Repair or Replacement of Bridges and Culvert Structures on Trunk Roads 3305, 3501, 5801, Divisional Road D2307, and Main Road 584

Prince Albert and Beaufort West Local Municipalities, Central Karoo District Municipality, Western Cape Province

Farm: N/a, Existing Structures

Fourie, H. Dr heidicindy@yahoo.com

012 322 7632/079 940 6048

Palaeontological Impact Assessment: Phase 1: Field Study

Facilitated by: Chameleon Environmental Consultants

P.O. Box 11788, Silver Lakes,

0054

Tel: 082 571 6920

2021/05/10

Ref: 16/3/3/6/7/1/C3/1/0162/20

Regisaurus (ESI) (H. Fourie)

B. Executive summary

Outline of the development project: Chameleon Environmental Consultants has facilitated the appointment of Dr H. Fourie, a palaeontologist, to undertake a Palaeontological Impact Assessment (PIA), Field Study of the suitability of the Repair or Replacement of Bridges and Culvert Structures on Trunk Roads 3305, 3501, 5801, Divisional Road D2307, and Main Road 584 in the Prince Albert (km 0.00 to km 50.47) and Beaufort West (km 50.47 to km 110.00) Local Municipalities, Central Karoo District Municipality, Western Cape Province on Farms as indicted of Figure 3.

The applicant, Western Cape Government: Department of Transport and Public Works entails to repair or replace 41 bridges and culvert structures located on several roads.

The Project includes one locality Option (see Figure 2):
Option 1: An area that spans over several roads in the Beaufort West area ending in the south at Klaarstroom north. The approximate size of the site on the N12 National Road is from km 0.00 to km 110.00.

Legal Requirements:

The **National Heritage Resources Act (Act No. 25 of 1999) (NHRA)** 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. The Republic of South Africa (RSA) has a remarkably rich fossil record that stretches back in time for some 3.5 billion years and must be protected for its scientific value. Fossil heritage of national and international significance is found within all provinces of the RSA. South Africa's unique and non-renewable palaeontological heritage is protected in terms of the National Heritage Resources Act. According to this act, palaeontological resources may not be excavated, damaged, destroyed or otherwise impacted by any development without prior assessment and without a permit from the relevant heritage resources authority.

The main aim of the assessment process is to document resources in the development area and identify both the negative and positive impacts that the development brings to the receiving environment. The PIA therefore identifies palaeontological resources in the area to be developed and makes recommendations for protection or mitigation of these resources.

"palaeontological" means 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 or traces.

For this study, resources such as geological maps, scientific literature, institutional fossil collections, satellite images, aerial maps and topographical maps were used. It provides an assessment of the observed or inferred palaeontological heritage within the study area, with recommendations (if any) for further specialist palaeontological input where this is considered necessary.

A Palaeontological Impact Assessment is generally warranted where rock units of **LOW** to **VERY HIGH** palaeontological sensitivity are concerned, levels of bedrock exposure within the study area are adequate; large scale projects with high potential heritage impact are planned; and where the distribution and nature of fossil remains in the proposed area is unknown. The specialist will inform whether further monitoring and mitigation are necessary.

Types and ranges of heritage resources as outlined in Section 3 of the National Heritage Resources Act (Act No.25 of 1999):
(i) (i) objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens.

This report adheres to the guidelines of Section 38 (1) of the National Heritage Resources Act (Act No. 25 of 1999).
Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorised as (a) the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length; (b) the construction of a bridge or similar structure exceeding 50 m in length; (c) any development or other activity which will change the character of a site (see Section 38); (d) the re-zoning of a site exceeding 10 000 m² (1 ha) in extent; (e) or any other category of development provided for in regulations by SAHRA or a PHRA authority.

This report (**1c)** aims to provide comment and recommendations on the potential impacts that the proposed development could have on the fossil heritage of the area and to state if any mitigation or conservation measures are necessary.

Outline of the geology and the palaeontology:
The geology was obtained from map 1:100 000, Geology of the Republic of South Africa (Visser 1984), 3222 Beaufort West (Marsh *et al.* 1978) and 3322 Oudtshoorn (Toerien and Roby 1979),1:250 000 geological maps.

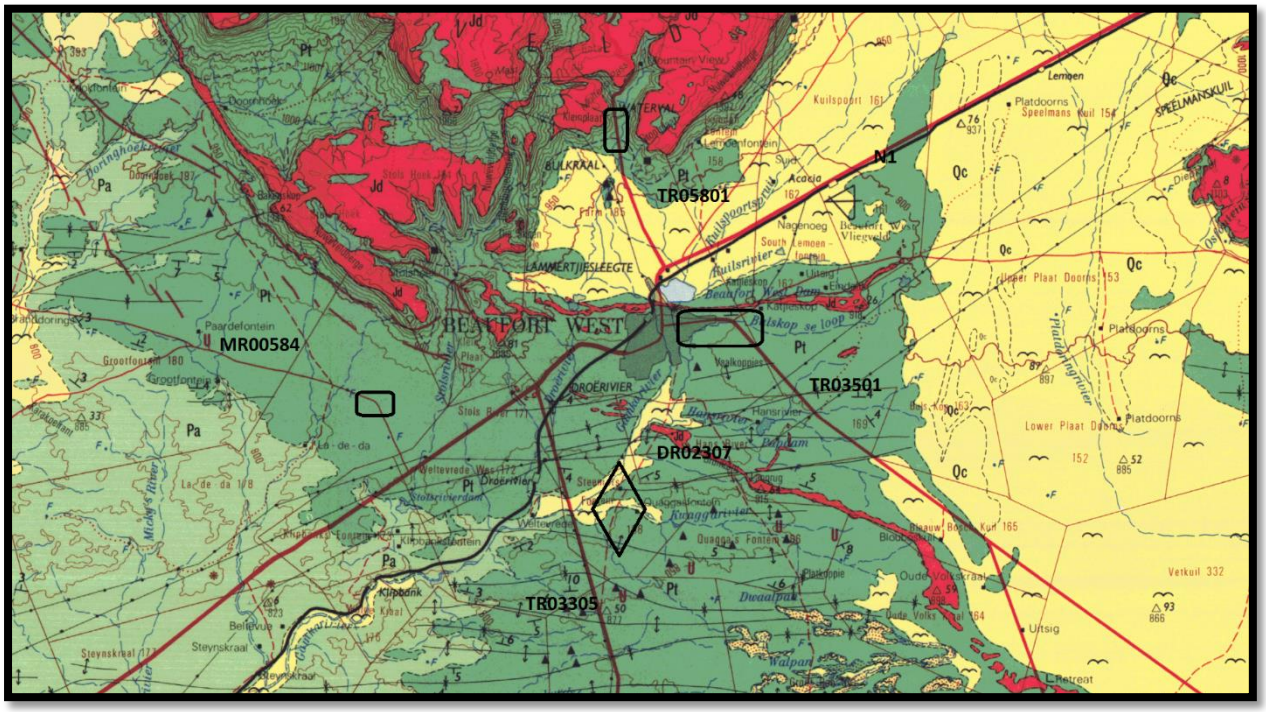

Figure 3: The geology of the development area.
Legend to Map and short explanation.
M – Alluvial valley deposits (m). Quaternary.
Jd – Karoo Dolerite suite (pink). Jurassic.
Pt – Mudstone (red in places), sandstone (Poortjie sandstone at base) (darker green). Teekloof Formation, Adelaide Subgroup, Karoo Supergroup. Permian.
Pa – Grey and reddish-brown mudstone; fine-grained sandstone (green). Abrahamskraal Formation, Adelaide Subgroup, Karoo Supergroup. Permian.
Pw – Sandstone, shale (medium brown). Waterford Formation, Ecca Group, Karoo Supergroup. Permian.
Pf – Shale with isolated thin sandstone beds (light brown). Fort Brown Formation, Ecca Group, Karoo Supergroup. Permian.
Pr – Mottled grey sandstone, shale (dark brown). Ripon Formation, Ecca Group, Karoo Supergroup. Permian.

Pd- Tillite, subordinate shale (grey blue). Dwyka Group, Karoo Supergroup. Carboniferous.
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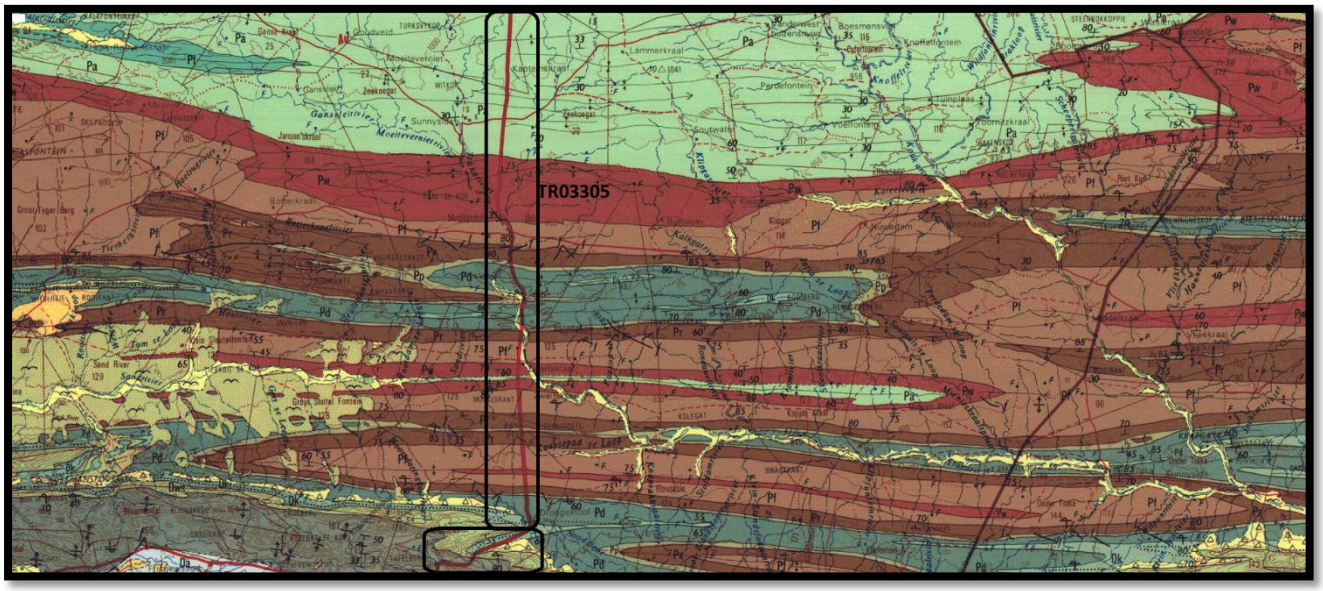

Palaeontology – Fossils in South Africa mainly occur in rocks of sedimentary nature and not in rocks from igneous or metamorphic nature. Therefore, if there is the presence of Karoo Supergroup strata the palaeontological sensitivity can generally be **LOW** to **VERY HIGH**, and here locally **VERY HIGH** for the Adelaide Subgroup (SG 2.2 SAHRA APMHOB, 2012).

