FIRST PHASE ARCHAEOLOGICAL, PALAEONTOLOGICAL & GEOLOGICAL INVESTIGATION OF THE PROPOSED TOWNSHIP & LIGHT INDUSTRIAL & AGRO-PROCESSING DEVELOPMENTS AT TSHIAME / INDUSTRIQUA, HARRISMITH, FREE STATE

REPORT PREPARED FOR:

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REPORT PREPARED BY:

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SPECIALIST PANEL & DECLARATION OF INDEPENDENCE

Cobus Dreyer (MA Archaeology (Wits), is an Archaeologist and accredited member of ASAPA, rated as Principal Investigator for Stone Age, Iron Age, Colonial and Industrial Archaeology, with Specialist rating on Anglo-Boer War history. Based in Bloemfontein he has been involved with heritage and archaeological impact assessments since 1998. After many environmental and heritage impact assessments in Lesotho, the Free State and North West Province, Karoo, Northern Cape, the upper part of the West Coast and along the Orange River towards the Richtersveld, I consider myself familiar with the archaeology and cultural heritage of the region and competent to do the investigation.

Dr Johan C. Loock, PhD (HC) from Bloemfontein has retired from the Geology Department at the University of the Free State after lecturing for over fifty years. Dr Loock has a thorough understanding of the geology and palaeontology of the Karoo and Free State. Born and bred in the Karoo he has a keen interest in, and a wide knowledge of the history and the farm and place names of the region. His love of fieldwork contributed to his expert knowledge of the saga and paraphernalia of the Anglo-Boer War. He is a member of the Geological Society, Palaeontological Society and the Archaeological Society of South Africa. His publication records include multiple articles in international and national recognised journals, books and popular articles.

Cobus Dreyer and Johan Loock are working as a team of independent specialists, in the delivery of consulting services on the project.

EXECUTIVE SUMMARY

Cobus Dreyer Heritage Resource Specialist was appointed by EnviroMatrix Environmental Consultants to undertake a Phase 1 Archaeological and Palaeontological survey as part of the Heritage Impact Assessment, assessing the potential palaeontological impact of the proposed establishment of the Maluti-A-Phofung Industrial Development Zone (MIDZ) situated on the Farm Randfontein 1878, at Tshiame within the Maluti-A-Phofung Local Municipality in the Free State Province.

This report forms part of the Environmental Impact Assessment and complies with the requirements of the South African National Heritage Resource Act No 25 of 1999. In accordance with Section 38 (Heritage Resources Management), a Heritage Impact Assessment (HIA) is required to assess any potential impacts to palaeontological heritage within the development footprint of the proposed MIDZ.

A township, light industrial and agro-processing developments are planned on a portion of the farm Randfontein 1878 near Harrismith, Free State. The present site encircles the existing Tshiame / Industriqua manufacturing area. The area consists of grazing fields, which seem to be undisturbed by farming or residential activities.

From the Archeologically Assessment the following:

During the Anglo-Boer War (1899-1902), British occupational forces were active at Harrismith. The remnants of their camps are still to be seen at King's Hill, Queen's Hill and 42nd Hill.

A cluster of three unmarked stone covered graves and another more recent burial with tomb stone were found at the site. It should be kept in mind that graves at unofficial settlements are mostly unmarked and can be located at any place where the soil is suitable for digging a grave. It is possible that more burials could be found at the site.

Archaeological material occurs in the form of a scatter near the quarry of un-worked Later Stone Age material and a single core tool resembling an Acheulian or Oldowan chopper. As this is a solitary find and no other cultural material occurred, the new developments will have no impact on any archaeological or cultural remains in the area.

From the Palaeological Report the Following:

The development site of the MIDZ is mostly underlain by the late Permian to early Triassic Adelaide Subgroup that consists of grey mudstone, dark-grey shale, siltstone and sandstone. Soils are derived from the underlying rock and are generally shallow and low in fertility. A small river valley on the north-western side of the development area is underlain by more recent Quaternary aged alluvial deposits.

A field investigation confirmed that very few outcrops of potential fossil-rich mudstone beds are present in the study area. There is a very small potential for fossil material in the underlying mudstones that could be uncovered during deep excavations.

Any outcrop areas of the Adelaide Subgroup of the development site have a moderate palaeontological sensitivity rating. Through adequate monitoring and mitigation measures during excavations the high impact severity can be lowered to beneficial. The exposure and subsequent reporting of fossils (that would otherwise have remained undiscovered) to a qualified palaeontologist for excavation will have a beneficial palaeontological impact.

It is recommended that:

- Further planning of the proposed project may continue and no archaeological mitigation measures will be required.
- Prior the construction phase of the MIDZ, the resident ECO be trained by a professional palaeontologist in the recognition of fossils. If fossil material is later discovered i must be appropriately protected and the discovery reported to a palaeontologist for the removal thereof as per SAHRA legislation.
- All earth-moving activities, with the potential to uncover bedrock, are monitored by the resident ECO under the control of a professional palaeontologist.

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1. INTRODUCTION & DESCRIPTION

Enviromatrix (Pty) Ltd, environmental consultants from Bethlehem had been commissioned to compile the Environmental Impact Assessments (EIA) on behalf of the Free State Development Corporation.

Scope and Limitations

The Free State Development Corporation is planning a township, light industrial and agro-processing developments on a 1000ha portion of the farm Randfontein 1878 near Harrismith. The land consists of seemingly undisturbed grazing fields.

The investigation provided the opportunity to examine the proposed area. The soil surface consists of a grass cover. This did not have any restrictive effect on the survey and no limitations were experienced during the field work. I have gained from several previous investigations in and around Harrismith.

Methodology

1. Standard archaeological survey and recording methods applied.
2. Survey of previous HIA reports in the area (SAHRIS).
3. Site inspection on foot and by vehicle.
4. Layout of the area and features plotted by GPS.
5. Surroundings and features recorded on camera.
6. Preparation of maps & literature.
7. Research on the history, archaeology & heritage remains.
8. Prepare map with coordinates transferred to Google Earth.

