The New Moretele Pipeline, Moretele Local Municipality, North West Province and the City of Tshwane Metropolitan Municipality, Gauteng Province

Phase 1 Palaeontological Impact Assessment

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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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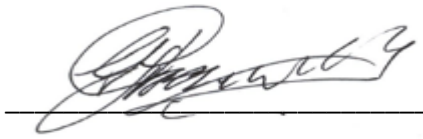
SIGNATURE - 

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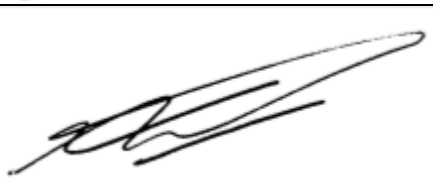
Project Sponsor	W. Fourie		Heritage Specialists/ Principal Investigator
Reviewed	Kristy Robertson		NEMAI Consulting

EXECUTIVE SUMMARY

PGS Heritage (Pty) Ltd was appointed by NEMAI Consulting to undertake a Phase 1 PIA, assessing the potential palaeontological impact of the construction of the new Moretele Pipeline in the Moretele Local Municipality of the Bojanala District Municipality, North West Province and the City of Tshwane Metropolitan Municipality, City of Tshwane District Municipality, Gauteng Province. The study refers to proposed development areas where the palaeontology might be impacted on by the construction activities.

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 development.

City of Tshwane (CoT) has requested Magalies Water to supply water to the Moretele Local Municipality (MLM) area as the municipality is under capacitated and is unable to provide sufficient water to all the communities within the area. Many of the communities have neither reliable or acceptable quality water supply source nor official piped or rudimentary supply at all. This poses a serious challenge to MLM, hence Magalies Water has proposed a new treatment unit and pipeline from the Klipdrift Water Treatment Works (WTW). The proposed new bulk pipeline route (approximately 800 mm in diameter and a length of 27 km) from Klipdrift WTW would follow the Moretele/CoT boundary and would allow Magalies Water to supply water to the Carousel View, Boschplaats West, CoT Babelegi, Mogogelo and the Far Western systems of MLM. This improved and reliable bulk water supply is the immediate solution to the problem of the municipality. It will resolve both water and sanitation challenges.

Dr Gideon Groenewald and David Groenewald, experienced field workers, visited the site of the Moretele Pipeline in the Moretele Local Municipality of the Bojanala District Municipality, North West Province and the City of Tshwane Metropolitan Municipality, City of Tshwane District Municipality, Gauteng Province on Thursday 19 November 2015. The site has very gentle slopes from south to north, and there are small streams, associated with floodwater outflows situated towards the western and northern portion of the site. The study area falls on the border of well-developed areas and relatively un-developed natural, albeit intensely utilized bushveld environments and vleilands. Some of the wetlands show signs of increasing erosion of highly productive soils.

The development area of the proposed new Moretele Pipeline in the Moretele Local Municipality of the Bojanala District Municipality, North West Province and the City of Tshwane Metropolitan Municipality, City of Tshwane District Municipality, Gauteng Province is underlain by Mogolian aged granites of the Nebo Granite, Lebowa Granite Suite, Bushveld Complexand Permian aged shale and sandstone of the Ecca Group, Karoo Supergroup. The Nebo Granites will not contain fossils. The Ecca Group is known for its richness in plant and trace fossils and has a high Palaeontological sensitivity. Although no outcrops were observed and the site is underlain by deep soils, the palaeontological sensitivity for the Ecca Group areas is retained as a high Palaeontological sensitivity. Following the geotechnical investigations, an assessment must be made of areas where excavation of more than 2 m depth into bedrock is envisaged by the engineers. These areas will need to be inspected during and after excavation to report the presence of any fossils in the bedrock.

It is recommended that:

1. The ECO of the project be informed of the possibility of finding well-defined plant and trace fossils in exposures of bedrock of the Ecca Group. If excavation of more than 2 m into

bedrock is planned, a qualified palaeontologist must be appointed to investigate the excavations and record and collect any fossils that might be present in the bedrock according to SAHRA specifications.

2. If fossils are observed during construction, they must be recorded and the palaeontologist must be informed of the finds.
3. These recommendations must be included in the EMPr of the project.

