

PHASE 1 HIA REPORT CALVINIA BULK WATER NORTHERN CAPE

PROPOSED BULK WATER SUPPLY WITH BOREHOLE INFRASTRUCTURE AND PIPELINE TRAJECTORY DEVELOPMENTS ON THE FARMS AURETS KLOOF NO. 854, FARM NO. 114, RIETFONTEIN NO. 550 PORTION 2, AND SPITSKOP NO. 552 PORTION 10, AND ALONG NOOIENSRIVIER ROAD, THE R355, R27, GROOT TOREN ROAD, AND KLIPWERF ROAD, CALVINIA, HANTAM LOCAL MUNICIPALITY, NAMAKWA DISTRICT MUNICIPALITY, NORTHERN CAPE.

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For this project, Jan Engelbrecht was responsible for the field survey of the development footprint, identification of heritage resources, and recommendations. Heidi Fivaz was responsible for research and report compilation. Sky-Lee Fairhurst conducted the desktop study, and Elize Butler completed the PIA.

Declaration of independence:

We, Jan Engelbrecht and Heidi Fivaz, partners of UBIQUE Heritage Consultants, hereby confirm our independence as heritage specialists and declare that:

- we are suitably qualified and accredited to act as independent specialists in this application;
- we do not have any vested interests (either business, financial, personal or other) in the proposed development project other than remuneration for the heritage assessment and heritage management services performed;
- the work was conducted in an objective and ethical manner, in accordance with a professional code of conduct and within the framework of South African heritage legislation.



Signed:

Date: 2020-12-14

J.A.C. Engelbrecht & H. Fivaz
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EXECUTIVE SUMMARY

Project description

UBIQUE Heritage Consultants were appointed by EnviroAfrica cc as independent heritage specialists in accordance with Section 38 of the NHRA and the National Environmental Management Act 107 of 1998 (NEMA), to conduct a cultural heritage assessment to determine the impact of the proposed bulk water supply project (seven boreholes infrastructure and pipeline trajectories) of Calvinia, Hantam Local Municipality, Namakwa District Municipality, Northern Cape, on any sites, features, or objects of cultural heritage significance.

Findings and Impact on Heritage Resources

One isolated MSA core was recorded close to the development footprint of borehole BH3. The lithic material may be affected negatively by the proposed development, but due to the low significance of the material, the impact is negligible.

A historical farmscape with graveyard, structural remains and middens, is situated close to the development footprints of the boreholes BH1 and BH2 and the pipeline P1. These heritage resources are of medium to high cultural and historical significance. The probability of impact is low, but a buffer/safety zone to mitigate and negate any possibility of negative impact is nonetheless recommended.

The development footprint is underlain by Quaternary Sediments; Jurassic dolerite, Tierberg and Whitehill Formation (Ecca Group; Karoo Supergroup). The Palaeontological Sensitivity of Quaternary sediments is low but locally high; the Jurassic dolerite is insignificant. At the same time, the Tierberg Formation has a Moderate and the Whitehill Formation a Very High Palaeontological Sensitivity. No fossiliferous outcrops were identified during the palaeontological field survey (Butler 2020: Appendix A). The scarcity of fossil heritage at the proposed development footprint indicates that the impact of the development footprint will be of a low significance in palaeontological terms. It is therefore considered that the proposed development is deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological reserves of the area (Butler 2020).

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. No significant heritage sites or features were identified within the surveyed sections of the BH4-7 borehole developments, and P2-4 pipeline trajectories. The isolated Middle

Stone Age cultural material identified at BH3 is not conservation worthy. No further mitigation is recommended with regards to these resources.

2. The historical farmscape situated close to BH1-2 borehole developments and the first section of the P1 pipeline is of medium to high heritage significance (sites AUK002-013). These resources would require costly mitigation before destruction. It is, therefore, our recommendation that a buffer/safety zone should be implemented and that development should not exceed a 20m radius from the boreholes BH1 and BH2. Including all development activities and vehicle use associated with the development phase.
3. The small graveyard (AUK001) situated close to the BH1 borehole development and the first section of the P1 pipeline is graded as IIIB and is of High Local Significance. These resources would require costly mitigation before destruction. It is, therefore, our recommendation that a buffer/safety zone should be implemented and that development should not exceed a 20m radius from the borehole BH1, including all development activities and vehicle use associated with the development phase.
4. Due to the low palaeontological significance of the area, no further palaeontological heritage studies, ground-truthing and/or specialist mitigation are required. It is considered that the development of the proposed development is deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological resources of the area (Butler 2020). If fossil remains or trace fossils are discovered during any phase of construction, either on the surface or exposed by excavations the Chance Find Protocol (Appendix A/11) must be implemented by the Environmental Control Officer (ECO) in charge of these developments. These discoveries ought to be protected, and the ECO must report to SAHRA (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za) so that mitigation can be carried out by a palaeontologist (Butler 2020).
5. Although all possible care has been taken to identify sites of cultural importance during the investigation of study areas, it is always possible that hidden or sub-surface sites could be overlooked during the assessment. If during construction, any evidence of archaeological sites or remains (e.g. remnants of stone-made structures, indigenous ceramics, bones, stone artefacts, ostrich eggshell fragments, charcoal and ash concentrations), fossils or other categories of heritage resources are found during the proposed development, SAHRA APM Unit (Natasha Higgitt/Phillip Hine 021 462 5402) must be alerted as per section 35(3) of the NHRA. If unmarked human burials are uncovered, the SAHRA Burial Grounds and Graves (BGG) Unit (Thingahangwi Tshivhase/Mimi Seetelo 012 320 8490), must be alerted immediately as per section 36(6) of the NHRA. A professional archaeologist or palaeontologist, depending on the nature of the finds, must be contacted as soon as possible to inspect the findings. If the newly discovered heritage resources prove to be of archaeological or palaeontological significance, a Phase 2 rescue operation may be required subject to permits issued by SAHRA. UBIQUE Heritage Consultants and its personnel will not be held liable for such oversights or costs incurred as a result of such oversights.

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ABBREVIATIONS

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

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

GLOSSARY

Archaeological:	<p>material remains resulting from human activity which are in a state of disuse and are in or on land and are older than 100 years, including artefacts, human and hominid remains and artificial features and structures;</p> <ul style="list-style-type: none"> – rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and is older than 100 years (as defined and protected by the National Heritage Resources Act (NHRA) (Act No. 25 of 1999) including any area within 10 m of such representation; – wrecks, being any vessel or aircraft, or any part thereof, which were wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the culture zone of the Republic, as defined respectively in sections 3, 4 and 6 of the Maritime Zones Act, 1994 (Act No. 15 of 1994), and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which SAHRA considers to be worthy of conservation; – features, structures and artefacts associated with military history, which are older than 75 years and the sites on which they are found.
Stone Age:	The first and longest part of human history is the Stone Age, which began with the appearance of early humans between 3-2 million years ago. Stone Age people were hunters, gatherers and scavengers who did not live in permanently settled communities. Their stone tools preserve well and are found in most places in South Africa and elsewhere.
Earlier Stone Age:	>2 000 000 - >200 000 years ago
Middle Stone Age:	<300 000 - >20 000 years ago
Later Stone Age:	<40 000 - until the historical period
Iron Age:	<p>(Early Farming Communities). Period covering the last 1800 years, when immigrant African farmer groups brought a new way of life to southern Africa. They established settled villages, cultivated domestic crops such as sorghum, millet and beans, and herded cattle as well as sheep and goats. As they produced their own iron tools, archaeologists call this the Iron Age.</p> <p>Early Iron Age: AD 200 - AD 900 Middle Iron Age: AD 900 - AD 1300 Later Iron Age: AD 1300 - AD 1850</p>
Historic:	Period of arrival of white settlers and colonial contact. AD 1500 to 1950
Historic building:	Structures 60 years and older.
Fossil:	Mineralised bones of animals, shellfish, plants and marine animals. A trace fossil is the track or footprint of a fossil animal that is preserved in stone or consolidated sediment.
Heritage:	That which is inherited and forms part of the National Estate (historic places, objects, fossils as defined by the National Heritage Resources Act 25 of 1999).
Heritage resources:	These mean any place or object of cultural significance, tangible or intangible.

- Holocene:** The most recent geological period that commenced 10 000 years ago.
- Palaeontology:** Any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site that contains such fossilised remains or traces
- Cumulative impacts:** “Cumulative Impact”, 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 may not be significant, but may become significant when added to existing and reasonably foreseeable impacts eventuating from similar or diverse activities.
- Mitigation:** Anticipating and preventing negative impacts and risks, then to minimise them, rehabilitate or repair impacts to the extent feasible.
- A ‘place’:** a site, area or region;
- a building or other structure which may include equipment, furniture, fittings and articles associated with or connected with such building or other structure;
 - a group of buildings or other structures which may include equipment, furniture, fittings and articles associated with or connected with such group of buildings or other structures;
 - an open space, including a public square, street or park; and
 - in relation to the management of a place, includes the immediate surroundings of a place.
- ‘Public monuments and memorials’:** mean all monuments and memorials—
- erected on land belonging to any branch of central, provincial or local government, or on land belonging to any organisation funded by or established in terms of the legislation of such a branch of government; or
 - which were paid for by public subscription, government funds, or a public-spirited or military organisation, and are on land belonging to any private individual;
- ‘Structures’:** any building, works, device or other facility made by people and which are fixed to land, and include any fixtures, fittings and equipment associated therewith.

1. INTRODUCTION

1.1 Scope of study

The project involves the bulk water supply initiative in Calvinia, in the Hantam Local Municipality, Namakwa District Municipality, Northern Cape. UBIQUE Heritage Consultants were appointed by EnviroAfrica cc as independent heritage specialists in accordance with the National Environmental Management Act 107 of 1998 (NEMA), and in compliance with Section 38 of the National Heritage Resources Act 25 of 1999 (NHRA), to conduct a cultural heritage assessment (AIA/HIA) of the development area.

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

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

The integrity and significance of heritage resources can be jeopardised by natural (e.g. erosion) and human (e.g. development) activities. In the case of human activities, a range of legislation exists to ensure the timeous and accurate identification and effective management of heritage resources for present and future generations.

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

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

1.2 Assumptions and limitations

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

The significance of the sites, structures and artefacts is determined by means of 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 the evaluation of any site is done with reference to any number of these aspects. Cultural significance is site-specific and relates to the content and context of the site.

All possible care has been taken during the comprehensive field survey and intensive desktop study 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 due to dense vegetation cover. No subsurface investigation (i.e. excavations or sampling) were undertaken since a permit from SAHRA 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 contacted for an assessment of the find. Observed or located heritage features and/or objects may not be disturbed or removed in any way until such time that the heritage specialist has been able to assess the significance of the site (or material) in question.

2. TERMS OF REFERENCE

An HIA/ AIA must address the following key aspects:

- the identification and mapping of all heritage resources in the area affected;
- an assessment of the significance of such resources in terms of heritage assessment criteria set out in regulations;
- an assessment of the impact of the development on heritage resources;
- an evaluation of the impact of the development on heritage resources relative to the sustainable social and economic benefits to be derived from the development;
- if heritage resources will be adversely affected by the proposed development, the consideration of alternatives; and
- plans for mitigation of any adverse effects during and after completion of the proposed development.

In addition, the HIA/AIA should comply with the requirements of NEMA, including providing the assumptions and limitations associated with the study; the details, qualifications and expertise of the person who prepared the report; and a statement of competency.

2.1. Statutory Requirements

2.1.1 General

The Constitution of the Republic of South Africa Act 108 of 1996 is the source of all legislation. Within the Constitution the Bill of Rights is fundamental, with the principle that the environment should be protected for present and future generations by preventing pollution, promoting conservation and practising ecologically sustainable development. With regard to spatial planning and related legislation at national and provincial levels the following legislation may be relevant:

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

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

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

2.1.2 National Heritage Resources Act 25 of 1999

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

- coordinate and promote the management of heritage resources at 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 the protection and management of conservation-worthy places and areas by local authorities.

2.1.3 Heritage Impact Assessments/Archaeological Impact Assessments

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

- the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;
- the construction of a bridge or similar structure exceeding 50m in length;
- any development or other activity that will change the character of a site—
 - exceeding 5000m² in extent; or
 - involving three or more existing erven or subdivisions thereof; or
 - involving three or more erven or divisions thereof which have been consolidated within the past five years; or
 - the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;
- the rezoning of a site exceeding 10 000m² in extent; or
- any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority.

2.1.4 Definitions of heritage resources

The NHRA defines a heritage resource as any place or object of cultural significance, i.e. of 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.

Furthermore, a place or object is to be considered part of the national estate if it has cultural significance or other special value because of—

- its importance in the community, or pattern of South Africa's history;
- its possession of uncommon, rare or endangered aspects of South Africa's natural or cultural heritage;
- its potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage;
- its importance in demonstrating the principal characteristics of a particular class of South Africa's natural or cultural places or objects;
- its importance in exhibiting particular aesthetic characteristics valued by a community or cultural group;
- its importance in demonstrating a high degree of creative or technical achievement at a particular period;
- its strong or special association with a particular community or cultural group for social, cultural or spiritual reasons; and
- its strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa.

2.1.5 Management of Graves and Burial Grounds

- **Graves younger than 60 years** are protected in terms of Section 2(1) of the Removal of Graves and Dead Bodies Ordinance 7 of 1925 as well as the Human Tissues Act 65 of 1983.
- **Graves older than 60 years, situated outside a formal cemetery administered by a local Authority** are protected in terms of Section 36 of the NHRA as well as the Human Tissues Act of 1983. Accordingly, such graves are the jurisdiction of SAHRA. The procedure for Consultation Regarding Burial Grounds and Graves (Section 36(5) of NHRA) is applicable to graves older than 60 years that are situated outside a formal cemetery administered by a local authority. Graves in the category located inside a formal cemetery administered by a local authority will also require the same authorisation as set out for graves younger than 60 years over and above SAHRA authorisation.

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

- (3) (a) No person may, without a permit issued by SAHRA or a provincial heritage resources authority—

(a) destroy, damage, alter, exhume or remove from its original position or otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves;

(b) destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority; or

(c) bring onto or use at a burial ground or grave referred to in paragraph (a) or (b) any excavation equipment, or any equipment which assists in the detection or recovery of metals.

(4) SAHRA or a provincial heritage resources authority may not issue a permit for the destruction or damage of any burial ground or grave referred to in subsection (3)(a) unless it is satisfied that the applicant has made satisfactory arrangements for the exhumation and re-interment of the contents of such graves, at the cost of the applicant and in accordance with any regulations made by the responsible heritage resources authority.

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

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

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

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

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

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

3. STUDY APPROACH AND METHODOLOGY

3.1 Desktop study

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

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

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

3.1.1 Literature review

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

3.2 Field study

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

3.2.1 Systematic survey

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

UBIQUE Heritage Consultants inspected the proposed development and surrounding areas from the 16th to 19th of November 2020 and completed a controlled-exclusive, pre-planned, pedestrian and vehicular survey. We conducted an inspection of the surface of the ground, 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 the inspection of rodent burrows, cut banks and other exposures fortuitously observed.

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

3.2.2 Recording significant areas

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

3.2.3 Determining significance

Levels of significance of the various types of heritage resources observed and recorded in the project area will be determined to the following criteria:

Cultural significance:

- Low A cultural object being found out of context, not being part of a site or without any related feature/structure in its surroundings.
- Medium Any site, structure or feature being regarded less important due to several factors, such as date and frequency. Likewise, any important object found out of context.
- High Any site, structure or feature 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.

Heritage significance:

- Grade I Heritage resources with exceptional qualities to the extent that they are of national significance
- Grade II Heritage resources with qualities giving it provincial or regional importance although it may form part of the national estate
- Grade III Other heritage resources of local importance and therefore worthy of Conservation

Field ratings:

- i. National Grade I significance should be managed as part of the national estate
- ii. Provincial Grade II significance should be managed as part of the provincial estate
- iii. Local Grade IIIA should be included in the heritage register and not be mitigated (high significance)
- iv. Local Grade IIIB should be included in the heritage register and may be mitigated (high/ medium significance)

- | | | |
|------|-----------------------------|---|
| v. | General protection A (IV A) | site should be mitigated before destruction (high/ medium significance) |
| vi. | General protection B (IV B) | site should be recorded before destruction (medium significance) |
| vii. | General protection C (IV C) | phase 1 is seen as sufficient recording and it may be demolished (low significance) |

Heritage value, statement of significance:

- a. its importance in the community, or pattern of South Africa's history;
- b. its possession of uncommon, rare or endangered aspects of South Africa's natural or cultural heritage;
- c. its potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage;
- d. its importance in demonstrating the principal characteristics of a particular class of south Africa's natural or cultural places or objects;
- e. its importance in exhibiting particular aesthetic characteristics valued by a community or cultural group;
- f. its importance in demonstrating a high degree of creative or technical achievement at a particular period;
- g. its strong or special association with a particular community or cultural group for social, cultural or spiritual reasons;
- h. its strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa; and
- i. sites of significance relating to the history of slavery in South Africa.

3.2.4 Assessment of development impacts

A heritage resource impact may be defined broadly as the net change, either beneficial or adverse, between the integrity of a heritage site with and without the proposed development. Beneficial impacts occur wherever a proposed development actively protects, preserves or enhances a heritage resource, by minimising natural site erosion or facilitating non-destructive public use, for example. 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 that are out of character with the heritage resource and its setting.

