PALAEONTOLOGICAL HERITAGE REPORT: DESKTOP ASSESSMENT

PROPOSED IMPALA SOLAR POWER PLANT ON PORTION 4, PORTION OF 13, OF THE FARM KLONDIKE 670, NALEDI LOCAL MUNICIPALITY, NORTH WEST PROVINCE

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EXECUTIVE SUMMARY

Impala Solar Power Plant (RF) (Pty) Ltd is proposing to develop a photovoltaic solar facility and associated infrastructure, including a battery storage facility, on Portion 4 of the Farm Klondike 670, situated *c*. 5 km southwest of the town of Vryburg in Naledi Local Municipality, North West Province. The solar facility will have an installed capacity of up to 150 MW and a total footprint of approximately 260 hectares. Connection to the National Grid will probably be *via* a *c*. 0.2 km long 132 kV powerline to the Ganyesa – Mookodi 132 kV distribution line which ties in to the existing Mookodi Substation for which a 100 m-wide corridor is assessed here as part of the Basic Assessment Process for this development.

The solar plant and grid connection project areas are underlain near-surface or at depth by Precambrian quartzitic sediments of the Vryburg Formation (Transvaal Supergroup) and Permo-Carboniferous glacial deposits of the Dwyka Group (Karoo Supergroup). Stromatolitic carbonate bedrocks of the Transvaal Group are not mapped here. The flat-lying solar power plant project area is entirely mantled by Neogene (Late Tertiary) to Holocene superficial sediments including alluvial gravels, sandy soils and calcrete hardpans that are generally of low to very low palaeosensitivity. Older Vryburg Formation and Dwyka Group bedrocks crop out within sectors of the grid connection corridor but these units are also of low palaeosensitivity in the Vryburg region.

It is concluded that the palaeontological sensitivity of the project area - including the solar power plant, 132 kV grid connection corridor and all associated infrastructure – is Low to Very Low. Potential impacts during the construction phase are assessed as being of Negative Low significance without mitigation and Negative Low significance following potential mitigation triggered by the Chance Fossil Finds Procedure which is to be implemented by the ECO during the Construction Phase. The anticipated cumulative impact of the proposed or authorized solar power plant developments in the Vryburg region - including the proposed Impala Solar Power Plant - is assessed as Negative Medium (without mitigation), potentially falling to Negative Low (with full mitigation), given their comparatively small footprints compared with the extensive outcrop areas of the fossiliferous rock units concerned. The No-Go Option would probably have a neutral impact significance.

There are no fatal flaws in the proposed solar power plant project from a palaeontological heritage viewpoint. There are no objections to authorization of the development, provided

that the recommended mitigation measures (summarized in Tables 4 and 5) are incorporated into the EMPr for this project and fully implemented.

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 2). 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 (SAHRA). Any fossil material collected should be curated within an approved repository (museum / university fossil collection) by a qualified palaeontologist.

1. PROJECT DESCRIPTION & BRIEF

The company Impala Solar Power Plant (RF) (Pty) Ltd is proposing to develop a photovoltaic solar facility and associated infrastructure on Portion 4 of the Farm Klondike 670, situated *c*. 5 km southwest of the town of Vryburg in Naledi Local Municipality, North West Province (Figs. 1 & 2). The Impala Solar Power Plant will have an installed capacity of up to 150 MW and a total footprint of approximately 260 hectares (including supporting infrastructure on site). According to the Project Description Document prepared by Environamics Environmental Consultants (19 March 2021) the proposed renewable energy development will comprise the following key components:

