

PALAEONTOLOGICAL HERITAGE ASSESSMENT: DESKTOP REPORT**Proposed Mier Rietfontein Solar PV and Battery Storage Project
near Rietfontein, ZF Mgcawu District Municipality, Northern Cape
Province**

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EXECUTIVE SUMMARY

Eskom Holdings SOC Ltd (“Eskom”) is proposing to develop the Mier Rietfontein Solar PV and Battery Storage Project, situated near Rietfontein in the ZF Mgcawu District Municipality (Dawid Kruiper Local Municipality), Northern Cape Province. The project will occupy a site approximately 10 hectares in area and will comprise 12 PV blocks with a total installed capacity of 2.04 MW as well as 11 independent battery storage systems (BESS) with a total installed capacity of 1.54 MW. It will be connected by underground cables to the Mier switching station, and above ground cables connecting to the Rietfontein 33KV feeder. In addition, a proposed telecommunications tower to the proposed BESS is required, to ensure communication to the project. The telecommunications tower will be positioned close to the village of Mier. The footprint area for the mast is only 15 x 15m², which will also contain a small equipment room.

The solar energy facility project area is underlain at depth by Permo-Carboniferous glacial deposits of the Dwyka Group (Karoo Supergroup). However, the Palaeozoic bedrocks here are entirely mantled by Neogene (Late Tertiary) to Holocene superficial sediments such as polymict surface gravels downwasted from the underlying bedrocks as well as reworked alluvial gravels and sandy soils, all of which are of very low palaeosensitivity.

Potential impacts on local palaeontological heritage during the construction phase are assessed as being of Low (Negative) significance without mitigation. They would remain of Low (Negative) significance following potential mitigation triggered by the Chance Fossil Finds Procedure which is to be implemented by the environmental control officer (ECO) during the Construction Phase. The No-Go Option would probably have a neutral impact significance. No further significant impacts are anticipated in the Planning, Operational and Decommissioning Phases. There are no fatal flaws in the proposed renewable energy project from a palaeontological heritage viewpoint.

The ECO responsible for the construction phase of the project should be aware of the potential for important new fossil finds and the necessity to conserve them for possible professional mitigation. The ECO should monitor all site clearance and substantial excavations for fossil remains on an on-going basis during the construction phase (See Chance Fossil Finds Procedure outlined in Appendix 1). Recommended mitigation of chance fossil finds involves safeguarding of the fossils (preferably *in situ*) by the responsible ECO

and reporting of finds to SAHRA (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Phone: +27 (0)21 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za). Where appropriate, judicious sampling and recording of fossil material and associated geological data by a qualified palaeontologist, appointed by the developer, may be necessary, under a Fossil Collection Permit issued by the relevant heritage resources authority (*i.e.* SAHRA). Any fossil material collected should be curated within an approved repository (museum / university fossil collection) by a qualified palaeontologist.

There are no objections on palaeontological heritage grounds to authorization of the development, provided that the recommended mitigation measures (summarised in Table 2 and Appendix 1) are incorporated into the Environmental Management Plan report (EMPr) for this project and fully implemented.

Palaeontological heritage impact statement

Aspect	Potential impact/risk	Significance without mitigation	Significance with mitigation
Construction			
Palaeontological heritage	Disturbance, damage or destruction of legally-protected fossil heritage at or beneath the ground surface	Low (negative)	Low (negative)

Index to report coverage

Section	Requirements	Section addressed in report
1.(1)	A specialist report prepared in terms of these Regulations must contain	
(a)	Details of	
(i)	the specialist who prepared the report; and	Section 9
(ii)	the expertise of that specialist to compile a specialist report including a curriculum vitae	Section 9
(b)	a declaration that the specialist is independent in a form as may be specified by the competent authority	Section 9.1
(c)	an indication of the scope of, and the purpose for which, the report was prepared;	Section 1
(cA)	an indication of the quality and age of base data used for the specialist report;	Section 2.1
(cB)	a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Sections 3,4 & 5
(d)	the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	n/a
(e)	a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 2
(f)	details of an assessment of the specific identified sensitivity of the site related to the	Section 4

Section	Requirements	Section addressed in report
	proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	
(g)	an identification of any areas to be avoided, including buffers;	n/a
(h)	a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	n/a
(i)	a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 2.2
(j)	a description of the findings and potential implications of such findings on the impact of the proposed activity (including identified alternatives on the environment) or activities;	Section 5
(k)	any mitigation measures for inclusion in the EMPr;	Section 6
(l)	any conditions for inclusion in the environmental authorisation;	Section 6
(m)	any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 6
(n)	a reasoned opinion—	
(i)	(as to) whether the proposed activity, activities or portions thereof should be authorised;	Section 5 & Executive Summary
(iA)	regarding the acceptability of the proposed activity or activities; and	
(ii)	if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	
(o)	a description of any consultation process that was undertaken during the course of preparing the specialist report;	n/a
(p)	a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	
(q)	any other information requested by the competent authority.	n/a
2.	Where a government notice <i>gazetted</i> by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	n/a

1. PROJECT DESCRIPTION & BRIEF

Eskom Holdings SOC Ltd (“Eskom”) is proposing to develop the Mier Rietfontein Solar PV and Battery Storage Project on the western outskirts of the small town of Rietfontein, situated close to the RSA – Namibia border in the ZF Mgcawu District Municipality (Dawid Kruiper Local Municipality), Northern Cape Province (Figs. 1 & 2). The project will occupy a site with an area of approximately 10 hectares and will comprise 12 independent PV blocks with a total installed capacity of 2.04 MW as well as 11 independent battery storage systems (“BESS”) with a total installed capacity of 1.54 MW (Fig. 3.).

