
4	High cumulative impact	The impact would result in significant cumulative effects
SIGNIFICANCE		
Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale and, therefore, indicates the level of mitigation required. The calculation of the significance of an impact uses the following formula: **(Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity = X.**		

The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.		
Points	Impact significance rating	Description
6 to 28	Negative low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive medium impact	The anticipated impact will have moderate positive effects.
51 to 73	Negative high impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive high impact	The anticipated impact will have significant positive effects.
74 to 96	Negative very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive very high impact	The anticipated impact will have highly significant positive

7.2 Summary of Impact Tables

Loss of fossil heritage will have a negative impact. Only the site will be affected by the proposed development. The expected duration of the impact is assessed as potentially permanent too long term. In the absence of mitigation procedures, the damage or destruction of any palaeontological materials will be permanent. Impacts on palaeontological heritage during the construction phase could potentially occur and are regarded as having a medium probability. As fossil heritage will be destroyed, the impact is irreversible. The significance of the impact occurring will be medium pre-mitigation and low post-mitigation.

Table 5: Summary of Impact Tables								
	Site	Probability	Duration	Magnitude	Reversibility	Irreplicable Loss	Cumulative Effect	Significance
	1	3	4		4	4	2	17

8 FINDINGS AND RECOMMENDATIONS

The study area is underlain by the Keimoes Suite (Namaqua-Natal Metamorphic Province). According to the PalaeoMap on the South African Heritage Resources Information System (SAHRIS) database, the Palaeontological Sensitivity of the Keimoes Suite is Zero as it is igneous in origin and thus unfossiliferous (Almond et al., 2013; SAHRIS website). The National Environmental Web-bases Screening Tool indicates that the development has a Medium Palaeontological Sensitivity.

A low Palaeontological Significance has thus been allocated to the proposed development. It is therefore recommended that no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required pending the discovery of newly discovered fossils. It is considered that the development of the proposed development will not lead to detrimental impacts on the palaeontological resources of the area.

If fossil remains are discovered during any phase of construction, either on the surface or below, the ECO in charge of these developments must be alerted immediately. These discoveries should be protected (if possible, *in situ*), and the ECO must report to SAHRA so that appropriate mitigation can be carried out by a professional palaeontologist. SAHRA Contact details: South African Heritage Resources Agency, 111 Harrington Street, PO Box 4637, Cape Town 8000, South Africa. Email: Phone: +27 (0)21 462 4502. Fax: +27 (0)21 462 4509 Web: www.sahra.org.za)
Preceding any collection of fossil material, the specialist would need to apply for a collection permit from SAHRA. Fossil material must be housed in an approved collection (museum or university), and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA.

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APPENDIX A

Curriculum Vitae

PROFESSION:	Palaeontologist
YEARS' EXPERIENCE:	30 years in Palaeontology
EDUCATION:	B.Sc Botany and Zoology, 1988 University of the Orange Free State
	B. Sc (Hons) Zoology/Palaeontology, 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 1998–2022

TECHNICAL REPORTS

Butler, E. 2014. Palaeontological Impact Assessment of the proposed development of private dwellings on portion 5 of farm 304 Matjesfontein Keurboomstrand, Knysna District, Western Cape Province. Bloemfontein.

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