

**HERITAGE SURVEY OF THE PROPOSED
ETHEMBENI LOW COST HOUSING PROJECT,
PIETERMARITZBURG, KWAZULU-NATAL**

FOR K2M ENVIRONMENTAL

DATE: 28 AUGUST 2017

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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 Msunduzi Municipality has, through its IDP process, and extensive consultation with respective communities residing within the Msunduzi Municipality, identified the need to provide an integrated mix of housing units within its area of jurisdiction. This process was initiated as a means to address the municipality’s housing need due to urbanization and the growth of the population.

The proposed eThembeni Integrated Mixed Use Housing Development aims to address the housing need by constructing Detached Low Cost Housing, Education facilities, GAP Housing, Government Employee Units, Medium Density Housing, Medium Density Housing Parking, Medium Density Subsidized Housing, Military Veteran Units, Mixed Use Commercial, Mixed Use Residential, Petrol Filling Station, Social Housing and places of Worship. The total extend of the project area is approximately 147.76Ha and is situated on a portion of Ward 37 of the Msunduzi Municipality “(K2M Environmental 2017)

Umlando was appointed by K2M Environmental to undertake the heritage survey of the proposed eThembeni mixed use development project. The location of the site is shown in figures 1 – 4.

FIG. 1 GENERAL LOCATION OF THE STUDY AREA

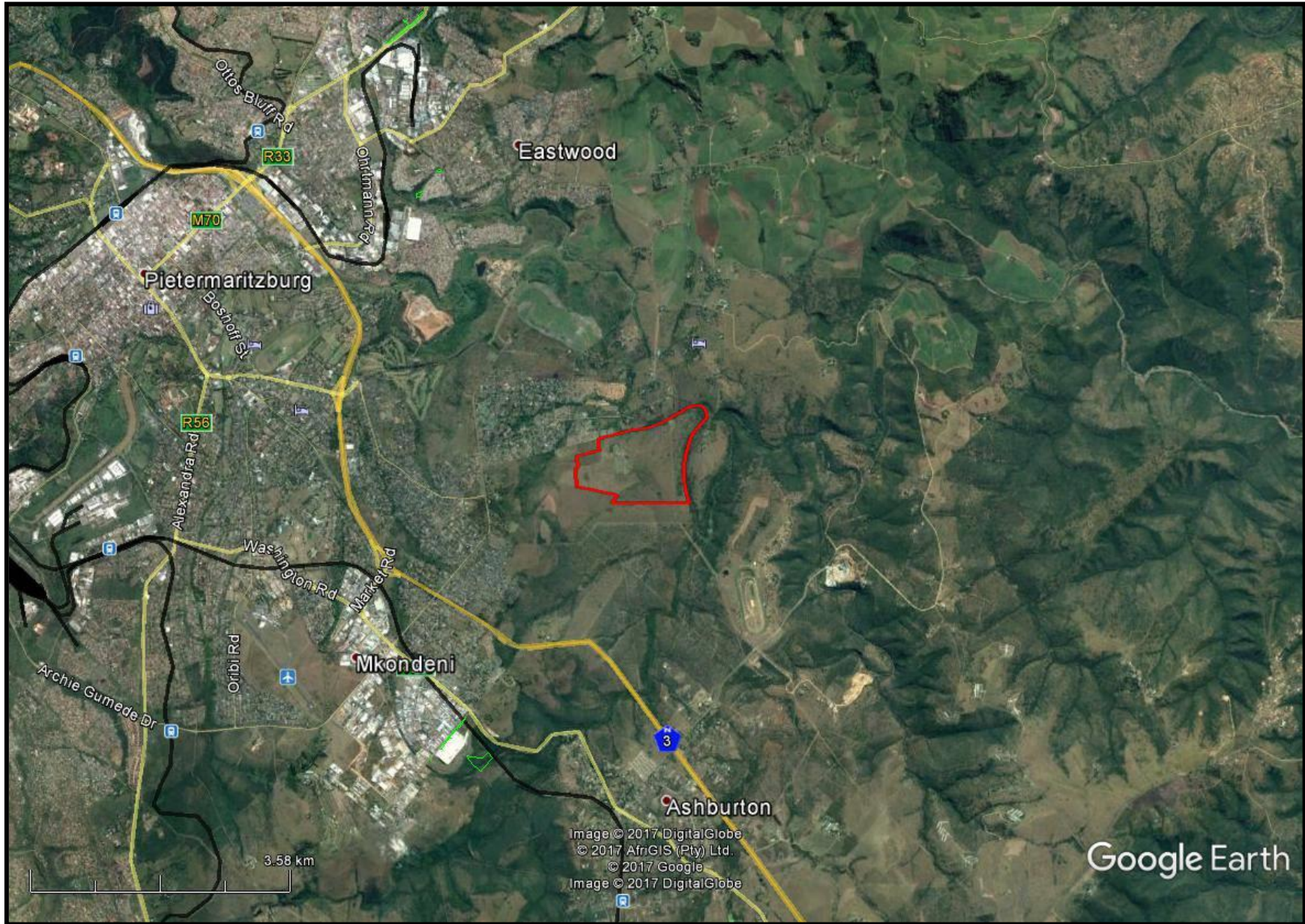


FIG. 2: AERIAL OVERVIEW OF THE STUDY AREA

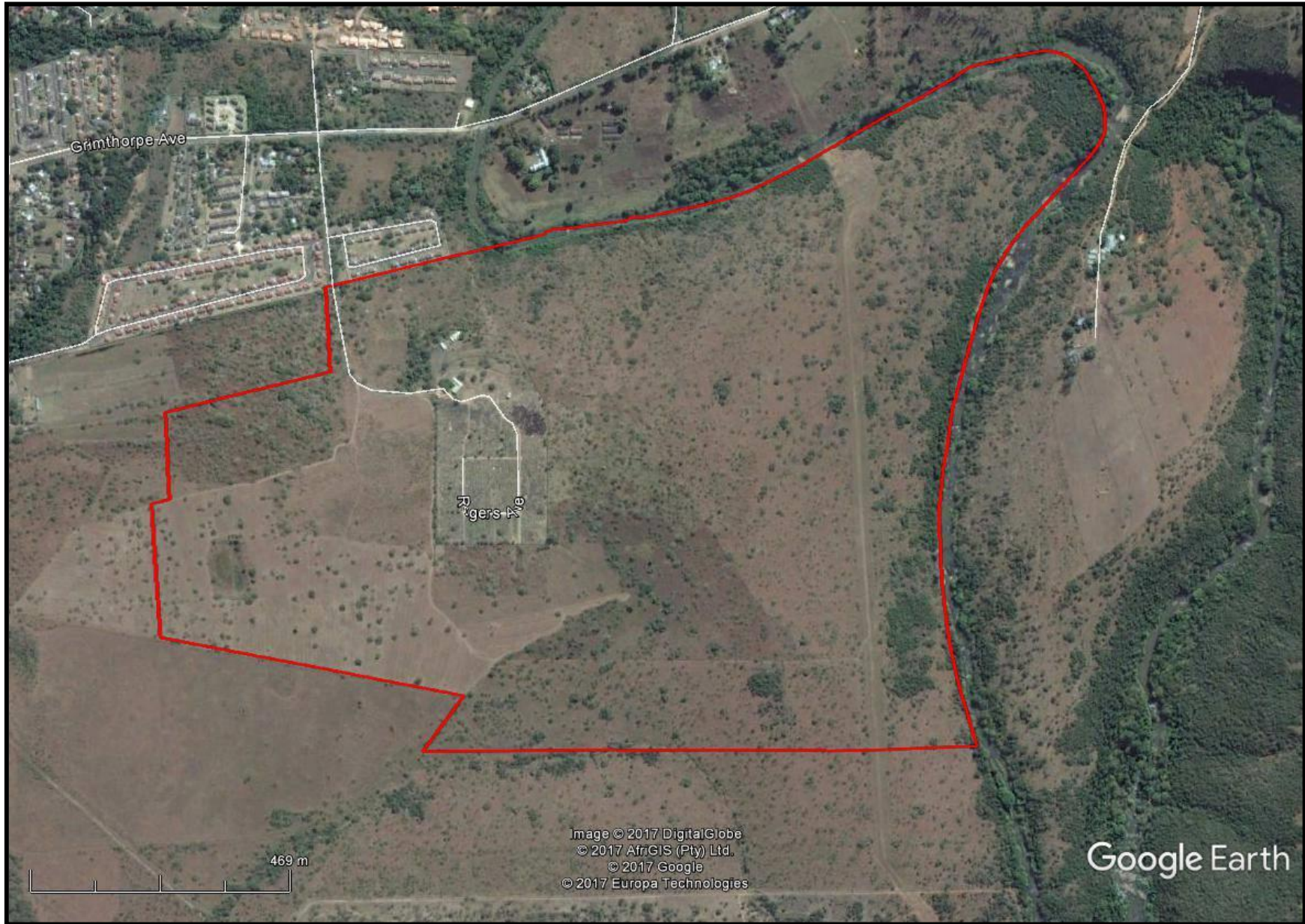


FIG. 3: TOPOGRAPHICAL OVERVIEW OF THE STUDY AREA

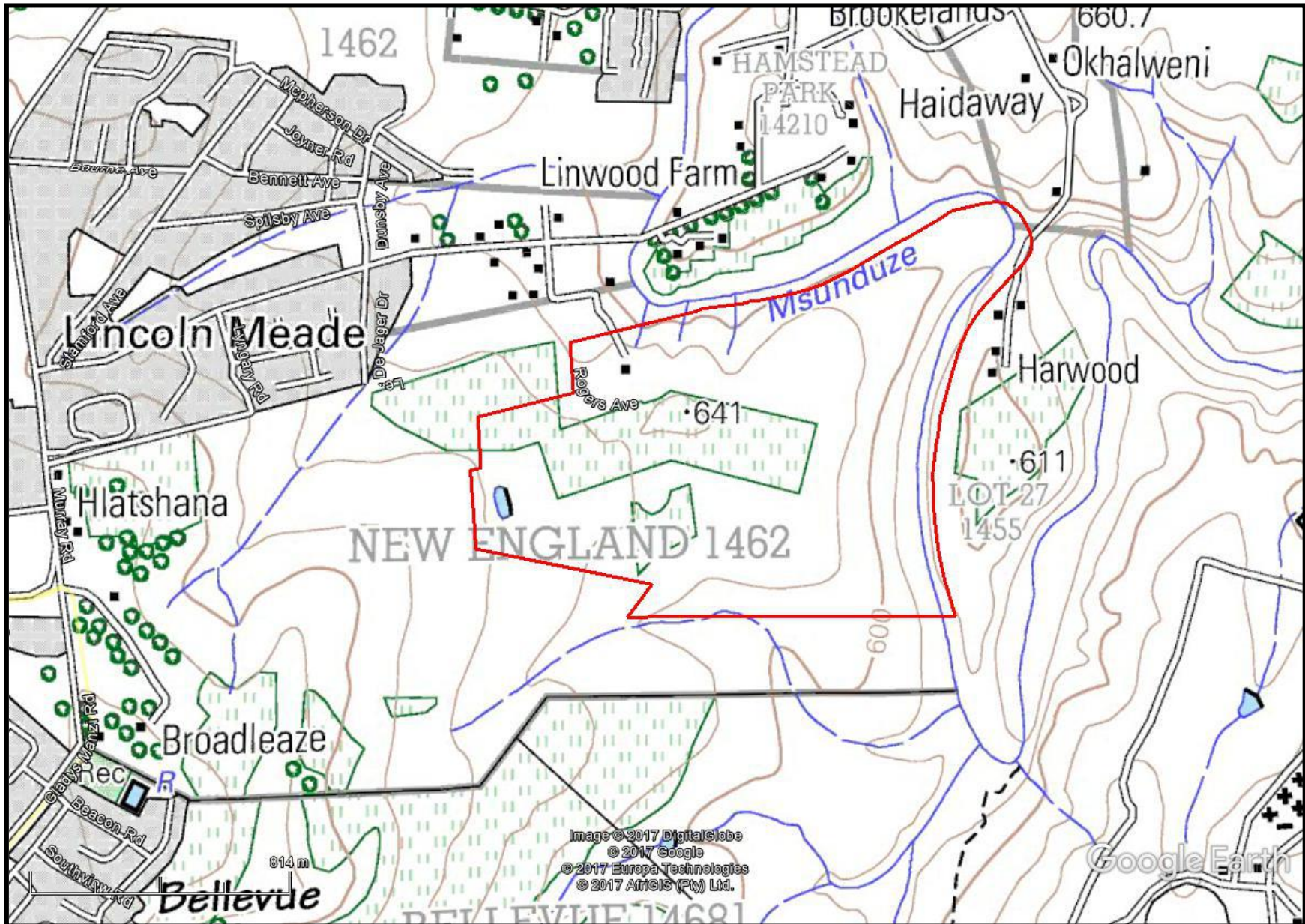


FIG. 4: SCENIC VIEWS OF THE PIPELINE ROUTE



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

VEGETATION

The final biodiversity report for the project had not been completed. However, a general vegetation survey was available from K2m Environmental.

The entire project area is covered by the KwaZulu – Natal Hinterland Thornveld. As per Musina & Rutherford (2006), KwaZulu-Natal Hinterland Thornveld occurs in the KwaZulu-Natal province with patches scattered above Eastern Valley Bushveld, at altitudes of 450 – 900m in river valleys of mainly the Mpisis, Mvoti, Umgeni, Mlazi, Lufafa and Mtungwane rivers. Vegetation and landscape features include undulating plains found on upper margins of river valleys. KwaZulu-Natal Hinterland Thornveld comprises open thornveld dominated by Acacia species.

Parts of the study area has been systematically ploughed, and thus farmed, since the 1930s.

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 archaeological sites in the general area (fig. 5: Anderson 2016; Anderson and Anderson 2008). These sites include all types of Stone Age and Iron Age sites. No known sites occur in the study area; however Anderson and Anderson surveyed a section of the study area (2008?).

