

**PALAEONTOLOGICAL DESKTOP
ASSESSMENT FOR THE PROPOSED
UPGRADE OF THE GOLELA TO NSEZI RAIL
LINE IN KWA-ZULU NATAL PROVINCE**

For:

HIA CONSULTANTS



DATE: 16 February 2014

By

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EXECUTIVE SUMMARY

Gideon Groenewald was appointed by PGS Heritage to undertake a desktop survey, assessing the potential palaeontological impact of the proposed upgrade of the Golela to Nsezi Rail Line in Kwa-Zulu Natal 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 project.

Transnet in collaboration with Swaziland Railway identified the construction and upgrade of the railway line between Davel in Mpumalanga and Richards Bay in KwaZulu-Natal, connecting via the Swaziland rail network, as a strategic project. The aim of the project is to unlock the potential of a multinational strategic rail corridor and divert general freight traffic off the dedicated heavy haul Richards Bay coal line which runs from Ermelo through rural KwaZulu-Natal to Richards Bay.

This report specifically pertains to the KwaZulu-Natal railway line from Golela to Nsezi (Reference number 14/12/16/3/3/2/552).

The section from Golela to Nsezi is underlain by volcanic rocks of the Jurassic Letaba Formation and sediments of the Cretaceous to Quaternary coastal plains of Kwa-Zulu Natal. Sections underlain by igneous rocks have been allocated a Low Palaeontological Sensitivity. Areas underlain by Cretaceous and Tertiary aged fossiliferous units of the Zululand Group were allocated a High Palaeontological Sensitivity. Areas underlain by more recent Makatini Group sediments and redistributed sand were allocated Medium and Low Palaeontological Sensitivity.

It is recommended that

1. The developer as well as the EAP must be informed of the fact that sections of the proposed upgrading of the railway line is underlain by rocks with a High and Moderate Palaeontological Sensitivity .
2. A qualified palaeontologist must be appointed to
 - apply for a collection and destruction permit for palaeontological material that might be present in all the areas where a High and Moderate Palaeontological Sensitivity is indicated
 - undertake a Phase 1 Palaeontological Impact Assessment in areas with a High and Moderate Palaeontological Sensitivity to record the presence of fossils
 - prepare a protocol document for the monitoring of the sensitive areas during construction
 - make the necessary arrangements with the developer and contractors to visit the sites during construction for regular inspection and reporting to SAHRA
 - make the necessary arrangement with an appropriate Institute for Palaeontological Research, as approved by SAHRA, where the fossils will be curated.
3. The developer must inform the palaeontologist and SAHRA of any fossils recorded in areas where a Moderate Palaeontological Sensitivity is indicated.

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1. INTRODUCTION

1.1. Background

Gideon Groenewald was appointed by PGS Heritage to undertake a desktop survey, assessing the potential palaeontological impact of the proposed upgrade of the Golela to Nsezi Rail Line in Kwa-Zulu Natal 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 project.

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 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. The known fossil heritage within each rock unit is inventoried from the published scientific literature and previous palaeontological impact studies in the same region.

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 a negligible impact on the fossil heritage is likely. 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 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. 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.).

2. DESCRIPTION OF THE PROPOSED DEVELOPMENT

Transnet SOC Limited (hereafter referred to as Transnet) is a government (state) owned company (SOC) and is the custodian of South Africa's railway, ports and pipelines, thereby responsible for delivering reliable freight transport and handling services that satisfy customer demand.

As such, Transnet in collaboration with Swaziland Railway identified the construction and upgrade of the railway line between Davel in Mpumalanga and Richards Bay in KwaZulu-Natal, connecting via the Swaziland rail network, as a strategic project. The aim of the project is to unlock the potential of a multinational strategic rail corridor and divert general freight traffic off the dedicated heavy haul Richards Bay coal line which runs from Ermelo through rural KwaZulu-Natal to Richards Bay.

