

**SCOPING HERITAGE SURVEY OF THE ZINKWAZI
MAIN BEACH - UPGRADE TO THE SEPTIC TANK**

FOR TRIPLO4 SUSTAINABLE SOLUTIONS

DATE: 30 AUGUST 2017

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EXECUTIVE SUMMARY

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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

Zinkwazi Beach is located ~30km east of Stanger and falls under the KwaDukuza Municipality. The Zinkwazi Beach sewerage system requires an upgrade. Some of the pumps are leaking effluent into the surrounds. Moreover, parts of the pump are not connected to the electricity grid, while a conservancy has not been used in over 4 years. The system requires a major overhaul.

It is proposed to build a new effluent system for solid and water waste. The proposal is given on the SAHRIS documentation.

Triplo4 Sustainable Solutions (Pty) Ltd was contracted to undertake the the EIA process of this upgrade. Umlando was subcontracted to undertake the HIA for the project.

Figures 1 – 4 show the location of the area.

FIG. 1 GENERAL LOCATION OF THE STUDY AREA

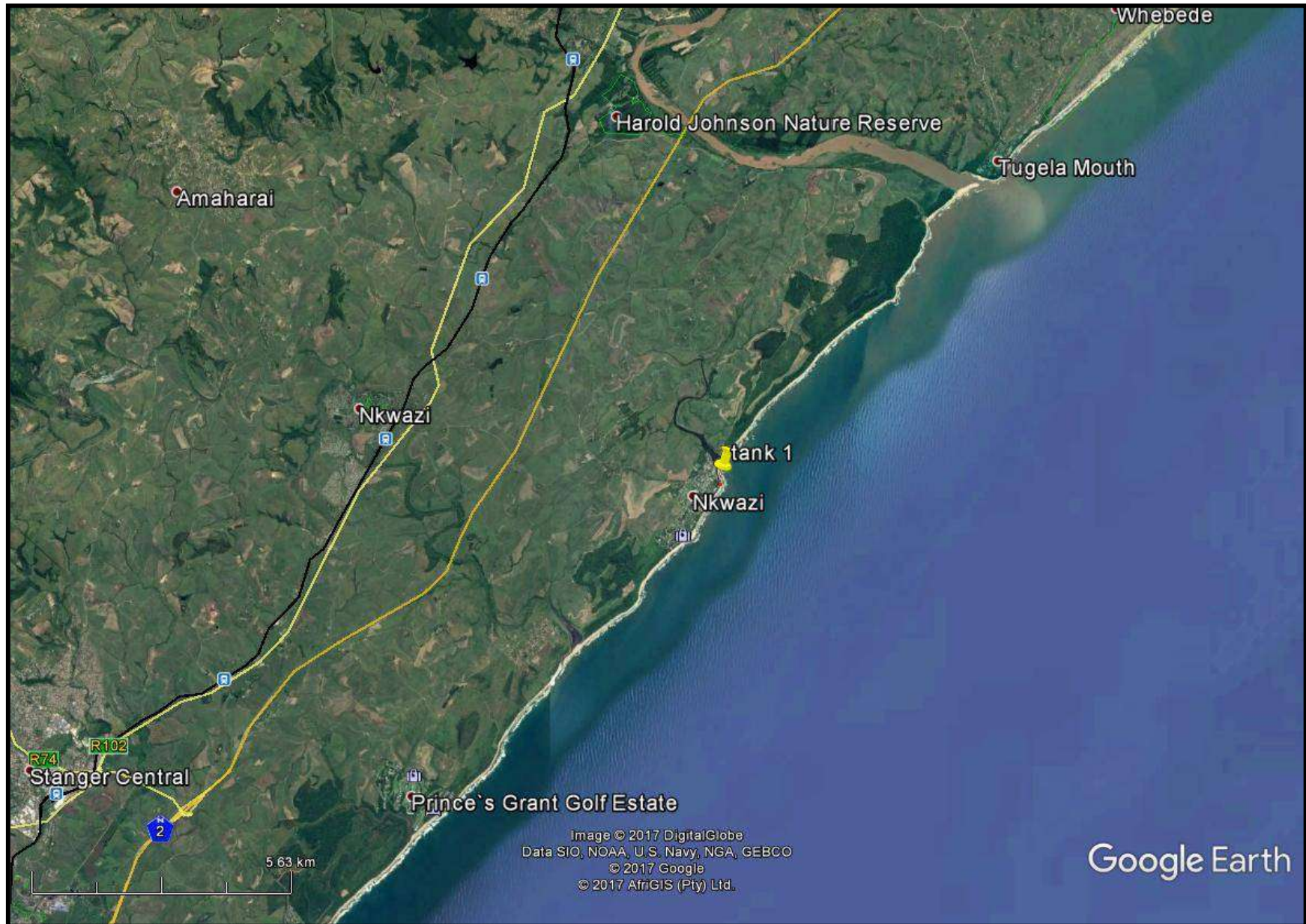


FIG. 2: AERIAL OVERVIEW OF THE STUDY AREA



FIG. 3: TOPOGRAPHICAL MAP OF THE STUDY AREA



FIG. 4: SCENIC VIEWS OF THE AREA



NATIONAL HERITAGE RESOURCES ACT OF 1999

The National Heritage Resources Act of 1999 (pp 12-14) protects a variety of heritage resources. These resources are defined as follows:

1. “For the purposes of this Act, those heritage resources of South Africa which are of cultural significance or other special value for the present community and for future generations must be considered part of the national estate and fall within the sphere of operations of heritage resources authorities.
2. Without limiting the generality of subsection (1), the national estate may include—
 - 2.1. Places, buildings, structures and equipment of cultural significance;
 - 2.2. Places to which oral traditions are attached or which are associated with living heritage;
 - 2.3. Historical settlements and townscapes;
 - 2.4. Landscapes and natural features of cultural significance;
 - 2.5. Geological sites of scientific or cultural importance;
 - 2.6. Archaeological and palaeontological sites;
 - 2.7. Graves and burial grounds, including—
 - 2.7.1. Ancestral graves;
 - 2.7.2. Royal graves and graves of traditional leaders;
 - 2.7.3. Graves of victims of conflict;
 - 2.7.4. Graves of individuals designated by the Minister by notice in the Gazette;
 - 2.7.5. Historical graves and cemeteries; and
 - 2.7.6. Other human remains which are not covered in terms of the Human Tissue Act, 1983 (Act No. 65 of 1983);
3. Sites of significance relating to the history of slavery in South Africa;
 - 3.1. Movable objects, including—

4. Objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens;
 - 4.1. Objects to which oral traditions are attached or which are associated with living heritage;
 - 4.2. Ethnographic art and objects;
 - 4.3. Military objects;
 - 4.4. objects of decorative or fine art;