No national monuments, battlefields, or historical cemeteries are known to occur in the study area. The study area does surround the more recent eThembeni cemetery. The project will not affect the cemetery.

The 1937 aerial photographs indicate that much of the study area was used for grazing and a small area for agriculture (fig. 6). No buildings are visible on the map. This is repeated in the 1968 1:50 000 topographical map (fig. 7). By 2010, at least half of the study area has been ploughed, and there is a dam on the upper part of the hill (fig. 2).

PALAEONTOLOGICAL IMPACT ASSESSMENT

The study area is in an area of medium palaeontological sensitivity (fig. 8). No further mitigation is required. A desktop study was undertaken by Dr Gideon Groenewald (Appendix A). The desktop notes that no significant fossils are expected before deep excavations (>1.5m) are done. If fossils are recorded during excavations into the rocks of the Dwyka Group, it will contribute significantly to our knowledge of the Palaeontological Heritage of the KwaZulu-Natal Province.

It is recommended that:

The EAP and ECO must be informed of the fact that a Moderate Palaeontological Sensitivity is allocated to the entire study site underlain by Dwyka Group sediments. A Phase 1 PIA document is only applicable if significant exposures (>1.5m) of rocks from this subgroup are foreseen.

If excavations of deeper than 1.5m is planned, a suitably qualified Palaeontologist must be appointed to visit the sites of excavation within the first week of construction, to produce a "Chance Find Protocol" for these sites.

If significant fossils are exposed, a "Chance Find Protocol" must be compiled and included in the EMP of the Project. Construction may continue once the cordoned off area has been assessed and fossils have been extracted.