2. INVESTIGATION

The investigation provided the opportunity to examine the piece of land proposed for the residential development. The site encircles the existing Tshiame / Industriqua manufacturing area (Maps 2&3). The site was investigated on 8 October 2014 in the company of Dr Johan C. Loock, geologist.

The study aims to locate and evaluate the significance of cultural heritage sites, archaeological material, manmade structures older than 60 years, and sites associated with oral histories and graves that might be affected by the proposed developments. In many cases, planted and self-sown trees and other types of vegetation represent a major part of the historical landscape of human settlements in villages and towns, on farmyards or even deserted places in the open veld. These features should be recognised and taken into consideration during any cultural investigation.

The site was examined for possible archaeological and historical material and to establish the potential impact on any cultural material that might be found. The Heritage Impact Assessment (HIA) is done in terms of the National Heritage Resources Act (NHRA), (25 of 1999) and under the National Environmental Management Act, 1998 (Act. 108 of 1998).

Several other impact assessments at Harrismith and environs produced information about archaeological and heritage remains. Investigations had been done at Verkykerskop (Dreyer 2008), Harrismith (Dreyer 2008), King's Hill (Dreyer 2007), Queen's Hill (Dreyer 2005, 2006) and 42nd Hill (Dreyer 2004). The results confirmed that Anglo-Boer War (1900-1902) camping sites are important at Harrismith (Dreyer 2013). Publications on the history of Harrismith also confirm these finds (Steytler 1932, Hawkins 1982, Strachan 2011).

The previous HIA investigations did not produce any Later Iron Age stone walled living sites near Harrismith.

3. ARCHAEOLOGICAL BACKGROUND

The archaeological environment of the Free State is rich and diverse, representing a long time span during the human past. The area is exceptionally rich in terms of Iron Age living sites (Maggs 1976, Dreyer 1996). These Iron Age settlements date between 1660 AD and 1810 AD. For various reasons, there is still a relative lack of information on certain Later Iron Age sites in the north eastern Free State (cf. Dreyer 1999).

The Later Iron Age phase brought people who cultivated crops, kept livestock, produced an abundance of pottery in a variety of shapes and sizes and smelted metals. Extensive stone walled enclosures characterised their permanent settlements. These living places are known from the prominent Sotho/Tswana settlements along the interior rivers in the Free State. A number of Taaibos Korana and Griqua groups, remnants of the Later Stone Age peoples, managed to survive the assimilation by Sotho/Tswana tribes at Mamusa near Schweizer Reneke (Van den Berg 1996:41).

Dramatic climate changes resulted in a rapid population growth along the east coast of South Africa. Increased pressure on natural resources and attempts to control trade during the early 19th century brought the emergence of powerful leaders to the area. The subsequent power struggles resulted in a period of instability in the central parts of Southern Africa. This period of strife or wars of devastation, known as the "difaqane" (Sotho/Tswana) or "Mfecane" (Nguni), affected many of the Black tribes in the interior. Attacks from east of the escarpment initiated by the AmaZulu impis of Chaka in about 1822, were carried on by the AmaNdebele of Mzilikazi and the

AmaNgwane of Matiwane into the Free State, thus uprooting among others, the Batlokwa of Sekonyela and Mantatise and various smaller Sotho/Tswana tribes. On their turn, the Batlokwa drove off the Bafokeng of Sebetoane, who, in their effort to escape the pursuit by the AmaNdebele forces, eventually landed up in the Caprivi (Dreyer & Kilby 2003).

This period of unrest directly affected the peoples of the Northern Free State, resulting in the displacement of scores of tribesmen, women and children. The stronger tribal groups, such as the AmaNdebele of Mzilikazi, assimilated many of these refugees.

Early European missionaries and travellers ventured into the interior of the country during the 19th century (Dreyer 2001).

The Iron Age archaeology of the Free State is characterised by a wide distribution of stone walled sites on the flat-topped ridges and hills. There is detail and consistency in the arrangement and design of the structures. People's expression of culture has left its imprint on the material environment. The settlement patterns display human perceptions with regard to social clustering, economic system and political organisation. Patterns culminate in the arrangement of huts, byres and middens in a particular order and in relation to one another. Spatial organisation in general is characterised by the central position of stock byres and the placing of the main dwelling area on the perimeter of the settlement.

The classification of sites is based on the assumption that settlement layout is bound and prescribed by cultural perceptions. The identification of different ethnic groups is thus possible from the way in which these traditional peoples organised their different living places in terms of space and time. The result was directed by cultural preference (choice) and function. The importance of livestock, personal status, kinship, social organisation and the diverse roles of men, women and offspring have always been important in the understanding of settlement patterns (Maggs 1976, Dreyer 1996).

The Later Iron Age classification of settlement patterns formulated by Maggs (1976), produced a standardised archaeological framework for the ordering of structures and sites characterised respectively by stock enclosures with connecting walls, in certain cases including corbelled huts (Type V), surrounding walls (Type N) and huts with bilobial courtyards (Type Z). Associated pottery assemblages with different decoration styles confirm the classification of sites based on layout (Maggs 1976:290). Different settlement patterns also produced huts of different materials in different styles.

4. HISTORY OF HARRISMITH

Harrismith, originally known as “Vrededorp” (Peace Town) was founded in 1849. The initial settlement on the Elands River was laid out by Robert Moffat at Aberfeldy about 25km from the present location. This site unfortunately proved to be deficient in water and was moved to the present site at the junction of the Winburg and Potchefstroom roads to Natal in 1850. It was then named after the British Governor Sir Harry Smith. The settlement obtained municipal status in 1874. During the diamond rush at Kimberley, the town became a busy staging post on the Natal transport route, bringing hotels, stores and public buildings to spring up. During the Anglo-Boer War (1899-1902), Harrismith became a major base of the British military forces with blockhouses, engineering works and a military cemetery to tell the story (Steytler 1932, Jacobs 1952, Hawkins 1982).

