Palaeontological heritage assessment: desktop letter of exemption from further specialist studies or mitigation

PROPOSED AGRICULTURAL DEVELOPMENTS ON PORTION 12 OF THE FARM SCHERPE HEUVEL 481 NEAR WORCESTER, CAPE WINELANDS DISTRICT MUNICIPALITY, WESTERN CAPE

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EXECUTIVE SUMMARY

Bass Diii Berries (Pty) Ltd, Paarl is proposing the clearing of new agricultural land for the cultivation of blue berries on the Farm Scherpe Heuwel 481/12, situated *c*. 15.3 km southeast of the town of Worcester, Cape Winelands District Municipality, Western Cape. An existing, small in-stream dam will also be rehabilitated.

The agricultural project area is underlain by Permian basinal mudrocks of the lower Ecca Group (Karoo Supergroup). Potential palaeontological heritage impacts of the proposed agricultural developments here are anticipated to LOW. This is because:

- The development footprint is small (< 20 ha);
- Deep, voluminous excavations are not anticipated, so major disturbance of fresh (unweathered) bedrocks is unlikely;
- The Ecca Group bedrocks in this region are not known to be highly fossiliferous, apart from the Whitehill Formation which will *not* be directly impacted here (*N.B.* The Scherpenheuwel quarry just *outside* the project area is a well-known Whitehill fossil site);
- Older alluvial sediments of the Breede River are not mapped in this area.

There are therefore no objections on palaeontological heritage grounds to authorisation of the project, and no specialist palaeontological monitoring or mitigation measures are proposed here, pending the potential discovery of new fossil finds during the construction phase.

In the case of any significant new fossil finds (*e.g.* concentrations of well-preserved fossil bones, teeth, shells, trace fossils or plant material such as petrified wood) exposed during land clearance or dam rehabilitation, 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 (A tabulated Chance Fossil Finds Procedure is attached to this report).

1. PROJECT OUTLINE & BRIEF

The company Bass Diii Berries (Pty) Ltd, Paarl is proposing the clearing of new agricultural land for the cultivation of blue berries on the Farm Scherpe Heuwel 481/12, situated along the Eilandia Road *c*. 15.3 km southeast of the town of Worcester, Cape Winelands District Municipality, Western Cape (Fig. 1). An existing, abandoned in-stream dam will also be rehabilitated (Fig. 2). Existing farm roads will be utilized, and no new roads will need to be constructed. The combined footprint area of the development is less than 20 ha.

The footprint of the proposed agricultural developments is underlain by potentially-fossiliferous bedrocks of the Ecca Group (Karoo Supergroup). A desktop paleontological heritage study for the proposed agricultural project as part of a broader-based Heritage Impact Assessment has been requested by Heritage Western Cape (HWC Case No: 20091516SB1020E, Interim response to NID dated 6 November 2020). The present report has accordingly been commissioned as part of an HIA by ACRM, Cape Town (Contact details: Mr Jonathan Kaplan. ACRM.5 Stuart Road, Rondebosch, 7700. Ph/Fax: 021 685 7589. Mobile: 082 321 0172. E-mail: acrm@wcacces.co.za).

1.1. Study approach

This PIA report provides a record of the observed or inferred palaeontological heritage resources within the agricultural project study area. The identified or inferred palaeontological heritage resources here have been assessed to evaluate their heritage significance in terms of the grading system outlined in Section 3 of the NHRA (Act 25 of 1999). Recommendations for specialist palaeontological mitigation are made where this is considered necessary. The report is based on (1) a review of the relevant scientific literature, including several previous desktop and field-based palaeontological impact assessments in the broader study region (*e.g.* Almond 2011, 2012, 2020), (2) Google Earth© satellite imagery and (2) published geological maps (1: 250 000 sheet 3319 Worcester, Council for Geoscience, Pretoria) as well as relevant sheet explanations (*e.g.* Gresse & Theron 1992).

2. LEGISLATIVE CONTEXT

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 HWC (2016) and SAHRA (2013).

