

## **Executive Summary**

- Investigation of the exposed sedimentological sections in the quarries and a foot survey of their boundaries indicate no potential archaeological impact. All thirty quarries are of low archaeological significance.
- Ten of the thirty quarries that were investigated are located on igneous bedrock (dolerite) and represent no palaeontological impact.
- Sedimentological deposits exposed in twenty of the thirty quarries that were investigated are derived from rocks belonging to the Late Permian, Ecca - Beaufort transition. Although no fossil evidence was found at these sites during the Phase 1 inspection, it is noted that the deposits may include fossil-bearing strata.
- The geological context of the region therefore suggests potential palaeontological impact for the shale and mudstone – bearing quarries.
- Considering the geological scale of the Ecca and Beaufort Groups of rocks in the region, the exposure of Late Permian rocks on the R354, is relatively low in intensity.
- However, for mitigation as part of the ongoing road construction process, regular monitoring by specialists is recommended.

## Introduction

An Archaeological Impact Assessment (AIA) and a Palaeontological Impact Assessment (PIA) were conducted for thirty-two shallow gravel quarries on the R354 between the Downes-turnoff on the R63 and Sutherland.

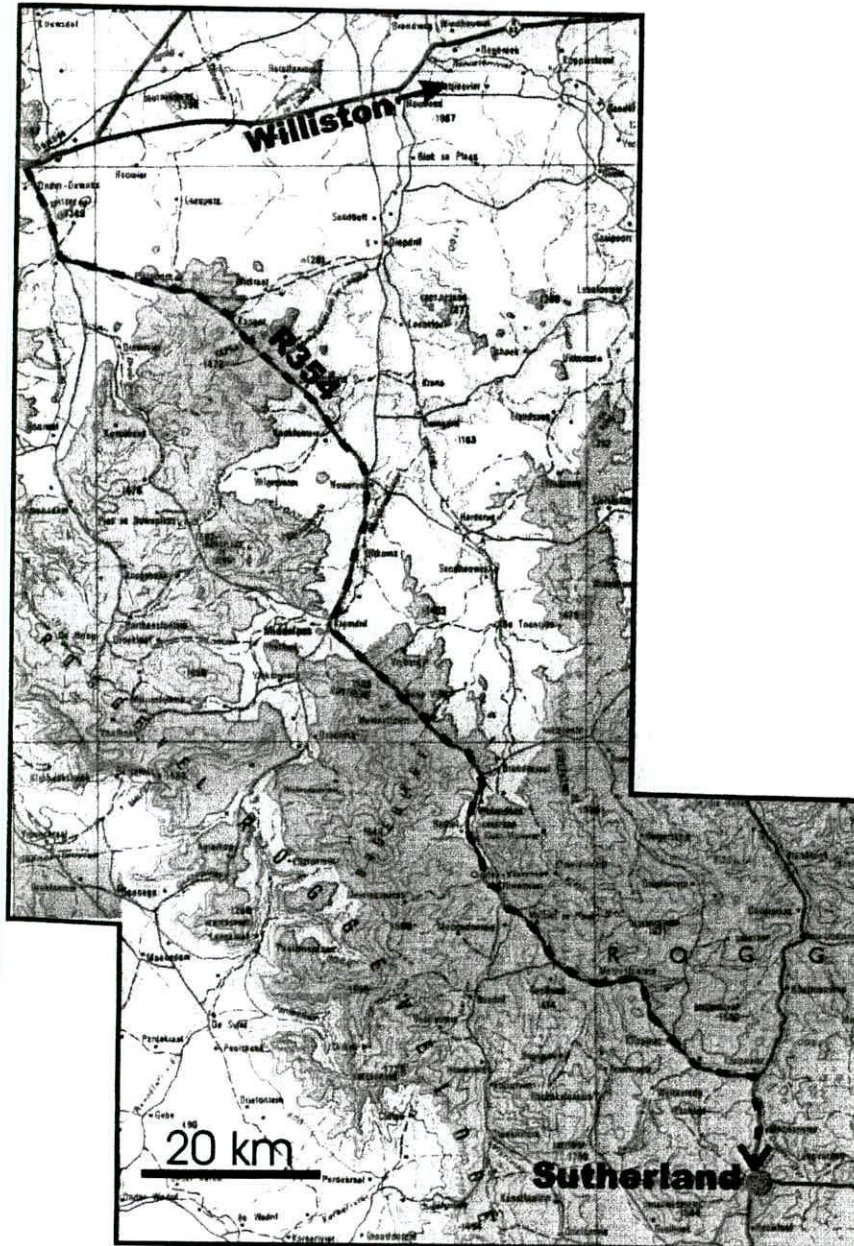


Figure 1. 1:500 000 topographical map of the R354 (dotted line).  
The quarries are located alongside the road (coordinates provided in Table 1).



The quarries will supply fresh gravel for the upgrade of the existing gravel road. The survey is 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 25 of 1999. The task involved identification of archaeological and palaeontological sites or occurrences, an assessment of their significance, possible impact by the proposed development and recommendations for mitigation.

## Description of the Affected Area

### Locality data

The quarries are located next to the R354 between the Downes-turnoff on the R63 and Sutherland (Fig. 1). All the localities are visible from the road and are situated at variable intervals from each other. The quarries are relatively shallow - existing excavations do not exceed more than five meters in depth. Overall site dimensions range from a few hundred square meters to several thousand square meters. The majority of sites are accessible via vehicle paths from the main road (Table1).