The rocks of the Karoo Supergroup are internationally acclaimed for their richness and diversity of fossils. The rocks of the Beaufort Group of South Africa cover approximately one-third of the land surface and have yielded an abundance of well-preserved therapsids and other tetrapods which have been used to subdivide this Group into seven faunal Assemblage Zones.

The Adelaide Subgroup in the study area comprises the *Tapinocephalus* Assemblage Zone and the overlying *Endothiodon* Assemblage Zone. The lowermost *Tapinocephalus* Assemblage Zone is named after the dinocephalian *Tapinocephalus* and spans the middle of the Abrahamskraal Formation. The pareiasaur *Bradysaurus* is also common. Stratigraphically above this is the uppermost strata of the Abrahamskraal Formation and lowermost strata of the overlying Teekloof Formation and includes the Poortjie Member. *Pristerognathus* is most common here. The lower part of the Teekloof Formation is characterised by the fossil *Tropidostoma* as well as *Diictodon* (Rubidge 1995).

The Ecca Group may contain fossils of diverse non-marine trace, *Glossopteris* flora, mesosaurid reptiles, palaeoniscid fish, marine invertebrates, insects, and crustaceans (Johnson 2009). *Glossopteris* trees rapidly colonised the large deltas along the northern margin of the Karoo Sea. Dead vegetation accumulated faster than it could decay, and thick accumulations of peat formed, which were ultimately converted to coal. It is only in the

northern part of the Karoo Basin that the glossopterids and cordaitales, ferns, clubmosses and horsetails thrived (McCarthy and Rubidge 2005).

Unidentifiable plant remains (mainly stem fragments) occur sporadically throughout the Ripon Formation, becoming fairly common in the lowermost part. Flattened silicified logs (*Dadoxylon?)* displaying annual rings at the base of the formation (Johnson and Kingsley 1993).

Trace fossils are relatively abundant in the shales occurring near the top of the Dwyka Group. Lycopods (*Leptophloem australe*) have been described from the northern Free State (Mac Rae 1999). Spores and acritarchs have been reported from the interglacial mudrocks of the Dwyka Group, also pollen, wood, and plant remains in the interbedded mudrocks as well as the diamictite itself, while anthropod trackways and fish trails are present in places on bedding planes (Visser *et al.* 1990).

Summary of findings (**1d)**: The Phase 1: Field Study was undertaken in April 2021 in autumn in dry and hot conditions during the official Level 1 Covid-19 lockdown, and the following is reported:

The Project includes one locality Option (see Figure) with a **VERY HIGH, MODERATE** and **LOW** sensitivities:
Option 1: An area that spans over several roads in the Beaufort West area ending in the south at Klaarstroom north. The approximate size of the site on the N12 National Road is from km 0.00 to km 110.00.

Other locality options will not be feasible as all of the options will be situated on the Beaufort Group sediments and are already present.

Field Observation - Fieldwork was done in April. The area is covered in plantation trees, lush grass and bushes. Outcrops are difficult to see because of the lush vegetation. As nothing could be seen on the site, it was necessary to check the surrounding area as Bulwer is known for fossil Therapsids. A dolerite outcrop opposite the road has a mudstone outcrop at the bottom, this was surveyed for fossils. No fossils were found.

Recommendation:
The potential impact of the development on fossil heritage is **VERY HIGH** and therefore a Phase 1: Field Survey was necessary for this development (according to SAHRA protocol), if a chance fossil is found during construction a Phase 2 Palaeontological Impact Assessment and Mitigation or conservation will be necessary.

Concerns/threats **(1g)** to be added to EMPr:

1. Threats to the National Heritage are earth moving equipment/machinery (for example haul trucks, front end loaders, excavators, graders, dozers) during construction, the sealing-in, disturbance, damage or destruction of the fossils by development, vehicle traffic, clearing, and human disturbance.
2. Special care must be taken during the clearing, digging, drilling, blasting and excavating of foundations, trenches, channels and footings and removal of overburden not to intrude fossiliferous layers.

The recommendations are (**1ni,1niA,1nii)**:

1. Mitigation may be needed if fossils are found during construction. Overburden and interburden must be surveyed for fossils.
2. No consultation with parties was necessary. The Environmental Control Officer must familiarise him- or herself with the formation present and its fossils.

3. The development may go ahead with caution. The ECO must survey for fossils before and or after clearing, blasting or excavating and keep a photographic record.
4. The EMPr already covers the conservation of heritage and palaeontological material that may be exposed during construction activities. For a chance find, the protocol is to immediately cease all construction activities, construct a 30 m no-go barrier, and contact SAHRA for further investigation. It is recommended that the EMPr be updated to include the involvement of a palaeontologist for pre-construction training of the ECO.

Stakeholders: Developer – Western Cape Government: Department of Transport and Public Works, P.O. Box 2603, Cape Town, 8000.
Environmental – Chameleon Environmental Consultants, P.O. Box 11788, Silver Lakes, 0054. Tel: 082 571 6920.
Landowner – Western Cape Government: Department of Transport and Public Works, P.O. Box 2603, Cape Town, 8000.

C. Table of Contents

D. Background information on the project

Report

This report is part of the environmental impact assessment process under the National Environmental Management Act, as amended (Act No. 107 of 1998) (NEMA) and includes Appendix 6 (May 2019) of the Environmental Impact Assessment Regulations (see Appendix 2). It also is in compliance with The Minimum Standards for Palaeontological Components of Heritage Impact Assessment Reports, SAHRA, APMHOB, Guidelines 2012, Pp 1-15 (**2**).

Outline of development (**1f)**

This report discusses and aims to provide the developer with information regarding the location of palaeontological material that will be impacted by the development. In the pre-construction phase it is necessary for the developer to apply for the relevant permit from the South African Heritage Resources Agency (SAHRA / PHRA).

The applicant, Western Cape Government: Department of Transport and Public Works entails to repair or replace 41 bridges and culvert structures located on several roads. Work to be done are new asphalt plug joints and new asphalt.

Related Infrastructure:

1. Culverts,
2. Bridges,
3. Bridge infrastructure,
4. Fencing,
5. Base concrete slabs.

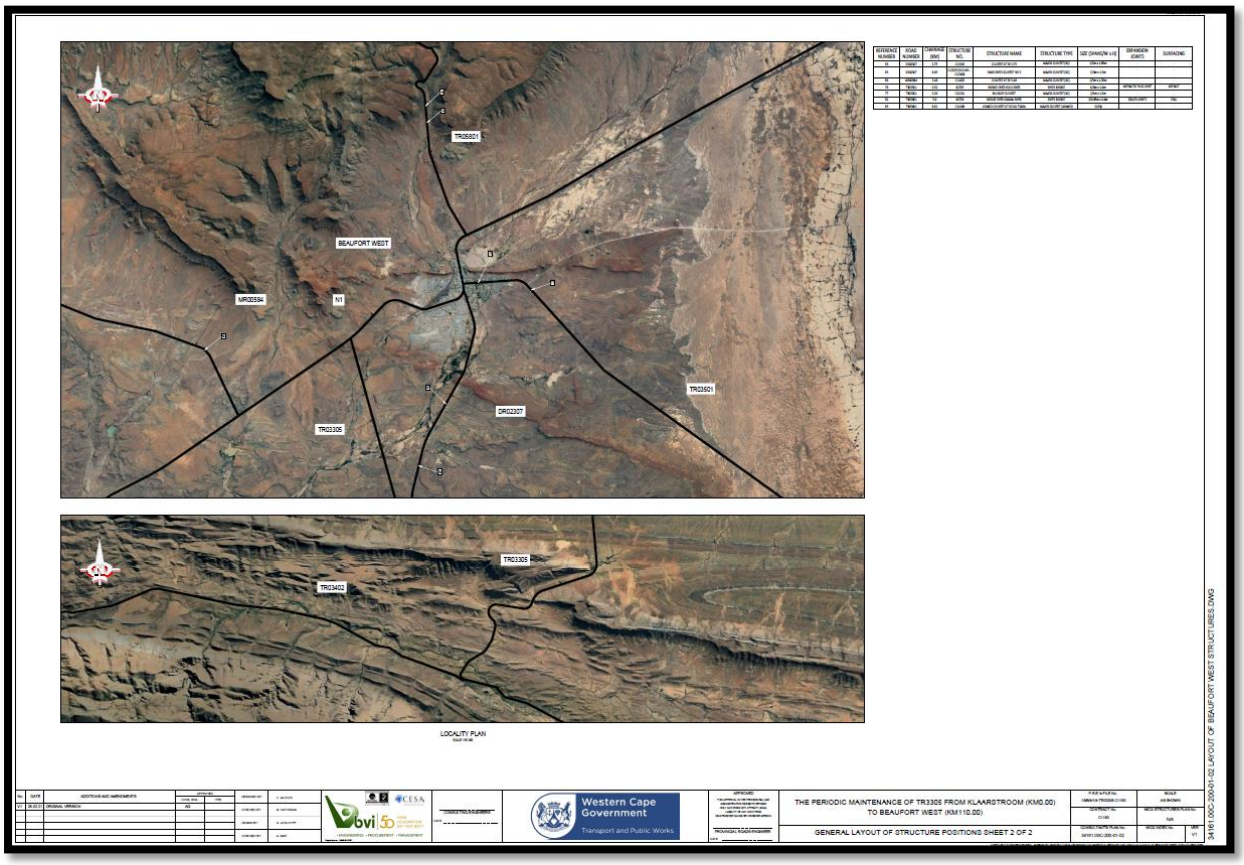

Figure 1: Figure showing bridge and culvert positions (Chameleon).

