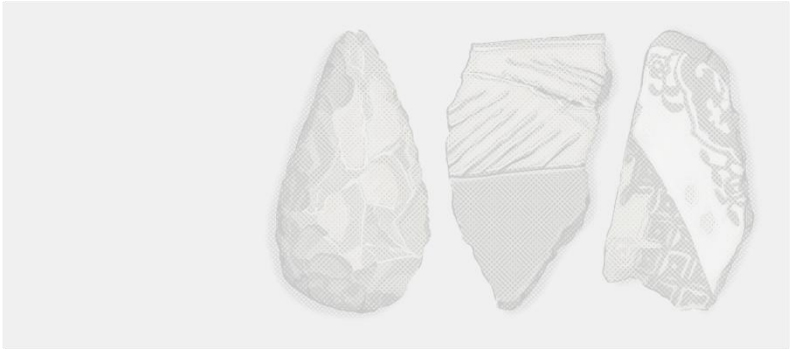


PHASE 1 HIA FOR BULK WATER SUPPLY, KAKAMAS, NORTHERN CAPE

PHASE 1 HERITAGE IMPACT ASSESSMENT FOR THE PROPOSED BULK WATER SUPPLY, KAKAMAS, KAI !GARIB LOCAL MUNICIPALITY, ZF MGCAWU DISTRICT MUNICIPALITY, NORTHERN CAPE PROVINCE.

PREPARED FOR:

ENVIROAFRICA CC

PREPARED BY:

JAN ENGELBRECHT, SKY-LEE FAIRHURST-BOOYSE

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UBIQUE HERITAGE

26 MAY 2026

VERSION 02

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Declaration of Independence:

UBIQUE Heritage 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: 2026-05-26**

J.A.C. Engelbrecht, H. Fivaz & S. Fairhurst-Booyse
UBIQUE Heritage Specialists (Pty) Ltd

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SUMMARY OF SPECIALIST EXPERTISE

SKY-LEE FAIRHURST-BOOYSE

ARCHAEOLOGIST

Sky-Lee Fairhurst-Booyse has been part of UBIQUE Heritage 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, focusing 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 12 years, she has gained considerable excavation and survey experience and has 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 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 the conservation of glass and ceramics. Ms Fivaz was awarded her MA in Archaeology (with distinction) by the University of South Africa (UNISA) in 2021, focusing on historical and industrial archaeology. She is a professional member of the Association of South African Archaeologists and has worked on numerous archaeological excavations and surveying projects over the past twenty 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 fifteen years of experience in heritage management. Mr Engelbrecht established Ubique Heritage in 2012. He is currently studying for his MA Degree in Archaeology.



EXECUTIVE SUMMARY

Project description

UBIQUE Heritage was appointed as independent heritage specialists under Section 38 of the NHRA to conduct a cultural heritage assessment to determine the impact of the proposed Kakamas Bulk Water Supply, Kai !Garib Local Municipality, ZF Mgcawu District Municipality, Northern Cape Province.

Findings and Impact on Heritage Resources

UBIQUE Heritage assessed the development footprint from the **13th to the 15th April 2026.**

An old stone-walled house (KNS/162/003) constructed from granite stones was identified. The structure consists of a single dwelling and is associated with agricultural use. It is located in close proximity to an existing farmhouse. This resource is given a 'General' Protection B (Field Rating IVB) and considered to be of medium significance. Impact would be negative. This resource is given a 'General' Protection B (Field Rating IVB) and considered to be of medium significance. **Any impact would be negative. The impact would be NEGATIVE MEDIUM before mitigation, NEGATIVE LOW after mitigation during the construction and operational phases.**

A railway bridge (KSS/001) is present near the Supply Line to WTP and forms part of the existing railway network. The bridge is older than 60 years. A new pump station is proposed to be constructed adjacent to the bridge, located just to the west of the existing structure. This resource is given a 'Local' Protection B (Field Rating IIIB) and considered to be of medium significance. **Any impact would be negative. The impact would be NEGATIVE HIGH before mitigation, NEGATIVE LOW after mitigation, during the construction and operational phases.**

Four cemeteries were identified (KSS/176/004, KSS/399/19/007, KSS/1500/F/19/006, KSS/1181/008). All graves are considered to be of high significance and should be mitigated. These cemeteries are given a 'Local Grade Protection' (Field Rating IIIA) and are of local importance and worthy of conservation. The two cemeteries at KSS/176/004, KSS/399/19/00) do not fall within the proposed development BWS trajectories, so neither will be impacted. **However unlikely, if an impact occurs, the impact would be NEGATIVE HIGH before mitigation, NEGATIVE LOW after mitigation during the construction phase, and NEGATIVE MEDIUM before and NEGATIVE LOW after mitigation during the operational phase.** While the two cemeteries at KSS/1500/F/19/006, KSS/1181/008 will likely be impacted. **The impact would be NEGATIVE HIGH before mitigation, NEGATIVE LOW after mitigation during the construction phase, and NEGATIVE MEDIUM before and NEGATIVE LOW after mitigation during the operational phase.**

In addition, a closed and abandoned veldspar mine was identified. The mine is likely not older than 60 years. It has since been repurposed and is currently used as a venue theatre. This resource is noted for record purposes only; however, it may hold future significance in terms of industrial and mining archaeology. **It is outside the proposed Kakamas BWS Augrabies Alternative trajectory footprint and will not be impacted.**

The development footprint is underlain by a diverse assemblage of geological units, ranging from ancient Proterozoic metamorphic basement rocks to recent Quaternary surficial deposits, spanning more than 1,000 million years and reflecting the complex tectonic and depositional history of the Northern Cape Province. The study area is underlain by the Nachap Gneiss, undifferentiated metamorphic rocks, and Keimoes Suite granite of the Namaqua Metamorphic Complex, overlain by Quaternary alluvium associated with the Orange River and its tributaries, and the Gordonia Formation of the Kalahari Group (Partridge et al., 2006). According to the SAHRIS Palaeosensitivity Map, the Namaqua Metamorphic Complex is classified as having Zero sensitivity (grey), while the Quaternary alluvium and Gordonia Formation have Moderate sensitivity (green) (Almond et al., 2013). In alignment with these sensitivities, the Department of Forestry, Fisheries and the Environment (DFFE) Screening Tool identifies the broader study area as falling within a Medium (orange) palaeontological sensitivity zone.

Based on desktop research, it is concluded that fossil heritage of scientific and conservational interest in the study area is rare. A Medium Paleontological Significance has been allocated for the construction phase of the development pre-mitigation (as stated on the SAHRIS PaleoMap) and a low significance post-mitigation. The construction phase will be the only development phase impacting Paleontological Heritage, and no significant impacts are expected to impact the Decommissioning phase. As the No-Go Alternative considers the option of 'doing nothing' and maintaining the status quo, it will have a Neutral impact on the Paleontological Heritage of the development. The cumulative impacts of the development are considered Low pre- and post-mitigation and fall within acceptable limits for the project. **It is therefore considered that the proposed development will not lead to damaging impacts on the Paleontological resources of the area.** The construction of the development may thus be permitted in its whole extent, as the development footprint is not considered sensitive in terms of Paleontological resources. It is consequently recommended that no further Paleontological heritage studies, ground truthing, and/or specialist mitigation are required pending the discovery of new fossils (Butler 2026, Appendix B).

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. ARCHAEOLOGICAL AND CULTURAL HERITAGE

SITE	FEATURE	RECOMMENDATION	IMPACT
MEDIUM SIGNIFICANCE (FIELD RATING IVB)			
KNS/162/003	An old stone-walled house (older than 60 years)	• A 15 x 20 m buffer zone • Alternatively, a destruction permit can be obtained from NBKB (Northern Cape Provincial Heritage Authority).	Negative Medium Impact Before Mitigation Negative Low Impact After Mitigation
MEDIUM SIGNIFICANCE (FIELD RATING IIIB)			
KSS/001	A railroad bridge older than 60 years	• A 10 m buffer zone • The resource is worthy of conservation, and destruction is not recommended.	Negative High Impact Before Mitigation Negative Low Impact After Mitigation
HIGH SIGNIFICANCE (FIELD RATING IIIA)			
KSS/176/004	Cemetery	• A 50 m precautionary buffer zone • The grave site should be demarcated and avoided by personnel and equipment. Gravesites should remain accessible to all descendants and family members during all phases of the project. • Grave relocation can be undertaken by accredited Grave Relocation Specialists with permits from SAHRA (BGG).	Negative High Impact Before Mitigation Negative Low Impact After Mitigation
KSS/399/19/007	Cemetery	• A 50 m precautionary buffer zone • The grave site should be demarcated and avoided by personnel and equipment. Gravesites should remain accessible to all descendants and family members during all phases of the project. • Grave relocation can be undertaken by accredited Grave Relocation Specialists with permits from SAHRA (BGG).	Negative High Impact Before Mitigation Negative Low Impact After Mitigation
KSS/1500/F/19/006	Cemetery	• A 15 x 30 m buffer zone • The grave site should be demarcated and avoided by personnel and equipment. Gravesites should remain accessible to all descendants and family members during all phases of the project. • Grave relocation can be undertaken by accredited Grave Relocation Specialists with permits from SAHRA (BGG).	Negative High Impact Before Mitigation Negative Low Impact After Mitigation
KSS/1181/008	Cemetery	• A 20 x 25 m buffer zone • The grave site should be demarcated and avoided by personnel and equipment. Gravesites should remain accessible to all descendants and family members during all phases of the project. • Grave relocation can be undertaken by accredited Grave Relocation Specialists with permits from SAHRA (BGG).	Negative High Impact Before Mitigation Negative Low Impact After Mitigation

2. **PALAEONTOLOGICAL HERITAGE:**

As the development footprint is not considered sensitive regarding palaeontological resources, the development construction may thus be approved in its entirety.

- However, if fossil remains are uncovered during any phase of construction, whether exposed on the surface or revealed through excavation, the Environmental Control Officer (ECO) or the responsible site manager must immediately contact SAHRA. All fossil discoveries must be safeguarded and reported to the South African Heritage Resources Agency (SAHRA) at 111 Harrington Street, Cape Town, PO Box 4637, Cape Town 8000, South Africa; Tel: 021 462 4502; Fax: 021 462 4509; Web: www.sahra.org.za. This ensures that a qualified palaeontologist can undertake recording and collection.

- 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 Paleontological impact studies proposed by SAHRA (2012). It is therefore recommended that no further Paleontological heritage studies, ground-truthing, or specialist mitigation be required pending the discovery of new fossils.

- **These recommendations should be included in the EMPr for the Bulk Water Supply in the Northern Cape Province** (Appendix B).

3. Although every effort has been made to identify sites of cultural importance during the investigation of study areas, it is 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 activity, 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 Specialists and its personnel will not be held liable for such oversights or costs incurred due to such oversights.

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ABBREVIATIONS

AIA:	Archaeological Impact Assessment
ASAPA:	Association of South African Professional Archaeologists
CRM:	Cultural Resource Management
EIA:	Early Iron Age
EMP:	Environmental Management Plan
ESA:	Earlier Stone Age
GPS:	Global Positioning System
HIA:	Heritage Impact Assessment
HWC:	Heritage Western Cape
IA:	Iron Age
IMP:	Integrated Management Plan
LSA:	Later Stone Age
MIA:	Middle Iron Age
MSA:	Middle Stone Age
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

UBIQUE Heritage was appointed as independent heritage specialists following Section 38 of the NHRA to conduct a cultural heritage assessment to determine the impact of the proposed Kakamas Bulk Water Supply, Kai !Garib Local Municipality, ZF Mgcawu District Municipality, Northern Cape Province.

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

South Africa's heritage resources are rich and widely diverse, encompassing sites from all periods of human history. Resources such as buildings, archaeological artefacts, landscapes, and living heritage may be tangible or intangible. 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.

This heritage impact assessment report presents the results of this investigation. 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 client's description of the proposed project 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 need to be repeated for 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 site's content and context.

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, as 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 area and the proposed development site's heritage background. This entailed scoping and scanning historical texts and records, as well as previous heritage studies and research in 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 by studying archaeological, historical, and grave sites.

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).
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 the anticipated direct, indirect, and cumulative impacts of the proposed project's development on them 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 relevant legislation, the code of ethics, and the Association of South African Professional Archaeologists (ASAPA) guidelines. The report aims to assist the developer in responsibly managing the documented heritage resources 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 was appointed as independent heritage specialists following Section 38 of the NHRA to determine the heritage impact of the proposed Kakamas Bulk Water Supply, Kai !Garib Local Municipality, ZF Mgcawu District Municipality, Northern Cape Province.

The proposed development entails the establishment of a new river pump station, rising main, water treatment facility, bulk storage reservoirs, and a comprehensive bulk pipeline network to supply Kakamas town and adjacent settlements.

The Kakamas Bulk Potable Water Supply Scheme is situated in the Kai !Garib Municipality, Northern Cape Province, South Africa. The project area is located next to the Orange River in the central-northern part of the province. Kakamas town serves as the principal service centre, with the surrounding service area comprising five adjacent villages: Augrabies, Alheit, Marchand, Lutzburg, and Cillie.

The proposed development comprises the following key infrastructure components distributed across the municipal area:

- Water Abstraction & Treatment Facilities:
    - New river pump station on the Orange River at Kakamas,
    - Rising main from pump station to Water Treatment Plant (WTP),
    - New Water Treatment Plant with capacity ranging from 5.5 to 10.5 ML/day (depending on option selected),
    - Bulk storage reservoirs (including a 7 ML high-level reservoir near Augrabies and potential 20 ML reservoir at Rhenosterkop).
- Bulk Pipeline Network:
    - Connector pipelines between WTP and reservoirs in Kakamas town,
    - Bulk supply pipelines extending to Augrabies, Marchand, Alheit, Lutzburg, and Cillie villages,
    - Extended pipeline routes to commercial farm areas, including Rooipad, Schroder (north of Orange River), Kakamas East, and Kakamas South (depending on the option selected).

The overall population to be served ranges from around 11,202 individuals (Kakamas town exclusively) to 45,689 individuals (including towns, villages, and commercial farming regions), plus an additional 4,000 students at schools within the service area. The region undergoes significant

population growth of 1.46% annually, principally fuelled by the burgeoning irrigated agriculture industry, encompassing export grapes, raisins, wine, and citrus production.

3.1 Technical Information

PROJECT DESCRIPTION	
Project name	Proposed Kakamas BWS, Northern Cape
Description	PHASE 1 Heritage Impact Assessment for the proposed Kakamas Bulk Water Supply, Kai !Garib Local Municipality, ZF Mgcawu District Municipality, Northern Cape Province.
DEVELOPER	
BVi Engineering Consultants	
Development type	Services=Water Services
PROPERTY DETAILS	
Province	Northern Cape
District municipality	ZF Mgcawu District Municipality
Local municipality	Kai !Garib Local Municipality
Topo-cadastral map	1: 50 000 2820DC
Farm name	Various portions of Kakamas South Settlement, Kakamas North Settlement, Farm 19, Orange Fall 16, Vorentoe 377, Nels Hoek 17, Reingeluk 430, Padrooi 431.
Closest town	Kakamas, Alheit, Lutzburg and Augrabies
GPS Coordinates	28°46'16.07"S 20°36'13.58"E
PROPERTY SIZE	N/A
DEVELOPMENT FOOTPRINT SIZE	Approximately 200 ha
ASSESSED AREA	Approximately 200 ha
LAND USE	
Previous	Municipal/Agriculture/Servitudes
Current	Municipal/Agriculture/Servitudes
Rezoning required	No
Subdivision 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.	No

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

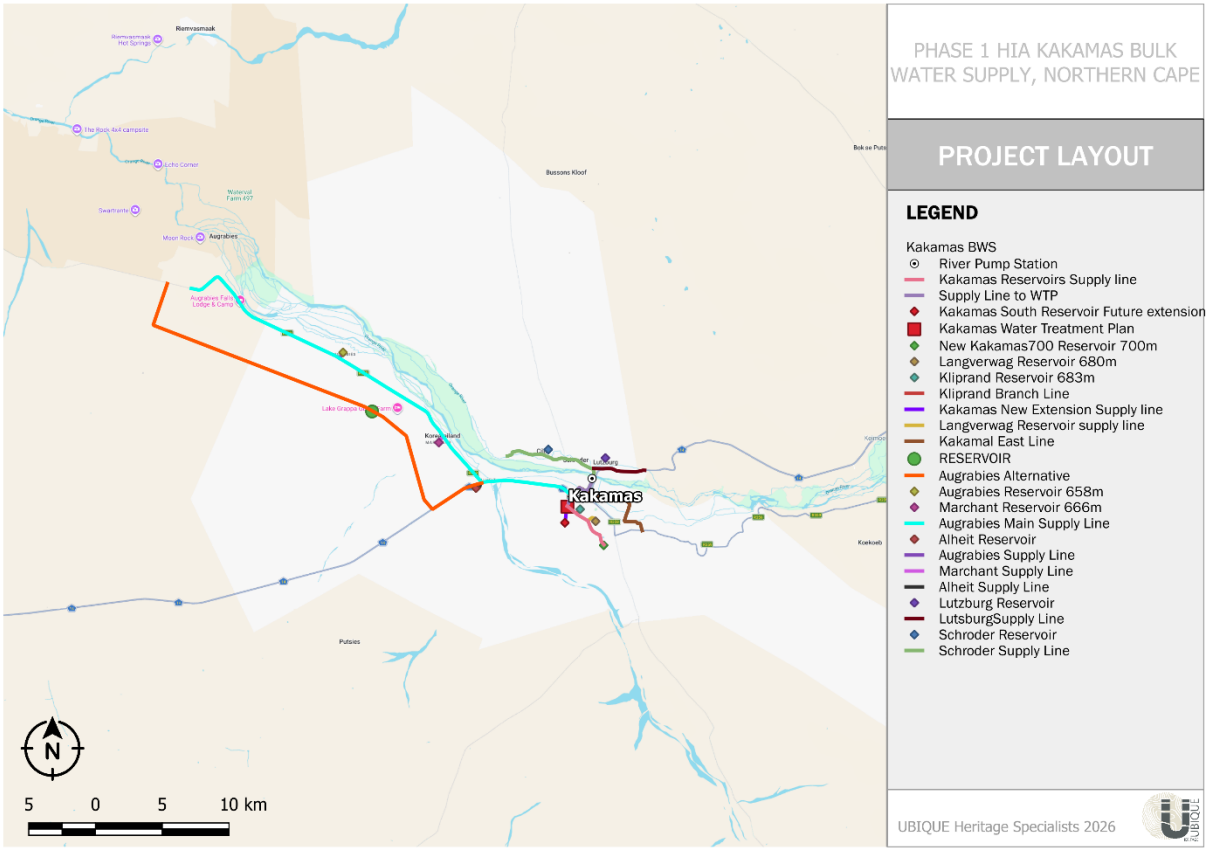


Figure 1 *Project Layout indicated on Google Maps.*

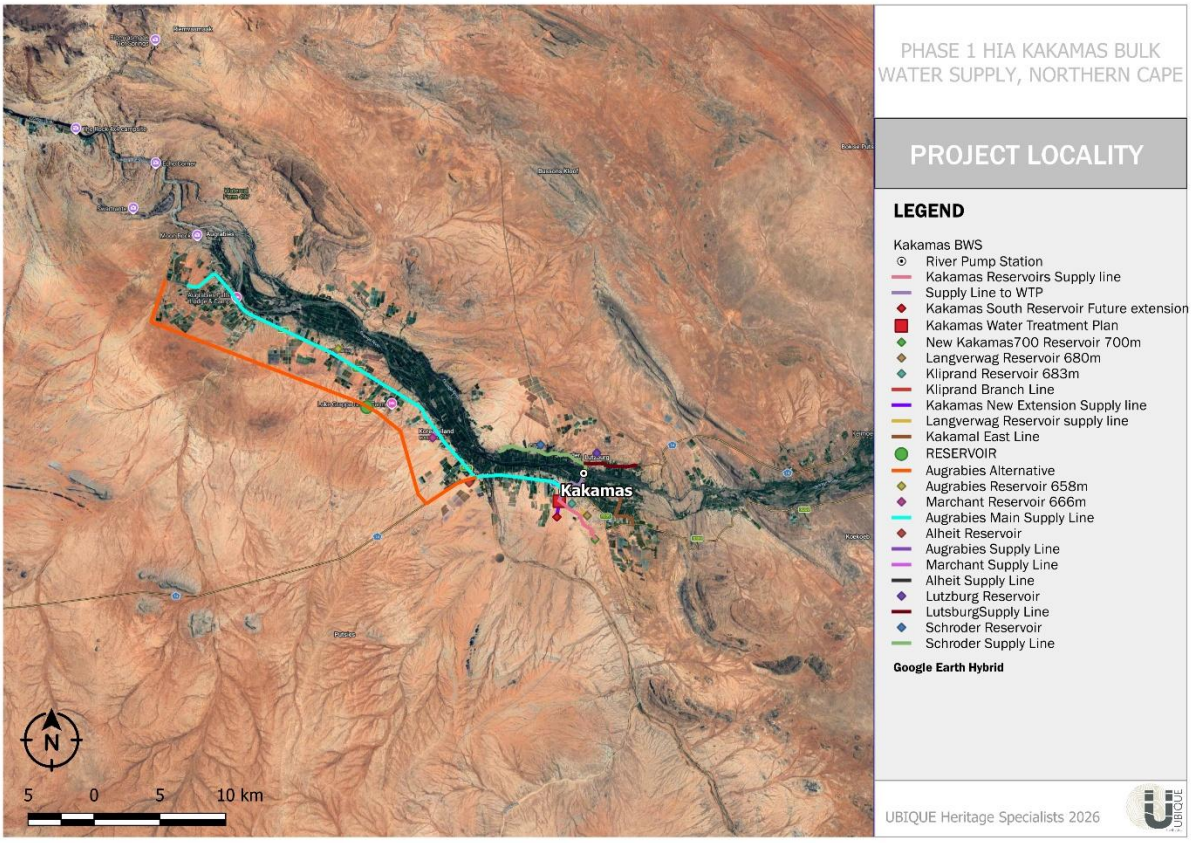


Figure 2 *Site locality indicated on Google Earth Satellite Imagery.*

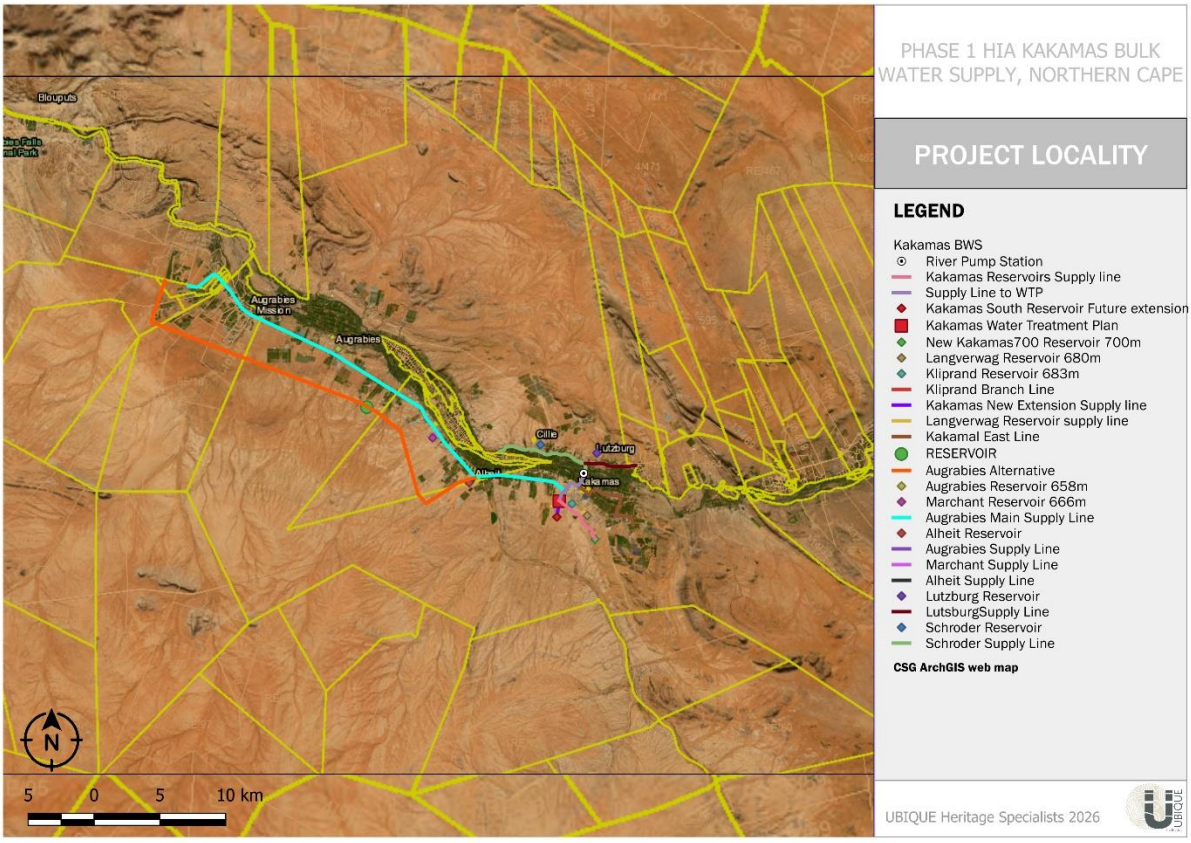


Figure 3 *Site locality indicated Chief-Surveyor General ArcGIS Web Map (https://csggis.drdlr.gov.za/psv/).*

