PIA INPUT: RECOMMENDED EXEMPTION FROM FURTHER PALAEONTOLOGICAL STUDIES

PROPOSED UPGRADE OF THE RISIVILLE / MCKAY 11 KV FEEDER LINE NEAR VEREENIGING, MIDVAAL LOCAL MUNICIPALITY, GAUTENG PROVINCE

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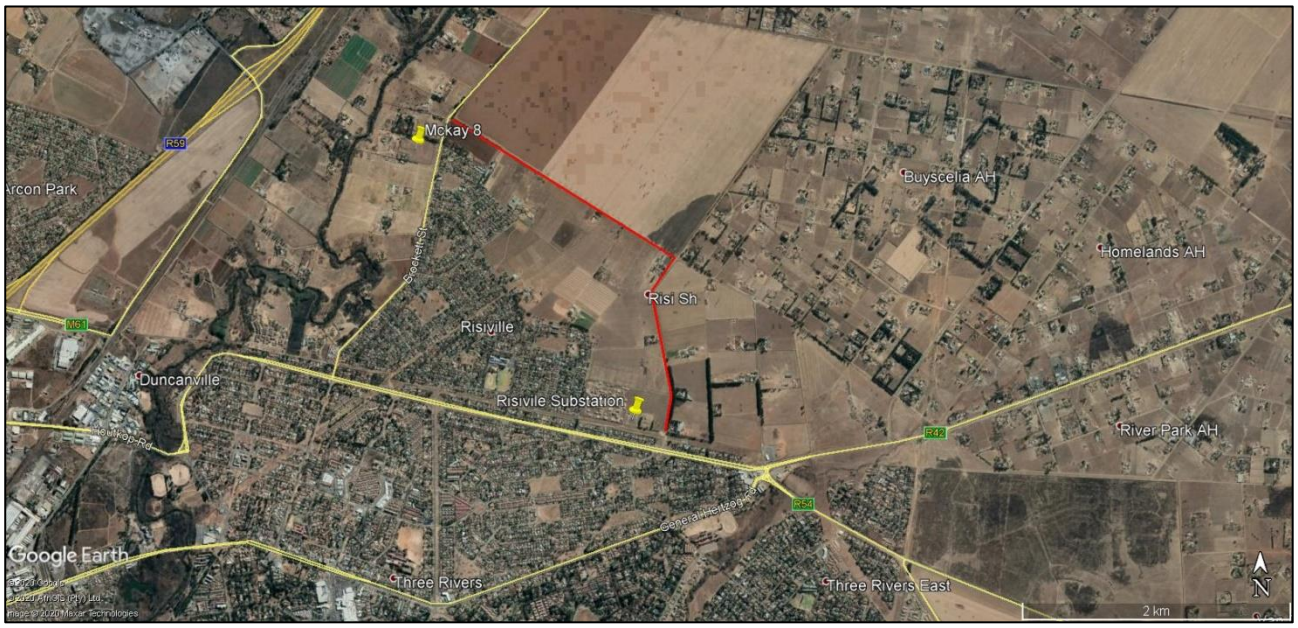

Figure 1. Google earth© satellite image showing the alignment for the Risiville / Mckay 11kV feeder line near Vereeniging, Midvaal Local Municipality, Gauteng Province.

1. Geological context

The project area for the 3.3 km-long Risiville / Mckay 11kV feeder line is situated within flat-lying agricultural terrain at *c*. 1450-1470 m amsl. on the north-eastern outskirts of Vereeniging (Fig. 1). The route is already disturbed by the existing powerline, road and agricultural developments. The meandering course of the Suikerbosrantrivier runs 3 to 5 km to the south of the project area, while there is a small tributary stream course just to the west and an opencast coalmine less than 2.5 km to the west. Satellite images suggest that the project area is mantled by alluvial soils and there is no bedrock exposure here.