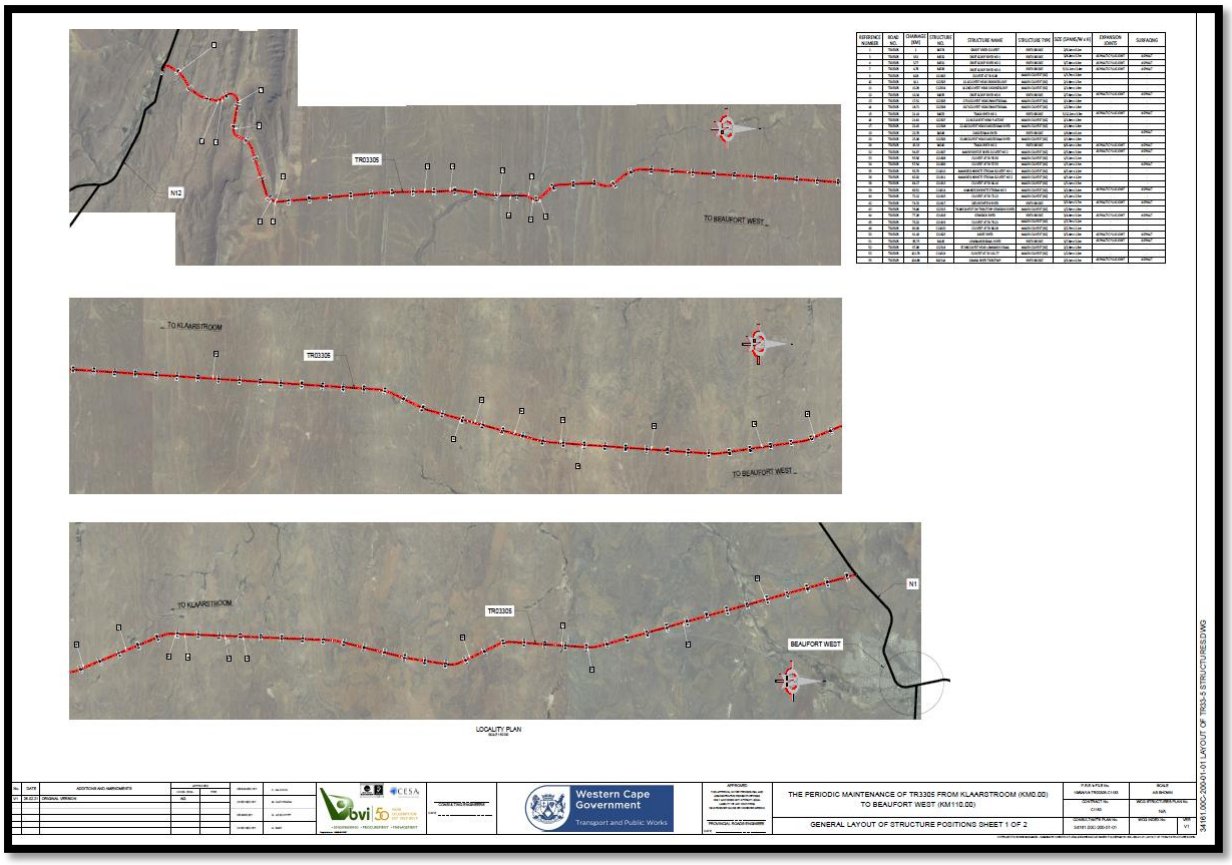

Figure 2: Figure showing bridge and culvert positions (Chameleon).

The Project includes one locality Option (see Figure 2):
Option 1: An area that spans over several roads in the Beaufort West area ending in the south at Klaarstroom north. The approximate size of the site on the N12 National Road is from km 0.00 to km 110.00.

Rezoning/ and or subdivision of land: No.
Name of Developer and Consultant: Western Cape Government: Department of Transport Public Works and Chameleon Environmental Consultants.
Terms of reference: Dr H. Fourie is a palaeontologist commissioned to do a palaeontological impact assessment: field study to ascertain if any palaeontological sensitive material is present in the development area. This study will advise on the impact on fossil heritage mitigation or conservation necessary, if any.
Short *Curriculum vitae:(**1ai, 1aii)*** Dr Fourie obtained a Ph.D from the Bernard Price Institute for Palaeontological Research (now ESI), University of the Witwatersrand. Her undergraduate degree is in Geology and Zoology. She specialises in vertebrate morphology and function concentrating on the Therapsid Therocephalia. At present she is curator of a large fossil invertebrate, Therapsid, dinosaur, amphibia, fish, reptile, and plant collections at Ditsong: National Museum of Natural History. For the past 14 years she carried out field work in the North West, Western Cape, Northern Cape, Eastern Cape, Limpopo, Mpumalanga, Gauteng and Free State Provinces and has done more than 200 PIA's since 2012. Dr Fourie has been employed at the Ditsong: National Museum of Natural History in Pretoria (formerly Transvaal Museum) for 26 years.
Legislative requirements: South African Heritage Resources Agency (SAHRA) for issue of permits if necessary. National Heritage Resources Act (Act No. 25 of 1999). An electronic copy of this report must be supplied to SAHRA (**2**).

E. Description of property or affected environment

Location and depth:
The Repair or Replacement of Bridges and Culvert Structures on Trunk Roads 3305, 3501, 5801, Divisional Road D2307, and Main Road 584 will be situated in the Prince Albert (km 0.00 to km 50.47) and Beaufort West (km 50.47 to km 110.00) Local Municipalities, Central Karoo District Municipality, Western Cape Province on Farms as indicted of Figure 3.

Depth is determined by the infrastructure to be developed and the thickness of the formation in the development area. Details of the location and distribution of all significant fossil sites or key fossiliferous rock units are often difficult to determine due to thick topsoil, subsoil, overburden and alluvium. Depth of the overburden may vary a lot. Geological maps do not provide depth or superficial cover, it only provides mappable surface outcrops.

Figure 2: Google Earth image showing location (Chameleon).

The bulk of the site is underlain by the Karoo Supergroup Formations covered by vegetation, grass, trees, the road and road shoulders.

F. Description of the Geological Setting

Description of the rock units:
Large areas of the southern African continent are covered by the Karoo Supergroup (Figure 3). It covers older geological formations with an almost horizontal blanket. Several basins are present with the main basin in the central part of south Africa and several smaller basins towards Lebombo, Springbok Flats and Soutpansberg. An estimated age is 150 – 180 Ma. And a maximum thickness of 7000 m is reached in the south. Three formations overlie the Beaufort Group, they are the Molteno, Elliot and Clarens Formations. The Elliot Formation is also known as the Red Beds and the old Cave Sandstone is known as the Clarens Formation. At the top is the Drakensberg Basalt Formation with its pillow lavas, pyroclasts, etc. (Kent 1980, Snyman 1996).

Dolerite dykes (Jd) occur throughout the Karoo Supergroup. Structural geological features such as dykes and faults can have a measurable influence on ground water flow and mass transport. Permian sediments are extensively intruded and thermally metamorphosed (baked) by subhorizontal sills and steeply inclined dykes of the Karoo Dolerite Suite (Jd). These early Jurassic (183 Ma) basic intrusions baked the adjacent mudrocks and sandstones to form splintery hornfels and quartzites respectively. Thermal metamorphism by dolerite intrusions tends to reduce the palaeontological heritage potential of the adjacent sediments.

The rocks of the Beaufort Group were deposited by large, northward-flowing, meandering rivers in which sand accumulated, flanked by extensive floodplains where periodic floods deposited mud. Following the end-Permian mass extinction, the meandering rivers were replaced by multi-channelled, braided river systems that deposited sand rather than the silts and muds of the earlier meandering rivers. The sandstone-dominated strata deposited by these braided rivers, known as the Katberg Formation, can be as much as 1000 m. thick. As time passed, the high-energy, braided rivers of the Katberg Formation reverted to a meandering form, possibly reflecting recovery of the vegetation. These sedimentary deposits are the Burgersdorp Formation (McCarthy and Rubidge 2005).

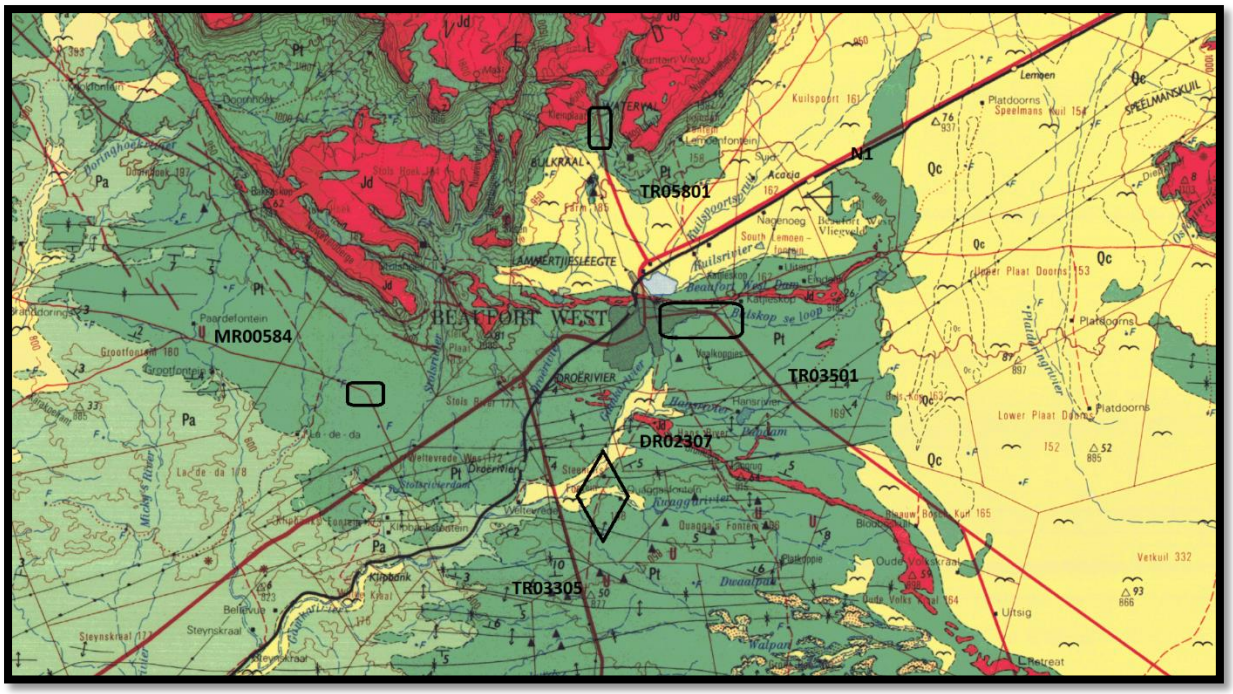

Figure 3: Geology of the development area () (**1h)**.

Legend to Map and short explanation.

M – Alluvial valley deposits (m). Quaternary.

Jd – Karoo Dolerite suite (pink). Jurassic.

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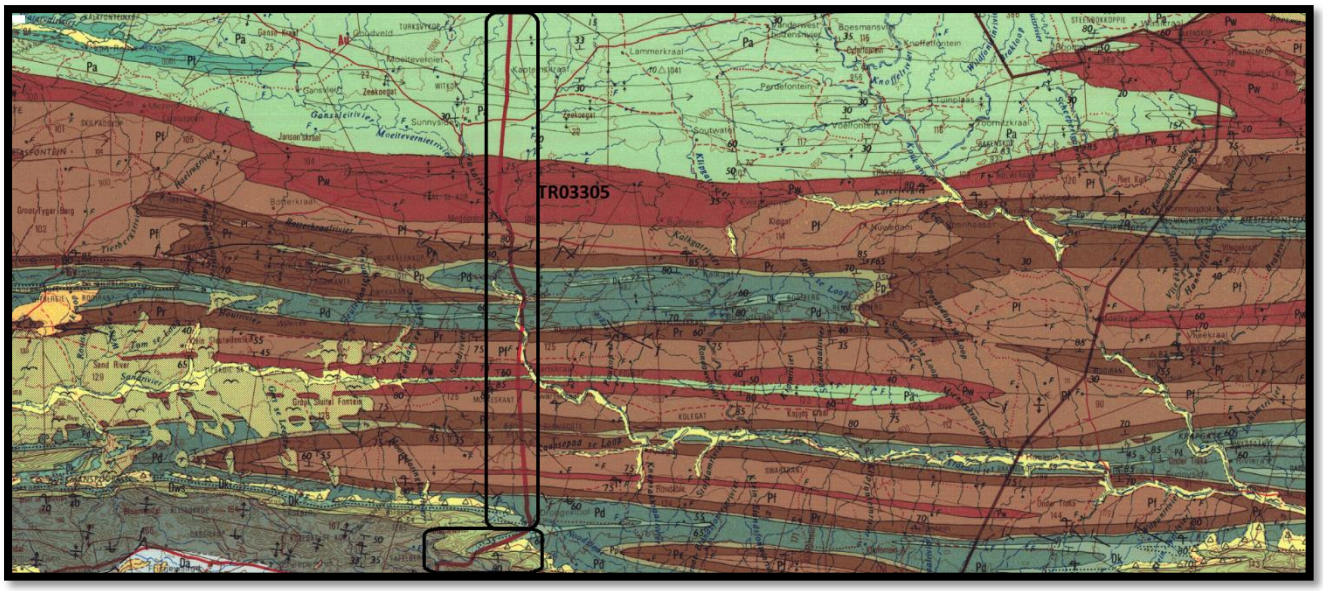

Mining Activities on Figure above:

Au – Gold Pc – Pseudocoal U – Uranium.