The project activities will consist of various works, including the upgrading of existing railway sections (including re-building certain sections), construction of an entirely new rail link from Lothair in South Africa to Sidvokodvo in Swaziland and construction of new rail yards. These proposed works trigger a number of listed activities as specified in the National Environmental Management Act (NEMA), 107 of 1998, the National Water Act (NWA), 36 of 1998 and the National Environmental Management: Waste Act (NEM:WA), 59 of 2008.

Due to the magnitude of the proposed project, which stretches over a distance of approximately 570 km including Swaziland, it was decided that three applications will be compiled as follows:

1. Davel yard and connections, DEA ref no 14/12/16/3/3/2/551;
2. Mpumalanga rail line from Davel to Nerston, DEA ref no 14/12/16/3/3/2/553;
3. KwaZulu-Natal railway line from Golela to Nsezi, DEA ref no 14/12/16/3/3/2/552.

Each of the three sections will go through the EIA process separately, although concurrently (as far as possible) in order to simplify the public participation process and to reduce any potential confusion. **This report specifically pertains to application 3 as mentioned above, i.e. the KwaZulu-Natal railway line from Golela to Nsezi (Reference number 14/12/16/3/3/2/552)**

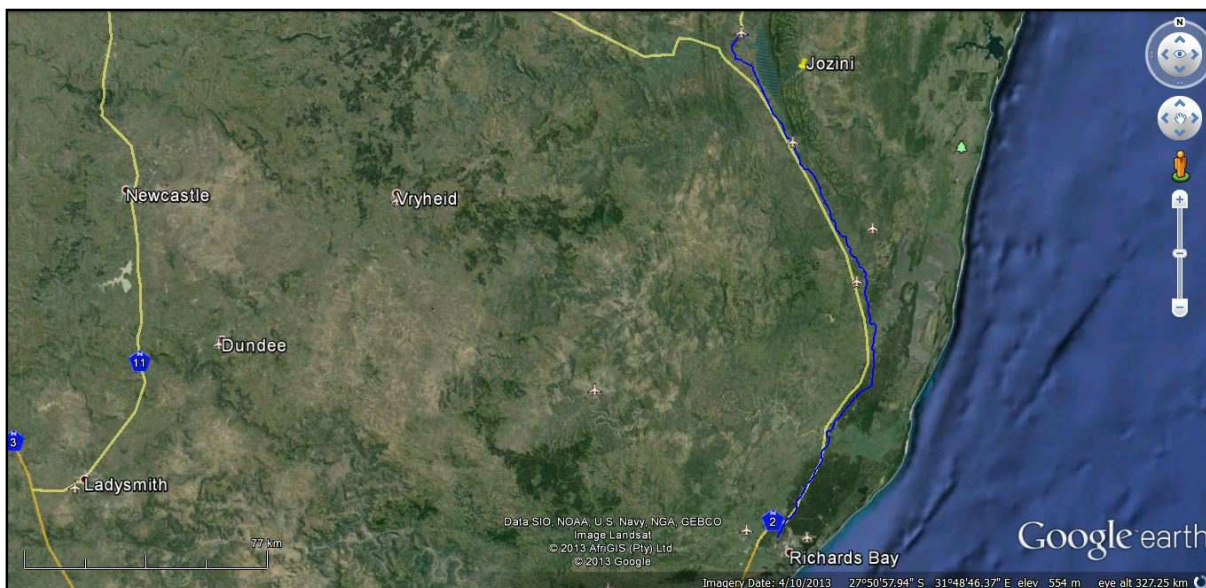


Figure 2.1 Locality of the Kwa-Zulu Natal Rail line from Golela to Nsezi

3. GEOLOGY

The route of the proposed railway line between Golela and Nsezi is underlain by Jurassic to Cretaceous aged rocks that comprises sedimentary as well as volcanic units. Quaternary sedimentary deposits also underlie parts of the project. A small section approximately 32 km N-NE of Nsezi is underlain by Swazian aged intrusive rocks (Figure 3.1).