5. ANGLO-BOER WAR (1899-1902)

During the Anglo-Boer War (1899-1902), the British occupational forces were active in and around Harrismith until up to or even until their official withdrawal at the outbreak of the First World War (WWI) in 1914 (Breytenbach 1978, Pakenham 1997, Dreyer 2007). The remnants of their camps can still be seen at King’s Hill, Queen’s Hill and 42nd Hill. The badges of the 80th Regiment of Foot (Staffordshire Volunteers), the Gloucestershire Regiment and 3rd Dragoon Guards are still recognisable against the hill to the north west of town. Regular maintenance by the Harrismith Heritage Foundation, the MOTHS Military Veteran Society and, until their disbandment, the Harrismith Commando, watched over the stone-built and whitewashed badges against the hill (Dreyer 2013).

6. LOCALITY

Township, light industrial and agro-processing developments are planned on a portion of the farm Randfontein 1878 near Harrismith, Free State (Fig. 13.1).

The development will cover about 1000ha south of the N5 main road to Kestell consisting mainly of undisturbed grazing fields (Figs. 13.1&13.2). The site is dissected Water course near the Quarry (Fig. 13.10).

The following GPS co-ordinates (Cape scale) were taken (2829AA) (Fig. 13.2&13.3):

- **A** 28°17’13”S 029°02’37”E Altitude 1642m (Fig. 13. 1).
- **D** 28°17’08”S 029°02’51”E Altitude 1633m (Fig. 13. 2).
- **Glenlennie** 28°15’57”S 029°00’35”E Altitude 1620m.
- **Borrow pit** 28°16’05”S 029°00’39”E Altitude 1635m (Fig.13.3) .
- **H** 28°17’30”S 029°00’06”E Altitude 1697m (Fig. 13. 4).
- **B** 28°17’19”S 028°59’40”E Altitude 1655m. (Fig. 13 .5).
- **J** 28°17’20”S 029°01’02”E Altitude 1678m (Fig. 13. 6).

- **E** 28°16’39”S 029°00’59”E Altitude 1652m (Fig. 13. 7).
- **G1** 28°16’10”S 029°00’24”E Altitude 1634m.
- **G2** 28°16’29”S 029°00’24”E Altitude 1635m.

7. RESULTS

During the Anglo-Boer War (1899-1902), British occupational forces were active in and around Harrismith. The remnants of their camps are at King’s Hill, Queen’s Hill and 42nd Hill. Insignia of the 80th Regiment of Foot (Staffordshire Volunteers), the Gloucestershire Regiment and 3rd Dragoon Guards, are still recognisable against the hill (Dreyer 2013). The actual campsite below the hill had been unlawfully scrutinised by treasure hunters using metal detectors, literally clearing the surface of all Anglo-Boer War material.

A cluster of three unmarked stone covered graves (G2) and another more recent burial with tomb stone (G1) were found (Map 3). It should be kept in mind that graves at unofficial settlements are mostly unmarked and can be located at any place where the soil is suitable for digging a grave. It is possible that more burials could be found at the site in future.

A scatter of un-worked Later Stone Age lithic material (Fig.8) and a single core tool (Fig.9) resembling an Acheulian or Oldowan chopper were found near the quarry. As this is a solitary find and no other cultural material occurred, the new developments will have no impact on any archaeological or cultural remains in the area.

8. IMPACT ASSESSMENT

Archaeological material appears to be a solitary find and no other cultural material occurred. The new developments will have no impact on any archaeological or cultural remains in the area.

The developments could have an impact on the graves. It is possible that more burials could be found at the site.

9. RECOMMENDATIONS

Further planning of the proposed project may continue.

10. MITIGATION

Mitigation measures will be required in case of the discovery of human skeletal material. In such a case the Free State Heritage in Bloemfontein and the South African Heritage Resources Agency (SAHRA) in Cape Town should immediately be informed.

11. ACKNOWLEDGEMENTS

I thank Tom Hugo from Bethlehem for directing us to the site. I also thank Dr Johan C. Loock, PhD (HC) from Bloemfontein for clearing up the geology and local Anglo-Boer War history in an exceptional way.

I owe gratitude to Mohlalefe Seleke for assistance and encouragement to complete the research and to prepare the paper.

I have also gained from previous investigations on the region of Harrismith.

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13. LIST OF ILLUSTRATIONS:

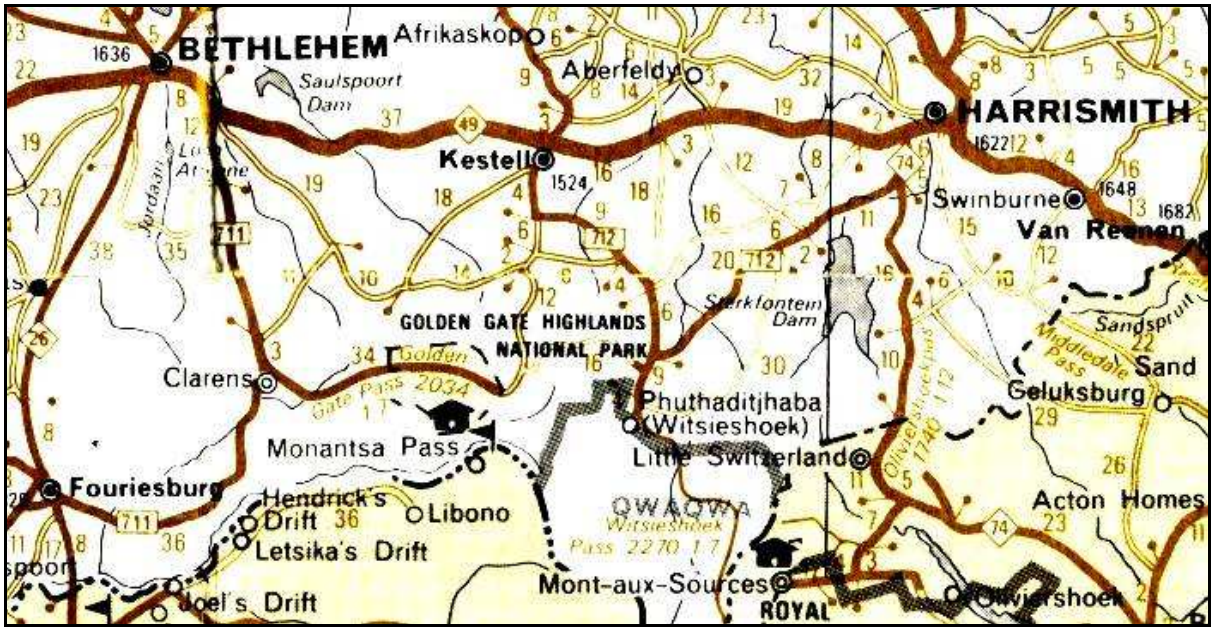

Figure 13.1 Harrismith in relation to the N5 to Kestell, Bethlehem and the N3 to Van Reenen.