Beneficial and adverse impacts can be direct or indirect, as well as 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. The following assessment criteria have been used to assess the impacts of the proposed development on possible identified heritage resources:

Criteria	Rating Scales	Notes
Nature	Positive	An evaluation of the type of effect the construction, operation and management of the proposed development would have on the heritage resource.
	Negative	
	Neutral	
Extent	Low	Site-specific affects only the development footprint.
	Medium	Local (limited to the site and its immediate surroundings, including the surrounding towns and settlements within a 10 km radius);
	High	Regional (beyond a 10 km radius) to national.
Duration	Low	0-4 years (i.e. duration of construction phase).
	Medium	5-10 years.
	High	More than 10 years to permanent.
Intensity	Low	Where the impact affects the heritage resource in such a way that its significance and value are minimally affected.
	Medium	Where the heritage resource is altered, and its significance and value are measurably reduced.
	High	Where the heritage resource is altered or destroyed to the extent that its significance and value cease to exist.
Potential for impact on irreplaceable resources	Low	No irreplaceable resources will be impacted.
	Medium	Resources that will be impacted can be replaced, with effort.
	High	There is no potential for replacing a particular vulnerable resource that will be impacted.
Consequence, (a combination of extent, duration, intensity, and the potential for impact on irreplaceable resources).	Low	A combination of any of the following: - Intensity, duration, extent and impact on irreplaceable resources are all rated low. - Intensity is low and up to two of the other criteria are rated medium. - Intensity is medium and all three other criteria are rated low.
	Medium	Intensity is medium and at least two of the other criteria are rated medium.

Criteria	Rating Scales	Notes
	High	Intensity and impact on irreplaceable resources are rated high, with any combination of extent and duration. Intensity is rated high, with all the other criteria being rated medium or higher.
Probability (the likelihood of the impact occurring)	Low	It is highly unlikely or less than 50 % likely that an impact will occur.
	Medium	It is between 50 and 70 % certain that the impact will occur.
	High	It is more than 75 % certain that the impact will occur, or it is definite that the impact will occur.
Significance (all impacts including potential cumulative impacts)	Low	Low consequence and low probability. Low consequence and medium probability. Low consequence and high probability.
	Medium	Medium consequence and low probability. Medium consequence and medium probability. Medium consequence and high probability. High consequence and low probability.
	High	High consequence and medium probability. High consequence and high probability.

3.3 Oral history

Where possible, people from local communities would be interviewed to obtain information relating to the surveyed area.

3.4 Report

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

4. PROJECT OVERVIEW

UBIQUE Heritage Consultants were appointed by EnviroAfrica cc as independent heritage specialists in accordance with Section 38 of the NHRA and the National Environmental Management Act 107 of 1998 (NEMA), to conduct a cultural heritage assessment to determine the impact of the proposed bulk water supply initiative in Calvinia, in the Hantam Local Municipality, on any sites, features, or objects of cultural heritage significance.

The proposed project aims to augment the current supply of water to the community of Calvinia through piped groundwater, originating from two newly developed well fields at the Kreitzberg Area along the Ceres-Karoo road and the Northwest Area along the gravel road from Calvinia to Loeriesfontein. The goal of the endeavour is to provide a sustainable system for supplying water suitable for human consumption for at least 15 to 20 years.

The Heritage Impact Assessment covers the footprints of seven groundwater borehole (BH1-7) infrastructure developments, including the pipeline trajectories from the boreholes towards Calvinia. Approximately 25 km of pipeline (P1-4) will be laid, predominantly along existing primary, secondary, and service road servitudes, with minimal crossover onto private property.

4.1 Technical information

Project description	
Project name	Calvinia Bulk Water Supply
Description	Proposed bulk water supply with seven boreholes, infrastructure and pipeline trajectory developments, Calvinia, Hantam Local Municipality, Namakwa District Municipality, Northern Cape.
Developer	
Hantam Local Municipality	
Contact information	Mr Riaan Van Wyk Tel: 027 – 341 8500 Fax: 027 – 341 8501 Email: vanwykrj@hantam.gov.za
Development type	Municipal infrastructure: water supply
Landowner	
Department of Transport Hantam Local Municipality road servitudes Affected private landowners: Mr Viviers, Mr Jansen van Wyk, Mr Vlok	
Consultants	
Environmental	EnviroAfrica cc.
Heritage and archaeological	UBIQUE Heritage Consultants
Paleontological	Banzai Environmental
Property details	
Province	Northern Cape
District municipality	Namakwa

Local municipality	Hantam	
Topo-cadastral map	1:50 000 3119BD, 3119BC, 3119DB, 3119DA	
Farm name	BH1&2: Aurets Kloof No. 854 BH3: Farm No. 114 BH4: R355, Rondeheuvel No. 765 Portion 1 BH5: R355, Beeswater No. 593 RE BH6: Groot Toren Road, Annex Groot Vlakte No. 585 RE BH7: Rietfontein No. 550 Portion 10 P1: Aurets Kloof No. 854, Nooiensrivier Road, R27 P2: R355 P3: Groot Toren Road P4: Rietfontein No. 550 Portion 10, Spitskop No. 553 Portion 10, Klipwerf Road, R27	
Closest town	Calvinia	
GPS Co-ordinates	BH1: 31° 39'1.29"S; 19° 48'3.77"E BH2: 31° 39'4.77"S; 19° 48'4.27"E BH3: 31° 38'2.10"S; 19° 45'23.27"E BH4: 31° 36'53.83"S; 19° 44'36.51"E BH5: 31° 24'4.21"S; 19° 33'24.04"E BH6: 31° 21'27.81"S; 19° 41'29.40"E BH7: 31° 22'22.31"S; 19° 58'15.00"E	
Property size	N/A	
Development footprint size	Pipeline length: approximately 25km Area: approximately 50ha	
Land use		
Previous	Agriculture and servitude area	
Current	Agriculture and servitude area	
Rezoning required	No	
Sub-division of land	No	
Development criteria in terms of Section 38(1) NHRA		Yes/No
Construction of a road, wall, power line, pipeline, canal or other linear form of development or barrier exceeding 300m in length.		Yes
Construction of bridge or similar structure exceeding 50m in length.		Yes
Construction exceeding 5000m ² .		Yes
Development involving three or more existing erven or subdivisions.		No
Development involving three or more erven or divisions that have been consolidated within the past five years.		No
Rezoning of site exceeding 10 000m ² .		No
Any other development category, public open space, squares, parks, recreation grounds.		No

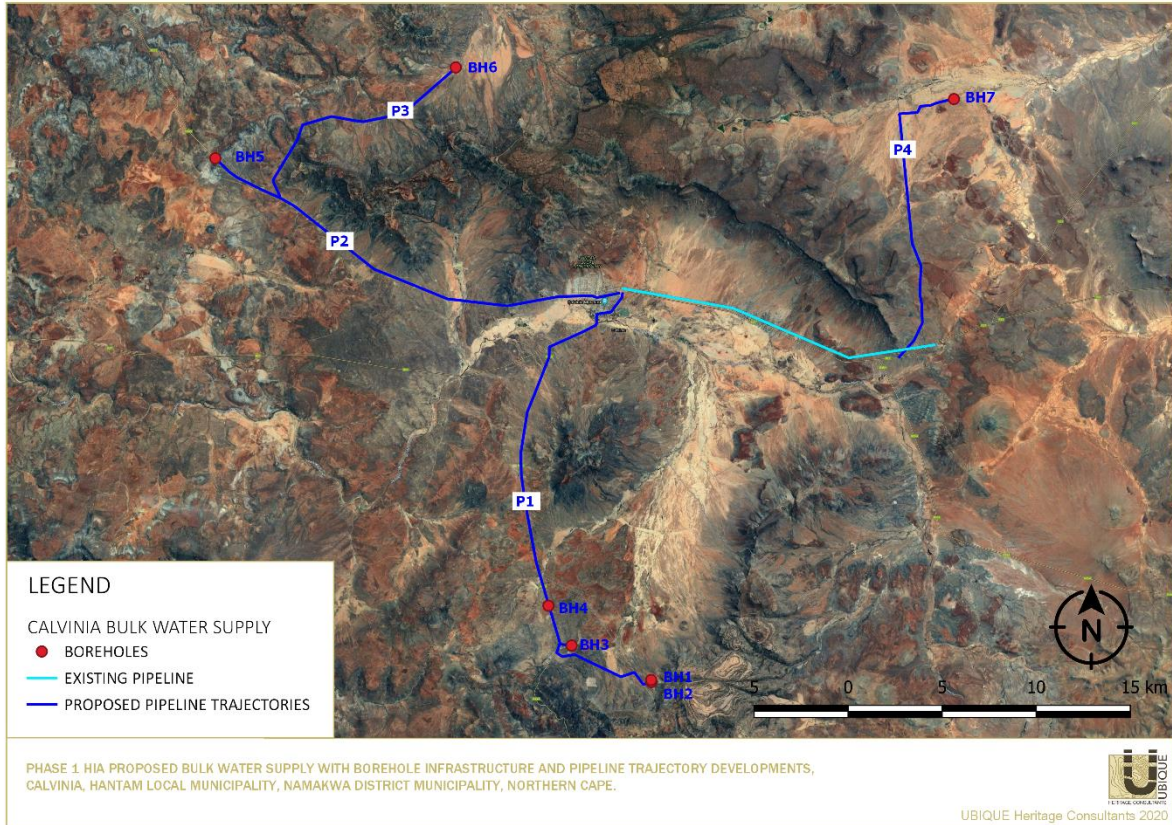


Figure 1 Regional locality of the development footprint, Calvinia, Hantam Local Municipality indicated on Google Earth Satellite imagery.

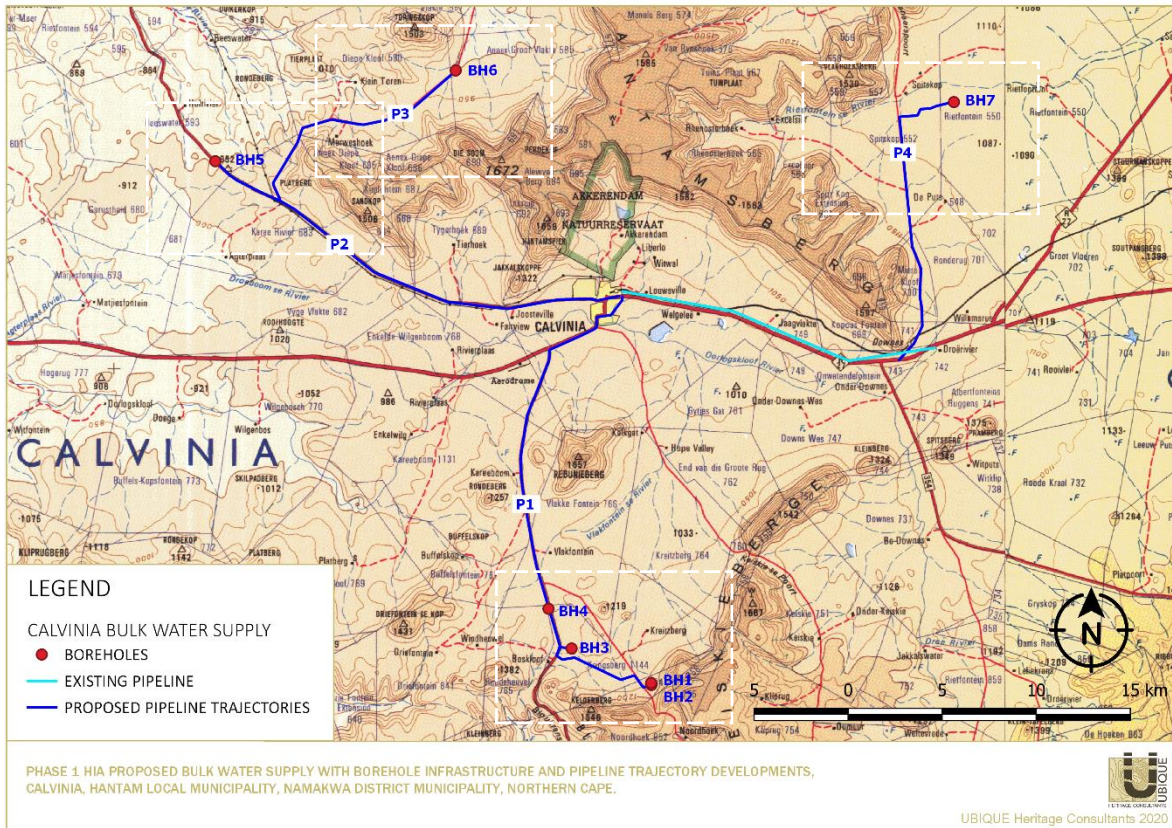


Figure 2 Regional locality of the development footprint, Calvinia, Hantam Local Municipality indicated on 1: 250 000 WGS3118.

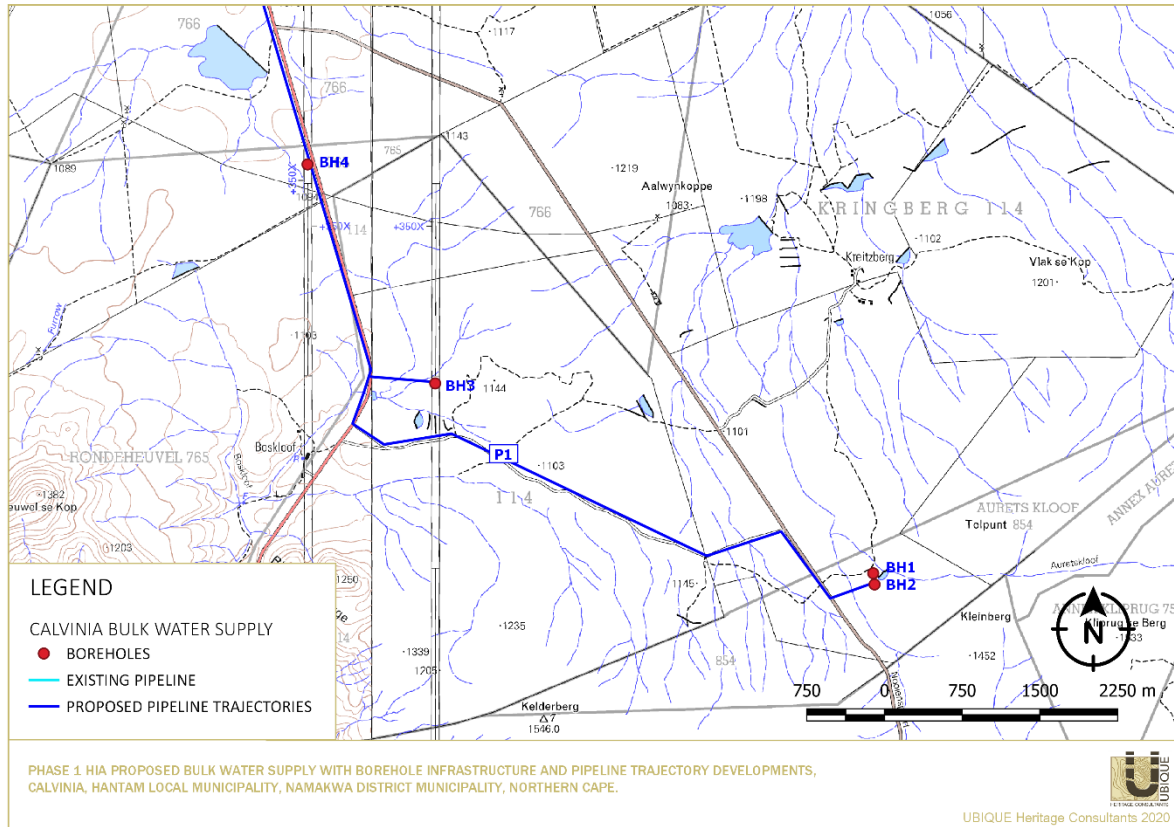


Figure 3 Locality of the development footprint of BH1-4, and P1 south of Calvinia, indicated on 1: 50 000 3119DA, 3119DB maps.

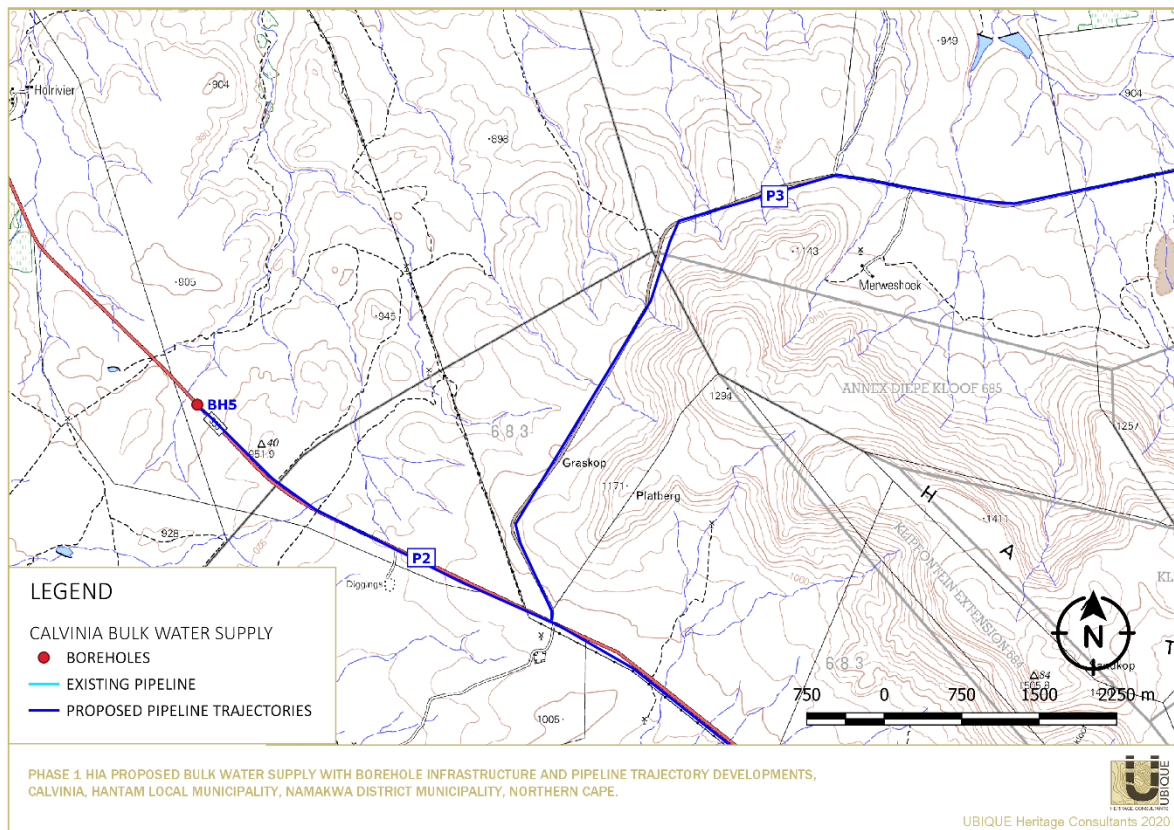


Figure 4 Locality of the development footprint of BH5, and P2-3 northwest of Calvinia, indicated on 1: 50 000 3119BC map.

