

**HERITGE IMPACT ASSESSMENT OF THE PROPOSED
DEVELOPMENTS AT THE GREATER UKUWELA GAME
RESERVE, HLUHLUWE, KZN**

FOR SIVEST SA (PTY) LTD

DATE: 7 JULY 2021

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EXECUTVE SUMMARY

The Greater Ukuwela Nature Reserve has been registered as an Ezemvelo KZN Biodiversity Stewardship Site and as such is proclaimed as a Protected Area as defined within the National Environmental Management: Protected Areas Act of 2003 (NEMPAA), as amended. The proposed development in the reserve intends to include four new buildings and associated tracks.

Most of the area has been under agricultural cultivation since the 1950s and plough lines and contours are visible. Buildings that occurred have been mostly demolished, but do not occur within the study areas.

The heritage survey noted a heritage site, as well as isolated artefacts at each proposed area. The tracks for the Donor's House will pass through parts of an archaeological site. The track will need to be monitored during construction and permits will be required for the collection of artefacts and destruction of a heritage site. The tented camp has isolated artefacts and fossils that appear to have rolled down the hill onto this platform.

The palaeontology of the area is of high significance. The desktop study suggested that fieldwork would be required to fully asses the proposed developments on the fossil record.

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Abbreviations

HP	Historical Period
IIA	Indeterminate Iron Age
LIA	Late Iron Age
EIA	Early Iron Age
ISA	Indeterminate Stone Age
ESA	Early Stone Age
MSA	Middle Stone Age
LSA	Late Stone Age
HIA	Heritage Impact Assessment
PIA	Palaeontological Impact Assessment

INTRODUCTION

The Greater Ukuwela Nature Reserve has been registered as an Ezemvelo KZN Biodiversity Stewardship Site and as such is proclaimed as a Protected Area as defined within the National Environmental Management: Protected Areas Act of 2003 (NEMPAA), as amended.

The proposed development is to include the following components:

- Donor House with associated Decking, Terraces, Landscaping and Walkways
- Managers House
- Reserve Office and FreeMe Complex
- Tented Camp
- Various internal access roads (x3) / tracks for reserve management / game viewing (Gravel Roads Proposed)

In terms of infrastructure requirements, the following is proposed:

- Potable water provision will be via a municipal source;
- On site sewer treatment will be required (Septic Tank and Soakaway System); and
- Electrical supply will be via Eskom.

Project Location:

The Greater Ukuwela Nature Reserve is approximately 1283,1 hectares and is located just north of the Hluhluwe town in Northern KwaZulu Natal. It falls within the uMkhanyakude District Municipality and the Big Five Hlabisa Local Municipality.

Ukuwela is located in the center of the Maputaland-Pondoland-Albany Hotspot, one of the world's biologically richest and most endangered land-based

ecoregions. It is surrounded by prestigious wildlife reserves, including Mkuze, St Lucia, Sodwana Bay, South Africa's first UNESCO World Heritage Site, the iSimangaliso Wetland Park, and the Phinda Private Game Reserve, with which Ukuwela shares a river border (Wild Tomorrow Fund, 2021).

DONOR HOUSE

Wild Tomorrow Fund is as a wildlife conservation charity, which receives financial donations from many people each year. Wild Tomorrow Fund would like its major donors to experience the reserve first-hand and to share in the conservation achievements that they made possible.

TENTED CAMP

Wild Tomorrow Fund has a paid volunteer program where local and international people take part in conservation activities on the Greater Ukuwela Nature Reserve for two weeks at a time. There are typically two to three volunteer trips each year.

To increase the profits Wild Tomorrow Fund generates from these trips, they would like their guests to stay on reserve, thus eliminating the need to pay for third-party lodging.

MANAGER'S HOUSE

Wild Tomorrow Fund intends to build a simple two-bedroom house on the Greater Ukuwela Nature Reserve for their General Manager. Having the General Manager reside on-site will increase the output and quality of work from this employee and all other staff.

RESERVE OFFICE AND FREEME COMPLEX

FreeMe is a South African wildlife rehabilitation organization based in Howick, SA. Wild Tomorrow Fund has entered into a legal agreement where FreeMe will lease four hectares of land from Wild Tomorrow Fund on the Greater Ukuwela Nature Reserve. The purpose is for FreeMe to create a wildlife

rehabilitation centre for the indigenous mammals, birds, reptiles, amphibians and invertebrates in accordance with the Ezemvelo KZN Wildlife permit conditions.

Adjacent to the FreeMe rehabilitation centre will be a Reserve Office where Wild Tomorrow Fund employees will work. Having all employees working from one location will increase the productivity and quality of conservation work.

Umlando was requested to undertake a Heritage Impact Assessment of the proposed development. Figures 1 – 3 show the location of the development.

FIG. 1 GENERAL LOCATION OF THE PROPOSED DEVELOPMENT

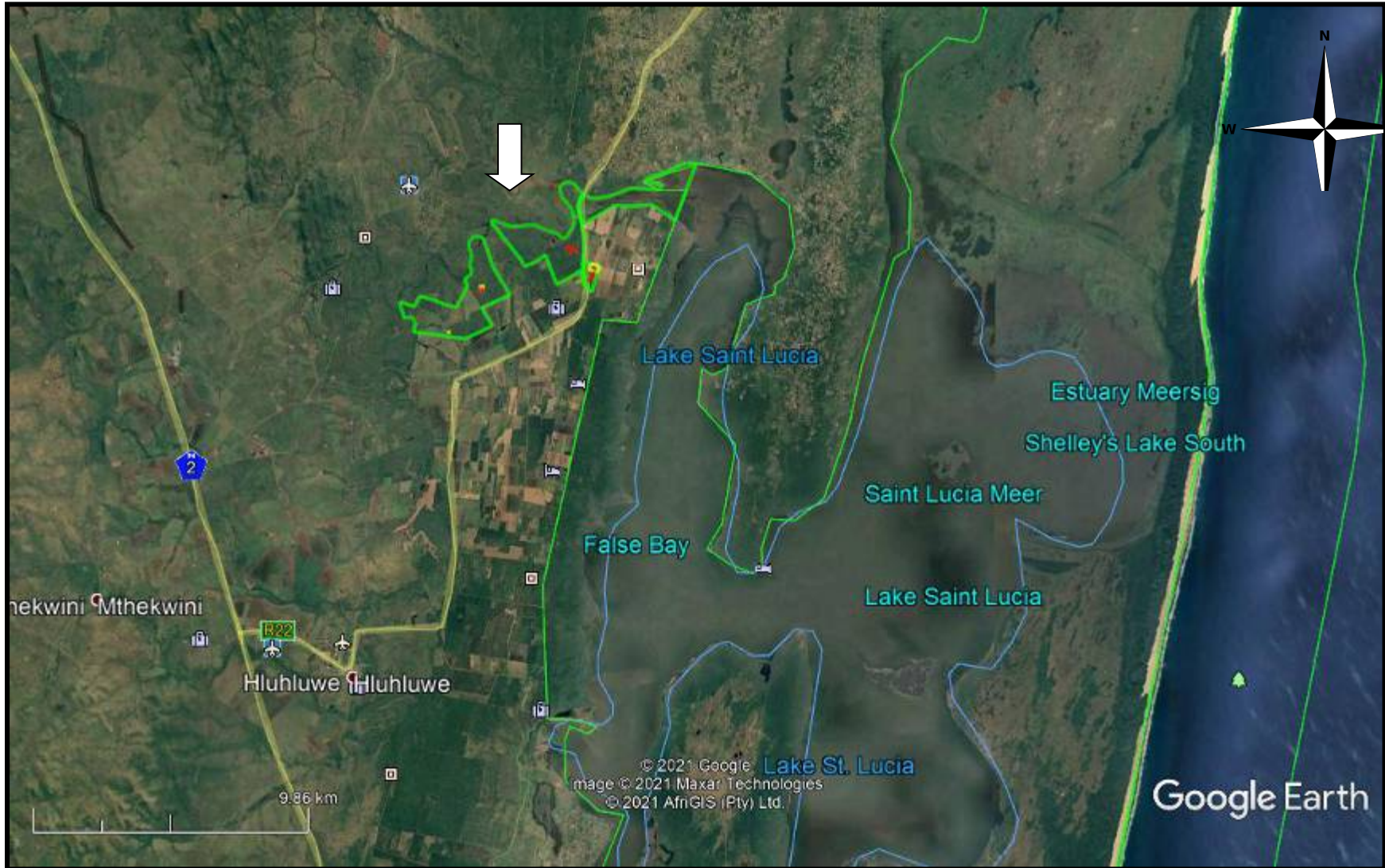


FIG. 2: AERIAL OVERVIEW OF THE PROPOSED DEVELOPMENT



FIG. 3: TOPOGRAPHICAL MAP OF THE PROPOSED DEVELOPMENT (2002)

