Phase 1 Palaeontological Impact Assessment of a new 132 kV power line route across Kolomela Mine, Postmasburg, NC Province.

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06 / 03 / 2019

Summary

A Phase 1 Heritage Impact Assessment was carried out for the proposed new 132 KV overhead powerline for the Kolomela Mine near Postmasburg in the Northern Cape Province. Two routes are identified: a Proposed Route and an Approved Route. Both routes will traverse the farms Strydfontein 614, Remiander of Leewfontein 448, Ploegfontein 487 (all part of Kolomela Mine), Soetfontein 606 and Kalkfontein 474, while the Approved Route will also include a small portion of the farm Olynfontein Portion 2. About 19 km of the total length of 22 km of the proposed route is located on surface limestone and overlying Kalahari sands (*Qs*), while the rest of the line traverses Asbestos Hills Subgroup strata (*Vak, Vad*), capped mostly by Quaternary windblown sand. The Approved Route is underlain by well-developed surface limestone. Surface limestone exposures were scanned for fossil vertebrate remains or exposures, but none were observed, most likely because of an absence of association with pans, springs or well-developed alluvial terraces. As expected, superficial Tertiary - Quaternary sediments (surface limestone and windblown sand) are generally not fossiliferous in the absence of pans, springs or well-developed alluvial terraces. Unconsolidated alluvial deposits observed at the Groenwaterspruit crossing also revealed no evidence for Quaternary fossil preservation. Given the nature of the proposed development (erection of pylons and creation of superficial track servitudes), direct impact on potential fossil heritage within sections A-E and G-H as well as the Approved Route is considered to be low. There are no palaeontological grounds to halt the development of these sections along the Proposed Route as well as the complete Aprroved Route. These sections are assigned a site rating of Generally Protected C (GP.**C**). Section E-G traverses Asbestos Hills Subgroup strata that is mainly capped by a veneer of Quaternary windblown sand, respectively considered to be of moderate to low palaeontological sensitivity. Given the nature of the proposed development (erection of pylons and creation of superficial track servitudes), direct impact on potential fossil heritage within the section is considered to be low. There are no major palaeontological grounds to halt the development of this section along the Proposed Route. The section is assigned a site rating of Generally Protected C (GP.**C**).

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Introduction

A Phase 1 Heritage Impact Assessment was carried out for the proposed new 132 KV overhead powerline for the Kolomela Mine near Postmasburg in the Northern Cape Province (**Fig. 1 & 2**). Two routes are identified: a Proposed Route (green line) and an Approved Route (red line) (**Fig. 3**). Both routes will traverse the farms Strydfontein 614, Remiander of Leewfontein 448, Ploegfontein 487 (all part of Kolomela Mine), Soetfontein 606 and Kalkfontein 474, while the Approved Route will also include a small portion of the farm Olynfontein Portion 2 (**Fig. 3**).

The primary legal trigger for identifying when heritage specialist involvement is required in the Environmental Impact Assessment process is the National Heritage Resources (NHR) Act (Act No 25 of 1999). The NHR Act requires that all heritage resources, that is, all places or objects of aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance are protected. Thus any assessment should make provision for the protection of all these heritage components, including archaeology, shipwrecks, battlefields, graves, and structures over 60 years of age, living heritage and the collection of oral histories, historical settlements, landscapes, geological sites, palaeontological sites and objects.

Heritage Impact Assessments are required as a prerequisite for new development in terms of the National Environmental Management Act and is also called for in terms of the National Heritage Resources Act (NHRA) 25 of 1999. The region's unique and non-renewable archaeological heritage sites are 'Generally' protected in terms of the National Heritage Resources Act (Act No 25 of 1999, section 35) and may not be disturbed at all without a permit from the relevant heritage resources authority. As many such heritage sites are threatened daily by development, both the environmental and heritage legislation require impact assessment reports that identify all heritage resources in the area to be developed, and that make recommendations for protection or mitigation of the impact of such sites.

The NHRA identifies what is defined as a heritage resource, the criteria for establishing its significance and lists specific activities for which a heritage specialist study may be required. In this regard, categories relevant to the proposed development are listed in Section 34 (1), Section 35 (4), Section 36 (3) and Section 38 (1) of the NHR Act and are as follows:

34. (1) No person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage resources authority.

35 (4) No person may, without a permit issued by the responsible heritage resources authority—

- 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;

36 (3) No person may, without a permit issued by SAHRA or a provincial heritage resources authority—

- (a) destroy, damage, alter, exhume or remove from its original position or otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves;
- (b) destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority; or
- (c) bring onto or use at a burial ground or grave referred to in paragraph *(a)* or *(b)* any excavation equipment, or any equipment which assists in the detection or recovery of metals.

