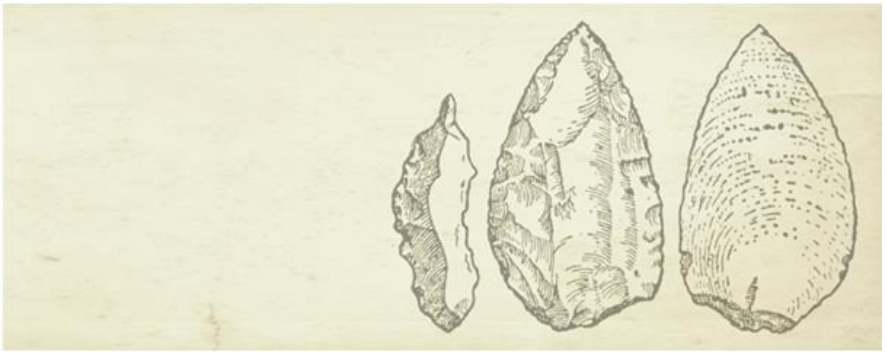
UBIQUE
HERITAGE CONSULTANTS



PHASE 1 HIA KTE WATER PIPELINE ROUTE, FROM KEIMOES TO SOAFSKOLK, NORTHERN CAPE

PHASE 1 HIA FOR THE PROPOSED DEVELOPMENT OF THE KTE PIPELINE PROJECT WITH ASSOCIATED INFRASTRUCTURE FROM KEIMOES TO SOAFSKOLK IN THE KAI !GARIB AND HATHAM LOCAL MUNICIPALITIES, ZF MGCAWU DISTRICT AND NAMAKWA DISTRICT MUNICIPALITIES, NORTHERN CAPE PROVINCE.

PREPARED FOR:

ENVIROAFRICA CC

PREPARED BY:

SKY-LEE FAIRHURST-BOOYSE & JAN ENGELBRECHT
ELIZE BUTLER & HEIDI FIVAZ
UBIQUE HERITAGE CONSULTANTS

20 AUGUST 2024

Web: www.ubiquecrm.com **Mail**: info@ubiquecrm.com CSD Supplier Number MAAA0586123

CLIENT:	EnviroAfrica
CONTACT PERSON:	**Bernard de Witt** Email: bernard@enviroafrica.co.za
HERITAGE CONSULTANT:	**UBIQUE Heritage Consultants** www.ubiquecrm.com info@ubiquecrm.com
CONTACT PERSON:	**Sky-Lee Fairhurst-Booyse** (archaeologist) Association of Southern African Professional Archaeologists member number: 541 Email: sky@ubiquecrm.com **Heidi Fivaz** (archaeologist) Association of Southern African Professional Archaeologists member number: 433 Email: heidi@ubiquecrm.com **Jan Engelbrecht** (archaeologist and lead CRM specialist) Association of Southern African Professional Archaeologists member number: 297 Email: jan@ubiquecrm.com

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: 2024-08-20**

J.A.C. Engelbrecht, H. Fivaz & S. Fairhurst-Booyse

UBIQUE Heritage Consultants

SUMMARY OF SPECIALIST EXPERTISE

SKY-LEE FAIRHURST-BOOYSE

ARCHAEOLOGIST

Sky-Lee Fairhurst-Booyse has been part of UBIQUE Heritage Consultants since 2019. 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 Paleontological sites.

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.

EXECUTIVE SUMMARY

Project description

Enviroafrica CC appointed UBIQUE Heritage Consultants as independent heritage specialists following Section 38 of the NHRA and Section 24(5) of the National Environmental Management Act[1] (NEMA) 107 of 1998. to conduct a cultural heritage assessment to determine the impact of the proposed development of the KTE Pipeline Project with associated infrastructure from Keimoes to Soafskolk in the Kai !Garib and Hatham Local Municipalities, Northern Cape Province.

Findings and Impact on Heritage Resources

UBIQUE Heritage Consultants assessed the proposed pipeline footprint from the **18th to the 20th of October 2022** and the **12th of March 2024**. The servitude of the R27 and other roads has been disturbed by previous pipelines and roadwork activities by SANRAL.

Several historical furrows and furrow systems (KTE-037 to KTE-039) were identified. These are dated to approximately ca. 1900-1950s. These features possibly have local significance for Kenhardt's industrial/agricultural archaeology. Since these resources are well outside the proposed footprint, they will not be impacted by development. However, in the unlikely event, that impact would be negative. The impact on these resources would be NEGATIVE MEDIUM before mitigation, NEGATIVE LOW after mitigation during the construction and decommissioning phases and NEGATIVE LOW before and after mitigation during the operational phases.

Two historical period archaeological sites, possibly a British military observation post or guard post (KTE-041) located near the proposed development footprint and a British campsite (KTE-006), were identified near Alternative 1. Although these sites are not situated directly within the proposed development footprint, development may negatively impact these resources. The impact on these resources would be NEGATIVE MEDIUM before mitigation, NEGATIVE LOW after mitigation during the construction and decommissioning phases and NEGATIVE LOW before and after mitigation during the operational phases.

Structures and features older than 60 years dating to the 1950s-1970s (KTE-002 to 005, and 033), such as an old farmhouse, retainer wall, stone foundation, and a kraal/cattle byre, as well as an additional cattle byre/kraal dating to the 1960s-1980s, were identified during the survey. These resources are situated near Alternatives 1 and 2 and will be negatively impacted if impact occurs. The impact on these resources would be NEGATIVE MEDIUM before mitigation, NEGATIVE

[1] NEMA is the national legislation that provides for the authorisation of certain controlled activities known as "listed activities".

LOW after mitigation during the construction and decommissioning phases and NEGATIVE LOW before and after mitigation during the operational phases.

A fenced-off cemetery was identified (KTE-011), and a single unmarked grave was identified (KTE-014). These resources are located near Alternatives 1 and 2. They are not situated directly within the proposed Alternatives. However, if an impact occurs, it will be negative. All graves are considered to be of importance and worthy of conservation. Thus, any impact on the cemetery and grave would be negative**.** The impact would be NEGATIVE MEDIUM before mitigation, NEGATIVE LOW after mitigation during the construction and decommissioning phases and NEGATIVE LOW before and after mitigation during the operational phases.

Additionally, the cumulative impact is considered to be NEGATIVE LOW.

Banzai Environmental assessed the development footprint from the 12th to 13th of November 2022 (Butler 2024, Appendix A). A site-specific field survey of the development footprint was conducted on foot and by motor vehicle. No fossiliferous outcrop was detected in the proposed development. The site investigation and desktop research (National Database and published data) concluded that **the area's fossil heritage of scientific and conservational interest is relatively rare and of low scientific and conservational value**. Data indicates that fossil sites are generally rare, sporadic and unpredictable. A **low significance** has thus been allocated to the development footprint. This is in contrast with the High Sensitivity allocated to the development area by the SAHRIS Palaeontological Sensitivity Map and DFFE Screening Tool. The **Very High Palaeontological Sensitivity indicated by the DFFE Screening Tool is thus contested/disputed, with a Low Palaeontological Sensitivity** assigned to the development based on the site investigation in November 2022.

In terms of palaeontological impacts, **a High Palaeontological Significance has been allocated for impacts associated with the construction phase of the KTE Pipeline development pre-mitigation and a low significance post-mitigation**. The construction phase will be the only development phase with the potential to impact Palaeontological Heritage, and **no significant impacts are expected to impact the Operational and Decommissioning phases**. As the No-Go Alternative considers the option of 'do nothing' and maintaining the status quo, it will have a Neutral impact on the Palaeontological Heritage of the development. The **Cumulative impacts of the KTE development and associated infrastructure are considered to be medium pre- mitigation (as the area is not highly fossiliferous) and Low post-mitigation and fall within the acceptable limits for the project**. Therefore, the proposed development will not have damaging impacts on the area's palaeontological resources. **The construction of the development may thus be permitted to its whole extent, as the development footprint is not considered sensitive in terms of palaeontological resources.** It is consequently recommended that **no further palaeontological heritage studies, ground truthing, or specialist mitigation be required pending the discovery of newly discovered fossils.**

Because the No-Go Alternative evaluates the alternative of 'doing nothing' and maintaining the *status quo*, it will have a Neutral influence on the development's Archaeological, Historical, Cultural, and Palaeontological Heritage.

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. Resources given a field rating of IVB:
   - The furrows and furrow systems (KTE-037, 038 and 039) are believed to be a part of Kenhardt's industrial/agricultural history. These resources are of **medium significance.** These resources are well outside the proposed footprint and will thus **not be impacted by development. No further mitigation is recommended.**
   - The British military observation or guard post (KTE-041) may be outside the development footprint. The site is of **medium significance**. Since it is well outside of the proposed footprint, it will thus **not be impacted by development. No further mitigation is recommended.**
   - The other British campsite (KTE-006) is located by Alternative 1. This resource is of **medium significance**; thus, any **impact would be negative. A 100 m buffer/safety zone is recommended to negate the negative impact on the British campsite (KTE-006).**

2. Resources given a field rating of IVA:
   - The Historical period structures and features dating to the 1950s-1980s (KTE-002, 003, 004, 005, and 033) are considered to be of **medium to high significance**. These resources are all situated near Alternatives 1 and 2, and although they are not located directly within the proposed Alternatives, they will be negatively impacted if an impact occurs. Therefore, a **200 m buffer/safety zone is recommended to negate the negative impact on these resources.**

3. A fenced-off cemetery was identified (KTE-011), and a single unmarked grave was identified (KTE-014). These resources are located near Alternatives 1 and 2. They are not situated directly within the proposed Alternatives. All graves/cemeteries, however, are considered to be of **high significance**. If the impact occurs, it will be negative. It is recommended that **a buffer/safety zone of 100m should be implemented around KTE-011 and a 50m buffer/safety zone around KTE-014. In addition, KTE-014 should be fenced off.**

4. Should it be impossible to avoid graveyard(s), grave(s) or burial(s) sites during development, mitigation in the form of grave relocation could be undertaken. This is, however, a lengthy and costly process. Grave relocation specialists should be employed to

manage the liaison process with the communities and individuals who, by tradition or familial association, might have an interest in these graves or burial grounds, as well as manage the permit acquisition from the SAHRA Burial Grounds and Graves (BGG) Unit and the arrangements for the exhumation and re-interment of the contents of the graves, at the cost of the applicant and in accordance with any regulations made by the responsible heritage resources authority.

5. Regarding palaeontological resources, **it is recommended that no further palaeontological heritage studies, ground truthing, or specialist mitigation be required pending the discovery of newly discovered fossils.** The construction of the development may thus be permitted to its whole extent, as the development footprint is **not considered sensitive in terms of palaeontological resources.** Although no fossils were identified, they could be exposed during excavations. The ESO for this project must be informed that the Prins Albert Formation of the Ecca Group has a **High Palaeontological Sensitivity**; therefore, in the event that:
   - Palaeontological Heritage is uncovered during surface clearing and excavations; the **Chance Find Protocol** attached should be implemented immediately. Fossil discoveries ought to be protected, and the ECO/site manager must report to South African Heritage Resources Agency (SAHRA) (Contact details: SAHRIS, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. 3rd floor Protea Assurance Building, 142 Longmarket St, Cape Town City Centre, Cape Town, 8000; Private Bag X9067, Cape Town, 8000 Tel: 021 483 9598. Fax: +27 (0) 21 483 9845. Web: https://sahris.sahra.org.za) so that mitigation (recording and collection) can be carried out.
   - Before any fossil material can be collected from the development site, the specialist involved would need to apply for a collection permit from SAHRA. Fossil material must be housed in an official collection (museum or university), while all reports and fieldwork should meet the minimum standards for palaeontological impact studies proposed by SAHRA (2012).
   - These recommendations should be incorporated into the Environmental Management Programme (EMPr) for the KTE Pipeline project and associated infrastructure.

6. 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 must be alerted as per section 35(3) of the NHRA. If unmarked human burials are uncovered, the SAHRA 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.

Figure 1 *NO GO Buffer/safety zones*

TABLE OF CONTENTS

TABLE OF FIGURES

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
NEMA:	National Environmental Management Act
NHRA:	National Heritage Resources Act
PHRA:	Provincial Heritage Resource Agency
PIA:	Palaeontological Impact Assessment
SADC:	Southern African Development Community
SAHRA:	South African Heritage Resources Agency
SAHRIS:	South African Heritage Resources Information System

1. INTRODUCTION

1.1 Scope of Study

The project involves the proposed development of the KTE Pipeline Project with associated infrastructure from Keimoes to Soafskolk in the Kai !Garib and Hatham Local Municipalities, Northern Cape Province. UBIQUE Heritage Consultants was appointed by Enviroafrica CC as independent heritage specialists 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 may be tangible, such as buildings and archaeological artefacts, 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 in this archaeological impact assessment report. It comprises the recording of present/ absent heritage resources and offers recommendations for managing them within the proposed development context.

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/archaeological 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 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 an 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 in any way until the heritage specialist has been able to assess the significance of the site (or material) in question.

2. STUDY APPROACH AND METHODOLOGY

2.1 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 HIA/AIA reports and a digital 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).

2.1.1 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.

2.2 Field Study

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

2.2.1 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.

2.2.2 Recording Significant Areas

The survey was tracked, and GPS points of identified significant areas were recorded with a handheld GPS and an Android smartphone using a Locus Map application. Photographs of the environment and identified heritage resources were taken, and 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.

2.2.3 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.

2.3 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	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).

FIELD RATINGS & GRADINGS	
General protection Grade IVC	Phase 1 is considered sufficient recording and may be demolished (low significance).

2.4 Determining Impact

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.

2.4.1 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.

2.5 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).

3. 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 development of the KTE Pipeline Project with associated infrastructure from Keimoes to Soafskolk in the Kai !Garib and Hatham Local Municipalities, Northern Cape Province.

The proposed KTE development entails the construction of a water provision pipeline from the Orange River, near Keimoes, to a hydrogen production facility located on Portion 1 and Portion 5 of Farm Uitkyk No. 889. The proposed pipeline will follow the existing road, mainly within the road servitudes. The project will also deliver a provisional bulk water supply to Kai !Garib Municipality at Kenhardt and the Hantam Municipality at Brandvlei. The distribution of water to these communities will remain the responsibility of the Kai !Garib and Hantam Municipalities. The project requires water to develop and operate, and as such, 10 950 000 m3/a of surface water will be abstracted from the Orange River, which will be pumped via a rising main and/or gravity-fed over 221 km for industrial and commercial use. The abstracted surface water will be stored across the project site at various locations. The pipeline route crosses numerous drainage lines, using existing culverts perpendicular to the R27 National Road. The biggest disturbance will be where the pipeline passes through an existing culvert of the Sishen-Saldanha railway bridge and crosses the Hartebees River. The abstracted surface water will undergo initial treatment in Lennertsville to SANS 241:2015 drinking water standards, where the by-products will be disposed of in a sludge-drying bed. Final treatment will occur on Farm Uitkyk, where the abstracted surface water first passes through a Reverse Osmosis (RO) treatment step, followed by an Electrodeionization step (EDI), where the by-products will be disposed of on-site in 80 ha evaporation ponds. Domestic wastewater from office blocks, messes/canteens and toilets will be collected in an on-site conservancy tank, abstracted by vacuum pumps into a fleet of Wastewater Tanker Trucks and transported to the inlet of the evaporation ponds, where it will be blended and homogenized with the brine waste and allowed to evaporate by natural process.

3.1 Technical Information

PROJECT DESCRIPTION	
Project name	Proposed development of the KTE water pipeline route, from Keimoes to Soafskolk
Description	Phase 1 HIA of the proposed development of the KTE Pipeline Project with associated infrastructure from Keimoes to Soafskolk in the Kai !Garib and Hatham Local Municipalities, Northern Cape Province.
DEVELOPER	
KTE ENERGY GROUP (Pty) Ltd	
Development type	Services=>Water services=>Treatment and Waste Water

PROPERTY DETAILS		
Province	Northern Cape	
District municipality	ZF Mgcawu, Namakwa	
Local municipality	Kai !Garib, Hantam	
Topo-cadastral map	1: 250 000 WGS_2820 and WGS_2920	
Farm names	Various	
Closest town	Keimoes, Kenhardt and Brandvlei	
GPS Coordinates	27° 42' 42.1" S 23° 04' 32.7" E Pumpstation at Orange River near Keimoes	
PROPERTY SIZE	N/A	
EIA FOOTPRINT SIZE	Approximately 200ha	
LAND USE		
Previous	Agriculture and servitude	
Current	Agriculture and servitude	
Rezoning required	No	
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 300 m in length.		Yes
Construction of bridge or similar structure exceeding 50 m in length.		No
Construction exceeding 5000m ².		Yes
Development involving three or more existing erven or subdivisions.		Yes
Development involving three or more erven or divisions that have been consolidated within the past five years.		No
Rezoning of site exceeding 10 000 m ².		No
Any other development category, public open space, squares, parks, recreation grounds.		No

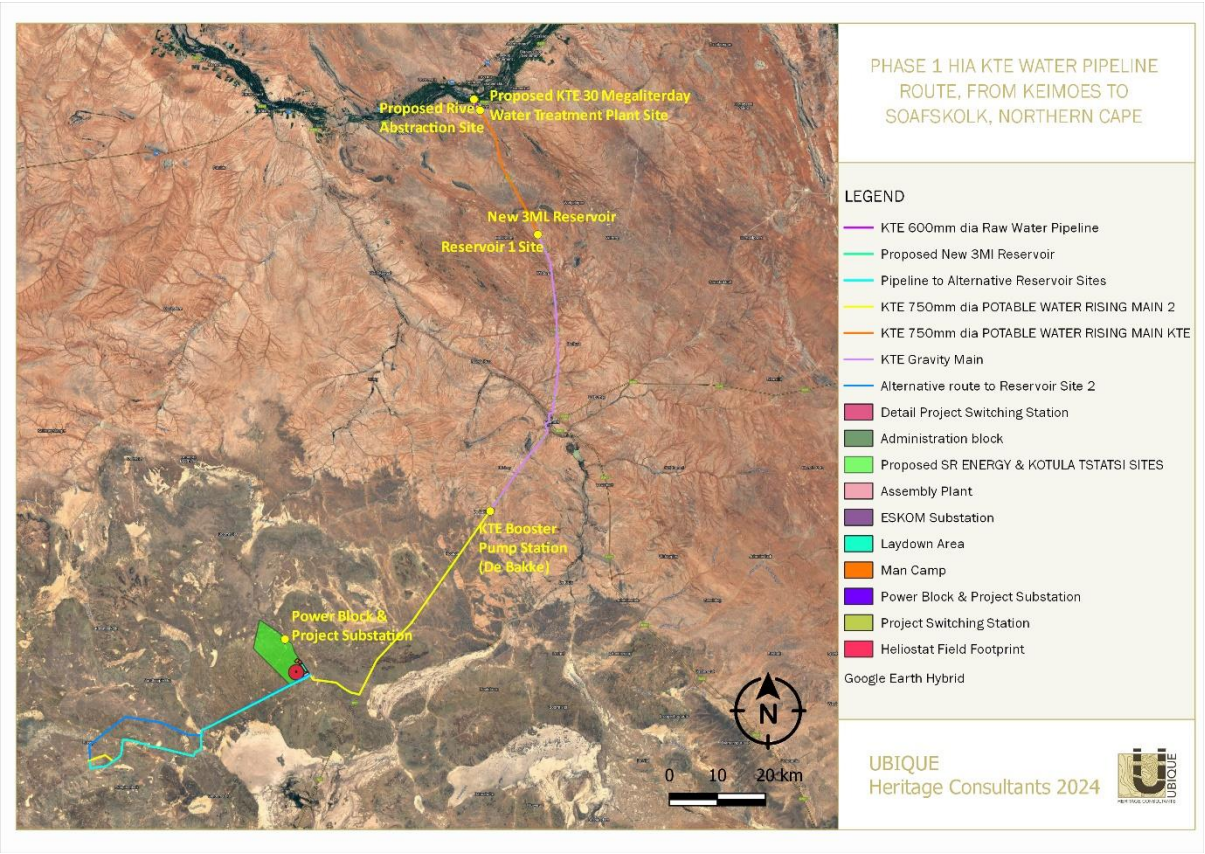


Figure 2 *Regional locality of the development footprint, indicated on Google Earth Satellite imagery.*

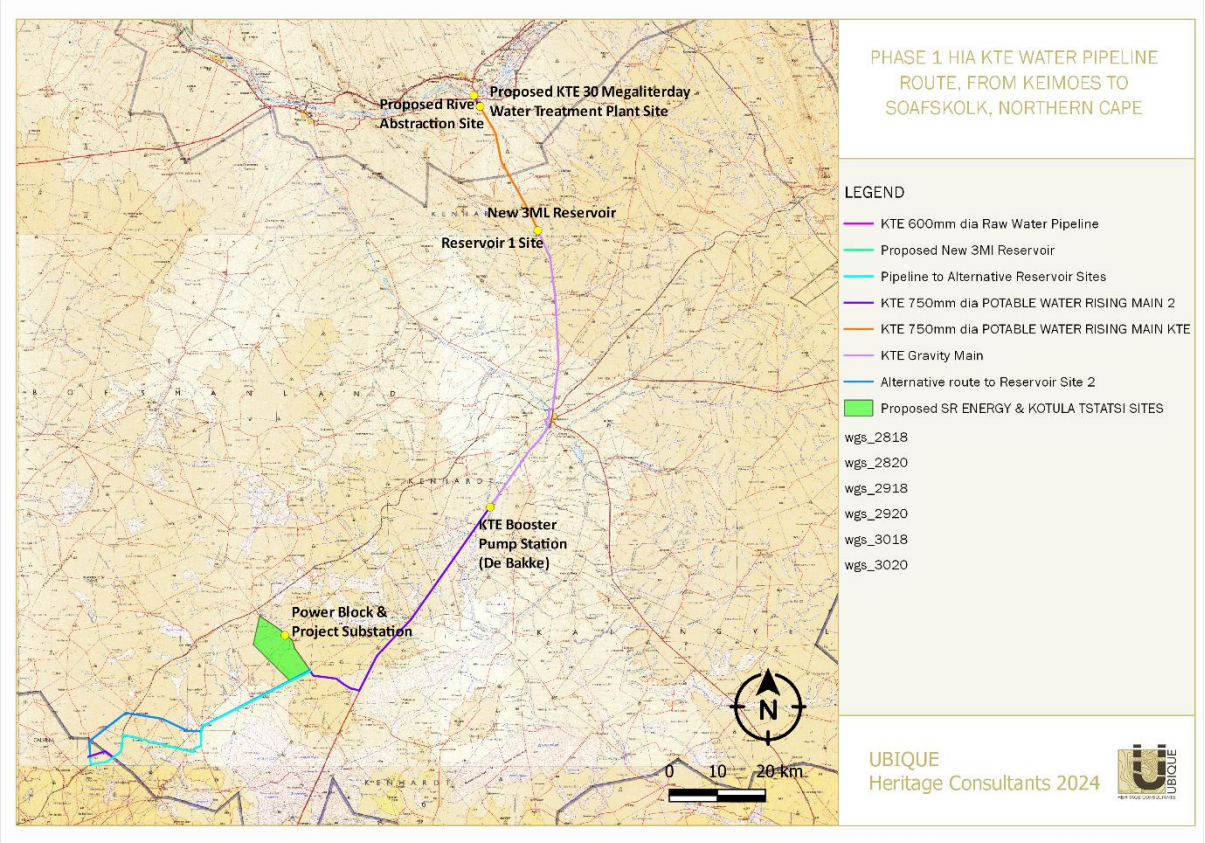


Figure 3 *Locality of the development footprint, indicated on the 1: 250 000 map.*

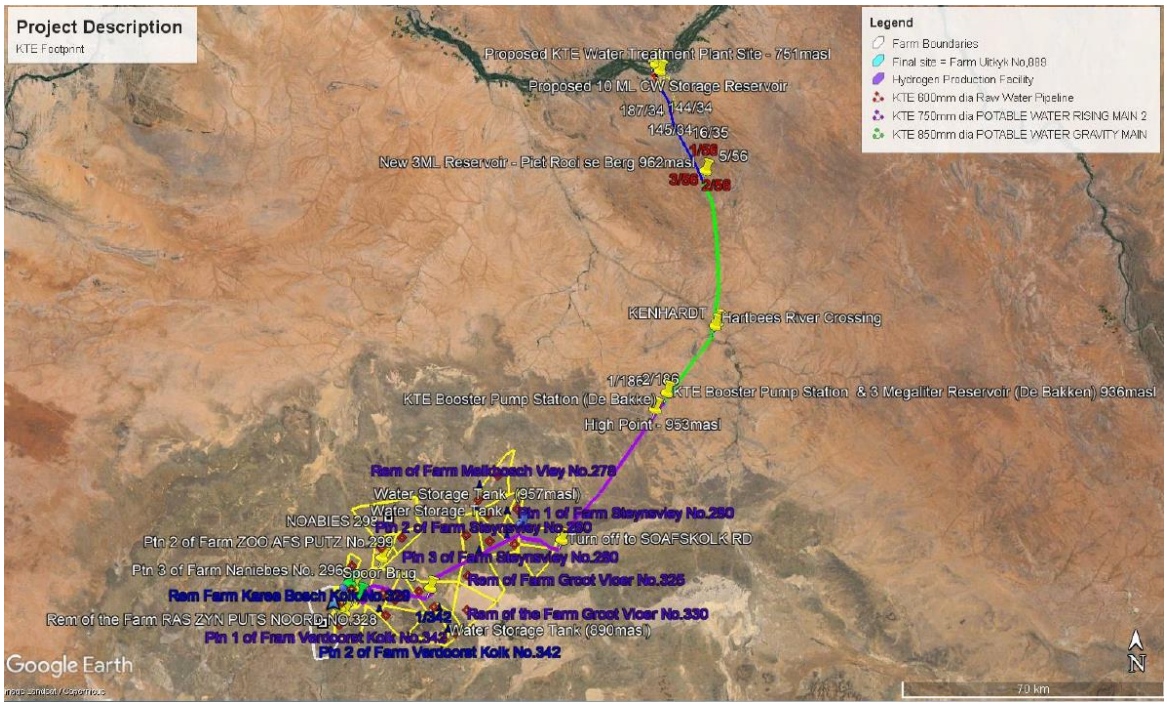


Figure 4 *KTE pipeline proposed development. Image provided by client.*

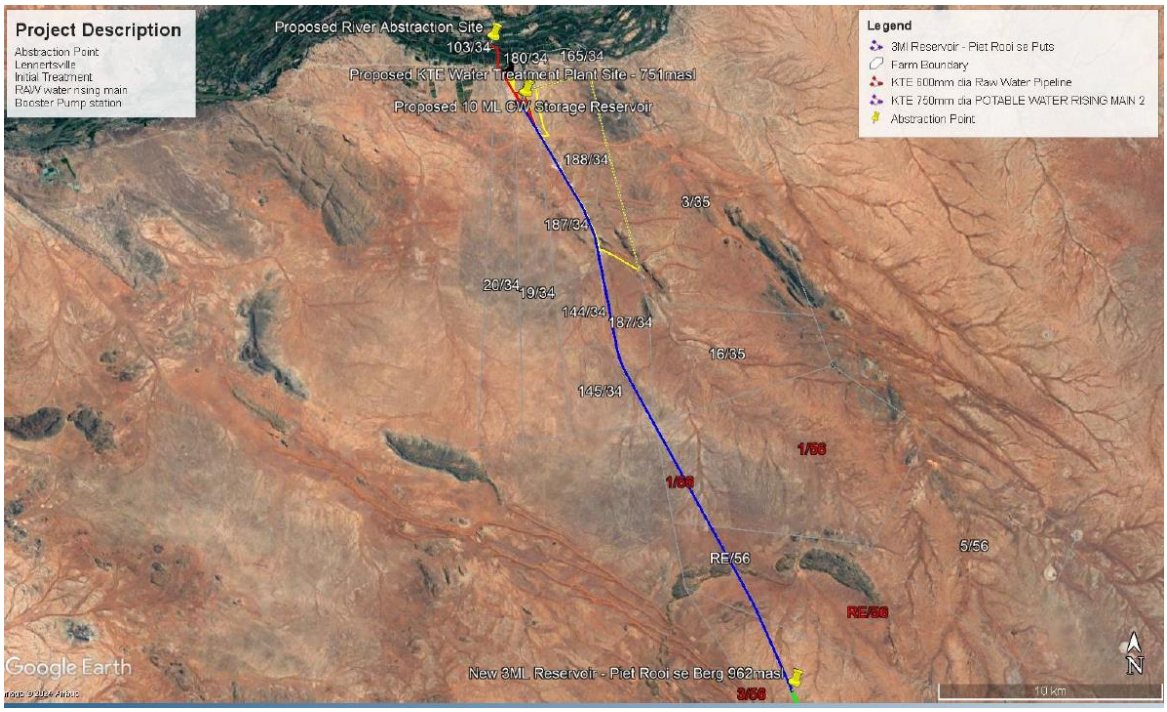


Figure 5 *KTE pipeline proposed development. Image provided by client.*

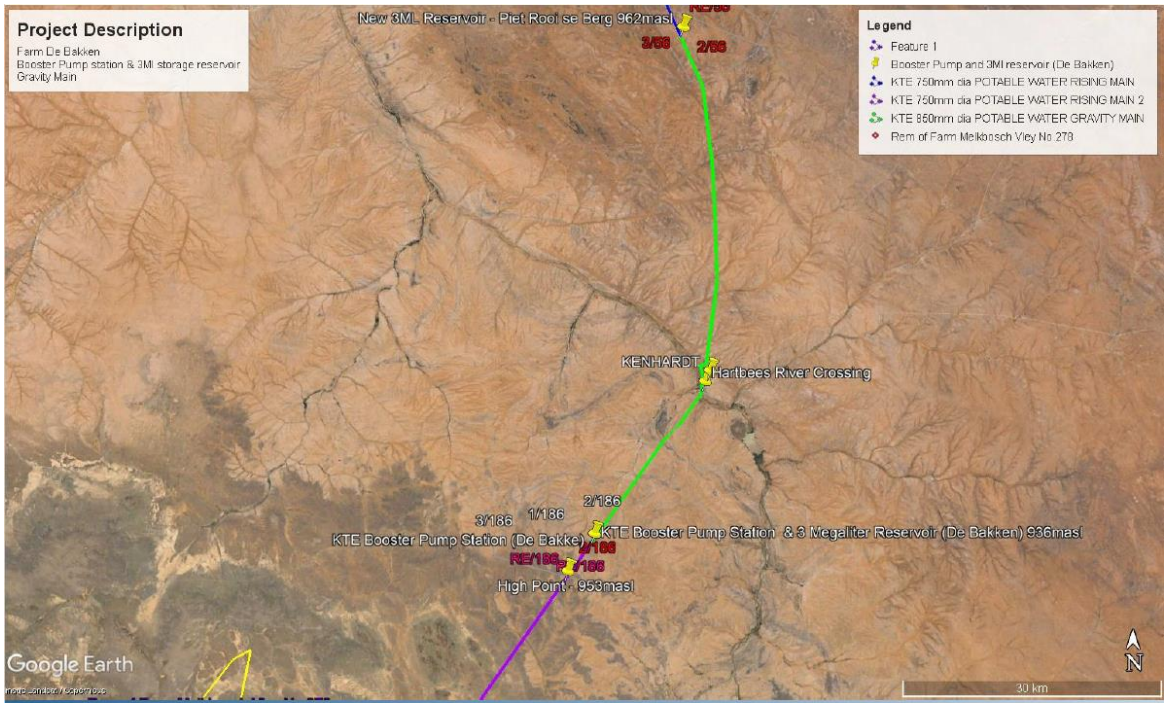


Figure 6 KTE pipeline proposed development. Image provided by client.

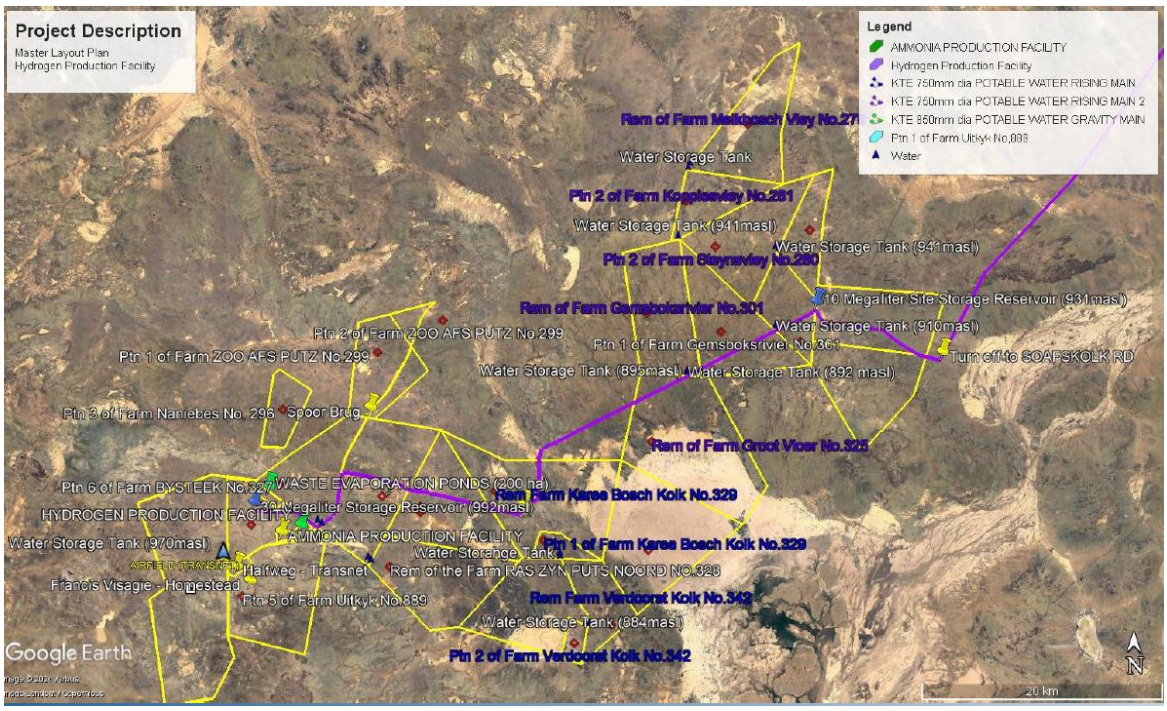


Figure 7 KTE pipeline proposed development. Image provided by client.

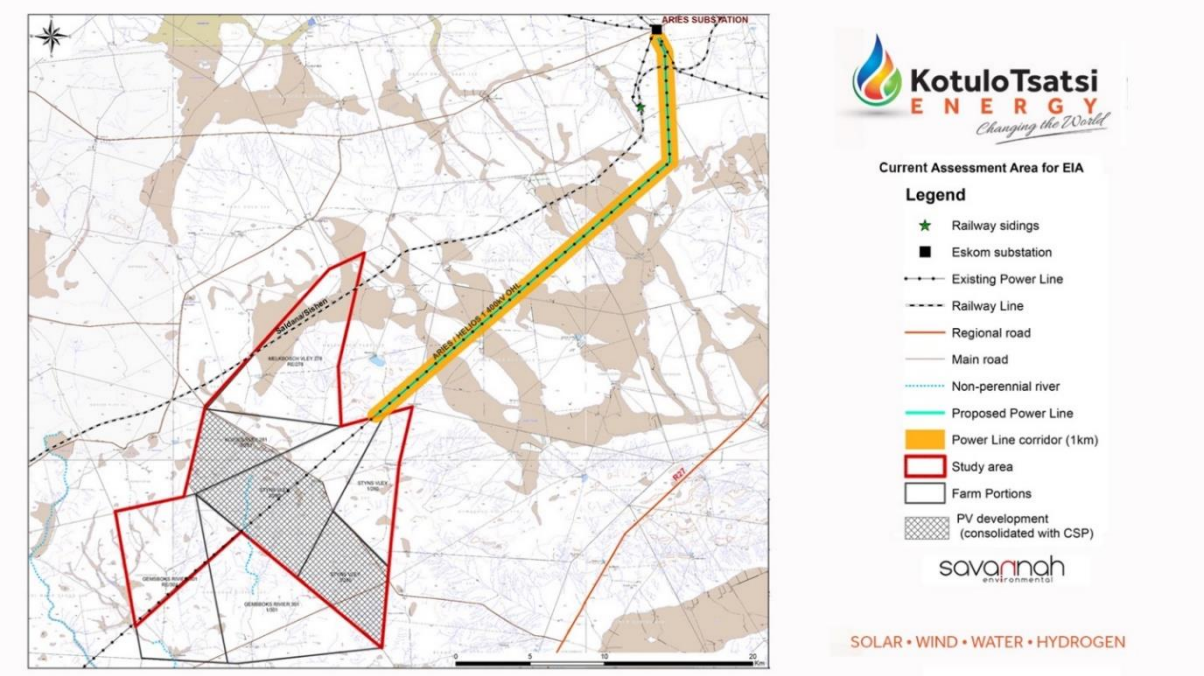


Figure 8 *The current project site relative to the transmission line. Image provided by client.*

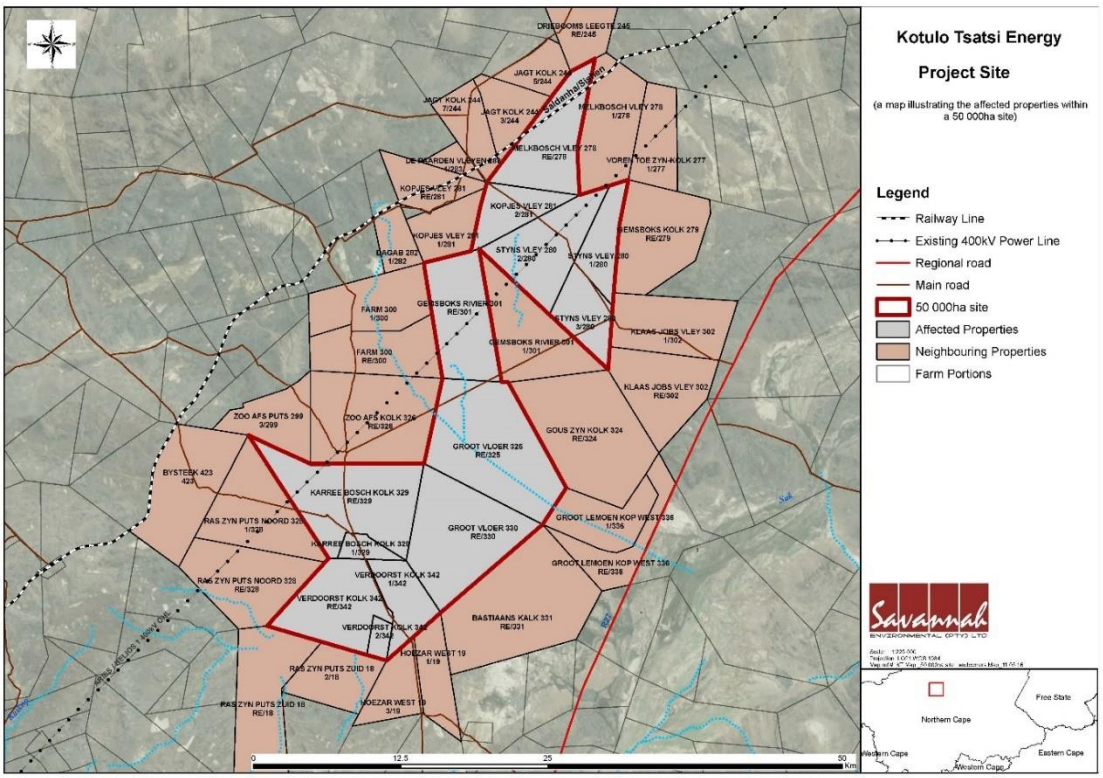


Figure 9 *The current map of the farms of which KTE owns all the purchase, development and option rights, showing the traversing of the Sishen - Saldanha Railway line as well as the 400kV Helios – Aries ESKOM Main Transmission Line. Image provided by client.*

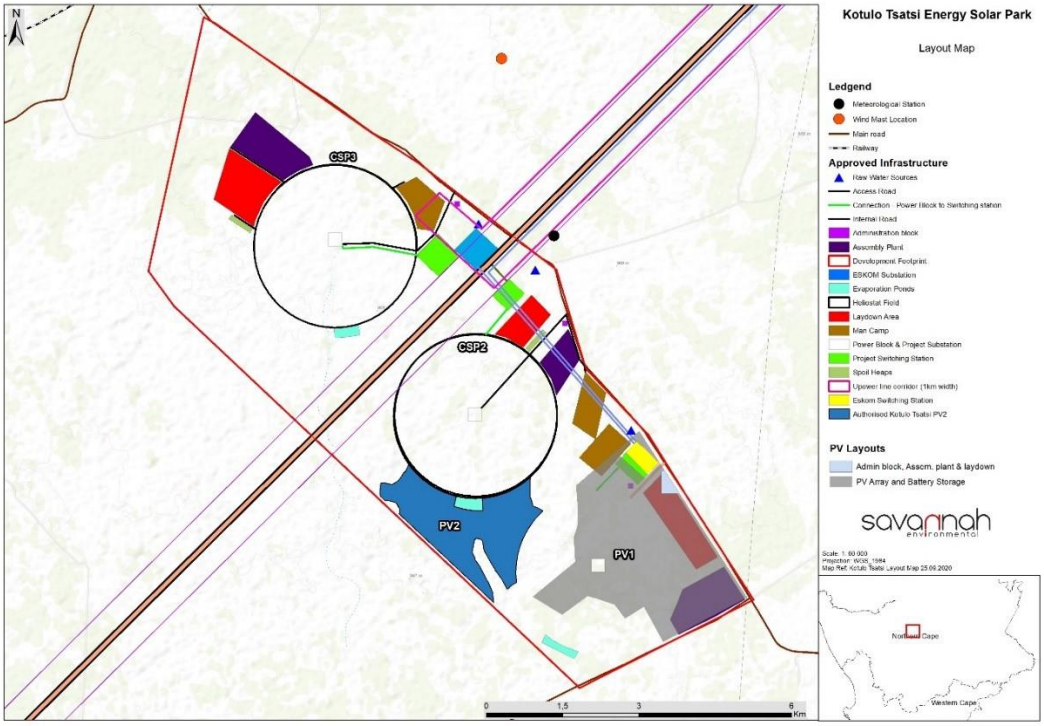


Figure 10 *Layout map. Image provided by client.*

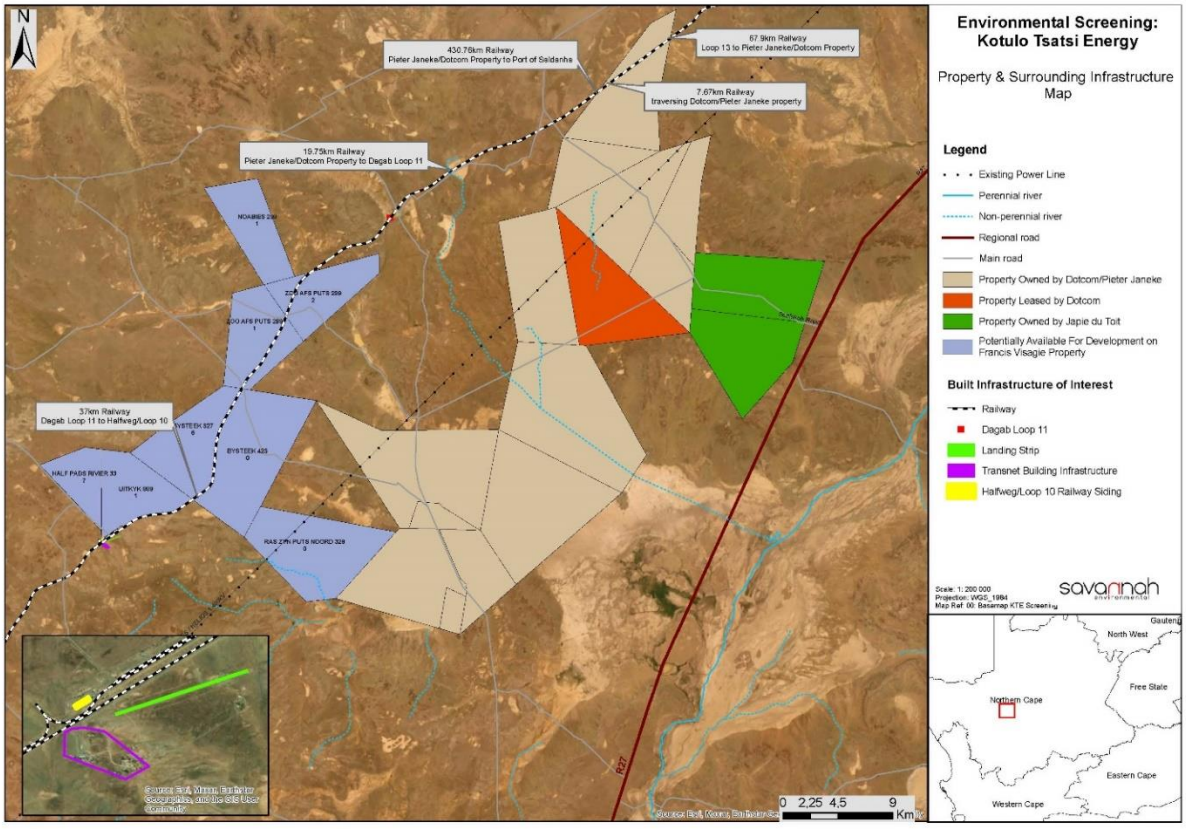


Figure 11 *Property and surrounding infrastructure map. Image provided by client.*

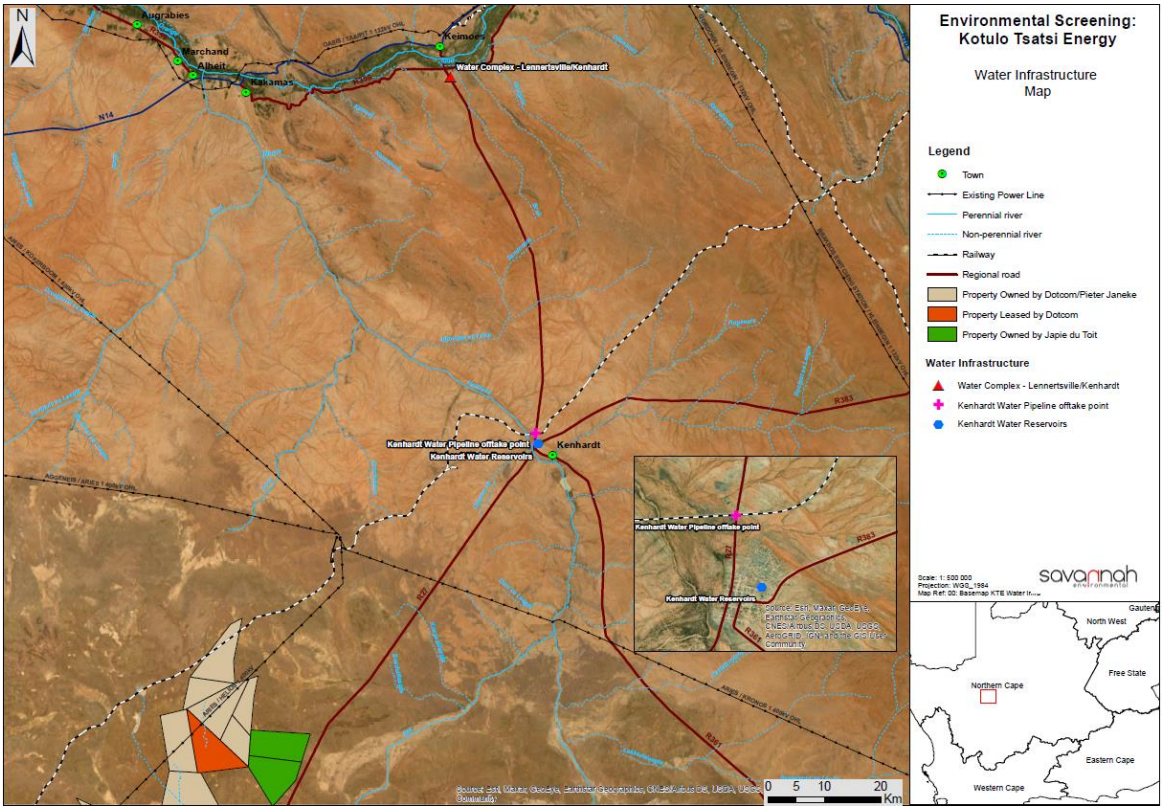


Figure 12 Water infrastructure map. Image provided by client.