3.1. Nseleni Gneiss (Zns)

A small section of the study area approximately 32km N-NE of Nsezi is underlain by Swazian aged granodioritic to tonalitic Gneiss.

3.2. Lebombo Group

3.2.1. Letaba Formation (Jl)

The Letaba formation is predominantly a Jurassic aged basalt with interbedded layers of rhyolitic lava.

3.3. Zululand Group

3.3.2. Makatini Formation (Km)

The Makatini Formation is a Cretaceous aged unit of conglomerate, sandstone and siltstone. The formation unconformably overlies much older Lebombo Group volcanic rocks and consists of a sequence of small pebble conglomerates, sandstone, siltstone and limestone up to 80 m in thickness (Johnson et al, 2006). The Makatini Formation is capped by a fossiliferous marine sandstone (Du Preez and Wolmarans, 1986).

3.3.3. Mzinene Formation (K mz)

The Mzinene Formation is mainly a glauconitic fossiliferous sandstone with well-defined *Teredo* –type hiatus concretions (Du Preez and Wolmarans, 1986). The Mzinene Formation is separated from the Makatini Formation by a hard ground or well indurated concretionary horizon bored by *Lithophaga*, a rock boring gastropod (Johnson et al, 2006).

3.3.4. St Lucia Formation (K-Ts)

The St Lucia Formation is lithologically similar to the Mzinene Formation, consisting of mainly siltstone and sandstone. It is also separated from the underlying formation by a similarly bored hard ground (Wolmarans and Du Preez, 1986; Johnson et al, 2006).

3.4. Berea Formation (Qbe)

The Berea formation consists of basal aeolianites, truncated by calcified beach and dune deposits of the Last Interglacial-age

3.5. Maputoland Group.

3.5.5. Muzi Formation (Qm).

The Muzi Formation comprises primarily a sequence of argillaceous sand that overlies the Zululand Group. The Pleistocene sediments represent a vlei or

swamp deposit consisting of mottled, brown clayey sand with few outcrops (Wolmarans and Du Preez, 1986).

3.6. Redistributed sand (Qs).

A relatively long section of the study area is underlain by redistributed sand deposits.