 - 4.5. Objects of scientific or technological interest; and
 - 4.6. books, records, documents, photographic positives and negatives, graphic, film or video material or sound recordings, excluding those that are public records as defined in section 1(xiv) of the National Archives of South Africa Act, 1996 (Act No. 43 of 1996).
5. Without limiting the generality of subsections (1) and (2), a place or object is to be considered part of the national estate if it has cultural significance or other special value because of—
 - 5.1. Its importance in the community, or pattern of South Africa's history;
 - 5.2. Its possession of uncommon, rare or endangered aspects of South Africa's natural or cultural heritage;
 - 5.3. Its potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage;
 - 5.4. Its importance in demonstrating the principal characteristics of a particular class of South Africa's natural or cultural places or objects;
 - 5.5. Its importance in exhibiting particular aesthetic characteristics valued by a community or cultural group;
 - 5.6. Its importance in demonstrating a high degree of creative or technical achievement at a particular period;
 - 5.7. Its strong or special association with a particular community or cultural group for social, cultural or spiritual reasons;
 - 5.8. Its strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa; and

5.9. sites of significance relating to the history of slavery in South Africa”

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 database contain 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

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. I also used various sources for historical information.

PREVIOUS ACHAEOLOGICAL & HERITAGE SURVEYS

Fig. 5 shows the location of known heritage sites in the general area. These sites are archaeological sites that consists of shell middens. The shell middens date to the LSA, EIA, LSA and HP. The occurrence of a rock outcrop along the beach tends to increase the density of archaeological sites in the area. These rock outcrops are important foci for food resources. As such I tend to place a 1km radius around these rock outcrops as having very high archaeological significance. One site, 2931AD 017, occurs in/near the study area.

The site was recorded in the 1960s and the Natal museum site records states:

“On beach in front of the old beach-dunes, which are heavily vegetated. Exposure 12' long with two superimposed layer of shells. The upper is 8" thick, the lower 14", and there is 3" of sterile beach-sand between them. Content: rather soft perna; a few limpets and oysters. Nondescript broken stones and heat-spalls.”

The midden was given the status of Indeterminate Iron Age. That is that there were was no obvious pottery (decorations) observed to date the site. Several other shell middens occur to the north and south of the study area.

The recording of the site indicates that it would have occurred within 1m from the then surface.

No national monuments, battlefields, or historical cemeteries are known to occur along the route.