4. HISTORICAL AND ARCHAEOLOGICAL BACKGROUND

4.1 Region: Northern Cape

South Africa has a long and varied history of human occupation (Deacon & Deacon 1999). This occupation dates to approximately 2mya (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.

4.1.1 Stone Age

The history of the Northern Cape Province 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, dating to the earlier, 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 produced from pebbles, cobbles, percussive tools, and 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. It is generally suggested that the aforementioned was made and utilised for hunting activities and had numerous functions (Wurz 2013). Hunter-gatherer lifeways are attested to in the Middle Stone Age record for at least the last 100,000 years (Wadley 2015). Such foraging groups continued to occupy the landscape throughout the Later Stone Age between 40,000 and 20,000 years ago, lasting until a couple of centuries.

About 2000 years ago, during the final ceramic Later Stone Age, the first evidence of goats/sheep was found in southern Africa, possibly associated with Khoekhoe herding groups (e.g., Sadr 2008). These groups came into being as a combination of the migration of East African pastoralists who mixed with local hunter-gatherers (e.g., Choudhury et al. 2021). However, it is almost impossible to differentiate between the San and Khoekhoe groups based on archaeological or genetic records. Presently, these populations are referred to as Khoisan (Barnard 1992). 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. These sites are commonly found on slopes, hilltops, rocky outcrops and occasionally in river beds (Kruger 2018).

4.1.2 Iron Age

Archaeologically, the arrival of African farming communities from West Africa about 1700 years ago and their subsequent settlement, first in the northeastern parts and later in much of southern Africa, is known as the Iron Age (Huffman 2007). These farmers encountered Khoisan communities (Mitchell 2002). The archaeology of farming communities of southern Africa encompasses three phases. The Early Iron Age, dated 200 – 900 CE, represents the arrival of farmers in southern Africa. The Middle Iron Age (900 – 1300 CE) is best associated with the onset of state formation in the Limpopo Valley of South Africa. Finally, the Late Iron Age (1300 – 1840 CE) marked the arrival and spread of ancestral Nguni- and Sotho-Tswana communities into southern Africa and the development of state-level societies, such as Great Zimbabwe and Mutapa (Huffman 2007; Badenhorst 2010).

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).

4.1.3 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. As an archaeological period, the Late Iron Age ended by the 1840s. By then, the ongoing Mfecane caused major socio-political disruptions in southern Africa. During the late 1600s and 1700s, Dutch settlers subjugated the Khoisan and established the Cape Colony. By the 1800s, a culmination of preceding tensions rooted in competition amongst local chiefdoms for trade at Delagoa Bay, increased demand for ivory by European traders, and droughts severely impacted maise-dependent communities. The steady rise of chiefdoms, such as the Mabhudu, Ndwande, Qwabe and Mtethwa, meant rulers expanded their patronage networks by conquering a competitor's land and people. Smaller chiefdoms caught up in the conflict fled and either attacked or merged with neighbouring populations. This political unrest would be followed by a similar uprising, the Mfecane (ca. 1818-1840 CE) (Bonner 2002; Chewins 2016; Ross 1999). European traders, travellers, and missionaries encountered Khoisan and African farmers during this time. Subsequent relations, with negative and positive impacts, continued into the 20th century (e.g., Hall 1987).

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 documented records of this region dating from the 18th- and 19th- centuries mainly pertain to areas south of and along the Orange River (Morris 2018a, b & c). The Swedish travellers Hendrick Wikar and Robert Gordon, 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.

The surveying, division, and transference of government-owned land to farmers marked 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 only later sold to individuals (Van Vollenhoven 2014). During the late 1920s, more permanent and large-scale settlements and possibly some of the first farmsteads started to appear in the region.

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. This period was prompted by the incursion of displaced refugees associated with the Fokeng, Tlokwa, Hlakwana and Phuting groups (De Jong 2010).

Moreover, during the 1830s, the Voortrekkers started migrating northwards from the Cape Colony. This migration was due to their dissatisfaction with British rule (Eldredge 1987). The Voortrekkers' migration is known as the "Groot Trek" (Great Trek). The Voortrekkers had conflict with Tswana and missionary groups who had settled near Bechuanaland and Griqualand West (Van Vollenhoven 2014). A series of wars and battles between the Voortrekkers, Zulu and Sotho-Tswana communities eventually arose due to the migrations (De Bruyn 2019).

Between 1879 and 1880, the region was also caught up in the Koranna War. 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). It is believed that any military settlement related to the Koranna Wars would have been closer to the Orange River (Webley & Halkett 2014).

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).

Bushmanland was one of the last regions of the Cape Province to be settled by early European farmers. This was because the region was very arid and far from Cape Town and the produce markets. Many of the farms in the Bushmanland area were only allocated after the introduction of the windpump to South Africa in the 1870s. In other words, the windpump made the arid lands accessible and suitable for grazing (Webley & Halkett 2012a). Historical literature also confirms that San hunter-gatherers occupied Bushmanland early in the 19th century. During the 19th century, Basters 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 2012a). 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 (Kaplan 2015).

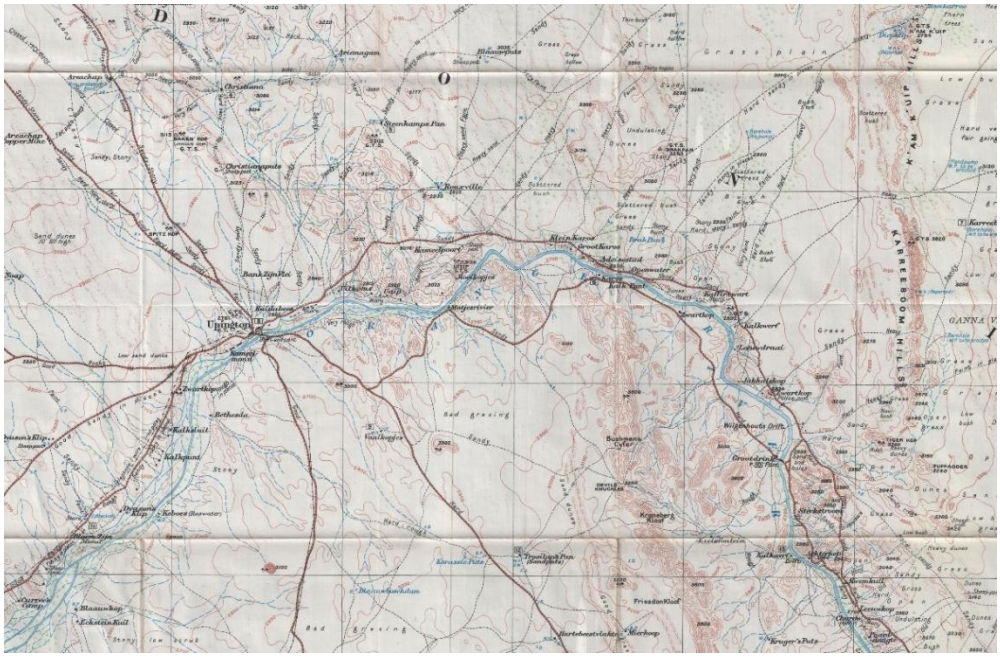


Figure 13 *Imperial Map of Upington and surrounds. Image from UCT digital collections, https://digitalcollections.lib.uct.ac.za/*

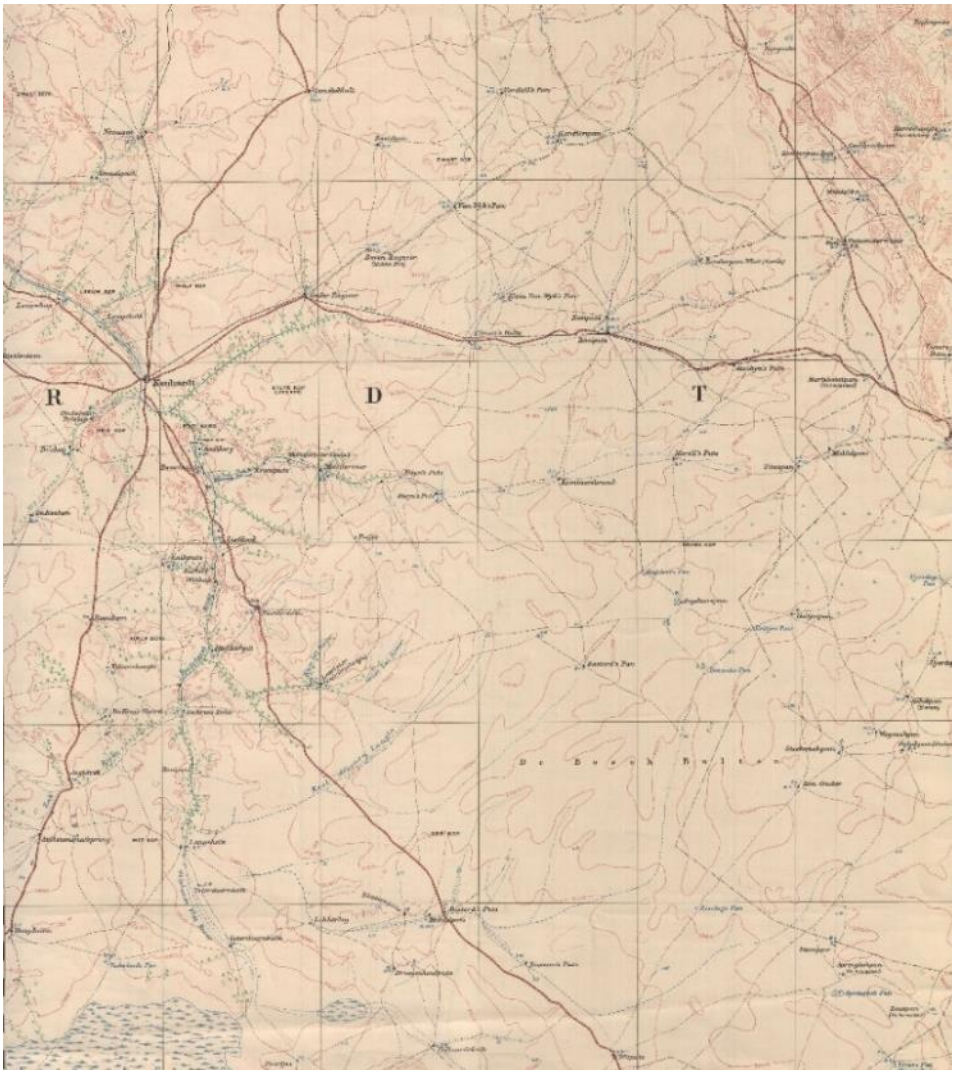


Figure 14 *Imperial Map of Kenhardt and surrounds. Image from UCT digital collections, https://digitalcollections.lib.uct.ac.za/Kenhardt*

Figure 15 *Imperial Map of Kakamas and surrounds. Image from UCT digital collections, https://digitalcollections.lib.uct.ac.za/*

4.2 Local

Due to the large study area, the majority of the local history is related to the wider region and the Orange River. The closest towns are Upington, Kakamas, Keimoes, and Kenhardt.

Portuguese sailors referred to the Gariep/Orange River as the St Anthonio, and on the maps from 1685, Simon van der Stel marked it as the Vigiti Magna. In 1760, Jacobus Coetzee, the elephant hunter, named the river: “de Groote Rivier” (the Great River). In 1761, land surveyor Carel Brink noted that the river is known to the local island inhabitants as the Tyen Gariep (Our River). The London Missionary Society’s (LMS) John Campbell spoke of the Gariep, Gareeb, and Garib as the names the Korannas used. The river’s contemporary name (Orange River) can be accredited to Robert Gordon, who proclaimed the river in the name of Prince van Oranje in 17799. From this day forward, the river was known (and indicated on maps) as the Orange River.

De Jong (2010) classifies the cultural landscape along the Gariep/Orange River as predominantly historic farmland. The affected area consists of working (operating) irrigation and grazing farms located in a typical Lower Orange River environment. These farms display heritage features that typically occur in the district, such as their large size, irrigation furrows and pipelines, fences, tracks, farmsteads, and irrigated fields. Farmsteads are clustered near rivers and primary roads (De Jong 2010).

Apart from a few exceptions, archaeology along the Orange River has mainly focused on the Middle Orange River and the Richtersveld (Orton & Webley 2012). The Middle Orange River was densely inhabited pre- and proto-colonial times (Mlilo 2019). The area is made up of several islands. Herders often lived on these islands for their natural protection from stock thieves and wild animals. Small-stock farmers mainly occupied the vicinity along the Orange River. It was during the 1930s that the first significant influx of people started. These people had developed an extensive network of irrigation channels that 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 first descriptions of the population of the Middle Orange River can be credited to the earlier mention of Hendrick Wikar (Ross 1975). Wikar started his long journey from Cape Town and eventually reached the middle and lower reaches of the Orange River. Wikar is believed to have been a deserter from the service of the Dutch East India Company. Thus, Wikar remained within the area for several years and compiled a report of his experiences in exchange for a pardon (Ross 1975). He recorded his encounters with the Khoisan groups, who called themselves Einiqua or River People. The Einiqua were divided into three “kraals”, namely the Namnykoa near the Augrabies Falls, the Aukokoa of Kanoneiland and the Kaukoa on islands west of Keimoes and other islands to the east (Engelbrecht & Fivaz 2020). Their kraals consisted of numerous sheep and cattle. The Einiqua also hunted game, gathered plants, and cultivated dagga, but according to Wikar, no other crops existed (Ross 1975). The Anoe eis people, whom Wikar characterised as “Bushmen”, were among the pastoralist groups living on the islands. As they had no domestic stock, they subsisted on fishing, game-trapping, hunting, and gathering plant foods (Morris & Beaumont 1991). However, Colonel Robert Jacob Gordon, who visited the region in 1779, remarked that Einiqua had lost their cattle because of an argument with the Namneiqua village (Morris & Beaumont 1991). The region's San and Khoekhoe hunter-gatherers had reached stability by the early 18th century (Mlilo 2019). However, the area west of the Langeberg and east of Upington was occupied by IA groups such as the BaTlaping. Their influence had reached as far down the river as Upington (Morris 1992).

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).

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). The credit for formalising and extending the irrigation system belongs to Reverend C.H.W. Schröder, a Dutch Reformed Church (DRC) missionary and Special Magistrate for the Northern Border John H. Scott. 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's innovation. Abraham September was born in slavery and became part of the Baster people of South Africa. 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…".

Briefly, the farms and communities south of the Gariep/Orange River were often raided during the 17th century. The Korana Wars of 1869 and 1878 resulted from increased land and resource competition between the Trekboers and Khoi and San groups. Klaas Lukas, a prominent Korana chief at Olyvenhouts Drift (Upington), played an essential role in defeating the Korana raiding groups with the support of most of the Korana, the Nama Afrikanders led by Jacobus Afrikander and several Griqua rebels under Gamka Pienaar. The Korana, who rejected a future under colonial rule, trekked further into the Kalahari. The Cape Government settled the Basters near Upington to form a buffer between the Boers and the Korana (SAHO 2020).

Olyvenhouts Drift was the location of a mission station founded in 1871 by the German missionary Rev Schröder and named after the many wild olivewood trees growing in the area around the ford. The town was renamed Upington in 1884 after Sir Thomas Upington, the Attorney-General of the Cape Colony. Rev Schröder has been credited with the building of the irrigation canal from 1883 to 1885, but current views attribute the original idea to a local inhabitant by the name of Abraham September. By 1884, 77 farms were being irrigated by the canal (Orton 2015; Van Schalkwyk 2014b).

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 hand-dug tunnels were remarkable engineering feats for the early 20th century (Orton 2012). Kakamas 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 which included canals dug by hand, beginning at the upper end of Neus Island (Hopkins 1978; Van Vuuren 2011). The development of canal systems played an essential role in irrigating extensive vineyards and orchards within the region and developing substantial agricultural initiatives within the area.

The Kakamas settlement is also known for its pioneering development of a hydroelectric power generator, which was 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 either the natural water fountain called Big Eye or Keimoes situated at the Roman Catholic Mission Station in the town or to the vast views that can be 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).

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 own hotel, prison, court, and police service (De Beer, 1992). It attained municipal status in 1949, and in 1951, Keimoes opened its power station and replaced candlelight with electricity (De Beer 1992; Van der Walt 2015).

The town of Kenhardt was founded in 1868. The town was initially established under a Camelthorn tree. On the 27th of December 1868, Mr M Jackson arrived and set up camp under this Camelthorn tree at the invitation of Louis Anthing, the Magistrate of Namaqualand. When Louis Anthing visited the region in 1863, he used the tree as his headquarters. By the time Jackson arrived, he had utilised these buildings. Kenhardt gradually grew, and a Dutch Reformed Church was erected in the town in 1889 (TurtleSA 2020).

Brandvlei was founded in the heart of Bushmanland, near the Sak River "vloer." At this location, "ou Brand," a 19th-century trekboer, once camped alongside the marsh (vlei) to allow his oxen to rest. Allegedly, he unintentionally ignited the dry grass, resulting in a veld fire, which led to the town's name, Brandvlei. In 1961, a flash flood divided the town into two parts, but it managed to recover, and in 1962, a municipality was established (Brandvlei n.d.).

5. SITE SENSITIVITY: ARCHAEOLOGICAL AND CULTURAL HERITAGE THEME

5.1 Site Verification

The site sensitivity verification was completed through a desktop analysis, satellite imagery and literature research, and on-site inspection.

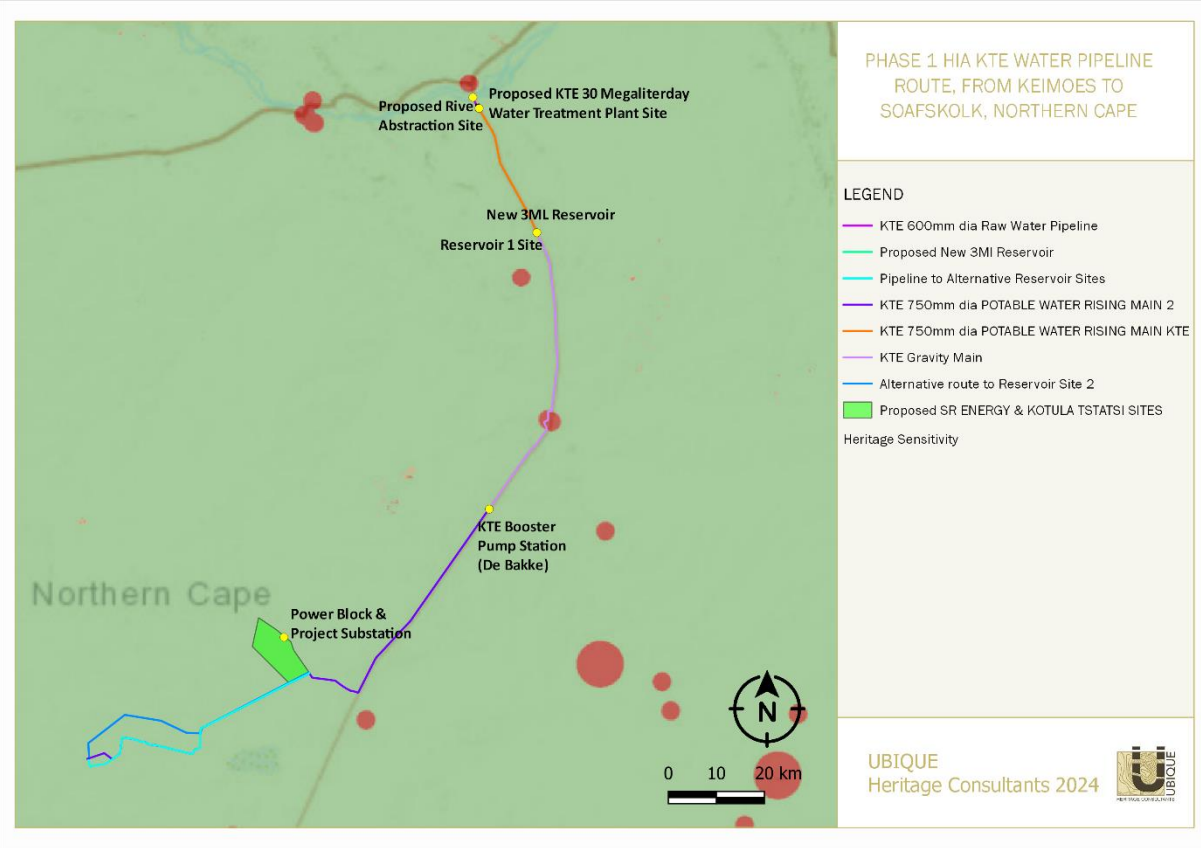


Figure 16 *The site-specific project area indicated on the DFFE Screening tool with Archaeological and Cultural Theme Sensitivity layer (https://screening.environment.gov.za/)*

Our findings confirm the predominantly Low Heritage Sensitivity indicated on the DFFE Screening Tool. However, there are isolated, site-specific occurrences of Medium to High Significance. The DFFE Screening Tool (https://screening.environment.gov.za/) shows a Low Archaeological and Cultural Theme Sensitivity along the proposed development footprint (Figure 16). The study area's consulted HIA and AIA reports predominantly reported on low significant resources. The Archaeological and Cultural Heritage Theme (DFFE Screening Tool) shows areas of high significance, mainly around Upington and Kakamas, with few areas toward the north, east, west and south of the proposed development.

Numerous incidences of artefacts, deposits, stone wallings, and structures have been documented around the proposed development footprint, and these have mainly been graded as IIIa, IIIb, IIIc, and IV. In addition, graves and burial grounds graded as IIIa have also been documented around Brandvlei, Upington and Kakamas. At the same time, sites of higher significance (Grade II), such as buildings, places, structures, and battlefields, have been documented around Kakamas, Kenhardt, and Upington. Grade I sites are rare; however, one is known in Upington, namely the Grave and Memorial of Magrieta Jantjies, Kameelboom Cemetry.

The closest incidences of high significance indicated on the DFFE Screening Tool are situated southeast, north and east of the footprint around Kakamas, Upington, Keimoes, and Brandvlei. This corresponds with the Grade II recorded on the SAHRA Database:

FullSiteName	SiteReference	SiteType	Grading	Coordinates	SiteID
Old Library Building, Park Street, Kenhardt	9/2/048/0005	Building	Grade II	-29.348528, 21.152564	28454
Kenhardt Orlight PV 001	KZB001	Artefacts	Grade IIIc	-29.481670, 20.782568	40396
Kenhardt Orlight PV 002	KZB002	Artefacts	Grade IIIc	-29.478545, 20.787524	40397
Kenhardt Orlight PV 003	KZB003	Artefacts	Grade IIIc	-29.478656, 20.788056	40398
Kenhardt Orlight PV 004	KZB004	Artefacts	Grade IIIc	-29.478645, 20.788138	40399
Kenhardt Orlight PV 005	KZB005	Artefacts	Grade IIIc	-29.478691, 20.788325	40400
Kenhardt Orlight PV 006	KZB006	Artefacts	Grade IIIc	-29.478734, 20.788597	40401
Kenhardt Orlight PV 007	KZB007	Artefacts	Grade IIIc	-29.478987, 20.788879	40402
Kenhardt Orlight PV 008	KZB008	Artefacts	Grade IIIc	-29.479263, 20.788850	40403
Kenhardt Orlight PV 009	KZB009	Artefacts	Grade IIIc	-29.479593, 20.788872	40404
Kenhardt Orlight PV 010	KZB010	Artefacts	Grade IIIc	-29.479726, 20.788936	40405
Kenhardt Orlight PV 011	KZB011	Artefacts	Grade IIIc	-29.479726, 20.788936	40406
Kenhardt Orlight PV 013	KZB013	Artefacts	Grade IIIc	-29.479896, 20.788977	40408
Kenhardt Orlight PV 012	KZB012	Artefacts	Grade IIIc	-29.479887, 20.788946	40409
Kenhardt Orlight PV 014	KZB014	Artefacts	Grade IIIc	-29.479967, 20.789226	40410
Kenhardt Orlight PV 015	KZB015	Artefacts	Grade IIIc	-29.480091, 20.789455	40411
Kenhardt Orlight PV 016	KZB016	Artefacts	Grade IIIc	-29.480290, 20.788869	40412
Kenhardt Orlight PV 018	KZB018	Artefacts	Grade IIIc	-29.480346, 20.788327	40414
Kenhardt Orlight PV 019	KZB019	Artefacts	Grade IIIc	-29.480362, 20.787773	40416
Kenhardt Orlight PV 017	KZB017	Artefacts	Grade IIIc	-29.480359, 20.788652	40419
Kenhardt Orlight PV 020	KZB020	Artefacts	Grade IIIc	-29.480498, 20.787266	40421
Kenhardt Orlight PV 021	KZB021	Artefacts	Grade IIIc	-29.480491, 20.787228	40422

Kenhardt Orlight PV 022	KZB022	Artefacts	Grade IIIc	-29.480457, 20.787173	40423
Kenhardt Orlight PV 025	KZB025	Artefacts	Grade IIIc	-29.480343, 20.786800	40426
Kenhardt Orlight PV 023	KZB023	Artefacts	Grade IIIc	-29.480426, 20.786854	40429
Kenhardt Orlight PV 024	KZB024	Artefacts	Grade IIIc	-29.480344, 20.786832	40431
Kenhardt Orlight PV 026	KZB026	Artefacts	Grade IIIc	-29.464109, 20.774589	40432
Kenhardt Orlight PV 027	KZB027	Artefacts	Grade IIIc	-29.464638, 20.774442	40433
Kenhardt Orlight PV 028	KZB028	Artefacts	Grade IIIc	-29.464575, 20.772758	40434
Kenhardt Orlight PV 029	KZB029	Artefacts	Grade IIIc	-29.464429, 20.772914	40435
Kenhardt Orlight PV 030	KZB030	Artefacts	Grade IIIc	-29.464243, 20.773100	40436
Kenhardt Orlight PV 031	KZB031	Artefacts	Grade IIIc	-29.463479, 20.773610	40437
Kenhardt Orlight PV 032	KZB032	Artefacts		-29.463412, 20.773789	40438
Kenhardt Orlight PV 032	KZB032	Artefacts	Grade IIIc	-29.463412, 20.773789	40438
Kenhardt Orlight PV 033	KZB033	Artefacts	Grade IIIc	-29.463651, 20.774462	40439
Kenhardt Orlight PV 034	KZB034	Artefacts	Grade IIIc	-29.463974, 20.774615	40440
Kenhardt Orlight PV 035	KZB035	Artefacts	Grade IIIc	-29.469945, 20.773311	40441
Kenhardt Orlight PV 036	KZB036	Artefacts	Grade IIIc	-29.470131, 20.773032	40442
Kenhardt Orlight PV 038	KZB038	Artefacts	Grade IIIc	-29.468505, 20.777163	40444
Kenhardt Orlight PV 040	KZB040	Artefacts	Grade IIIc	-29.471640, 20.782725	40446
Kenhardt Orlight PV 037	KZB037	Artefacts	Grade IIIc	-29.470605, 20.776301	40449
Kenhardt Orlight PV 039	KZB039	Artefacts	Grade IIIc	-29.471409, 20.782089	40451
Kenhardt Orlight PV 041	KZB041	Artefacts	Grade IIIc	-29.470918, 20.782575	40452
Kenhardt Orlight PV 042	KZB042	Artefacts	Grade IIIc	-29.463580, 20.789908	40453
Kenhardt Orlight PV 043	KZB043	Artefacts	Grade IIIc	-29.464296, 20.789890	40454
Kenhardt Orlight PV 044	KZB044	Artefacts	Grade IIIc	-29.482054, 20.782447	40455
Kenhardt Orlight PV 045	KZB045	Artefacts	Grade IIIc	-29.477404, 20.786346	40456
Kenhardt Orlight PV 046	KZB046	Artefacts	Grade IIIc	-29.474407, 20.788362	40457
Kenhardt Orlight PV 048	KZB048	Artefacts	Grade IIIc	-29.474797, 20.786143	40459
Kenhardt Orlight PV 050	KZB050	Artefacts	Grade IIIc	-29.474080, 20.785707	40461
Kenhardt Orlight PV 049	KZB049	Artefacts	Grade IIIc	-29.474903, 20.785706	40463
Kenhardt Orlight PV 047	KZB047	Artefacts	Grade IIIc	-29.474888, 20.786848	40465
Kenhardt Orlight PV 051	KZB051	Artefacts	Grade IIIc	-29.473946, 20.786516	40470
Kenhardt Orlight PV 053	KZB053	Artefacts	Grade IIIc	-29.473745, 20.788430	40472
Kenhardt Orlight PV 054	KZB054	Artefacts	Grade IIIc	-29.476552, 20.794453	40473
Kenhardt Orlight PV 055	KZB055	Artefacts	Grade IIIc	-29.476230, 20.794142	40474

Kenhardt Orlight PV 056	KZB056	Artefacts	Grade IIIc	-29.476128, 20.794165	40475
Kenhardt Orlight PV 057	KZB057	Artefacts	Grade IIIc	-29.472860, 20.795460	40476
Kenhardt Orlight PV 052	KZB052	Artefacts	Grade IIIc	-29.473349, 20.788124	40477
Kenhardt Orlight PV 058	KZB058	Artefacts	Grade IIIc	-29.461829, 20.795067	40478
Kenhardt Orlight PV 059	KZB059	Artefacts	Grade IIIc	-29.462069, 20.794213	40479
Kenhardt Orlight PV 060	KZB060	Artefacts	Grade IIIc	-29.462534, 20.793224	40480
Kenhardt Orlight PV 061	KZB061	Artefacts	Grade IIIc	-29.461875, 20.792216	40481
Kenhardt Orlight PV 062	KZB062	Artefacts	Grade IIIc	-29.460115, 20.793532	40482
Kenhardt Orlight PV 063	KZB063	Artefacts	Grade IIIc	-29.463084, 20.774913	40483
Kenhardt Orlight PV 064	KZB064	Artefacts	Grade IIIc	-29.464137, 20.775364	40484
Kenhardt Orlight PV 065	KZB065	Artefacts	Grade IIIc	-29.463572, 20.776172	40485
Kenhardt Orlight PV 066	KZB066	Artefacts	Grade IIIc	-29.464804, 20.776980	40486
Kenhardt Orlight PV 067	KZB067	Artefacts	Grade IIIc	-29.468372, 20.777189	40487
Kenhardt Orlight PV 068	KZB068	Artefacts	Grade IIIc	-29.466031, 20.777089	40492
Kenhardt Orlight PV 070	KZB070	Artefacts	Grade IIIc	-29.466330, 20.776097	40494
Kenhardt Orlight PV 073	KZB073	Artefacts	Grade IIIc	-29.463331, 20.790498	40497
Kenhardt Orlight PV 074	KZB074	Artefacts	Grade IIIc	-29.463086, 20.789870	40498
Kenhardt Orlight PV 076	KZB076	Artefacts	Grade IIIc	-29.463535, 20.788832	40500
Kenhardt Orlight PV 069	KZB069	Artefacts	Grade IIIc	-29.466003, 20.775914	40501
Kenhardt Orlight PV 071	KZB071	Artefacts	Grade IIIc	-29.470298, 20.782108	40502
Kenhardt Orlight PV 072	KZB072	Artefacts	Grade IIIc	-29.468366, 20.784011	40503
Kenhardt Orlight PV 075	KZB075	Artefacts	Grade IIIc	-29.462389, 20.789002	40504
Keimoes-Kenhardt 01	KEI-KEN01	Artefacts	Grade IIIc	-28.756444, 20.995667	42009
Keimoes-Kenhardt 02	KEI-KEN02	Artefacts	Grade IIIc	-28.761917, 20.993194	42010
Keimoes-Kenhardt 03	KEI-KEN03	Artefacts	Grade IIIc	-28.790583, 21.018528	42011
Kenhardt (place marked on Bleek map)	Kenhardt	Place	Grade II	-29.344197, 21.144557	89855
Rooipunt 001	ROOI001	Artefacts	Grade IV	-28.479300, 21.007490	45727
Rooipunt 002	ROOI002	Artefacts	Grade IV	-28.481650, 21.002950	45728
Rooipunt 003	ROOI003	Artefacts	Grade IV	-28.480960, 21.002470	45729
Rooipunt 004	ROOI004	Artefacts	Grade IV	-28.477420, 21.002320	45731
Rooipunt 005	ROOI005	Artefacts	Grade IV	-28.484640, 21.006790	45733
Rooipunt 006	ROOI006	Artefacts	Grade IV	-28.484960, 21.010180	45735
Rooipunt 007	ROOI007	Artefacts	Grade IV	-28.491660, 21.014860	45736
Rooipunt 008	ROOI008	Artefacts	Grade IV	-28.497920, 21.029990	45737

Rooipunt 009	ROOI009	Artefacts	Grade IV	-28.480580, 21.029540	45738
Rooipunt 010	ROOI010	Artefacts	Grade IV	-28.469810, 21.019930	45739
Rooipunt 011	ROOI011	Artefacts	Grade IV	-28.454260, 21.023790	45740
Rooipunt 012	ROOI012	Artefacts	Grade IV	-28.466110, 21.008350	45741
Rooipunt 013	ROOI013	Artefacts	Grade IV	-28.464460, 21.005980	45742
Rooipunt 014	ROOI014	Artefacts	Grade IV	-28.463380, 21.001250	45743
Rooipunt 015	ROOI015	Artefacts	Grade IV	-28.460010, 21.006260	45744
Rooipunt 016	ROOI016	Artefacts	Grade IV	-28.468180, 21.032120	45758
Rooipunt 017	ROOI017	Artefacts	Grade IV	-28.462910, 21.017700	45759
Rooipunt 018	ROOI018	Artefacts	Grade IV	-28.480320, 21.032800	45760
Rooipunt 019	ROOI019	Artefacts	Grade IV	-28.495910, 21.015410	45761
Rooipunt 020	ROOI020	Artefacts	Grade IV	-28.478040, 21.049250	45762
Rooipunt 021	ROOI021	Artefacts	Grade IV	-28.476020, 21.035110	45763
Rooipunt 022	ROOI022	Artefacts	Grade IV	-28.476600, 21.032660	45764
Rooipunt 023	ROOI023	Stone walling	Grade IV	-28.478240, 21.049590	45765
Rooipunt 024	ROOI024	Structures	Grade IV	-28.493260, 21.020460	45766
Rooipunt 025	ROOI025	Conservation Area	Grade IV	-28.494450, 21.028060	45767
Rooipunt 026	ROOI026	Conservation Area	Grade IV	-28.493800, 21.028330	45768
Rooipunt 027	ROOI027	Conservation Area	Grade IV	-28.495220, 21.030050	45779
Rooipunt 028	ROOI028	Structures	Grade IV	-28.492890, 21.020990	45780
Rooipunt 029	ROOI029	Conservation Area	Grade IV	-28.485470, 21.040290	45781
Rooipunt 030	ROOI030	Structures	Grade IV	-28.495210, 21.015370	45782
Rooipunt 031	ROOI031	Structures	Grade IV	-28.475360, 21.025250	45783
Rooipunt 032	ROOI032	Structures	Grade IV	-28.476780, 21.024940	45784
Rooipunt 033	ROOI033	Structures	Grade IV	-28.493240, 21.020730	45785
Rooipunt 034	ROOI034	Structures	Grade IV	-28.494230, 21.021950	45786
Rooipunt 035	ROOI035	Structures	Grade IV	-28.494560, 21.022500	45787
Rooipunt 036	ROOI036	Structures	Grade IV	-28.494740, 21.022970	45788
Rooipunt 037	ROOI037	Structures	Grade IV	-28.495880, 21.022240	45789
Dutch Reformed Church, Voortrekker Street, Brandvlei, Calvinia District	9/2/017/0001	Building	Grade II	-30.464442, 20.485675	29392
Brandvlei 01	BRAND01	Burial Grounds & Graves	Grade IIIa	-26.141718, 27.585688	40166
Brandvlei 02	BRAND02	Burial Grounds & Graves	Grade IIIa	-26.141837, 27.586086	40167

