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**APPENDIX 7:**  
**SPECIALIST REPORT:**  
**DESKTOP PALAEOLOGICAL IMPACT ASSESSMENT**

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**BRIEF PALAEOLOGICAL IMPACT ASSESSMENT**

**PROPOSED EXPANSION OF BORROW PIT BP R27-8 KM 32.6 RHS 6.2  
HANTAM LOCAL MUNICIPALITY, CALVINIA DISTRICT, NORTHERN  
CAPE PROVINCE  
Portion 1 of the Farm Bloedzuigerfontein Noord 782**

**By**

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**On behalf of**

**Haw & Inglis Civil Engineering (Pty) Ltd for  
South African National Roads Agency SOC Limited**

**PROJECT: PROPOSED STRENGTHENING OF THE R27/7&8 BETWEEN THE  
WESTERN/NORTHERN CAPE BORDER AND CALVINIA AND DEVELOPMENT OF  
BORROW PIT.**

**16 July 2012**

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## **SUMMARY**

The South African National Roads Agency (SANRAL) proposes to expand borrow pit BP R27-8 km 32.6 RHS 6.2 to provide gravel required for strengthening the R27 between Nieuwoudtville and Calvinia (Figure 1). CCA Environmental (Pty) Ltd is the independent Environmental Assessment Practitioner appointed to compile an amended Environmental Management Programme for submission to the Department of Mineral Resources as part of the formal application to expand the pit/quarry.

Borrow pit BP R27-8 km 32.6 RHS 6.2 is situated off the R364 on Portion 1 of the Farm Bloedzuigerfontein Noord 782 (aka Merino), Hantam Local Municipality, Calvinia District, Northern Cape Province (Figure 1). It is the site of an abandoned Iceland Spar mining operation (Figure 2) in the north side of a hill between 860-890 m asl. The tailings or waste dolerite rock from the defunct operation have been approved for roadmaking use, but it is of variable quality. The current proposal is to expand the “borrow pit” to the west in the form of a quarry exploiting fresh dolerite rock. The rock will be drilled, blasted and crushed and the upslope wall of the quarry will be ~15 m high.

The project site is situated on a **Karoo Dolerite** sill that intrudes the **Prince Albert Formation** shales of the Ecca Group (Karoo Supergroup), just above the lower contact of the dolerite body (Figures 3 & 4). The Prince Albert Formation is locally fossiliferous, but no substantial exposure and impact upon the fossil content of the formation is expected during the operation of the quarry.

The Karoo Dolerite is an igneous rock and has no fossil content.

In view of the limited potential impact upon fossil heritage it is considered that no specialist palaeontological mitigation is required.

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The author, John Pether, is an independent consultant/researcher and is a recognized authority in the field of coastal-plain and continental-shelf palaeoenvironments and is consulted by exploration and mining companies, by the Council for Geoscience, the Geological Survey of Namibia and by colleagues/students in academia pursuing coastal-plain/shelf projects.

