FULL PALAEONTOLOGICAL HERITAGE IMPACT ASSESSEMENT REPORT ON THE SITE OF THE PROPOSED NEW THABAMETSI POWER STATION AND THREE ASSOCIATED ALTERNATIVE POWER LINE ROUTES, NEAR LEPHALALE, LIMPOPO PROVINCE

9 July 2014

Prepared for:
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On behalf of:

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Prepared By:

Prof B.D. Millsteed

EXECUTIVE SUMMARY

New Shelf 1282 (Pty) Ltd desires to construct a coal-fired power station on a site near Lephalale in the Limpopo Province. The power station will have a capacity of up to 1200 MW, to be developed in two phases of 600 MW each. The proposed site is located approximately 17 km north-west of Lephalale. The identified site for the proposed power station is located near the Grootegeluk Coal Mine, Matimba Power Station and the Medupi Power Station - which is currently being constructed. The power station is proposed on the Farm Onbelyk 257 LQ. It is further required that a power transmission line must be constructed to connect the power station to the national power grid. Three alternative routes have been proposed (named alternatives 1-3 herein). The three routes largely run parallel to each other, but differ in their length and the location of their terminal points. All three power line routes exit the eastern margin of the power station site and arc to the south, and in the case of alternative route 3, thence to the west and will traverse numerous farms.

New Shelf 1282 (Pty) Ltd has appointed Savannah Environmental (Pty) Ltd to conduct an Environmental Impact Assessment report of the proposed project. Savannah Environmental (Pty) Ltd has appointed BM Geological Services to provide a Full Palaeontological Heritage Impact Assessment Report in respect of the proposed project. The site was visited during the periods 26-28 May 2014 and 2-3 July 2014 by Prof B. Millsteed in order to ascertain the fossil potential of the rock units underlying the study area. No fossil materials were located during the conduct of the study.

Only minimal outcrops of bedrock were identified within the area (due to the ubiquitous regolith cover). However, published geological data suggests the regolith cover is underlain by by sedimentary rocks of the Mogalakwena Formation (Waterberg Group), the Swartrant, Endragtpan, Lisbon and Clarens Formations of the Karoo Supergroup and lavas of the Letaba Formation.

The potential for a negative impact on the fossil heritage of the area can be quantified in the following manner. The probability of a negative impact on the palaeontological heritage of the Cenozoic regolith is assessed as low as is that for the Eendragtpan, Lisbon and Clarens Formations. Where plant macrofossil assemblages are located they frequently contain dense accumulations and so often plant macrofossils are more commonly encountered than vertebrate fossils; as such the potential for negative impact upon the floras of the Swartrant Formation is assessed as medium. The potential for any negative impacts posed by the proposed project on the palaeontological heritage of the Letaba formation and the Mogalakwena Formation is assessed as being nil. Despite the low to medium potential for a negative impact upon the palaeontological heritage of the Karoo Super group rocks and the low probability of an impact upon the Cenozoic regolith, these units (or their stratigraphic equivalents) are known to contain fossil

faunas and floras of the highest scientific and cultural significance elsewhere in South Africa and as a result any negative impact could be of high significance.

The project has been assessed as being socially beneficial, herein, as it would provide electricity to an increasingly stressed national power grid. A significant additional positive outcome emanating from the implementation of the project would be the creation of significant employment during both the construction phase and during the operational life of the power plant. The possibility of any negative impact on the palaeontological heritage of the project area could be minimised by the conduct of thorough and regular examinations by a palaeontologist of any excavations within in the Karoo Supergroup and Cenozoic strata for fossil materials as they are being performed. Should any fossil materials be identified during the construction phase, the excavations in that area should be halted and SAHRA informed of the discovery. A potential positive outcome of these mitigation protocols could be that fossil materials become available for scientific study that would otherwise have been hidden within or beneath the regolith. Should such new palaeontological material be located as a result of this site investigation this could prove to have a positive effect on the understanding of the fossil record of South Africa and positively affect the palaeontological heritage of the country.

In summary, this study has not identified any palaeontological reason to prejudice the construction of the power plant, its associated infrastructure or any of the three preferred alternative routes for a power transmission line, subject to adequate mitigation programs being put in place.

TABLE OF CONTENTS

TABLE OF FIGURES

1 INTRODUCTION

New Shelf 1282 (Pty) Ltd desires to construct a coal-fired power station on a site near Lephalale in the Limpopo Province. The power station will have a capacity of up to 1200 MW, and is to be developed in two phases of 600 MW each. The proposed site is located approximately 17 km north-west of Lephalale. The identified site for the proposed power station is located near the Grootegeluk Coal Mine, Matimba Power Station and the Medupi Power Station - which is currently being constructed. The power station is proposed on the farm Onbelyk 257 LQ, Magisterial District of Lephalale (Figures 1 and 2). It is further required that a power transmission line will be necessary to connect the power station to the national power grid. Three alternative routes have been proposed (named alternatives 1-3 herein). The three routes largely run parallel to each other, but differ in their length and the location of their terminal points. All three power line routes exit the eastern margin of the power station site and arc to the south, and in the case of alternative route 3, thence to the west (Figure 1 and 2) and will traverse numerous farms.

New Shelf 1282 (Pty) Ltd has appointed Savannah Environmental (Pty) Ltd to conduct an Environmental Impact Assessment report of the proposed project. Savannah Environmental (Pty) Ltd has appointed BM Geological Services to provide a Full Palaeontological Heritage Impact Assessment Report in respect of the proposed project.

2 TERMS OF REFERENCE AND SCOPE OF THE STUDY

The terms of reference for this study were as follows:-

- Identify all palaeontological materials located in the area to be affected by the proposed new construction activities.
- Quantify the palaeontological heritage significance of any fossil materials identified.
- Describe the possible impact of the proposed development on the palaeontological heritage of the site, according to a standard set of conventions.
- Propose suitable mitigation measures to minimise possible negative impacts, if any are identified, on the palaeontological heritage of the site.
- Provide an overview of the applicable legislative framework.
- Make recommendations concerning future work programs as, and if, necessary.

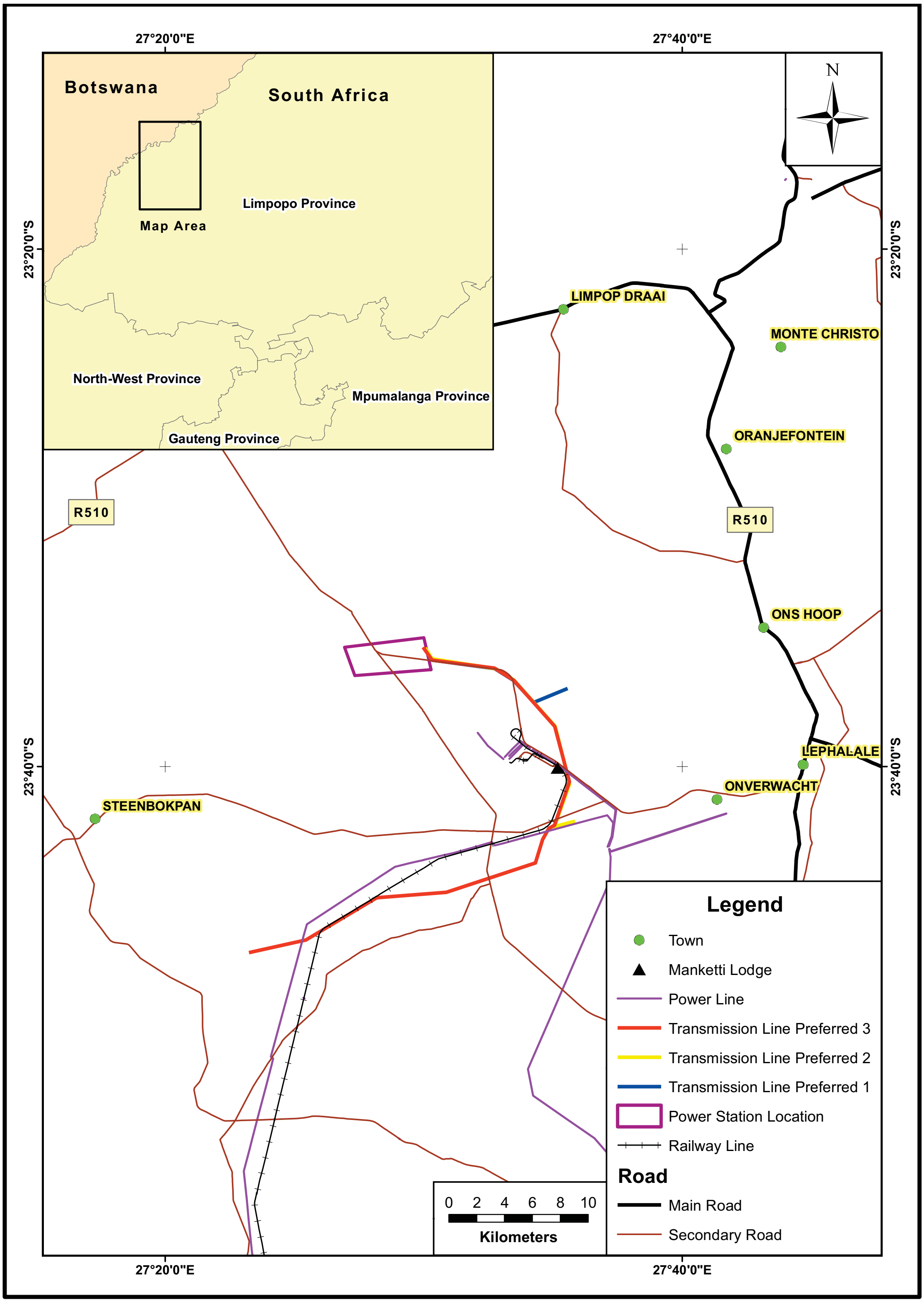

Figure 1: Map showing the location of the proposed power station and alternative power line routes 1-3.

