PALAEONTOLOGICAL HERITAGE REPORT: COMBINED DESKTOP & FIELD STUDY

Proposed enlargement of the Driefontein Dam, Portion 33 of Farm Rietvalley No. 364, Ceres, Witzenburg Local Municipality, Western Cape

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1. EXECUTIVE SUMMARY

Agterfontein Boerdery (Pty.) Ltd is proposing to enlarge an existing dam, known as the Driefontein Dam, on Portion 33 of Farm Rietvalley No. 364 near Ceres in the Witzenburg Local Municipality, Western Cape so as to inundate an area of *c*. 13 hectares of transformed agricultural land. Lower Bokkeveld Group (Voorstehoek Formation) bedrocks in the Warm Bokkeveld region have yielded rich assemblages of shelly marine invertebrates. However, in the Driefontein Dam study area the Voorstehoek Formation bedrocks are generally poorly exposed, highly-weathered near surface, fractured and secondarily mineralised locally. Shelly fossil remains here are very sparse, with only two invertebrate specimens recorded during the site visit - *viz.* a poorly-preserved orthocone nautiloid and a juvenile homalonotid trilobite (Field heritage grading IIIC – Low Significance). It is concluded that the bedrocks here are generally of low palaeontological sensitivity and that the proposed dam project does not pose a significant threat to local palaeontological heritage resources. Pending the chance discovery of substantial new fossil remains during construction, no further specialist palaeontological studies or mitigation are recommended here.

In the case of any significant new fossil finds exposed during dam construction (*e.g.*concentrations of well-preserved fossil shells such as “starfish beds”), these should be safeguarded - preferably *in situ* - and reported by the ECO as soon as possible to Heritage Western Cape (Contact details: Heritage Western Cape. Protea Assurance Building, Green Market Square, Cape Town 8000. Private Bag X9067, Cape Town 8001. Tel: 086-142 142. Fax: 021-483 9842. Email: hwc@pgwc.gov.za). This is so that appropriate mitigation (*i.e.* recording, sampling or collection) by a palaeontological specialist can be considered and implemented (Please refer to the tabulated Chance Fossil Finds Procedure attached to this report). These recommendations should be incorporated into the Environmental Management Programme (EMPr) for the proposed dam project.

2. INTRODUCTION & BRIEF

Agterfontein Boerdery (Pty.) Ltd is proposing to enlarge an existing dam, known as the Driefontein Dam, on Portion 33 of Farm Rietvalley No. 364 near Ceres in the Witzenburg Local Municipality, Western Cape so as to inundate an area of *c*. 13 hectares of transformed agricultural land. The dam wall will be lengthened from 300 m to 367 m and its height will be raised by 1 m. The dam’s

full capacity will be 321 000 m³. Construction will involve the removal of 8 900m³ of ground from the floor of the dam to be used to enlarge the dam wall.

The Driefontein Dam site overlies potentially-fossiliferous sedimentary rocks of the Voorstehoek Formation (Bokkeveld Group) of Palaeozoic age. The present palaeontological heritage study (PIA) has been commissioned by ACRM (5 Stuart Road, Rondebosch, 7700. Ph/Fax: 021 685 7589. Cell: 082 321 0172. E-mail: acrm@wcaccess.co.za) as part of the Basic Assessment process for this agricultural project that is being co-ordinated by EnviroAfrica cc, Somerset West (Contact details: Mnr. Bernard de Witt. EnviroAfrica cc. Cell: +27 82 448999. Office tel: +27 21 851 1616. Fax: 0865120154. Postal address: P. O. Box 5367, Helderberg, 7135. Street address: 29 St James St, Somerset West).