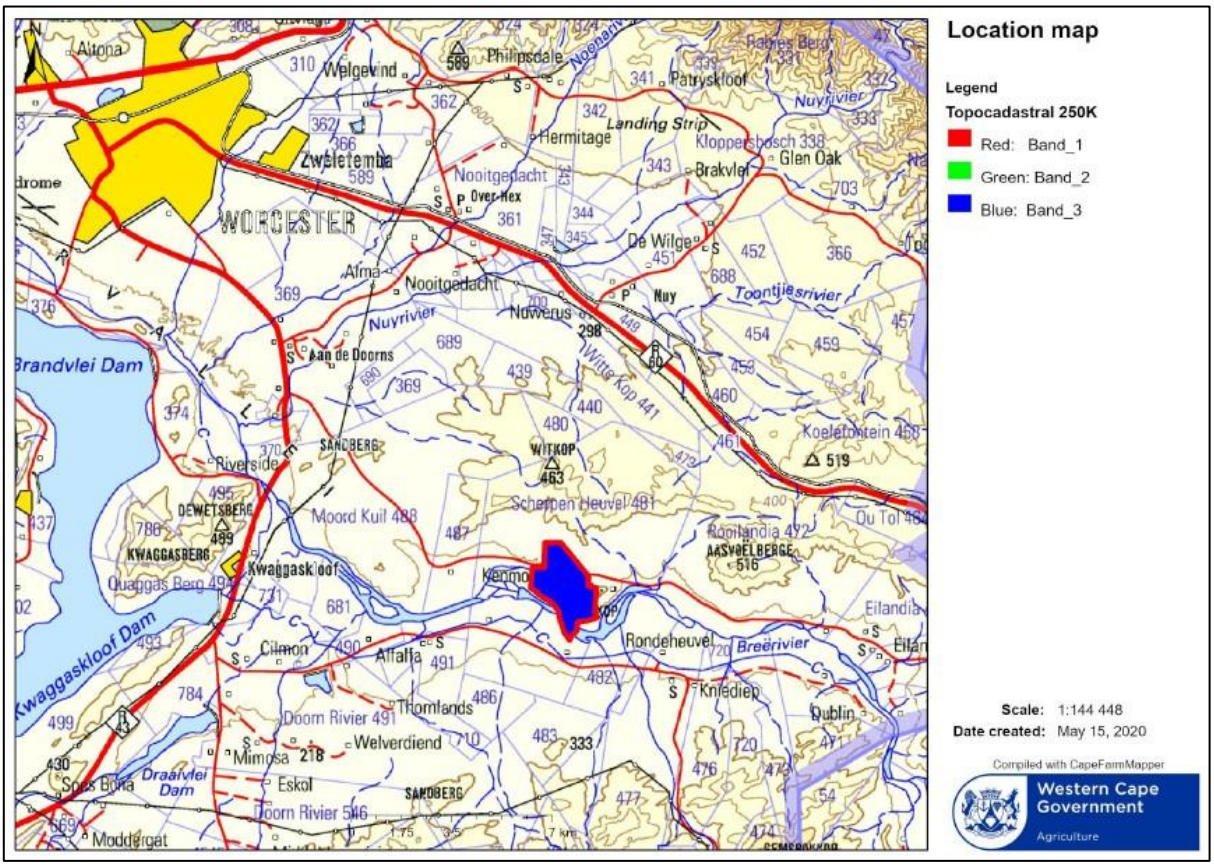

Figure 1: Topographical map based on the 1: 250 000 sheet 3319 Worcester showing the location of the proposed agricultural project area on Farm Scherpe Heuwel 481/12, situated on the northern side of the Breede River *c*. 15.3 km southeast of the town of Worcester, Cape Winelands District Municipality, Western Cape (red and blue polygon).