Several faults are present near the development area.

The mining past and present has no influence on the project.

The Adelaide Subgroup consists of up to three formations (Koonap, Middleton, Balfour in the east). Mudrock predominates with subordinate sandstone and is Upper Permian in age. It overlies the Ecca Group conformably and is overlain by the Katberg Formation of the Tarkastad Subgroup. Siltstone beds are common (Cole *et al.* 2004). The Koonap Formation reaches a thickness of 1 300 m. (Kent 1980). The Balfour Formation is distinguished from the Middleton Formation by the lack of 'red' mudstone and is ±2 150 m. thick, whereas the Middleton Formation is ±1 600 m. thick (sheet info, Kent 1980). The Abrahamskraal and Teekloof Formations form part of the Adelaide Subgroup in the west (Snyman 1996) with the Member Poortjie at the top of the Teekloof Formation. Chert is present in the Abrahamskraal Formation. The Adelaide Subgroup has a maximum thickness of 1750 m. in the south (Visser 1989).

The Ecca Group is early to mid-Permian (545-250 Ma) in age. Sediments of the Ecca group are lacustrine and marine to fluvio-deltaic (Snyman 1996). The Ecca group is known for its coal (mainly the Vryheid Formation) (five coal seams) and uranium. Coalfields formed due to the accumulation of plant material in shallow and large swampy deltas (see Appendix 1). The Ecca Group conformably overlies the Dwyka Group and is conformably overlain by the Beaufort Group, Karoo Supergroup. It consists essentially of mudrock (shale), but sandstone-rich units occur towards the margins of the present main Karoo basin in the south, west and north-east, with coal seams also being present in the north-east (Kent 1980, Johnson 2009).

The Waterford Formation (Pw) overlies the Fort Brown shale and where present constitutes the uppermost formation of the Ecca Group. It reaches a maximum thickness of about 800 m and is characterised by a relative abundance of grey sandstone and the presence of dark blue-grey shale (Kent, 1980; Snyman, 1996). It weathers yellow-brown (Visser, 1989). The Fort Brown (Pf) is middle-Ecca and reaches a maximum thickness of 1,500 m. Blue shale is interlayered with sandstone (Kent, 1980; Visser, 1989). The Ripon Formation (Pr) is lower-Ecca and is 1000 m in thickness (Visser, 1989). The strata are usually flat-lying except along the southern margin of the basin where they were folded and faulted during the Cape Fold Belt orogeny (Johnson, 2009).

The Ripon Formation conformably overlies the Collingham Formation and is in turn conformably overlain by the Fort Brown Formation. It is Permian in age and named after a railway station 70 km WNW of Grahamstown. Available thickness varies between 570 m to 1660 m It consists of three members, the Trumpeters, Wonderfontein and Pluto's Vale (Johnson and Kingsley 1993).

The Dwyka Group is the lowermost unit of the Karoo Supergroup overlain by the Ecca Group and underlain by the Witteberg Group, Bokkeveld or Table Mountain Groups and various other groups. It ranges in age from Late Carboniferous to early Permian. Clastic rocks containing diamictite, varved shale, conglomerate, pebbly sandstone and mudrock are present. The rocks display features reflecting a glacial and glacially-related origin (Kent 1980, Visser *et al.* 1990). Thickness varies between 100-800 m (Visser *et al.* 1990). As Gondwana drifted northward the first sediments to be deposited would have been the Dwyka. As the glaciers melted they left striations on the surface also vast quantities of mud and large fragments of rock which formed the characteristic, poorly sorted Dwyka tillite (McCarthy and Rubidge 2005). Visser *et al.* (1990) proposed two subdivisions for the Dwyka Group in the main Karoo basin, the Elandsvlei and Mbizane Formations. In the far north, the Tshidzi and Wellington Formations also form part of the Dwyka Group. Fossils are present.

The Elandsvlei Formation is confined to the southern part of the Main Karoo Basin. It is conformably overlain by the Mbizane Formation, but elsewhere it is conformably overlain by the Prince Albert, Vryheid and Pietermaritzburg Formations or undifferentiated Ecca Group. An estimated age of Middle/Late Carboniferous (289.6 ± 3.8 Ma and 288 ± 3 Ma) is assigned. The name derived from the farm Elandsvlei 1116 located about 100 km south of Calvinia. Thickness varies from 100 min the north to 800 m in the south (Visser 2002).

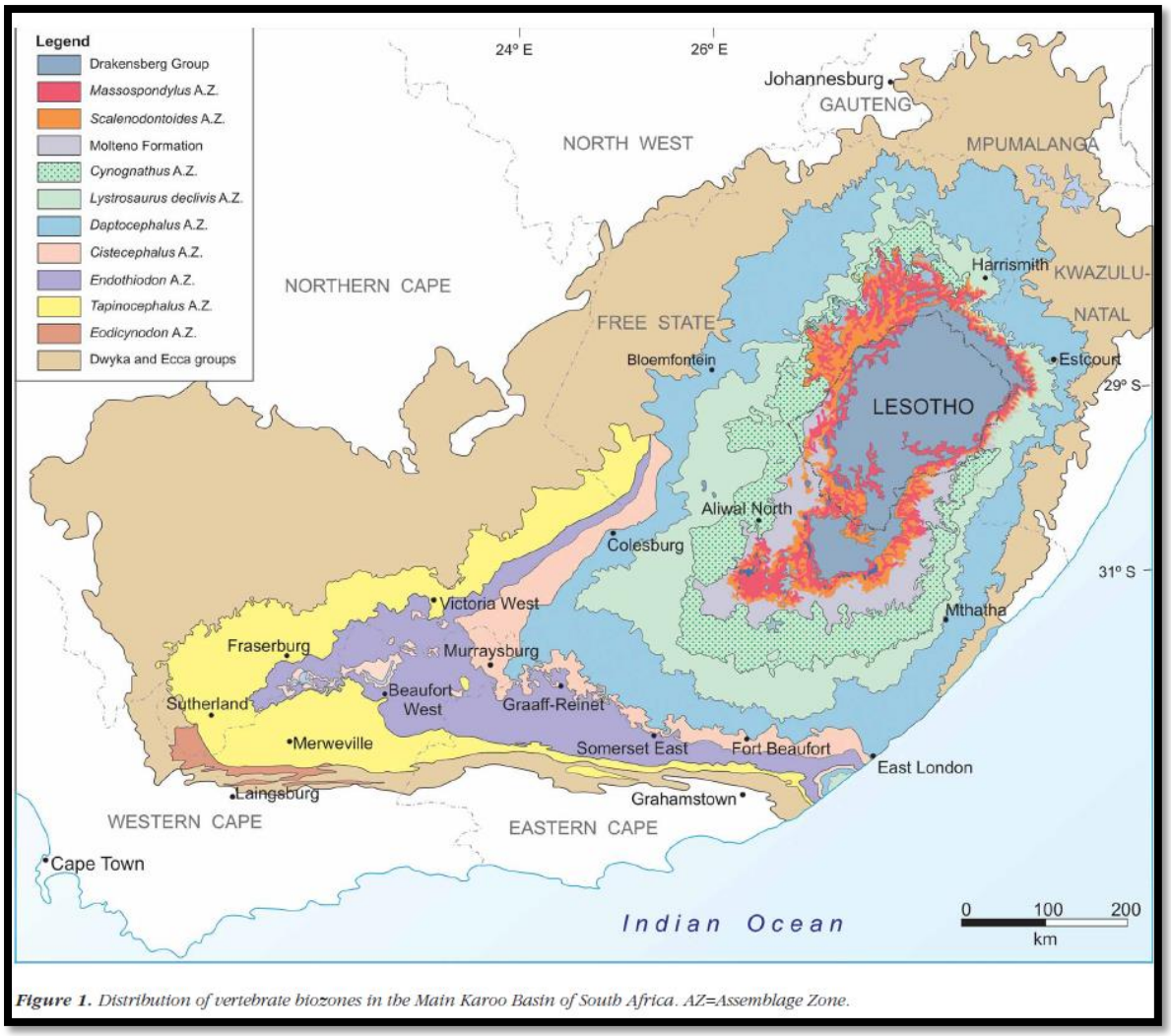

Figure 4: Geographic distribution of the vertebrate biozones of the Beaufort Group (Smith *et al.* 2020).

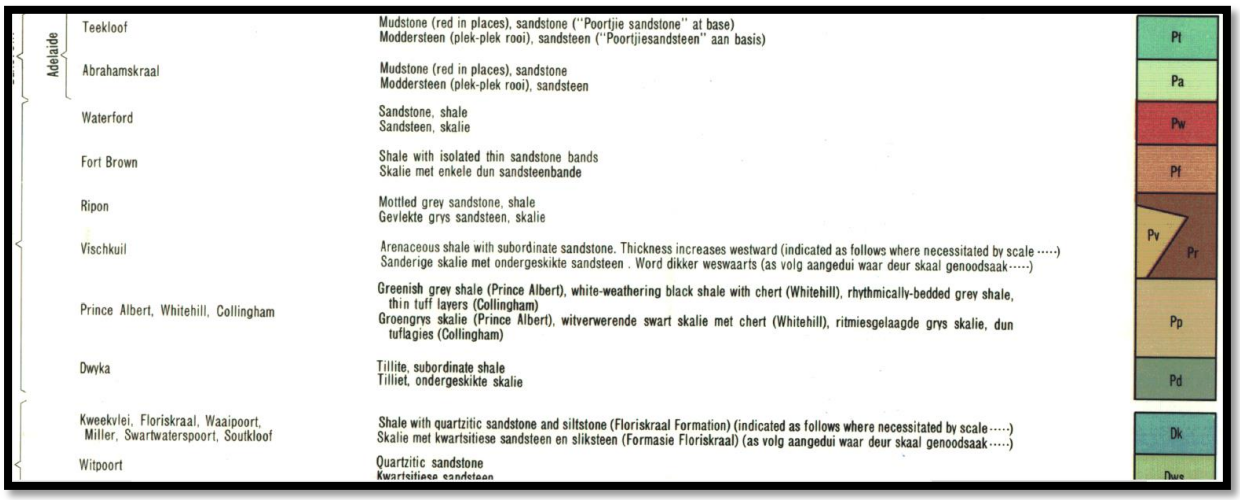

Figure 5: Lithostratigraphic column of the Karoo Supergroup present in the project area (3322 Oudtshoorn)

Field Observation - Fieldwork was done in April. The area is covered in plantation trees, lush grass and bushes. Outcrops are difficult to see because of the lush vegetation. As nothing could be seen on the site, it was

necessary to check the surrounding area as Bulwer is known for fossil Therapsids. A dolerite outcrop opposite the road has a mudstone outcrop at the bottom, this was surveyed for fossils. No fossils were found.