Brandvlei 03	BRAND03	Building	Grade IIIb	-26.143829, 27.589269	40168
BRANDVLEI 001	BRNDV001	Artefacts	Grade IIIc	-30.456500, 20.487233	46336
BRANDVLEI 002	BRNDV002	Artefacts	Grade IIIc	-30.456350, 20.487167	46338
BRANDVLEI 003	BRNDV003	Artefacts	Grade IIIc	-30.456667, 20.487983	46340
BRANDVLEI 004	BRNDV004	Artefacts	Grade IIIc	-30.457100, 20.488433	46341
BRANDVLEI 005	BRNDV005	Artefacts	Grade IIIc	-30.457883, 20.489517	46344
BRANDVLEI 006	BRNDV006	Artefacts	Grade IIIc	-30.457867, 20.489033	46346
BRANDVLEI 007	BRNDV007	Artefacts	Grade IIIc	-30.457883, 20.489067	46348
BRANDVLEI 008	BRNDV008	Artefacts	Grade IIIc	-30.757817, 20.659500	46349
BRANDVLEI 009	BRNDV009	Artefacts	Grade IIIc	-30.757567, 20.659383	46350
BRANDVLEI 010	BRNDV010	Artefacts	Grade IIIc	-30.757267, 20.659317	46351
BRANDVLEI 011	BRNDV011	Artefacts	Grade IIIa	-30.744950, 20.648867	46352
BRANDVLEI 012	BRNDV012	Artefacts	Grade IIIa	-30.747383, 20.650850	46353
BRANDVLEI 013	BRNDV013	Artefacts	Grade IIIa	-30.750367, 20.653667	46354
BRANDVLEI 014	BRNDV014	Artefacts	Grade IIIa	-30.751317, 20.653667	46355
BRANDVLEI 015	BRNDV015	Artefacts	Grade IIIc	-30.761350, 20.645000	46356
BRANDVLEI 016	BRNDV016	Artefacts	Grade IIIc	-30.761283, 20.644367	46367
BRANDVLEI 017	BRNDV017	Artefacts	Grade IIIc	-30.760550, 20.599550	46368
BRANDVLEI 018	BRNDV018	Artefacts	Grade IIIc	-30.752150, 20.584750	46369
BRANDVLEI 019	BRNDV019	Artefacts	Grade IIIc	-30.751950, 20.584483	46370
BRANDVLEI 020	BRNDV020	Artefacts	Grade IIIc	-30.744217, 20.575267	46371
BRANDVLEI 021	BRNDV021	Artefacts	Grade IIIb	-30.744133, 20.575250	46372
BRANDVLEI 022	BRNDV022	Artefacts	Grade IIIc	-30.730683, 20.560217	46373
BRANDVLEI 023	BRNDV023	Artefacts	Grade IIIb	-30.722233, 20.552733	46374
BRANDVLEI 024	BRNDV024	Artefacts	Grade IIIc	-30.717700, 20.529867	46375
BRANDVLEI 025	BRNDV025	Artefacts	Grade IIIc	-30.717550, 20.529333	46376
BRANDVLEI 026	BRNDV026	Artefacts	Grade IIIc	-30.717300, 20.528700	46377
BRANDVLEI 027	BRNDV027	Artefacts	Grade IIIc	-30.713367, 20.519783	46378
Brandvlei Reverse Osmosis Treatment Plant 001	BROTP001	Artefacts	Grade IIIc	-30.457667, 20.487167	52623
Brandvlei Reverse Osmosis Treatment Plant 002	BROTP002	Artefacts	Grade IIIc	-30.456361, 20.489500	52625
Brandvlei Reverse Osmosis Treatment Plant 003	BROTP003	Deposit	Grade IIIc	-30.456972, 20.489889	52626
Brandvlei Reverse Osmosis Treatment Plant 004	BROTP004	Deposit	Grade IIIc	-30.456833, 20.491722	52628
Brandvlei (place mentioned in Bleek and Lloyd manuscripts)	Brandvlei	Place	Grade II	-30.459789, 20.494880	89881
Brandvlei Reverse Osmosis	BRDO001	Artefacts	Grade IIIc	-30.456361, 20.489500	131954

Old Dutch Reformed Mission Church, Main Street, Keimoes	9/2/032/0011	Building	Grade II	-28.709745, 20.974679	28790
Water Wheel, Main Street, Keimoes	9/2/032/0012	Structures	Grade II	-28.709773, 20.974089	28786
Keimoes-Kenhardt 01	KEI-KEN01	Artefacts	Grade IIIc	-28.756444, 20.995667	42009
Keimoes-Kenhardt 02	KEI-KEN02	Artefacts	Grade IIIc	-28.761917, 20.993194	42010
Keimoes-Kenhardt 03	KEI-KEN03	Artefacts	Grade IIIc	-28.790583, 21.018528	42011
Palm Tree Avenue, The Island, Upington	9/2/032/0015	Building	Grade II	-28.463217, 21.248977	28784
Old Watermill, Upington	9/2/032/0016	Building	Grade II	-28.462620, 21.240514	28785
Cathedral of St Augustine, Le Roux Street, Upington	9/2/032/0017	Building	Grade II	-28.454859, 21.246264	28782
Museum Complex, 4 Schroder Street, Upington	9/2/032/0018	Building	Grade II	-28.461569, 21.243716	28783
Dutch Reformed Church, Schroder Street, Upington	9/2/032/0019	Building	Grade II	-28.454175, 21.250271	28779
Dakota Drive, Upington 01	DAKOTA01	Artefacts, Burial Grounds & Graves	Grade IIIa	-28.446639, 21.227889	44796
Dakota Drive, Upington 02	DAKOTA02	Burial Grounds & Graves	Grade IIIa	-28.444111, 21.228778	44797
Upington 08	UP08	Artefacts	Grade IIIc	-28.492871, 21.064911	44977
Upington 09	UP09	Burial Grounds & Graves	Grade IIIa	-28.183889, 21.768611	44980
Upington 01	UPING01	Artefacts	Grade IIIa	-28.492270, 21.515880	45504
Upington 04	UPING04	Artefacts	Grade IIIa	-28.493950, 21.521720	45507
Upington 06	UPING06	Artefacts	Grade IIIa	-28.492630, 21.522790	45509
Upington 08	UPING08	Structures	Grade IIIc	-28.480100, 21.549740	45511
Upington 02	UPING02	Artefacts	Grade IIIa	-28.493890, 21.517990	45512
Upington 03	UPING03	Artefacts	Grade IIIa	-28.494640, 21.521330	45513
Upington 05	UPING05	Artefacts	Grade IIIa	-28.493410, 21.521840	45514
Upington 07	UPING07	Structures	Grade IIIc	-28.481760, 21.545030	45515
Upington 10	UPING10	Burial Grounds & Graves	Grade IIIa	-28.831389, 20.808889	45541
Upington 11	UPING11	Burial Grounds & Graves	Grade IIIa	-28.183889, 21.768611	45542
Upington 12	UPING12	Burial Grounds & Graves	Grade IIIa	-27.958056, 22.748056	45543
Grave and Memorial of Magrieta Jantjies, Kameelboom Cemetry, Upington	Grave of Magrieta Jantjies	Burial Grounds & Graves, Monuments & Memorials	Grade I	-28.474194, 21.192806	130121
North Furrow, Kakamas, Gordonia District	9/2/032/0005	Building	Grade II	-28.785592, 20.639647	28797
Battlefield, Kakamas, Gordonia District	9/2/032/0006	Battlefield	Grade II	-28.742640, 20.635730	28798
Water wheel, near DR Church Parsonage, South Furrow, Kakamas	9/2/032/0008	Building	Grade II	-28.772950, 20.622203	28799

Water wheel No. 2, Plot 103, South Furrow, Kakamas	9/2/032/0009/001	Building	Grade II	-28.783353, 20.635208	28793
Water Wheel No. 1, Plot 103, South Furrow, Kakamas	9/2/032/0009/004	Building	Grade II	-28.783504, 20.635524	28794
Water wheel, Plot 1057, North Furrow, Kakamas	9/2/032/0009/005	Building	Grade II	-28.785597, 20.640039	28792
Water wheel, Plot 68, North Furrow, Kakamas	9/2/032/0009/006	Building	Grade II	-28.785335, 20.638437	28791
Water Wheel, Plot 1467, South Furrow, Kakamas	9/2/032/0009/009	Building	Grade II	-28.783988, 20.636358	28788
Kakamas Museum, Voortrekker Street, Kakamas	9/2/032/0010	Building	Grade II	-28.770215, 20.617134	28789
Kakamas Suid 01	KAKA01	Burial Grounds & Graves	Grade IIIa	-28.762890, 20.535580	44550
Kakamas Suid 02	KAKA02	Burial Grounds & Graves	Grade IIIa	-28.762510, 20.538010	44551
Kakamas Suid 03	KAKA03	Artefacts	Grade IIIc	-28.677430, 20.432480	44602
Kakamas Suid 04	KAKA04	Artefacts	Grade IIIc	-28.679640, 20.434860	44603
KAKAMAS 5	KAKA5	Artefacts	Grade IIIc	-28.765417, 20.733972	45879
KAKAMAS 6	KAKA6	Artefacts	Grade IIIc	-28.765250, 20.734139	45880
KAKAMAS 7	KAKA7	Artefacts	Grade IIIc	-28.764667, 20.734472	45881
KAKAMAS 8	KAKA8	Artefacts	Grade IIIc	-28.764528, 20.734194	45882
KAKAMAS 9	KAKA9	Artefacts	Grade IIIc	-28.767170, 20.737350	46281
KAKAMAS 10	KAKA10	Artefacts	Grade IIIc	-28.766910, 20.738660	46282
KAKAMAS 11	KAKA11	Artefacts	Grade IIIc	-28.767200, 20.736940	46283
KAKAMAS 12	KAKA12	Artefacts	Grade IIIc	-28.766840, 20.738510	46284
KAKAMAS 14	KAKA14	Structures	Grade IIIc	-28.770850, 20.728150	46285
KAKAMAS 15	KAKA15	Deposit	Grade IIIb	-28.770860, 20.728370	46286

5.2 Site Sensitivity Desktop Results

Due to the wide range of CRM reports done in the region, this desktop study does not include all the CRM reports. However, most reports recorded artefacts and features relating to the Stone Age and the Historical Period. These reports were obtained from the SAHRIS database.

The desktop study revealed that few Impact Assessments had been done near the proposed development footprint. Some assessments reported on cultural material and features relating to the Stone Age and the Historical/Colonial era (e.g. Kaplan 2008, Rossouw 2014, Van der Walt 2015a, b, 2016).

5.2.1 Stone Age

Numerous impact assessments have been conducted around the proposed pipeline route and nearby towns in the wider region. Lithic occurrences dating to the ESA, MSA and LSA periods have been identified around the Kenhardt area. Most of these occurrences were surface scatters of low significance – these scatters mainly consisted of flakes and blades, with few instances of ostrich eggshell fragments (OES) (for example, Dreyer 2011; Nilssen 2016a and b; Orton 2014; 2016a; Pelser 2012; Van der Walt 2015). In addition, instances of lithic material that range between low to medium significance include implements such as hand axes, flakes, cores, chunks, retouched scrapers, and bladelets (for example, Orton 2015, 2016b; Pelser 2011; Webley & Halkett 2012b). Instances of OES and decorated pottery, glass, and lower grindstones and upper grindstones have also been recorded within the 50km periphery as well as extensive quarry sites and an MSA-LSA pan site (Lavin 2021a and b, 2023; Nilssen 2016a and b Orton 2016a). A large number of ESA and MSA tools, flakes and cores, some instances of OES, and a probable knapping site were identified by Pelser (2011), which has been given a rating of medium to high significance.

The majority of the reports conducted in the Brandvlei, Upington, Kakamas, Keimoes, and Kenhardt regions reported on lithic material dating from the ESA, MSA and LSA by but not limited to ACRM (2016, 2017), Beaumont (2008b), Dreyer (2006), Engelbrecht & Fivaz (2018, 2019 a), Fivaz & Engelbrecht (2019, 2020a, b and c, 2021 a and b), Kaplan (2011, 2012a, 2016a and b), Morris (2010, 2011, 2013d, 2017b), Orton (2013, 2014, 2016, 2020), Van der Walt (2020), Van Schalkwyk (2010, 2011, 2013, 2014) and Webley & Halkett (2010, 2014). Most lithic occurrences recorded ranged from cores, flakes, blades, chunks, and scrapers. Some sites also yielded fragments of OES and grindstones. Most of which were of low significance.

A few consulted HIA conducted near the proposed pipeline route reported scatters of stone implements. Kaplan (2008), for example, recorded low-density to higher densities of tool scatters during his survey for the Plant and Supply Pipeline From Keimoes To Kenhardt Water Treatment Plan. The finds include small flakes, chunks, OES, core, LSA retouched flake, bladelets and blade tools backed pieces and points, miscellaneous retouched tools, fine punch struck flakes, and small round cores. Rossouw (2014) and Van der Walt (2015a and b) have also identified other scatters. Rossouw recorded parallel flake blades, core, convergent flake blades, and irregular flakes during the assessment of Neilersdrift 34 East of the proposed pipeline development. Van der Walt (2015a and b) noted lithic occurrences relating to the MSA and LSA, such as flakes, triangular flakes with faceted platforms, Discoid core and snapped blades and chunks, MSA or possibly macro-lithic LSA blades on granite and OES fragments, as well as an MSA/LSA quarry site with a variety of flakes.

Several consulted reports conducted in the Brandvlei area reported scatters and low densities of lithic material dating to the ESA, MSA and LSA. These include cores, flakes, blades, scrapers, notched scrapers, chunks, Ostrich Eggshell fragments and beads and upper grindstones (ACRM 2016; Dreyer 2007; Fivaz & Engelbrecht 2019, 2020d; Kaplan 2013d, 2014, 2017; Orton 2014a, b, 2017a & b Rossouw 2007, 2017; Van der Walt 2013, 2015a; 2016; Van Schalkwyk 2011; Webley 2014).

Higher densities of scatters have also been noted around the Brandvlei area, consisting of MSA and LSA material, such as flakes and chunks, a nicked/retouched flake and a partially retouched flake, in banded ironstone, quartzite and indurated shale (Kaplan 2013d) cylindrical and bladelet cores, bladelets, chips, chunks, utilized and retouched pieces (Kaplan 2017), as well as Domestic Stock Kraals, stone implements, Ostrich eggshell fragments, 19th-century glass and ceramic (Kaplan 2013d).

5.2.2 Rock Art

Numerous rock art sites have been documented on the SAHRA Database in the wider Northern Cape region. Kaplan (2013) (through personal observations) and Morris (1998) have reported that rock engravings occur along the Orange River. This coincides with De Kock (2012), who remarks that rock engravings may generally be located on flat rocky outcrops along the river.

5.2.3 Iron Age

None of the consulted HIAs/AIAs reported on any cultural material or features relating to the Iron Age near the proposed development area.

5.2.4 Historical/Colonial Period

Several HIAs around the Kenhardt region reported on cultural material and features dating to the Historical/Colonial period. The historical period resources identified mainly included scatters of low-significance material such as brown glass bottle fragments (dating to the late 20th century), metal, glass, porcelain, ceramics and faunal material (Lavin 2021b, 2023; Orton 2016a). Interestingly, one isolated (low significance) Martini-Henry cartridge dating to the 19th century was identified by Pelser (2011), who notes that it could have been used during the First Koranna War or the Anglo-Boer War. Large middens of high significance with bone, ceramic, metal and glass (Orton 2016a) were also noted. Various structures, such as farmhouse complexes, circular stone enclosures, a historic stock post, and a brick foundation (early to mid-20th century), have also been identified. Several additional farming-related features were also identified, such as wind pumps, kraal complexes, dam walls, and cement reservoirs (Lavin 2021b, 2023; Orton 2014, 2016a; Pelser 2011; Van der Walt 2015). During Orton's (2018a and b) survey, he also identified an old farm complex comprised of two stone livestock enclosures, a 20th-century house ruin, ruins of a small stone-built cottage and other stone features as well as a midden with material dating to the late 19th century and early 20th century.

The majority of the reports conducted in the Brandvlei, Upington, Kakamas, Keimoes, and Kenhardt regions reported on historical material relating to the historic farming period and the ABW (for example, Dreyer 2006, Engelbrecht & Fivaz 2019a, Fivaz & Engelbrecht 2020b and c Morris 2010, 2013d, Van Schalkwyk 2010, Webley & Halkett 2014). However, only one impact

assessment was reported on cultural material/sites associated with the Historical/Colonial Period along the proposed study area's pipeline route. A farmhouse complex (Van der Walt 2016) Situated approx. 34m N of Proposed SR Energy & Kotula Tstatsi Site approx. 3.9km NW from the KTE Rising Main 2.

A handful of the consulted HIAs conducted in the Brandvlei area reported on resources related to the historical period, such as scatters of material (e.g. glass, a shotgun cartridge, Scatters of 20th-century debris such as glass fragments, rusted tin cans, ceramic and bone, few scatters of very recent 20th-century glass, tin and ceramics), Interlocking machine soldered tin with trademarks (Bourneville Cadbury's England), Historical fuel/oil tin with machine soldered seems with trademarks, Structures, farmsteads and associated outbuildings, farming related features such as wind pumps and reservoirs, stone livestock kraals, foundations, middens, dam and retaining walls, dry-packed, stone stock enclosures/kraals, farm buildings and farm labourer's cottages (Fivaz & Engelbrecht 2019 2020d; Kaplan 2014; Orton 2014a and b; Webley & Halkett 2009; Webley & Orton 2012; Van der Walt 2016).

Various heritage sites have been documented and declared in the broader area, most of which are provincial heritage sites, such as buildings. There are also several monuments, memorials, and burial grounds, some of which are listed in this table below, which can also be found on the SAHRA Database:

DECLARED HERITAGE SITES IN AND AROUND UPINGTON, KEIMOES, KAKAMAS AND KENHARDT AREAS DOCUMENTED ON THE SAHRA DATABASE:

Site/Object Name	Coordinates	Archive Status	Declaration Type	Site type	Site Reference	Site ID
Palm Tree Avenue, The Island, Upington	-28.463217 21.248977	National monument	Provincial Heritage Site	Building	9/2/032/0015	28784
Old Watermill, Upington	-28.462620 21.240514	National monument	Provincial Heritage Site	Building	9/2/032/0016	28785
Cathedral of St Augustine, Le Roux Street, Upington	-28.454859 21.246264	National monument	Provincial Heritage Site	Building	9/2/032/0017	28782
Museum Complex, 4 Schroder Street, Upington	-28.461569 21.243716	National monument	Provincial Heritage Site	Building	9/2/032/0018	28783
Dutch Reformed Church, Schroder Street, Upington	-28.454175 21.250271	National monument	Provincial Heritage Site	Building	9/2/032/0019	28779
Grave and Memorial of Magrieta Jantjies, Kameelboom Cemetry, Upington	-28.474194 21.192806		Provincial Heritage Site	Burial Grounds & Graves, Monuments & Memorials	Grave of Magrieta Jantjies	130121
North Furrow, Kakamas, Gordonia District	-28.785592 20.639647	National monument	Provincial Heritage Site	Building	9/2/032/0005	28797

DECLARED HERITAGE SITES IN AND AROUND UPINGTON, KEIMOES, KAKAMAS AND KENHARDT AREAS DOCUMENTED ON THE SAHRA DATABASE:						
Site/Object Name	Coordinates	Archive Status	Declaration Type	Site type	Site Reference	Site ID
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
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
Old Library Building, Park Street, Kenhardt	-29.348528 21.152564	National Monument	Provincial Heritage Site	Building	9/2/048/0005	28454
Old Dutch Reformed Mission Church, Main Street Keimoes	-28.709745 20.974679	National Monument	Provincial Heritage Site	Building	9/2/032/0011	28790
Water Wheel, Main Street, Keimoes	-28.709773 20.974089	National Monument	Provincial Heritage Site	Structures	9/2/032/0012	28786

Two monuments (KTE-040, 043) were noted during the field survey, one related to the establishment of Kenhardt and the second a memorial to the Anglo-Boer War. Both are situated well outside the development footprint.

Figure 17 *Kenhardt establishment and ABW Monuments*

5.2.5 Graves/Burials

Graves are readily found throughout the landscape. Several graves, burial sites, and cemeteries have been recorded in the wider region; however, only a handful of graves were reported in the consulted HIAs. These include a cemetery of approximately six graves dated to around 1876 at Stof Bakjes 303, a single grave dating to 1965 on farm 390, Vleikolk, and a Grave/memorial of Danie Taljaard (Van der Walt 2015 a &b, 2016). Several cemeteries (around 60 to 140 graves)

graves/burials were also noted in consulted HIAs around the Brandvlei area (Van der Walt 2005; Fivaz & Engelbrecht 2020d).

5.2.6 Palaeontological Sensitivity

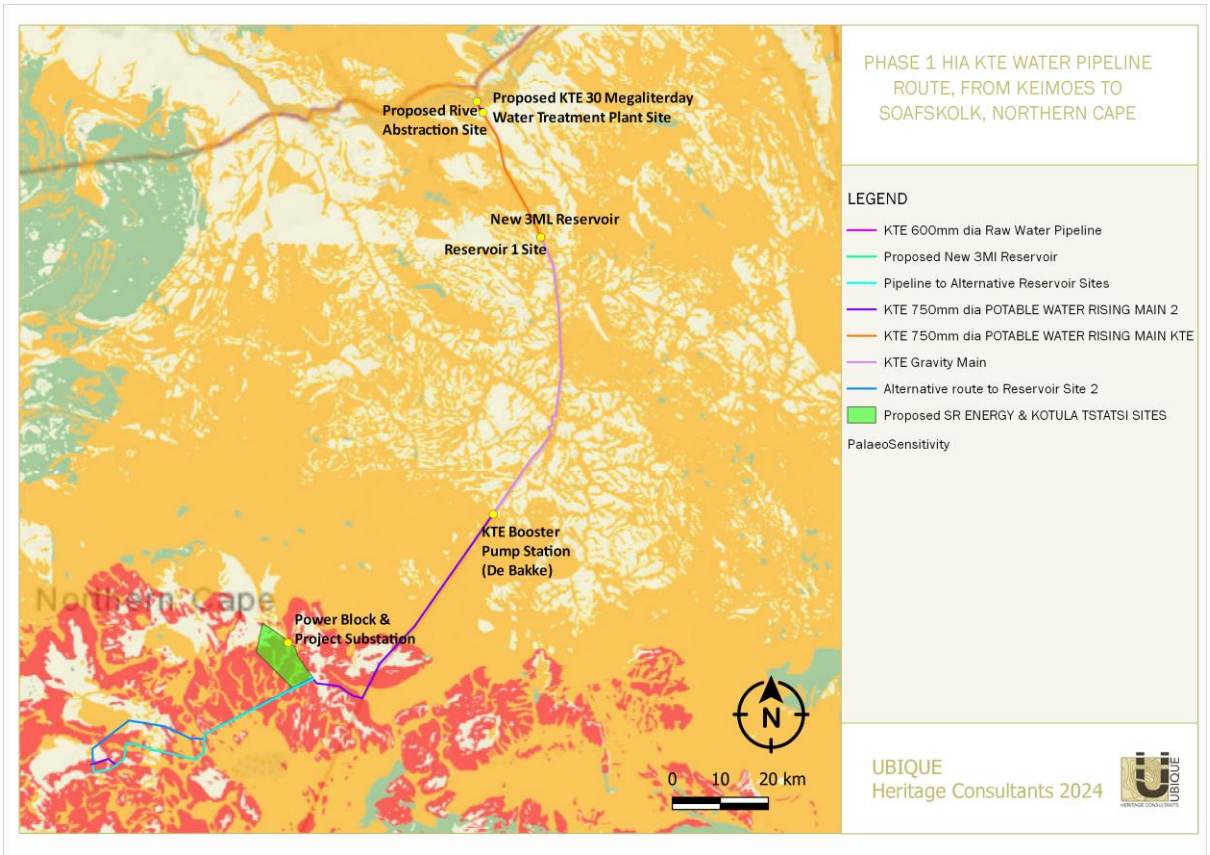


Figure 18 *The DFFE Screening tool Palaeontological Theme and SAHRIS PalaeoSensitivity Map, indicating Low (Green, Medium (orange) and High (Red) palaeontological significance in the larger study area (https://screening.environment.gov.za/).*

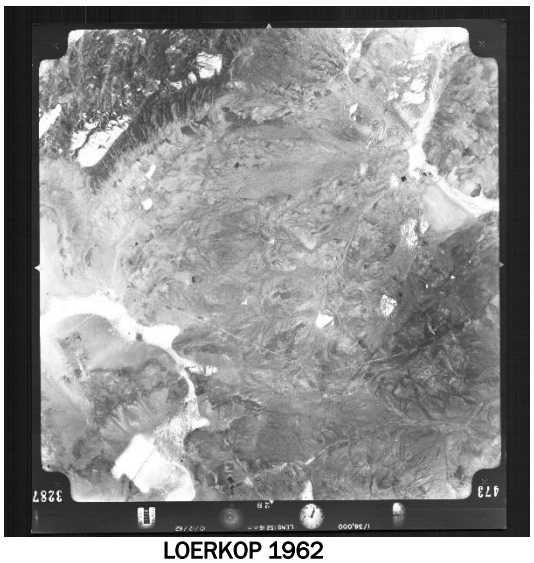
The SAHRIS PalaeoMap indicates that the Palaeontological Sensitivity of the Quaternary Kalahari and Dwyka Groups is Moderate, while that of the Prins Albert Formation of the Ecca Group is High. Unfossiliferous sediment with Zero Palaeontological Sensitivity includes Jurassic Dolerite as well as sediments of the Namaqua-Natal Province (Almond and Pether, 2009; Almond et al., 2013; Groenewald et al. 2014). **The suggested location is classified as having a High (orange) Palaeontology Theme Sensitivity in the DFFE Screening Report.**

The site investigation and desktop research (National Database and published data) concluded that **the area's fossil heritage of scientific and conservational interest is relatively rare and of low scientific and conservational value.** Data indicates that fossil sites are generally rare, sporadic and unpredictable. A **low significance** has thus been allocated to the development footprint. This contrasts with the High Sensitivity allocated to the development area by the SAHRIS Palaeontological Sensitivity Map and DFFE Screening Tool. The **Very High Palaeontological Sensitivity indicated by the DFFE Screening Tool is thus contested/disputed, with a Low**

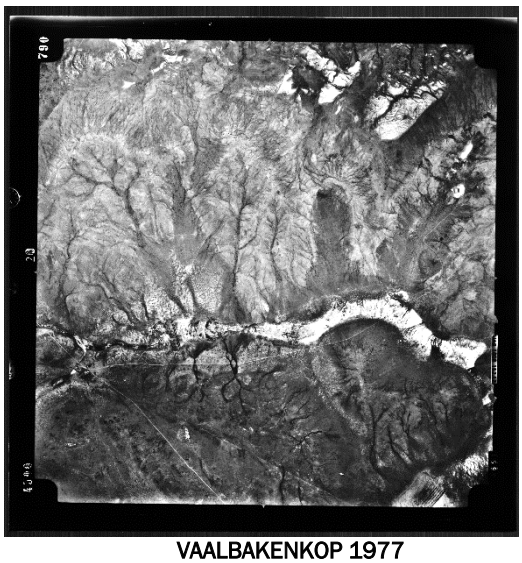
Palaeontological Sensitivity assigned to the development based on the site investigation in November 2022 (Butler 2024, Appendix A).

5.3 Digital Survey

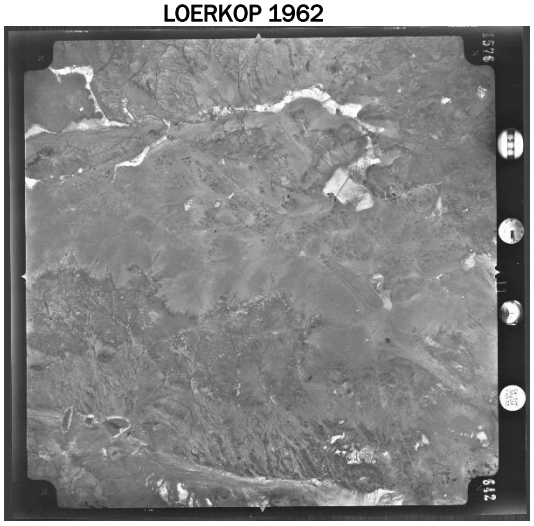
A review of aerial photos dating from the 1940s-70s shows a predominately undeveloped landscape with limited cultivated lands and structures.



LOERKOP 1962



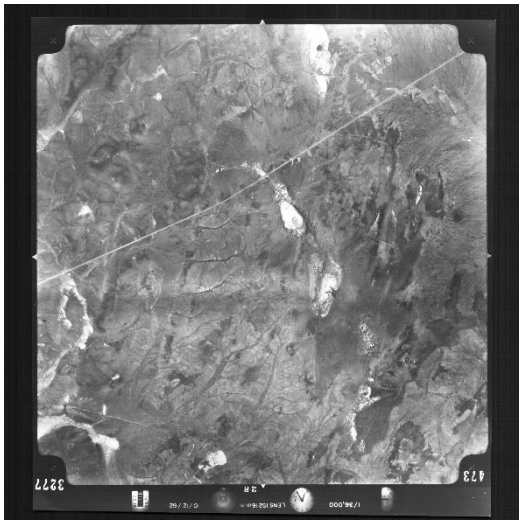
VAALBAKENKOP 1977



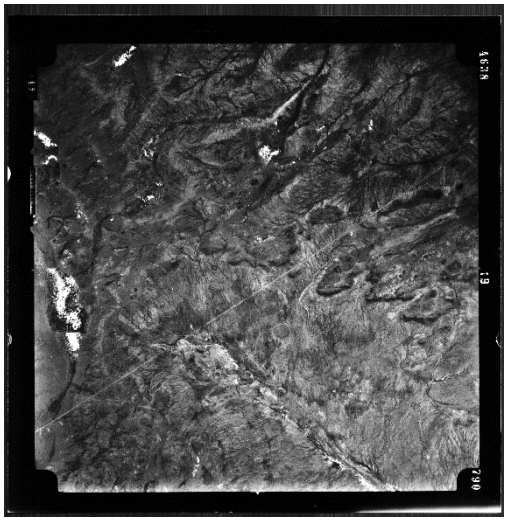
BULSNY 1969

EVAPORATION PONDS SITE 1962

SITE STORAGE RESERVOIR 1964

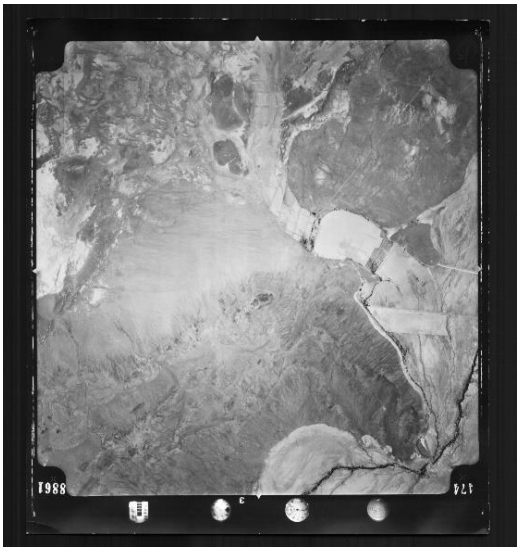


SITE STORAGE RESERVOIR 1967



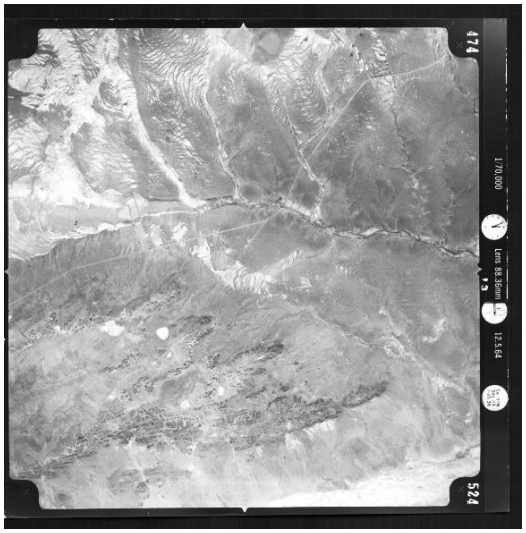
SITE STORAGE RESERVOIR 1977

BRANDVLEI 1967

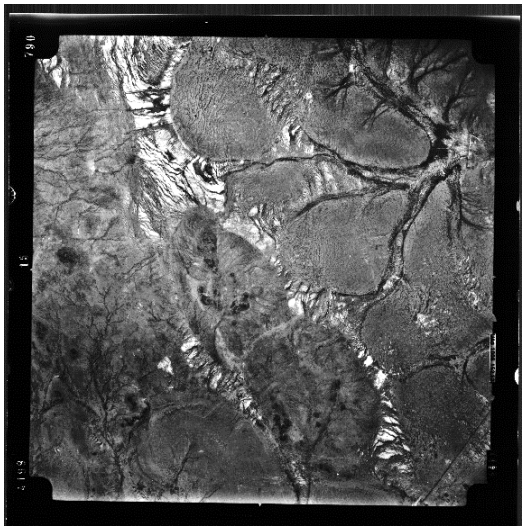


BRANDVLEI 1963

BRANDVLEI 1963

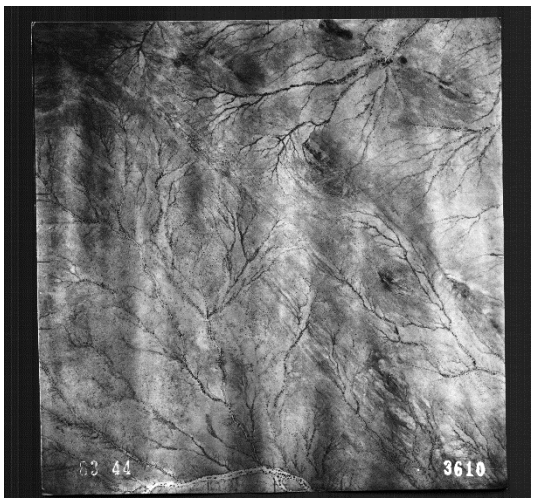


BOSDUIF LAAGTE SOUTH 1967

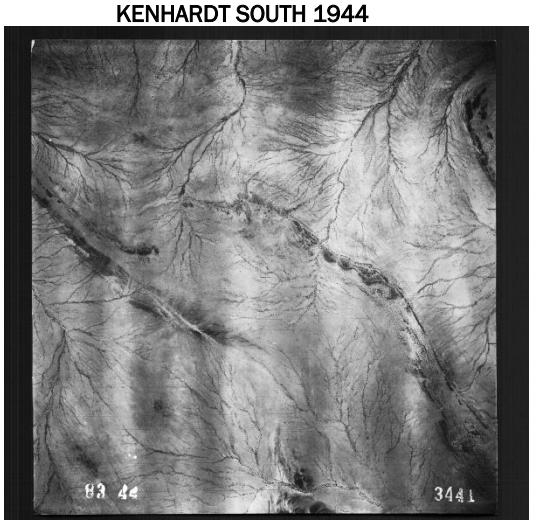


BOSDUIF LAAGTE 1977

KENHARDT SOUTH 1944



KENHARDT 1977

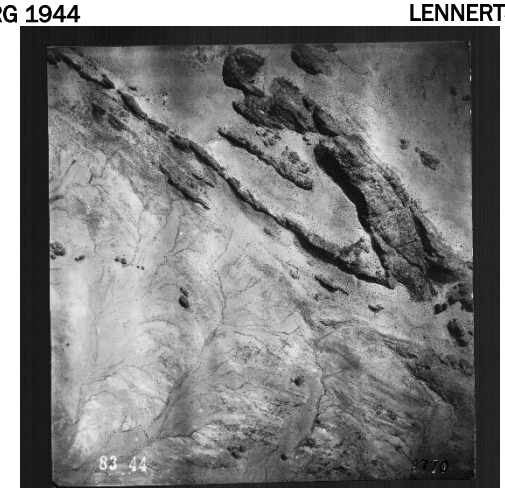


KENHARDT NORTH 1944

PIET ROOIS BERG SOUTH 1944

PIET ROOIS BERG 1944

LENNERTSVILLE SOUTH 1941



LENNERTSVILLE 1944

Figure 19 *Aerial Photographs taken between 1941 and 1977 of the larger landscape around the proposed powerline connection corridor footprint. (*http://www.cdngiportal.co.za/CDNGIPortal/)

5.4 Description of the Affected Environment

The archaeological site visit was conducted during late summer on the **18th to the 20th of October 2022,** in late spring**,** and on the **12th of March 2024,** in early autumn. The development area mainly falls within the Bushmanland Arid Grassland vegetation type, surrounded by Gordonia Duneveld, Kalahari karroid shrubland, Bushmanland Basin Shrubland, Bushmanland Vloere, Lower Gariep brokenveld and Lower Gariep alluvial vegetation (Mucina & Rutherford 2006).

The primary geology observed on the ground surface throughout the survey was as follows: Calcrete/Limestone, Banded Ironstone Formation (BIF), a few Dolomite and Dolomite outcrops, Crypto-crystalline silicates (CCS), Quartz (minimal), Schale (minimal), and Quartzite.

Dominant (Primary) vegetation observed: Black Thorn Acacia/Swarthaak (*Acacia mellifera*), Camelthorn Tree/Kameeldoringboom (*Acacia erioloba*), Grey Camelthorn

Tree/Vaalkameeldoringboom (*Acacia haematoxylon*), Campher Bush (*Tarchonanthus camphorates*), Tumbleweed/Gifbol (*Ammocharis coranica*), Feathertop chloris/Vingergras (*Chloris virgata*), Bluestem/Vleivingergras (*Dichanthium annulatum*), Tall Bushmangrass/Lanbeen Boesmangras (*Stipagrostis ciliate*), Silky Bushmangrass/Blinkblaar Boesmangras (*Stipagrostis uniplumis*), Branched needlegrass/Berggras (*Triraphis ramosissima*), Pearly love grass/Reengras (*Eragrostis rotifer*), Ringed lovegrass/Blougras (*Eragrostis annulata*), Krulblaargras (Eragrostis biflora), Blinkblaar-wag-'n-bietjie Tree (*Zizipus mucronata*), Sweet Thorn Tree (*Vachellia karroo*), Green-Hair Thron Tree (*Parkinsonia africana*), Prosopis Tree (*Prosopis glandulosa*), and Kraalbos (*Galenia Africana*).

Several natural dry riverine waterways, which are non-perennial, are situated along R27 and Soafskolk road and cross the R27 from north to south and east to west. The Orange River towards the north is perennial, flowing towards the west. The Hartbees River flows adjacent to Kenhardt to the west of Kenhardt in a northwestern direction towards the Orange River. A tributary of the Hartbees River named "Driekop se Rivier" flows toward the Hartbees from west to east, just outside Kenhardt to the west of the town. Several dry pans were also identified, especially on the Soafskolk road, where some pans are part of the gravel road and servitude to Soafskolk.

The terrain is relatively flat, with a few high grounds along the R27 servitude and Soafskolk gravel road servitude towards Kenhardt and Brandvlei. The terrain is mainly klipveld, and the relatively large rocky "Rooikop" mountain range is situated north of Kenhardt, between Kenhardt and Keimoes.


19/10/2022


19/10/2022


19/10/2022


19/10/2022


19/10/2022


19/10/2022


19/10/2022


19/10/2022


19/10/2022


19/10/2022


20/10/2022


20/10/2022

Figure 20 *Views of the affected development area*

6. SURVEY AND IDENTIFIED HERITAGE RESOURCES

6.1 Surveyed Area

UBIQUE Heritage Consultants inspected the proposed development and surrounding areas from the **18th to the 20th of October 2022 and the 12th of March 2024.** 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 and with no effort to look beneath the surface beyond inspecting rodent burrows, cut banks and other exposures fortuitously observed.

The areas surveyed for the impact assessment were dictated by the Google Earth map of the development footprints provided by the client. The proposed development areas were surveyed by vehicle and on foot.

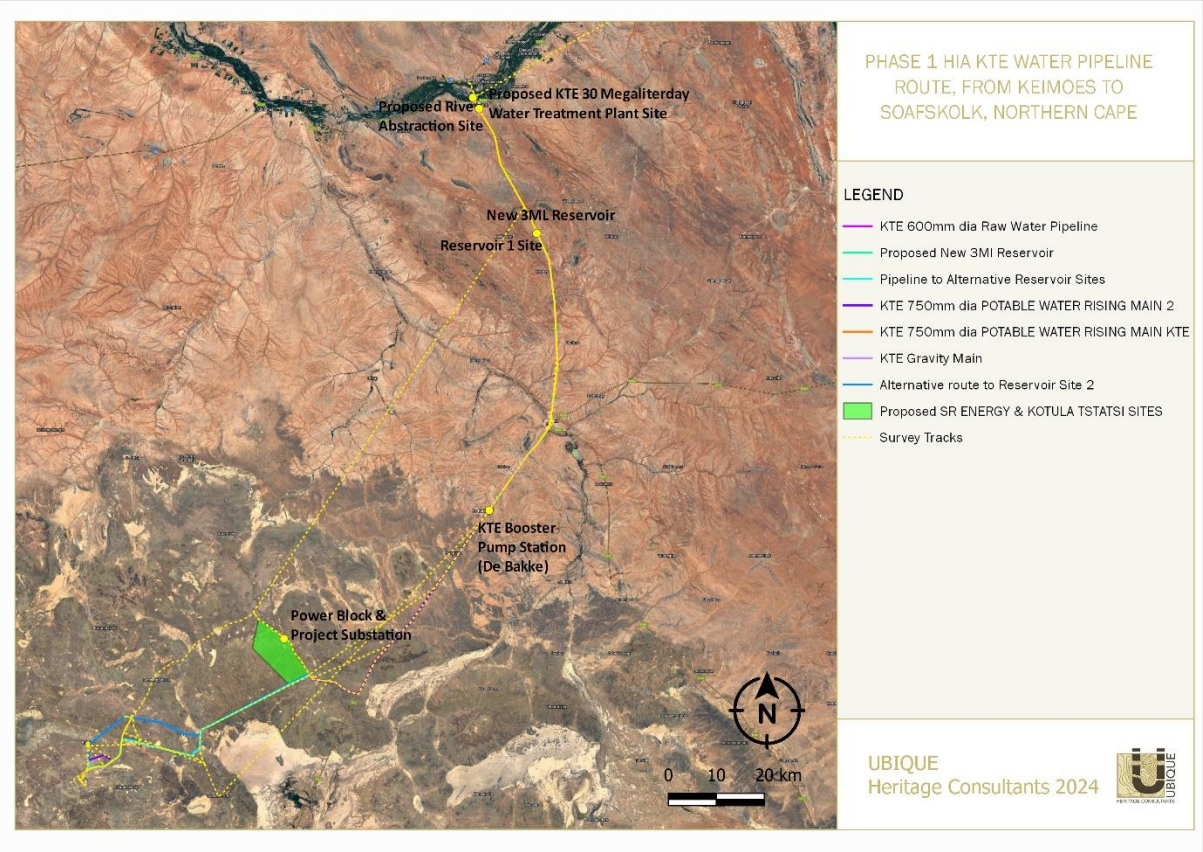


Figure 21 *Survey tracks across the proposed KTE footprint.*

6.2 Identified Heritage Resources

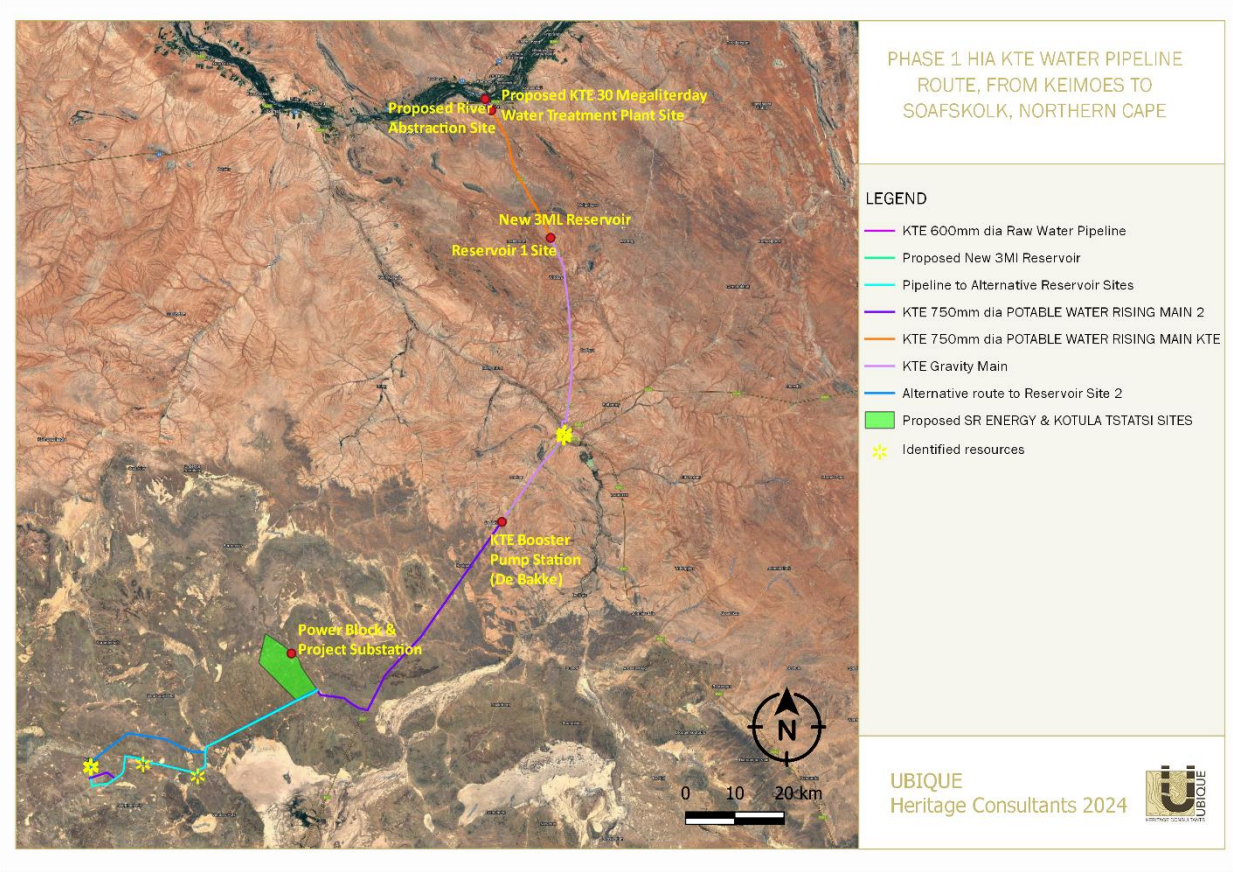


Figure 22 *Distribution of identified heritage resources at the proposed development area.*

Figure 23 Distribution of identified heritage resources at the proposed development area.

