GAMMA-KAPPA 765kV Transmission Line, Western Cape Province

SCOPING REPORT
PALAEONTOLOGY

Compiled by: Dr JF Durand (Sci.Nat.)

For:
Nzumbululo Heritage Solutions
4 Berger Road
Vorna Valley
Midrand
1686

9 June 2013

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1. Introduction

This scoping report is to assess the impact of the proposed strengthening of Eskom's power grid by the construction of a new 765kV transmission line between the interior (Gamma substation near Victoria West) to the Omega Substation near Koeberg, on the palaeontological heritage of this region. This transmission line will run for approximately 550km in a west southwest direction mainly through the Western Cape and a small section will pass through the Northern Cape. The Gamma-Kappa section will extend from Victoria West to Koruson and the Kappa-Omega section will extend from Koruson to Koeberg.

The palaeontological heritage of South Africa is unsurpassed and can only be described in superlatives. The South African palaeontological record gives us insight in *i.a.* the origin of life, mammals, dinosaurs and humans. Fossils are also used to identify rock strata and determine the geological context of the sub region with other continents and to study evolutionary relationships, sedimentary processes and palaeoenvironments. The Cape Supergroup is renowned for its invertebrate fossils and the Beaufort Group of the Karoo Supergroup contains amongst others approximately 70% of all known synapsid (also known as mammal-like reptile) fossils in the world which have played a crucial role in our understanding of the origin of mammals and the Permo-Triassic terrestrial palaeoenvironment including the existence of Gondwanaland.

The Heritage Act of South Africa stipulates that fossils and fossil sites may not be altered or destroyed. The purpose of this document is to detail the probability of finding fossils in the study area which may be impacted by the proposed development. The impact of the development can be ameliorated in several ways in the areas where fossils are common.

2. Terms of reference for the report

According to the South African Heritage Resources Act (Act 25 of 1999) (Republic of South Africa, 1999), certain clauses are relevant to palaeontological aspects for a terrain suitability assessment.

- **Subsection 35(4)** No person may, without a permit issued by the responsible heritage resources authority-
- (a) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;
- (b) destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;
- (c) trade in, sell for private gain, export or attempt to export from the republic any category of archaeological or palaeontological material or object, or any meteorite; or
- (d) bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist with the detection or recovery of metals or archaeological material or objects, or use such equipment for the recovery of meteorites.
- **Subsection 35(5)** When the responsible heritage resources authority has reasonable cause to believe that any activity or development which will destroy, damage or alter any archaeological or palaeontological site is under way, and where no application for a permit has been submitted and no heritage resources management procedures in terms of section 38 has been followed, it may-
- (a) serve on the owner or occupier of the site or on the person undertaking such development an order for the development to cease immediately for such period as is specified in the order;
- (b) carry out an investigation for the purpose of obtaining information on whether or not an archaeological or palaeontological site exists and whether mitigation is necessary;
- (c) if mitigation is deemed by the heritage resources authority to be necessary, assist the person on whom the order has been served under paragraph (a) to apply for a permit as required in subsection (4); and
- (d) recover the costs of such investigation form the owner or occupier of the land on which it is believed an archaeological or palaeontological site is located or from the person proposing to undertake the development if no application for a permit is received within two weeks of the order being served.

South Africa's unique and non-renewable palaeontological heritage is protected in terms of the NHRA. According to this act, heritage resources may not be excavated, damaged, destroyed or otherwise impacted by any development without prior assessment and without a permit from the relevant heritage resources authority.

As areas are developed and landscapes are modified, heritage resources, including palaeontological resources, are threatened. As such, both the environmental and heritage legislation require that development activities must be preceded by an

assessment of the impact undertaken by qualified professionals. Palaeontological Impact Assessments (PIAs) are specialist reports that form part of the wider heritage component of:

- Heritage Impact Assessments (HIAs) called for in terms of Section 38 of the National Heritage Resources Act, Act No. 25, 1999 by a heritage resources authority.
- Environmental Impact Assessment process as required in terms of other legislation listed in s. 38(8) of NHRA;
- Environmental Management Plans (EMPs) required by the Department of Mineral Resources.

HIAs are intended to ensure that all heritage resources are protected, and where it is not possible to preserve them in situ, appropriate mitigation measures are applied. An HIA is a comprehensive study that comprises a palaeontological, archaeological, built environment, living heritage, etc specialist studies. Palaeontologists must acknowledge this and ensure that they collaborate with other heritage practitioners. Where palaeontologists are engaged for the entire HIA, they must refer heritage components for which they do not have expertise on to appropriate specialists. Where they are engaged specifically for the palaeontology, they must draw the attention of environmental consultants and developers to the need for assessment of other aspects of heritage. In this sense, Palaeontological Impact Assessments that are part of Heritage Impact Assessments are similar to specialist reports that form part of the EIA reports.
The standards and procedures discussed here are therefore meant to guide the conduct of PIAs and specialists undertaking such studies must adhere to them.
The process of assessment for the palaeontological (PIA) specialist components of heritage impact assessments, involves:

Scoping stage in line with regulation 28 of the National Environmental Management Act (No. 107 of 1998) Regulations on Environmental Impact Assessment. This involves an **initial assessment** where the specialist evaluates the scope of the project (based, for example, on NID/BIDs) and advises on the form and extent of the assessment process. At this stage the palaeontologist may also decide to compile a **Letter of Recommendation for Exemption from further Palaeontological Studies**. This letter will state that there is little or no likelihood that any significant fossil resources will be impacted by the development. This letter should present a reasoned case for exemption, supported by consultation of the relevant geological maps and key literature.

A **Palaeontological Desktop Study** – the palaeontologist will investigate available resources (geological maps, scientific literature, previous impact assessment reports, institutional fossil collections, satellite images or aerial photos , etc) to inform an assessment of fossil heritage and/or exposure of potentially fossiliferous rocks within the study area. A Desktop studies will conclude whether a further field assessment is warranted or not. Where further studies are required, the desktop study would normally be an integral part of a field assessment of relevant palaeontological resources.

