

**HERITAGE SURVEY OF THE PROPOSED  
INJISUTHI BRIDGE UPGRADE, KWAZULU-NATAL  
  
FOR AFZELIA ENVIRONMENTAL CONSULTANTS  
  
DATE: 23 AUGUST 2014**

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## **INTRODUCTION**

KwaZulu Natal Department of Transport (KZN DoT) proposes to upgrade the Injisuthi river bridge in the Emoyeni area within the Imbabazane Local Municipality under uThukela District Municipality. The land, on which construction of the bridge will take place, is under the jurisdiction of Ingonyama trust Board and approval to utilise this land have been obtained from Ingonyama Trust Board

The existing one lane bridge is part of the D214, situated approximately 32km west, north west of Estcourt a few kilometers past Loskop toward Winterton. The D214 has presently a single lane bridge. The proposed activity includes the construction of a concrete causeway using concrete culverts instead of pipes; the size of the causeway is approximately 5.800m wide and 8.250m in length. These dimensions could vary depending on the width of the waterway / stream to be crossed. The one lane bridge will be demolished to make way for the construction of the new two lane bridge.

Figures 1 – 3 show the location of bridge.

FIG. 1 GENERAL LOCATION OF THE GOURTON BRIDGE

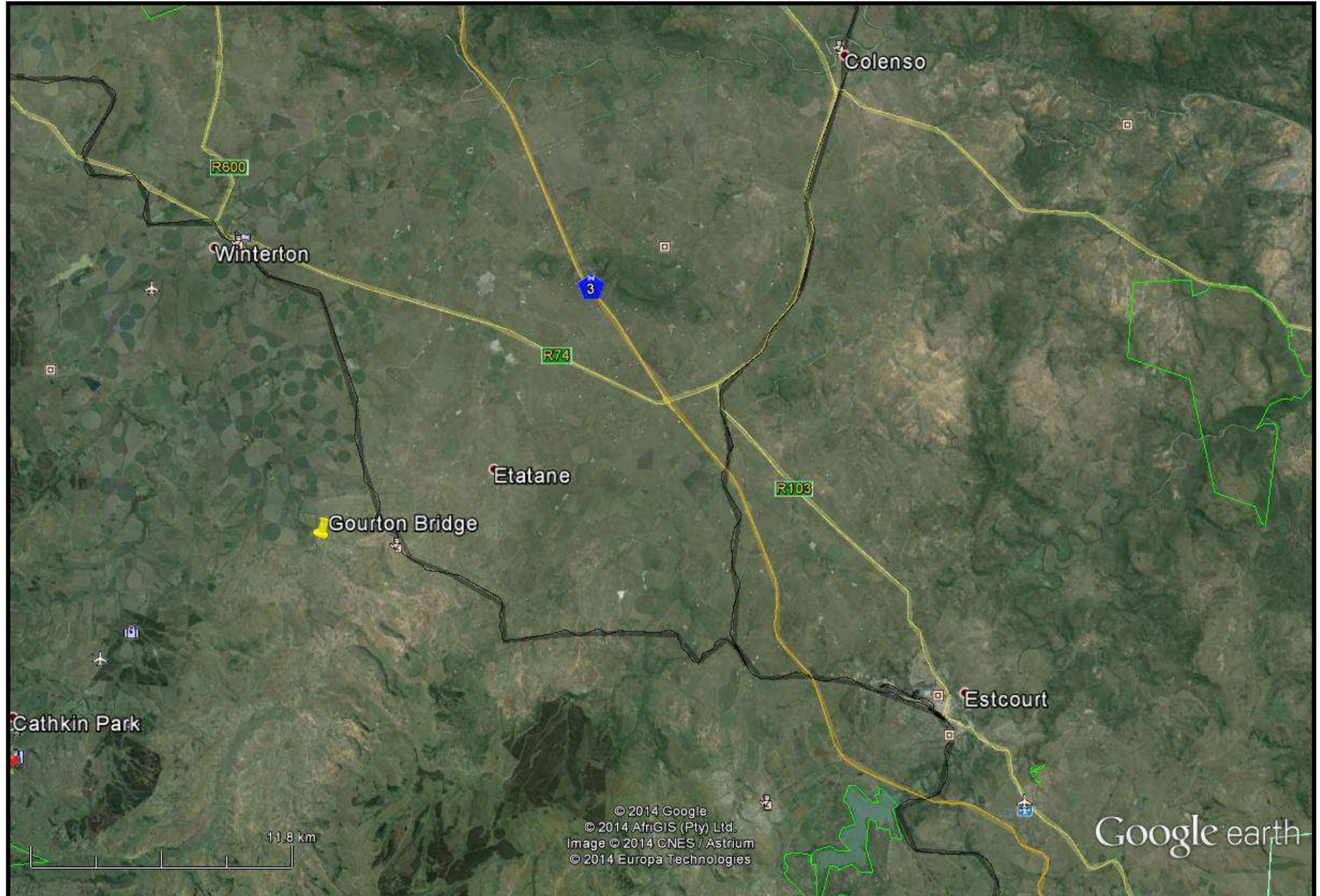