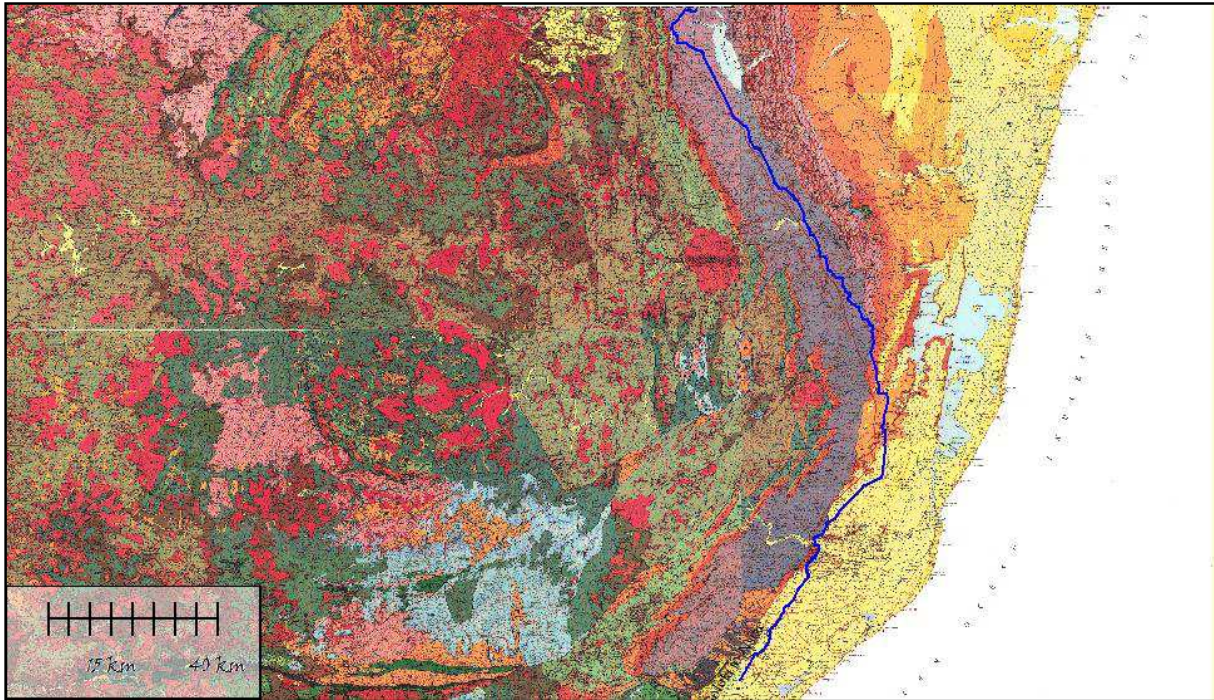
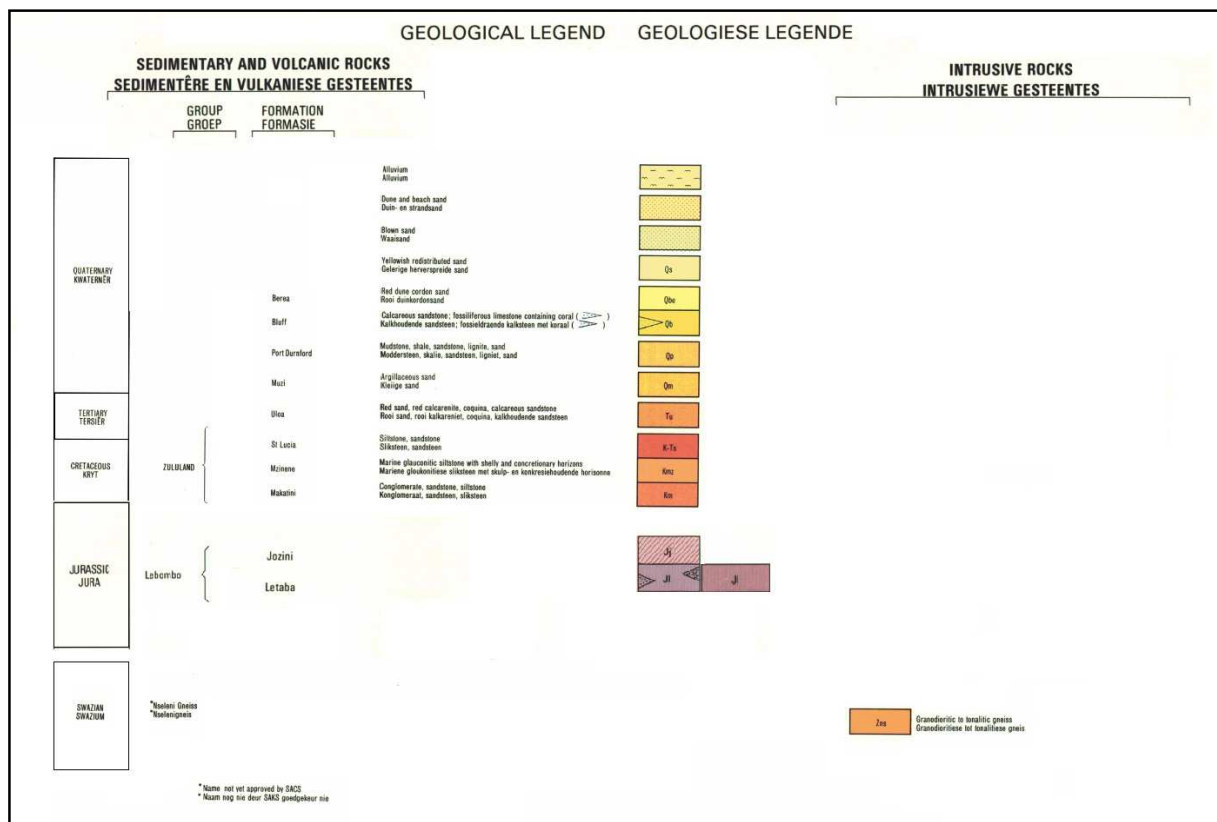


