

**SURVEY OF THE PROPOSED TONGAAT
COASTLANDS HOTEL, TONGAAT, CASUARINAS,
KWAZULU-NATAL**

FOR TRIPLO4

DATE: 31 May 2016

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INTRODUCTION

Umlando was appointed by Triplo4 Sustainable Solutions to undertake an HIA of land marked for development. The property is located between “Boys Town” (The Genazzano Priory) and Westbrooke Beach. The property occurs on the end of Casuarina Rd adjacent to Beach Bums Restaurant and is commonly referred to as “The (Westbrooke) Ghost House”. Figures 1 – 3 show the location of the property. Figure 4 shows the views of the study area.

The property, and the house specifically, have become a landmark along the M4. According to various unverified internet sources, the property belonged to Mr. Gurusamy Veerasamy Naidu, in 1926 – 1928. The original house was a single story wooden house slightly away from the existing house. The existing house was apparently built in the 1950s or 1960s. The sources do quote the existing land owner, Mr GV Naidu’s grandson (<http://northcoastcourier.co.za/32615/westbrooks-haunted-house/>).

The house is noted as being the first in the area to have electricity and a telephone, and was originally lavish. The house is currently in ruins with the upper story walls breaking apart. The house was abandoned in 1994.

The proposed development will be to demolish the existing ruin and build a hotel.