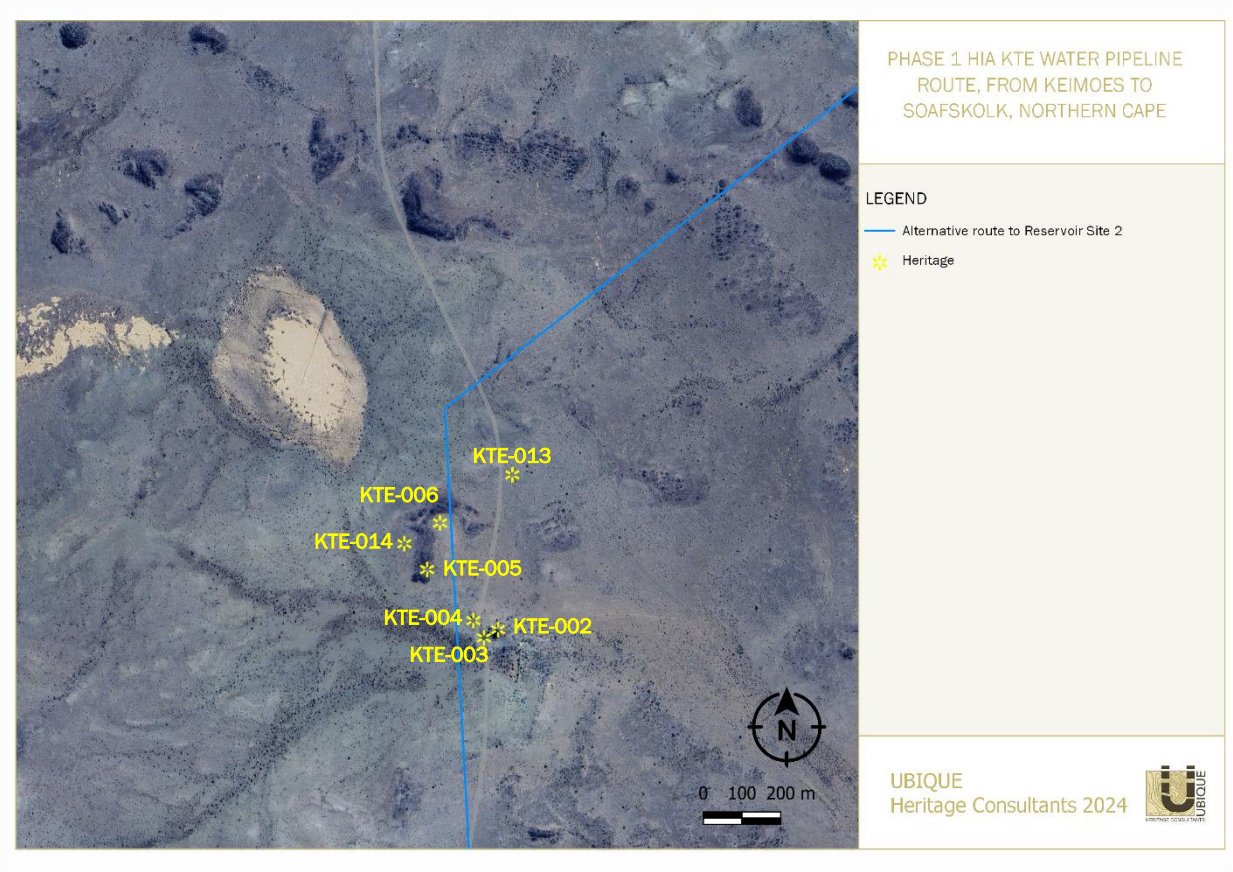


Figure 24 *Distribution of identified heritage resources at the proposed development area.*

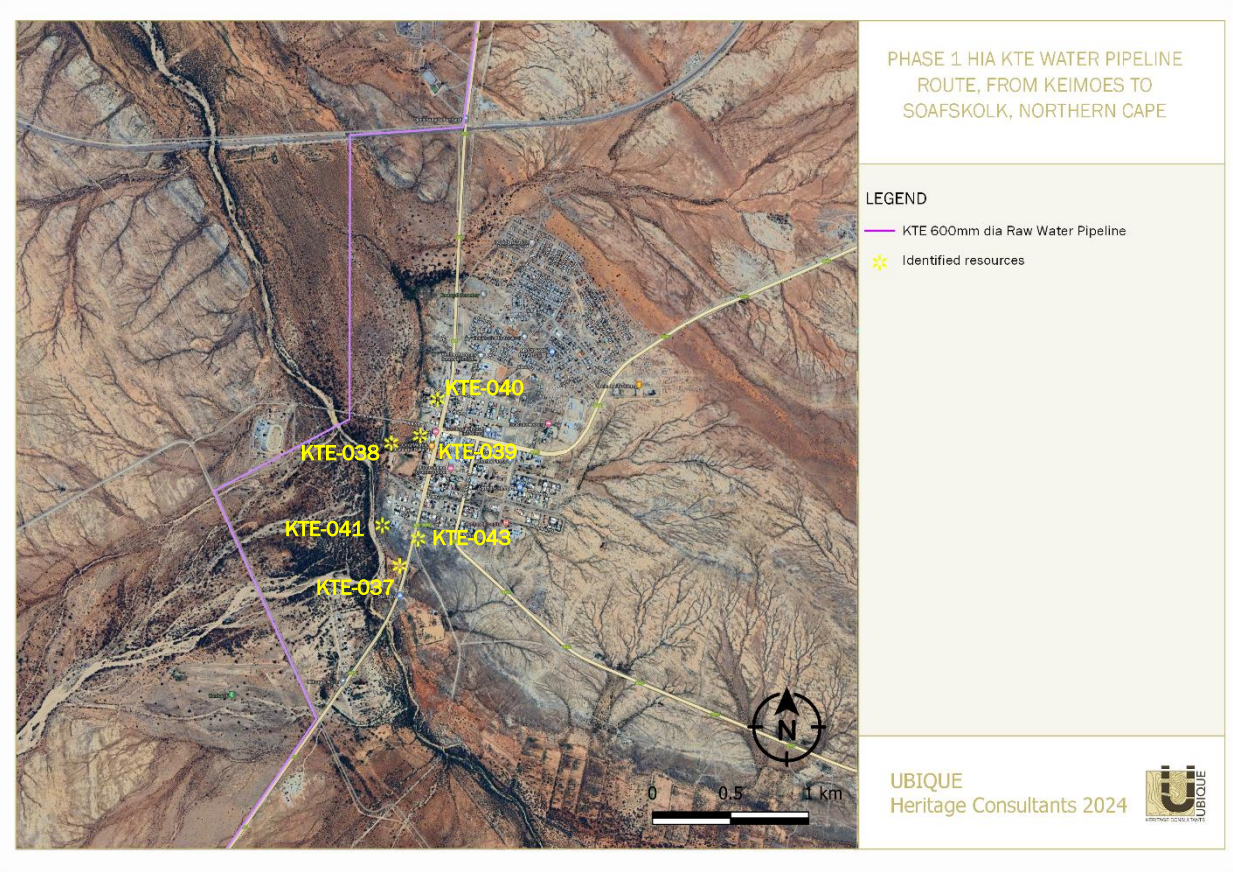


Figure 25 *Distribution of identified heritage resources at the proposed development area.*

6.2.1 Stone Age Identified

No cultural material attributed to the Stone Age period was recorded within the development footprint.

6.2.2 Iron Age Identified

No cultural material, features or structures attributed to the Iron Age period were recorded within the development footprint.

6.2.3 Historical/Colonial Period Identified

HISTORICAL PERIOD RESOURCES IDENTIFIED					
SITE ID #	DESCRIPTION		PERIOD	LOCATION	FIELD RATING/ SIGNIFICANCE/ RECOMMENDED MITIGATION
KTE-037	Type of feature	Water irrigation or supply furrows		29° 21' 18.7" S	Field Rating IV B

HISTORICAL PERIOD RESOURCES IDENTIFIED					
SITE ID #	DESCRIPTION		PERIOD	LOCATION	FIELD RATING/ SIGNIFICANCE/ RECOMMENDED MITIGATION
	Material	Cement furrows	Ca. 1900s-1950s	**21° 08' 58.2" E**	Medium Significance. These features might have local significance for industrial/agricultural archaeology. No mitigation (outside of proposed footprint)
	N in m².	N/A			
	Context	Irrigation or water supply			
	Additional	This is located adjacent to the Hartbees River riverbed in the floodplain.			
KTE-038	Type of feature	Water reservoir linked to the furrow system to hold water for irrigation or water supply	Ca. 1900s-1950s	**29° 20' 53.2" S 21° 08' 56.1" E**	Field Rating IV B Medium Significance. These features might have local significance for industrial/agricultural archaeology. No mitigation (outside of the proposed footprint)
	Material	Stone-built reservoir with cement and cement furrows			
	N in m².	N/A			
	Context	Irrigation or water supply			
	Additional	This is located adjacent to the Hartbees River riverbed in the floodplain.			
KTE-039	Type of feature	Water irrigation or supply furrows	Ca. 1900s-1950s	**29° 20' 51.7" S 21° 09' 03.0" E**	Field Rating IV B Medium Significance. These features might have local significance for industrial/agricultural archaeology. No mitigation (outside of the proposed footprint)
	Material	Cement furrows			
	N in m².	N/A			
	Context	Irrigation or water supply			
	Additional	This is located adjacent to the Hartbees River riverbed in the floodplain.			
KTE-040	Type of feature	Monument: "Stigtingsboom" indicates the location where Kenhardt was proclaimed a town in 1868 and the proclamation of a magisterial district under British Cape Colonial Rule.	1868	**29° 20' 44.2" S 21° 09' 07.1" E**	Field Rating IIIA High Significance No mitigation (outside of the proposed footprint)
	Material	Monument and tree (*Camel Thorn Tree: Acacia erioloba*)			
	N in m².	N/A			
	Context	Historic location			
	Additional	This monument is located outside the development footprint but has regional, cultural, and historical significance.			
KTE-041	Type of feature	Ceramics, a "Hole in Cap" tin can, and a Musket No. 2 Rifle used cartridges. Artificial terraces.	Ca. 1870 to 1914	**29° 21' 10.2" S 21° 08' 54.0" E**	Field Rating IV B Medium Significance. These features might have local significance for conflict or military archaeology/history. No mitigation (outside of proposed footprint)
	Material	Tin can, ceramics and ammunition debris. Terraces.			
	N in m².	10/50m²			
	Context	Possible British military observation post or guard post			
	Additional	This location is scattered with old tin cans and ceramics. Terraces were levelled to be occupied by people such as soldiers.			

HISTORICAL PERIOD RESOURCES IDENTIFIED					
SITE ID #	DESCRIPTION		PERIOD	LOCATION	FIELD RATING/ SIGNIFICANCE/ RECOMMENDED MITIGATION
		This area is located outside the development footprint but reasonably close and is significant for the local and regional archaeology and cultural history.			
KTE-043	Type of feature	Monument ABW	Unknown	29º 21' 13.0" S 21º 09' 02.5" E	Field Rating IIIA High Significance No mitigation (outside of proposed footprint)
	Material	N/A			
	N in m².	N/A			
	Context	ABW monument			
	Additional	In Memorium of two Boers who were executed by the British military command			
KTE-002	Type of feature	Old farmhouse	Ca. 1950s-1970's	29º 57' 33.5" S 20º 09' 13.9" E	Field Rating IVA Medium/high Significance 100m NO-GO safety/buffer zone
	Material	Architecture/House			
	N in m².	N/A			
	Context	Historical approx. Ca. 1950's			
	Additional	Old farmhouse with ruins of outside buildings in relation. Built with clay bricks			
KTE-003	Type of feature	Retainer wall	Ca. 1950s-1970's	29º 57' 34.1" S 20º 09' 12.5" E	Field Rating IV A Medium/high Significance 100m NO-GO safety/buffer zone
	Material	Stone			
	N in m².	50 m			
	Context	In context with old farmhouse WP 002			
	Additional	Retainer wall to control water and livestock			
KTE-004	Type of feature	Old stone foundation	Ca. 1950s-1970's	29º 57' 32.7" S 20º 09' 11.5" E	Field Rating IV A Medium/high Significance 100m NO-GO safety/buffer zone
	Material	Stone			
	N in m².	2 room foundation			
	Context	In context with old farmhouse WP 002			
	Additional	Possible workers house			
KTE-005	Type of feature	Stone kraal/Livestock byre	Ca. 1950s-1970's	29º 57' 28.6" S 20º 09' 07.1" E	Field Rating IV A Medium/high Significance. These features might have local significance for industrial/ agricultural archaeology 100m NO-GO safety/buffer zone
	Material	Dolerite stone			
	N in m².	50mx50m with lamb kraal attached			
	Context	In context with old farmhouse WP 002			
	Additional	Livestock, possibly sheep kept in kraal			
KTE-006	Type of feature	Historical campsite, possibly a temporary British military campsite with related artefacts.	Ca. 1890s-1918	29º 57' 24.8" S 20º 09' 08.2" E	Field Rating IV B Medium Significance. These features might have local significance for industrial/ agricultural archaeology 100m NO-GO safety/buffer zone
	Material	Glass, metal and ceramics			
	N in m².	10/20m²			
	Context	Near the kraal. The material located on site dates to the late 1800s to early 1900s			
	Additional	Earlier occupation than the farmstead			

HISTORICAL PERIOD RESOURCES IDENTIFIED					
SITE ID #	DESCRIPTION		PERIOD	LOCATION	FIELD RATING/ SIGNIFICANCE/ RECOMMENDED MITIGATION
KTE-013	Type of feature	Musical instrument reed plate	Ca. 1950s to 1970's	**29º 57' 20.5" S 20º 09' 15.2" E**	Field Rating IVC Low significance No mitigation
	Material	Brass			
	N in m².	1/50m²			
	Context	In context with old farmhouse WP002			
	Additional	Entertainment			
KTE-033	Type of feature	Kraal/ Livestock byre	Ca. 1960s to 1980's	**29º 58' 28.3" S 20º 22' 40.8" E**	Field Rating IVA Medium/high Significance 100m NO-GO safety/buffer zone
	Material	Dolerite stone			
	N in m².	N/A			
	Context	Beside gravel road near a farmstead on the opposite of the road			
	Additional	Lamb kraal attached			

6.2.3.1 Discussion: Historical Period Resources

The furrows and furrow system (KTE-037, 038, 039) may be of local significance for the industrial/agricultural archaeology of Kenhardt. Although they are not situated directly within the proposed pipeline route, they are likely negatively impacted by the proposed pipeline; therefore, we recommend at least a 20 m safety/buffer zone around all such features. **These sites are given a 'General' Protection B (Field Rating IV B). The site/resource should be recorded before destruction (medium significance). However, these resources are outside the proposed development, so no further mitigation is recommended.**

Figure 26 *Example images of the Water furrows and systems*

A historical, archaeological site believed to be a British military observation post or guard post (KTE-041) was recorded with ceramics, a "Hole in Cap" tin can, a Musket No 2 Rifle used cartridge and artificial terraces. This site is located outside the development footprint but is close to the proposed pipeline route. **This site is given a 'General' Protection B (Field Rating IV B). The site/resource should be recorded before destruction (medium significance). However, it is outside the proposed development, and no further mitigation is recommended.**

In addition, another historical campsite, possibly a temporary British military campsite with associated artefacts, was also identified (KTE-006). The material located on site dates to the late 1800s to early 1900s. **This site is given a 'General' Protection B (Field Rating IV B). The site/resource should be recorded before destruction (medium significance). Therefore, we recommend a 50m safety/buffer zone around this location.**

KTE-041

KTE-041

KTE-006

Figure 27 *Example images of historical period resources*

Structures and features older than 60 years, dating to the 1950s-1970s, such as an old farmhouse, retainer wall, stone foundation, and a kraal/cattle byre, as well as an additional cattle byre/kraal dating to the 1960s-1980s, were identified during the survey. **These sites are given a 'General' Protection A (Field Rating IV A). The site/resource should be mitigated before destruction (high/ medium significance). Therefore, we recommend a 100 m safety/buffer zone around this location.**

KTE-002

KTE-003

KTE-004

KTE-005

KTE-033

Figure 28 *Example images of the Historical period structures*

A musical instrument reed plate (KTE-013) was recorded in context with the old farmhouse at KTE-002. This is an isolated resource that has been given a Field Rating of IVC **and has been sufficiently recorded.**

KTE-013

Figure 29 *Example images of the reed plate*

6.2.4 Graves Identified

GRAVE RESOURCES IDENTIFIED					
SITE ID #	DESCRIPTION		PERIOD	LOCATION	FIELD RATING/ SIGNIFICANCE/ RECOMMENDED MITIGATION
KTE-011	Grave markers	Marked and unmarked graves of previous owners who lived on the farm.	Ca. 1970s	**29° 57' 10.2" S 20° 15' 46.2" E**	Field Rating of Local Grade IIIA High/medium significance 100 m NO-GO safety/buffer zone
	Inscription	See grave images			
	Graves' Orientation	East-west			
	Dimensions/ Extent	Approximately. 1 ha in size			

GRAVE RESOURCES IDENTIFIED					
SITE ID #	DESCRIPTION		PERIOD	LOCATION	FIELD RATING/ SIGNIFICANCE/ RECOMMENDED MITIGATION
	Additional	Only 3 graves in the cemetery			
KTE-014	Grave markers	Unmarked grave	Ca. 1950's or earlier. Probably a farm worker's grave.	**29° 57' 26.3" S 20° 09' 04.8" E**	Field Rating of Local Grade IIIA High/medium significance 50 m NO-GO safety/buffer zone
	Inscription	None			
	Graves' Orientation	East-West			
	Dimensions/ Extent	1,5mx1m			
	Additional	Small headstone. Possible infant. Random grave not fenced off.			

6.2.4.1 Discussion: Grave Resources

Two grave sites were also recorded, KTE-011 and 014. KTE-011 consists of three graves, unmarked and marked. It is approximately 1 ha in size and is fenced off, while KTE-014 is an unfenced, unmarked grave (1.5 m x 1 m). **These grave sites have been given a Field Rating of IIIA (High – medium significance) and should thus be mitigated. It is recommended that a buffer/safety zone of 100 m should be implemented around KTE-011 and a 50 m buffer/safety zone around KTE-014. In addition, KTE-014 should be fenced off.**

KTE-011

KTE-011

KTE-014

Figure 30 *Example images of the identified graves*

6.2.5 Palaeontological Resources

The proposed KTE Pipeline development is located in flat-lying terrain within the semi-arid Bushmanland region. The study area is underlain by the potentially fossiliferous Quaternary Kalahari Group, Prins Albert Formation and Dwyka Group of the Karoo Supergroup. At depth, the area is underlain by a diversity of unfossiliferous Precambrian basement rocks (*c.* 2 billion years old) of the Namaqua-Natal Province.

During the field survey, no fossiliferous outcrops were detected in the proposed development. The site investigation and desktop research (National Database and published data) concluded that **the area's fossil heritage of scientific and conservational interest is relatively rare and of low scientific and conservational value**. Data indicates that fossil sites are generally rare, sporadic and unpredictable. A **low significance** has thus been allocated to the development footprint. This is in contrast with the High Sensitivity allocated to the development area by the SAHRIS Palaeontological Sensitivity Map and DFFE Screening Tool. The **Very High Palaeontological Sensitivity indicated by the DFFE Screening Tool is thus contested/disputed, with a Low Palaeontological Sensitivity** assigned to the development based on the site investigation in November 2022.

7. IMPACT ASSESSMENT OF THE DEVELOPMENT

7.1 Impact Assessment Tables

ARCHAEOLOGICAL, HISTORICAL, & CULTURAL

NATURE	HERITAGE AND CULTURAL RESOURCES IDENTIFIED SITE(S): Field Rating IVB (**KTE-037, 038, 039, 041, 006**)							
DEVELOPMENT PHASE	DEVELOPMENT IMPACT			IMPACT RATING		RECOMMENDED MITIGATION	IS IMPACT ACCEPTABLE?	
	CRITERIA	*BM	**AM	BEFORE MITIGATION	AFTER MITIGATION		*BM	**AM
PLANNING PHASE	Extent	1	1	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	6	6					
CONSTRUCTION PHASE	Extent	1	1	Negative Medium impact	Negative low impact	Buffer/Safety Zone	NO	YES
	Probability	3	1					
	Reversibility	3	1					
	Irreplaceability	3	1					
	Duration	3	1					
	Cumulative Effect	3	1					
	Magnitude	2	1					
	Impact Significance	32	6					
OPERATIONAL PHASE	Extent	1	1	Positive low impact	Positive low impact	Buffer/Safety Zone	NO	YES
	Probability	1	1					
	Reversibility	1	1					
	Irreplaceability	1	1					
	Duration	1	1					
	Cumulative Effect	1	1					
	Magnitude	1	1					
	Impact Significance	6	6					
DECOMMISSIONING PHASE	Extent	1	1	Negative Medium impact	Negative low impact	Buffer/Safety Zone	NO	YES
	Probability	3	1					
	Reversibility	3	1					
	Irreplaceability	3	1					
	Duration	3	1					
	Cumulative Effect	3	1					
	Magnitude	2	1					
	Impact Significance	32	6					

*BM = BEFORE MITIGATION =; **AM = AFTER MITIGATION

IMPACT: The furrows (KTE-037, 038, 039) as well as the possible British site (KTE-041), are situated outside of the proposed pipeline route and will thus likely not be impacted. However, in the unlikely event that an impact occurs, it will be negative.

The other British campsite (KTE-006) is located near Alternative 1 and will likely be negatively impacted by development.

The impact on these resources would be NEGATIVE MEDIUM before mitigation, NEGATIVE LOW after mitigation during the construction and decommissioning phases and NEGATIVE LOW before and after mitigation during the operational phases.

MITIGATION:

- No further mitigation is recommended since KTE-037, 038, 039, and 041 are outside the proposed footprint.
- A 100 m buffer/safety zone is recommended to negate the negative impact on the British campsite (KTE-006). The buffer/safety zones implemented should be clearly demarcated during the project's construction phase and completely avoided by personnel and equipment.

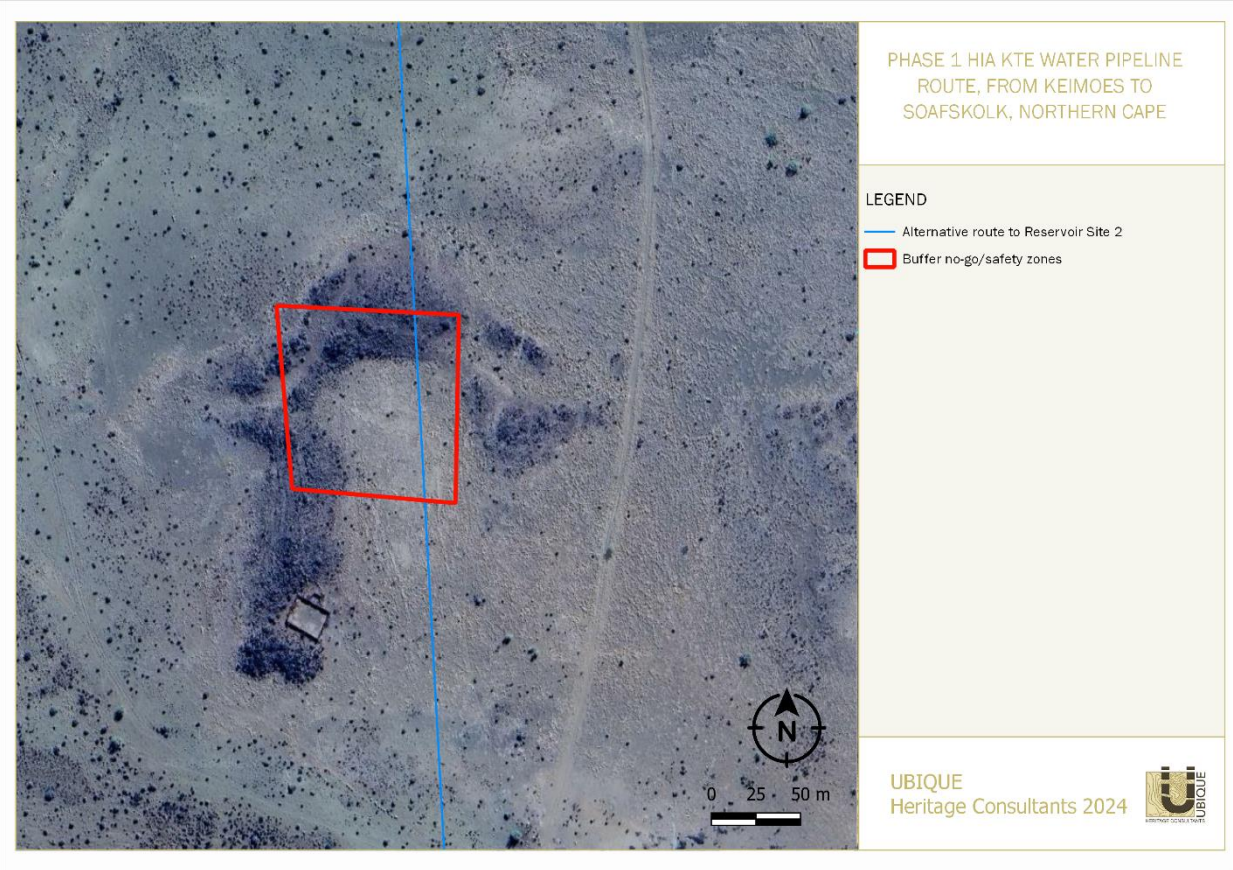


Figure 31 *NO-GO buffer Zone for KTE-006.*

ARCHAEOLOGICAL, HISTORICAL, & CULTURAL								
NATURE	HERITAGE AND CULTURAL RESOURCES IDENTIFIED SITE(S): Field Rating IVA (**KTE-002, 003, 004, 005, 033**)							
DEVELOPMENT PHASE	DEVELOPMENT IMPACT			IMPACT RATING		RECOMMENDED MITIGATION	IS IMPACT ACCEPTABLE?	
	CRITERIA	*BM	**AM	BEFORE MITIGATION	AFTER MITIGATION		*BM	**AM
PLANNING PHASE	Extent	1	1	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	6	6					
CONSTRUCTION PHASE	Extent	1	1	Negative medium impact	Negative low impact	Buffer/Safety Zone	NO	YES
	Probability	3	1					
	Reversibility	3	1					
	Irreplaceability	3	1					
	Duration	3	1					
	Cumulative Effect	3	1					
	Magnitude	2	1					
	Impact Significance	32	6					
OPERATIONAL PHASE	Extent	1	1	Positive low impact	Positive low impact	Buffer/Safety Zone	NO	YES
	Probability	1	1					
	Reversibility	1	1					
	Irreplaceability	1	1					
	Duration	1	1					
	Cumulative Effect	1	1					
	Magnitude	1	1					
	Impact Significance	6	6					
DECOMMISSIONING PHASE	Extent	1	1	Negative Medium impact	Negative low impact	Buffer/Safety Zone	NO	YES
	Probability	3	1					
	Reversibility	3	1					
	Irreplaceability	3	1					
	Duration	3	1					
	Cumulative Effect	3	1					
	Magnitude	2	1					
	Impact Significance	32	6					

IMPACT: Historical period structures and features dating to the 1950s-1970s, such as an old farmhouse, retainer wall, stone foundation, and a kraal/cattle byre as well as an additional cattle byre/kraal dating to the 1960s-1980s, were identified near Alternative 1 and 2. They will be negatively impacted.

The impact on these resources would be NEGATIVE MEDIUM before mitigation, NEGATIVE LOW after mitigation during the construction and decommissioning phases and NEGATIVE LOW before and after mitigation during the operational phases.

MITIGATION: A 200 m buffer/safety zone is recommended to negate the negative impact on these resources. The buffer/safety zones implemented should be clearly demarcated during the project's construction phase and wholly avoided by personnel and equipment.

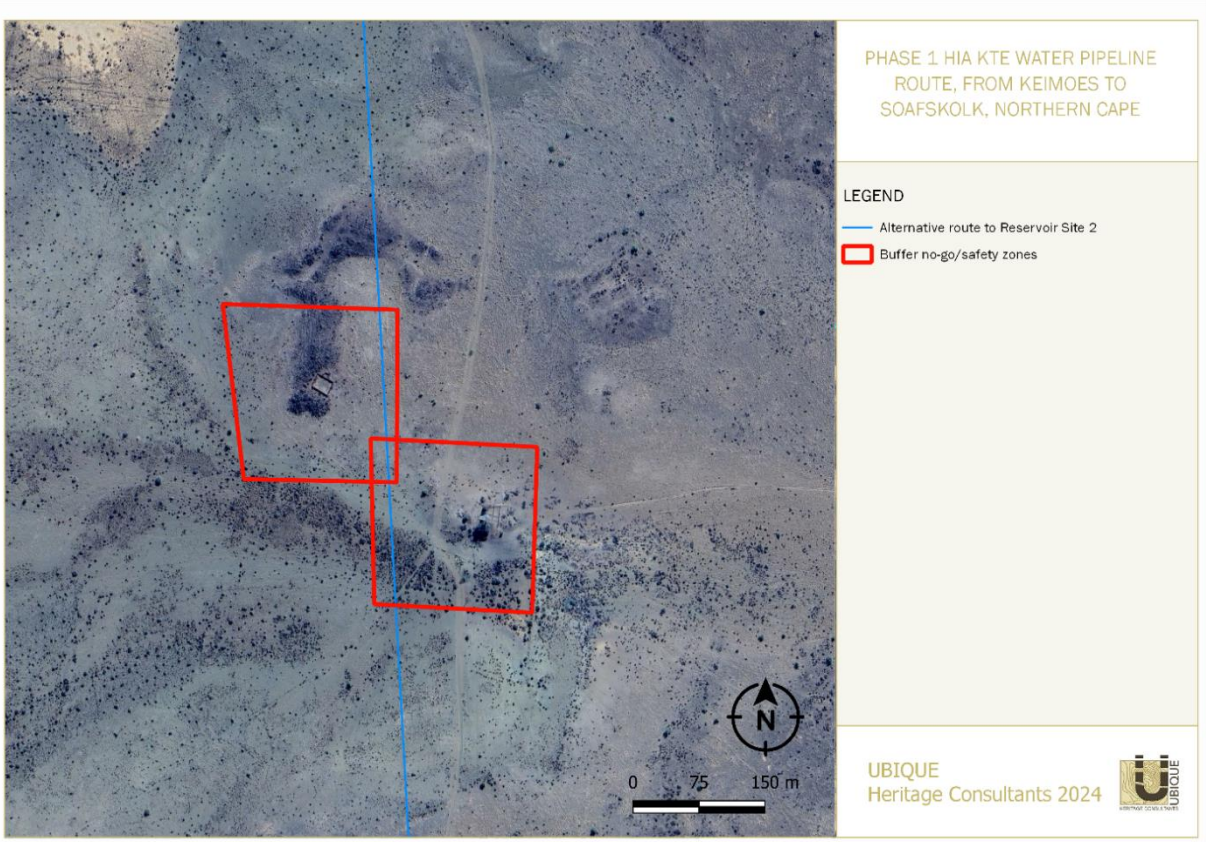


Figure 32 NO-GO buffer Zone for KTE-002, 003, 004, 005.

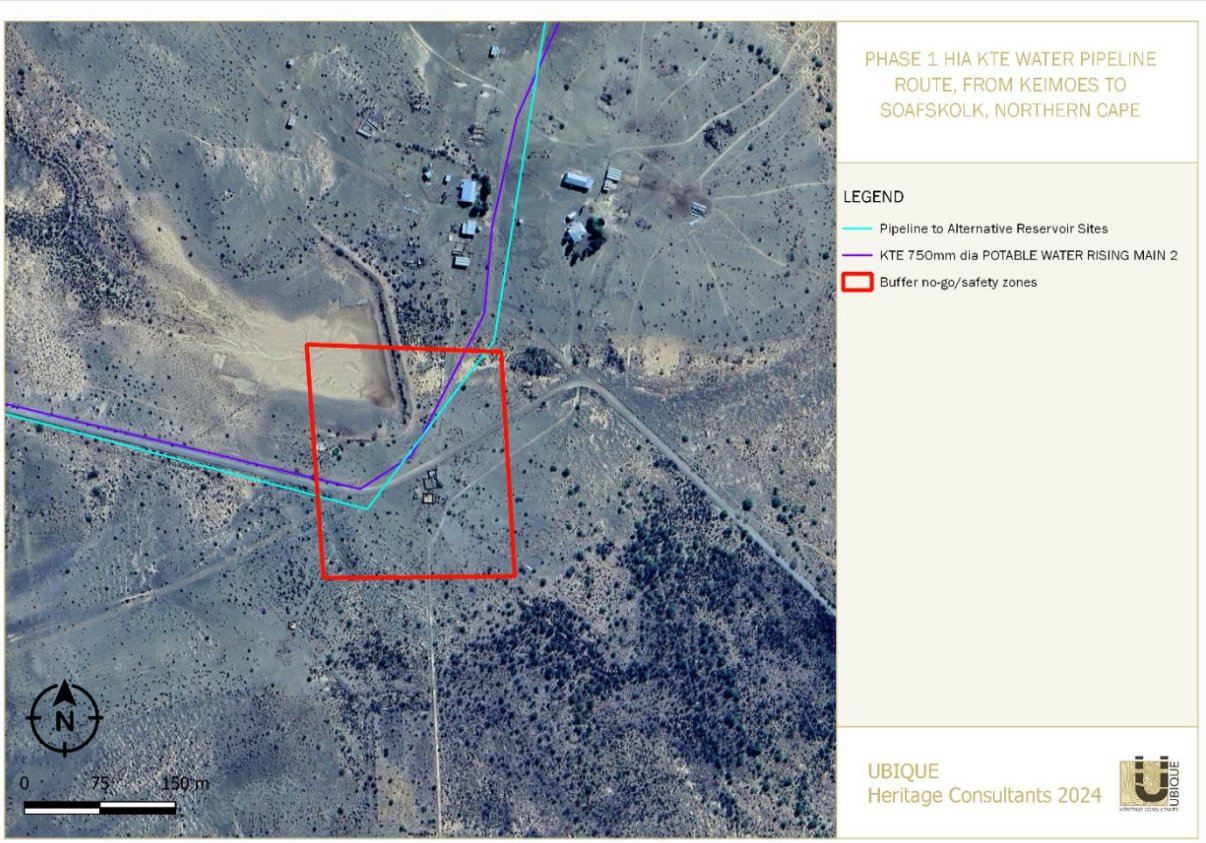


Figure 33 NO-GO buffer Zone for KTE-033.

ARCHAEOLOGICAL, HISTORICAL, & CULTURAL								
NATURE	HERITAGE AND CULTURAL RESOURCES IDENTIFIED SITE(S): Graves with Field Rating IIIA (**KTE-011, 014**)							
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	2	Negative Medium impact	Negative low impact	Buffer/Safety Zone	NO	YES
	Probability	2	1					
	Reversibility	3	1					
	Irreplaceability	3	1					
	Duration	3	1					
	Cumulative Effect	3	1					
	Magnitude	3	1					
	Impact Significance	48	7					
OPERATIONAL PHASE	Extent	2	2	Negative low impact	Positive low impact	Buffer/Safety Zone	NO	YES
	Probability	1	1					
	Reversibility	1	1					
	Irreplaceability	1	1					
	Duration	1	1					
	Cumulative Effect	1	1					
	Magnitude	1	1					
	Impact Significance	7	7					
DECOMMISSIONING PHASE	Extent	2	2	Negative Medium impact	Negative low impact	Buffer/Safety Zone	NO	YES
	Probability	2	1					
	Reversibility	3	1					
	Irreplaceability	3	1					
	Duration	3	1					
	Cumulative Effect	3	1					
	Magnitude	3	1					
	Impact Significance	48	7					

IMPACT: A fenced-off cemetery was identified (KTE-011), and a single unmarked grave was identified (KTE-014) near Alternatives 1 and 2. They are not situated directly within the proposed Alternatives. However, in the event that impact occurs, it will be negative. The impact on the cemetery and grave would be NEGATIVE MEDIUM before mitigation, NEGATIVE LOW after mitigation during the construction and decommissioning phases and NEGATIVE LOW before and after mitigation during the operational phases.

MITIGATION: It is recommended that a buffer/safety zone of 100 m should be implemented around KTE-011 and a 50 m buffer/safety zone around KTE-014. In addition, KTE-014 should be fenced off. The buffer/safety zones implemented should be clearly demarcated during the project's construction phase and wholly avoided by personnel and equipment.

Figure 34 NO-GO buffer Zone for KTE-011.

Figure 35 NO-GO buffer Zone for KTE-014.

PALAEONTOLOGICAL								
NATURE	LOSS OF FOSSIL HERITAGE BY DESTRUCTION, MOVEMENT OR SEALING OF FOSSIL HERITAGE IN OR BELOW THE EARTH'S SURFACE							
	SITE(S):							
DEVELOPMENT PHASE	DEVELOPMENT IMPACT			IMPACT RATING		RECOMMENDED MITIGATION	IS IMPACT ACCEPTABLE?	
	CRITERIA	*BM	**AM	BEFORE MITIGATION	AFTER MITIGATION		*BM	**AM
PLANNING PHASE	Extent	1	1	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	6	6					
CONSTRUCTION PHASE	Extent	1	1	Negative High impact	Medium Low impact	Protocol of Finds	NO	YES
	Probability	2	2					
	Reversibility	4	4					
	Irreplaceability	4	4					
	Duration	4	4					
	Cumulative Effect	2	1					
	Magnitude	3	1					
	Impact Significance	51	16					
OPERATIONAL PHASE	Extent	1	1	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	6	6					
DECOMMISSIONING PHASE	Extent	1	1	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	6	6					

IMPACT: In terms of the palaeontological effects, a High Palaeontological Significance has been allocated for impacts associated with the construction phase of the KTE Pipeline development pre-mitigation and a low significance post-mitigation. The construction phase will be the only development phase with the potential to impact Palaeontological Heritage, and no significant impacts are expected to impact the Operational and Decommissioning phases.

MITIGATION: Although no further mitigation is recommended, it is recommended that if Palaeontological Heritage is uncovered during surface clearing and excavations, the Chance Find Protocol attached should be implemented immediately (Butler 2024).

7.2 Cumulative Impact

The EIA Regulations 2014 (as amended in 2017) determine that cumulative impacts, "*in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities.*"

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 desktop research shows heritage resources are sparsely distributed in the broader landscape, with highly significant (Grade 1) sites being rare and Grade II and III sites being the most prominent. The historical and cultural significance of the area is mainly centred around Brandvlei, Upington, Keimoes and Kenhardt. The KTE Pipeline project's impact cannot be compared to similar projects within the broader landscape. However, even if similar projects are launched within the broader landscape, the nature of the project means the cumulative impact of the development on heritage is localised and should be low. In addition, graves and burial grounds can be found anywhere in Southern Africa. However, the impact on graves would be site-specific. Thus, it is considered that if mitigation recommendations are followed for the identified heritage resources, no cumulative impact is expected. Therefore, the proposed development **will have a LOW NEGATIVE cumulative impact.**

New developments proposed within the study area cannot potentially negatively impact the significant archaeological resources in the larger geographical area or vice versa. The impact is considered positive, as each new development that requires an HIA assessment allows for a more thorough investigation of the broader landscape and contributes to our understanding of the landscape.

