



DESKTOP PALAEOONTOLOGICAL IMPACT ASSESSMENT

**AfriSam (South Africa) (Pty) Ltd: Dudfield Cement Factory Photo-Voltaic plant
development on the farm Dudfield 35 IP in Ditsobotla Local Municipality near
Lichtenburg, North-West Province**

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EXECUTIVE SUMMARY

Bruce Rubidge was appointed by Shangoni Management Services (Pty) Ltd under instruction from AfriSam (South Africa) (Pty) Ltd: Dudfield Cement Factory to undertake a desktop Palaeontological Impact Assessment for the proposed photovoltaic (PV) solar plant adjacent to the existing cement factory for power supply to the cement factory. The proposed development will take place Portion 18 of the farm Dudfield 35 IP in the Ditsobotla Local Municipality near Lichtenburg in the North-West Province.

The entire study area is deeply underlain by rocks of the Precambrian Transvaal Supergroup and more superficially by Tertiary-Quaternary sediments. Dolomites of the Transvaal Supergroup are known to contain fossil stromatolites, and there is a slight, but unlikely, possibility that the unconsolidated Tertiary Quaternary sediments could contain fossils.

As the Precambrian Transvaal Supergroup rocks are overlain by thick Tertiary-Quaternary sediments and are not exposed in the study area no stromatolites are evident and it is highly unlikely that palaeontological heritage will be affected by the proposed PV development. The overlying Tertiary- Quaternary sediments are not consolidated and it is very unlikely that any fossils will be present.

This desktop study has indicated that no stromatolites are exposed, and if deep excavations are undertaken for the development it could expose fossil stromatolites and could create an opportunity for further study. It is thus recommended that if in the unlikely event that fossils are exposed in the Precambrian Transvaal Supergroup rocks or Quaternary sediments during the proposed development, a qualified palaeontologist must be contacted to assess the exposure for fossils so that the necessary rescue operations are implemented.

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Introduction and Brief

A Palaeontological Impact Assessment was requested by Lesley Keay of Shangoni Management Services (Pty) Ltd under instruction from AfriSam (South Africa) (Pty) Ltd: Dudfield Cement Factory to undertake a desktop Palaeontological Impact Assessment for the proposed photovoltaic (PV) solar plant adjacent to the existing mine and cement factory development on Portion 18 of the farm Dudfield 35 IP in the Ditsobotla Local Municipality near Lichtenburg in North-West Province (Figure 1&2). The proposed development comprises a total area of about 35 hectares.