- **PV Panel Array** - To produce up to 150MW, the proposed facility will require numerous linked cells placed behind a protective glass sheet to form a panel. Multiple panels will be required to form the solar PV arrays which will comprise the PV facility. The PV panels will be tilted at a northern angle in order to capture the most sun, or using one-axis tracker structures to follow the sun to increase the Yield.
- **Wiring to Inverters** - Sections of the PV array will be wired to inverters. The inverter is a pulse width mode inverter that converts direct current (DC) electricity to alternating current (AC) electricity at grid frequency.
- **Connection to the grid** - Connecting the array to the electrical grid requires transformation of the voltage from 480V to 33kV to 132kV. The normal components and dimensions of a distribution rated electrical substation will be required. Output voltage from the inverter is 480V and this is fed into step up transformers to 132kV. An onsite substation will be required on the site to step the voltage up to 132kV, after which the power will be evacuated into the national grid. Whilst Impala Solar Power Plant (RF) (Pty) Ltd. has not yet received a cost estimate letter from Eskom, it is expected that generation from the facility will tie in with the Mookodi MTS Substation. The Project will inject up to 100MW into the National Grid. The installed capacity will be approximately 150MW. There is one possible connection line route proposed to tie in with the Ganyesa-Mookodi 132kV powerline that connects to the Mookodi MTS

substation, located approximately 5 kilometres south-east of the site. This 100m-wide grid corridor is assessed here.

- **Electrical reticulation network_**– An internal electrical reticulation network will be required and will be laid ~2-4m underground, as far as practically possible.
- **Supporting Infrastructure** – The following auxiliary buildings with basic services including water and electricity will be required on site:
  - Office (~200m²);
  - Switch gear and relay room (~400m²);
  - Staff lockers and changing room (~200m²); and
  - Security control (~60m²)
- **Battery storage** – A Battery Storage Facility with a maximum height of 8m and a maximum volume of 1740m^3 of batteries and associated operational, safety and control infrastructure.
- **Roads** – Access will be obtained via a public gravel road off the N14 National Road. An internal site road network will also be required to provide access to the solar field and associated infrastructure. The access and internal roads will be constructed within a 25-meter corridor.
- **Fencing** - For health, safety and security reasons, the facility will be required to be fenced off from the surrounding farm. Fencing with a height of 2.5 meters will be used.

Further technical details for the project are outlined in Table 1 below (likewise abstracted from the Project Description Document prepared by Environamics Environmental Consultants).

According to the Environmental Screening Report prepared for the proposed solar facility by Environamics the project area is of Medium to High Palaeosensitivity (Fig. 4) but previous field-based PIA reports in the vicinity (*e.g.* Almond 2016) inferred a Low palaeosensitivity for the region. The present desktop palaeontological heritage assessment has accordingly been commissioned on behalf of the proponent by the responsible independent EAP, Environamics Environmental Consultants, Potchefstroom (Contact details: Christia van Dyk. Environamics Environmental Consultants, 14 Kingfisher Street, Tuscany Ridge Estate, Potchefstroom, 2531. Telephone: 086 762 8336 (f); 083 450; 0406 (Cell). Electronic Mail: christia@environamics.co.za). This report will contribute to the Basic Assessment Process for the proposed development, including the overarching Heritage Impact Assessment as well as the Environmental Management Programme (EMPr) for the solar plant development.

Table 1: Technical details for the proposed Impala Solar Power Plant

Component	Description / dimensions
Height of PV panels	6 meters
Area of PV Array	260 Hectares
Number of inverters required	Minimum 50
Area occupied by inverter / transformer stations / substations / BESS	Central inverters+ LV/MV trafo: 20 m^2 HV/MV substation with switching station: 15 000 m^2 BESS: 4 000 m^2
Capacity of on-site substation	Minimum 130MVA in HV/MV substation

Area occupied by both permanent and construction laydown areas	Permanent Laydown Area: 280 Hectares Construction Laydown Area: ~2000 m^2
Area occupied by buildings	Security Room: ~60 m^2 Office: ~200 m^2 Staff Locker and Changing Room: ~200 m^2
Battery storage facility	Maximum height: 8m Maximum volume: 1740 m^3
Length of internal roads	Approximately 15 km
Width of internal roads	Between 6 & 12 meters
Proximity to grid connection	Approximately 0.2 kilometers
Height of fencing	Approximately 2.5 meters