FIG. 1 GENERAL LOCATION OF THE STUDY AREA

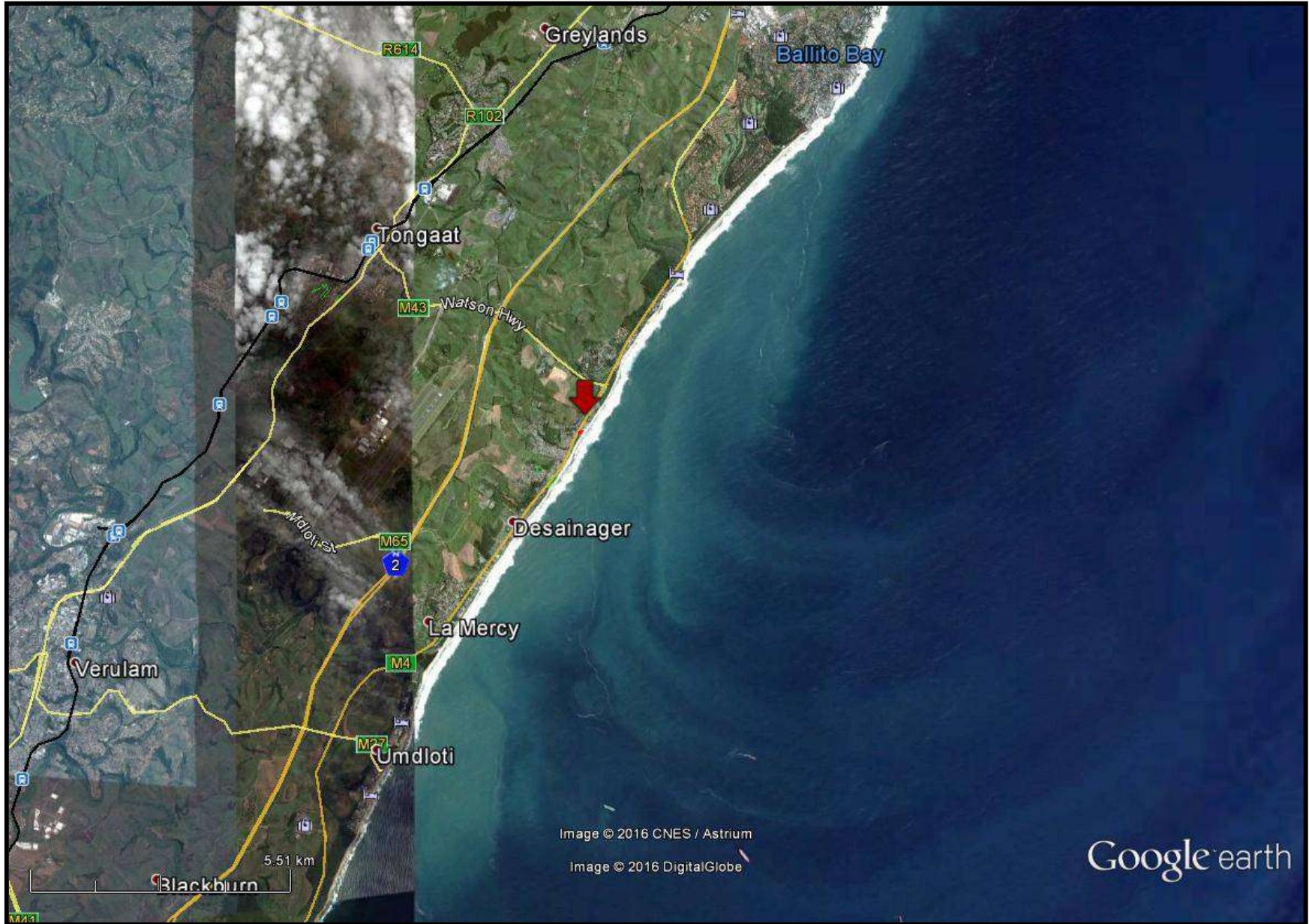


FIG. 2: AERIAL OVERVIEW OF THE STUDY AREA



FIG. 3: TOPOGRAPHICAL OVERVIEW OF THE STUDY AREA

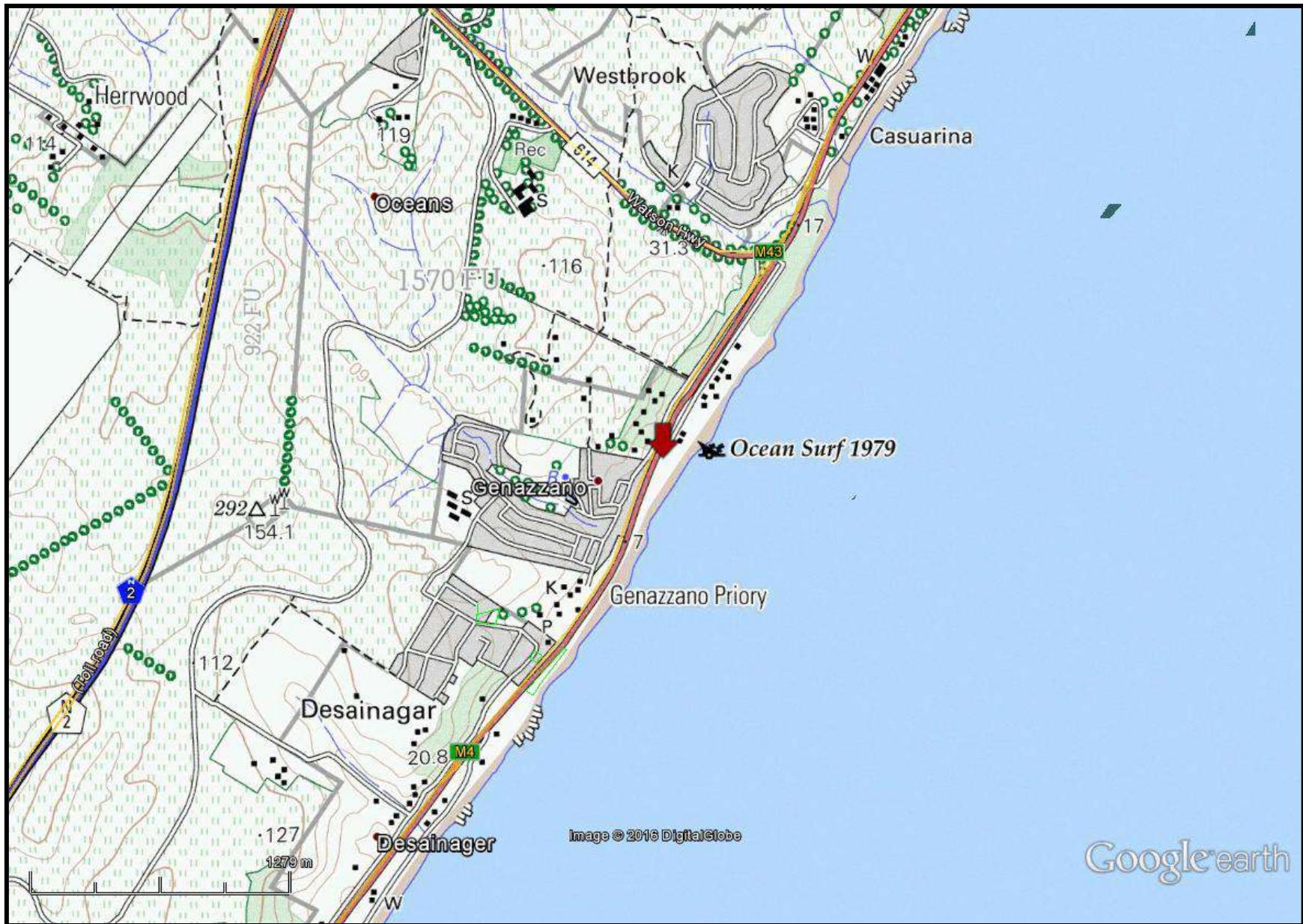


FIG. 4: SCENIC VIEWS OF THE STUDY AREA



KWAZULU-NATAL HERITAGE ACT NO. 4 OF 2008

“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." (KZN Heritage Act of 2008)

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. These 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.

The above significance ratings allow one to grade the site according to SAHRA's grading scale. This is summarised in Table 1.

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. The archaeological database indicates that there are many archaeological sites in the general area (fig. 5). Most of these sites are the result of systematic surveys. These sites include all types of Stone Age and Iron Age sites. No sites occur in the study area. There are six archaeological sites within 1km of the property in order of distance from the house):

- 2931CA 016 – Late Stone Age shell midden
- 2931CA 075 - Early Iron Age shell midden
- 2931CA 076 - Late Stone age shell midden
- 2931CA 14 – Early Iron Age
- 2931CA 153 -. Early? Iron Age

2931CA 153 was excavated in 1996 and yielded a well preserved midden (Anderson 1997).

A general rule of thumb for the coastal line is that any area within 1km of a beach rock outcrop will have a very high density of archaeological sites. The outcrops have shellfish that formed a large portion of past inhabitants diets. The shell middens alongside these outcrops can be food processing sites and/or living areas. Shell middens are important when recreating the past as the alkaline in the shell often counters the acidity in the soil, and thus organic remains tend to be very well preserved in these middens.

The land was originally surveyed in the 1880s (probably 1882-1883) and the property was on Sub 6 or Sub 24 Lot 44 1544. There is no indication as to the landowner. The land, and adjacent properties were later incorporated in the Township of Tongaat.