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1. INTRODUCTION

1.1. Background

PGS Heritage (Pty) Ltd (PGS) was appointed by NEMAI Consulting to undertake a Phase 1 Palaeontological Impact Assessment (PIA), assessing the potential palaeontological impact of the construction of the new Moretele Pipeline in the Moretele Local Municipality of the Bojanala District Municipality, North West Province and the City of Tshwane Metropolitan Municipality, City of Tshwane District Municipality, Gauteng Province. The study refers to proposed development areas where the palaeontology might be impacted on by the construction activities.

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 development.

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.

1.1. 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.

Prior to the field investigation a preliminary assessment (desktop study) of the topography and geology of the study area was made using appropriate 1:250 000 geological maps (2528 Pretoria) in conjunction with Google Earth. Potential fossiliferous rock units (Groups, Formations etc.) were identified within the study area and the known fossil heritage within each rock unit was inventoried from the published scientific literature, previous palaeontological impact studies in the same region and the author's field experience.

Priority palaeontological areas were identified within the development footprint to focus the field investigator's time and resources. The aim of the fieldwork was 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 was determined on the basis of the palaeontological sensitivity of the rock units concerned and the nature and scale of the development itself. The different sensitivity classes used are explained in Table 1.1 below.

Table 1.1 Palaeontological Sensitivity Analysis Outcome Classification

PALAEONTOLOGICAL SIGNIFICANCE/VULNERABILITY OF ROCK UNITS	
The following colour scheme is proposed for the indication of palaeontological sensitivity classes. This classification of sensitivity is adapted from that of Almond et al (2008, 2009) (Groenewald et al., 2014).	
RED	Very High Palaeontological sensitivity/vulnerability. Development will most likely have a very significant impact on the Palaeontological Heritage of the region. Very high possibility that significant fossil assemblages will be present in all outcrops of the unit. Appointment of professional palaeontologist, desktop survey, Phase I Palaeontological Impact Assessment (PIA) (field survey and recording of fossils) and Phase II PIA (rescue of fossils during construction) as well as application for collection and destruction permit compulsory.
ORANGE	High Palaeontological sensitivity/vulnerability. High possibility that significant fossil assemblages will be present in most of the outcrop areas of the unit. Fossils most likely to occur in associated sediments or underlying units, for example in the areas underlain by Transvaal Supergroup dolomite where Cenozoic cave deposits are likely to occur. Appointment of professional palaeontologist, desktop survey and Phase I Palaeontological Impact Assessment (field survey and collection of fossils) compulsory. Early application for collection permit recommended. Highly likely that a Phase II PIA will be applicable during the construction phase of projects.
GREEN	Moderate Palaeontological sensitivity/vulnerability. High possibility that fossils will be present in the outcrop areas of the unit or in associated sediments that underlie the unit. For example areas underlain by the Gordonia Formation or undifferentiated soils and alluvium. Fossils described in the literature are visible with the naked eye and development can have a significant impact on the Palaeontological Heritage of the area. Recording of fossils will contribute significantly to the present knowledge of the development of life in the geological record of the region. Appointment of a professional palaeontologist, desktop survey and Phase I PIA (ground proofing of desktop survey) recommended.
BLUE	Low Palaeontological sensitivity/vulnerability. Low possibility that fossils that are described in the literature will be visible to the naked eye or be recognized as fossils by untrained persons. Fossils of for example small domal stromatolites as well as micro-bacteria are associated with these rock units. Fossils of micro-bacteria are extremely important for our understanding of the development of Life, but are only visible under large magnification. Recording of the fossils will contribute significantly to the present knowledge and understanding of the development of Life in the region. Where geological units are allocated a blue colour of significance, and the geological unit is surrounded by highly significant geological units (red or orange coloured units), a palaeontologist must be appointed to do a desktop survey and to make professional recommendations on the impact of development on significant palaeontological finds that might occur in the unit that is allocated a blue colour. An example of this scenario will be where the scale of mapping on the 1:250 000 scale maps excludes small outcrops of highly significant sedimentary rock units occurring in larger alluvium deposits. Collection of a representative sample of potential fossiliferous material is recommended.