A **Phase 1 Palaeontological Impact Assessment** is generally warranted where rock units of high palaeontological sensitivity are concerned, levels of bedrock exposure within the study area are adequate; large-scale projects with high potential heritage impact are planned; and where the distribution and nature of fossil remains in the proposed project area is unknown. In the recommendations of Phase 1, the specialist will inform whether further monitoring and mitigation are necessary. The Phase 1 should identify the rock units and significant fossil heritage resources present, or by inference likely to be present, within the study area, assess the palaeontological significance of these rock units, fossil sites or other fossil heritage, comment on the impact of the development on palaeontological heritage resources and make recommendations for their mitigation or conservation, or for any further specialist studies that are required in order to adequately assess the nature, distribution and conservation value of palaeontological resources within the study area.

A **Phase 2 Palaeontological Mitigation** involves planning the protection of significant fossil sites, rock units or other palaeontological resources and/or the recording and sampling of fossil heritage that might be lost during development, together with pertinent geological data. The mitigation may take place before and / or during the construction phase of development. The specialist will require a Phase 2 mitigation permit from the relevant Heritage Resources Authority before Phase 2 may be implemented.

A **'Phase 3' Palaeontological Site Conservation and Management Plan** may be required in cases where the site is so important that development will not be allowed, or where development is to co-exist with the resource. Developers may be required to enhance the value of the sites retained on their properties with appropriate interpretive material or displays as a way of promoting access of such resources to the public.

The assessment reports will be assessed by the relevant heritage resources authority, and depending on which piece of legislation triggered the study, a response will be given in the form of a Review Comment or Record of Decision (ROD). In the case of PIAs that are part of EIAs or EMPs, the heritage resources authority will issue a comment or a record of decision that may be forwarded to the consultant or developer, relevant government department or heritage practitioner and where feasible to all three.

3. Details of study area and the type of assessment:

The relevant literature and geological maps for the region in which the development is proposed to take place, have been studied for this Scoping Report.

The Gamma-Kappa section traverses the Central Karoo District Municipality and extends over part of the Ceres Karoo, the Tanqua Karoo, the Klein Roggeveld, the Moordenaarskaroo, Die Koup, The Great Karoo, over the Great Escarpment south of Nelspoort and ends in the mountainous area southeast of Victoria West. This area is dominated by the sandstones and mudrocks of the Karoo Supergroup which is mostly covered in alluvium but good exposures are found in road cuts, gullies, hillsides and mountains.

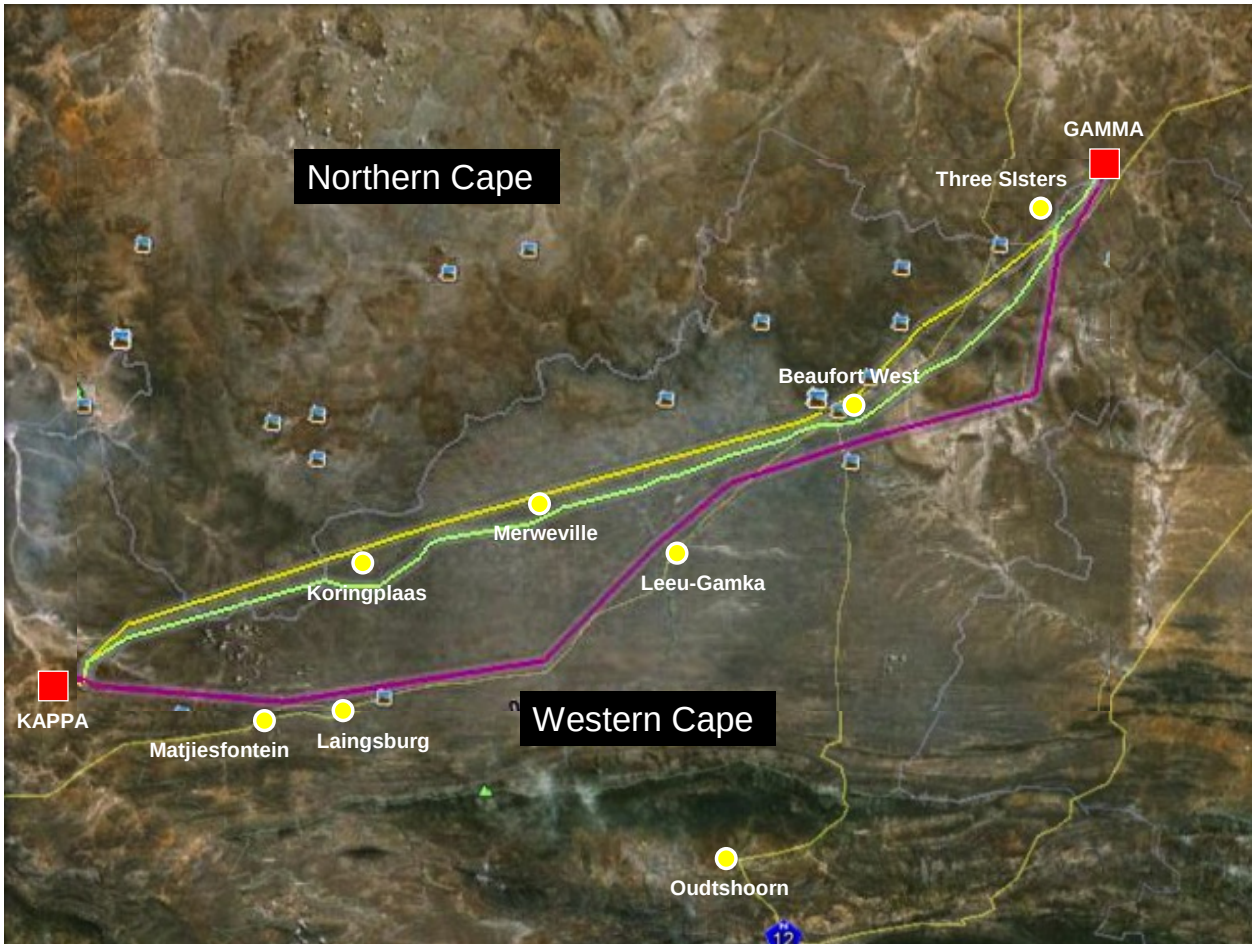

Figure 1: Google Earth photo indicating the study area

4. Geological setting

The 1: 250 000 geological maps relevant to the Gamma-Kappa section are the Ladismith 3320, Beaufort West 3222 and the Victoria West 3122 maps.

The sedimentary sequences forming the Dwyka Group were set down between the Late Carboniferous to Early Permian. These sediments consist largely of glacial tillites which were set down by glacial action and interglacial mudrocks that were set down when mud was transported by water from melting glaciers (Johnson *et al*., 2006).

