

## **RECOMMENDED EXEMPTION FROM FURTHER PALAEOLOGICAL STUDIES: DESKTOP STUDY**

### **RE-LOCATION OF EXISTING EVAPORATION PONDS AND THE CONSTRUCTION OF VINEYARDS ACROSS STREAMS ON PORTION 75 OF FARM KEBOES NO 37 NEAR KEIMOES, KAI! GARIB MUNICIPALITY, NORTHERN CAPE**

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**May 2019**

#### **EXECUTIVE SUMMARY**

A palaeontological heritage assessment has been requested by SAHRA as part of a Section 24G rectification process due to the unauthorised clearance of 30 ha of indigenous vegetation and construction of evaporation ponds within a watercourse on Portion 75 of Farm Keboes No. 37 near Keimoes, Kai! Garib Municipality, Northern Cape Province. The Precambrian granitoid basement rocks underlying the study area are entirely unfossiliferous. The overlying aeolian sands and stream gravels of the Kalahari Group mantling the older bedrocks are generally of low to very low palaeontological sensitivity. It is concluded that unauthorised agricultural developments are unlikely to have had significant impacts on local palaeontological heritage resources. It is therefore recommended that, pending the discovery of significant new fossils remains within the development footprint, exemption from further specialist palaeontological studies and mitigation be granted for the unauthorised agricultural developments on Farm Keboes No. 37 near Keimoes, Northern Cape. A tabulated Chance Fossil Finds Procedure is appended to this report.

#### **1. PROJECT OUTLINE & BRIEF**

The company Newgro Farming (Pty) Ltd has been required to conduct a Section 24G rectification process due to the unauthorised clearance of 30 ha of indigenous vegetation and construction of evaporation ponds within a watercourse on Portion 75 of Farm Keboes No 37 near Keimoes, Kai! Garib Municipality, Northern Cape Province. The project area is situated on the south-eastern side of the Gariep River, approximately 2 kilometers outside of the small town of Kanoneiland, between the Upington and Keimoes (Fig. 1).

A short palaeontological heritage comment by Professor B. Rubidge of Wits University, Johannesburg, concluding that the proposed agricultural project was of low impact significance, was originally submitted in 2009 (Rubidge 2009). The SAHRA Archaeology, Palaeontology and Meteorites (APM) Unit has since requested a further assessment of the potential palaeontological resources that may have been impacted by the unauthorised activities (SAHRA Case ID 13469, Interim Comment of March 18 2019). This study forms part of a Section 24G Heritage Impact Assessment compiled under the aegis of ACRM, Rondebosch (Jonathan Kaplan. 5 Stuart Road,

