

**Palaeontological Heritage Study for Amanzi Estates**

**Prepared for:** Public Process Consultants / Amanzi Lifestyle Development

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## 1. Stratigraphy

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. Where there is a considerable cessation of deposition, or where some strata are eroded off before deposition of new strata, the latter are said to unconformably overlie the former.

The stratigraphically lowest unit in the study area is the buried Table Mountain Group sandstone peak that forms the hill on which the farm house is situated and that constitutes the medium through which the farm's aquifer reaches the surface. This peak is carved from Ordovician to Silurian aged rocks

This is unconformably stratigraphically overlain by the Kirkwood and coeval Sundays River Formations of the Cretaceous Uitenhage Group.

These are, in turn, unconformably overlain by a capping of Miocene to Pliocene deposits of the Alexandria Formation.

## 2. Age, Origin and Palaeontology of Strata

The Table Mountain Group constitutes the stratigraphically lowest of three subdivisions of the Cape Supergroup. It consists of quartzitic sandstones derived from coarse sands deposited within 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. It was deposited from during the Ordovician till the Silurian, approximately 500-400 million years ago. In the western Cape, early chordate and invertebrate fossils have been found in the Pakhuis Formation, a shaly layer interbedded within the Table Mountain sandstones. The Pakhuis Formation has, however, as yet not been found in the Eastern Cape. In this situation, it would, even if originally present, have been too deeply weathered and altered by hydrothermal activity to have any palaeontological potential.

Most of the area destined for direct development is underlain by strata of the Kirkwood and Sundays River Formations. These and the, locally not represented, Enon Formation make up the Uitenhage Group. The Uitenhage Group sediments were laid down in one of a number of small coastal basins created by stretching and tearing of the crust during the final breakup of the supercontinent Gondwana during the early Cretaceous, 140 to 120 million years ago.

The Enon Formation consists of pebbly conglomerates, deposited where rivers ran down into this steep sided rift basin. More distally, sand and muddy material formed a narrow coastal plane deposited by braided rivers, which would ultimately become the Kirkwood Formation strata. Silt and mud washed out onto the marine coastal shelf formed the clays of the Sundays River Formation. Three marine transgressions (rises in sea level) during the Cretaceous, resulted in interlayering of the Sundays River marine clay deposits and sandy, terrestrial, Kirkwood Formation deposits.

The deposits of the Sundays River Formation contain a wealth of marine invertebrate Fossils, including a range of Ammonite species, nautiloids, bellomnites, bivalves, gastropods. In addition, the skull and partial skeleton of a 3metre long Plesiosaur (marine reptile) is known from Sundays River Formation rocks in the Swartkops River valley.

The Kirkwood Formation is South Africa's primary source of Cretaceous Dinosaur fossils. It was in Kirkwood Formation rocks, on the banks of the Bushman's River that South Africa's first dinosaur discovery was made in 1845 by William Atherstone and his wife. Originally dubbed "Cape Iguanodon" the fragmentary remains have, more recently been shown to be those of a Stegosaurus. Remains of two types of Sauropod Dinosaurs, as well as a Theropod Dinosaur and an Ornithopod Dinosaur have subsequently been collected from Kirkwood Formation strata at various localities. Recent research has also revealed the remains of a primitive lizard, a type of crocodile and a primitive early mammal. These remains are sometimes found in association with fossil logs and chunks of fossil wood, which are fairly common in Kirkwood Formation rocks. Associated mudstones have yielded a range of finely preserved plant leaves and fructifications, including those of a number of species of ferns, cycads and conifers

The flat plateau to the north of the property is capped with far more recent lime rich strata of the Alexandria Formation. The Alexandria Formation generally consists of alternating layers of calcareous sandstone, conglomerate and coquinite (shelly conglomerate), containing a rich assemblage of marine invertebrates. It is considered Miocene to Pliocene in age. In the sandstones some gastropod and pelycopod shells are preserved, as well as *in situ* *Echinodiscus* ("pansy shells"), and burrows. Oyster shells occur within the conglomerate, whereas the coquinite layer consists of about 70 percent marine organic remains, including those of pelycopods, gastropods, corals, bryozoans, brachiopods, echinoids and sharks teeth. Some mammal bones have also been recorded. As the Alexandria Formation appears to have been laid down in a full range of coastal depositional environments ranging from shoreface and foreshore to lagoonal and/or estuarine it is likely that further exploration of the Alexandria Formation would provide an even greater range of fossils including possibly more vertebrate remains.

### **3. Approach and Methodology**

An initial desk-top investigation consisted of examination of geological maps to determine the underlying geology of the area. Prior knowledge, as well as reference to general palaeontological literature, was used to draw up a picture of the types of palaeontological materials likely to be encountered in the study area.

Two site visits were conducted. The first was to examine the narrow footprint of development in order to ascertain the likelihood of palaeontological material being disturbed during the construction phase. A tour of the area was provided by the land owners.

A second site visit was conducted to ascertain the likelihood of palaeontological material being disturbed in the immediate hinterland of the development. Suitable

outcrops were identified with the assistance of the landowners. These were examined on a square metre by square metre basis.