The installation of these PV blocks and BESS will be staggered according to the expected growth in electrical demand:

- Initial installation of 5 x 170 kW PV blocks and 4 x 140 kW BESS for the “electrification scenario”;
- Installation of an additional 3 x 170 kW PV blocks and 3 x 140 kW BESS for the “LPUs scenario”
- Installation of an additional 4 x PV blocks and 4 x 140 kW for the “unforeseen demand scenario”.

In addition to the PV blocks and BESS, the proposed Project will also include the following main infrastructure:

- 12 x 200 kW inverters to convert the direct current (“DC”) electricity from the PV modules to the alternative current (“AC”) electricity at grid frequency;
- 12 x LV/MV step-up transformers to step up the voltage from low voltage (“LV”) at the output of the inverter to the required medium voltage (“MV”) at the point of connection;
- Transmission Yard and underground AC cables to connect the proposed PV and BESS to the Mier switching station, and above ground cables connecting to the Rietfontein 33KV feeder.
- Admin Block, Control & Storeroom, Workshop & Storeroom, and parking area;
- Access road, service road, and internal roads (all gravel).

In addition, a proposed telecommunications tower to the proposed BESS is required, to ensure communication to the project. The tower will be positioned c. 34 km east of Rietfontein and close to the village of Groot Mier (Fig. 2). The footprint area for the mast is only

15 x 15 m, which will also contain a small equipment room.

A Basic Assessment (BA) Process for the proposed development is being conducted on behalf of the proponent by Golder Associates Africa (Pty) Ltd (Address: P.O. Box 6001 Halfway House, 1685 Building 1, Maxwell Office Park, Magwa Crescent West Waterfall City Midrand, 1685 South Africa). Since the site overlies potentially fossiliferous bedrocks, the present report has been commissioned as part of a broad-based Heritage Impact Assessment for the project 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).

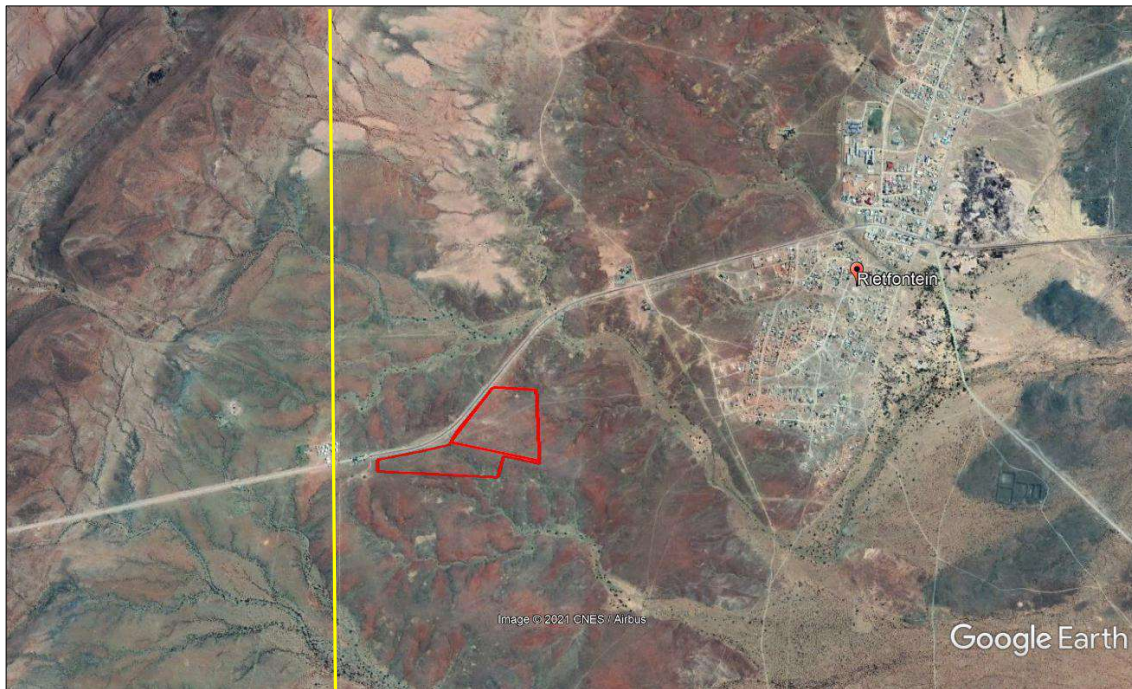


Figure 1: Google Earth© satellite image showing the location of the proposed Mier Rietfontein Solar PV and Battery Storage Project area (red polygon) on the western outskirts of Rietfontein, c. 500 m east of the RSA- Namibia border (yellow line), ZF Mgcawu District Municipality, Northern Cape Province. Note the low-relief, sparsely-vegetated, arid terrain within the project area (on the south-eastern side of the tar road between Rietfontein and the RSA-Namibia border).