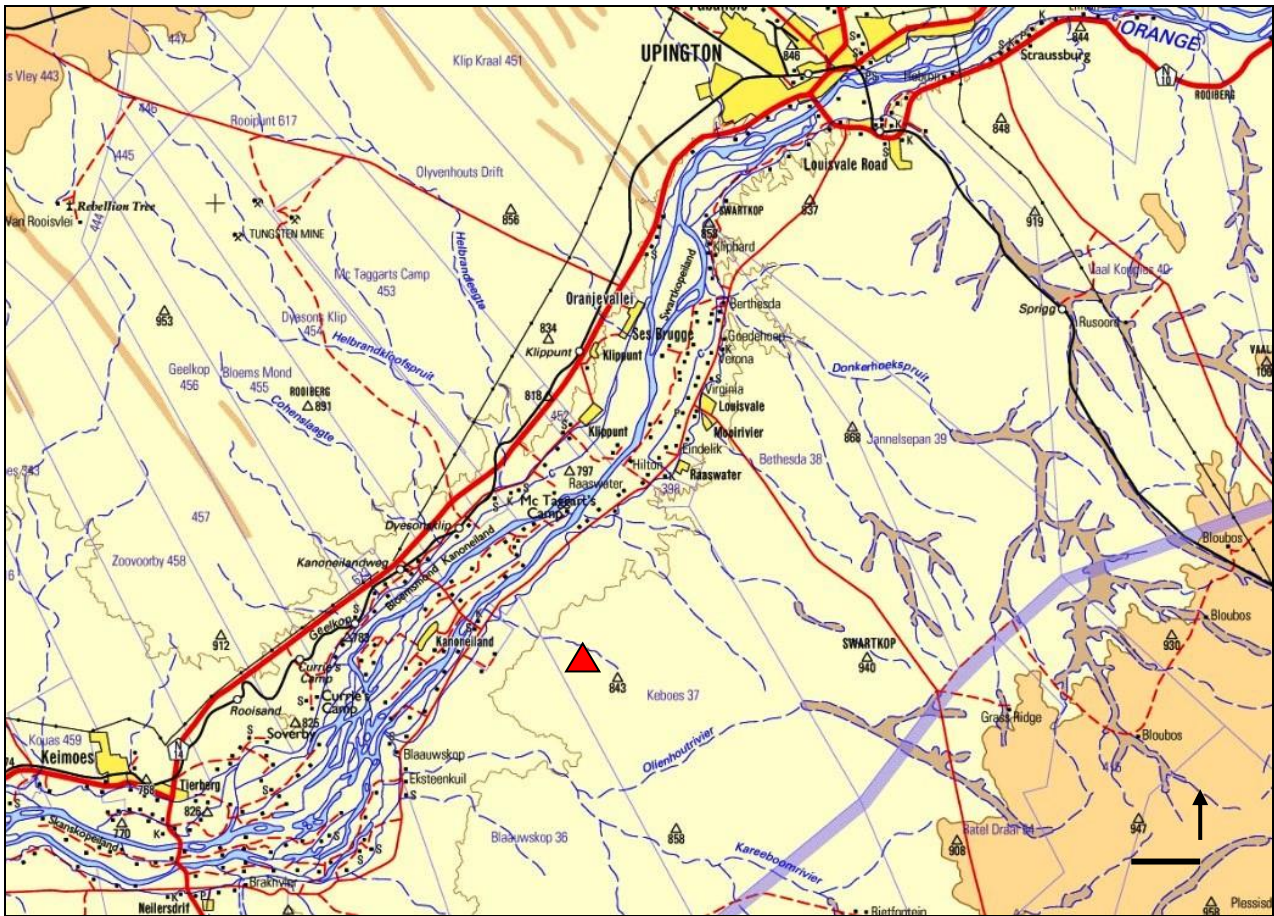
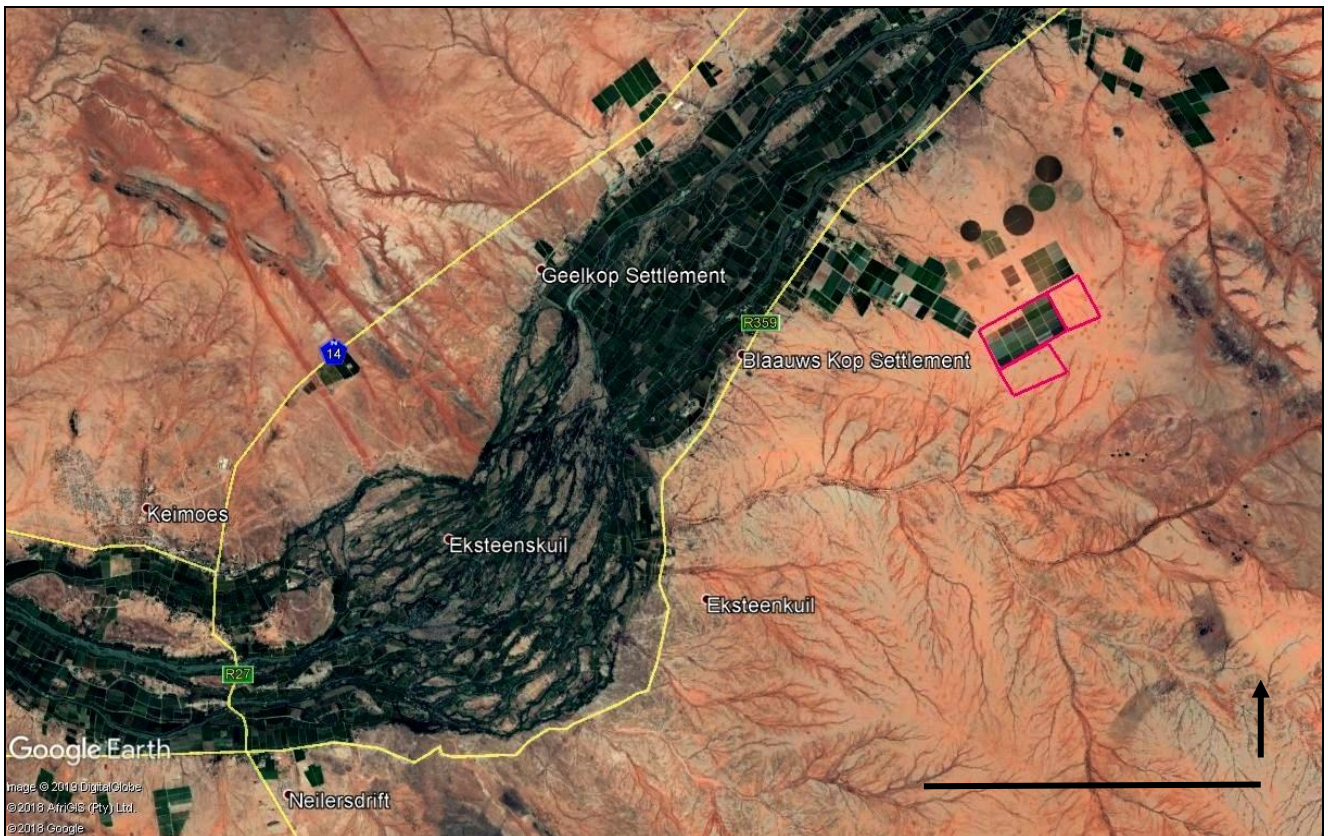