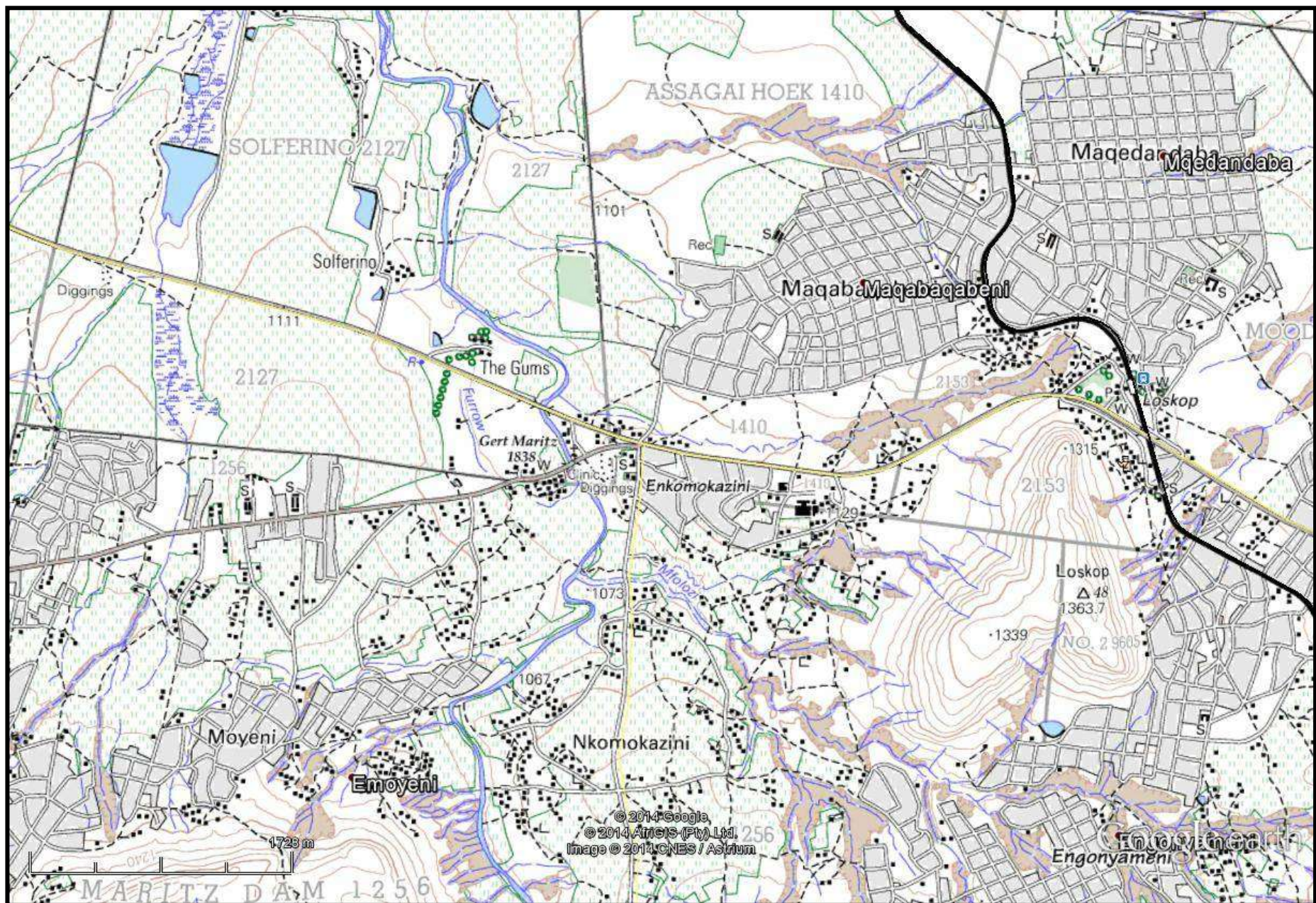


FIG. 2: AERIAL OVERVIEW OF THE GOURTON BRIDGE





FIG. 3: TOPOGRAPHICAL MAP OF THE GOURTON BRIDGE





## 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 1<sup>st</sup> and 2<sup>nd</sup> 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.

## **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. 4). These sites include all types of Stone Age and Iron Age sites. No sites occur in the study area.

One National Monument occurs in the study area. This is the Gerit Maritz Saailaer (1838) monument.



FIG. 4: LOCATION OF KNOWN HERITAGE SITES NEAR THE STUDY AREA



The 1944 topographical map indicates that the area has no settlements on either side of the road and river bank (fig. 5).

The 1973 aerial photograph indicates that the area is still undisturbed and that the Gerit Maritz monument has been erected. The Monument was established in 1956 by the then Historical Monuments Council, now called SAHRA. The monument is to Gerit Maritz who established his settlement, Sooilager) in 1838, along the banks of the Injisuthi River. Another lager was established on the opposite side of the river. Maritz died here, and was later reburied at Blaauwkrantz. The outer walls of the two laagers were made from earth sods. The laager was used over a short time and no fixed structures appear to have been made.