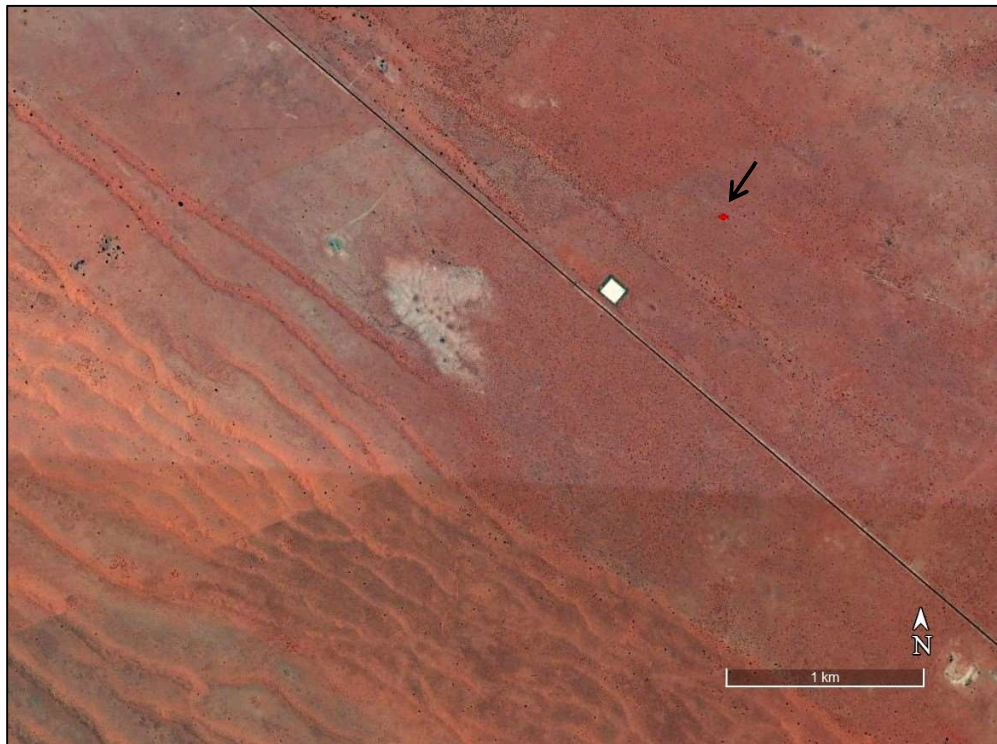


Figure 2: Google Earth© satellite image showing the proposed location (arrowed) of the proposed Groot Mier RS telecommunications tower in the Kalahari duneveld near Groot Mier Village and c. 34 km east of Rietfontein and 730 m NE of the R31 tar road.