#### Expertise

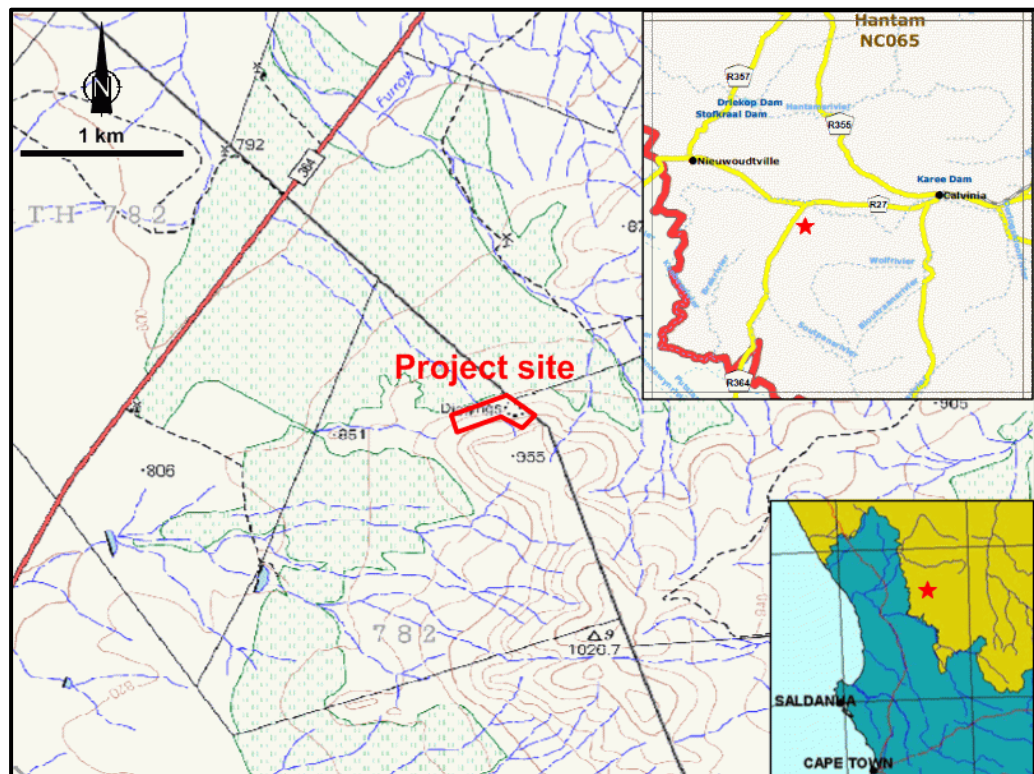
- Shallow marine sedimentology.
- Coastal plain and shelf stratigraphy (interpretation of open-pit exposures and on/offshore cores).
- Marine macrofossil taxonomy (molluscs, barnacles, brachiopods).
- Marine macrofossil taphonomy.
- Sedimentological and palaeontological field techniques in open-cast mines (including finding and excavation of vertebrate fossils (bones)).

#### Membership of Professional Bodies

- South African Council of Natural Scientific Professions. Earth Science. Reg. No. 400094/95.
- Geological Society of South Africa.
- Palaeontological Society of Southern Africa.
- Southern African Society for Quaternary Research.
- Heritage Western Cape. Member, Permit Committee for Archaeology, Palaeontology and Meteorites.
- Accredited member, Association of Professional Heritage Practitioners, Western Cape.

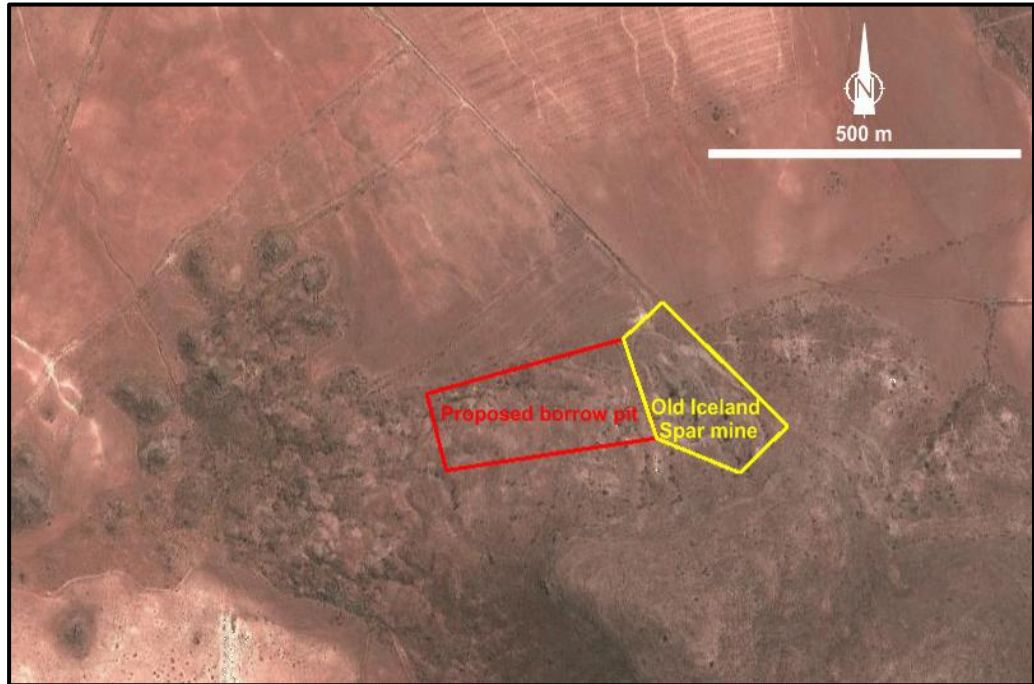
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The South African National Roads Agency (SANRAL) proposes to expand the licenced so-called borrow pit BP R27-8 km 32.6 RHS 6.2 to provide gravel for the road layers required for strengthening of the R27 between Nieuwoudtville and Calvinia (Figure 1). Haw & Inglis Civil Engineering (Pty) Ltd (H&I) is the contractor for the project and has appointed CCA Environmental (Pty) Ltd (CCA) as the independent Environmental Assessment Practitioner to compile an amended Environmental Management Programme (EMP) for submission to the Department of Mineral Resources (DMR) as part of the formal application to expand the pit/quarry.