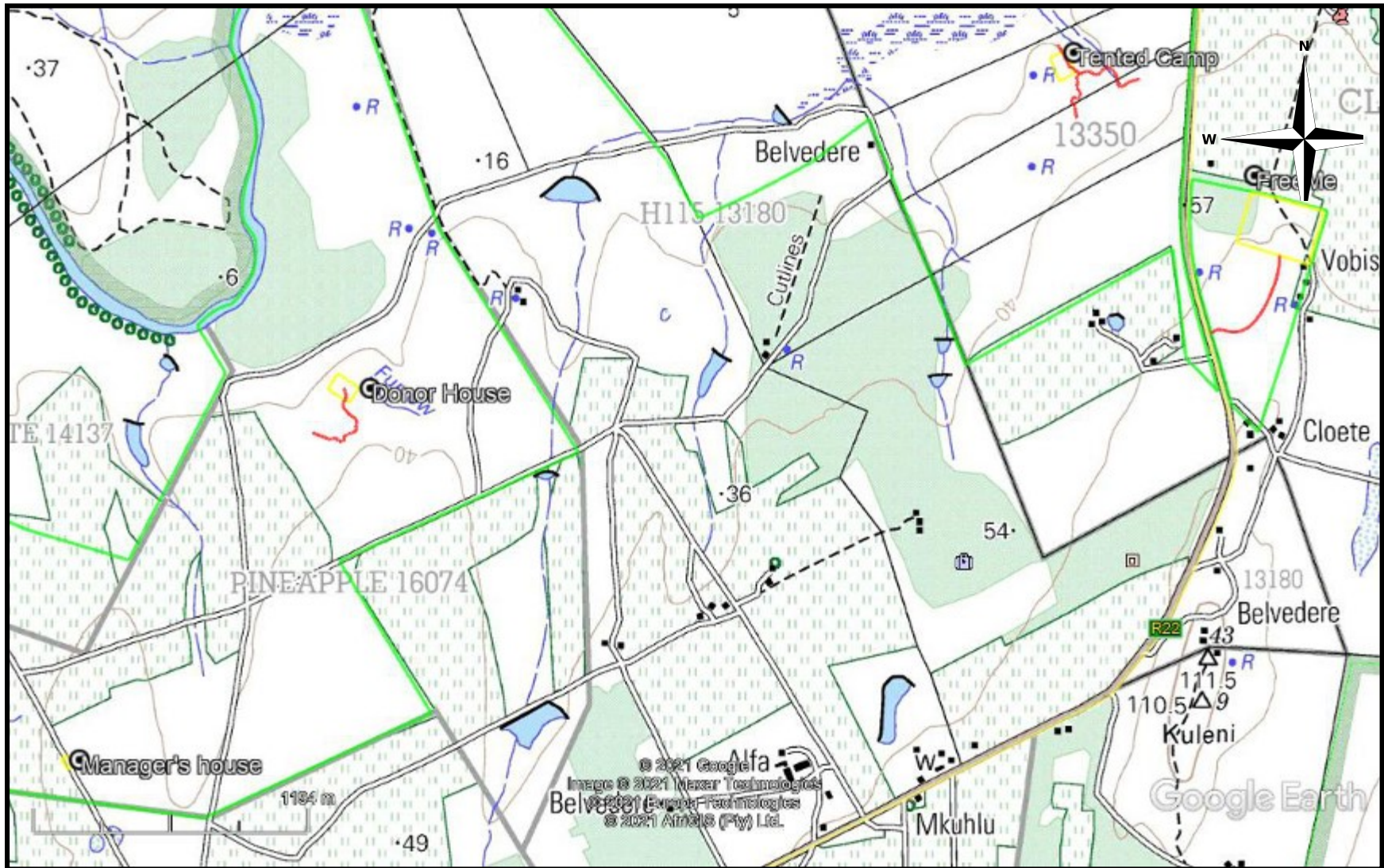


FIG. 4: SCENIC VIEW OF THE STUDY AREA



KWAZULU NATAL AMAFA AND RESEARCH INSTITUTE, ACT 05, 2018

“General protection: Structures.—

- No structure which is, or which may reasonably be expected to be older than 60 years, may be demolished, altered or added to without the prior written approval of the Council having been obtained on written application to the Council.
- Where the Council does not grant approval, the Council must consider special protection in terms of sections 38, 39, 40, 41 and 43 of Chapter 9.
- The Council may, by notice in the *Gazette*, exempt—
- A defined geographical area; or
- defined categories of sites within a defined geographical area, from the provisions of subsection where the Council is satisfied that heritage resources falling in the defined geographical area or category have been identified and are adequately protected in terms of sections 38, 39, 40, 41 and 43 of Chapter 9.
- A notice referred to in subsection (2) may, by notice in the *Gazette*, be amended or withdrawn by the Council.

General protection: Graves of victims of conflict.—No person may damage, alter, exhume, or remove from its original position—

- the grave of a victim of conflict;
- a cemetery made up of such graves; or
- any part of a cemetery containing such graves, without the prior written approval of the Council having been obtained on written application to the Council.
- General protection: Traditional burial places.—
- No grave—
- not otherwise protected by this Act; and
- not located in a formal cemetery managed or administered by a local authority, may be damaged, altered, exhumed, removed from its original

position, or otherwise disturbed without the prior written approval of the Council having been obtained on written application to the Council.

The Council may only issue written approval once the Council is satisfied that—

- the applicant has made a concerted effort to consult with communities and individuals who by tradition may have an interest in the grave; and
- the applicant and the relevant communities or individuals have reached agreement regarding the grave.

General protection: Battlefield sites, archaeological sites, rock art sites, palaeontological sites, historic fortifications, meteorite or meteorite impact sites.—

- No person may destroy, damage, excavate, alter, write or draw upon, or otherwise disturb any battlefield site, archaeological site, rock art site, palaeontological site, historic fortification, meteorite or meteorite impact site without the prior written approval of the Council having been obtained on written application to the Council.
- Upon discovery of archaeological or palaeontological material or a meteorite by any person, all activity or operations in the general vicinity of such material or meteorite must cease forthwith and a person who made the discovery must submit a written report to the Council without delay.
- The Council may, after consultation with an owner or controlling authority, by way of written notice served on the owner or controlling authority, prohibit any activity considered by the Council to be inappropriate within 50 metres of a rock art site.
- No person may exhume, remove from its original position or otherwise disturb, damage, destroy, own or collect any object or material associated with any battlefield site, archaeological site, rock art site, palaeontological site, historic fortification, meteorite or meteorite impact site without the prior written approval of the Council having been obtained on written application to the Council.
- No person may bring any equipment which assists in the detection of metals and archaeological and palaeontological objects and material, or

- excavation equipment onto any battlefield site, archaeological site, rock art site, palaeontological site, historic fortification, or meteorite impact site, or use similar detection or excavation equipment for the recovery of meteorites, without the prior written approval of the Council having been obtained on written application to the Council.
- The ownership of any object or material associated with any battlefield site, archaeological site, rock art site, palaeontological site, historic fortification, meteorite or meteorite impact site, on discovery, vest in the Provincial Government and the Council is regarded as the custodian on behalf of the Provincial Government.”

METHOD

The method for Heritage assessment consists of several steps.

The first step forms part of the desktop assessment. Here we would consult the database that has been collated by Umlando. This databases contains archaeological site locations and basic information from several provinces (information from Umlando surveys and some colleagues), most of the national and provincial monuments and battlefields in Southern Africa (<http://www.vuvuzela.com/googleearth/monuments.html>) and cemeteries in southern Africa (information supplied by the Genealogical Society of Southern Africa). We use 1st and 2nd edition 1:50 000 topographical and 1937 aerial photographs where available, to assist in general location and dating of buildings and/or graves. The database is in Google Earth format and thus used as a quick reference when undertaking desktop studies. Where required we would consult with a local data recording centre, however these tend to be fragmented between different institutions and areas and thus difficult to access at times. We also consult with an historical architect, palaeontologist, and an historian where necessary.