The bridge was opened in 1893 by the Hon. F.R. Moor Premier of Natal (1906-1910). The bridge was reconstructed in 1913.



FIG. 5: STUDY AREA IN 1944

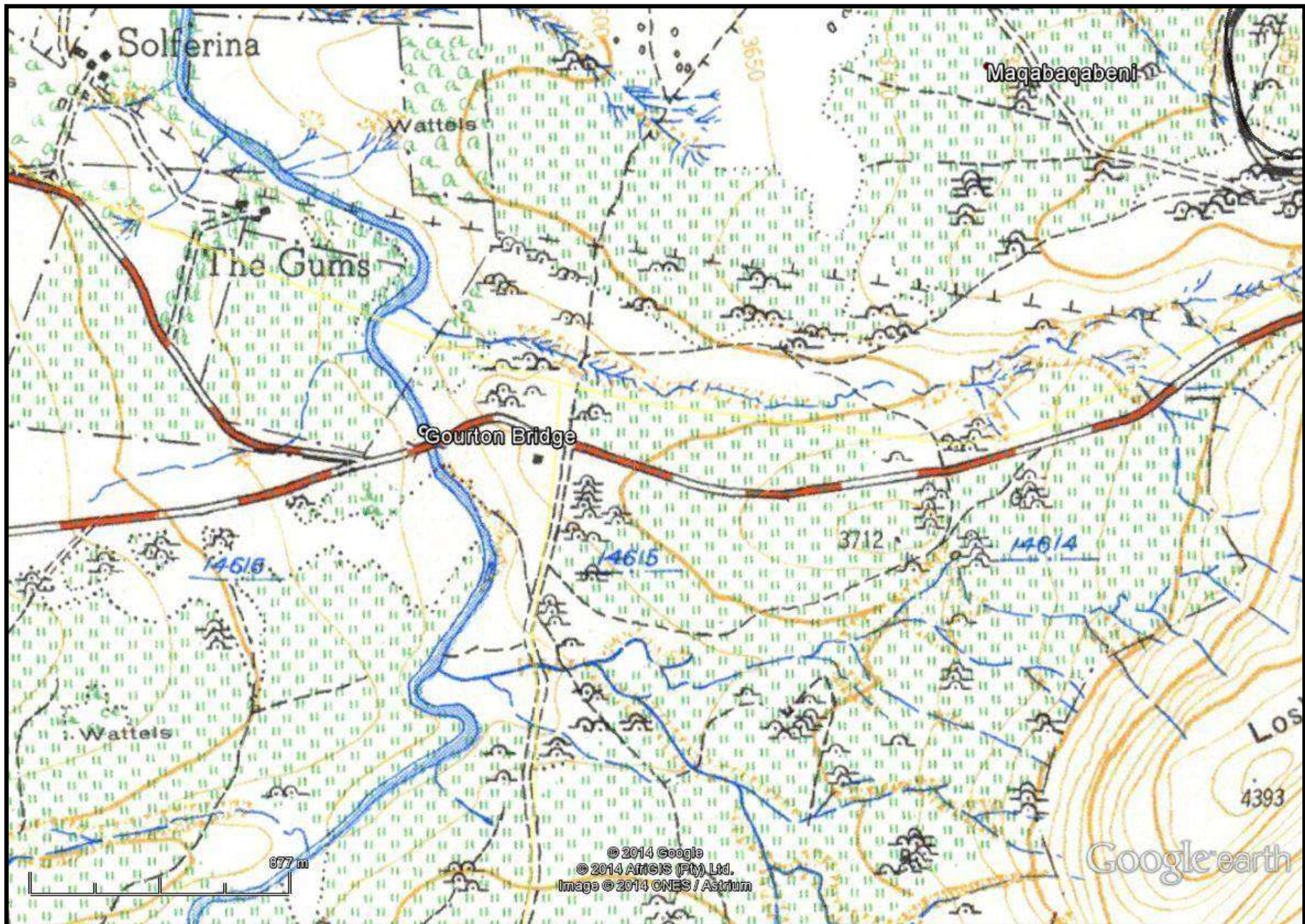




FIG. 6: STUDY AREA IN 1973



## FIELD SURVEY

The field survey was undertaken in August 2014. Two heritage sites were noted: Gourton Bridge and the Gerit Maritz Soolaer Monument.

The Gourton Bridge is a single lane bridge over the Injisuthi River. The Gourton Bridge was initially built in 1893, and later rebuilt in 1913. The bridge is still in use, however the railings have been damaged – these are presumably more recent railings. Fig. 7 shows the main bridge and plaques.

The bridge foundations are still in tact, however they would only support a single lane bridge. Figure 8 shows these foundations and on-ramps.

Significance: The bridge is generally protected as it is a built structure over 60 years in age. The bridge itself is of low significance, but the structures are of architectural interest.

Mitigation: The bridge is automatically protected by the KZNHA as it is older than 60 years. A permit will be required to damage and/or alter the bridge.

I have consulted with Amafa KZN Built Environment who suggested that the piers are preserved and the deck construction is reinforced with concrete. This was recently undertaken for the Venterspruit Bridge, near Royal Natal. The bridge will be widened and the engineers should salvage the low walls at the on-ramps containing the foundation stones and have them repositioned on the new on ramps.