38 (1) Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorised as—

- The construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;
- The construction of a bridge or similar structure exceeding 50m in length;
- Any development or other activity which will change the character of the site

a) exceeding 5000 m² in extent; or

b) involving three or more existing erven or subdivisions thereof; or

c) involving three or more subdivisions thereof which have been consolidated within the past five years;

- The rezoning of a site exceeding 10 000 m²; or

- Any other category of development provided for in regulations by the South African Heritage Resources Agency (SAHRA).

The significance or sensitivity of heritage resources within a particular area or region can inform the EIA process on potential impacts and whether or not the expertise of a heritage specialist is required. A range of contexts can be identified which typically have high or potential cultural significance and which would require some form of heritage specialist involvement. This may include formally protected heritage sites or unprotected, but potentially significant sites or landscapes. In many cases, the nature and degree of heritage significance is largely unknown pending further investigation (e.g. capped sites, assemblages or subsurface fossil remains). On the other hand, it is also possible that a site may contain heritage resources (e.g. structures older than 60 years), with little or no conservation value. In most cases it will be necessary to engage the professional opinion of a heritage specialist in determining whether or not further heritage specialist input in an EIA process is required. This requires site-significance classification standards as prescribed by SAHRA (**Table 1**). Alternatively, useful sources of information on heritage resources in South Africa can also be obtained through SAHRA's national database of heritage resources, including existing heritage survey information as well as other published or secondary source material on the overall history of a particular area or site.

Methodology

The palaeontological significance of the Proposed Route was evaluated through a desktop study and carried out on the basis of existing field data, database information and published literature. This was followed by a field assessment by means of a pedestrian survey of the power line route. A Garmin Etrex Vista GPS hand model (set to the WGS 84 map datum) and a digital camera were used for recording purposes. Relevant archaeological information, aerial photographs and site records were consulted and integrated with data acquired during the on-site inspection. The localities of heritage sites recorded during the survey are provided as kmz – files.

Terms of reference:

- Identify and map possible heritage sites and occurrences using available resources.

- Determine and assess the potential impacts of the proposed development on potential heritage resources;
- Recommend mitigation measures to minimize potential impacts associated with the proposed development.

Locality data

1 : 50 000 scale topographic map: 2823AC Postmasburg

1 : 250 000 scale geological map 2822 Postmasburg

Coordinates Proposed Powerline Route (**Fig. 4**):

A) 28°22'59.50"S 22°57'20.28"E

B) 28°21'18.29"S 22°57'14.94"E

C) 28°20'5.62"S 22°57'47.55"E

D) 28°21'51.98"S 23° 2'12.70"E

E) 28°22'31.12"S 23° 3'36.13"E

F) 28°23'2.25"S 23° 4'47.41"E

G) 28°22'29.26"S 23° 5'0.22"E

H) 28°20'56.54"S 23° 5'36.53"E

The Proposed power line route is located on low topography terrain on the farms Strydfontein, Leewfontein and Ploegfontein, while traversing more undulating landscape on the farms Soetfontein and Kalkfontein (**Fig. 4**). According to the 1:250 000 scale geological map 2822 Postmasburg, the proposed development footprint is possibly underlain by palaeontologically significant Vaalian rocks of the ~ 2.5 Ga old Cambellrand Subgroup (Ghaap Group, Transvaal Supergroup) (capped by thick deposits of Tertiary to Quaternary surface limestone (Ql) (Partridge & Maud, 2000), windblown Kalahari sand (Qs) occasionally included within a pebbly rubble matrix with reddish-brown sandy soils and alluvium. Isolated outcrops of the ~2.4 Ga old, iron-rich Asbestos Hills Subgroup (Kuruman Formation) containing banded ironstone, haematites and manganiferous iron ores and "blinkklip breccias" are exposed to the east (Beukes 1980, 1983; Erikson *et al*. 2006) (**Fig. 5**).

Background

The carbonate rocks of the Cambellrand Subgroup (Ghaap Group, Transvaal Supergroup) consist of stromatolite- and microfossil-bearing dolomite, dolomitic limestone and chert members that were formed by the precipitation of carbonate rocks when colonies of stromatolites thrived in shallow, tropical marine environments towards the end of the Archaean Eon, 2.6 billion years ago (Truswell & Eriksson 1973; Beukes 1983; Altermann & Schopf 1995). The shallow marine and lacustrine stromatolites and organic-walled microfossils preserved within the dolomites provide a record of early microbial dominated life in shallow seas and lakes during the Early / Mid Precambrian (c. 2.7-2.5 Ga). Stromatolites are layered mounds, columns, and sheet-like sedimentary rocks. They were originally formed by the growth of layer upon layer of cyanobacteria, a single-celled photosynthesizing microbe that lives today in a wide range of environments ranging from the shallow shelf to lakes, rivers, and even soils. Bacteria, including the photosynthetic cyanobacteria, were the only form of life on Earth for the first 2 billion years that life existed on Earth. The banded iron formations (BIF) of the Kuruman Formation reflect significant early Proterozoic environmental conditions following massive iron deposition as a result of the build-up of free O^2 in the oceans by cyanobacterial photosynthesis (Beukes 1980. A major cold episode as a result of the resulting net removal of atmospheric CO^2, culminating in a glacial maximum at the Makganyene Formation diamictites (Postmasburg Group), is interpreted as evidence for major early Proterozoic glaciations at low palaeolatitudes around 2.4 Ga (De Villiers and Visser 1977; Moore *et. al* 2001).