#### 4. Potential Palaeontological Resources at the Study Site

##### Site Visits

A guided site tour was conducted for specialist consultants, of the proposed developmental footprint, on the afternoon of 5 March 2008. It became clear that most of the developmental footprint is to fall on formerly disturbed areas including areas historically developed for farming infrastructure and residences, as well as previously farmed land e.g. pasture, fallow cultivated lands and citrus orchards. These former lands are, by and large, situated on a series of river terraces deposited by the Coega River, and are comprised of silty alluvium interspersed with mature river pebbles of quartzite. As a result no outcrop of the underlying Uitenhage Group was found within the development footprint.

River worn chunks of fossil wood, and weathered specimens of two species of Cretaceous bivalve, *Steinmanella herzogi* and "*Trigonia*" *conocardioformis* were noticed amongst the farm curiosities assembled at the old farm house. The fossil wood is very characteristic of the Kirkwood Formation, whereas the two bivalves are typical of the Sundays River Formation. The water worn appearance of the fossil wood, suggests that it was recovered from a river bed.

Discussion with Clyde and Philip Niven confirmed that outcrop consistent with the Uitenhage Group is present, at three localities along the river bed, at a tall, several hundred metre long cliff known as "The Elephant", at the weir, and across the river from the quarry. Due to the impassable and overgrown nature of the roads, at the time of this visit it was impossible to visit these localities.

The Amanzi Estates was revisited on the 8 July 2008 and the farm foreman was delegated by Phillip Niven to take the consultant to these outcrops

The most promising of these was, 'The Elephant.' Here, a low cliff of pinkish Kirkwood formation sandy clays follows the line of the river for several hundred metres. It was minutely examined but no fossils were encountered.

At the weir, sediments belonging to the Sundays River Formation are exposed, over a limited area, in the river bed. Again a thorough examination was conducted and no palaeontological material was found

Finally, a number of poorly exposed outcrops were investigated, across the river from the quarry. In the river bed, at this point, are exposures of Sunday's River Formation strata, whilst the slope rising from



Kirkwood Formation strata exposed at 'The Elephant' on the Coega River, at Amanzi Estates

the river level reveals patches of Kirkwood Formation. No fossils were found despite a systematic examination.

## 5. Potential Impacts on Palaeontological Resources at the Study Site

### 5.1. Construction Phase

|                                       |  |
|---------------------------------------|--|
| <b>Nature of the Impact</b>           | Disruption of fossil bearing strata during construction (direct)   |
| <b>Extent</b>                         | Site specific  |
| <b>Duration</b>                       | Temporary  |
| <b>Intensity</b>                      | Low  |
| <b>Probability</b>                    | Improbable to probable   |
| <b>Status of Impact</b>               | Negative   |
| <b>Degree of Confidence</b>           | Medium   |
| <b>Significance (no mitigation)</b>   | Medium -   |
| <b>Mitigation</b>                     | As the construction teams are unlikely to differentiate between recent alluvium and weathered ancient clay, it is recommend that a palaeontologist educate the Environmental Control Officer, and Contractors in this regard so that a specialist can be involved immediately should the relevant strata be uncovered during the construction process. The Environmental Management Plan should contain the requirement that, should bed rock be exposed during excavation, a palaeontologist should be contacted to investigate prior to the re-covering thereof. |
| <b>Significance (with mitigation)</b> | Low +  |

### 5.2. Operational Phase

|                                     |   |
|-------------------------------------|---|
| <b>Nature of the Impact</b>         | Discovery (and removal) of fossils in Wilderness area by new residents. |
| <b>Extent</b>                       | Local   |
| <b>Duration</b>                     | Long term   |
| <b>Intensity</b>                    | Low   |
| <b>Probability</b>                  | Improbable to probable  |
| <b>Status of Impact</b>             | Negative  |
| <b>Degree of Confidence</b>         | Medium  |
| <b>Significance (no mitigation)</b> | Medium  |
| <b>Mitigation</b>                   | The home owners association should therefore                            |

|                                       |  |
|---------------------------------------|--|
|                                       | educate new residents regarding the advisability of reporting any fossil finds to a qualified palaeontologist. |
| <b>Significance (with mitigation)</b> | Low +  |

## 6. Comments and Recommendations

Due to the thick cover of recent alluvium over most of the actual proposed development footprint, it is difficult to definitively say whether or not important Uitenhage Group rocks will be disturbed during the excavations associated with building and bulk service supply. Over most of the area, however, it does not seem likely.

As the construction teams are unlikely to differentiate between recent alluvium and weathered ancient clay, it is recommend that a palaeontologist educate the Environmental Control Officer, and Contractors in this regard so that a specialist can be involved immediately should the relevant strata be uncovered during the construction process. The Environmental Management Plan should contain the requirement that, should bed rock be exposed during excavation, a palaeontologist should be contacted to investigate prior to the re-covering thereof.

There will be an influx of residents to the area that will have access to the bed of the Coega River, and the natural area on its northern side for recreational activities. This will pose a possible challenge to heritage management. It is probable that a large number of these will be prone to pick up and remove “curiosities” on their walks, should these be exposed by further weathering. The home owners association should therefore educate new residents regarding the advisability of reporting any fossil finds to a qualified palaeontologist

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