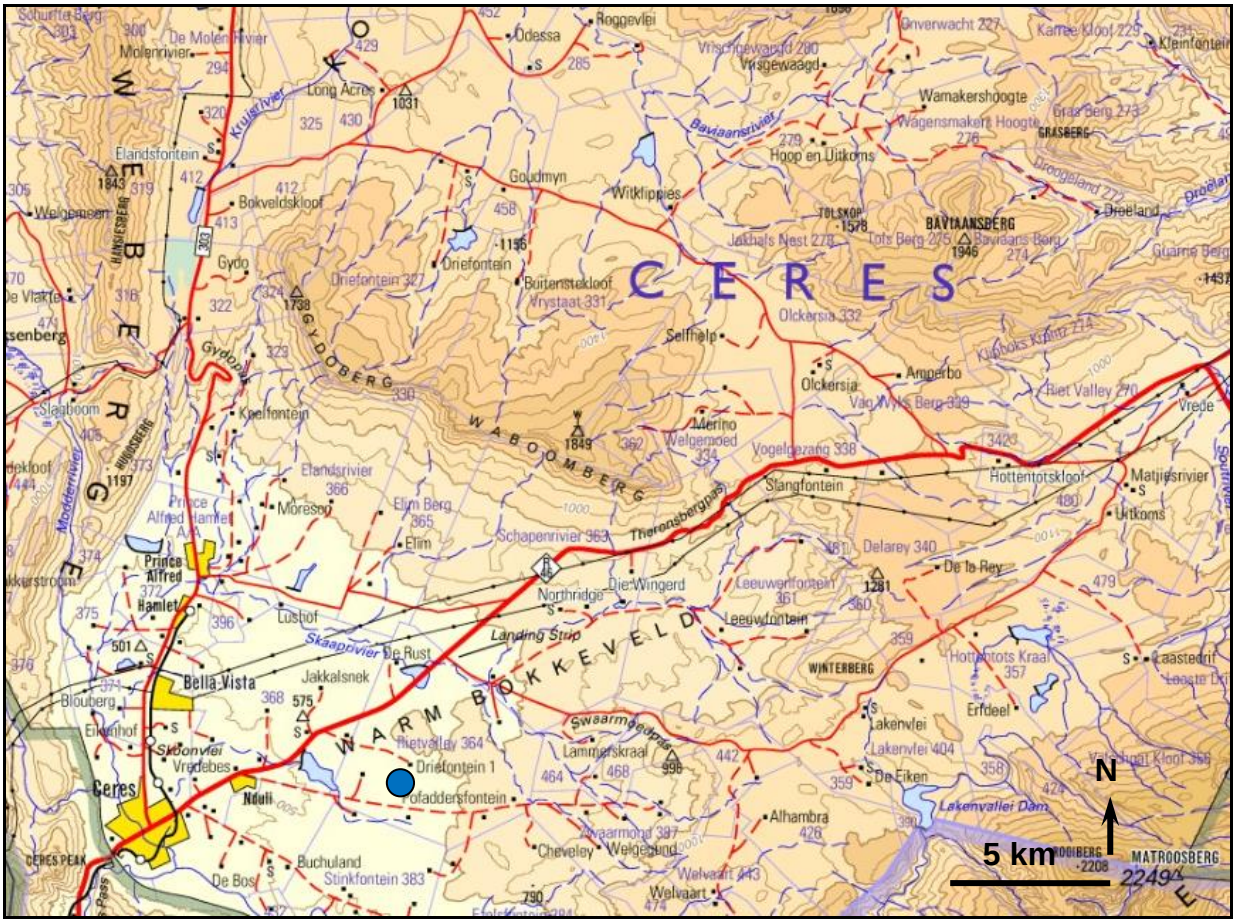

Figure 1: Extract from topographical sheets 3119 Worcester (Courtesy of the Chief Directorate: National Geo-spatial Information, Mowbray) showing the approximate location of the existing Driefontein Dam on Portion 33 of Farm Rietvalley No. 364, *c*. 8.2 km ENE of Ceres, Warm Bokkeveld region, Western Cape (blue dot).

Figure 2: View southwards across the existing Driefontein Dam from the dam wall towards the Hexrivier Mountains on the skyline. Low exposures of Bokkeveld Group bedrocks are visible along the north-western edge of the dam.