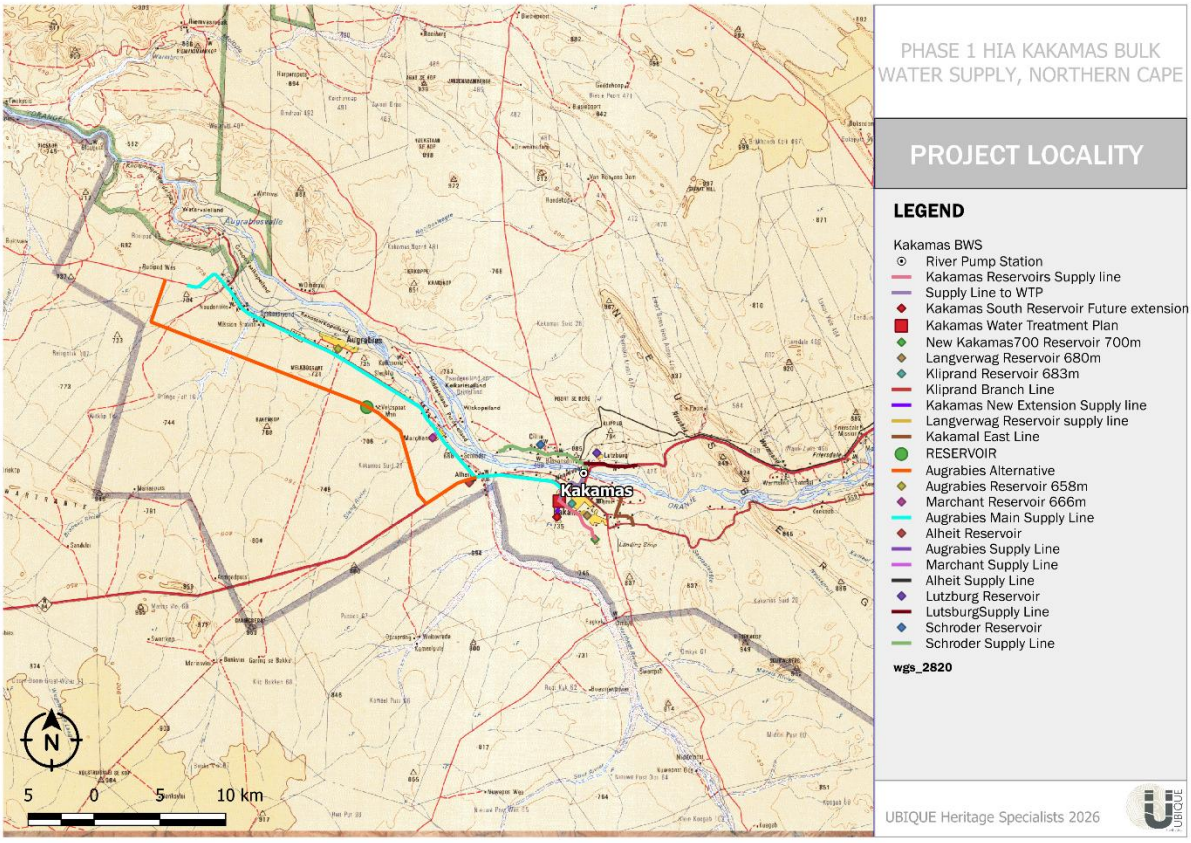


Figure 4 *Site locality indicated on 1: 250 000 wgs_2820 map.*

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. Additionally, numerous archaeological and historical sites have been identified and documented throughout South Africa, including those in 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. The aforementioned is generally believed to have been made and utilised for hunting activities and to have 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, and persisted for 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 through 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 riverbeds (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, marks 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 the Middle Iron Age should be included in this period; his dates have been widely accepted in the field of IA 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). The archaeological record shows that IA groups migrated with their material culture (Huffman 2002).

4.1.3 Historical Period

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

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

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

slave and Khoekhoe). According to Van der Walt (2015), the term also conveys an economic category of possessing property and being culturally European.

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

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

The region has been the backdrop to various incidents of conflict. Numerous factors, such as population growth, increasing pressure on natural resources, attempts by power blocs to control trade, the emergence of the Griquas, and the 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, sociocultural stress, and transformation (Mlilo 2019).

The period known as the Difaqane/Mfecane began in the late 18th century and effectively ended with the settlement of white farmers in the interior (De Jong 2010; Mlilo 2019). The Difaqane/Mfecane period also affected the Northern Cape Province around the 1820s, relatively later than the rest of southern Africa (De Jong 2010). This period was prompted by the incursion of displaced refugees associated with the Fokeng, Tlokwa, Hlakwana and Phuting groups (De Jong 2010). Between 1879 and 1880, the region was caught up in the Koranna War. With the arrival of the Dutch settlers in the Cape in the mid-17th century, clashes between Europeans and Khoi tribes on the Cape Peninsula led to the Goringhaiqua and Goraxouqua migrating north towards the Gariep/Orange River in 1680. These tribes became known as the Korannas, living as small tribal entities in separate areas (Penn 2005). It is believed that any military settlement related to the Koranna Wars would have been closer to the Orange River (Webley & Halkett 2014).

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

4.2 Local

The town of Kakamas was formally laid out in 1931 and attained full municipal status in 1964 (Kitto 2019, Van Schalkwyk 2013). The name Kakamas originated with the Einiqua. 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 may have become associated with the place because the nearby river banks were sloped, making it an easy crossing 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).

The towns of Kakamas, Marchand and Alheit have an intertwined history. The town of Marchand was named after one of its founding members, Rev B. P. J. Marchand, also known as the 'father of Kakamas'. Kakamas was started as the first labour colony by the N. G Church in 1898 to uplift poor whites in rural communities. These people were victims of the Industrial Revolution, and their lack of even elementary education made them inferior to the European immigrants flooding into South Africa at that time. The labour colonies were intended to equip these people with the skills needed to adapt and survive in the modern economy. Kakamas was identified as the site for the first colony, and 1.5 hectares of land were allocated to each family. The land did not belong to the families but to the church, and the families had to pay a meagre yearly rent. This was done to curb any attempts by debt collectors to seize and sell the land to recover the money owed. The town soon grew to be inhabited by 800 families. Kakamas grew so quickly that the church had to bring in assistant reverends to minister to all the people in the wards of Alheit and Marchand. The assistant reverend who was asked to take the lead declined, whereafter, the decision was taken to establish Marchand and Alheit's entire congregations independently (AF Wikipedia 2025, SA Venues 2025, Gemeentegeskiendenis 2025; Kitto 2019).

It is the people who lived in this labour colony whose hard physical labour can still be seen in the water-related infrastructure in the Kakamas area, which was essential for agricultural development. The town of Kakamas originated from an irrigation scheme established in 1898 for farmers left destitute by severe drought (1895-1897). 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). 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 and in establishing substantial agricultural initiatives in the region. The Kakamas settlement is also known for its pioneering development of a hydroelectric power generator, completed in 1914 and housing the first hydroelectric power station in South Africa (Hopkins 1978, SA Venues 2025). The building, located on Voortrekker Street, housed the old transformer and was earmarked for museum use (Morris 2010; SAHRA

database). These water furrows are still used today and supply the town with water. Eleven waterwheels are still in use and can be seen in Voortrekker Street and along the canals running through the vineyards, lucerne, and cotton fields (Kakamas 2025).

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

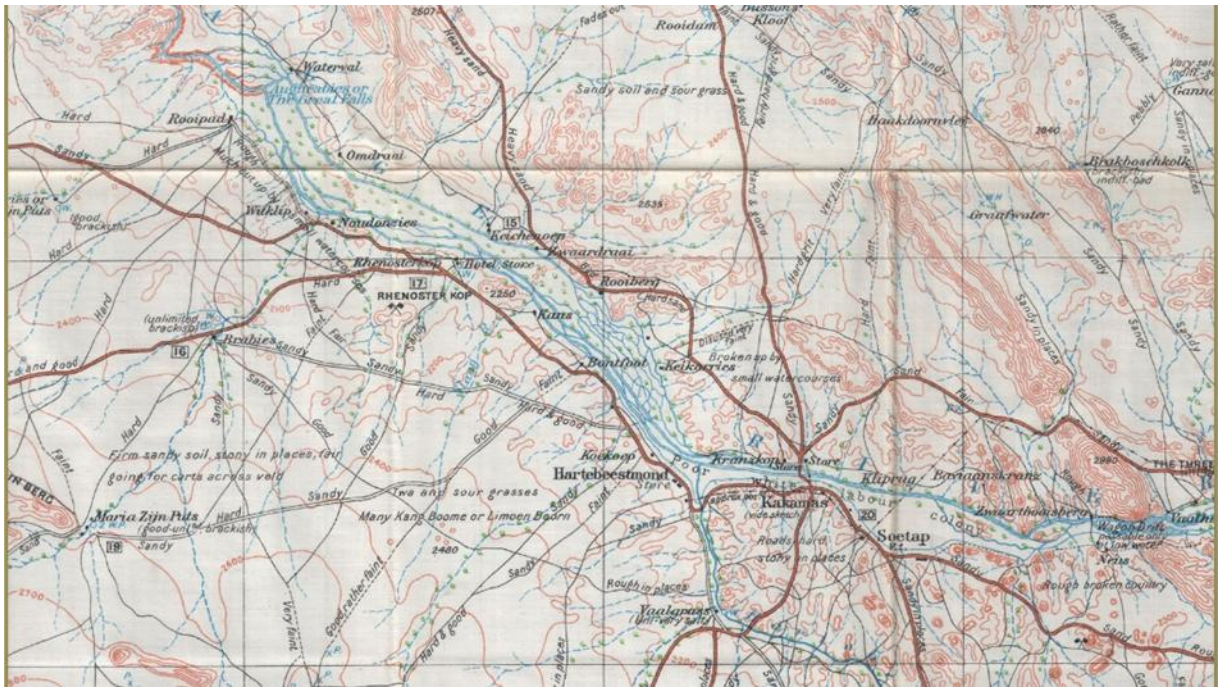


Figure 5 *1910-1911 Imperial Map of Kakamas and Augrabies, with the wagon routes indicated. Image from UCT digital collections, https://digitalcollections.lib.uct.ac.za/*

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.

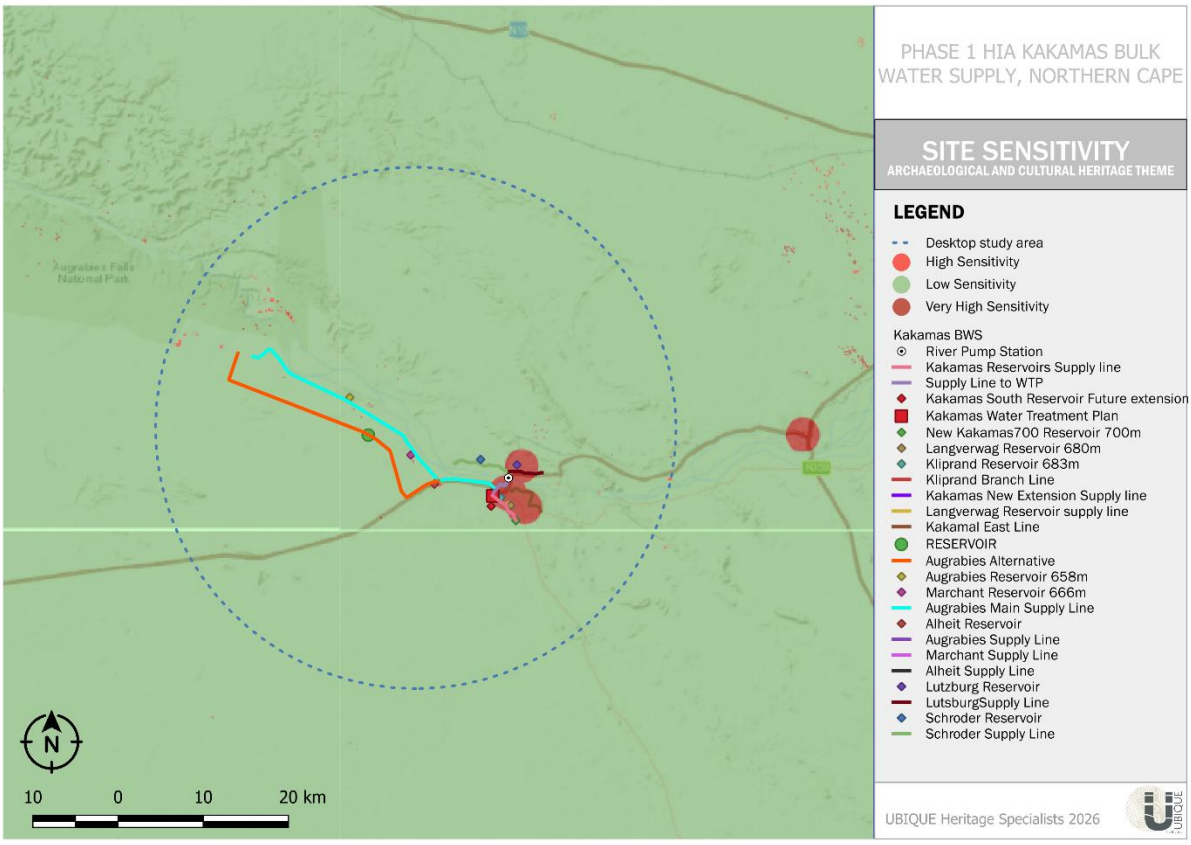


Figure 6 *The Project area indicated on the DFFE Screening tool with Archaeological and Cultural Theme Sensitivity layer (https://screening.environment.gov.za/)*

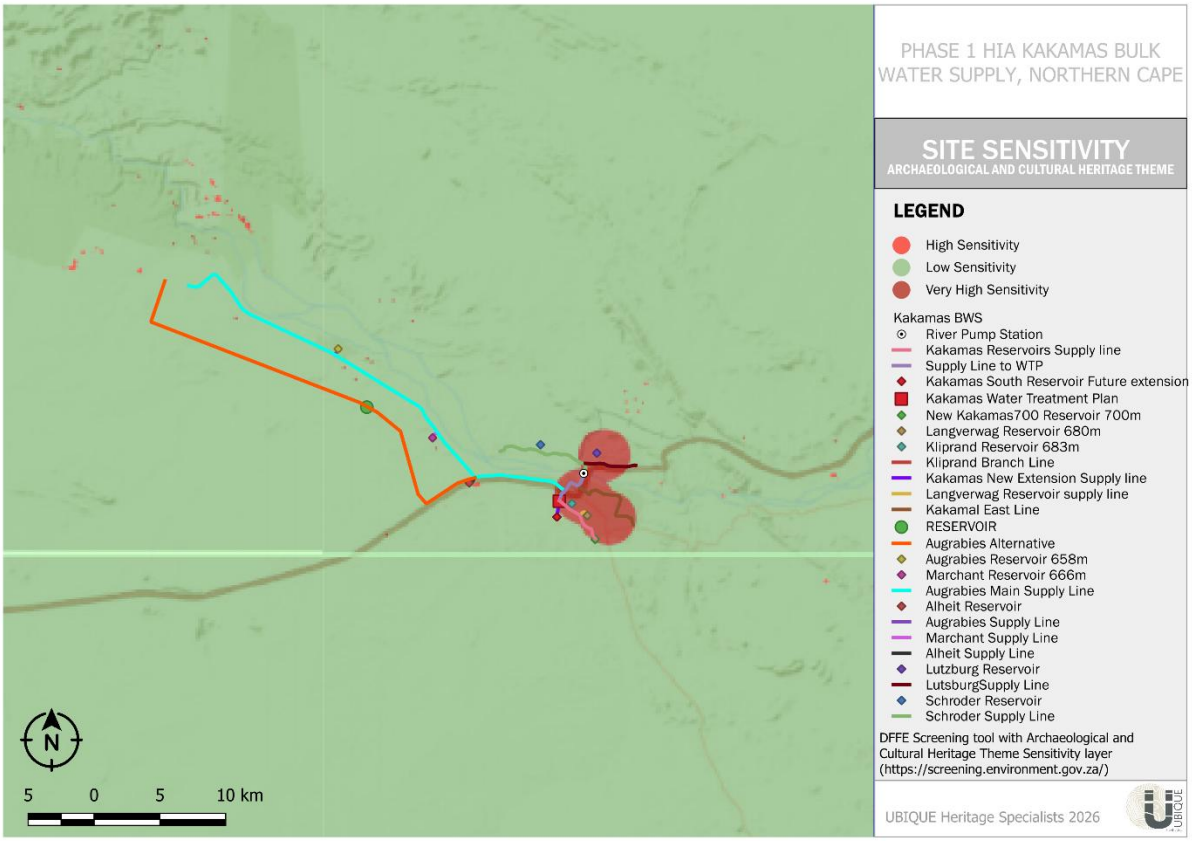


Figure 7 The Project area indicated on the DFFE Screening tool with Archaeological and Cultural Theme Sensitivity layer (https://screening.environment.gov.za/)

Our findings confirm the predominantly Low Heritage Sensitivity indicated on the DFFE Screening Tool. However, site-specific instances of medium- to high-significance resources were recorded. The DFFE Screening Tool (https://screening.environment.gov.za/) indicates a Low to Very High Archaeological and cultural theme sensitivity at the Kakamas site. The consulted HIA and AIA reports for the study area predominantly addressed low-significance resources. However, medium to high-significance resources are located on surrounding properties and within a 30 km study area. These were mainly resources on the historical and Stone Age periods, as well as on graves and cemeteries. The High and Very High Sensitivity areas indicated on the DFFE Screening Tool generally correspond with known Graded sites.

5.2 Site Sensitivity Desktop Results

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

The desktop study revealed that no Heritage Impact Assessments had been conducted directly on the proposed development area. Numerous impact assessments were conducted within a 20- to 30-km radius of the proposed development.

The consulted reports, located within a 20- to 30-km periphery of the study area, reported on materials predominantly related to the Stone Age and the Historical Period. Resources were identified by, but not limited to, ACRM (2016, 2017, 2020a; 2020c), Beaumont (2008a & b), Engelbrecht (2015), Engelbrecht & Fivaz (2019a), Fivaz & Engelbrecht (2021), Kaplan (2008, 2018), Kinahan (2003), Kitto (2019), Kruger (2012, 2015, 2017), Morris (2013, 2014, 2017b), Morris & Beaumont (1991), Orton (2012), Orton & Webley (2012), Parsons (2007), Pelser (2012), Rossouw (2013, 2019, 2022), Smith (1995), Van der Walt & Lombard (2018), Van Ryneveld (2007). The absence of Iron Age evidence is not surprising, as remnants of this period are rarely found in the Northern Cape.

5.2.1 Stone Age

Numerous reports from the study area document lithic artefacts dating to the ESA, MSA, and LSA. Rossouw (2013) identified isolated brown jasper lithics on Blaauwskop 36, likely of LSA origin, which appeared fresh and unrefined. Kruger (2015) found MSA tools at Eenduin farm, including blades, scrapers, and an adze, while Engelbrecht (2015) recorded similar finds near Blaauwskop. Kaplan (2018) documented a large silcrete core, an LSA retouched flake, and other tools near Lennertsville, 10 km from Kousas. Kaplan (2008) also recorded LSA tools, including convex scrapers and adzes, as well as an ESA core, attributing most of these to the Wilton Complex.

Morris (2013) reported grinding grooves at Dyason's Klip and LSA flakes. Morris (2017b) recorded a rare rock gong on granite-gneiss, the first of its kind locally. Van der Walt & Lombard (2018) identified two dolerite "kite" features 22 km north of Keimoes, which were likely used for hunting (Holzer et al., 2010, in Van der Walt & Lombard, 2018). However, their attribution to Stone Age herders remains uncertain.

Morris (2014; Morris & Beaumont, 1991) suggested intensive farming along the Orange River may have destroyed archaeological remains of herder/hunter-gatherer camps. At Orange Falls 16, Rossouw (2019) and Kaplan (2018) found sparse lithics and minor scatters of LSA/MSA tools, including an MSA point, an adze, and a hammerstone, potentially linked to flaking during wetter periods.

ACRM (2020a; 2020c) surveys on Farms Tierkop 355 and Oorkant revealed isolated MSA/LSA tools and a pottery fragment. Fivaz & Engelbrecht (2021) also noted weathered tools without context. Kitto (2019) recorded a medium-to-high-density 4200 m² MSA scatter between outcrops.