1.1. Brief for the palaeontological study

1.1.1. General requirements

Specialists' reports must be aligned with Appendix 6 of GNR326 published under sections 24(5), and 44 of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and whereby the following are to be included:

- The details of-
    - the specialist who prepared the report; and
    - the expertise of that specialist to compile a specialist report including a curriculum vitae;
- A declaration that the specialist is independent in a form as may be specified by the competent authority;
- An indication of the scope of, and the purpose for which, the report was prepared;
    - An indication of the quality and age of base data used for the specialist report;
    - A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;
- The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;
- A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;
- Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;
- An identification of any areas to be avoided, including buffers;
- 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;
- A description of any assumptions made and any uncertainties or gaps in knowledge;
- A description of the findings and potential implications of such findings on the impact of the proposed activity, or activities;
- Any mitigation measures for inclusion in the EMPr;
- Any conditions for inclusion in the environmental authorisation;

- Any monitoring requirements for inclusion in the EMPr or environmental authorisation;
- A reasoned opinion-
    - whether the proposed activity, activities or portions thereof should be authorised;
        - regarding the acceptability of the proposed activity or activities; and
    - 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;
- A description of any consultation process that was undertaken during the course of preparing the specialist report;
- A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and
- Any other information requested by the competent authority.

In addition to the above, specialists are expected to:

- Identify any issue or aspect that needs to be assessed and provide expert opinion on any issue in their field of expertise that they deem necessary in order to avoid potential detrimental impacts;
- Assess the degree and extent of all identified impacts (including cumulative impacts) that the preferred project activity and its proposed alternatives, including that of the no-go alternative, may have;
- Identify and list all legislation and permit requirements that are relevant to the development proposal in context of the study;
- Reference all sources of information and literature consulted; and
- Include an executive summary to the report.

1.1.2. Terms of reference for the paleontological heritage assessment

The scope of work for the palaeontological assessment study will consist of:

- A desktop investigation of the area, in which all geological maps, published scientific literature, previous paleontological impact studies in the same region and the author's field of experience (consultation with professional colleagues as well as examination of institutional fossil collections and data) should be studied and used.
- Based on the outcome of the screening report, the need for a field assessment must be determined. The desktop investigation must be supplemented with a field assessment if required.
- Assess the potential impacts, based on a supplied methodology.
- Describe mitigation measures to address impacts during the construction, operation and decommissioning stages.
- Describe cumulative impacts of the project on paleontological resources in both the local study area regional study area and the proponent's plans to manage those effects.
- Supply the client with geo-referenced GIS shape files of any sensitive areas.