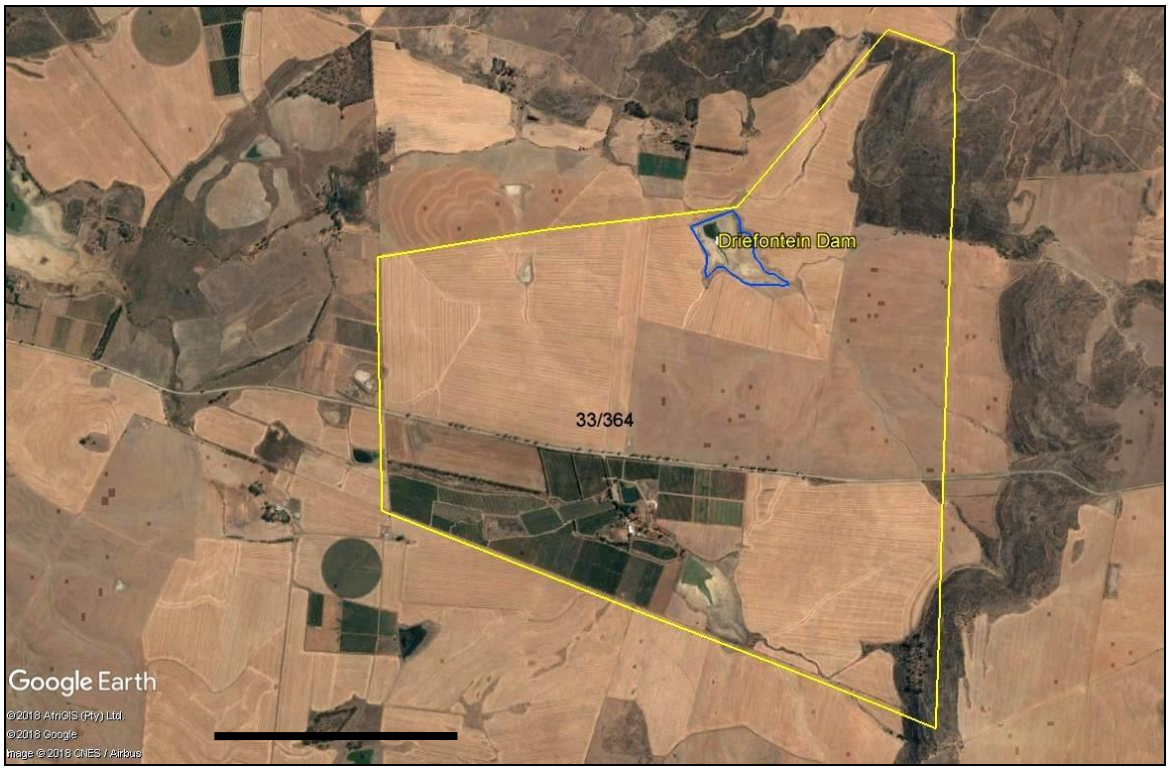

Figure 3: Google Earth© satellite image of Portion 33 of Farm Rietvalley No. 364 (yellow polygon) showing the dam study site in blue. Scale bar = 1 km. North towards the top of the image.

2. APPROACH TO THE PALAEONTOLOGICAL HERITAGE STUDY

The approach to this palaeontological heritage study is briefly as follows. Fossil bearing rock units occurring within the broader study area are determined from geological maps and satellite images. Known fossil heritage in each rock unit is inventoried from scientific literature, previous assessments of the broader study region, and the author's field experience and palaeontological database. Based on this data as well as field examination of representative exposures of all major sedimentary rock units present, the impact significance of the proposed development is assessed with recommendations for any further studies or mitigation.

In preparing a palaeontological desktop study the potentially fossiliferous rock units (groups, formations *etc*) represented within the study area are determined from geological maps and satellite images. The known fossil heritage within each rock unit is inventoried from the published scientific literature, previous palaeontological impact studies in the same region, and the author's field experience (Almond & Pether 2008). Consultation with professional colleagues as well as examination of institutional fossil collections may play a role here, or later following field assessment during the compilation of the final report. This data is then used to assess the palaeontological sensitivity of each rock unit to development. The likely impact of the proposed development on local fossil heritage is then determined on the basis of (1) the palaeontological sensitivity of the rock units concerned and (2) the nature and scale of the development itself, most significantly the extent of fresh bedrock excavation envisaged. When rock units of moderate to high palaeontological sensitivity are present within the development footprint, a Phase 1 field assessment study by a professional palaeontologist is usually warranted to identify any palaeontological hotspots and make specific recommendations for any monitoring or mitigation required before or during the construction phase of the development.

On the basis of the desktop and Phase 1 field assessment studies, the likely impact of the proposed development on local fossil heritage and any need for specialist mitigation are determined. Adverse palaeontological impacts normally occur during the construction rather than the operational or decommissioning phase. Phase 2 mitigation by a professional palaeontologist – normally involving the recording and sampling of fossil material and associated geological information (*e.g.* sedimentological data) may be required (a) in the pre-construction phase where important fossils are already exposed at or near the land surface and / or (b) during the construction phase when fresh fossiliferous bedrock has been exposed by excavations. To carry out mitigation, the palaeontologist involved will need to apply for palaeontological collection permits from the relevant heritage management authorities, *i.e.* Heritage Western Cape (Contact details: Heritage Western Cape. Protea Assurance Building, Green Market Square, Cape Town 8000. Private Bag X9067, Cape Town 8001. Tel: 086-142 142. Fax: 021-483 9842. Email: hwc@pgwc.gov.za). It should be emphasized that, *providing appropriate mitigation is carried out*, the majority of developments involving bedrock excavation can make a *positive* contribution to our understanding of local palaeontological heritage.

2.1. Information sources

The information used in this scoping palaeontological heritage study was based on the following:

1. Project descriptions, maps, kmz files and supporting documents provided by ACRM;

2. A review of the relevant satellite images, topographical maps and scientific literature, including published geological maps and accompanying sheet explanations, as well as several previous desktop and field-based palaeontological assessment studies in the Ceres region and comparable bedrocks elsewhere (*e.g.* Almond 2009, 2010a, 2010b, 2010c, 2013).