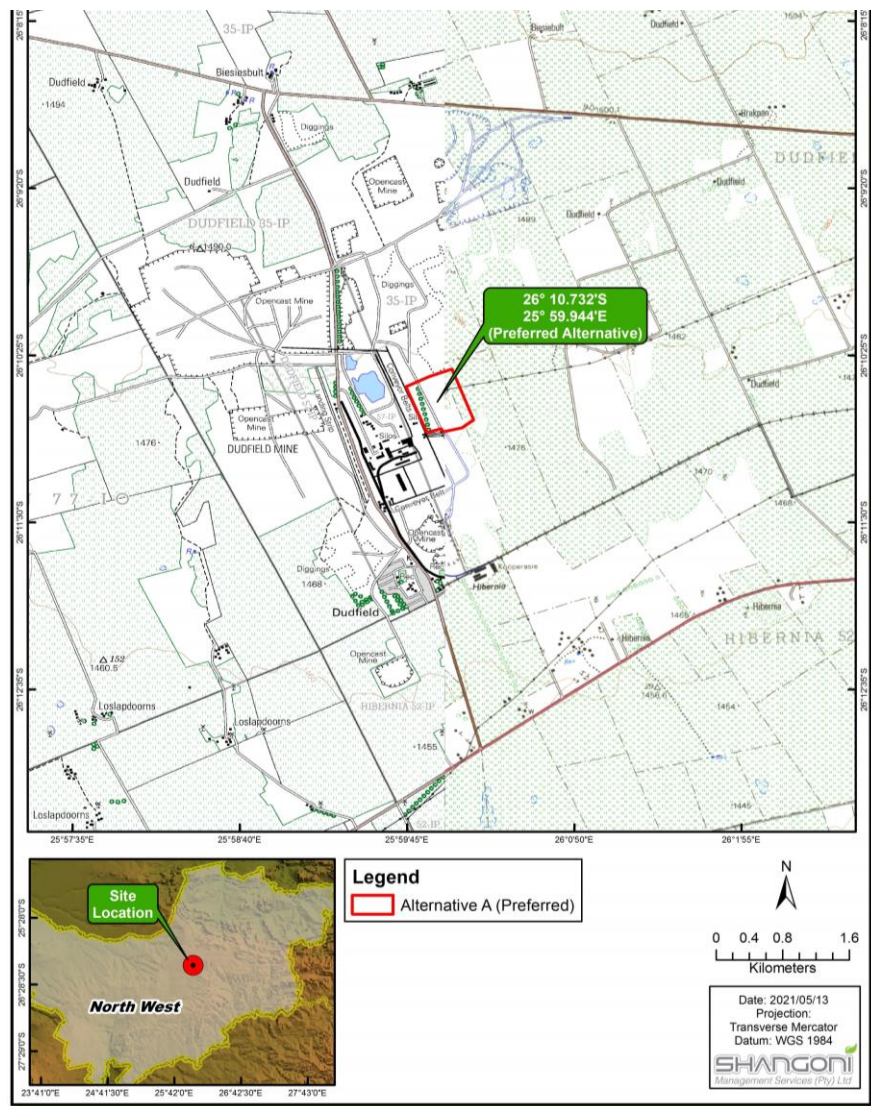


Figure 1. 1:10 000 topographic map (2723AD) showing the site (red outline) for the proposed PV plant on Portion 18 of the farm Dudfield 35 IP in the Ditsobotla Local Municipality near Lichtenburg in the North-West Province.

Legislative framework

The Department of Forestry Fisheries and Environmental Affairs (DFFE) through the National Environmental Management Act (NEMA Act 107 of 1998) requires that developers apply to the