The sedimentary sequences forming the Ecca Group were set down between the Early to Mid Permian. These fine layered sediments were set down in an inland sea (Johnson *et al*., 2006; Johnson, 2009).

The lower Beaufort Group sedimentary rocks which occur in the study area were set down from the Mid to Late Permian (Durand, 2005). The lithology of the Karoo Supergroup consists mostly of sandstones, mudstones and siltstones with areas to the north and east, outside the study area, where dolerite intrusions occur. The Dwyka Group, Ecca Group and Beaufort Group represent the Karoo Supergroup in the study area (Gamma-Kappa section) (see Fig.6).

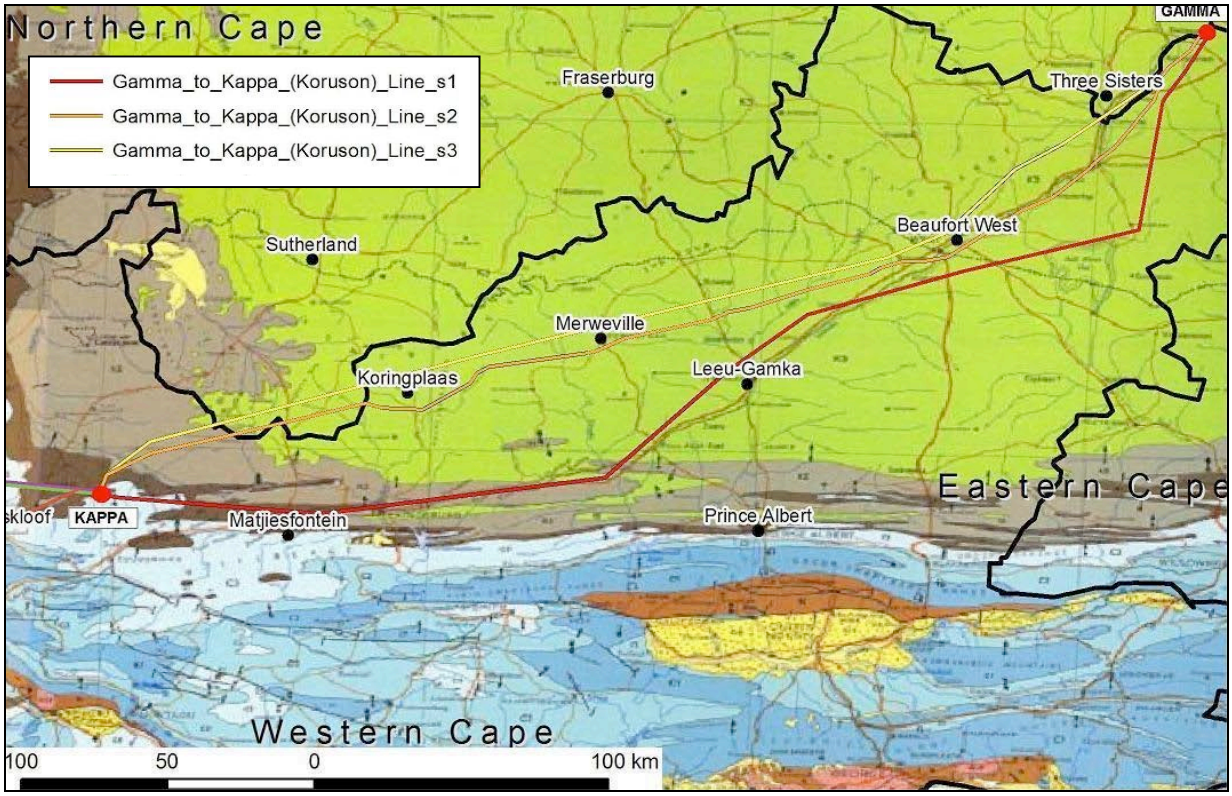

Figure 2: Geology map of the study area with the proposed power grid for the Gamma-Kappa section (adapted from the 1: 1 000 000 Geology Map for South Africa, Lesotho and Swaziland, Geological Survey, 1970)

LEGEND:

	Unconsolidated superficial deposits.			Quaternary	Cainozoic
Cr1	Conglomerate, sandstone, shale, limestone.	Sandveld Group		Cretaceous	Mesozoic
K3	Mudrock, sandstone	Adelaide Subgroup (Beaufort Group)	Karoo Supergroup	Permian	Palaeozoic
K2	Shale, sandstone, grit, coal	Ecca Group			
K1	Tillite, sandstone, shale	Dwyka Group		Carboniferous	
C3	Quartzite, shale	Witteberg Group	Cape Supergroup		
C2	Shale, sandstone	Bokkeveld Group		Devonian	
C1	Quartzite, shale, tillite	Table Mountain Group		Ordovician	
KI	Conglomerate, greywacke, shale	Klipheuwel Group		Cambrian	
AG9	Granite, syenitic rocks, quartz, porphyry	Cape granite suite			Namibian
N	Quartzite, arkose, tillite, limestone, shale, lava, tuff	Malmesbury Group			

5. Palaeontology of the study area

The study area is dominated by sedimentary rocks (Carboniferous to Cretaceous) which were set down over older igneous, metamorphic and sedimentary rocks. The proposed transmission line will run over the Dwyka and Ecca Groups of the Karoo Supergroup of which the palaeontological content varies from barren, to negligible, to moderately important, to highly significant. The study area is in general relatively fossil poor except for certain areas where exceptional concentrations of highly scientific significant fossils may occur.

The fossils of the region include fossilised wood, leaf and stem imprints, invertebrates and vertebrate skeletal material. The Gamma-Kappa Section coincides with the geology and fossiliferous nature of the Karoo Supergroup.

The Karoo Supergroup

The proposed s2 and s3 lines and largest part of the proposed s1 lines run over the Karoo Supergroup and cross the Dwyka, Ecca and Beaufort Groups (see Fig.2).

5.1 Dwya Group

The Dwyka is relatively fossil poor and mostly limited to arthropod and fish trace fossils. Outcrops of Dwyka rocks are scarce and are mostly covered by alluvium occur in the areas demarcated for proposed power lines.