GREY	Very Low Palaeontological sensitivity/vulnerability. Very low possibility that significant fossils will be present in the bedrock of these geological units. The rock units are associated with intrusive igneous activities and no life would have been possible during emplacement of the rocks. It is however essential to note that the geological units mapped out on the geological maps are invariably overlain by Cenozoic aged sediments that might contain significant fossil assemblages and archaeological material. Examples of significant finds occur in areas underlain by granite, just to the west of Hoedspruit in the Limpopo Province, where significant assemblages of fossils and clay-pot fragments are associated with large termite mounds. Where geological units are allocated a grey colour of significance, and the geological unit is surrounded by very high and highly significant geological units (red or orange coloured units), a palaeontologist must be appointed to do a desktop survey and to make professional recommendations on the impact of development on significant palaeontological finds that might occur in the unit that is allocated a grey colour. An example of this scenario will be where the scale of mapping on the 1:250 000 scale maps excludes small outcrops of highly significant sedimentary rock units occurring in dolerite sill outcrops. It is important that the report should also refer to archaeological reports and possible descriptions of palaeontological finds in Cenozoic aged surface deposits.

When rock units of moderate to high palaeontological sensitivity are present within the development footprint, palaeontological mitigation measures should be incorporated into the Environmental Management Plan (EMPr).

1.2. Scope and Limitations of the Phase 1 Investigation

The scope of a Phase 1 investigation includes:

- an analysis of the area's stratigraphy, age and depositional setting of fossil-bearing units;
- a review of all relevant palaeontological and geological literature, including geological maps, and previous palaeontological impact reports;
- data on the proposed development provided by the developer (e.g. location of footprint, depth and volume of bedrock excavation envisaged) and
- where feasible, examination of fossil collections from the study area (e.g. museums).
- an on-site investigation to assess the identified palaeontological sensitive areas within the development footprint/study area rather than formal palaeontological collection. The investigation should focus on the sites where bedrock excavations would definitely require palaeontological monitoring.

The results of the field investigation are then used to predict the potential of buried fossil heritage within the development footprint. In some investigations this involves the examination of similar accessible bedrock exposures, such as road cuttings and quarries, along roads that run parallel to or across the development footprint.

2. DESCRIPTION OF THE PROPOSED DEVELOPMENT

City of Tshwane (CoT) has requested Magalies Water to supply water to the Moretele Local Municipality (MLM) area as the municipality is under capacitated and is unable to provide sufficient water to all the communities within the area. Many of the communities have neither reliable or acceptable quality water supply source nor official piped or rudimentary supply at all. This poses a serious challenge to MLM, hence Magalies Water has proposed a new treatment unit and pipeline from the Klipdrift Water Treatment Works (WTW). The proposed new bulk pipeline route (approximately 800 mm in diameter and a length of 27 km) from Klipdrift WTW would follow the Moretele/CoT boundary and would allow Magalies Water to supply water to the Carousel View, Boschplaats West, CoT Babelegi, Mogogelo and the Far Western systems of MLM. This improved and reliable bulk water supply is the immediate solution to the problem of the municipality. It will resolve both water and sanitation challenges (Figure 2.1).

Figure 2.1 Locality of the route of the Moretele Pipeline (green line) and Water Treatment works (red)

3. GEOLOGY

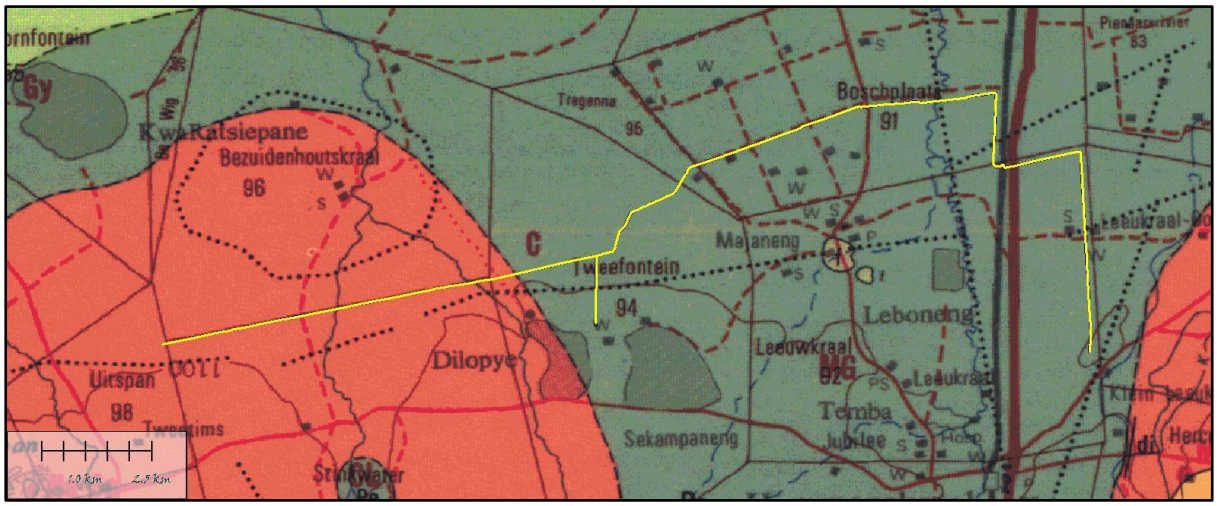
The study area is underlain by Mogolian aged coarse-grained granite of the Nebo Granite, Lebowa Granite Suite of the Bushveld Complex and Permian aged shale and coarse-grained sandstone, with coal beds of the Ecca Group, Karoo Supergroup (Figure 3.1).