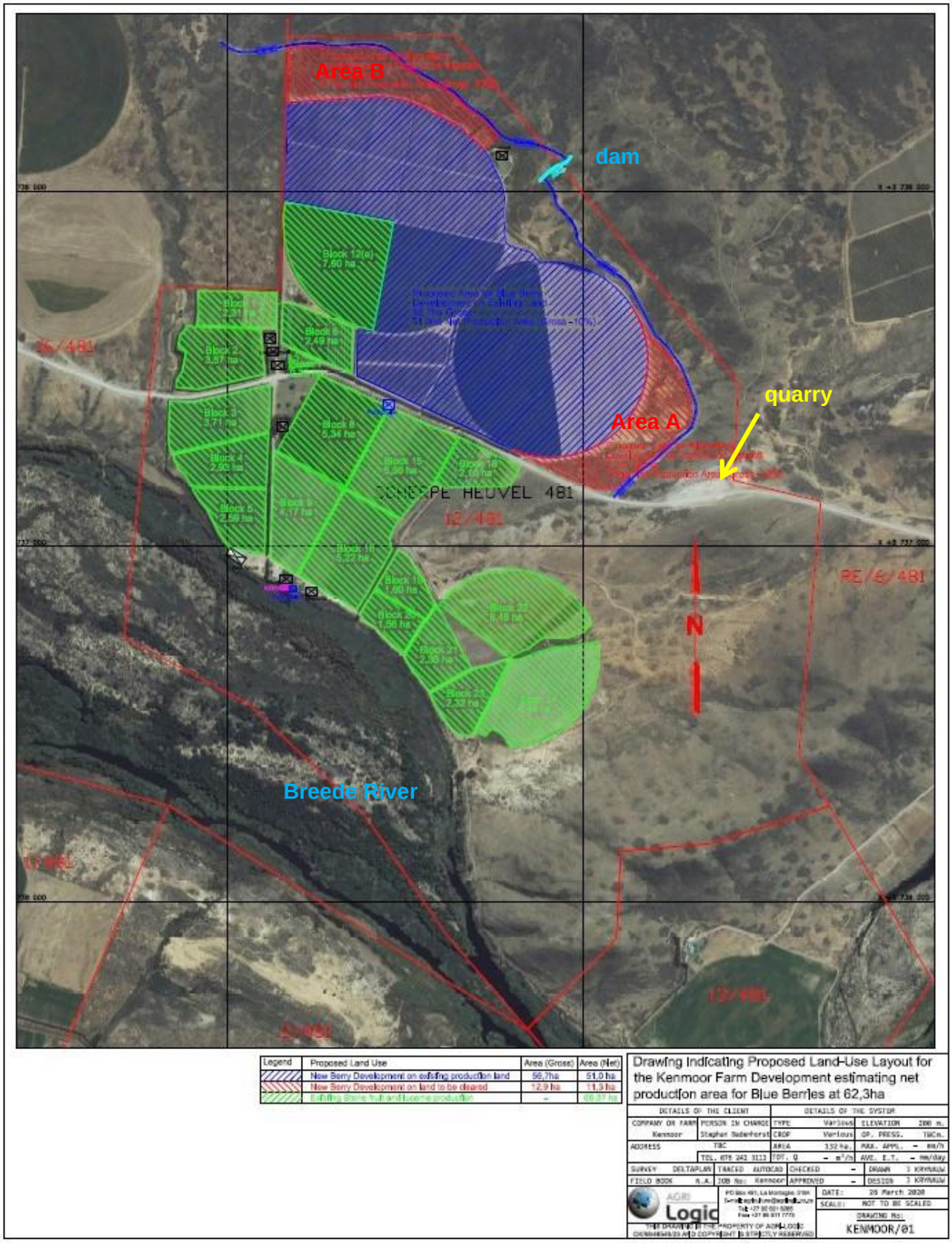

Figure 2: Satellite image of the project area on Farm Scherpe Heuwel 481/12. Blue and green shaded areas to the north and south of the Eilandia road have already been developed for agriculture. The two new small areas earmarked for cultivation are shown in red and the in-stream dam to be rehabilitated is indicated in pale blue. The existing roadside quarry excavated into the fossiliferous Whitehill Formation is indicated by the yellow arrow. This lies outside the project area.