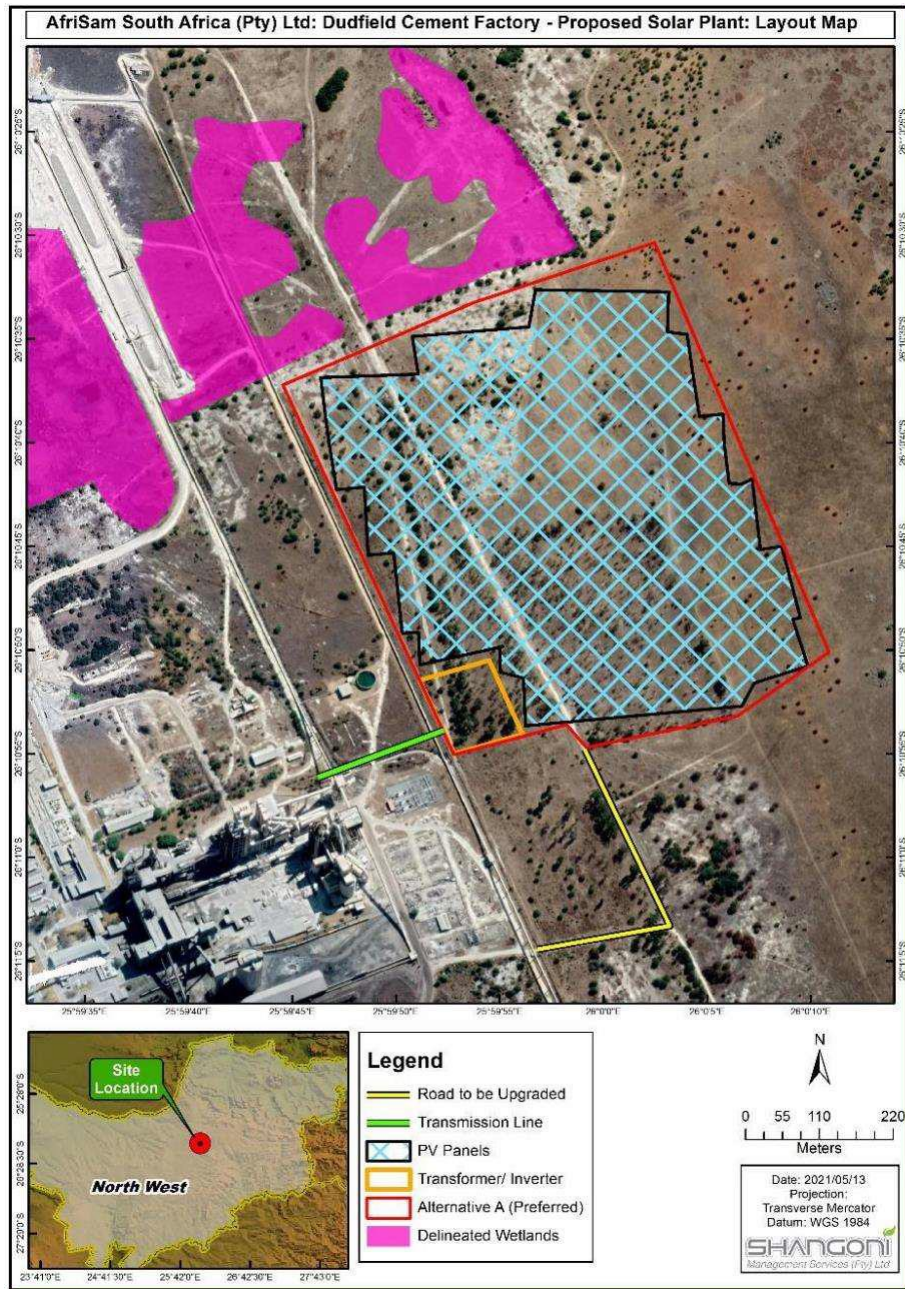


Figure 2. Google Earth image of the study area (outlined in x-hatched blue) on a Portion 18 of the farm Dudfield 35 IP in the Ditsobotla Local Municipality near Lichtenburg in the North-West Province.

competent authority for approval of the proposed development as more than 1 hectare of indigenous vegetation is to be removed (Listing Notice 1 of the EIA regulations).

National Heritage is protected by the South African Heritage Resources Act (Act No 25 of 1999). Developers are required to submit development plans to SAHRA for approval. These plans must include documentation detailing the expected impact that the development will have on national heritage.

Categories of heritage resources recognised as part of the National Estate in Section 3 of the Heritage Resources Act include:

- Geological sites of scientific or cultural significance
- Objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects, material, meteorites and rare geological specimens.
- Objects with the potential to contribute to understanding South Africa's natural or cultural heritage.

Accordingly, a Heritage Impact Assessment (HIA) is required to assess the possible impacts of a proposed development on archaeological and palaeontological heritage. This report addresses the palaeontological aspects of the HIA as part of the Environmental Management Plan (EMP).

Details of the study area

The study area for the proposed PV plant is located on Portion 18 of the Fram Dudfield 35IP in the Ditsobotla Local Municipality near Lichtenburg in North-West Province (Figure 1) The topography of the study area is flat with no rocky outcrops and is covered with grassland vegetation.

The main infrastructure expansion is associated with the layout of a new photovoltaic plant.