FIG. 7: GENERAL VIEWS OF THE GOURTON BRIDGE

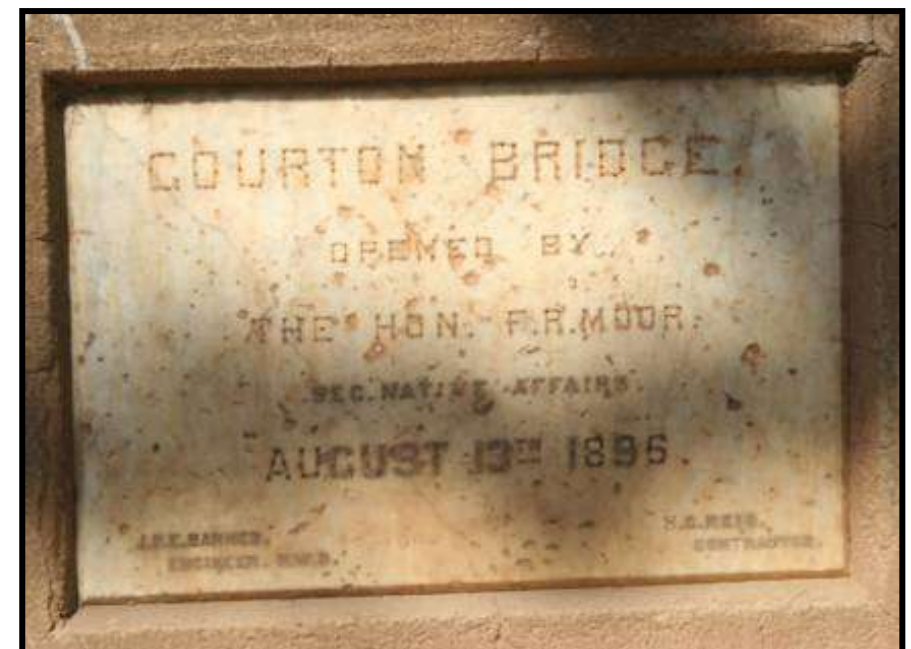
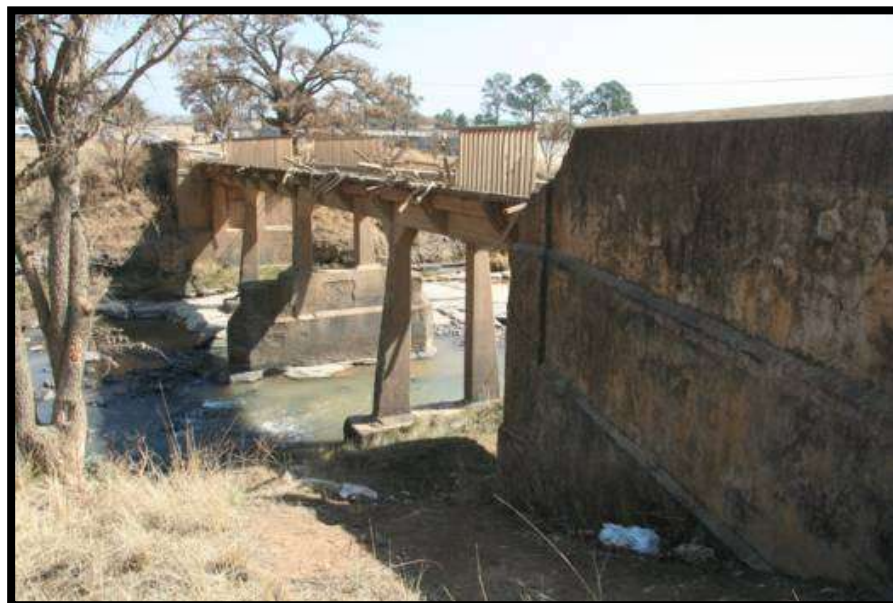




FIG. 8: GENERAL VIEWS OF THE GOURTON BRIDGE FOUNDATIONS



The Gerit Maritz Monument was established in 1956. The monument is to Gerit Maritz who established his settlement, Sooilager, in 1838, along the banks of the Injisuthi River. Another lager was established on the opposite side of the river. Maritz died here, and was later reburied at Blaauwkrantz. The outer walls of the two laagers were made from earth sods.

The monument itself is in a good status; however the land around the monument has been severely disturbed. There is a quarry to the east of the monument, while the area to the west is eroded and has a recent cattle containment area. These are shown in fig. 9. The laager made by Hans Dons would have occurred where the clinic currently stands. The northern side of the road both have buildings.

The laager was used over a short time and no fixed structures appear to have been made. The walling was made from earth and these would have eroded within a few years after the camp was deserted. While the Voortrekkers would have left artefacts in the ground, the duration of the encampment would result in ephemeral scatters of, or a few isolated, artefacts. That is the deposit would be of low significance.