The survey results will define the significance of each recorded site, as well as a management plan.

All sites are grouped according to low, medium, and high significance for the purpose of this report. Sites of low significance have no diagnostic artefacts or features. Sites of medium significance have diagnostic artefacts or features and these sites tend to be sampled. Sampling includes the collection of artefacts for future analysis. All diagnostic pottery, such as rims, lips, and decorated sherds are sampled, while bone, stone, and shell are mostly noted. Sampling usually occurs on most sites. Sites of high significance are excavated and/or extensively sampled. Those sites that are extensively sampled have high research potential, yet poor preservation of features.

Defining significance

Heritage sites vary according to significance and several different criteria relate to each type of site. However, there are several criteria that allow for a general significance rating of archaeological sites.

These criteria are:

1. State of preservation of:

- 1.1. Organic remains:
 - 1.1.1. Faunal
 - 1.1.2. Botanical
- 1.2. Rock art
- 1.3. Walling
- 1.4. Presence of a cultural deposit
- 1.5. Features:
 - 1.5.1. Ash Features
 - 1.5.2. Graves

- 1.5.3. Middens
- 1.5.4. Cattle byres
- 1.5.5. Bedding and ash complexes

2. Spatial arrangements:

- 2.1. Internal housing arrangements
- 2.2. Intra-site settlement patterns
- 2.3. Inter-site settlement patterns

3. Features of the site:

- 3.1. Are there any unusual, unique or rare artefacts or images at the site?
- 3.2. Is it a type-site?
- 3.3. Does the site have a very good example of a specific time period, feature, or artefact?

4. Research:

- 4.1. Providing information on current research projects
- 4.2. Salvaging information for potential future research projects

5. Inter- and intra-site variability

- 5.1. Can this particular site yield information regarding intra-site variability, i.e. spatial relationships between various features and artefacts?
- 5.2. Can this particular site yield information about a community's social relationships within itself, or between other communities?

6. Archaeological Experience:

6.1. The personal experience and expertise of the CRM practitioner should not be ignored. Experience can indicate sites that have potentially significant aspects, but need to be tested prior to any conclusions.

7. Educational:

- 7.1. Does the site have the potential to be used as an educational instrument?
- 7.2. Does the site have the potential to become a tourist attraction?
- 7.3. The educational value of a site can only be fully determined after initial test-pit excavations and/or full excavations.

8. Other Heritage Significance:

- 8.1. Palaeontological sites
- 8.2. Historical buildings
- 8.3. Battlefields and general Anglo-Zulu and Anglo-Boer sites
- 8.4. Graves and/or community cemeteries
- 8.5. Living Heritage Sites
- 8.6. Cultural Landscapes, that includes old trees, hills, mountains, rivers, etc related to cultural or historical experiences.

The more a site can fulfill the above criteria, the more significant it becomes. Test-pit excavations are used to test the full potential of an archaeological deposit. This occurs in Phase 2. These test-pit excavations may require further excavations if the site is of significance (Phase 3). Sites may also be mapped and/or have artefacts sampled as a form of mitigation. Sampling normally occurs when the artefacts may be good examples of their type, but are not in a primary archaeological context. Mapping records the spatial relationship between features and artefacts. Table 1 lists the grading system.

TABLE 1: SAHRA GRADINGS FOR HERITAGE SITES

SITE SIGNIFICANCE	FIELD RATING	GRADE	RECOMMENDED MITIGATION
High Significance	National Significance	Grade 1	Site conservation / Site development
High Significance	Provincial Significance	Grade 2	Site conservation / Site development
High Significance	Local Significance	Grade 3A / 3B	
High / Medium Significance	Generally Protected A		Site conservation or mitigation prior to development / destruction
Medium Significance	Generally Protected B		Site conservation or mitigation / test excavation / systematic sampling / monitoring prior to or during development / destruction
Low Significance	Generally Protected C		On-site sampling monitoring or no archaeological mitigation required prior to or during development / destruction

RESULTS

DESKTOP STUDY

The desktop study consisted of analysing various maps for evidence of prior habitation in the study area, as well as for previous archaeological surveys. Many archaeological sites occur in the general area and are mainly from the surveys at Mun-y-wana Game Reserve (Anderson 2018, 2019). The archaeological sites tend to be open Stone Age scatters, a few caves and overhangs with deposit, and Late Iron Age and Historical Period settlements (fig. 5).

The three farms, Cloete 13350 and Lot H114 and 115, were originally surveyed in 1924 (for Cloete) and 1928 (fig. 6 – 7). The farms were probably leased for a while, since they are only granted in 1941. By 1937 the area is still in its natural state with no evidence of agricultural crop activity (fig. 8). No buildings are noticeable either. This is continued into 1942 (fig. 9),

By 1966, much of the land has been transformed into agricultural fields, with a few areas of natural vegetation (fig. 10). There are buildings on the farms, but these have now been demolished, presumably when the land became a reserve. No buildings occur in the four study areas.

FIG. 6: SURVEYOR GENERAL MAP OF CLOETE 13350 (1924)

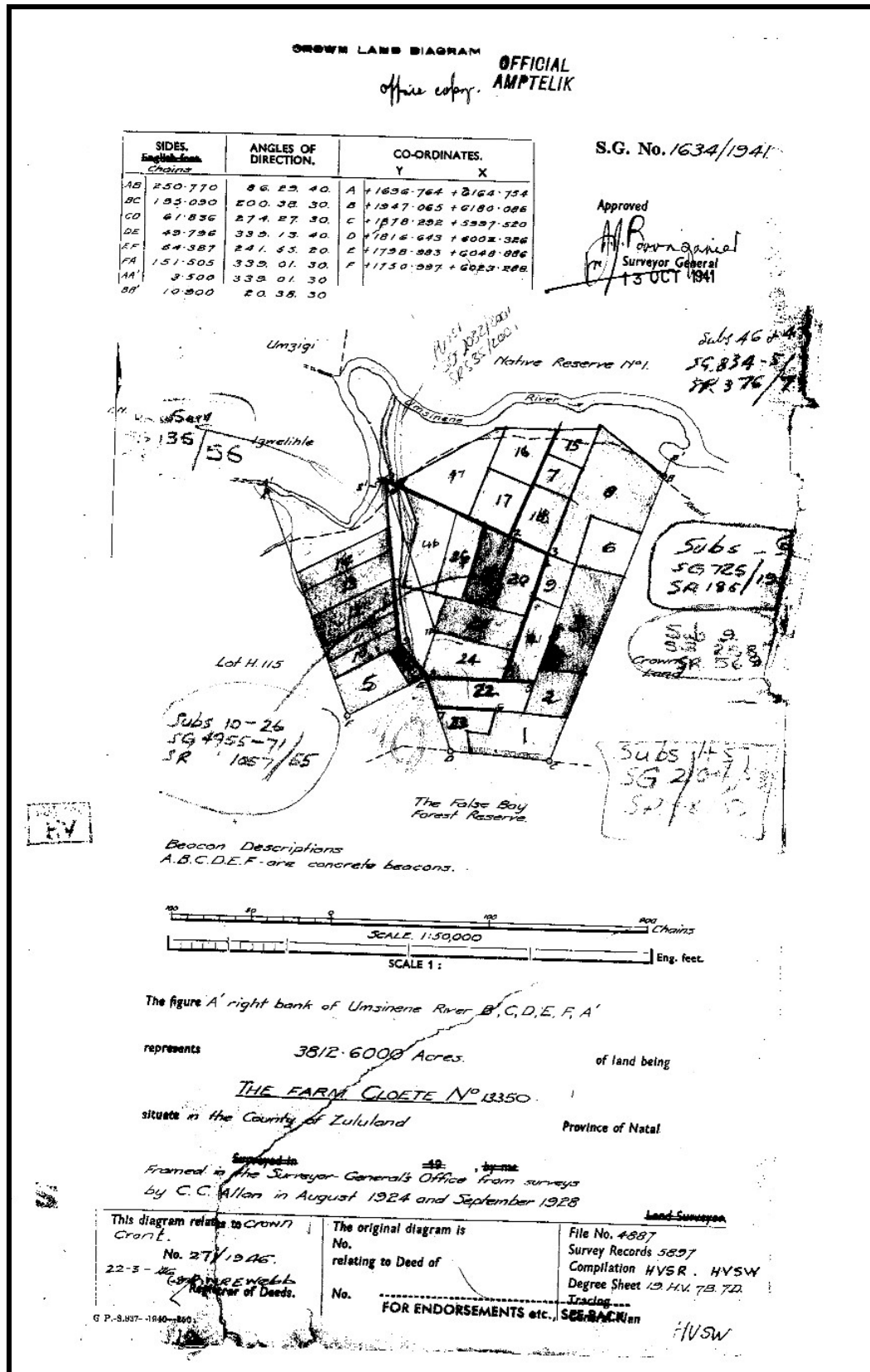


FIG. 7: SURVEYOR GENERAL MAP OF LOT H 115 (1928)