Field Assessment

Outcrop observed along the Proposed Route include the following (**see Fig. 6 - 11):**

- Surface limestone, Section A - D
- Surface limestone capped by unconsolidatred alluvium, Section D
- Surface limestone and Aeolian sand, Section D – E
- Asbestos Hills Subgroup banded ironstone, haematites and pebbly rubble matrix within aeolian sand cover, Section E – G
- Surface limestone, aeolian sand cover, Section G - H

About 19 km of the total length of 22 km of the proposed route is located on surface limestones (*Ql*) and overlying Kalahari sands (*Qs*), while the rest of the line traverses

Asbestos Hills Subgroup strata (*Vak, Vad*), capped mostly by Quaternary windblown sand. Surface limestone exposures were scanned for fossil vertebrate remains or exposures, but none were observed, most likely because of an absence of association with pans, springs or well-developed alluvial terraces.

Impact Statement and Recommendations

Proposed Route

Sections A - E

Recent borehole cores indicate that potential stromatolite- and microfossil-bearing dolomite of the Cambellrand Subgroup underlying the study area at Ploegfontein 487 and Remainder of Leewfontein 448 is capped by well-developed and widespread surface limestone varying in thickness between 2 m and 8 m (Isak Gouws, Kolomela Mine Environmental Officer, pers. comm.). As expected, superficial Tertiary - Quaternary sediments (surface limestone and windblown sand) are generally not fossiliferous in the absence of pans, springs or well-developed alluvial terraces. Unconsolidated alluvial deposits observed at the Groenwaterspruit crossing (point D) also revealed no evidence for Quaternary fossil preservation. Given the nature of the proposed development (erection of pylons and creation of superficial track servitudes), direct impact on potential fossil heritage within the section is considered to be low. There are no palaeontological grounds to halt the development of this section along the Proposed Route. The section is assigned a site rating of Generally Protected C (GP.**C**).

Section E - G

The footprint traverses Asbestos Hills Subgroup strata (*Vak, Vad*), that is mainly capped by a veneer of Quaternary windblown sand, respectively considered to be of moderate to low palaeontological sensitivity (see **Fig. 4**). Given the nature of the proposed development (erection of pylons and creation of superficial track servitudes), direct impact on potential fossil heritage within the section is considered to be low. There are no major palaeontological grounds to halt the development of this section along the Proposed Route. The section is assigned a site rating of Generally Protected C (GP.**C**).

Section G - H

The section is capped by well-developed and widespread surface limestone of varying thickness and as expected, superficial Tertiary - Quaternary sediments (surface limestone and windblown sand) are generally not fossiliferous in the absence of pans, springs or well-developed alluvial terraces. Given the nature of the proposed development (erection of pylons and creation of superficial track servitudes), direct impact on potential fossil heritage within the section is considered to be low. There are no palaeontological grounds to halt the development of this section along the Proposed Route. The section is assigned a site rating of Generally Protected C (GP.**C**).

Approved Route

The whole section is underlain by well-developed and widespread surface limestone of varying thickness. Given the nature of the proposed development (erection of pylons and creation of superficial track servitudes), direct impact on potential fossil heritage within the section is considered to be low. There are no palaeontological grounds to halt the development of this section along the Proposed Route. The route is assigned a site rating of Generally Protected C (GP.**C**).

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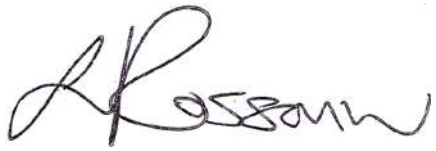
DECLARATION OF INDEPENDENCE

I, Lloyd Rossouw, declare that I act as an independent specialist consultant. I do not have or will not have any financial interest in the undertaking of the activity other than remuneration for work as stipulated in the terms of reference. I have no interest in secondary or downstream developments as a result of the authorization of this project.



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Tables and Figures

Table 1. Archaeological Field rating categories as prescribed by SAHRA.