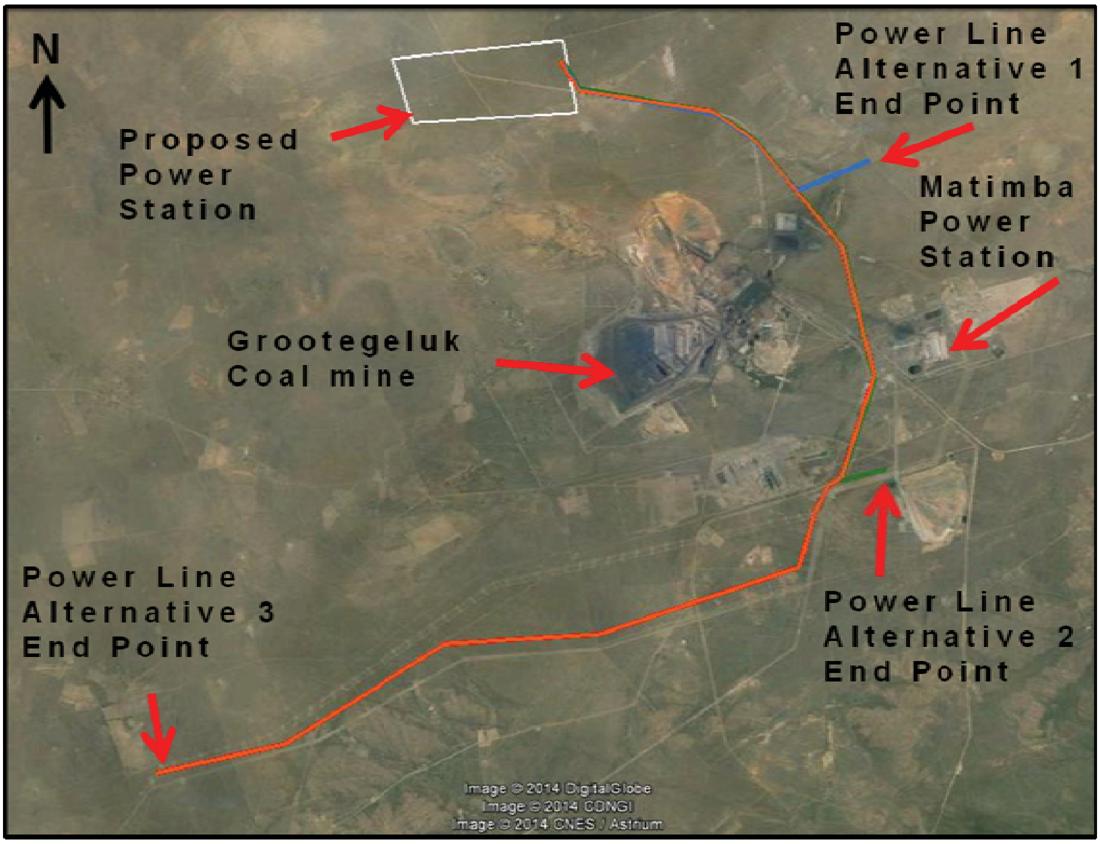

Figure 2: Google earth image showing the location of the proposed power station and alternative power line routes 1-3 in relation to Grootegeluk Coal Mine and the Matimba Power Station.

3 LEGISLATIVE REQUIREMENTS

South Africa's cultural resources are primarily dealt with in two Acts. These are the National Heritage Resources Act (Act 25 of 1999) and the National Environmental Management Act (Act 107 of 1998).

3.1 The National Heritage Resources Act

The following are protected as cultural heritage resources by the National Heritage Resources Act:

- Archaeological artefacts, structures and sites older than 100 years,
- Ethnographic art objects (e.g. prehistoric rock art) and ethnography,
- Objects of decorative and visual arts,
- Military objects, structures and sites older than 75 years,

- Historical objects, structures and sites older than 60 years,
- Proclaimed heritage sites,
- Grave yards and graves older than 60 years,
- Meteorites and fossils,
- Objects, structures and sites or scientific or technological value.

The Act also states that those heritage resources of South Africa which are of cultural significance or other special value for the present community and for future generations must be considered part of the national estate and fall within the sphere of operations of heritage resources authorities. The national estate includes the following:

- Places, buildings, structures and equipment of cultural significance,
- Places to which oral traditions are attached or which are associated with living heritage,
- Historical settlements and townscapes,
- Landscapes and features of cultural significance,
- Geological sites of scientific or cultural importance,
- Sites of Archaeological and palaeontological importance,
- Graves and burial grounds,
- Sites of significance relating to the history of slavery,
- Movable objects (e.g., archaeological, palaeontological, meteorites, geological specimens, military, ethnographic, books etc.).

3.2 Need for Impact Assessment Reports

Section 38 of the Act stipulates that any person who intends to undertake an activity that falls within the following:

- The construction of a linear development (road, wall, power line, canal etc.) exceeding 300 m in length,
- The construction of a bridge or similar structure exceeding 50 m in length,
- Any development or other activity that will change the character of a site and exceed 5 000 m^2 or involve three or more existing erven or subdivisions thereof,
- Re-zoning of a site exceeding 10 000 m^2,
- Any other category provided for in the regulations of SAHRA or a provincial heritage authority,

must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development. If there is reason to believe that heritage resources will be affected by such development, the developer may be notified to submit an impact assessment report. A Palaeontological Impact Assessment (PIA) only looks at the potential impact of the development palaeontological resources of the proposed area to be affected.

3.3 Legislation Specifically Pertinent to Palaeontology*

***Note:** Section 2 of the Act defines "palaeontological" material as "any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains".

Section 35(4) of this Act specifically deals with archaeology, palaeontology and meteorites. The Act states that no person may, without a permit issued by the responsible heritage resources authority (national or provincial):

- Destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite,
- Destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite,
- 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
- Bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment that assists in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites,
- Alter or demolish any structure or part of a structure which is older than 60 years as protected.

The above mentioned palaeontological objects may only be disturbed or moved by a palaeontologist, after receiving a permit from the South African Heritage Resources Agency (SAHRA). In order to demolish such a site or structure, a destruction permit from SAHRA will also be needed.

Further to the above point, Section 35(3) of this Act indicates that "any person who discovers archaeological or palaeontological objects or material or a meteorite in the course of development or agricultural activity must immediately report the find to the responsible heritage resources authority, or to the nearest local authority offices or museum, which must immediately notify such heritage resources authority". Thus, regardless of the granting of any official clearance to proceed with any development based on an earlier assessment of its impact on the Palaeontological Heritage of an area, the development should be halted and the relevant authorities informed should fossil objects be uncovered during the progress of the development.

3.4 The National Environmental Management Act [as amended]

This Act does not provide the detailed protections and administrative procedures for the protection and management of the nation's Palaeontological Heritage as are detailed in the National Heritage Resources Act, but is more general in is application. In particular Section 2(2) of the Act states that environmental management must place people and their needs at the forefront of its concerns and, amongst other issues, serve their cultural interests equitably. Further to this point section 2(4)(a)(iii) states that disturbances of sites that constitute the nation's cultural heritage should be avoided, and where it cannot be avoided should be minimised and remedied.

Section 23(1) indicates that a general objective of integrated environmental management is to identify, predict and evaluate the actual and potential impact of activities upon the cultural heritage. This section also highlights the need to identify options for mitigating of negative effects of activities with a view to minimising negative impacts.

In order to give effect to the general objectives of integrated environmental management outlined in the Act the potential impact on cultural heritage of activities that require authorisation or permission by law must be investigated and assessed prior to their implementation and reported to the relevant organ of state. Thus, a survey and evaluation of cultural resources must be done in areas where development projects that will potentially negatively affect the cultural heritage will be performed. During this process the impact on the cultural heritage will be determined and proposals for the mitigation of the negative effects made.

4 RELEVENT EXPERIENCE

Prof Millsteed holds a PhD in palaeontology and has previously been employed as a professional palaeontologist with the Council for Geoscience in South Africa. He is currently the principle of BM Geological Services and has sufficient knowledge of palaeontology and the relevant legislation required to produce this Palaeontological Impact Assessment Report. Prof Millsteed is registered with the South African Council for Natural Scientific Professions (SACNASP), and is a member of both the Palaeontological Society of South African and the Geological Society of South Africa.

5 METHODOLOGY

The study area was visited on two separate periods, these being conducted on the 26th to 28th of May and again on the 2nd to 3rd of July 2014 by Prof B.D. Millsteed. Mr Sanford Njoepe (of Exxaro Resources) and Mr Alan Bosman (of Eskom) accompanied Prof Millsteed on the first and second visits respectively on the lands owned by their respective companies; both gentlemen facilitated time effective and unhindered access to all areas under their companies control.

The site of all the new infrastructure elements that will constitute the Thabametsi Power Station, its associated infrastructure and the power transmission line required to connect the power station to the national grid expansion were traversed by a combination of foot traverses and detailed spot checks. The intervening ground between the sites of the spot checks was travelled by car looking for bedrock outcrop and making observations of the geology and fossiliferous potential of the various geological units being made at all times. The entire extent of the proposed power plant site was traversed by foot. The paths of the various traverses were recorded as a series of trackways on a hand-held GPS and their locations are indicated in Figure 3. Photographs were taken and detailed observations made were taken at a number of locations (see data waypoint locations in Figure 3). The location of the photographs and detailed observation points was recorded using a hand-held GPS.

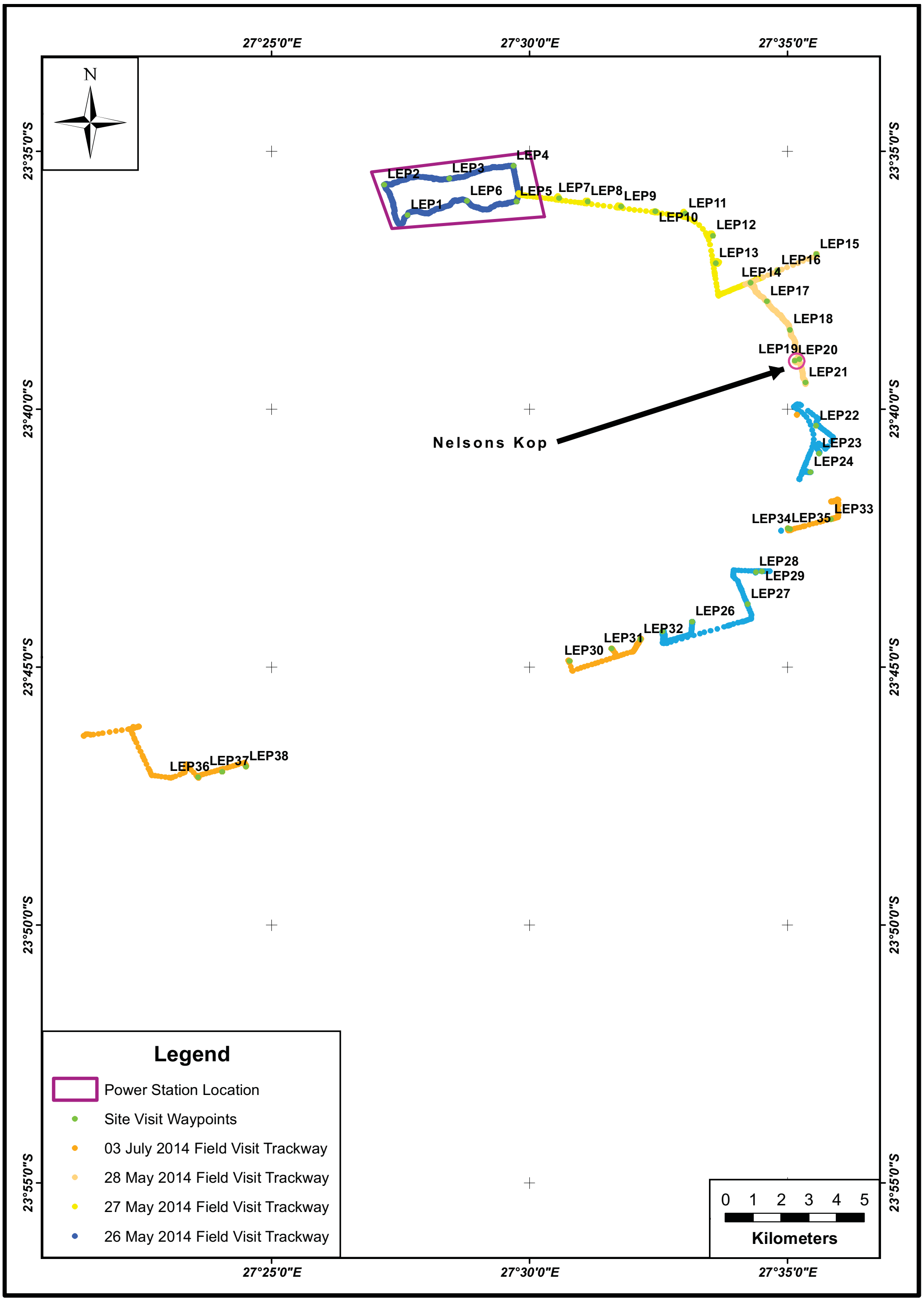

Figure 3: The location of all traverses that were conducted in the area underlying the proposed power station and alternative power line routes 1-3. Shown also are the location of GPS waypoints where photographs were taken and detailed observations were made. The location of the one hill in the area (Nelsons Kop) is also indicated.