**Figure 1. Location of borrow pit BP R27-8 km 32.6 RHS 6.2. Extract from 3119CB\_2003\_ED2\_GEO.TIF 1:50k topo-cadastral map. Chief Directorate: Surveys & Mapping.**

Borrow pit BP R27-8 km 32.6 RHS 6.2 is situated off the R364 on Portion 1 of the Farm Bloedzuigerfontein Noord 782 (aka Merino), Hantam Local Municipality, Calvinia District, Northern Cape Province (Figure 1). It is the site of an abandoned Iceland Spar mining operation (Figure 2) in the north side of a hill between 860-890 m asl. Iceland Spar is rhombohedral crystals of calcite of very transparent, optical quality, previously much in demand as a light polarizer prior to the development of Polaroid. The tailings or waste dolerite rock from the defunct operation have been approved for roadmaking use, but it is of variable quality. The current proposal is to expand the “borrow pit” to the west in the form of a quarry exploiting fresh dolerite rock. The rock will be drilled, blasted and crushed and the upslope wall of the quarry will be ~15 m high.



**Figure 2. Aerial view of the project site. From Google Earth.**

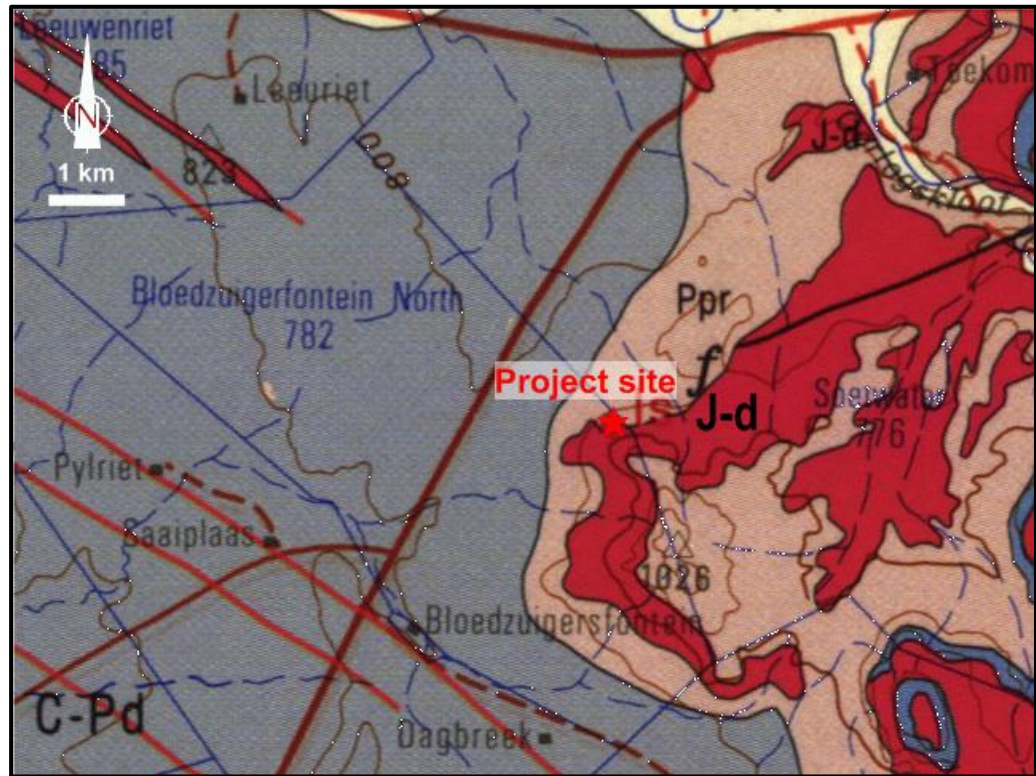
## **2 GEOLOGICAL SETTING**

The site is near the western margin of the Main Karoo Basin and the region is underlain by sedimentary formations of the **Karoo Supergroup**. To the west the landscape has formed on glacial diamictites of the **Dwyka Group (C-Pd)** (Figure 3) which were deposited when southern Africa was covered by large ice sheets and was located near the South Pole during the Permo-Carboniferous ~300 Ma.

When the glaciers melted, the sagged crust hosted a marine basin in which the **Ecca Group** was deposited. The **Prince Albert Formation (Ppr)** is the lowermost formation of the Ecca Group and is of early Permian age ~290-280 Ma. It is mainly composed of grey to greenish shales in which calcareous concretions are common and was deposited in a marine deeper-deltaic environment (Johnson *et al.*, 2006). In this area, siltstones and sandstones pass upwards into shales (Cole, 2005).