The beach itself was used by the Swedish (then Norwegian Missionaries) to baptize converts. One such missionary, Anders Anderson with the assistance of his wife-to-be Mathilda Gustafson frequently baptized people in the small bay (Rill undated). They were linked to the Mission near Stanger, on the Farm Bethany.

The 1937 aerial photograph indicates that part of the areas already converted into seaside accommodation.

By 1968 there is an increase in buildings in the area. Much of the land is under sugar cane production, as it is today.

FIG. 5: KNOWN HERITAGE SITES IN THE AREA



FIG. 6: STUDY AREA IN 1937



FIG. 7: STUDY AREA IN 1968



PALAEONTOLOGICAL DESKTOP IMPACT ASSESSMENT

A desktop study was undertaken by Dr Gideon Groenewald for the area (Appendix A). The exact sizes and depths of the excavations were at the time unknown; hence we opted for a general desktop study. The study area is in a moderate sensitive palaeontological zone.

The entire development falls in the Dwyka Group of the Karoo Supergroup and it is likely that significant fossils can be present. The excavation for foundations that exceeds 1.5m must be inspected and if any trace fossils are present, a suitably qualified Palaeontologist must inspect the sites within one week of the start of excavations to record the fossils and collect a representative sample of at least 1m³ of rock for study purposes. The appointed Palaeontologist must then provide a "Chance Find Protocol for this development and keep monitoring the site for at least the duration of the excavation process

It is recommended that:

The EAP and ECO must be informed of the fact that a Medium Palaeontological Sensitivity is allocated to the study area. A Phase 1 PIA document is only applicable if significant exposures (>1.5m) of Dwyka Group sediments are foreseen.

If any exposure of rock at 1.5m depth is predicted in the Geotechnical Reports for this project, suitably qualified Palaeontologist must be appointed to visit the site during the first week of excavation to produce a "Chance Find Protocol".

No further mitigation for Palaeontological Heritage is needed if the geotechnical reports indicate that no significant excavation into bedrock deeper than 1.5m is expected. Following discussions with the implementing agent, this is most probably the case,

FIG. 8: PALAEOLOGICAL SENSITIVITY 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.

FIELD SURVEY

A field survey was undertaken on 22 August 2017. The current car park appears to have been placed on top of, or destroyed, the archaeological site 2931AD 017. There are remnants of marine shell in the area between the dune

vegetation and the carpark. This suggests that some of the midden might still occur. Figure 4 (top left and top right) shows this area.

The main tank system will be placed in this general area. The excavations for the tank should be monitored by a competent archaeologist in case any of the midden is exposed during excavations.

The second tank will be placed behind the existing lifeguard buildings (fig. 4 bottom left and bottom right). This area was densely vegetated, however some areas were exposed. These exposed areas had fragments of *Perna perna* near the surface (fig. 9). These could be the remains of an archaeological shell midden.

The excavations for this tank should be monitored by a competent archaeologist in case any of the midden is exposed during excavations.

FIG. 9: SHELL FRAGMENTS IN THE STUDY AREA



MANAGEMENT PLAN

Both areas noted for excavations should have a qualified archaeologists on site during the initial excavations. This will determine if shell middens still occur in the area. The necessary sampling and/or excavation can be undertaken. This should occur in the beginning of the construction period so as to limit time delays.

I suggest that a permit to damage/destroy an archaeological site is obtained by the developer before construction occurs. This will limit delays in construction time while the permit applications are being processed by Amafa KZN.

If the excavations exceed 1.5m and/or expose Dwyka Group formations, then a qualified palaeontologist will need to inspect the site.

CONCLUSION

A heritage survey was undertaken of th proposed Zinkwazi waste water treatment system.

The area is of very high archaeological sensitivity due to the proximity of the rock outcrop. Fragments of marine shell possibly associated with previous surveys were noted in the area. Excavations for the project have the potential to disturb archaeological sites and thus require on-site monitoring.

The area is of medium palaeontological sensitivity and requires monitoring if Dwyka Group formations are exposed and exceed 1.5m in depth.

REFERENCES

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R. Rill (translator). Undated. "KHUMBUZO AFRICA" A HISTORY of MISSIONS in SOUTHERN AFRICA. Translation of the Diaries of Anders Anderson and Mathilda Gustafson

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 'G. Anderson', with a horizontal line underneath.