Beaumont (2008b) documented fresh Acheulean quartzite and ironstone artefacts on Kakamas South Farm 2092, though lacking formal tools. ACRM (2017) noted sparse LSA/MSA artefacts, scrapers, and minimal knapping evidence at Renosterkop Extension. Rossouw (2022) found a broken grindstone and debitage but no in situ material.

Van Ryneveld (2007) reported that MSA artefacts on Cnydas East 439 were mainly quartz-based. Pelser (2012) found ESA-MSA-LSA tools, quartz scatters, and a handaxe near Augrabies Falls on Padrooi 13. Orton (2012) recorded MSA/LSA artefacts, including a large scatter near a koppie at Rooipad 15/9, potentially an LSA campsite.

Engelbrecht & Fivaz (2019a) found ESA-MSA-LSA materials and LSA ceramics at Rozynen Bosch No. 104. David Morris reported fishbone-rich herder sites near Riemvasmaak (Pelser 2012), while Beaumont (2008a) recorded undiagnostic artefacts and a possible kraal. Orton & Webley (2012) noted MSA scatters, LSA sites with Khoekhoen links, grindstones, and shelters.

Kruger (2012) observed MSA dominance in the area, noting the presence of LSA. His 2017 survey at Sonfin Oseiland indicated MSA lithics remained beyond the cleared development footprint. At Renosterkop, Morris & Beaumont (1991) found LSA materials, scrapers, beads, and a rock shelter with MSA/LSA layers. ACRM (2016) reported scattered lithics, MSA tools, and ostrich eggshell fragments.

The area immediately west of Augrabies Falls has been subject to archaeological research by Professor Andrew Smith. Prof. Smith conducted informal surveys within the National Park and on river-bordering farms in the Kakamas area. He also excavated several caves (Zoovoorbij, Droegrond, Waterval), which produced MSA and LSA material (Pelser 2012). Smith (1995) recovered at Zoovoorbj (some 64 km east of Augrabies) a collection of MSA flakes stone artefacts from the lower levels of the excavation. The upper levels contained LSA material and artefacts such as bone, OES beads, and a few potsherds. According to Pelser (2012), Prof. Smith recognised that the Khoekhoen herders depended on living close to the Orange River, which was rich in resources. The research also revealed that San hunter-gatherers lived in a refuge deeper in the hinterland. Smith (1986; 1995) recorded pottery, sheep bones, an informal stone artefact assemblage, retouched pieces, beads, and a decorated flask-mouth fragment at Waterval 1, near Augrabies Falls. The site was dated to 760 ± 40 BP (Pta-3847) and has been occupied by herders (Orton 2012). Assemblages excavated from sites (Biesje Poort 2 and Bokvasmaak 3) in the Augrabies Falls area by Peter Beaumont have been analysed by Parsons (2007). The two sites were dated to around 1390 ± 70 BP (Pta-4772) and 120 ± 50 (Pta-4872) by Beaumont et al. (1995). Biesje Poort 2 yielded numerous retouched items. Beaumont ascribed both sites to herders, but Parsons' (2007) analyses showed the relevant characteristics as unclear and unreliable (Orton 2012).

5.2.2 Rock Art

Several rock art sites have been documented on the SAHRA Database in the Northern Cape Province. No sites have, however, been recorded in the Kakamas region. Instead, rock art sites have been recorded at Augrabies.

ROCKART SITES AROUND THE STUDY AREA				
Site/Object Name	Coordinates	Site type	Site Reference	Site ID
Augrabies sites RVM19 historical engraving	-28.464711, 20.287494	Rock Art	RVM19	93896
Augrabies sites RVM3 LSA engraving	-28.395425, 20.386838	Rock Art	RVM3	93893

5.2.3 Iron Age

It is rare, but not uncommon, to find sites associated with the 'Iron Age' of southern Africa in the Northern Cape. None of the consulted HIA's indicated any material uncovered relating to the Iron Age.

5.2.4 Historical/Colonial Period

Very few HIA and AIAs reported on artefacts/sites associated with the Historical/Colonial period.

While assessing a portion of the farm Cnydas East 439, Van Ryneveld (2007) recorded a historical complex and observed two historic structures: a kraal, a wind pump, a dam, and an associated workers' unit. Van Ryneveld comments that the two historical structures probably represent early farming occupations and activity. The area lacked associated historical artefacts, but the stone kraal is still used. The wind pump and dam, situated near the two historic structures, are of more recent origin and associated with earlier prospecting activities on the property post-dating 60 years and, by implication, are not protected by the NHRA. In contrast, the workers' unit and its associated historical artefacts (such as metal, porcelain and glass) predate 60 years.

Pelser (2012) recorded a low stone wall (single row of stones) in front of a section of the outcrop during his survey on Padrooi 13. He found glass and metal, such as tins, near the stone feature. Pelser (2012) explains that they are unsure of the age and function of this feature and that it may be relatively recent and could have been used by herd boys. Orton (2012) recorded a 28 m by 6 m flat-roofed farm building that was most likely built in the early to mid-20th century. However, the

structure has since been added to and altered several times over the years. Orton (2012) also noted that the outbuildings were made of poles and reeds, and that a sheep dip, which is of more recent age, was present. These outbuildings have also been added to and altered.

Orton and Webley (2012) reported that abundant historical remains were found at Riemvasmaak. The sites are related to the ancestors of the Riemvasmaak community, who were forcibly removed from the land in 1973 and 1974 during the Apartheid regime. Orton and Webley (2012) recorded ruins of structures, stone features (with indeterminate function), and artefacts such as metal objects, glass bottles, and a plastic bead. Most historical artefacts are relatively recent (mid-20th century), but occasional ceramic fragments were undoubtedly originally of late 19th-century origin. However, they state that these materials were likely deposited only during the early to mid-20th century.

Kinahan (2003) conducted fieldwork in Augrabies Falls. However, it was limited to the gorge, where the archaeological material was infrequent. Various historical remains (related to the Anglo-Boer War and the rebellion led by Manie Maritz) dating to the late 19th and early 20th centuries are well preserved within the Falls, including the Manie Maritz Fort in the western part of the Park. Historically, it has been unclear whether the fort can be associated with Maritz (Orton 2012).

Beaumont (2008b) found a minor scatter of undiagnostic tin and glass fragments and what seemed to be some minor levelling of the ground surface. He remarks that these vestiges may be where a small group of people camped briefly in the early 20th century while digging for nearby diamonds, leaving behind pieces of a spade and some sieve mesh.

During Engelbrecht and Fivaz's (2019a) survey of Plot 1763, Plot 2372, and Plot 2363, various surface scatters of material relating to the historical/colonial period, such as a hole-in-cap tin lid with lead solder and a tin can with folded/cramped hand-soldered seam, and cast-iron potsherds, a broken horseshoe, green and weathered clear glass, whiteware ceramics, and tin can with folded/crimped hand-soldered seam was recorded. At Rozynen Bosch No. 104, recorded surface scatters include a historical fuel/oil tin with machine-soldered seams and trademarks, a historical green liquor bottle, the partial base of a bottle, a historically fired shotgun cartridge, and a metal casing for a 12 BR.

Just outside the town of Kakamas North on Lot 189 is a monument that commemorates First World War German *Schutztruppe* killed in a battle against South African Union forces on the 4th of February 1915. Union troops assembled near Upington to launch an attack on German South West Africa while the German forces prepared an attack on Kakamas. A heavy battle ensued between two unevenly matched forces, resulting in seven dead, six wounded, and sixteen German prisoners of war captured. The memorial was erected by the '*Volksbund Deutschen Kriegsgräberfürsorge* (SAHRA database, Kakamas 2025).

A handful of sites have been graded in the area. Most of these sites have been graded as Grade II with one instance of an IIIa. The sites range from buildings, structures, ruins and monuments/memorials. These can all be found on the SAHRIS database:

SITES IDENTIFIED ON THE SAHRA DATABASE						
Site/Object Name	Coordinates	Archive Status	Declaration Type	Site type	Site Reference	Site ID
North Furrow, Kakamas, Gordonia District	-28.785592; 20.639647	National monument	Provincial heritage	Building	9/2/032/0005	28797
Battlefield, Kakamas, Gordonia District	-28.743329; 20.635730	National monument	Provincial heritage	Battlefield, Monuments & Memorials, Burial Grounds & Graves	9/2/032/0006	28798
Water wheel, near DR Church Parsonage, South Furrow, Kakamas	-28.772950; 20.622203	National monument	Provincial heritage	Building	9/2/032/0008	28799
Water wheel No. 2, Plot 103, South Furrow, Kakamas	-28.783353; 20.635208			Building	9/2/032/0009/001	28793
Water wheel No. 2, Plot 103, South Furrow, Kakamas	-28.783353; 20.635208	National monument	Provincial heritage	Building	9/2/032/0009/001	28793
Water Wheel No. 1, Plot 103, South Furrow, Kakamas	-28.783504; 20.635524	National monument	Provincial heritage	Building	9/2/032/0009/004	28794
Water wheel, Plot 1057, North Furrow, Kakamas	-28.785597; 20.640039	National monument	Provincial heritage	Building	9/2/032/0009/005	28792
Water wheel, Plot 68, North Furrow, Kakamas	-28.785335; 20.638437	National monument	Provincial heritage	Building	9/2/032/0009/006	28791
Water Wheel, Plot 1467, South Furrow, Kakamas	-28.783988; 20.636358	National monument	Provincial heritage	Building	9/2/032/0009/009	28788
Kakamas Museum, Voortrekker Street, Kakamas	-28.770215; 20.617134	National monument	Provincial heritage	Building	9/2/032/0010	28789

5.2.5 Graves/Burials

Graves are readily found throughout the landscape, especially on old farms and around homesteads. Graves and burial sites are widespread across the region, ranging from informal graves to large cemeteries. For example, ACRM (2016), Beaumont (2008a), and Van Schalkwyk (2013a) reported graves, cemeteries, and burials within a 30 km radius in the consulted HIAs. A small military graveyard and declared heritage site commemorates several German soldiers who

were killed in a battle against a force of the Union of South Africa, which took place here on the 4th of February 1915 was recorded by Rossouw (2021) during a survey for the proposed Lutzburg cemetery.

During Orton's (2012) survey, he recorded a single historic grave dating to 1955. In the same HIA, Orton also reported a large pile of rocks, seemingly placed on top of the degraded bedrock. Although a burial on bedrock exposure is unlikely, there have been reports of burial shafts dug into degraded bedrock covered with a cairn. This cairn is, therefore, assumed to be similar to the other burial sites found within the region. Nicholas Wiltshire (2018) recorded a possible gravesite on the soft, red sands at the base of Renosterkop Peak. These stones were deliberately arranged, although no head or footstones were present, thus suggesting that it is not a Christian burial. ACRM (2019) also noted the grave in their report.

Orton and Webley (2012) identified several features likely to be graves during their survey of the proposed hydroelectric facilities near Riemvasmaak. However, they note that they cannot be certain of this interpretation without subsurface testing, as these features may have been historical in the 20th century. They also found a memorial with the inscription: "Eerste Landsdienskom Dept v Landbou 21.6.52 – 5.?.52". During Beaumont's (2008a) survey, he examined a graveyard with about 50 to 60 burials. This graveyard was adequately fenced and contained headstones dating from 1959 to 2009, with some unmarked interments that could be older.

Prof. Allan Morris excavated and analysed a collection of burials from the Kakamas area. He studied the materials he collected in 1984 and 56 individuals exhumed by Dreyer and Meiring in 1936. The burial cairns and other information suggested that they belonged to the Khoekhoen people, specifically the Einiqua. According to Pelser (2012), historical data indicate that most graves dating back to the 18th and early 19th centuries have been recorded as containing grave goods, including trade beads and red ochre.

5.2.6 Palaeontological Sensitivity

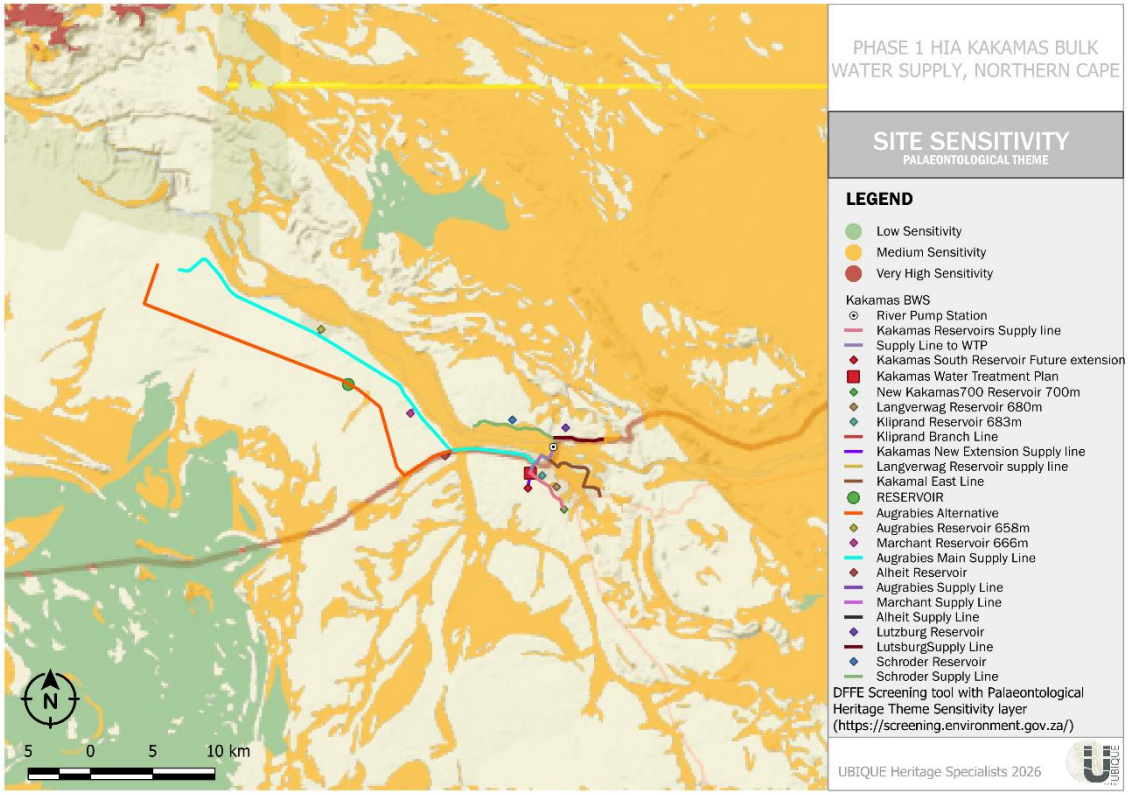


Figure 8 *The Project area indicated on the DFFE Screening tool; Palaeontological Theme layer, indicating Medium (Orange) palaeontological significance north of the study area (https://screening.environment.gov.za/).*

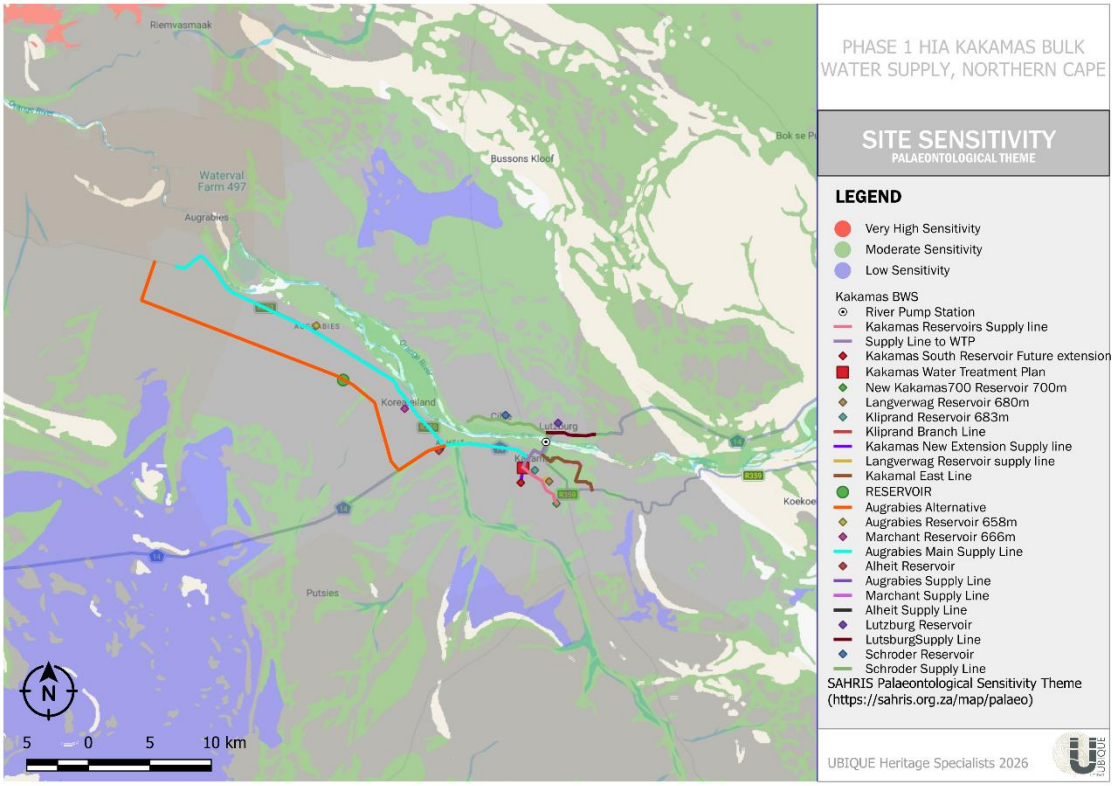


Figure 9 *The SAHRIS PalaeoMap indicates Zero/Insignificant (Grey) and Moderate (Green) palaeontological significance in the study area (https://sahris.org.za/map/palaeo).*

The SAHRIS Palaeosensitivity map (Figure 9) indicates that the proposed development is underlain by sediments with a Moderate (green) and Zero (grey) Palaeontological Sensitivity, which is supported by the DFFE Screening Tool (Figure 8). Due to the mapped Palaeontological Sensitivity, no site investigation was conducted, and thus the actual Palaeontological Sensitivity of the development was not verified. However, desktop research confirmed that the area has a LOW sensitivity for paleo resources (Butler 2026, Appendix B).

5.3 Digital Survey

The Google satellite imagery and topographic maps (2820DA, 2820CB, 2820CD and 2820DC) indicate that the proposed agricultural development will be situated in an open landscape with ongoing agricultural expansions over the years.

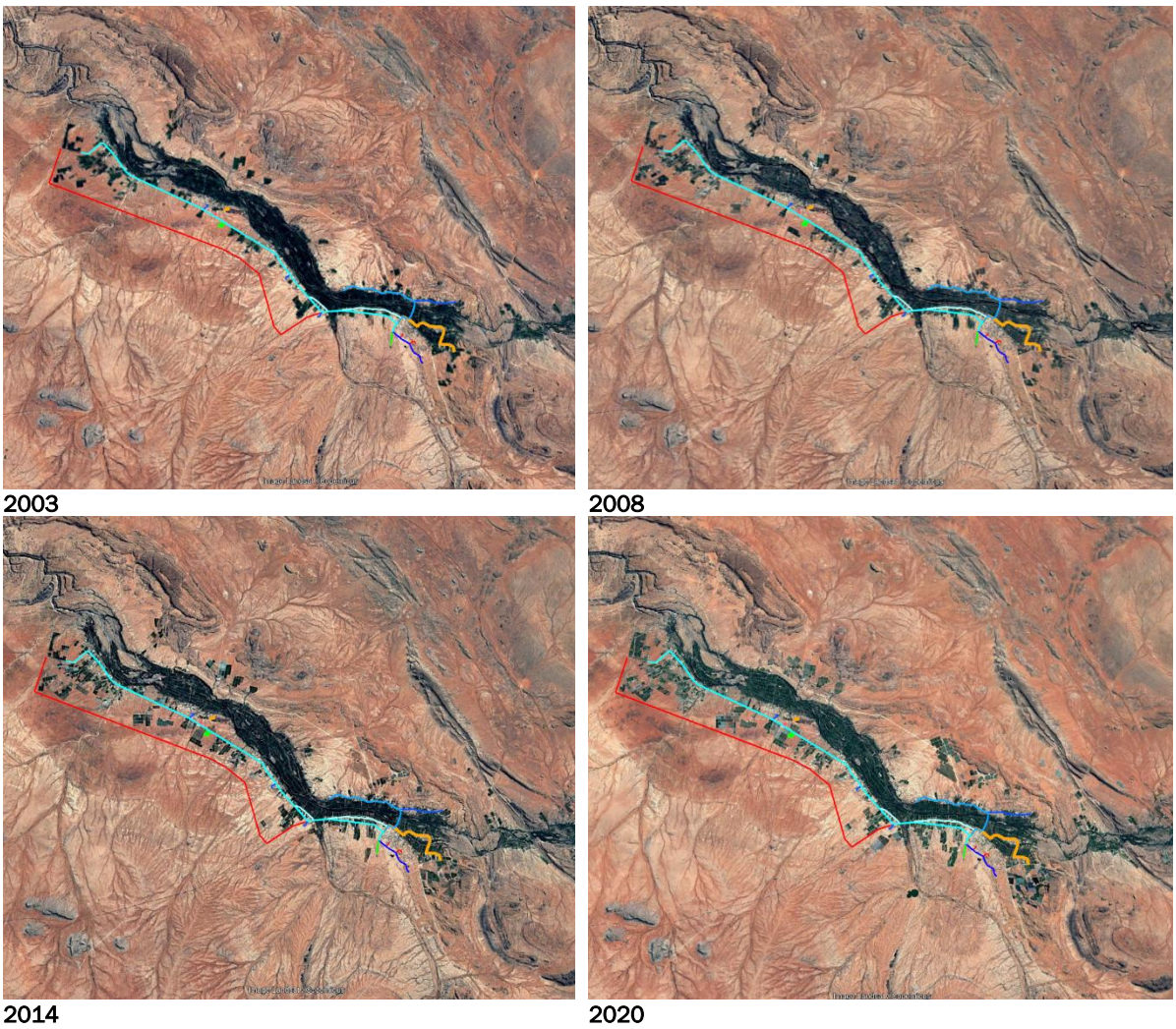


Figure 10 *Historical Google Earth Satellite imagery showing the assessed area between 2003 and 2025.*

5.4 Description of the Affected Environment

The archaeological site visit was conducted during late Autumn from the **13th to the 15th of April 2026.** The development area falls within the Bushmanland Arid Grassland (SANBI BGIS Map Viewer 2018 National Vegetation Map). The geology observed at the ground surface throughout the survey included quartz, quartzite, dolomite, granite, calcrete/limestone, and BIF. The vegetation consisted predominantly of grassland, with scattered trees and shrubs. Primary vegetation includes *Acacia karoo, Acacia erioloba, Acacia haematoxylin, Prosopis glandilosa, Acacia melifera, Rhigozum trichotomum, Aizoon africanum (Kraalbos), Stipagrostis uniplumis.*

The assessed area is generally flat, with slightly higher ground gently sloping towards the Orange River. It falls within the Orange River floodplain and the broader regional basin. Several rocky outcrops and koppies are present across the site, contributing to localised landscape variation. Water resources in the area are limited and consist mainly of intermittent, dry riverine. The valleys are well drained, with dry stream channels that typically flow only during periods of heavy rainfall. Natural erosion is evident in shallow trenches and small riverbeds caused by water runoff in several locations; however, no severe erosion was observed. Two-track roads and borrow pits were observed across the site. The surrounding land use is predominantly agricultural, with neighbouring farmland bordering the site to the north, east, south, and west. At the same time, the Orange River forms a boundary along much of the northern, eastern, and southern extents.