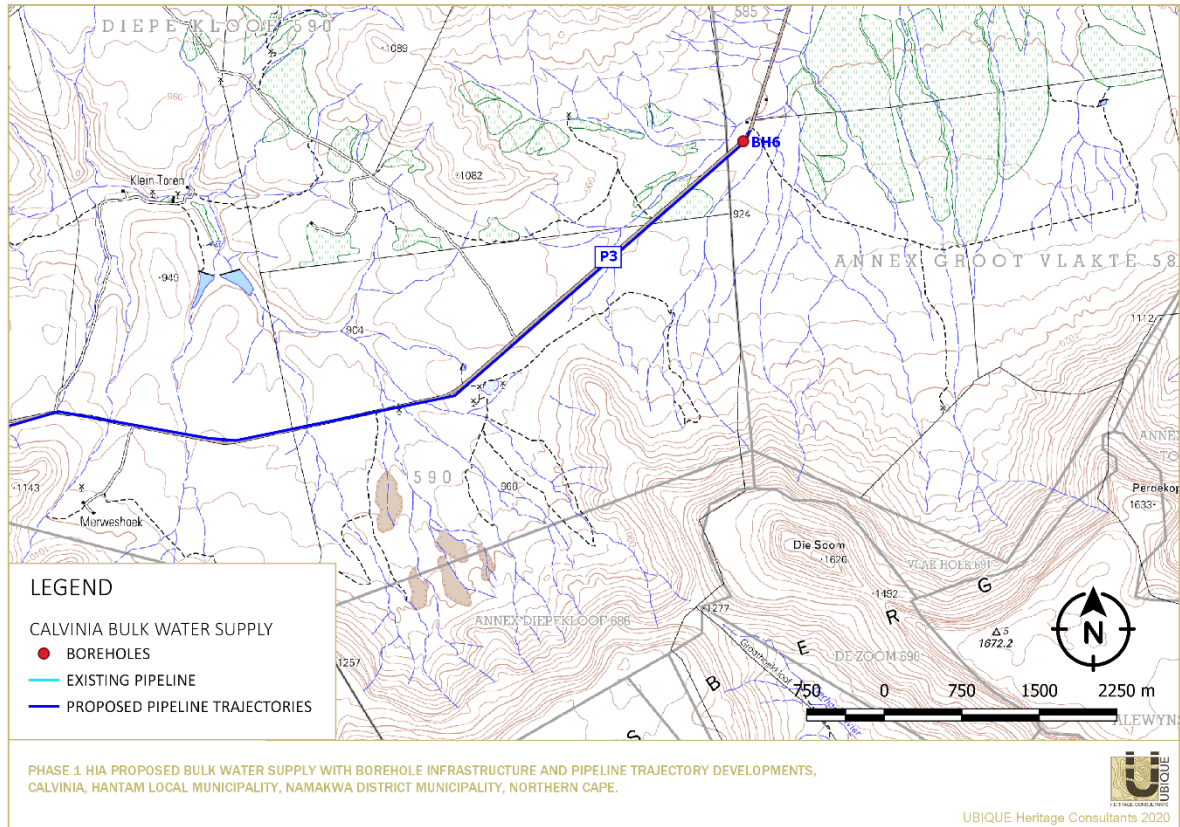


Figure 5 Locality of the development footprint of BH6, and P3 northwest of Calvinia, indicated on 1: 50 000 3119BC map.

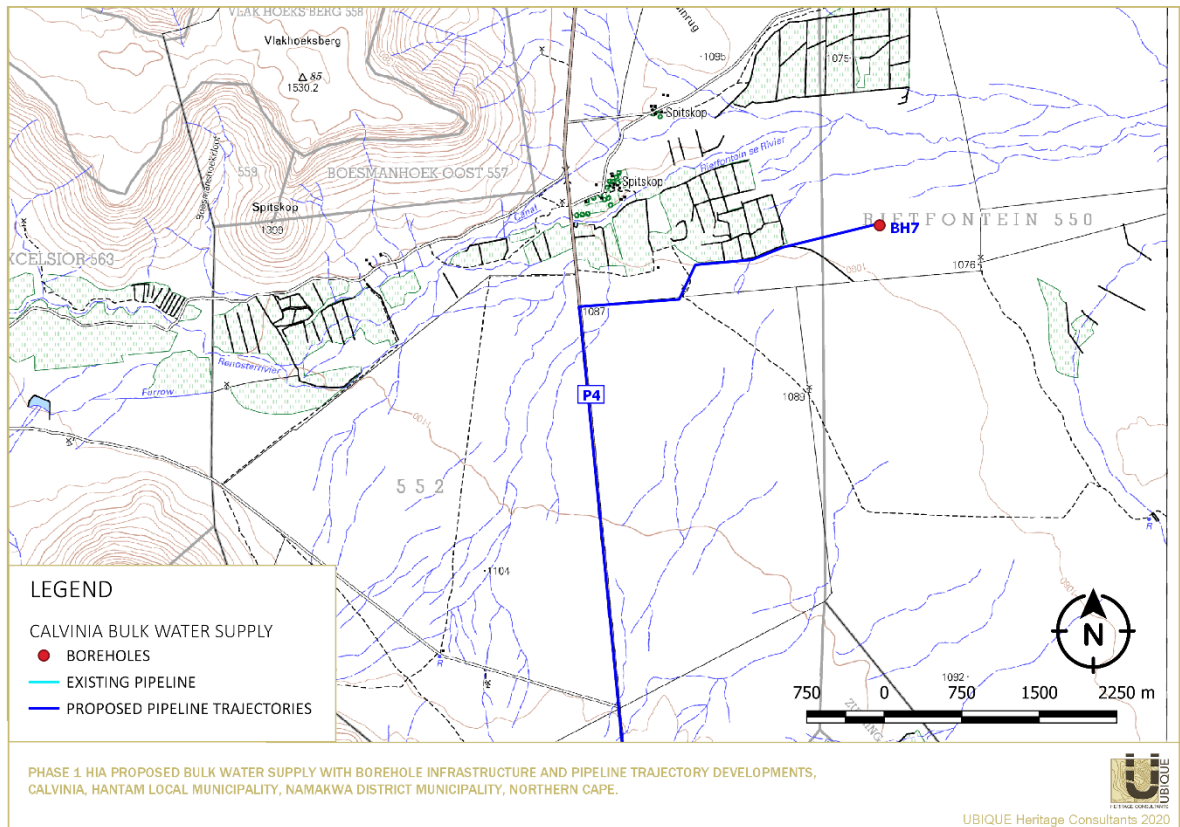


Figure 6 Locality of the development footprint of BH7, and P4 northeast of Calvinia, indicated on 1: 50 000 3119BD map.

4.2 Description of the affected environment

The borehole and pipeline developments fall predominantly within the Bokkeveld Sandstone Fynbos area, with intermittent crossover into Hantam Plateau Dolerite Renosterveld, and Hantam Karoo vegetation areas (SANBI 2020). The landscape is characterised by typical Fynbos shrubland, its diversity dependent on differences in soil depth and moisture. Large areas of weathered rock and rocky pavements support dwarf succulents and shrubs, lichens and mosses. At the same time, annuals and bulbs are particularly common in more open areas where Graminoids (restios and grasses), proteoids and shrubby Asteraceae are often dominant (Mucina & Rutherford 2006).

The terrain in the study areas consists of flat stone pavements, combined with sandy plains, surrounded by slopes and the Hantam Mountains. There are predominantly shale, hornfels and granite visible on the surface, with dolomite outcrops present in certain areas.

BH1 & 2 is situated in a non-perennial wetland area, with an active fountain, as well as dry human-made dams present in the vicinity. BH 2 is located within the servitude of the gravel road towards Tankwa, and the pipeline will run along the servitude trajectory.

BH3 has non-perennial dry riverbeds to the north and south which will not be impacted by the borehole. The pipeline route will, however, impact on these dry waterways from the borehole towards the Ceres gravel road.

BH4 is located inside the servitude of the gravel road towards Ceres. The pipeline route is within the Ceres gravel road servitude.

BH5 is situated within the gravel road servitude towards Loeriesfontein (No major waterways at the borehole) Several dry riverine and waterways are however crossing the pipeline route within the servitude.

BH6 is located within the Toren gravel road servitude close to a non-perennial waterway to the north of the borehole. Many dry waterways cross the Toren gravel road servitude on the pipeline route towards the Loeriesfontein gravel road. This route is also very mountainous.

BH7 is situated on privately owned land with no significant waterways nearby. The area is flat, sandy with klipveld. Several dry riverine and dry waterways cross the pipeline route from this borehole. The pipeline route will run west through the field and then continue within the Klipwerf road servitude towards the R27 where it will link up with an existing pipeline towards Calvinia.

Figure 7 Views of the affected development area.



BH1



Panorama BH1&2 and P1



BH3



Panorama BH3 and P1



BH4, P1 and environment



Environment P1



BH5



Panorama P2



BH6



Panorama P3



BH7 environment



Panorama P4

5. HISTORICAL AND ARCHAEOLOGICAL BACKGROUND

5.1 Region

The Northern Cape is rich in archaeological sites and landscapes that reflect the complex South African heritage from the Stone Age to Colonial history.

5.1.1 Stone Age

The Stone Age is the period in human history when lithic material was mainly used to produce tools (Coertze & Coertze 1996). In South Africa, the Stone Age can be divided into three periods. It is, however, important 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:	>2 000 000 - >200 000 years ago
Middle Stone Age:	<300 000 - >20 000 years ago
Later Stone Age:	<40 000 - until the historical period.

In short, the Stone Age refers to humans that mainly utilised stone as their technological marker. Each of the sub-divisions represents a group of industries where the assemblages share attributes or common traditions (Lombard et al. 2012). The ESA is characterised by flakes produced from pebbles, cobbles and percussive tools, as well as objects created later during this period such as large hand axes, cleavers and other bifacial tools (Klein 2000). The MSA is associated with small flakes, blades and points. The aforementioned are commonly inferred to have been made and utilised for hunting activities and had numerous functions (Wurz 2013). Lastly, the LSA is characterised by microlithic stone tools, scrapers and flakes (Binneman 1995; Lombard et al. 2012). The LSA is also associated with rock art. Numerous LSA rock art sites, mainly in the form of rock engravings and paintings have been identified in the Northern Cape (Beaumont 2008; Kruger 2018; Morris 1988). These sites are commonly found on slopes, hilltops, rocky outcrops and occasionally in river beds (Kruger 2018). Banded ironstone occurs on several sites throughout the Northern Cape and appears to have been a favoured raw material for making stone tools due to its superior flaking qualities (Morris 2012). Prominent sites that exemplify these periods in the Nama-Karoo Biome are Rooidam and Bundu Farm (Earlier Stone Age and Middle Stone Age), and Biesje Poort 2, Bokvasmaak 3, Melkboom 1, Vlermuisgat, and Jagtpan 7 (Later Stone Age) (Lombard et al. 2012).

Within the region, Stone Age sites and complexes have been, and are still being investigated in some detail. For instance, in the Kathu landscape, the longest preserved lithostratigraphic and archaeological sequence of human occupation has been documented and excavated. Evidence of 500 000-year-old hafted stone points, ancient specularite working (and mining), and associated Ceramic Later Stone Age material has been recorded on the eastern side of Postmasburg and Doornfontein. Older transitional ESA/MSA Fauresmith sites at Lyly Feld, Demaneng, Mashwening, King, Rust & Vrede, Paling, Gloucester and Mount Huxley have been recorded (Beaumont 2004; Beaumont 2013; Beaumont & Morris 1990; Beaumont & Vogel 2006; Morris 2005; Morris & Beaumont 2004; Porat et al. 2010; Thackeray et al. 1983; Walker et al. 2014; Wilkins et al. 2012).

Beaumont et al. (1995) commented that thousands of square kilometres of Bushmanland are covered by low-density lithic scatters. It is therefore not surprising that Stone Age sites and lithic scatters were identified by CRM practitioners between the Garona substation and the Gariep/Orange River in numerous surveys conducted during the recent years. Scatters of MSA material have been recorded close to Griekwastad, Hotazel, Postmasburg and Kenhardt, Pofadder, Marydale, and in the Upington district (Dreyer 2006, 2012, 2014; Pelsler & Lombard 2013; PGS Heritage 2009, 2010; Webley 2013). MSA and LSA tools, as well as rock engravings, were also found at Putsonderwater, Beeshoek and Bruce (Morris 2005; Snyman 2000; Van Vollenhoven 2012b; Van Vollenhoven 2014).

Archaeological surveys have shown that rocky outcrops, hills, drainage lines, riverbanks and confluences, are prime localities for archaeological finds (Lombard 2011). Sites can likewise be found close to local sources of highly-prized raw materials such as previously mentioned banded iron formations (BIF), as well as jaspilite and specularite (Morris 2012; Kruger 2015; 2018). If any such features occur in the study area, Stone Age manifestations can be anticipated.

5.1.2 Iron Age

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

- Early Iron Age (EIA) 200 – 1000 AD
- Late Iron Age (LIA) 1000 – 1850 AD

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

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

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

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

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

The expansion of early farmers/agropastoralists occurred in this region between 400 AD and 1100 AD. These early farmers settled in semi-permanent settlements (De Jong 2010). According to De Jong (2010), there is some evidence that the EIA continued in the Lowveld until the 15th-century. However, on the escarpment, it ended by 1100 AD. From the 15th-century onwards the Highveld became active again, on account of the gradually warmer and wetter climate. This later phase (the LIA) was accompanied by extensive stone walled settlements, such as the Thlaping capital Dithakong, approximately 40 km north of Kuruman (De Jong 2010). The Sotho-Tswana and Nguni speaking societies, who are the descendants of the LIA mixed farming communities, had found that the region was already sparsely inhabited by LSA Khoisan groups (the "first people"). De Jong (2010) comments that many of them were eventually assimilated by LIA communities, and only a few had managed to survive. Some of the surviving groups included the Korana and the Griqua. It should be mentioned, however, that this contact period has often been referred to as the Ceramic LSA. It is often represented by sites such as the earlier mentioned Blinkklipkop specularite mine near Postmasburg and with archaeological material at the Kathu Pan (De Jong 2010).

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

5.1.3 Historical period

The historical period within the region coincides with the incursion of white traders, hunters, explorers, and missionaries into the interior of South Africa. Buildings and structures associated with the early missionaries, travellers, and traders such as PJ Truter's and William Somerville (arriving in 1801), Donovan, Burchell and Campbell, James Read (arriving around 1870) William Sanderson, John Ryan and John Ludwig's (De Jong 2010; Snyman 2000) arrival during the 19th century, and the settlement of the first white farmers and towns, are still evident in the Northern Cape. Numerous heritage reports that provide a synthesis of the incursions of travellers, missionaries and the early European settlers have been captured on the SAHRIS database.

San hunter-gatherer groups utilised the landscape for thousands of years, and Khoi herders moved into South Africa with their cattle and sheep approximately 2000 years ago. With the arrival of the Dutch settlers in the Cape in the mid-17th century, clashes between the Europeans and Khoi tribes

in the Cape Peninsula resulted in the Goringhaiqua and Goraxouqua migrating north towards the Gariep/Orange River in 1680. These tribes became collectively known as the Korannas, living as small tribal entities in separate areas (Penn 2005).

Because of its distance from the Cape Colony, this arid part of South Africa's interior was generally not colonised until relatively recent. According to history, the remote northern reaches of the Cape Colony were home to cattle rushers, gunrunners, river pirates and various manner of outlaws. Distribution of land to colonial farmers only occurred from the 1880s onwards when Government-owned land was surveyed, divided into farms, and transferred to farmers. More permanent large-scale settlement however only started in the late 1920s, and the first farmsteads were possibly built during this period. The region remained sparsely populated until the advent of the 20th century (De Jong 2010, Penn 2005).

The region has been the backdrop to various incidents of conflict. Numerous factors such as population growth, increasing pressure on natural resources, the emergence of power blocs, attempts to control trade, and the emergence of the Griquas, and penetration of the Koranna and early white communities from the southwest resulted in a period of instability in the Northern Cape. 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 volatility and sociocultural stress and transformation in the region (Mlilo 2019).