The monument does have high significance in terms of Voortrekker history in KwaZulu-Natal. Maritz had moved from Doornkop to Loskop to establish a settlement. Late in December 1838, member of this settlement had left to support A.W.J. Pretorius at Blood River, or Ncome River. After the Battle of Blood River, the commando returned and the Voortrekker dispersed. Gerit Maritz, amongst others, died at Sooilager. These remains were relocated in 1895 to the Blaauwkrans Monument.

Significance: The monument is of high significance. However the deposit and surrounding area has been affected by roads, erosion and the quarry.



FIG. 9: GERIT MARITZ MONUMENT



Mitigation: The monument should not be affected by the bridge upgrade. It is currently 35m from the road, and 73m from the bridge. A 20m buffer should be placed around the monument. It is highly unlikely that artefacts related to Sooilager will be found in the bridge footprint, and thus no mitigation will be required for the rest of the monument.

## **PALAEONTOLOGICAL DESKTOP ASSESSMENT**

The bridge is located in a an area of high palaeontological sensitivity, and will probably expose fossils at a depth of 2m. "All sections of the development where bedrock is exposed due to erosion or where geotechnical surveys indicate that bedrock will be exposed during excavation, must be inspected by a Professional Palaeontologist and fossils collected according to SAHRA and AMAFA specifications as part of a Phase 1 Palaeontological Impact Assessment" (Groenewald PIA desktop, Appendix A).

## **CONCLUSION**

A heritage survey was undertaken for the Injisuthi, or Gourton, Bridge upgrade. The bridge will become a double lane bridge. The Gourton Bridge was originally built in 1896, and rebuilt in 1913, and is still in use today. The Gerit Monument for Sooilager also occur in the study area.

The bridge may be rebuilt, however the existing structures should be incorporated with the new structures. The monument should not be affected by the new bridge. A palaeontologist will be required if the construction impacts on the bedrock.

The Dept. Of Transport will need to apply to Amafa KZN for a permit to alter the bridge. The application will need full details of the new bridge design indicating how the older bridge will be incorporated.

**APPENDIX A**  
**PALAEONTOLOGICAL DESKTOP IMPACT ASSESSMENT**



**DESKTOP PALAEOONTOLOGICAL  
ASSESSMENT FOR THE PROPOSED  
UPGRADE OF THE INJISUTHI RIVER  
BRIDGE IN THE EMOYENI AREA WITHIN  
THE IMBABAZANE LOCAL MUNICIPALITY  
UNDER UTHUKELA DISTRICT  
MUNICIPALITY, KWAZULU-NATAL  
PROVINCE.**

**FOR  
Umlando**

**DATE: 22 August 2014**

**By**

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Cell: 082 339 9202**

## EXECUTIVE SUMMARY

Gideon Groenewald was appointed to undertake a desktop survey, assessing the potential Palaeontological Impact of the proposed construction of an upgrade of the Injisuthi river bridge in the Emoyeni area within the Imbabazane Local Municipality under uThukela District Municipality. The proposed activity includes the construction of a concrete causeway using concrete culverts instead of pipes; the size of the causeway is approximately 5.800m wide and 8.250m in length. These dimensions could vary depending on the width of the waterway / stream to be crossed.

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 footprint of the proposed construction of an upgrade of the Injisuthi river bridge in the Emoyeni area within the Imbabazane Local Municipality under uThukela District Municipality is underlain by Permian to Triassic aged siltstone and sandstone of the Adelaide Subgroup, as well as silt and sand of the Quaternary Alluvium deposits. Numerous plant fossils, mainly associated with the *Glossopteris* Assemblage, as well as vertebrate fossils of the *Dicynodon* and *Lystrosaurus* Assemblage Zones of the Adelaide Subgroup and trace fossils, including casts of vertebrate burrows have been described from these units. A High Palaeontological sensitivity is allocated to areas underlain by the Adelaide Subgroup, on the assumption that fresh outcrops are present, or that excavation activity will expose fresh bedrock. A High Palaeontological sensitivity is allocated to the area underlain by alluvium on the assumption that the alluvium will be removed during construction, which will expose Adelaide Subgroup sediments.

### Recommendations:

1. The EAP and ECO of the project must be informed of the fact that numerous fossils have been described from the geological formations that underlies the development site.
2. All sections of the development where bedrock is exposed due to erosion or where geotechnical surveys indicate that bedrock will be exposed during excavation, must be inspected by a Professional Palaeontologist and fossils collected according to SAHRA and AMAFA specifications as part of a Phase 1 Palaeontological Impact Assessment.

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## INTRODUCTION

Gideon Groenewald was appointed to undertake a desktop survey, assessing the potential Palaeontological Impact of the proposed construction of an upgrade of the Injisuthi river bridge in the Emoyeni area within the Imbabazane Local Municipality under uThukela District Municipality. The proposed activity includes the construction of a concrete causeway using concrete culverts instead of pipes; the size of the causeway is approximately 5.800m wide and 8.250m in length. These dimensions could vary depending on the width of the waterway / stream to be crossed. The one lane bridge will be demolished to make way for the construction of the new two lane bridge. Lower Thukela Region in KwaZulu-Natal. The existing one lane bridge is part of the D214, situated approximately 32km west, north west of Estcourt a few kilometers past Loskop toward Winterton. The D214 has presently an old bridge wide enough to accommodate for one smaller vehicle at a time (Figure 1).