Table 1. Details of quarries surveyed.

Quarry number	Coordinates		Geology	Potential Impact	
	South	East		Archaeology	Palaeontology
1	31.31.366	19.56.621	Shale	No	Yes
2	31.35.277	19.59.132	Shale	No	Yes
3	31.36.474	20.04.461	Dolerite	No	No
4	31.31.354	20.06.944	Dolerite	No	No
5	31.40.87	20.11.239	Dolerite	No	No
6	31.42.215	20.30.107	Dolerite	No	No
7	31.44.51	20.14.533	Dolerite	No	No
8	31.45.584	20.15.998	Dolerite	No	No
9	31.46.110	20.16.409	Sandstone	No	Yes
10	31.54.294	20.14.225	Dolerite	No	No
11	31.55.33	20.16.181	Shale & Dolerite	No	Yes
12	31.55.963	20.18.363	Sandstone, Shale & Dolerite	No	Yes

13	31.57.141	20.17.854	Sandstone, Shale	No	Yes
14	31.57.496	20.18.345	Mudstone	No	Yes
15	32.01.608	20.23.194	Shale	No	Yes
16	32.02.913	20.22.913	Dolerite	No	No
17	32.04.118	20.22.192	Shale, Siltstone	No	Yes
18	32.07.161	20.23.93	Shale	No	Yes
19	42.09.708	20.25.245	Dolerite	No	No
20	40.10.679	20.26.328	Dolerite	No	No
21	32.11.08	20.26.706	Shale, Siltstone	No	Yes
22	32.12.976	20.28.870	Sandstone, Shale	No	Yes
23	32.13.222	20.30.895	Shale	No	Yes
24	32.13.392	20.32.860	Sandstone, Shale	No	Yes
25	32.15.177	20.33.385	Sandstone, Shale	No	Yes
26	32.16.265	20.34.876	Sandstone, Shale	No	Yes
29	32.17.34	20.35.581	Shale	No	Yes
30	32.17.463	20.35.893	Sandstone, Shale	No	Yes
32	32.18.201	20.38.682	Sandstone, Shale	No	Yes
33	32.22.805	20.39.806	Mudstone, Shale	No	Yes

### **Geology**

The survey area is mainly covered by sedimentary rocks of Late Permian age of the upper Ecca and lower Beaufort Groups of the Karoo Supergroup. The Ecca Group, which crops out in the northern part of the survey area is subdivided into several shale and siltstone-dominated formations. The lowermost beds of the Beaufort Group of rocks follow conformably on beds of the upper Ecca and are best exposed between 31° 40' and 32° 20' latitude and 20° and 20° 40' longitude of the survey area. The Beaufort Group (Subgroup Adelaide) can be subdivided into two formations consisting of shales and grey to red mudstones with fine to medium-grained, interbedded sandstones.