5.2 Ecca Group

The fossils that occur in the Ecca Group in the Ceres Karoo have a limited diversity and are mostly limited to trace fossils and fragmented plant material. These fossils are of low palaeontological importance. The Whitehill Formation of the Ecca Group in the Tanqua Karoo on the other hand yields fossils of palaeoniscoid fish and *Mesosaurus* skeletons (see Fig.3) which are scientifically important. *Mesosaurus* was one of the fossil species that enabled palaeontologists to prove the existence of Gondwanaland. Fossils of crustaceans and other invertebrates, trace fossils and fossilised wood have been found in the Whitehill Formation as well. There are exposures of fossiliferous Ecca Group rocks in the Matjiesfontein and De Doorns regions.

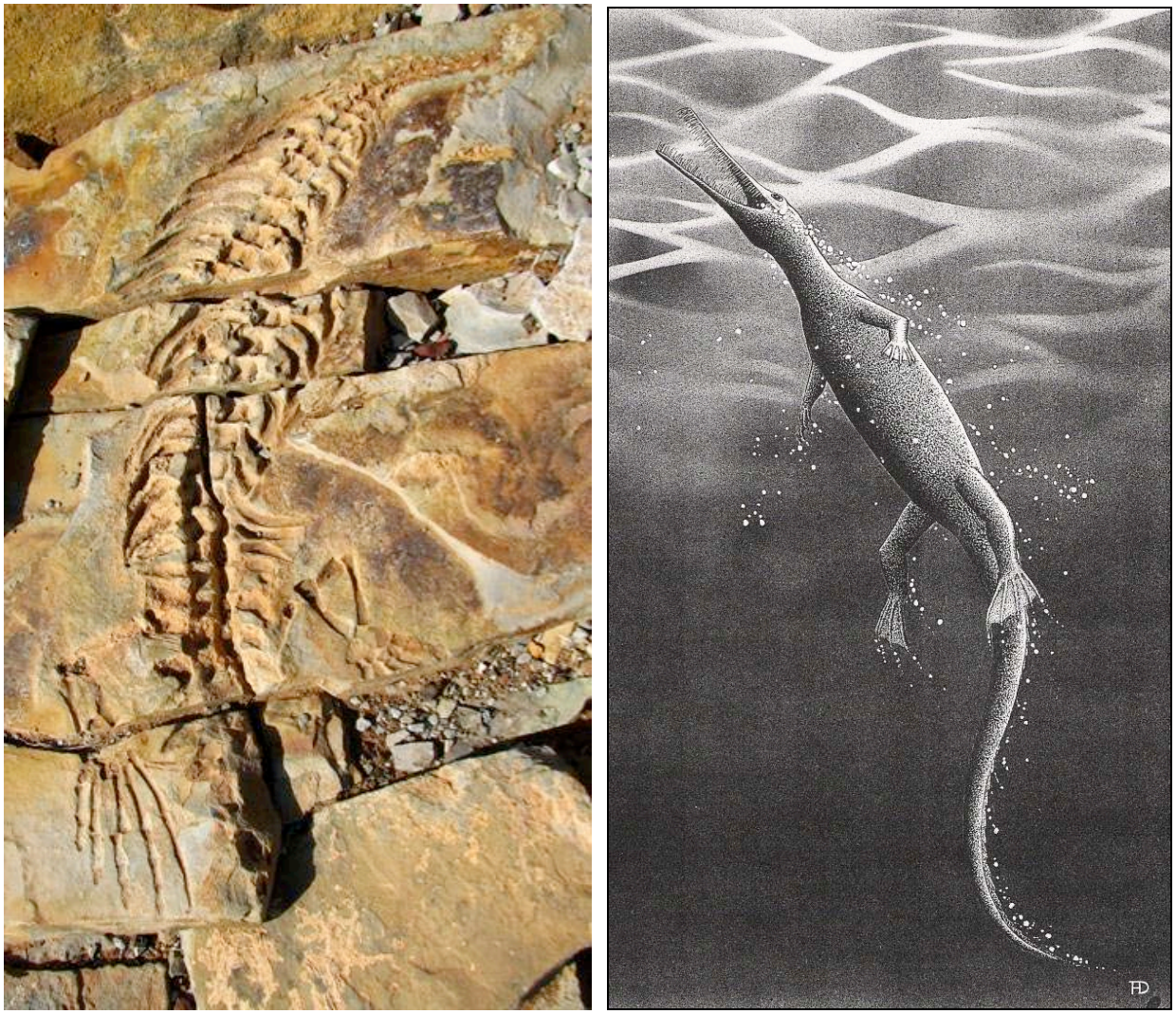

Figure 3: *Mesosaurus* fossil skeleton (left) and reconstruction (right)

5.3 Lower Beaufort Group

The region from Karoopoort to Victoria West is generally fossil rich. Fossils have been found on several of the farms in the study area (Kitching, 1977). Fossils of plant and vertebrate skeletal material have been found *inter alia* on the farms Rietfontein, Waaikraal, La-De-Da, Spitskop, Kuilspoort and Vindragersfontein.

The proposed routes for the transmission lines run through the Lower Beaufort Group of the Karoo Supergroup and traverse the *Tapinocephalus* Assemblage Zone and *Pristerognathus* Assemblage Zone for most of the distance between the Gamma and Kappa substations. The *Eodicynodon* Assemblage Zone is traversed only by the s1 line in the south while the s2 and s3 lines pass to the north of it (see Fig. 4). The Gamma to Kappa lines s2 and s3 traverse the *Tropidostoma* Assemblage zone southwest of the Gamma substation while s1 skirts most of it (see Fig. 4). The lines do not cross the *Cistecephalus* Assemblage zone and it is therefore irrelevant to this report and not discussed.