1.3. Nebo Granite

Coarse-grained grey to pink granite forming relatively deep soils in the outcrop areas.

1.4. Ecca Group

The Ecca Group sediments consist predominantly of grey and black carbonaceous shale and very



coarse-grained sandstone. Coal beds are present in this group (Johnson et al., 2009).

Figure 3.1 Geology of the Moretele pipeline route. The route is underlain by Nebo Granite in the western part and sediments of the Ecca Group in the central and eastern parts.

4. PALAEONTOLOGY OF THE STUDY AREA

1.5. Nebo Granite

Due to the igneous nature of this rock type it will not contain any fossils and no fossils were observed in the deep sandy overburden that overlies the granite.

1.6. Ecca Group

The Ecca Group sediments are known to be highly sensitive for palaeontological heritage due to the rich assemblage of plant fossils that it contains. The Ecca Group in the study area can therefore be compared to the Vryheid Formation of the Ecca Group that contains rich fossil assemblages.

The Vryheid Formation is well-known for the occurrence of coal beds that resulted from the accumulation of plant material over long periods of time. Plant fossils described by Bamford (2011) from the Vryheid Formation are; *Azaniodendron fertile, Cyclodendron leslii, Sphenophyllum hammanskraalensis, Annularia sp., Raniganjia sp., Asterotheca spp., Liknopetalon enigmata, Glossopteris > 20 species, Hirsutum 4 spp., Scutum 4 spp., Ottokaria 3 spp., Estcourtia sp., Arberia 4 spp., Lidgetonnia sp., Noeggerathiopsis sp. and Podocarpidites sp.*

According to Bamford (2011), little data has been published on these potentially fossiliferous deposits. Good fossil material is likely around the coal mines and yet in other areas the exposures may be too poor to be of interest. When they do occur, fossil plants are usually abundant and it would not be feasible to preserve and maintain all the sites. In the interests of heritage and science, however, such sites should be well recorded, sampled and the fossils kept in a suitable institution.
Although no vertebrate fossils have been recorded from the Vryheid Formation, invertebrate trace fossils have been described in some detail by Mason and Christie (1986). It should be noted, however, that the aquatic reptile, *Mesosaurus*, which is the earliest known reptile from the Karoo Basin, as well as fish (*Palaeoniscus capensis*), have been recorded in equivalent-aged strata in the Whitehill Formation in the southern part of the basin (MacRae, 1999). Indications are that the

Whitehill Formation in the main basin might be correlated with the mid-Vryheid Formation. If this assumption proves correct, there is a possibility that *Mesosaurus* could be found in the Vryheid Formation.

The late Carboniferous to early Jurassic, Karoo Supergroup of South Africa includes economically important coal deposits within the Vryheid Formation of Natal. The Karoo sediments are almost entirely lacking in body fossils but ichnofossils (trace fossils) are locally abundant. Modern sedimentological and ichnofaunal studies suggest that the north-eastern part of the Karoo Basin was marine. In KwaZulu-Natal a shallow basin margin accommodated a prograding fluviodeltaic complex forming a broad sandy platform on which coal-bearing sediments were deposited. Ichnofossils include U-burrows (formerly *Corophioides*) which are assigned to ichnogenus *Diplocraterion* (Mason and Christie, 1986).