Figure 1: Extract from 1: 250 000 topographical sheet 2820 Upington showing the *approximate* location (red triangle) of the unauthorised agricultural developments on Portion 75 of Farm Keboes No 37, situated on the south-eastern side of the Gariep River c. 16.5 km ENE of Keimoes and c. 25.5 km SW of Upington, Northern Cape (Map courtesy of the Chief Directorate, National Geo-spatial Information, Mowbray). Scale bar = c. 5 km. Arrow points to North



**Figure 2: Google Earth© satellite image of the area east of Keimoes showing the location of the unauthorised agricultural developments on Portion 75 of Farm Keboes No 37 (pink polygons). Scale bar = 7 km. Arrow points towards the N.**

## 2. GEOLOGICAL BACKGROUND

As is apparent from satellite images (Fig. 2) as well as site photographs, the unauthorised agricultural project area on Portion 75 of Farm Keboes No. 37 lies in arid, sandy to gravelly terrain some 4 km southeast of the banks of the Gariep River (Orange River) and the R359. The site is now highly disturbed due to surface clearance and other agricultural activities. It is fairly flat-lying (c. 820-840 m amsl) and lies along the watershed between shallow, ephemeral, dendritic drainage networks of the Olienhoutrivier to the south and another stream system to the north, both draining into the Gariep River. The site is mantled by sandy to gravelly soils and surface gravels, with low rocky exposures of basement rocks some 2 km to the east.

The geology of the study area near Keimoes is shown on the 1: 250 000 geology map 2820 Upington (Council for Geoscience, Pretoria; Fig. 3). A comprehensive sheet explanation for this map has been published by Moen (2007). The study area is underlain at depth by ancient Precambrian basement rocks that belong to the **Namaqua-Natal Province** of Mid Proterozoic (Mokolian) age (Cornell *et al.* 2006, Moen 2007), notably the **Keboes Granite** (Mkb, dark brown in Fig. 3) and the **Kanoneiland Granite** (Mka, dark brown) of the **Keimoes Suite**. These basement rocks are approximately one billion years old and entirely unfossiliferous (Almond & Pether 2008). Parts of the study area are covered by downwasted granitoid rock rubble, shallow Late Cenozoic stream sediments (both unmapped at 1: 250 000 scale) as well as areas of fine-grained aeolian (wind-blown) sands of the **Gordonia Formation** (Qg, pale yellow with dark yellow stripes in Fig. 3), the youngest, Pleistocene to Recent, subunit of the **Kalahari Group**. The geology of the Late Cretaceous to Recent Kalahari Group is reviewed by Thomas (1981), Dingle *et al.* (1983), Thomas

& Shaw 1991, Haddon (2000) and Partridge *et al.* (2006). The Gordonia dune sands are considered to range in age from the Late Pliocene / Early Pleistocene to Recent, dated in part from enclosed Middle to Later Stone Age stone tools (Dingle *et al.*, 1983, p. 291). The stream sediments in this region are likely to be unconsolidated (loose), but some cementation by calcrete may have occurred locally. According to the 1: 250 000 geological map, older (pre-Holocene) alluvial sediments of the Gariep River do not occur in this area.