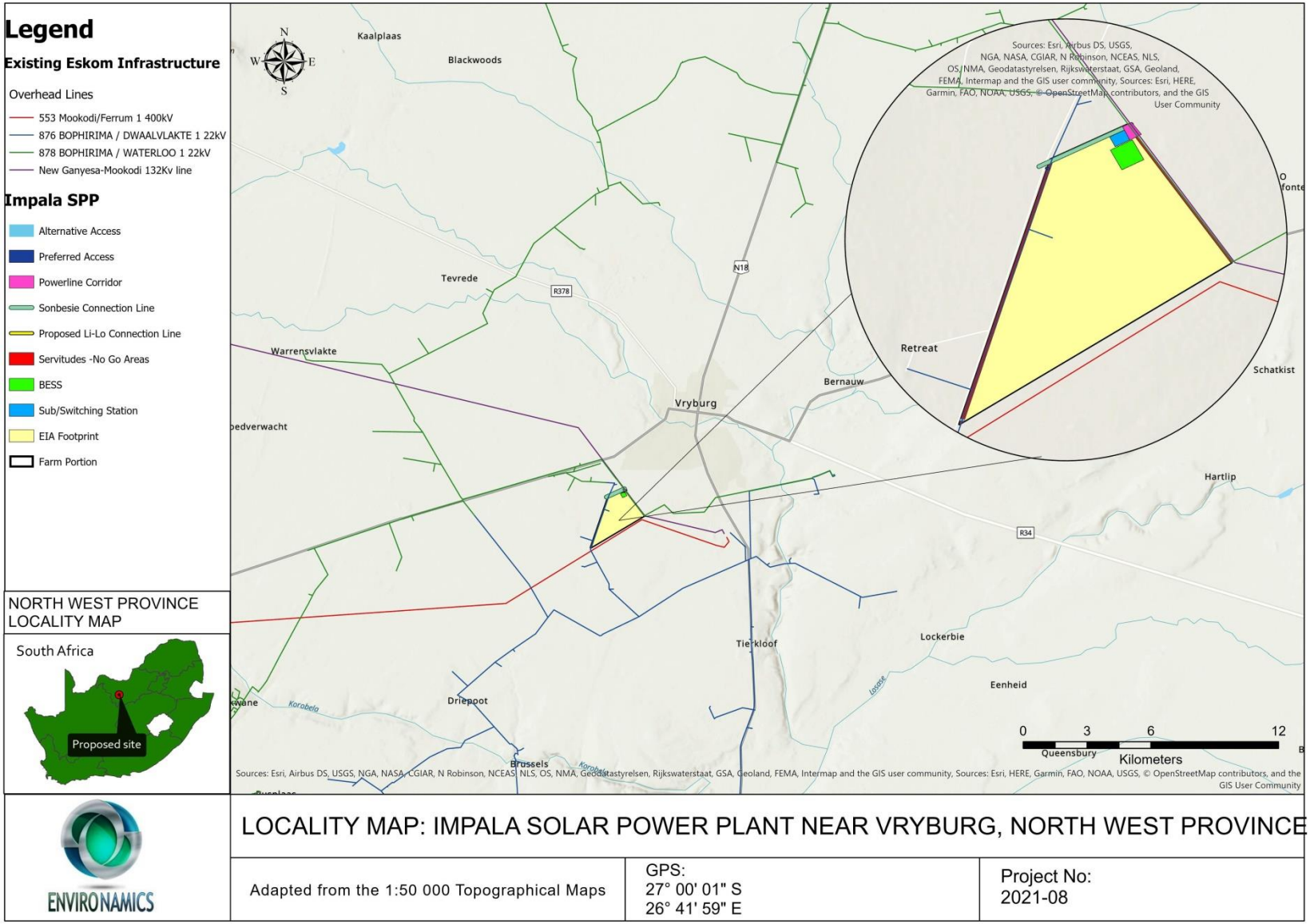

Figure 1: Locality map for the proposed Impala Solar Power Plant near Vryburg, North West Province (Image supplied by Environamics Environmental Consultants).