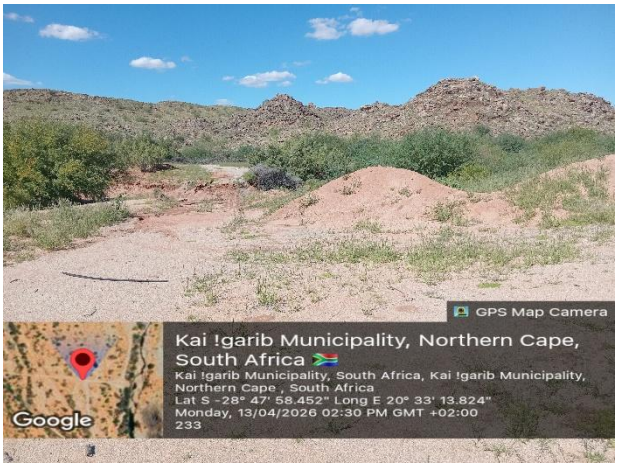
Seasonality had no bearing on the study; the fieldwork was deemed sufficient for the nature of the project.



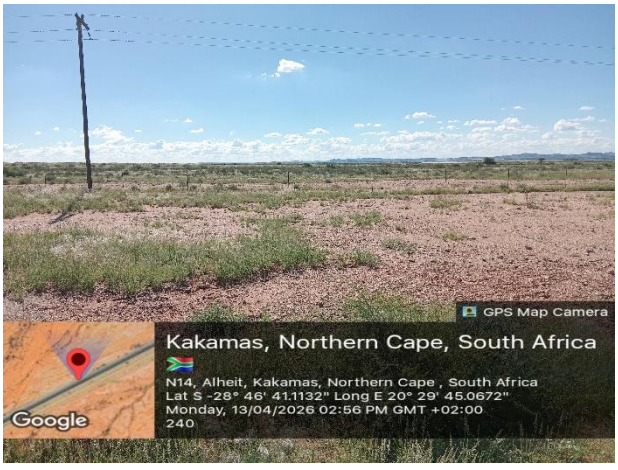



GPS Map Camera
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R359, ZF Mgcawu District Municipality, Northern Cape , South Africa
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GPS Map Camera
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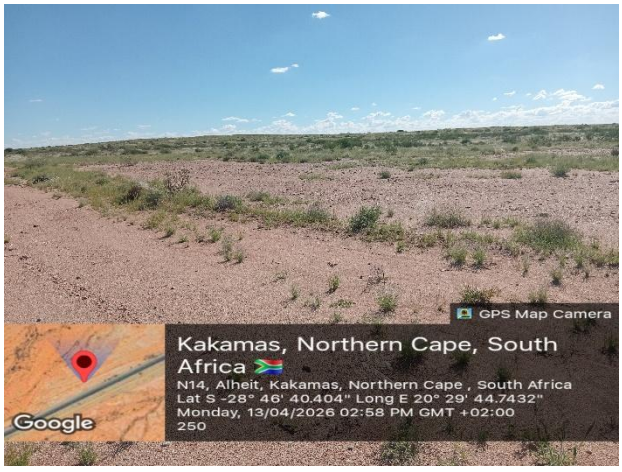

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Figure 11 *Views of the affected development area*

6. SURVEY AND IDENTIFIED HERITAGE RESOURCES

6.1 Surveyed Area

UBIQUE Heritage inspected the proposed development and surrounding areas from the **13th to the 15th of April 2026** and completed a controlled, exclusive, pre-planned pedestrian 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. Seasonality had no bearing on the study; the fieldwork was deemed sufficient for the nature of the project.

The areas surveyed for the impact assessment were dictated by the Google Earth map of the development footprint provided by the client. A one-person survey team surveyed the proposed development footprint on foot.

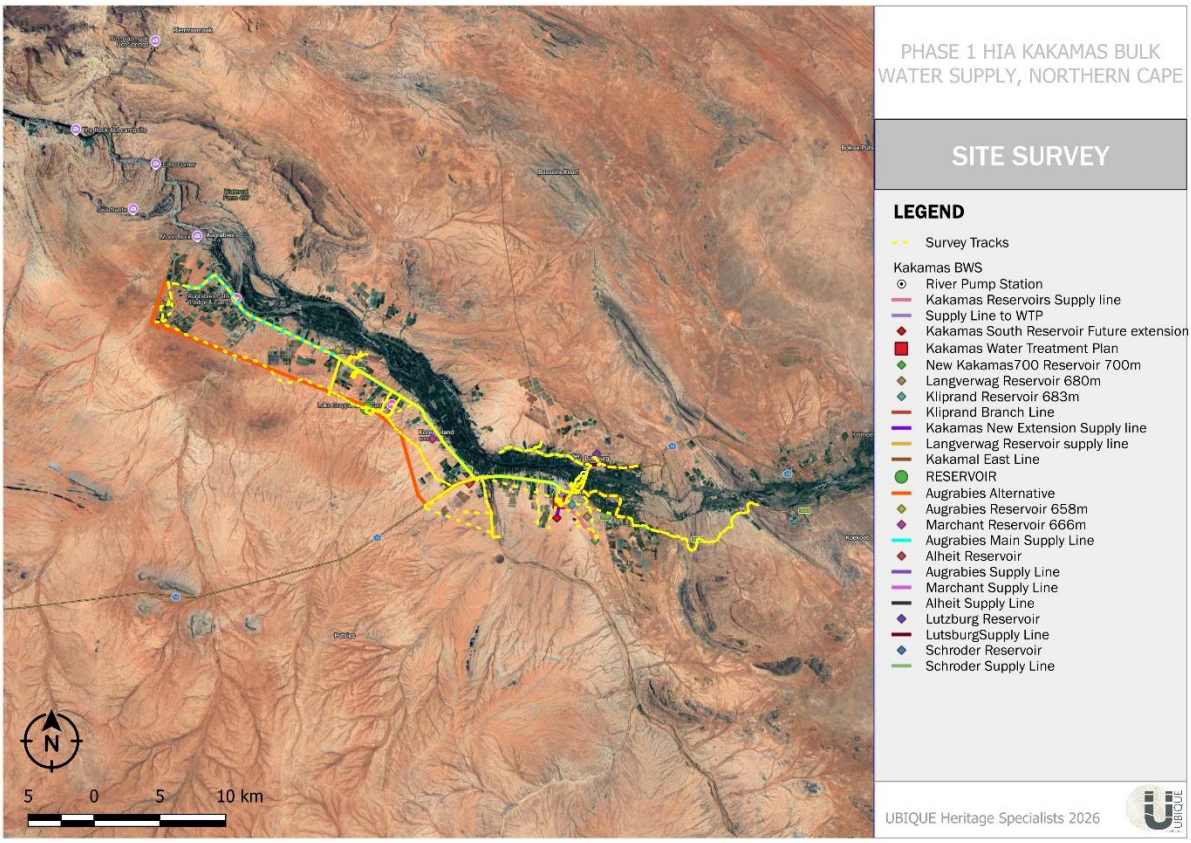


Figure 12 *Survey tracks across the development footprint.*

6.2 Identified Heritage Resources

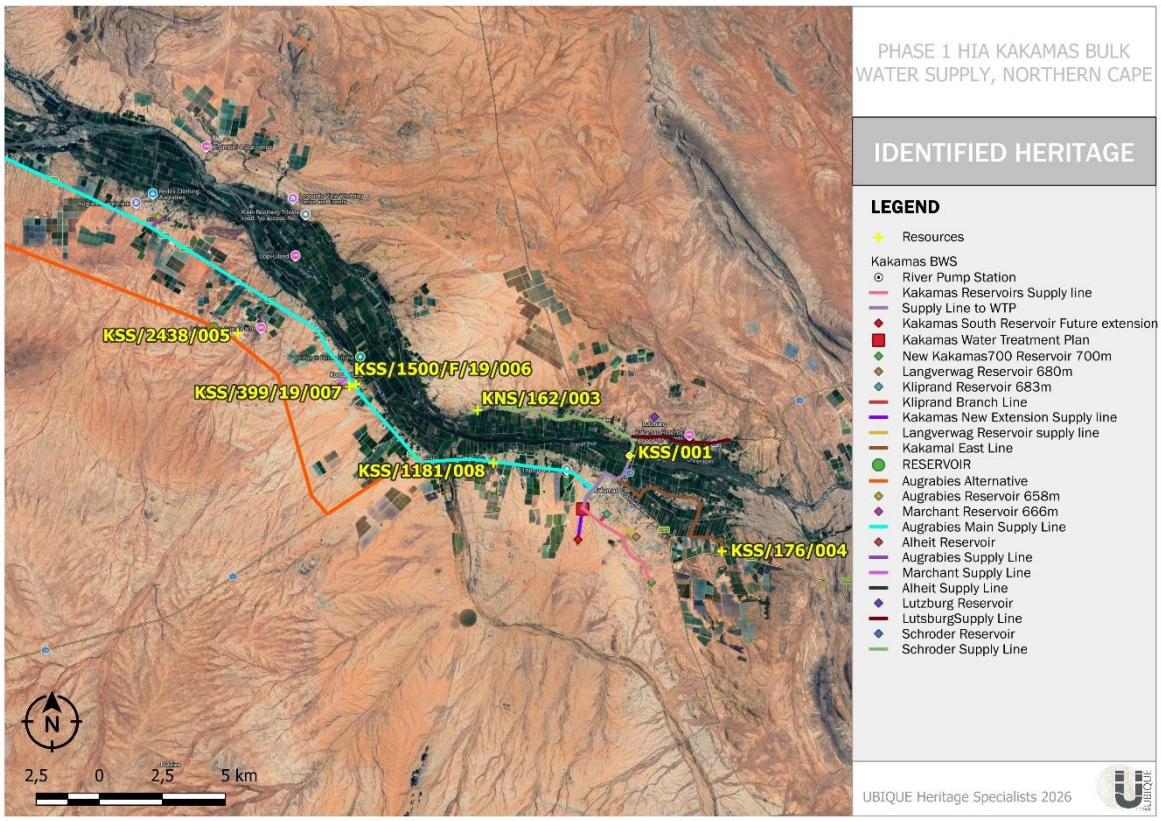


Figure 13 *Distribution of identified heritage resources at the proposed development area.*

6.2.1 Stone Age Identified

No lithic material attributed to the Stone Age 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 RECORDED					
SITE ID	DESCRIPTION		PERIOD	LOCATION	FIELD RATING/ SIGNIFICANCE/ RECOMMENDED MITIGATION
KSS/001	Type of Feature	Railway bridge	1960's	**28° 45' 24.7" S 20° 37' 12.2" E**	Field Rating IIIB Medium Significance 10 m Buffer
	Material	Metal and concrete			
	N in m².	1			
	Context	Railway network			
	Additional	60 years or older. New proposed pumpstation will be constructed adjacent to the bridge just west of existing bridge.			
KNS/162/003	Type of Feature	Old stone walled house	1950-1970's	**28° 44' 26.3" S 20° 33' 28.8" E**	Field Rating IVB Medium Significance 15 x 20 m Buffer/destruction permit
	Material	Granite stones			
	N in m².	1 dwelling			
	Context	Agriculture			
	Additional	Near existing farmhouse.			
KSS/2438/005	Type of Feature	Veldspar mine (Closed and abandoned)	1980-1990's	**28° 42' 48.0" S 20° 27' 38" E**	No mitigation required
	Material	N/A			
	N in m².	1 Mine remnants			
	Context	Mining			
	Additional	Mine possibly not older than 60 years. Currently converted to venue theatre. Just for notification. This site may be significant in future for industrial and mining archaeology.			

6.2.3.1 Discussion: Historical Period

A railway bridge, constructed of metal and concrete, is located near the Supply Line to WTP and forms part of the existing railway network. The bridge is older than 60 years. A new pump station is proposed to be constructed adjacent to the bridge, located just to the west of the existing structure. **This resource is given a 'Local Protection B (Field Rating IIIB) and considered to be of medium significance. Destruction is not advised. A 10 m buffer is recommended around the bridge at KSS/001.**

An old stone-walled house constructed from granite stones was identified. The structure consists of a single dwelling and is used for agricultural purposes. It is located in close proximity to an existing farmhouse. **This resource is given a 'General' Protection B (Field Rating IVB) and considered to be of medium significance. The site/resource should be recorded before destruction (medium significance). A 15 x 20 m buffer zone is recommended. Alternatively, a destruction permit can be obtained from NBKB (Northern Cape Provincial Heritage Authority).**

A closed and abandoned veldspar mine was identified. The mine is likely not older than 60 years. It has since been repurposed and is currently used as a venue theatre. This resource is noted for record purposes only; however, it may have future significance for industrial and mining archaeology. **It is outside the proposed Kakamas BWS Augrabies Alternative trajectory footprint and will not be impacted.**



KSS/001



KSS/001



KNS/162/003



KNS/162/003



KSS/2438/005



KSS/2438/005

Figure 14 *Examples of Historical period resources recorded*

6.2.4 Graves Identified

GRAVES RECORDED					
SITE ID	DESCRIPTION		PERIOD	LOCATION	FIELD RATING/ SIGNIFICANCE/ RECOMMENDED MITIGATION
KSS/176/004	Grave markers	Headstones	1950-2000's	**28° 47' 26.9" S 20° 39' 25.9" E**	Field Rating IIIA High Significance **50 m precautionary buffer zone and fencing**
	Inscription	Various			
	Graves' orientation	East/West			
	Dimensions/ Extent	Approximately 2ha			
	Additional	Local municipal cemetery			
KSS/1500/F/19/006	Grave markers	Headstones	1950-2000's	**28° 43' 53.4" S 20° 30' 30.5" E**	Field Rating IIIA High Significance **15 x 30 m buffer zone and fencing**
	Inscription	Various			
	Graves' orientation	East/West			
	Dimensions/ Extent	Approximately 2ha			
	Additional	Local municipal cemetery			
KSS/399/19/007	Grave markers	Headstones	1950-2000's	**28° 43' 55.0" S 20° 30' 25.0" E**	Field Rating IIIA High Significance **50 m precautionary buffer zone and fencing**
	Inscription	Various			
	Graves' orientation	East/West			
	Dimensions/ Extent	Approximately 3ha			
	Additional	Local municipal cemetery			
KSS/1181/008	Grave markers	Headstones	1850-2000's	**28° 45' 33.7" S 20° 33' 52.0" E**	Field Rating IIIA High Significance **20 x 25 m buffer zone and fencing**
	Inscription	Various			
	Graves' orientation	East/West			
	Dimensions/ Extent	Approximately 4ha			
	Additional	Local municipal cemetery			

6.2.4.1 Discussion: Graves

Four cemeteries were identified. Each cemetery contains a variety of headstones, generally aligned east–west. The cemeteries at KSS/176/004 and KSS/1500/F/19/006 each cover approximately 2 hectares, while KSS/399/19/007 extends over roughly 3 hectares, and KSS/1181/008 over approximately 4 hectares. All four cemeteries are established municipal burial grounds.

All graves are considered to be of high significance and should be mitigated. **These cemeteries are given a 'Local Grade Protection' (Field Rating IIIA) and are of local importance and worthy of conservation.**

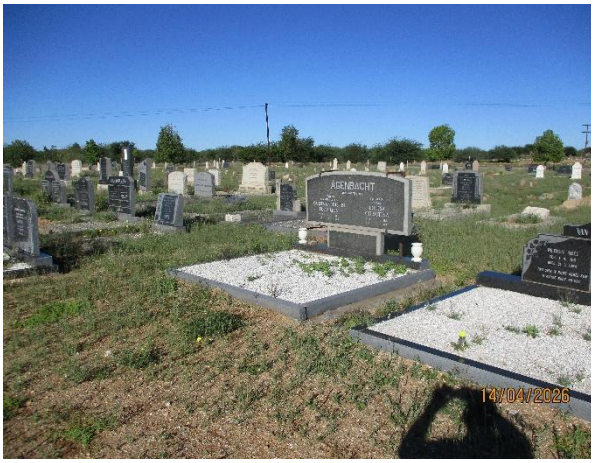
- The cemetery at KSS/1500/F/19/006 is located approximately 10 m north of an existing road and the proposed Augrabies main supply line. **A 15 x 30 m no-go buffer**

is therefore recommended around the cemetery, and the cemetery should be fenced off to ensure its protection.

- The cemetery at KSS/1181/008 is located approximately 11 m south of an existing road. **A 20 x 25 m no-go buffer is therefore recommended around the cemetery, and the cemetery should be fenced off to ensure its protection.**
- The cemetery at KSS/176/004 is located approximately 65 m west of an existing road. **Although no direct impact is anticipated, a precautionary buffer zone should be implemented to manage potential risks associated with heavy vehicle and equipment movement. A 50 m precautionary no-go buffer is therefore recommended around the cemetery, and the site should be fenced off to ensure its protection.**
- The cemetery at KSS/399/19/007 is located approximately 107 m west of an existing road. **Although no direct impact is anticipated, a precautionary buffer zone should be implemented to manage potential risks associated with heavy vehicle and equipment movement. A 50 m precautionary no-go buffer is therefore recommended around the cemetery, and the site should be fenced off to ensure its protection.**
- **The cemetries should be demarcated and avoided by personnel and equipment. Gravesites should remain accessible to all descendants and family members during all phases of the project.**
- **Grave relocation can be undertaken by accredited Grave Relocation Specialists with permits from SAHRA (BGG).**



KSS/176/004



KSS/1500/F/19/006



KSS/399/19/007



KSS/1181/008

Figure 15 *Examples of Graves recorded*

6.2.5 Palaeontological Resources

The proposed Kakamas Bulk Potable Water Supply Scheme is situated in the Kai !Garib Municipality in the Northern Cape Province and is mapped on the 1:250,000 Upington 2820 geological sheet (Council for Geoscience, Pretoria). The development footprint is underlain by a diverse assemblage of geological units, ranging from ancient Proterozoic metamorphic basement rocks to recent Quaternary surficial deposits, spanning more than 1,000 million years and reflecting the complex tectonic and depositional history of the Northern Cape Province. The study area is underlain by the Nachap Gneiss, undifferentiated metamorphic rocks, and Keimoes Suite granite of the Namaqua Metamorphic Complex, overlain by Quaternary alluvium associated with the Orange River and its tributaries, and the Gordonia Formation of the Kalahari Group (Partridge et al., 2006). According to the SAHRIS Palaeosensitivity Map, the Namaqua Metamorphic Complex is classified as having Zero sensitivity (grey), while the Quaternary alluvium and Gordonia Formation have Moderate sensitivity (green) (Almond et al., 2013). In alignment with these sensitivities, the Department of Forestry, Fisheries and the Environment (DFFE) Screening Tool identifies the broader study area as falling within a Medium (orange) palaeontological sensitivity zone.

Based on desktop research, it is concluded that fossil heritage of scientific and conservational interest in the study area is rare. **A Medium Paleontological Significance has been allocated for the construction phase of the development pre-mitigation (as stated on the SAHRIS PaleoMap) and a low significance post-mitigation** (Butler 2026, Appendix B).

7. IMPACT ASSESSMENT OF THE DEVELOPMENT

7.1 Impact Assessment Tables

ARCHAEOLOGICAL, HISTORICAL, & CULTURAL								
NATURE	HERITAGE AND CULTURAL RESOURCES IDENTIFIED SITE(S): MEDIUM SIGNIFICANCE Field Rating IVB – KNS/162/003							
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	Safety/No-Go Buffer Zone	NO	YES
	Probability	3	2					
	Reversibility	3	2					
	Irreplaceability	3	2					
	Duration	3	2					
	Cumulative Effect	3	2					
	Magnitude	3	2					
	Impact Significance	48	22					
OPERATIONAL PHASE	Extent	1	1	Negative Medium Impact	Negative Low impact	Safety/No-Go Buffer Zone	NO	YES
	Probability	2	2					
	Reversibility	3	2					
	Irreplaceability	3	2					
	Duration	3	2					
	Cumulative Effect	3	2					
	Magnitude	3	2					
	Impact Significance	45	22					

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

IMPACT: One instance of Medium Significance resources were noted:

- An old stone-walled house (KNS/162/003).

This resource is given a 'General' Protection B (Field Rating IVB) and considered to be of medium significance. Any impact would be negative. The impact would be NEGATIVE MEDIUM before mitigation, NEGATIVE LOW after mitigation during the construction and operational phases.

MITIGATION: The following mitigation measures are recommended for Medium Significance (Field Rating IVB) heritage resources recorded:

- A 15 x 20 m buffer zone is recommended around KNS/162/003.

- Alternatively, a destruction permit can be obtained from NBKB (Northern Cape Provincial Heritage Authority).



Figure 16 *Recommended Buffer for KNS/162/003*

MITIGATION CONFIDENCE: The significance of the impact is assessed following the implementation of mitigation measures based on the confidence levels that the mitigation measures will reduce the impact.

MITIGATION CONFIDENCE		
NEGATIVE IMPACTS		
0.2-0.3	High	80% confidence that the mitigation measures will reduce the impact

ARCHAEOLOGICAL, HISTORICAL, & CULTURAL								
NATURE	HERITAGE AND CULTURAL RESOURCES IDENTIFIED SITE(S): MEDIUM SIGNIFICANCE Field Rating IIIB – KSS/001							
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	2	2	Negative High impact	Negative Low impact	Safety/No-Go Buffer Zone	NO	YES
	Probability	3	1					
	Reversibility	3	2					
	Irreplaceability	4	1					
	Duration	3	2					
	Cumulative Effect	3	3					
	Magnitude	3	2					
	Impact Significance	54	22					
OPERATIONAL PHASE	Extent	2	2	Negative High Impact	Negative Low impact	Safety/No-Go Buffer Zone	NO	YES
	Probability	2	1					
	Reversibility	3	2					
	Irreplaceability	4	1					
	Duration	3	2					
	Cumulative Effect	3	3					
	Magnitude	3	2					
	Impact Significance	51	22					

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

IMPACT: One instance of Medium Significance resources were noted:

- A railroad bridge older than 60 years (KSS/001).