6 ACCESS AND INDEPENDENCE

The area to be impacted by the construction of the proposed power station and power transmission line alternative routes was supplied to BM Geological Services as a .kmz file. The site visits were conducted completely free of any hindrance. Access was freely available to those portions of the study area visited during the two site visits and the field visits were able to be conducted wherever required within those farms visited. Similarly, on those farms there were no topographic or environmental features associated with the study area which made physical inspection impossible or unduly difficult. Accordingly, there were no areas that could not be easily visited and studied on the farms owned by Exxaro Resources and Eskom.

However, a significant area of land underlying the proposed power line 3 could not be visited, as the landowners could not be contacted to obtain permission to enter the land (Figure 4). It is apparent from Figure 4 that the entire extent of the areas underlying the proposed power station and alternative power line routes 1 and 2 were available for inspection and that only a portion of alternative route 3 was available for investigation. It is also evident from the geological discussion below that the geology underlying alternative route 3 in the area not visited were inspected elsewhere in the study area. As such, the observations made in those areas that were visited are considered herein to be representative of the area not inspected.

Prof Millsteed was contracted as an independent consultant to conduct this Palaeontological Heritage Impact Assessment study and shall receive fair remuneration for these professional services. Neither Prof Millsteed nor BM Geological Services has any financial interest in either New Shelf 1282 (Pty) or the proposed power station or the associated power distribution lines.

7 GEOLOGY AND FOSSIL POTENTIAL

Figures 5 and 6 show that the project area is underlain by the strata of several geological sequences that in part constitute the basin fill succession of the Ellisras Basin and the Waterberg Basin. The oldest of the bedrock units is found in the southern portions of the project area and consists of Achaean rocks of the Kransberg Subgroup, Waterberg Group. The younger bedrock lithological sequence is found in the northern portions of the study area and is composed of Permian to Jurassic sedimentary rocks of the Karoo Supergroup and Jurassic lavas of the Letaba Formation. The majority of the land surface is essentially flat lying and is extensively overlain by a regolith composed of coarse-grained, unconsolidated Cenozoic sands. Outcrops of bedrock units are very rare, and the most significant by far is formed by an exposure of the Clarens Formation that forms the isolated hill known as Nelsons Kop (Figures 3, 7 and 8). A summary of the characteristics of the geological units and their fossiliferous potentials follows.

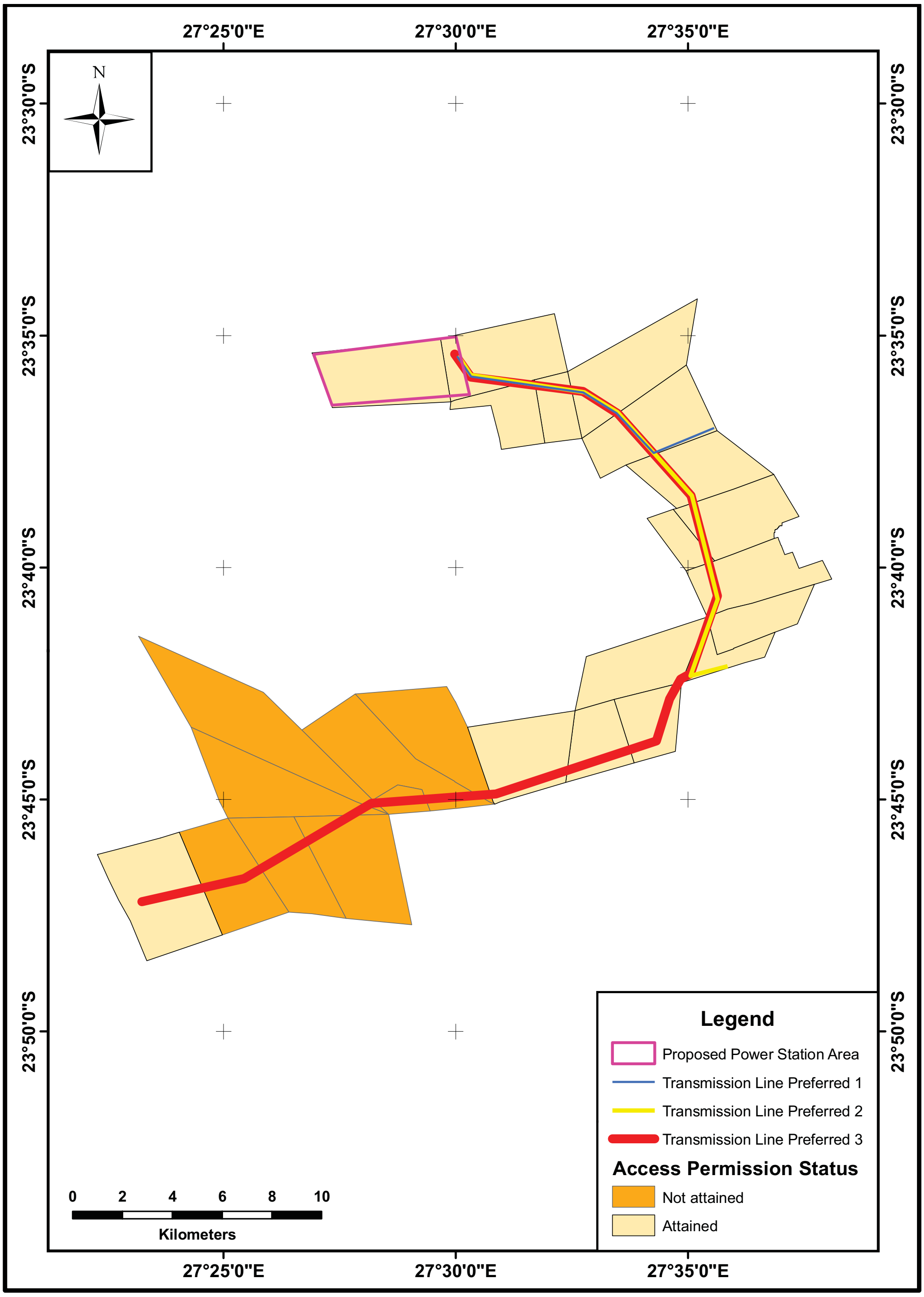

Figure 4: Map showing the location of those farms that underlie the project infrastructure and for which of these permission to enter the farms were either granted or which could not be obtained.

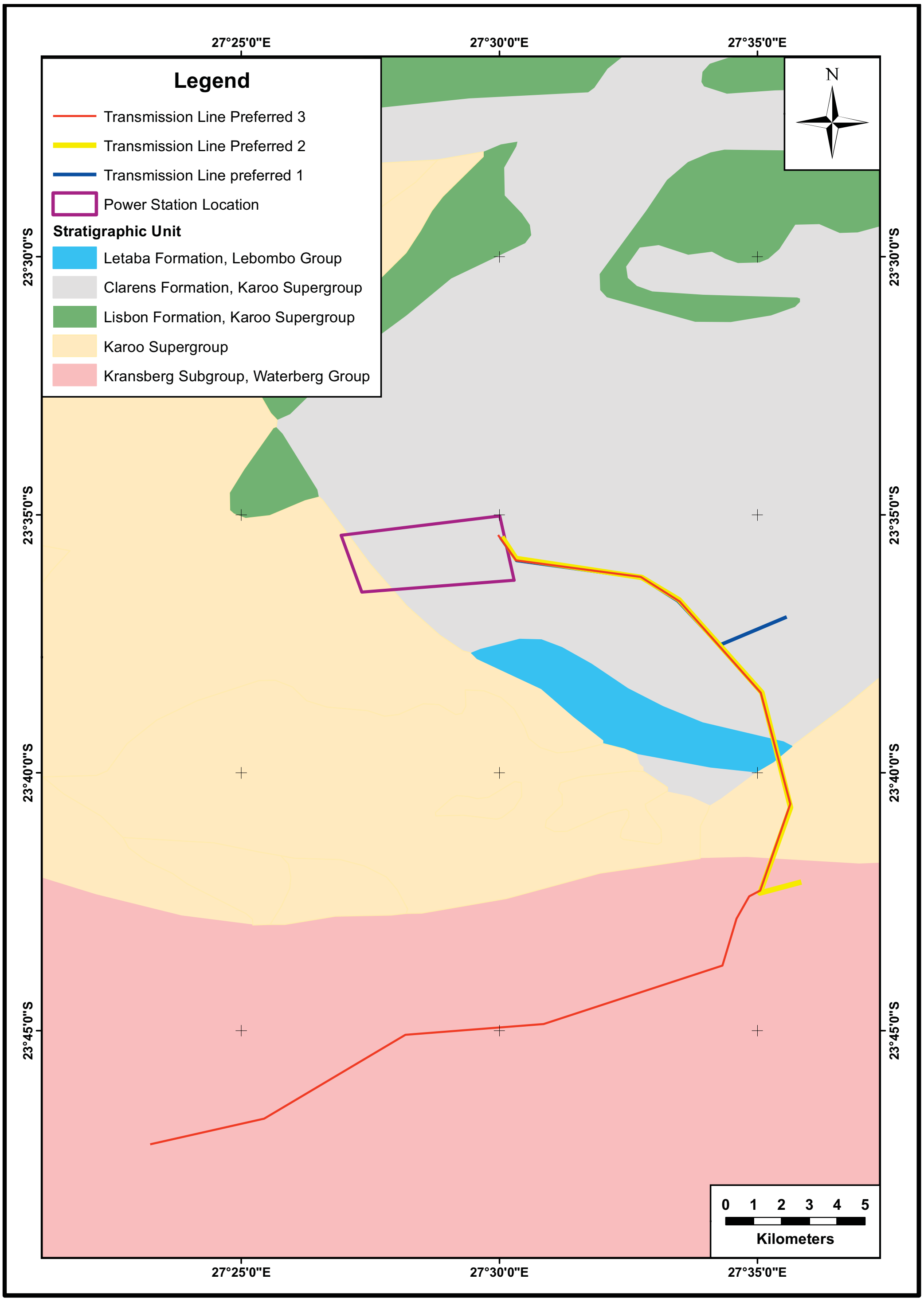

Figure 5: Simplified geological map showing the distribution of bedrock geological units that underlie the proposed project infrastructure.