The Ecca-Beaufort transition is interpreted as a change from subaqueous to subaerial conditions. The geological environment of the Beaufort Group was terrestrial with rock deposition as a result of large, meandering rivers, overbank floodplains and lacustrine conditions. Intrusions of Jurassic age Karoo dolerite, in the form of sills and dykes, occur extensively throughout the survey area. Calcrete occasionally covers weathered dolerite sills (Fig. 2). Surface deposits of Quaternary age cover the Karoo rocks in places, especially along river courses. These deposits consist mainly of river terrace gravels and alluvium, including both sheet-wash and channel-transported deposits.

### **Methodology**

All the sites were surveyed on foot using a Garmin Etrex Vista GPS hand model (set to the WGS 84 map datum) and a SonyW17 digital camera.

### **Archaeological Background**

Potential archaeological features in the region include historical dwellings, rock art as well as Stone Age archaeological remains particularly in the form of stone tool kits. As a result of the relatively thin mantle of Quaternary surface deposits, Stone Age archaeological remains in the region are generally represented as uncapped surface scatters, but near the vicinity of large river courses archaeological material may be located within river terrace or alluvium deposits.

The amount of archaeological data from this region is limited. Available archaeological evidence suggests that the southwestern Karoo region was marginal in terms of human occupation, especially during the late Pleistocene when conditions deteriorated with progressively colder and drier climates culminating in the Last Glacial Maximum 18 000 years ago.

### **Palaeontological Background**

The Ecca group of rocks contains plant impressions, silicified wood and trace fossils, but reptile fossils from the Upper Ecca have also been reported in the southern Karoo. The Beaufort Group of rocks contains vertebrate fossils, which are divided into three vertebrate biozones; the *Dinocephalia*, *Pristerognathus-Diictodon* and *Tropidostom-Endothiodon* Assemblage zones. Vertebrate fossil localities from the Lower Beaufort beds have been recorded south and east of Sutherland and particularly between Sutherland and Fraserburg.

There is currently no record of Quaternary fossil localities present in the survey area. Recently, fossil material of a giant alcelaphine antelope, *Megalotragus priscus*, were reported from erosional gullies on the Ongers River near Britstown in the central Karoo, which suggests much wetter environmental conditions during pre-Holocene times compared to the modern semi-arid conditions of the Karoo. This species is one of several extinct species known from a variety of late Quaternary sites in the interior of South Africa, which define the Florisian Land Mammal Age.

## **Results of Survey**

### **Archaeology**

A single dolerite core was recorded at Quarry # 6. (Fig. 3). The artefact was uncapped, isolated and is most likely out of context. There is no indication of additional surface scatters at Quarry # 6. There is also no indication of Stone Age archaeological material, distributed as surface scatters, in or in the immediate vicinity of the remaining quarries.

### **Palaeontology**

There are no large river courses, (a major source of Quaternary fossil localities) in the vicinity of the quarries.

Out of the thirty quarries that were surveyed, nine are located in igneous bedrock (dolerite). The sedimentary deposits exposed in the other twenty-one quarries are derived from the sequence of fossil-bearing strata from the upper Ecca / lower Beaufort transition (Fig. 4). However, no fossil material was observed or located in these exposures at the time of inspection.

## **Statement of Significance**

1. All thirty quarries are of low archaeological significance.
2. No fossil material was observed or located, but the geological context of the region suggests potential palaeontological impact for the shale and mudstone – bearing quarries.