Figure 1. Locality of the Injisuthi Bridge

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

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

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

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

**METHODOLOGY**

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

to identify exposed and subsurface rock formations that are considered to be palaeontologically significant;

to assess the level of palaeontological significance of these formations;

to comment on the impact of the development on these exposed and/or potential fossil resources and

to make recommendations as to how the developer should conserve or mitigate damage to these resources.

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

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

**Table 1 Palaeontological sensitivity analysis outcome classification**

<b>Sensitivity</b>	<b>Description</b>
<b>Low Sensitivity</b>	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.
<b>Moderate Sensitivity</b>	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.
<b>High Sensitivity</b>	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

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

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

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

- an underestimation of the palaeontological significance of a given study area due to ignorance of significant recorded or unrecorded fossils preserved there, or
- an overestimation of the palaeontological sensitivity of a study area, for example when originally rich fossil assemblages inferred from



geological maps have in fact been destroyed by weathering, or are buried beneath a thick mantle of unfossiliferous “drift” (soil, alluvium etc).

## GEOLOGY

The larger part of the study area is underlain by Permian to Triassic aged rocks of the Adelaide and Tarkastad Subgroups, Beaufort Group of the Karoo Supergroup, Jurassic aged dolerite intrusions and Quaternary aged sediments of the Masotcheni Formation and alluvium (Figure 2).

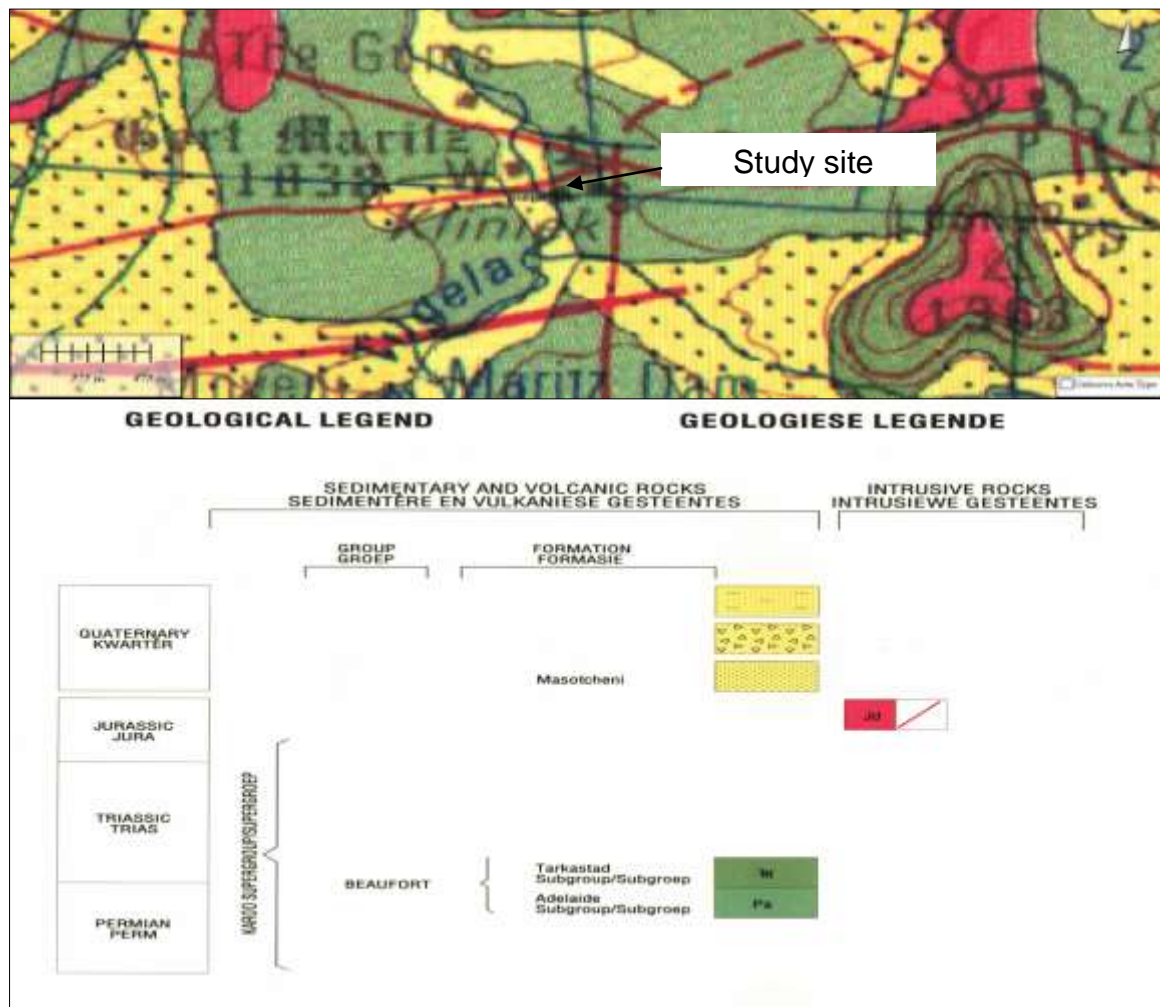


Figure 2 Geology of the Study Area

The specific site where the Injisuthi Bridge is planned falls partly on sedimentary rocks of the Adelaide Subgroup and alluvium.