The general Palaeontological Sensitivity of the area is Zero to Very High. The **cumulative impacts of the KTE development and associated infrastructure are considered to be medium pre-mitigation (as the area is not highly fossiliferous) and low post-mitigation, and they fall within the acceptable limits for the project.**

RESOURCE TYPE	DEVELOPMENT IMPACT			IMPACT RATING	
	CRITERIA	*BM	**AM	BEFORE MITIGATION	AFTER MITIGATION
ARCHAEOLOGICAL, HISTORICAL, CULTURAL	Extent	2	2	Negative low impact	Positive low impact
	Probability	2	2		
	Reversibility	2	2		
	Irreplaceability	2	2		
	Duration	3	3		
	Magnitude	2	2		
	Impact Significance	22	22		
PALAEONTOLOGICAL	Extent	2	2	Medium Negative impact	Negative low impact
	Probability	3	2		
	Reversibility	4	2		
	Irreplaceability	4	2		
	Duration	3	3		
	Magnitude	2	2		
	Impact Significance	32	22		

8. 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. Resources given a field rating of IVB:
   - The furrows and furrow systems (KTE-037, 038 and 039) are believed to be a part of Kenhardt's industrial/agricultural history. These resources are of **medium significance.** These resources are well outside the proposed footprint and will thus **not be impacted by development. No further mitigation is recommended.**
   - The British military observation or guard post (KTE-041) may be outside the development footprint. The site is of **medium significance**. Since it is well outside of the proposed footprint, it will thus **not be impacted by development. No further mitigation is recommended.**
   - The other British campsite (KTE-006) is located by Alternative 1. This resource is of **medium significance**; thus, any **impact would be negative. A 100 m buffer/safety zone is recommended to negate the negative impact on the British campsite (KTE-006).**

2. Resources given a field rating of IVA:
   - The Historical period structures and features dating to the 1950s-1980s (KTE-002, 003, 004, 005, and 033) are considered to be of **medium to high significance**. These resources are all situated near Alternatives 1 and 2, and although they are not located directly within the proposed Alternatives, they will be negatively impacted if an impact occurs. Therefore, a **200 m buffer/safety zone is recommended to negate the negative impact on these resources.**

3. A fenced-off cemetery was identified (KTE-011), and a single unmarked grave was identified (KTE-014). These resources are located near Alternatives 1 and 2. They are not situated directly within the proposed Alternatives. All graves/cemeteries, however, are considered to be of **high significance**. If the impact occurs, it will be negative. It is recommended that **a buffer/safety zone of 100m should be implemented around KTE-011 and a 50m buffer/safety zone around KTE-014. In addition, KTE-014 should be fenced off.**

4. Should it be impossible to avoid graveyard(s), grave(s) or burial(s) sites during development, mitigation in the form of grave relocation could be undertaken. This is, however, a lengthy and costly process. Grave relocation specialists should be employed to manage the liaison process with the communities and individuals who, by tradition or

familial association, might have an interest in these graves or burial grounds, as well as manage the permit acquisition from the SAHRA Burial Grounds and Graves (BGG) Unit and the arrangements for the exhumation and re-interment of the contents of the graves, at the cost of the applicant and in accordance with any regulations made by the responsible heritage resources authority.

5. Regarding palaeontological resources, **it is recommended that no further palaeontological heritage studies, ground truthing, or specialist mitigation be required pending the discovery of newly discovered fossils.** The construction of the development may thus be permitted in its whole extent, as the development footprint is **not considered sensitive in terms of palaeontological resources.** Although no fossils were identified, they could be exposed during excavations. The ESO for this project must be informed that the Prins Albert Formation of the Ecca Group has a **High Palaeontological Sensitivity**; therefore, in the event that:
   - Palaeontological Heritage is uncovered during surface clearing and excavations; the **Chance Find Protocol** attached should be implemented immediately. Fossil discoveries ought to be protected, and the ECO/site manager must report to South African Heritage Resources Agency (SAHRA) (Contact details: SAHRIS, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. 3rd floor Protea Assurance Building, 142 Longmarket St, Cape Town City Centre, Cape Town, 8000; Private Bag X9067, Cape Town, 8000 Tel: 021 483 9598. Fax: +27 (0) 21 483 9845. Web: https://sahris.sahra.org.za) so that mitigation (recording and collection) can be carried out.
   - Before any fossil material can be collected from the development site, the specialist involved would need to apply for a collection permit from SAHRA. Fossil material must be housed in an official collection (museum or university), while all reports and fieldwork should meet the minimum standards for palaeontological impact studies proposed by SAHRA (2012).
   - These recommendations should be incorporated into the Environmental Management Programme (EMPr) for the KTE Pipeline project and associated infrastructure.

6. 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 must be alerted as per section 35(3) of the NHRA. If unmarked human burials are uncovered, the SAHRA 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.

9. CONCLUSION

This HIA has identified significant heritage resources. Several historical furrows and furrow systems (KTE-037 to KTE-039) were identified. These are dated to approximately ca. 1900-1950s. These features possibly have local significance for Kenhardt's industrial/agricultural archaeology. Since these resources are well outside of the proposed footprint, they will not be impacted by development. However, in the unlikely event, that impact would be negative. Since KTE-037, 038, 039, are situated outside of the proposed footprint, no further mitigation is recommended.

Two historical period archaeological sites, possibly a British military observation post or guard post (KTE-041) located near the proposed development footprint and a British campsite (KTE-006), were identified near Alternative 1. Although these sites are not situated directly within the proposed development footprint, development may negatively impact these resources. A 100 m buffer/safety zone is recommended to negate the negative impact on the British campsite (KTE-006). The buffer/safety zones implemented should be clearly demarcated during the construction phase of the project and completely avoided by personnel and equipment.

Historical period structures and features dating to the 1950s-1970s, such as an old farmhouse, retainer wall, stone foundation, and a kraal/cattle byre as well as an additional cattle byre/kraal dating to the 1960s-1980s, were identified near Alternative 1 and 2. They will be negatively impacted. A 200 m buffer/safety zone is recommended to negate the negative impact on these resources. The buffer/safety zones implemented should be clearly demarcated during the project's construction phase and wholly avoided by personnel and equipment.

A fenced-off cemetery was identified (KTE-011), and a single unmarked grave was identified (KTE-014). These resources are located near Alternatives 1 and 2. They are not situated directly within the proposed Alternatives. However, if an impact occurs, it will be negative. All graves are considered to be of importance and worthy of conservation. Thus, any impact on the cemetery and grave would be negative. It is recommended that a buffer/safety zone of 100 m should be implemented around KTE-011 and a 50 m buffer/safety zone around KTE-014. In addition, KTE-014 should be fenced off. The buffer/safety zones implemented should be clearly demarcated during the project's construction phase and wholly avoided by personnel and equipment.

The proposed development of the KTE Pipeline Project with associated infrastructure from Keimoes to Soafskolk in the Kai !Garib and Hatham Local Municipalities, Northern Cape Province,

may continue, provided the recommendations stipulated within this report and the subsequent SARHA decision are followed.

10. BIBLIOGRAPHY

ACRM. 2016. Archaeological Impact Assessment: Proposed vineyard development on Farm 1726 Renosterkop, Farm 1290 & Farm 1537 Augrabies Northern Cape. Unpublished report. ACRM: Rondebosch.

ACRM 2017. Archaeological Impact Assessment: Proposed citrus development, Renosterkop Extension (Kakamas South Settlement No. 2185 & 2193) Augrabies, Northern Cape. Unpublished report. ACRM: Rondebosch.

Badenhorst, S. 2010. Descent of Iron Age Farmers on Southern Africa during the last 2000 years. African Archaeological Review 27:87–106.

Barnard, A. 1992. Hunters and Herders of southern Africa: A Comparative Ethnography of the Khoisan peoples. Cambridge: Cambridge University Press.

Beaumont, P. B. 2008b. Phase 1 Archaeological Impact Assessment Report On Portions Of The Farm Alheit Near Kakamas, Siyanda District Municipality, Northern Cape Province. Unpublished report. McGregor Museum: Kimberley.

Bonner, P. 2002. Kings, commoners and concessionaries: The evolution and dissolution of the nineteenth-century Swazi State. Cambridge: Cambridge University Press.

Binneman, J. F. 1995. Symbolic construction of communities during the Holocene Later Stone Age in the South–Eastern Cape. Unpublished PhD thesis. Johannesburg: University of the Witwatersrand.

Chewins, L. 2016. The relationship between trade in southern Mozambique and state formation: Reassessing Hedges on cattle, ivory and brass. Journal of Southern African Studies 42: 725- 741.

Choudhury, A., Sengupta, D., Ramsay, M. & Schlebusch, C. 2021. Bantu-speaker migration and admixture in southern Africa. Human Molecular Genetics 30: 56-63.

Coertze, P.J. & Coertze, R.D. 1996. *Verklarende vak woordeboek vir Antropologie en Argeologie*. R.D. Coertze: Pretoria.

De Bruyn, C. 2019. Heritage Impact Assessment for the proposed mining rights on the farm Waterkloof 95 located between Griekwastad and Groblershoop in The Pixley Ka Seme District Municipality within the Northern Cape Province. Unpublished report. NGT. Johannesburg, Northcliff.

De Jong, R.C. 2010. *Heritage impact assessment report: proposed manganese and iron ore mining right application in respect of the remainder of the farm Paling 434, Hay registration division, Northern Cape.* Unpublished report. Cultmatrix: Pretoria.

De Kock, S. 2012. Phase one integrated Heritage Impact Assessment compiled in terms of Section 38(8) of the National Heritage Resources Act, 1999 (Act 25 of 1999) Proposed 10 MW Solar Facility: Portion (45ha) of the Farm Skuitdrift 426, Kenhardt District, Northern Cape Province. Unpublished Report. Perception Heritage Planning. George.

Deacon, H.J. & Deacon, J. 1999. *Human Beginnings in South Africa: Uncovering the secrets of the Stone Age.* David Phillips Publishers: Cape Town.

Dreyer, C. 2006. First Phase Archaeological And Cultural Heritage Assessment Of The Proposed Concentrated Solar Thermal Plant (Csp) At The Farms Olyvenhouts Drift, Upington, Bokpoort 390 And Tampansrus 294/295, Groblershoop, Northern Cape. Unpublished Eia Report. Bohlweki Consultants: Johannesburg.

Dreyer, J. 2007. First phase archaeological and cultural heritage assessment of the proposed Borrow Pit sites along the R63 road between Carnavon & Williston, Northern Cape. Unpublished EIA report.

Dreyer, C. 2011. Archaeological & Heritage Investigation Of The Proposed Mtn Cell Phone Mast At Breekkierie Near Kenhardt, Northern Cape. Northern Cape. Unpublished Eia Report.

Eldredge, E.A. 1987. Drought, famine and disease in nineteenth-century Lesotho. *African Economic History*, (16): 61-93.

Engelbrecht, J. and Fivaz, H. 2018. Phase 1 HIA Report Plot 1178 Kakamas South, Northern Cape. Unpublished report. UBIQUE Heritage Consultants: Roodepoort.

Engelbrecht, J. & Fivaz, H. 2019a. Phase 1 Hia Report Agricultural Development Plot 1763, 2372, And 2363 Kakamas South, Northern Cape Proposed Agricultural Development, Plot 1763, 2372, And 2363, Kakamas South Settlement, Kai !Garib Municipality, Z.F. Mgcawu District Municipality, Northern Cape. Unpublished report. UBIQUE heritage Consultants: Roodepoort.

Engelbrecht, J. & Fivaz, H. 2020. Phase 1 HIA report !Kheis township expansion Groblershoop, Northern Cape. Unpublished report. UBIQUE Heritage Consultants: Roodepoort.

Fivaz, H. & Engelbrecht, J. 2019. Phase 1 HIA Report Feldspar Mining, Farm Rozynen Bosch No. 104, Portions 4 And 5, Kakamas South, Northern Cape Proposed Feldspar Prospecting Rights And Mining Permit Application, Farm Rozynen Bosch No. 104, Portion 4 And 5, Kakamas South Settlement, Kai !Garib Municipality, Z.F. Mgcawu District Municipality, Northern Cape. Unpublished report. UBIQUE heritage Consultants: Roodepoort.

Fivaz, H. and Engelbrecht, J. 2020a. Phase 1 HIA Report !Kheis Township Expansion Gariep Northern Cape Proposed Township Expansion On Plot 113, Gariep Settlement, Farm Boegoebergnedersetting Re/48, !Kheis Local Municipality, Zf Mgcawu District Municipality, Northern Cape. Unpublished report. UBIQUE Heritage Consultants: Roodepoort

Fivaz, H. and Engelbrecht, J. 2020b. Phase 1 HIA Report !Kheis Township Expansion Grootdrink Northern Cape Proposed Township Expansion On Erf 131, Grootdrink, And Plot 2627, Boegoeberg Settlement (Kenhardt), On The Farm Boegoebergnedersetting Re/48, !Kheis Local Municipality, Zf Mgcawu District Municipality, Northern Cape. Unpublished report. UBIQUE Heritage Consultants: Roodepoort

Fivaz, H. and Engelbrecht, J. 2020c. Phase 1 HIA Report Agricultural And Irrigation Dam Development, Olyvenhouts Drift Settlement, Northern Cape Proposed Development Of An Irrigation Dam And Agricultural Expansion On Erven 1074 And 754, Olyvenhouts Drift Settlement, Upington, Dawid Kruiper Municipality, Z.F. Mgcawu District Municipality, Northern Cape. Unpublished report. UBIQUE Heritage Consultants: Roodepoort

Fivaz, H. & Engelbrecht, J. 2021a. Phase 1 HIA Report Bakenrant Plot 106 Kakamasnorth Northern Cape Proposed Agricultural Developments, Bakenrant Plot 106, Kakamas-North, Kai !Garib Local Municipality, Z.F. Mgcawu District Municipality, Northern Cape.
Unpublished Report. Ubique Heritage Consultants: Roodepoort.

Fivaz, H. & Engelbrecht, J. 2021b. Phase 1 HIA Report Proposed Agricultural Developments On Plot 337 And Plot 396, Kakamas-North, Kai !Garib Local Municipality, Z.F. Mgcawu District Municipality, Northern Cape. Unpublished Report. Ubique Heritage Consultants: Roodepoort.

Hall, M. 1987. *The changing past: farmers, kings and traders in southern Africa. 200-1860*. Cape Town: David Philip.

Huffman, T. 2002. Regionality in the Iron Age: the case of the Sotho-Tswana. *Southern African Humanities,* 14: 1–22.

Huffman, T. 2007. *Handbook to the Iron Age*. Pietermaritzburg: University of Kwazulu-Natal Press.

Kaplan, J. 2008. Phase 1 Archaeological Impact Assessment proposed construction of a Water Treatment Plant and Supply Pipeline from Keimoes to Kenhardt, Northern Cape Province. Unpublished report. Agency for Cultural Resource Management: Riebeek West.

Kaplan, J. 2011 Archaeological Impact Assessment The Proposed Solar Cape 100 Mw Photovoltaic Energy Generation Facility Near Kenhardt Northern Cape Province. Unpublished Report. Agency For Cultural Resource Management: Riebeek West.

Kaplan, J. 2012a. Archaeological Impact Assessment: The Proposed Keren Energy Kakamas Solar Farm on ERF 1654 Kakamas Northern Cape Province. Unpublished report. Agency for Cultural Resource Management: Rondebosch.

Kaplan, J. 2013d. Heritage Impact Assessment the Proposed Brandvlei Bulk Water Supply Pipeline & Reservoir, Brandvlei Northern Cape. Agency for Cultural Resource Management: Riebeek West.

Kaplan, J. 2016a. Archaeological Impact Assessment Proposed Cultivation Of Vineyards On The Farm Bethesda 238/38 & 335/38 Louisevale, Upington Northern Cape. Unpublished Report. ACRM: Rondebosch

Kaplan, J. 2016b. Archaeological Scoping Proposed Housing Development On Erf 745 Olyvenhoutsdrift, Near Upington Northern Cape. Unpublished Report. ACRM: Rondebosch

Kaplan, J. 2017. Archaeological Scoping, Proposed Extension Of An Existing Borrow Pit On Portion 5 Of Farm Hol Pads Leegte No. 32 Near Brandvlei, Northern Cape Province. ACRM: Rondebosch

Klein, R. G. 2000. The Earlier Stone Age of Southern Africa. *The South African Archaeological Bulletin*, 27(172): 107-122.

Kruger, N. 2018. Archaeological Impact Assessment (AIA) for the Biesieputs Prospecting Project on a portion of the farm Biesieputs 67 in the ZF Mgcawu District Municipality, Northern Cape Province. Unpublished report. Pretoria.

Lavin, J. 2021a.Heritage Impact Assessment In Terms Of Section 38(8) Of The Nhra For The Proposed Development Of Kotulo Tsatsi Energy Pv 1 Near Kenhardt, Northern Cape. Unpublished Report. Cts Heritage.

Lavin, J. 2021b. Archaeological Specialist Study In Terms Of Section 38(8) Of The Nhra For A Proposed Development Of Kotulo Tsatsi Energy Pv 1, Pv3 And Pv4 Near Kenhardt, Northern Cape. Unpublished Report. Cts Heritage.

Lavin, J. 2023. Heritage Impact Assessment In Terms Of Section 38(8) Of The Nhra For The Proposed Development Of Kotulo Tsatsi Energy Pv 3 Near Kenhardt, Northern Cape. Unpublished Report. Cts Heritage.

Lombard, M., Wadley, L., Deacon, J., Wurz, S., Parsons, I., Mohapi, M. Swart, J. & Mitchell, P. 2012. South African and Lesotho Stone Age sequence updated. *South African Archaeological Bulletin* 67: 123-144.

Mitchell, P. 2002. *The archaeology of Southern Africa*. Cambridge: Cambridge University Press.

Mlilo, T. 2019. Phase 1 Archaeological Impact Assessment Report for Prospecting right application for various minerals (NC12177PR and NC12215PR) in ZF Mgcawu Magisterial District in Kai! Garib Local

Municipality Northern Cape Province. Unpublished report. Integrated Specialists Services (PTY) LTD: Midrand.

Morris, D. 2010. Heritage Impact Assessment Of The Proposed Hydropower Station On The Orange River At Neus Island On The Farm Zwartbooisberg, East Of Kakamas, Northern Cape. Unpublished Report. Mcgregor Museum: Kimberley.

Morris, D. 2011. Heritage Impact Assessment Of The Proposed New Power-Line Route South Of The River To Kakamas, Northern Cape. Unpublished Report. Mcgregor Museum: Kimberley.

Morris, D. 2013d. Re Capital 3 Solar Development On The Property Dyason's Klip West Of Upington, Northern Cape: Scoping Phase Heritage Input. Unpublished Report. Mcgregor Museum: Kimberley.

Morris, D. 2017b. Heritage Impact Assessment Of Proposed Sand Mining In The Bed Of The Hartebees River On Lot 1768 Kakamas South, Near Kakamas, Northern Cape. Unpublished Report. Mcgregor Museum: Kimberley.

Morris, D. 2018a. Heritage Impact Assessment of proposed sand mining in the bed of a spruit on Olywenhoutsdrift-Suid, near Louisvale, Northern Cape. Unpublished report. McGregor Museum: Kimberley.

Morris, D. 2018b. Heritage Impact Assessment of proposed sand mining in the bed of the Donkerhoekspruit on Jannelsepan, near Louisvale, Northern Cape. Unpublished report. McGregor Museum: Kimberley.

Morris, D. 2018c. Heritage Impact Assessment at the site of proposed irrigation development on the farm Openwater near Upington, Northern Cape. Unpublished report. McGregor Museum, Kimberley.

Morris, D. & Beaumont, P.B. 1991. !Nawabdanas: archaeological sites at Renosterkop, Kakamas District, Northern Cape. *South African Archaeological Bulletin* 46:115-124.

Nilssen, P. 2016a. Phase1a Archaeological Impact Assessment Proposed Development Of The Amda Bravo Pv (Solar Energy Facility) On Portion 1 Of N' Rougas Zuid No 121, Straussheim, And Overhead Power Line Grid Connection To The Eskom Nieuwehoop Mts Sub-Station Across Portion 3 Of Gemsbok Bult No 120, Kenhardt Registration Division, Northern Cape Province. Unpublished Report.

Nilssen, P. 2016b. Phase1a Archaeological Impact Assessment Proposed Development Of The Amda Alpha Pv (Solar Energy Facility) On Portion 1 Of N'rougas Zuid No 121, Straussheim, And Overhead Power Line Grid Connection To The Eskom Nieuwehoop Mts Sub-Station Across Portion 3 Of Gemsbok Bult No120, Kenhardt Registration Division, Northern Cape Province. Unpublished Report.

Orton, J. 2013. Archaeological Inspection Of A Spoil Heap Location For The Kakamas Hydro Electric Facility, Northern Cape. Unpublished Report. Aco Associates. Cape Town.

Orton, J. 2014 a. Heritage Impact Assessment for the proposed re-alignment of the authorised 132 kV power line for the Loeriesfontein 2 wind energy facility, Calvinia Magisterial District, Northern Cape. Unpublished Report. ASHA Consulting: Muizenberg.

Orton, J. 2014 b. Heritage Impact Assessment for the proposed new facilities at Hantam national Botanical Garden, Nieuwoudtville, Calvinia Magisterial District, Northern Cape. Unpublished Report. ASHA Consulting: Muizenberg.

Orton, J. 2014c. Heritage Impact Assessment For The Proposed Boven Solar Pv1 Facility, Kenhardt Magisterial District, Northern Cape. Unpublished Report. Asha Consulting: Cape Town.

Orton, J. 2015. Scoping And Environmental Impact Assessment For The Proposed Development Of A 75 Mw Solar Photovoltaic Facility (Kenhardt Pv 2) On The Remaining Extent Of Onder Rugzeer Farm 168, North-East Of Kenhardt, Northern Cape Province: Eia Report - Heritage Impact Assessment. Unpublished Report. Asha Consulting: Cape Town.

Orton, J. 2016a. Heritage Impact Assessment Environmental Impact Assessment For The Proposed Development Of A 75 Mw Solar Photovoltaic Facility (Boven Solar Pv4) On Boven Rugzeer 169/Remainder, Northeast Of Kenhardt, Northern Cape Province. Unpublished Report. Asha Consulting: Cape Town.

Orton, J. 2016b. Scoping And Environmental Impact Assessment For The Proposed Development Of A 75 Mw Solar Photovoltaic Facility (Kenhardt Pv 1) On The Remaining Extent Of Onder Rugzeer Farm 168, North-East Of Kenhardt, Northern Cape Province: Eia Report - Heritage Impact Assessment. Unpublished Report. Asha Consulting: Cape Town.

Orton, J. 2018a. Heritage Impact Assessment: Proposed 300 Mw Photovoltaic Facility And Power Line On Olyven Kolk 187/3, 187/6 & 187/7, Kenhardt Magisterial District, Northern Cape. Unpublished Report. Asha Consulting: Cape Town.

Orton, J. 2018b. Heritage Impact Assessment: Proposed 400 Mw Photovoltaic Facility And Power Line On Olyven Kolk 187/3 & 187/7, Kenhardt Magisterial District, Northern Cape. Unpublished Report. Asha Consulting: Cape Town.

Orton, J. and Webley, L. 2012. Heritage Impact Assessment for proposed Hydroelectric facilities near Riemvasmaak, Northern Cape. Unpublished report. ACO associates. Cape Town.

Pelser, A. J. 2011. Report On An Archaeological Impact Assessment (Aia) For The Proposed Solar Energy Plant On Klein Zwart Bast 188, Kenhardt District, Northern Cape. Unpublished Report. Archaetnos.

Pelser, A. J. 2012. A Report On A Heritage Impact Assessment (Hia) For A Proposed Photo-Voltaic Solar Power Generation Plant On Klein Zwart Bast 188, Kenhardt District, Northern Cape. Unpublished Report. Archaetnos.

Penn, N. 2005. *The Forgotten Frontier: Colonist and Khoisan on the Cape's Northern Frontier in the 18th Century*. Athens. Ohio University Press and Double Storey Books: Ohio and Cape Town.

Ross, R. 1999. A concise history of South Africa. Cambridge: Cambridge University Press.

Rossouw, L. 2014. Phase 1 Archaeological Impact Assessment of a proposed new cemetery on portion 213 (a portion of portion 173) of the farm Neilersdrift 34, Lennertsville, NC Province. Unpublished report. Langenhovenpark.

Van der Ryst, M.M. & Meyer, A. 1999. *Die Ystertydperk. Bergh, J.S. (red.). Geskiedenisatlas van Suid-Afrika. Die vier noordelike provinsies.* Pretoria: J.L. van Schaik.

Van der Walt, J. 2005. Portion of the proposed pipeline from Brandvlei to Krugersdorp on the farm Brandvlei 261 IQ, District Mogale City, Gauteng Province. Unpublished Report. Heritage Contracts and Archaeological Consulting.

Van Der Walt, J. 2013. Archaeological Impact Assessment for the Mining Right Application on the Farm Dikpens 182 Portions 2 and 4 situated in the District of Calvinia (Northern Cape Province). Unpublished Report. Heritage Contracts and Archaeological Consulting

Van der Walt, J. 2015a. Archaeological Impact Assessment for the Proposed Kotulo Tsatsi CSP 3 Facility, located close to Kenhardt in the Northern cape. Unpublished report. Heritage Contracts and Archaeological Consulting.

Van der Walt, J. 2015b. Archaeological Impact Assessment for the Proposed Kotulo Tsatsi CSP 1 Facility, located close to Kenhardt in the Northern cape. Unpublished report. Heritage Contracts and Archaeological Consulting.

Van der Walt, J. 2016. Archaeological Impact Assessment for the Proposed Kotulo Tsatsi CSP 2 Facility, located close to Kenhardt in the Northern cape. Unpublished report. Heritage Contracts and Archaeological Consulting.

Van Der Walt, J. 2020. Heritage Impact Assessment (Required Under Section 38(8) Of The Nhra (No. 25 Of 1999) For The Dyasons Klip 5 PV Project, Upington, Northern Cape Province. HCAC: Modimolle
Van Ryneveld, K. 2007. Phase 1 archaeological impact assessment: Portion of the farm Boksputs 118, Groblershoop, Northern Cape, South Africa. Unpublished report.

Van Schalkwyk, J.A. 2010. Archaeological impact survey report for the Land Use Change on a Section of the Farm Kakamas North, Gordonia District. Northern Cape Province. Unpublished report. CULTMATRIX Consultants: Pretoria.

Van Schalkwyk, J. A. 2011. Heritage Impact Assessment For The Proposed Establishment Of The Inca Solar Pv Power Plant, Kakamas Region, Northern Cape Province. Unpublished Report. Pretoria.

Van Schalkwyk, J. A. 2013. A Cultural Heritage Impact Assessment For The Proposed Township Development On A Section Of The Farm Kakamas Suid 28, Alheit, Kai !Garib Municipality, Northern Cape Province. Unpublished Report. Pretoria.

Van Schalkwyk, J. A. 2014. Cultural Heritage Impact Assessment For The Proposed Hotel Development On A Section Of The Farm Kakamas Suid 28, Marchand, Kai !Garib Municipality, Northern Cape Province. Unpublished Report. Pretoria.

Van Schalkwyk, J. A. 2019. Phase 1 Cultural Heritage Impact Assessment: Prospecting right application with bulk sampling on various portions of the Farms Zonderhuis 402, Onder Plaats 401 and Namakwari 656, Siyanda District Municipality, Northern Cape Province. Unpublished report. Pretoria.

Van Vollenhoven, A. C. 2014. A report on a basic heritage assessment for the proposed Eskom Fibre-Groblershoop 132 Kv power line, Northern Cape Province. Unpublished report. Archaetnos: Groenkloof.

Wadley, L. 2015. Those marvellous millennia: The Middle Stone Age of southern Africa. Azania: Archaeological Research in Africa 50: 155-226.

Webley , L and Halkett, D. 2010. An Archaeological Impact Assessment (Report 4): Proposed Construction of A Substation between Aries-Garona and Associated Loop in and Loop Out Lines, North-West of Kenhardt in the Northern Cape. Unpublished report. ACO Associates.

Webley, L. And Halkett, D. 2012a. Heritage Impact Assessment: Proposed Loeriesfontein Photo-Voltaic Solar Power Plant On Portion 5 Of The Farm Klein Rooiberg 227, Northern Cape Province. Unpublished Report. Aco Associates.

Webley, L. And Halkett, D. 2012b. Heritage Impact Assessment: Proposed Kenhardt Photo-Voltaic Solar Power Plant On Remainder Of The Farm Klein Zwart Bast 188, Northern Cape Province. Unpublished Report. Aco Associates.

Webley, L. and Halkett, D. 2014. Archaeological Impact Assessment:Proposed Construction Of Re Capital 11 Solar Development On The Remainder of the Farm Dyason's Klip 454, Northern Cape. Unpublished report. ACO Associates cc: St James.

Webley, L. and Orton, J. 2012. Heritage Impact Assessment of the proposed reverse osmosis plant and associated infrastructure, Brandvlei, Hantam Local Municipality, Northern Cape. Unpublished report. ACO Associates cc: St James.

Wurz, S., 2013. Technological trends in the Middle Stone Age of South Africa between MIS 7 and MIS 3. *Current Anthropology*, 54(S8): S305-S319.

WEB

https://sahris.sahra.org.za/declaredsites (Accessed 7/11/2022).

https://sahris.sahra.org.za/allsitesfinder (Accessed 7/11/2022).

https://screening.environment.gov.za/ (Accessed 12/08/2024).

https://www.sanbi.org/gardens/free-state/history/ (Accessed 12/08/2024).

https://www.sahistory.org.za/article/kora (Accessed 9/11/2022).

http://www.turtlesa.com/Kenhardt.html (Accessed 9/11/2022).

11. TERMS OF REFERENCE

11.1 Statutory Requirements

11.1.1 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)

11.1.2 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.

12.1.3 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.

11.1.4 Management of Graves and Burial Grounds

- **Graves younger than 60 years** are protected in terms of the Graves and Dead Bodies Ordinance (Ord 7) of 1925 (re-instituted by the Proclamation 109 of June 17 1994), the Exhumations Ordinance (Ord 12 of 1980), as well as either the Human Tissues Act (Act 65 of 1983 as Amended) or the National Health Act (Act 61 of 2003).

- **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 under 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.

APPENDIX A

PALAEONTOLOGICAL IMPACT ASSESSMENT: PROPOSED KTE PIPELINE ROUTE IN THE NORTHERN CAPE PROVINCE

PALAEONTOLOGICAL IMPACT ASSESSMENT

PROPOSED KTE PIPELINE ROUTE IN THE NORTHERN CAPE PROVINCE

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

Disclosure of Vested Interest

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

PALAEONTOLOGICAL CONSULTANT: Banzai Environmental (Pty) Ltd

CONTACT PERSON: Elize Butler

Tel: +27 844478759

Email: info@banzai-group.com

SIGNATURE: 

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

Table 1: NEMA Table

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	**Relevant section in report**
1.(1) (a) (i) Details of the specialist who prepared the report	Page ii and Section 2 of Report – Contact details and company and Appendix A
(ii) The expertise of that person to compile a specialist report including a curriculum vitae	Section 2 – refer to **Appendix A**
(b) A declaration that the person is independent in a form as may be specified by the competent authority	Page ii of the report
(c) An indication of the scope of, and the purpose for which, the report was prepared	Section 4 – 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, 7 and 9
(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
(f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternative;	Section 1 and 9
(g) An identification of any areas to be avoided, including buffers	Section 5 No buffers or areas of sensitivity identified
(h) A map superimposing the activity including the associated structures and infrastructure on the	Section 5 – Geological and Palaeontological history

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	Relevant section in report
environmental sensitivities of the site including areas to be avoided, including buffers;	
(i) A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 4.1 – Assumptions and Limitation
(j) A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Section 1 and 9
(k) Any mitigation measures for inclusion in the EMPr	Section 10
(l) Any conditions for inclusion in the environmental authorisation	Section 10
(m) Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 10
(n)(i) A reasoned opinion as to whether the proposed activity, activities or portions thereof should be authorised and	Section 1 and 9
(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 and 9
(o) A description of any consultation process that was undertaken during the course of carrying out the study	N/A
(p) A summary and copies if any comments that were received during any consultation process	N/A
(q) Any other information requested by the competent authority.	N/A
(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 commissioned by Unique Heritage Consultants to conduct the Palaeontological Impact Assessment (PIA) to evaluate the fossil heritage of the KTE Pipeline development near Keimoes in the Northen Cape Province. This PIA is required to confirm whether fossil material may potentially be present in the planned development area and to assess the potential impact of the proposed development on the local palaeontological heritage in order to comply with the National Heritage Resources Act (No 25 of 1999, section 38) (NHRA).

The proposed KTE Pipeline development is located in flat-lying terrain within the semi-arid Bushmanland region. The study area is basically underlain by the potentially fossiliferous Quaternary Kalahari Group, Prins Albert Formation and Dwyka Group of the Karoo Supergroup. At depth, the area is underlain by a diversity of unfossiliferous Precambrian basement rocks (*c.* 2 billion years old) of the Namaqua-Natal Province.

The SAHRIS PalaeoMap indicates that the Palaeontological Sensitivity of the Quaternary Kalahari and Dwyka Groups is Moderate, while that of the Prins Albert Formation of the Ecca Group is High. Unfossiliferous sediment with a Zero Palaeontological Sensitivity includes Jurassic Dolerite as well as sediments of the Namaqua-Natal Province (Almond and Pether, 2009; Almond et al., 2013, Groenewald et al. 2014). The suggested location is classified as having a High (orange) Palaeontology Theme Sensitivity in the DFFE Screening Report.

A site-specific field survey of the development footprint was conducted on foot and by motor vehicle on 12-13 November 2022. No fossiliferous outcrop was detected in the proposed development. The site investigation as well as desktop research (National Database and published data) concluded that **fossil heritage of scientific and conservational interest in the area is relatively rare and of low scientific and conservational value**. Data indicates that fossil sites are generally rare, sporadic and unpredictable. A **low significance** has thus been allocated to the development footprint. This is in contrast with the High Sensitivity allocated to the development area by the SAHRIS Palaeontological Sensitivity Map and DFFE Screening Tool. The **Very High Palaeontological Sensitivity indicated by the DFFE Screening Tool is thus contested/disputed, with a Low Palaeontological Sensitivity** assigned to the development based on the site investigation in November 2022.

In terms of palaeontological impacts, **a High Palaeontological Significance has been allocated for impacts associated with the construction phase of the KTE Pipeline development pre-mitigation and a low significance post-mitigation**. The construction phase will be the only development phase with the potential to impact Palaeontological Heritage, and **no significant impacts are expected to impact the Operational and Decommissioning phases**. As the No-Go Alternative considers the option of 'do nothing'

and maintaining the status quo, it will have a Neutral impact on the Palaeontological Heritage of the development. The **Cumulative impacts of the KTE development and associated infrastructure are considered to be medium pre-mitigation (as the area is not highly fossiliferous) and Low post-mitigation and fall within the acceptable limits for the project**. It is therefore considered that the proposed development will not have damaging impacts on the area's palaeontological resources. **The construction of the development may thus be permitted to its whole extent, as the development footprint is not considered sensitive in terms of palaeontological resources.** It is consequently recommended that **no further palaeontological heritage studies, ground truthing, or specialist mitigation be required pending the discovery of newly discovered fossils.**

Recommendations:

The ESO for this project must be informed that the Prins Albert Formation of the Ecca Group has a **High Palaeontological Sensitivity**. Although fossils were not identified during the site investigation, fossils could be exposed during excavations.

If Palaeontological Heritage is uncovered during surface clearing and excavations, the **Chance Find Protocol** attached should be implemented immediately. Fossil discoveries ought to be protected and the ECO/site manager must report to South African Heritage Resources Agency (SAHRA) (Contact details: SAHRIS, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. 3rd floor Protea Assurance Building, 142 Longmarket St, Cape Town City Centre, Cape Town, 8000; Private Bag X9067, Cape Town, 8000 Tel: 021 483 9598. Fax: +27 (0) 21 483 9845. Web: https://sahris.sahra.org.za) so that mitigation (recording and collection) can be carried out.

Before any fossil material can be collected from the development site, the specialist involved would need to apply for a collection permit from SAHRA. Fossil material must be housed in an official collection (museum or university), while all reports and fieldwork should meet the minimum standards for palaeontological impact studies proposed by SAHRA (2012).

These recommendations should be incorporated into the Environmental Management Programme (EMPr) for the KTE Pipeline project and associated infrastructure.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

GLOSSARY OF TERMS

Fossil

A fossil is the preserved remnants or vestiges of a long-dead organism, generally from millions of years ago. Fossils can be mineralized skeletons, shells, or other hard pieces of ancient animals and plants, as well as impressions, moulds, and casts left in sedimentary rock when the organism's remains decomposed and left an impression. Fossils provide valuable insights into the evolution and biodiversity of ancient species, allowing scientists to study and understand their evolution and biodiversity.

Heritage

That which is inherited and forms part of the National Estate (historical places, objects, fossils as defined by the National Heritage Resources Act No 25 of 1999).

Heritage resources

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

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

Palaeontology

Any fossilised remains or fossil trace of animals or plants which lived in the geological past (other than fossil fuels or fossiliferous rock intended for industrial use) and any site which comprises of fossilised remains or traces of past life.

LIST OF ABBREVIATIONS

BA	Basic Assessment
DEA	Department of Environmental Affairs
DFFE	Department of Forestry, Fisheries and the Environment
CA	National Competent Authority
ECO	Environmental Control Officer
EDI	Electrodeionization
EMPr	Environmental Management Programme
ESO	Environmental Site Officer
HIA	Heritage Impact Assessment
KTE	Kutulo Tsatsi Energy
Ma	Millions of years ago
NEMA	National Environmental Management Act
NHRA	National Heritage Resources Act
PIA	Palaeontological Impact Assessment
PSSA	Palaeontological Society of South Africa
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System
S&EIA	Scoping & Environmental Impact Assessment
ToR	Terms of Reference

1 INTRODUCTION

The proposed KTE development entails the construction of a water provision pipeline from the Orange River, near Keimoes, to a hydrogen production facility located on Portion 1 and Portion 5 of Farm Uitkyk No. 889. The proposed pipeline will follow the existing road, and mainly falls within the road servitudes. The project will also deliver provisional bulk water supply to Kai !Garib Municipality at Kenhardt and the Hantam Municipality at Brandvlei. The distribution of water to these communities will remain the responsibility of the Kai !Garib and Hantam Municipalities. The project requires water to develop and operate, and as such, 10 950 000 m^3/a of surface water will be abstracted from the Orange River, which will be pumped via a rising main and/or gravity-fed over 221 km for industrial and commercial use. The abstracted surface water will be stored at various locations across the project site. The pipeline route crosses numerous drainage lines, using existing culverts, which are perpendicular to the R27 National Road. The biggest disturbance will be where the pipeline passing through an existing culvert of the Sishen-Saldanha railway bridge and crossing the Hartebees River. The abstracted surface water will undergo initial treatment in Lennertsville to SANS 241:2015 drinking water standards where the by-products will be disposed of in a sludge drying bed. Final treatment will occur on Farm Uitkyk where the abstracted surface water first passes through a Reverse Osmosis (RO) treatment step, followed by an Electrodeionization step (EDI), where the by-products will be disposed of on-site in 80 ha evaporation ponds. Domestic wastewater from office blocks, messes/canteens and toilets will be collected in an on-site conservancy tank, abstracted by vacuum pumps into a fleet of Wastewater Tanker Trucks and transported to the inlet of the evaporation ponds, where it will be blended and homogenized with the brine

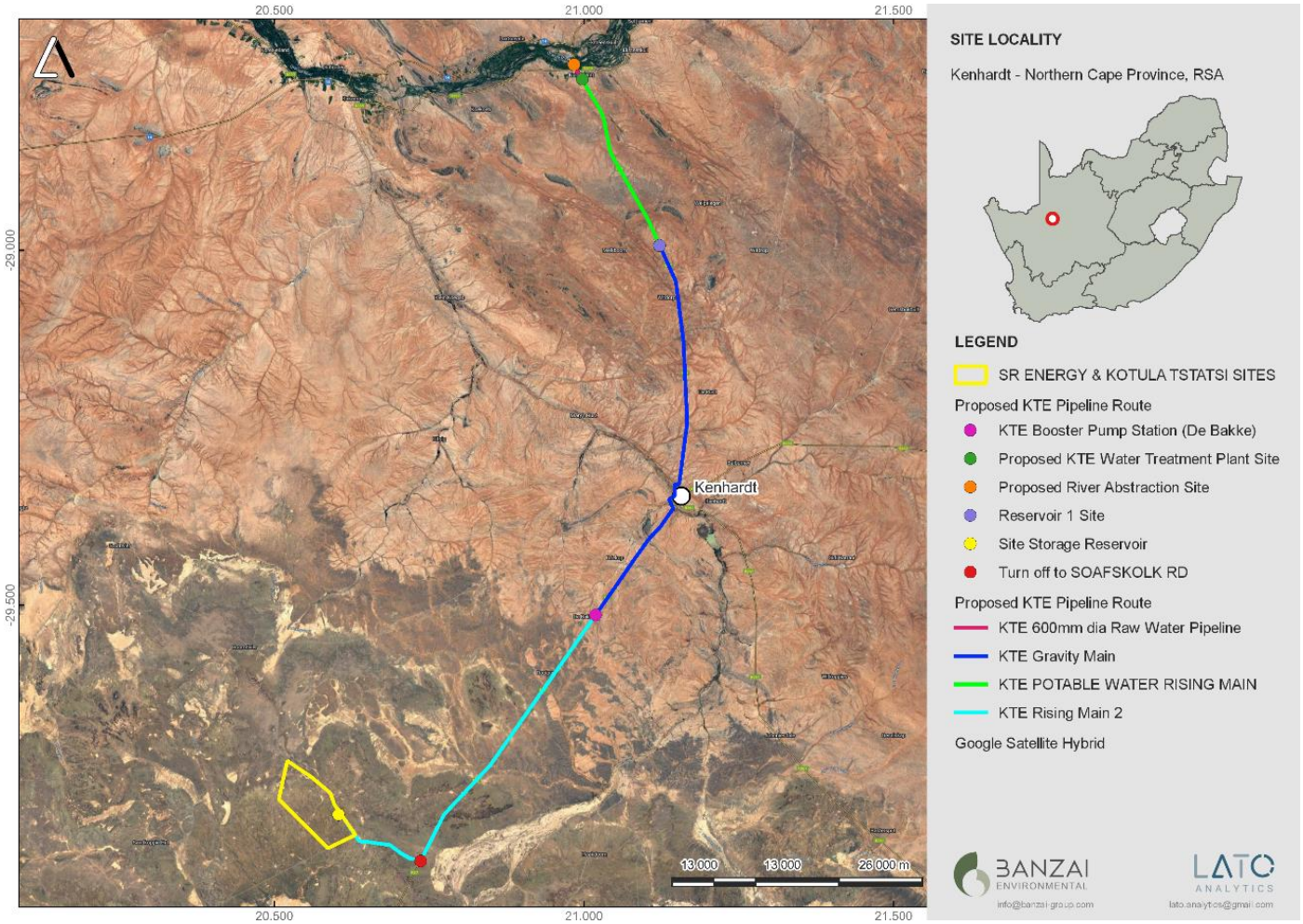


Figure 1. Site locality of the proposed KTE pipeline development in the Northen Cape Province.