FIG. 5: LOCATION OF KNOWN HERITAGE SITES NEAR THE STUDY AREA

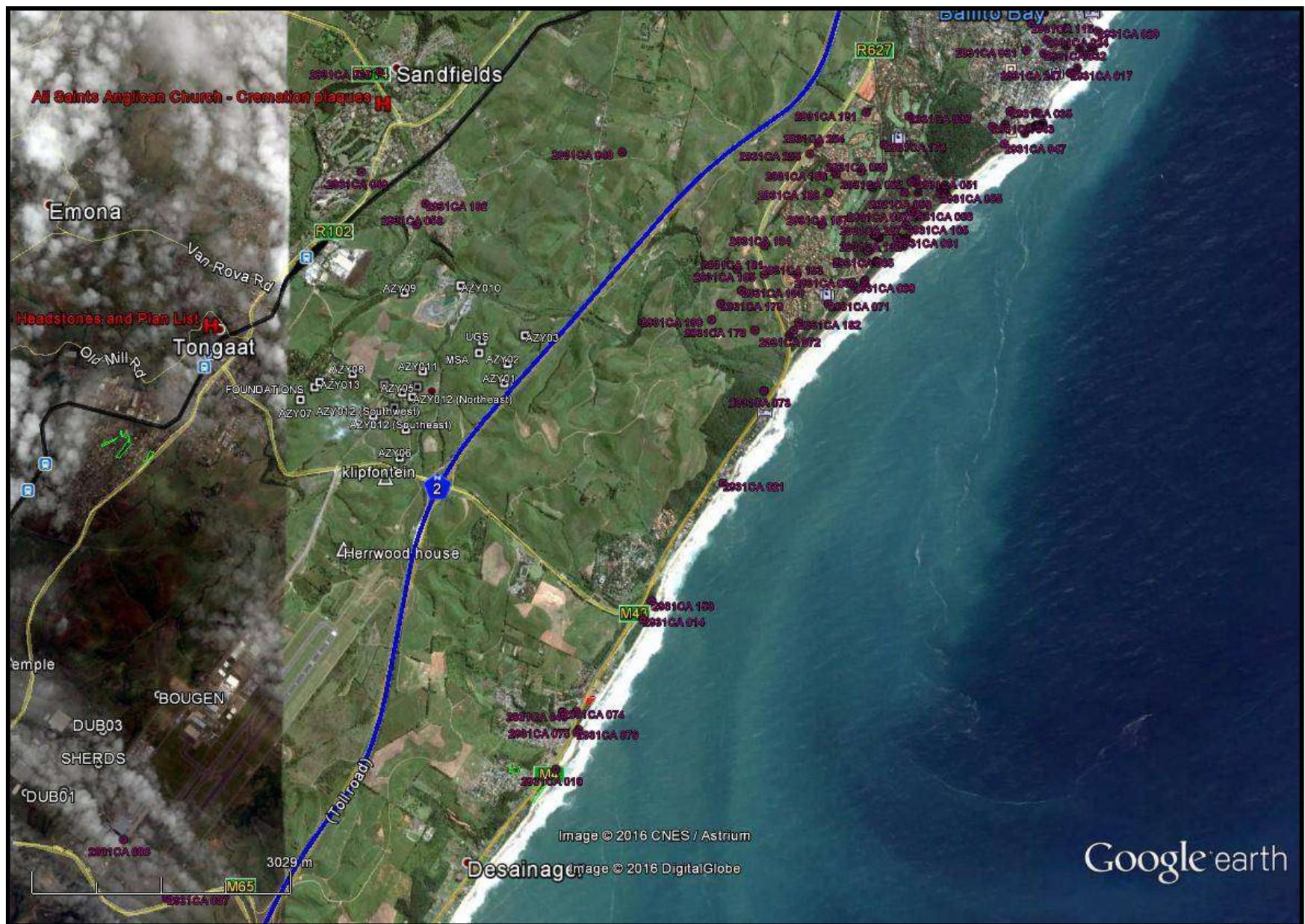


FIG. 6: ORIGINAL SURVEYOR GENERAL MAP (1880S)