3. GEOLOGICAL CONTEXT

The small agricultural project areas on Farm Scherpe Heuwel 481/12 comprse gently hilly terrain of the semi-arid Worcester-Robertson Karoo region, situated at elevations of 230-260 m amsl and between 800 m and 1200 m distant from the Breede River (Figs. 1 & 2). The bedrock geology of the project area is shown on 1: 250 000 geology sheet 3319 Worcester (Council for Geoscience, Pretoria) with a sheet explanation by Gresse and Theron (1992) (Fig. **). The area lies astride the axis of a WSW-ENE trending synclinal fold within marine / lacustrine sediments of the lower Ecca Group of Early to Middle Permian age that form part of the Worcester-Robertson Karoo Outlier (Johnson *et al.* 2006). Satellite imagery indicates that the two small agricultural project areas are underlain by turbidite fan sediments of the **Collingham Formation** as well as basinal mudrocks of the overlying **Tierberg Formation** while the in-stream dam lies within the outcrop area of the Tierberg Formation (Fig. 4). Brief, illustrated accounts of these dark, silty to clay-rich offshore mudrocks in the Worcester – Robertson Karoo region have been provided by Gresse and Theron (1992) as well as Almond (2012) and will not be repeated at length here. Field photographs in the draft HIA report by Kaplan (Feb. 2021) show that the areas are largely mantled by low karroid *bossieveld* with extensive cover by alluvial to colluvial soils, especially along stream gullies. Bedrock exposure is generally very poor, although limited exposure of surface-weathered shales within deeper erosion gullies is possible. Older alluvial deposits of the Breede River – such as High Level Gravels - are not mapped in the region but small erosional relicts of these might be preserved locally.