This resource is given a 'Local' Protection B (Field Rating IIIB) and considered to be medium significance. Any impact would be negative. The impact would be NEGATIVE HIGH before mitigation, NEGATIVE LOW after mitigation, during the construction operational phases.

MITIGATION: The following mitigation measures are recommended for Medium Significance (Field Rating IIIB) heritage resources recorded:

- A 10 m buffer zone is recommended around KSS/001.
- The destruction of this resource is not recommended.



Figure 17 *Recommended Buffer for KSS/001*

MITIGATION CONFIDENCE: The significance of the impact is assessed following the implementation of mitigation measures based on the confidence levels that the mitigation measures will reduce the impact.

MITIGATION CONFIDENCE		
NEGATIVE IMPACTS		
0.2-0.3	High	80% confidence that the mitigation measures will reduce the impact

ARCHAEOLOGICAL, HISTORICAL, & CULTURAL								
NATURE	HERITAGE AND CULTURAL RESOURCES IDENTIFIED SITE(S): HIGH SIGNIFICANCE Field Rating IIIA – KSS/176/004, KSS/399/19/007							
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	2	2	Negative High impact	Negative Low impact	Precautionary Safety/No-Go Buffer Zone	NO	YES
	Probability	1	1					
	Reversibility	3	2					
	Irreplaceability	4	1					
	Duration	4	2					
	Cumulative Effect	3	3					
	Magnitude	3	2					
	Impact Significance	51	22					
OPERATIONAL PHASE	Extent	2	2	Negative Medium Impact	Negative Low impact	Precautionary Safety/No-Go Buffer Zone	NO	YES
	Probability	1	1					
	Reversibility	3	2					
	Irreplaceability	4	1					
	Duration	3	2					
	Cumulative Effect	3	3					
	Magnitude	3	2					
	Impact Significance	48	22					

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

IMPACT: Two cemeteries (KSS/176/004, KSS/399/19/007) were noted that will likely not be directly impacted. All graves are of High significance and should be protected. However, neither of these cemeteries falls within the proposed development BWS trajectories, so neither will be impacted. However unlikely, if an impact occurs, the impact would be NEGATIVE HIGH before mitigation, NEGATIVE LOW after mitigation during the construction phase, and NEGATIVE MEDIUM before and NEGATIVE LOW after mitigation during the operational phase.

MITIGATION: The following mitigation measures are recommended for High Significance (Field Rating IIIA) heritage resources recorded:

- Although the probability of impact is extremely low (less than 25%), the impact can be avoided by implementing a precautionary buffer (no-go) zone around the cemeteries.
  - Although no direct impact is anticipated, a precautionary buffer zone should be implemented to manage potential risks associated with heavy vehicle and equipment movement. **A 50 m precautionary no-go buffer is therefore recommended around the cemetery at** KSS/176/004**, and the site should be fenced off to ensure its protection.**
  - Although no direct impact is anticipated, a precautionary buffer zone should be implemented to manage potential risks associated with heavy vehicle and equipment movement. **A 50 m precautionary no-go buffer is therefore recommended around the cemetery at** KSS/399/19/007**, and the site should be fenced off to ensure its protection.**
- **The cemeteries should be demarcated and avoided by personnel and equipment. Gravesites should remain accessible to all descendants and family members during all phases of the project.**
- **Grave relocation can be undertaken by accredited Grave Relocation Specialists with permits from SAHRA (BGG).**

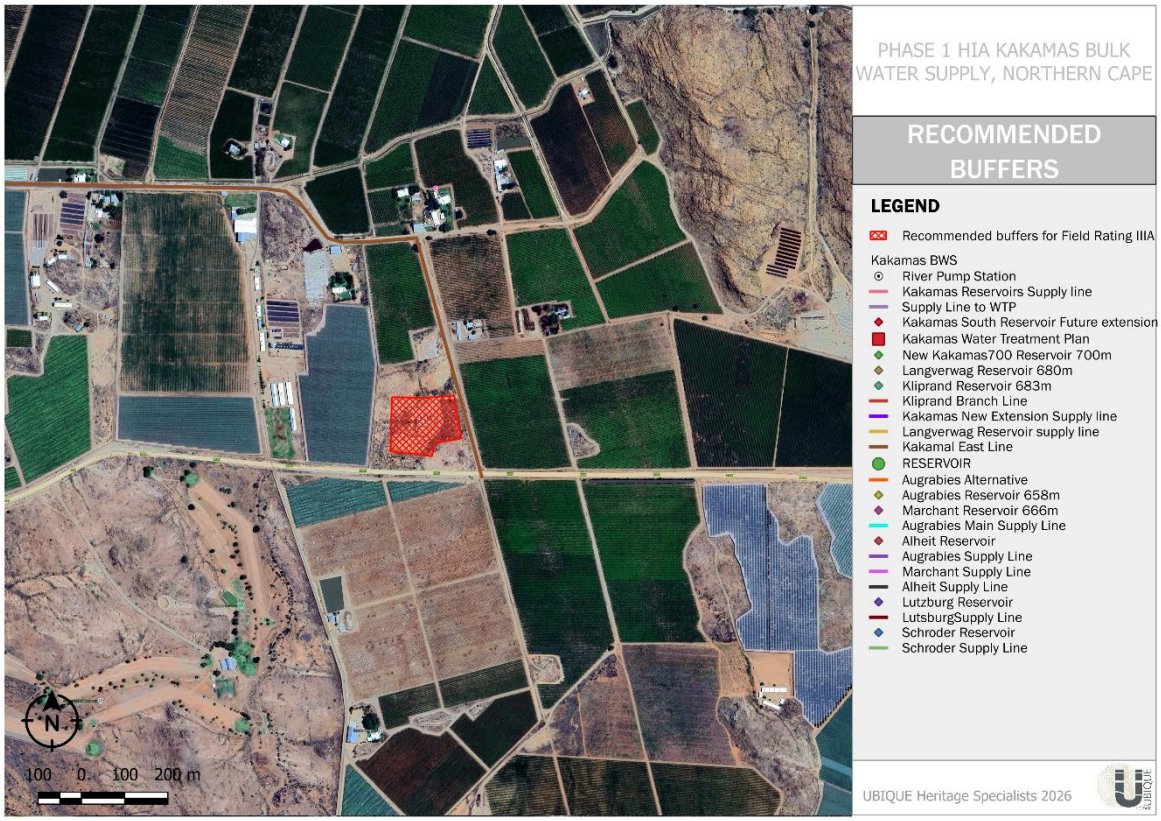


Figure 18 *Precautionary Buffer for KSS/176/004*

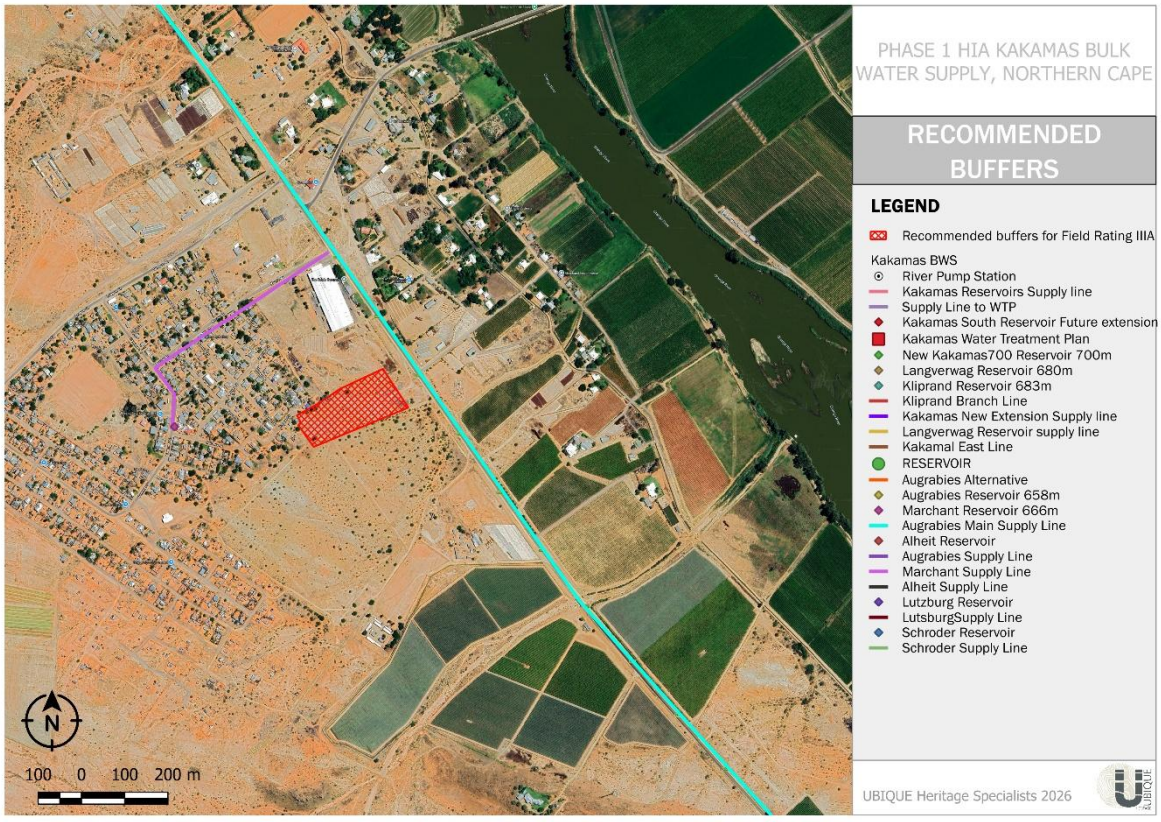


Figure 19 *Precautionary Buffer for KSS/399/19/007*

MITIGATION CONFIDENCE: The significance of the impact is assessed following the implementation of mitigation measures based on the confidence levels that the mitigation measures will reduce the impact.

MITIGATION CONFIDENCE		
NEGATIVE IMPACTS		
0.2-0.3	High	80% confidence that the mitigation measures will reduce the impact

ARCHAEOLOGICAL, HISTORICAL, & CULTURAL								
NATURE	HERITAGE AND CULTURAL RESOURCES IDENTIFIED SITE(S): HIGH SIGNIFICANCE Field Rating IIIA –KSS/1500/F/19/006, KSS/1181/008							
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	2	2	Negative High impact	Negative Low impact	Safety/No-Go Buffer Zone	NO	YES
	Probability	3	1					
	Reversibility	3	2					
	Irreplaceability	4	1					
	Duration	4	2					
	Cumulative Effect	3	3					
	Magnitude	3	2					
	Impact Significance	57	22					
OPERATIONAL PHASE	Extent	2	2	Negative Medium Impact	Negative Low impact	Safety/No-Go Buffer Zone	NO	YES
	Probability	2	1					
	Reversibility	3	2					
	Irreplaceability	4	1					
	Duration	3	2					
	Cumulative Effect	3	3					
	Magnitude	3	2					
	Impact Significance	54	22					

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

IMPACT: Two cemeteries (KSS/1500/F/19/006, KSS/1181/008) were noted that will likely be directly impacted. All graves are of High significance and should be protected. Any impact will be negative. The impact would be NEGATIVE HIGH before mitigation, NEGATIVE LOW after mitigation during the construction phase, and NEGATIVE MEDIUM before and NEGATIVE LOW after mitigation during the operational phase.

MITIGATION: The following mitigation measures are recommended for High Significance (Field Rating IIIA) heritage resources recorded:

- A 15 x 30 m no-go buffer is recommended around the cemetery at KSS/1500/F/19/006, and the cemetery should be fenced off to ensure its protection.
- A 20 x 25 m no-go buffer is therefore recommended around the cemetery at KSS/1181/008, and the cemetery should be fenced off to ensure its protection.
- The cemeteries should be noted and avoided by personnel and equipment. Gravesites should remain accessible to all descendants and family members during all phases of the project.
- The cemeteries should be demarcated and avoided by personnel and equipment. Gravesites should remain accessible to all descendants and family members during all phases of the project.
- Grave relocation can be undertaken by accredited Grave Relocation Specialists with permits from SAHRA (BGG).

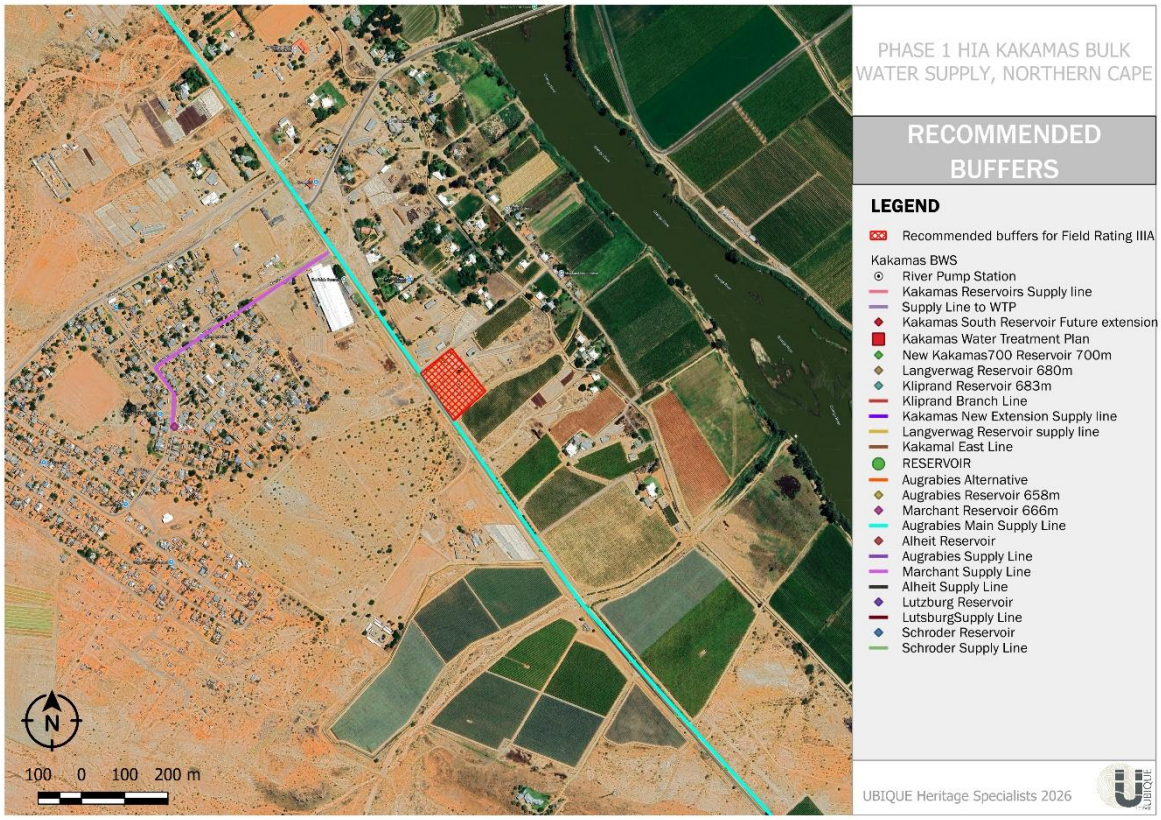


Figure 20 *Recommended Buffer for KSS/1500/F/19/006*

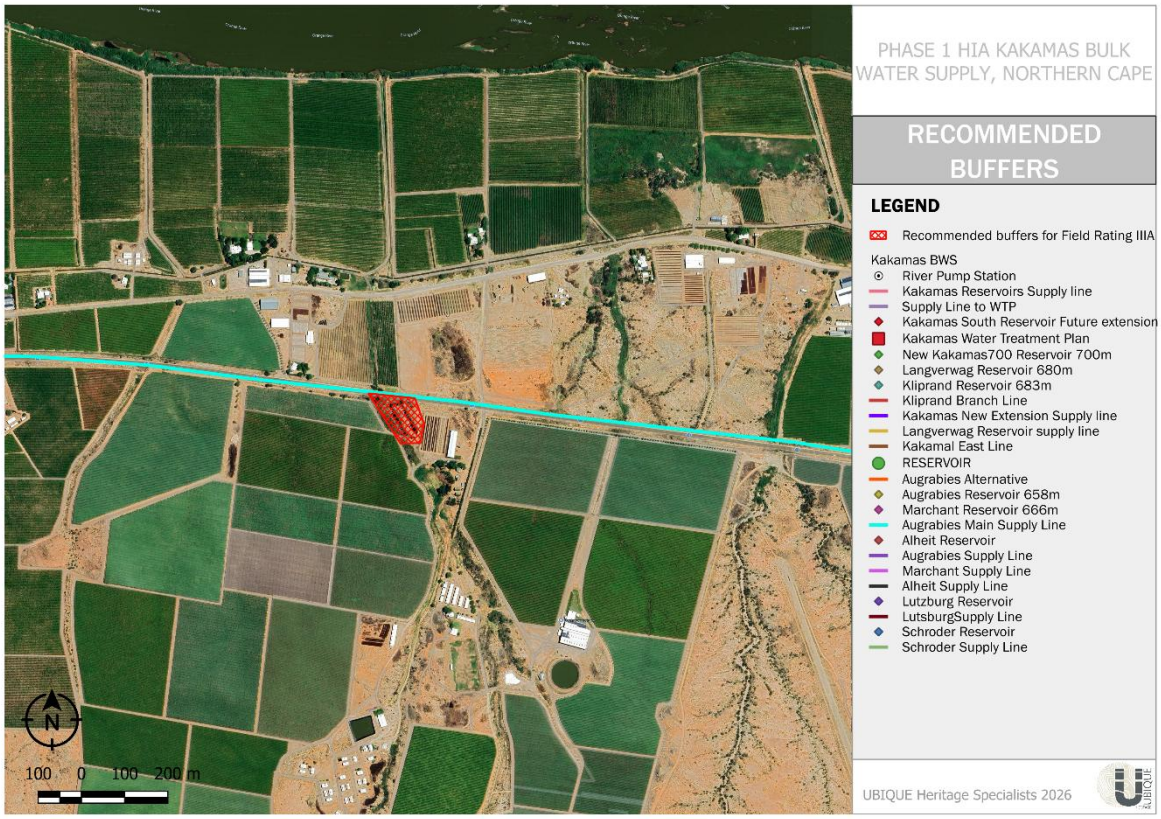


Figure 21 *Recommended Buffer for KSS/1181/008*

MITIGATION CONFIDENCE: The significance of the impact is assessed following the implementation of mitigation measures based on the confidence levels that the mitigation measures will reduce the impact.

MITIGATION CONFIDENCE		
NEGATIVE IMPACTS		
0.2-0.3	High	80% confidence that the mitigation measures will reduce the impact

PALAEONTOLOGICAL								
NATURE	LOSS OF FOSSIL HERITAGE BY DESTRUCTION, MOVEMENT OR SEALING IN 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 Medium impact	Negative low impact	NONE	NO	YES
	Probability	2	1					
	Reversibility	4	4					
	Irreplaceability	4	4					
	Duration	4	4					
	Cumulative Effect	1	1					
	Magnitude	2	1					
	Impact Significance	32	15					
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 palaeontological impacts, **a Medium Paleontological Significance has been allocated for the construction phase of the development pre-mitigation (as stated on the SAHRIS PaleoMap) and a low significance post-mitigation.** The construction phase will be the only development phase impacting Paleontological Heritage, and **no significant impacts are expected to impact the Decommissioning phase.** As the No-Go Alternative considers the option of 'doing nothing' and maintaining the status quo, it will have a Neutral impact on the Paleontological Heritage of the development. **The cumulative impacts of the development are considered Low pre- and post-mitigation and fall within the acceptable limits for the project.** It is therefore considered that the proposed development will not lead to damaging impacts on the Paleontological resources of the area. The construction of the development may thus be permitted in its whole extent, as the development footprint is not considered sensitive in terms of Paleontological resources. **It is consequently recommended that no further Paleontological heritage studies, ground truthing, and/or specialist mitigation are required pending the discovery of new fossils** (Butler 2026, Appendix B).

MITIGATION: If fossil remains are uncovered during any phase of construction, whether exposed on the surface or revealed through excavation, the Environmental Control Officer (ECO) or the responsible site manager must immediately contact SAHRA. All fossil discoveries must be safeguarded and reported to the South African Heritage Resources Agency (SAHRA) at 111 Harrington Street, Cape Town, PO Box 4637, Cape Town 8000, South Africa; Tel: 021 462 4502; Fax: 021 462 4509; Web: www.sahra.org.za. This ensures that recording and collection can be undertaken by a qualified palaeontologist.

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 Paleontological impact studies proposed by SAHRA (2012). It is consequently recommended that no further Paleontological heritage studies, ground truthing, and/or specialist mitigation are required pending the discovery of new fossils.

These recommendations should be included in the EMPr for the Kakamas Bulk Water supply in the Northern Cape Province (Butler 2026, Appendix B).

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.*"

For this report, the term "cumulative effect" has been defined as the summation of effects over time that can be attributed to the operation of the project itself and the overall effects on the heritage significance of the site within a 30 km radius that can be attributed to the project and other similar existing and planned future projects.

7.2.1 Geographical Area to be Assessed

The geographic area of evaluation is the spatial boundary within which the cumulative effects analysis was undertaken. The geographical area evaluated for the cumulative effects assessment includes a 30 km radius surrounding the proposed development (Figure 22). Development has transformed the area minimally.