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



FIG. 6: STUDY AREA IN 1937



FIG. 7: STUDY AREA IN 1968

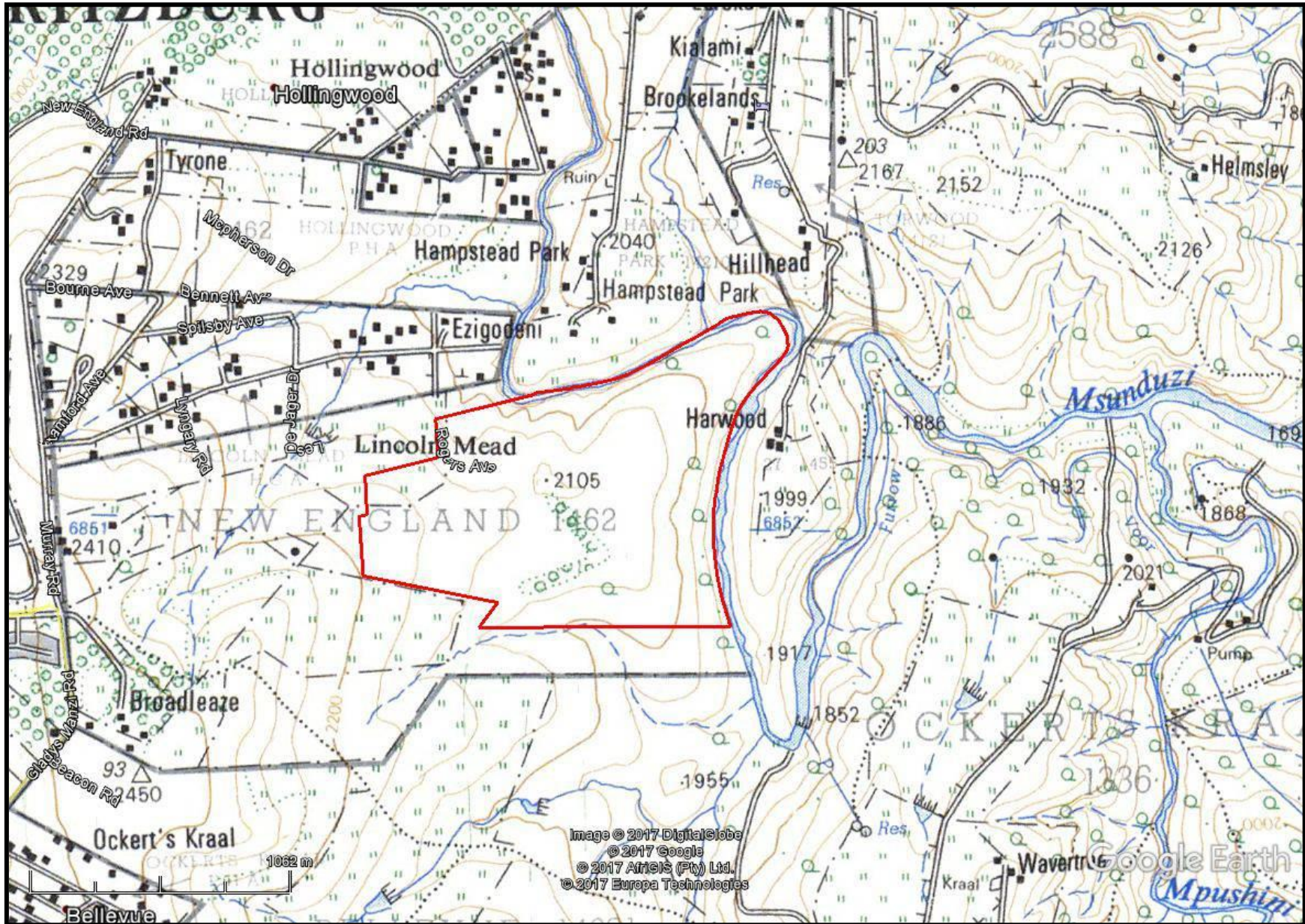


FIG. 8: PALAEOLOGICAL SENSITIVITY MAP OF THE STUDY AREA

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.

It is essential that the appointed palaeontologist, in consultation with the Project Manager of the excavation works develop a short-term strategy for the recovery of significant fossils during the excavation operation. This assessment can only be done once the excavations have started and the financial implications are relatively small as the Palaeontologist only needs to visit the site once to inform the contractors of what they must look out for and then be informed by the ECO if any “unforeseen” fossils are reported.

FIELD SURVEY

A field survey was undertaken on 15 August 2017. Much of the area had been burnt recently and ground visibility was good. Since the 2010 Google imagery, even more land has been visibly ploughed. This is itself a positive as the ground is very hard and ploughing has brought artefacts to the surface.

No archaeological sites per se were recorded however; artefacts are dispersed across the study area (fig. 9). MSA and LSA stone tools were noted along a cutting near the cemetery (fig. 10). These included MSA cores and flakes and a LSA add. This was expected as most of the neighbouring hills have Stone Age scatters. These tools are in a secondary context and are of low significance.

Three pottery shards were noted in a recently burnt area (fig. 11). Two upper and one lower grinding stones were also located in the vicinity of the shards. The shards are thin-walled and grey, brown and black in colour. They shards are undecorated. The two upper grinding stones are from river pebbles and the lower grinding stone appears to be made from dolerite. The artefacts indicate that the site dates to the LIA or HP. These artefacts also suggest that there might be a settlement in this area, even if the ground has been ploughed. While I did not observe any stone cairns, there is a possibility that human graves could occur and be exposed during construction. There are too few artefacts to register the finds as a site and no features were noted.

Significance: The artefacts are of low significance and are probably in a secondary context.

Mitigation: No further mitigation is required. However, the client should be made aware that human graves could occur on the site. If human graves are exposed during construction, then that area needs to be cordoned off with a 5m buffer. Amafa KZN needs to be informed regarding the skeletons immediately. Construction will be allowed to continue after the human remains and area have been assessed.

FIG. 9 LOCATION OF ARTEFACTS IN THE STUDY AREA



FIG. 10: STONE TOOLS IN THE STUDY AREA



FIG. 11: POTTERY SHARDS IN THE STUDY AREA



CONCLUSION

A heritage survey was undertaken for the proposed eThembeni mixed use development, in New England, Pietermaritzburg. No heritage sites were observed during the survey, however several artefacts were noted. These artefacts are in a secondary context as a result of ploughing activity. No features were noted and the artefacts do not constitute an archaeological site.

The occurrence of pottery sherds indicates that a settlement could occur in the study area. If this is the case, then the developer needs to be aware of the possibility of sub-surface human graves that could occur. If human graves are uncovered during construction then Amafa KZN needs to be informed and the area needs to be demarcated.

REFERENCES

Aerial Photographs

117B_018_05550

117B_018_05551

1:50 000 topographical map

2930CB Pietermaritzburg 1968, 2000

Data Base

Natal Museum Site Record Database

SAHRIS

Umlando

Anderson, G. 1996. Archaeological Survey Of Proposed Northern Feeder Line.

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Mucina, L & Rutherford, M.C. (eds) 2006. The Vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria

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.

A handwritten signature in black ink, appearing to read 'Anderson', with a large, stylized initial 'A'.