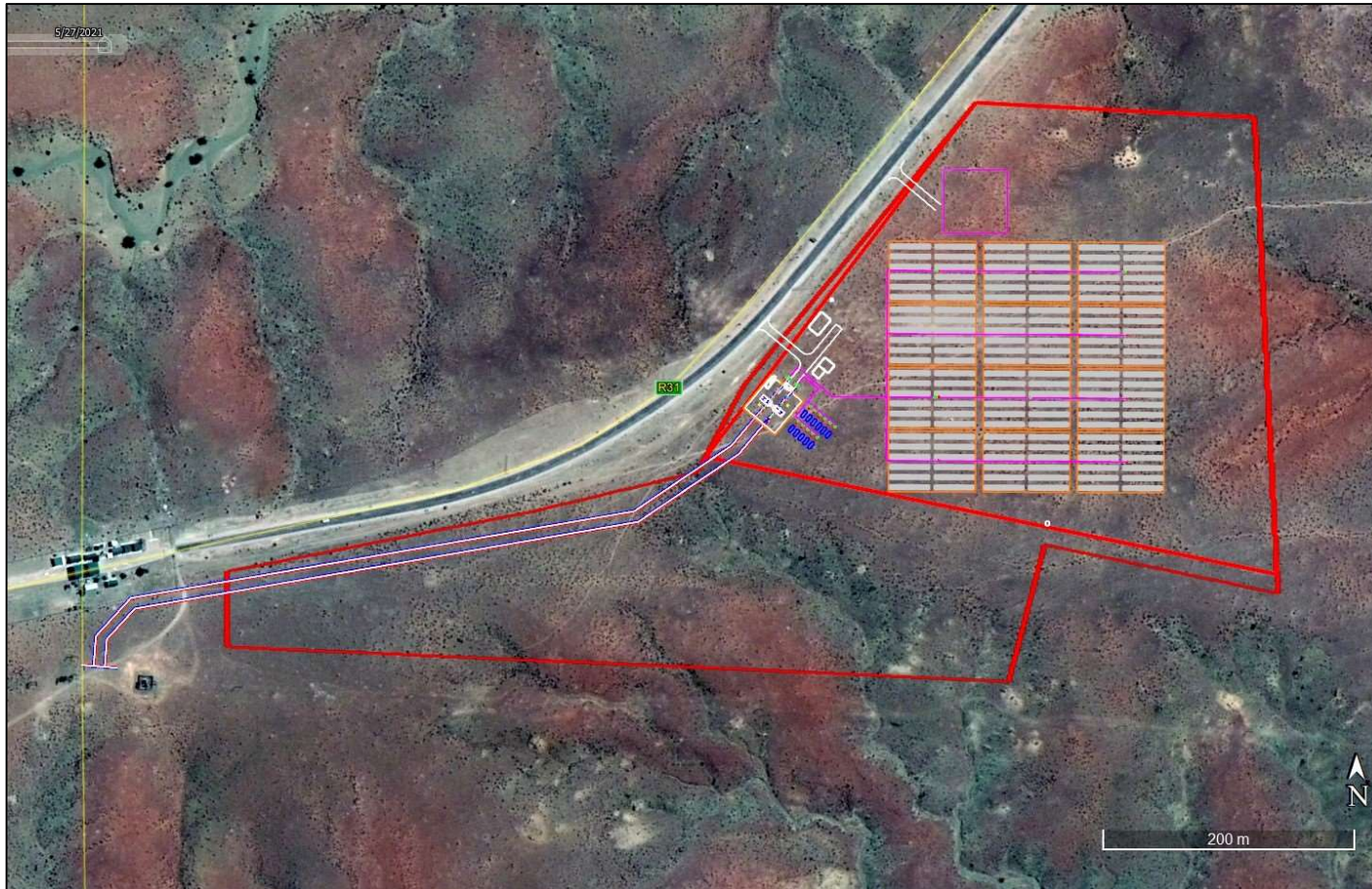


Figure 3: Preferred layout for the proposed Mier Rietfontein Solar PV and Battery Storage Project. The main infrastructure components shown here include: BESS containers (blue), access roads (white), PV panel blocks (orange, white), electrical servitude for 33 kV line (pink), contractors' yard (lilac) and distribution substation (yellow).

2. APPROACH TO THE PALAEOLOGICAL 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, 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. 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.* SAHRA for the Northern Cape (Contact details: SAHRA, 111 Harrington Street, Cape Town. P.O. Box 4637, Cape Town 8000, South Africa. Phone: +27 (0)21 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.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 palaeontological heritage study was based on the following:

1. A short project description, maps and kmz files provided by Golder Associates Africa as well as field photos kindly provided by Jonathan Kaplan of 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 broader study region (e.g. Almond 2015, 2017, 2019); and
3. The author's previous field experience with the formations concerned and their palaeontological heritage (cf Almond & Pether 2008).

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 in the Kalahari region of the Northern Cape exposure of potentially fossiliferous bedrocks is very limited due to the largely flat terrain with extensive sand / soil / gravel cover. However, a number of relevant field-based palaeontological studies have been carried out in the broader region by the author and others so confidence levels for this desktop level assessment are rated as medium.

2.3. Legislative context for palaeontological assessment studies

The proposed alternative energy 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 construction phase of the proposed development will entail substantial excavations into the superficial sediment cover and into the underlying bedrock as well. These may include, for example, surface clearance and excavations for the PV panel footings, internal and access roads, underground cables, powerline pylon footings, on-site electrical substation and BESS, auxiliary buildings and construction site camp. All these developments may adversely affect potential, legally-protected 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 operational and decommissioning phases of the renewable energy facility are unlikely to involve further adverse impacts on local palaeontological heritage, however.

- **National Heritage Resources Act**

The aim of the National Heritage Resources Act 25 of 1999 (“NHRA”) is promote good management of the national estate, and to enable and encourage communities to nurture and conserve their legacy so that it may be bequeathed to future generations.

The sections of the NHRA which are most relevant to this palaeontological heritage assessment are as follows:

Section 5 sets out the general principles for heritage resources management

Sections 34, 35, 36, and 37 provide for the general protection of structures (older than 60 years), archaeology, palaeontology and meteorites sites, burial grounds and graves, and public monuments and memorials

Section 38 sets out the requirements for notifying the responsible heritage resources

authority if a listed activity is to be undertaken

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 CONTEXT

The project area for the proposed Mier Rietfontein Solar PV and Battery Storage Project is situated in topographically subdued, arid terrain of the Kalahari Geomorphic Province (Partridge *et al.* 2010) of the Northern Cape. It lies at elevations of between c. 860 – 870 m amsl. and, based on satellite imagery as well as field photos kindly supplied by ACRM, is extensively mantled in polymict surface gravels with sparse to dense, bushy and grassy vegetation (Figs. 1,2 & 4). Levels of bedrock exposure are very low to non-existent. Shallow drainage lines drain towards the Vetrivier and Hakskeen Pan in the east. The telecommunications tower will be located in Kalahari duneveld terrain at around 880 m amsl, due east of Hakskeen Pan (Fig. 2).



Figure 4: Field photo showing flat-lying terrain in the project area near Rietfontein with an extensive mantle of polymict surface gravels derived by downwasting of underlying Dwyka Group bedrocks. Bedrock exposure levels here are very low to non-existent (Image courtesy of Jonathan Kaplan, ACRM).

The geology of the Rietfontein region is shown on 1: 250 000 geology sheet 2620 Twee Rivieren (Council for Geoscience, Pretoria; Thomas *et al.* 1988) (Fig. 5). It is located within an extensive, broadly oval (W-E) patch of bedrock exposure spanning the RSA / Namibia border and surrounded by Kalahari dune sands. The bedrocks here belong to the Karoo Supergroup succession on the southern margins of the Kalahari - Aranos Basin (*not* the Main Karoo Basin) with representatives of the Permo-Carboniferous, glacially influenced Dwyka Group as well as overlying Early Permian post-glacial mudrocks of the Eccia Group. North of Rietfontein the Karoo beds unconformably overlie reddish-brown Early Cambrian

sandstones of the Fish River Subgroup (Nama Group). According to the geological map, the small solar PV and battery storage project area overlies Dwyka Group sediments but these are apparently not well-exposed at surface here (J. Kaplan pers. comm., 2021). Instead, the ground surface is extensively mantled by poorly-sorted, desert-varnished, polymict gravels derived by downwasting from the underlying Dwyka Group tillites (Fig. 4). These time-composite Late Caenozoic gravels may be provisionally assigned to the **Obogorogop Formation** of the Kalahari Group (Partridge *et al.* 2006). No substantial alluvial deposits are associated with the shallow drainage lines within the area.

