

PALAEONTOLOGICAL HERITAGE COMMENT:**KAKAMAS BULK WATER SUPPLY, KAKAMAS, KAI! GARIB MUNICIPALITY, NORTHERN CAPE****John E. Almond PhD (Cantab.)****Natura Viva cc,
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The overall palaeontological heritage impact significance of the proposed bulk water treatment development at Kakamas, Northern Cape, is considered to be LOW because most of the development footprint is underlain by unfossiliferous metamorphic basement rocks (granite-gneisses, migmatites etc) of Precambrian age or mantled by superficial sediments of low palaeontological sensitivity. Orange River alluvial deposits within the footprint are likely to be very young and already highly disturbed near-surface. Significant impacts on potentially-fossiliferous older (Tertiary / Quaternary) Orange River alluvial sediments are not anticipated. It is therefore recommended that, pending the exposure of significant new fossils during development, exemption from further specialist palaeontological studies and mitigation be granted for this development.

Any substantial unmapped areas or good sections through alluvial gravels or well-consolidated finer alluvial sediments encountered during the archaeological field survey for this project should be reported to SAHRA since these may contain fossil bones and teeth of mammals – including hominids (*cf* Orange River Man skull).

1. PROJECT OUTLINE

The proposed bulk water supply development at Kakamas, Northern Cape involves the following infrastructural components (CTS Heritage 2017; Fig. 1):

- New raw water abstraction works on the bank of the Orange River;
- New raw water rising main (either within the railroad reserve or the N14 road reserve) to the new Water Treatment Works;
- New Water Treatment Works on Erf 1851, Kakamas (Erf 1851 to be subdivided);
- Upgrading potable water rising mains to the existing potable water reservoirs (Kliprand and Langverwacht);
- New potable water rising main and new potable water reservoir and pressure tower for the development south of Langverwacht;
- New potable water rising mains to the existing Lutzburg and Cillie reservoirs.

2. GEOLOGICAL CONTEXT

The footprint of the proposed bulk water development is situated in arid, gravelly terrain on both northern and southern banks of the Orange River (Gariep) at Kakamas, which are drained by

several non-perennial, shallow, dendritic tributary stream systems, as well as traversing agricultural lands along the river banks (Fig. 1).

The geology of the study area near Kakamas is shown on the 1: 250 000 geology map 2820 Upington (Council for Geoscience, Pretoria; Fig. 2 herein). A comprehensive sheet explanation for this map has been published by Moen (2007). The proposed bulk water development is underlain by ancient Precambrian basement rocks – notably the **Riemvasmaak Granite-gneiss (Mrm)** and the **Kenhardt Migmatite (Mke)**– that belong to the **Namaqua-Natal Province** of Mid Proterozoic (Mokolian) age (Cornell *et al.* 2006, Moen 2007). These high grade metamorphic basement rocks are approximately two to one billion years old and entirely unfossiliferous (Almond & Pether 2008).

The Precambrian basement rocks away from the Orange River are mantled with a spectrum of coarse to fine-grained Late Caenozoic **superficial deposits** such as rocky soils, downwasted surface gravels, colluvium (slope deposits), sheet wash, calcrete hardpans, alluvium of intermittently-flowing streams as well as small relict areas of aeolian sands of the **Gordonia Formation (Kalahari Group)**. These deposits are generally young (Quaternary to Recent) and largely unfossiliferous. The agricultural lands close to the river are underlain by **Late Caenozoic alluvium** and are extensively disturbed near-surface. According to Moen (2007) ancient river terrace gravels occur “all along the river” within 2 km of the present banks and at elevations of up to 45 m (rarely as high as 85m) above the present flood plain. However, it is considered unlikely that significant undisturbed deposits of Late Tertiary to Quaternary **Orange River alluvial gravels** are present within the present study area, and none are mapped here on the 1: 250 000 Upington geology sheet.