Gavin Anderson
Archaeologist/Heritage Impact Assessor

APPENDIX A
PALAEONTOLOGICAL DESKTOP ASSESSMENT

**DESKTOP PALAEOLOGICAL
ASSESSMENT FOR THE PROPOSED
SEWER UPGRADE SYSTEM AT ZINGWAZI
BEACH, KWADUKUZA LOCAL
MUNICIPALITY, ILEMBE 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 sewer upgrade system At Zingwazi Beach, KwaDukuza Local Municipality, iLembe 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 sewer upgrade system At Zingwazi Beach, KwaDukuza Local Municipality, iLembe District Municipality, Kwazulu-Natal Province is underlain by Carboniferous to Permian aged tillites of the Dwyka Group and dune sand.

No significant fossils are expected before deep excavation (>1.5m) are done, but if fossils are recorded during excavations into the Dwyka Group rocks, 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 Medium Palaeontological Sensitivity is allocated to the study area. A Phase 1 PIA document is only applicable if significant exposures (>1.5m) of Dwyka Group sediments are foreseen.
- If any exposure of rock at 1.5m depth is predicted in the Geotechnical Reports for this project, suitably qualified Palaeontologist must be appointed to visit the site during the first week of excavation to produce a "Chance Find Protocol".
- No further mitigation for Palaeontological Heritage is needed if the geotechnical reports indicate that no significant excavation into bedrock deeper than 1.5m is expected. Following discussions with the implementing agent, this is most probably the case,

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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 sewer upgrade system At Zingwazi Beach, KwaDukuza Local Municipality, iLembe 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 (3029 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>

	<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.</p>
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When rock units of moderate to 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 proposed sewer upgrade is at the Zinkwazi Beach on the KwaZulu-Natal coast and the site falls mainly on deep sandy deposits. The development will be constructed as surface born pipelines with the only excavations associated with the septic tanks.



Figure 1 The proposed excavation sites at Zingwazi Beach, associated with upgrading of the sewer system.

The project aims to upgrade the sewer system and no deep trenching for pipelines are planned.

GEOLOGY

The study area is underlain predominantly by Carboniferous to Permian aged tillites of the Dwyka Group, Karoo Supergroup and deep sand (Figure 2).



Figure 2 Geology of the Zingwazi Beach site

Karoo Supergroup

Dwyka Group

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 with cobble stones. The deposits represent predominantly Carboniferous to Permian aged glacial and shallow marine 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 Settlers's Park 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. Other trace fossils include coprolites (fossilized faeces) of chondrichthyans (sharks, skates and rays).

Body fossils include aranaceous foraminifera and radiolarians (single-celled organisms), bryozoans, sponge spicules (internal support elements of sponges), 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).

Dune Sand Deposits

Dune sand deposits can overlie the Dwyka Group rocks in places.

PALAEONTOLOGICAL IMPACT AND MITIGATION

The predicted palaeontological impact of the borrow 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 fine-grained dark coloured to dark grey shale, sandstone beds and tillite of the Dwyka Group of the Karoo Supergroup which normally leads to the formation of either light coloured Avalon Form, or dark Vertic Arcadia Form soils or sand cover. The dunes sand can cover the Dwyka Group as well.



Figure 3 The study area is allocated a Moderate sensitivity for Palaeontological Heritage, but it will only apply when excavation is more than 1.5m deep.

The entire development falls in the Dwyka Group of the Karoo Supergroup and it is likely that significant fossils can be present (Figure 3). The excavation for foundations that exceeds 1.5m must be inspected and if any trace fossils are present, a suitably qualified Palaeontologist must inspect the sites within one week of the start of excavations to record the fossils and collect a representative sample of at least 1m³ of rock for study purposes. The appointed Palaeontologist must then provide a “Chance Find Protocol for this development and keep monitoring the site for at least the duration of the excavation process.

CONCLUSION

The development site for the proposed sewer upgrade system At Zingwazi Beach, KwaDukuza Local Municipality, iLembe District Municipality, Kwazulu-Natal Province is underlain by Carboniferous to Permian aged tillites of the Dwyka Group and dune sand.

No significant fossils are expected before deep excavation (>1.5m) are done, but if fossils are recorded during excavations into the Dwyka Group rocks, 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 Medium Palaeontological Sensitivity is allocated to the study area. A Phase 1 PIA document is only applicable if significant exposures (>1.5m) of Dwyka Group sediments are foreseen.
- If any exposure of rock at 1.5m depth is predicted in the Geotechnical Reports for this project, suitably qualified Palaeontologist must be appointed to visit the site during the first week of excavation to produce a "Chance Find Protocol".
- No further mitigation for Palaeontological Heritage is needed if the geotechnical reports indicate that no significant excavation into bedrock deeper than 1.5m is expected. Following discussions with the implementing agent, this is most probably the case,

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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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