### 3. PALAEOLOGICAL HERITAGE

The fossil heritage associated with each of the main rock units represented in the broader Farm Keboes No. 37 study area has been previously outlined in previous desktop studies for the region to the southwest of Upington by Almond (2014a, 2014b, 2015, 2016a, 2016b).

The granitoid (igneous) basement rocks of the **Namaqua-Natal Province** are entirely unfossiliferous. The fossil record of the **Kalahari Group** is generally sparse and low in diversity. The **Gordonia Formation** dune sands were mainly active during cold, drier intervals of the Pleistocene Epoch that were inimical to most forms of life, apart from hardy, desert-adapted species. Porous dune sands are not generally conducive to fossil preservation. However, mummification of soft tissues may play a role here and migrating lime-rich groundwaters derived from the underlying bedrocks (including, for example, dolerite) may lead to the rapid calcretisation of organic structures such as burrows and root casts. Occasional terrestrial fossil remains that might be expected within this unit include calcretized rhizoliths (root casts) and termitaria (e.g. *Hodotermes*, the harvester termite), ostrich egg shells (*Struthio*) and shells of land snails (e.g. *Trigonephrus*) (Almond 2008, Almond & Pether 2008). Other fossil groups such as freshwater bivalves and gastropods (e.g. *Corbula*, *Unio*) and snails, ostracods (seed shrimps), charophytes (stonewort algae), diatoms (microscopic algae within siliceous shells) and stromatolites (laminated microbial limestones) are associated with local watercourses and pans. Microfossils such as diatoms may be blown by wind into nearby dune sands. These Kalahari fossils (or subfossils) can be expected to occur sporadically but widely, and the overall palaeontological sensitivity of the Gordonia Formation is therefore considered to be low. Underlying calcretes of the **Mokolanen Formation** – if present here - might also contain trace fossils such as rhizoliths, termite and other insect burrows, or even mammalian trackways. Shallow stream sediments and downwasted surface rock rubble overlying granitoid basement rocks are unlikely to be fossiliferous, or at most very sparsely so. No potentially-fossiliferous older alluvial deposits associated with the Gariep River are apparently represented in the study area according to the 1: 250 000 geological map (Fig. 3).