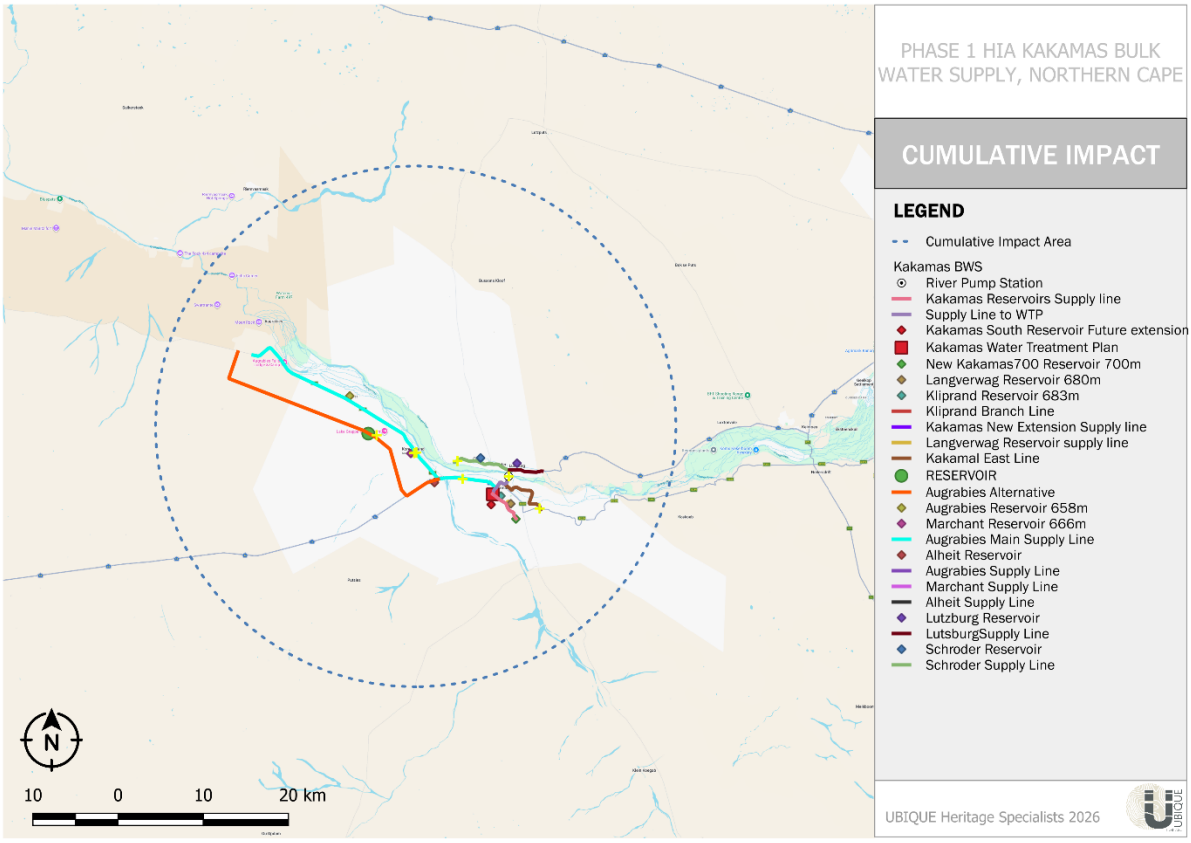


Figure 22 *Map showing the 30 km radius of the geographical area.*

7.2.2 Temporal Boundary

The temporal boundary refers to the timeframe for the expected cumulative impacts. As heritage resources are finite, if negative impacts occur, their effects are likely to accumulate and exceed the temporal boundary.

7.2.3 Specialist Assessments: Archaeological and Palaeontological

The desktop research shows that heritage resources are predominantly sparsely distributed in the broader landscape, with highly significant sites around Kakamas. The heritage resources recorded during our assessment add minimal understanding of the wider archaeological, historical, and cultural landscape, even though they are site-specific. More significant heritage sites are located within a 30 km radius, but the cumulative effect of resources recorded within the footprint will not affect their significance, positively or negatively. Therefore, the proposed development will have a **LOW NEGATIVE** cumulative impact. **The proposed development within the study area cannot negatively impact the significant archaeological resources in the larger area, nor can it be negatively impacted by them.**

The general Palaeontological Sensitivity of the greater area is Zero to Medium. **If all the mitigation measures are carried out, a conservative estimate of the Cumulative impacts on fossil Heritage will be Low.**

RESOURCE TYPE	ACTIVITY IMPACT			IMPACT RATING	
	CRITERIA	*BM	**AM	BEFORE MITIGATION	AFTER MITIGATION
ARCHAEOLOGICAL, HISTORICAL, CULTURAL	Extent	2	2	Negative low impact	Negative 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	Negative low impact	Negative low impact
	Probability	2	2		
	Reversibility	2	2		
	Irreplaceability	2	2		
	Duration	3	3		
	Magnitude	2	2		
	Impact Significance	22	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. ARCHAEOLOGICAL AND CULTURAL HERITAGE

SITE	FEATURE	RECOMMENDATION	IMPACT
MEDIUM SIGNIFICANCE (FIELD RATING IVB)			
KNS/162/003	An old stone-walled house (older than 60 years)	• A 15 x 20 m buffer zone • Alternatively, a destruction permit can be obtained from NBKB (Northern Cape Provincial Heritage Authority).	Negative Medium Impact Before Mitigation Negative Low Impact After Mitigation
MEDIUM SIGNIFICANCE (FIELD RATING IIIB)			
KSS/001	A railroad bridge older than 60 years	• A 10 m buffer zone • The resource is worthy of conservation, and destruction is not recommended.	Negative High Impact Before Mitigation Negative Low Impact After Mitigation
HIGH SIGNIFICANCE (FIELD RATING IIIA)			
KSS/176/004	Cemetery	• A 50 m precautionary buffer zone • The grave site should be demarcated and avoided by personnel and equipment. Gravesites should remain accessible to all descendants and family members during all phases of the project. • Grave relocation can be undertaken by accredited Grave Relocation Specialists with permits from SAHRA (BGG).	Negative High Impact Before Mitigation Negative Low Impact After Mitigation
KSS/399/19/007	Cemetery	• A 50 m precautionary buffer zone • The grave site should be demarcated and avoided by personnel and equipment. Gravesites should remain accessible to all descendants and family members during all phases of the project. • Grave relocation can be undertaken by accredited Grave Relocation Specialists with permits from SAHRA (BGG).	Negative High Impact Before Mitigation Negative Low Impact After Mitigation
KSS/1500/F/19/006	Cemetery	• A 15 x 30 m buffer zone • The grave site should be demarcated and avoided by personnel and equipment. Gravesites should remain accessible to all descendants and family members during all phases of the project.	Negative High Impact Before Mitigation Negative Low Impact After Mitigation

SITE	FEATURE	RECOMMENDATION	IMPACT
		• Grave relocation can be undertaken by accredited Grave Relocation Specialists with permits from SAHRA (BGG).	
KSS/1181/008	Cemetery	• A 20 x 25 m buffer zone • The grave site should be demarcated and avoided by personnel and equipment. Gravesites should remain accessible to all descendants and family members during all phases of the project. • Grave relocation can be undertaken by accredited Grave Relocation Specialists with permits from SAHRA (BGG).	Negative High Impact Before Mitigation Negative Low Impact After Mitigation

2. **PALAEONTOLOGICAL HERITAGE:**

As the development footprint is not considered sensitive regarding palaeontological resources, the development construction may thus be approved in its entirety.

- However, if fossil remains are uncovered during any phase of construction, whether exposed on the surface or revealed through excavation, the Environmental Control Officer (ECO) or the responsible site manager must immediately contact SAHRA. All fossil discoveries must be safeguarded and reported to the South African Heritage Resources Agency (SAHRA) at 111 Harrington Street, Cape Town, PO Box 4637, Cape Town 8000, South Africa; Tel: 021 462 4502; Fax: 021 462 4509; Web: www.sahra.org.za. This ensures that recording and collection can be undertaken by a qualified palaeontologist.

- 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 Paleontological impact studies proposed by SAHRA (2012). It is therefore recommended that no further Paleontological heritage studies, ground-truthing, or specialist mitigation be required pending the discovery of new fossils.

- **These recommendations should be included in the EMPr for the Kakamas Bulk Water Supply in the Northern Cape Province.** (Appendix B).

3. Although every effort has been made to identify sites of cultural importance during the investigation of study areas, it is 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 activity, 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 Specialists and its personnel will not be held liable for such oversights or costs incurred due to such oversights.



9. CONCLUSION

This HIA has identified various resources during the assessment. An old stone-walled house (KNS/162/003) constructed from granite stones was identified. The structure consists of a single dwelling and is associated with agricultural use. It is located in close proximity to an existing farmhouse. This resource is given a 'General' Protection B (Field Rating IVB) and considered to be of medium significance. Impact would be negative. This resource is given a 'General' Protection B (Field Rating IVB) and considered to be of medium significance. Any impact would be negative. A 15 x 20 buffer zone is recommended for this resource. Alternatively, a destruction permit can be obtained from NBKB (Northern Cape Provincial Heritage Authority).

A railway bridge (KSS/001) is present near the Supply Line to WTP and forms part of the existing railway network. The bridge is older than 60 years. A new pump station is proposed to be constructed adjacent to the bridge, located just to the west of the existing structure. This resource is given a 'Local' Protection B (Field Rating IIIB) and considered to be of medium significance. Any impact would be negative. A 10 m buffer zone is recommended for this resource. The resource is worthy of conservation, and destruction is not recommended.

Four cemeteries were identified (KSS/176/004, KSS/399/19/007, KSS/1500/F/19/006, KSS/1181/008). All graves are considered to be of high significance and should be mitigated. These cemeteries are given a 'Local Grade Protection' (Field Rating IIIA) and are of local importance and worthy of conservation. The two cemeteries at KSS/176/004, KSS/399/19/00) do not fall within the proposed development BWS trajectories, so neither will be impacted. Any impact, however unlikely, would be negative; 50 m precautionary buffer zones are recommended for KSS/176/004 and KSS/399/19/007.

While the two cemeteries at KSS/1500/F/19/006, KSS/1181/008 will likely be impacted. Any impact would be negative. Thus, a 15 x 30 m buffer zone is recommended for KSS/1500/F/19/006, and a 20 x 25 m buffer zone for KSS/1181/008.

In addition, a closed and abandoned veldspar mine was identified. The mine is likely not older than 60 years. It has since been repurposed and is currently used as a venue theatre. This resource is noted for record purposes only; however, it may hold future significance in terms of industrial and mining archaeology. It is outside the proposed Kakamas BWS Augrabies Alternative trajectory footprint and will not be impacted.

Based on desktop research, it is concluded that fossil heritage of scientific and conservational interest in the study area is rare. A Medium Paleontological Significance has been allocated for the construction phase of the development pre-mitigation (as stated on the SAHRIS PaleoMap) and a low significance post-mitigation. The construction phase will be the only development phase

affecting Paleontological Heritage, and no significant impacts are expected during the Decommissioning phase. The construction of the development may thus be permitted in its whole extent, as the development footprint is not considered sensitive in terms of Paleontological resources. It is consequently recommended that no further Paleontological heritage studies, ground truthing, and/or specialist mitigation are required pending the discovery of new fossils.

The Kakamas Bulk Water Supply, Kai !Garib Local Municipality, ZF Mgcawu District Municipality, Northern Cape Province, may continue, provided the recommendations stipulated within this report and the subsequent SAHRA decision are followed.

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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

SPECIALIST CVS

HEIDI FIVAZ

ABRIDGED CURRICULUM VITAE

heidi@ubiquecrm.com

QUALIFICATIONS

2021 MA: Archaeology (Cum Laude) - UNISA
Dissertation: Late 19th-century railroad workcamps associated with the NZASM Oosterlijn: An archaeological survey. https://uir.unisa.ac.za/handle/10500/28082

2015 BA Honours: Archaeology - UNISA
Dissertation: Architecture, Material Remains and the Use of Domestic Space: the evidence from a 19th-century Venda household on Magoro Hill.

2012 BA: CUA – Historical Studies - UNISA
Majors: Archaeology and History

2000 B-Tech: Fine Art - Tshwane University of Technology

1998 National Diploma: Fine Art - Vaal Triangle Technikon

1995 G.E.D Matriculation - Hoërskool Brandwag

COURSES

October 2015 Care and Conservation of Archaeological Collections – City of Angels Conservation

March 2013 Conservation: Ceramic & glass colour fills – SA Institute of Object Conservation

September 2012 GIS and mapping workshop - University of South Africa

March 2012 Conservation of Low-fired and non-fired wares - SA Institute of Object Conservation

September 2011 Introduction to Ceramic Conservation - SA Institute of Object Conservation

March 2011 Introduction to Ceramic Conservation - SA Institute of Object Conservation

2010-2012 Intern Archaeozoological Analysis - Archaeozooologist Karin Scott

SKILLS

Archaeology:
Excavation Techniques and Methodology - Historical and Iron Age; **Survey** – Historical, Iron Age and Stone Age; **Site Mapping** - Historical and Iron Age; **Cultural Material Identification and Analysis** - Historical and Iron Age (Specialist); **Faunal Material Analysis** (Basic); **Lithic Tool Identification** (intermediate)

Related skills:
On and off-site Archaeological Material Conservation; Ceramic and Glass objects Conservation and Restoration; Scientific and Technical Writing; Archival Research; Archaeological Illustration

ARCHAEOLOGICAL FIELDWORK EXPERIENCE

Archaeological Excavations:
Ms Fivaz has been involved in nearly 40 archaeological excavations since 2005, including historical and agropastoral research excavations, Phase 2 mitigation rescue excavations, and grave rescue and relocation projects.

Cultural Resource Management / Heritage Impact Assessments:
Ms Fivaz has conducted numerous Heritage Impact Assessments, including field surveys, report writing and permit applications since 2015, compiling Heritage Inventories, and providing support for local Heritage Initiatives.

PROFESSIONAL BODIES

ASAPA (Association for Southern African Professional Archaeologists) Professional Membership number: 433

ARCSOC (Archaeological Society of South Africa)

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SKY-LEE FAIRHURST-BOOYSE

ABRIDGED CURRICULUM VITAE

sky@ubiquecrm.com

QUALIFICATIONS

2023 MA: Archaeology - UNISA
Dissertation: An archaeological investigation of the *Bakgatla Baga Kgafela* at Mabeleapodi, Pilanesberg National Park, North West Province.

2018 BA Honours: Archaeology (Cum Laude)- UNISA
Dissertation: An archaeological investigation of a 19th-century Tswana townhouse, Pilanesberg National Park, North West Province.

2016 BA (Bachelor of Arts): - UNISA
Majors: Archaeology and Biblical Archaeology.

2012 National Senior Certificate - High school/Hoërskool Westonaria

COURSES

July 2019 Historical Ceramics and Interpretation Workshop - ASAPA

December 2017 Student Development Workshop – ASAPA Student Council and PAST

August 2017 Archaeozoology/Bone Identification - HeritageworX-Ditsong Museum of Natural History

SKILLS

Archaeology:
Excavation Techniques and Methodology - Historical and Iron Age; **Survey –** Historical, Iron Age and Stone Age; **Site Mapping -** Historical and Iron Age; **Cultural Material Identification and Analysis -** Historical and Iron Age (Specialist); **Faunal Material Analysis** (Basic); **Lithic Tool Identification** (intermediate)

Related skills:
On-site Archaeological Material Conservation; Scientific and Technical Writing; Archival Research; Archaeological Illustration

ARCHAEOLOGICAL FIELDWORK EXPERIENCE

Archaeological Excavations:
Mrs Fairhurst-Booyse has been involved in 31 archaeological excavations since 2013, including historical and agropastoral research excavations and a Phase 2 mitigation rescue excavation.

Cultural Resource Management / Heritage Impact Assessments:
Mrs Fairhurst-Booyse started conducting numerous desktop assessments in 2019, but as of 2021 she has conducted numerous Heritage Impact Assessments, which included field surveys, report writing, and assisted with permit applications.

PROFESSIONAL BODIES

ASAPA (Association for Southern African Professional Archaeologists) Professional Membership number: 541

ARCSOC (Archaeological Society of South Africa)

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JAN ENGELBRECHT

ABRIDGED CURRICULUM VITAE

jan@ubiquecrm.com

QUALIFICATIONS

2011 BA Honours: Archaeology - UNISA
Dissertation: The Historical Site of Dr. David Bruce at Ubombo.

2009 BA: Archaeology, Biblical Archaeology and Ancient History. - UNISA
Majors: Archaeology

2004 B-Tech: Animal Health (UNISA)

1997 National Diploma: Animal Health (SA Technikon)

1989 G.E.D Matriculation

COURSES

2024: UNISA workshop: Archaeobotany

2022: Occupational Safety and Health Course (Khumba-Anglo American)

2018: Report Writing Skills (DALRRD)

2012: GIS and Mapping Workshop (Wits)

2010: Occupational Safety and Health Course (Richards Bay Minerals)

2010: Ceramics Workshop (UNISA)

2009: Project Management Course (Northwest University)

2008: Employee Performance Management (Dept. of Agriculture)

2008: Nature Conservation Workshop-Invasive Aquatic Plants and Honorary Ranger Course (Ezemvelo KZN)

2007: Workshop on Environmental and Heritage Management Plans (UNISA)

SKILLS

Archaeology:
Excavation Techniques and Methodology - Historical and Iron Age; Survey – Historical, Iron Age and Stone Age; Site Mapping - Historical and Iron Age; Cultural Material Identification and Analysis - Historical and Iron Age; Lithic Tool Identification (intermediate)

Related skills:
Site interpretation and survey (Expert); Scientific and Technical Writing

ARCHAEOLOGICAL FIELDWORK EXPERIENCE

Archaeological Excavations:
Mr Engelbrecht has been involved in nearly 20 archaeological excavations since 2005, including historical and agropastoral research excavations Phase 2 mitigation rescue excavations.

Cultural Resource Management / Heritage Impact Assessments:
Mr Engelbrecht has been involved in over 60 Heritage Impact Assessments since 2006, including field surveys and report writing, compiling Heritage Inventories, and supporting local Heritage Initiatives.

PROFESSIONAL BODIES

ASAPA (Association for Southern African Professional Archaeologists) Professional Membership number: 297

ARCSOC (Archaeological Society of South Africa)

South African Military Historical Society

South African Veterinary Council

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APPENDIX B

PALAEONTOLOGICAL IMPACT ASSESSMENT EXEMPTION

PALAEONTOLOGICAL DESKTOP ASSESSMENT FOR THE PROPOSED KAKAMAS BULK POTABLE WATER SUPPLY SCHEME, KAI !GARIB MUNICIPALITY, PART OF THE ZF MGCAWU DISTRICT MUNICIPALITY IN THE NORTHERN CAPE PROVINCE

26 May 2026

Compiled for Ubique Heritage Specialists

Compiled by Banzai Environmental

Declaration of Independence

I, Elize Butler, declare that –

General declaration:

- I act as the independent Paleontological 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 Paleontological 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 Paleontological 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.

PALEONTOLOGICAL CONSULTANT : Banzai Environmental (Pty) Ltd

CONTACT PERSON: Elize Butler

Email: info@banzai-group.com

SIGNATURE: 

This Palaeontological Impact Assessment report (as part of the Heritage Impact Assessment) has been compiled considering the Environmental Impact Assessment Regulations (Government Notice 982, Government Gazette 38282, 4 December 2014) Appendix 6 as amended by Government Notice 326 (Government Gazette 40772, 7 April 2017) requirements for specialist reports as indicated in the table below:

Table 1: Checklist for Specialist studies conformance with Appendix 6 of the EIA Regulations of 2014 (as amended).

Requirements Environmental Impact Assessment Regulations (Government Notice 982, Government Gazette 38282, 4 December 2014) Appendix 6 as amended	**The relevant section in the report**
1. (1) (a) (i) Details of the specialist who prepared the report	Page iii and Section 1.2 of the Report – Contact details and company, and Appendix B
(ii) The expertise of that person to compile a specialist report, including a curriculum vitae	Section 2.3 – refer to Appendix 1
(b) A declaration that the person is independent in a form as may be specified by the competent authority	Page iii of the report
(c) An indication of the scope of, and the purpose for which, the report was prepared	Section 2 – Scope of the report
(cA) An indication of the quality and age of the base data used for the specialist report	Section 5 – Geological and Palaeontological History of the Baseline Environment
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development, and levels of acceptable change;	Section 6
(d) The duration, date, and season of the site investigation and the relevance of the season to the outcome of the assessment	Executive Summary and Section 6
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process, inclusive of equipment and modelling used	Section 4 – Assessment Methodology
(f) Details of an assessment of the specifically identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Sections 5
(g) An identification of any areas to be avoided, including buffers	Executive Summary and Sections 7
(h) A map superimposing the activity, including the associated structures and infrastructure, on the environmental sensitivities of the site, including areas to be avoided, including buffers;	Section 5 – Geological and Palaeontological History

Requirements Environmental Impact Assessment Regulations (Government Notice 982, Government Gazette 38282, 4 December 2014) Appendix 6 as amended	**The relevant section in the report**
(i) A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 5.1 – Assumptions and Limitations
(j) A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Executive Summary and 7
(k) Any mitigation measures for inclusion in the EMPr	Executive Summary and Sections 7
(l) Any conditions for inclusion in the environmental authorisation	Executive Summary and Sections 7
(m) Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Executive Summary and Sections 7
(n)(i) A reasoned opinion as to whether the proposed activity, activities, or portions thereof should be authorised and	Executive Summary and Sections 7
(n)(iA) A reasoned opinion regarding the acceptability of the proposed activity or activities; and	
(n)(ii) If the opinion is that the proposed activity, activities, or portions thereof should be authorised, any avoidance, management, and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Executive Summary and Sections 7
(o) A description of any consultation process that was undertaken during the carrying out of the study	Not applicable. A public consultation process was handled as part of the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) process.
(p) A summary and copies of any comments that were received during any consultation process	Not applicable. To date, no comments regarding heritage resources that require input from a specialist have been raised.
(q) Any other information requested by the competent authority.	N/A
(2) Where a government notice by the Minister provides for any protocol or minimum information requirement to be applied to a	Section 1.4: Compliance with SAHRA guidelines

Requirements Environmental Impact Assessment Regulations (Government Notice 982, Government Gazette 38282, 4 December 2014) Appendix 6 as amended	**The relevant section in the report**
specialist report, the requirements as indicated in such notice will apply.	

1 EXECUTIVE SUMMARY

UBIQUE HERITAGE SPECIALISTST was commissioned to conduct the Heritage Impact Assessment (HIA) (archaeology and palaeontology) for the Proposed Kakamas Bulk Potable Water Supply Scheme in the Kai !Garib Municipality, part of the ZF Mgcawu District Municipality in the Northern Cape Province. This study is the Palaeontological Desktop Assessment (PDA) for the proposed project. In compliance with the National Environmental Management Act (Act No. 107 of 1998) (NEMA) and the National Heritage Resources Act (Act No. 25 of 1999, Section 38) (NHRA), this PDA aims to determine the potential presence of fossil material within the proposed development area, assess the likely impact of the project on palaeontological heritage, and recommend appropriate mitigation measures to protect any fossil resources that may be affected.

The development footprint is underlain by a diverse assemblage of geological units ranging from ancient Proterozoic metamorphic basement rocks to recent Quaternary surficial deposits, representing a geological time span exceeding 1,000 million years and reflecting the complex tectonic and depositional history of the Northern Cape Province. The study area is underlain by the Nachap Gneiss, undifferentiated metamorphic rocks, and Keimoes Suite granite of the Namaqua Metamorphic Complex, overlain by Quaternary alluvium associated with the Orange River and its tributaries, and the Gordonia Formation of the Kalahari Group (Partridge et al., 2006). According to the SAHRIS Palaeosensitivity Map, the Namaqua Metamorphic Complex is classified as having Zero sensitivity (grey), while the Quaternary alluvium and Gordonia Formation have Moderate sensitivity (green) (Almond et al., 2013). In alignment with these sensitivities, the Department of Forestry, Fisheries and the Environment (DFFE) Screening Tool identifies the broader study area as falling within a Medium (orange) palaeontological sensitivity zone.