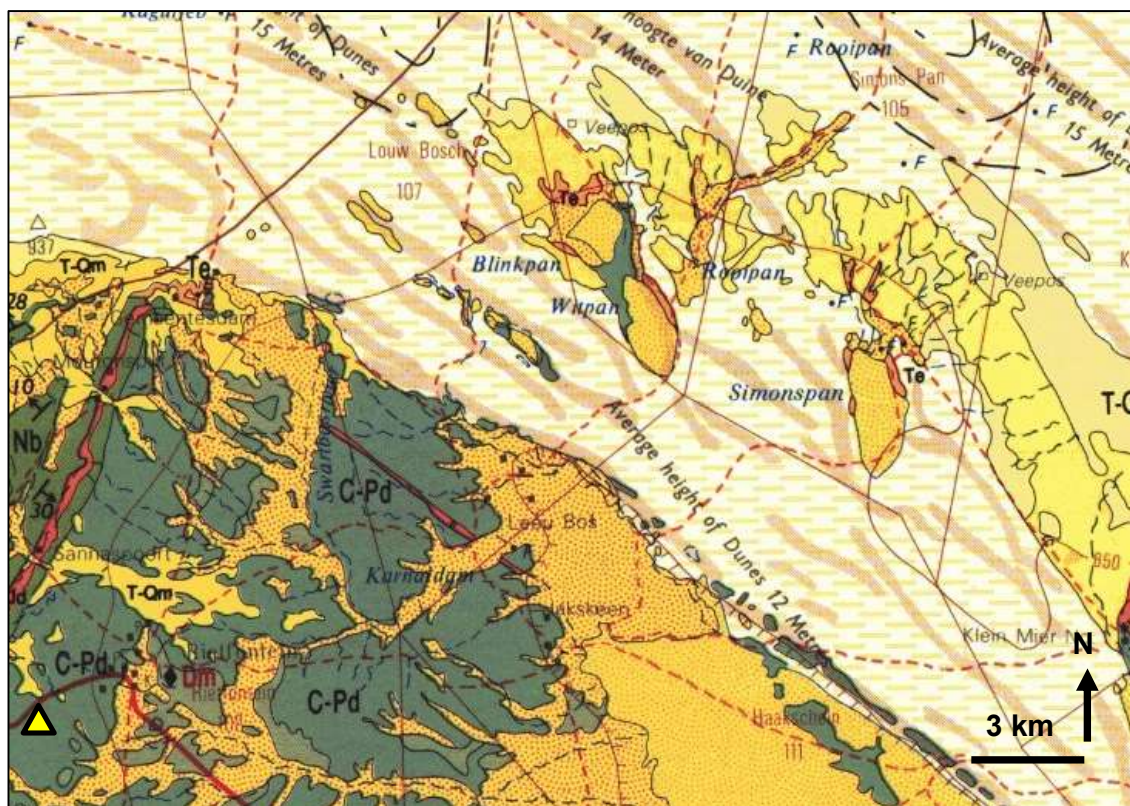


Figure 5: Extract from the 1: 250 000 geology map 2620 Twee Rivieren (Council for Geoscience, Pretoria) showing the location of the proposed Mier Rietfontein Solar PV and Battery Storage Project area on the western outskirts of Rietfontein, Northern Cape Province (yellow triangle). The area is underlain by dark surface gravels mantling glacial bedrocks of the Dwyka Group (Karoo Supergroup) (C-Pd, dark grey). The surface gravels are assigned to the Obogorogop Formation of the Kalahari Group.

4. PALAEOONTOLOGICAL HERITAGE

The generally poor fossil record of the **Dwyka Group** (McLachlan & Anderson 1973, Anderson & McLachlan 1976, Visser 1989, Visser *et al.*, 1990, Von Brunn & Visser 1999, Visser 2003, Almond & Pether 2008) is hardly surprising given the glacial climates that prevailed during much of the Late Carboniferous to Permian Periods in southern Africa. However, most Dwyka sediments were deposited during periods of glacial retreat associated with climatic amelioration. Sparse, low diversity fossil biotas from the **Mbizane Formation** in particular mainly consist of arthropod trackways associated with interglacial to post-glacial

dropstone laminites and sporadic vascular plant remains (drifted wood and leaves of the *Glossopteris* Flora), while palynomorphs (organic-walled microfossils) are also likely to be present within finer-grained mudrock facies. Glacial diamictites (tillites or “boulder mudstones”) are normally unfossiliferous but do occasionally contain fossiliferous carbonate erratics (*cf* Cooper & Oosthuizen 1974), fragmentary transported plant material as well as palynomorphs in the fine-grained matrix. Thomas *et al.* (1988, p. 4; after Meyer 1953) report *Glossopteris* leaf impressions within flaggy sandstones on the north-western side of Hakskeen Pan. Such rocks might also contain petrified wood (*cf* Bangert & Bamford 2001, Bamford 2004) which may then be weathered out and concentrated in surface gravels.