## **Recommendations**

Considering the geological scale of the Ecca and Beaufort Groups of rocks in the region, the exposure of Late Permian rocks on the R354, is relatively low in intensity. However, for mitigation as part of the ongoing road construction process, regular monitoring by specialists is recommended.



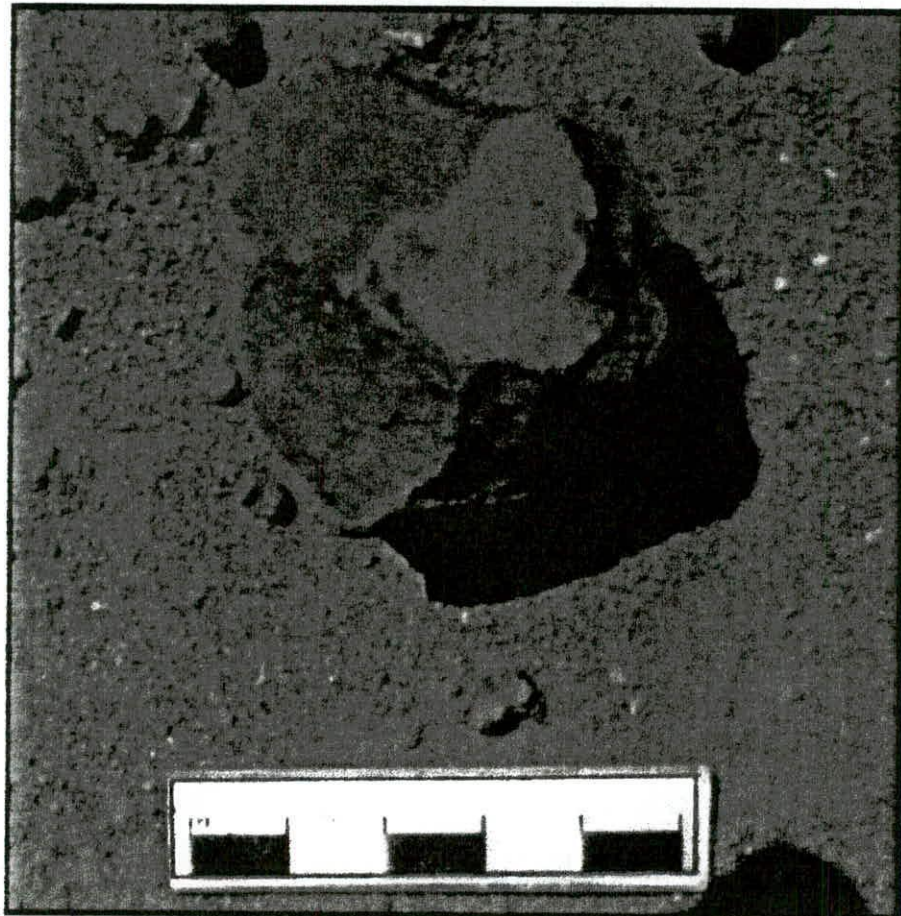
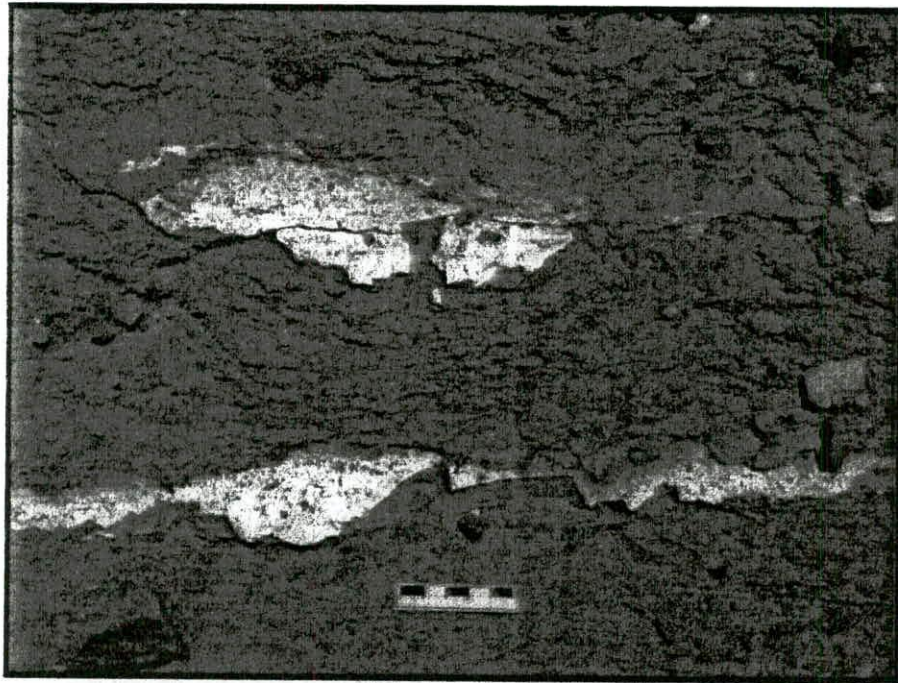
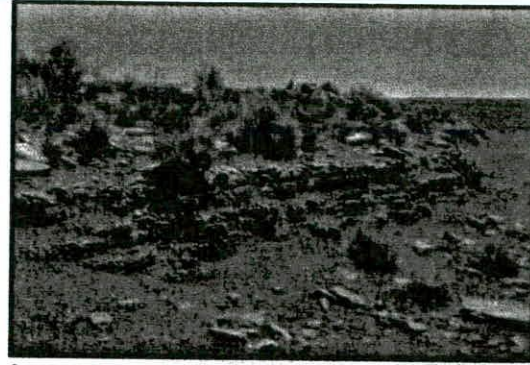