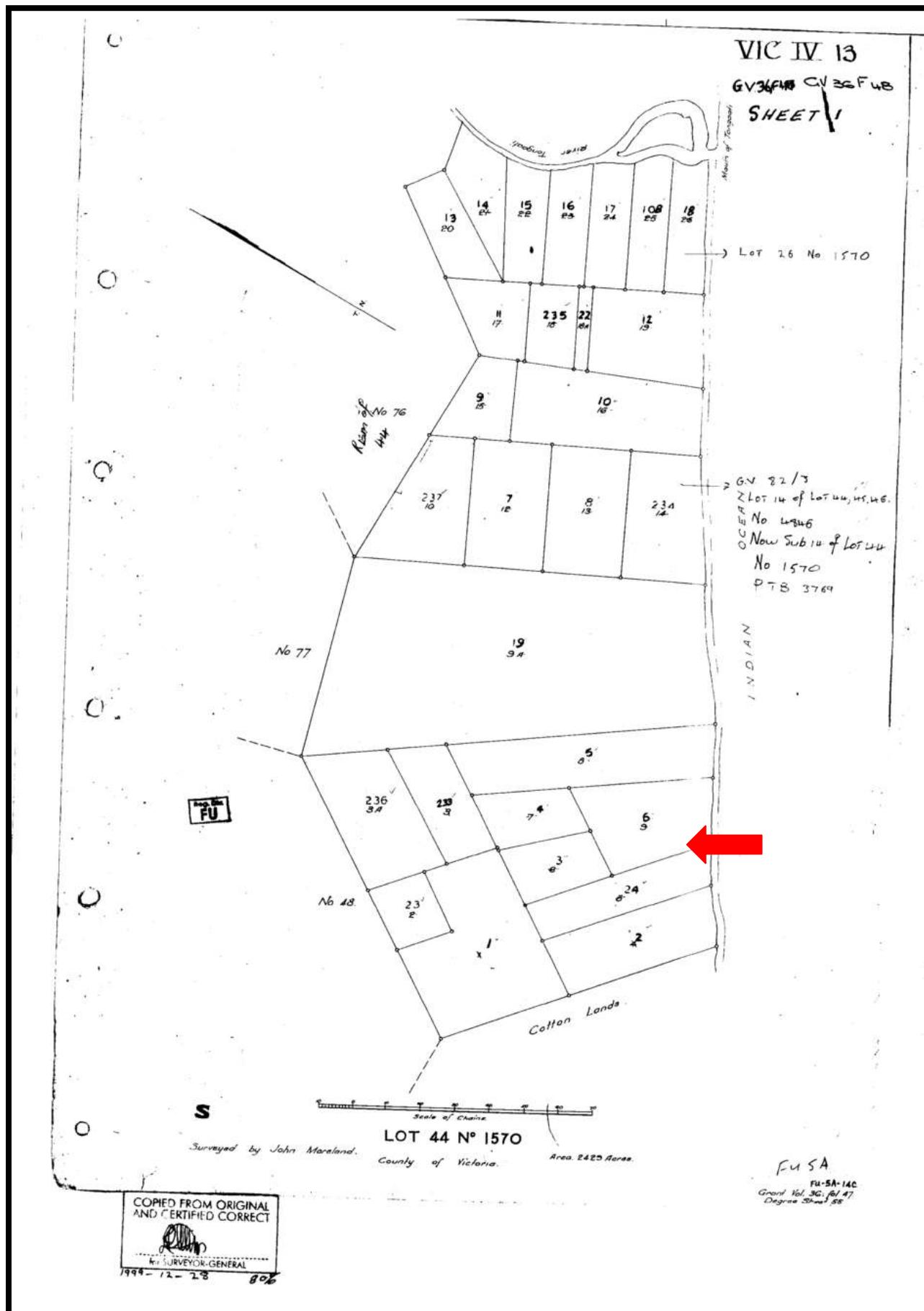


FIG. 7: STUDY AREA IN 1937

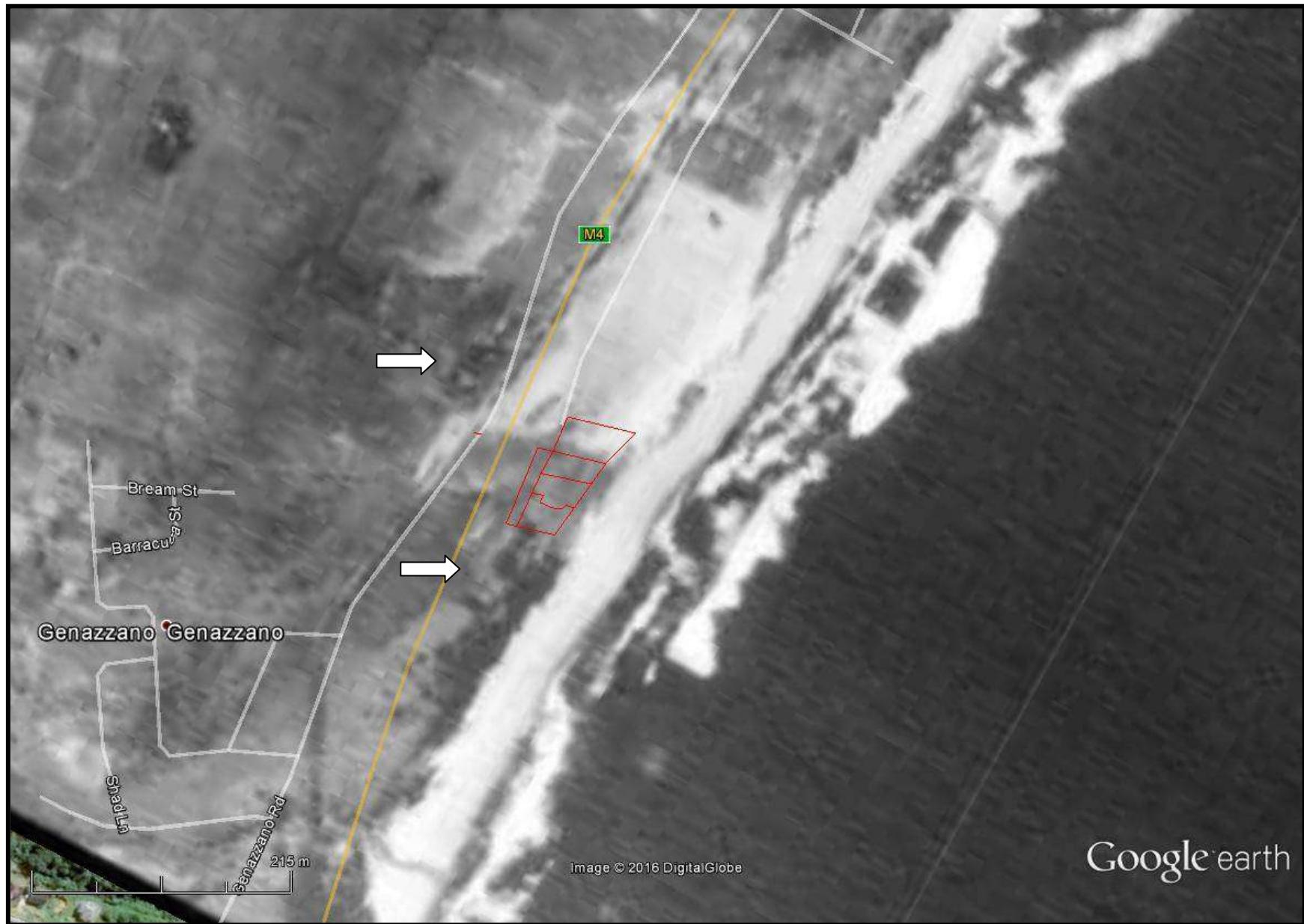
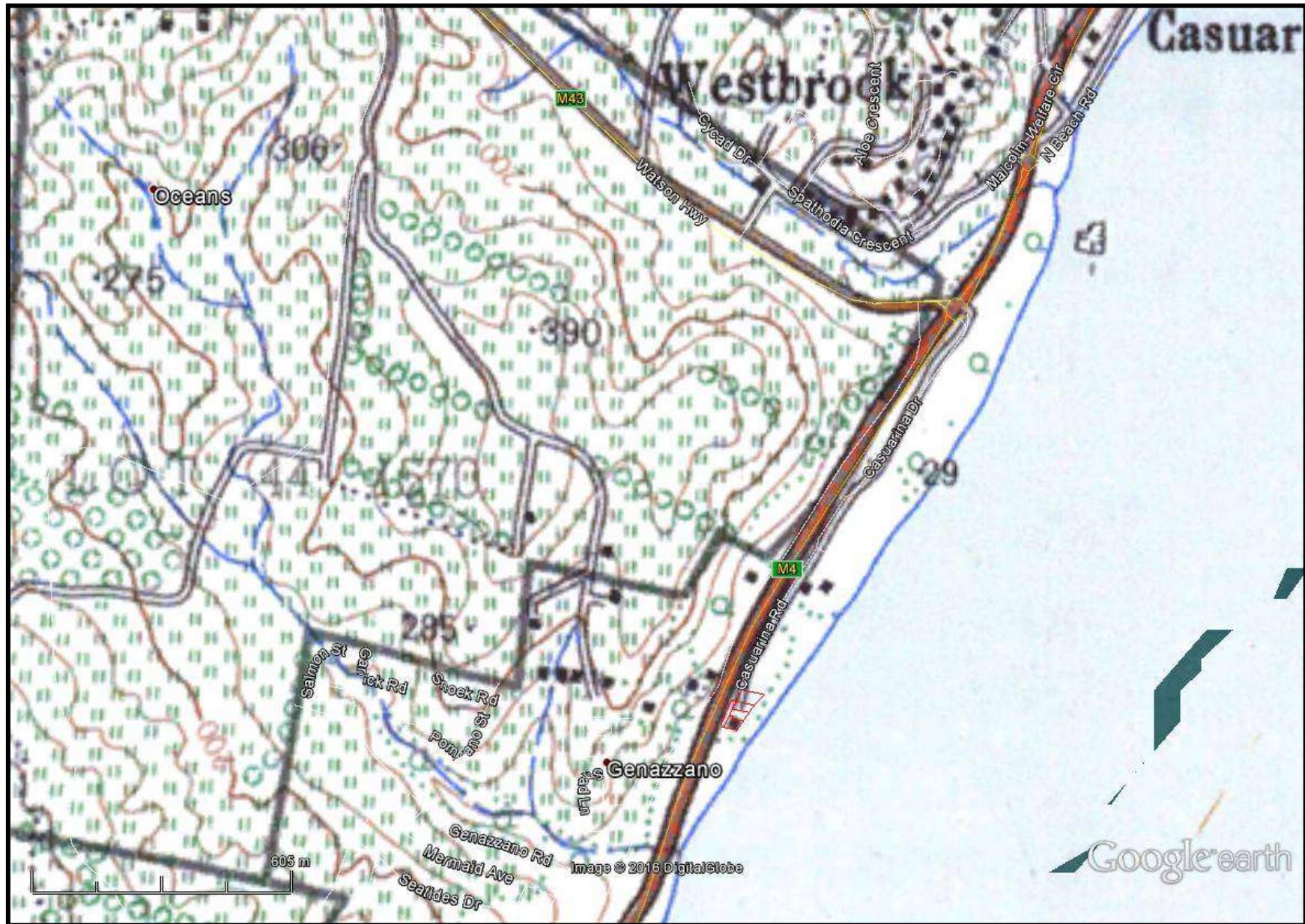


FIG. 8: STUDY AREA IN 1969



The 1937 aerial photographs indicate that the bricked house does not exist. There are two possible structures to the northwest and south of the existing house (fig. 7). Any of these could be the original wooden structure. The proposed development may affect the area of the southern structure(s).

The 1969 map clearly shows the existing house structures (fig. 8). This would collaborate the view that the house was built in the 1950s or 1960s. The house is thus just under or over 60 years in age and would thus be protected by the KZN Heritage Act. Documentation indicating the date the house was built will be required to prove it is younger than 60 years in age if the client does not want to apply for a permit to destroy the house.

FIELD SURVEY

The field survey was undertaken in May 2016. Archaeological visibility was very poor due to dense coastal bush and grass. Only the area around the house and along the beach could be surveyed, as well as the area at Beach Bums Restaurant.