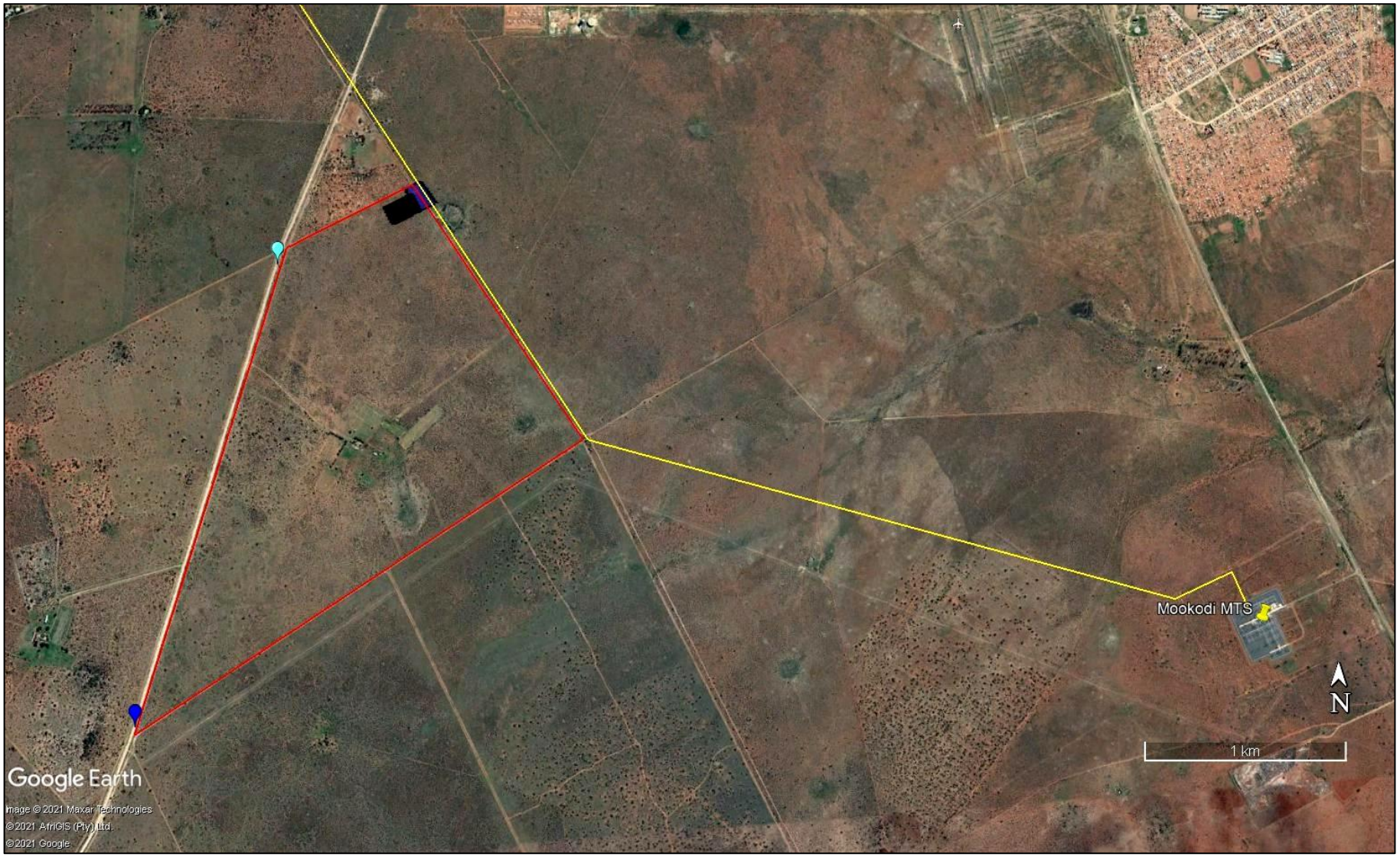

Figure 2: Google Earth© satellite image showing the Portion 4 of the Farm Klondike 670, situated *c.* 5 km southwest of the town of Vryburg (red polygon), North West Province, the project area for the proposed Impala Solar Power Plant. Also shown are proposed and alternative access points (pale blue and dark blue symbols respectively), on-site substation / switching station, and the New Ganesa – Mookodi 132 kV powerline (yellow line) which may be involved in the power plant grid connection to the existing Mookodi Substation.

John E. Almond (2021) **_Natura Viva_ cc**

2. APPROACH TO THE PALAEONTOLOGICAL HERITAGE STUDY

The approach to this palaeontological heritage study is briefly as follows. Fossil bearing rock units occurring within the broader study area are determined from geological maps and satellite images. Known fossil heritage in each rock unit is inventoried from scientific literature, previous assessments of the broader study region, and the author's field experience and palaeontological database. Based on this data, 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 North West Province (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 Environamics Environmental Consultants, Potchefstroom;

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 2013a-c, Almond 2016a-i, Butler 2016, 2018, Groenewald 2016, Rubidge 2012, Durand 2018, several of which include project areas adjoining the present one).