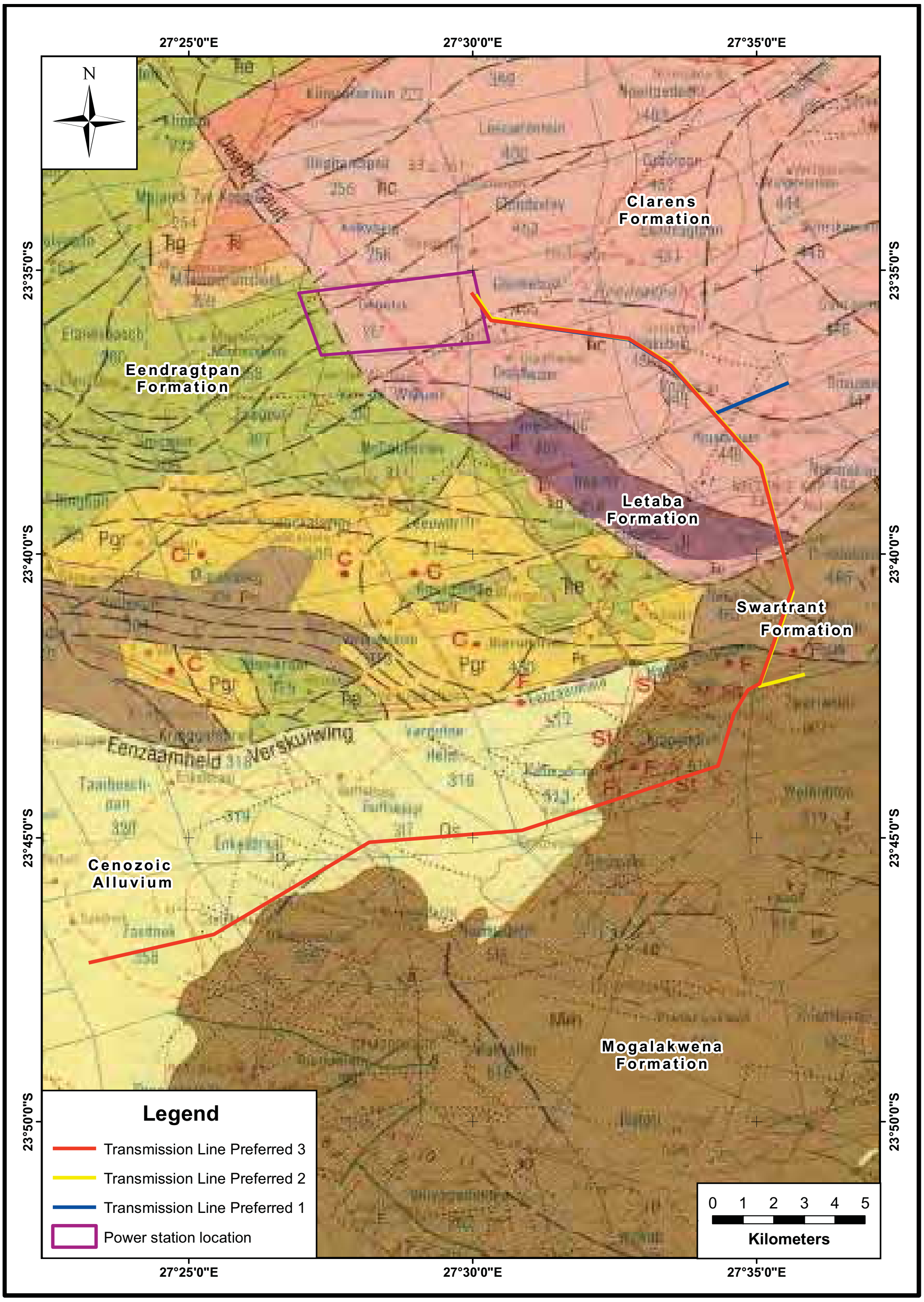

Figure 6: Detailed geological map showing the aerial extent of the superficial geological units that underlie the proposed project infrastructure [modified from the 1:250 000 Geological Series Sheet 2326 Ellisras (Geological Survey of South Africa, 1993)].

Figure 7: View of Nelsons Kop (composed of sandstones of the Clarens Formation). Mr Sandford Njoepe appears at the base of the hill for scale. The location is waypoint 19 (see Figure 3) and the view is to the southwest.

Figure 8: Close-up view of the massive sandstones of the Clarens Formation that comprise Nelsons Kop (near waypoint Lep 19, see Figure 3). The view is to the southwest.

7.1 Mogalakwena Formation, Kransberg Subgroup, Waterberg Group

7.1.1 Geology

The Achaean Mogalakwena Formation, Kransberg Subgroup, Waterberg Group forms part of the basin fill sequence of the Waterberg Basin and consists of granule-rich lithic arenites and granule rudites with pebble washes and interbedded pebble to cobble rudites (Figures 9-11). Clast-and matrix-supported rudites are subordinate in volume to the arenites. Palaeocurrents are generally directed towards the west-southwest. It has been proposed that both the Mogalakwena Formation and the underlying Sandriviersberg Formation were deposited by large braided rivers flowing from highlands to the north-northwest. The coarse-grained nature of the Mogalakwena Formation unit as well as its higher percentage of lutite matrix and the presence of clay drapes suggest that the unit is more proximal than the immediately underlying Sandriviersberg Formation (Barker *et al*., 2006).

7.1.2 Palaeontological potential

The combination of Achaean age as well the coarse-grained, fluviatile origin of the rocks of the Mogalakwena Formation confirms the unfossiliferous nature of this rock unit. Within the Achaean strata of South Africa the only known fossiliferous sequences consist of stromatolitic sequences formed within marine carbonate lithologies.

7.2 Karoo Supergroup

7.2.1 Introduction

Rock units belonging to the Karoo Supergroup that underlie the project area include the Swartrant, Eendragtpan and Clarens Formations. A brief description of the possible Karoo Supergroup units that may be present within the study area and their palaeontological potential follows.

7.2.2 Swartrant Formation

7.2.2.1 Geology

The Early Permian Swartrant Formation attains a maximum known thickness of 130 m in the central parts of the basin, but no outcrops of this unit were located during the site investigations. It has been stratigraphically subdivided into lower, middle and upper zones based on borehole intersections. The lower zone consists of 6–10 m of alternating sandstone and siltstone overlain by flaser-bedded and ripple cross-bedded sandstones, which are in turn overlain by 17-26 m of coarse-grained, cross bedded sandstones. The top of the lower zone is comprised of a 1 m thick coal seam. The lower zone is believed

Figure 9: Out crop of the Mogalakwena Formation (waypoint Lep 28, see Figure 3). Mr Alan Bosman appears on the outcrop for scale.

Figure 10: View of the pebble-rich sandstones and conglomerates of the Mogalakwena Formation (waypoint Lep 28, see Figure 3).

Figure 11: Strikingly x-bedded pebbly sandstones of the Mogalakwena Formation (waypoint Lep 28, see Figure 3)

to represent deposition in a delta front environment with provenience from the east (Johnson *et al*., 2006).

The middle zone attains a maximum thickness of 15 m and comprises coarse-grained sandstone overlain by grey laminated mudstones. This zone is capped by up to 6 m of alternating coal and mudstone (Johnson *et al*., 2006). The majority of this zone is believed to have been deposited in a glaciolacustrine environment, with occasional dropstones indicating the presence of scattered icebergs.

The upper zone is up to 36 m thick and grades upwards from coarse-grained, white sandstone at the base to a 6 m thick mudstone unit. The coarse sandstones of the upper zone can be interpreted as fluvial channel fills, with the mudstone unit being deposited in the low-energy interchannel area (Johnson *et al*., 2006).

7.2.2.2 Palaeontological potential

The Swartrant Formation should be expected to contain plant macrofossils of the scientifically significant *Glossopteris* flora. The plant macrofossil assemblages to be expected within the Early Permian strata of South Africa have been summarised by Bamford (2004).

7.2.3 Eendragtpan Formation

7.2.3.1 Geology

The Eendragtpan Formation is composed entirely of variegated mudstones, with purplish-red colours dominant. The unit attains a maximum thickness of 110 m in the central portions of the basin. The Eendragtpan Formation signals a significant change in climatic conditions from the underlying Swartrant and Grootegeluk Formations with the complete disappearance of coal and the appearance of reddish and purplish colours within the succession. The formation was probably formed in a low-energy, well drained depositional environment (flood-basin or flood plain). The reddish and purplish colours indicate deposition under subaerial conditions (Johnson *et al*., 2006). Figure 22 of Johnson *et al*., (2006) suggests a general correlation between the Eendragtpan Formation and the Volksrust Formation to upper Beaufort Group succession of the Main Karoo Basin. If this correlation is correct, the purple and reddish colours of the unit suggest a more precise correlation with the rocks of the Beaufort Group, restricting the age of the unit to possible Late Permian to Early Triassic. No outcrops of this unit were located during the site investigations.

7.2.3.2 Palaeontological Potential

Due to its mudstone composition the Eendragtpan Formation crops out poorly in the region; accordingly, the palaeontological content of the unit is not well known. No outcrops of the unit were observed during the conduct of the site visits. As a result, the stratigraphic position of the unit relative to the strata of the Main Karoo Basin is not well constrained, but as indicated in the preceding section it appears to correlate with some portion of the Beaufort Group. Given this correlation it is possible that the unit could contain vertebrate fossil materials equivalent to some portion of the transition between the *Eodicynodon* to *Cyanognathus* Assemblage Zones of Rubidge *et al*., (1995). The vertebrate fossils of this stratigraphic interval are of the highest scientific and cultural importance, in part, as they document the evolutionary transition from reptile to mammals. The scientific and cultural significance of any fossil materials that may occur within this formation are elevated due to the poor state of knowledge of the palaeontology of this unit and the value insights that any new fossil materials would provide.

7.2.4 Lisbon Formation

7.2.4.1 Geology

The Lisbon Formation has a consistent thickness of 100-110 m, with a maximum thickness of 130 m. It comprises a sequence of dominantly red, massive mudstone and siltstone, as well as minor medium- to coarse-grained sandstones. The various rock types are arranged in fining-upward cycles 5-10 m thick. Most of the formation was deposited on an extensive floodplain by meandering rivers. Some of the sandstones may, however, be aeolian in origin (Johnson *et al*., 2006). No outcrops of this unit were located during the site investigations.

The fact that the Lisbon Formation immediately underlies the Clarens Formation and that it also possible contains sandstones of aeolian origin suggest a conformable and transitional relationship between the two stratigraphic units. This apparent relationship, taken in concert with the fact that the Lisbon Formation is composed of red coloured mudstones further suggests a correlation of the unit with the Elliot Formation of the Main Karoo Basin. A correlation with the Elliot Formation infers a Late Triassic age for the Lisbon Formation.