The Karoo Basin subsequently filled up with ~12 km of marine, deltaic, fluvial and, finally, aeolian deposits. The basin was then blanketed over by a vast outpouring of 'Continental Flood Basalt' lavas over just a few million years around 183 Ma, up to 5 km thick and covering two million km<sup>2</sup>. Its remnants are seen today as the Drakensberg and Lebombo mountain ranges. The feeder systems or "plumbing" for the flood basalts is preserved as the **Karoo Dolerite Suite (J-d)**, a network of vertical dykes and horizontal sills and

sheets of frozen magma that, due to hardness, are prominent features in the landscape.



**Figure 3. Geology of the study area. Extract from 1:250 000 Geological Series Map Sheet 3118 Calvinia. Council for Geoscience (2001).**

Jd – Karoo dolerites.  
Ppr – Prince Albert Formation, Ecca Group.  
C-Pd – Dwyka Group.

### **3 EXPECTED PALAEOLOGY**

The project site is situated on a Karoo Dolerite sill that intrudes the Prince Albert Formation shales, just above the lower contact of the dolerite body. The latter is marked by a distinct slope break between the resistant, hill-forming dolerite and the weathered, plain-forming Prince Albert shales (Figure 4).

In the Prince Albert Formation, trace fossils such as arthropod tracks and fish trails are common. Rare fish remains (sharks, palaeoniscoids) have been found in nodules. Marine invertebrates and fossil wood and leaves also occur. Most of the fossils are found in the lowermost part of the formation (Cole, 2005). However, no substantial exposure and impact upon the fossil content of the formation is expected during the operation of the quarry.

The Karoo Dolerite is an igneous rock and has no fossil content.





**Figure 4.** *View of the proposed borrow pit expansion area showing the dolerite rock intended for quarrying. Image from McDonald (2011).*

#### **4**            **RECOMMENDATIONS**

In view of the apparent limited potential impact upon fossil heritage it is considered that no specialist palaeontological mitigation is required.

#### **5**            **REFERENCES**

- Cole, D.I. 2005. Prince Albert Formation. SA Committee for Stratigraphy, Catalogue of South African Lithostratigraphic Units 8: 33-36.
- 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.
- McDonald, D.J. 2011. Botanical Assessment for the proposed strengthening (partial reconstruction) of National Route 27 Sections 7 & 8 between the Western Cape Province/ Northern Cape Province Border and Calvinia. For CCA Environmental (Pty) Ltd).