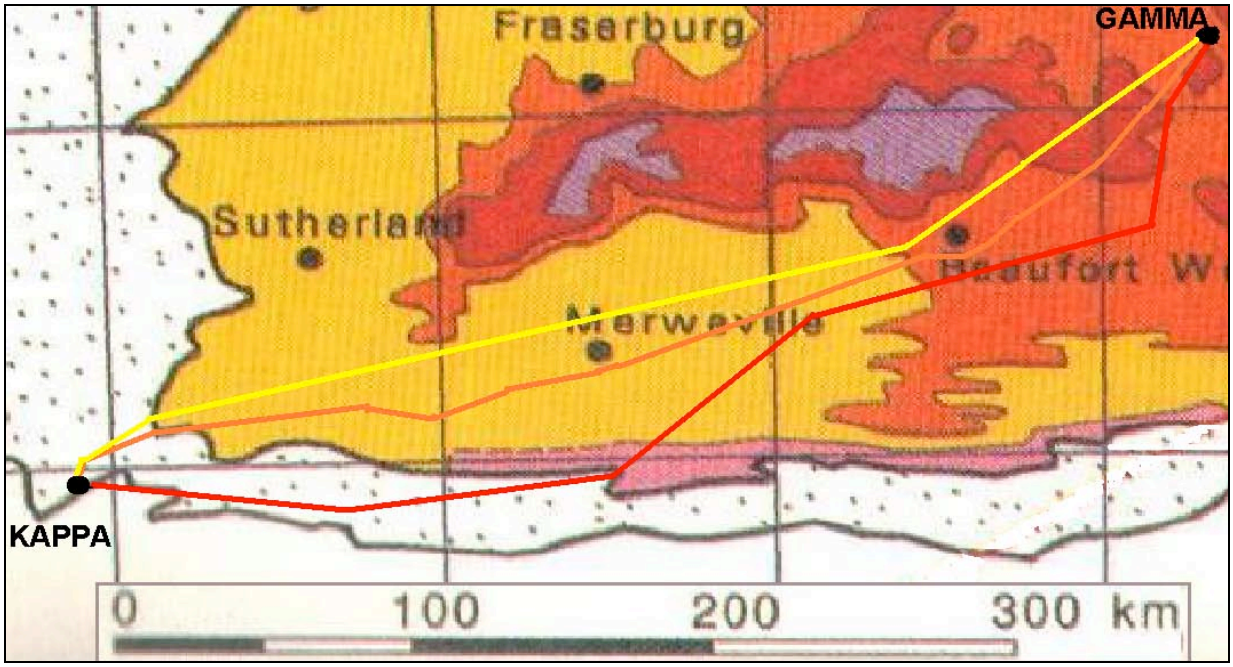

Figure 4: Biostratigraphical map indicating the Karoo Supergroup strata including the biozonation of the Lower Beaufort Group in the study area (adapted from Rubidge1995)

LEGEND:

- *Cistecephalus* Assemblage Zone
- *Tropidostoma* Assemblage Zone
- *Pristerognathus* Assemblage Zone
- *Tapinocephalus* Assemblage Zone
- *Eodicynodon* Assemblage Zone

Lower Beaufort Group

- Dwyka and Ecca Groups

5.3.1 *Eodicynodon* Assemblage Zone

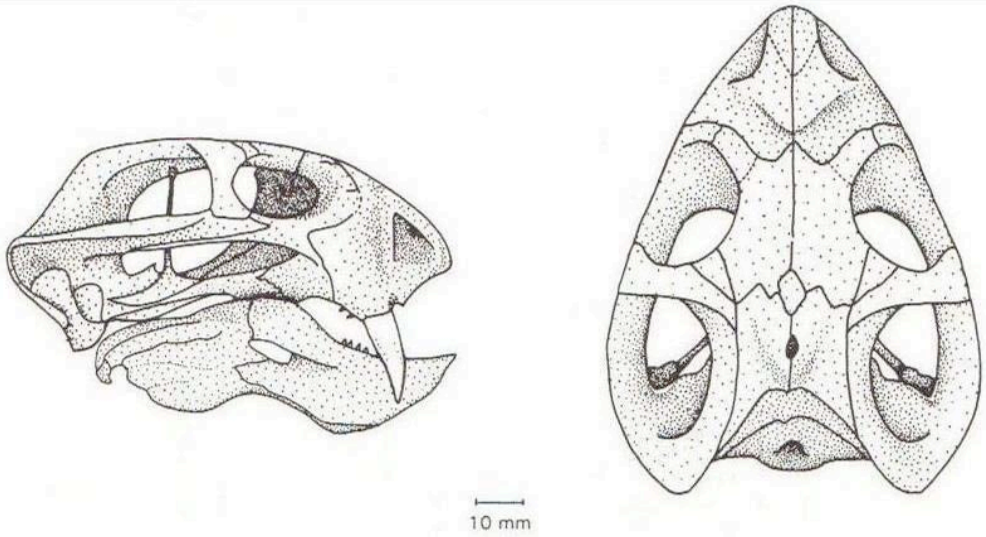

Figure 5: Skull of *Eodicynodon* (left lateral view, right dorsal view) (adapted from Rubidge, 1995)

The *Eodicynodon* Assemblage Zone occurs only in the southern part of the study area and forms the oldest biostratigraphical layer of the Adelaide Subgroup of the Beaufort Group. Fossils are relatively scarce in this layer which makes fossil discoveries scientifically very important. A variety of fossils have been found in this biozone including fish scales, amphibians (1% of the fossil yield), theriodonts (gorgonopsians and therocephalians) (4%), the primitive dicynodont *Eodicynodon* which constitutes 85% of the fossil yield from this biozone (see Fig.5) and from which the name of this biozone was derived, and the dinocephalian *Tapinocaninus* (10%) (see Fig.6) (Rubidge, 1995). Only the proposed s3 line will traverse this Assemblage Zone. Plant fossils from this assemblage zone include *Glossopteris* and *Equisetum*.

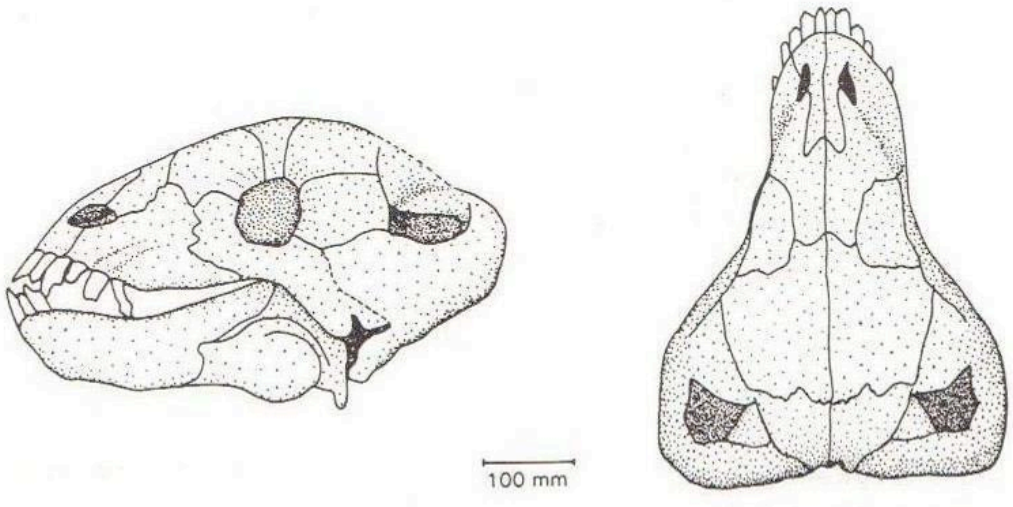

Figure 6: *Tapinocaninus* skull (left lateral view, right dorsal view) (adapted from Rubidge, 1995)

5.3.2 *Tapinocephalus* Assemblage Zone

The *Tapinocephalus* Assemblage Zone overlies the *Eodicynodon* Assemblage Zone and occurs over a wide range in the study area and all three proposed lines traverse it (see Fig.4). In the case of the s1 and s2 lines the distance is over 200km.