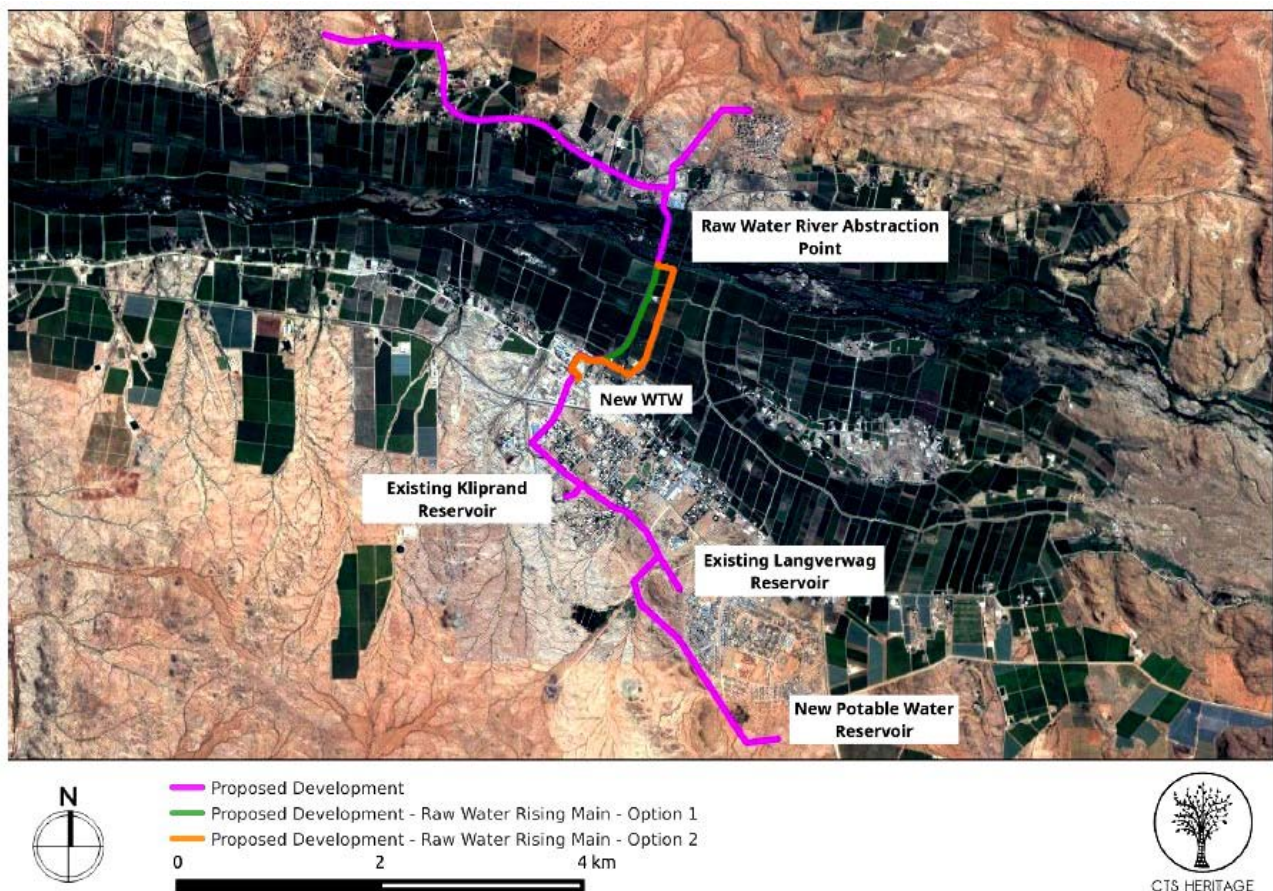


Figure 1: Satellite image of the Kakamas area, Northern Cape, showing the footprint of the proposed bulk water supply development (Image abstracted from Heritage Screener by CTS Heritage 2017).