3. The author's previous field experience with the formations concerned and their palaeontological heritage (Almond & Pether 2008);

4. A short palaeontological field assessment on 12 April 2018 by the author and an experienced field assistant.

2.2. Assumptions & limitations

The accuracy and reliability of palaeontological specialist studies as components of heritage impact assessments are generally limited by the following constraints:

1. Inadequate database for fossil heritage for much of the RSA, given the large size of the country and the small number of professional palaeontologists carrying out fieldwork here. Most development study areas have never been surveyed by a palaeontologist.

2. Variable accuracy of geological maps which underpin these desktop studies. For large areas of terrain these maps are largely based on aerial photographs alone, without ground-truthing. The maps generally depict only significant ("mappable") bedrock units as well as major areas of superficial "drift" deposits (alluvium, colluvium) but for most regions give little or no idea of the level of bedrock outcrop, depth of superficial cover (soil *etc*), degree of bedrock weathering or levels of small-scale tectonic deformation, such as cleavage. All of these factors may have a major influence on the impact significance of a given development on fossil heritage and can only be reliably assessed in the field.

3. Inadequate sheet explanations for geological maps, with little or no attention paid to palaeontological issues in many cases, including poor locality information.

4. The extensive relevant palaeontological "grey literature" - in the form of unpublished university theses, impact studies and other reports (*e.g*. of commercial mining companies) - that is not readily available for desktop studies.

5. Absence of a comprehensive computerized database of fossil collections in major RSA institutions which can be consulted for impact studies. A Karoo fossil vertebrate database is now accessible for impact study work.

In the case of palaeontological desktop studies without supporting Phase 1 field assessments these limitations may variously lead to either:

(a) *underestimation* of the palaeontological significance of a given study area due to ignorance of significant recorded or unrecorded fossils preserved there, or

(b) *overestimation* of the palaeontological sensitivity of a study area, for example when originally rich fossil assemblages inferred from geological maps have in fact been destroyed by tectonism or weathering, or are buried beneath a thick mantle of unfossiliferous “drift” (soil, alluvium *etc*).

Since most areas of the RSA have not been studied palaeontologically, a palaeontological desktop study usually entails *inferring* the presence of buried fossil heritage within the study area from relevant fossil data collected from similar or the same rock units elsewhere, sometimes at localities far away. Where substantial exposures of bedrocks or potentially fossiliferous superficial sediments are present in the study area, the reliability of a palaeontological impact assessment may be significantly enhanced through field assessment by a professional palaeontologist.

In the case of the present study area near Ceres in the Western Cape levels of natural bedrock exposure are limited by extensive superficial deposits, especially alluvium, soils and surface gravels. However, the palaeontology of the region is comparatively well known from a number of borrow pit and other sites in the Warm Bokkeveld (See References).

2.3. Legislative context for palaeontological assessment studies

The proposed dam project is located in an area that is underlain by potentially fossiliferous sedimentary rocks of Palaeozoic and younger, Late Tertiary or Quaternary, age (Sections 3 and 4). The proposed mining development will entail voluminous excavations into the superficial sediment cover and the underlying bedrock as well. This development may adversely affect potential fossil heritage within the study area by destroying, disturbing or permanently sealing-in fossils at or beneath the surface of the ground that are then no longer available for scientific research or other public good. The rehabilitation phase of the mine is unlikely to involve further adverse impacts on local palaeontological heritage.

The present combined desktop and field-based palaeontological heritage study falls under the South African Heritage Resources Act (Act No. 25 of 1999). It will also inform the Environmental Management Programme (EMPr) for this agricultural project.

The various categories of heritage resources recognised as part of the National Estate in Section 3 of the National Heritage Resources Act include, among others:

- geological sites of scientific or cultural importance;
- palaeontological sites;
- palaeontological objects and material, meteorites and rare geological specimens.

According to Section 35 of the National Heritage Resources Act, dealing with archaeology, palaeontology and meteorites:

(1) The protection of archaeological and palaeontological sites and material and meteorites is the responsibility of a provincial heritage resources authority.

(2) All archaeological objects, palaeontological material and meteorites are the property of the State.

(3) Any person who discovers archaeological or palaeontological objects or material or a meteorite in the course of development or agricultural activity must immediately report the find to the responsible heritage resources authority, or to the nearest local authority offices or museum, which must immediately notify such heritage resources authority.

(4) No person may, without a permit issued by the responsible heritage resources authority—

(a) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;

(b) destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;

(c) trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite; or

(d) bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites.