Five individual shell middens had been exposed by the high water mark on the sea side of the dunes (fig. 9). They are 2m – 3m below the current dune surface and are on the same level, with the exception of GH05. Table 2 has their locations.

GH01 – GH04

These four shell middens occur within 70m of each other, and are 20m to 25m apart. GH01 is the best preserved midden that has a stratified deposit, an ash feature and a lot of charcoal. GH02 to GH04 are less well preserved but appear to be the edge of the midden, with the rest still underneath the dune. The middens are ~1.5m wide.

The middens consists of brown mussels, oysters and limpets, with a range of smaller shell species. No faunal remains, pottery sherds, nor stone tools were noted at these middens. However the lack of pottery sherds suggest that the middens date to the Late Stone Age, probably between 2000 and 4000 years ago. These middens will extend inland for several meters, and if there are living areas, then for at least 20-40m further inland. Brown mussel fragments were noted on the surface behind the first dune cordon; however these could also be recent fragments. The good charcoal sample is important as these tend to be rare for coastal sites.

Fig. 10 shows three of these middens.

Only GH01 could be affected by the proposed development.

Significance: The middens are of medium significance as few Stone Age middens have been excavated along the eastern seaboard. These middens could also include faunal remains as well as human remains.. GH01 has a stratified deposit with an ash feature.

Mitigation: Any part of the site might need excavation if affected by the development.

SAHRA rating: GH01 = 3A, while the others are currently rated as 3B.

GH05

G05 has been destroyed by ground levelling activity at some stage in the past (FIG. 11). Despite this, the shell midden occurs over a 50m radius and is thus indicative of the size these middens and/or living areas. GH05 differs from the other four middens in that it contains Mzonjani pottery. This pottery dates from 1 700 – 1 500 years ago and is part of the first Early Iron Age farmers along the eastern seaboard. It appears to be a least 1m higher than GH01 – GH04.

FIG. 9: LOCATION OF RECORDED SHELL MIDDENS



FIG. 10: SHELL MIDDENS AT GH01 (top left) , GH02 (top right) , and GH03 (bottom)



Fig. 11: POTTERY AND LOCATION OF SHELL AT GH05



Significance: The site is too damaged for any salvage excavations, and is thus of low significance.

Mitigation: No excavations are required, however it should be monitored for possible human remains at the beginning of construction.

SAHRA Rating: 3C

THE NAIDU HOUSE(S)

The desktop study noted that there were two possible houses for the original Naidu house. It is highly unlikely that this house still remains as the wooden structures would have decayed. However, any middens associated with the house would be of historical interest. Fig. 12 shows the original house and the location indicates that it was originally in the area of the existing informal settlement.

The one area that could have the remains of the original house, as per 1937 aerial photograph, was not accessible due to dense vegetation (fig. 13). This will need to be reassessed after vegetation clearance.

The existing house/ruin was built in the late 1950s or early 1960s. This will place it on the border of being 60 years old. The developer will need to prove the age of the house. If the house is older than 60 years in age then it will require a permit for its destruction.

The existing house/ruin is a landmark on the eastern seaboard; however, according to the landowner the house was abandoned shortly after 1994. This is not time for it to be established as a cultural landmark. Moreover, the building is currently a ruin and will be a safety hazard shortly. There is no justification to keep the existing house on any heritage terms.

Significance: The house is of low significance

Mitigation: No mitigation is required. A permit might be required depending on the age of the house.

SAHRA Rating: 3C

FIG. 12: ORIGINAL HOUSE



FIG. 13: LOCATION OF POSSIBLE STRUCTURE



TABLE 2: LOCATION OF RECORDED SITES

name	latitude	longitude	name	Description
GH01	-29.606493000	31.161774000	GH01	Shell midden
GH02	-29.606743000	31.161601000	GH02	Shell midden
GH03	-29.606909000	31.161467000	GH03	Shell midden
GH04	-29.607078000	31.161369000	GH04	Shell midden
GH05	-29.605609297	31.162215984	GH05	Shell midden
house?	-29.606294578	31.161276534	house?	Posibe house

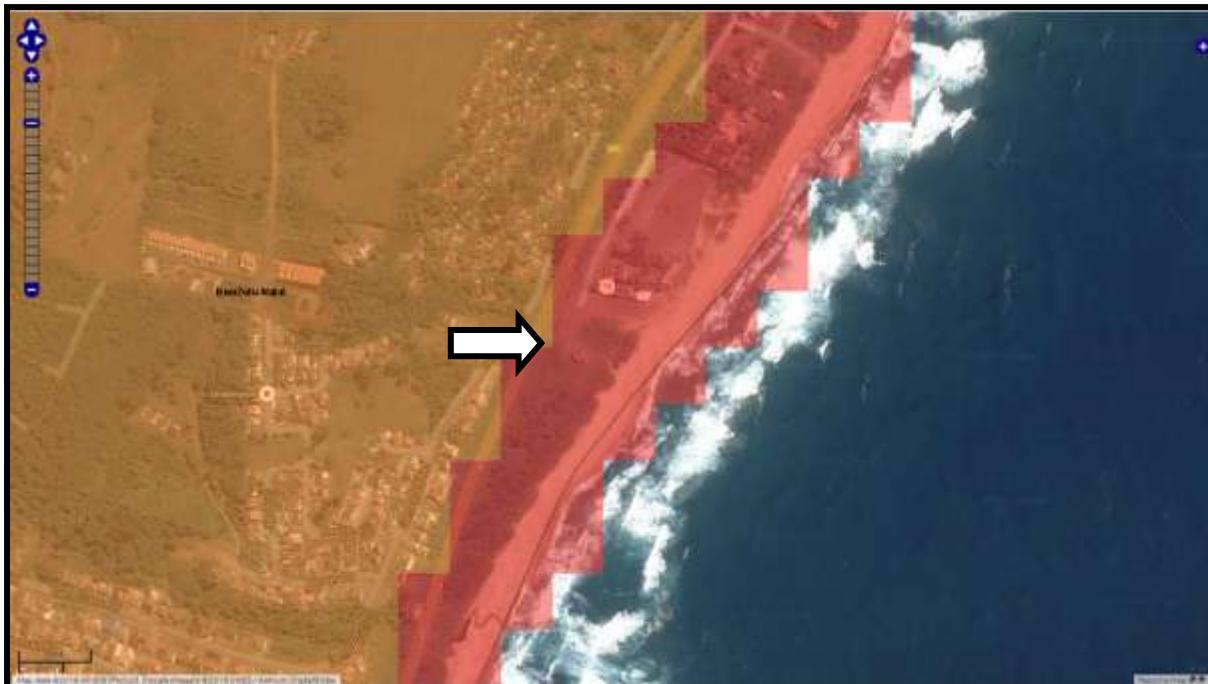
PALAEONTOLOGICAL IMPACT ASSESSMENT

The study area falls into an area of very high palaeontological significance (fig. 14). The study area is underlain by sedimentary rocks of the Permian-aged Vryheid Formation of the Ecca Group, where fossils are associated with the sandstone as well as bedding planes of shales exposed during excavation of trenches or foundations deeper than 1,5m. A Very High Palaeontological Sensitivity is allocated to these rocks. Very rich assemblage of plant fossils, coal beds and significant trace fossils have been described from the Vryheid Formation. Interpretation of the Google images indicates that the study area is mostly underlain by deeply weathered soil. A phase 1 PIA is therefore recommended during excavations of infrastructure deeper than 1,5m during the initial phases of the construction.