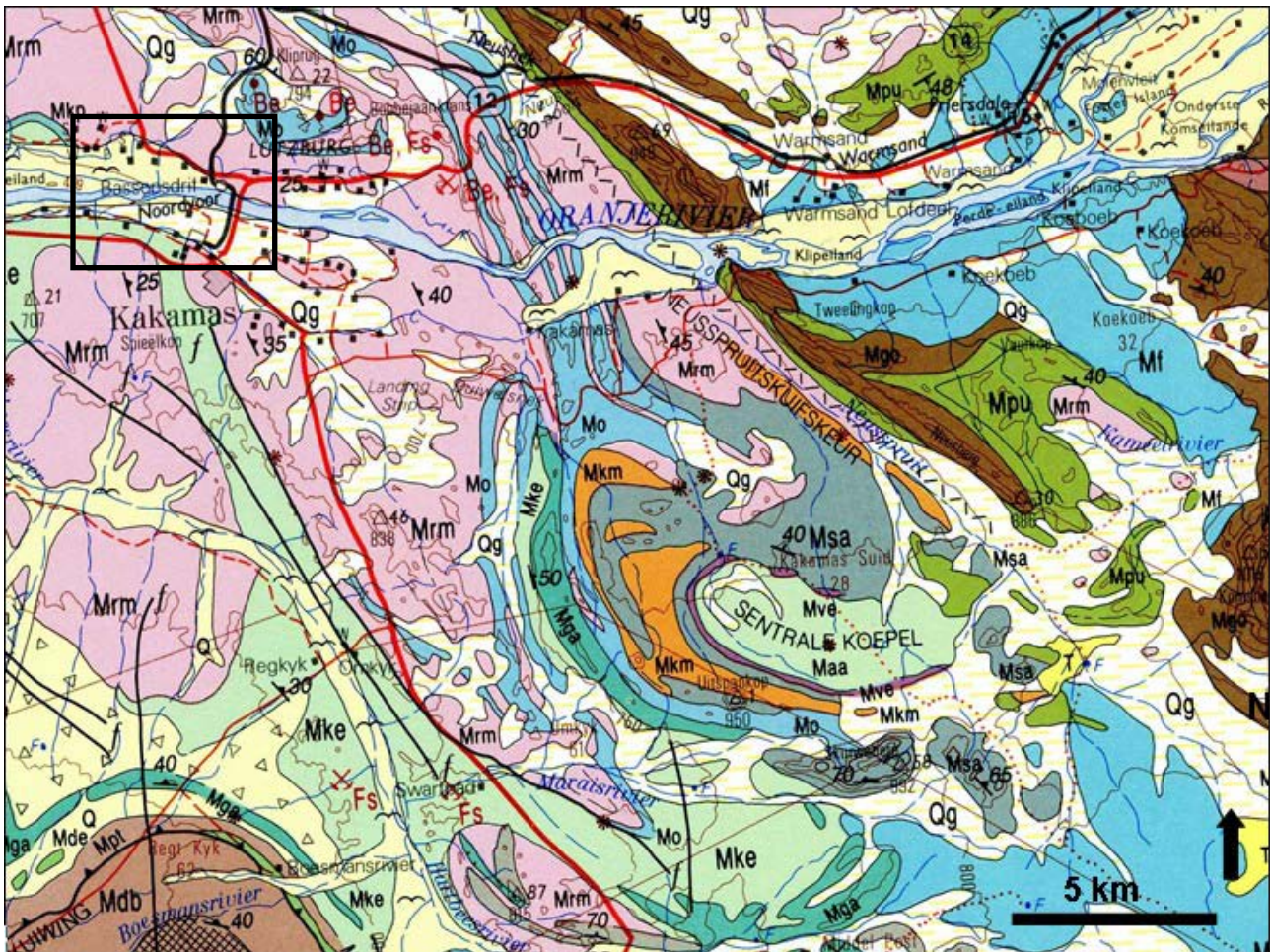


Figure 2: Extract from 1: 250 000 geological map 2820 Upington (Council for Geoscience, Pretoria) showing approximate location of proposed bulk water development across the Orange River at Kakamas, Northern Cape Province (small black rectangle). The study area is underlain at depth by unfossiliferous Precambrian (Middle Proterozoic / Mokolian) basement rocks of the Namaqua-Natal Metamorphic Province, principally the Riemvasmaak Granite-gneiss (Mrm, pink) and the Kenhardt Migmatite (Mke, pale green). Late Cenozoic alluvial deposits (medium yellow with flying bird symbol) and aeolian sands of the Gordonia Formation (Kalahari Group) (Qg, pale yellow) are mapped along the Orange River.

3. PALAEOLOGICAL HERITAGE

The **Precambrian metamorphic and igneous basement** rocks of the Namaqua-Natal Metamorphic Province in the study area are entirely unfossiliferous (Almond & Pether 2008).

Alluvial gravels of the Orange River of Miocene and younger age are locally highly fossiliferous (e.g. Hendy 1984, Schneider & Marias 2004, Almond 2009 and extensive references therein) but, as argued above, these are *not* mapped within the study area and are unlikely to occur here. Any substantial unmapped areas or good sections through alluvial gravels or well-consolidated finer alluvial sediments encountered during the archaeological field survey should be reported to SAHRA since these may contain fossil bones and teeth of mammals – including hominids (cf Orange River Man skull recorded by Senutet *al.* 2000). **Younger alluvial deposits** of the Orange River may host a range of subfossil mammalian remains (teeth, bones, horncores), transported plant material (e.g. wood), crustaceans, freshwater molluscs and trace fossils (including human artefacts). Fossils here tend to be sporadic but of widespread occurrence.

The fossil record of the **Kalahari Group** is generally sparse and low in diversity (Almond & Pether 2008). 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 rocks 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*). 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.

The overall palaeontological sensitivity of the Kakamasbulk water development study area is assessed as LOW, although pockets of high sensitivity within Orange River alluvium cannot be discounted.

4. CONCLUSIONS & RECOMMENDATIONS

The overall palaeontological impact significance of the proposed bulk watertreatment development at Kakamas is considered to be LOW because:

- Most of the study area is underlain by unfossiliferous metamorphic basement rocks (granite-gneisses, migmatites etc) or mantled by superficial sediments of low palaeontological sensitivity;
- No older (Tertiary / Quaternary) terrace gravels are mapped along this stretch of the Orange River;
- Large parts of the area are already highly disturbed due to agricultural development along the Orange River.

It is therefore recommended that, pending the exposure of significant new fossils during development, exemption from further specialist palaeontological studies and mitigation be granted for this development.

There are no objections on palaeontological heritage grounds to authorisation of the proposed bulk development. Should any substantial fossil remains (e.g. vertebrate bones and teeth, shells, calcretised burrows) be encountered during excavation, however, these should be reported to SAHRA for possible mitigation by a professional palaeontologist (Contact details: Dr Ragna Redelstorff, SAHRA, P.O. Box 4637, Cape Town 8000. Tel: 021 202 8651. Email: rredelstorff@sahra.org.za). The archaeologist carrying out the field assessment of the study area should report to SAHRA any substantial unmapped areas of alluvial gravels or well-consolidated finer alluvial sediments encountered, since these may contain fossil bones and teeth of mammals – including hominids (cf Orange River Man skull; Senut *et al.* 2000).

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, Limpopo, Gauteng, KwaZulu-Natal, Mpumalanga, Northwest and Free State 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 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.



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