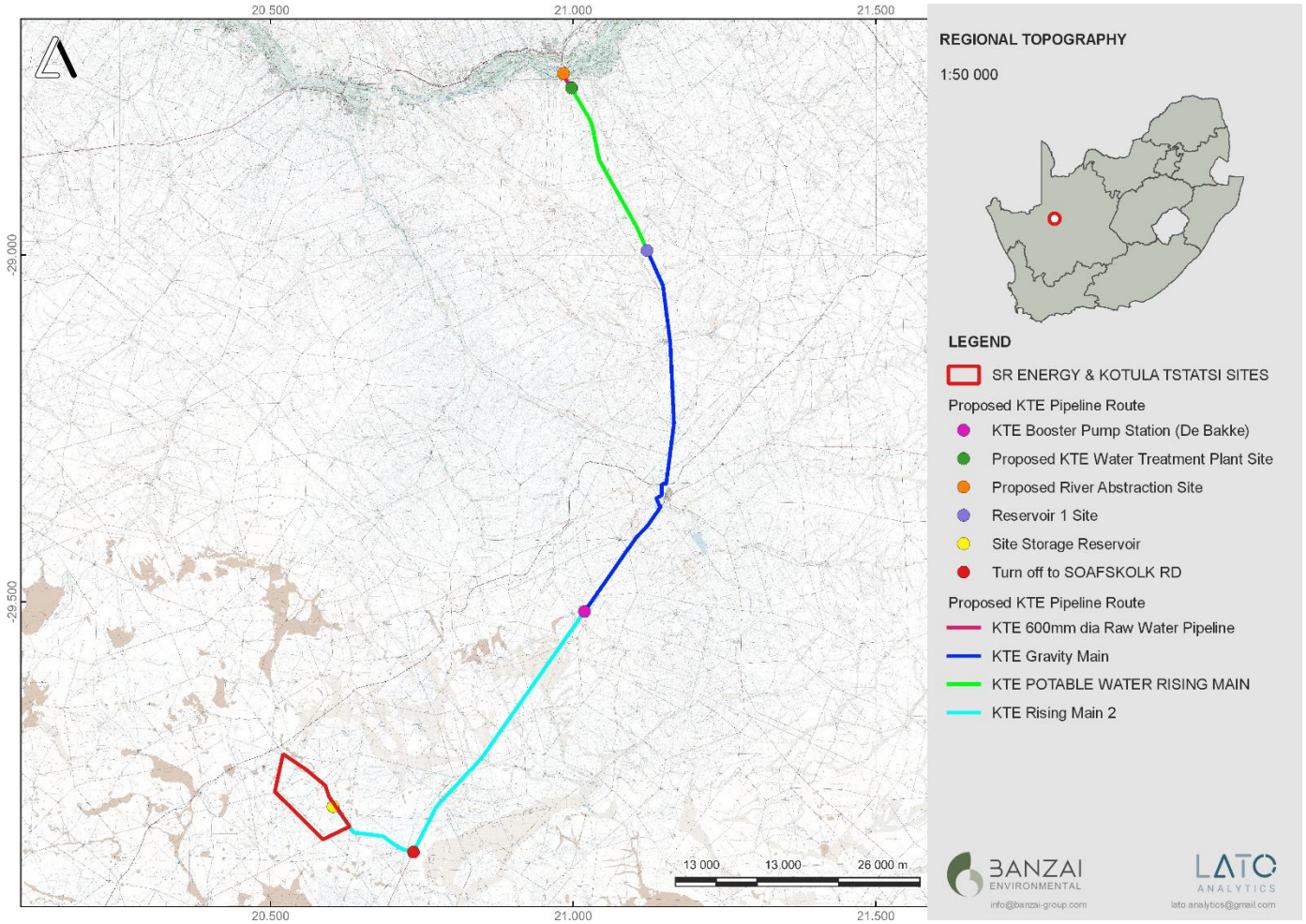


Figure 2. Regional Topography of the proposed KTE pipeline development in the Northen Cape Province.

2 QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

This study has been conducted by Mrs. Elize Butler of Banzai Environmental (Pty) Ltd. She has conducted approximately 700 palaeontological impact assessments (PIA) for developments in the Free State, KwaZulu-Natal, Eastern and Northern Cape, Northwest, Gauteng, Limpopo, and Mpumalanga. She has an MSc (*cum laude*) in Zoology (specializing in Palaeontology) from the University of the Free State, South Africa and has been working in Palaeontology for more than thirty years. She has experience in locating, collecting, and curating fossils, including exploration field trips in search of new localities in the Karoo Basin. She has been a member of the Palaeontological Society of South Africa (PSSA) since 2006 and has been conducting PIAs since 2014.

3 LEGISLATION

3.1 National Heritage Resources Act (25 of 1999)

Cultural Heritage in South Africa, includes all heritage resources, is protected by the National Heritage Resources Act (Act No. 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 No. 107 of 1998
- National Heritage Resources Act (NHRA) Act No. 25 of 1999
- Minerals and Petroleum Resources Development Act (MPRDA) Act No. 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 No. 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 No. 25 of 1999

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

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

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

- the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length.
- the construction of a bridge or similar structure exceeding 50 m in length.
- any development or other activity which will change the character of a site—
    - exceeding 5 000 m^2 in extent; or
    - involving three or more existing erven or subdivisions thereof; or
    - involving three or more erven or divisions thereof which have been consolidated within the past five years; or
    - the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority or
    - the re-zoning of a site exceeding 10 000 m^2 in extent or

any other category of development provided for in regulations by SAHRA or a Provincial heritage resources authority.

4 METHODS AND TERMS OF REFERENCE

This PIA assesses the development's potential impact on the fossil heritage of the area. 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.

When the development footprint has a moderate to high palaeontological sensitivity, a field-based assessment is necessary. 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, which is primarily made up of recently exposed (unweathered) rock. These exposures may be man-made (such as quarries, open building excavations, even railway and road cuttings) or natural (such as cliffs, and dongas as well as rocky outcrops along stream or river banks). It is usual practice for palaeontologists to record well-preserved fossils (GPS, and stratigraphic data) during field assessment examinations.

Although mitigation is often done prior to construction, it may take place 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 of the proposed project and provide information regarding the developer and consultant who commissioned the study;
- Describe 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 at the place of the activity.
    b. Indirect impacts of an activity are indirect or induced changes that may occur as a result of the activity.
    c. Cumulative impacts 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 is 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, the field investigation conducted for this report will improve the accuracy of the desktop evaluation.

5 GEOLOGICAL AND PALAEONTOLOGICAL HISTORY

The proposed KTE pipeline route and associated infrastructure is depicted on the 2820 Upington (1988) and 2920 Kenhardt (1998) Geological maps (Council of Geoscience, Pretoria) (Figure 3-5, Table 2-3). As indicated on the geological maps the geology of the area is highly differentiated.

The proposed KTE Pipeline development is located in flat-lying terrain within the semi-arid Bushmanland region. The study area is basically underlain by the potentially fossiliferous Quaternary Kalahari Group, Prins Albert Formation and Dwyka Group of the Karoo Supergroup. At depth, the area is underlain by a diversity of unfossiliferous Precambrian basement rocks (*c.* 2 billion years old) of the Namaqua-Natal Province. Sediments comprise of ancient igneous and high-grade metamorphic rocks (Cornell et al., 2006). These surface outcrops are small patches and entirely unfossiliferous and thus not relevant to this project.

Important geological phenomenon in the region is the Strausheim Shear that crosses the potable water rising main pipeline (indicated in green, Figure 3). The Wolfkop Fault runs north of Kenhardt, whereas the Kalkputs Thrust Fault is located between the Hartbees River and De Bakke booster pump station (Figure 4). The SAHRIS PalaeoMap indicates that the Palaeontological Sensitivity of the Quaternary Kalahari and Dwyka Groups is Moderate (green), while that of the Prins Albert Formation of the Ecca Group is High (orange). Unfossiliferous sediments (grey on the SAHRIS PalaeoMap) include Jurassic Dolerite as well as sediments of the Namaqua-Natal Province, (Figure 6, Table 4); Almond and Pether, 2009; Almond et al., 2013, Groenewald et al 2014). The suggested location is classified as having a High (orange) Palaeontology Theme Sensitivity in the DFFE Screening Report (Figure 7).

The basement rocks are primarily mantled by Late Cenozoic surface layers, including members of the Kalahari Group. These sediments are primarily thin, unconsolidated deposits comprising of patches of calcretes (soil limestones), small gravelly to sandy river alluvium, pan sediments along watercourses, colluvium (scree), surface gravels and Quaternary to Recent aeolian (wind-blown) sands of the Gordonia Formation (Kalahari Group) Almond et al. (2019).

The late Cretaceous to Recent Kalahari Group has been reviewed by the following authors: Thomas (1981), Dingle *et al.* (1983), Thomas & Shaw 1991, Haddon (2000) and Partridge *et al.* 2006. The Middle to Later Stone Age stone tools found from the Quaternary Gordonia Formation (Kalahari Group) date from the Late Pliocene/Early Pleistocene to recent periods (Dingle et al., 1983). The fossil assemblages of the Quaternary are generally low in diversity and exist over a large range, and has a moderate paleontological sensitivity. These fossils represent terrestrial plants and animals with a close resemblance to living forms. Fossil assemblages include bivalves, diatoms, gastropod shells, ostracods, and trace fossils. The palaeontology of the Quaternary superficial deposits has been relatively neglected in the past. Late Cenozoic calcrete may comprise of bones, horn corns as well as mammalian teeth. Tortoise remains have also been uncovered as well as trace fossils which includes termite and insect's

burrows and mammalian trackways. Amphibian and crocodile skeletons have been uncovered where the depositional settings in the past were wetter.

depositional settings in the past were wetter.

The Karoo igneous province is one of the worlds classic continental basalt (CFB) provinces. This province consists of intrusive and extrusive rocks that occur over a large area (Duncan et al, 2006). Generally, the flood basalts do not contribute to prominent volcanic structures, but instead are formed by successive eruptions from a set of fissures that form sub-horizontal lava flows (sills and dykes) varying in thickness. This lava caps the landscape on which they erupted. As the Karoo is an old flood basalt province it is today preserved as erosional fragments of a more extensive lava cap that covered much of southern Africa in the geological past. It is estimated that the Karoo lava outcrop currently covered at least 140 000 km^2 while it was larger in the past [~2 000 000 km^2 (Cox 1970, 1972)].

The Karoo Igneous Province contains a large volume of flood basalts as well as silicic volcanic rocks. These units are comprised of rhyodacite and rhyolitic magma and crops out along the Lebombo monocline. Individual units span up to 60 km and sometimes show massive pyroclastic structures and are thus classified as rheoignimbrites. The basal lavas lie conformable on the Clarens Formation but in specific localities sandstone erosion occurred before the volcanic eruptions took place. Lock *et al* (1974) found evidence in the Eastern Cape that in the early stages of volcanism magma interacted with ground water to produce volcaniclastic deposits as well as phreatic and phreatomagmatic diatremes. Eales *et al* (1984) also found evidence of aqueous environments during early volcanism by the existence of pillow lavas and associated hyaloclastite breccias and thin lenses of fluviatile sandstones interbedded with the lowermost magmas.

The Prince Albert Formation is restricted to the Karoo Basin's south-west. The northern facies are distinguished by the presence of greyish to olive-green micaceous shale and grey, silty shale, as well as a distinct transition from the underlying glacial deposits. There is also dark-grey to black carbonaceous shale and fine- to medium-grained feldspathic arenite and wacke. The southern facies are distinguished by the occurrence of dark-grey, pyrite-bearing splintery shale and siltstone, as well as dark-coloured chert and phosphatic nodules and lenses.

The Prince Albert Formation is normally between 50 and 200 m thick, with a thickness of roughly 145 m observed in the type area near Prince Albert. It is thicker (230 to 497 m) between Brandvlei and Jansenville, thinning north-eastwards to between 30 and 60 m between Kimberley and East London. The formation is just 25 to 50 m thick in the Kalahari Basin due to post-Karoo erosion of its upper section. The Prince Albert Formation contains marine invertebrates, palaeoniscoid fish, sharks, sponge spicules, foraminiferans, radiolarians, acritarchs, and ichnofossils such as fish trails, arthropod trackways, and invertebrate burrows. Wood and leaf fragments are also present in these sediments. However, fossils of the Prince Albert Formation are scarce.

High Rb/K ratios in mudstones indicate a marine shelf environment. Sedimentation started in the Late Palaeozoic during a massive transgression event following the final melting of Dwyka Group-related ice sheets in southern Gondwana. The Prince Albert Formation (Pp), in the south of the development is intruded by Early Jurassic (Jd) dolerite sills (Figure 5). The Prince Albert Formation (Pp) post-glacial basinal mudrocks are the Ecca Group's lowest component. This Early Permian laminated mudrock-dominated to thin-bedded succession was previously known as the "Upper Dwyka Shales." Visser (1992) and Cole (2005) provide important geological descriptions of this formation. These bedrocks are most often covered by surface gravels deposited by down wasting, shallow streams, and sheet wash. A mixture of dolerite gravels and locally weathered diagenetic nodules from the Prince Albert Formation may also be present.
The "marine" sediments of the Prince Albert Formation (Lower Ecca Group, Karoo Supergroup) are mostly composed of dark, well-laminated basinal mudrocks (shales and siltstones), with a minor quantity of fine-grained, thin-bedded siltstone lenses and sandstone. Mudrocks are rich in carbonate minerals and iron and contain a variety of diagenetic concretions. Various authors (Visser et al. 1977–1978, Siebrits 1989, Zawada 1992, Bosch 1993) found that these concretions are micaceous, carbonaceous, or pyritic in nature. Carbonate concretions, some of which are larger than a metre in diameter, are abundant in certain regions of the Main Karoo Basin.

The Prince Albert sequence is dominated by tabular-bedded mudrocks of olive-grey, blue-grey, to reddish-brown hue, with intermittent thin (dm) buff sandstones and occasionally thinner (few cm), soft-weathering layers of yellowish water-lain tuff (volcanic ash layers). Extensive diagenetic modification of these sediments has resulted in the development of pearly-blue phosphatic nodules, thin cherty beds, rusty iron carbonate nodules, and beds and elongate ellipitical concretions impregnated with iron and manganese minerals. The brittle rocks are well-jointed and frequently exhibit a well-developed tectonic cleavage that results in sharp, elongate cleavage flakes ("pencil cleavage"). Extensive bedding planes are thus rare in the southern outcrop area along the Cape Fold Belt, whereas Northern Cape outcrops are significantly less distorted.

Cole (2005) gives a valuable review of the fossil biota of the Prince Albert Formation, whilst Almond (2008a, 2008b) examines the characteristic Umfolozia / Undichna dominated trace fossil assemblages of the non-marine Mermia Ichnofacies. Throughout the Ecca Basin, these assemblages were frequently found in basinal mudrock facies of the Prince Albert Formation. Diagenetic nodules in the Ceres Karoo have been discovered to contain sharks, palaeoniscoids (primitive bony fish), spiral bromalites (coprolites, etc.), and wood. Uncommon shark remains (Dwykaselachus) near Prince Albert on the Great Karoo's southern boundary has also been described (Oelofsen 1986). This deposit contains microfossil remnants of acritarchs, sponge spicules, foraminiferal and radiolarian protozoans, as well as miospores.

The most diverse fossil biota from the Prince Albert Formation can be discovered in calcareous concretions exposed along the Vaal River in the Northern Cape's Douglas district. It is also the most

interesting in terms of paleobiogeography, palaeoecology and biostratigraphy (McLachlan and Anderson 1973; Visser et al., 1977-78). The significant includes articulate brachiopods, spiral and other "coprolites" (possibly sharks as well as fish), nuculid bivalves, petrified wood and large tree trunks, palynomorphs (miospores), while well-articulated palaeoniscoid fish remains are abundant. Evans (2005) found that the majority of the fish are categorised as belonging to the palaeoniscoid genus Namaichthys. Most of the preserved invertebrates are in the form of moulds.

The Dwyka Group is Late Carboniferous to Early Permian in age (300-290 million years ago (Ma) and overlies glaciated Precambrian bedrock faces along the northern margin of the basin. In the south the Dwyka overlies the Cape Supergroup unconforrmably/paraconformably and in the east it unconformably overlies the Natal Group and Msikaba Formation. Underlying rocks, especially in the north, form in places well-developed striated glacial pavements. Visser (1986) identified several types of lithofacies which he perceived to be deposited in a marine basin.

The Dwyka Group is divided into northern and southern facies (Visser, 1981) due to the distinctive lithological variations over the basin. The Mbizane Formation consists mainly of the northern inlet facies which is characterised by thickness changes, extremely varying lithology and low massive diamictite (~20 %) and high mudrock (~40%) content. Visser et al. (1990) and Von Brunn and Visser (1999) found that the Dwyka rocks in the Douglas-Prieska area (close to the northern edge of the Main Karoo Basin) belong to the Mbizane Formation which can be up to 190 m thick. The Elandsvlei Formation is the southern platform and are depicted by a high massive diamictite (~70%) and low mudrock (~8%) content, gradual southernly increase in thickness (100 m to 800 m). Debris eroded, from the highlands was deposited by a ground ice sheet but in the west fluctuations in the ice front caused bedded diamictons and subaqueous and subglacial outwash sediments (Visser *et al* 1987). The key Reference Stratotype C section for the Mbizane Formation is situated a few km west of Douglas on the northern side of the Vaal River (Von Brunn & Visser, 1999)

The Permo-Carboniferous Dwyka Group is known for its track-ways (trace fossils), which are also known as ichnofacies, that were formed by fish and arthropods, while fossilized coprolites (faeces) have also been recovered. Body fossils comprise gastropods, invertebrates, and marine fish. Fossil plants include a rich diversity of conifers, glossopterids, cordaitaleans, ginkgoaleans, horsetails, lycopods, pollens and fern spores (Almond and Pether, 2008). Fossil assemblages of the Kalahari are generally low in diversity that occur over a wide range. These fossils represent terrestrial plants and animals with a close resemblance to living forms. Fossil assemblages include bivalves, diatoms, gastropod shells, ostracods, and trace fossils. Late Cenozoic calcrete may comprise of bones, horn corns as well as mammalian teeth. Tortoise remains have also been uncovered as well as trace fossils which includes termite and insect's burrows and mammalian trackways. Amphibian and crocodile remains have been uncovered where the depositional settings in the past were wetter. Fossils are mostly associated with ancient lakes, pans, and river systems.

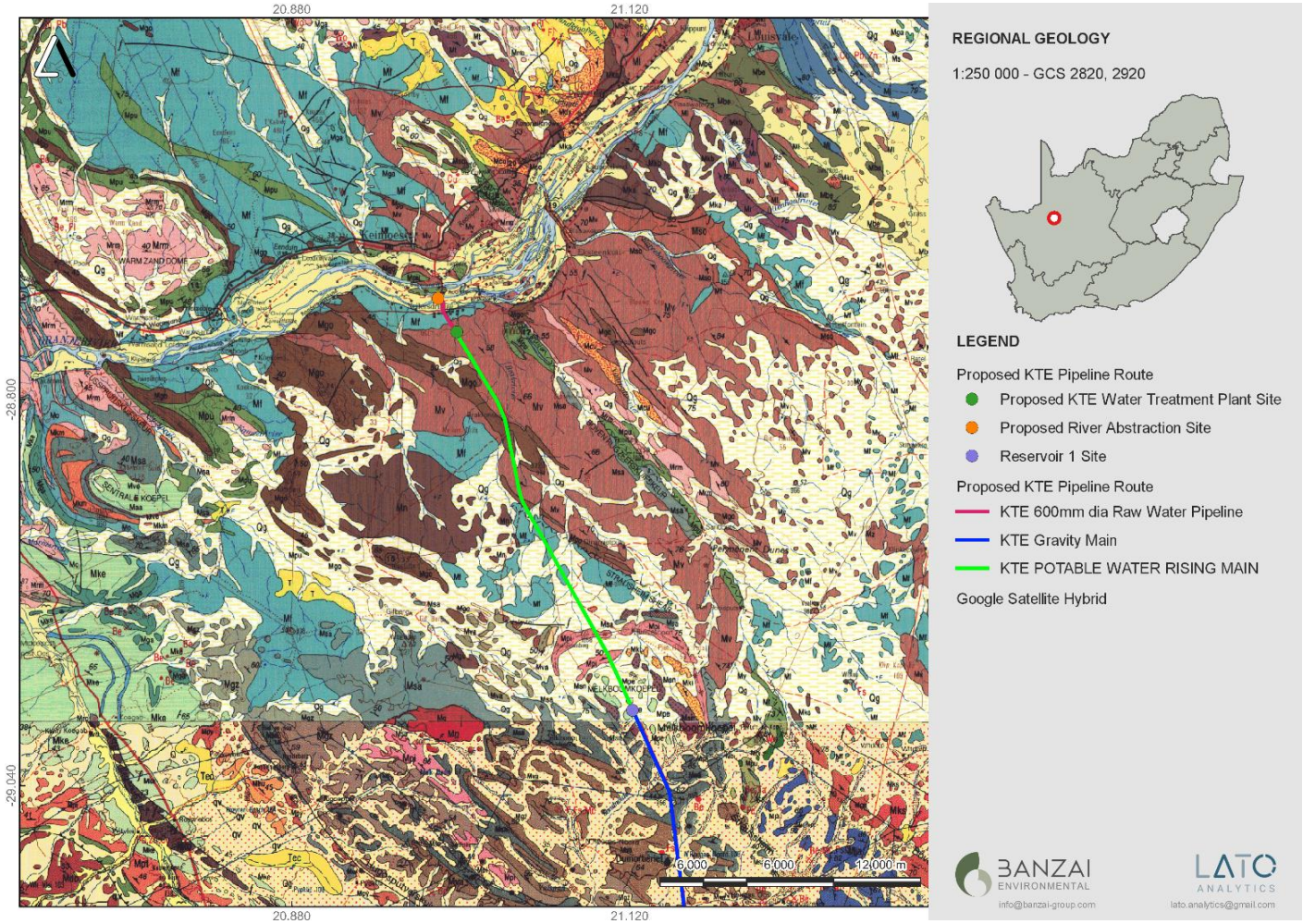


Figure 3: Extract of the 2820 Upington (1988) and 2920 Kenhardt (1998) Geological maps (Council of Geoscience, Pretoria) indicating the northern portion of the KTE pipeline development.

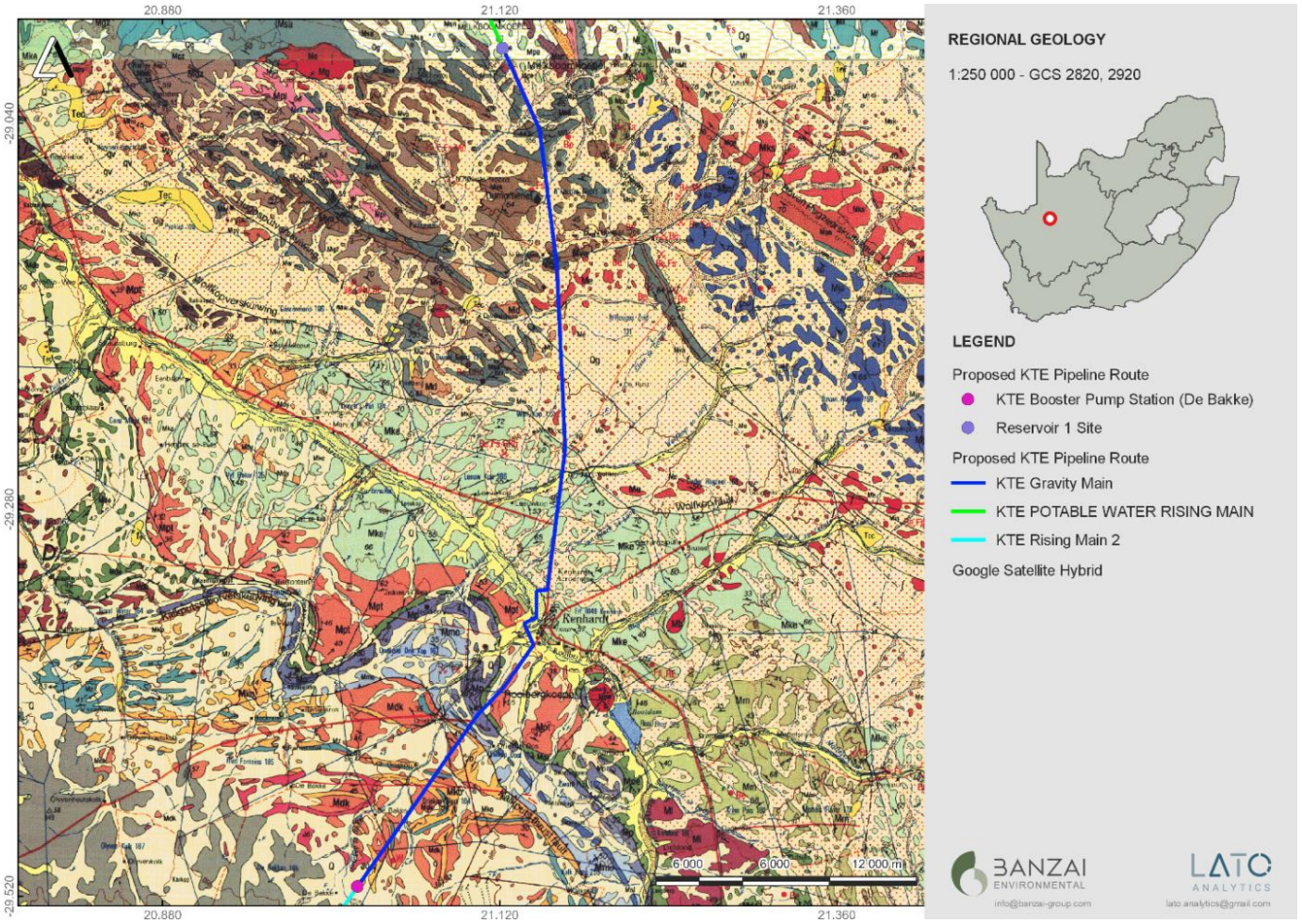


Figure 4: Extract of the 2820 Upington (1988) and 2920 Kenhardt (1998) Geological maps (Council of Geoscience, Pretoria) indicating the central portion of the KTE pipeline development.

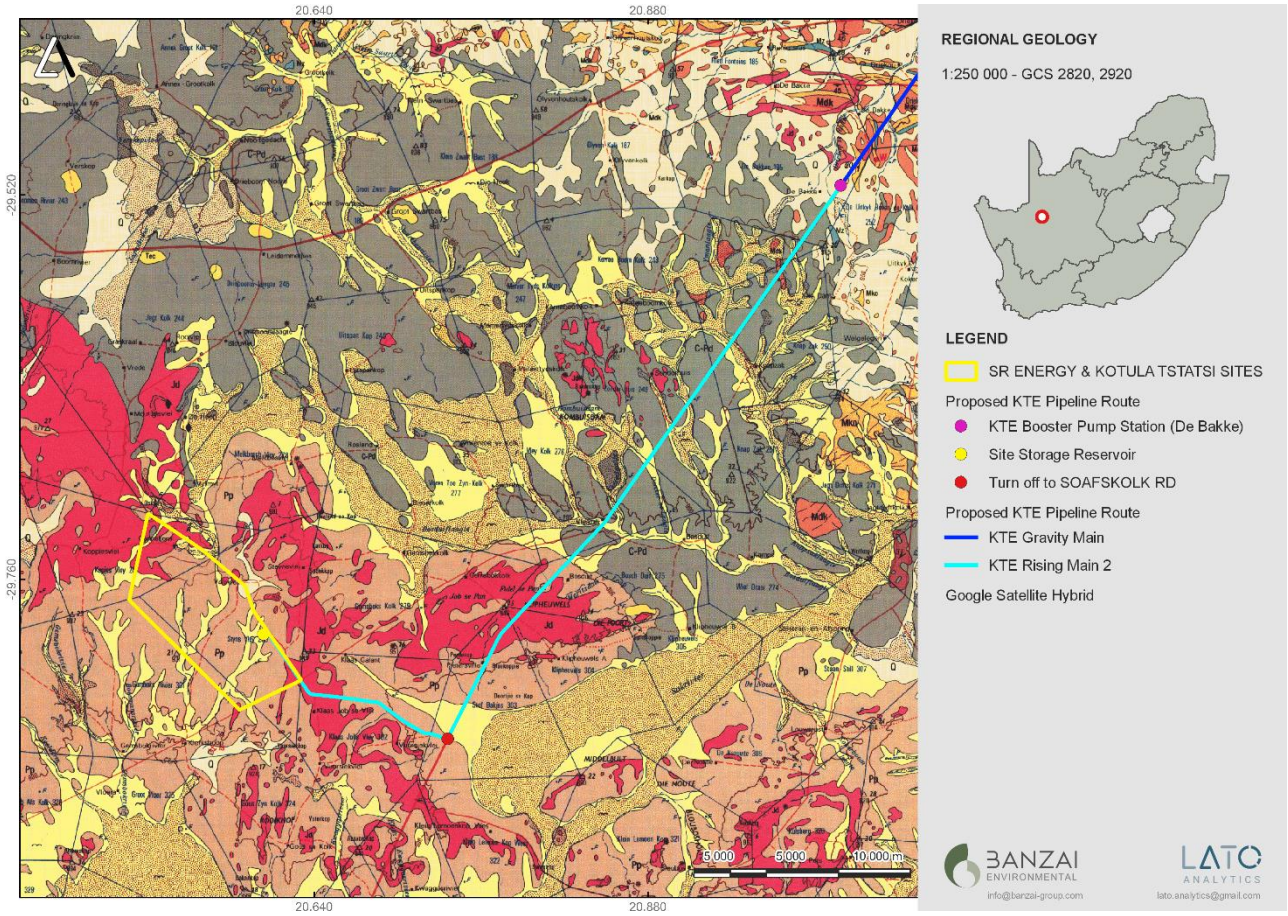


Figure 5: Extract of the 2920 Kenhardt (1998) Geological maps (Council of Geoscience, Pretoria) indicating the southern portion of the KTE pipeline development.

Table 2: Extract of the Northern Cape Palaeotechnical report (Almond, J and Pether, J. 2009) present in the study area

19. OTHER CAENOZOIC FLUVIAL, LACUSTRINE & TERRESTRIAL DEPOSITS OF INTERIOR **(Most too small to be indicated on 1: 250 000 geological maps)** ***eg* Kwaggaskop, Dasdap, Vaalputs, Arries Drift, Windsorton, Rietputs, Riverton Fms**		Fluvial, pan, lake and terrestrial sediments, including diatomite (diatom deposits), pedocretes, spring tufa / travertine, cave deposits, peats, colluvium Late Cretaceous /Palaeocene to Holocene	Bones and teeth of wide range of mammals, including mammals (*eg* teeth & bones of mastodont proboscideans, rhinos, bovids, horses, micromammals), reptiles (crocodiles, tortoises), ostrich egg shells, fish, freshwater and terrestrial molluscs (unionid bivalves, gastropods), crabs, trace fossils (*eg* termitaria, horizontal invertebrate burrows, stone artefacts), petrified wood, leaves, rhizoliths, diatom floras, peats and palynomorphs. Calcareous tufas at edge of Ghaap Escarpment might be highly fossiliferous (*cf* Taung in NW Province – abundant Makapanian Mammal Age vertebrate remains, including australopithecines)	Scattered records, many poorly studied and of uncertain age Reflect ancient drainage systems of subcontinental interior (eg Geelvloer – Koa River Valley system, Palaeo-Orange and Vaal systems) Include fossil equivalents of famous Arriesdrift Mid Miocene fauna from S. Namibia (*eg* at Bosluispan, Proto-Orange Terrace Gravels of lower Orange River) Fossils threatened by alluvial diamond mining (Vaal & Mid to Lower Orange River gravels) Orange River Man (100-50 Ka, *H. heidelbergensis*) See archaeological literature for fossil & subfossil remains from archaeological sites (eg Wonderwerk Cave nr Kuruman, Kathu Pan near Sishen)
18. KALAHARI GROUP **Wessels (Tw), Budin (Tb), Eden (Te), Mokalanen (T-Qm), Obobogorop, Gordonia (Qg) and Lonely Formations**		Fluvial gravels, sands, lacustrine and pan mudrocks, diatomites and diatomaceous limestones, evaporites, consolidated to unconsolidated aeolian sands, pedocretes (especially calcrete) Late Cretaceous to Recent <90 Ma → 0 Ma	Palynomorphs, root casts (rhizomorphs / rhizoliths) and burrows (*eg* termitaria), rare vertebrate remains (mammals, fish, ostrich egg shell *etc*), diatoms, freshwater stromatolites, freshwater and terrestrial shells (gastropods, bivalves), ostracods, charophytes	Fossils mainly associated with ancient pans, lakes and river systems Palaeontology poorly studied. Basal Late Cretaceous gravels and lacustrine clays probably fossiliferous (bones, teeth, petrified wood, palynomorphs?) but v. rarely exposed.
15. KAROO DOLERITE SUITE **(Jd)** Early Jurassic (182-183 Ma)		Intrusive dolerites (dykes, sills), associated diatremes	NO fossils recorded	Massive igneous activity (dolerite intrusion, basaltic volcanism) of Karoo-Ferrar Large Igneous Province preceded break-up of Gondwana and may have caused Early Jurassic extinction event (183Ma)
ECCA GROUP Early – Mid Permian (290 – 266 Ma)	**13a. Prince Albert Fm (Ppr)**	Marine to hyposaline basin plain mudrocks, minor volcanic ashes, phosphates and ironstones, post-glacial mudrocks at base	Low diversity marine invertebrates (bivalves, nautiloids, brachiopods), palaeoniscoid fish, sharks, fish coprolites, protozoans (foraminiferans, radiolarians), petrified wood, palynomorphs (spores, acritarchs), non-marine trace fossils (especially arthropods, fish, also various "worm" burrows), possible stromatolites, oolites	Transition from marine to brackish salinities early in history of epicontinental Ecca Sea. Marine body fossils rare (*eg* Douglas area) Biogenic origin of "stromatolites" within carbonate rocks needs confirmation.

12. DWYKA GROUP (C-Pd) Late Carboniferous – Early Permian *c.* 320-290 Ma	**12c. Mbizane Fm** Early Permian	Varied glacially-related sediments, including valley glacier deposits (tillites, conglomerates, sandstones mudrocks)	Low diversity non-marine trace fossil assemblages (predominantly fish, arthropod traces, *Rhizocorallium*) scattered vascular plant remains (*eg Glossopteris* leaves, petrified wood)	Restricted to N. margin of Main Karoo Basin. Overlies basement (N)or Elandsvlei Fm (S). Reports of stromatolites, oolites in limestone lenses require confirmation.
	12b. Elandsvlei Fm Late Carboniferous – Early Permian	Predominantly massive tillites, with interglacial mudrocks at intervals	Interglacial mudrocks occasionally with low diversity marine fauna of invertebrates (molluscs, starfish, brachiopods, coprolites *etc*), palaeoniscoid fish, petrified wood, leaves (rare) and palynomorphs of *Glossopteris* Flora. Well-preserved non-marine ichnofauna (traces of fish, arthropods) in laminated mudrocks. Possible stromatolites, oolites at top of succession.	Main Dwyka subunit within south and central portion of Main Karoo Basin. Body fossils v. rare. Richer interglacial & postglacial biotas recorded from southern Namibia (*eg Eurydesma* fauna) and may eventually be traced into N. Cape. Reports of stromatolites require confirmation.
	12a. "Red Dwyka" Late Carboniferous (>300Ma)	Glacial tillites, proglacial outwash sandstones & conglomerates, glaciolacustrine mudrocks *etc.*	Well-preserved, non-marine trace fossil assemblages (mainly of fish, arthropods), sparse *Glossopteris* Flora plant remains (wood, twigs, leaves)	This unit occurs just south of Orange River, extending into S. Namibia. Underlies Elandsvlei Fm.
4. NAMAQUA METAMORPHIC PROVINCE **large number of subunits (M*….)**	Igneous and metamorphic rocks (including high grade metasediments) Early to Mid Proterozoic (Mokolian) *c.* 2-1 Ga	NO FOSSILS RECORDED	Check map keys to identify metamorphic and igneous rocks	

Table 3: Palaeontological Significance of Rock units in the Northern Cape Paleotechnical Report (Almond, J and Pether, J. 2009).

COLOUR OF ROCK UNIT	PALAEONTOLOGICAL SIGNIFICANCE / VULNERABILITY	RECOMMENDED ACTION
RED	very high	field scoping study recommended before excavation takes place
PURPLE	high	desk top study + scoping study may be necessary
GREEN	moderate	desk top study
BLUE	low	no action required (any fossil finds to be reported by developer)
BLACK	insignificant or zero	no action required

NB.1. These significance / vulnerability ratings are *provisional*
NB.2. Some rock units are largely unfossiliferous, but have thin subunits of high palaeontological significance (*eg* Table Mountain Group).

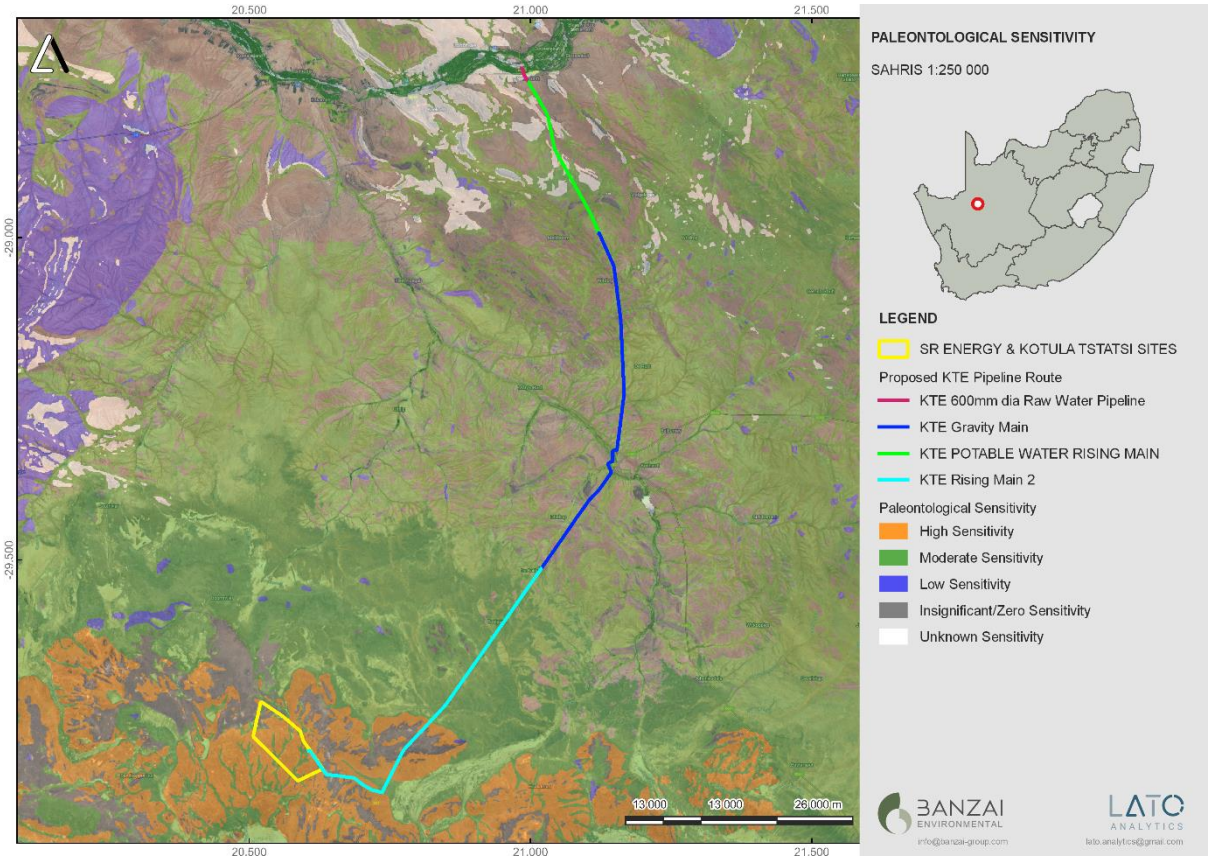


Figure 6: Extract of the SAHRIS PalaeoMap map (Council of Geosciences) indicates that the proposed development is underlain by sediments with an Unknown (white), Zero (grey), Moderate (green) and High (orange) Palaeontological Sensitivity.

Table 4: Palaeontological Sensitivity

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

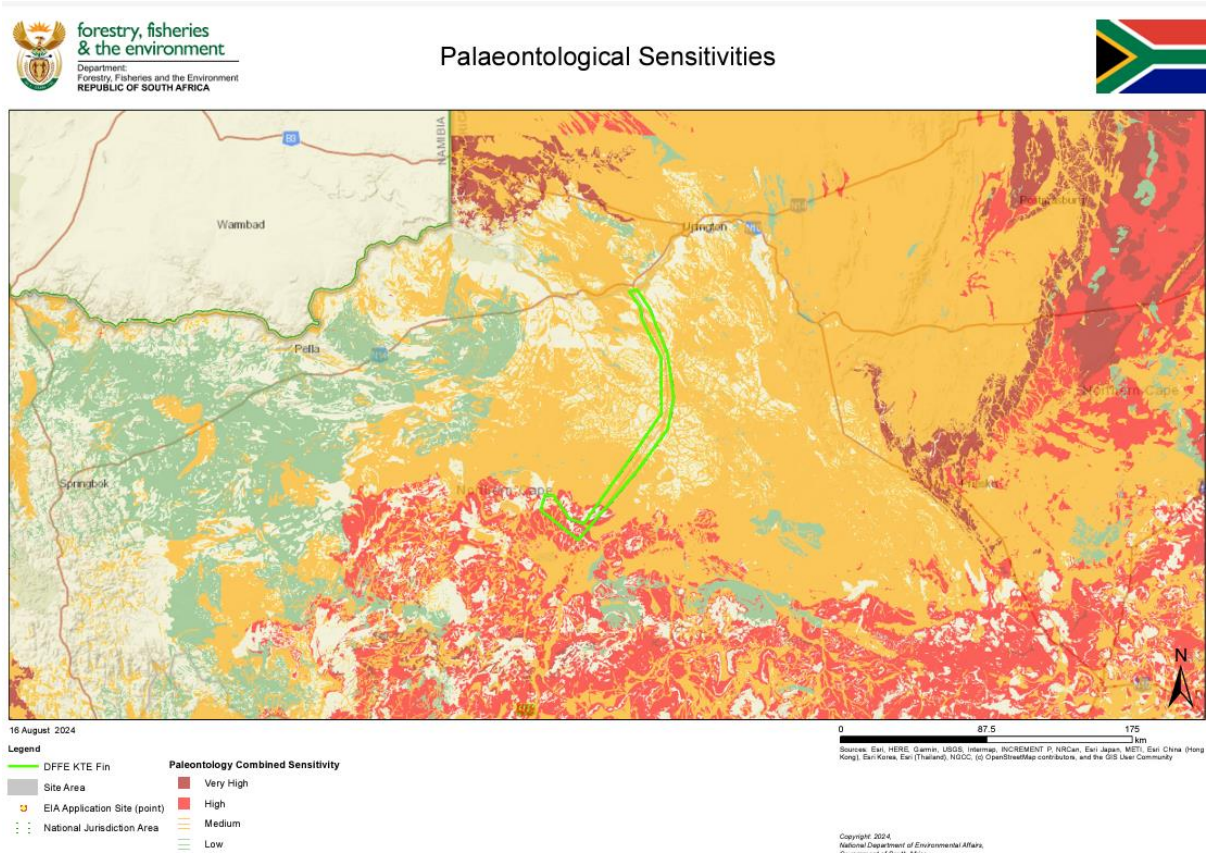


Figure 7: Palaeontological Sensitivity generated by the National Environmental Web-Based Screening indicating the High (red) Palaeontological Sensitivity of the proposed development.