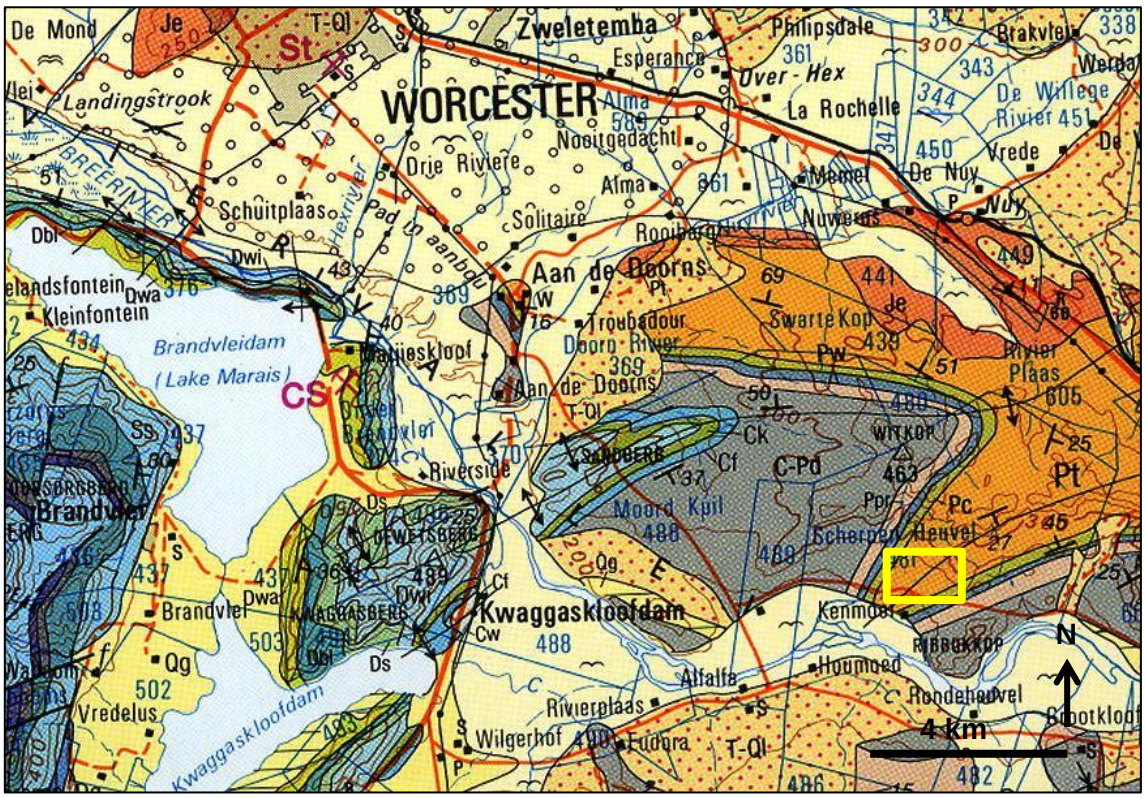

Figure 3: Extract from 1: 250 000 geology map 3319 Worcester (Council for Geoscience, Pretoria) showing the approximate location (yellow rectangle) of the proposed agricultural developments on Farm Scherpe Heuwel 481/12, located north of the Breede River near Worcester, Western Cape. The main geological units underlying or in the vicinity of the proposed development footprint are:
ECCA GROUP (Early – Middle Permian)

Ppr (grey-brown): Prince Albert Formation
Pw (blue-grey): Whitehill Formation
Pc (green): Collingham Formation
Pt (dark yellow): Tierberg Formation

SUPERFICIAL SEDIMENTS (Late Tertiary / Quaternary – Recent)
Pale yellow with flying bird symbol: alluvium of Breede River and its tributaries

(*N.B.* most superficial soils and colluvial gravels are not mapped at this scale)