The *Difaqane/Mfecane*, which began in the late-18th century, affected the Northern Cape Province around 1820, which was much later than the rest of southern Africa (De Jong 2010; Mlilo 2019). During this time, there was an incursion of displaced refugees associated with the Fokeng, Tlokwa, Hlakwana and Phuting groups into the northeast (De Jong 2010). The arrival of large numbers of Great Trek Boers from the Cape Colony to the borders of Bechuanaland and Griqualand West in 1836 caused friction with many Tswana groups and the missionaries of the London Mission Society. The conflict between Boer and Tswana communities escalated in the 1860s and 1870s when the Koranna and Griqua communities and the British government became involved. The Koranna wars took place during 1879-1880.

According to Breutz (1953, 1954), and Van Warmelo (1935), several Batswana tribes, including the different Thlaping and Thlaro sections as well as other smaller groups, take their 18th and 19th-century roots back to the area around Groblershoop, Olifantshoek, the Langeberg (Majeng) and Korannaberg ranges in the western part of the region. After Britain annexed Bechuanaland in 1885, the land of the indigenous inhabitants was limited to a few reserves. After the failed Tswana revolt in 1895, the British continued to divide the Tswana land up, and grant it to settling colonial farmers.

The Northern Cape was critical in the Anglo-Boer War (1899-1902), and significant battles took place within 120 km of Kimberley, including the battle of Magersfontein. Boer guerrilla forces roamed the entire Northern Cape region and skirmishes between Boer and Brits were regular

occurrences. Furthermore, many graves in the region tell the story of battles fought during the 1914 Rebellion (Hopkins 1978).



Figure 8 1899-1902 Imperial Map of Calvinia and surrounds, with the wagon routes indicated. Image from UCT digital collections, <https://digitalcollections.lib.uct.ac.za/islandora/object/islandora%3A24815/datastream/OBJ/view>

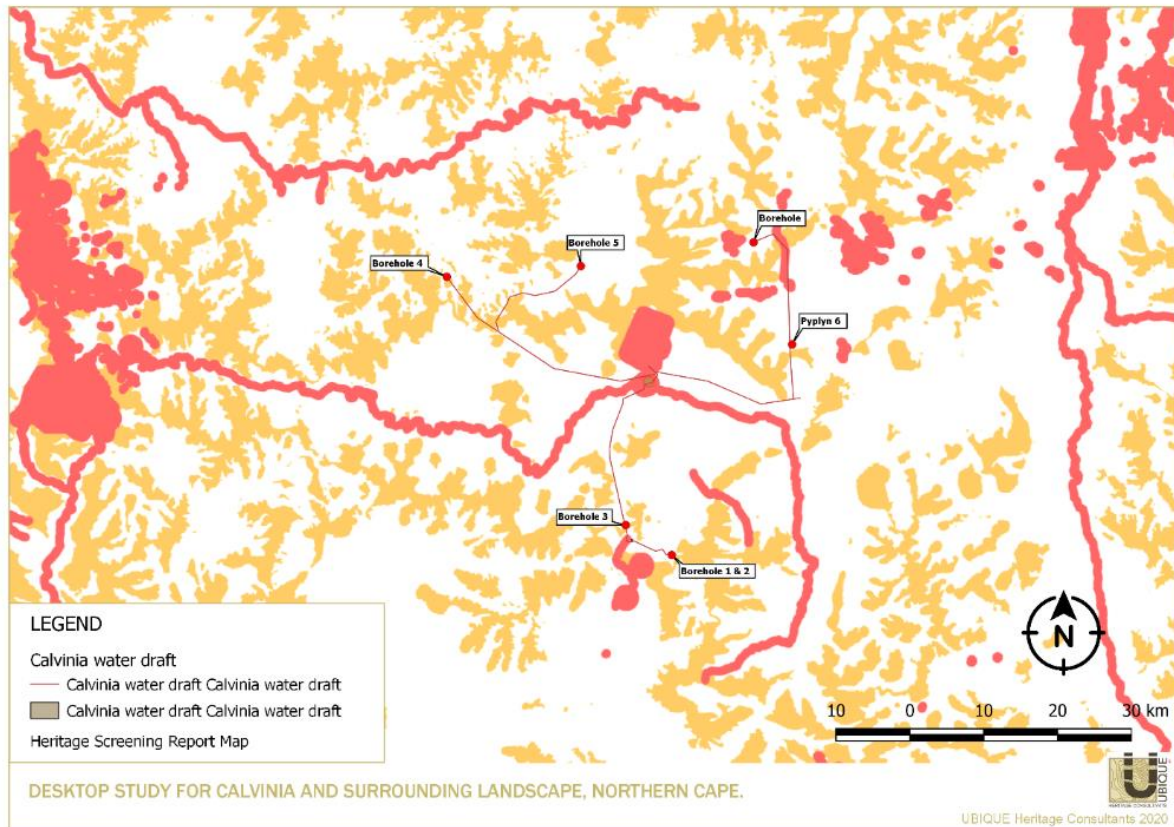


Figure 9 Heritage Screening tool (<https://screening.environment.gov.za/>) indicating projected heritage sensitivity around Calvinia

5.2 Local

The Calvinia district is part of the Great Karoo region of South Africa. Calvinia is the principal town of the Hantam Karoo and lies at the crossroads to several towns scattered across the wide-open spaces of Bushmanland and the Tankwa, Roggeveld and Hantam Karoo. The town is south of the Hantam mountains on the banks of the Oorlogskloof River. According to Webley (2014), the Hantam Mountains has not been subjected to any archaeological research programs or surveys. Thus, there is little information on this area.

In short, Calvinia was established in the 1840s on the farm Hoogekraal. However, the town initially had a different name: Hantam. The name Hantam has its roots in the distant past with the Khoi/Khoekhoen people. It derives from the word "*hanami*" which means: "the mountain where the red bulbs grow" or "the hill where the red nutsedge grows" (Calvinia Information Pamphlet 1. 2020; K-SA 2019). The Khoi/Khoekhoen called this place Hantam/Heyntama due to the abundance of the plant *Pelargonium biflorium* (Amschwand 2019). With the arrival of Reverend N. J. Hofmeyr in 1851 the town's name was changed to Calvinia in honour of the Protestant theologian and reformer, John Calvin.

The desktop study revealed that only a handful of HIA and AIA reports (e.g. Dreyer 2003; Halkett & Hart 2011; Webley 2014; Webley & Halkett 2009a & b; Rossouw 2007) had been done in and around (within a 50 km radius) the town of Calvinia and the current development. To obtain the

most comprehensive archaeology/heritage review of the landscape surrounding Calvinia, the scope for the desktop study was extended to include several reports near Nieuwoudtville, Loeriesfontein, and Williston (e.g. ACRM 2016; Dreyer 2007; Kaplan 2014; Morris 2007; 2013; Orton 2014a & b, 2017a & b; Rossouw 2017; Van Der Walt 2013; Van Schalkwyk 2011; Webley & Halkett 2012; Webley & Orton 2012). Additionally, since there have been reasonably few reports conducted in the area, the Heritage Screening tool (<https://screening.environment.gov.za/>) was used to complement the assessment of the study area's heritage sensitivity (Figure 9).

5.2.1 Stone Age

Very few scatters of stone implements have been recorded in and around Calvinia. The lithics that have been recorded have been attributed to the MSA and LSA. Most of the reports, in general, revealed that the scatters of stone implements are very widely distributed and do not generally appear to be concentrated in any specific locations. These scatters of stone implements are of low significance.

During the survey for the AIA for the proposed expansion of Borrow Pit BR R27.8 M 32.6 RHS 6.2, on Portion 1 of the Farm Bloedzeuigerfontein Noord 782 (Merino), Calvinia, Webley (2014) recorded several stone artefacts such as flakes and cores of quartzite and silcrete flake as well as a single Upper Grindstone. Webley (2014) notes that the artefacts are very widely distributed across the old lands at the base of the hill, and thus, theorises that they may have been uncovered by ploughing or by the shallow ditch which runs at right angles across the property and is probably related to farming activities. A single dolerite core was recorded at Quarry #6 during the Phase 1 AIA and PIA of 30 gravel quarries on the R354 between Sutherland and Calvinia by Rossouw (2007). Rossouw (2007) believes that this core was most likely out of context, as it was uncapped and isolated. Webley and Orton (2012) found very few stone tools (e.g. quartz flakes between Shepherd's Rock and Nathan's site) during their survey for the in the Oorlogskloof Nature Reserve (the nature reserve is situated ± 40 km southwest - as the crow flies - from the current study's Borehole 4).

No archaeological resources were recorded or encountered during the field assessment for the construction of sports and field irrigation and facilities infrastructure in Calvinia (ACRM 2020). Webley and Halkett (2009a & b) found no significant archaeological material during the two small surveys that were conducted in the Calvinia District. Dreyer (2003) found no indication of archaeological material during his survey for the proposed development at Calvinia. Halkett and Hart (2011) did not find any significant archaeological remains/material during their survey for the proposed strengthening of National Route 27 section 7 & 8 between Western/Northern Cape border and Calvinia.

However, archaeological material and occurrences have been recorded around Nieuwoudtville, Loeriesfontein, and Williston. For example, several ostrich eggshell (OES) fragments were recorded by Van Der Walt (2013) during his survey on the Farm Dikpens 182 situated in the District of Calvinia (± 145 km north/northwest of the town of Calvinia). Orton (2017a & b) found several MSA/LSA scatters, an isolated lower grindstone as well as OES fragments and a potsherd during his surveys for the proposed Kokerboom 1 and 2 wind energy facility on the Farms 215/REM, 1164/REM, 227/REM and 1163/REM. Several LSA artefacts and OES beads have been reported near Nieuwoudtville (Orton 2014b). According to Orton (2014b), the vicinity of the Doring River and

Cederberg Mountains has an abundance of archaeological sites. Two light scatters of artefacts (one was a mixed occurrence with occasional ESA and MSA artefacts amongst a scattering of LSA material) were recorded along the R27 between Nieuwoudtville and Calvinia by Halkett and Hart (Orton 2014b). One broken LSA silcrete flake of low significance was recorded during a study undertaken by ACRM (2016) for the proposed cultivation of Rooibos Tea on Farm 951 Zonderwaterkraal, near Nieuwoudtville. Orton (2014b) recorded several scatters of MSA stone artefacts on the surface during his survey on the site for the proposed new structure at Hantam National Botanical Garden, Nieuwoudtville. They were low in density and were considered to be background scattered with no significance (Orton 2014b).

Rossouw (2017) did a pedestrian survey for a Phase 1 AIA of a proposed new 10ha residential development in Williston and found two highly weathered hornfels stone flakes. They were recorded as isolated surface scatters. Additionally, sparsely-scattered, highly-patinated MSA/LSA flakes were found at BP6 during the first phase archaeological and cultural heritage assessment of the proposed borrow pit sites along the R63 road between Carnarvon & Williston approximately 193km northeast of Calvinia (as the crow flies) (Dreyer 2007).

It is interesting to note that in the Loeriesfontein Museum, a collection of OES water containers, bored stones and soapstone pipes are on display (Kaplan 2014). Kaplan (2010) encountered several scatters of MSA and LSA artefacts in Loeriesfontein approximately 66km (as the crow flies) northwest of Calvinia during an AIA for a proposed low-cost housing project on the southwestern edge of the town (Kaplan 2014). During Kaplan's (2014) surveys for the proposed pipeline route on the farms Rheebofsfontein, De Brak and Hoek van Berg he recorded several MSA and LSA implements. These include MSA flakes in indurated shale, a weathered ironstone MSA flake, and one snapped LSA indurated shale flake, several large, flat, utilised/retouched pieces and a sizeable flat-convex scraper in indurated shale. He also recorded a worked out disc core in indurated shale, a large, flat, edge-nicked banded ironstone chunk and a large weathered, indurated shale core (Kaplan 2014).

Additionally, alongside an eroded donga at the base of a steep hill near the Loeriesfontein reservoir, he found one weathered indurated shale MSA flake. He encountered several weathered indurated shale MSA flakes, including two broken/snapped LSA flakes/blades alongside the R355 in the open veld (Kaplan 2014). According to Kaplan (2014), traces of MSA material was recorded during an HIA for a proposed solar energy plant at the Naronsies farm north of Loeriesfontein by Van der Walt (2010).

Moreover, random scatters of weathered MSA artefacts were recorded across the landscape in the western part of Bushmanland for the HIA of the proposed solar energy farm north of Loeriesfontein (Webley & Halkett 2012). Webley and Halkett (2012) also identified several LSA sites on low koppies and near the river. These sites exhibit a pattern of formal stone artefacts and raw material, as well as pottery and OES, which have not been recorded in combination in Western Bushmanland before (Webley & Halkett 2012). Webley and Halkett (2012) posit that these sites have the potential to inform us on a regional pattern of LSA settlements and the sites are, therefore, considered to be of medium to high significance. During this study, they also found LSA lithics and portable grooved stones on the banks of a small stream (Webley & Halkett 2012). During an HIA for a proposed power line for the Loeriesfontein 2, Wind Energy Facility about 50kms north of the town ephemeral scatters of highly weathered MSA objects and scatters of LSA material were encountered (Orton 2014a). Van Schalkwyk (2011) also encountered open sites with surface scatters of MSA and LSA material on hilltops during an HIA for a proposed wind energy farm north

of Loeriesfontein. Morris (2007) recorded several small MSA artefacts near a rocky knoll (hill) during his survey for the upgrading of the railway infrastructure on the Sishen-Saldanha Ore line in the vicinity of the new Loop 7a near Loeriesfontein. In the same study, he encountered sparse MSA artefacts on a hill feature near km 318 and by an existing borrow pit at km 322 (adjacent to the Brakfontein road bridge) (Morris 2007). During an assessment of powerline options, access roads and substation sites for the Khobab wind energy facility farm, Morris (2013) encountered very sparse scatters of Stone Age artefacts.

5.2.1.1 Rock Art

Research and surveys undertaken in and around the Oorlogskloof Nature Reserve have revealed that rock art (specifically San and Khoehoen art) is quite common (ACRM 2016; Orton 2013; Webley & Orton 2012). However, the associated archaeological remains appear to be more ephemeral (Orton 2014b). Several rock-art sites have been recorded around Calvinia (Nightjar Travel 2017). These include, but are not limited to Papkuilsfontein (± 57 km as the crow flies from Calvinia); Traveller's Rest (± 94 km as the crow flies from Calvinia); Bushman's Kloof Wilderness Reserve (approx. 95km as the crow flies from Calvinia); Gifberg (± 101 km as the crow flies from Calvinia). There are also reports of numerous rock shelters containing rock art in the Koebee River valley, about 40km south of Oorlogskloof (ACRM 2016).

5.2.2 Iron Age

CRM reports near the study area have recorded no IA artefacts/structures.

5.2.3 Historical/Colonial period

The first colonists arrived in the area during the 1740s and 1750s. They consisted of hunters, barbers and sheep farmers. The sheep farmers applied for grazing rights and later on loan farms. The quitrent system (a tax or land tax imposed on occupants) was introduced in 1813 and eventually led to conflicts with the Khoi and the San since they could no longer roam around the countryside with their herds in search of the best grazing spots. They, in turn, became part of the system. In other words, many of them went to live and work on the farms as labourers, some of which were allowed to keep their livestock (Calvinia Information Pamphlet 9. 2020).

On the 19th of January 1847, on the Farm Tygerhoek (approximately 5km west of the present town of Calvinia) a meeting was held where it was decided to establish a parish of the Dutch Reformed Church (DRC). Later, in 1848, a portion of the farm Hoogekraal (Ramskop) was bought for 60 000 Gulden. Thus, the town of Hantam (now Calvinia) was born. This was also the founding of the Church's 33rd parish. As noted earlier, Rev. Hofmeyr, the minister of the DRC, later requested permission from the church council to have the town (Hantam) renamed after John Calvin. His request was granted, and the new town name was declared in the Government Gazette of the 30th of October 1851. The church council governed the town until 1892, after which an independent town management board eventually took it over. The town gained municipal status in 1904. The town commonage was also bought from the DRC for £3 000 in 1914 (Calvinia Information Pamphlet 9. 2020)

Countless towns such as Calvinia were often established to build churches. It is said that soon after the establishment of the churches various traders, agriculturalists, artisans (e.g. carpenters and joiners) soon followed, and lawyers to sort out disputes and draw up contracts (Amschwand 2019). The original Church of Calvinia was situated at the end of the square in Church Street. Rev McCarter, a Scotsman, was the minister of the Church in 1862. Unfortunately, he was not fluent in Dutch; thus, it is believed that his sermons "became so tedious" that part of the congregation broke away to form another church. It was only when Rev McCarter returned to Scotland that the Church reunited (Amschwand 2019).

Interestingly, Calvinia was one of the leading centres for the collection and shipping of feathers to Europe during the two ostrich-feather booms in 1865-1870 and 1900-1914. Nevertheless, this industry collapsed at the start of the First World War (Amschwand 2019).

It is worth mentioning that in the town of Calvinia, Abraham Esau's life and death had a significant influence on the development of political and cultural identities as well as social relations. He was a patriotic coloured blacksmith loyal to the British. Esau, having gained some prosperity as a blacksmith in Calvinia, rose as a leader of the coloured population in Calvinia (Van Der Walt 2013). The Anglo-Boer War (1899-1902) played a significant role in shaping South Africa's history. This war affected the lives of white, coloured and black South African populations (Van Der Walt 2013). During the Anglo-Boer War, in 1901, Calvinia was attacked by raiding Boer Commandos. Abraham Esau had gathered a force of 70 locals to defend the town against the raiding Boer Commando. Through displaying an active devotion to Britain and defiantly asserting the restricted civic rights enjoyed by coloureds in the Cape Colony at the time, Esau earned the contempt of the Boers. Esau was captured and eventually executed by Stephanus Strydom, one of the Boer Commandos. It would appear that this was all in vain because a few days later, the British arrived and had recaptured the town (Amschwand 2019; K-SA 2019).