The geology of the study area near Vereeniging, which lies towards the northern edge of the Main Karoo Basin, is shown on 1: 250 000 sheet 2626 West Rand (Council for Geoscience, Pretoria) (Fig. 2). A geological sheet explanation for this map has not yet been published but a more detailed geological map for Vereeniging has been published more recently by Bosch & Cronwright (2009). The Risiville / Mckay powerline project area is underlain by Middle Permian fluvio-deltaic sediments of the **Vryheid Formation** (Ecca Group, Karoo Supergroup) (Pv, grey in Fig. 2). This formation contains important seams of coal near-surface in the Vereeniging region, as shown by the opencast mines in the area (Johnson *et al.* 2006). It is likely that the subsurface Vryheid sediments within the development footprint are weathered and disturbed near surface. Outcrop

strips of Late Caenozoic alluvium (pale yellow in Fig. 2) run along the tributary stream of the Suikerbosrantrivier west and just outside the powerline project area.

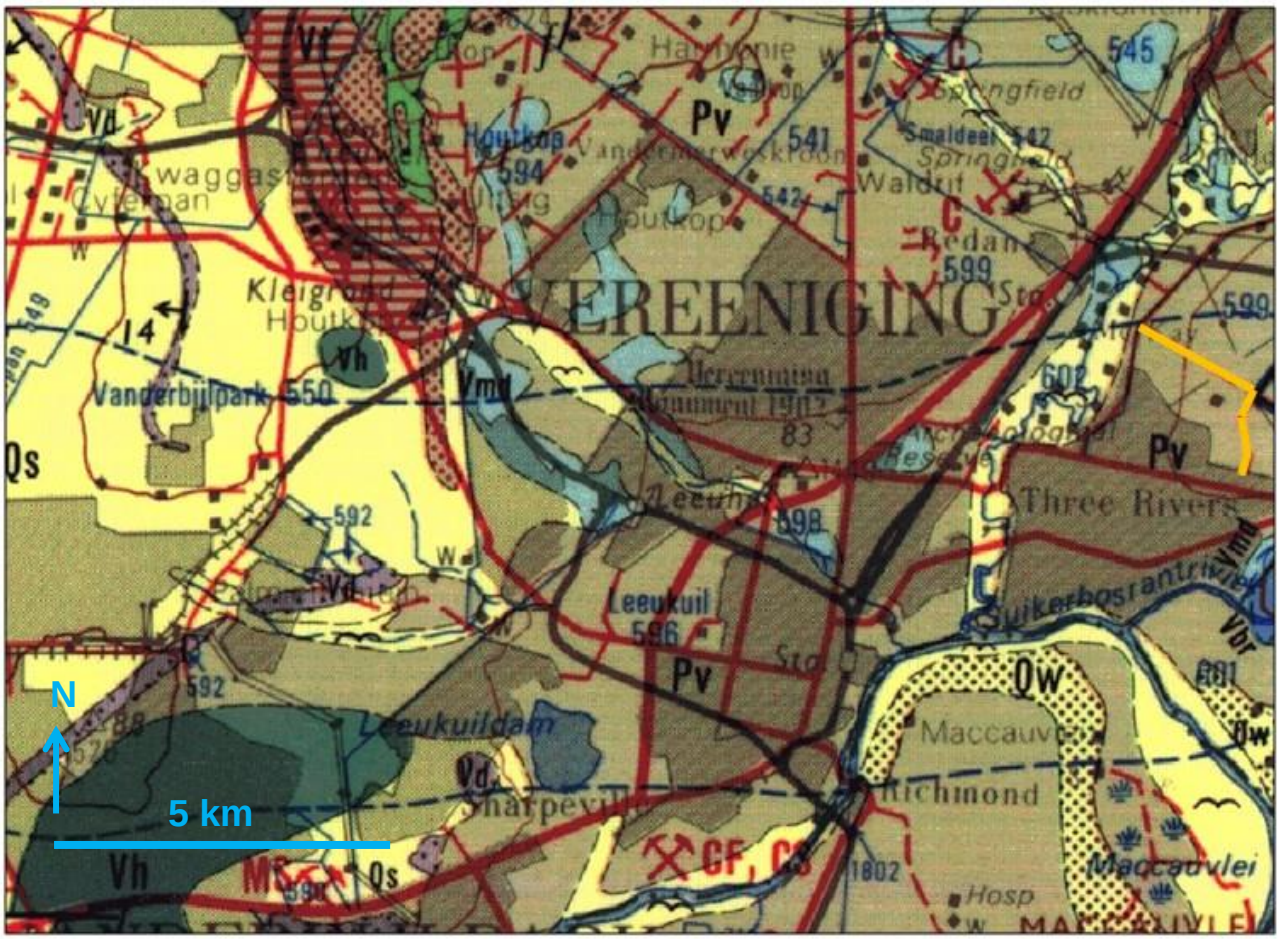

Figure 2: Extract from 1: 250 000 geology sheet 2626 West Rand showing the route of the existing Risiville / Mckay 11kV feeder line (orange line) on the NE outskirts of Vereeniging, Gauteng Province. The region is underlain by Middle Permian deltaic sediments of the Vryheid Formation (Ecca Group, Karoo Supergroup) (Pv, grey). A narrow strip of Late Caenozoic alluvium (pale yellow) is associated with a stream tributary of the Suikerbosrantrivier drainage system just to the west.

2. Palaeontological heritage