Figures in Appendix 3.

G. Background to Palaeontology of the area

Summary: When rock units of moderate to very high palaeontological sensitivity are present within the development footprint, a desk top and or field scoping (survey) study by a professional palaeontologist is usually warranted. The main purpose of a field scoping (survey) study would be to identify any areas within the development footprint where specialist palaeontological mitigation during the construction phase may be required (SG 2.2 SAHRA AMPHOB, 2012).

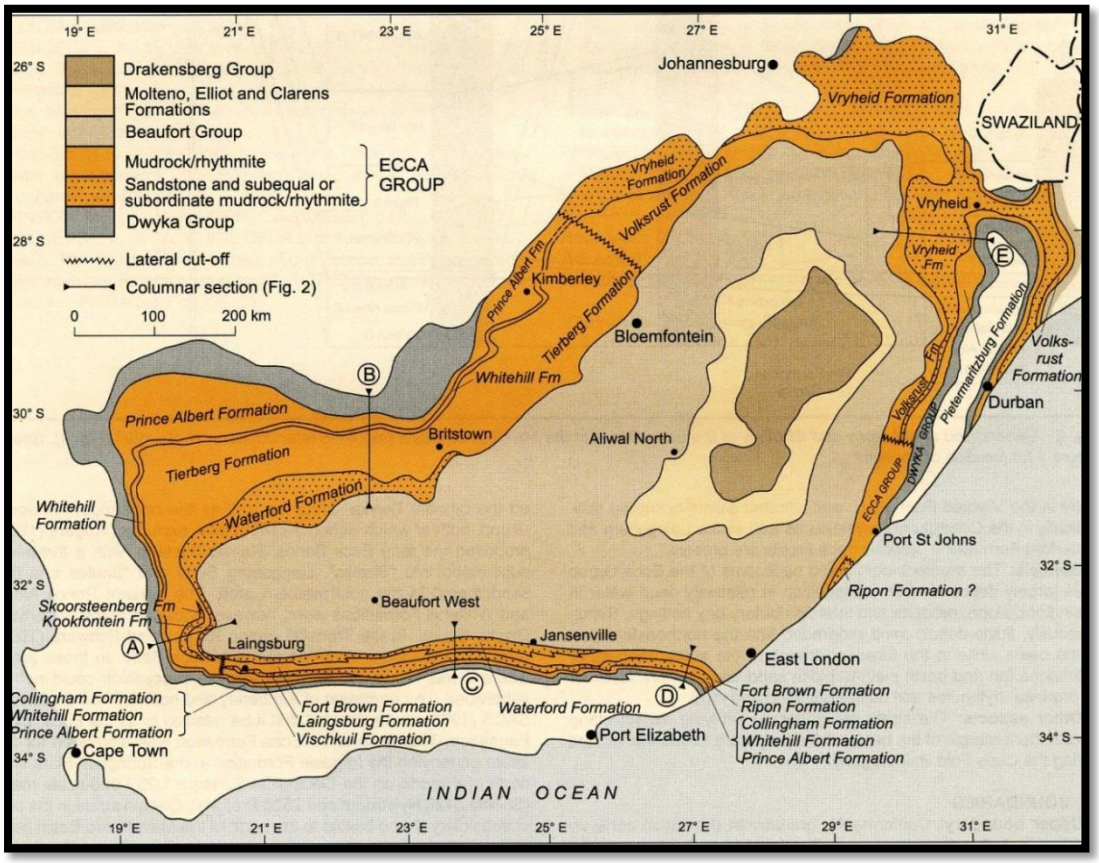

Figure 6: Extent of the Karoo Supergroup (Johnson 2009).

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Unidentifiable plant remains (mainly stem fragments) occur sporadically throughout the Ripon Formation, becoming fairly common in the lowermost part. Flattened silicified logs (*Dadoxylon?)* displaying annual rings at the base of the formation (Johnson and Kingsley 1993).

Trace fossils are relatively abundant in the shales occurring near the top of the Dwyka Group. Lycopods (*Leptophloem australe*) have been described from the northern Free State (Mac Rae 1999). Spores and acritarchs have been reported from the interglacial mudrocks of the Dwyka Group, also pollen, wood, and plant remains in the interbedded mudrocks as well as the diamictite itself, while anthropod trackways and fish trails are present in places on bedding planes (Visser *et al.* 1990).

Fossils in South Africa mainly occur in rocks of sedimentary nature and not in rocks from igneous or metamorphic nature. Therefore, if there is the presence of Karoo Supergroup strata the palaeontological sensitivity is generally **LOW** to **VERY HIGH**, but here locally **VERY HIGH** for the Beaufort Group.

Table 1: Taken from Palaeotechnical Report (Groenewald 2012) (**1cA)**.

8. BEAUFORT GROUP	**8b. Tarkastad Subgroup: Katberg, Burgersdorp Fms (TRt)**	continental (fluvial, lacustrine) siliciclastic sediments, pedocretes (calcretes)	diverse terrestrial and freshwater tetrapods of *Tapinocephalus* to *Cynognathus* Biozones (amphibians, true reptiles, synapsids – especially therapsids), palaeoniscoid fish, freshwater bivalves, trace fossils (including tetrapod trackways), sparse vascular plants (*Glossopteris* Flora, including petrified wood)	Biozonation of Beaufort Group in some areas of E. Cape still requires resolution richest Permotriassic tetrapod fauna from Pangaea / Gondwana key evidence for evolution of mammalian characters among therapsids continental record of Late Permian Mass Extinction Events
	8a. Adelaide Subgroup: Koonap, Middleton, Balfour Fms **(Pa)**	Late Permian – Early Triassic *c.* 266 – 250 Ma		
7. ECCA GROUP **(Pr, Pf, Pwa, Pe)**		Early – Mid Permian non-marine / lacustrine sediments (basin plain, turbidite fan, delta	diverse non-marine trace fossil assemblages, *Glossopteris* flora, mesosaurid reptiles,	
		etc), minor tuffs (volcanic ashes)	palaeoniscoid fish, crustaceans	
6. DWYKA GROUP (C-Pd) **Elandsvlei Formation** **?Mbizane Formation**		Late Carboniferous – Early Permian	interglacial and post-glacial trace fossil assemblages possibility of body fossils (*eg* molluscs, fish, plants)	

Table 2: Criteria used (Fossil Heritage Layer Browser/SAHRA) (**1cB)**:

Rock Unit	Significance/vulnerability	Recommended Action
Jurassic Dolerite	Very Low	No action required
Adelaide Subgroup	Very High	Desktop Study and Field Assessment

Ecca Group	Moderate	Desktop Study and possible Field Assessment
Dwyka Group	Low	Protocol for finds is required

Databases and collections: Ditsong: National Museum of Natural History. Evolutionary Studies Institute, University of the Witwatersrand (ESI).
Impact: **VERY HIGH** for the Adelaide Subgroup, Beaufort Group, Karoo Supergroup, **MODERATE** for the Ecca Group and **LOW** for the Dwyka Group. There are significant fossil resources that may be impacted by the development (mudstone, shale) and if destroyed are no longer available for scientific research or other public good (Almond, *et al.* 2009).

The Project includes one locality Option (see Figure 2) with the above sensitivities (**1j)**:
Option 1: An area that spans over several roads in the Beaufort West area ending in the south at Klaarstroom north. The approximate size of the site on the N12 National Road is from km 0.00 to km 110.00.

H. Description of the Methodology (1e)
The palaeontological impact assessment field study was undertaken in April 2021 during the official Level 1 of the Covid-19 lockdown. A Phase 1: Field Study includes a survey of the affected portion with photographs taken (in 7.1 mega pixels) of the site with a digital camera (Canon PowerShot A470). Additionally, a Global Positioning System (GPS) (Garmin eTrex 10) is used to record fossiliferous finds and outcrops (bedrock) when the area is not covered with topsoil, subsoil, overburden, vegetation, grassland, trees or waste. The survey did identify the Karoo Supergroup. A literature survey is included and the study relied heavily on geological maps.

SAHRA document 7/6/9/2/1 requires track records/logs from archaeologists not palaeontologists as palaeontologists concentrate on outcrops which may be recorded with a GPS. Isolated occurrences of rocks usually do not constitute an outcrop. Fossils can occur in dongas, as nodules, in fresh rock exposures, and in riverbeds. Finding fossils require the experience and technical knowledge of the professional palaeontologist, but that does not mean that an amateur can't find fossils. The geology of the region is used to predict what type of fossil and zone will be found in any particular region. Archaeozoologists concentrate on more recent fossils in the quaternary and tertiary deposits.

Assumptions and Limitations (**1i)**:-
The accuracy and reliability of the report **may be** limited by the following constraints:

1. Most development areas have never been surveyed by a palaeontologist or geophysicist.
2. Variable accuracy of geological maps and associated information.
3. Poor locality information on sheet explanations for geological maps.
4. Lack of published data.
5. Lack of rocky outcrops.
6. Inaccessibility of site.
7. Insufficient data from developer and exact lay-out plan for all structures.

A Phase 2 Palaeontological Impact Assessment: Mitigation will include:

1. Recommendations for the future of the site.
2. Description of work done (including number of people and their responsibilities.
3. A written assessment of the work done, fossils excavated, not removed or collected and observed.
4. Conclusion reached regarding the fossil material.
5. A detailed site plan.
6. Possible declaration as a heritage site or Site Management Plan.

The National Heritage Resources Act No. 25 of 1999 further prescribes.

Act No. 25 of 1999. National Heritage Resources Act, 1999.
National Estate: 3 (2) (f) archaeological and palaeontological sites,
(i)(1) objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens,
Heritage assessment criteria and grading: (a) Grade 1: Heritage resources with qualities so exceptional that they are of special national significance;
(b) Grade 2: Heritage resources which, although forming part of the national estate, can be considered to have special qualities which make them significant within the context of a province or a region; and (c) Grade 3: Other heritage resources worthy of conservation.
SAHRA is responsible for the identification and management of Grade 1 heritage resources.
Provincial Heritage Resources Authority (PHRA) identifies and manages Grade 2 heritage resources.
Local authorities identify and manage Grade 3 heritage resources.