Field Rating	**Grade**	**Significance**	**Mitigation**
National Significance (NS)	Grade 1	-	Conservation; national site nomination
Provincial Significance (PS)	Grade 2	-	Conservation; provincial site nomination
Local Significance (LS)	Grade 3A	High significance	Conservation; mitigation not advised
Local Significance (LS)	Grade 3B	High significance	Mitigation (part of site should be retained)
Generally Protected A (GP.A)	-	High/medium significance	Mitigation before destruction
Generally Protected B (GP.B)	-	Medium significance	Recording before destruction
Generally Protected C (GP.C)	-	Low significance	Destruction

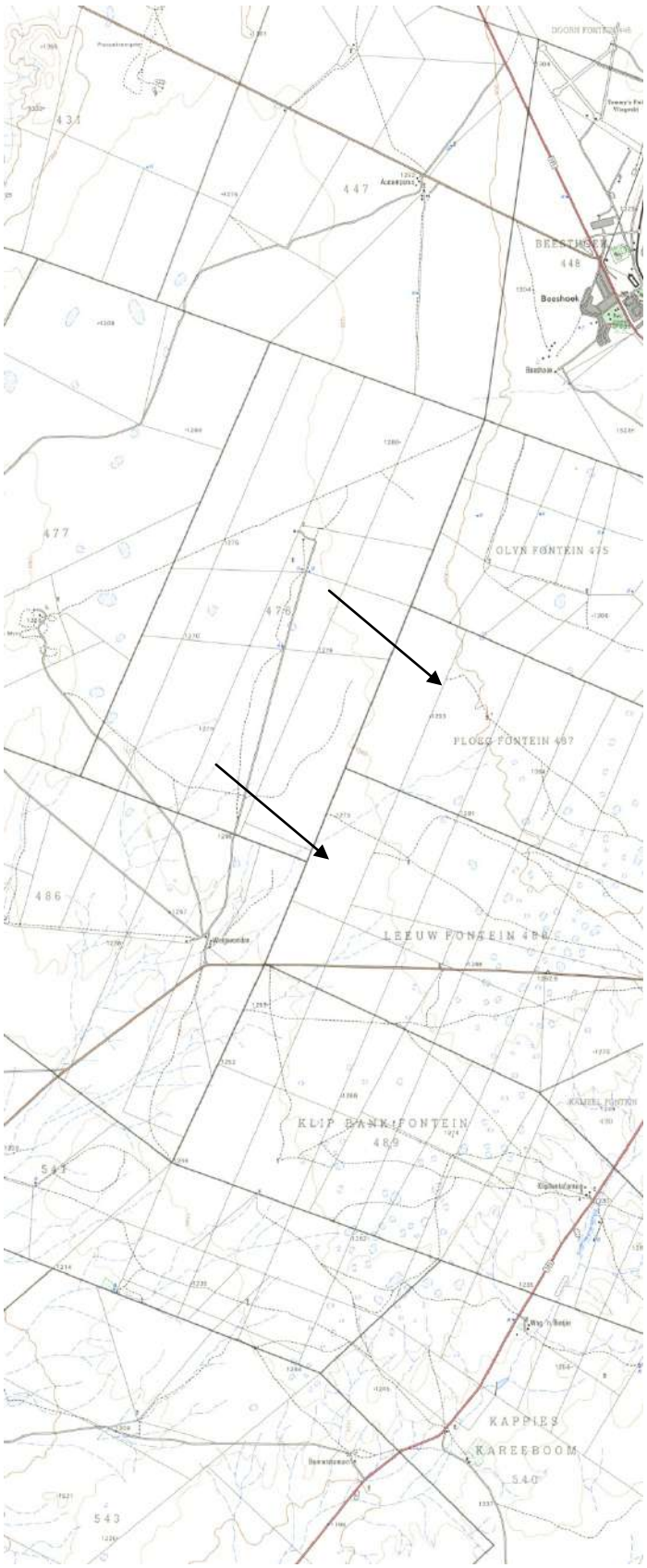

Figure 1. Portion of 1:50 000 scale topographic map 2822BD Groenwater. Leeuwfontein and Ploegfontein are indicated by arrows.