Gavin Anderson
Archaeologist/Heritage Impact Assessor

APPENDIX A
PALAEONTOLOGICAL DESKTOP IMPACT ASSESSMENT

**DESKTOP PALAEOLOGICAL
ASSESSMENT FOR THE PROPOSED
ETHEMBENI INTEGRATED MIXED USE
HOUSING DEVELOPMENT, THE
MSUNDUZI LOCAL MUNICIPALITY,
UMGUNGUNDLOVU DISTRICT
MUNICIPALITY, KWAZULU-NATAL
PROVINCE**

For Umlando

DATE: 24 August 2017

By

Gideon Groenewald

Cell: 078 713 6377

EXECUTIVE SUMMARY

- Gideon Groenewald was appointed by Umlando to undertake a Desktop Survey, assessing the Potential Palaeontological Impact related to the proposed Ethembeni integrated mixed use Housing Development, The Msunduzi Local Municipality, Umgungundlovu 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 development site for the proposed Ethembeni integrated mixed use Housing Development, The Msunduzi Local Municipality, Umgungundlovu District Municipality, Kwazulu-Natal Province, is underlain by Carboniferous to Permian aged sediments of the Dwyka Group.

- No significant fossils are expected before deep excavation (>1.5m) are done, but if fossils are recorded during excavations into the rocks of the Dwyka Group, it will contribute significantly to our knowledge of the Palaeontological Heritage of the KwaZulu-Natal Province.

It is recommended that:

The EAP and ECO must be informed of the fact that a Moderate Palaeontological Sensitivity is allocated to the entire study site underlain by Dwyka Group sediments. A Phase 1 PIA document is only applicable if significant exposures (>1.5m) of rocks from this subgroup are foreseen.

If excavations of deeper than 1.5m is planned, a suitably qualified Palaeontologist must be appointed to visit the sites of excavation within the first week of construction, to produce a "Chance Find Protocol" for these sites.

If significant fossils are exposed, a "Chance Find Protocol" must be compiled and included in the EMP of the Project. Construction may continue once the cordoned off area has been assessed and fossils have been extracted.

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INTRODUCTION

Gideon Groenewald was appointed by Umlando to undertake a Desktop Survey, assessing the Potential Palaeontological Impact related to the proposed Ethembeni integrated mixed use Housing Development, The Msunduzi Local Municipality, Umgungundlovu District Municipality, Kwazulu-Natal Province.

Legal Requirements

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; and
- objects with the potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage.

Aims and Methodology

A Desktop investigation is often the only opportunity to record the fossil heritage within the development footprint. These records are very important to understand the past and form an important part of South Africa's National Estate.

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 identifying exposed and subsurface rock formations that are considered to be palaeontologically significant;
- to assessing 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.

Prior to a field investigation a preliminary assessment (desktop study) of the topography and geology of the study area is made using appropriate 1:250 000 geological maps (2930 Durban) in conjunction with Google Earth. Potential fossiliferous rock units (groups, formations etc) are identified within the study area and 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.

Priority palaeontological areas are identified within the development footprint to focus the field investigator’s time and resources. The aim of the desktop survey is to document any exposed fossil material and to assess the palaeontological potential of the region in terms of the type and extent of rock outcrop in the area.

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 minimal extent of fresh 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) and 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.

<p>GREEN</p>	<p>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) compulsory.</p>
<p>BLUE</p>	<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 of 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</p>

	<p>mapping on the 1:250 000 scale maps excludes small outcrops of highly significant sedimentary rock units occurring in dolerite sill outcrops. Collection of a representative sample of potential fossiliferous material recommended. At least a Desktop Survey and “Chance Find Protocol” is compulsory. The Chance Find Protocol must be included in the EMPr for the project.</p>
<p>GREY</p>	<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 emplacement 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</p>

	outcrops. It is important that the report should also refer to archaeological reports and possible descriptions of palaeontological finds in Cenozoic aged surface deposits. At least a Desktop Survey and “Chance Find Protocol” document is compulsory. The Chance Find Protocol must be included in the EMPr of the project.
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When rock units of moderate to very high palaeontological sensitivity are present within the development footprint, palaeontological mitigation measures must be incorporated into the Environmental Management Plan. All projects falling on Low to Very Low Palaeontological sensitivity geology must be discussed in either a Phase 1 PIA or Chance Find Protocol (CFP) document that must form part of the EMPr of the project.

Scope and Limitations of the Desktop Study

The study will include: i) an analysis of the area’s stratigraphy, age and depositional setting of fossil-bearing units; ii) a review of all relevant palaeontological and geological literature, including geological maps, and previous palaeontological impact reports; iii) data on the proposed development provided by the developer (e.g. location of footprint, depth and volume of bedrock excavation envisaged) and iv) where feasible, location and examination of any fossil collections from the study area (e.g. museums).

The key assumption for this scoping 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. There is also an inadequate database for fossil heritage for much of the RSA, due to the small number of professional palaeontologists carrying out fieldwork in RSA and the Kingdom of Lesotho. Most development study areas have never been surveyed by a palaeontologist.

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.).