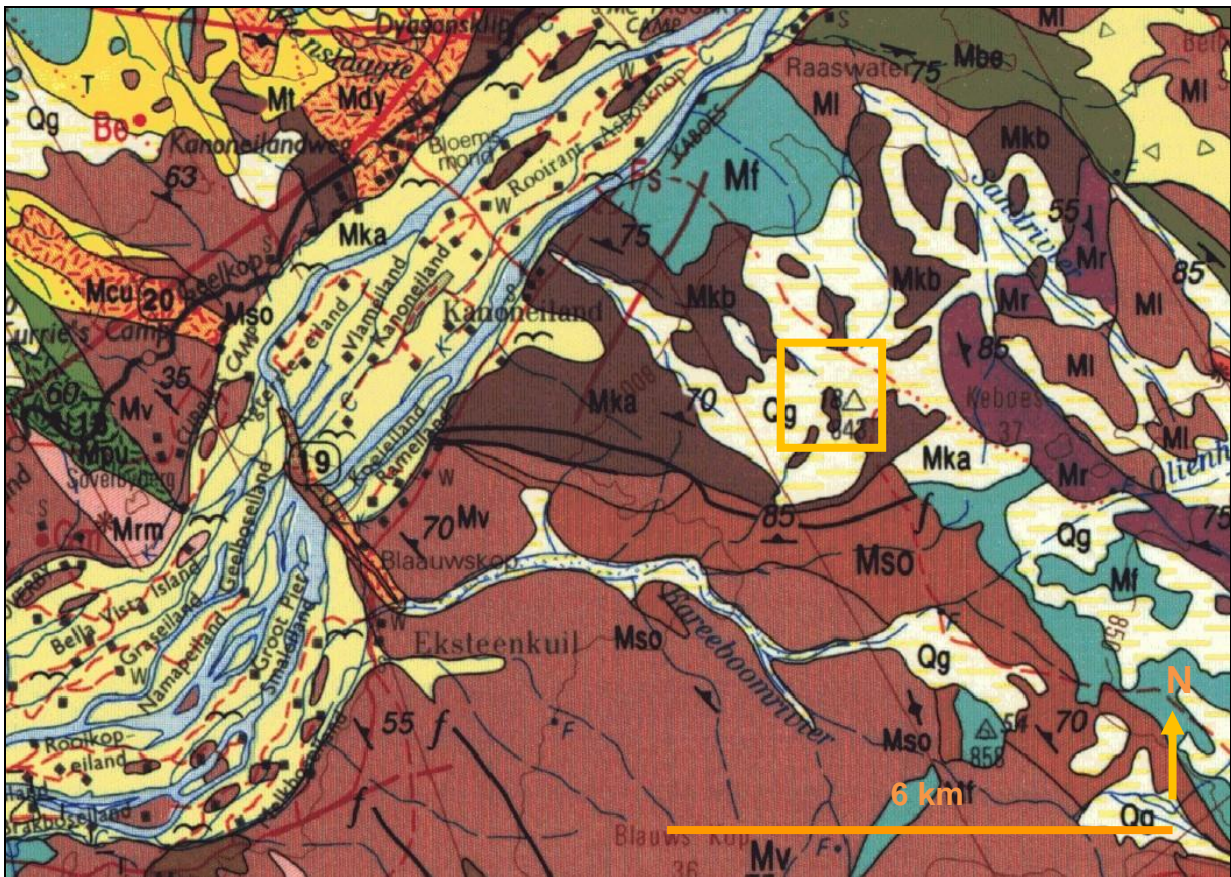


Figure 3: Extract from 1: 250 000 geological map 2820 Upington (Council for Geoscience, Pretoria) showing the *approximate* location of the unauthorised agricultural developments on Farm Koeboes No. 37, c. 16.5 km ENE of Keimoes and c. 25.5 km SW of Upington, Northern Cape Province. The study region is underlain at depth by unfossiliferous Precambrian (Middle Proterozoic / Mokolian) basement rocks of the Namaqua-Natal Metamorphic Province, including intrusive igneous rocks such as the Keboes Granite (Mkb, dark brown) and the Kanoneiland Granite (Mka, dark brown) within the Keimoes Suite. The basement rocks are extensively mantled by red aeolian (wind-blown) sand of the Gordonia Formation (Kalahari Group) (Qg, white with yellow stripes) and by Late Caenozoic stream alluvium. The overall palaeontological sensitivity of the entire study area is LOW.

#### 4. CONCLUSIONS & RECOMMENDATIONS

The Precambrian granitoid basement rocks underlying the Farm Keboes No. 37 study area are entirely unfossiliferous. The overlying aeolian sands and stream gravels of the Kalahari Group mantling the older bedrocks are generally of low to very low palaeontological sensitivity. It is concluded, in concurrence with the previous palaeontological report by Rubidge (2009), that agricultural developments on Portion 75 of Farm Keboes No. 37 near Keimoes are unlikely to have had significant impacts on local palaeontological heritage resources.

It is therefore recommended that, pending the discovery of significant new fossils remains within the development footprint, exemption from further specialist palaeontological studies and mitigation be granted for the unauthorised agricultural developments on Farm Keboes No. 37 near Keimoes, Northern Cape.

Should any substantial fossil remains (e.g. mammalian bones and teeth) be encountered during development, however, these should be safeguarded, preferably *in situ*, and reported by the ECO to SAHRA, i.e. The South African Heritage Resources Authority, as soon as possible (Contact details: Ms Natasha Higgitt. SAHRA. 111 Harrington Street, Cape Town 8001. P.O. Box 4637, Cape Town 8000. Tel: 021 462 4502. E-mail: nhiggitt@sahra.org.za) so that appropriate action can be taken by a professional palaeontologist, at the developer's expense. Mitigation would normally involve the scientific recording and judicious sampling or collection of fossil material as well as associated geological data (e.g. stratigraphy, sedimentology, taphonomy) by a professional palaeontologist. A tabulated Chance Fossil Finds Procedure is appended to this report.

## 5. KEY REFERENCES

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## **6. QUALIFICATIONS & EXPERIENCE OF THE AUTHOR**

Dr John Almond has an Honours Degree in Natural Sciences (Zoology) as well as a PhD in Palaeontology from the University of Cambridge, UK. He has been awarded post-doctoral research fellowships at Cambridge University and in Germany, and has carried out palaeontological research in Europe, North America, the Middle East as well as North and South Africa. For eight years he was a scientific officer (palaeontologist) for the Geological Survey / Council for Geoscience in the RSA. His current palaeontological research focuses on fossil record of the Precambrian - Cambrian boundary and the Cape Supergroup of South Africa. He has recently written palaeontological reviews for several 1: 250 000 geological maps published by the Council for Geoscience and has contributed educational material on fossils and evolution for new school textbooks in the RSA.