No person may damage, deface, excavate, alter, remove from its original position, subdivide or change the planning status of a provincially protected place or object without a permit issued by a heritage resources authority or local authority responsible for the provincial protection.
Archaeology, palaeontology and meteorites: Section 35.
(2) Subject to the provisions of subsection (8) (a), all archaeological objects, palaeontological material and meteorites are the property of the State.
(3) 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.

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

The Mitigation is done in order to rescue representative fossil material from the study area to allow and record the nature of each locality and establish its age before it is destroyed and to make samples accessible for future research. It also interprets the evidence recovered to allow for education of the public and promotion of palaeontological heritage.

Should further fossil material be discovered during the course of the development (*e. g.* during bedrock excavations), this must be safeguarded, where feasible *in situ,* and reported to a palaeontologist or to the Heritage Resources authority. In situations where the area is considered palaeontologically sensitive (*e. g.* Karoo Supergroup Formations, ancient marine deposits in the interior or along the coast) the palaeontologist might need to monitor all newly excavated bedrock. The developer needs to give the palaeontologist sufficient time to assess and document the finds and, if necessary, to rescue a representative sample.

When a Phase 2 palaeontological impact study is recommended, permission for the development to proceed can be given only once the heritage resources authority has received and approved a Phase 2 report and is satisfied that (a) the palaeontological resources under threat have been adequately recorded and sampled, and (b) adequate development on fossil heritage, including, where necessary, *in situ* conservation of heritage of high significance. Careful planning, including early consultation with a palaeontologist and heritage management

authorities, can minimise the impact of palaeontological surveys on development projects by selecting options that cause the least amount of inconvenience and delay.

Three types of permits are available; Mitigation, Destruction and Interpretation. The specialist will apply for the permit at the beginning of the process (SAHRA 2012).

I. Description of significant fossil occurrences

All Karoo Supergroup geological formations are ranked as **LOW** to **VERY HIGH**, and here the impact is potentially **VERY HIGH** for the Beaufort Group.

The Jurassic Dolerite does not contain fossils.

Well preserved fossils of therapsids occur in mudrock horizons, and are usually found as dispersed, isolated specimens associated with an abundance of calcareous nodules. An abundant and varied therapsid fauna as well as amphibian and fish fossils have been recovered (Rubidge 1995).

The Adelaide Subgroup comprises the *Daptocephalus* Assemblage Zone and possibly the underlying *Cistecephalus* Assemblage Zone. The lowermost *Tapinocephalus* Assemblage Zone is named after the dinocephalian *Tapinocephalus* and spans the middle of the Abrahamskraal Formation. The pareiasaur *Bradysaurus* is also common. Stratigraphically above this is the uppermost strata of the Abrahamskraal Formation and lowermost strata of the overlying Teekloof Formation and includes the Poortjie Member. *Pristerognathus* is most common here. The lower part of the Teekloof Formation is characterised by the fossil *Tropidostoma* as well as *Diictodon* (Rubidge 1995).

The Ecca Group may contain fossils of diverse non-marine trace, *Glossopteris* flora, mesosaurid reptiles, palaeoniscid fish, marine invertebrates, insects, and crustaceans (Johnson 2009). *Glossopteris* trees rapidly colonised the large deltas along the northern margin of the Karoo Sea. Dead vegetation accumulated faster than it could decay, and thick accumulations of peat formed, which were ultimately converted to coal. It is only in the northern part of the Karoo Basin that the glossopterids and cordaitales, ferns, clubmosses and horsetails thrived (McCarthy and Rubidge 2005).

Unidentifiable plant remains (mainly stem fragments) occur sporadically throughout the Ripon Formation, becoming fairly common in the lowermost part. Flattened silicified logs (*Dadoxylon?)* displaying annual rings at the base of the formation (Johnson and Kingsley 1993).

Trace fossils are relatively abundant in the shales occurring near the top of the Dwyka Group. Lycopods (*Leptophloem australe*) have been described from the northern Free State (Mac Rae 1999). Spores and acritarchs have been reported from the interglacial mudrocks of the Dwyka Group, also pollen, wood, and plant remains in the interbedded mudrocks as well as the diamictite itself, while anthropod trackways and fish trails are present in places on bedding planes (Visser *et al.* 1990).

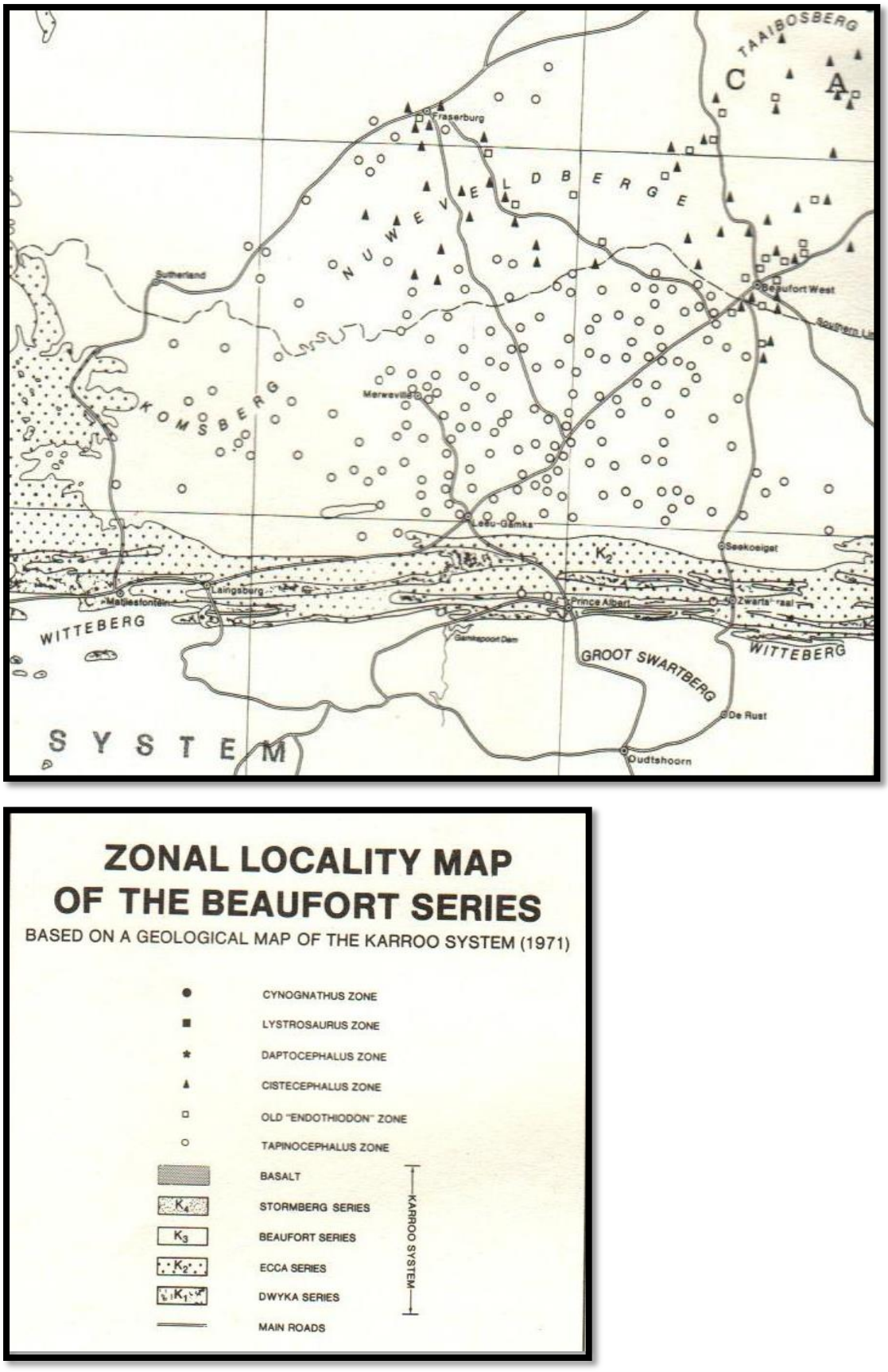

Figure 7: Map to show fossil localities close to Beaufort West (Kitching 1977).

There are 311 fossils recorded from the Beaufort West area and 216 from the Murraysburg area.

Details of the location and distribution of all significant fossil sites or key fossiliferous rock units are often difficult to be determined due to thick topsoil, subsoil, overburden and alluvium. Depth of the overburden may vary a lot.

The threats are:-

- Earth moving equipment/machinery (front end loaders, excavators, graders, dozers) during construction,
- The sealing-in or destruction of fossils by development, vehicle traffic, and human disturbance. See Description of the Geological Setting (F) above.

J. Recommendation (1o,1p,1q)

a. There is no objection (see Recommendation B) to the development, it was necessary to request a Phase 1 Palaeontological Impact Assessment: Field Study to determine whether the development will affect fossiliferous outcrops as the palaeontological sensitivity is **VERY HIGH.** If chance fossils are found during construction a Phase 2 Palaeontological Assessment: Mitigation is recommended. Protocol is attached (Appendix 2).
b. This project may benefit the economy, the life expectancy of the community, the growth of the community and social development in general.
c. Preferred choice: Only one locality Option is presented.
d. The following should be conserved: if any palaeontological material is exposed during clearing, digging, excavating, drilling or blasting SAHRA must be notified. All construction activities must be stopped, a 30 m no-go barrier constructed, and a palaeontologist should be called in to determine proper mitigation measures.
e. No consultation with parties was necessary.
f. This report must be submitted to SAHRA together with the Heritage Impact Assessment.

Sampling and collecting **(6m,6k)**:
Wherefore a permit is needed from the South African Heritage Resources Agency (SAHRA / PHRA).

a. Objections: Cautious. See heritage value and recommendation.
b. Conditions of development: See Recommendation.
c. Areas that may need a permit: Yes, if a fossil is found.
d. Permits for mitigation: **Needed from SAHRA/PHRA prior to Mitigation**.

K. Conclusions

a. All the land involved in the development was assessed and none of the property is unsuitable for development (see Recommendation B).
b. All information needed for the Palaeontological Impact Assessment was provided by the Consultant. All technical information was provided by Chameleon Environmental Consultants.
c. Areas that would involve mitigation and may need a permit from the South African Heritage Resources Agency are discussed.
d. The following should be conserved: if any palaeontological material is exposed during digging, excavating, drilling or blasting, SAHRA must be notified. All development activities must be stopped and a palaeontologist should be called in to determine proper mitigation measures.
e. Condition in which development may proceed: It is further suggested that a Section 37(2) agreement of the Occupational, Health and Safety Act 85 of 1993 is signed with the relevant contractors to protect the environment (fossils/dongas) and adjacent areas as well as for safety and security reasons.

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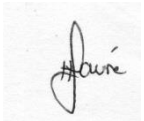
Acknowledgement
To my field assistant Candice Devenish for her keen eyes and enthusiasm.