During a recent site visit to Hakskeen Pan near Rietfontein by Almond (2019) no fossil plants, including leaves or petrified wood, were observed within the Dwyka Group exposures or reworked into the associated surface gravels. The only fossils recorded within the Dwyka Group here are low-diversity trace fossil assemblages including “segmented” epichnial grooves on wave-rippled sandstone bed tops (possibly of molluscan origin) and small-arthropod burrows on thin sandstone sole surfaces (*ibid.*). The latter include small-scale rusophycids and cruzianaeform burrows of possible crustacean origin (“*Isopodichnus*” as well as possible *Cruziana carbonaria*) that might be attributable to the *Scoyenia* Ichnofacies (*cf* Buatois & Mangano 2011).

Fossil remains have not been recorded from the Late Caenozoic coarse, downwasted gravels of the **Obogorogop Formation** (Kalahari Group) that are largely derived from erosion of Dwyka Group bedrocks or from the associated thin gravely alluvium of similar provenance. Elsewhere in the Northern Cape occasional erratic (ice-transported) boulders of Precambrian carbonate rocks (limestone / dolomite) with well-preserved stromatolites (fossil microbial mounds) have occasionally been recorded with Obogorogop surface gravels (J. Almond., pers. obs.). The Kalahari dune sands of the **Gordonia Formation** are generally of low palaeosensitivity.

It is concluded that the palaeosensitivity of the Mier Rietfontein Solar PV and Battery Storage Project area is VERY LOW.

5. EVALUATION OF IMPACTS ON PALAEOLOGICAL HERITAGE

The Mier Rietfontein Solar PV and Battery Storage Project project area is located in a region that is underlain by potentially fossiliferous sedimentary rocks of Palaeozoic and younger, Neogene to Holocene age (Sections 3 & 4 herein). Existing impacts to palaeontological heritage within the project area are likely to be minimal, largely comprising very occasional damage to fossils exposed at the ground surface through agricultural or vehicle activities or other human disturbance. These on-going impacts are offset by the slow exposure of fresh fossil material through bedrock weathering.

The construction phase of the proposed renewable energy facility will entail substantial excavations into the superficial sediment cover and perhaps locally into the underlying bedrock as well. These include, for example, surface clearance and excavations for the PV panel footings, laydown areas, internal and access roads, underground cables, powerline pylon footings, on-site electrical substation and battery storage facility. All these activities may adversely affect potential legally-protected, scientifically-valuable fossil heritage within the project footprint as a result of excavations and surface disturbance (*e.g.* surface clearing and vehicle activity) during the construction phase by destroying, disturbing or permanently

sealing-in fossils preserved at or beneath the surface of the ground that are then no longer available for scientific research or other public good.

The inferred impact of the proposed expansion of the Mier Rietfontein Solar PV and Battery Storage Project on legally-protected, local fossil heritage resources of scientific or broader conservation value is briefly evaluated here in Table 1. This assessment applies only to the *construction phase* of the development since further significant impacts on fossil heritage during the planning, operational and decommissioning phases of the facility are not anticipated. Confidence levels in this assessment are *High*, given (1) very low levels of bedrock exposure within the project area and (2) the availability of relevant recent palaeontological field data from the Rietfontein area (Almond 2019).

As motivated in Table 1, the impact significance of the proposed development in terms of palaeontological heritage is assessed as *Negative Low* without mitigation. Should the recommended mitigation measures for the construction phase of the renewable energy facility development, as outlined in Section 6 (*viz.* Chance Fossil Finds Procedure), be consistently followed-though, the impact significance would remain *Negative Low* but would entail both positive and negative impacts. Residual negative impacts from possible loss of *some* valuable fossil heritage would be partially offset by an improved palaeontological database for the study region as a direct result of appropriate mitigation. The latter is a *positive* outcome because any new, well-recorded and suitably-curated fossil material would constitute a useful addition to our scientific understanding of the fossil heritage of the Mier region. The No-Go option would probably have a neutral impact significance; protection of local fossils from damage or destruction would be partially offset by natural surface weathering processes as well as lost opportunities to improve the palaeontological database through professional mitigation of chance fossil finds.

There are no fatal flaws in the proposed renewable energy project from a palaeontological heritage viewpoint and no objects to authorisation of the development, provided that the recommended mitigation measures are fully implemented.

5.1. Cumulative impact assessment

Based on the SAHRIS website, there are no renewable energy projects within a radius of 30 km of the proposed project near Rietfontein.

In the author's opinion:

- Palaeontological impact significances inferred for renewable energy projects, where these are assessed at all, may well to some extent reflect different assessment approaches rather than contrasting palaeontological sensitivities and impact levels;
- Meaningful cumulative impact assessments require comprehensive data on *all* major developments within a region, not just those involving renewable energy, as well as an understanding of the extent to which recommended mitigation measures are followed through;
- Trying to assess cumulative impacts on different fossil assemblages from different stratigraphic units (for example, Precambrian stromatolites from 2.6 billion years ago

versus Late Caenozoic alluvial and calcrete sediments less than 2.5 million years old) has limited value.

6. RECOMMENDATIONS FOR MONITORING AND MITIGATION

The Mier Rietfontein Solar PV and Battery Storage Project area has been assigned here a VERY LOW palaeosensitivity (Section 4). No palaeontological High Sensitivity or No-Go areas or other fossil sites requiring specialist mitigation have been identified within the project area. Given the LOW impact significance of the development (with and without mitigation), no further specialist palaeontological studies or mitigation for this project, pending the potential discovery of new fossil heritage within the project area before or during the construction phase. No further significant impacts or mitigation requirements are anticipated in subsequent phases of the development.