Figure 3.1 Geology of the Kwa-Zulu Natal rail line from Golela to Nsezi



4. PALAEOLOGY AND PALAEOLOGICAL SENSITIVITY OF THE STUDY AREA

4.1. Nseleni Gneiss (Zns)

Due to the volcanic character and age of this formation it is unlikely to contain any significant fossils. A Low Palaeontological Sensitivity is allocated to this section of the route.

4.2. Lebombo Group

4.2.1. Letaba Formation (Jl)

Due to the volcanic character of this formation it is unlikely to contain any significant fossils and no fossils have been recorded to date. A Low Palaeontological Sensitivity is allocated to this section of the route.

4.3. Zululand Group

4.3.2. Makatini Formation (Km).

The Makatini Formation contains large fossil logs that are pervasively drilled by *Teredo* wood boring organisms (Johnson et al, 2006). Interfingering fine-grained sediments contain bored fossil tree trunks, smaller plant fragments and marine invertebrates. A High Palaeontological Sensitivity is allocated to the formation.

4.3.3. Mzinene Formation (K mz).

The Mzinene Formation consists of glauconitic siltstone and sandstone with a rich invertebrate fauna, including bivalves, gastropods, ammonites, nautiloids and echinoids. *Lithophaga*, i.e. bored concretions, are common. Fossil logs, bored by *Teredo* are frequently found in the formation (Johnson

et al, 2006). The palaeo-environment is interpreted as shallow-marine. The formation is allocated a High Palaeontological Sensitivity.

4.3.4. St Lucia Formation (K-Ts).

The St Lucia Formation is more fossiliferous than the underlying Mzinene Formation and contains an abundance of echinoid, bivalve, gastropod and cephalopod remains as well as fossil logs, plant fragments, reptile bones and at least 62 ostracod species (Johnson et al, 2006). A High Palaeontological Sensitivity is allocated to the formation.

4.4. Berea Formation (Qbe)

Oyster beds are present in karst potholes and an elephant tusk was collected at the Umlaas Canal outfall, associated with the Last Interglacial beach. A High Palaeontological Sensitivity is allocated to the formation.

4.5. Maputuland Group.

3.1 Muzi Formation (Qm).

The clayey nature and mottled appearance with root-like structures leads to the interpretation of a swamp or vlei deposit for this unit (Wolmarans and Du Preez, 1986). No other fossils are described from this unit. A Moderate Palaeontological Sensitivity is allocated to the formation.

4.6. Redistributed sand (Qs).

Large areas of the coastal plain of KwaZulu-Natal are covered in a blanket of alluvial sand and no significant fossils have been described from these sediments (Wolmarans and Du Preez, 1986; Johnson et al, 2006). A Low Palaeontological Sensitivity is allocated to the areas underlain by redistributed sand.