Geological Setting

Referral to the geological map (1986 sheet 2626 *West-Rand*; 1:250 000 series) indicates that the entire area is deeply underlain by rocks of the Transvaal Supergroup comprising the Black Reef Quartzite formation, to the south, overlain by the Malmani Subgroup, comprising chert free and chert rich dolomites of the Oaktree, Monte Christo and Lyttelton formations. These Precambrian rocks are overlain by thick unconsolidated Tertiary -Quaternary alluvial sediments. These comprise calcrete, gravel, alluvium, chert rubble, clay and red soils.

Palaeontological Heritage

The dolomites and carbonite rocks of the Malmani Subgroup which are covered by Tertiary and Quaternary sediments, and are thus not exposed in the study area, could potentially host fossil of stromatolites. The overlying Tertiary to Quaternary sediments, which are also of sedimentary origin, could also potentially host much younger fossils but this is unlikely.

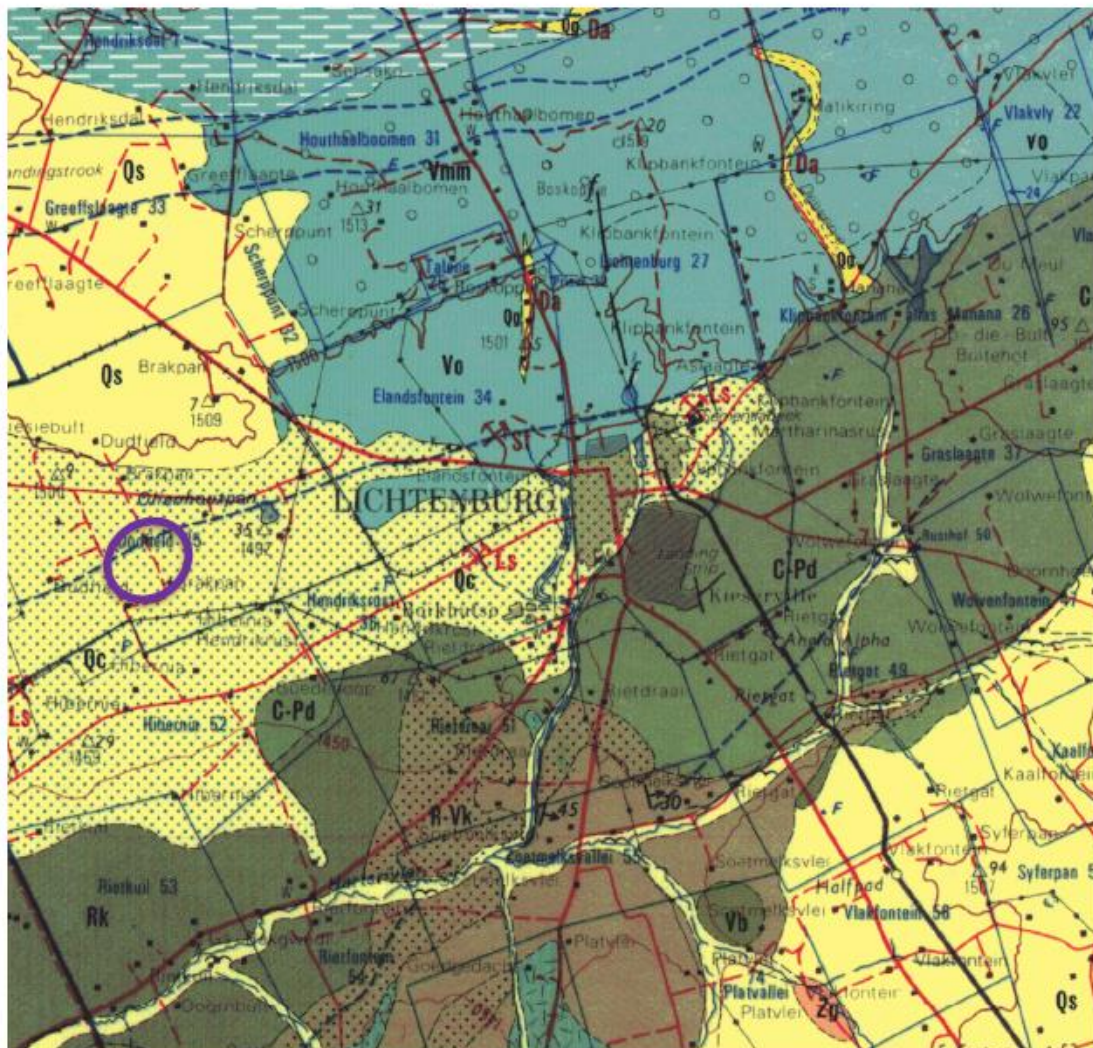


Figure 3: 1: 250 000 scale geological map (2626 West-Rand) showing the position of the proposed PV (purple ovoid) on a Portion 18 of the farm Dudfield 35 IP in the Ditsobotla Local Municipality near Lichtenburg in relation to the regional geology. Vgd – Malmani Subgroup (blue); Cpd Dwyka Group (grey); Qc-Qs – Tertiary - Quaternary alluvial deposits (yellow).

Collections of stromatolites from the Transvaal Supergroup are present in the collections of the Evolutionary Studies Institute (ESI), formerly BPI Palaeontology, at the University of the Witwatersrand, and the Council for Geoscience in Pretoria.

Methodology

The study area is underlain by Precambrian rocks of the Transvaal Supergroup which is considered of high palaeontological sensitivity because of the possibility of finding fossil stromatolites. However, because these Precambrian rocks are overlain by thick unconsolidated Tertiary and Quaternary sediments in the study area and are not exposed (Figure 4), a desktop Palaeontological Impact Assessment was undertaken to identify possible sensitive fossil occurrences, assess the significance of possible fossil occurrences, comment on the impact of the proposed development on palaeontological heritage, and to make mitigating recommendations. The thick covering of Tertiary to Quaternary sediment over the entire study area covering the rocks of the Transvaal Supergroup means that a field study will not yield anything of palaeontological significance. The proposed area for the PV plant was also previously mined, which means that the ground is already disturbed and reduces the chances of finding fossilized material.