(5) When the responsible heritage resources authority has reasonable cause to believe that any activity or development which will destroy, damage or alter any archaeological or palaeontological site is under way, and where no application for a permit has been submitted and no heritage resources management procedure in terms of section 38 has been followed, it may—

(a) serve on the owner or occupier of the site or on the person undertaking such development an order for the development to cease immediately for such period as is specified in the order;

(b) carry out an investigation for the purpose of obtaining information on whether or not an archaeological or palaeontological site exists and whether mitigation is necessary;

(c) if mitigation is deemed by the heritage resources authority to be necessary, assist the person on whom the order has been served under paragraph *(a)* to apply for a permit as required in subsection (4); and

(d) recover the costs of such investigation from the owner or occupier of the land on which it is believed an archaeological or palaeontological site is located or from the person proposing to undertake the development if no application for a permit is received within two weeks of the order being served.

Minimum standards for the palaeontological component of heritage impact assessment reports (PIAs) have been published by SAHRA (2013).

3. GEOLOGICAL BACKGROUND

The study area for the Driefontein Dam on Portion 33 of Farm Rietvalley No. 364 is situated at an elevation of *c*. 550 m amsl in gently rolling hill terrain of the Warm Bokkeveld region some 8.2 km to the ENE of Ceres, Western Cape (Figs. 1 to 3). The surrounding area has been completely transformed for agriculture, with relict patches of karroid *bossieveld* clothing low hills to the north and east. Several shallow drainage lines converging on the dam site are incised into thick soils and saprolite with no fresh bedrock exposure.

The geology of the Warm Bokkeveld study area near Ceres is shown on 1: 250 000 geology sheet 3319 Worcester (Council for Geoscience, Pretoria) and is illustrated here in Fig. 4. A short sheet explanation has been published by Gresse & Theron (1992; see also the older 1: 125 000 Worcester- Hermanus map and sheet explanation by De Villiers *et al.* 1964). An incisive recent review of Bokkeveld Group geology has been submitted by Penn-Clarke (2013).

The Driefontein Dam study area overlies marine mudrocks of the **Voorstehoek Formation** (**Dv**, Lower Bokkeveld Group / Ceres Subgroup) of Middle Devonian (Eifelian) age. The sedimentology of this unit has been briefly described by Gresse and Theron (1992) and in more detail by Theron (2003). It comprises an upward-coarsening, shallowing succession of grey-green and grey mudrocks that are increasingly interbedded with wave-rippled wackes (impure sandstones) of tempestite origin towards the top. The Voorstehoek Formation is about 200 m thick in the Koue Bokkeveld and Hex River Valley area.

The Cape Supergroup rocks in the Warm Bokkeveld study region, to the NW of the Hex River Mountains, show a complex pattern of tectonic deformation related to the Cape syntaxis where the western and southern branches of the Cape Fold Belt intersect. The Lower Bokkeveld Formations here – notably the Hexrivier and underlying Voorstehoek Formations - are folded along SW-NE trending axes in a down-faulted block bounded by two major WNW-ESE fault planes (Fig. 4). Despite this pattern of deformation, the Voorstehoek bedrocks in the study are not highly cleaved, favouring good fossil preservation in the area (Almond 2013).

Bokkeveld Group bedrock exposure in the present study area is largely confined to small outcrops of gently- to steeply-dipping beds of dark grey, grey-green, blueish-green, rusty-brown to khaki, massive to laminated siltstone and wacke. These sediments crop out around the north-western and north-eastern margins of the existing dam as well as in the walls of a short pipeline trench leading from a small concrete reservoir on the southern side of the dam (Figs. 2, 5 & 6). The bedrocks are highly-weathered, fractured and hackly with very little bedding plane exposure. They are locally impregnated with secondary iron and manganese minerals (*e.g.* pyrolusite), including small ferruginous nodules. Soft-sediment loading of wacke units is locally developed and the succession is cut by several small-scale faults. Mottling of some horizons indicates high levels of bioturbation.

The bedrocks are overlain by fairly thick, sparsely gravelly, loamy to clay-rich soils of mixed alluvial and colluvial origin. A zone of downwasted coarse gravels along the eastern side of the dam includes angular to occasionally well-rounded clasts of pale quartzite, sandstone (often ferruginised), wacke and vein quartz (Fig. 7). The surface gravels include sparse crudely-flaked quartzite bifaces of probable Early Stone Age affinity (Fig. 8).

