

**Palaeontological Heritage Study for proposed establishment of Borrow Pits  
(for road and concrete construction materials) to primarily serve the  
Tsitsikamma Community wind farm project**

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## Background

Rob Gess Consulting was subcontracted by Setplan to carry out a Palaeontological Impact Assessment for the proposed establishment of four new and one re-used Borrow Pits (for road and concrete construction materials) under Mining Permits in terms of the Mineral and Petroleum Resources Development Act (MPRDA) (Act 28 of 2002) to primarily serve the Tsitsikamma Community wind farm project and other related infrastructure projects in the District of the Farms: Moeilikheid 662 (Borrow Pit 2), Diep Rivier Mond 358 portion 8 remaining extent (Borrow Pit 4), Farm 678 portion 2 remaining extent (Borrow Pit 5) and two additional borrow pits (Borrow Pits 6,7), in the Humansdorp Registration Division, Eastern Cape (see Figure 1).

In order to provide suitable materials for the construction/maintenance of gravel access roads, and crane platforms and concrete aggregate for the concrete bases to serve the wind energy project, Haw and Inglis (Construction), through its quarrying subsidiary Great Karoo prospecting (Pty) Ltd (GKP) have identified five sites which could meet the materials requirements for the project.

Given the extent of the project, the volume and range of materials required, five gravel pits have been identified for use, with two of these pits to provide gravel and hard rock aggregate, and three of the pits to provide natural gravels, with optional blasting of materials if they are too compact or partly lithified, and with in-pit crushing even of gravels should they be too coarse.

GKP has appointed Site Plan Consulting CC to conduct the Applications on their behalf, which has entailed lodging of the five Applications with the Department Mineral Resources (DMR) Eastern Cape (which has been completed) and now further entails the identification and notification of Interested and Affected Parties (I&APs) in a public participation process, involving the Environmental Impact Assessment (EIA), identification of attenuation measures to limit impacts, and prescribing the environmental management in an Environmental Management Plan (EMP).

Only Borrow Pit 2 has been identified as the re-use of an existing pit, offering sufficient development area and materials quality to meet the project requirements. All other borrow pits are virgin sites, as the project calls for road materials with high load-bearing capacities.