Figure 7: *Tapinocephalus* skull

The *Tapinocephalus* Assemblage Zone is characterized by the occurrence of fossils of the dinocephalian *Tapinocephalus* (see Fig.7) and the pareiasaur *Bradysaurus* (see Fig.8). Other fossils from this biozone include dicynodonts such as *Diictodon* and *Emydops*, gorgonopsians such as *Gorgonops*, therocephalians such as *Lycosuchus* and *Pristerognathus*, fish such as Atherstonia (see Fig. 9) and amphibians such as *Rhinesuchus* (see Fig.10). Plant fossils include leaf imprints of *Glossopteris*, *Phyllotheca* and *Schizoneura*.and fossil wood of *Dadoxylon*.

Figure 8 : *Bradysaurus* skeleton

Figure 9: *Atherstonia*

Figure 10. *Rhinesuchus* skull

5.3.3 *Pristerognathus* Assemblage Zone

The proposed routes for the transmission lines will intersect with the *Pristerognathus* Assemblage Zone in the northeastern part of the study area. This biozone is characterised by the presence of fossils of the theriodont *Pristerognathus* (see Fig.11), an abundance of *Diictodon* fossils (see Fig.12) and the absence of dinocephalian fossils which are characteristic of the underlying assemblage zones. Other fossils that occur in this low-diversity assemblage zone include the therocephalian *Ictidosuchoides* and the gorgonopsians Gorgonops (see Fig. 13). Plant fossils include leaf and stem impressions of *Glossopteris*, *Phyllotheca* and *Schizoneura*.

Figure 11 : *Pristerognathus* skull

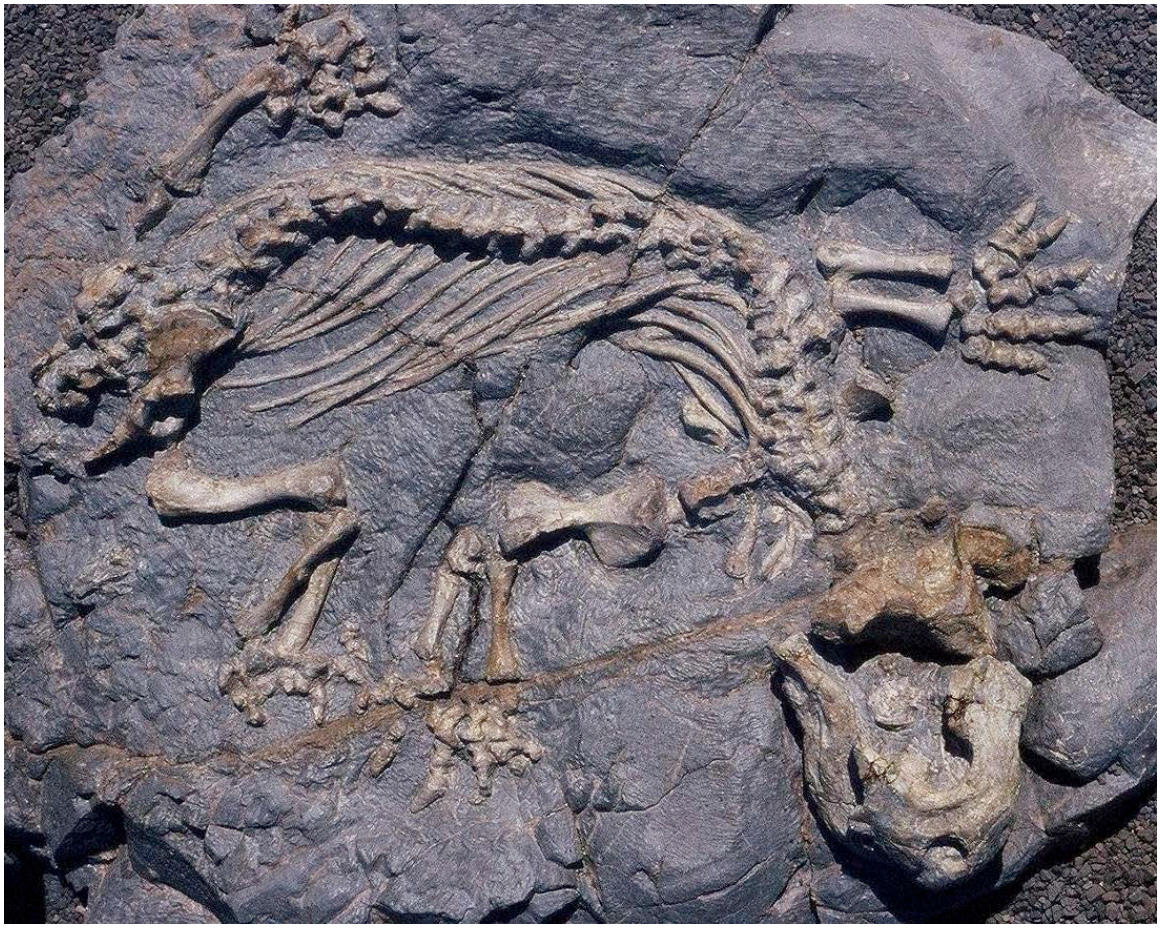

Figure 12: *Diictodon* skeleton

Figure 13: Gorgonopsian skull

5.3.4 *Tropidostoma* Assemblage Zone

This assemblage zone occurs in the north eastern corner of the study area and overlies all the previously discussed assemblage zones. The proposed s2 and s3 routes for the transmission lines traverse this Assemblage Zone while the proposed s1 route skirts most of it.