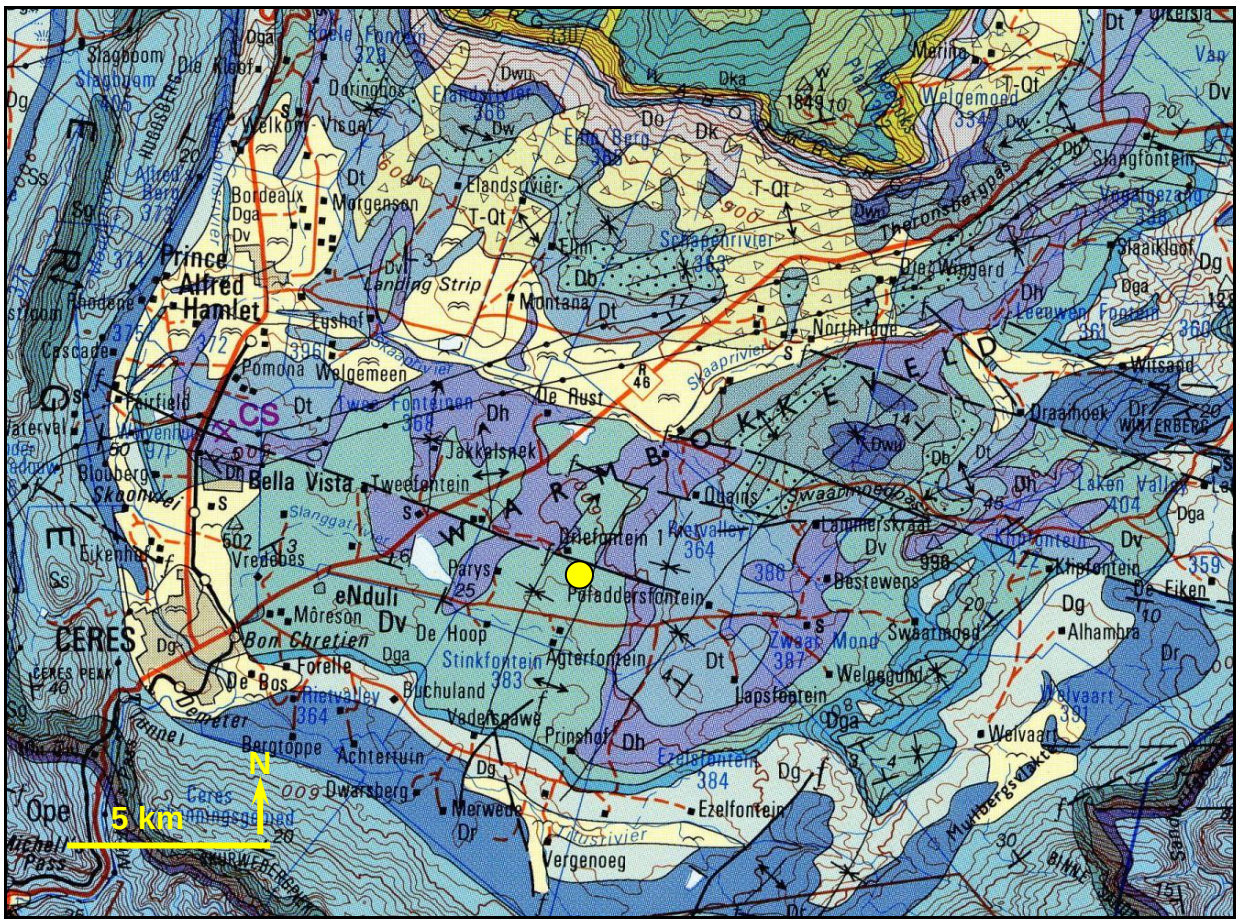

Figure 4: Extract from 1: 250 000 geology sheet 3119 Worcester (Council for Geoscience, Pretoria) showing the approximate location of the Driefontein Dam study area on Portion 33 of Farm Rietvalley No. 364, *c*. 8.2 km ENE of Ceres (yellow dot). The dam is excavated into marine sediments of the Voorstehoek Formation (Dv, middle blue), Lower Bokkeveld Group (Cape Supergroup).

Figure 5: Low exposures of gently-dipping Voorstehoek Formation mudrocks and wackes along the north-western margins of the Driefontein Dam (dam wall in the background) (Hammer = 30 cm).

Figure 6: Highly fractured, faulted and weathered Voorstehoek Formation bedrocks exposed in a short pipeline trench on the southern edge of the exisiting dam.

Figure 7: Dense scatter of downwasted angular clasts of quartzite, wacke and vein quartz along the eastern margins of the dam.

Figure 8: Examples of sparse bifacially-flaked quartzite artefacts (probably Early Stone Age / Pleistocene) scattered within the gravel-rich area illustrated above (33 21 10.5 S, 19 24 18.6 E).