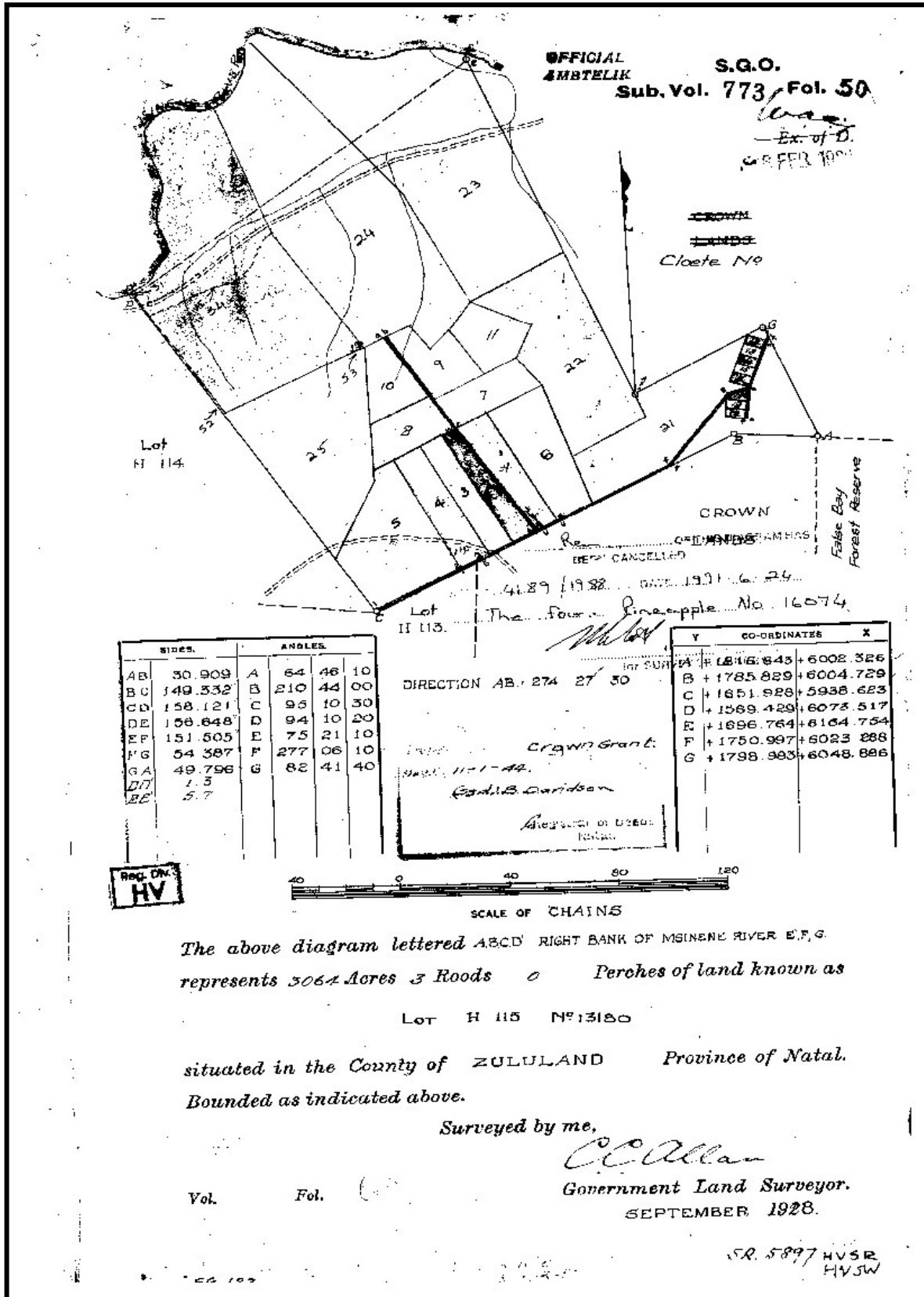


FIG. 8: LOCATION OF THE STUDY AREA IN 1937



FIG. 9: LOCATION OF THE STUDY AREA IN 1942

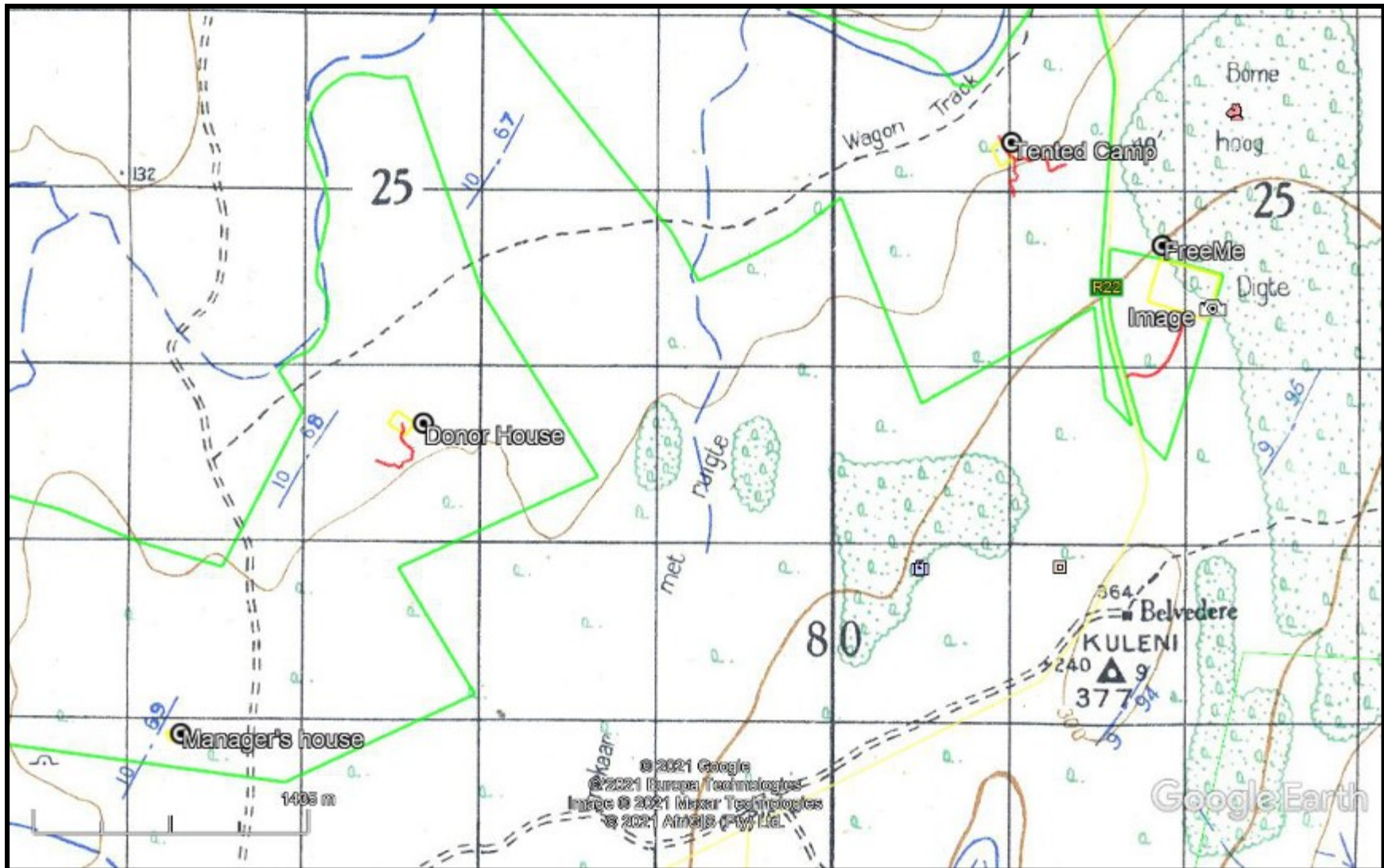
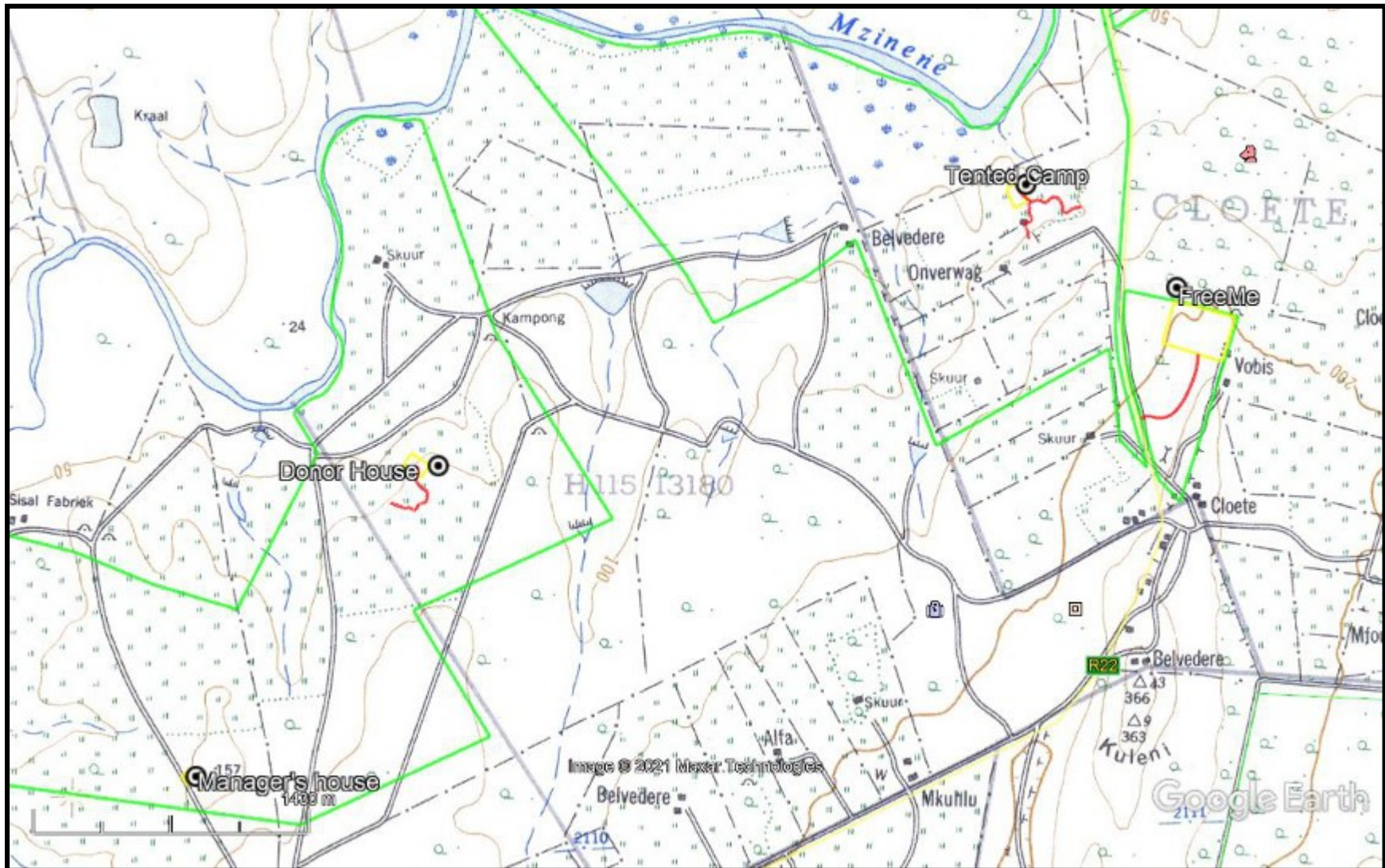


FIG. 10: LOCATION OF THE STUDY AREA IN 1966



PALAEONTOLOGICAL SENSITIVITY

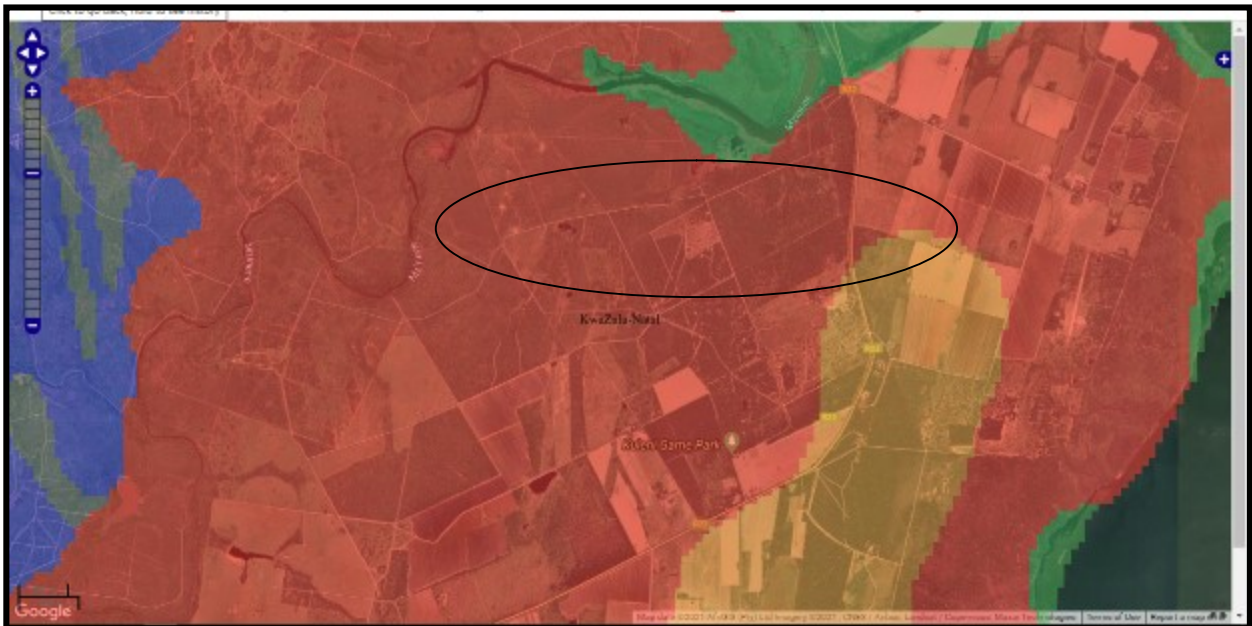
The area is in an area of very high palaeontological sensitivity (fig. 11). A desktop PIA was undertaken by Dr Alan Smith to determine the need for a full PIA, and the management of possible palaeontological remains. The PIA desktop report (Appendix A) states:

“The Cretaceous Rocks... were deposited during the rifting of the Gondwana Supercontinent. At this time the Indian Ocean was opening up, when the continent of Africa was starting to take on its present shape. In this area, Gondwana fragmentation took place in two phases. Continental break-up was initiated during the Jurassic and continued into the Early Cretaceous. Watkeys (2006) believes that Gondwana rifting commenced between 155 and 135 Ma. The break-up of Gondwana may have been initiated in the Jurassic (~183 Ma), coincident with the outpouring of the Karoo Continental Flood Basalts (Hanson et al., 2009). However, actual seafloor spreading only began at ~130 Ma (Veevers, 2012). Along the eastern Cape and southern KwaZulu-Natal coast... the Falklands Islands had separated from southern Africa by ~125 Ma (Watkeys, 2006)...

This location is within what will become the Buffer Zone for the iSimangaliso World Heritage Site. Fossil Cephalopods, including ammonites, nautiloids (Figure 4) and belemnites, and fossil (petrified) wood (Figure 5) have been found within the underlying rocks, which are well known for their fossil content (Table 2). The adjacent lake margin outcrop is known to be fossiliferous, as is the Nibela Peninsula. At Lister's Point (nearby) a very rare fossil marine carbonate reef is present (Cooper et al, 2013). This lithology has not been reported from the project area, but attention should be paid to this possibility.