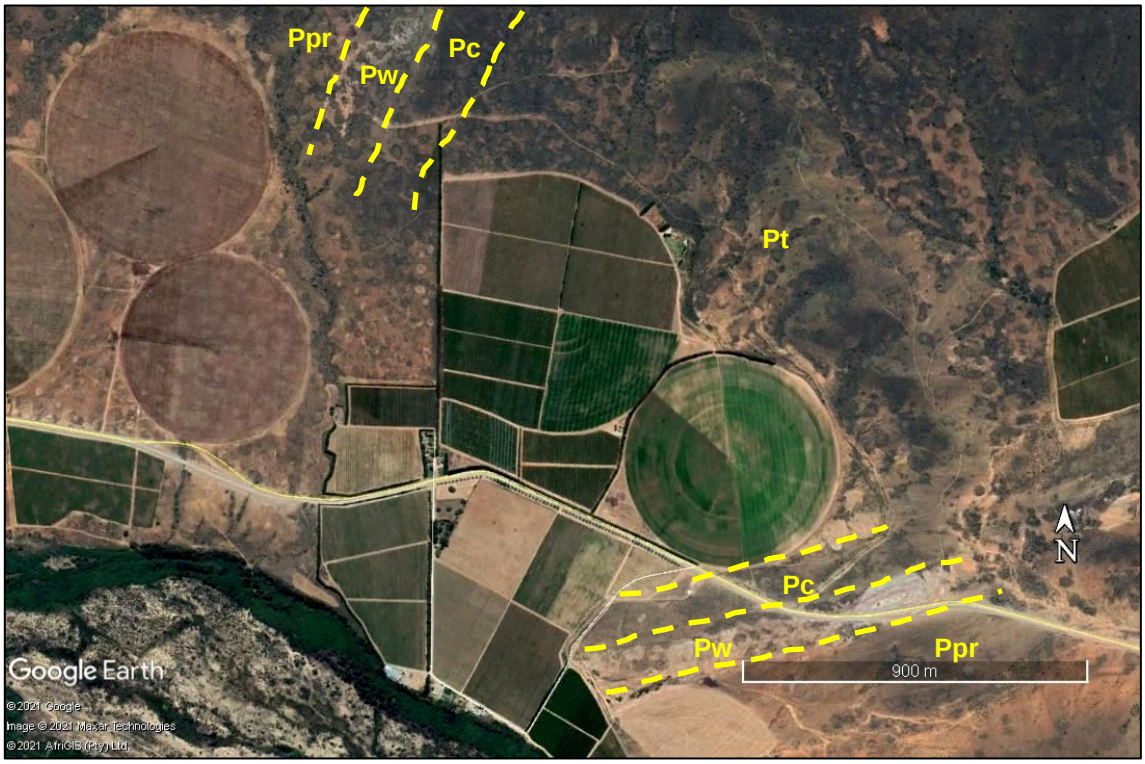

Figure 4: Google Earth© satellite image of the project area north of the Breede River. The small agricultural project areas (A, B) are underlain by the Collingham and Tierberg Formations (Pc, Pt) while the in-stream dam site lies within the Tierberg outcrop area (Compare Figures 2 & 3). Direct impacts on the palaeontologically sensitive Whitehill Formation (Pw) and Prince Albert Formation (Ppr) are not anticipated here.

4. PALAEONTOLOGICAL HERITAGE

The fossil record of the various formations of the **Ecca Group** in the Western Cape has been briefly reviewed by Almond (2008a, 2008b, 2010a, 2010b, 2012) and Almond and Pether (2008); the following account is largely based on these resources. Ecca fossils in the Worcester sheet area are briefly mentioned by Gresse and Theron (1992).

The palaeontology of the **Collingham Formation** has been reviewed by Viljoen (1992, 1994) and Almond (2008a). Transported, water-logged plant debris and tool marks generated by logs are often associated with thicker turbidite beds, especially within the upper part of the Collingham Formation. Substantial blocks of silicified wood are known from the Laingsburg area. The heterolithic character

of this succession favours trace fossil preservation, with very high levels of bioturbation recorded locally. Abundant, moderately diverse trace fossil assemblages have been recorded from the Collingham Formation (Anderson 1974). They include horizontal, 2cm-wide epichnial grooves with obscurely segmented levees ("*Scolicia*", possibly generated by gastropods), narrow, bilobate arthropod furrows ("*Isopodichnus*"), reticulate horizontal burrows (perhaps washed out *Megagrapton*-like systems), densely packed horizontal burrows with a rope-like surface texture covering selected bedding planes (*cf Palaeophycus*), narrow branching burrows, rare arthropod trackways (*Umfolozia*) and fish swimming trails (*Undichna*). The trackway of a giant sweep-feeding eurypterid has been identified from the upper Collingham Formation near Laingsburg, and fragmentary body fossils of similar animals are known from coeval sediments in South America (Almond 2002). At over two metres long, these bottom-feeding predators are the largest animal so far known from the Ecca Sea.

The fossil record of the **Tierberg Formation** has been reviewed in detail by Almond (2008a). Rare body fossil records include disarticulated microvertebrates (*e.g.* fish teeth and scales) from calcareous concretions in the Koffiefontein sheet area (Zawada 1992) and allochthonous plant remains (drifted leaves, petrified wood). The latter become more abundant in the upper, more proximal (prodeltaic) facies of the Tierberg (*e.g.* Wickens 1984). Prinsloo (1989) records numerous plant impressions and unspecified "fragmentary vertebrate fossils" within fine-grained sandstones in the Britstown sheet area. Dark carbonaceous Ecca mudrocks are likely to contain palynomorphs (*e.g.* pollens, spores, acritarchs). The commonest fossils by far in the Tierberg Formation are sparse to locally concentrated assemblages of trace fossils of the non-marine *Mermia* Ichnofacies that are often found in association with thin event beds (*e.g.* distal turbidites, prodeltaic sandstones) within more heterolithic successions. A modest range of ten or so different ichnogenera have been recorded from the Tierberg Formation (Almond 2008a and refs. therein). These are mainly bedding parallel, epichnial and hypichnial traces, some preserved as undertracks. Penetrative, steep to subvertical burrows are rare, perhaps because the bottom sediments immediately beneath the sediment / water interface were anoxic. Most Tierberg ichnoassemblages display a low diversity and low to moderate density of traces.