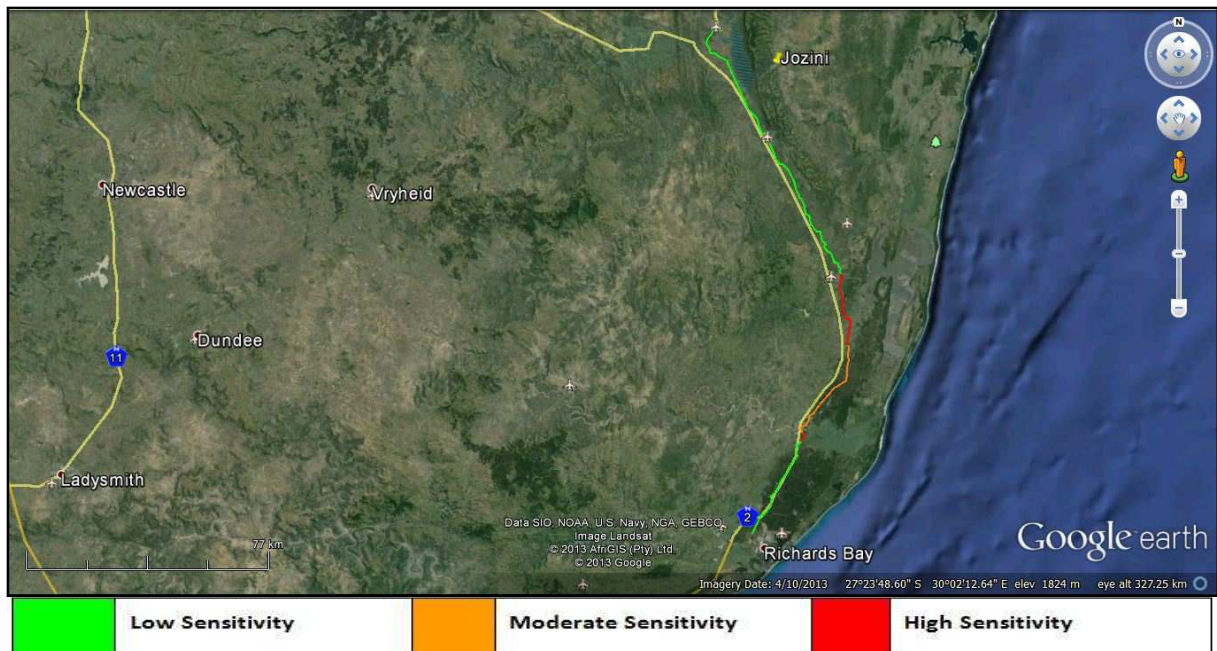


Figure 4.1 Palaeontological Sensitivity of the Kwa-Zulu Natal rail line from Golela to Nsezi

5. CONCLUSION AND RECOMMENDATIONS

The section from Golela to Nsize is underlain by volcanic rocks of the Jurassic Letaba Formation and sediments of the Cretaceous to Quaternary coastal plains of QwaZulu-Natal. Sections underlain by igneous rocks have been allocated a Low Palaeontological Sensitivity. Areas underlain by Cretaceous and Tertiary aged fossiliferous units of the Zululand Group were allocated a High Palaeontological Sensitivity. Areas underlain by more recent Makatini Group sediments and redistributed sand were allocated Medium and Low Palaeontological Sensitivity.

It is recommended that

4. The developer as well as the EAP must be informed of the fact that sections of the proposed upgrading of the railway line is underlain by rocks with a High Palaeontological Sensitivity .
5. A qualified palaeontologist must be appointed to
 - apply for a collection and destruction permit for palaeontological material that might be present in all the areas where a High Palaeontological Sensitivity is indicated
 - undertake a Phase 1 Palaeontological Impact Assessment in areas with a High and Medium Palaeontological Sensitivity to record the presence of fossils
 - prepare a protocol document for the monitoring of the sensitive areas during construction
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 - make the necessary arrangement with the appropriate Institute for Palaeontological Research, as approved by SAHRA, where the fossils will be curated.
6. The developer must inform the palaeontologist and SAHRA of any fossils recorded in areas where a Moderate Palaeontological Sensitivity is indicated.

6. REFERENCES

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MacRae C. 1999. Life Etched in Stone. Geological Society of South Africa, Linden, South Africa

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Wolmarans LG. and Du Preez JW. 1986 The Geology of the St Lucia Area. Explanation: Sheet 27.532 (1:250 000), Geological Survey of South. Africa.

7. 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 palaeoecological 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).

8. DECLARATION OF INDEPENDENCE

I, Gideon Groenewald, declare that I am an independent specialist consultant and have no financial, personal or other interest in the proposed development, nor the developers or any of their subsidiaries, apart from fair remuneration for work performed in the delivery of palaeontological heritage assessment services. There are no circumstances that compromise the objectivity of my performing such work.



Dr Gideon Groenewald
Geologist