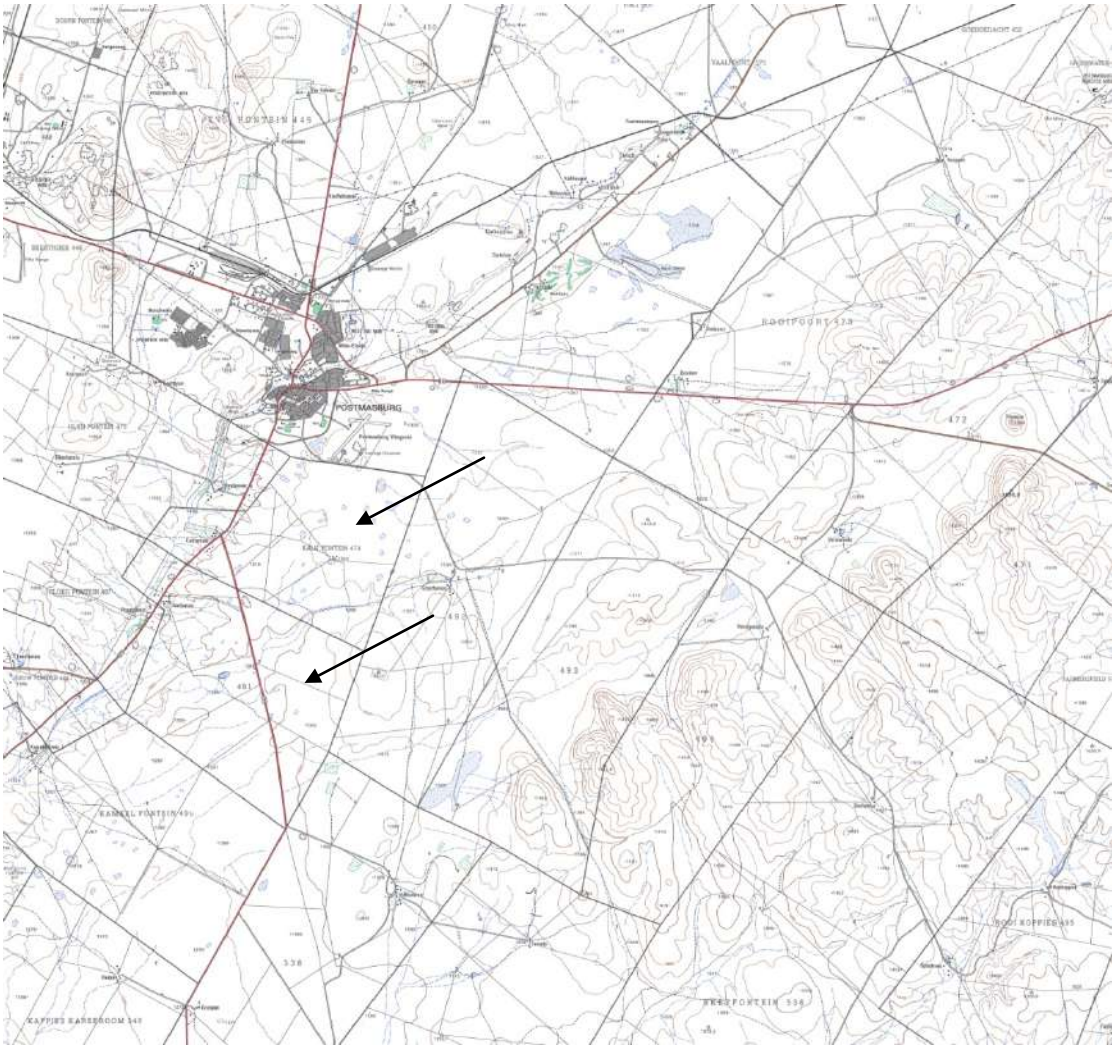

Figure 2. Portion of 1:50 000 scale topographic map 2823AC Postmasburg. Soetfontein and Kalkfontein are indicated by arrows.