### Adelaide Subgroup (Pa)

The Permian to Triassic aged Adelaide Subgroup is an assemblage of fluvial sediments, ranging from grey-green mudstone, siltstone and fine-grained

sandstone. The deposits represent meandering river deposits in this part of Gondwanaland during the Late Permian and Early Triassic (Johnson et al, 2006). The site at the bridge falls about 100m below the boundary of the Adelaide and Tarkastad Subgroups and can therefore be correlated with the upper part of the Normandien Formation, and possibly the Harrismith Member (Groenewald, 1996).

### **Alluvium**

The alluvium associated with this development site consists mainly of fine-grained sand and silts with associated pebble layers.

## **PALAEONTOLOGY**

### **Adelaide Subgroup (Pa)**

The Adelaide Subgroup, with special reference to the Normandien Formation, is highly productive as far as fossils are concerned. Fossils, including plant fossils of *Glossopteris* and vertebrate fossils of the *Dicynodon* and *Lystrosaurus* Assemblage zones have been recorded from these rock units (Rubidge et al, 1995; Groenewald, 1996; Johnson et al, 2006).

The upper part of the Normandien Formation is characterised by a prominent red mudstone unit, the Triassic aged Harrismith Member, dominated by the occurrence of fossils from the *Lystrosaurus* Assemblage Zone, including casts of vertebrate burrows (Groenewald, 1996; MacRae, 1999; McCarthy and Rubidge, 2005).

### **Quaternary Alluvium**

Quaternary aged fossil remains have not been recorded from the sediments in the study area. Significant fossils have however been recorded from similar deposits in South Africa.

## **DISCUSSION**

The predicted palaeontological impact of the development is based on the initial mapping assessment and literature reviews.

A variety of fossils have been described from the Permian to Triassic aged Adelaide Subgroup and includes plant fossils of the *Glossopteris* Assemblage and vertebrate fossils of the *Dicynodon* and *Lystrosaurus* Assemblage Zones. Invertebrate fossils include several small trace fossils as well as casts of vertebrate burrows.

The palaeontological significance is summarised in Table 2.

**Table 2 Palaeontological significance of geological units on site**

Geological Unit	Rock Type and Age	Fossil Heritage	Vertebrate Biozone	Palaeontological Sensitivity
Adelaide Subgroup	Siltstone and fine-grained sandstone PERMIAN/TRIASSIC	Plant fossils of the <i>Glossopteris</i> Assemblage. Vertebrate fossils of the <i>Dicynodon</i> and <i>Lystrosaurus</i> Assemblage Zones Trace fossils including casts of vertebrate burrows	Dicynodon and Lystrosaurus	High Sensitivity
Quaternary Alluvium	Silt and sand QUATERNARY	Vertebrate fossils	None	High Sensitivity (Assumption that Alluvium will be removed during construction)