Locality and Proposed Development

“The Msunduzi Municipality has, through its IDP process, and extensive consultation with respective communities residing within the Msunduzi Municipality, identified the need to provide an integrated mix of housing units within its area of jurisdiction (Figure 1). This Palaeontological Impact Assessment (PIA) forms part of the EIA process that was initiated as a means to address the municipality’s housing need due to urbanization and the growth of the population.



Figure 1 Locality of the eThembeni Mixed Housing Development

The proposed eThembeni Integrated Mixed Use Housing Development aims to address the housing need by constructing Detached Low Cost Housing, Education facilities, GAP Housing, Government Employee Units, Medium Density Housing, Medium Density Housing Parking, Medium Density Subsidized Housing, Military Veteran Units, Mixed Use Commercial, Mixed Use Residential, Petrol Filling Station, Social Housing and places of Worship. The total extend of the project area is approximately 147.76Ha and is situated on a portion of Ward 37 of the Msunduzi Municipality “(K2M Environmental 2017)

GEOLOGY

The study area is entirely underlain by Carboniferous to Permian aged tillite of the Dwyka Group, Karoo Supergroup in South Africa (Figure 2).

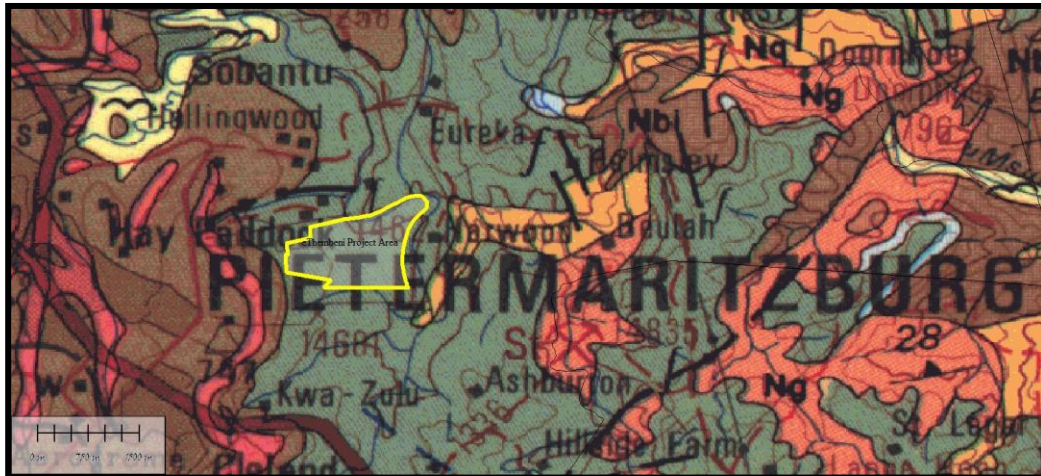


Figure 2 Geology underlying the area earmarked for development of the eThembeni Housing Development. The entire study site falls on Dwyka Group sediments

Karoo Supergroup

Dwyka Group

In the study area the Carboniferous to Permian aged Dwyka Group consist of an assemblage of fine-grained to very agglomeritic tillite and sediments, consisting mainly of dark grey shale and subordinate sandstone layers. The deposits represent predominantly Carboniferous to Permian aged glacial deposits that were deposited in offshore shelf, but possibly also nearshore / lacustrine / lagoonal environments in this part of Gondwanaland. The upper part of the formation becomes more shale rich and is indicative of a southward migration of a glacial system into the predominantly marine environments that existed during the Permian in this part of the Karoo Basin (Johnson et al, 2009).

PALAEONTOLOGY

Karoo Supergroup

Dwyka Group

The eThebesi Development falls on Dwyka Group sediments and it is possible that exposure of these rocks can lead to the discovery of significant fossils.

Trace fossils have been recorded from the fine-grained shales of the Dwyka Group in KwaZulu-Natal (Linstrom, 1987; MacRae, 1999). All of the following could potentially be found in KwaZulu-Natal. Trackways, produced mostly by fish and arthropods (invertebrates), have been recovered in shales from the uppermost Dwyka Group. Although difficult to identify, other trace fossils can include coprolites (fossilized faeces) of chondrichthyans (sharks, skates and rays).

Body fossils include micro-fossils such as araneous foraminifera and radiolarians (single-celled organisms), bryozoans, sponge spicules (internal support elements of sponges). The Dwyka Group also produced some primitive starfish, orthoceroid nautiloids (marine invertebrates similar to the living *Nautilus*), goniatite cephalopods (*Eoasinites* sp.), gastropods (marine snails such as *Peruvispira viperdorfensis*), bivalves (*Nuculopsis* sp., *Phestia* sp., *Aphanaia haibensis*, *Eurydesma mytiloides*), brachiopods (*Attenuatella* sp.) and palaeoniscoid fish such as *Namaichthys schroederi* and *Watsonichthys lotzi*.