Figure 10 Monument commemorating Abraham Esau inside servitude along R27 main road towards Calvinia (31° 28' 17.99" S; 19° 49' 45.60" E).

The railway linking Calvinia and Hutchinson arrived in 1917. This railway was the outlet for the district's agricultural products for many years and aided in the economic development of the town and district. It, however, closed in 2001 (Amschwand 2019; K-SA 2019). Additionally, a sizeable Jewish community made its home in Calvinia in the early twentieth century. This community made significant contributions to Calvinia's commercial development. In 1920, a Jewish Synagogue was

constructed and opened in the town. However, the Jewish community started to diminish over the years. The synagogue was closed and converted into the Museum of Calvinia (K-SA 2019).

Very few AIA/HIAs reported archaeological/cultural material or buildings relating to the colonial period in and around Calvinia. For example, during the survey for the proposed construction of a new cemetery at Calvinia, Webley and Halkett (2009) found that there are few scatters of very recent 20th-century glass, tin and ceramics. They note that the material they found confirms that the area they surveyed functioned as an informal rubbish dump. They found no structures or any evidence of previous burials (Webley & Halkett 2009). As mentioned earlier, Halkett and Hart (2011) did not find any significant archaeological remains/material during their survey for the proposed strengthening of National Route 27 section 7 & 8. They did, however, note the Oorlogskloof River Bridge, which is more than 60 years of age and is thus protected by the NHRA.

During an HIA for a proposed power line for the Loeriesfontein 2, Wind Energy Facility, Orton (2014a) recorded two farmsteads (one with a graveyard) and noted that they are significant resources. He also found a stone kraal, some reservoirs and wind pumps. During Orton's (2014b) survey for the proposed new structure at Hantam National Botanical Garden, Nieuwoudtville, Orton (2014b) noted four structures on the site that are greater than 60 years of age and are protected under the NHRA. Three of these structures, he states, have heritage significance due to their construction style and materials that are strongly associated with the Nieuwoudtville area and are uncommon. The fourth structure is a corrugated shed (Orton 2014b). During Kaplan's (2014) survey for an HIA for the proposed Loeriesfontein bulk water supply pipeline and reservoir, he found the ruins of a small stone structure (either a shepherd's hut or stock pen) alongside the proposed pipeline route overlooking the gravel road on the Farm Rheebofsfontein and a few pieces of late 19th-/early 20th - century English transferware (Kaplan 2014). Kaplan (2014) also noted several old, dry-packed, stone stock enclosures/kraals, farm buildings and farm labourer's cottages in the general area of the proposed pipeline route (Kaplan 2014). Orton (2017a) recorded a few historical finds (e.g. earthenware plate fragments on a hilltop, two small medicine bottles, rusted end of a metal fuel canister, a .577/45 Martini-Henry cartridge case inscribed with 'GK', and an incomplete 'B' on its headstamp) during his survey.

Webley and Halkett (2012) surveyed the proposed solar energy farm on the Farm Klein Rooiberg and recorded some historical archaeological material (material associated with European contact) such as fragments of ceramics with spongeware decoration, several metal lids, wire, tins (some with wire handles), fencing posts and white bottle glass. The majority of the material they encountered were found on river banks. Webley and Halkett (2012) thus suggested that it is possible that during the early 20th century, the river may have formed a focus for seasonal settlement by agricultural workers. During the same study, they encountered an old enamel bowl, a tin, a wire hook and two rusted sardine cans associated with a single semi-circular structure (a stock pen/post) in the area north of Loeriesfontein (Webley & Halkett 2012).

Webley and Orton (2012) had encountered an old rusted plough at Doltuin and found circular lower grindstones on three different instances during the survey for the proposed construction of chalets and associated infrastructure on existing campsites in the Oorlogskloof Nature Reserve. They also recorded rectangular and circular structures of varying sizes. There was no associated historical material, and thus these structures could not be dated accurately, however, according to the Reserve Manager, these settlements date to the 1930s (Webley & Orton 2012).

Currently, four old National Monuments, now Provincial Heritage sites, are associated with Calvinia and have been documented on the SAHRA database.

Site/Object Name	Location	Coordinates	Archive Status	Declaration Type	Grading	Site type	Site Reference	Site ID	Nid
Dutch Reformed Church	Voortrekker Street, Brandvlei, Calvinia District	-30.464442 20.485675	National Monument	Provincial Heritage Site	Grade II	Building	9/2/017/0001	29392	16563
Dutch Reformed Church	15 Dorp Street, Calvinia	-31.475314 19.772665	National Monument	Provincial Heritage Site	Grade II	Building	9/2/017/0005	29391	16564
42-44 Hope Street, Calvinia	Hope Street, Calvinia	-31.475164 19.771193	National Monument	Provincial Heritage Site	Grade II	Building	9/2/017/0009	29389	16566
The Dorpshuis	63 Water Street, Calvinia	-31.476136, 19.769656	National Monument	Provincial Heritage Site	Grade II	Building	9/2/017/0010	29390	16567

5.2.4 Graves/Burials

Three known cemeteries have been recorded in the Calvinia district (APPENDIX B). Very few HIA and AIAs reported on Graves/Burials. Orton (2014a) encountered a small graveyard (also reported by Van Schalkwyk 2011) during his study. The landowner reported that the named grave belonged to his grandfather's brother (Orton 2014a). Additionally, Orton (2014a) encountered a small cairn, although its function is unknown; he does not believe that it is a grave.

Similarly, a stone cairn made of round dolerite cobbles (there are no such cobbles naturally occurring in the immediate area) was recorded during the assessment for the proposed Kokerboom 2 wind energy facility (Orton 2017). Orton (2017) comments that its location would suggest that it is unlikely to be a grave. Webley and Halkett (2012) noted a few cairns on the top of low koppies during their study of the proposed Loeriesfontein PV solar power plant on portion 5 of the farm Klein Rooiberg 227, they, however, believe that these may be elevation markers. During Webley and Orton's (2012) assessment for the construction of chalets in the Oorlogskloof Nature Reserve encountered two graves. Most of the graveyards in the Reserve have been recorded by the Reserve Manager.

Recorded graves/burials/cemeteries in and around the areas of study

Name	Cemetery ID	Site Type	Coordinates	URL Reference link
Northern Cape, CALVINIA, Calvinia town, Hoogekraal, Ramskop, old farm cemetery	6146	Burial Grounds & Graves	-31 28.602, 19 46.698	https://graves-at-eggssa.org/main.php?g2_itemId=3841741
Northern Cape, CALVINIA, Main cemetery	679	Burial Grounds & Graves	-31 28.059, 19 45.950	https://graves-at-eggssa.org/main.php?g2_itemId=39685
Northern Cape, CALVINIA, Museum	524	Burial Grounds & Graves	-31 28.334, 19 46.494	https://graves-at-eggssa.org/main.php?g2_itemId=3035359

6. IDENTIFIED RESOURCES AND HERITAGE ASSESSMENT

6.1 Surveyed area

The area surveyed for the impact assessment was dictated by the Google Earth map of the development footprints provided by the client.

The pipeline trajectories were surveyed by vehicle and foot. The pedestrian survey was conducted in predominantly 40-50 m transects. Areas that have been severely disturbed were surveyed in wider transects or only scoped. The survey extended beyond the development footprints to take into consideration the full impact of the development by investigating probable areas on the landscape adjacent to the development footprints that may contain heritage.

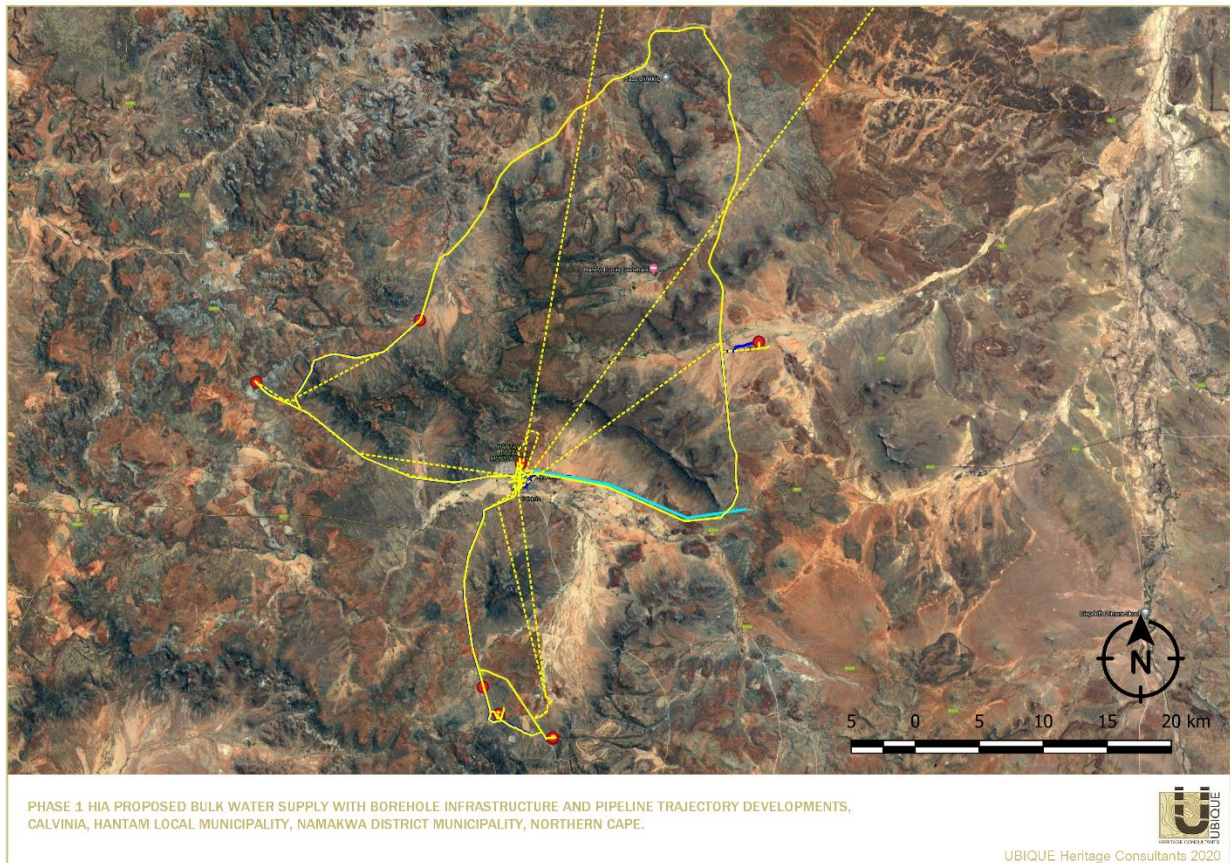


Figure 11 Survey tracks across the development footprint.

6.2 Identified heritage resources

HERITAGE RESOURCES RECORDING

Stone Age Resources Identified

Point ID & Site Name	Description	Period	Location	Field rating/ Significance/ Recommended Mitigation	
WP 002 F114001 Farm No. 114	Type of feature	Core	ESA/ MSA	31° 38' 1.32" S 19° 45' 1.92" E	Field Rating IV C Low significance No Mitigation Required
	Material	Quartzite			
	N in m ² .	1/1000m ²			
	Context	Surface scatter. No context. Random			
	Additional	None			

Historical Period Resources Identified

Point ID & Site Name	Description	Period	Location	Field rating/ Significance/ Recommended Mitigation	
WP 003 AUK002 Aurets Kloof No. 854	Type of feature	Foundation	Late 19 th to early 20 th century	31° 39' 3.63" S 19° 48' 4.15" E	Field Rating IV B Medium significance Recording required before destruction
	Material	Stone			
	N in m ² .	3m x 5m			
	Context	Historical farmscape			
	Additional	None			
WP 004 AUK003 Aurets Kloof No. 854	Type of feature	Midden	Late 19 th to early 20 th century	31° 39' 3.55" S 19° 48' 4.67" E	Field Rating IV A Medium/High significance Mitigation required before destruction
	Material	Surface scatter of glass, ceramics, and faunal material			
	N in m ² .	3m x 3m			
	Context	Midden associated with AUK003			
	Additional	None			
WP 005 AUK004 Aurets Kloof No. 854	Type of feature	Dam wall and retaining wall	Late 19 th to early 20 th century	31° 39' 2.98" S 19° 48' 5.82" E	Field Rating IV B Medium significance Recording required before destruction
	Material	Stone			
	N in m ² .	130m			
	Context	Historical farmscape			
	Additional	Surface scatter of metal artefacts close to the dam wall			
WP 006 AUK005 Aurets Kloof No. 854	Type of feature	Circular foundation	Late 19 th to early 20 th century	31° 38' 59.16" S 19° 48' 7.29" E	Field Rating IV B Medium significance Recording required before destruction
	Material	Stone			
	N in m ² .	3m x 3m			
	Context	Historical farmscape			
	Additional	None			
WP 007 AUK006 Aurets Kloof No. 854	Type of feature	Stone foundation of the main house's clay wall remnants <i>in situ</i> .	Late 19 th to early 20 th century	31° 38' 57.87" S 19° 48' 6.19" E	Field Rating IV B Medium significance
	Material	Stone and clay			
	N in m ² .	50m x 20m			

Historical Period Resources Identified

Point ID & Site Name	Description	Period	Location	Field rating/ Significance/ Recommended Mitigation	
	Context	Historical farmscape			
	Additional	None		Recording required before destruction	
WP 008	Type of feature	Midden	Late 19 th to early 20 th century	31° 38' 57.62" S 19° 48' 6.57" E	Field Rating IV A
AUK007	Material	Surface scatter of glass and ceramics			Medium/High significance
Aurets Kloof No. 854	N in m ² .	10m x 10m			
	Context	Midden associated with AUK006			Mitigation required before destruction
	Additional	None			
WP 009	Type of feature	Foundation	Late 19 th to early 20 th century	31° 38' 57.37" S 19° 48' 7.56" E	Field Rating IV B
AUK008	Material	Stone			Medium significance
Aurets Kloof No. 854	N in m ² .	3m x 5m			
	Context	Historical farmscape			Recording required before destruction
	Additional	None			
WP 010	Type of feature	Stone walls of livestock kraal	Late 19 th to early 20 th century	31° 38' 58.30" S 19° 48' 7.87" E	Field Rating IV B
AUK009	Material	Stone			Medium significance
Aurets Kloof No. 854	N in m ² .	40m x 40m			
	Context	Historical farmscape			Recording required before destruction
	Additional	None			
WP 012	Type of feature	Retaining wall	Late 19 th to early 20 th century	31° 38' 59.56" S 19° 48' 7.87" E	Field Rating IV B
AUK010	Material	Stone			Medium significance
Aurets Kloof No. 854	N in m ² .				
	Context	Historical farmscape			Recording required before destruction
	Additional	None			
WP 013	Type of feature	Wagon road	Late 19 th to early 20 th century	31° 38' 59.28" S 19° 48' 3.51" E	Local Grade IIIA
AUK011	Material	Road and packed stone			High significance
Aurets Kloof No. 854	N in m ² .				
	Context	Local historical road			Should be included in the heritage register and not be mitigated
	Additional	The road is still in use			
WP 014	Type of feature	Stone walls of livestock kraal	Late 19 th to early 20 th century	31° 38' 59.01" S 19° 48' 2.41" E	Field Rating IV B
AUK012	Material	Stone			Medium significance
Aurets Kloof No. 854	N in m ² .	100m x 100m			
	Context	Historical farmscape			Recording required before destruction
	Additional	None			
WP 015	Type of feature	Midden	Late 19 th to early 20 th century	31° 38' 57.40" S 19° 48' 3.19" E	Field Rating IV A
AUK013	Material	Surface scatters of ceramic, glass, metal artefacts			Medium/High significance
Aurets Kloof No. 854	N in m ² .	3m x 3m			
	Context	Historical farmscape, possible outspan area			Mitigation required before destruction
	Additional	None			

Graves Identified

Point ID & Site Name	Description	Period	Location	Field rating/ Significance/ Recommended Mitigation	
WP 002 AUK001 Aurets Kloof No. 854	Grave markers	Late 19 th to early 20 th century	31° 39' 1.27" S 19° 48' 2.67" E	Field Rating of Local Grade IIIB	
	Inscription			None	High/medium significance No-go area: no mitigation recommended
	Graves' Orientation			East/West	
	Dimensions/ Extent			1,5m x 1m each	
	Additional			Enclosed within an old stone kraal 7m x 5m	
Calvinia Town Municipal Cemeteries	Grave markers	Late 19 th to current day	31° 28' 3.24" S 19° 46' 5.77" E	Local Grade IIIA	
	Inscription			Various	High significance
	Graves' Orientation		East/West	31° 28' 0.76" S 19° 44' 51.38" E	Should be included in the heritage register and not be mitigated
	Dimensions/ Extent		10ha, 12 ha, and 5ha		
	Additional		The three formal town cemeteries, two of which are currently still utilised for new burials		
			31° 28' 14.78" S 19° 45' 53.51" E		



Figure 12 Distribution of identified heritage resources around BH1 and BH2, on the Farm Aurets Kloof No. 854, Calvinia.



Figure 13 Distribution of identified heritage resources around BH3 and P1, on the Farm No. 114, Calvinia.