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).
- A Google Earth map with polygons of the proposed development was obtained from Ubique Heritage Consultants
- 1: 250 000 Upington 2820 Geological Map (1988) (Council of Geosciences, Pretoria
- 1: 250 000 Kenhardt 2920 Geological Map (1998))
- Updated Geology produced by the Council of Geosciences (Pretoria).
- Palaeosensitivity map on SAHRIS website.
- The National Environmental Web-based Screening Tool.
- Palaeontological Impact assessments near the study area includes that of Almond 2016, 2019 (See references)

7 SITE INVESTIGATION

The site investigation for the proposed KTE Pipeline development was conducted on foot and by motor vehicle on 12-13 November 2022. No fossiliferous outcrops were identified during the site visit.

Figure 8:Aeolian sand mantling calcrete, granite and quartzite

Figure 9: Unfossiliferous rocks of the Namaqua-Natal Metamorphic Province.

Figure 10: Well sorted quartzite and granite scree near a drainage line.

Figure 11: Downwashed scree in drainage lines.

8 IMPACT ASSESSMENT METHODOLOGY

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 is used:

Table 5: 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 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 is result 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

8.1 Summary of Impact Tables

Loss of fossil heritage will be a negative impact. If fossils are recovered from the study area it could have a positive effect as fossils will be available for research. Only the site will be affected by the proposed development. The expected duration of the impact is assessed as potentially permanent to 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 Low probability. As fossil heritage will be destroyed the impact is irreversible. The significance of the impact occurring will be low.

Table 6: Summary of Impact Tables

	Site	Probability	Duration	Magnitude	Reversibility	Irreplicable Loss	Cumulative Effect	Significance
Pre-Mitigation	1	2	4	3	4	4	2	51
Post-Mitigation	1	2	4	1	4	4	1	16

9 FINDINGS AND RECOMMENDATIONS

The proposed KTE Pipeline development is located in flat-lying terrain within the semi-arid Bushmanland region. The study area is basically underlain by the potentially fossiliferous Quaternary Kalahari Group, Prins Albert Formation and Dwyka Group of the Karoo Supergroup. At depth, the area is underlain by a diversity of unfossiliferous Precambrian basement rocks (*c.* 2 billion years old) of the Namaqua-Natal Province.

The SAHRIS PalaeoMap indicates that the Palaeontological Sensitivity of the Quaternary Kalahari and Dwyka Groups is Moderate, while that of the Prins Albert Formation of the Ecca Group is High. Unfossiliferous sediment with a Zero Palaeontological Sensitivity includes Jurassic Dolerite as well as sediments of the Namaqua-Natal Province (Almond and Pether, 2009; Almond et al., 2013, Groenewald et al. 2014). The suggested location is classified as having a High (orange) Palaeontology Theme Sensitivity in the DFFE Screening Report.

A site-specific field survey of the development footprint was conducted on foot and by motor vehicle on 12-13 November 2022. No fossiliferous outcrop was detected in the proposed development. The site investigation as well as desktop research (National Database and published data) concluded that fossil heritage of scientific and conservational interest in the area is relatively rare and of low scientific and conservational value. Data indicates that fossil sites are generally rare, sporadic and unpredictable. A low significance has thus been allocated to the development footprint. This is in contrast with the High Sensitivity allocated to the development area by the SAHRIS Palaeontological Sensitivity Map and DFFE Screening Tool. The Very High Palaeontological Sensitivity indicated by the DFFE Screening Tool is thus contested/disputed, with a Low Palaeontological Sensitivity assigned to the development based on the site investigation in November 2022.

In terms of palaeontological impacts, a High Palaeontological Significance has been allocated for impacts associated with the construction phase of the KTE Pipeline development pre-mitigation and a

low significance post mitigation. The construction phase will be the only development phase with the potential of impacting Palaeontological Heritage, and no significant impacts are expected to impact the Operational and Decommissioning phases. As the No-Go Alternative considers the option of 'do nothing' and maintaining the status quo, it will have a Neutral impact on the Palaeontological Heritage of the development. The Cumulative impacts of the KTE development and associated infrastructure is considered to be medium pre-mitigation (as the area is not highly fossiliferous) and Low post-mitigation, and falls within the acceptable limits for the project. It is therefore considered that the proposed development will not have damaging impacts on the area's palaeontological resources. The construction of the development may thus be permitted to its whole extent, as the development footprint is not considered sensitive in terms of palaeontological resources. It is consequently recommended that no further palaeontological heritage studies, ground truthing, or specialist mitigation be required pending the discovery of newly discovered fossils.

Recommendations:

The ESO for this project must be informed that the Prins Albert Formation of the Ecca Group has a High Palaeontological Sensitivity. Although fossils were not identified during the site investigation, fossils could be exposed during excavations.

If Palaeontological Heritage is uncovered during surface clearing and excavations, the Chance Find Protocol attached should be implemented immediately. Fossil discoveries ought to be protected and the ECO/site manager must report to South African Heritage Resources Agency (SAHRA) (Contact details: SAHRIS, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. 3rd floor Protea Assurance Building, 142 Longmarket St, Cape Town City Centre, Cape Town, 8000; Private Bag X9067, Cape Town, 8000 Tel: 021 483 9598. Fax: +27 (0) 21 483 9845. Web: https://sahris.sahra.org.za) so that mitigation (recording and collection) can be carried out.

Before any fossil material can be collected from the development site, the specialist involved would need to apply for a collection permit from SAHRA. Fossil material must be housed in an official collection (museum or university), while all reports and fieldwork should meet the minimum standards for palaeontological impact studies proposed by SAHRA (2012).

These recommendations should be incorporated into the Environmental Management Programme (EMPr) for the KTE Pipeline project and associated infrastructure.

10 MITIGATION AND EMPR REQUIREMENTS

The naturally preserved remnants (or traces) of plants or animals imbedded in rock are known as fossils. These plants and animals existed millions of years ago in the geologic past. Fossils are incredibly valuable and difficult to replace. It is possible to identify the environmental conditions that occurred in a certain geographical area millions of years ago by analysing fossils.

This fact sheet is intended for construction workers and foremen. It describes what to do if fossil material is discovered accidently during mining.

It is the responsibility of the project's Environmental Site Officer (ESO) or site manager to train the workers and foremen on what to do if a fossil is accidently discovered. In the absence of the ESO, a member of staff must be designated to be accountable for the effective application of the chance discovery protocol so that the conservation of fossil material is not jeopardized.

If fossils are discovered during excavation, the following method shall be followed.

10.1 Legislation

Cultural Heritage in South Africa (includes all heritage resources) is protected by the **National Heritage Resources Act (Act No 25 of 1999) (NHRA).** According to Section 3 of the Act, all Heritage resources include **"all objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens**".

The NHRA protects and owns the state's palaeontological legacy, which is unique and non-renewable. It is consequently the responsibility of the state to manage and protect fossils on behalf of South African citizens. According to Section 35 of the NHRA, palaeontological resources may not be excavated, broken, transferred, or destroyed by any development without previous assessment and a permit from the relevant heritage resources authority.

10.2 Chance Find Procedure

- If a chance find is made, the person responsible for the find must immediately stop working, and all work in the immediate vicinity of the find must stop as well.
- The individual who discovered the item must immediately notify his or her direct supervisor, who must then notify his or her management and the ESO or site manager. The ESO or site manager must notify the relevant Heritage Agency (South African Heritage Resources Agency, SAHRA) of the discovery. (Contact information: SAHRA, 111 Harrington Street, Cape Town, South Africa. PO Box 4637, Cape Town 8000, South Africa. Fax: +27 (0)21 462 4509. Tel: 021 462 4502. Web address: www.sahra.org.za). Photographs of the find from various perspectives, as well as GPS coordinates, must be submitted to the Heritage Agency.

- Within 24 hours of the discovery, a preliminary report must be sent to the Heritage Agency, which must include the following: 1) the date of finding; 2) a description of the discovery; and 3) a description of the fossil and its context (depth and position of the fossil), as well as GPS coordinates.
- Photographs of the discovery (the more the merrier) must be of high quality, in focus, and accompanied by a scale. Photographs of the vertical part (side) where the fossil was discovered are also required.
- Upon receipt of the preliminary report, the Heritage Agency will notify the ESO (or site manager) whether a palaeontologist rescue excavation or collection is required.
- The place must be guarded to prevent future damage. There should be no attempt to remove material from their environment. Stabilize the exposed items and cover them with a plastic sheet or sand bags. The Heritage organization will also be able to advise on the best way to protect the find.
- If the fossil cannot be stabilized, the ESO (site manager) may carefully collect the fossil.
- Once the Heritage Agency has received the written authorization, the developer may continue with the development on the affected area.
- Fossil finds must be placed in tissue paper and in an appropriate box while necessary care must be taken to remove any fossil material from the rescue site.

11 BIBLIOGRAPHY

Almond, J. E., 2016. Environmental Impact Assessment for the Proposed Development of a 75 MW Solar Photovoltaic Facility (BOVEN SOLAR PV2) on the Remaining Extent of Boven Rugzeer Farm 169, north-east of Kenhardt, Northern Cape Province.

ALMOND, J.E. & PETHER, J. 2008. Palaeontological heritage of the Northern Cape. Interim SAHRA technical report, 124 pp. Natura Viva cc., Cape Town.

ALMOND, J.E. & PETHER, J. 2009. Palaeontological heritage of the Northern Cape. Interim SAHRA technical report, 124 pp. Natura Viva cc., Cape Town.

ALMOND, J., PETHER, J, and GROENEWALD, G. 2013. South African National Fossil Sensitivity Map. SAHRA and Council for Geosciences. Schweitzer *et al*. (1995) pp p288.

ALMOND, J.E. 2008a. Fossil record of the Loeriesfontein sheet area (1: 250 000 geological sheet 3018). Unpublished report for the Council for Geoscience, Pretoria, 32 pp.

ALMOND, J.E. 2011. Proposed Solar Cape Photovoltaic Electricity Generation Facility near Kenhardt, Northern Cape Province. Palaeontological impact assessment: desktop study, 18 pp. Natura Viva cc, Cape Town.

ALMOND, J.E. 2014a. Proposed Exheredo CSP and PV solar energy facilities on the farm Styns Vley 280 near Kenhardt, Northern Cape Province. Palaeontological heritage assessment: desktop study, 28 pp. Natura Viva cc, Cape Town.

ALMOND, J.E. 2014b. Proposed Exheredo CSP and PV solar energy facilities near Kenhardt, Northern Cape Province. Palaeontological heritage assessment: combined desktop & field-based study, 61 pp. Natura Viva cc, Cape Town.

ALMOND, J.E. 2014c. Proposed Gemsbok Solar PV1 Solar Energy Facility near Kenhardt, Northern Cape Province. Desktop study, 21 pp. Natura Viva cc, Cape Town.

ALMOND, J.E. 2014d. Proposed Boven Solar PV1 Solar Energy Facility near Kenhardt, Northern Cape Province. Desktop study, 21 pp. Natura Viva cc, Cape Town.
ANDERSON, A.M. & MCLACHLAN, I.R. 1976. The plant record in the Dwyka and Ecca Series (Permian) of the south-western half of the Great Karoo Basin, South Africa. Palaeontologia africana 19: 31-42.
ANDERSON, A.M. 1974. Arthropod trackways and other trace fossils from the Early Permian lower Karoo Beds of South Africa. Unpublished PhD thesis, University of Witwatersrand, Johannesburg, 172 pp.
ANDERSON, A.M. 1975. Turbidites and arthropod trackways in the Dwyka glacial deposits (Early Permian) of southern Africa. Transactions of the Geological Society of South Africa 78: 265-273.
ANDERSON, A.M. 1976. Fish trails from the Early Permian of South Africa. Palaeontology 19: 397- 409, pl. 54.
ANDERSON, A.M. 1981. The *Umfolozia* arthropod trackways in the Permian Dwyka and Ecca Groups of South Africa. Journal of Paleontology 55: 84-108, pls. 1-4.
ANDERSON, J.M. & ANDERSON, H.M. 1985. Palaeoflora of southern Africa. Prodromus of South African megafloras, Devonian to Lower Cretaceous, 423 pp, 226 pls. Botanical Research Institute, Pretoria & Balkema, Rotterdam.
ANDERSON, J.M. 1977. The biostratigraphy of the Permian and the Triassic. Part 3: A review of Gondwana Permian palynology with particular reference to the northern Karoo Basin, South Africa. Memoirs of the Botanical Survey of South Africa 45, 14-36.
BAMFORD, M.K. & DE WIT, M.C.J. 1993. Taxonomic description of fossil wood from Cainozoic Sak River terraces, near Brandvlei, Bushmanland, South Africa. Palaeontologia africana 30: 71-80.
BAMFORD, M.K. 2000. Cenozoic macro-plants. In: Partridge, T.C. & Maud, R.R. (Eds.) The Ceozoic of southern Africa, pp.351-356. Oxford University Press, Oxford.
BAMFORD, M.K. 2000a. Fossil woods of Karoo age deposits in South Africa and Namibia as an aid to biostratigraphical correlation. Journal of African Earth Sciences 31, 119-132.
BAMFORD, M.K. 2000b. Cenozoic macro-plants. In: Partridge, T.C. & Maud, R.R. (Eds.) The Cenozoic of southern Africa, pp.351-356. Oxford University Press, Oxford.
BAMFORD, M.K. 2004. Diversity of woody vegetation of Gondwanan South Africa. Gondwana Research 7, 153-164.
BANGERT, B. & BAMFORD, M. 2001. Carboniferous pycnoxylic woods from the Dwyka Group of southern Namibia. Palaeontologia africana 37, 13-23.
BARNOSKY, A.D. 2005. Effects of Quaternary Climatic Change on Speciation in Mammals. *Journal of Mammalian Evolution.* 2005(12):247-264, June
BENDER, P.A. & BRINK, J.S. 1992. A preliminary report on new large mammal fossil finds from the Cornelia-Uitzoek site. South African Journal of Science 88: 512-515.
BEUKES, N.J. 1983. Palaeoenvironmental setting of iron formations in the depositional basin of the Transvaal Supergroup, South Africa. In: Trendall, A.F. & Morris, R.C. (Eds.) Iron-formation: facts and problems, 131-210. Elsevier, Amsterdam.
BEUKES, N.J. 1986. The Transvaal Sequence in Griqualand West. In: Anhaeusser, C.R. & Maske, S. (Eds.) Mineral deposits of Southern Africa, Volume 1, pp. 819-828. Geological Society of South Africa.
BEUKES, N.J. & KLEIN, C. 1990. Geochemistry and sedimentology of facies transition from the micro banded to granular iron-formation in the Early Proterozoic Transvaal Supergroup, South Africa. Precambrian Research 47, 99-139.
BOUSMAN, C.B. et al. 1988. Palaeoenvironmental implications of Late Pleistocene and Holocene valley fills in Blydefontein Basin, Noupoort, C.P., South Africa. Palaeoecology of Africa 19: 43-67.
BRINK, J.S. & ROSSOUW, L. 2000. New trial excavations at the Cornelia-Uitzoek type locality. Navorsinge van die Nasionale Museum Bloemfontein 16, 141-156.
BRINK, J.S. 1987. The archaeozoology of Florisbad, Orange Free State. Memoirs van die Nasionale Museum 24, 151 pp.
BRINK, J.S. *et al.* 1995. A new find of *Megalotragus priscus* (Alcephalini, Bovidae) from the Central Karoo, South Africa. Palaeontologia africana 32: 17-22.
BRINK, J.S. et al. 1995. A new find of *Megalotragus priscus* (Alcephalini, Bovidae) from the Central Karoo, South Africa. Palaeontologia africana 32: 17-22.
BUATOIS, L. & MANGANO, M.G. 1995. The paleoenvironmental and paleoecological significance of the lacustrine *Mermia* ichnofacies: an archetypal subaqueous nonmarine trace fossil assemblage. Ichnos 4: 151-161.
BUATOIS, L. & MANGANO, M.G. 2004. Animal-substrate interactions in freshwater environments: applications of ichnology in facies and sequence stratigraphic analysis of fluvio-lacustrine successions.

In: McIlroy, D. (Ed.) The application of ichnology to palaeoenvironmental and stratigraphic analysis. Geological Society, London, Special Publications 228, pp 311-333.
BUTZER, K.W., HELGREN, D.M., FOCK, G. & STUCKENRATH, R. 1973. Alluvial terraces of the Lower Vaal River, South Africa: a re-appraisal and re-investigation. Journal of geololgy 81, 341-362.
CHURCHILL, S.E. et al. 2000. Erfkroon: a new Florisian fossil locality from fluvial contexts in the western Free State, South Africa. South African Journal of Science 96: 161-163.
COLE, D.I. 2005. Prince Albert Formation. SA Committee for Stratigraphy, Catalogue of South African Lithostratigraphic Units 8: 33-36.
COOKE, H.B.S. 1949. Fossil mammals of the Vaal River deposits. Memoirs of the geological Survey of South Africa 35, 1-117.
CORNELL, D.H., ARMSTRONG, R. A., and WALRAVEN, F. 1998. Geochronology of the Hartley Formation, South Africa:constraints on the Kheis tectonogenesis and the Kaapvaal Craton's earliest Wilson Cycle. J.Afr. Earth. Sci., 26: 5-27.
CORNELL, D.H., THOMAS, R.J., MOEN, H.F.G., REID, D.L., MOORE, J.M. & GIBSON, R.L. 2006. The Namaqua-Natal Province. In: Johnson, M.R., Anhaeusser, C.R. & Thomas, R.J. (Eds.) The geology of South Africa, pp. 461-499. Geological Society of South Africa, Marshalltown.
COWAN, R., 1995. History of Life. 2nd Edition. Blackwell Scientific Publications, Boston. 462pp
DE WIT, M.C.J. 1990. Palaeoenvironmental interpretation of Tertiary sediments at Bosluispan, Namaqualand. Palaeoecology of Africa and the surrounding islands 21: 101-118.
DE WIT, M.C.J. & BAMFORD, M.K. 1993. Fossil wood from the Brandvlei area, Bushmanland as an indication of palaeoenvironmental changes during the Cainozoic. Palaeontologia africana 30: 81-89.
DE WIT, M.C.J. 1999. Post-Gondwana drainage and the development of diamond placers in western South Africa. Economic Geology 94: 721-740.
DE WIT, M.C.J., MARSHALL, T.R. & PARTRIDGE, T.C. 2000. Fluvial deposits and drainage evolution. In: Partridge, T.C. & Maud, R.R. (Eds.) The Cenozoic of southern Africa, pp.55-72. Oxford University Press, Oxford.
DINGLE, R.V., SIESSER, W.G. & NEWTON, A.R. 1983. Mesozoic and Tertiary geology of southern Africa. viii + 375 pp. Balkema, Rotterdam.
DU TOIT, A. 1954. The geology of South Africa. xii + 611pp, 41 pls. Oliver & Boyd, Edinburgh.
DUNCAN, R.A., HOOPER, P.R., REHACEK, J., MARSG J.S., AND DUNCAN A.R., 1997. THE timing and duration of the Karoo igneous event, southern Gondwana. Journal of Geophysical Research, v. 102, p. 18127–18138, doi: 10.1029/97JB00972.
EALES, H.V., MARSH, J.S. AND COX, K.G. (1984). The Karoo Igneous Province: an introduction. *In*: Erlank, A.J. (Ed.), Petrogenesis of the Volcanic Rocks of the Karoo Province Spec. Publ. Geol. Soc. S. Afr., 13, 1–26.
EALES, H.V., MARSH, J.S. AND COX, K.G. (1984). The Karoo Igneous Province: an introduction. In: Erlank, A.J. (Ed.), Petrogenesis of the Volcanic Rocks of the Karoo Province. Spec. Publ. Geol. Soc. S. Afr., 13, 1–26
EVANS, F.J.E. 2005. Taxonomy, palaeoecology and palaeobiogeography of some Palaeozoic fish of southern Gondwana. Unpublished PhD thesis, University of Stellenbosch, 628 pp.
glacially-related sea-level changes, Carboniferous-Permian, southern Namibia. Palaeogeography, Palaeoclimatology, Palaeoecology 161: 127-150.
GRILL, H. 1997. The Permo-Carboniferous glacial to marine Karoo record in southern Namibia: sedimentary facies and sequence stratigraphy. Beringeria 19: 3-98, 1 pl.
GROENEWALD, G. and GROENEWALD, D. 2014. SAHRA Palaeotechnical Report: Palaeontological Heritage of the Free State Province. South African Heritage Resources Agency, Pp 1-20.
HADDON, I.G. 2000. Kalahari Group sediments. In: Partridge, T.C. & Maud, R.R. (Eds.) The Cenozoic of southern Africa, pp. 173-181. Oxford University Press, Oxford.
HELGREN, D.M. 1977. Geological context of the Vaal River faunas. South African Journal of Science 73, 303-307.
HERBERT, C.T. & COMPTON, J.S. 2007. Depositional environments of the lower Permian Dwyka diamictite and Prince Albert shale inferred from the geochemistry of early diagenetic concretions, southwest Karoo Basin, South Africa. Sedimentary Geology 194: 263-277.
HUNTER, D.R., JOHNSON, M.R., ANHAEUSSER, C. R. AND THOMAS, R.J. 2006. Introduction. (*In*: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J. (Eds), *The Geology of South Africa*. Geological Society of South Africa, Johannesburg/Council for Geoscience, Pretoria, 585-604.)
JOHNSON, M.R., VAN VUUREN, C.J., VISSER, J.N.J., COLE, D.I., De V. WICKENS, H., CHRISTIE,

JOHNSON, M.R., Visser, J.N.J., et al.2006. Sedimentary rocks of the Karoo Supergroup In JOHNSON, M.R., ANHAEUSSER, C.R. & THOMAS, R.J.. (eds). The geology of South Africa. 691 pp. Geological Society of South Africa, Johannesburg and Council for Geoscience, Pretoria.
KENT, L. E., 1980. Part 1: Lithostratigraphy of the Republic of South Africa, South West Africa/Namibia and the Republics of Bophuthatswana, Transkei, and Venda. SACS, Council for Geosciences, Pp 535-574.
KIBERD, P. 2006. Bundu Farm: a report on archaeological and palaoenvironmental assemblages from a pan site in Bushmanland, Northern Cape, South Africa. South African Archaeological Bulletin 61, 189-201.
KLEIN, R. 1980. Environmental and ecological implications of large mammals from Upper Pleistocene and Hoocene sites in southern Africa. Annals of the South African Museum 81, 223-283.
KLEIN, R.G. 1984. The large mammals of southern Africa: Late Pliocene to Recent. In: Klein, R.G. (Ed.) Southern African prehistory and paleoenvironments, pp 107-146. Balkema, Rotterdam.
KLEIN, R. 2000. The Earlier Stone Age in southern Africa. The South African Archaeological Bulletin 40, 107-122.
LOCK, B.E., PAVERD, A.L. AND BRODERICK, T.J. (1974). Stratigraphy of the Karroo volcanic rocks of the Barkly East District. Trans. Geol. Soc. S. Afr., 77, 117–129
MACRAE, C. 1999. Life etched in stone. Fossils of South Africa. 305 pp. The Geological
MALHERBE, S.J., KEYSER, A.W., BOTHA, B.J.V., CORNELISSEN, A., SLABERT, M.J. &
MAUD, R. 2012. Macroscale Geomorphic Evolution. (*In* Holmes, P. and Meadows, M. Southern Africa Geomorphology, New trends and new directions. Bloemfontein: Sun Press. p. 7- 21)
MCCARTHY, T. & RUBIDGE, B. 2005. The story of Earth and life: a southern African perspective on a 4.6-billion-year journey. 334pp. Struik, Cape Town
MCCLAREN, C.H., and LIEBENBERG, J. (1975-1976). The Ventersdorp Group between Taungs and Britstown, Northern Cape Province. Ann Geol. Surv. S. Afri. 11: 15-28.
MCLACHLAN, I.R. & ANDERSON, A. 1973. A review of the evidence for marine conditions in southern Africa during Dwyka times. Palaeontologia africana 15: 37-64.
MEADOWS, M.E. & WATKEYS, M.K. 1999. Palaeoenvironments. In: Dean, W.R.J. & Milton, S.J. (Eds.) The karoo. Ecological patterns and processes, pp. 27-41. Cambridge University Press, Cambridge.
MILLER, R.M. 2008. Karoo Supergroup, pp. 16-1 to 16-115 *in* Miller, R.G. The geology of Namibia. Volume 3. Upper Palaeozoic to Cenozoic. Geological Survey, Namibia.
MOSAVEL, H., AND COLE, D.I. 2021. Lithostratigraphy of the Prince Albert Formation (Ecca Group, Karoo Supergroup). South African Journal of Geology. 122: 4(cc-dd).
OELOFSEN, B.W. 1986. A fossil shark neurocranium from the Permo-Carboniferous (lowermost Ecca Formation) of South Africa. In: Uyeno, T, Arai, R., Taniuchi, T & Matsuura, K. (Eds.) Indo-Pacific fish biology. Proceedings of the Second International Conference on Indo-Pacific Fishes. Ichthyological Society of Japan, Tokyo, pp 107-124.
ORTON, J. 2012. Heritage impact assessment for a proposed solar energy facility on the farm Hoekplaas near Copperton, Northern Cape, 32 pp. Archaeology Contracts Office, University of Cape Town, Cape Town.
PARTRIDGE, T.C. & SCOTT, L. 2000. Lakes and Pans. In: Partridge, T.C. & Maud, R.R. (Eds.) The Cenozoic of southern Africa, pp.145-161. Oxford University Press, Oxford.
PARTRIDGE, T.C., BOTHA, G.A. & HADDON, I.G. 2006. Cenozoic deposits of the interior. In: Johnson, M.R., Anhaeusser, C.R. & Thomas, R.J. (Eds.) The geology of South Africa, pp. 585-604. Geological Society of South Africa, Marshalltown.
PICKFORD, M. & SENUT, B. 2002. The fossil record of Namibia. 39 pp. The Geological Survey of Namibia.
PLUMSTEAD, E.P. 1969. Three thousand million years of plant life in Africa. Alex Du Toit Memorial Lectures No. 11. Transactions of the Geological Society of South Africa, Annexure to Volume 72, 72pp. 25 pls.
PLUMSTEAD, E.P. 1969. Three thousand million years of plant life in Africa. Alex Du Toit Memorial Lectures No. 11. Transactions of the Geological Society of South Africa, Annexure to Volume 72, 72pp. 25 pls.
PRINSLOO, M.C. 1986. The Tertiary Koa River and the development of the Orange River drainage. Annals of the Geological Survey of South Africa 20, 13-23.
ROSSOUW, L. 2006. Florisian mammal fossils from erosional gullies along the Modder River at Mitasrust Farm, Central Free State, South Africa. Navorsinge van die Nasionale Museum Bloemfontein 22, 145-162.
ROSSOUW, L. 2006. Florisian mammal fossils from erosional gullies along the Modder River at Mitasrust Farm, Central Free State, South Africa. Navorsinge van die Nasionale Museum Bloemfontein 22, 145-162.

SAHRA 2013. Minimum standards: palaeontological component of heritage impact assessment reports, 15 pp. South African Heritage Resources Agency, Cape Town.
SAVAGE, N.M. 1970. A preliminary note on arthropod trace fossils from the Dwyka Series in Natal. IUGS Second Gondwana Symposium, South Africa, 1970, Proceedings and Papers, pp 627-635, pls. 1-5.
SAVAGE, N.M. 1971. A varvite ichnocoenosis from the Dwyka Series of Natal. Lethaia 4: 217-233.
SCHNEIDER, G. & MARAIS, C. 2004. Passage through time. The fossils of Namibia. 158 pp. Gamsberg MacMillan, Windhoek.
SCOTT, L. 2000. Pollen. In: Partridge, T.C. & Maud, R.R. (Eds.) The Cenozoic of southern Africa, pp.339-35. Oxford University Press, Oxford.
SEILACHER, A. 2007. Trace fossil analysis, xiii + 226pp. Springer Verlag, Berlin.
SENUT, B., PICKFORD, M., WARD, J., DE WIT, M., SPAGGIARI, R. & MORALES, J. 1996. Biochronology of the Cainozoic sediments at Bosluis Pan, Northern Cape Province, South Africa. South African Journal of Science 92: 249-251.
SENUT, B., PICKFORD, M., WARD, J., DE WIT, M., SPAGGIARI, R. & MORALES, J. 1996.
SIEBRITS, L.B. 1989. Die geologie van die gebied Sakrivier. Explanation of 1: 250 000 geology sheet 3020, 19 pp. Council for Geoscience, Pretoria.
SKEAD, C.J. 1980. Historical mammal incidence in the Cape Province. Volume 1: The Western and Northern Cape. 903pp. Department of Nature and Environmental Conservation, Cape Town.
SLABBERT, M.J., MOEN, H.F.G. & BOELEMA, R. 1999. Die geologie van die gebied Kenhardt. Explanation to 1: 250 000 geology Sheet 2920 Kenhardt, 123 pp. Council for Geoscience, Pretoria.
SMITH, A.B. 1999. Hunters and herders in the Karoo landscape. Chapter 15 in Dean, W.R.J. & Milton, S.J. (Eds.) The Karoo; ecological patterns and processes, pp. 243-256. Cambridge University Press, Cambridge.
STAPLETON, R.P. 1977. Carboniferous unconformity in southern Africa. Nature 268, 222-223.
STEPHENSON, M.H. 2008. A review of the palynostratigraphy of Gondwanan Late Carboniferous to Early Permian glacigene successions. In: Fielding, C.R., Frank, T.D. & Isbell, J.L. (eds). Resolving the Late Paleozoic Ice Age in time and space. Geological Society of America Special Paper 441, 317-330.
STOLLHOFEN, H., STANISTREET, I.G., BANGERT, B. & GRILL, H. 2000. Tuffs, tectonism and
THOMAS, D.S.G. & SHAW, P.A. 1991. The Kalahari environment, 284 pp. Cambridge University Press.
THOMAS, M.J. 1981. The geology of the Kalahari in the Northern Cape Province (Areas 2620 and 2720). Unpublished MSc thesis, University of the Orange Free State, Bloemfontein, 138 pp.
THOMAS, R.J., THOMAS, M.A. & MALHERBE, S.J. 1988. The geology of the Nossob and Twee Rivieren areas. Explanation for 1: 250 000 geology sheets 2520-2620. 17pp. Council for Geoscience, Pretoria.
TOOTH, S. BRANDT, D., HANCOX P.J. AND MCCARTHY, T. S. 2004. Geological controls on alluvial river behavior: a comparative study of three rivers in the South African Highveld. *Journal of African Earth Sciences,* 38(2004): 79-97, 15 Aug.
VEEVERS, J.J., COLE, D.I. & COWAN, E.J. 1994. Southern Africa: Karoo Basin and Cape Fold Belt. Geological Society of America, Memoir 184: 223-279.
VISSER, D.J.L. (ed) 1984. Geological Map of South Africa 1:100 000. South African Committee for Stratigraphy, Council for Geoscience, Pretoria.
VISSER, D.J.L. (ed) 1989. *Toeligting: Geologiese kaart (1:100 000). Die Geologie van die Republieke van Suid Afrika, Transkei, Bophuthatswana, Venda, Ciskei en die Koningkryke van Lesotho en Swaziland*. South African Committee for Stratigraphy. Council for Geoscience, Pretoria, Pp 494.
VISSER, J.N.J. 1992. Deposition of the Early to Late Permian Whitehill Formation during a sea-level highstand in a juvenile foreland basin. South African Journal of Geology 95: 181-193.
VISSER, J.N.J. 1997. Deglaciation sequences in the Permo-Carboniferous Karoo and Kalahari Basins of southern Africa: a tool in the analysis of cyclic glaciomarine basin fills. Sedimentology 44: 507-521.
VISSER, J.NJ., 1989. The Permo-Carboniferous Dwyka Formation of southern Africa: deposition by predominantly subpolar marine ice sheet. Palaeogreogr., Palaeoclimatol, Palaeoecol., 70:377-391.
WELLS, L.H. 1964. The Vaal River 'Younger Gravels" faunal assemblage: a revised list. South African Journal of Science 60, 92-94.

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, 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.

Butler, E. 2014. Palaeontological Impact Assessment for the proposed upgrade of existing water supply infrastructure at Noupoort, Northern Cape Province. 2014. Bloemfontein.

Butler, E. 2015. Palaeontological impact assessment of the proposed consolidation, re-division, and development of 250 serviced erven in Nieu-Bethesda, Camdeboo local municipality, Eastern Cape. Bloemfontein.

Butler, E. 2015. Palaeontological impact assessment of the proposed mixed land developments at Rooikraal 454, Vrede, Free State. Bloemfontein.

Butler, E. 2015. Palaeontological exemption report of the proposed truck stop development at Palmiet 585, Vrede, Free State. Bloemfontein.

Butler, E. 2015. Palaeontological impact assessment of the proposed Orange Grove 3500 residential development, Buffalo City Metropolitan Municipality East London, Eastern Cape. Bloemfontein.

Butler, E. 2015. Palaeontological Impact Assessment of the proposed Gonubie residential development, Buffalo City Metropolitan Municipality East London, Eastern Cape Province. Bloemfontein.

Butler, E. 2015. Palaeontological Impact Assessment of the proposed Ficksburg raw water pipeline. Bloemfontein.

Butler, E. 2015. Palaeontological Heritage Impact Assessment report on the establishment of the 65 mw Majuba Solar Photovoltaic facility and associated infrastructure on portion 1, 2 and 6 of the farm Witkoppies 81 HS, Mpumalanga Province. Bloemfontein.

Butler, E. 2015. Palaeontological Impact Assessment of the proposed township establishment on the remainder of portion 6 and 7 of the farm Sunnyside 2620, Bloemfontein, Mangaung metropolitan municipality, Free State, Bloemfontein.

Butler, E. 2015. Palaeontological Impact Assessment of the proposed Woodhouse 1 photovoltaic solar energy facilities and associated infrastructure on the farm Woodhouse729, near Vryburg, North West Province. Bloemfontein.

Butler, E. 2015. Palaeontological Impact Assessment of the proposed Woodhouse 2 photovoltaic solar energy facilities and associated infrastructure on the farm Woodhouse 729, near Vryburg, North West Province. Bloemfontein.

Butler, E. 2015.Palaeontological Impact Assessment of the proposed Orkney solar energy farm and associated infrastructure on the remaining extent of Portions 7 and 21 of the farm Wolvehuis 114, near Orkney, North West Province. Bloemfontein.

Butler, E. 2015. Palaeontological Impact Assessment of the proposed Spectra foods broiler houses and abattoir on the farm Maiden Manor 170 and Ashby Manor 171, Lukhanji Municipality, Queenstown, Eastern Cape Province. Bloemfontein.

Butler, E. 2016. Palaeontological Impact Assessment of the proposed construction of the 150 MW Noupoort concentrated solar power facility and associated infrastructure on portion 1 and 4 of the farm Carolus Poort 167 and the remainder of Farm 207, near Noupoort, Northern Cape. Prepared for Savannah Environmental. Bloemfontein.

Butler, E. 2016. Palaeontological Impact Assessment of the proposed Woodhouse 1 Photovoltaic Solar Energy facility and associated infrastructure on the farm Woodhouse 729, near Vryburg, North West Province. Bloemfontein.

Butler, E. 2016. Palaeontological Impact Assessment of the proposed Woodhouse 2 Photovoltaic Solar Energy facility and associated infrastructure on the farm Woodhouse 729, near Vryburg, North West Province. Bloemfontein.

Butler, E. 2016. Proposed 132kV overhead power line and switchyard station for the authorised Solis Power 1 CSP project near Upington, Northern Cape. Bloemfontein.

Butler, E. 2016. Palaeontological Impact Assessment of the proposed Senqu Pedestrian Bridges in Ward 5 of Senqu Local Municipality, Eastern Cape Province. Bloemfontein.

Butler, E. 2016. Recommendation from further Palaeontological Studies: Proposed Construction of the Modderfontein Filling Station on Erf 28 Portion 30, Founders Hill, City of Johannesburg, Gauteng Province. Bloemfontein.

Butler, E. 2016. Recommendation from further Palaeontological Studies: Proposed Construction of the Modikwa Filling Station on a Portion of Portion 2 of Mooihoek 255 Kt, Greater Tubatse Local Municipality, Limpopo Province. Bloemfontein.

Butler, E. 2016. Recommendation from further Palaeontological Studies: Proposed Construction of the Heidedal filling station on Erf 16603, Heidedal Extension 24, Mangaung Local Municipality, Bloemfontein, Free State Province. Bloemfontein.

Butler, E. 2016. Recommended Exemption from further Palaeontological studies: Proposed Construction of the Gunstfontein Switching Station, 132kv Overhead Power Line (Single or Double Circuit) and ancillary infrastructure for the Gunstfontein Wind Farm Near Sutherland, Northern Cape Province. Savannah South Africa. Bloemfontein.

Butler, E. 2016. Palaeontological Impact Assessment of the proposed Galla Hills Quarry on the remainder of the farm Roode Krantz 203, in the Lukhanji Municipality, division of Queenstown, Eastern Cape Province. Bloemfontein.

Butler, E. 2016. Chris Hani District Municipality Cluster 9 water backlog project phases 3a and 3b: Palaeontology inspection at Tsomo WTW. Bloemfontein.

Butler, E. 2016. Palaeontological Impact Assessment of the proposed construction of the 150 MW Noupoort concentrated solar power facility and associated infrastructure on portion 1 and 4 of the farm Carolus Poort 167 and the remainder of Farm 207, near Noupoort, Northern Cape. Savannah South Africa. Bloemfontein.

Butler, E. 2016. Palaeontological Impact Assessment of the proposed upgrading of the main road MR450 (R335) from Motherwell to Addo within the Nelson Mandela Bay Municipality and Sunday's River valley Local Municipality, Eastern Cape Province. Bloemfontein.

Butler, E. 2016. Palaeontological Impact Assessment construction of the proposed Metals Industrial Cluster and associated infrastructure near Kuruman, Northern Cape Province. Savannah South Africa. Bloemfontein.

Butler, E. 2016. Palaeontological Impact Assessment for the proposed construction of up to a 132kv power line and associated infrastructure for the proposed Kalkaar Solar Thermal Power Plant near Kimberley, Free State and Northern Cape Provinces. PGS Heritage. Bloemfontein.

Butler, E. 2016. Palaeontological Impact Assessment of the proposed development of two burrow pits (DR02625 and DR02614) in the Enoch Mgijima Municipality, Chris Hani District, Eastern Cape.

Butler, E. 2016. Ezibeleni waste Buy-Back Centre (near Queenstown), Enoch Mgijima Local Municipality, Eastern Cape. Bloemfontein.

Butler, E. 2016. Palaeontological Impact Assessment for the proposed construction of two 5 Mw Solar Photovoltaic Power Plants on Farm Wildebeestkuil 59 and Farm Leeuwbosch 44, Leeudoringstad, North West Province. Bloemfontein.

Butler, E. 2016. Palaeontological Impact Assessment for the proposed development of four Leeuwberg Wind farms and basic assessments for the associated grid connection near Loeriesfontein, Northern Cape Province. Bloemfontein.

Butler, E. 2016. Palaeontological impact assessment for the proposed Aggeneys south prospecting right project, Northern Cape Province. Bloemfontein.

Butler, E. 2016. Palaeontological impact assessment of the proposed Motuoane Ladysmith Exploration right application, KwaZulu Natal. Bloemfontein.

Butler, E. 2016. Palaeontological impact assessment for the proposed construction of two 5 MW solar photovoltaic power plants on farm Wildebeestkuil 59 and farm Leeuwbosch 44, Leeudoringstad, North West Province. Bloemfontein.

Butler, E. 2016: Palaeontological desktop assessment of the establishment of the proposed residential and mixed-use development on the remainder of portion 7 and portion 898 of the farm Knopjeslaagte 385 Ir, located near Centurion within the Tshwane Metropolitan Municipality of Gauteng Province. Bloemfontein.

Butler, E. 2017. Palaeontological impact assessment for the proposed development of a new cemetery, near Kathu, Gamagara local municipality and John Taolo Gaetsewe district municipality, Northern Cape. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment of The Proposed Development of The New Open Cast Mining Operations on The Remaining Portions Of 6, 7, 8 And 10 Of the Farm Kwaggafontein 8 In the Carolina Magisterial District, Mpumalanga Province. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment for the Proposed Development of a Wastewater Treatment Works at Lanseria, Gauteng Province. Bloemfontein.

Butler, E. 2017. Palaeontological Scoping Report for the Proposed Construction of a Warehouse and Associated Infrastructure at Perseverance in Port Elizabeth, Eastern Cape Province.

Butler, E. 2017. Palaeontological Desktop Assessment for the Proposed Establishment of a Diesel Farm and a Haul Road for the Tshipi Borwa mine Near Hotazel, In the John Taolo Gaetsewe District Municipality in the Northern Cape Province. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment for the Proposed Changes to Operations at the UMK Mine near Hotazel, In the John Taolo Gaetsewe District Municipality in the Northern Cape Province. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment for the Development of the Proposed Ventersburg Project-An Underground Mining Operation near Ventersburg and Henneman, Free State Province. Bloemfontein.

Butler, E. 2017. Palaeontological desktop assessment of the proposed development of a 3000 MW combined cycle gas turbine (CCGT) in Richards Bay, Kwazulu-Natal. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment for the Development of the Proposed Revalidation of the lapsed General Plans for Elliotdale, Mbhashe Local Municipality. Bloemfontein.

Butler, E. 2017. Palaeontological assessment of the proposed development of a 3000 MW Combined Cycle Gas Turbine (CCGT) in Richards Bay, Kwazulu-Natal. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed development of the new open cast mining operations on the remaining portions of 6, 7, 8 and 10 of the farm Kwaggafontein 8 10 in the Albert Luthuli Local Municipality, Gert Sibande District Municipality, Mpumalanga Province. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed mining of the farm Zandvoort 10 in the Albert Luthuli Local Municipality, Gert Sibande District Municipality, Mpumalanga Province. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment for the proposed Lanseria outfall sewer pipeline in Johannesburg, Gauteng Province. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment of the proposed development of open pit mining at Pit 36W (New Pit) and 62E (Dishaba) Amandelbult Mine Complex, Thabazimbi, Limpopo Province. Bloemfontein.

Butler, E. 2017. Palaeontological impact assessment of the proposed development of the sport precinct and associated infrastructure at Merrifield Preparatory school and college, Amathole Municipality, East London. PGS Heritage. Bloemfontein.

Butler, E. 2017. Palaeontological impact assessment of the proposed construction of the Lehae training and fire station, Lenasia, Gauteng Province. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment of the proposed development of the new open cast mining operations of the Impunzi mine in the Mpumalanga Province. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment of the construction of the proposed Viljoenskroon Munic 132 KV line, Vierfontein substation and related projects. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment of the proposed rehabilitation of 5 ownerless asbestos mines. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment of the proposed development of the Lephalale coal and power project, Lephalale, Limpopo Province, Republic of South Africa. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed construction of a 132KV powerline from the Tweespruit distribution substation (in the Mantsopa local municipality) to the Driedorp rural substation (within the Naledi local municipality), Free State province. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment of the proposed development of the new coal-fired power plant and associated infrastructure near Makhado, Limpopo Province. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed construction of a Photovoltaic Solar Power station near Collett substation, Middelburg, Eastern Cape. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment for the proposed township establishment of 2000 residential sites with supporting amenities on a portion of farm 826 in Botshabelo West, Mangaung Metro, Free State Province. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment for the proposed prospecting right project without bulk sampling, in the Koa Valley, Northern Cape Province. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment for the proposed Aroams prospecting right project, without bulk sampling, near Aggeneys, Northern Cape Province. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed Belvior aggregate quarry II on portion 7 of the farm Maidenhead 169, Enoch Mgijima Municipality, division of Queenstown, Eastern Cape. Bloemfontein.