7.2.4.2 Palaeontological potential

The strata of the Elliot Formation contain a varied vertebrate fauna containing cynodonts (*Scalenodontoides*, *Trytylodon*, *Pachygenelus* and *Tritheledon*), dinosaurs (*Euskelosaurus*, *Syntarus*, *Massospoldylus*, *Fabrosaurus*, *Lycorhinus*, *Lanasaurus, Fabrosaurus, Lesothosaurus, Heterodontosaurus, Eucnemesaurus* (=*Aliwalia*) and *Abrictosaurus*), thecodonts (*Sphenosucus,* Rauisuchids and Pedeticosaurids), crocodilia (*Orthosuchus* and *Baroqueosuchus*), amphibians (Capitosurids and a brachyopid), a turtle (a *proganochelyid*) and dinosaur eggs (Kitching and Raath, 1984; Weishampel *et al*., 1990). As such, any of these fossil types may be expected to be present within the Lisbon Formation if the correlation with the Elliot Formation suggested herein is correct.

The trace fossil general *Skolithus* and *Cruziana* are common throughout the unit (Johnson *et al*., 2006). There is a complete absence of plant material within this unit so no plant macrofossil materials are expected to be present.

7.2.5 Clarens Formation

7.2.5.1 Geology

The Late Triassic/Early Jurassic Clarens Formation forms prominent hills and ridges within the wider region, but in the study area was only observed in outcrop where it forms the hill known as Nelsons Kop (Figures 3, 7 and 8). The unit attains a maximum thickness of 130 m and is composed almost entirely of massive, well sorted, mostly cream coloured, fine-grained sandstones comprised of well rounded quarts grains. Most of the sandstone, particularly in the upper part is considered to be aeolian (Johnson *et al*., 2006). Minor coarse-grained detrital material contained within the unit was presumably transported by small, ephemeral streams.

7.2.5.2 Palaeontological potential

Significant fossils assemblages, but less diverse than those identified within the underlying Elliot Formation, have been reported within this unit and its lateral equivalents throughout South Africa and southern Zimbabwe. The vertebrate fossil assemblages of the Clarens Formation include dinosaurs (*Aristosaurus, Fabrosaurus, Geranosaurus, Gyposaurus, Heterodontosaurus, Hortalotarsus, Massospondylus and Thecodontosaurus*), sinapsid reptiles (*Pachygenelus and Tritylodon*) and a mammal (*Erythrotherium*) (Haughton, 1924; Raath, 1969; South African Committee for Stratigraphy (SACS), 1980; Olsen and Galton, 1984; Kitching and Raath, 1984; Weishampel *et al*., 1990). There have also been at least 10 different types of vertebrate footprints identified within the Clarens Formation and its lateral equivalents within South Africa (Van Dijk *et al*., 1978; Olsen and Galton, 1984).

Plant macrofossil fossils are uncommon with the formation and the assemblage is restricted to a single genus of sphenophyte (*Equisetum*) and the fossil wood *Podocarpoxylon* (Bamford, 2004).

These fossil (both plant and vertebrate) assemblages are uncommon and sporadic in their occurrence, but this rarity means that each fossil that does exist is potentially extremely scientifically significant.

7.3 Letaba Formation

7.3.1.1 Geology

The Letaba Formation (Lebombo Group) comprises a sequence of picritic (olivine-rich) lavas which form part of the Jurassic Karoo Igneous Province (Duncan and Marsh, 2006). The unit accordingly correlates with part of the Drakensberg Group lavas that terminate the Karoo sedimentation in the Main Karoo Basin. No outcrops of this unit were observed in the areas investigated.

7.3.1.2 Palaeontological potential

The extrusive, magmatic origin of the rocks that comprise the Letaba Formation preclude the possibility of any fossil materials being present within the unit. Thus, the Lataba Formation has no palaeontological potential

7.4 Cenozoic Regolith

7.4.1 Geology

Almost the entire extent of the area examined during the conduct of the site visit, as well as the surrounding general area, is underlain by unconsolidated, coarse- to medium-grained, orange red to light brown, quartz rich Cenozoic sands (Figures 12-16). The maximum thickness of this sandy regolith is unknown, but immediately to the south of waypoint Lep 38 (see Figure 3) is a shallow mining excavation in which approximately 1.5 of regolith profile is exposed. In other areas such as way point Lep 26 (see Figures 3 and 15) the regolith is thickly vegetated with a species of grass belonging to the genus *Erogrostus* known locally as "broom grass" which Mr A. Bosman (Eskom lands manager) indicated that the presence of this species suggests a regolith cover in excess of 3.5 m in thickness.

7.4.2 Palaeontological potential

No fossil materials were located within this unit during the conduct of the site investigation. Given the coarse-grained and oxidised nature of these sediments it is unlikely that any biological materials incorporated into the sediments would have been preserved and fossilised, but the possibility cannot be discounted completely.

8 ENVIRONMENT OF THE PROPOSED PROJECT SITE

The site proposed for the construction of the Thabametsi Power Station is large measuring approximately 5 km east-west and 2.2 km north-south (approximately 1 145 ha). It is probable that the area that would be directly impacted by the construction of the power station would be smaller, but the proportions of the proposed power station are unknown to the author. The length of each of the three power transmission line alternative routes differs with that alternative route 1 being approximately 11.2 km, alternative route 2 being approximately 19.7 km and alternative route 3 is approximately 41.6 km in length. Accordingly, the length of the area to be impacted by the construction of the necessary transmission lines can only be determined once the choice of alternative route is finalised, but all three alternatives extend for considerable distances. The width of the area to be impacted by the construction of the power lines is unknown to the author, but the width will be at least as wide as the accompanying servitude road and the base of the support pylons.

The land surface underlying almost the entire extent of the power station and the three alternative power line routes is flat and featureless, save for the prominent hill Nelsons Kop (Figures 17-21). No significant fluvial drainage lines cross-cut the site of the proposed power station, but a small number of ephemeral channels (particularly in the extreme south of the area) cross-cut the routes of the proposed power lines (Figure 21).

Figure 12: Unconsolidated sands of the Cenozoic regolith (waypoint Lep 1, see Figure 3).

Figure 13: Unconsolidated orange-red sands of the Cenozoic regolith (waypoint Lep 3, see Figure 3)

Figure 14: Unconsolidated orange-red sands of the Cenozoic regolith (waypoint Lep 13, see Figure 3).

Figure 15: Unconsolidated orange-red, coarse-grained sands of the Cenozoic regolith (waypoint Lep 26, see Figure 3). The grass evident in the image is a species of *Erogrostus* that indicate that the regolith is at least 3.5 m thick in the area (information courtesy of Mr Alan Bosman *pers comm*.).

Figure 16: Light brown, coarse-grained, unconsolidated sands of the Cenozoic regolith.

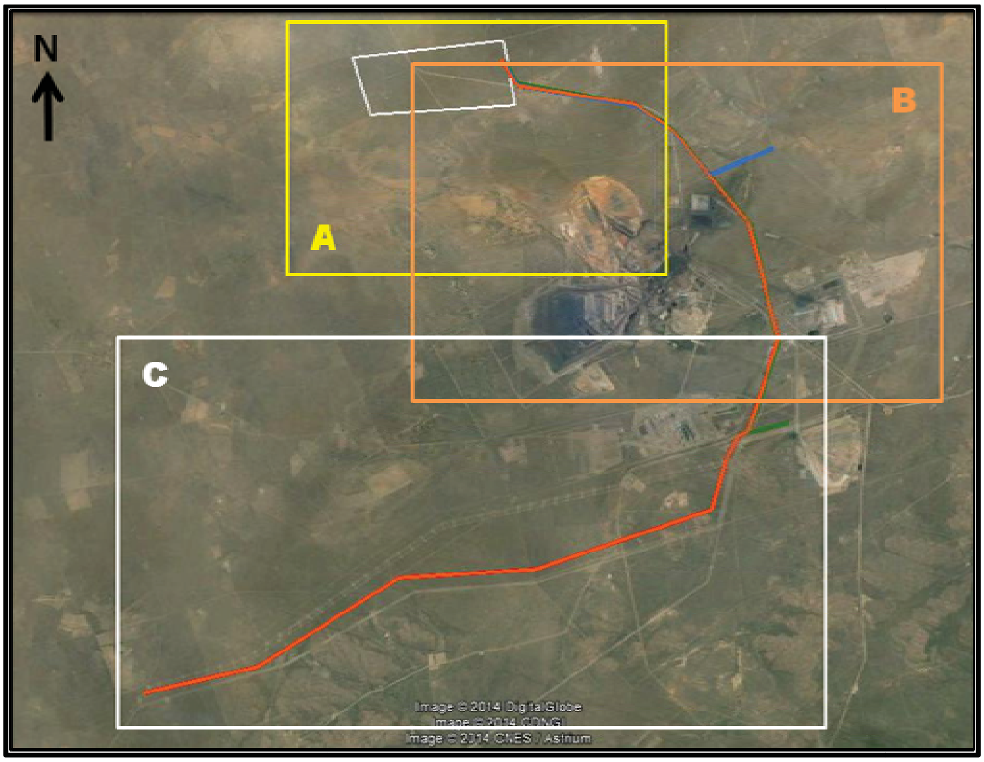

Figure 17: Google earth image of the area underlying the project infrastructure and the immediate environs. Insets A-C refer to those areas that are expanded in Figures 18-20 below.

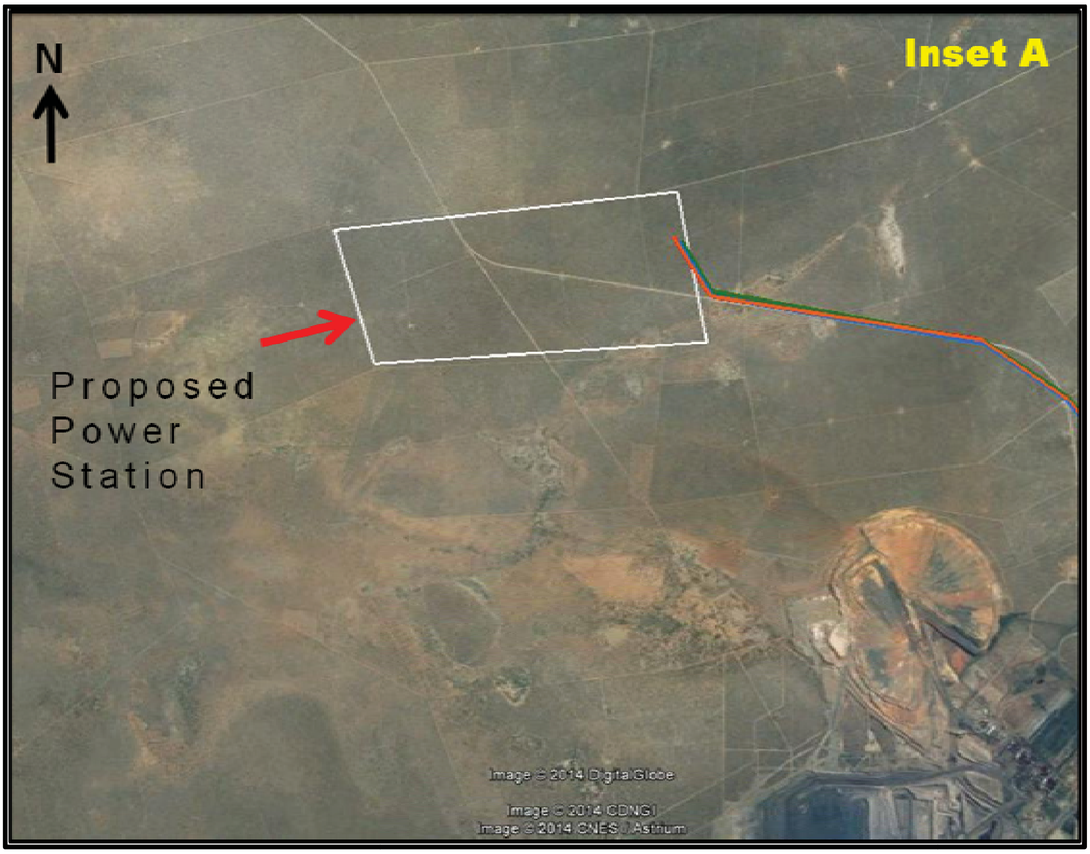

Figure 18: Google earth image of the area indicated as Inset A in Figure 17. The white polygon is the area that will contain the power station. Grootegeluk Coal Mine is located in the bottom right-hand corner; otherwise the area is topographically flat and featureless.