Figure 13.2 Locality of the development area with GPS coordinates indicated.

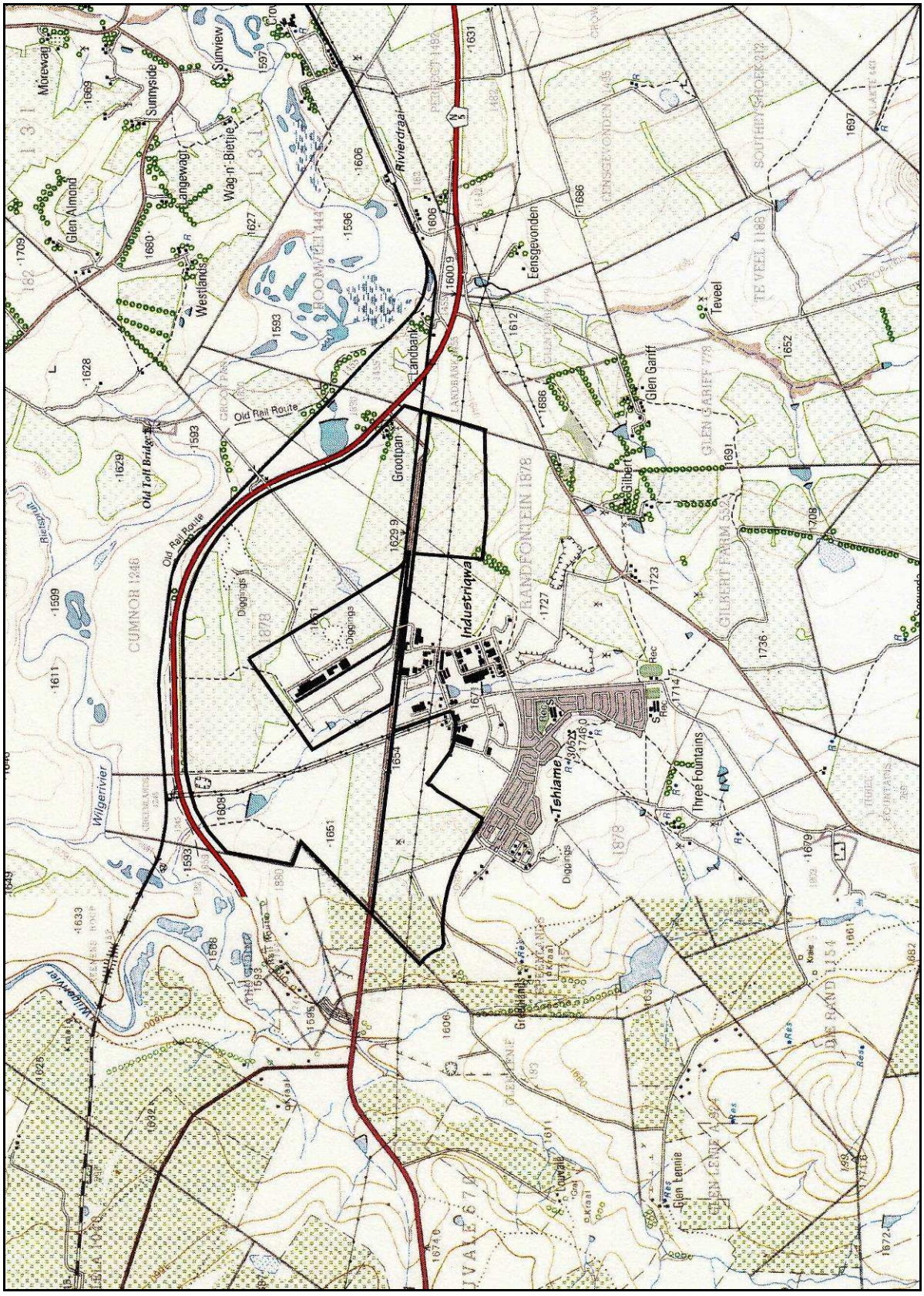

Figure 13.3 Locality of the proposed developments at Randfontein 1878, Harrismith (2829AA).

Figure 13.4 Point A at Industriqua near Harrismith.

Figure 13.5 Point D at Industriqua near Harrismith.

Figure 13.6 Quarry at Industriqua / Randfontein 1878 near Harrismith.

Figure 13.7 Informal stock kraals at Point H, Industriqua / Randfontein 1878 near Harrismith.

Figure 13.8 Point B, Industriqua / Randfontein 1878 near Harrismith.

Figure 13.9 Point J, Industriqua / Randfontein 1878 near Harrismith.

Figure 13.10 Point E, Industriqwa / Randfontein 1878 near Harrismith.

Figure 13.11 LSA lithic material near the Quarry, Industriqua / Randfontein 1878, Harrismith.

Figure 13.12 Stone artefacts near the Quarry, Industriqua / Randfontein 1878, Harrismith. (Pocket knife = 84mm).

Figure 13.13 Water course near the Quarry Industriqua / Randfontein 1878, Harrismith.