5. PRELIMINARY ASSESSMENT RESULTS

The palaeontological sensitivity was predicted after identifying potentially fossiliferous rock units; ascertaining the fossil heritage from the literature and evaluating the nature and scale of the development itself. Following a desktop survey the palaeontological sensitivity of the area underlying the Moretele Pipeline development can be described as very low to highly significant due to the very low possibility of finding fossils in granite and the high potential abundance of Permian aged plant fossils, as well as trace fossils known to occur within the Ecca Group.

6. FIELD INVESTIGATION

Dr Gideon Groenewald and David Groenewald, experienced field workers, visited the site of the Moretele Pipeline in the Moretele Local Municipality of the Bojanala District Municipality, North West Province and the City of Tshwane Metropolitan Municipality, City of Tshwane District Municipality, Gauteng Province on Thursday 19 November 2015. The site has a very gentle slopes from south to north, and there are small streams, associated with floodwater outflows situated towards the western and northern portion of the site. The study area falls on the border of well-developed areas and relatively un-developed natural, albeit intensely utilized bushveld environments and wetlands. Some of the wetlands show signs of increasing erosion of highly productive soils.

Photographic observations are summarised in Table 6.1, with positions of observations illustrated in Figure 6.1.

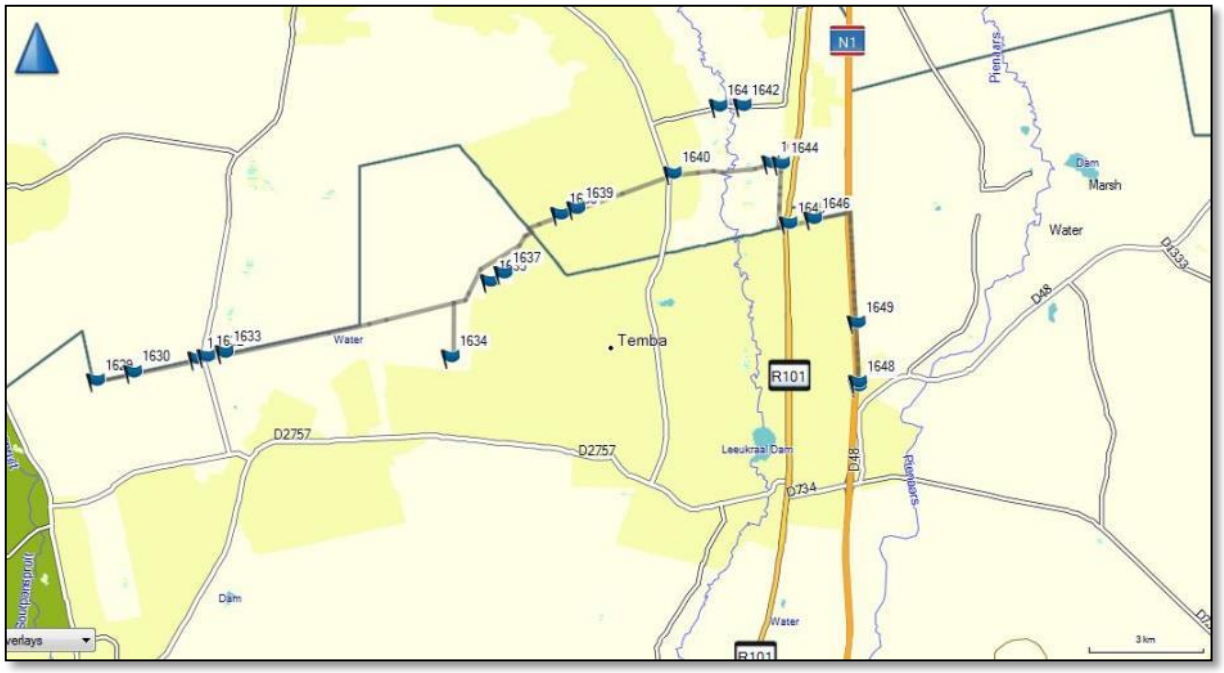


Figure 6.1 GPS locations of photographic records of observations on site

Table 6.1 Photographic information on site

Photo no	GPS Coordinates	Description	Photograph
1	-25° 22' 44.5" 28° 06' 41.1"	Deep soils on granite with sparse vegetation – no outcrop, no fossils observed.	
2	-25° 22' 44.5" 28° 06' 41.1"	Deep soils on granite with sparse vegetation – no outcrop, no fossils observed.	