Declaration (1b)
I, Heidi Fourie, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed development project for which I was appointed to do a palaeontological assessment. There are no circumstances that compromise the objectivity of me performing such work.

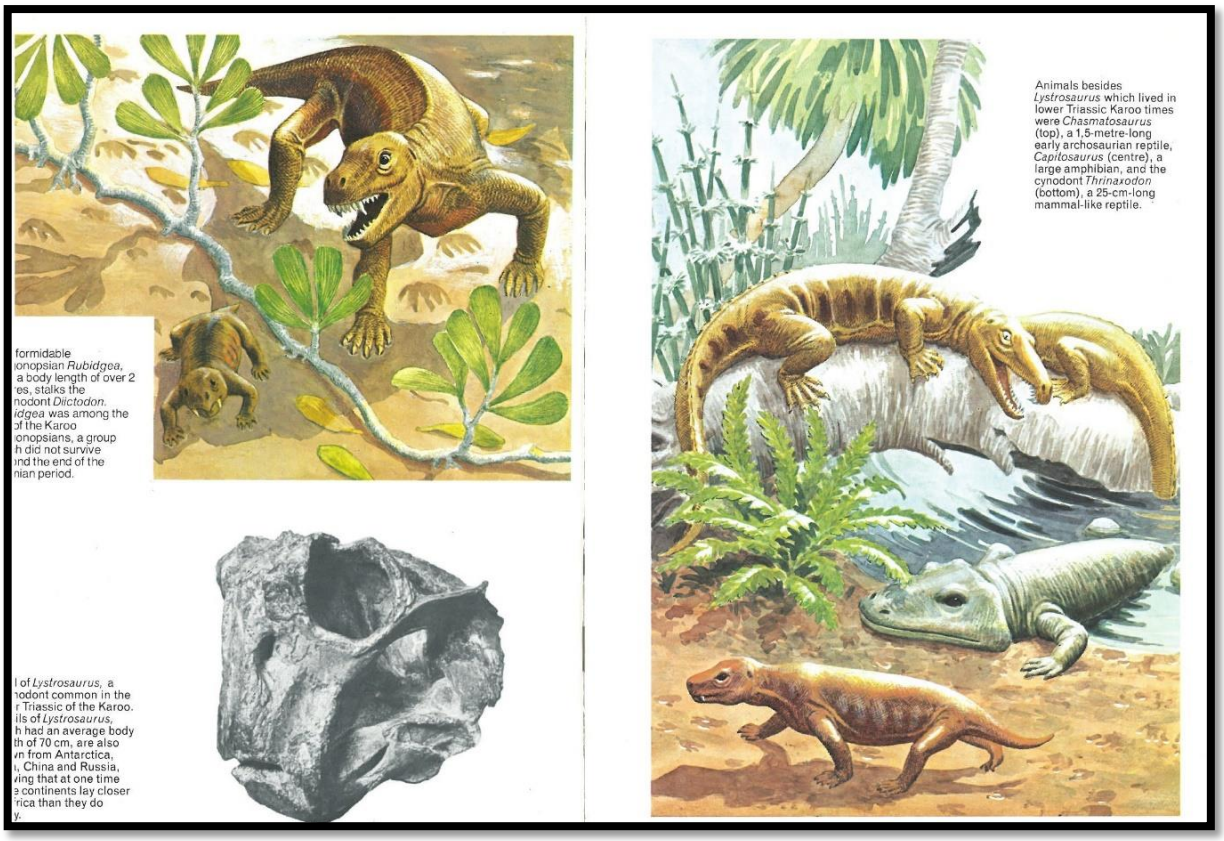
I accept no liability, and the client, by receiving this document, indemnifies me against all actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, directly or indirectly by the use of the information contained in this document.

It may be possible that the Palaeontological Impact Assessment may have missed palaeontological resources in the project area as outcrops are not always present or visible while others may lie below the overburden of earth and may only be present once development commences.

This report may not be altered in any way and any parts drawn from this report must make reference to this report.



Heidi Fourie
2021/05/10



formidable
ionopsian *Rubidgea*,
a body length of over 2
es, stalks the
nodont *Dictodon*.
idgea was among the
of the Karoo
ionopsians, a group
h did not survive
nd the end of the
nian period.

l of *Lystrosaurus*, a
odont common in the
r Triassic of the Karoo.
ils of *Lystrosaurus*,
h had an average body
th of 70 cm, are also
m from Antarctica,
, China and Russia,
ving that at one time
e continents lay closer
rica than they do
y.

Animals besides *Lystrosaurus* which lived in lower Triassic Karoo times were *Chasmatosaurus* (top), a 1,5-metre-long early archosaurian reptile, *Capitosaurus* (centre), a large amphibian, and the cynodont *Thrinaxodon* (bottom), a 25-cm-long mammal-like reptile.

Appendix 1: **Protocol for Chance Finds and Management Plan (also include Section B) (1k,1l,1m)**
This section covers the recommended protocol for a Phase 2 Mitigation process as well as for reports where the Palaeontological Sensitivity is **LOW**; this process guides the palaeontologist / palaeobotanist on site and should not be attempted by the layman / developer. As part of the Environmental Authorisation conditions, an Environmental Control Officer (ECO) will be appointed to oversee the construction activities in line with the legally binding Environmental Management Programme (EMPr). The EMPr already covers the conservation of heritage and palaeontological material that may be exposed during construction activities:

- For a chance find, the protocol is to immediately cease all construction activities, construct a 30 m no-go barrier, and contact SAHRA for further investigation.
- Construction workers must be informed that this is a no-go area. Any fossil find must be placed in a safe area.
- It is recommended that the EMPr be updated to include the involvement of a palaeontologist for pre-construction training of the ECO and possibly during the digging and excavation phase of the development.
- The ECO must visit the site after clearing, excavations, blasting or drilling and keep a photographic record.
- The developer may have to survey the areas affected by the development and indicate on plan where the construction / development may take place. Trenches may have to be dug to ascertain how deep the sediments are above the bedrock (can be a few hundred metres). This will give an indication of the depth of the topsoil, subsoil, and overburden, if need be trenches should be dug deeper to expose the interburden.

Mitigation will involve recording, rescue and judicious sampling of the fossil material present in the layers sandwiched between the geological / coal layers. It must include information on number of taxa, fossil abundance, preservational style, and taphonomy. This can only be done during mining or excavations. In order for this to happen, in case of coal mining operations, the process will have to be closely scrutinised by a professional palaeontologist / palaeobotanist to ensure that only the coal layers are mined and the interlayers (siltstone and mudstone) are surveyed for fossils or representative sampling of fossils are taking place.

The palaeontological impact assessment process presents an opportunity for identification, access and possibly salvage of fossils and add to the few good plant localities. Mitigation can provide valuable onsite research that can benefit both the community and the palaeontological fraternity.

A Phase 2 study is very often the last opportunity we will ever have to record the fossil heritage within the development area. Fossils excavated will be stored at a National Repository.

A Phase 2 Palaeontological Impact Assessment: Mitigation will include (SAHRA) -

1. Recommendations for the future of the site.
2. Description and purpose of work done (including number of people and their responsibilities).
3. A written assessment of the work done, fossils excavated, not removed or collected and observed.
4. Conclusion reached regarding the fossil material.
5. A detailed site plan and map.
6. Possible declaration as a heritage site or Site Management Plan.
7. Stakeholders.
8. Detailed report including the Desktop and Phase 1 study information.
9. Annual interim or progress Phase 2 permit reports as well as the final report.
10. Methodology used.

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

The Mitigation is done in order to rescue representative fossil material from the study area to allow and record the nature of each locality and establish its age before it is destroyed and to make samples accessible for future research. It also interprets the evidence recovered to allow for education of the public and promotion of palaeontological heritage.

Should further fossil material be discovered during the course of the development (*e. g.* during bedrock excavations), this must be safeguarded, where feasible *in situ,* and reported to a palaeontologist or to the Heritage Resources authority. In situations where the area is considered palaeontologically sensitive (*e. g.* Karoo Supergroup Formations, ancient marine deposits in the interior or along the coast) the palaeontologist might need to monitor all newly excavated bedrock. The developer needs to give the palaeontologist sufficient time to assess and document the finds and, if necessary, to rescue a representative sample.

When a Phase 2 palaeontological impact study is recommended, permission for the development to proceed can be given only once the heritage resources authority has received and approved a Phase 2 report and is satisfied that (a) the palaeontological resources under threat have been adequately recorded and sampled, and (b) adequate development on fossil heritage, including, where necessary, *in situ* conservation of heritage of high significance. Careful planning, including early consultation with a palaeontologist and heritage management authorities, can minimise the impact of palaeontological surveys on development projects by selecting options that cause the least amount of inconvenience and delay.

Three types of permits are available; Mitigation, Destruction and Interpretation. The specialist will apply for the permit at the beginning of the process (SAHRA 2012).

The Palaeontological Society of South Africa (PSSA) does not have guidelines on excavating or collecting, but the following is suggested:

1. The developer needs to clearly stake or peg-out (survey) the areas affected by the mining/ construction/ development operations and dig representative trenches and if possible supply geological borehole data. When the route is better defined, it is recommended that a specialist undertake a 'walk through' of the entire road as well as construction areas, including camps and access roads, prior to the start of any construction activities, this may be done in sections.
2. When clearing vegetation, topsoil, subsoil or overburden, hard rock (outcrop) is found, the contractor needs to stop all work.
3. A Palaeobotanist / palaeontologist (contact SAHRIS for list) must then inspect the affected areas and trenches for fossiliferous outcrops / layers. The contractor / developer may be asked to move structures, and put the development on hold.
4. If the palaeontologist / palaeobotanist is satisfied that no fossils will be destroyed or have removed the fossils, development and removing of the topsoil can continue.
5. After this process the same palaeontologist / palaeobotanist will have to inspect and offer advice through the Phase 2 Mitigation Process. Bedrock excavations for footings may expose, damage or destroy previously buried fossil material and must be inspected.

6. When permission for the development is granted, the next layer can be removed, if this is part of a fossiliferous layer, then with the removal of each layer of sediment, the palaeontologist / palaeobotanist must do an investigation (a minimum of once every week).
7. At this stage the palaeontologist / palaeobotanist in consultation with the developer / mining company must ensure that a further working protocol and schedule is in place. Onsite training should take place, followed by an annual visit by the palaeontologist / palaeobotanist.

Fossil excavation if necessary during Phase 2:

1. Photography of fossil / fossil layer and surrounding strata.
2. Once a fossil has been identified as such, the task of extraction begins.
3. It usually entails the taking of a GPS reading and recording lithostratigraphic, biostratigraphic, date, collector and locality information.
4. Using Paraloid (B-72) as an adhesive and protective glue, parts of the fossil can be kept together (not necessarily applicable to plant fossils).
5. Slowly chipping away of matrix surrounding the fossil using a geological pick, brushes and chisels.
6. Once the full extent of the fossil / fossils is visible, it can be covered with a plaster jacket (not necessarily applicable to plant fossils).
7. Chipping away sides to loosen underside.
8. Splitting of the rock containing palaeobotanical material should reveal any fossils sandwiched between the layers.