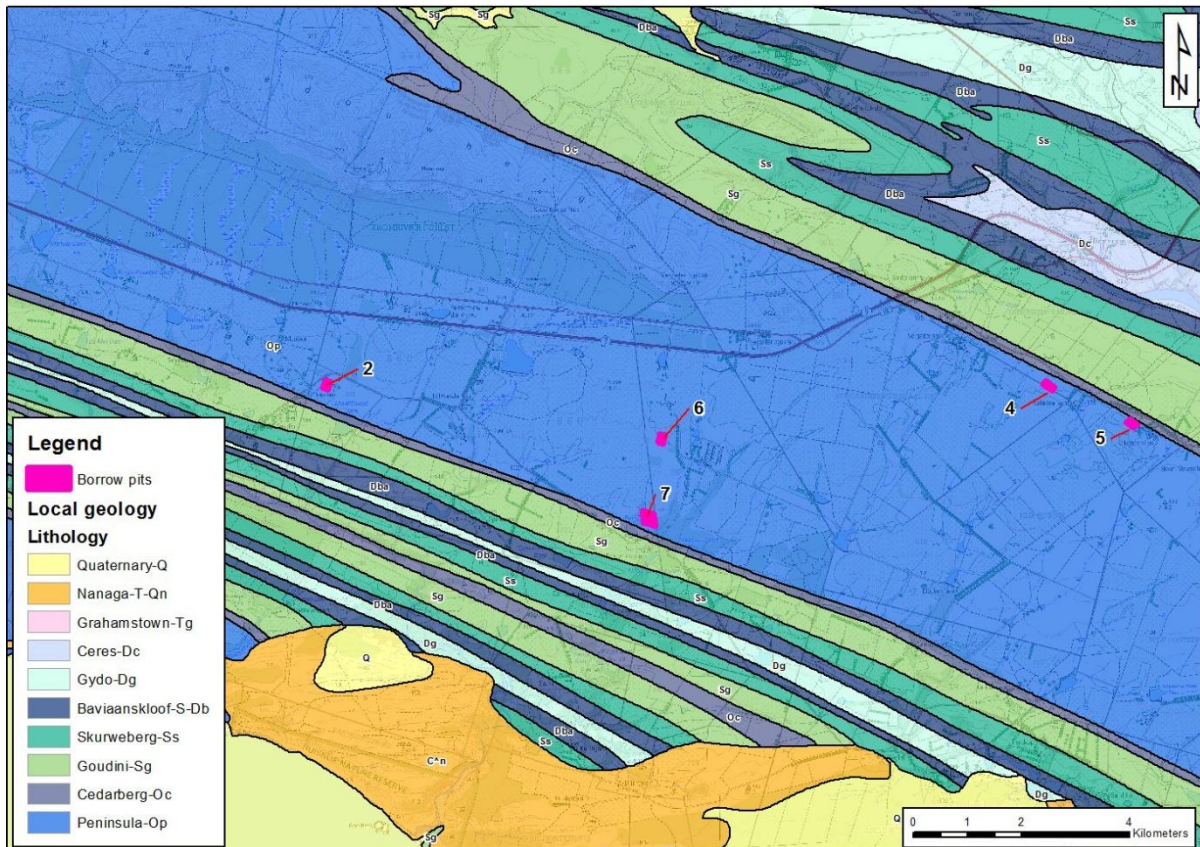


Figure 1: Published geological survey data and borrow pit positions superimposed on 1: 50 000 topographic map data.

### Stratigraphy, Age, Origin and Palaeontology of Strata

- Stratigraphy is the sequence of rock layers, from the lowest (oldest) to the highest (youngest). Conformably deposited rocks are ones which are continually deposited, layer upon layer, with only limited periods of disruption or erosion between them.
- A syncline is a fold in (once horizontal) geological strata in which the strata are thrust down in the middle and up on the sides. If this is cut through, along a horizontal plane, younger rocks are exposed in the middle flanked by progressively older ones

The study area is situated within strata of the Cape Supergroup - more specifically, within the middle portion of the Table Mountain. These rocks represent sediments deposited in the Agulhas Sea, which had opened to the south of the current southern African landmass in response to early rifting between Africa and South America.

The Table Mountain Group constitutes the first of three subdivisions of the Cape Supergroup. It consists of quartzitic sandstones derived from coarse sands deposited within the Agulhas Sea, and along its coastal plane. It was deposited during the Ordovician, Silurian and earliest Devonian Periods, approximately 500-400 million years ago.

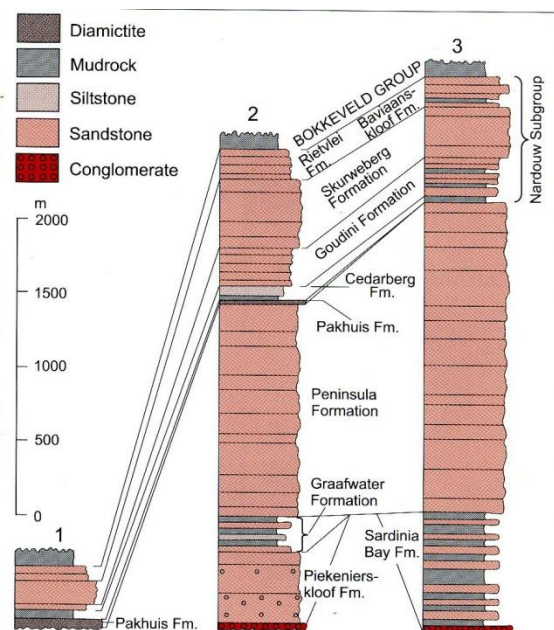


Fig. 2. Stratigraphy of the Table Mountain Group, 3 represents the Eastern Cape (Johnson *et al.*, 1999)

The study area is situated within a large roughly east-west trending anticline, bounded in the north and south by rocks of the Cedarberg Formation of the Table Mountain Group, with older sediments of the Peninsular Formation of the Table Mountain Group outcropping constituting the bedrock beneath the areas to be quarried.

Very rare trace fossils have been recorded from the Peninsular Formation of the Table Mountain Group in the Western Cape and these may be expected in the Eastern Cape.

More importantly, shale and mudstone interbeds within the Table Mountain Group are known to contain rare records of early Agulhas Sea life. Significantly the Soom and Disa shales, which comprise the Cedarberg Formation provide an extremely valuable record of latest Ordovician life. The Soom shale exhibits soft tissue preservation, and has yielded specimens of primitive jawless fish, eurypterids, trilobites, orthocone nautiloids, brachiopods and molluscs. A brachiopod dominated invertebrate fauna has also been recorded from the somewhat sandier overlying Disa Formation. In addition to brachiopods this fauna includes trilobites, bryozoans, crinoids, tentaculitids and crustaceans. Due to poor outcrop, fossil faunas of this unit have not yet been uncovered in the Eastern Cape.

## Site Visit

All proposed borrow pit sites were surveyed on the 12<sup>th</sup> July 2013. As several of the borrow pits are to be situated close to the contact with the Cederberg Formation it was also requisite to confirm their geological setting due to fine scale inaccuracies in the geological maps.