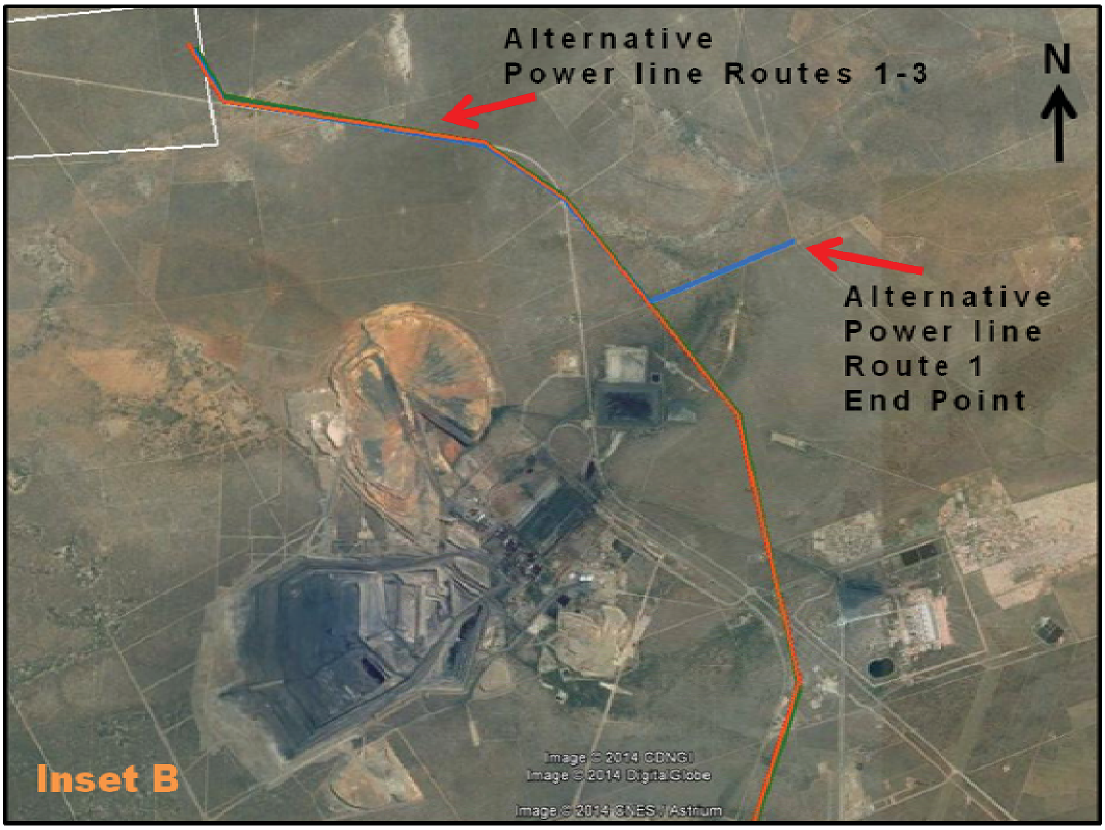

Figure 19: Google earth image of the area indicated as Inset B in Figure 17. The alternative power line routes 1-3 pass between the Grootegeluk Coal Mine to the west and the Matimba Power Station to the east. Topographically the surrounding, undeveloped landscape is flat and featureless.

Figure 20: Google earth image of the area indicated as Inset C in Figure 17. Alternative power line route 2 terminates in the upper right-hand corner of the image. Only Alternative power line route 3 continues to the south of the Grootegeluk Coal Mine, where it bends sharply to the west. It is evident that the landscape in this portion of the project area is topographically flat and featureless.

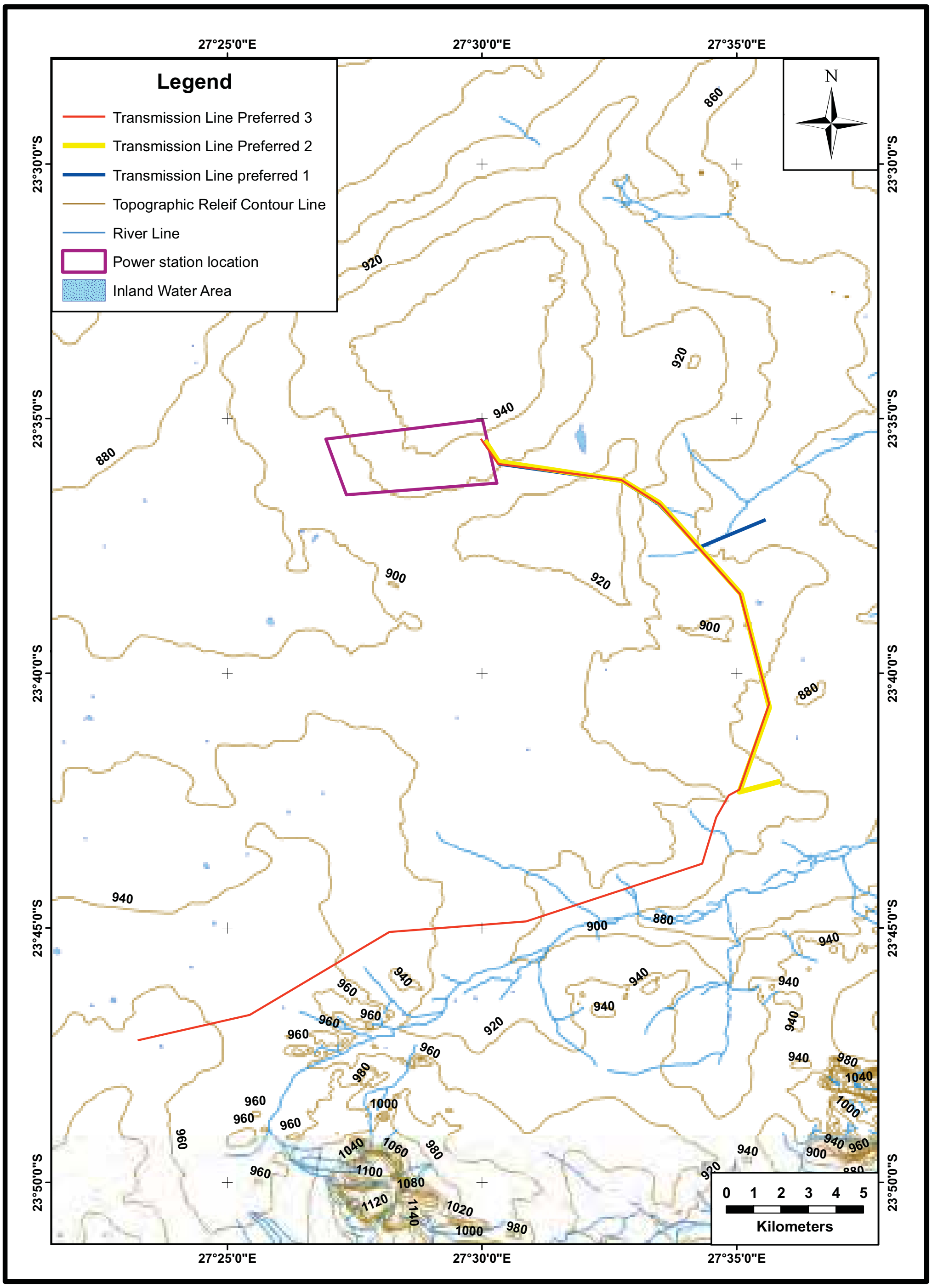

Figure 21: Map of the environment of the project area and its immediate environs. The topographic relief contour interval is 20 m, so it is evident that the majority of the region is very flat. No significant fluvial drainage lines traverse the area of the proposed Thabametsi Power Station, one it located proximally to the termination of alternative power line route 2 and several cross-cut alternative power line route 3 in its southern extent.

The majority of the project area is vegetated with mixed broadleaf/acacia forest of the Limpopo Sweet Bushveld veld type (Figure 22). A small proportion of the site of the southern-most extent of power line alternative route 3 is vegetated with forests of the Western Sandy Bushveld type (Figure 22). Mucina and Rutherford (2006) indicate that the conservation status of both the Limpopo Sweet Bushveld and Western Sandy Bushveld vegetation types is categorised as least threatened. The land underlying the project area is currently utilised for game farming, game conservation and cattle grazing.

9 OVERVIEW OF SCOPE OF THE PROJECT

The proposed project will consists of two separate development types. The first will consist of a 1200 MW coal-fired power station and its associated infrastructure. The power station is proposed to be constructed in two phases, each 600 MW in capacity.

The second major component of the project will consist of the construction of a power transmission line to connect the power plant to the national power grid. Three alternative routes are proposed for the power line (named alternatives 1-3 herein). All three routes originate in the eastern end of the areas proposed for the power station, run mostly parallel to each other and arc to the south east. Power line alternative route 1 extends for a distance of being approximately 11.2 km (with its final section bending sharply to the northeast), alternative route 2 being approximately 19.7 km (with its final section bending sharply to the east) and alternative route 3 is approximately 41.6 km in length (and eventually runs in an approximately east-west direction) (Figures 17-20). Only one of these route options will eventually be selected should the project proceed. The power transmission lines will be accompanied by a servitude that will include a service road, although it is likely that this road will be a twin spoor dirt road as utilised in the other transmission lines constructed within the region.