Figure 4: Photographs of the study area to show the grassland vegetation on the Tertiary-Quaternary sediments

Recommendations

From the documentation supplied regarding the development it is extremely unlikely that the proposed development will have any affect on palaeontological heritage. The underlying Precambrian rocks of the Malmani Subgroup are not exposed in the study area and it is unlikely that fossils will be preserved in the overlying Tertiary to Quaternary alluvial deposits.

It is thus recommended that, in the unlikely event that fossils are exposed as a result of construction activities, a qualified palaeontologist must be contacted to assess the

exposure for fossils before further development takes place so that the necessary rescue operations are implemented. Depending on the nature of the fossils discovered this could entail excavation and removal of fossils to a registered palaeontological museum collection. A list of professional palaeontologists is available from South African Heritage Resources Agency (SAHRA).

Conclusion

The proposed photovoltaic (PV) solar plant development adjacent to the existing AfriSam (South Africa) (Pty) Ltd mine and cement factory near Lichtenburg in the North-West Province is underlain by Precambrian aged rocks of the Malmani Subgroup Group which in turn is overlain by unconsolidated Tertiary-Quaternary aged alluvial deposits. It is extremely unlikely that fossils will be exposed as a result of the development.

From a palaeontological perspective, the proposed PV plant development should proceed but, if fossils are uncovered in the course of construction activities, the developer must immediately call in a qualified palaeontologist to assess the situation and, if necessary, undertake excavation of the fossils (see Appendix A).

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APPENDIX A – CHANCE FIND PROTOCOL (CFP)

It is noted that following the findings of this desktop Palaeontological Impact Assessment it is unlikely that fossils will be recovered as a result of the proposed photovoltaic (PV) solar plant development. The following procedure is required if fossils are exposed by excavations.