The ECO responsible for the construction phase of the renewable development should be aware of the potential for important fossil finds – such as boulders of stromatolitic limestone or dolomite - and the necessity to conserve them for possible professional mitigation. The ECO should monitor all substantial surface clearance operations and excavations into sedimentary rocks for fossil remains on an on-going basis during the construction phase. A Chance Fossil Finds Procedure for this development is outlined in Appendix 1.

Recommended mitigation of chance fossil finds during the construction phase of the renewable energy facility involves safeguarding of the fossils (preferably *in situ*) by the responsible ECO and reporting of finds to SAHRA (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Phone: +27 (0)21 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za). Where appropriate, judicious sampling and recording of fossil material and associated geological data by a qualified palaeontologist, appointed by the developer, may be required by the relevant heritage regulatory authorities. Any fossil material collected should be curated within an approved repository (museum / university fossil collection) by a qualified palaeontologist.

These recommendations should be included within the Environmental Management Programme for the proposed renewable energy project (See tabulated Chance Fossil Finds Procedure appended to this report).

7. ACKNOWLEDGEMENTS

Golder Associates Africa and ACRM are both thanked for commissioning this study and for providing the relevant background information. Additionally, I am very grateful to ACRM for providing useful field photos of the project area.

Table 1: Evaluation of anticipated impacts on local palaeontological heritage resources due to the proposed Mier Rietfontein Solar PV and Battery Storage Project (Construction Phase)

Aspect	Potential Impact	Impact Assessment Factors		Probability	Significance without mitigation	Impact Assessment Factors		Probability	Significance with mitigation
Construction phase									
Palaeontological heritage resources]	Disturbance, damage or destruction of legally-protected fossil heritage* within the development footprint during the construction phase	<i>Direction:</i>	Negative	Improbable	Low	<i>Direction:</i>	Negative	Improbable	Low
		<i>Magnitude:</i>	Minor			<i>Magnitude:</i>	Minor		
		<i>Duration:</i>	Permanent			<i>Duration:</i>	Permanent		
		<i>Scale:</i>	Site only			<i>Scale:</i>	Site only		
		<i>Reversibility:</i>	Irreversible			<i>Reversibility:</i>	Irreversible		

* *N.B.* Refers essentially to impacts on well-preserved and / or rare fossils of scientific and conservation value.

Table 2: Summary of palaeontological heritage monitoring and mitigation measures for the Mier Rietfontein Solar PV and Battery Storage Project (Construction Phase)

Category	Potential impact/risk	Description	Prescribed standards or practices	Mitigation type	Time period	Responsible person
Construction phase						
Palaeontological heritage	Disturbance, damage or destruction of legally-protected fossil heritage at or beneath the ground surface	Monitoring of all major site clearance and excavation work for fossil remains.	Best practice for palaeontological fieldwork.	Minimisation	On-going during construction phase	ECO
		Substantial well-preserved fossils (stromatolites, vertebrate bones, teeth <i>etc</i>) to be safeguarded, preferably <i>in situ</i> , and immediately reported to SAHRA.				ECO
		Fossil recording and sampling.			Following alert from ECO	Palaeontological specialist

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9. 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 **John E. Almond (2021)** *Natura Viva* cc

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).

9.1. 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

APPENDIX 1: CHANCE FOSSIL FINDS PROCEDURE: Mier Rietfontein Solar PV and Battery Storage Project near Rietfontein		
Province & region:	Northern Cape: ZF Mgcawu District Municipality	
Responsible Heritage Resources Agency	SAHRA, P.O. Box 4637, Cape Town 8000. Contact: Dr Ragna Redelstorff. Tel: 021 202 8651. Email: rredelstorff@sahra.org.za or Ms Natasha Higgitt. Tel: 021 462 4502. Email: nhiggitt@sahra.org.za	
Rock unit(s)	Dwyka Group (Karoo Supergroup). Neogene to Holocene alluvium, aeolian sands, downwasted surface gravels, calcrete hardpans	
Potential fossils	Stromatolitic carbonate erratics within or eroding out of Dwyka tillites. Vertebrate bones & teeth, vertebrate and other burrows (e.g. calcretised termitaria), land snails within superficial sediments.	
ECO protocol	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"> • 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) <i>in situ</i> with scale, from different angles, including images showing context (e.g. rock layering) 	
	3. If feasible to leave fossils <i>in situ</i> : <ul style="list-style-type: none"> • 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 	3. If <i>not</i> feasible to leave fossils <i>in situ</i> (emergency procedure only): <ul style="list-style-type: none"> • <i>Carefully</i> 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
	4. If required by Heritage Resources Agency, 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 Agency	
Specialist palaeontologist	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 Agency. Adhere to best international practice for palaeontological fieldwork and Heritage Resources Agency minimum standards.	