The possibility of finding Significant Palaeontological Material is very high... It is a recommendation of this report that a suitably qualified palaeontologist visits this site to assess for the presence of fossils in the proposed development area.”

FIG. 11: PALAEOLOGICAL SENSITIVITY MAP



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.

A field survey will be required if the proposed development is approved. It will require a permit from KZNARI to damage/destroy the fossils. KZNARI It would be preferable to undertake the survey as soon as possible, so that it can be included into the SAHRIS application.

It is unlikely that the occurrences of fossils will hinder the development since they can be managed and collected.

FIELD SURVEY

The field survey was undertaken in July 2021. Ground visibility ranged from poor to very good. I concentrated on opened areas and tracks to assess the general area around each of the four development areas. All of the areas appear to have been ploughed, while some of the larger trees have been kept.

Manager's House

The manager's house is a 30m x 50m area that appears to have been levelled in the past (fig. 12). No artefacts were observed within the demarcated area or the adjacent road.

FIG. 12: AREA FOR MANAGER'S HOUSE



Donor House

The Donor's House is in the least disturbed area (fig. 13). Isolated artefacts dating to the Middle and Late Stone Age were noted within the demarcated area, as well as a few pottery sherds. The Donor's House is located lower down on the slope and appears to have been contoured in the past.

The proposed track runs uphill in a southerly direction, and then westwards. As the track leaves the Donor's House area, there is an increase in Late Iron Age, or Historical Period pottery and grinding stones (fig. 14). The site is called DH01. The pottery is undecorated and mainly thin-walled, suggesting it might be Historical Period. A single thick and weathered shard was noted and this might date to the Early Iron Age. Amongst these shards are Late Stone Age flakes and cores. The artefacts become more concentrated as one heads uphill. As the road veers west, there is an old *Euphorbia ingens* (fig. 15). These are normally associated with graves in traditional Zulu culture in this area. By default, I consider all old *E. ingens* to be graves unless proven otherwise, especially when associated with an archaeological site. The *E. ingens* will not be affected by the track.

Significance: The site is of low-medium significance. There is a high density of artefacts suggesting that the site may be extensive; however, it has also been affected by farming. My experience shows that most of these sites occur 30cm below the surface, and thus it is unlikely to be affected by a track.

Mitigation: The track and Donor House should be monitored during vegetation clearance and especially while the track is being set out. A sampling permit should be obtained in case any artefacts are exposed.

SAHRA Rating: 3B

FIG. 13: DONOR'S HOUSE



FIG. 14: POTTERY AND LOWER GRINDING STONE AT DH01



FIG. 15: EUPHORBIA INGENS AT DHO1



Tented camp

The tented camp occurs near the base of the hill overlooking the Mzinene River. The area has been contoured for agriculture in the past (fig. 16). There are a few stone tools in the cleared area and along the track and the occasional pottery shard. These are probably rolling down from further uphill.

Significance: The isolated shards and stone tools do not form a site and are of low significance.

Mitigation: No further mitigation is required.

SAHRA Rating: n/a

FIG. 16: TENTED CAMP



FreeMe Facility

The FreeMe area is located on original Sand Forest that was cleared for agriculture (fig. 17). My experience with Sand Forest is that it was not used for settlements in the past: one will find the occasional artefact. It is only in the mid 20th century onwards when human settlements start to occur within the Sand Forests to a larger degree.

The current area is under dense vegetation; however, several furrows for the pineapple farm occur just outside. These furrows and ploughed were surveyed for artefacts as it occurs on the same hill as the facility. No artefacts were observed.

FIG. 17: FREEME FACILITY



RECOMMENDATIONS

The proposed developments at Ukuwela will only affect part of one archaeological site. DH01. The impact will be low and only affect the upper 10cm of topsoil. I suggest that the area is monitored by a suitably qualified archaeologist after vegetation clearance and during any topsoil removal. A collection permit should be obtained so that any significant artefacts can be sampled. If needs be, the track can be altered if any features are noted.

A PIA field survey will be required to determine the full extent of the fossil record.

CONCLUSION

A HIA was undertaken for the proposed four developments at Ukuwela Game Reserve. There will be four built structures with access tracks located at different parts on the Game Reserve. Two of the structures have no heritage sites. The tented camp has isolated artefacts that originate further up the hill. The Donor's House has artefacts in a secondary context, while part of the track passes areas of high artefact concentration. It is not necessary to divert the track at this stage, and I recommended that the area be monitored when cleared.

REFERENCES

Anderson, G. and Anderson, L. 2018. Heritage Survey Of The Mun-Ya-Wana Conservancy, Kwa-Zulu Natal. For The Mun-Ya-Wana Conservancy

Anderson, G. and Anderson, L. 2019. Heritage Survey Of The Mun-Ya-Wana Conservancy, Kwa-Zulu Natal. For The Mun-Ya-Wana Conservancy

Maps:

SR 5897 HVSR

SG 1654/1941

117C_039_65266 - 117C_039_65269

117C_041_65297

2732CD Hluhluwe 1942, 2002

Database:

SAHRIS Database

Umlando Database

EXPERIENCE OF THE HERITAGE CONSULTANT

Gavin Anderson has a M. Phil (in archaeology and social psychology) degree from the University of Cape Town. Gavin has been working as a professional archaeologist and heritage impact assessor since 1995. He joined the Association of Professional Archaeologists of Southern Africa in 1998 when it was formed. Gavin is rated as a Principle Investigator with expertise status in Rock Art, Stone Age and Iron Age studies. In addition to this, he was worked on both West and East Coast shell middens, Anglo-Boer War sites, and Historical Period sites.

DECLARATION OF INDEPENDENCE

I, Gavin Anderson, declare that I am an independent specialist consultant and have no financial, personal or other interest in the proposed development, nor the developers or any of their subsidiaries, apart from fair remuneration for work performed in the delivery of heritage assessment services. There are no circumstances that compromise the objectivity of my performing such work.

Gavin Anderson
Archaeologist/Heritage Impact Assessor

**APPENDIX A
PIA DESKTOP**

PROPOSED TENTED CAMP AND ACCESSORY BUILDINGS

**GREATER UKUWELA NATURE RESERVE, UMKHANYAKUDE DISTRICT
MUNICIPALITY, KWAZULU-NATAL**

DESKTOP PALAEOLOGICAL IMPACT ASSESMENT

FOR

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July 2021

EXECUTIVE SUMMARY

The Sahris Palaeosensitivity Map classifies most of this area Red, i.e. very high sensitivity, requiring a field assessment and protocol for finds. The chances of finding in situ significant palaeontological material is high. The proposed footprint is small and shallow, but it is a recommendation of this report that a suitably qualified palaeontologist visit the site. A “Chance Find” Protocol has also been inserted into this report.

1. BACKGROUND

According to information supplied, the Project Area is located to the northwest of False Bay, within the Greater Ukuwela Nature Reserve (Figure 1). The project area is approximately 1283 hectares and straddles the R22 Hluhluwe to Mbazwana road. It is located in the Big Five Hlabisa Local Municipality, within the uMkhanyakhude District Municipality, in the Maputaland area of the KwaZulu-Natal province. The site is located between two nature reserves: On the eastern side, the site is adjacent to the iSimangaliso Wetland Park World Heritage Site and falls within the Park's Buffer Zone. The Buffer Zone is a UNESCO and World Heritage Convention Act requirement to protect the Outstanding Universal Values of the Park from external threats. The process for delineating this is currently underway and will be gazetted in due course; however the proximity of the development site to the Park means that it will fall within the Park buffer. As such, Environmental Authorisation is required for any activities under Listing Notice 3 of the EIA regulations (Dec 2014) within 10 km of the Park boundary. On the western side of the site is the Phinda game reserve.

The proposed development will include:

- Donor House with associated Decking, Terraces, Landscaping and Walkways
- Manager's House
- Reserve Office and FreeMe Complex
- Tented Camp
- Various internal access roads (x3) / tracks for reserve management / game viewing (Gravel Roads Proposed)

The development footprint is small in relation to the total area.



Figure 1: Location map of proposed Ukuwela Project area (green boundary).



Figure 2: Zoomed in view of Ukuwela Project area.