The *Tropidostoma* Assemblage Zone is characterized by the presence of the dicynodonts *Tropidostoma* (Fig. 14) and *Endothiodon* (Fig.15). Other fossils in this assemblage zone include the dicynodonts *Pristerodon* and many *Diictodon* fossils. Leaf imprints of the plant *Glossopteris* (Fig. 16) and fossilised wood of *Dadoxylon* are also known from this unit.

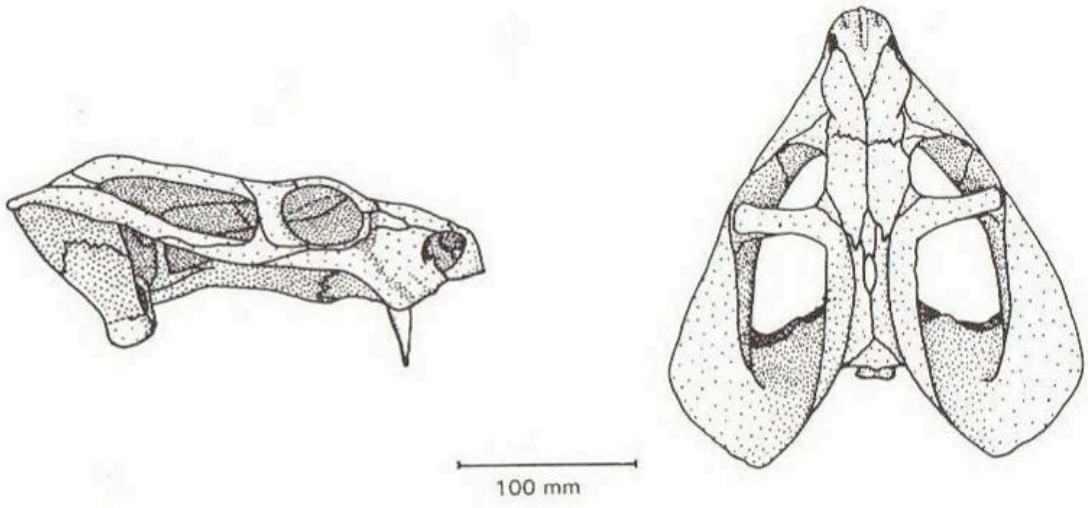

Figure 14: *Tropidostoma* skull (left lateral view, right dorsal view) (adapted from Rubidge, 1995)

Figure 15: *Endothiodon* skull

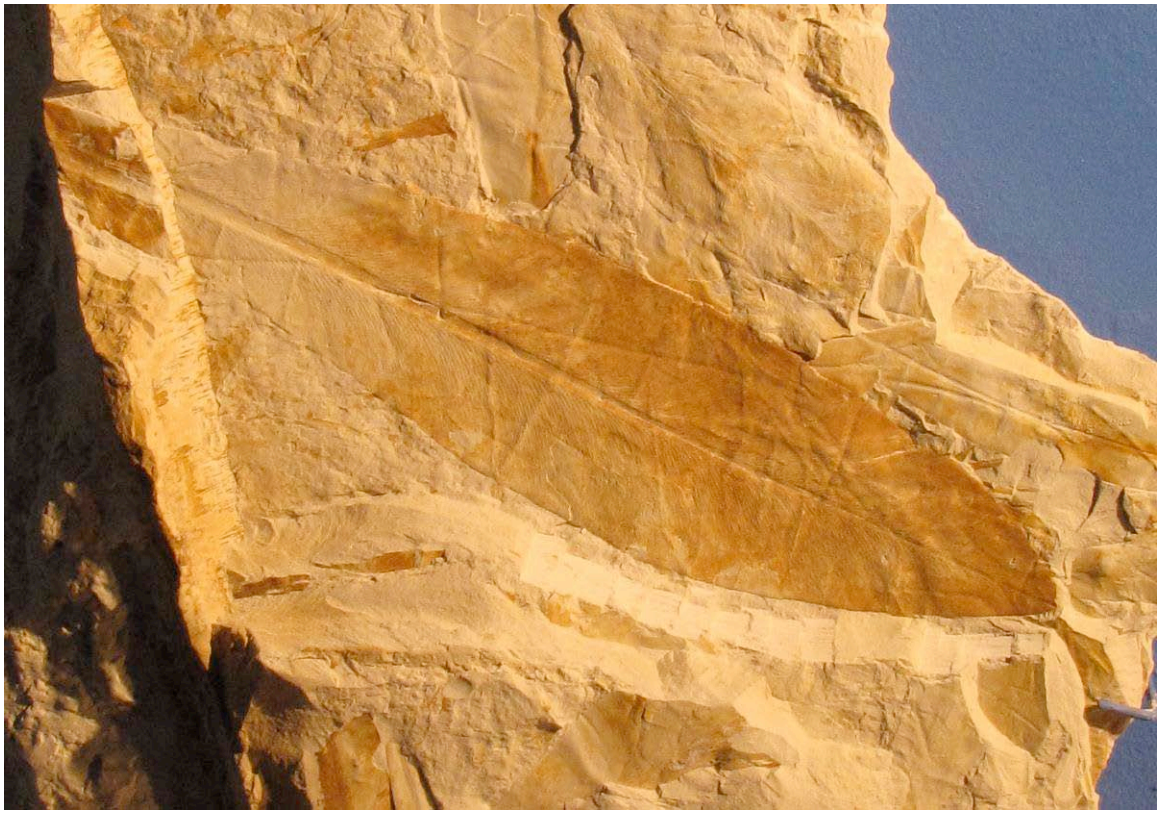

Figure 16: *Glossopteris* leaf imprint

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Johnson, M.R.; Van Vuuren, C.J.; Visser, J.N.J.; Cole, D.I.; Wickens, H. De V.; Christie, A.D.M.; Roberts, D.L. & Brandl, G. (2006). Sedimentary rocks of the Karoo Supergroup, pp. 461-499. *In*: Johnson. M.R., Anhaeusser, C.R. & Thomas, R.J. (Eds.) *The geology of South Africa*. Geological Society of South Africa, Johannesburg & the Council for Geoscience, Pretoria.

Kitching, J.W. (1977). The distribution of the Karoo vertebrate fauna. Memoir 1, Bernard Price Institute for Palaeontological Research, University of the Witwatersrand.
MacRae, C.S. (1999) *Life Etched in Stone - Fossils of South Africa*, Geological Society of Southern Africa.

Rubidge, B.S. (*Ed.*) (1995). Biostratigraphy of the Beaufort Group (Karoo Supergroup), Biostratigraphic Series no.1, South African Committee for Stratigraphy, Council for Geoscience.