14. ANNEXURE A – PALAEOLOGICAL REPORT

PALAEONTOLOGICAL IMPACT ASSESSMENT REPORT

FOR THE PROPOSED ESTABLISHMENT OF AN INDUSTRIAL DEVELOPMENT ZONE BY THE FREE STATE DEVELOPMENT CORPORATION AT TSHIAME, MALUTI-A-PHOFUNG LOCAL MUNICIPALITY

10 OCTOBER 2014

JOHAN C. LOOCK GEOLOGIST

EXCLUSIVE SUMMARY

Johan C. Loock Geologist was appointed by EnviroMatrix Environmental Consultants to undertake a Phase 1 Palaeontological survey as part of the Heritage Impact Assessment, assessing the potential palaeontological impact of the proposed establishment of the Maluti-A-Phofung Industrial Development Zone (MIDZ) situated on the Farm Randfontein 1878, at Tshiame within the Maluti-A-Phofung Local Municipality in the Free State Province.

This report forms part of the Environmental Impact Assessment and complies with the requirements of the South African National Heritage Resource Act No 25 of 1999. In accordance with Section 38 (Heritage Resources Management), a Heritage Impact Assessment (HIA) is required to assess any potential impacts to palaeontological heritage within the development footprint of the proposed MIDZ.

A basic assessment of the topography and geology of the area was made by using appropriate geological (1:250 000) maps in conjunction with Google Earth. A review of the literature on the geological formations exposed at surface in the development site and the fossils that have been associated with these geological strata was undertaken. A field investigation was conducted on 08 October 2014, with the aim 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 development site of the MIDZ is mostly underlain by the late Permian to early Triassic Adelaide Subgroup that consists of grey mudstone, dark-grey shale, siltstone and sandstone. Soils are derived from the underlying rock and are generally shallow and low in fertility. A small river valley on the north-western side of the development area is underlain by more recent Quaternary aged alluvial deposits.

The field investigations confirmed that very few outcrops of potential fossil-rich mudstone beds are present in the study area. There is a very small potential for fossil material in the underlying mudstones that could be uncovered during deep excavations.

Any outcrop areas of the Adelaide Subgroup of the development site have a moderate palaeontological sensitivity rating. Through adequate monitoring and mitigation measures during excavations the high impact severity can be lowered to beneficial. The exposure and subsequent reporting of fossils (that would otherwise have remained undiscovered) to a qualified palaeontologist for excavation will have a beneficial palaeontological impact.

It is recommended that, prior the construction phase of the MIDZ, the resident ECO be trained by a professional palaeontologist in the recognition of fossils. If fossil material is later discovered during the construction phase it must be appropriately protected and the discovery reported to a palaeontologist for the removal thereof as per SAHRA legislation. All earth-moving activities, with the potential to uncover bedrock, are monitored by the resident ECO under the control of a professional palaeontologist. A monitoring report should be submitted to SAHRA after completion of the earth-moving activities.

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1. INTRODUCTION

1.1. Background

Johan C. Loock Geologist was appointed by EnviroMatrix Environmental Consultants to undertake a Phase 1 Palaeontological survey as part of the Heritage Impact Assessment, assessing the potential palaeontological impact of the proposed establishment of the Maluti-A-Phofung Industrial Development Zone (MIDZ) situated on the Farm Randfontein 1878, at Tshiame within the Maluti-A-Phofung Local Municipality in the Free State Province.

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

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.

1.2. Aims and Methodology

Following the *"SAHRA APM Guidelines: Minimum Standards for the Archaeological & Palaeontological Components of Impact Assessment Reports"* the aims of the palaeontological impact Phase 1 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;
- conducting fieldwork to assess the immediate risk to exposed fossils as well as to document and sample these localities;
- to commenting on the impact of the development on these exposed and/or potential fossil resources and
- to making recommendations as to how the developer should conserve or mitigate damage to these resources.

In preparing a palaeontological study the potential fossiliferous rock units (groups, formations etc) represented within the study area are determined from geological maps. 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.

A field investigation of the site was conducted on 08 October 2014 by Dr J Loock and Mr Cobus Dreyer, both experienced fieldworkers. The aim of the fieldwork was to confirm the results of the desktop study, 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 extent of fresh bedrock excavation envisaged. The different sensitivity classes used are explained in Table 1.1 below.

Table 1.1 Palaeontological Sensitivity Analysis Outcome Classification

Sensitivity	Description
Low Sensitivity	Areas where there is likely to be a negligible impact on the fossil heritage. This category is reserved largely for areas underlain by igneous rocks. However, development in fossil bearing strata with shallow excavations or with deep soils or weathered bedrock can also form part of this category.
Moderate Sensitivity	Areas where fossil bearing rock units are present but fossil finds are localised or within thin or scattered sub-units. Pending the nature and scale of the proposed development the chances of finding fossils are moderate. A field-based assessment by a professional palaeontologist is usually warranted.
High Sensitivity	Areas where fossil bearing rock units are present with a very high possibility of finding fossils of a specific assemblage zone. Fossils will most probably be present in all outcrops and the chances of finding fossils during a field-based assessment by a professional palaeontologist are very high. Palaeontological mitigation measures need to be incorporated into the Environmental Management Plan

1.3. Scope and Limitations of the 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), iv) a field assessment in the form of a site walk over to gain first hand knowledge of the site and v) 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 are also inadequate databases for fossil heritage for much of the RSA, due to the small number of professional palaeontologists carrying out fieldwork in RSA. 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 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 tectonism or weathering, or are buried beneath a thick mantle of unfossiliferous “drift” (soil, alluvium etc).

2. DESCRIPTION OF THE PROPOSED DEVELOPMENT

The proposed establishment of a MIDZ is an open area of approximately 1000 ha that will be altered into a industrial area and is situated on the Farm Randfontein 1878, forming an oxbow around the current Industriqwa industrial development, south of the N5 Kestell to Harrismith National road, at general GPS coordinates 28°17’04.3”S and 29°01’06.3”E as illustrated in figure 2.1.