6.3 Discussion

6.3.1 Archaeological features

6.3.1.1 Prehistorical

Only one isolated lithic was recorded across the project development footprint (F114001). A small MSA quartzite core was found close to BH3 and P1, adjacent to the R355 on the Farm No. 114 (Figure 13). The lithic material shows various degrees of weathering and is without substantial archaeological context or matrix, and is therefore deemed of minor scientific importance, and not conservation worthy (NCW).

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



F114001

Figure 14 Photographic selection of the lithic material recorded.

6.3.1.2 Historical

Twelve occurrences of historical features and material have been recorded on the Farm Aurets Kloof No. 854, in a 70-160m radius from BH 1 and BH2 (Figure 12). Sites AUK002-013 consists of features associated with a historical farm and probable outspan area. These include homestead structural remains, as well as outbuildings and livestock kraals constructed from stone as well as clay. Three substantial middens (AUK003, AUK007, AUK013) have been documented, but there are smaller middens, and concentrated ashy deposits and surface scatters throughout the area. The documented surface material included post-1880s European porcelain, Refined Industrial Ware, as well as historic thick-walled black glass sherds, and embossed bottle fragments. Metal artefacts included remnants of farm implements, such as wheels, blades and foodstuff tins.

An interview with the current fourth-generation landowner, Mr Viviers, confirmed the area as the earliest settlement location of his forebears. The presence of a perennial spring, as well as the old wagon branch road between the main Calvinia-Ceres, and Calvinia-Sutherland roads that runs through the site (Figure 8), making it the ideal location for settlement and outspan. Areas of the wagon route have been packed with stones and compacted with soil (AUK011). The road is currently still in use.

The sites (AUK001-013) should be considered as an entity and parts of a larger site with local significance. The historical farmscape identified is considered as a typical 19th-century colonial farm type-site, with Medium to High significance. The structures on the sites should be recorded, and the middens should be mitigated before destruction.

The material is given a 'General' Protection C Field Rating IV A and Field Rating IV B. This means sites should be recorded and mitigated before destruction.



AUK002



AUK003



AUK004



AUK004



AUK005



AUK006



AUK006



AUK007



AUK008



AUK009



AUK010



AUK011



AUK012



AUK013

Figure 15 Photographic selection of the historical material recorded.

6.3.2 Graves

Three graves were found on the Farm Aurets Kloof No. 854 (AUK001), situated less than 50m from the BH1 development. The graves are marked with stone cairns and unscripted headstones. A rectangular stone enclosure demarcates the extent of the graves.

There are three Calvinia municipal cemeteries, two that are still currently being used for interments, located outside the development footprint.

These sites are given a ‘Local Grade IIIB’ rating. This means the graves should be included in the heritage register and may be mitigated (high/ medium significance).



AUK001



Figure 16 Selected photographs of the graveyard within the Calvinia development footprint.

6.3.3 Palaeontological resources

Quaternary Sediments, Jurassic dolerite, Tierberg and Whitehill Formation (Ecca Group; Karoo Supergroup), underlies the development footprint. According to the PalaeoMap of the South African Heritage Resources Information System, the Palaeontological Sensitivity of Quaternary sediments is low but locally high; the Jurassic dolerite is insignificant. At the same time, the Tierberg Formation has a Moderate and the Whitehill Formation a Very High Palaeontological Sensitivity (Butler 2020).

Elize Butler from Banzai Environmental conducted a site-specific field survey of the development footprint (see Appendix 1). During the site visit, no fossiliferous outcrops were identified. The scarcity of fossil heritage at the proposed development footprint indicates that the impact of the development footprint will be of a low significance in palaeontological terms. It is therefore considered that the proposed development is deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological reserves of the area (Butler 2020).

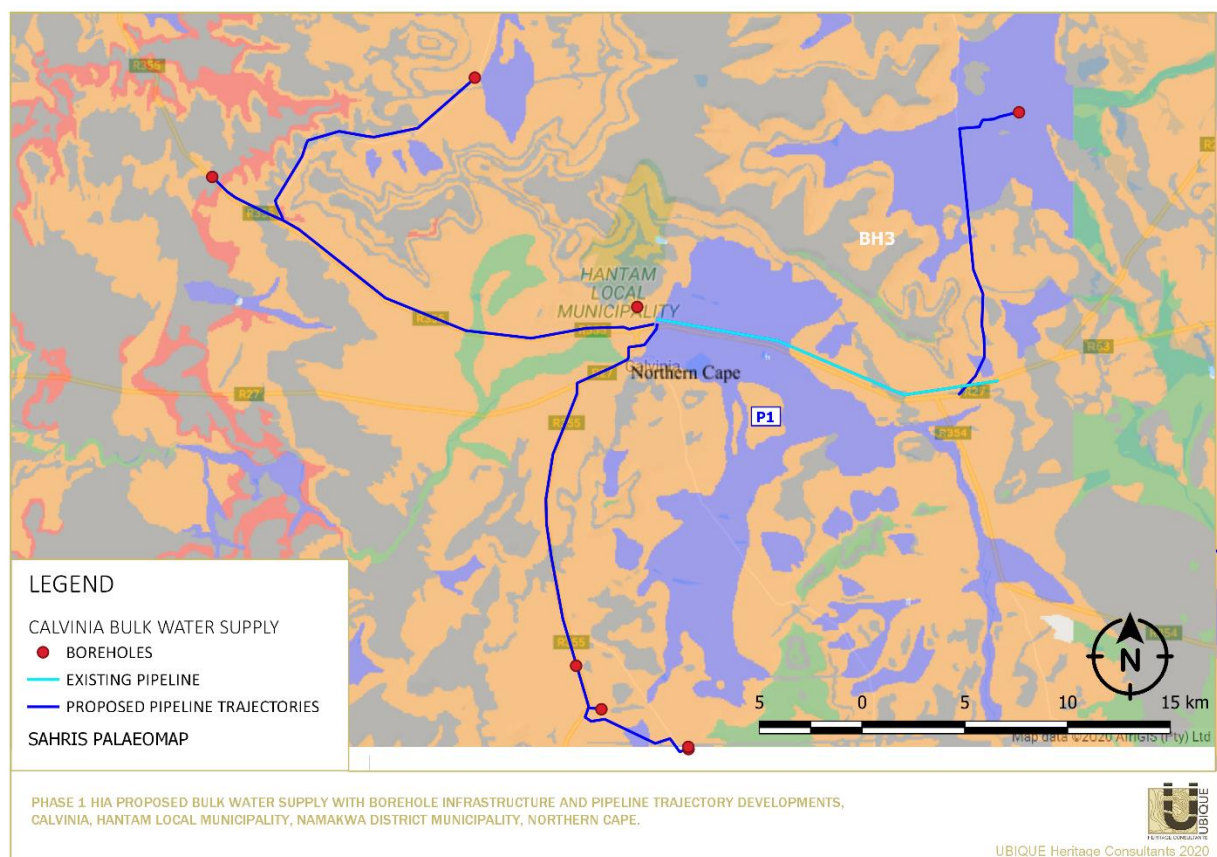


Figure 17 SAHRIS PalaeoSensitivity Map, indicating Moderate (green), Low (blue), Insignificant/Zero (grey), and Unknown (clear) as well as High (orange) and Very High (red) palaeontological significance in the study area, (<https://sahris.sahra.org.za/map/palaeo>).

7. ASSESSMENT OF THE IMPACT OF THE DEVELOPMENT

Description	Development Impact	Mitigation	Field rating/ Significance	
Archaeological				
1. The one occurrence of MSA core, located on the Farm No. 114, near BH3, P1. Site F114001	Nature	Neutral	No mitigation required.	Field Rating IV C Low significance
	Extent	Low		
	Duration	Low		
	Intensity	Low		
	Potential of impact on irreplaceable resource	Low		
	Consequence	Low		
	Probability of impact	Low		
2. Twelve occurrences of historical features and material recorded on the Farm Aurets Kloof No. 854, in a 70-160m radius from BH 1 and BH2. Sites AUK002-013	Nature	Negative	Recording and mitigation required, before destruction. Buffer Zone recommended.	Field Rating IV C Low significance
	Extent	Medium		
	Duration	Low		
	Intensity	Medium		
	Potential of impact on irreplaceable resource	High		
	Consequence	High		
	Probability of impact	Low		
Significance	Medium			
Graves				
3. Three graves enclosed by stonewalls, AUK001, less than 50m from BH1.	Nature	Negative	Sites should be included in the heritage register and may be mitigated. Buffer zone recommended.	Field Rating of Local Grade IIIB High significance
	Extent	Medium		
	Duration	Low		
	Intensity	Medium		
	Potential of impact on irreplaceable resource	High		
	Consequence	High		
	Probability of impact	Medium		
Significance	High			
Paleontological				
4. The Palaeontological Sensitivity of Quaternary sediments is low but locally high; the Jurassic dolerite is insignificant; the Tierberg Formation has a Moderate and the Whitehill Formation a Very High Palaeontological Sensitivity.	Nature	Negative	No mitigation required. Chance Finds Protocol provided.	N/A
	Extent	High		
	Duration	High		
	Intensity	High		
	Potential of impact on irreplaceable resource	Low		
	Consequence	Low		
	Probability of impact	High		
Significance	Low			

The impact on the lithic material recorded at F114001 is not conservation worthy, and therefore, in the unlikely event that impact should occur, the negative impact is negligible. The sites associated with the historical farmscape situated on the Farm Aurets Kloof No. 854, close to BH1 and BH2 (AUK002-013), are of Medium to High significance. The cumulative impacts on the site are considered as high, and detrimental to the integrity of the site. However, the probability for impact is low, and a buffer zone is recommended to ensure that it remains low. The graves on the Farm Aurets Kloof No. 854 are of high significance, but the probability of impact on the graves are low, especially with the inclusion of a buffer zone.

With regards to the impact on palaeontological resources, fossil heritage will be negatively impacted; however, only the site will be affected by the proposed development. The expected duration of the impact is assessed as potentially permanent to long term. In the absence of mitigation procedures, the damage or destruction of any palaeontological materials will be permanent. Impacts on palaeontological heritage during the construction phase could potentially occur and are regarded as having a high probability. The magnitude of the impact on fossil heritage will be low. The significance of the impact occurring will be low (Butler 2020).

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. No significant heritage sites or features were identified within the surveyed sections of the BH4-7 borehole developments, and P2-4 pipeline trajectories. The isolated Middle Stone Age cultural material identified at BH3 is not conservation worthy. No further mitigation is recommended with regards to these resources. Therefore, from a heritage point of view, we recommend that the proposed development can continue at BH3-7, P2-4.
2. The historical farmscape situated close to BH1-2 borehole developments and the first section of the P1 pipeline is of medium to high heritage significance (sites AUK002-013). These resources would require costly mitigation before destruction. It is, therefore, our recommendation that a buffer/safety zone should be implemented and that development should not exceed a 20m radius from the boreholes BH1 and BH2. Including all development activities and vehicle use associated with the development phase.
3. The small graveyard (AUK001) situated close to the BH1 borehole development and the first section of the P1 pipeline is graded as IIIB and is of High Local Significance. These resources would require costly mitigation before destruction. It is, therefore, our recommendation that a buffer/safety zone should be implemented and that development should not exceed a 20m radius from the borehole BH1. This includes all development activities and vehicle use associated with the development phase.
4. Due to the low palaeontological significance of the area, no further palaeontological heritage studies, ground-truthing and/or specialist mitigation are required. It is considered that the development of the proposed development is deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological resources of the area (Butler 2020). If fossil remains or trace fossils are discovered during any phase of construction, either on the surface or exposed by excavations the Chance Find

Protocol (Appendix A/11) must be implemented by the Environmental Control Officer (ECO) in charge of these developments. These discoveries ought to be protected, and the ECO must report to SAHRA (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za) so that mitigation can be carried out by a palaeontologist (Butler 2020).

5. Although all possible care has been taken to identify sites of cultural importance during the investigation of study areas, it is always possible that hidden or sub-surface sites could be overlooked during the assessment. If during construction, any evidence of archaeological sites or remains (e.g. remnants of stone-made structures, indigenous ceramics, bones, stone artefacts, ostrich eggshell fragments, charcoal and ash concentrations), fossils or other categories of heritage resources are found during the proposed development, SAHRA APM Unit (Natasha Higgitt/Phillip Hine 021 462 5402) must be alerted as per section 35(3) of the NHRA. If unmarked human burials are uncovered, the SAHRA Burial Grounds and Graves (BGG) Unit (Thingahangwi Tshivhase/Mimi Seetelo 012 320 8490), must be alerted immediately as per section 36(6) of the NHRA. A professional archaeologist or palaeontologist, depending on the nature of the finds, must be contacted as soon as possible to inspect the findings. If the newly discovered heritage resources prove to be of archaeological or palaeontological significance, a Phase 2 rescue operation may be required subject to permits issued by SAHRA. UBIQUE Heritage Consultants and its personnel will not be held liable for such oversights or costs incurred as a result of such oversights.

9. CONCLUSION

This HIA has identified significant heritage resources, a graveyard and historical farmscape that may be impacted negatively by the proposed development, without the strict adherence to a buffer/safety zone around BH1 and BH2. The proposed bulk water supply with borehole infrastructure and pipeline trajectory developments on the Farms Aurets Kloof No. 854, Farm No. 114, Rietfontein No. 550 Portion 2, And Spitskop No. 552 Portion 10, and along Nooiensrivier Road, the R355, R27, Groot Toren Road, and Klipwerf Road, Calvinia, Hantam Local Municipality, Namakwa District Municipality, Northern Cape, may continue, provided the recommendations stipulated within this report, and the subsequent decision by SAHRA, are followed.

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INFORMATION PAMPHLETS

Calvinia Information Pamphlet 1. (Obtained November 2020).

Calvinia Information Pamphlet 9. (Obtained November 2020).

APPENDIX A

PALAEONTOLOGICAL FIELD ASSESSMENT FOR THE PROPOSED CALVINIA BULK WATER SUPPLY, HANTAM LOCAL MUNICIPALITY, NORTHERN CAPE



**PALAEONTOLOGICAL FIELD ASSESSMENT FOR THE PROPOSED CALVINIA BULK
WATER SUPPLY, HANTAM LOCAL MUNICIPALITY, NORTHERN CAPE**

**Compiled for:
UBIQUE Heritage Consultants**

Prepared by
Banzai Environmental
12 December 2020

Declaration of Independence

I, Elize Butler, declare that –

General declaration:

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

Disclosure of Vested Interest

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

PALAEONTOLOGICAL CONSULTANT:

CONTACT PERSON:

Banzai Environmental (Pty) Ltd

Elize Butler

Tel: +27 844478759

Email: elizebutler002@gmail.com

SIGNATURE:

A handwritten signature in black ink, appearing to read 'Elize Butler'.

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

Table 1: NEMA Table

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

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	Relevant section in report	Comment where not applicable.
environmental sensitivities of the site including areas to be avoided, including buffers;	Palaeontological history	
(i) A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 7.1 – Assumptions and Limitation	-
(j) A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Section 1 and 11	
(k) Any mitigation measures for inclusion in the EMPr	Section 12	
(l) Any conditions for inclusion in the environmental authorisation	Section 12	
(m) Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 12	
(n)(i) A reasoned opinion as to whether the proposed activity, activities or portions thereof should be authorised and	Section 1 and 11	
(n)(iA) A reasoned opinion regarding the acceptability of the proposed activity or activities; and		
(n)(ii) If the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Section 1 and 11	-
(o) A description of any consultation process that was undertaken during the course of carrying out the study	N/A	Not applicable. A public consultation process will be conducted as part of the EIA and EMPr process.
(p) A summary and copies if any comments that were received during any consultation process	N/A	
(q) Any other information requested by the competent authority.		Not applicable.

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	Relevant section in report	Comment where not applicable.
(2) Where a government notice by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements, as indicated in such notice will apply.	Section 3 compliance with SAHRA guidelines	

EXECUTIVE SUMMARY

Banzai Environmental was appointed by UBIQUE Heritage Consultants to conduct the Palaeontological Field Assessment to assess the proposed Calvinia Bulk Water Supply. Hantam Local Municipality in the Northern Cape. The National Heritage Resources Act (No 25 of 1999, section 38) (NHRA), states that a Palaeontological Impact Assessment (PIA) is necessary to confirm if fossil material is present in the planned development. This study is thus necessary to evaluate the effect of the construction on the palaeontological heritage.

The development footprint is underlain by the Quaternary Sediments; Jurassic dolerite, Tierberg and Whitehill Formation (Ecca Group; Karoo Supergroup). According to the PalaeoMap of the South African Heritage Resources Information System the Palaeontological Sensitivity Quaternary sediments is low, but local high, that of the Jurassic dolerite is insignificant, while the Tierberg Formation has a Moderate and the Whitehill Formation a Very High Palaeontological Sensitivity.

A site-specific field survey of the development footprint was thus conducted on foot and by a motor vehicle on 5 December 2020. During the site visit, no fossiliferous outcrops were identified. The scarcity of fossil heritage at the proposed development footprint indicates that the impact of the development footprint will be of a low significance in palaeontological terms. It is therefore considered that the proposed development is deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological reserves of the area.

If fossil remains are discovered during any phase of construction, either on the surface or exposed by excavations the **Chance Find Protocol** must be implemented by the ESO (Environmental Site Officer) in charge of these developments. These discoveries ought to be protected (if possible, *in situ*) and the ESO must report to SAHRA (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za) so that proper mitigation (recording and collection) can be carried out by a palaeontologist.

It is consequently recommended that no further palaeontological heritage studies, ground-truthing and/or specialist mitigation are required pending the discovery of newly discovered fossils.