6. Conclusion and Recommendations:

Whereas large parts of the proposed routes for the transmission lines traverse areas of no to negligible palaeontological importance, there are areas that are palaeontologically highly significant.

Care should be given to constructions such as access routes, construction facilities, substations, pylons and buildings that are going to be built within the fossiliferous Lower Beaufort Group of the Karoo Supergroup which is encountered over the largest part of the Gamma-Kappa line. It is recommended that a palaeontological surface survey is conducted in all these fossiliferous areas prior to construction.

Due to the fact that it would be impractical and very expensive for a qualified palaeontologist to do a field survey in the potentially fossiliferous areas in a 10km corridor along each proposed route, it would be more practical to and cost effective to employ a palaeontologist to do a surface survey only along the preferred route and sites where the proposed infrastructure such as access roads, buildings and substations are going to be built. This field survey will indicate which areas along the route are more palaeontologically sensitive than others and where construction should be avoided. It is also advised that the palaeontologist should salvage any highly scientifically significant fossil he or she may encounter during the field survey and donate it to the South African Museum in Cape Town.

None of the proposed routes for the transmission lines have a clear advantage above the others from a palaeontological perspective. The s1 route has a slight advantage above the others because runs over a significant distance of Ecca Group rocks which, except for the Whitehill Formation is relatively fossil poor. It is the only line which passes over the *Eodicynodon* Assemblage Zone however.

It is also important to mention that excavations are not necessarily detrimental to palaeontology. In many cases we would not have known of a fossil's existence if it were not for it being exposed during mining or construction. The success of the venture from a palaeontological perspective depends however on the diligence of the Environmental Control Officer and the quality of the surface survey.

<u>Mitigation</u>

Due to the fact that it would be impractical and very expensive for a qualified palaeontologist to be present at all localities and for the duration of construction, the responsibility of the recording of fossil localities and the collection of samples such as trace fossils and plant fossil material will fall upon the ECO. Fossil localities should be recorded in all cases by means of photographs and GPS readings and written up in a log book with the date, locality, photograph number and short description of the site.

In the case of trace fossils and plant fossils, it would be sufficient for the ECO to collect samples from areas being excavated for construction. In the case of *Mesosaur* or fish

fossils these should be collected in the rocks in which they occur and kept aside for a palaeontologist to collect for an acknowledged fossil repository such as the South African Museum in Cape Town. No attempt must be made to remove the fossils from the rock further.

It is recommended that a palaeontologist be appointed do a site visit to determine whether fossils are exposed in the area earmarked for development in the area where Lower Beaufort strata are exposed. This survey would of course be limited to a surface inspection only. In the event of fossils being uncovered during the construction phase, the ECO should photograph and record the position of fossiliferous material. If the fossiliferous material is going to be damaged during construction, the ECO could make an attempt to salvage it and store it safely in order for a professional appointed palaeontologist to collect it at his or her earliest convenience. If however the fossil is part of a skeleton or too big or delicate to remove, palaeontological assistance should be called for immediately. Little harm will come to a fossil if it could be collected simply by picking it up (as long as it is numbered and the locality is recorded by means of GPS), but actual excavations should be left to a professional palaeontologist. A professional palaeontologist should be appointed to salvage and collect fossiliferous material from the site which is exposed during construction.

The excavations and collection of fossils should be performed by a qualified palaeontologist and with a permit from the South African Heritage Resources Agency. The fossils should preferably be donated to South African Museum.

It is also recommended that the ECO be sent to the South African Museum where he or she must familiarise him- or herself with the fossils to be expected in the areas where development is going to take place. It is important for the ECO to study fossils in their unprepared state as well and not only prepared (cleaned) fossils and fossil reconstructions because that is not how they will appear in nature. It is very important that the ECO accompanies the palaeontologist on his or her site visit in order to be sensitised to the occurrence and appearance of fossils in their natural state.

Palaeontological specialist:
Dr JF Durand (Sci. Nat.)
BSc Botany & Zoology (RAU), BSc Zoology (WITS), Museology Dipl. (UP),
Higher Education Diploma (RAU), PhD Palaeontology (WITS)

Experience:
Palaeontological assessments:

- Urban development in Cradle of Humankind World Heritage Site (Gauteng): Letamo, Honingklip, Windgat, Sundowners, Ekutheni
- Urban development at Goose Bay, Vereeniging, Gauteng
- Upgrade of R21 between N12 and Hans Strydom Drive, Gauteng

- Vele Colliery, Limpopo Province
- De Wildt 50 MW Solar Power Station, Gauteng
- 10 MW PV Plant Potchefstroom, North West Province
- Omega 342 50MW Solar Power Station, Viljoenskroon, Free State
- Springfontein wind and solar energy facility, Free State
- Solar power plant, Bethal, Mpumalanga
- Diamond mine on Endora, Limpopo Province
- Development at Tubatse Ext.15, Limpopo Province
- Manganese mine south of Hotazel, Northern Cape
- Wind energy facility at Cookhouse, Eastern Cape
- Energy facility at Noupoort, Northern Cape
- Fluorspar mine near Wallmannsthal, Gauteng
- ESKOM power line, Dumo, KwaZulu-Natal
- ESKOM Gamma-Omega 765KV transmission line, Western Cape
- ESKOM 44KV power line at Elandspruit near Middelburg, Mpumalanga
- ESKOM Makopane Substation, Limpopo Province
- ESKOM Platreef Substation and power lines to Borutho MTS Substation, Limpopo Province
- Upgrading of storm water infrastructure in Valencia, Addo, Sundays River Valley Municipality, Eastern Cape
- Development of a 10 MW Solar Energy facility on the Farm Liverpool 543 KQ Portion 2 at Koedoeskop, Limpopo Province
- Extension of limestone mine on the farms Buffelskraal 554 KQ Portion1 and Krokodilkraal 545 KQ, Limpopo Province

Palaeontological research:

- Gauteng: Wonder Cave
- KwaZulu/Natal: Newcastle, Mooi River, Rosetta, Impendle, Himeville Underberg, Polela & Howick Districts, Sani Pass
- Eastern Cape: Cradock District, Algoa Basin
- Western Cape: Clanwilliam District
- Free State: Memel & Warden Districts
- Limpopo Province: Nyalaland (KNP), Vhembe Reserve, Pont Drift
- Zimbabwe: Sentinel Ranch, Nottingham