The Vryheid Formation is internationally famous for its Middle Permian fossil plants of the *Glossopteris* Flora of Gondwana (*e.g.* Plumstead 1969, 1973, Anderson & Anderson 1985, MacRae 1999, McCarthy & Rubidge 2005, Johnson *et al.* 2006, Prevec 2016) and its palaeosensitivity is therefore generally rated as Very High. Rich plant fossil assemblages – most notably well-preserved compression fossils preserved within shaly facies between coal seams - include rare mosses, lycopods and ferns (sphenophytes and others) as well as abundant and diverse representatives of the glossopterid “seed ferns”, cordaitaleans, conifers and ginkgoales. Other fossil groups represented include rich palynomorph assemblages (spores and pollens), leaf cuticles, algae, low-diversity non-marine trace fossils and sparse invertebrate faunas (*e.g.* non-marine bivalves, insects, conchostracan crustaceans). Vertebrate fossils are very poorly represented, comprising disarticulated fish remains (*e.g.* scales) as well as unsubstantiated reports of occasional “labyrinthodont” amphibians.

The Vereeniging coalfields have historically yielded especially rich Early Permian (late Sakmarian to late Artinskian) macrofossill plant assemblages of the *Glossopteris* Flora, including early examples of glossopterid leaves with attached fructifications (Leslie 1903, Leslie 1921, Anderson & Anderson 1985, Le Roux & Anderson 1977, Adendorff *et al.* 2003, Prevec *et al.* 2008, Bosch & Cronwright 2009 and refs. therein) However, the fossiliferous plant beds at Vereeniging are now largely inaccessible (Prevec *et al*. 2008). Palynomorph (spore and pollen) assemblages from the region have been treated by Millsteed (1994). The Vereeniging palaeoflora is a typical Early Permian Gondwanan assemblage dominated by:

- Several spp of *Glossopteris* leaves (incl. gangamopteroid forms)
- *Noeggerathiopsis*
- *Palaeovittaria*
- Various lycophytes (*e.g. Cyclodendron*)
- Ferns (*Asterotheca, Sphenopteris, Liknopetalon*)
- Conifers (*Walkomiella*)
- Ginkgoalean leaves (*Ginkgophyllum*)
- Sphenophyte stems
- *Botrychiopsis*
- Range of scale leaves and seeds