Based on desktop research, it is concluded that fossil heritage of scientific and conservational interest in the study area is rare. A Medium Paleontological Significance has been allocated for the construction phase of the development pre-mitigation (as stated on the SAHRIS PaleoMap) and a low significance post-mitigation. The construction phase will be the only development phase impacting Paleontological Heritage, and no significant impacts are expected to impact the Decommissioning phase. As the No-Go Alternative considers the option of 'doing nothing' and maintaining the status quo, it will have a Neutral impact on the Paleontological Heritage of the development. Cumulative impacts of the development are considered Low pre- and post-mitigation and fall within the acceptable limits for the project. It is therefore considered that the proposed development will not lead to damaging impacts on the Paleontological resources of the area. The construction of the development may thus be permitted in its whole extent, as the development footprint is not considered sensitive in terms of Paleontological resources. It is consequently recommended that no further Paleontological heritage studies, ground truthing and/or specialist mitigation are required pending the discovery of newly discovered fossils.

If fossil remains are uncovered during any phase of construction, whether exposed on the surface or revealed through excavation, the Environmental Control Officer (ECO) or the responsible site manager must immediately contact SAHRA. All fossil discoveries must be safeguarded and reported to the South African Heritage Resources Agency (SAHRA) at: 111 Harrington Street, Cape Town, PO Box 4637, Cape Town 8000, South Africa; Tel: 021 462 4502; Fax: 021 462 4509; Web: www.sahra.org.za. This ensures that recording and collection can be undertaken by a qualified palaeontologist.

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 Paleontological impact studies proposed by SAHRA (2012). It is consequently recommended that no further Paleontological heritage studies, ground truthing and/or specialist mitigation are required pending the discovery of newly discovered fossils.

These recommendations should be included in the EMPr for the Kakamas Bulk Water supply in the Northern Cape Province.

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APPENDIX 1: CURRICULUM VITAE

ABBREVIATIONA AND TERMINOLOGY

BA	Basic Assessment
DEA	Department of Environmental Affairs
DFFE	Department of Forestry, Fisheries and the Environment
CA	National Competent Authority
DMR	Department of Mineral Resources
ECO	Environmental Control Officer
EA	Environmental Authorisation
EMPr	Environmental Management Programme
ESO	Environmental Site Officer
HIA	Heritage Impact Assessment
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

Fossil

A fossil is the preserved remains or traces of an organism that lived in the distant past, typically millions of years ago. These remains may include shells, mineralised bones, and other hard parts of ancient animals and plants, as well as impressions, moulds, and casts left in sedimentary rocks where organic material has decayed. Fossils offer important insights into the history of life on Earth, enabling scientists to study the evolution, diversity, and distribution of past organisms and ecosystems.

Heritage

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

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 National Heritage Resources Act (Act 25 of 1999) as amended,

- 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

Palaeontology is the scientific study of ancient life through time and entails the examination of fossils—remains, traces, or impressions of organisms preserved in rocks. It seeks to understand the evolution, diversity, and interactions of past life forms, as well as the environmental conditions in which they lived. By integrating geology and biology, palaeontology provides crucial insights into the history of life on Earth over geological time.

The term palaeontology derives from the Latin palaeontologia, which in turn originates from the Greek words palaios (παλαιός), meaning "ancient," and ontos (ὄντος), meaning "being" or "creature," combined with the suffix -logia, meaning "study of." The literal translation is therefore "the study of ancient beings." In English usage, the classical Latin, British and South African spelling is palaeontology, while the American spelling omits the a after the p, rendering paleontology. In this report the Latin, English and South African spelling of Palaeontology will be used.

2 INTRODUCTION

BVI Engineering has been appointed by Kai !Garib Municipality to undertake a feasibility assessment for the planned Kakamas Bulk Potable Water Supply Scheme. The project is ideally situated in the Kai !Garib Municipality, part of the ZF Mgcawu District Municipality in the Northern Cape Province. The proposed development entails the establishment of a new river pump station, rising main, water treatment facility, bulk storage reservoirs, and a comprehensive bulk pipeline network to supply Kakamas town and adjacent settlements.

This Palaeontological Desktop Assessment has been conducted in compliance with the National Environmental Management Act 107 of 1998 (NEMA) and the National Heritage Resources Act 25 of 1999 (NHRA, Section 38) to evaluate the palaeontological sensitivity of the development footprint, assess potential impacts on fossil heritage resources, and recommend necessary mitigation measures. The evaluation constitutes a component of the comprehensive Environmental Impact Assessment (EIA) procedure mandated for the project.

2.1 Locality

The Kakamas Bulk Potable Water Supply Scheme is situated in the Kai !Garib Municipality, Northern Cape Province, South Africa. The project area is located next to the Orange River in the central-northern part of the province. Kakamas town functions as the principal service centre, with the encompassing supply region comprising five adjacent villages: Augrabies, Alheit, Marchand, Lutzburg, and Cillie.

Project Components & Location

The proposed development comprises the following key infrastructure components distributed across the municipal area:

Water Abstraction & Treatment Facilities:

- New river pump station on the Orange River at Kakamas
- Rising main from pump station to Water Treatment Plant (WTP)
- New Water Treatment Plant with capacity ranging from 5.5 to 10.5 ML/day (depending on option selected)
- Bulk storage reservoirs (including a 7 ML high-level reservoir near Augrabies and potential 20 ML reservoir at Rhenosterkop)

Bulk Pipeline Network:

- Connector pipelines between WTP and reservoirs in Kakamas town
- Bulk supply pipelines extending to Augrabies, Marchand, Alheit, Lutzburg, and Cillie villages
- Extended pipeline routes to commercial farm areas including Rooipad, Schroder (north of Orange River), Kakamas East, and Kakamas South (depending on option selected)

The overall population to be served varies from around 11,202 individuals (Kakamas town exclusively) to 45,689 individuals (including towns, villages, and commercial farming regions), along with an additional 4,000 students at schools within the service area. The region undergoes significant population growth of 1.46% annually, principally fuelled by the burgeoning irrigated agriculture industry, encompassing export grapes, raisins, wine, and citrus production.

2.2 Scope of the Study

The aim of the study is to identify palaeontological resources and sensitivity within the proposed project area. The Palaeontological Desktop Assessment (PDA) is intended to inform the Environmental Impact Assessment (EIA) and to assist the developer in managing any identified heritage resources responsibly, thereby ensuring their protection, conservation, and appropriate development in accordance with the National Heritage Resources Act (Act 25 of 1999), as amended.

2.3 Specialist Qualifications

Mrs Elize Butler from Banzai Environmental has conducted this study. She has undertaken over 900 Paleontological impact assessments for developments in the Free State, KwaZulu-Natal, the Eastern, Western and Northern Cape, the Northwest, Gauteng, Limpopo, and Mpumalanga. She holds an MSc (*cum laude)* in Zoology (with a focus in Palaeontology) from the University of the Free State in South Africa and has worked in the field for over thirty years. She has expertise identifying, collecting, and curating fossils, as well as going on exploration field expeditions in the Karoo Basin in search of new sites. She has been conducting PIAs since 2014 and is a member of the Paleontological Society of South Africa (PSSA).

A short CV is attached in Appendix 1, while a detailed CV could be provided on request.

2.4 Additional Information Consulted

In compiling this report the following sources were consulted:

- Geological map 1:100 000, Geology of the Republic of South Africa (Visser 1984)
- 1: 50 000 scale topographic maps.
- Palaeosensitivity map on SAHRIS (South African Heritage Resources Information System) website.
- DFFE Screening Tool of the study area
- A Google Earth kmz files and background information on the proposed development was supplied by Ubique Heritage Specialists as received from the developer.
- Google Earth© satellite imagery;
- 1:250 000 Upington 2820 Geological Map (Council for Geosciences, Pretoria).
- Palaeontological Impact Assessments in the same area are studied
- Due to the Palaeontological Sensitivities of the Project, no site investigation was conducted for the Project.

3 LEGISLATION

The cultural and palaeontological heritage in South Africa is safeguarded by an extensive legal framework that facilitates the identification, assessment, and management of heritage resources. The National Heritage Resources Act (NHRA, Act 25 of 1999) serves as the foundation of this framework, delineating heritage resources as components of the national estate, which include cultural, historical, archaeological, palaeontological, and geological elements of importance. Section 3 of the NHRA explicitly encompasses “all items retrieved from the soil or waters of South Africa, including archaeological and palaeontological artefacts, meteorites, and rare geological specimens.” Palaeontological heritage is non-renewable and safeguarded by Section 35, which prohibits the disturbance, destruction, or removal of fossils without a valid permit from SAHRA or the pertinent Provincial Heritage Resources Authority (PHRA). Fossil specimens must be gathered and preserved in a recognised institution in accordance with SAHRA's minimal standards.

The NHRA is governed nationally by SAHRA and provincially by PHRAs, establishing a three-tier system that reflects South Africa's cooperative governance framework. This method facilitates the identification, safeguarding, and preservation of heritage treasures for the advantage of current and future generations.

3.1 SUPPORTING LEGISLATION AND REGULATIONS

Heritage and palaeontological management are integrated into South Africa's broader environmental governance framework through the National Environmental Management Act (NEMA, Act 107 of 1998) and the Environmental Impact Assessment (EIA) Regulations (GN 982 of 2014, as amended by GN 326 of 2017). Section 23(2)(b) of NEMA explicitly requires integrated environmental management to *"identify, predict, and evaluate actual and potential impacts on the environment, socio-economic conditions, and cultural heritage."*

Government Notice 320 (GN 320, Government Gazette 43110, 20 March 2020) establishes standardized protocols for conducting initial site sensitivity verification where specific assessment procedures are not otherwise defined. GN 320 mandates the following requirements:

- Desktop analysis using satellite imagery and spatial databases
- Preliminary on-site inspection by a qualified specialist
- Verification of current and historical land use patterns
- Submission of supporting documentation (e.g., site photographs, GPS coordinates)
- Professional confirmation or refutation of indicated environmental sensitivity
- Evidence-based motivation for assessment findings

Table below summarizes these regulatory requirements and indicates where they have been addressed within this assessment.

GN 320	Relevant section in report	Where not applicable in this report
2.2(a) Desktop analysis using satellite imagery	Section 1	–
2.2(b) Preliminary on-site inspection	Executive Summary and Section 7	–
2.3(a) Confirm or dispute environmental sensitivity	Executive Summary and Section 7	–
2.3(b) Motivation and evidence	Executive Summary and Section 7	–

3.2 HERITAGE SCREENING – DFFE NATIONAL WEB-BASED ENVIRONMENTAL SCREENING TOOL

A heritage screening was performed utilising the DFFE National Web-based Environmental Screening Tool, as mandated by GN 982. The April 2025 standards state that thematic layers for cultural, archaeological, and palaeontological resources encompass only a finite number of documented sites, which may be extensively dispersed and perhaps located at any development site. The directives specify:

A Heritage Impact Assessment is required for all developments, irrespective of the sensitivity indicated on the archaeological and cultural heritage theme layers. A Palaeontological Impact Assessment is required for all developments according to the SAHRIS PalaeoSensitivity Map, regardless of the indicated sensitivity.

According to the heritage screening report, the Palaeontological Sensitivity of the proposed development area is Moderate (orange), indicating that a detailed palaeontological desktop assessment is required as well as a Chance Find Protocol.

3.3 SECTION 38: HERITAGE IMPACT ASSESSMENTS

Section 38 of the NHRA regulates the administration of heritage resources concerning development. Specific forms of development necessitate a Heritage Impact Assessment (HIA), including: Linear constructions including roads, pipelines, canals, or electricity lines that surpass 300 meters; Bridges or other constructions surpassing 50 meters; Changes that modify site characteristics, including those beyond 5,000 m², involving three or more properties, or rezoning exceeding 10,000 m².

Upon activation, SAHRA or the pertinent PHRA must be informed, and the HIA is required to: Identify and delineate heritage resources within the impacted region; Evaluate importance and possible effects; Evaluate viable alternatives; Propose suitable mitigation and management strategies.

3.4 INTEGRATION WITH ENVIRONMENTAL ASSESSMENT

Section 38(8) of the NHRA permits the amalgamation of historic evaluations with NEMA EIA processes, thereby eliminating redundancy. Palaeontological Impact Assessments (PIAs) can be executed as a component of the Heritage Impact Assessment (HIA) under the overarching Environmental Impact Assessment (EIA) framework. This guarantees the prompt identification, safeguarding, and administration of fossil heritage throughout development planning.

If no environmental process is necessary, but the development activates Section 38(1) of the NHRA, SAHRA or the pertinent PHRA assumes the role of the authorising authority and may mandate a comprehensive HIA, encompassing public participation and stakeholder interaction.

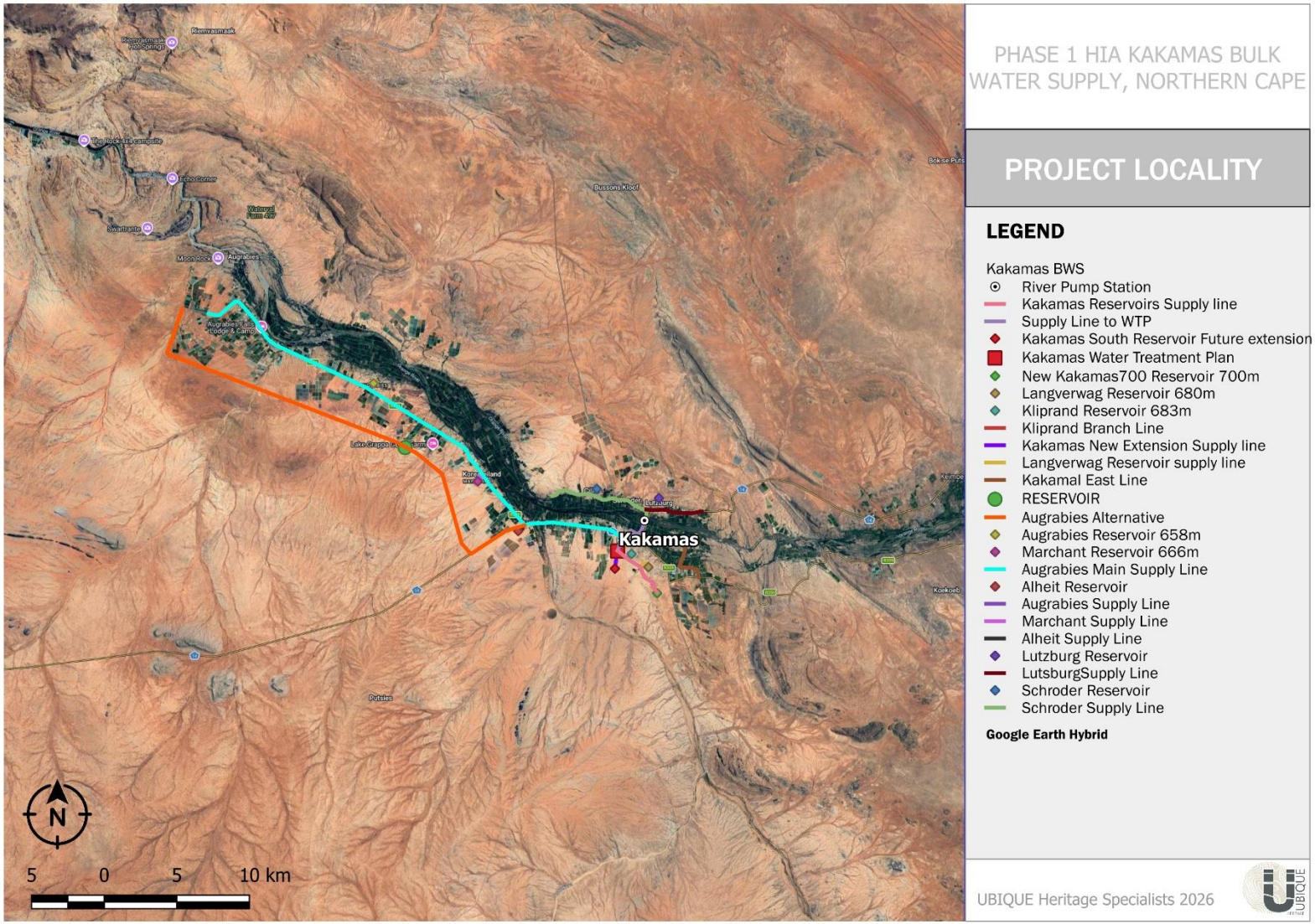


Figure 1: Regional Locality of the proposed Kakamas Bulk Potable Water Supply Scheme is situated in the Kai !Garib Municipality, part of the ZF Mgcawu District Municipality in the Northern Cape Province.

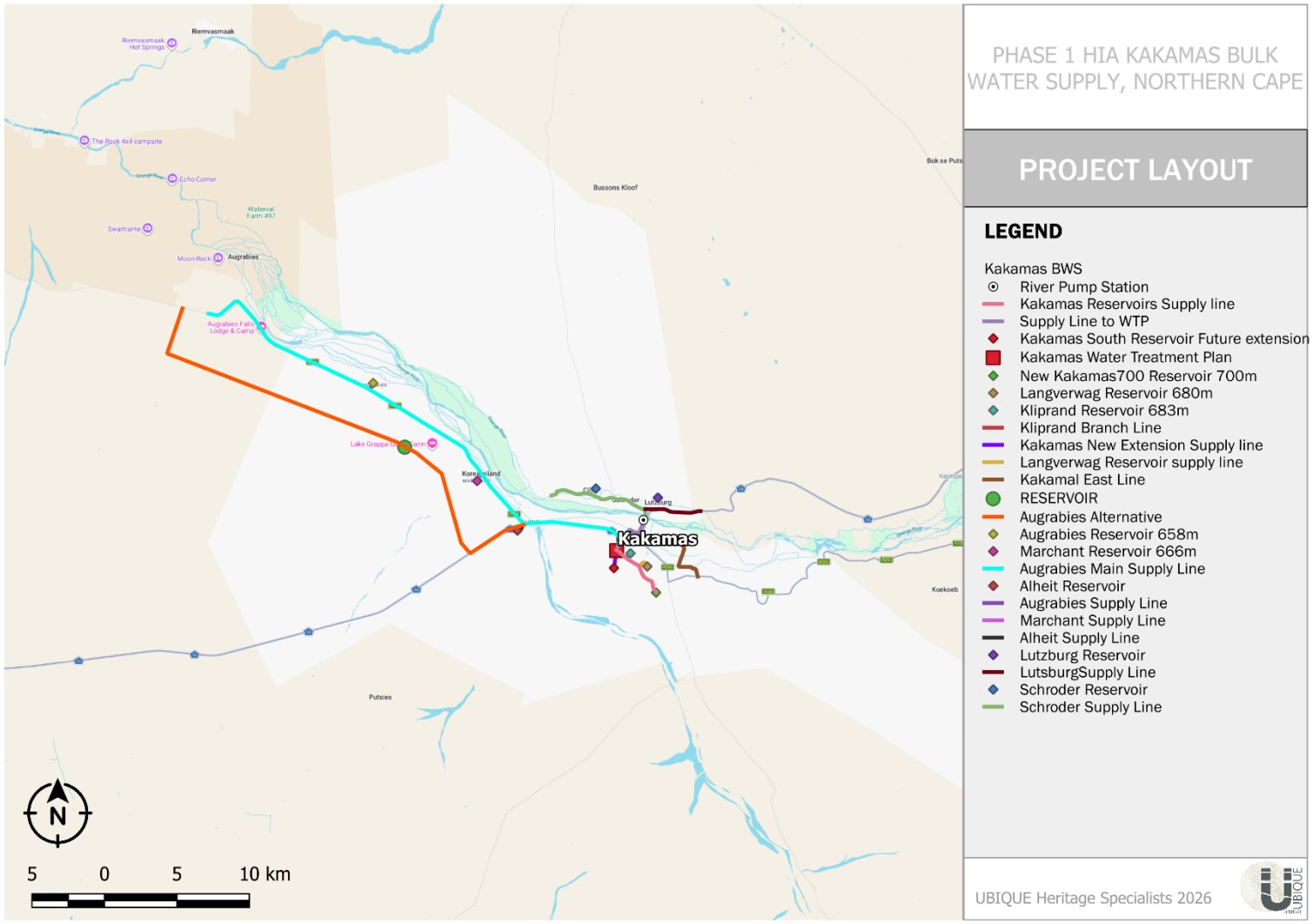


Figure 2: Project layout.

4 METHODS AND TERMS OF REFERENCE

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

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

The Provisional DFFE Screening Tool, the SAHRIS Palaeosensitivity map, all Palaeontological Impact Assessment reports for the same area, Google Earth images, topographical and geological maps, as well as academic articles about specimens from the development area and Assemblage Zones, are all used to create scoping reports.

When the development footprint has a Very 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 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).

5.1 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 Paleontological 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.

5 GEOLOGICAL AND PALEONTOLOGICAL HISTORY

The proposed Kakamas Bulk Potable Water Supply Scheme is situated in the Kai !Garib Municipality in the Northern Cape Province and is mapped on the 1:250,000 Upington 2820 geological sheet (Council for Geoscience, Pretoria). The development footprint is underlain by a diverse assemblage of geological units ranging from ancient Proterozoic metamorphic basement rocks to recent Quaternary surficial deposits, representing a geological time span exceeding 1,000 million years and reflecting the complex tectonic and depositional history of the Northern Cape Province (Figure 3). The study area is underlain by the Nachap Gneiss (Mrn), undifferentiated metamorphic rocks (Mrm), and Keimoes Suite granite (Mke) of the Namaqua Metamorphic Complex, overlain by Quaternary alluvium associated with the Orange River and its tributaries, and the Gordonia Formation of the Kalahari Group (Partridge et al., 2006). According to the SAHRIS Palaeosensitivity Map, the Namaqua Metamorphic Complex is classified as having Zero sensitivity (grey), while the Quaternary alluvium and Gordonia Formation have Moderate sensitivity (green) (Almond et al., 2013; Figure 4, Table 2). In alignment with these sensitivities, the Department of Forestry, Fisheries and the Environment (DFFE) Screening Tool identifies the broader study area as falling within a Medium (orange) palaeontological sensitivity zone (Figure 5). These geological formations are described in detail below, with particular emphasis on their palaeontological significance and implications for the proposed development.

The Proterozoic basement rocks of the Namaqua Metamorphic Complex, including the Nachap Gneiss (Mrn), undifferentiated metamorphic rocks (Mrm), and Keimoes Suite granite (Mke), have zero palaeontological sensitivity and are entirely unfossiliferous (Almond and Pether, 2009). The Nachap Gneiss and undifferentiated metamorphic rocks comprise igneous or metasedimentary protoliths (original rock types) that have undergone subsequent high-grade metamorphism. The extreme temperatures and pressures experienced during metamorphism—exceeding 650°C at depths of 20 to 30

kilometers—would have destroyed any organic material or fossils that may have been present in the original sedimentary or volcanic rocks (Cornell et al., 2006). The processes of recrystallization and mineral reorganization during metamorphism completely obliterate any original biological structures, precluding fossil preservation in rocks of this type. Similarly, the Keimoes Suite granite, as a crystalline igneous rock formed from cooling magma at temperatures exceeding 700°C, is entirely unfossiliferous. No organic material or fossils can exist in igneous rocks of this type, as they crystallized directly from molten rock at temperatures incompatible with the preservation of biological material. The Proterozoic basement rocks are therefore barren of palaeontological heritage and pose no palaeontological constraints to development.