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» **INTRODUCTION**

The proposed Calvinia Bulk Water Supply entails seven boreholes, infrastructure, and pipeline trajectory developments (Figure 1-2). The proposed project aims to augment the current supply of water to the community of Calvinia through piped groundwater, originating from two newly developed well fields at the Kreitzberg Area along the Ceres-Karoo road and the Northwest Area along the gravel road from Calvinia to Loeriesfontein. The goal of the endeavour is to provide a sustainable system for supplying water suitable for human consumption for at least 15 to 20 years (Information provided by Ubique Heritage Consultants).

The study covers the footprints of seven groundwater borehole (BH1-7) infrastructure developments, including the pipeline trajectories from the boreholes towards Calvinia. Approximately 25 km of pipeline (P1-4) will be laid, predominantly along existing primary, secondary, and service road servitudes, with minimal cross-over onto private property (Information provided by Ubique Heritage Consultants).

○ **Technical information**

Table 2: Technical Information

Project description	
Project name	Calvinia Bulk Water Supply
Description	Proposed bulk water supply with seven boreholes, infrastructure and pipeline trajectory developments, Calvinia, Hantam Local Municipality, Namakwa District Municipality, Northern Cape.
Developer	
Hantam Local Municipality	
Contact information	Mr Riaan Van Wyk Tel: 027 – 341 8500 Fax: 027 – 341 8501 Email: vanwykrj@hantam.gov.za
Development type	Municipal infrastructure: water supply
Landowner	
Department of Transport Hantam Local Municipality road servitudes Affected private landowners: Mr Viviers, Mr Jansen van Wyk, Mr Vlok	
Consultants	
Environmental	EnviroAfrica cc.
Heritage and archaeological	UBIQUE Heritage Consultants
Paleontological	Banzai Environmental
Property details	

Province	Northern Cape	
District municipality	Namakwa	
Local municipality	Hantam	
Topo-cadastral map	1:50 000 3119BD, 3119BC, 3119DB, 3119DA	
Farm name	BH1&2: Aurets Kloof No. 854 BH3: Farm No. 114 BH4: R355, Rondeheuvel No. 765 Portion 1 BH5: R355, Beeswater No. 593 RE BH6: Groot Toren Road, Annex Groot Vlakte No. 585 RE BH7: Rietfontein No. 550 Portion 10 P1: Aurets Kloof No. 854, Nooiensrivier Road, R27 P2: R355 P3: Groot Toren Road P4: Rietfontein No. 550 Portion 10, Spitskop No. 553 Portion 10, Klipwerf Road, R27	
Closest town	Calvinia	
GPS Co-ordinates	BH1: 31°39'1.29"S; 19°48'3.77"E BH2: 31°39'4.77"S; 19°48'4.27"E BH3: 31°38'2.10"S; 19°45'23.27"E BH4: 31°36'53.83"S; 19°44'36.51"E BH5: 31°24'4.21"S; 19°33'24.04"E BH6: 31°21'27.81"S; 19°41'29.40"E BH7: 31°22'22.31"S; 19°58'15.00"E	
Property size	N/A	
Development footprint size	Pipeline length: approximately 25km Area: approximately 50ha	
Land use		
Previous	Agriculture and servitude area	
Current	Agriculture and servitude area	
Rezoning required	No	
Sub-division of land	No	
Development criteria in terms of Section 38(1) NHRA	Yes/No	
Construction of a road, wall, power line, pipeline, canal or other linear form of development or barrier exceeding 300m in length.	Yes	
Construction of bridge or similar structure exceeding 50m in length.	Yes	
Construction exceeding 5000m ² .	Yes	

Development involving three or more existing erven or subdivisions.	No
Development involving three or more erven or divisions that have been consolidated within the past five years.	No
Rezoning of site exceeding 10 000m ² .	No
Any other development category, public open space, squares, parks, recreation grounds.	No

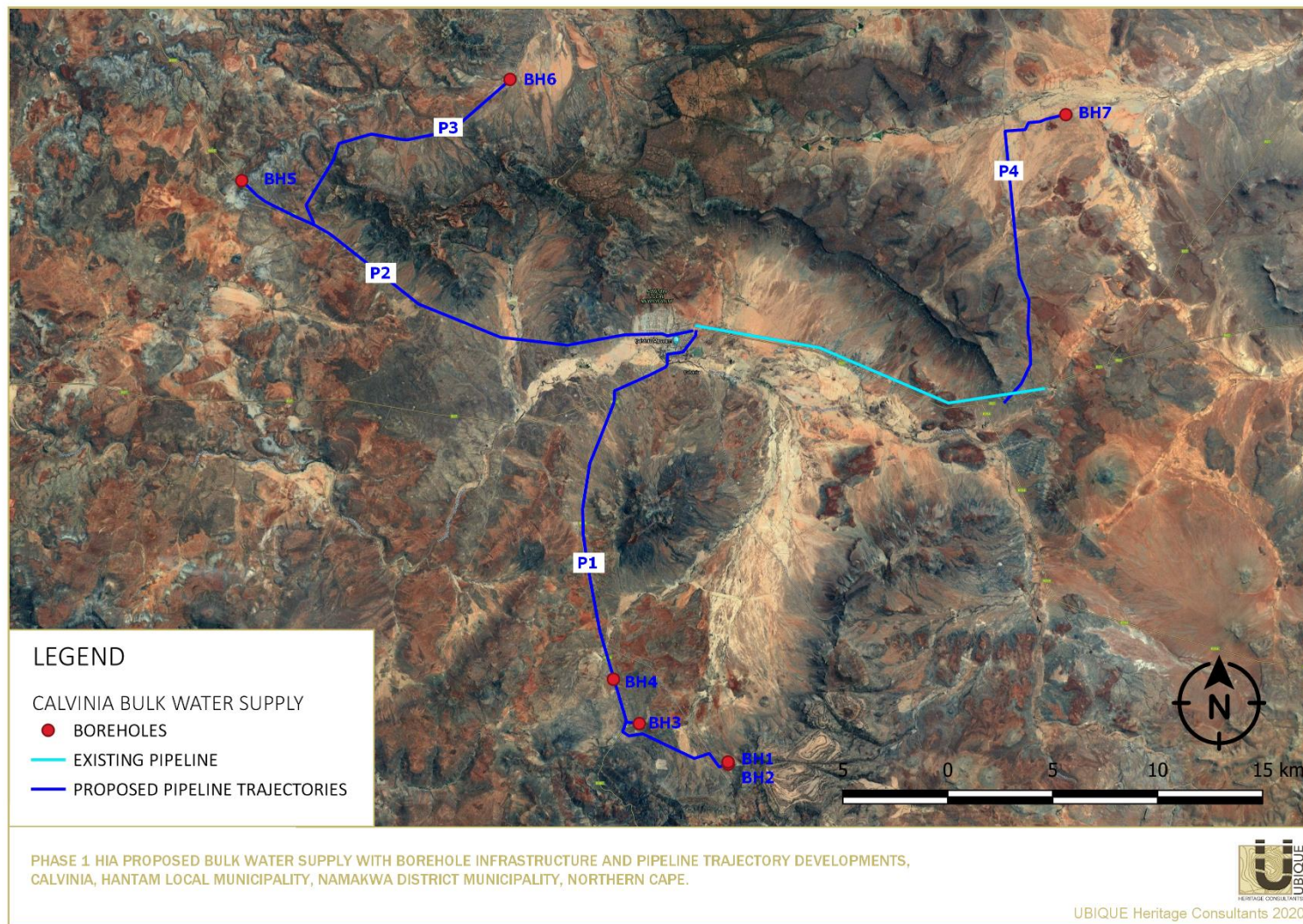


Figure 1:Locality Map of the Calvinia Bulk Water Supply.

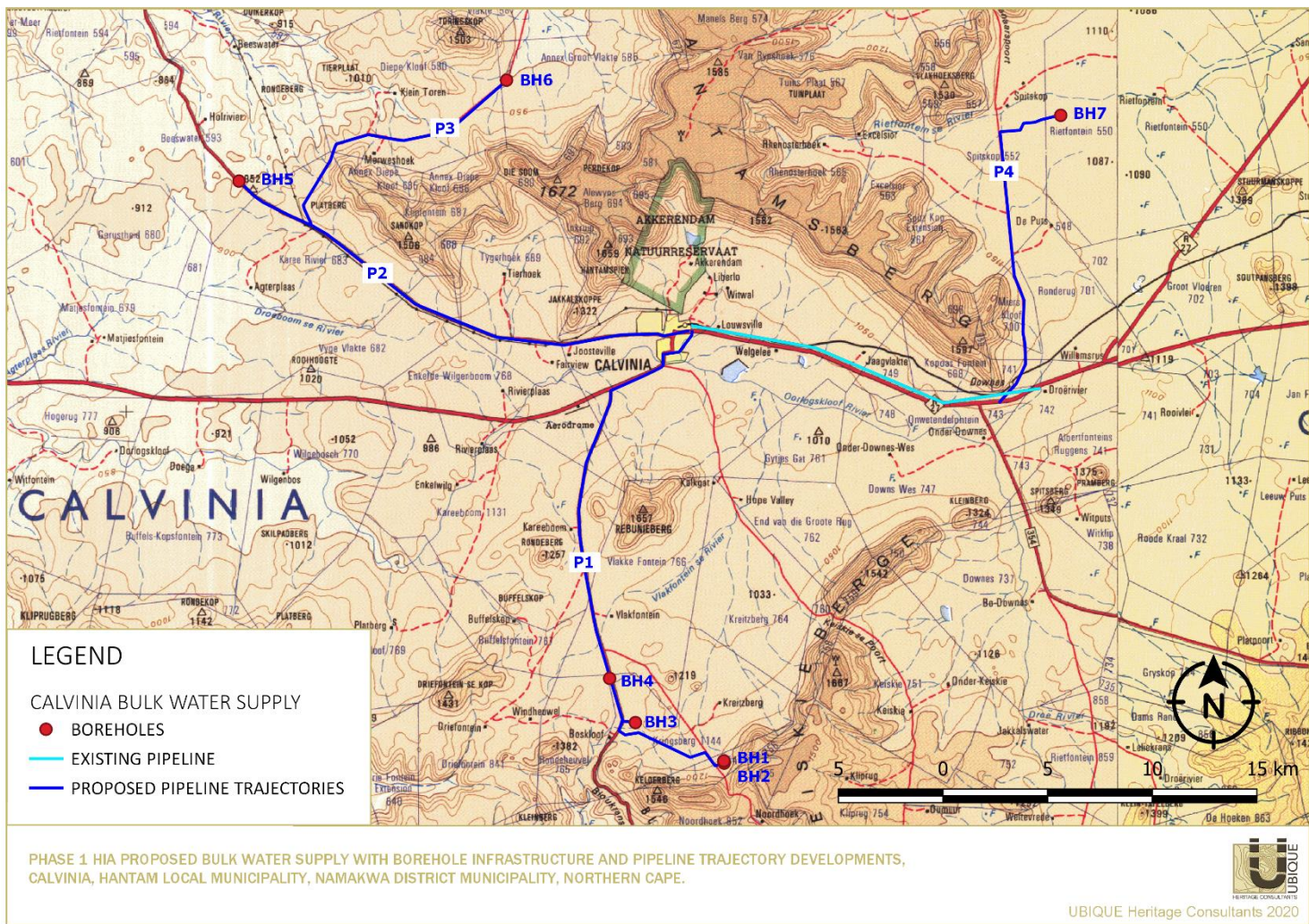


Figure 2: Locality Map.

» QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

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

» LEGISLATION

○ National Heritage Resources Act (25 of 1999)

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

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

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

- the construction of a road, wall, power line, pipeline, canal or other similar forms 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 which will change the character of a site—
 - a. (exceeding 5 000 m² in extent; or
 - b. involving three or more existing erven or subdivisions thereof; or
 - c. involving three or more erven or divisions thereof which have been consolidated within the past five years; or
 - d. the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority
 - e. 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.

» **OBJECTIVE**

The objective of a Palaeontological Impact Assessment (PIA) is to determine the impact of the development on potential palaeontological material at the site.

According to the "SAHRA APM Guidelines: Minimum Standards for the Archaeological and Palaeontological Components of Impact Assessment Reports" the aims of the PIA are: 1) to **identify** the palaeontological status of the exposed as well as rock formations just below the surface in the development footprint 2) to estimate the **palaeontological importance** of the formations 3) to determine the **impact** on fossil heritage, and 4) to recommend how the developer ought to protect or mitigate damage to fossil heritage.

The terms of reference of a PIA are as follows:

General Requirements:

Adherence to the content requirements for specialist reports in accordance with Appendix 6 of the EIA Regulations 2014, as amended;

Adherence to all applicable best practice recommendations, appropriate legislation and authority requirements;

Submit a comprehensive overview of all appropriate legislation, guidelines;

Description of the proposed project and provide information regarding the developer and consultant who commissioned the study;

Description and location of the proposed development and provide geological and topographical maps;

Provide Palaeontological and geological history of the affected area;

Identification sensitive areas to be avoided (providing shapefiles/kmls) in the proposed development;

Evaluation of the significance of the planned development during the Pre-construction, Construction, Operation, Decommissioning Phases and Cumulative impacts. Potential impacts should be rated in terms of the direct, indirect and cumulative:

- f. **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.
- g. **Indirect impacts** of an activity are indirect or induced changes that may occur as a result of the activity.
- h. **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
Implications of specialist findings for the proposed development (such as permits, licenses
etc.).

» **GEOLOGICAL AND PALAEOONTOLOGICAL HISTORY**

The proposed Calvinia Bulk Water Supply is depicted on the 1:250 000 3118 Calvinia Geological Map (2001) (Council of Geoscience) (Figure 3). The development footprint is underlain by the White with single bird sign-Quaternary sediments; Jd- Jurassic dolerite; Pt- Tierberg Formation and Pw- Whitehill Formation (Ecca Group; Karoo Supergroup). According to the PalaeoMap of the South African Heritage Resources Information System the Palaeontological Sensitivity Quaternary sediments is low, but local high, that of the Jurassic dolerite is insignificant, while the Tierberg Formation has a Moderate and the Whitehill Formation a very High Palaeontological Sensitivity.

The **Cenozoic Kalahari Group** is the most widespread body of terrestrial sediments in southern Africa. The Cenozoic sands and calcretes of the Kalahari Group range in thickness from a few metres to more than 180m (Partridge et al., 2006). The youngest formation of the Kalahari group is the Gordonia Formation which is generally termed Kalahari sand and comprises of red aeolian sands that cover most of the Kalahari Group sediments. The pan sediments of the area originated from the Gordonia Formation and contain white to brown fine-grained silts, sands and clays. Some of the pans consist of clayey material mixed with evaporates that shows seasonal effects of shallow saline groundwaters. Quaternary alluvium, aeolian sands, surface limestone, silcrete, and terrace gravels are also included in the Kalahari Group (Kent 1980).

Partridge *et al.*, (2006) describe numerous types of superficial deposits of Late Cenozoic (Miocene to Pliocene to Recent) age throughout the Karoo Basin. Sands and gravel in the development footprint have a possible fluvial origin. These fossils represent terrestrial plants and animals with a close resemblance to living forms. Fossil assemblages include bivalves, diatoms, gastropod shells, ostracods and trace fossils. The palaeontology of the Quaternary superficial deposits has been relatively neglected in the past. Late Cenozoic calcrete may comprise of bones, horn cores as well as mammalian teeth. Tortoise remains have also been uncovered as well as trace fossils which include termite and insect's burrows and mammalian trackways. Amphibian and crocodile remains have been uncovered where the depositional settings in the past were wetter.

Almond and Pether 2008 allocated a low significance to the Kalahari Group because fossil assemblages are generally rare and low in diversity and occur over a wide-ranging geographic area. In the past palaeontologists did not focus on Cenozoic superficial deposits although they sometimes comprise of significant fossil biotas. However, Groenewald and Groenewald (2014) allocated a high palaeontological sensitivity to the Cenozoic aged terrestrial organisms, which are essential indicators of palaeo-environmental conditions.

The **dolerite** (Jd) present in the development belongs to the Karoo Igneous Province that is a classic continental flood basalt province formed during the Early Jurassic. This province occurs over a large area in southern Africa and comprises a widespread system well developed igneous bodies (dykes, sills) that invaded the sediments of the Main Karoo Basin. Flood basalts do not typically form any visible volcanic structures, but with a series of outbursts form a suite of fissures of sub-horizontal lava flows that may vary in thickness. The Karoo is an old flood basalt province and is preserved today as erosional remnants of a more extensive lava cap that covered much of southern Africa in the geological past. As this Suite consist of igneous rocks, it is unfossiliferous.

The majority of the **Tierberg Formation** (Pt) (Ecca Group) comprises of well-laminated, dark grey to black shale (Johnson et al. 2006). Some yellowish tuffaceous beds up to 10cm thick occur in the lower part of the succession along the western and northern margins of the Basin. Calcareous concretions are common towards the top of the formation. Clastic rhythmites occur at various levels in the sequence (Cole, 2005). This formation is a deep-water deposit associated with event beds. The Tierberg formation is known for its rare trace fossils assemblages. Vascular plants (including petrified wood) and palynomorphs of *Glossopteris* flora have been found while fish fossils, crustaceans, shelly marine invertebrates, insects and as well as microfossils have been identified.