2. GEOLOGY

This area is underlain by Cretaceous strata and red sand of the Umkwelane Formation (previously known as Berea Red Sand). The latter is Middle Miocene (~ 14 Ma) in age (Botha and Porat, 2018). The Cretaceous strata (approx. 65 – 140 Ma) comprise the Makatini, Mzinene and St Lucia Formations (Fig. 2; Table 1) of the Zululand Group.

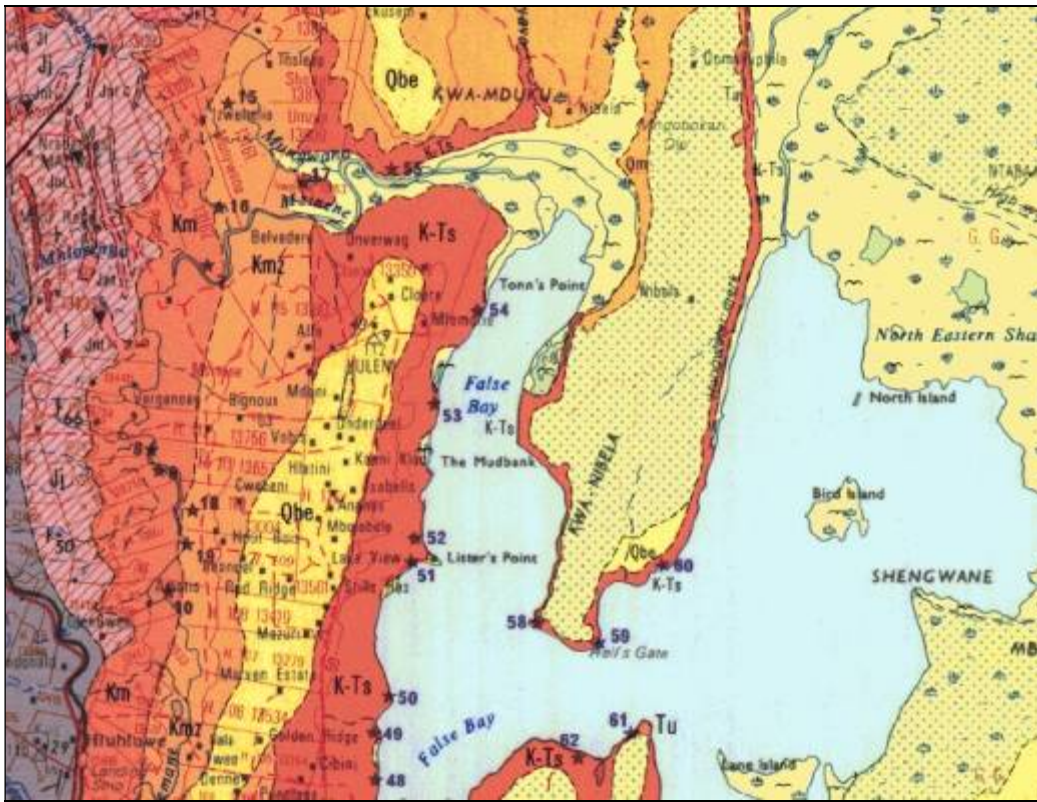


Figure 3: Extract from the St Lucia 2732 1: 250 000 scale Geological Map showing the area of interest. Makatini: Km, Mzinene: Kmz, St Lucia: K-Ts and alluvium (light yellow).

Table 1: The Geology of the Project Site (see Figure 2 for codes).

Code	Rock Description	Formation
Km	Conglomeratic sandstone, siltstone	Makatini Formation

Kmz	Marine glauconitic siltstone with shelly and concretionary horizons	Mzinene Formation
K-Ts	Siltstone and Sandstone	St Lucia Formation
Qbe	Berea Red Sand	Umkwelane Formation
Alluvium	Water-derived deposits (may be present on surface or at depth)	

The Cretaceous Rocks (Figure 3; Table 1) were deposited during the rifting of the Gondwana Supercontinent. At this time the Indian Ocean was opening up, when the continent of Africa was starting to take on its present shape. In this area, Gondwana fragmentation took place in two phases. Continental break-up was initiated during the Jurassic and continued into the Early Cretaceous. Watkeys (2006) believes that Gondwana rifting commenced between 155 and 135 Ma. The break-up of Gondwana may have been initiated in the Jurassic (~183 Ma), coincident with the outpouring of the Karoo Continental Flood Basalts (Hanson et al., 2009). However, actual seafloor spreading only began at ~130 Ma (Veevers, 2012). Along the eastern Cape and southern KwaZulu-Natal coast (Figure 1) the Falklands Islands had separated from southern Africa by ~125 Ma (Watkeys, 2006),

4. PALAEOLOGY

This location is within what will become the Buffer Zone for the iSimangaliso World Heritage Site. Fossil Cephalopods, including ammonites, nautiloids (Figure 4) and belemnites, and fossil (petrified) wood (Figure 5) have been found within the underlying rocks, which are well known for their fossil content (Table 2). The adjacent lake margin outcrop is known to be fossiliferous, as is the Nibela Peninsula. At Lister's Point (nearby) a very rare fossil marine carbonate reef is

present (Cooper et al, 2013). This lithology has not been reported from the project area, but attention should be paid to this possibility.



Figure 4: Example of ammonites and nautiloids found within the St Lucia Formation (K-Ts)



Figure 5: Example of what fossil (petrified) wood looks like.

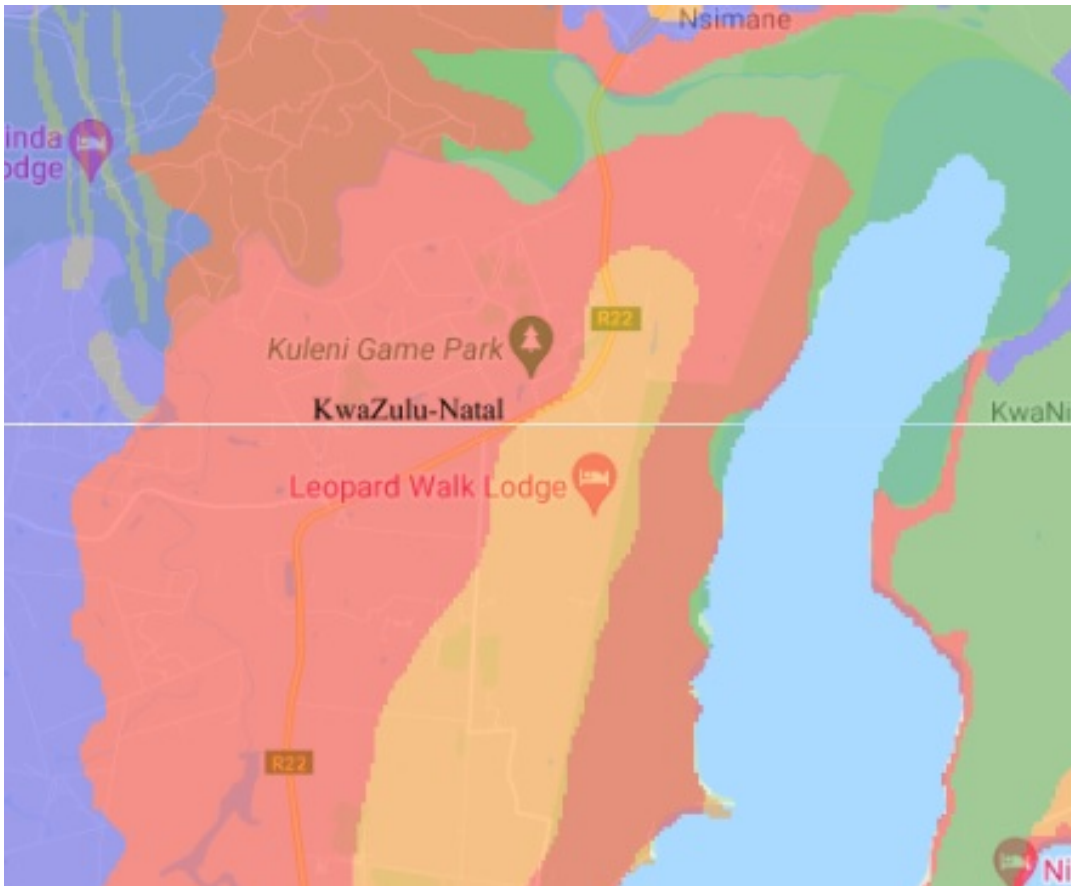


Figure 6: Palaeosensitivity map. Red (Km, Kmz, K-Ts) is very highly sensitive. The yellow shaded area corresponds to Qbe (red sands) and, although designated as highly sensitive, is unlikely to contain fossils (Table 2). The areas shaded green correspond to alluvial deposits at the surface, unlikely to contain fossils.