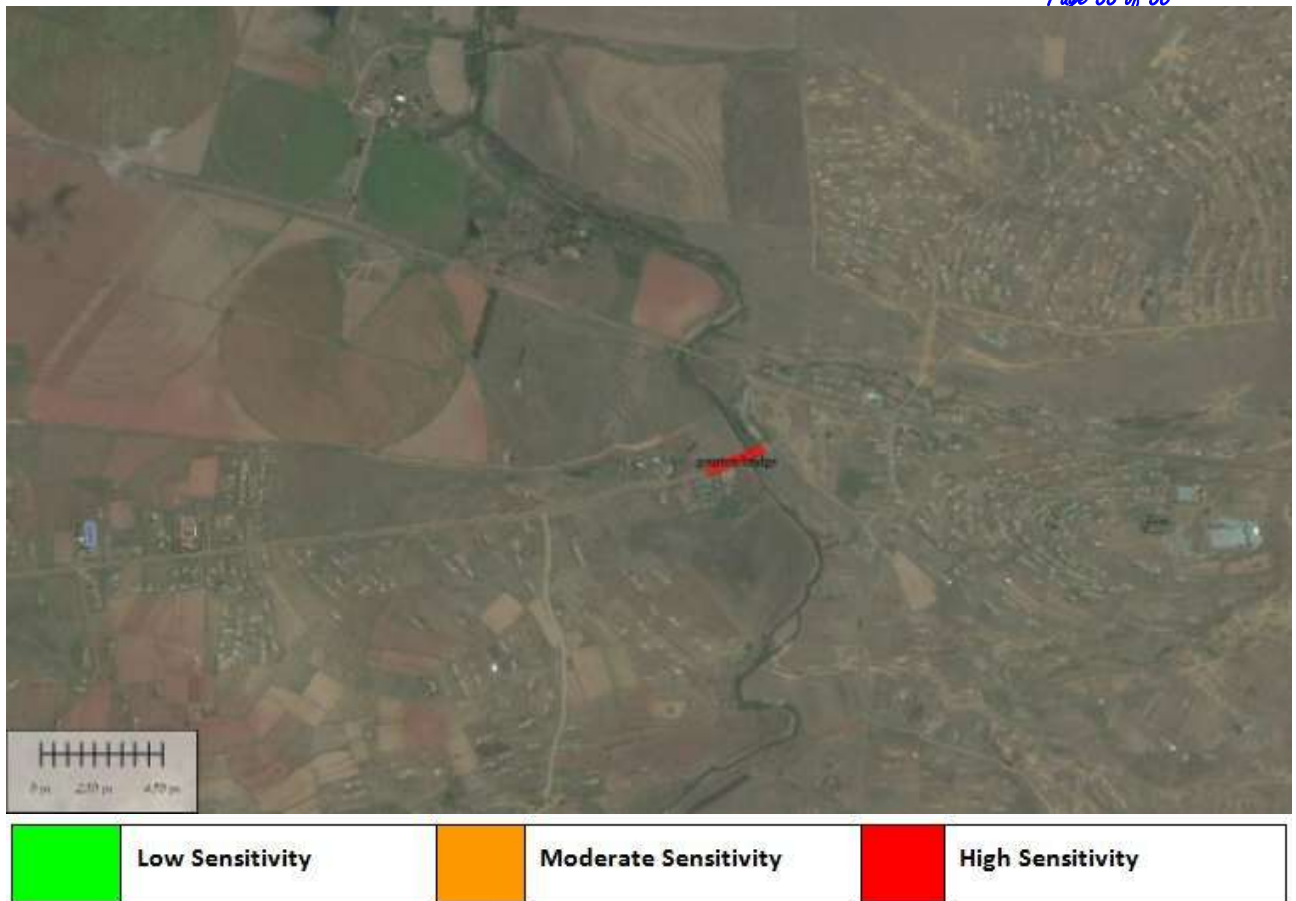
## MANAGEMENT PLAN

The likely impact of the proposed development on local fossil heritage is determined on the basis of the palaeontological sensitivity of the rock units concerned and the nature and scale of the development itself, most notably the extent of fresh bedrock excavation envisaged. The different sensitivity classes used are explained in Table 1 and the palaeontological sensitivity of the rock units are provided in Table 2.

The palaeontological sensitivity of the development is related to the specific geology that underlies the development footprints. For the sake of this desktop survey it is assumed that trenching of up to 2m depth will in fact expose fresh bedrock. In areas underlain by rocks of the Adelaide Subgroup and specifically where trenching into alluvial material will potentially expose fresh bedrock, a High Palaeontological sensitivity is allocated to the study site.

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





**Figure 3 Palaeontological Sensitivity of the Injisuthi Bridge development**

### **CONCLUSION AND RECOMMENDATIONS**

The footprint of the proposed construction of an upgrade of the Injisuthi river bridge in the Emoyeni area within the Imbabazane Local Municipality under uThukela District Municipality is underlain by Permian to Triassic aged siltstone and sandstone of the Adelaide Subgroup, as well as silt and sand of the Quaternary Alluvium deposits. Numerous plant fossils, mainly associated with the *Glossopteris* Assemblage, as well as vertebrate fossils of the *Dicynodon* and *Lystrosaurus* Assemblage Zones of the Adelaide Subgroup and trace fossils, including casts of vertebrate burrows have been described from these units. A High Palaeontological sensitivity is allocated to areas underlain by the Adelaide Subgroup, on the assumption that fresh outcrops are present, or that excavation activity will expose fresh bedrock. A High Palaeontological sensitivity is allocated to the area underlain by alluvium on the assumption that the alluvium will be removed during construction, which will expose Adelaide Subgroup sediments.

Recommendations:

1. The EAP and ECO of the project must be informed of the fact that numerous fossils have been described from the geological formations that underlies the development site.

2. All sections of the development where bedrock is exposed due to erosion or where geotechnical surveys indicate that bedrock will be exposed during excavation, must be inspected by a Professional Palaeontologist and fossils collected according to SAHRA and AMAFA specifications as part of a Phase 1 Palaeontological Impact Assessment.

### REFERENCES

**Groenewald GH. 1996.** Stratigraphy and Sedimentology of the Tarkastad Subgroup, Karoo Supergroup, South Africa. Unpublished PhD Thesis, University of Port Elizabeth.

**Johnson MR , Anhaeusser CR and Thomas RJ (Eds). 2006.** The Geology of South Africa. GSSA, Council for Geoscience, Pretoria.

**Linstrom W. 1987.** Die Geologie van die gebied Durban. Explanation Sheet 2930 (1:250 000). Geological Survey of South. Africa.

**MacRae C. 1999.** Life Etched in Stone. GSSA Publication.

**McCarthy T and Rubidge B. 2005.** The Story of Earth and Life. Struik Publishers.

**Rubidge BS (ed) 1995.** Biostratigraphy of the Beaufort Group (Karoo Supergroup), South Africa. South African Committee for Stratigraphy.

## **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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Geologist