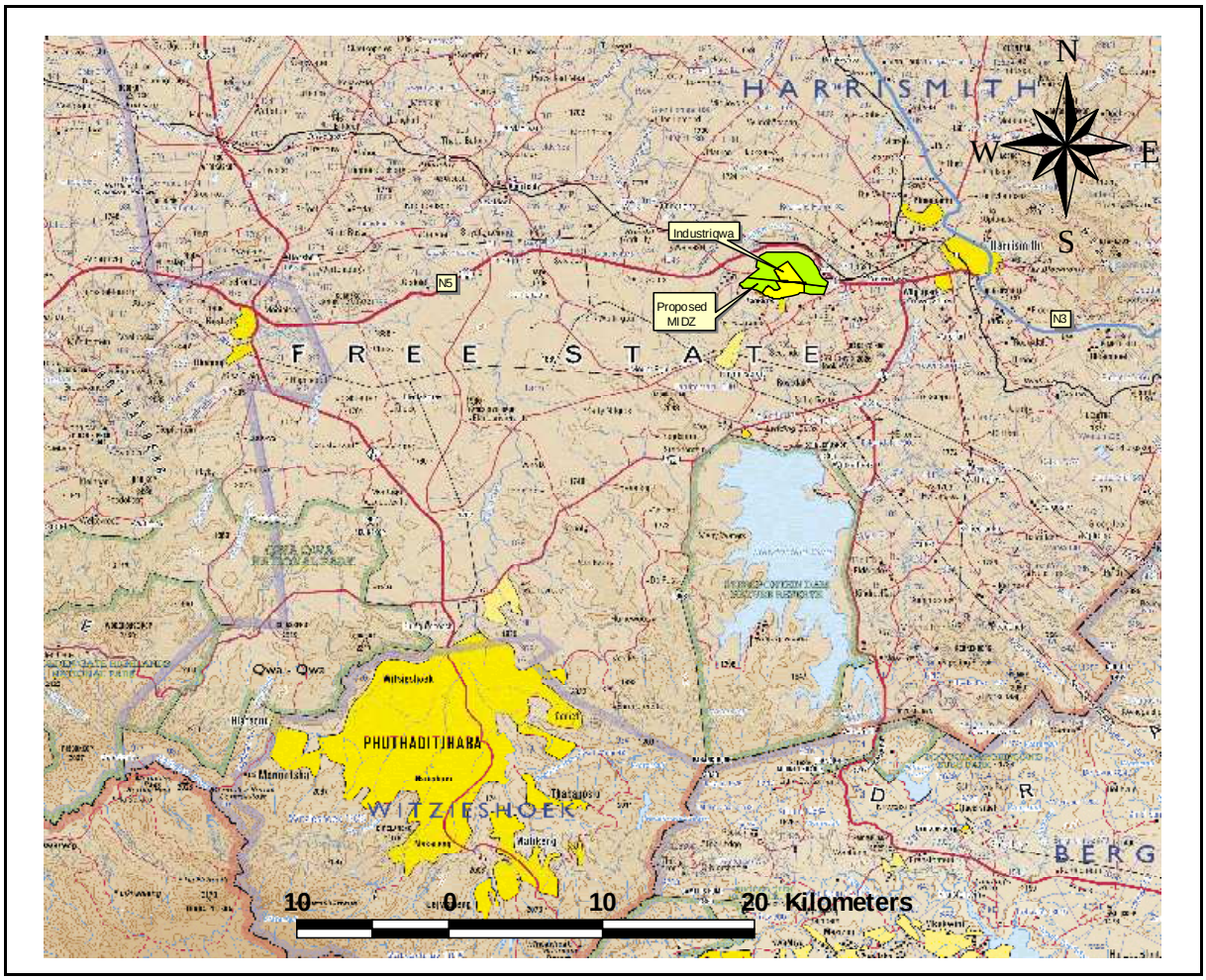


Figure 2.1 Locality of the proposed MIDZ

3. GEOLOGY OF THE AREA

The proposed MIDZ development is situated on the northern middle slopes bordering the Wilger River flood plains. The geology around development area, as illustrated in figure 3.1, is underlain by the Adelaide and Tarkastad Subgroups of the Beaufort Group of the Karoo Supergroup. Dolerite sills dominate the high laying areas and Quaternary sediments occur in the valley floors.