In contrast to the unfossiliferous basement rocks, Quaternary alluvial deposits have moderate to high palaeontological sensitivity and may contain a diverse assemblage of fossil material (Partridge et al., 2006). The alluvium may preserve vertebrate fossils including mammalian remains of extinct Pleistocene megafauna such as giant buffalo (*Syncerus antiquus*, *Pelorovis antiquus*), extinct equids including the giant Cape horse (*Equus capensis*), large bovids (hartebeest, springbok, eland), and carnivores (lion, hyena, wild dog) (Klein, 1984; Brink, 1987). Micromammal remains including rodents, shrews, and bats may be preserved in fine-grained sediments, along with reptile fossils (tortoises, lizards, snakes), amphibian remains (frogs), and freshwater fish fossils (Avery, 1982). Invertebrate fossils may include freshwater molluscs (bivalves and gastropods), terrestrial snails, ostracods (seed shrimps)—which are important palaeoenvironmental indicators—and insect remains in organic-rich layers. Plant fossils may be represented by wood fragments and petrified wood, seeds, fruits, and plant macrofossils, pollen and phytoliths (microscopic plant silica bodies), and charcoal from ancient fires (Scott, 1982). Trace fossils including vertebrate trackways preserved on bedding planes, burrows, root casts (rhizoliths), and invertebrate trace fossils (insect burrows, termite structures) may also be present. The alluvial deposits may contain associated archaeological material including Stone Age artifacts (Early, Middle, and Late Stone Age), human occupation sites along ancient river margins, and evidence of past human-environment interaction (Beaumont, 1990).

The Orange River valley alluvium is particularly significant as it may preserve a continuous record of environmental change spanning the last 100,000 years or more, including climate fluctuations (wetter and drier periods), vegetation changes, faunal turnover and extinctions, and human migration and technological development (Partridge and Maud, 2000). The preservation potential for fossil material in alluvial deposits is enhanced where rapid burial occurred during flood events, where fine-grained sediments provided a protective matrix around bones and organic material, where waterlogged conditions inhibited decomposition and oxidation, and where subsequent calcrete development cemented and protected fossils within a hardened matrix (Behrensmeyer, 1978). The scientific importance of fossils from the Orange River valley alluvium lies in their ability to provide evidence of past climates and environments in the interior of South Africa, document the extinction of Pleistocene megafauna and the causes thereof, record the evolution and migration patterns of modern fauna,

preserve evidence of early human populations and their interaction with the environment, and enable correlation with other Quaternary sequences in southern Africa and globally (Klein, 1984; Brink, 1987).

The Gordonia Formation has low to moderate palaeontological sensitivity (Almond and Pether, 2009). While the bulk of the formation comprises barren aeolian sands with minimal fossil preservation potential, localized fossiliferous horizons may occur, particularly in calcretized layers and paleosol horizons (Partridge et al., 2006). Vertebrate fossils, though rare, may include mammalian remains in calcretized horizons and paleosol layers, with teeth and bone fragments of Tertiary and Quaternary mammals generally sparse and fragmentary due to low preservation potential in sandy environments (Klein, 1984). Microfossils may include mammalian microfauna (rodents, insectivores) preserved in calcrete nodules, which are important for biostratigraphic correlation and palaeoenvironmental reconstruction (Avery, 1982). Plant fossils may be represented by petrified wood fragments, particularly in silcrete-rich horizons, root casts (rhizoliths) preserved in calcretized layers, rare leaf impressions in fine-grained paleosol layers, and pollen preserved in clay-rich interdune deposits (Scott, 1982). Trace fossils may include termitaria (fossil termite mounds and nest structures), which are locally abundant, vertebrate burrows in calcrete horizons, root traces and bioturbation structures, and invertebrate burrow systems.

Calcrete horizons within the Gordonia Formation are of particular palaeontological significance (Netterberg, 1980). Calcretes form through the precipitation of calcium carbonate in soils and sediments under semi-arid conditions, creating hardened layers that can preserve bone fragments and teeth within the calcrete matrix, contain micromammal remains accumulated by owls and small predators, record evidence of ancient vegetation through root casts, and preserve land snail shells and other terrestrial invertebrates (Watts, 1980). The Gordonia Formation provides important evidence for long-term climate change in southern Africa over the last 20 million years or more, the evolution of arid and semi-arid ecosystems, vegetation history and landscape evolution, and faunal turnover associated with progressive aridification (Partridge and Maud, 2000; Thomas and Shaw, 1991). While individual fossil finds in the Gordonia Formation may be sporadic and localized, they contribute to understanding the development of the modern arid landscape and the adaptation of flora and fauna to increasingly dry conditions over geological time.

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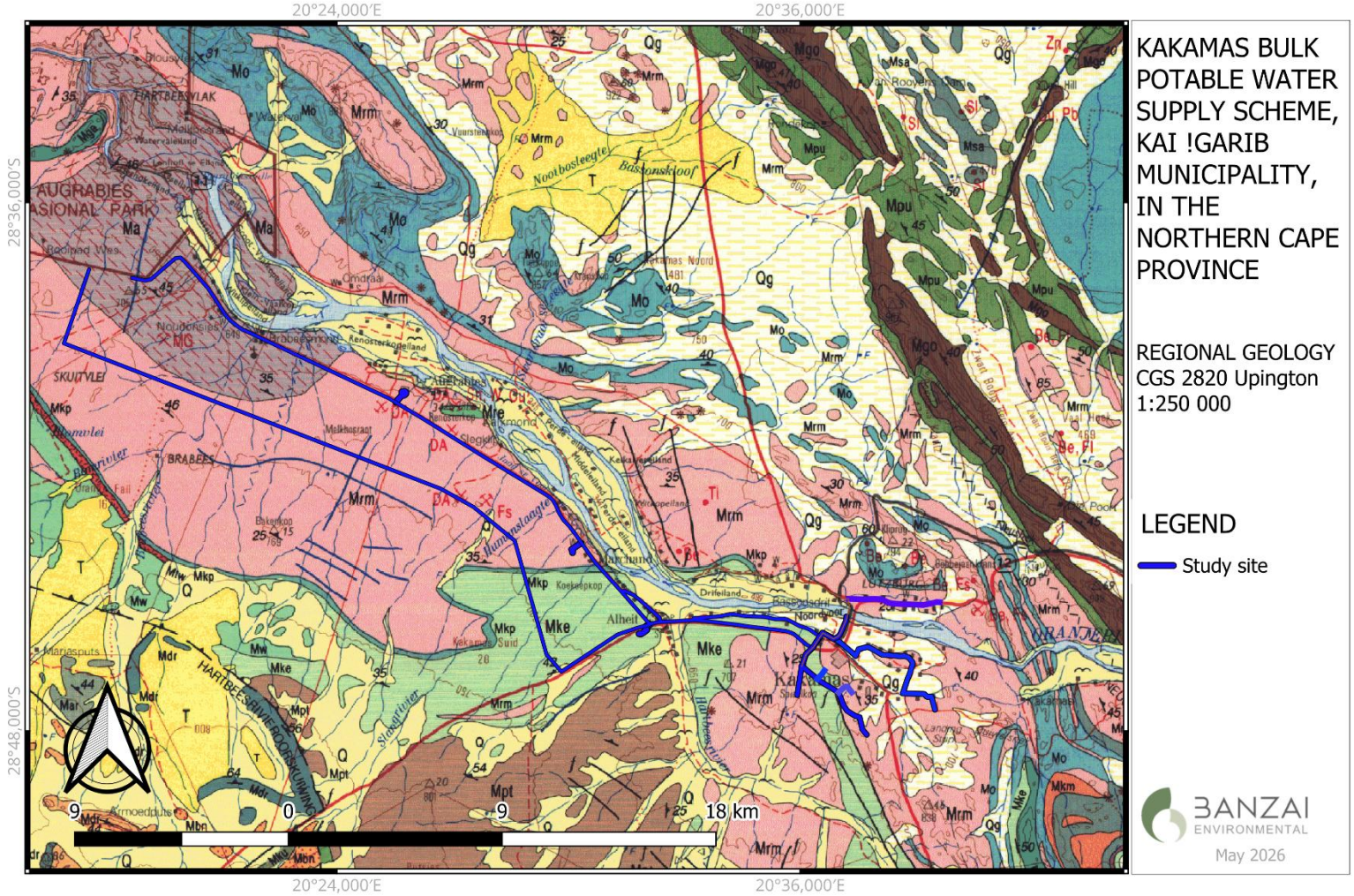


Figure 3: Extract of the Upington 2820 Geological Map (Council for Geoscience, Pretoria) indicates that the study area is predominantly underlain by Nachap Gneiss (Mrn), undifferentiated metamorphic rocks (Mrm), and Keimoes Suite granite (Mke) of the Namaqua Metamorphic Complex, overlain by Quaternary alluvium associated with the Orange River and its tributaries, and the Gordonia Formation of the Kalahari Group

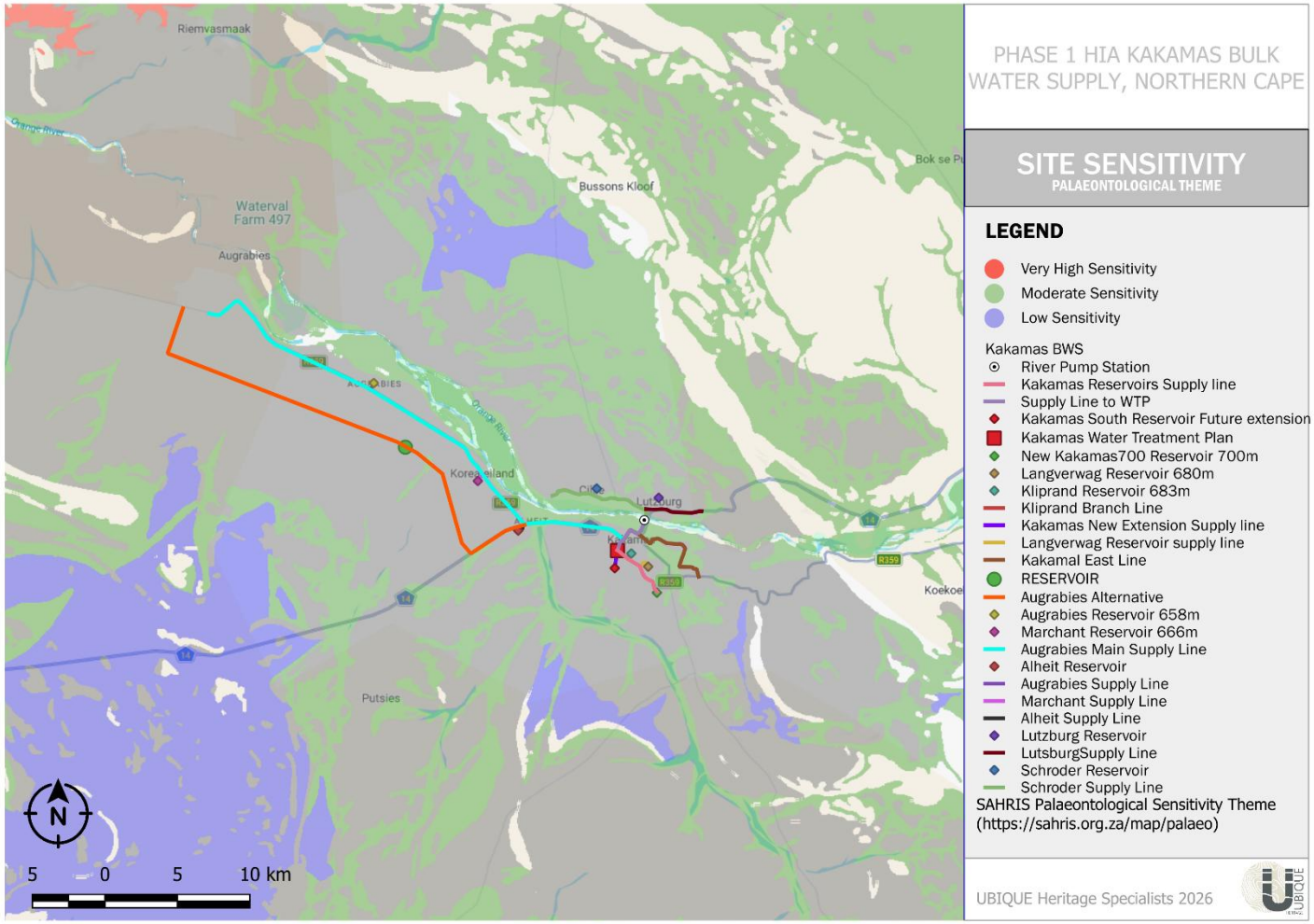


Figure 4: Extract of the SAHRIS PalaeoMap (Council for Geosciences, Pretoria) indicates that the proposed study area is underlain by sediments with Moderate (green) and Zero (grey) Paleontological Sensitivity.

Table 2: Paleontological Sensitivity according to the SAHRIS PalaeoMap (Almond et al, 2013; SAHRIS website.

Colour	Sensitivity	Required Action
RED	VERY HIGH	Field assessment and protocol for finds 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 Paleontological studies are required however a protocol for finds is required
GREY	INSIGNIFICANT/ZERO	No Paleontological 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.

The SAHRIS Palaeosensitivity map (Figure 54 Table 2) indicates that the proposed development is underlain by sediments with a Moderate (green) and Zero (grey) Palaeontological Sensitivity, which is supported by the DFFE Screening Tool (Figure 5). Due to the mapped Palaeontological Sensitivity, no site investigation was conducted and thus the actual Palaeontological Sensitivity of the development was not verified, but desktop research confirmed that the area has a LOW sensitivity for paleo resources.

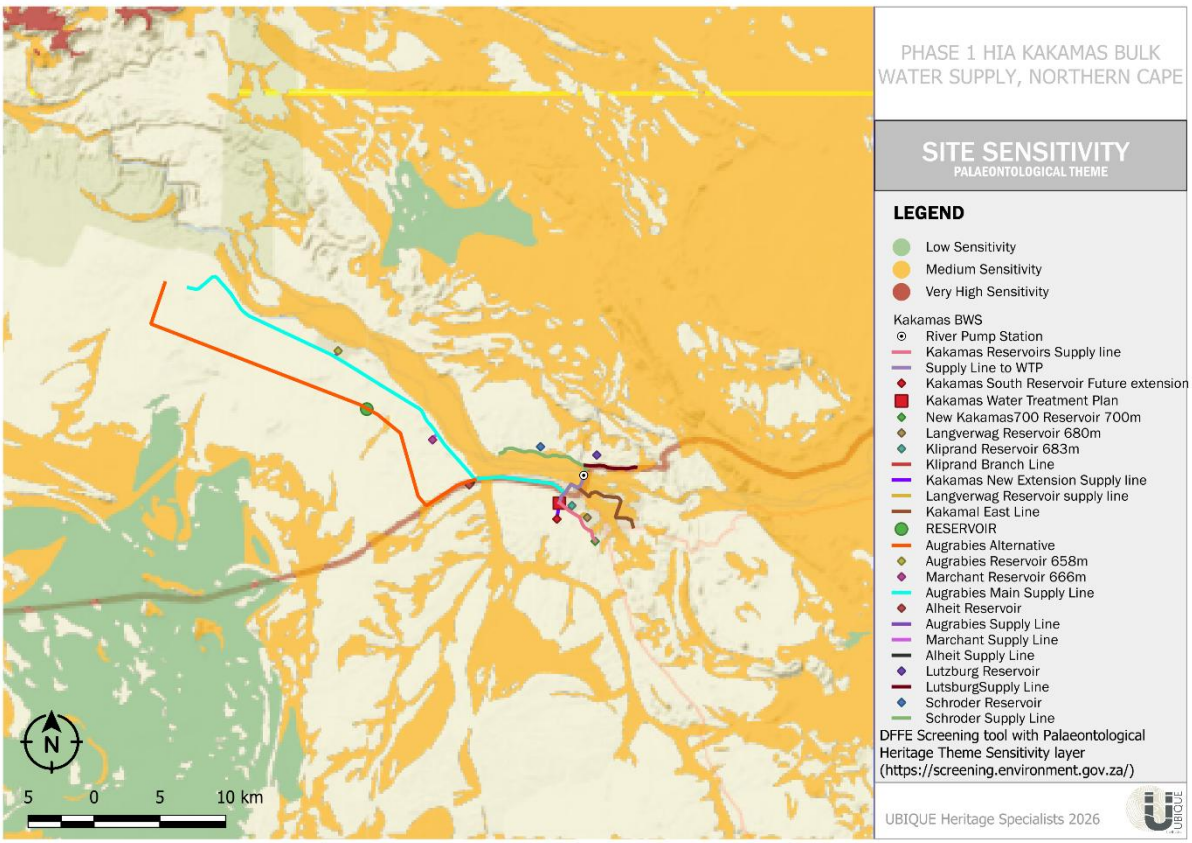


Figure 5: Paleontological Sensitivity of the proposed study area by the National Environmental Web-based Screening Tool indicates a Medium (orange) and unknown (white) Palaeontological Sensitivity.

6 ASSESSMENT METHODOLOGY

The impact assessment and mitigation, identifies and evaluates the significance of potential impacts according to the assessment criteria. The impact assessment methodology will furthermore describe the factors involved in assessing the significance of impacts and the standard rating scale that has been defined. Notably, the scale is defined since impacts have a number of parameters that need to be assessed.

Nevertheless, the nature of impact on the environment is also important in understanding the interaction between a planned project activity and the receiving environment. Table below outlines the type or nature if impact as well as its definition

Table 3: 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

Table 4: Summary of Impacts

PALAEONTOLOGICAL								
NATURE	LOSS OF FOSSIL HERITAGE BY DESTRUCTION, MOVEMENT OR SEALING IN 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							
	Probability							
	Reversibility							
	Irreplaceability							
	Duration							
	Cumulative Effect							
	Magnitude							
	Impact Significance							
CONSTRUCTION PHASE	Extent	1	1	Negative moderate impact	Negative low impact	NONE	NO	YES
	Probability	2	1					
	Reversibility	4	4					
	Irreplaceability	4	4					
	Duration	4	4					
	Cumulative Effect	1	1					
	Magnitude	2	1					
	Impact Significance	32	15					
OPERATIONAL PHASE	Extent							
	Probability							
	Reversibility							
	Irreplaceability							
	Duration							
	Cumulative Effect							
	Magnitude							
	Impact Significance							
DECOMMISSIONING PHASE	Extent							
	Probability							
	Reversibility							
	Irreplaceability							
	Duration							
	Cumulative Effect							
	Magnitude							

	Impact Significance	6	6					

7 FINDINGS AND RECOMMENDATIONS

The proposed Kakamas Bulk Potable Water Supply Scheme is situated in the Kai !Garib Municipality in the Northern Cape Province and is mapped on the 1:250,000 Upington 2820 geological sheet (Council for Geoscience, Pretoria). The development footprint is underlain by a diverse assemblage of geological units ranging from ancient Proterozoic metamorphic basement rocks to recent Quaternary surficial deposits, representing a geological time span exceeding 1,000 million years and reflecting the complex tectonic and depositional history of the Northern Cape Province. The study area is underlain by the Nachap Gneiss, undifferentiated metamorphic rocks, and Keimoes Suite granite of the Namaqua Metamorphic Complex, overlain by Quaternary alluvium associated with the Orange River and its tributaries, and the Gordonia Formation of the Kalahari Group (Partridge et al., 2006). According to the SAHRIS Palaeosensitivity Map, the Namaqua Metamorphic Complex is classified as having Zero sensitivity (grey), while the Quaternary alluvium and Gordonia Formation have Moderate sensitivity (green) (Almond et al., 2013). In alignment with these sensitivities, the Department of Forestry, Fisheries and the Environment (DFFE) Screening Tool identifies the broader study area as falling within a Medium (orange) palaeontological sensitivity zone.

Based on desktop research, it is concluded that the fossil heritage of scientific and conservational interest in the study area is rare. A Medium Paleontological Significance has been allocated for the construction phase of the development pre-mitigation (as stated on the SAHRIS PaleoMap) and a low significance post-mitigation. The operational phase will be the only development phase impacting Paleontological Heritage, and no significant impacts are expected to impact the Decommissioning phase. As the No-Go Alternative considers the option of 'doing nothing' and maintaining the status quo, it will have a Neutral impact on the Paleontological Heritage of the development. The cumulative impacts of the development are considered to be Low pre- and post-mitigation and fall within the acceptable limits for the project. It is therefore considered that the proposed development will not lead to damaging impacts on the Paleontological resources of the area. The construction of the development may thus be permitted in its whole extent, as the development footprint is not considered sensitive in terms of Paleontological resources. It is consequently recommended that no further Paleontological heritage studies, ground truthing and/or specialist mitigation are required pending the discovery of newly discovered fossils.

If fossil remains are uncovered during any phase of construction, whether exposed on the surface or revealed through excavation, the Environmental Control Officer (ECO) or the responsible site manager must immediately contact SAHRA. All fossil discoveries must be safeguarded and reported to the South

African Heritage Resources Agency (SAHRA) at: 111 Harrington Street, Cape Town, PO Box 4637, Cape Town 8000, South Africa; Tel: 021 462 4502; Fax: 021 462 4509; Web: www.sahra.org.za. This ensures that recording and collection can be undertaken by a qualified palaeontologist.

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 Paleontological impact studies proposed by SAHRA (2012). It is consequently recommended that no further Paleontological heritage studies, ground truthing and/or specialist mitigation are required pending the discovery of newly discovered fossils.

These recommendations should be included in the EMPr for the Kakamas Bulk Water Supply in the Northern Cape Province.

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APPENDIX 1

CURRICULUM VITAE: E. Butler

PROFESSION:	Palaeontologist
YEARS' EXPERIENCE:	30 years in Palaeontology
EDUCATION:	University of the Orange Free State
	B.Sc Botany and Zoology, 1988
	University of the Orange Free State
	B. Sc (Hons) Zoology, 1991
	University of the Free State
	M. Sc. *Cum laude* (Zoology), 2009

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

EMPLOYMENT HISTORY

Research Assistant	National Museum, Bloemfontein 1993 – 1997
Principal Research Assistant	National Museum, Bloemfontein
and Collection Manager	1998–2022
Banzai Environmental	2016 to present

Elize Butler has conducted approximately 900 Paleontological Impact Assessments for developments in the Free State, KwaZulu-Natal, Eastern, Northern and Western 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. She has experience in locating, collecting, and curating fossils. She has been a member of the Paleontological Society of South Africa (PSSA) since 2006 and has been conducting PIAs since 2014.

MEMBERSHIP

Paleontological Society of South Africa (PSSA) 2006-currently.

A full CV is available on request.