Neogene to Recent **alluvial deposits** may contain fossil remains of various types. In coarser sediments (*e.g.* conglomerates, alluvial gravels) these tend to be very sparse and largely confined to robust, highly disarticulated and abraded rolled bones and teeth of vertebrates. Well-preserved skeletal remains of plants and invertebrate animals as well various trace fossils may occasionally be found within fine-grained alluvium and overlying soils, but are usually rare. Late Caenozoic fossil biotas from superficial deposits include non-marine molluscs (freshwater bivalves, gastropods, crustaceans), ostrich egg shells, trace fossils (*e.g.* calcretised termitaria, coprolites, rhizoliths or root casts), and plant remains such as wood, carbonized roots, peats or palynomorphs (pollens) in organic-rich alluvial horizons. Human artefacts such as stone tools that can be assigned to a specific interval of the archaeological time scale (*e.g.* Middle Stone Age) can be of value for constraining the age of Pleistocene to Recent drift deposits like alluvial terraces. Ancient alluvial "High Level Gravels" tend to be coarse and to have suffered extensive reworking (*e.g.* winnowing and erosional downwasting), so they are generally unlikely to contain useful fossils.

Apart from low-diversity trace fossil assemblages, no significant fossil remains have been recorded from the Collingham and Tierberg Formations of the Scherpenheuwel region, to the author's knowledge (Almond 2012). It is noted that the substantial Scherpenheuwel Quarry excavated into pale grey, weathered mudrocks of the Whitehill Formation that is situated just outside and southeast of the project area (arrowed in Fig. 2) has yielded important fossil material of Early Permian

mesosaurid reptiles, pygocephalomorph crustaceans, palaeoniscoid fish, trace fossils and insects (*e.g.* Geertsema *et al.* 2002) in recent years while arthropod walking traces have been observed within the Prince Albert Formation mudrocks just south of the Eilandia road (Almond, pers. obs.). To the author's knowledge, there are no records of Caenozoic fossil remains within the alluvial sands and gravels or other superficial sediments of the Breede River drainage system near Worcester.

5. CONCLUSIONS & RECOMMENDATIONS

Potential palaeontological heritage impacts of the proposed agricultural developments on Farm Scherpe Heuwel 481/12 near Worcester, Western Cape are anticipated to LOW. This is because:

- The development footprint is small (< 20 ha);
- Deep, voluminous excavations are not anticipated, so major disturbance of fresh (unweathered) bedrocks is unlikely;
- The Ecca Group bedrocks in this region are not known to be highly fossiliferous, apart from the Whitehill Formation which will not be directly impacted here (*N.B.* The Scherpenheuwel quarry just *outside* the project area is a well-known Whitehill fossil site);
- Older alluvial sediments of the Breede River are not mapped in this area.

There are therefore no objections on palaeontological heritage grounds to authorisation of the project, and no specialist palaeontological monitoring or mitigation measures are proposed here, pending the potential discovery of new fossil finds during the construction phase. In the case of any significant new fossil finds (*e.g.* concentrations of well-preserved fossil bones, teeth, shells, trace fossils or plant material such as petrified wood) exposed during land clearance or dam rehabilitation, 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 (A tabulated Chance Fossil Finds Procedure is attached to this report).

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7. 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, KwaZulu-Natal, Northwest, Limpopo and Gauteng under the aegis of his Cape Town-based company *Natura Viva* cc. He is 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.

<table>
<tr><td colspan="3">CHANCE FOSSIL FINDS PROCEDURE: Agricultural developments on Farm Scherpe Heuvel 481/12 near Worcester</td></tr>
<tr><td>Province & region:</td><td colspan="2">Western Cape, Cape Winelands District Municipality</td></tr>
<tr><td>Responsible Heritage Resources Agency</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">Collingham and Tierberg Formations (Lower Ecca Group)</td></tr>
<tr><td>Potential fossils</td><td colspan="2">Trace fossil assemblages, petrified wood and other plant remains, possible small vertebrate remains (e.g. fish bones, teeth)</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 Agency 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 Agency 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 Agency and project palaeontologist (if any) who will advise on any necessary mitigation</td></tr>
<tr><td colspan="2">4. If required by Heritage Resources Agency, 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 Agency</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>