**Borrow pit 2** is to be situated in the vicinity of a previously established Borrow pit. Here it is intended to produce hard aggregate by blasting and crushing the bedrock. Despite the instruction that it is “to be located in an abandoned unrehabilitated gravel pit, where the hard rock is exposed in the floor” it was established that the borrow pit had been entirely refilled and rehabilitated, though it was overgrown with alien vegetation (figure 3).

It was therefore not possible to examine the bedrock. A few chunks of rock extracted during previous mining of the site were located and were consistent with bedrock of the Peninsular Formation (figure 4).



Figure 3: Proposed site of borrow pit 2, showing rehabilitated area of former borrow pit.



Figure 4: Slab of abandoned Peninsular Formation bedrock excavated and abandoned in the vicinity of borrow pit 2.

**Borrow pit 4** is intended to target soft aggregate in the form of scree accumulated at the base of a resistant clean quartzite outcrop that defines the ridge crest to the south west of the proposed site (figure 5). At the extreme south west of the site itself, more impure reddish brown weathering quartzites break the surface of soily alluvium that mantles the upper slope (figure 6). This has at some time been tilled but has subsequently become partially revegetated. Below the site, to the north east, ploughed fields expose unconsolidated sand containing recent marine shell fragments.



Figure 5: General view of proposed borrow pit 4 site. Tote quartzite ridge in background



Figure 6: Impure reddish-brown weathering quartzite in foreground with clean, white, more resistant quartzite stratigraphically underlying it in the background (borrowpit site 4).

**Borrow pit 5** is to be situated along the same ridge as borrow pit 4 and is likewise envisioned as primarily a source of soft aggregate, though the developers concede that bedrock may also be blasted and crushed if encountered. The north eastern (downslope) third of the area encompasses fairly deep soil of a ploughed field. The more southerly upslope area is situated on more shallow rocky soils supporting a windswept fynbos vegetated slope. Outcrop is poor though quartzitic strata protrude through the soil in many places. This is very weathered and consists of reddish/purplish material. Cleaner, more resistant, white quartzite outcrops along the south western boundary, particularly towards the west where the area extends nearer to the hill crest. A test pit near the south eastern boundary reveals a rocky soil with chunks of reddish weathered sandstone.



Figure 7: View across proposed borrow pit 5 area from south east corner to north west corner



Figure 8: Outcrop near south easterly corner of proposed borrow pit five site.



Figure 8: Outcrop near south westerly corner of proposed borrow pit five site





Figure 9: Soil and stones disturbed in the test pit area of proposed borrow pit five site.

**Borrow pit 6** is to be developed in an area currently covered in grassland and alluvium. A resistant white quartzite horizon, consistent with Peninsular Formation sediments, cuts the area in a roughly east-west direction.



Figure 10: Looking west along a ridge of Peninsular Formation quartzite which bisects the proposed borrow pit 6 site.

**Borrow pit 7** is proposed to be situated on land currently covered by fynbos invaded with exotics and small grain cropping fields. Very little outcrop is exposed, but what is present is consistent with Peninsular Formation quartzite.

A mere 120 metres south west of the permit area a small quarry exploits decayed clay rich strata of the Cedarberg Formation. The probable approximate contact between the Peninsular and Cedarberg Formations exhibits shallow water invertebrate trace fossils (in the form of vertical burrow casts and spiral infaunal feeding traces) as well as mud dessication cracks.



Figure 11: General views of area intended for borrow pit 7.



Figure 12: Quartzite outcropping in proposed borrow pit 7 area



Figure 13: Invertebrate burrow casts and spiral infaunal feeding traces near the contact between the Peninsular and Cederberg Formations approximately 120 metres south west of the borrow pit 7 area.



Figure 14: Petrified mud dessication cracks near the contact between the Peninsular and Cederberg Formations approximately 120 metres south west of the borrow pit 7 area.

## Conclusions and Recommendations

Due to the planed off and deeply weathered nature of most of this area of the country, knowledge of its palaeontology is particularly poor. For the same reasons it was difficult to adequately assess the sensitivity of the borrow pit sites.

It was possible to confirm that the sites are (at least largely) to be sited on or over Peninsular Formation bedrock, which is generally taken to be of low palaeontological sensitivity. Due to the natural recessive weathering of softer rock units in this landscape palaeontological sensitivity is largely projected from what is known of these rock units further to the west. Exposure of fresh bedrock would therefore be of potential interest to palaeontologists.

**It is therefore recommended that those borrowpits that are excavated into the bedrock should be visited by a palaeontologist about midway through their utilisation, to establish their actual palaeontological heritage interest.**

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