4. PALAEONTOLOGICAL HERITAGE

The fossil record of the mudrock-dominated **Voorstehoek Formation** (**Dv**, Middle Devonian / Eifelian) has been summarised by Oosthuizen (1984), Almond *et al.* (1996), Gresse and Theron (1992), Theron (2003), Almond (2008, 2010) and Penn-Clarke *et al.* (2018). Generally fossil assemblages in this unit are much sparser and less diverse than in the underlying Gydo Formation, and they are correspondingly less well known. Rich trace fossil assemblages in the northern outcrop area attest to the presence of a flourishing invertebrate fauna at the time (Almond *in* De Beer *et al*. 2002). Abundant shelly fossils are recorded from mudrocks in the lower half of this stratigraphic unit in the southwestern outcrop area including the Warm Bokkeveld, Matroosberg and Theronsberg Pass region (Theron 1972, Oosthuizen 1984, Gresse & Theron 1992, Theron 2003). Borrow pits along the Swaarmoed Pass in particular have yielded a wealth of well-preserved shelly fossils in recent decades, including important material of some rare taxa (Gresse & Theron 1992, Almond *et al.* 1996, Almond 2013).

Voorstehoek shelly fossils have often been concentrated by storm winnowing and currents into thin shelly lenses or *coquinas*. Fossil biotas are dominated by shelly invertebrates such as trilobites, articulate brachiopods, crinoids, ophiuroids, bivalves, bellerophontid "gasteropods", orthocone nautiloids, and problematic conical-shelled groups such as hyolithids and tentaculitids (Theron 1972, Oosthuizen 1984, Gresse & Theron 1992, Theron 2003, Almond 2008). Heterolithic, tempestite-dominated successions within the Voorstehoek Formation, especially in its northern outcrop area, have yielded rich shallow marine trace fossil assemblages of the *Cruziana* Ichnofacies (Almond 1998, Almond *in* De Beer *et al.* 2002, Theron 2003, Almond 2008). Shelly fossils are often concentrated in thin coquinas and are usually, but far from invariably, disarticulated due to current action, notably by storm waves in nearshore sediments. Mudrocks often show high levels of bioturbation, *i.e.* churning by burrowing, sediment-feeding invertebrates such as homalonotid triobites, nuculid bivalves, bellerophontid gastropods and other, unidentified invertebrate taxa. Remobilisation and re-suspension of soupy shelf muds may have limited or excluded larval settling and / or feeding by suspension-feeding taxa such as crinoids and brachiopods that are poorly represented in many offshore Voorstehoek fossil assemblages (Almond *et al.* 1996). Occasional thin, dense fossil *Lagerstätte* dominated by fully-articulated echinoderms (brittlestars, starfish, carpoids *etc*) are recorded from lower Bokkeveld mudrock units of the Warm Bokkeveld, Hex River Valley region and further east (Theron 1972, Oosthuizen 1984, Jell & Theron 1999, Reid *et al.* 2015). These so-called "starfish beds" are attributed to *obrution* or sudden smothering of benthic invertebrates by storm re-suspended muds and provide useful, albeit biased "snapshots" of offshore marine life on the Early Devonian seabed.

The Voorstehoek Formation bedrocks in the Driefontein Dam study area are generally highly weathered, fractured and locally secondarily mineralised, compromising preservation of scientifically-useful fossil remains. The only fossils recorded during the site visit were internal moulds of an orthocone nautiloid (Fig. 9) and an incomplete juvenile homalonotid trilobite (Fig. 10). Nautiloids are comparatively rare in existing Bokkeveld Group fossil collections. The specimen here is unfortunately poorly preserved, while homalonotid trilobites are a very common element within Voorstehoek invertebrate biotas. Neither of these fossils is considered to be of high scientific or conservation value (proposed field heritage grading IIIC – Low Significance). No fossils were recorded from the overlying soils and downwasted gravels. The presence here of sparse ESA quartzite artefacts in a disturbed context is noted (Fig. 8). Comparable stone artefact assemblages have been reported elsewhere in the Warm Bokkeveld region by Kaplan (2007a, 2007b, 2009, 2010). It is concluded that the overall palaeontological sensitivity of the study site is LOW.

Figure 9: Poorly-preserved internal mould of an orthocone nautiloid showing nested series of lens-shaped, biconvex casts of the shell chambers preserved within massive dark siltstone (Specimen is *c*. 3 cm long) (33 21 12.4 S, 19 24 19.1 E).

Figure 10: Internal mould of the posterior trunk and pygidium of a small (probably juvenile) homalonotid trilobite (*Burmeisteria*) preserved within massive dark siltstone (Specimen is *c*. 5.5 cm long) (33 21 12.4 S, 19 24 19.1 E).