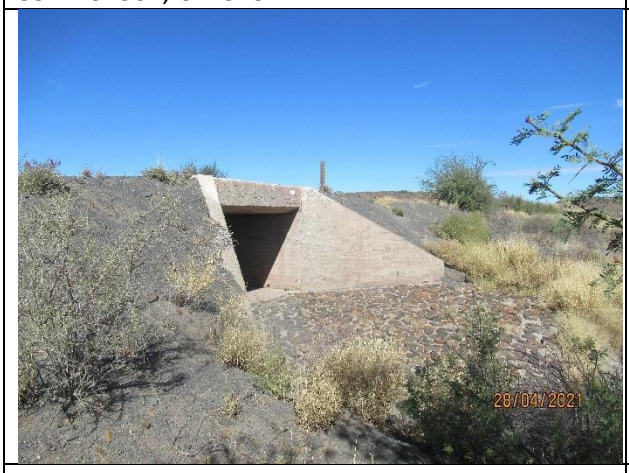
The South African Heritage Resources Agency has the following documents in place:
Guidelines to Palaeontological Permitting policy.
Minimum Standards: Palaeontological Component of Heritage Impact Assessment reports.
Guidelines for Field Reports.
Palaeotechnical Reports (Eastern Cape, North West, Northern Cape, Mpumalanga, Gauteng, Western Cape, Free State, KwaZulu Natal, and Limpopo)

Appendix 2:
Table 2: Listing points in Appendix 6 of the Act and position in Report (bold in text).

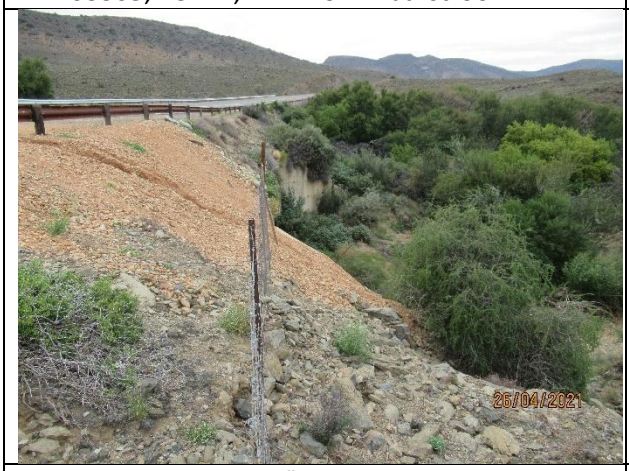
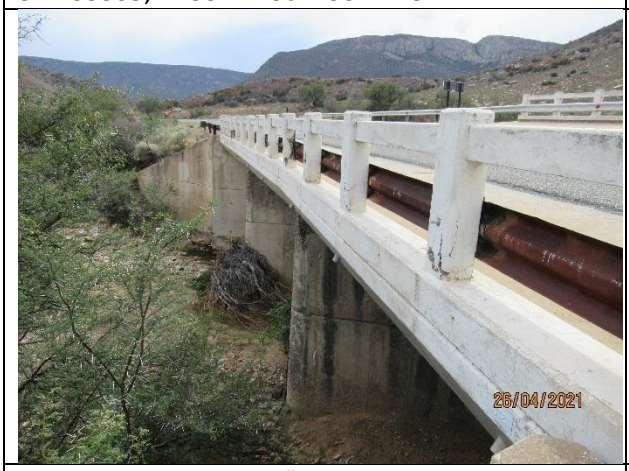
Section in Report	**Point in Act**	**Requirement**
B	1(c)	Scope and purpose of report
B	1(d)	Duration, date and season
B	1(g)	Areas to be avoided
D	1(ai)	Specialist who prepared report
D	1(aii)	Expertise of the specialist
F Figure 3	1(h)	Map
F	1(ni)	Authorisation
F	1(nii)	Avoidance, management, mitigation and closure plan
G Table 1	1(cA)	Quality and age of base data
G Table 2	1(cB)	Existing and cumulative impacts
G	1(f)	Details or activities of assessment
G	1(j)	Description of findings
H	1(e)	Description of methodology
H	1(i)	Assumptions
J	1(o)	Consultation
J	1(p)	Copies of comments during consultation

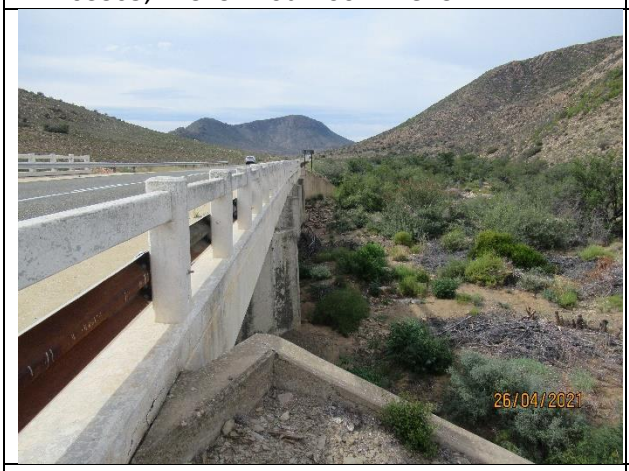
J	1(q)	Information requested by authority
Declaration	1(b)	Independent declaration
Appendix 2	1(k)	Mitigation included in EMPr
Appendix 2	1(l)	Conditions included in EMPr
Appendix 2	1(m)	Monitoring included in EMPr
D	2	Protocol or minimum standard

Appendix 4: Photographs.

59 DR02307, C11343	Major culver 1/3mx1.85m
	
63 DR02307, C12325	Major culvert 3.3mx1.5m
	
69 MR00584, C11403 to Fraserburg	Major culvert 1.3mx1.35m
	
76 TR03501, C11301, Bullskop. R61	Culvert 2/3mx1.5

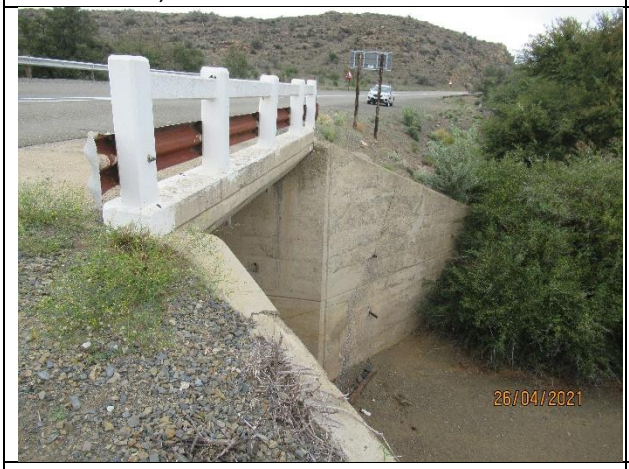
	
77 TR03501, B2705 Kuils River	River bridge 6/5mx1.6m
	
82 TR05801, B4728 Gamka River	Bridge3/9.85mx4.4m
	
83 TR05801, C11408 Ko Ka-Tsara	Major culvert 305ø

	
1 TR03305, B3474, N12 from Klaarstroom	River bridge 2/9.1mx6.1, Groot River
	
3 TR03305, B4332 Droë Kloof River 1	River bridge 3/8.2mx3.7m
	
4 TR03305, B4331 Droë Kloof River 2	River bridge 3/7.6mx4.9m

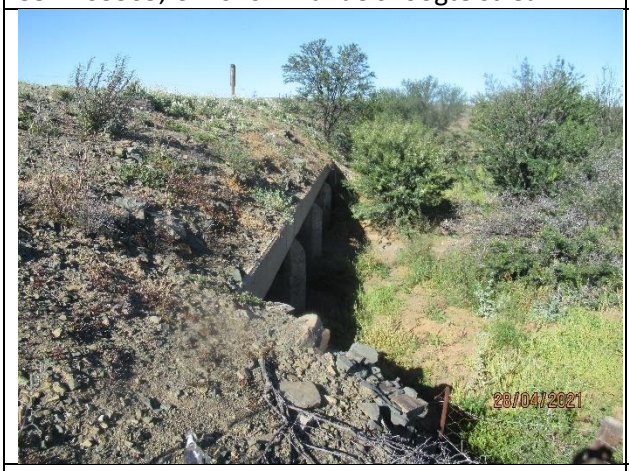
	
7 TR03305, B4329 Droë Kloof River 3	River bridge 5/11.1mx3.4m
	
9 TR03305, C11603	Major culvert 1/3.7mx3.4m
	
10 TR03305, C12303 near Droogekloof	Major culvert 2/1.8mx1.5m

	
11 TR03305, C12304 near Droogekloof	Major culvert 2/1.8mx1.8m
	
12 TR03305, B4035 Droë Kloof River 6	River bridge 2/7.6mx3.3m
	
13 TR03305, C12305 near Zwartskraal	Major culvert 2/1.8mx1.8m

	
14 TR03305, C12306	
	
15 TR03305, B4033 Traka River 1	River bridge 5/12.2mx3.5m
	
16 TR03305, C12307 near Platdrif	Major culvert 2/1.8mx1.8m

	
17 TR03305, C12308 near Dassiedraai River	Major culvert 2/1.8mx1.8m
	
19 TR03305, B4048	River bridge 1/6.8mx6.1m
	
20 TR03305, C12309	Major culvert 2/1.8mx1.8m

	
26 TR03305, B4040 Traka River 2	River bridge 6/6.1mx1.8m
	
32 TR03305, C11607	Major culvert 2/3.8mx3.9m
	
33 TR03305 C11608	Major culvert 1/3.1mx2.1m

	
34 TR03305 C11609	Major culvert 1/3/1mx2.3m
	
35 TR03305, C11610 Amandelshoogte stream 1	Major culvert 1/3.1mx2.3m
	
36 TR03305, C11611 Amandelshoogte stream 2	Major culvert 4/3.1mx1.2m

	
38 TR03305, C11613	Major culvert 1/3.2mx2.4m
	
39 TR03305, C11614 Amandelshoogte stream 3	Major culvert 3/2.9mx2.4
	
40 TR03305, C11615	Major culvert 1/3.1mx2.5m

	
42 TR03305, C11617 Skeurfontein River	River bridge 3/3.5mx3.7m
	
43 TR03305, C12315 Gemsbok River	Major culvert ½.5mx1.8m
	
44 TR03305, C11618 Gemsbok River	River bridge ¾.4mx3.0m

	
45 TR03305, C11619	Major culvert 1/3/7mx3.2m
	
46 TR03305, C11620	Major culvert 2/2.7mx2.1m
	
50 TR03305, C11623 Karee River	Major culvert 3/3.4mx1.9m

	
51 TR03305, B4145 Lombaardskraal River	River bridge 3/76mx3.0m
	
52 TR03305, C12316	Major culvert 2/2.9mx1.8m
	
53 TR03305, C11624	Major culvert ½.5mx1.9m

	
55 TR03305, B4131A Gamka River	River bridge 2/91mx4.3m