The PIA desktop occurs in Appendix A.

Mitigation: A suitably qualified palaeontologist will need to be site during the construction phase if the foundations and/or earthmoving equipment goes deeper then 1.5m

SANRA Rating: 3A

FIG. 14: PALAEONTOLOGICAL 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.

MANAGEMENT PLAN

The coastal dune vegetation was too dense to adequately assess the extent of the shell middens and the possible location of the original house. The area will need to be assessed after vegetation clearance for the development has occurred.

Currently no excavations of the middens are required. However this might change after vegetation clearance. If excavations do not occur then the area will require on site monitoring during the initial construction phases. This will be to observe any potential finds and/or *in situ* features that could occur below the surface. Selected archaeological excavations could occur during this phase.

The client will need to prove the age of the existing house, or apply for a permit to destroy the ruin as it might be over 60 years in age.

A qualified palaeontologist will be required to monitor all excavations that are more than 1.5m in depth.

CONCLUSION

An heritage survey was undertaken for the proposed Tongaat Coastlands hotel. The original house dates back to the 1920s, while the existing house dates to the 1950s/1960s. The house has become a landmark along the coastal road, however it is in ruin and has been stripped of all furnishings. The upper story walls are also in the process of collapsing.

Five late Stone Age shell middens were found on the ocean side of the first dune cordon and these probably extend further inland. GH01 will probably be affected by the development. An Early iron Age shell midden to the east of the existing building has been damaged, however it clearly shows the extent of the middens. GH05 might extend south into the proposed development.

The area will need to be resurveyed after vegetation clearance to assess the possible location of the original house. The development will require on site monitoring during construction by an archaeologist and palaeontologist. Archaeological excavations may occur during construction if *in tact* features are exposed.

APPENDIX A

PALAEONTOLOGICAL DESKTOP STUDY

**DESKTOP PALAEONTOLOGICAL
ASSESSMENT FOR THE PROPOSED
GHOST HOUSE HOTEL DEVELOPMENT,
ETHEKWINI METROPOLITAN
MUNICIPALITY, ETHEKWINI DISTRICT
MUNICIPALITY, KWAZULU-NATAL
PROVINCE.**

**FOR
Umlando**

DATE: 28 May 2016

By

**Gideon Groenewald
Cell: 078 713 6377**

EXECUTIVE SUMMARY

Gideon Groenewald was appointed to undertake a desktop survey, assessing the potential palaeontological impact of the proposed development of the Ghost House Hotel Development, ETHEKWINI METROPOLITAN MUNICIPALITY, ETHEKWINI DISTRICT MUNICIPALITY, KWAZULU-NATAL PROVINCE.

This Palaeontological Assessment forms part of the Heritage Impact Assessment (HIA) and complies with the requirements of the South African National Heritage Resource Act No 25 of 1999 as well as the KwaZulu-Natal Heritage Act No 4 of 2008. In accordance with Section 38 of the National Resources Act No 25 of 1999 (Heritage Resources Management), a HIA is required to assess any potential impacts to palaeontological heritage within the development footprint.

The study area is underlain by sedimentary rocks of the Permian-aged Vryheid Formation of the Ecca Group, where fossils are associated with the sandstone as well as bedding planes of shales exposed during excavation of trenches or foundations deeper than 1,5m. A Very High Palaeontological Sensitivity is allocated to these rocks. Very rich assemblage of plant fossils, coal beds and significant trace fossils have been described from the Vryheid Formation. Interpretation of the Google images indicates that the study area is mostly underlain by deeply weathered soil. A phase 1 PIA is therefore recommended during excavations of infrastructure deeper than 1,5m during the initial phases of the construction.

Recommendations:

1. The EAP and ECO of the projects must be informed of the fact that significant plant fossils have been described from the Vryheid Formation. Chance recording of fossils will contribute significantly to our understanding of the palaeo-environments of this region.
2. All sections of the development are allocated a Very High Palaeontological sensitivity and areas where trenching or excavation for infrastructure will be deeper than 1,5m, must be identified during geotechnical surveys. Where the trenches and excavations will reach this depth, a suitably qualified Palaeontologist must be appointed to record and collect the fossils according to SAHRA and AMAFA specifications as part of a Phase 1 Palaeontological Impact Assessment during the initial stages of excavation at each individually proposed development node on this property.

These recommendations must form part of the EMP for the project.

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INTRODUCTION

Gideon Groenewald was appointed to undertake a desktop survey, assessing the potential palaeontological impact of the proposed development of the Ghost House Hotel Development, ETHEKWINI METROPOLITAN MUNICIPALITY, ETHEKWINI DISTRICT MUNICIPALITY, KWAZULU-NATAL PROVINCE (Figure 1).



Figure 1 Locality of the proposed site

SOUTH AFRICAN NATIONAL HERITAGE RESOURCE ACT NO 25/1999 AND KWAZULU-NATAL HERITAGE ACT NO 4/2008

This Palaeontological Assessment forms part of the Heritage Impact Assessment (HIA) and complies with the requirements of the South African National Heritage Resource Act No 25 of 1999 as well as the KwaZulu-Natal Heritage Act No 4 of 2008. In accordance with Section 38 of the National Resources Act No 25 of 1999 (Heritage Resources Management), a HIA is required to assess any potential impacts to palaeontological heritage within the development footprint.

Categories of heritage resources recognised as part of the National Estate in Section 3 of the Heritage Resources Act, and which therefore fall under its protection, include:

- geological sites of scientific or cultural importance;
- objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens;
- objects with the potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage.

METHODOLOGY

Following the "SAHRA APM Guidelines: Minimum Standards for the Archaeological & Palaeontological Components of Impact Assessment Reports" the aims of the palaeontological impact assessment are:

- to identify exposed and subsurface rock formations that are considered to be palaeontologically significant;
- to assess the level of palaeontological significance of these formations;
- to comment on the impact of the development on these exposed and/or potential fossil resources and
- to make recommendations as to how the developer should conserve or mitigate damage to these resources.

In preparing a palaeontological desktop study the potential fossiliferous rock units (groups, formations etc) represented within the study area are determined from geological maps and Google Earth imagery. The known fossil heritage within each rock unit is inventoried from the published scientific literature, previous palaeontological impact studies in the same region and the author's field experience.