3	-25° 22' 44.5" 28° 06' 41.1"	Deep soils on granite with sparse vegetation – no outcrop, no fossils observed.	
4	-25° 22' 44.5" 28° 06' 41.1"	Deep soils on granite with sparse vegetation – no outcrop, no fossils observed.	
5	-25° 22' 44.5" 28° 06' 41.1"	Deep soils on granite with sparse vegetation – no outcrop, no fossils observed.	
6	-25° 22' 37.6" 28° 07' 14.1"	Deep sandy soils on granite – no outcrop, no fossils observed.	

7	-25° 22' 26.3" 28° 08' 11.3"	Ferricrete layers overlying granite terrains. Deep soils with no outcrop. No fossils observed.	
8	-25° 22' 26.3" 28° 08' 11.3"	Deep soils on granite with sparse vegetation - no outcrop – no fossils observed.	
9	-25° 22' 24.3" 28° 08' 19.5"	Deep soils in disturbed areas with sparse vegetation - no outcrop – no fossils observed.	
10	-25° 22' 20.9" 28° 08' 35.7"	Very deep soils and erosion into possibly Tertiary aged horizons with lush vegetation - no outcrop – no fossils observed. Erosion threatening to destroy wetland.	

11	-25° 22' 20.9" 28° 08' 35.7"	Highly weathered sedimentary rocks or possibly sub-outcrop of Ecca Group shale in wetland with a high water table. Very poor outcrop and no fossils observed. Exposure of bedrock during deep excavation might reveal plant fossils.	
12	-25° 22' 20.9" 28° 08' 35.7"	Highly weathered sedimentary rocks or possibly sub-outcrop of Ecca Group shale in wetland with a high water table. Very poor outcrop and no fossils observed.	
13	-25° 22' 24.7" 28° 11' 57.3" Site of water treatment plant. No obvious graves observed	Deep sandy soil cover and sparse vegetation on coarse-grained sandstone of the Ecca Group. No outcrop and no fossils observed. Deep excavation might reveal plant fossils.	
14	-25° 22' 24.7" 28° 11' 57.3"	Deep sandy soil cover and sparse vegetation on coarse-grained sandstone of the Ecca Group. No outcrop and no fossils observed. Deep excavation might reveal plant fossils.	

15	-25° 22' 24.7" 28° 11' 57.3"	Deep sandy soil cover and sparse vegetation on coarse-grained sandstone of the Ecca Group. No outcrop and no fossils observed. Deep excavation might reveal plant fossils.	
16	-25° 21' 21.3" 28° 12' 32.1"	Deep dark vertic soils with grass cover probably on sub-outcrop of Ecca group shale. No outcrop and no fossils observed. Deep excavation might reveal plant fossils.	
17	-25° 21' 14.4" 28° 12' 44.1"	Deep dark vertic soils with grass cover probably on sub-outcrop of Ecca group shale. No outcrop and no fossils observed. Deep excavation might reveal plant fossils.	
18	-25° 20' 25.0" 28° 13' 34.8"	Deep sandy soil on sub outcrop of coarse-grained sandstone of the Ecca Group. No outcrop, no fossils observed. Deep excavation might reveal plant fossils.	

19	-25° 20' 25.0" 28° 13' 34.8"	Deep sandy soil on sub outcrop of coarse-grained sandstone of the Ecca Group. No outcrop, no fossils observed. Deep excavation might reveal plant fossils.	
20	-25° 20' 20.3" 28° 13' 49.1"	Deep sandy soils with no outcrops. No fossils observed. Deep excavation into Ecca Group sandstone might reveal plant fossils.	
21	-25° 19' 50.7" 28° 15' 15.2"	Deep sandy soils on coarse grained sandstone of Ecca Group with no outcrops. No fossils observed.	
22	-25° 18' 54.2" 28° 15' 56.0"	Deep soils in valley floor, no outcrop and no fossils observed. Wetland environments.	