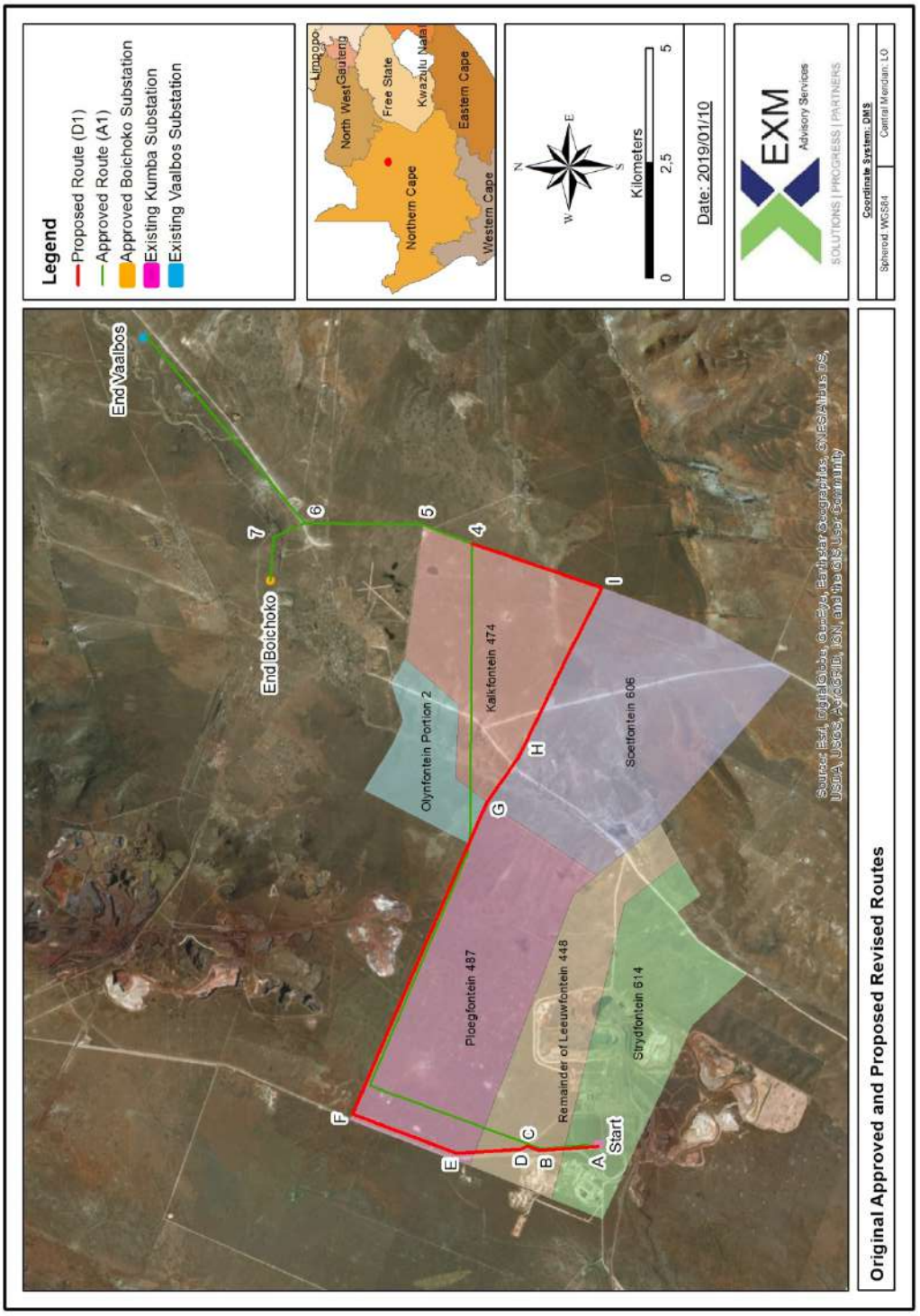

Figure 3. Layout of the Approved (green) and Proposed (red) power line routes.

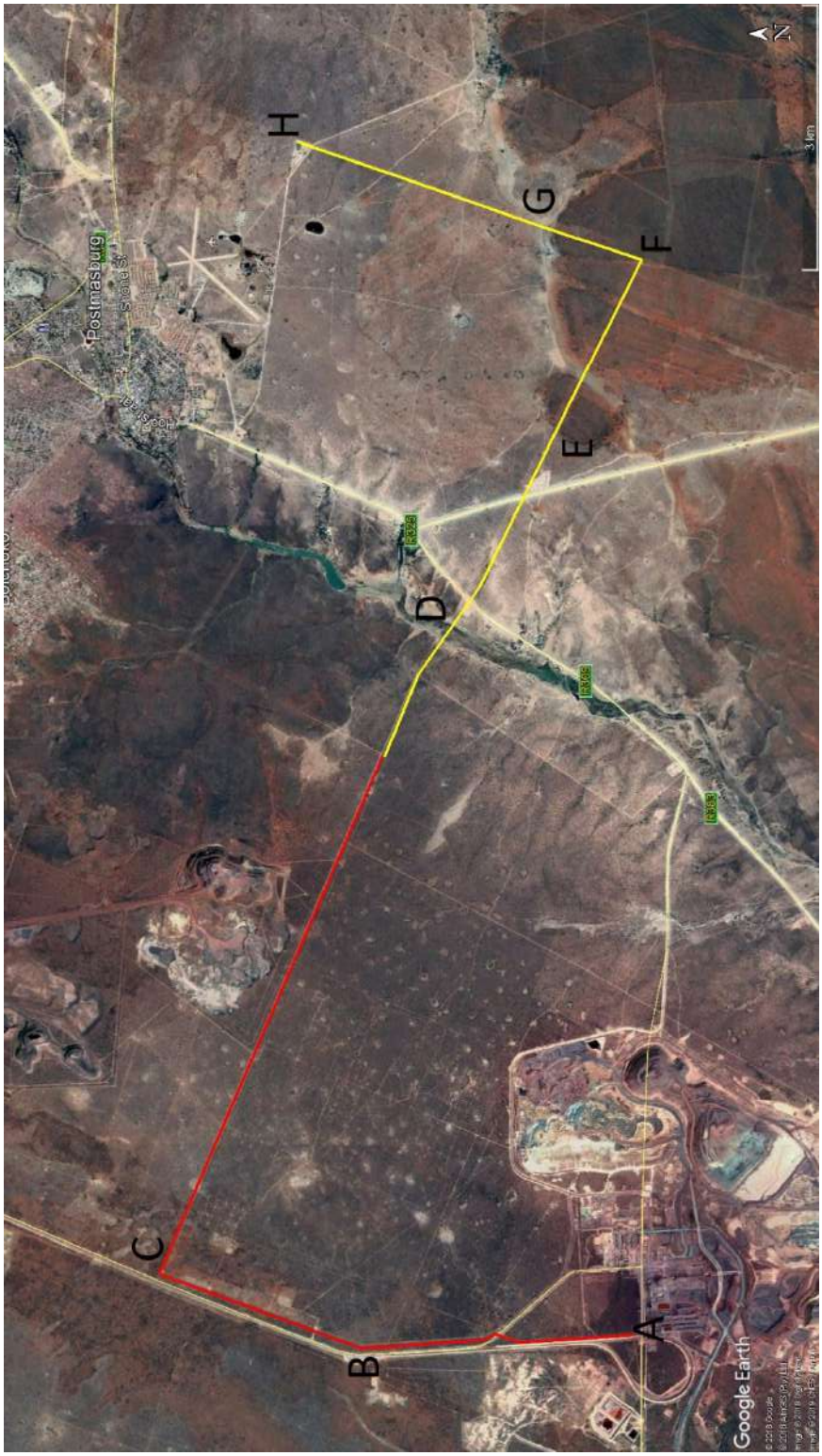

Figure 4. Aerial view of the Proposed power line route.