The likely impact of the proposed development on local fossil heritage is determined on the basis of the palaeontological sensitivity of the rock units concerned and the nature and scale of the development itself, most notably the extent of bedrock excavation envisaged. The different sensitivity classes used are explained in Table 1 below.

Table 1 Palaeontological sensitivity analysis outcome classification

PALAEONTOLOGICAL SIGNIFICANCE/VULNERABILITY OF ROCK UNITS	
The following colour scheme is proposed for the indication of palaeontological sensitivity classes. This classification of sensitivity is adapted from that of Almond et al (2008, 2009) (Groenewald et al., 2014).	
RED	Very High Palaeontological sensitivity/vulnerability. Development will most likely have a very significant impact on the Palaeontological Heritage of the region. Very high possibility that significant fossil assemblages will be present in all outcrops of the unit. Appointment of professional palaeontologist, desktop survey, phase I Palaeontological Impact Assessment (PIA) (field survey and recording of fossils) and phase II PIA (rescue of fossils during construction) as well as application for collection and destruction permit compulsory.
ORANGE	High Palaeontological sensitivity/vulnerability. High possibility that significant fossil assemblages will be present in most of the outcrop areas of the unit. Fossils most likely to occur in associated sediments or underlying units, for example in the areas underlain by Transvaal Supergroup dolomite where Cenozoic cave deposits are likely to occur. Appointment of professional palaeontologist, desktop survey and phase I Palaeontological Impact Assessment (field survey and collection of fossils) compulsory. Early application for collection permit recommended. Highly likely that a Phase II PIA will be applicable during the construction phase of projects.
GREEN	Moderate Palaeontological sensitivity/vulnerability. High possibility that fossils will be present in the outcrop areas of the unit or in associated sediments that underlie the unit. For example areas underlain by the Gordonia Formation or undifferentiated soils and alluvium. Fossils described in the literature are visible with the naked eye and development can have a significant impact on the Palaeontological Heritage of the area. Recording of fossils will contribute significantly to the present knowledge of the development of life in the geological record of the region. Appointment of a professional palaeontologist, desktop survey and phase I PIA (ground proofing of desktop survey) recommended.

BLUE	<p>Low Palaeontological sensitivity/vulnerability. Low possibility that fossils that are described in the literature will be visible to the naked eye or be recognized as fossils by untrained persons. Fossils for example small domal Stromatolites as well as micro-bacteria are associated with these rock units. Fossils of micro-bacteria are extremely important for our understanding of the development of Life, but are only visible under large magnification. Recording of the fossils will contribute significantly to the present knowledge and understanding of the development of Life in the region. Where geological units are allocated a blue colour of significance, and the geological unit is surrounded by highly significant geological units (red or orange coloured units), a palaeontologist must be appointed to do a desktop survey and to make professional recommendations on the impact of development on significant palaeontological finds that might occur in the unit that is allocated a blue colour. An example of this scenario will be where the scale of mapping on the 1:250 000 scale maps excludes small outcrops of highly significant sedimentary rock units occurring in larger alluvium deposits. Collection of a representative sample of potential fossiliferous material is recommended.</p>
GREY	<p>Very Low Palaeontological sensitivity/vulnerability. Very low possibility that significant fossils will be present in the bedrock of these geological units. The rock units are associated with intrusive igneous activities and no life would have been possible during implacement of the rocks. It is however essential to note that the geological units mapped out on the geological maps are invariably overlain by Cenozoic aged sediments that might contain significant fossil assemblages and archaeological material. Examples of significant finds occur in areas underlain by granite, just to the west of Hoedspruit in the Limpopo Province, where significant assemblages of fossils and clay-pot fragments are associated with large termite mounds. Where geological units are allocated a grey colour of significance, and the geological unit is surrounded by very high and highly significant geological units (red or orange coloured units), a palaeontologist must be appointed to do a desktop survey and to make professional recommendations on the impact of development on significant palaeontological finds that might occur in the unit that is allocated a grey colour. An example of this scenario will be where the scale of mapping on the 1:250 000 scale maps excludes small outcrops of highly significant sedimentary rock units occurring in dolerite sill outcrops. It is important that the report should also refer to archaeological reports and possible descriptions of palaeontological finds in Cenozoic aged surface deposits.</p>

When rock units of moderate to high palaeontological sensitivity are present within the development footprint, a field-based assessment by a professional palaeontologist is usually warranted.

The key assumption for this desktop study is that the existing geological maps and datasets used to assess site sensitivity are correct and reliable. However, the geological maps used were not intended for fine scale planning work and are largely based on aerial photographs alone, without ground-truthing.

These factors may have a major influence on the assessment of the fossil heritage significance of a given development and, without supporting field assessments, may lead to either:

- an underestimation of the palaeontological significance of a given study area due to ignorance of significant recorded or unrecorded fossils preserved there, or
- an overestimation of the palaeontological sensitivity of a study area, for example when originally rich fossil assemblages inferred from geological maps have in fact been destroyed by weathering, or are buried beneath a thick mantle of unfossiliferous “drift” (soil, alluvium etc).

GEOLOGY

The study area is underlain by Permian-aged rocks of the Vryheid Formation of the Ecca Group, Karoo Supergroup (Figure 2).

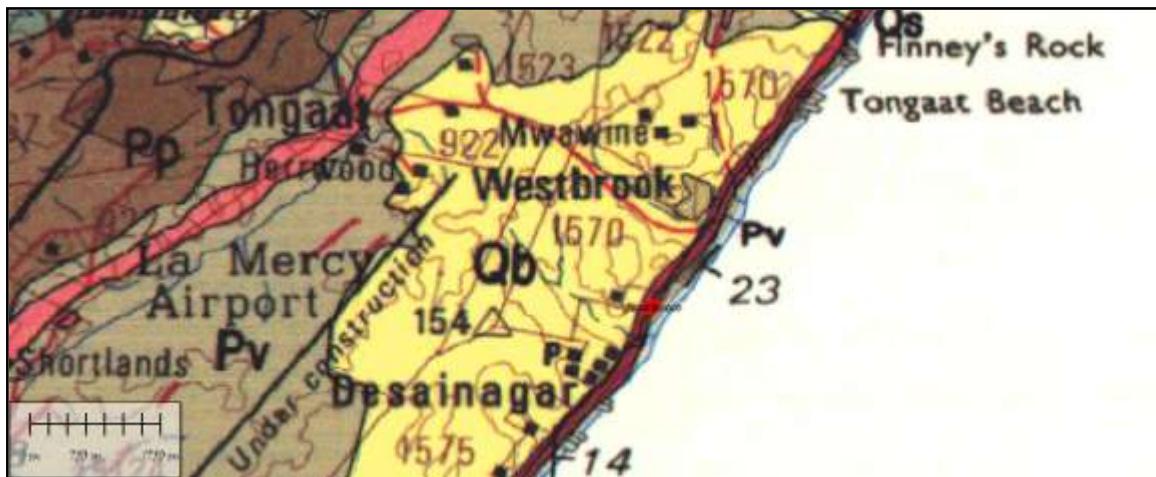


Figure 2 Geology of the study area (red dot). The entire site is underlain by sedimentary rocks of the Vryheid Formation

Ecca Group

Vryheid Formation (Pv)

The Permian aged Vryheid Formation is a thick sequence of sedimentary rocks dominated by light grey sandstones with interbedded grey shale and thick, economically important coal seams. These sandstones were deposited along ancient sandy shorelines behind which lay vast swamplands. Burial of vegetation in the swamps eventually formed coal which is mined at various localities in the outcrop areas of the formation in South Africa (Johnson et al, 2009).