23	-25° 18' 53.8" 28° 16' 17.5"	Deep soil and deeply weathered dolerite (not mapped) and shale of the Ecca Group, no fossils observed.	
24	-25° 18' 53.8" 28° 16' 17.5"	Deep soils in valley floor, sparse vegetation, deeply weathered shale, poor outcrop, no fossils observed.	
25	-25° 19' 41.6" 28° 16' 42.8"	Deep sandy soils. No outcrop and no fossils observed.	
26	-25° 19' 42.5" 28° 16' 51.7"	Deep sandy soils. No outcrop and no fossils observed.	

27	-25° 20' 32.7" 28° 16' 58.3"	Deep sandy soils. No outcrop and no fossils observed.	
28	-25° 20' 28.7" 28° 17' 20.2"	Deep sandy soils. No outcrop and no fossils observed.	
29	-25° 22' 49.3" 28° 18' 00.1"	Deep sandy soils. No outcrop and no fossils observed.	
30	-25° 22' 49.3" 28° 18' 00.1"	Deep sandy soils. No outcrop and no fossils observed.	

31	-25° 22' 46.1" 28° 18' 00.2"	Deeply weathered coarse-grained sandstone of the Ecca Group with thin, highly weathered shale beds. No fossils observed but deep excavation can reveal plant fossils.	
32	-25° 22' 46.1" 28° 18' 00.2"	Deeply weathered coarse-grained sandstone of the Ecca Group with thin, highly weathered shale beds. No fossils observed but deep excavation can reveal plant fossils.	
33	-25° 21' 56.0" 28° 17' 59.0"	Deep sandy soils on highly weathered coarse-grained sandstone of the Ecca Group and thin shale beds. No fossils observed. Deep excavation might reveal plant fossils.	

7. PALAEONTOLOGICAL SENSITIVITY AND SIGNIFICANCE

The desktop study suggests that the study area is underlain by Nebo Granite and sedimentary deposits of the Permian aged Ecca Group, Karoo Supergroup. The Nebo Granite has a very low to insignificant Sensitivity for palaeontological heritage and will not contain fossils. The Ecca Group has a high sensitivity for plant fossils but the field investigation confirmed that the entire area proposed for this development is overlain by deep soils with no outcrop of granitic or well-defined sedimentary rocks (Table 6.1).

It is however expected that excavations for the foundations for buildings associated with the construction of the water works as well as excavations for the large diameter pipeline will be deep enough to expose bedrock. It is therefore recommended that palaeontological sensitivity rating for the study area underlain by sediments of the Ecca Group be retained as a High Palaeontological sensitivity, as illustrated in Figure 7.1. Following the geotechnical investigations, all the areas where excavation of at least 2 m or more into bedrock is planned need to be recorded as potentially fossilliferous areas and a qualified palaeontologist must be appointed if fossils are recorded from the sites after exposure of the bedrock. If any fossils are observed during the construction phase of this

project the ECO must be informed and the fossils must be recorded according to SAHRA specifications.

8. CONCLUSION AND RECOMMENDATIONS

The development area of the proposed new Moretele Pipeline in the Moretele Local Municipality of the Bojanala District Municipality, North West Province and the City of Tshwane Metropolitan Municipality, City of Tshwane District Municipality, Gauteng Province is underlain by Mogolian aged granites of the Nebo Granite, Lebowa Granite Suite, Bushveld Complex and Permian aged shale and sandstone of the Ecca Group, Karoo Supergroup. The Nebo Granites will not contain fossils. The Ecca Group is known for its richness in plant and trace fossils and has a High Palaeontological sensitivity. Although no outcrops were observed and the site is underlain by deep soils, the palaeontological sensitivity for the Ecca Group areas is retained as a High Palaeontological sensitivity. Following the geotechnical investigations, an assessment must be made of areas where excavation of more than 2m depth into bedrock is envisaged by the engineers. These areas will need to be inspected during and after excavation to report the presence of any fossils in the bedrock.