5. SUMMARY & RECOMMENDATIONS

In the Driefontein Dam study area near Ceres the Voorstehoek Formation (Lower Bokkeveld Group) bedrocks are generally poorly exposed, highly-weathered near surface, fractured and secondarily mineralised locally. Shelly fossil remains here are very sparse, with only two invertebrate specimens recorded during the site visit - *viz.* a poorly-preserved orthocone nautiloid and a juvenile homalonotid trilobite (Field heritage grading IIIC – Low Significance). It is concluded that the bedrocks here are generally of low palaeontological sensitivity and that the proposed dam project does not pose a significant threat to local palaeontological heritage resources. Pending the chance discovery of substantial new fossil remains during construction, no further specialist palaeontological studies or mitigation are recommended here.

In the case of any significant new fossil finds exposed during dam construction (*e.g.*concentrations of well-preserved fossil shells such as "starfish beds"), these should be safeguarded - preferably *in situ* - and reported by the ECO as soon as possible to Heritage Western Cape (Contact details: Heritage Western Cape. Protea Assurance Building, Green Market Square, Cape Town 8000. Private Bag X9067, Cape Town 8001. Tel: 086-142 142. Fax: 021-483 9842. Email: hwc@pgwc.gov.za). This is so that appropriate mitigation (*i.e.* recording, sampling or collection) by a palaeontological specialist can be considered and implemented (Please refer to the tabulated Chance Fossil Finds Procedure attached to this report). These recommendations should be incorporated into the Environmental Management Programme (EMPr) for the proposed dam project.

6. ACKNOWLEDGEMENTS

Mr Jonathan Kaplan of ACRM, Rondebosch, is thanked for commissioning this study and for providing the required background information. I am very grateful to Ms Madelon Tusenius for assistance and companionship in the field – including the finding the key fossil material illustrated herein.

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8. 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, Free State, Limpopo, Northwest and Kwazulu-Natal 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.

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

<table>
<tr><td colspan="3">CHANCE FOSSIL FINDS PROCEDURE: Driefontein Dam, Portion 33 of Farm Rietvalley No. 364 near Ceres</td></tr>
<tr><td>Province & region:</td><td colspan="2">Western Cape, Witzenburg Local Municipality</td></tr>
<tr><td>Responsible Heritage Management Authority</td><td colspan="2">HERITAGE WESTERN CAPE. Protea Assurance Building, Green Market Square, Cape Town 8000. Private Bag X9067, Cape Town 8001. Tel: 086-142 142. Fax: 021-483 9842. Email: hwc@pgwc.gov.za</td></tr>
<tr><td>Rock unit(s)</td><td colspan="2">Voorstehoek Formation (Lower Bokkeveld Group)</td></tr>
<tr><td>Potential fossils</td><td colspan="2">Shelly invertebrate fossils, including “starfish beds”</td></tr>
<tr><td rowspan="5">ECO protocol</td><td colspan="2">1. Once alerted to fossil occurrence(s): alert site foreman, stop work in area immediately (N.B. safety first!), safeguard site with security tape / fence / sand bags if necessary.</td></tr>
<tr><td colspan="2">2. Record key data while fossil remains are still in situ:
Accurate geographic location – describe and mark on site map / 1: 50 000 map / satellite image / aerial photo
Context – describe position of fossils within stratigraphy (rock layering), depth below surface
Photograph fossil(s) in situ with scale, from different angles, including images showing context (e.g. rock layering)</td></tr>
<tr><td>3. If feasible to leave fossils in situ:
Alert Heritage Resources Authority and project palaeontologist (if any) who will advise on any necessary mitigation
Ensure fossil site remains safeguarded until clearance is given by the Heritage Resources Authority for work to resume</td><td>3. If not feasible to leave fossils in situ (emergency procedure only):
Carefully remove fossils, as far as possible still enclosed within the original sedimentary matrix (e.g. entire block of fossiliferous rock)
Photograph fossils against a plain, level background, with scale
Carefully wrap fossils in several layers of newspaper / tissue paper / plastic bags
Safeguard fossils together with locality and collection data (including collector and date) in a box in a safe place for examination by a palaeontologist
Alert Heritage Resources Authority and project palaeontologist (if any) who will advise on any necessary mitigation</td></tr>
<tr><td colspan="2">4. If required by Heritage Resources Authority, ensure that a suitably-qualified specialist palaeontologist is appointed as soon as possible by the developer.</td></tr>
<tr><td colspan="2">5. Implement any further mitigation measures proposed by the palaeontologist and Heritage Resources Authority</td></tr>
<tr><td>Specialist palaeontologist</td><td colspan="2">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.</td></tr>
</table>