Table 2: Palaeontology of the lithologies that may be encountered (after Groenewald, 2012).

Map Code	Formation	Fossils Likely to be Encountered
Km	Makatini	Fossil wood (extensively bored by Teredo worm), plant fragments, marine invertebrates
Kmz	Mzinene	Ammonites, nautiloids, gastropods, echinoids, fossil logs (bored by Teredo worm) and arthropod burrows.
K-Ts	St Lucia	Ammonite, nautiloid, echinoid, bivalve, gastropod and reptile bone fossils
Qbe	Umkwelane	Very unlikely
Alluvium	Berea Red Sand	Very unlikely

The bulk of the area is classified red (highly sensitive) by the Sahrís Palaeosensitivity map (Figure 6). The possibility of finding Significant Palaeontological Material is very high (Table 2). It is a recommendation of this report that a suitably qualified palaeontologist visits this site to assess for the presence of fossils in the proposed development area.

5. CHANCE FIND PROTOCOL

This protocol is based on that of Groenevald (2017). This Protocol will ONLY kick-in if palaeontological material is found.

In the case of any unusual structures, the Palaeontologist must be notified immediately by the ECO and/or EAP, and a site visit must be arranged at the earliest possible time with the Palaeontologist.

In the case of the ECO or the Site Manager becoming aware of suspicious looking palaeo-material

- The construction must be halted in that specific area and the Palaeontologist must be given enough time to reach the site and remove the material before excavation continues.

- Mitigation will involve the attempt to capture all rare fossils and systematic collection of all fossils discovered. This will take place in conjunction with descriptive, diagrammatic and photographic recording of exposures, also involving sediment samples and samples of both representative and unusual sedimentary or biogenic features. The fossils and contextual samples will be processed (sorted, sub-sampled, labeled, and boxed) and documentation consolidated, to create an archive collection from the excavated sites for future researchers.

Functional responsibilities of the Developer

1. At full cost to the project, and guided by the appointed Palaeontological Specialist, ensure that a representative archive of palaeontological samples and other records is assembled to characterize the palaeontological occurrences affected by the excavation operation.

2. Provide field aid, if necessary, in the supply of materials, labour and machinery to excavate, load and transport sampled material from the excavation areas to the sorting areas, removal of overburden if necessary, and the return of discarded material to the disposal areas.

3. Facilitate systematic recording of the stratigraphic and palaeo-environmental features in exposures in the fossil-bearing excavations, by described and measured geological sections, and by providing aid in the surveying of positions where significant fossils are found.

4. Provide safe storage for fossil material found routinely during excavation operations by construction personnel. In this context, isolated fossil finds in disturbed material qualify as “normal” fossil finds.

5. Provide covered, dry storage for samples and facilities for a work area for sorting, labeling and boxing/bagging samples.

6. Costs of basic curation and storage in the sample archive at the Museum in Durban (labels, boxes, shelving and, if necessary, specifically-tasked temporary employees) as specified by or agreed with AMAFA. Documentary record of palaeontological occurrences

7. The contractor will in collaboration with the Palaeontologist, make the excavation plan available to the appointed specialist, in which appropriate information regarding plans for excavations and work schedules must be indicated on the plan of the excavation sites. This must be done in conjunction with the appointed specialist:

8. Initially, all known specific palaeontological information will be indicated on the plan. This will be updated throughout the excavation period

9. Locations of samples and measured sections are to be pegged, and routinely accurately surveyed. Sample locations, measured sections, etc., must be recorded three-dimensionally if any “significant fossils” are recorded during the time of excavation. Functional responsibilities of the appointed palaeontologist

10. Establishment of a representative collection of fossils and a contextual archive of appropriately documented and sampled palaeoenvironmental and sedimentological geodata at the Museum in Durban.

11. Undertake an initial evaluation of potentially affected areas and of available exposures in excavations.

12. On the basis of the above, and evaluation during the early stages of excavation development, in collaboration with the contractor management team, more detailed practical strategies to deal with the fossils encountered routinely during excavation, as well as the strategies for major finds.

13. Informal on-site training in responses applicable to “normal” fossil finds must be provided for the ECO and environmental staff by the appointed specialist.

14. Transport of material from the site to the Museum in Durban.

15. Reporting on the significance of discoveries, as far as can be preliminarily ascertained. This report is in the public domain and copies of the report must be deposited at ESI, AMAFA, and the South African Heritage Resources Authority (SAHRA). It must fulfill the reporting standards and data requirements of these bodies.

16. Reasonable participation in publicity and public involvement associated with palaeontological discoveries. In the event of construction exposing new

palaeontological material, not regarded as normative/routine as outlined in the initial investigation, such as a major fossil plant find, the following procedure must be adhered to:

17. The appointed specialist or alternates (AMAFSA, SAHRA; University) must be notified by the responsible officer (e.g. the ECO or contractor manager), of major or unusual discoveries during excavation, found by the Contractor Staff.

18. Should a major in situ occurrence be exposed, excavation will immediately cease in that area so that the discovery is not disturbed or altered in any way until the appointed specialist or scientists from the ESI at WITS University, or its designated representatives at AMAFA, have had reasonable opportunity to investigate the find. Such work will be at the expense of the Developer.

6. CONCLUSIONS & RECOMMENDATIONS

Based on the rock formations present in the proposed development area, the possibility of finding fossils is high, thus a field assessment is recommended to examine the resource in relation to the development area. A “Chance Find” Protocol has been included in this report as the possibility of finding palaeontological material is high.

7. REFERENCES

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8. DETAILS OF SPECIALIST

Dr Alan Smith Pr. Sc. Nat., I.A.H.S.

Private Consultant: Alan Smith Consulting, 29 Brown's Grove, Sherwood, Durban, 4091

&

Honorary Research Fellow: Discipline of Geology, School of Agriculture, Earth and Environmental Sciences, University of KwaZulu-Natal, Durban.

Role: Specialist Palaeontological Report production

Expertise of the specialist:

- MSc in stromatolites (University of KwaZulu-Natal)
- PhD in Geology (University of KwaZulu-Natal).
- Expert in Vryheid Formation (Ecca Group) in northern KZN, this having been the subject of PhD.
- Scientific Research experience includes: Fluvial geomorphology, palaeoflood hydrology, Cretaceous deposits.
- Experience includes understanding Earth Surface Processes in both fluvial and coastal environments (modern & ancient).
- Alan has published in both national and international, peer-reviewed journals. He has published more than 50 journal articles with 360 citations (detailed CV available on request).
- Attended and presented scientific papers and posters at numerous international and local conferences (UK, Canada, South Africa) and is actively involved in research.

Selected recent palaeo-related work includes:

- Desktop PIA: Proposed middle income housing units on Portion 23 of Farm Lot H Weston 13026, Bruntville, Mpofana Local Municipality. Client: UMLANDO.
- Desktop PIA: Proposed ByPass Pipeline for Ulundi bulk water pipeline upgrade. Client: UMLANDO.
- Fieldwork PIA: Bhekuzulu Epangweni KZN water reticulation project, Cathkin Park. Client: Mike Webster, HSG Attorneys.
- Desktop PIA: Zuka valley, Ballito. Client: Mike Webster, HSG Attorneys.
- Mevamhlope proposed quarry palaeontology report. Client: Enviropro.
- Desktop PIA: Proposed Lovu Desalination site. Client: eThembeni Cultural Heritage.
- Desktop PIA: Tinley Manor phase 2 North & South banks: eThembeni Cultural Heritage
- Desktop PIA: Tongaat. Client: eThembeni Cultural Heritage.
- Palaeontological Assessment Reports (3) to Scatec Solar SA (Pty) Ltd on an Appraisal of Inferred Palaeontological Sensitivity for a Potential Photo Voltaic Park at (1) Farm Rooilyf near Groblershoop, N Cape; (2) Farm Riet Fountain No. Portions 1 and 6, 18km SE of De Aar, N Cape; and (3) Dreunberg, near Burgersdorp, Eastern Cape. Client: Sustainable Development Projects.