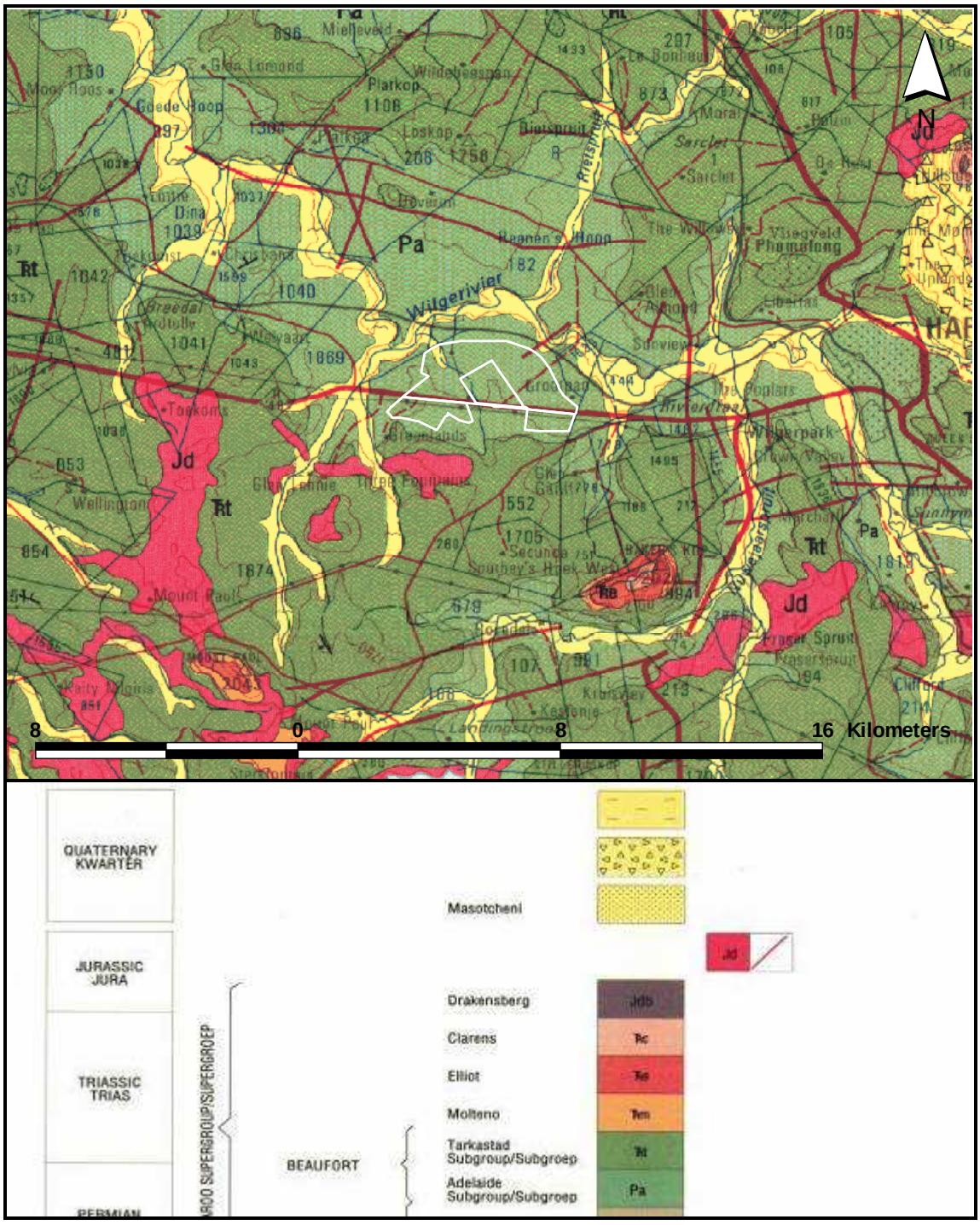


Figure 3.1 **The geology of the MIDZ development area (Geo Map 2828- Harrismith)**

3.1. The Adelaide Subgroup

The development site is mostly underlain by the late Permian to early Triassic Adelaide Subgroup that consists of grey mudstone, dark-grey shale, siltstone and sandstone. Soils are derived from the underlying rock and are generally shallow and low in fertility.

3.1.1. The Harrismith Member

The Triassic Harrismith Member (Normandien Formation of the Adelaide Subgroup) comprises a brightly coloured mudstone that underlies the prominent sandstone of the Katberg Formation of the Tarkastad Subgroup.

3.2. Quaternary Deposits

A small river valley on the north-western side of the development area is underlain by more recent Quaternary aged alluvial deposits.

4. PALAEONTOLOGY OF THE AREA

4.1. The Adelaide Subgroup Formation

The late Permian to Triassic Adelaide Subgroup can have a moderate to high potential for fossils from the *Dicynodon* and *Lystrosaurus* Assemblage Zones (Rubidge et al, 1995; Johnson et al, 2006). Rubidge (1995) lists Fishes, Amphibians, Reptiles, Invertebrates and Plant fossils in the Adelaide Formation, upper portion as at Harrismith.

Plant fossils expected from these rocks include examples of *Glossopteris* assemblages and examples of other genera include *Cyclodendron, Phyllotheca* and *Noeggerathiopsis.* Invertebrate fossils are restricted to trace fossils, including casts of some vertebrate burrows (Groenewald, 1996).

Seventy eight different species of fossils were found in the total area of the Karoo. However, it does not mean that anyone fossil or for that matter, all of then could occur on any farm.

4.1.1. The Harrismith Member

The Triassic Harrismith Member is very productive and is palaeontologically known as the *Lystrosaurus* Assemblage zone. It contains fossils of the *Lystrosaurus* Assemblage zone, including casts of vertebrate burrows (Groenewald, 1996).

4.2. Quaternary Deposits

Due to the alluvial character of this sediment no fossils will be found.

5. FIELD INVESTIGATION

The general topography of the development area is dominated by rolling hills (Figure 5.1). However, the proposed MIDZ are restricted to the flat to slightly undulating terrain central to the development area. Outcrops of the Adelaide Subgroup are restricted to road cuttings and erosion gullies (Figure 5.2).

Figure 5.1 **Rolling hill topography underlain by Adelaide Subgroup**

Figure 5.2 Typical outcrops of the Adelaide Subgroup sediments just outside the study area

Figure 5.3 Slab with small slivers of unidentified fossil bones

During the field investigation on 08 October 2014 all roads in and around the proposed development area were examined. It a few places the road-builders had cut through the Karoo beds and left a jumble of soil and rock chips. No fossil bones or rocks with identifiable bones were seen. In a small slab next to the road, a very thin clay-pebble conglomerate was observed. Very small slivers of bones were seen (Figure 5.3). However, these fragments are too small to identify the type or species of fossil.

An abandoned borrow pit on the eastern site of the property exposed the mudstone of the Adelaide Formation, Karoo Supergroup (Figure 5.4). A few hundred small calcareous concretions were examined within and around the borrow pit. The reason is that some calcareous concretions may contain skulls of reptiles of the Karoo. Unfortunately not a single fossil was found.

In his massive compilation of farms listing Karoo fossils Kitching (1977) does not even mentioned the proposed development area or adjoining farms. Likewise Rubidge (1995) in his publication on the biostratigraphic of the Beaufort Group does not list the area.

Figure 5.4 Abandoned borrow pit with exposed the mudstone of the Adelaide Formation

6. PALAEONTOLOGICAL SIGNIFICANCE

The predicted palaeontological impact of the development is based on the initial mapping assessment and literature reviews as well as information gathered during the field investigation.