Curriculum Vitae

JOHN E. ALMOND Ph.D. (Cantab)

**Natura Viva cc, PO Box 12410 Mill Street, CAPE TOWN 8010, RSA
tel: (021) 462 3622 e-mail: naturaviva@universe.co.za**

- **Honours Degree in Natural Sciences (Zoology)**, University of Cambridge, UK (1980).
- **PhD in Earth Sciences (Palaeontology)**, University of Cambridge, UK (1986).
- **Post-doctoral Research Fellowships** at University of Cambridge, UK and Tübingen University, Germany (Humboldt Research Fellow).
- **Visiting Scientist** at various research institutions in Europe, North America, South Africa and fieldwork experience in all these areas, as well as in North Africa.
- **Scientific Officer, Council for Geoscience, RSA** (1990-1998) – palaeontological research and fieldwork – especially in western RSA and Namibia.
- **Managing Member, Natura Viva cc** – a Cape Town-based company specialising in broad-based natural history education, tourism and research – especially in the Arid West of Southern Africa (2000 onwards). *Natura Viva cc* produces **technical reports** on palaeontology, geology, botany and other aspects of natural history for public and private nature reserves.
- **Current palaeontological research** focuses on fossil record of the Precambrian / Cambrian boundary (especially trace fossils), and the Cape Supergroup of South Africa.
- **Registered Field Guide for South Africa and Namibia**
- **Member of the A-team, Botanical Society of SA** (Kirstenbosch Branch) – involved in teaching and training leaders for botanical excursions. Invited leader of annual Botanical Society excursions (Kirstenbosch Branch) to Little Karoo, Cederberg, Namaqualand and other areas since 2005.
- **Professional training of Western and Eastern Cape Field Guides** (FGASA Level 1 & 2, in conjunction with *The Gloriosa Nature Company*) and of Tourist Guides in various aspects of natural history.
- Involved in **extra-mural teaching in natural history** since the early 1980s. Extensive experience in **public lecturing**, running **intensive courses** and leading **field excursions for professional academics as well as enthusiastic amateurs** (e.g. Geological Society / Archaeological Society / Friends of the SA Museum / Cape Natural History Club / Mineral Club / Botanical Society of South Africa / SA Museum Summer & Winter School Programmes / UCT Summer School)
- **Development of palaeontological teaching materials** (textbooks, teachers guides, palaeontological displays) and **teacher training** for the new school science curriculum (GET, FET).
- Former long-standing member of **Archaeology, Palaeontology and Meteorites Committee for Heritage Western Cape (HWC)**. Advisor on palaeontological conservation and management issues for the Palaeontological Society of South Africa (PSSA), HWC and SAHRA (including APM Permit Committee at HWC). Compilation of **technical reports on provincial palaeontological heritage of Western, Northern and Eastern Cape** for SAHRA and HWC. Accredited member of PSSA and APHP (Association of Professional Heritage Practitioners, Western Cape).
- **Palaeontological impact assessments for developments in the Western Cape, Eastern Cape, Northern Cape, Free State, Northwest Province, Mpumalanga, Gauteng, KwaZulu-Natal.**

- Several hundred **palaeontological heritage desktop studies and field assessments** completed over the past few years. Examples of recent larger projects include:
 - (1) Several major alternative energy projects (wind / solar) in the Prieska, De Aar, Sutherland, Loeriesfontein, Bedford / Cookhouse / Middleton / Somerset East, Kouga, Coega, East London, Uitenhage areas (N. Cape, E. Cape)
 - (2) Palaeontological heritage survey of the Coega IDZ (E. Cape)
 - (3) On-going survey of borrow pits in the Western Cape
 - (4) Palaeontological heritage assessments for the Transnet 16 mtpa railway development, Hotazel to Coega IDZ (N. Cape, E. Cape)
 - (5) Eskom transmission line developments such as Gamma-Omega and Gamma Perseus projects (N. Cape, W. Cape, Free State)
 - (6) Mining exploration studies on the Great Karoo
 - (7) Strategic Environmental Assessment Specialist Report – Heritage (palaeontological component) For National Wind and Solar PV, Shale Gas in the Karoo, Square Kilometre Array (Karoo), Aquaculture
- **Reviews of fossil heritage** related to new 1: 250 000 geological maps published by the Council for Geoscience (Geological Survey of SA) – e.g. Clanwilliam, Loeriesfontein, Alexander Bay sheets.



environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

File Reference Number:	(For official use only)
NEAS Reference Number:	DEA/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

Mier Rietfontein Solar PV and Battery Storage Project

Kindly note the following:

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at <https://www.environment.gov.za/documents/forms>.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

Departmental Details

Postal address:

Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

Physical address:

Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

1. SPECIALIST INFORMATION

Specialist Company Name:	NATURA VIVA CC			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	100
Specialist name:	Dr John Edward Almond			
Specialist Qualifications:	PhD (palaeontology)			
Professional affiliation/registration:	Palaeontological Society of Southern Africa, Association of Professional Heritage Practitioners (W Cape)			
Physical address:	76 Breda Park, Breda Street, Oranjezicht, CAPE TOWN			
Postal address:	PO Box 12410 Mill Street, Cape Town			
Postal code:	8010	Cell:	n/a	
Telephone:	021 462 3622	Fax:	n/a	
E-mail:	naturaviva@universe.co.za			

DECLARATION BY THE SPECIALIST

I, **Dr John Edward Almond**, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

John E Almond

Signature of the Specialist

NATURA VIVA CC

Name of Company:

15 August 2021

Date

2. UNDERTAKING UNDER OATH/ AFFIRMATION

I, Dr John Edward Almond, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

John E Almond

Signature of the Specialist

NATURA VIVA CC

Name of Company

15 RA
14 August 2021

Date

[Handwritten Signature]

Signature of the Commissioner of Oaths

2021-08-15

Date