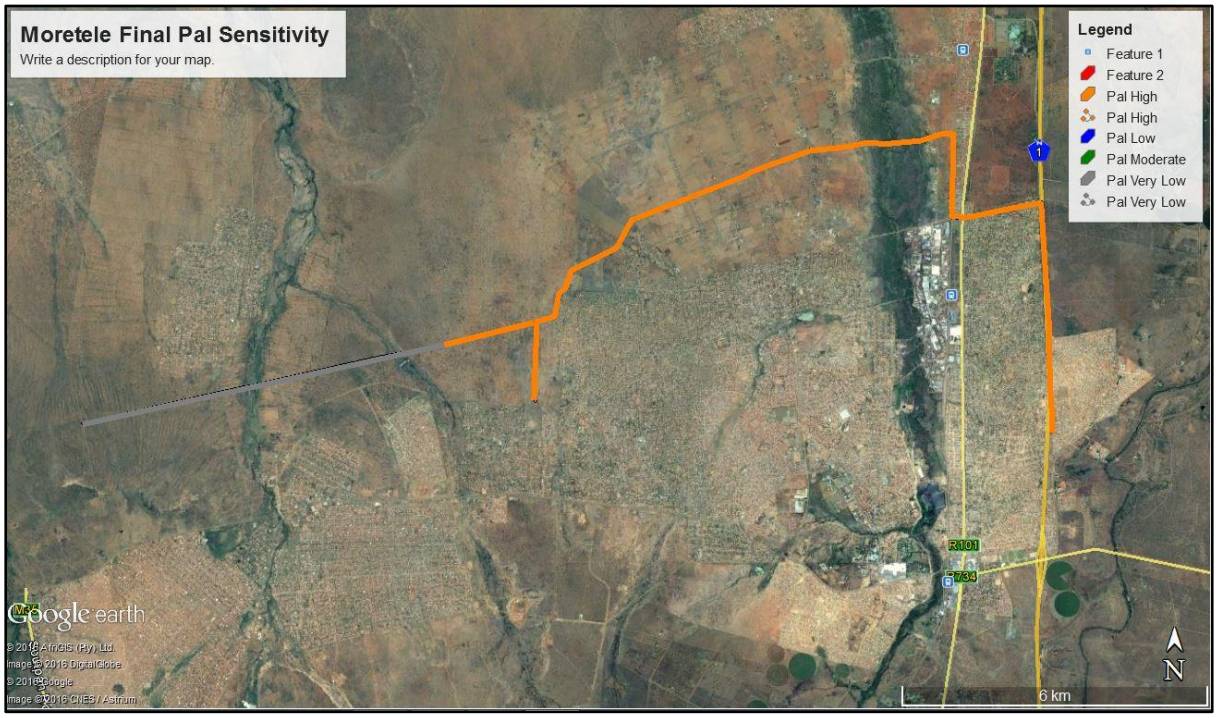


Figure 8.1 Palaeontological sensitivity for the areas along the route of the pipeline. For explanation of colour coding see Table 1.1

It is recommended that:

1. The ECO of the project be informed of the possibility of finding well-defined plant and trace fossils in exposures of bedrock of the Ecca Group. If excavation of more than 2m into bedrock is planned, a qualified palaeontologist must be appointed to investigate the excavations and record and collect any fossils that might be present in the bedrock according to SAHRA specifications.
2. If fossils are observed during construction, they must be recorded and the palaeontologist must be informed of the finds.
3. These recommendations must be included in the EMPr of the project.

9. REFERENCES

Almond J.E. and Pether J. 2008. *Palaeontological Heritage of the Western Cape.* Internal Report Heritage Western Cape.

Almond J.E., De Klerk B. and Gess R., 2009. *Palaeontological Heritage of the Eastern Cape*. Internal Report, SAHRA.

Bamford M. 2011. Desktop study Palaeontology Ermelo to Empangeni – Eskom powerline. Internal report Bernard Price Institute for Palaeontological Research, University of the Witwatersrand.

Groenewald G.H., Groenewald D.P. and Groenewald S.M., 2014. *Palaeontological Heritage of the Free State, Gauteng, Limpopo, Mpumalanga and North West Provinces*. Internal Palaeotechnical Reports, SAHRA.

Johnson MR, Anhausser CR and Thomas RJ. 2006. The Geology of South Africa. Geological Society of South Africa.

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

Mason TR and Christie ADM 1986. Palaeoevironmental significance of ichnogenus *Diplocraterion* torell from the Permian Vryheid Formation of the Karoo Supergroup, South Africa. Palaeogeography, Palaeoclimatology, Palaeoecology 53(3-4):249-265.

10. 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).