The **Whitehill Formation** of the Ecca Group is a comparatively thin succession of well-laminated carbon-rich mudrocks. The mudstone weathers to a characteristic pale grey to creamy white colour (Johnson et al. 2006). The Permian aged Whitehill Formation (high Palaeontological Sensitivity) is renowned for an abundance of body fossils as well as trace fossils. Almond (2011) described the main groups of Early Permian fossils found within the Whitehill Formation include as follows:

- A low diversity of trace fossils (possible shark coprolites/faeces and king crab trackways)
- Aquatic mesosaurid reptiles (the earliest known sea-going reptiles)
- Insects (preserved as isolated wings, although some intact specimens have also been recovered)
- Occasional cephalochordates (ancient relatives of the living lancets)
- Other rare vascular plant remains (*Glossopteris* leaves, lycopods etc.)".
- Palynomorphs (organic-walled spores and pollens)
- Petrified wood (mostly of primitive gymnosperms, silicified or calcified)
- Several palaeoniscid fish species (primitive bony fish)
- Small eocarid crustaceans are very common (bottom-living shrimp-like forms)

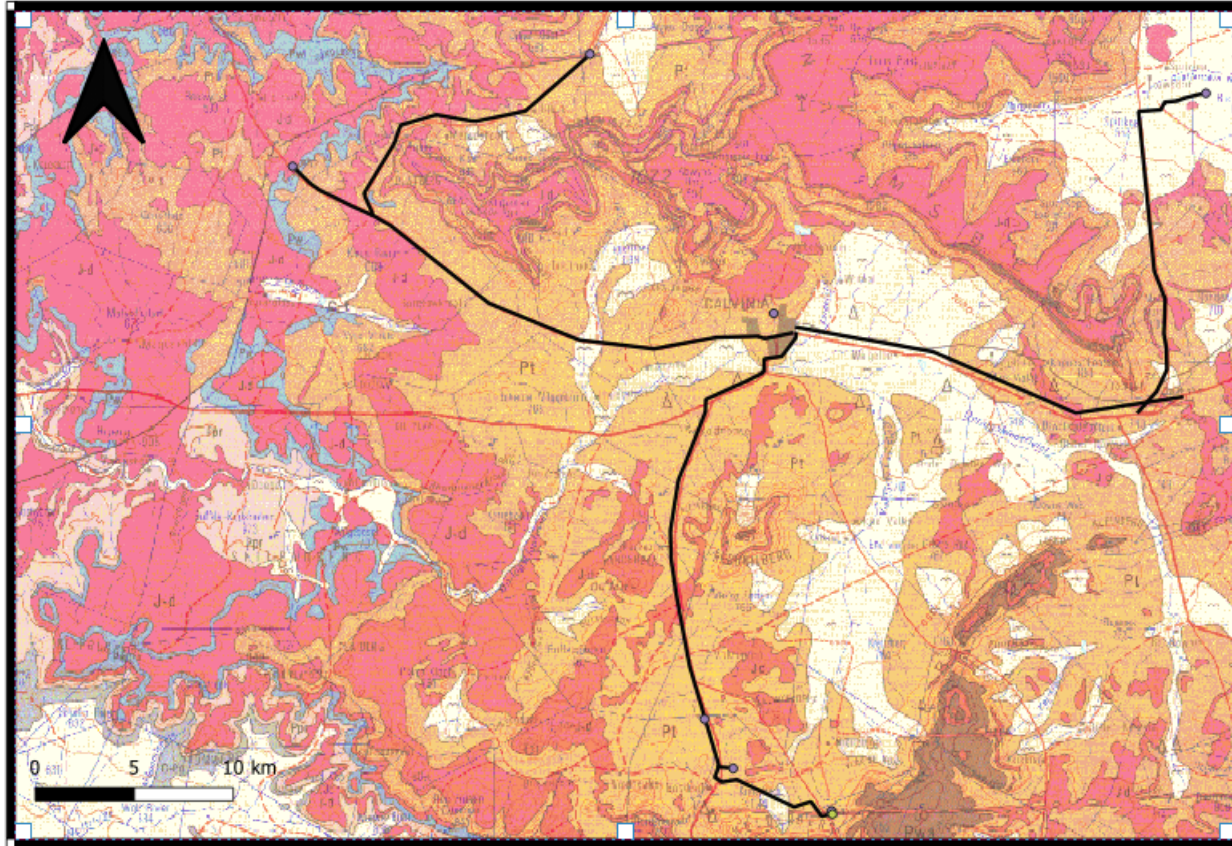
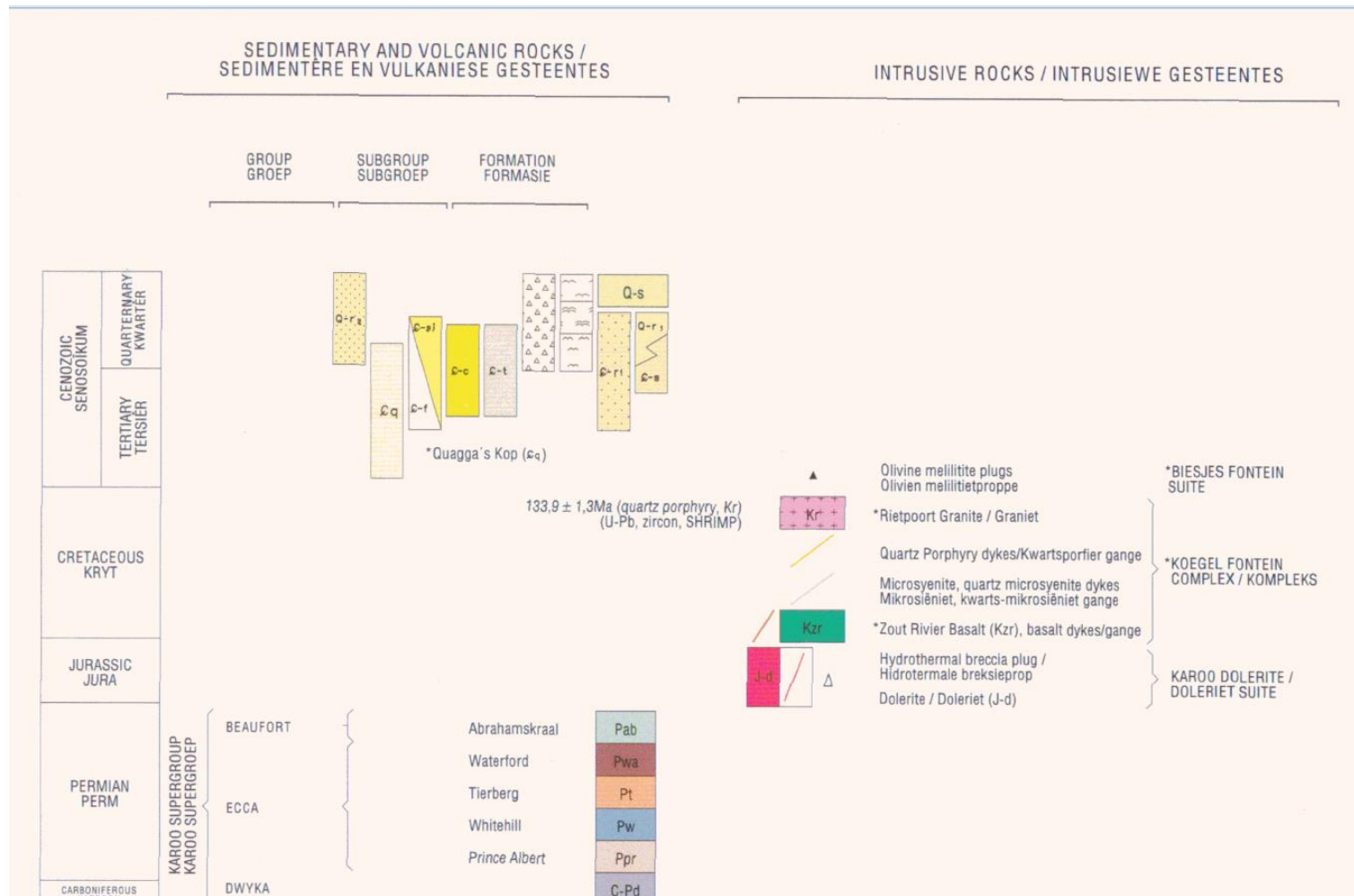


Figure 3: Extract of the 1:250 000 3118 Calvinia Geological Map (Council of Geoscience, Pretoria) indicating the locality of the proposed Calvinia Bulk Water Supply and Bore Holes in the Northern Cape. Legend: White with single bird siph-Quaternary sediments; J-D- Jurassic dolerite; Pt- Tierberg Formation and Pw- Whitehill Formation (Ecca Group, Karoo Supergroup). Map drawn by QGIS 2.18.28.



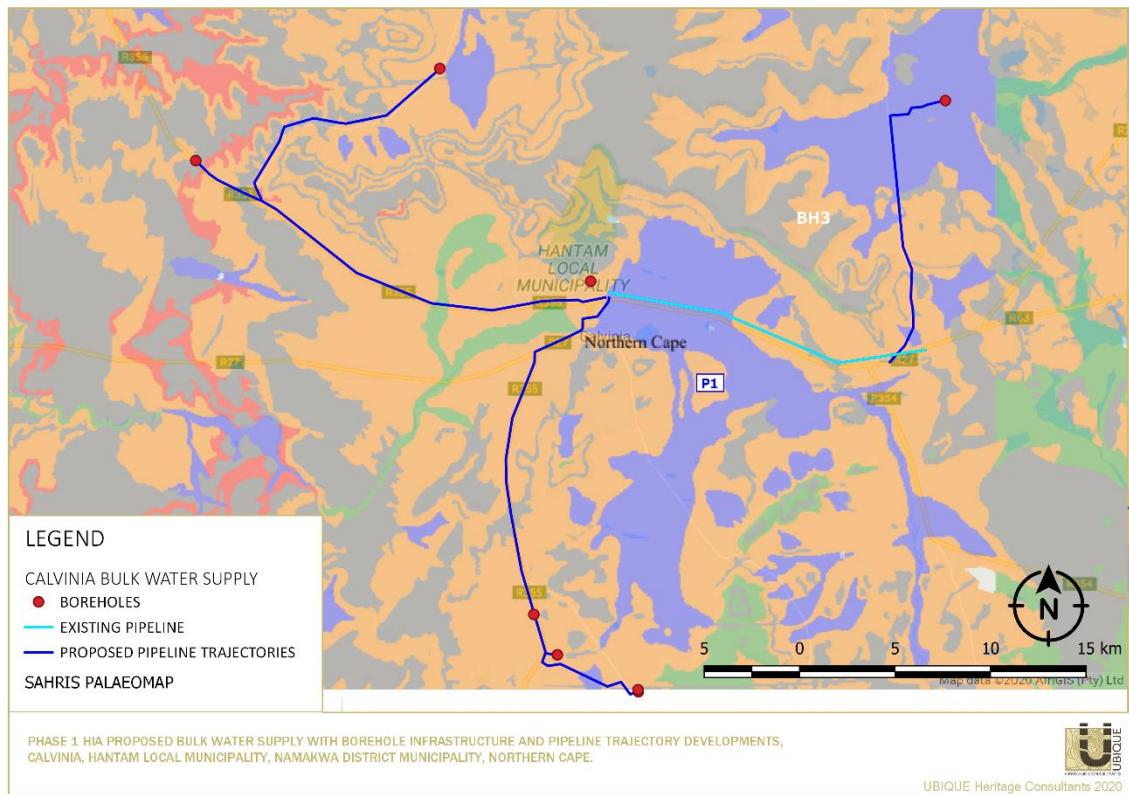


Figure 4: Extract of the 1 in 250 000 SAHRIS PalaeoMap map (Council of Geosciences) indicating the location of the proposed development.

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

According to the SAHRIS palaeo-sensitivity map (Figure 4), there is a very high chance of finding fossils in the red area, a high chance in the orange area and a moderate chance in the green area. The grey area is unfossiliferous.

» **GEOGRAPHICAL LOCATION OF THE SITE**

The proposed Calvina Bulk Water Supply consist of seven groundwater borehole (BH1-7) infrastructure developments, including the pipeline trajectories from the boreholes towards Calvina. Approximately 25 km of pipeline (P1-4) will be laid, predominantly along existing primary, secondary, and service road servitudes, with minimal cross-over onto private property.

» **METHODS**

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

○ **Assumptions and Limitations**

The focal point of geological maps is the geology of the area, and the sheet explanations were not meant to focus on palaeontological heritage. Many inaccessible regions of South Africa have never been reviewed by palaeontologists and data is generally based on aerial photographs alone. Locality and geological information of museums and universities databases have not been kept up to date or data collected in the past have not always been accurately documented.

Comparable Assemblage Zones in other areas is sourced to provide information on the existence of fossils in an area which was not documented in the past. When using similar Assemblage Zones and geological formations for Desktop studies, it is generally **assumed** that exposed fossil heritage is present within the footprint. **A field-assessment will thus improve the accuracy of the desktop assessment.**

» **ADDITIONAL INFORMATION CONSULTED**

In compiling this report, the following sources were consulted:

Geological map 1:100 000, Geology of the Republic of South Africa (Visser 1984),

1: 250 000 3118 Calvina (2001) Geological map (Council of Geoscience, Pretoria),

A Google Earth map with polygons of the proposed development was obtained from Unique Heritage Consultants.

» **SITE VISIT**

A site-specific field survey of the development footprint was thus conducted on foot and by a motor vehicle on 5 December 2020. The following photographs were taken during the site visit where no

fossiliferous outcrops were identified. However, fossil heritage may be unearthed during the construction phase of the development. The scarcity of fossil heritage at the proposed development footprint indicates that the impact of the development footprint will be of a low significance in palaeontological terms. A Chance find protocol is thus attached if fossils are found during the construction phase.



Figure 5: Bore hole 1

GPS: -31.470000; 19.753056



*Figure 6: Area around Borehole 1 and 2. No fossiliferous outcrops present
GPS -31.470000; 19.753056*



Figure 6: Borehole 3
GPS -31.650278; 19.801111



Figure 7: Trajectory of pipeline 2

GPS -31.648889; 19.784722



Figure 8: Borehole 4
GPS -31.617500; 19.744722



Figure 9: Pipeline trajectory just out of Calvinia on the R27
GPS -31.480080; 19.767888



Figure 10: Trajectory on the way to Borehole 5
GPS -31.38278 19.629444



Figure 11: Borehole 5
GPS -31.470000; 19.753056



Figure 12: Borehole 6
GPS - -31.470000 19.753056



Figure 13: Vegetation around borehole 6
GPS -31.353889; 19.693056



Figure 14: View over the existing pipeline along the R27
GPS -31.484722; 19.875556



Figure 15: Bore hole 7

GPS: -31.470000 19.753056

Photo Mr J.Engelbrecht



Figure 16: View over existing pipeline towards Borehole 7

GPS -31.442222; 19.947778

» **IMPACT ASSESSMENT METHODOLOGY**

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

- Construction;
- Operation; and
- Decommissioning.

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

NOTE: it is important to note the three alternatives proposed for this project has the same Geology, and there is, therefore NO Preference between the three alternatives. The rating for the alternatives will, consequently be the same.

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. 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

(Extent (1) + probability (3) + reversibility (4) + irreplaceability (4) + duration (4) + cumulative effect) (2) x magnitude/intensity (1) = 18

- **Summary of Impact Tables**

The development footprint is underlain by the Quaternary Sediments; Jurassic dolerite, Tierberg and Whitehill Formation (Ecca Group; Karoo Supergroup). According to the PalaeoMap of the South African Heritage Resources Information System the Palaeontological Sensitivity Quaternary sediments is low, but local high, that of the Jurassic dolerite is insignificant, while the Tierberg Formation has a Moderate and the Whitehill Formation a Very High Palaeontological Sensitivity.

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

» **FINDINGS AND RECOMMENDATIONS**

The development footprint is underlain by the Quaternary Sediments; Jurassic dolerite, Tierberg and Whitehill Formation (Ecca Group; Karoo Supergroup). According to the PalaeoMap of the South African Heritage Resources Information System the Palaeontological Sensitivity Quaternary sediments is low, but local high, that of the Jurassic dolerite is insignificant, while the Tierberg Formation has a Moderate and the Whitehill Formation a Very High Palaeontological Sensitivity.

A site-specific field survey of the development footprint was thus conducted on foot and by a motor vehicle on 5 December 2020. During the site visit, no fossiliferous outcrops were identified. The scarcity of fossil heritage at the proposed development footprint indicates that the impact of the development footprint will be of a low significance in palaeontological terms. It is therefore considered that the proposed development is deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological reserves of the area.

If fossil remains are discovered during any phase of construction, either on the surface or exposed by excavations the **Chance Find Protocol** must be implemented by the ESO (Environmental Site Officer) in charge of these developments. These discoveries ought to be protected (if possible, *in situ*) and the ESO must report to SAHRA (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za) so that correct mitigation (recording and collection) can be carried out by a palaeontologist.

It is consequently recommended that no further palaeontological heritage studies, ground-truthing and/or specialist mitigation are required pending the discovery of newly discovered fossils.

» **CHANCE FINDS PROTOCOL**

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

○ **Legislation**

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

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

○ **Background**

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

○ **Introduction**

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

The Environmental Site Officer (ESO) [an internal appointment who is on-site permanently during construction, to ensure legal compliance] is responsible for training the workmen and foremen in the procedure to follow when a fossil is accidentally uncovered. The ESO reports to the ECO (Environmental Compliance Officer) which is an external appointment to ensure legal compliance and is only on-site occasionally. In the absence of the ESO, a member of the staff must be

appointed to be responsible for the proper implementation of the chance find protocol as not to compromise the conservation of fossil material.

○ **Chance Find Procedure**

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

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

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

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Appendix A – Elize Butler CV

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

PRESENTATION

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INTERNATIONAL

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INTERNATIONAL VISITS

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Paleontological Institute, Russian Academy of Science, Moscow

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