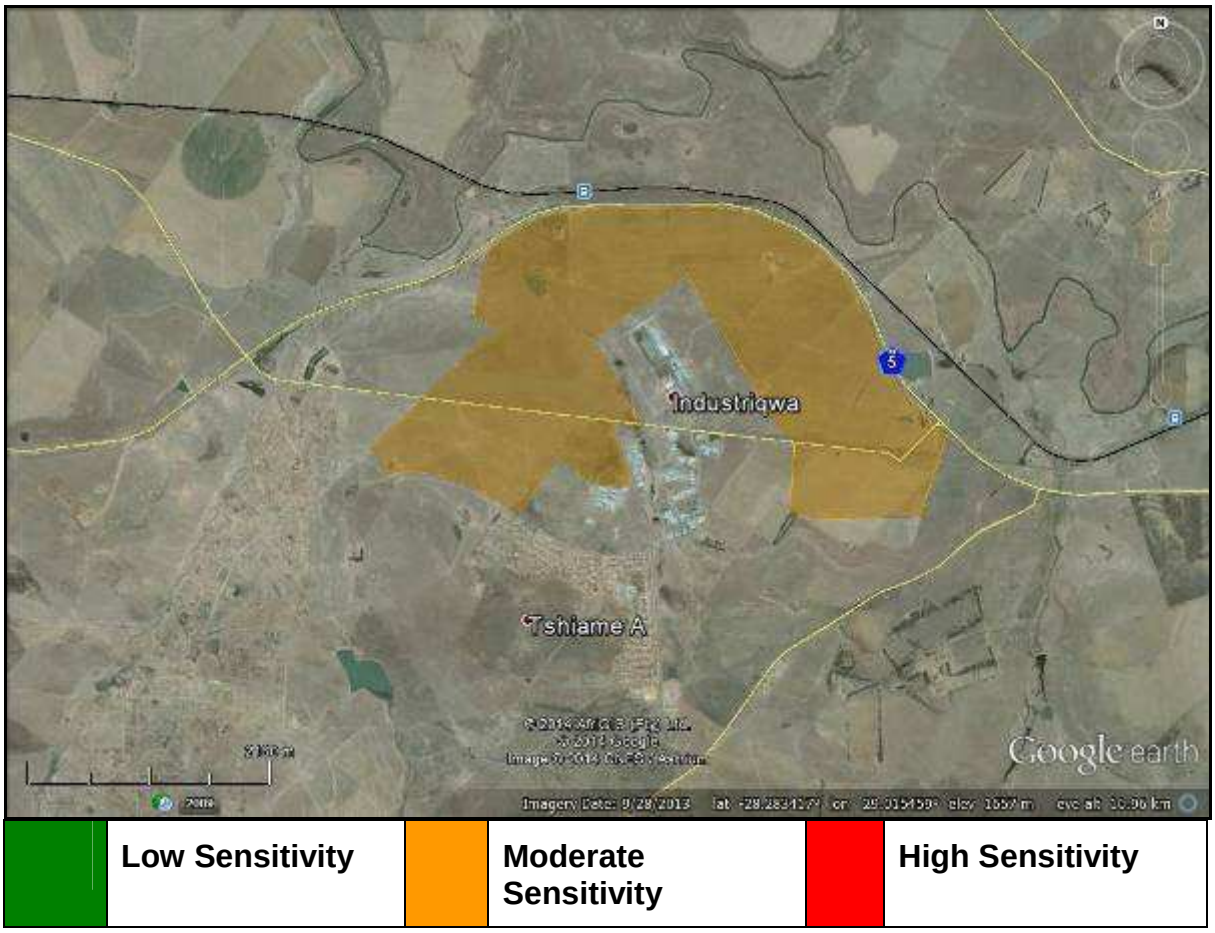
There is a very small possibility that fossils could be encountered during deep excavation of bedrock within the development footprint and these fossils would be of international significance. The palaeontological significance is summarised in Table 6.1 and illustrated in figure 6.1.

Table 6.1 Palaeontological significance of geological units on site

Geological Unit	Rock Type and Age	Fossil Heritage	Vertebrate Biozone	Palaeontological Sensitivity
Adelaide Subgroup including Harrismith Member	Fluvial and lacustrine mudstones and sandstones. LATE PERMIAN TO EARLY TRIASSIC	Vertebrate fossils from the *Dicynodon* and *Lystrosaurus* assemblage zones can be expected. Plant fossils such as *Glossopteris* assemblages and other genera including *Cyclodendron, Phyllotheca* and *Noeggerathiopsis.* Invertebrate fossils are restricted to trace fossils, including casts of some vertebrate burrows	*Dicynodon* and *Lystrosaurus* Assemblage Zones	High sensitivity

Unfortunately within the Adelaide Subgroup, there is no way of assessing the likelihood of encountering fossils during excavation. As evidenced in other similar areas with exposures, fossils were apparently absent or very scarce over large areas but locally dense accumulations were found.

If effective mitigation measures are in place at the time of exposure, and the fossils are successfully excavated for study, this would represent a beneficial palaeontological impact.



	Low Sensitivity		**Moderate Sensitivity**		**High Sensitivity**

Figure 6.1 Palaeontological sensitivity of the proposed MIDZ

7. CONCLUSION AND RECOMMENDATIONS

The development site for the proposed MIDZ is underlain by the Late Permian Adelaide Subgroup, with outcrops limited to road cutting and erosion gullies. There is a small potential for fossil material in the underlying mudstones that could be uncovered during deep excavations.

Any outcrop areas of the Adelaide Subgroup of the development site have a moderate palaeontological sensitivity rating. Through adequate monitoring and mitigation measures during excavations the high impact severity can be lowered to beneficial. The exposure and subsequent reporting of fossils (that would otherwise have remained undiscovered) to a qualified palaeontologist for excavation will have a beneficial palaeontological impact.

It is recommended that:

Prior to the construction phase of the MIDZ the resident ECO must be trained by a professional palaeontologist in the recognition of fossils. If fossil material is later discovered it must be appropriately protected and the discovery reported to a palaeontologist for the removal thereof as per SAHRA legislation.

During the construction phase all earth-moving activities, with the potential to uncover bedrock, are monitored by the resident ECO under the control of a professional palaeontologist. A monitoring report should be submitted to SAHRA after completion of the earth-moving activities.

8. REFERENCES

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9. QUALIFICATIONS & EXPERIENCE OF THE AUTHOR

Dr Johan C. Loock has a PhD (HC) from the University of the Orange Free State in Bloemfontein. He specialises in research on the Karoo and has 50 years of experience in fieldwork and the teaching of the stratigraphy and sedimentology. He is a member of the Palaeontological, Geological and Archaeological Societies of Southern Africa. His publication records include multiple articles in international and national recognised journals, books and popular articles.

10. DECLARATION OF INDEPENDENCE

I, Johan Loock, 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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Geologist