The anticipated effects of the proposed constructions upon the underlying geological units can be summarised as follows. The construction of the power transmission line will involve the emplacement of regularly spaced pylons. It is anticipated, herein, that the pylons will have foundations that will require excavation of the land surface down to bedrock where they will affect the upper 1-2 m of the bed rock. The servitude road that will accompany the power line will be a twin spoor track that will only affect the immediate land surface and, as such, will only affect the Cenozoic regolith in almost all areas. The depth of any excavations required to construct the power station are unknown to the author, but for the purposes of this report it is assumed that they may be up to 10 m deep; in this event the power station construction will directly impact upon both the regolith cover and the underlying bed rock. The infrastructure associated with the power plant (e.g., roads, car parks and out buildings) are expected to only

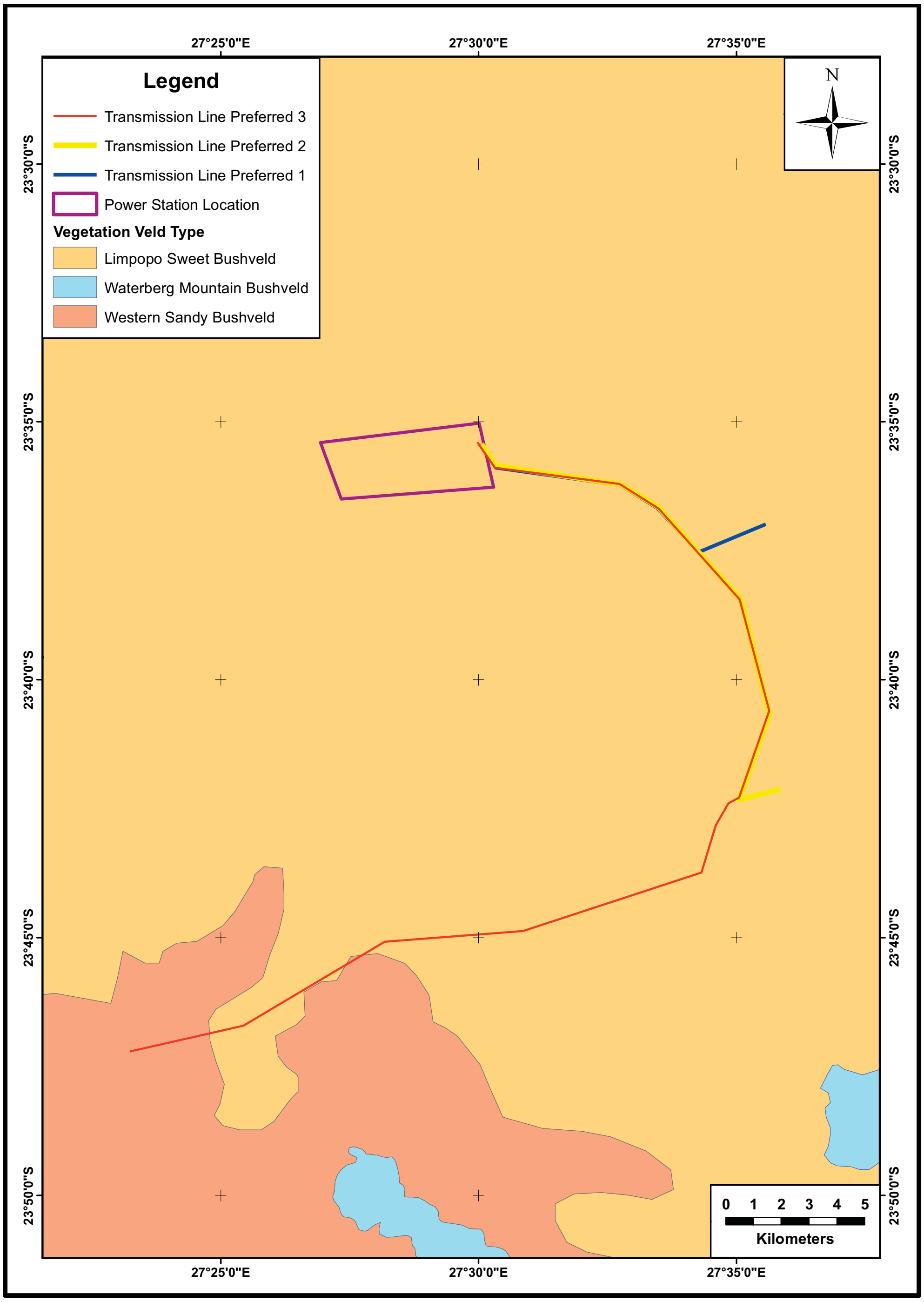

Figure 22: The distribution of the various vegetation veld types occurring beneath the proposed project area and its immediate environs. It is evident that almost the entire area to be underlain by the project infrastructure consists of the Limpopo Sweet Bushveld veld type, while a small portion of the southern termination of alternative power line route 3 is vegetated with the western sandy Bushveld veld type (after Mucina and Rutherford, 2006).

impact upon the upper 1-2 m of the land surface. Thus, they will be expected to only impact upon the regolith cover in most areas.

The anticipated life of the power station and the power transmission line is unknown to the author, but should be considered long term to permanent.

10 IMPACT ASSESSMENT

The potential impact of the proposed mining area is categorised below according to the following criteria:-

10.1 Nature of Impact

The potential negative impacts of the proposed project on the palaeontological heritage of the area are:

- Damage or destruction of fossil materials during the construction of project infrastructural elements to a maximum depth of those excavations. Many fossil taxa (particularly vertebrate taxa) are known from only a single fossil and, thus, any fossil material is potentially highly significant. Accordingly, the loss or damage to any single fossil can be potentially significant to the understanding of the fossil heritage of South Africa and to the understanding of the evolution of life on Earth in general. Where fossil material is present and will be directly affected by the building or construction of the projects infrastructural elements the result will potentially be the irreversible damage or destruction of the fossil(s).
- Movement of fossil materials during the construction phase, such that they are no longer *in situ* when discovered. The fact that the fossils are not *in situ* would either significantly reduce or completely destroy their scientific significance.
- The loss of access for scientific study to any fossil materials present beneath infrastructural elements for the life span of the existence of those constructions and facilities.

10.2 Extent of impact

The possible extent of the permanent impact of the proposed project on the palaeontological heritage of South Africa is restricted to the damage, destruction or accidental relocation of fossil material caused by the excavations and construction of the necessary infrastructure elements forming part of the project. The possible source of a less permanent negative impact on the palaeontological heritage is the loss of access for scientific research to any fossil materials that become covered by the various infrastructural elements that comprise the project. The **extent of the area of potential impact is, accordingly, categorised as local** (i.e., restricted to the project site).

10.3 Duration of impact

The anticipated duration of the identified impact is assessed as potentially **permanent to long term**. This is assessment is based on the fact that, in the absence of mitigation procedures (should fossil material be present within the area to be affected) the damage or destruction of any palaeontological materials will be permanent. Similarly, any fossil materials that exist below any new infrastructural elements (e.g., the power station, out associated buildings, car parks roads, power line pylons or the power line servitude road), but which are not be uncovered during the necessary excavations, will be unavailable for scientific study for the life of the existence of those features.

10.4 Probability of impact

The rocks of the Karoo Supergroup are extremely poorly exposed within the project area and little meaningful investigation of their palaeontological potential was possible during the site visits. It is known that units or their stratigraphic equivalents are fossiliferous elsewhere in southern Africa; as such there is a reasonable chance of fossil materials occurring within any Karoo rocks underlying the project area. However, it is pertinent to realise that fossils (particularly vertebrate fossils) are generally scarce and sporadic in their occurrence (but where fossil plants occur they are often found is dense accumulations). The probability of fossils within the Karoo strata being negatively impacted by the proposed developments is further lessened by the fact that the Karoo strata appear to be uniformly covered by Cenozoic sands that were interpreted (on the basis of the grasses present) to be at least 3.5 m thick in several locations. As the majority of the infrastructure to be constructed will probably only affect the upper few (1-2 m) of the land surface little impact on the Karoo rocks is anticipated over the majority of the project area. The probability of the construction of the new infrastructure elements associated with the power station and power transmission line negatively impacting upon the palaeontological heritage of the Karoo Supergroup is accordingly assessed as **low in general, but as medium in the Swartrant Formation** due to the generally more abundant nature of plant macrofossils compared to vertebrate fossils.

The rocks of the Letaba Formation are not fossil-bearing. As such the probability of any negative impact on the palaeontological heritage of this unit is assessed as **nil**.

The rocks of the Mogalakwena Formation consist of Achaean, coarse-grained, fluviatile siliclastic sediments. As macrofossil assemblages within South Africa’s Achaean rocks are restricted to stromatolite assemblages that occur in marine carbonate rocks the probability of any negative impact on the palaeontological heritage of this unit is assessed as **nil**.

No fossil materials were located within the Cenozoic regolith during the site visit. The Cenozoic sediments are both coarse-grained and oxidised which also reduces the possibility of any organic materials having been preserved post deposition; however, the possibility remains that palaeontological materials may be present in subsurface horizons. The probability of any construction activities negatively impacting upon the palaeontological heritage of the Cenozoic regolith is accordingly assessed as **low**.

10.5 Significance of the impact

The palaeontological content of the Karoo Supergroup rocks of the Ellisras Basin is poorly know due to the very poor to usually non-existent outcrop, but scientifically and culturally significant fossil assemblages are known to occur within the rocks of the Karoo Supergroup elsewhere is Southern Africa. The Early Permian rocks of the Swartrant Formation contain coals and are correlative with the Ecca Group in the Main Karoo Basin. These rocks could reasonably be expected to contain significant plant macrofossil assemblages belonging to the *Glossopteris* flora as are known to occur in the lithologically similar and approximately time equivalent Vryheid Formation. Any new fossil materials occurring within this palaeontologically poorly know unit would potentially be of great scientific significance.

Correlation of the Eendragtpan Formation with the rocks of the Main Karoo Basin is not well constrained, but it is suggested, herein, that is probably time equivalent with part of the Beaufort Group. If this correlation is correct it is entirely possible that the unit may contain vertebrate fossils equivalent to those of the world famous assemblages of the Beaufort Group. The Beaufort Group vertebrate faunas are highly significant to the understanding of the evolutionary transition from reptiles to mammals.

The Lisbon Formation has been correlated, herein, with the Elliot Formation of the Main Karoo Basin. Accordingly, the Lisbon Formation may be expected to contain scientifically and culturally significant vertebrate fossil assemblages including mammal-like reptiles, mammals, amphibians and some of the earliest dinosaur forms [belonging to the *Euskelosaurus* and/or *Massospondylus* Zones of Kitching and Raath, (1984)].

The Clarens Formation is not richly fossiliferous anywhere in southern Africa, but does contain a range of early dinosaur taxa, some of the earliest mammals and vertebrate trackways amongst other fossil types. Plant macrofossils are very sparingly present, but are know. Any fossil material present within the Clarens Formation rocks underlying the project area would potentially be both highly scientifically and culturally significant.

The rocks of the Letaba Formation consist of extrusive pictritic lavas. No fossil materials are expected to be present within these rocks and, as such, the palaeontological heritage significance of any development upon these rocks would be nil.

The Achaean rocks of the Mogalakwena Formation (Waterberg Group) are considered to be unfossiliferous herein. As such, the palaeontological heritage significance of any development upon these rocks would be nil.

Any palaeontological materials that may have been incorporated into the Cenozoic sandy regolith would potentially provide scientifically important data concerning the paleoenvironment and palaeoclimate of the region. Fossil deposits of Cenozoic age are not common within the geological record of the wider region; thus, the rarity of fossils within the sequence makes each fossil that may be present, **potentially highly scientifically significant**.

The scientific and cultural significance of fossil materials is underscored by the fact that many fossil taxa (particularly vertebrate taxa) are known from only a single fossil and, thus, any fossil material is potentially highly significant. Accordingly, the loss or damage to any single fossil can be potentially significant to the understanding of the fossil heritage of South Africa and to the understanding of the evolution of life on Earth in general. Where fossil material is present and will be directly affected by the building or construction of project infrastructural elements the result will potentially be the irreversible damage or destruction of the fossil(s).