3. Conclusions and recommendations

The Early Permian fluvio-deltaic bedrocks of the Vryhied Formation (Ecca Group) are potentially highly fossiiferous in the Vereeniging area where unusually rich fossil plant assemblages have been recorded in the past. However, within the Risiville / Mckay 11kV feeder line project footprint the Vryheid Formation bedrocks are likely to be highly-weathered and disturbed near-surface. Pylon footings are small and shallow and will largely (or perhaps entirely) impact Late Caenozoic alluvial soils and gravels of low palaeontological sensitivity. The powerline footprint is minuscule compared with that of nearby open-cast mines that are exploiting local, highly-fossiliferous coal seams. Late Caenozoic superficial sediments in the area (*e.g.* soils, colluvium) are likely to be of low palaeontological sensitivity. The additional or cumulative impact on local heritage resources posed by the proposed powerline development is considered to be negligible (Very Low impact significance).

There are no objections on palaeontological heritage grounds to authorisation of the proposed powerline development. Pending the discovery of substantial new fossil remains during construction, it is recommended that exemption from further specialist palaeontological studies is granted for the proposed upgrade of the Risiville / Mckay 11kV feeder line near Vereeniging, Gauteng Province

Any substantial fossil remains (*e.g.* vertebrate bones and teeth, shells, well-preserved plant remains) encountered during excavation should be reported to SAHRA for possible mitigation by a professional palaeontologist (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Phone: +27 (0)21 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za). A tabulated Chance Fossil Finds Procedure is appended to this report.

4. References

ADENDORFF, R., BAMFORD, M.K. & MCLOUGHLIN, S. 2003. *Liknopetalon*: a review of a rare Gondwanan, Permian pteridophyte. Review of Palaeobotany and Palynology 126, 83–101.

ANDERSON, J.M. & ANDERSON, H.M. 1985. Palaeoflora of southern Africa. Prodromus of South African megafloras, Devonian to Lower Cretaceous, 423 pp. Botanical Research Institute, Pretoria & Balkema, Rotterdam.

BOSCH, P.J.A. & CRONWRIGHT, M.S. 2009. The geology of the Vereeniging area. Explanation to 1: 50 000 geology sheet 2627 DB, 39 pp. Council for Geoscience, Pretoria.

JOHNSON, M.R., VAN VUUREN, C.J., VISSER, J.N.J., COLE, D.I., DE V. WICKENS, H., CHRISTIE, A.D.M., ROBERTS, D.L. & BRANDL, G. 2006. Sedimentary rocks of the Karoo Supergroup. In: Johnson, M.R., Anhaeusser, C.R. & Thomas, R.J. (Eds.) The geology of South Africa, pp. 461-499. Geological Society of South Africa, Marshalltown.

LE ROUX, S.F. & ANDERSON, H.M. 1977. A review of the localities nd flora of the Lower Permian Karoo strat at Vereeniging, South Africa. Palaeontologica Africana 20, 27-42.

LESLIE, T.N. 1903. The fossil flora of Vereeniging, Transvaal. Transactions of the Geological Society of South Africa 6, 82-88.

LESLIE, T.N. 1921. Observations on some fossil plants from the Permo-Carboniferous of Vereeninging. Proceedings of the Geological Society of South Africa 24, 30 pp.

MACRAE, C. 1999. Life etched in stone. Fossils of South Africa, 305 pp. The Geological Society of South Africa, Johannesburg.

McCARTHY, T. & RUBIDGE, B. 2005. The story of Earth and life: a southern African perspective on a 4.6-billion-year journey. 334pp. Struik, Cape Town.

MILSTEED, B.D.1994. Palaynological evidence for the age of the Permian Karoo coal deposits near Vereeniging, northern Orange Free State, South Africa. South African Journal of Geology 71, 15-20.

PLUMSTEAD, E.P. 1969. Three thousand million years of plant life in Africa. Alex du Toit Memorial Lecture 11. Transactions of the Geological Society of South Africa 72, 1-72.

PLUMSTEAD, E.P. 1973. The Late Palaeozoic *Glossopteris* Flora. In: Hallam, A. (Ed.) Atlas of palaeobiogeography, pp. 187-205. Elsevier, Amsterdam.