1. If fossils are exposed by excavation in the Tertiary – Quaternary sedimentary deposits or in the dolomites of the underlying Transvaal Supergroup they must be inspected by the environmental officer or designated person.
2. If fossils are noted in the unconsolidated Tertiary - Quaternary sediments (includes bones, insects or plants) a suitably qualified palaeontologist must be approached for a verdict.
3. Fossil material displaced by excavation should be placed in a protected area, in this way development activities will not be held up.
4. Appropriate photographs of the fossils which have been noted should be sent to a qualified palaeontologist for a verdict on how to proceed. This may require a site inspection and excavation by the palaeontologist.
5. Fossils that are deemed to be of good quality or of scientific importance by the palaeontologist must be removed and curated in a recognised palaeontological museum collection where they can be made available for further study.
6. Before fossils are removed from the site a collecting permit must be obtained from SAHRA, and the required permitting procedures and requirements must be followed.
7. If the fossil material is deemed by the registered palaeontologist (as a result of photographic evidence or a site visit) to not be worthy of excavation and curation in a museum collection, the material will not be removed.
8. Mitigation will involve an attempt to capture all rare fossils and systematic collection of all fossils discovered by a registered palaeontologist. This will require routine collecting protocols involving descriptive, diagrammatic and photographic recording of fossils and exposures. The fossils and appropriate contextual samples will be processed to create an archive collection.
9. Should a major *in situ* occurrence be exposed, excavation will immediately cease in that area so that the discovery is not disturbed or altered in any way until the appointed palaeontologist has investigated the find.
10. Should no fossils be discovered in the process of development and excavations have been completed, no further monitoring will be required.
11. Any site visits by a registered palaeontologist and/or excavation of fossil material required, will be undertaken at the cost of the developer.

Table 1: Determination of potential impacts.

Environmental Component	Activity	Impact Description	Reversibility	Irreplicable loss	Phase	Pre-mitigation			Mitigation type	Post- Mitigations		
						Probability	Magnitude	Significance		Probability	Magnitude	Significance
Palaeontology	The construction of a PV plant	During the Impact Assessment, it was found that the Precambrian rocks that may possibly contain fossil stromatolites are overlain by thick unconsolidated Tertiary and quaternary sediments and are not exposed, which indicated that a field study will not yield anything of palaeontological significance	Not reversible	No	Construction	1	1	L	Avoid / Manage	1	1	L

Table 2: Measures to rehabilitate the environment affected by the proposed project

Aspect affected	Activity	Potential Impact	Phase	Mitigation type	Impact management actions / Mitigation measures	Impact management outcome	Standard to be achieved	Time period for implementation
Palaeontology	The construction of a PV plant	During the desktop Palaeontological Impact Assessment, it was found that the Precambrian rocks that may possibly contain fossil stromatolites are overlain by thick unconsolidated Tertiary and quaternary sediments and are not exposed, which indicated that a field study will not yield anything of palaeontological significance	Construction	Avoid / Manage	<p>If fossils are exposed by excavation in the Tertiary – Quaternary sedimentary deposits or in the dolomites of the underlying Transvaal Supergroup they must be inspected by the environmental officer or designated person.</p> <p>If fossils are discovered a registered palaeontologist must be contacted to capture and systematically document the finding. This will require routine collecting protocols involving descriptive, diagrammatic, and photographic recording of fossils and exposures. The fossils and appropriate contextual samples will be processed to create an archive collection.</p> <p>Should a major in situ occurrence be exposed, excavation will immediately cease in that area so that the discovery is not disturbed or altered in any way until the appointed palaeontologist has investigated the find.</p>	L	<p>Following SAHRA legislation.</p> <p>Fossils discovered need to be removed and protected by a Palaeontologist and curated in a palaeontology collection in a South African museum.</p>	Construction