Figure 2 (above). Calcrite lens covering weathered dolerite.  
Figure 3 (below). Single, isolated dolerite core from Quarry # 6.

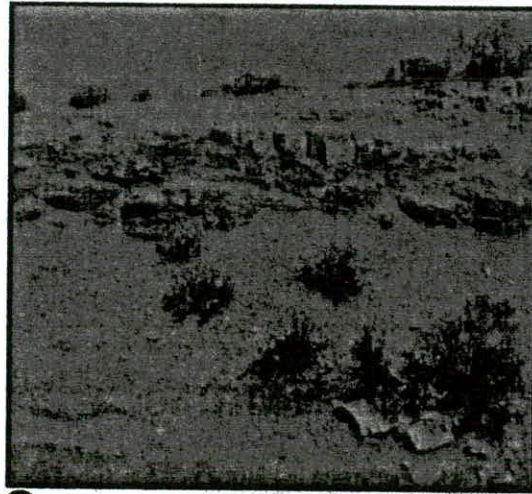




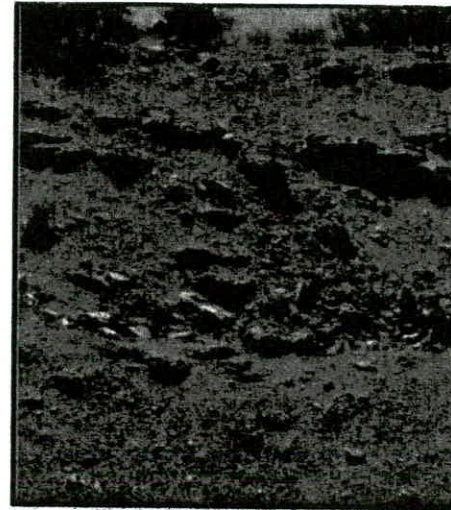
A



B



C



D

Figure 4. Late Permian fossil-bearing strata. Dark-grey shales capped by yellowish, medium-grained sandstones (A); purple shales (B); argillaceous mudstones (C); and a sequence of weathered, purple-grey shales underlying dark-coloured, blocky-weathering mudstones (D).



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