PREVEC, R., MCLOUGHLIN, S. & BAMFORD, M.K. 2008. Novel double wing morphology revealed in a South African ovuliferous glossopterid fructification: *Bifariala intermittens* (Plumstead 1958) comb. Nov. Review of Palaeobotany and Palynology 150, 22-36.

PREVEC, R. 2016. *Glossopteris* in South Africa. In: Annhaeusser, C.R., Viljoen, M.J. & Viljoen, R.P. Eds. Africa's top geological sites, pp. 88-94. Struik Nature, Cape Town.

<table>
<tr><td colspan="3">CHANCE FOSSIL FINDS PROCEDURE: UPGRADE OF THE RISIVILLE / MCKAY 11 KV FEEDER LINE NEAR VEREENIGING</td></tr>
<tr><td>Province & region:</td><td colspan="2">Gauteng, Midvaal Local Municipality</td></tr>
<tr><td>Responsible Heritage Resources Agency</td><td colspan="2">SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa.
Phone: +27 (0)21 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za</td></tr>
<tr><td>Rock unit(s)</td><td colspan="2">Early Permian Vryheid Formation (Ecca Group, Karoo Supergroup)
Late Caenozoic alluvium, calcretes along water courses and calcrete hardpans</td></tr>
<tr><td>Potential fossils</td><td colspan="2">Potentially rich assemblages of plant fossils (Glossopteris Flora), including tree trunks, stumps and roots, palynomorphs, rare insects, conchostracans, low diversity trace fossil assemblages within Ecca Group bedrocks.
Bones, teeth and horn cores of mammals, freshwater molluscs, calcretised termitaria and other trace fossils within Late Caenozoic alluvial deposits</td></tr>
<tr><td rowspan="5">ECO protocol</td><td colspan="2">1. Once alerted to fossil occurrence(s): alert site foreman, stop work in area immediately (N.B. safety first!), safeguard site with security tape / fence / sand bags if necessary.</td></tr>
<tr><td colspan="2">2. Record key data while fossil remains are still in situ:
• Accurate geographic location – describe and mark on site map / 1: 50 000 map / satellite image / aerial photo
• Context – describe position of fossils within stratigraphy (rock layering), depth below surface
• Photograph fossil(s) in situ with scale, from different angles, including images showing context (e.g. rock layering)</td></tr>
<tr><td>3. If feasible to leave fossils in situ:
Alert Heritage Resources Agency and project palaeontologist (if any) who will advise on any necessary mitigation
Ensure fossil site remains safeguarded until clearance is given by the Heritage Resources Agency for work to resume</td><td>3. If not feasible to leave fossils in situ (emergency procedure only):

Carefully remove fossils, as far as possible still enclosed within the original sedimentary matrix (e.g. entire block of fossiliferous rock)
Photograph fossils against a plain, level background, with scale
Carefully wrap fossils in several layers of newspaper / tissue paper / plastic bags
Safeguard fossils together with locality and collection data (including collector and date) in a box in a safe place for examination by a palaeontologist
Alert Heritage Resources Agency and project palaeontologist (if any) who will advise on any necessary mitigation</td></tr>
<tr><td colspan="2">4. If required by Heritage Resources Agency, ensure that a suitably-qualified specialist palaeontologist is appointed as soon as possible by the developer.</td></tr>
<tr><td colspan="2">5. Implement any further mitigation measures proposed by the palaeontologist and Heritage Resources Agency</td></tr>
<tr><td>Specialist palaeontologist</td><td colspan="2">Record, describe and judiciously sample fossil remains together with relevant contextual data (stratigraphy / sedimentology / taphonomy). Ensure that fossils are curated in an approved repository (e.g. museum / university / Council for Geoscience collection) together with full collection data. Submit Palaeontological Mitigation report to Heritage Resources Agency. Adhere to best international practice for palaeontological fieldwork and Heritage Resources Agency minimum standards.</td></tr>
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