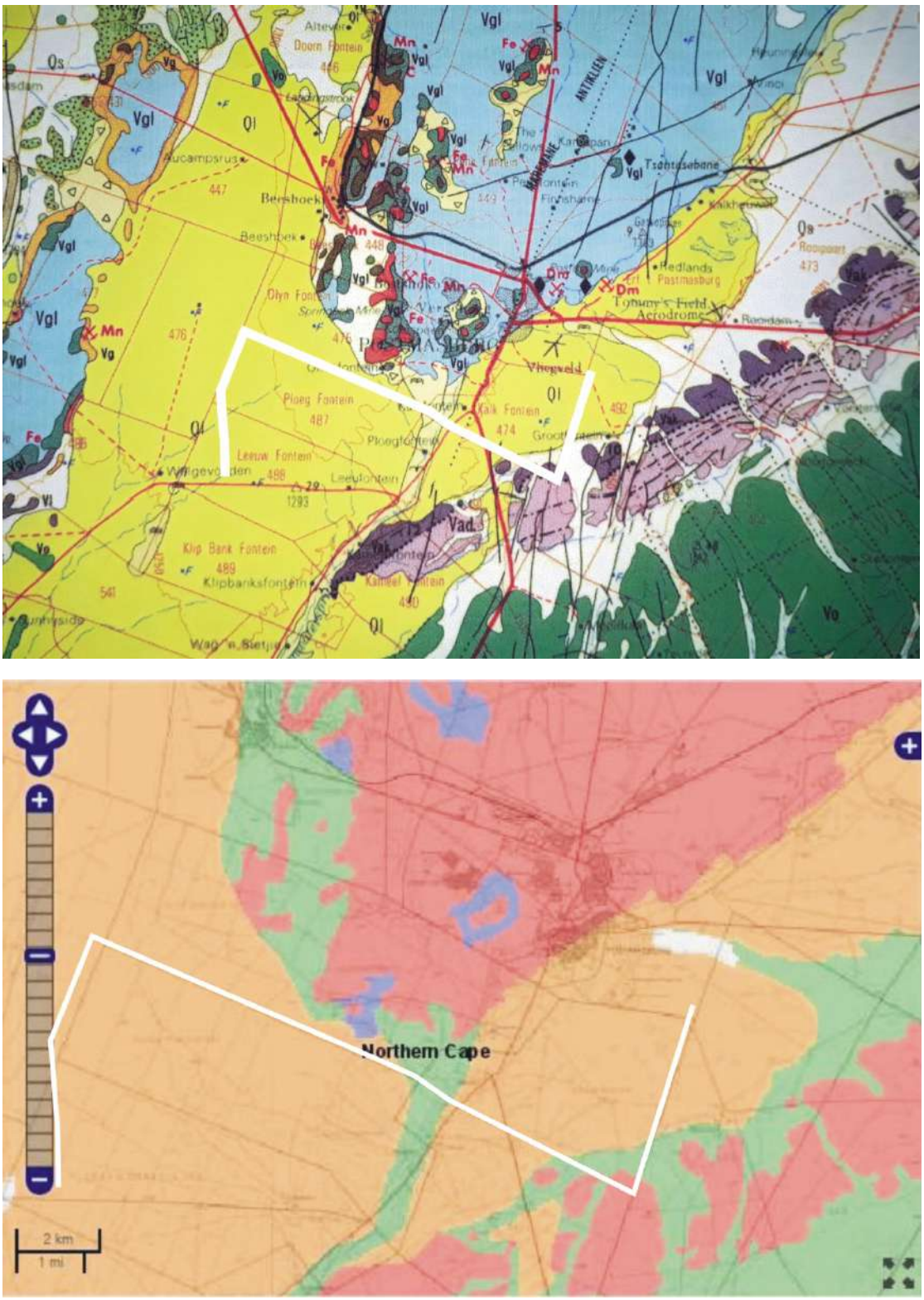

Figure 5. Portion of 1:250 000 scale geological map 2822 Postmasburg (above) showing position of Proposed power line route traversing late Neogene surface limestone (*Ql*), Kalahari sand (*Qs*) and Vaalian rocks assigned to the Asbestos Hills Subgroup of the Transvaal Supergroup (*Vak, Vad*). Although the SAHRIS Palaeontological sensitivity map (below) indicate high sensitivity for the Vaalian outcrop, the latter is generally considered to be of moderate palaeontological sifnificance and vulnerability (Almond and Pether 2009).