Since 2002 Dr Almond has also carried out palaeontological impact assessments for developments and conservation areas in the Western, Eastern and Northern Cape, Mpumalanga, Limpopo, Free State, KwaZulu-Natal and Northwest Province under the aegis of his Cape Town-based company *Natura Viva* cc. He has been a long-standing member of the Archaeology, Palaeontology and Meteorites Committee for Heritage Western Cape (HWC) and an advisor on palaeontological conservation and management issues for the Palaeontological Society of South Africa (PSSA), HWC and SAHRA. He is currently compiling technical reports on the provincial palaeontological heritage of Western, Northern and Eastern Cape for SAHRA and HWC. Dr Almond is an accredited member of PSSA and APHP (Association of Professional Heritage Practitioners – Western Cape).

## **Declaration of Independence**

I, John E. Almond, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed development project, application or appeal in respect of which I was appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of my performing such work.



**Dr John E. Almond,  
Palaeontologist, *Natura Viva* cc**



<b>TABLE 1: CHANCE FOSSIL FINDS PROCEDURE: AGRICULTURAL DEVELOPMENTS ON FARM KEBOES NO 37 NEAR KEIMOES, NORTHERN CAPE</b>	
<b>Province &amp; region:</b>	Northern Cape, Kai! Garib Municipality
<b>Responsible Heritage Resources Authority</b>	SAHRA (111 Harrington Street, Cape Town 8001. P.O. Box 4637, Cape Town 8000. Tel: 021 462 4502. E-mail: nhiggitt@sahra.org.za).
<b>Rock unit(s)</b>	Late Caenozoic alluvium.
<b>Potential fossils</b>	Fossil bones, teeth and horn cores, freshwater molluscs, trace fossils and plant remains within Late Caenozoic alluvium.
<b>ECO protocol</b>	1. Once alerted to fossil occurrence(s): alert site foreman, stop work in area immediately ( <i>N.B.</i> safety first!), safeguard site with security tape / fence / sand bags if necessary.
	2. Record key data while fossil remains are still <i>in situ</i> : <ul style="list-style-type: none"> <li>• Accurate geographic location – describe and mark on site map / 1: 50 000 map / satellite image / aerial photo</li> <li>• Context – describe position of fossils within stratigraphy (rock layering), depth below surface</li> <li>• Photograph fossil(s) <i>in situ</i> with scale, from different angles, including images showing context (e.g. rock layering)</li> </ul>
	3. If feasible to leave fossils <i>in situ</i> : <ul style="list-style-type: none"> <li>• Alert Heritage Resources Authority and project palaeontologist (if any) who will advise on any necessary mitigation</li> <li>• Ensure fossil site remains safeguarded until clearance is given by the Heritage Resources Authority for work to resume</li> </ul>
	3. If <i>not</i> feasible to leave fossils <i>in situ</i> (emergency procedure only): <ul style="list-style-type: none"> <li>• <i>Carefully</i> remove fossils, as far as possible still enclosed within the original sedimentary matrix (e.g. entire block of fossiliferous rock)</li> <li>• Photograph fossils against a plain, level background, with scale</li> <li>• Carefully wrap fossils in several layers of newspaper / tissue paper / plastic bags</li> <li>• Safeguard fossils together with locality and collection data (including collector and date) in a box in a safe place for examination by a palaeontologist</li> <li>• Alert Heritage Resources Authority and project palaeontologist (if any) who will advise on any necessary mitigation</li> </ul>
	4. If required by Heritage Resources Authority, ensure that a suitably-qualified specialist palaeontologist is appointed as soon as possible by the developer.
	5. Implement any further mitigation measures proposed by the palaeontologist and Heritage Resources Authority
<b>Specialist palaeontologist</b>	Record, describe and judiciously sample fossil remains together with relevant contextual data (stratigraphy / sedimentology / taphonomy). Ensure that fossils are curated in an approved repository (e.g. museum / university / Council for Geoscience collection) together with full collection data. Submit Palaeontological Mitigation report to Heritage Resources Authority. Adhere to best international practice for palaeontological fieldwork and Heritage Resources Authority minimum standards.