Butler, E. 2017. PIA site visit and report of the proposed Galla Hills Quarry on the remainder of the farm Roode Krantz 203, in the Lukhanji Municipality, division of Queenstown, Eastern Cape Province. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed construction of Tina Falls Hydropower and associated power lines near Cumbu, Mthlontlo Local Municipality, Eastern Cape. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment of the proposed construction of the Mangaung Gariep Water Augmentation Project. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed Belvoir aggregate quarry II on portion 7 of the farm Maidenhead 169, Enoch Mgijima Municipality, division of Queenstown, Eastern Cape. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed construction of the Melkspruit-Rouxville 132KV Power line. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment of the proposed development of a railway siding on a Portion of portion 41 of the farm Rustfontein 109 is, Govan Mbeki local municipality, Gert Sibande district municipality, Mpumalanga Province. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed consolidation of the proposed Ilima Colliery in the Albert Luthuli local municipality, Gert Sibande District Municipality, Mpumalanga Province. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment of the proposed extension of the Kareerand Tailings Storage Facility, associated borrow pits as well as a storm water drainage channel in the Vaal River near Stilfontein, North West Province. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment of the proposed construction of a filling station and associated facilities on the Erf 6279, district municipality of John Taolo Gaetsewe District, Ga-Segonyana Local Municipality Northern Cape. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment of the proposed of the Lephalale Coal and Power Project, Lephalale, Limpopo Province, Republic of South Africa. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment of the proposed Overvaal Trust PV Facility, Buffelspoort, North West Province. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed development of the H_2 Energy Power Station and associated infrastructure on Portions 21; 22 And 23 of the farm Hartebeestspruit in the Thembisile Hani Local Municipality, Nkangala District near Kwamhlanga, Mpumalanga Province. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed upgrade of the Sandriver Canal and Klippan Pump station in Welkom, Free State Province. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed upgrade of the 132kv and 11kv power line into a dual circuit above ground power line feeding into the Urania substation in Welkom, Free State Province. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment of the proposed Swaziland-Mozambique border patrol road and Mozambique barrier structure. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed diamonds alluvial & diamonds general prospecting right application near Christiana on the remaining extent of portion 1 of the farm Kaffraria 314, registration division HO, North West Province. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment for the proposed development of Wastewater Treatment Works on Hartebeesfontein, near Panbult, Mpumalanga. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment for the proposed development of Wastewater Treatment Works on Rustplaas near Piet Retief, Mpumalanga. Bloemfontein.

Butler, E. 2018. Palaeontological Impact Assessment for the Proposed Landfill Site in Luckhoff, Letsemeng Local Municipality, Xhariep District, Free State. Bloemfontein.

Butler, E. 2018. Palaeontological Impact Assessment of the proposed development of the new Mutsho coal-fired power plant and associated infrastructure near Makhado, Limpopo Province. Bloemfontein.

Butler, E. 2018. Palaeontological Impact Assessment of the authorisation and amendment processes for Manangu mine near Delmas, Victor Khanye local municipality, Mpumalanga. Bloemfontein.

Butler, E. 2018. Palaeontological Desktop Assessment for the proposed Mashishing township establishment in Mashishing (Lydenburg), Mpumalanga Province. Bloemfontein.

Butler, E. 2018. Palaeontological Desktop Assessment for the Proposed Mlonzi Estate Development near Lusikisiki, Ngquza Hill Local Municipality, Eastern Cape. Bloemfontein.

Butler, E. 2018. Palaeontological Phase 1 Assessment of the proposed Swaziland-Mozambique border patrol road and Mozambique barrier structure. Bloemfontein.

Butler, E. 2018. Palaeontological Desktop Assessment for the proposed electricity expansion project and Sekgame Switching Station at the Sishen Mine, Northern Cape Province. Bloemfontein.

Butler, E. 2018. Palaeontological field assessment of the proposed construction of the Zonnebloem Switching Station (132/22kV) and two loop-in loop-out power lines (132kV) in the Mpumalanga Province. Bloemfontein.

Butler, E. 2018. Palaeontological Field Assessment for the proposed re-alignment and de-commissioning of the Firham-Platrand 88kv Powerline, near Standerton, Lekwa Local Municipality, Mpumalanga province. Bloemfontein.

Butler, E. 2018. Palaeontological Desktop Assessment of the proposed Villa Rosa development In the Buffalo City Metropolitan Municipality, East London. Bloemfontein.

Butler, E. 2018. Palaeontological field Assessment of the proposed Villa Rosa development In the Buffalo City Metropolitan Municipality, East London. Bloemfontein.

Butler, E. 2018. Palaeontological desktop assessment of the proposed Mookodi – Mahikeng 400kV line, North West Province. Bloemfontein.

Butler, E. 2018. Palaeontological Desktop Assessment for the proposed Thornhill Housing Project, Ndlambe Municipality, Port Alfred, Eastern Cape Province. Bloemfontein.

Butler, E. 2018. Palaeontological desktop assessment of the proposed housing development on portion 237 of farm Hartebeestpoort 328. Bloemfontein.

Butler, E. 2018. Palaeontological desktop assessment of the proposed New Age Chicken layer facility located on holding 75 Endicott near Springs in Gauteng. Bloemfontein.

Butler, E. 2018 Palaeontological Desktop Assessment for the development of the proposed Leslie 1 Mining Project near Leandra, Mpumalanga Province. Bloemfontein.

Butler, E. 2018. Palaeontological field assessment of the proposed development of the Wildealskloof mixed use development near Bloemfontein, Free State Province. Bloemfontein.

Butler, E. 2018. Palaeontological Field Assessment of the proposed Megamor Extension, East London. Bloemfontein

Butler, E. 2018. Palaeontological Impact Assessment of the proposed diamonds Alluvial & Diamonds General Prospecting Right Application near Christiana on the Remaining Extent of Portion 1 of the Farm Kaffraria 314, Registration Division HO, North West Province. Bloemfontein.

Butler, E. 2018. Palaeontological Impact Assessment of the proposed construction of a new 11kV (1.3km) Power Line to supply electricity to a cell tower on farm 215 near Delportshoop in the Northern Cape. Bloemfontein.

Butler, E. 2018. Palaeontological Field Assessment of the proposed construction of a new 22 kV single wood pole structure power line to the proposed MTN tower, near Britstown, Northern Cape Province. Bloemfontein.

Butler, E. 2018. Palaeontological Exemption Letter for the proposed reclamation and reprocessing of the City Deep Dumps in Johannesburg, Gauteng Province. Bloemfontein.

Butler, E. 2018. Palaeontological Exemption letter for the proposed reclamation and reprocessing of the City Deep Dumps and Rooikraal Tailings Facility in Johannesburg, Gauteng Province. Bloemfontein.

Butler, E. 2018. Proposed Kalabasfontein Mine Extension project, near Bethal, Govan Mbeki District Municipality, Mpumalanga. Bloemfontein.

Butler, E. 2018. Palaeontological Desktop Assessment for the development of the proposed Leslie 1 Mining Project near Leandra, Mpumalanga Province. Bloemfontein.

Butler, E. 2018. Palaeontological Desktop Assessment of the proposed Mookodi – Mahikeng 400kV Line, North West Province. Bloemfontein.

Butler, E. 2018. Environmental Impact Assessment (EIA) for the Proposed 325mw Rondekop Wind Energy Facility between Matjiesfontein and Sutherland in the Northern Cape Province.

Butler, E. 2018. Palaeontological Impact Assessment of the proposed construction of the Tooverberg Wind Energy Facility, and associated grid connection near Touws River in the Western Cape Province. Bloemfontein.

Butler, E. 2018. Palaeontological impact assessment of the proposed Kalabasfontein Mining Right Application, near Bethal, Mpumalanga.

Butler, E., 2019. Palaeontological Desktop Assessment of the proposed Westrand Strengthening Project Phase II.

Butler, E., 2019. Palaeontological Field Assessment for the proposed Sirius 3 Photovoltaic Solar Energy Facility near Upington, Northern Cape Province

Butler, E., 2019. Palaeontological Field Assessment for the proposed Sirius 4 Photovoltaic Solar Energy Facility near Upington, Northern Cape Province

Butler, E., 2019. Palaeontological Field Assessment for Heuningspruit PV 1 Solar Energy Facility near Koppies, Ngwathe Local Municipality, Free State Province.

Butler, E., 2019. Palaeontological Field Assessment for the Moeding Solar Grid Connection, North West Province.

Butler, E., 2019. Recommended Exemption from further Palaeontological studies for the Proposed Agricultural Development on Farms 1763, 2372 And 2363, Kakamas South Settlement, Kai! Garib Municipality, Mgcawu District Municipality, Northern Cape Province.

Butler, E., 2019. Recommended Exemption from further Palaeontological studies: of Proposed Agricultural Development, Plot 1178, Kakamas South Settlement, Kai! Garib Municipality

Butler, E., 2019. Palaeontological Desktop Assessment for the Proposed Waste Rock Dump Project at Tshipi Borwa Mine, near Hotazel, Northern Cape Province:

Butler, E., 2019. Palaeontological Exemption Letter for the proposed DMS Upgrade Project at the Sishen Mine, Gamagara Local Municipality, Northern Cape Province

Butler, E., 2019. Palaeontological Desktop Assessment of the proposed Integrated Environmental Authorisation process for the proposed Der Brochen Amendment project, near Groblershoop, Limpopo

Butler, E., 2019. Palaeontological Desktop Assessment of the proposed updated Environmental Management Programme (EMPr) for the Assmang (Pty) Ltd Black Rock Mining Operations, Hotazel, Northern Cape

Butler, E., 2019. Palaeontological Desktop Assessment of the proposed Kriel Power Station Lime Plant Upgrade, Mpumalanga Province

Butler, E., 2019. Palaeontological Impact Assessment for the proposed Kangala Extension Project Near Delmas, Mpumalanga Province.

Butler, E., 2019. Palaeontological Desktop Assessment for the proposed construction of an iron/steel smelter at the Botshabelo Industrial area within the Mangaung Metropolitan Municipality, Free State Province.

Butler, E., 2019. Recommended Exemption from further Palaeontological studies for the proposed agricultural development on farms 1763, 2372 and 2363, Kakamas South settlement, Kai! Garib Municipality, Mgcawu District Municipality, Northern Cape Province.

Butler, E., 2019. Recommended Exemption from further Palaeontological Studies for Proposed formalisation of Gamakor and Noodkamp low-cost Housing Development, Keimoes, Gordonia Rd, Kai !Garib Local Municipality, ZF Mgcawu District Municipality, Northern Cape Province.

Butler, E., 2019. Recommended Exemption from further Palaeontological Studies for proposed formalisation of Blaauwskop Low-Cost Housing Development, Kenhardt Road, Kai !Garib Local Municipality, ZF Mgcawu District Municipality, Northern Cape Province.

Butler, E., 2019. Palaeontological Desktop Assessment of the proposed mining permit application for the removal of diamonds alluvial and diamonds kimberlite near Windsorton on a certain portion of Farm Zoelen's Laagte 158, Registration Division: Barkly Wes, Northern Cape Province.

Butler, E., 2019. Palaeontological Desktop Assessment of the proposed Vedanta Housing Development, Pella Mission 39, Khâi-Ma Local Municipality, Namakwa District Municipality, Northern Cape.

Butler, E., 2019. Palaeontological Desktop Assessment for The Proposed 920 KWP Groenheuwel Solar Plant Near Augrabies, Northern Cape Province

Butler, E., 2019. Palaeontological Desktop Assessment for the establishment of a Super Fines Storage Facility at Amandelbult Mine, Near Thabazimbi, Limpopo Province

Butler, E., 2019. Palaeontological Impact Assessment for the proposed Sace Lifex Project, Near Emalahleni, Mpumalanga Province

Butler, E., 2019. Palaeontological Desktop Assessment for the proposed Rehau Fort Jackson Warehouse Extension, East London

Butler, E., 2019. Palaeontological Desktop Assessment for the proposed Environmental Authorisation Amendment for moving 3 Km of the Merensky-Kameni 132KV Powerline

Butler, E., 2019. Palaeontological Impact Assessment for the proposed Umsobomvu Solar PV Energy Facilities, Northern and Eastern Cape

Butler, E., 2019. Palaeontological Desktop Assessment for six proposed Black Mountain Mining Prospecting Right Applications, without Bulk Sampling, in the Northern Cape.

Butler, E., 2019. Palaeontological field Assessment of the Filling Station (Rietvlei Extension 6) on the Remaining Portion of Portion 1 of the Farm Witkoppies 393JR east of the Rietvleidam Nature Reserve, City of Tshwane, Gauteng

Butler, E., 2019. Palaeontological Desktop Assessment of The Proposed Upgrade of The Vaal Gamagara Regional Water Supply Scheme: Phase 2 And Groundwater Abstraction

Butler, E., 2019. Palaeontological Desktop Assessment of The Expansion of The Jan Kempdorp Cemetery on Portion 43 Of Farm Guldenskat 36-Hn, Northern Cape Province

Butler, E., 2019. Palaeontological Desktop Assessment of the Proposed Residential Development on Portion 42 Of Farm Geldunskat No 36 In Jan Kempdorp, Phokwane Local Municipality, Northern Cape Province

Butler, E., 2019. Palaeontological Impact Assessment of the proposed new Township Development, Lethabo Park, on Remainder of Farm Roodepan No 70, Erf 17725 And Erf 15089, Roodepan Kimberley, Sol Plaatjies Local Municipality, Frances Baard District Municipality, Northern Cape

Butler, E., 2019. Palaeontological Protocol for Finds for the proposed 16m WH Battery Storage System in Steinkopf, Northern Cape Province

Butler, E., 2019. Palaeontological Exemption Letter of the proposed 4.5WH Battery Storage System near Midway-Pofadder, Northern Cape Province

Butler, E., 2019. Palaeontological Exemption Letter of the proposed 2.5ml Process Water Reservoir at Gloria Mine, Black Rock, Hotazel, Northern Cape

Butler, E., 2019. Palaeontological Desktop Assessment for the Establishment of a Super Fines Storage Facility at Gloria Mine, Black Rock Mine Operations, Hotazel, Northern Cape:

Butler, E., 2019. Palaeontological Desktop Assessment for the Proposed New Railway Bridge, and Rail Line Between Hotazel and the Gloria Mine, Northern Cape Province

Butler, E., 2019. Palaeontological Exemption Letter of The Proposed Mixed Use Commercial Development on Portion 17 of Farm Boegoeberg Settlement Number 48, !Kheis Local Municipality in The Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2019. Palaeontological Desktop Assessment of the Proposed Diamond Mining Permit Application Near Kimberley, Sol Plaatjies Municipality, Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2019. Palaeontological Desktop Assessment of the Proposed Diamonds (Alluvial, General & In Kimberlite) Prospecting Right Application near Postmasburg, Registration Division; Hay, Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2019. Palaeontological Desktop Assessment of the proposed diamonds (alluvial, general & in kimberlite) prospecting right application near Kimberley, Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2019. Palaeontological Phase 1 Impact Assessment of the proposed upgrade of the Vaal Gamagara regional water supply scheme: Phase 2 and groundwater abstraction. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2019. Palaeontological Desktop Assessment of the proposed seepage interception drains at Duvha Power Station, Emalahleni Municipality, Mpumalanga Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2019. Palaeontological Desktop Assessment letter for the Proposed PV Solar Facility at the Heineken Sedibeng Brewery, near Vereeniging, Gauteng. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2019. Palaeontological Phase 1 Assessment for the Proposed PV Solar Facility at the Heineken Sedibeng Brewery, near Vereeniging, Gauteng. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2019. Palaeontological field Assessment for the Proposed Upgrade of the Kolomela Mining Operations, Tsantsabane Local Municipality, Siyanda District Municipalitty, Northern Cape Province, Northern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2019. Palaeontological Desktop Assessment of the proposed feldspar prospecting rights and mining application on portion 4 and 5 of the farm Rozynen 104, Kakamas South, Kai! Garib Municipality, Zf Mgcawu District Municipality, Northern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2019. Palaeontological Phase 1 Field Assessment of the proposed Summerpride Residential Development and Associated Infrastructure on Erf 107, Buffalo City Municipality, East London. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2019. Palaeontological Desktop Impact Assessment for the proposed re-commission of the Old Balgay Colliery near Dundee, KwaZulu Natal.

Butler, E., 2019. Palaeontological Phase 1 Impact Assessment for the Proposed Re-Commission of the Old Balgay Colliery near Dundee, KwaZulu Natal. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2019. Palaeontological Desktop Assessment for the Proposed Environmental Authorisation and Amendment Processes for Elandsfontein Colliery. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2019. Palaeontological Impact Assessment and Protocol for Finds of a Proposed New Quarry on Portion 9 (of 6) of the farm Mimosa Glen 885, Bloemfontein, Free State Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2019. Palaeontological Impact Assessment and Protocol for Finds of a proposed development on Portion 9 and 10 of the Farm Mimosa Glen 885, Bloemfontein, Free State Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2019. Palaeontological Exemption Letter for the proposed residential development on the Remainder of Portion 1 of the Farm Strathearn 2154 in the Magisterial District of Bloemfontein, Free State. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2019. Palaeontological Field Assessment for the Proposed Nigel Gas Transmission Pipeline Project in the Nigel Area of the Ekurhuleni Metropolitan Municipality, Gauteng Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2019. Palaeontological Desktop Assessment for five Proposed Black Mountain Mining Prospecting Right Applications, Without Bulk Sampling, in the Northern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E. 2019. Palaeontological Desktop Assessment for the Proposed Environmental Authorisation and an Integrated Water Use Licence Application for the Reclamation of the Marievale Tailings Storage Facilities, Ekurhuleni Metropolitan Municipality - Gauteng Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2019. Palaeontological Impact Assessment for the Proposed Sace Lifex Project, near Emalahleni, Mpumalanga Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2019. Palaeontological Desktop Assessment for the proposed Golfview Colliery near Ermelo, Msukaligwa Local Municipality, Mpumalanga Province

Butler, E., 2019. Palaeontological Desktop Assessment for the Proposed Kangra Maquasa Block C Mining development near Piet Retief, in the Mkhondo Local Municipality within the Gert Sibande District Municipality. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2019. Palaeontological Desktop Assessment for the Proposed Amendment of the Kusipongo Underground and Opencast Coal Mine in Support of an Environmental Authorization and Waste Management License Application. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2019. Palaeontological Exemption Letter of the Proposed Mamatwan Mine Section 24g Rectification Application, near Hotazel, Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Field Assessment for the Proposed Environmental Authorisation and Amendment Processes for Elandsfontein Colliery. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Desktop Assessment for the Proposed Extension of the South African Nuclear Energy Corporation (Necsa) Pipe Storage Facility, Madibeng Local Municipality, North West Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Field Assessment for the Proposed Piggery on Portion 46 of the Farm Brakkefontien 416, Within the Nelson Mandela Bay Municipality, Eastern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological field Assessment for the proposed Rietfontein Housing Project as part of the Rapid Land Release Programme, Gauteng Province Department of Human Settlements, City of Johannesburg Metropolitan Municipality. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Desktop Assessment for the Proposed Choje Wind Farm between Grahamstown and Somerset East, Eastern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Desktop Assessment of the Proposed Prospecting Right Application for the Prospecting of Diamonds (Alluvial, General & In Kimberlite), Combined with A Waste License Application, Registration Division: Gordonia and Kenhardt, Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Impact Assessment for the Proposed Clayville Truck Yard, Ablution Blocks and Wash Bay to be Situated on Portion 55 And 56 Of Erf 1015, Clayville X11, Ekurhuleni Metropolitan Municipality, Gauteng Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Desktop Assessment for the Proposed Hartebeesthoek Residential Development. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Desktop Assessment for the Proposed Mooiplaats Educational Facility, Gauteng Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Impact Assessment for the Proposed Monument Park Student Housing Establishment. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Field Assessment for the Proposed Standerton X10 Residential and Mixed-Use Developments, Lekwa Local Municipality Standerton, Mpumalanga Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Field Assessment for the Rezoning and Subdivision of Portion 6 Of Farm 743, East London. Banzai Environmental (Pty) Ltd, Bloemfontein. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Field Assessment for the Proposed Matla Power Station Reverse Osmosis Plant, Mpumalanga Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Desktop Assessment of the Proposed Prospecting Right Application Without Bulk Sampling for the Prospecting of Diamonds Alluvial near Bloemhof on Portion 3 (Portion 1) of the Farm Boschpan 339, the Remaining Extent of Portion 8 (Portion 1), Portion 9 (Portion 1) and Portion 10 (Portion 1) and Portion 17 (Portion 1) of the Farm Panfontein 270, Registration Division: Ho, North West Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Desktop Assessment of the Proposed Prospecting Right Application Combined with a Waste Licence Application for the Prospecting of Diamonds Alluvial, Diamonds General and Diamonds near Wolmaransstad on the Remaining Extent, Portion 7 and Portion 8 Of Farm Rooibult 152, Registration Division: HO, North West Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Desktop Assessment of the Proposed Prospecting Right Application With Bulk Sampling combined with a Waste Licence Application for the Prospecting of Diamonds Alluvial (Da), Diamonds General (D), Diamonds (Dia) and Diamonds In Kimberlite (Dk) near Prieska On Portion 7, a certain Portion of the Remaining Extent of Portion 9 (Wouter), Portion 11 (De Hoek), Portion 14 (Stofdraai) (Portion of Portion 4), the Remaining Extent of Portion 16 (Portion Of Portion 9) (Wouter) and the Remaining Extent of Portion 18 (Portion of Portion 10) of the Farm Lanyon Vale 376, Registration Division: Hay, Northern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Desktop Assessment of the Proposed Prospecting Right Area and Mining Permit Area near Ritchie on the Remaining Extent of Portion 3 (Anna's Hoop) of the Farm Zandheuvel 144, Registration Division: Kimberley, Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Desktop Assessment of the Proposed Okapi Diamonds (Pty) Ltd Mining Right of Diamonds Alluvial (Da) & Diamonds General (D) Combined with a Waste Licence Application on the Remaining Extent of Portion 9 (Wouter) of the Farm Lanyon Vale 376; Registration Division: Hay; Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Field Assessment of the Proposed Prospecting Right Application for the Prospecting of Diamonds (Alluvial & General) between Douglas and Prieska on Portion 12, Remaining Extent of Portion 29 (Portion of Portion 13) and Portion 31 (Portion of Portion 29) on the Farm Reads Drift 74, Registration Division; Herbert, Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Desktop Assessment for the Proposed Mining Permit Application Combined with a Waste License Application for the Mining of Diamonds (Alluvial) Near Schweitzer-Reneke on a certain Portion of Portion 12 (Ptn of Ptn 7) of the Farm Doornhoek 165, Registration Division: HO, North West Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Desktop Assessment for Black Mountain Koa South Prospecting Right Application, Without Bulk Sampling, in the Northern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Impact Assessment of the Proposed AA Bakery Expansion, Sedibeng District Municipality, Gauteng. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Desktop Assessment for the Proposed Boegoeberg Township Expansion,! Kheis Local Municipality, ZF Mgcawu District Municipality, Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Desktop Assessment for the Proposed Gariep Township Expansion, !Kheis Local Municipality, ZF Mgcawu District Municipality, Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Desktop Assessment for the Proposed Groblershoop Township Expansion, !Kheis Local Municipality, Zf Mgcawu District Municipality, Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Desktop Assessment for the Proposed Grootdrink Township Expansion, !Kheis Local Municipality, ZF Mgcawu District Municipality, Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Exemption Letter for the Proposed Opwag Township Expansion,! Kheis Local Municipality, ZF Mgcawu District Municipality, Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Exemption Letter for the Proposed Topline Township Expansion, !Kheis Local Municipality, ZF Mgcawu District Municipality, Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Desktop Assessment for the Proposed Wegdraai Township Expansion, !Kheis Local Municipality, Zf Mgcawu District Municipality, Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological field Assessment for the Proposed Establishment of an Emulsion Plant on Erf 1559, Hardustria, Harrismith, Free State. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler. 2020. Part 2 Environmental Authorisation (EA) Amendment Process for the Kudusberg Wind Energy Facility (WEF) near Sutherland, Western and Northern Cape Provinces- Palaeontological Impact Assessment. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Desktop Assessment Proposed for the Construction and Operation of the Battery Energy Storage System (BESS) and Associated Infrastructure and inclusion of Additional Listed Activities for the Authorised Droogfontein 3 Solar Photovoltaic (PV) Energy Facility Located near Kimberley in the Sol Plaatje Local Municipality, Francis Baard District Municipality, in the Northern Cape Province of South Africa. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Impact Assessment for the Proposed Development of a Cluster of Renewable Energy Facilities between Somerset East and Grahamstown in the Eastern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for the Proposed Amaoti Secondary School, Pinetown, eThekwini Metropolitan Municipality KwaZulu Natal. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Impact Assessment for the Proposed an Inland Diesel Depot, Transportation Pipeline and Associated Infrastructure on Portion 5 of the Farm Franshoek No. 1861, Swinburne, Free State Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Impact Assessment for the proposed erosion control gabion installation at Alpine Heath Resort on the farm Akkerman No 5679 in the Bergville district Kwazulu-Natal. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Impact Assessment for the proposed Doornkloof Residential development on portion 712 of the farm Doornkloof 391 Jr, City of Tshwane Metropolitan Municipality in Gauteng, South Africa. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for the Proposed Expansion of the Square *Kilometre* Array (SKA) Meerkat Project, on the Farms Mey's Dam RE/68, Brak Puts RE /66, Swartfontein RE /496 & Swartfontein 2/496, in the Kareeberg Local Municipality, Pixley Ka Seme District Municipality, and the Farms Los Berg 1/73 & Groot Paardekloof RE /74, in the Karoo Hoogland Local Municipality, Namakwa District Municipality, Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for De Beers Consolidated Mines: Proposed Drilling on Portion 6 of Scholtzfontein 165 and Farm Arnotsdale 175, Herbert District in the Northern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for De Beers Consolidated Mines: Proposed Drilling on the Remaining Extent of Biessie Laagte 96, and Portion 2 and 6 of Aasvogel Pan 141, Near Hopetown in the Northern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for De Beers Consolidated Mines: Proposed Drilling in the North West Province: on Portions 7 (RE) (of Portion 3), 11, 12 (of Portion 3), 34 (of Portion

30), 35 (of Portion 7) of the Farm Holfontein 147 IO and Portions 1, 2 and the RE) of the Farm Kareeboschbult 76 Ip and Portions 1, 2, 4, 5, 6, (of Portion 3), 7 (of Portion 3), 13, 14, and the Re of the farm Oppaslaagte 100IP and portions 25 (of Portion 24) and 30 of the farm Slypsteen 102 IP. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for the Proposed Expansion of the Cavalier Abattoir on farm Oog Van Boekenhoutskloof of Tweefontein 288 JR, near Cullinan, City of Tshwane Metropolitan Municipality, Gauteng. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Impact Assessment for the Proposed Doornkloof Residential Development on Portion 712 of the Farm Doornkloof 391 JR, City of Tshwane Metropolitan Municipality in Gauteng, South Africa. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for the proposed High Density Social Housing Development on part of the Remainder of Portion 171 and part of Portion 306 of the farm Derdepoort 326 JR, City of Tshwane. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for the proposed Red Rock Mountain Farm activities on Portions 2, 3 and 11 of the Farm Buffelskloof 22, near Calitzdorp in the Western Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for the proposed Mixed-use Development on a Part of Remainder of Portion 171 and Portion 306 of the farm Derdepoort 326 JR, City of Tshwane. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Impact Assessment for the Proposed Realignment of the D 2809 Provincial Road as well as the Mining Right Application for the Glisa and Paardeplaats Sections of the NBC Colliery (NBC) near Belfast (eMakhazeni), eMakhazeni Local Municipality, Nkangala District Municipality, Mpumalanga Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for the proposed construction of Whittlesea Cemetery within Enoch Mgijima Local Municipality area, Eastern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Impact Assessment for the establishment of a mixed-use development on Portion 0 the of Erf 700, Despatch, Nelson Mandela Bay Municipality, Eastern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for the proposed East Orchards Poultry Farm, Delmas/Botleng Transitional Local Council, Mpumalanga. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Impact Assessment for the proposed East Orchards Poultry Farm, Delmas/Botleng Transitional Local Council, Mpumalanga. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment to assess the proposed Gariep Road upgrade near Groblershoop, Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Impact Assessment for the Ngwedi Solar Plant which forms part of the authorised Paleso Solar Powerplant near Viljoenskroon in the Free State. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Impact Assessment for the Noko Solar Power Plant and power line which forms part of the authorised Paleso Solar Powerplant near Orkney in the North West. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Impact Assessment for the Proposed Power Line as part of the Paleso Solar Power Plant near Viljoenskroon in the Free State. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Impact Assessment for the Thakadu Solar Plant which forms part of the authorised Paleso Solar Powerplant near Viljoenskroon in the Free State. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Desktop Assessment for the proposed Farming Expansions on Portions 50 of the Farm Rooipoort 555 JR, Portion 34 of the Farm Rooipoort 555 JR, Portions 20 and 49 of the Farm Rooipoort 555 JR and Portion 0(RE) of the Farm Oudou Boerdery 626 JR, Tshwane Metropolitan Municipality, Gauteng Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Desktop Assessment for the proposed Saselamani CBD on the Remainder of Tshikundu's Location 262 MT, and the Remainder of Portion 1 of Tshikundu's Location 262 MT, Collins Chabane Local Municipality, Limpopo Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Impact Assessment for the proposed expansions of the existing Molare Piggery infrastructure and related activities on Portion 0(Re) of the farm Arendsfontein 464 JS, Portion 0(Re) of the farm Wanhoop 443 JS, Portion 0(Re) of the farm Eikeboom 476 JS and Portions 2 & 7 of the farm Klipbank 467 JS within the jurisdiction of the Steve Tshwete Local Municipality, Mpumalanga Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for the proposed Nchwaning Rail Balloon Turn Outs at Black Rock Mine Operations (BRMO) near Hotazel in the John Taolo Gaetsewe District Municipality in the Northern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for the proposed Black Rock Mining Operations (BRMO) new rail loop and stacker reclaimer Project at Gloria Mine near Hotazel in the Northern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Desktop Assessment for the proposed Nchwaning Rail Balloon Turn Outs at Black Rock Mine Operations (BRMO) near Hotazel in the John Taolo Gaetsewe District Municipality in the Northern Cape.

Butler, E., 2021. Palaeontological Impact Assessment for the proposed utilization of one Borrow Pit for the planned Clarkebury DR08034 Road Upgrade, Engcobo Local Municipality, Eastern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for the proposed Kappies Kareeboom Prospecting Project on Portion 1 and the Remainder of the farm Kappies Kareeboom 540, the

Remainder of Farm 544, Portion 5 of farm 534 and Portion 1 of the farm Putsfontein 616, ZF Mgcawu District Municipality, Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for the proposed Kameel Fontein Prospecting Project on the Remainder of the farm Kameel Fontein 490, a portion of the farm Strydfontein 614 and the farm Soetfontein 606, ZF Mgcawu District Municipality, Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for the proposed Lewis Prospecting Project on Portions of the Farms Lewis 535, Spence 537, Wright 538, Symthe 566, Bredenkamp 567, Brooks 568, Beaumont 569 and Murray 570, John Taolo Gaetsewe District Municipality in the Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for the Construction of the Ganspan Pering 132kV Powerline, Phokwane Local Municipality, Frances Baard District Municipality in the Northern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for the Longlands Prospecting Project on a Portion of the farm Longlands 350, Frances Baard District Municipality, Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Impact Assessment for the proposed development of 177 new units in the northern section of Mpongo Park in the Eastern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for the proposed Qhumanco Irrigation Project, Chris Hani District Municipality Eastern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for the proposed Raphuti Settlement Project on Portions of the Farm Weikrans 539KQ in the Waterberg District Municipality of the Limpopo Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Impact Assessment for the Senqu Rural Project, Joe Gqabi District Municipality, Senqu Local Municipality, in the Eastern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Impact Assessment for the proposed new Township development on portion of the farm Klipfontein 716 and farm Ceres 626 in Bloemfontein, Mangaung Metropolitan Municipality, Free State. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for the ECDOT Borrow Pits and WULA near Sterkspruit, Joe Gqabi District Municipality in the Eastern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for the proposed SANRAL Stone Crescent Embankment Stabilisation Works along the N2 on the farm Zyfer Fonteyn 253 (Portion 0, 11 and 12RE) and Palmiet Rivier 305 (Portion 34, 36) near Grahamstown in the Eastern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Impact Assessment for the Klein Rooipoort Trust Citrus Development, in the Eastern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Impact Assessment for the proposed Victoria West water augmentation project in the Northern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for the proposed Campbell Sewer, Internal Reticulation, Outfall Sewer Line and Oxidation Ponds, located on ERF 1, Siyancuma Local Municipality in the Northern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for the proposed Development and Upgrades within the Great Fish River Nature Reserve, Eastern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for proposed Parsons Power Park a portion of Erf 1. within the Nelson Mandela Bay Municipality in the Eastern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for the proposed expansion of the farming operations on part of portions 7 and 8 of farm Boerboonkraal 353 in the Greater Tubatse Local Municipality of Sekhukhune District, Limpopo Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment to assess the proposed low-level pedestrian bridge, in Heilbron, Free State. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment to assess the proposed township developments in Hertzogville, Malebogo, in Heilbron, Free State. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Impact Assessment for the proposed construction of Malangazana Bridge on Farm No.64 Nkwenkwana, Engcobo Local Municipality, Eastern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Impact Assessment to assess the proposed Construction of Middelburg Integrated Transport Control Centre on Portion 14 of Farm 81 Division of Middelburg, Chris Hani District Municipality in the Eastern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for the Witteberge Sand Mine on the remainder of farm Elandskrag Plaas 269 located in the Magisterial District of Laingsburg and Central Karoo District Municipality in the Western Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Impact Assessment (PIA) to assess the proposed Agrizone 2, Dube Trade Port in KwaZulu Natal Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment assessing the proposed Prospecting Right application without bulk sampling for the prospecting of Chrome ore and platinum group metals on the Remaining Extent of the farm Doornspruit 106, Registration Division: HO; North West Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2022. Palaeontological Desktop Assessment for the proposed Ennerdale Extension 2 Township Establishment on the Undeveloped Part of Portion 134 of the Farm Roodepoort 302IQ, City of Johannesburg Metropolitan Municipality, Gauteng Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2022. Palaeontological Desktop Assessment for the Construction of the ESKOM Mesong 400kV Loop-In Loop-Out Project, Ekurhuleni Municipality, Gauteng Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2022. Palaeontological Desktop Assessment for the Proposed Vinci Prospecting Right Application on the Remainder of the Farm Vinci 580, ZF Mgcawu District Municipality, in the Northern Cape Province, Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2022. Palaeontological Desktop Assessment for the proposed Farm 431 Mining Right Application (MRA), near Postmasburg, ZF Mgcawu District Municipality, in the Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2022. Palaeontological Impact Assessment for the Leeuw Braakfontein Colliery Expansion Project (LBC) in the Amajuba District Municipality, KwaZulu-Natal. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2022. Palaeontological Desktop Assessment for the proposed reclamation of the 5L23 TSF in Ekurhuleni, Gauteng Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2022. Palaeontological Desktop Assessment for the Proposed Mogalakwena Mine Infrastructure Expansion (near Mokopane in the Mogalakwena Local Municipality, Limpopo Province). Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2022. Palaeontological Desktop Assessment for the proposed 10km Cuprum to Kronos Double Circuit 132kV Line and Associated Infrastructure in Copperton in the Northern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2022. Palaeontological Impact Assessment for the proposed Hoekplaas WEF near Victoria West in the Northern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2022. Palaeontological Desktop Assessment (PDA) assessing the proposed Prospecting Right Application without bulk sampling for the Prospecting of Diamonds Alluvial (DA), Diamonds General (D), Diamonds in Kimberlite (DK) & Diamonds (DIA) on the Remaining Extent of the Farm Goede Hoop 547, Remaining Extent of the Farm 548, Remaining Extent of Portion 2 and Portion 3 of the Farm Skeyfontein 536, Registration Division: Hay, Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2022. Palaeontological Impact Assessment for the proposed extension of Duine Weg Road between Pellsrus and Marina Martinique as well as a Water Use Authorisation (WUA) for the project. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2022. Proposed Mimosa Residential Development and Associated Infrastructure on Fairview Erven, in Gqeberha (Port Elizabeth), Nelson Mandela Bay Metropolitan Municipality, Eastern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2022. Palaeontological Impact Assessment for the Witteberge Sand Mine on the remainder of farm Elandskrag Plaas 269 located in the Magisterial District of Laingsburg and Central Karoo District Municipality in the Western Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2022. Palaeontological Desktop Assessment to assess the Palaeontology for the Somkhele Anthracite Mine's Prospecting Right Application, on the Remainder of the Farm Reserve no 3 No

15822 within the uMkhanyakude District Municipality and the Mtubatuba Local Municipality, KwaZulu Natal. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler. E. 2022. Palaeontological Desktop Assessment to assess the proposed Altina 120 MW Solar Photovoltaic (PV) Project near Orkney in the Free State,

Butler. E. 2022. Palaeontological Desktop Assessment to assess the proposed SERE Solar Photovoltaic Plant Phase 1A and associated infrastructure in the Western Cape Province.

Butler. E. 2022. Palaeontological Impact Assessment for the proposed development of a 10 MW Solar Photovoltaic (PV) Plant and associated grid connection infrastructure on Portion 9 of the Farm Little Chelsea 10, Eastern Cape Province.

Butler. E. 2022. Palaeontological Desktop Assessment to assess the proposed Dominion 1 Solar Park, located on the Remaining Extent of Portion 18 of Farm 425, near Klerksdorp within the North-West Province.

Butler. E., 2022. Palaeontological Desktop Assessment to assess the proposed Dominion 2 Solar Park, located on the Remaining Extent of Portion 8 of Farm 425, near Klerksdorp within the North-West Province.

Butler. E., 2022.Palaeontological Desktop Assessment to assess the proposed Dominion 3 Solar Park, located on the Remaining Extent of Portion 11 of Farm 425, and Remaining Extent of Portion 31 of Farm 425 near Klerksdorp within the North-West Province

Butler. E., 2022. Palaeontological Impact Assessment to assess the Delta Solar Power Plant on the remaining extent of the farm Kareefontein No. 340, Dr Ruth Segomotsi Mompati District Municipality, Lekwa-Teemane Local Municipality near Bloemhof in the North West Province

Butler. E., 2022. Palaeontological Impact Assessment to assess the Sonneblom Solar Power Plant (SPP) on Portion 1 of the farm Blydschap No. 504 within the Mangaung Metropolitan Municipality, southeast of Bloemfontein in the Free State.

Butler. E., 2022. Palaeontological Impact Assessment for the proposed Naos Solar PV One Project near Viljoenskroon in the Free State.

Butler. E., 2022.Palaeontological Impact Assessment for the proposed Naos Solar PV Two Project near Viljoenskroon in the Free State.

Butler. E., 2022.Palaeontological Impact Assessment for the proposed Naos Solar PV Two Project near Viljoenskroon in the Free State

Butler. E., 2022.Palaeontological Impact Assessment for the Ngwedi Solar Power near Viljoenskroon in the Free State.

Butler. E., 2022. Palaeontological Impact Assessment for the Noko Solar Power Plant and power line near Orkney in the North West.

Butler. E., 2022. Palaeontological Impact Assessment for the Proposed Power Line as part of the Paleso Solar Power Plant near Viljoenskroon in the Free State

Butler. E., 2022. Palaeontological Impact Assessment for the Thakadu Solar Plant which near Viljoenskroon in the Free State

Butler. E., 2022. Palaeontological Impact Assessment of the Kentani, Braklaagte, Klipfontein, Klipfontein 2, Leliehoek and Sonoblomo PV Facilities located near Dealsville in the Free State Province

Butler. E., 2022. Palaeontological Impact Assessment for the proposed Harvard 1 Solar Photovoltaic (PV) facility on Portion 5 of Farm Spes Bona no 2355, Mangaung Metropolitan Municipality in the Free State.

Butler. E., 2022. Palaeontological Impact Assessment for proposed Harvard 2 Solar Photovoltaic (PV) facility on Portion 8 of Farm Spes Bona No 2355, Mangaung Metropolitan Municipality in the Free State.

Butler. E., 2022. Palaeontological Impact Assessment for the proposed Doornrivier Solar 1, southwest of Matjhabeng (formerly Virginia) in the Free State

Butler. E., 2022. Palaeontological Desktop Assessment for the proposed Leeuwbosch PV solar photovoltaic (PV) plant and associated infrastructure on Portion 37 of the Farm Leeuwbosch No. 44 near Leeudoringstad within the Maquassi Hills Local Municipality in the Dr Kenneth Kaunda District Municipality in the North West Province.

Butler. E., 2023. Palaeontological Impact Assessment to assess the Carmel Solar 1 Photovoltaic Solar Energy Facility, near Carletonville, Gauteng Province.

Butler. E., 2023. Palaeontological Impact Assessment to assess the Carmel Solar 2 Photovoltaic Solar Energy Facility, near Carletonville, Gauteng Province

Butler. E., 2023. Palaeontological Impact Assessment to assess the Carmel Solar 3 Photovoltaic Solar Energy Facility, near Carletonville, Gauteng Province.

Butler. E., 2023. Palaeontological Desktop Assessment for the proposed Droogfontein 6 Solar Energy Facility and Battery Energy Storage System, near Kimberley, Northern Cape Province

Butler. E., 2023. Palaeontological Desktop Assessment to assess the Icarus Solar Power Plant near Klerksdorp, North West Province.

Butler. E., 2023. Palaeontological Desktop Assessment to assess the proposed Virgo Solar Power Plant near Kathu in the Northern Cape Province

Butler. E., 2023. Palaeontological Desktop Assessment to assess the proposed Libra Solar Power Plant near Kathu in the Northern Cape Province

Butler. E., 2023. Palaeontological Impact Assessment to assess the proposed Khwezi Solar Grid Infrastructure near Excelsior, in the Free State Province

Butler. E., 2023. Palaeontological Impact Assessment to assess the proposed Khwezi Solar Power Plant near Excelsior, in the Free State Province

Butler. E., 2023. Palaeontological Impact Assessment to assess the proposed Lengana Solar Grid Infrastructure near Excelsior, in the Free State Province

Butler. E., 2023. Palaeontological Impact Assessment to assess the proposed Lengana Solar Power Plant near Excelsior, in the Free State Province

Butler. E., 2023. Palaeontological Desktop Assessment for Luckhoff Solar 1 Photovoltaic Solar Energy Facility (SEF) and associated infrastructure near Luckhoff in the Free State