The certainty of the exact *in situ* location of fossils and their precise location within the stratigraphic sequence is essential to the scientific value of fossils. The movement of any fossil material during the construction of the facility that results in the exact original location of the fossil becoming unknown will either greatly diminish or destroy the scientific value of the fossil.

Thus, the probability of a negative impact on the palaeontological heritage contained within the Swartrant Formation is categorised as medium and as low in the remainder of the Karoo Supergroup (the Eendragtpan, Lisbon and Clarens Formations). Similarly, the probability of a negative impact on the palaeontological heritage contained within the Cenozoic regolith underlying the project area is categorised as low, the significance of any negative impact posed by the project on the palaeontological heritage is categorised as potentially high if appropriate mitigation procedures are put into place.

10.6 Severity / Benefit scale

The proposed project is categorised, herein, as being potentially **beneficial**. This classification is based on the intention that the project will facilitate the production and supply of electricity to an increasingly stressed national power grid. The project will also provide a mix of short term (i.e., the construction phase) and permanent employment in a region that is historically short of work opportunities. The power production and supply project will, accordingly, provide a long term benefit to the community in terms of the provision of electrical power as well as employment.

The probability of a negative impact on the palaeontological heritage of the project area has been categorised as **low** in areas underlain by Karoo-age rocks of the Eendragtpan, Lisbon and Clarens Formations as well as within the Cenozoic regolith, but **medium** in the rocks of the Swartrant Formation. The probability of any negative impact upon the palaeontological heritage of the area posed by any development that impacts either the Mogalakwena Formation or the Letaba Formation has been assessed as being **nil**. The probability of any negative palaeontological heritage impact is low to medium underneath the proposed power station complex. Power line route alternatives 1 and 2 are almost completely underlain by rock presenting a low to medium probability of negative impact; with the area underlain by the Letaba Formation and the southern-most termination of alternative 2 being located on rocks providing nil risk. The risk profile of power line alternative 3 varies from those of alternatives 1 and 2 only in that the portion of that route that extends south of alternative 2 is located entirely on unfossiliferous Achaean bedrock and bearing a Cenozoic regolith cover; the risk in this section of the alternative route is accordingly uniformly low.

The low to medium likelihood of fossils being directly affected by portions of the planned project must be weighed in conjunction with the severity of any negative impact that may result. Many fossil taxa (particularly vertebrate forms) are known from only a single fossil and, thus, any fossil material is potentially highly significant. This potential significance is highlighted by the fact that elsewhere in the region the Rocks of the Karoo Supergroup contain extremely significant fossils for documenting the transition from reptiles to mammals as well as the early evolution of dinosaurs. Scientifically significant plant macrofossil assemblages are also found throughout the Karoo Supergroup sequence. Cenozoic regolith sequences within South Africa occasionally contain fossils that provide a rare insight into the palaeoecology and palaeoclimate of the period. Thus, it is possible that there are fossils of the highest scientific and cultural significance present within the sediments underlying the project area. Accordingly, the loss or damage to any single fossil or fossil locality can be potentially significant to the understanding of the fossil heritage of South. **Thus, while the likely hood of any disturbance of palaeontological materials is low in the Karoo Supergroup and Cenozoic deposits, the severity of any impact is potentially extremely high**. The possibility of a negative impact on the palaeontological heritage of the area can, however, be minimised by the implementation of adequate damage mitigation procedures. **If damage mitigation is properly undertaken the benefit/severity scale for the project will lie within the beneficial category**.

A potential secondary benefit of the project would be that the excavations resulting from the progress of the project may uncover fossils materials that were hidden beneath the surface regolith exposures and, as such, would have remained unknown to science. If the planned excavations are inspected, while they are occurring, with a view to identifying any possible palaeontological materials present the possibility would be generated of being able to study and excavate fossil materials that would otherwise be hidden to scientific study.

10.7 Status

Given the combination of factors discussed above, it is anticipated that as long as adequate mitigation processes are emplaced during the conduct of those construction activities located upon the Karoo Supergroup and Cenozoic regolith any negative effect on the palaeontological heritage of the area will be minimised to the extent possible. As the proposed project would facilitate the ongoing supply steaming coal for the supply of electricity and coking coal for the production of steel the project is determined as having a **positive status** herein.

11 DAMAGE MITIGATION, REVERSAL AND POTENTIAL IRREVERSABLE LOSS

The degree to which the possible negative effects of the proposed project can be mitigated, reversed or will result in irreversible loss of the palaeontological heritage can be determined as discussed below.

11.1 Mitigation

It is recommended that thorough and regular examinations of all excavations that occur within the sediments of the Karoo Supergroup and Cenozoic regolith be made by a palaeontologist while they are occurring. Should any fossil materials be identified, the excavations in that area should be halted in that location and SAHRA informed of the discovery (see Section 3.4 above). A significant potential benefit of the examination of the excavations associated with the construction of the project is that currently unobservable fossils may be uncovered. As long as the construction process is closely monitored it is possible that potentially significant fossil material may be made available for scientific study.

Should scientifically or culturally significant fossil material exist within the project area any negative impact upon it could be mitigated by its excavation (under permit from SAHRA) by a palaeontologist and the resultant material being lodged with an appropriately permitted institution. In the event that an excavation is impossible or inappropriate the fossil or fossil locality should be protected and the fossil site excluded from any further mining.

11.2 Reversal of damage

Any damage to, or the destruction of, palaeontological materials or reduction of scientific value due to a loss of the original location is **irreversible**.

11.3 Degree of irreversible loss

Once a fossil is damaged, destroyed or moved from its original position without its geographical position and stratigraphic location being recorded the **damage is irreversible**.

Fossils are usually scarce and sporadic in their occurrence and the chances of negatively impacting on a fossil in any particular area are low. However, any fossil material that may be contained within the strata underlying the project area is potentially of the greatest scientific and cultural importance. Thus, the potential always exists during the conduct of mining operations within potentially fossiliferous rocks for the permanent and irreversible loss of extremely significant or irreplaceable fossil material. This said, many fossils are incomplete in their state of preservation or are examples of relatively common taxa. As such, just because a fossil is present it is not necessarily of great scientific value. Accordingly, not all fossils are necessary significant culturally of scientifically significant and the potential degree of irreversible loss will vary from case to case. The judgement on the significance of the fossil must be made by an experienced palaeontologist.

12 ASSUMPTIONS, UNCERTAINTIES AND GAPS IN KNOWLEDGE

The information provided within this report was derived, in part, from a detailed site investigation conducted on foot. No fossil materials were observed during the conduct of that survey. However, the potentially fossiliferous Karoo Supergroup strata that underlie much of the study area are almost completely covered by Cenozoic regolith and, accordingly, the fossiliferous potential of the Karoo Supergroup rocks within the study area could not be comprehensively ascertained. Similarly, despite the fact that no fossil materials were located within the Cenozoic regolith, the presence of fossils within the subsurface levels of these strata remains a possibility.

No direct observations were possible in those farms for which permission to access the land could not be obtained. The palaeontological potential of the strata underlying those farms has been extrapolated from those exposures of the same strata that occur to the east and the west of the affected farms. It is a possibility that the extrapolated interpretation may be erroneous. However, given the uniformity of data collected on either side of the affected farms this is not considered to be a significant possibility herein.

13 ENVIRONMENTAL IMPACT STATEMENT

New Shelf 1282 (Pty) Ltd desires to construct a 1200 MW coal-fired power station (in two separate 600 MW phases), necessary associate infrastructure and a power transmission line to connect the power station to the national electrical grid. A detailed, investigation involving foot traverses as well as car-based traverses with regular detailed spot investigations has been conducted on the site by Prof B. Millsteed. Observations made during the conduct of that investigation form the basis of this report. A number of farms forming a discreet block underlying the southern portion of power line alternative route 3 were not visited as the land owners could not be contacted to obtain permission to access the farms. However, the geological units that are believed to underlie those farms also occur immediately to the east and west of the farms; these areas were visited and data collected. The data collected either side of the region that was not visited were of a uniform nature and their interpretation was extrapolated to the area that was unvisited. The fact that this area was not directly observed is not considered, herein, to negatively impact on the conclusions drawn in this report.

Any negative impacts to the palaeontological heritage of the region will be limited to the footprint area of the construction activities and, as such, the extent of any impact is accordingly characterised as local.

The construction of the power plant will affect the will definitely affect the Cenozoic regolith, with a reduced possibility of any effects occurring to the strata of the Karoo Supergroup. The associated infrastructure and out buildings are expected to have relatively shallow impacts (i.e., < 1-2 m) and should mostly affect the Cenozoic regolith. The power line pylons will impact upon the Cenozoic regolith as well as the upper-most 1-2 m of the underlying bedrock units. The servitude road associated with the power lines will only impact upon the Cenozoic regolith. Where the construction activities will impact upon the Cenozoic regolith or the Eendragtpan, Lisbon and Clarens Formations The probability of any negative impact upon the palaeontological heritage of these units is assessed as low. In those locations where the Swartrant Formation will be impacted the probability of any negative impact upon the palaeontological heritage is assessed as being medium. The rocks of the Mogalakwena and Letaba Formations are unfossiliferous and, as such, any disruption of these units will result in nil possibility of any negative impact upon their palaeontological heritage.

Despite the characterisation of the risk of a negative impact resulting upon the palaeontological heritage of the either the Cenozoic regolith or the Eendragtpan, Lisbon and Clarens Formations being assessed as low and that of the Swartrant Formation being assessed as medium any fossil materials that they may contain will potentially be of high scientific and cultural importance. No fossil materials were located during the conduct of the present site investigation. However, this study has identified that the underlying strata of the Karoo Supergroup and the Cenozoic cover sequences are fossiliferous elsewhere in South Africa. As such, fossils are potentially present beneath the planned construction projects (particularly in the Karoo Supergroup which is completely covered by the regolith and, as such, could not be directly investigated). Any damage, destruction or inadvertent movement of these fossils will result in permanent and irreversible damage. Similarly, any fossil materials that remain undiscovered after the construction of the project and which are located beneath the maximum depth of the anticipated excavations associated with the constructions will only be negatively affected in so far as they will be unavailable for scientific study for the life expectancy of the infrastructural elements that comprise the project.

The potential negative impact to the palaeontological heritage of the area can be minimised by the implementation of appropriate mitigation processes. It recommended that thorough and regular examination of all excavations that are conducted upon or within the Karoo Supergroup or Cenozoic regolith be made by a palaeontologist while they are occurring. Should any fossil materials be identified, the mining operations should be halted in that area and SAHRA informed of the discovery.

The social benefits of the project have been classified as beneficial, herein, as the project aims to facilitate the supply and delivery of electricity to an increasingly stressed national power grid. The project will also provide considerable employment during the construction phase as well as ongoing employment opportunities during the operational life of the power plant. As such, **this study has not identified any palaeontological reason to prejudice the construction of either the power plant or a power transmission line, subject to adequate mitigation programs being put in place**.

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