Figure 6. General view of the starting point and surrounding landscape at Strydfontein at the start of the proposed route.

Figure 6. General view of the landscape along the route at Leeuwfontein.

Figure 7. Well-developed surface limestone outcrop along the route at Ploegfontein. Scale 1 =10 cm

Figure 8. Well-developed surface limestone breccias exposed along the route at Ploegfontein

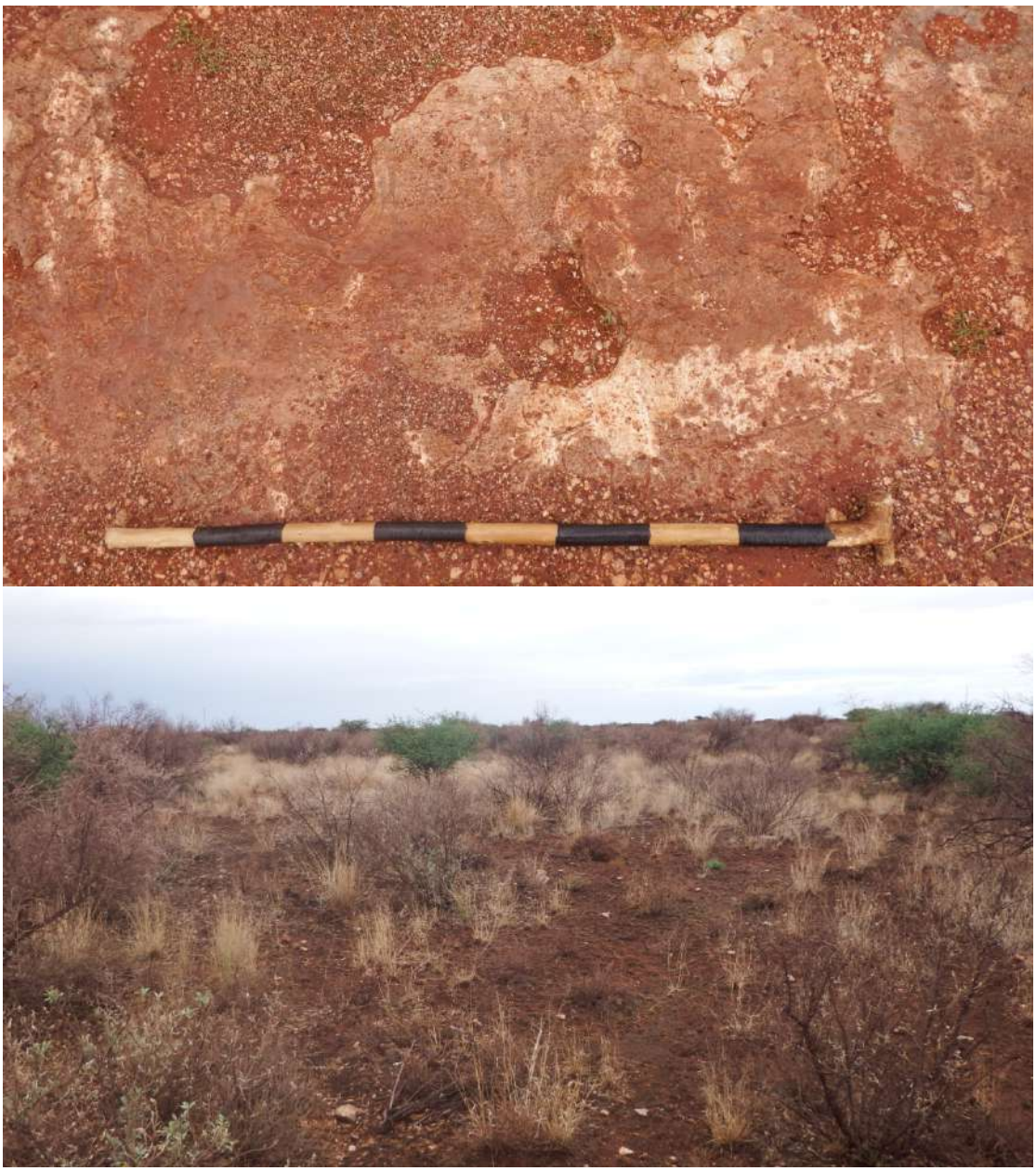

Figure 9. Surface limestone (above) covered by a pebbly rubble matrix with reddish-brown sandy soils (below) along the route at Soetfontein. Scale 1 = 10 cm.

Figure 10. Banded ironstone, haematites and manganiferous iron ores of the Asbestos Hills Subgroup (above) occasionally capped by surface limestone and windblown sand along the route at Soetfontein. Scale 1 = 10 cm.

Figure 11. Typical Kalahari sand substrate (*Qs*) along the route at Kalkfontein.