Fossil plants have also been found, including lycopods (*Leptophloem australe*), moss, leaves and stems (possibly belonging to a proto-glossopterid flora). Fossil spores and pollens (such as moss, fern and horsetail spores and primitive gymnosperm pollens) as well as fossilized wood probably belonging to

primitive gymnosperms have also been recorded from Dwyka deposits (MacRae, 1999; McCarthy and Rubidge, 2005).

PALAEONTOLOGICAL IMPACT AND MITIGATION

The predicted palaeontological impact of the development is based on the initial mapping assessment and literature reviews as well as information gathered during the desktop investigation. The desktop investigation confirms that the study area is underlain by Carboniferous to Permian aged, moderately significant, fossiliferous sediments of the Dwyka Group. Due to the extremely deep weathering in this region (personal experience of the author) the chance find of significant fossils in excavations less than 1.5m deep is very low.

The Palaeontological sensitivity of Moderately sensitive in the areas underlain by Dwyka Group rocks is retained for this desktop survey and if any excavations of deeper than 1.5m are planned in the study area, a suitably qualified Palaeontologist must be appointed to inspect these excavations for possible fossils (Figure 3).

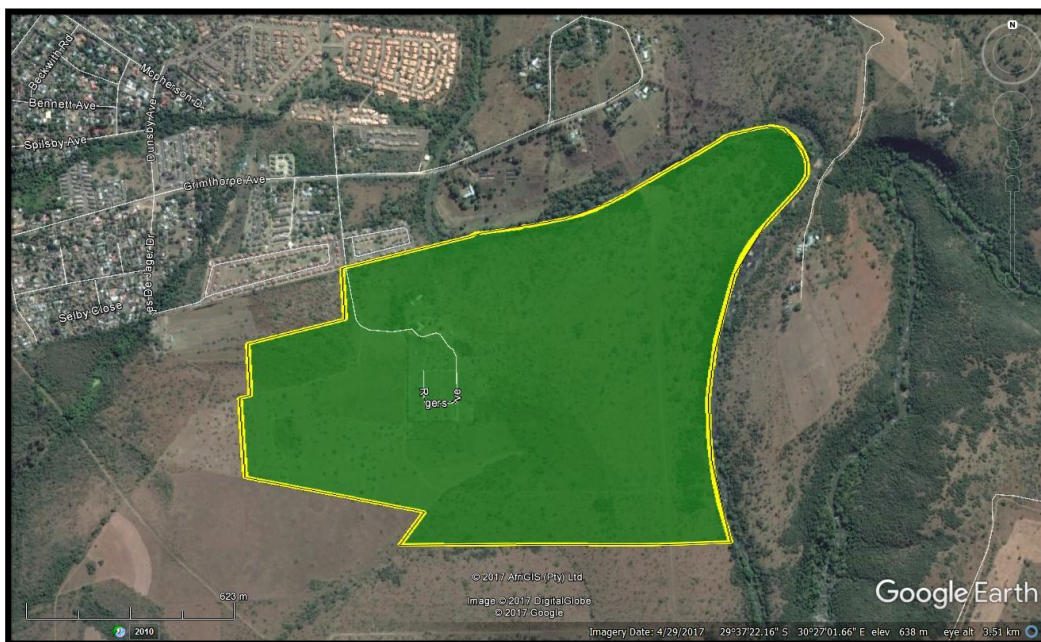


Figure 3 Paleontological sensitivity of the study area is Moderate and it is unlikely that fossils will be observed prior to excavation of 1.5m deep trenches

CONCLUSION

- The development site for the proposed Ethembeni integrated mixed use Housing Development, The Msunduzi Local Municipality, Umgungundlovu District Municipality, Kwazulu-Natal Province, is underlain by Carboniferous to Permian aged sediments of the Dwyka Group.

No significant fossils are expected before deep excavation (>1.5m) are done, but if fossils are recorded during excavations into the rocks of the Dwyka Group, it will contribute significantly to our knowledge of the Palaeontological Heritage of the KwaZulu-Natal Province.

It is recommended that:

The EAP and ECO must be informed of the fact that a Moderate Palaeontological Sensitivity is allocated to the entire study site underlain by Dwyka Group sediments. A Phase 1 PIA document is only applicable if significant exposures (>1.5m) of rocks from this subgroup are foreseen. If excavations of deeper than 1.5m is planned, a suitably qualified Palaeontologist must be appointed to visit the sites of excavation within the first week of construction, to produce a "Chance Find Protocol" for these sites.

If significant fossils are exposed, a "Chance Find Protocol" must be compiled and included in the EMP of the Project. Construction may continue once the cordoned off area has been assessed and fossils have been extracted.

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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.



Dr Gideon Groenewald
Geologist