PALAEONTOLOGY

Ecca Group

Vryheid Formation (Pv)

The Vryheid Formation is well-known for the occurrence of coal beds that resulted from the accumulation of plant material over long periods of time. Plant fossils described by Bamford (2011) from the Vryheid Formation are; *Azaniodendron fertile*, *Cyclodendron leslii*, *Sphenophyllum hammanskraalensis*, *Annularia* sp., *Raniganja* sp., *Astrotheca* spp., *Liknopetalon enigmata*, *Glossopteris* > 20 species, *Hirsutum* 4 spp., *Scutum* 4 spp., *Ottokaria* 3 spp., *Estcourtia* sp., *Arberia* 4 spp., *Lidgemonia* sp., *Noeggerathiopsis* sp. and *Podocarpidites* sp.

According to Bamford (2011) "Little data have been published on these potentially fossiliferous deposits. Around the coal mines there is most likely to be good material and yet in other areas the exposures may be too poor to be of interest. When they do occur fossil plants are usually abundant and it would not be feasible to preserve and maintain all the sites, however, in the interests of heritage and science such sites should be well recorded, sampled and the fossils kept in a suitable institution."

Although no vertebrate fossils have been recorded from the Vryheid Formation, invertebrate trace fossils have been described in some detail by Mason and Christie (1985). It should be noted, however, that the aquatic reptile, *Mesosaurus*, which is the earliest known reptile from the Karoo Basin, as well as fish (*Palaeoniscus capensis*), have been recorded in equivalent-aged strata in the Whitehill Formation in the southern part of the basin (MacRae, 1999;

Modesto, 2006). Indications are that the Whitehill Formation in the main basin might be correlated with the mid-Vryheid Formation. If this assumption proves correct, there is a possibility that Mesosaurus could be found in the Vryheid Formation.

The late Carboniferous to early Jurassic Karoo Supergroup of South Africa includes economically important coal deposits within the Vryheid Formation of Natal. The Karoo sediments are almost entirely lacking in body fossils but ichnofossils (trace fossils) are locally abundant. Modern sedimentological and ichnofaunal studies suggest that the north-eastern part of the Karoo basin was marine. In KwaZulu-Natal a shallow basin margin accommodated a prograding fluviodeltaic complex forming a broad sandy platform on which coal-bearing sediments were deposited. Ichnofossils include U-burrows (formerly *Corophioides*) which are assigned to ichnogenus *Diplocraterion* (Mason and Christie, 1985).

DISCUSSION

The predicted palaeontological impact of the development is based on the initial mapping assessment and literature reviews. Significant fossils have been recorded from the Vryheid Formation and the recording of plant and trace fossils from this part of the Karoo Basin will contribute significantly to our understanding of the palaeo-environments that existed during the Permian times in this part of KwaZulu-Natal.

MANAGEMENT PLAN

The likely impact of the proposed development on local fossil heritage is determined on the basis of the palaeontological sensitivity of the rock units concerned and the nature and scale of the development itself, most notably the extent of unweathered bedrock excavation envisaged. The different sensitivity classes used are explained in Table 1.

The palaeontological sensitivity of the development is related to the specific geology that underlies the development footprints. For the sake of this desktop survey it is assumed that there are no significant outcrops on site, but that trenching of more than 1.5m depth will expose bedrock of the Vryheid Formation during excavation for foundations and infrastructure. Due to the fact that the recording of fossils will have a significant impact on our understanding of the palaeo-environments in this part of the basin, a Very High Palaeontological sensitivity is allocated to the entire study area.

The palaeontological sensitivity of the study area is shown in Figure 3.



Figure 3 Palaeosensitivity of the proposed development sites. Colour coding is explained in Table 1

CONCLUSION AND RECOMMENDATIONS

The study area is underlain by sedimentary rocks of the Permian-aged Vryheid Formation of the Ecca Group, where fossils are associated with the sandstone as well as bedding planes of shales exposed during excavation of trenches or foundations deeper than 1,5m. A Very High Palaeontological Sensitivity is allocated to these rocks. Very rich assemblage of plant fossils, coal beds and significant trace fossils have been described from the Vryheid Formation. Interpretation of the Google images indicates that the study area is mostly underlain by deeply weathered soil. A phase 1 PIA is therefore recommended during excavations of infrastructure deeper than 1,5m during the initial phases of the construction.

Recommendations:

3. The EAP and ECO of the projects must be informed of the fact that significant plant fossils have been described from the Vryheid Formation. Chance recording of fossils will contribute significantly to our understanding of the palaeo-environments of this region.
4. All sections of the development are allocated a Very High Palaeontological sensitivity and areas where trenching or excavation for infrastructure will be deeper than 1,5m, must be identified during geotechnical surveys. Where the trenches and excavations will reach this depth, a suitably qualified Palaeontologist must be appointed to record and collect the fossils according to SAHRA and AMAFA specifications as part of a Phase 1 Palaeontological Impact Assessment during the initial stages of excavation at each individually proposed development node on this property.
5. These recommendations must form part of the EMP for the project.

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QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

Dr Gideon Groenewald has a PhD in Geology from the University of Port Elizabeth (Nelson Mandela Metropolitan University) (1996) and the National Diploma in Nature Conservation from Technicon RSA (the University of South Africa) (1989). He specialises in research on South African Permian and Triassic sedimentology and macrofossils with an interest in biostratigraphy, and palaeo-ecological aspects. He has extensive experience in the locating of fossil material in the Karoo Supergroup and has more than 20 years of experience in locating, collecting and curating fossils, including exploration field trips in search of new localities in the southern, western, eastern and north-eastern parts of the country. His publication record includes multiple articles in internationally recognized journals. Dr Groenewald is accredited by the Palaeontological Society of Southern Africa (society member for 25 years).

DECLARATION OF INDEPENDENCE

I, Gideon Groenewald, 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 palaeontological heritage assessment services. There are no circumstances that compromise the objectivity of my performing such work.



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