3. The author's previous field experience with the formations concerned and their palaeontological heritage.

2.2. Assumptions & limitations

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

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

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

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

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

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

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

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

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

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

In the case of the present study area near Vryburg in North West Province exposure of potentially fossiliferous bedrocks is very limited due to the largely flat terrain, extensive soil cover and dense grassy vegetation during summer. 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 Precambrian 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.

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 Impala Solar Power Plant, including the grid connection corridor, is situated in very low-relief terrain of the Ghaap Plateau region, here lying between *c*. 1200 and 1240 m amsl., between the N14 and N18 tar roads to the southwest of Vryburg. On satellite images (Fig. 2) the solar plant project area appears fairly featureless, apart from two small pan areas in the south and east of the power plant project area as well as agriculturally disturbed terrain and buildings towards its centre. There are no major water courses. Scattered small, circular features marked by bushes may be related to termite activity. Pale areas around pans and in the east may relate to near-surface calcrete (*i.e.* pedogenic limestone). The climate is semi-arid and the dense vegetation cover of grassy thornveld is mapped as Ghaap Plateau Vaalbosveld. Bedrock exposure within the project area is more or less non-existent due to extensive cover by superficial deposits such as

sandy soils and calcrete. Palaeontological field studies on very similar terrain on the adjacent farms Retreat 671-IN and the Remaining Extent of Klondike No. 670-IN have recently been carried out by the author (Almond 2016a, 2016b) who has also previously submitted a desktop palaeontological assessment for Farm Rosendal 673-IN where the Mookodi Substation is located (Almond 2013b).

The geology of the solar plant and associated grid connection project area to the southwest of Vryburg is shown on the adjoining 1: 250 000 geology maps 2624 Vryburg and 2724 Christiana (Council for Geoscience, Pretoria) (Fig. 3) and has been summarised by Almond (2016a, 2016b). An explanation for the Vryburg geological map has been published by Keyser & Du Plessis (1993) and that for the adjoining Christiana sheet 2724 to the south by Schutte (1994). The entire study area is underlain *at depth* by ancient Precambrian sedimentary rocks of the **Schmidtsdrif Subgroup** that are almost flat-lying in this area. These Precambrian bedrocks are unlikely to be directly impacted by the proposed solar facility development since they are largely or entirely mantled by much younger superficial deposits. These include Late Tertiary (Neogene) to Quaternary **calcrete hardpans** in the east (T-Qc, pale yellow in Fig. 3) and **alluvial gravels** of probable Quaternary age over the majority of the area (Qa, dark yellow with and without stipple in Fig. 3).

Calcrete occurs widely in the Vryburg area, especially overlying the Ventersdorp, Boomplaas and Dwyka outcrop areas, notably in association with ancient drainage lines and pans. The most extensive calcrete deposits tend to occur on the south-western side of pans as a consequence of the prevailing northwest winds (Keyser & Du Plessis 1993). Schutte (1994) notes that terraces of well-indurated calcrete occur in the valley of the Dröe Harts River some 30 km south of the present study area. The calcretes there contain rounded clasts of various rock types that have a probable Dwyka Group provenance. Calcretes on the farm Rosendal to the southeast of the present study area contain embedded “Palaeolithic stone tools” indicating a Quaternary or younger age for these deposits.

River terrace alluvial gravels in the Vryburg area are typically dominated by clasts of brown quartzite that are probably derived from the Vryburg Formation (Keyser & Du Plessis 1993, Schutte 1994, Almond 2016a). They also contain agates from the Ventersdorp lavas, and sometimes diamonds too. Based on field studies on the adjacent farm Retreat 671-IN (Almond 2016a), much of the present study area is probably mantled in pale orange-brown sandy soils, in part of aeolian origin since the region lies on the margins of the Kalahari Basin, with sparse surface gravels of calcrete, ferricrete and quartzite.

The proposed short (*c*. 5 km) 132 kV transmission line connection between the solar plant project area on Portion 4 of the Farm Klondike and the existing Mookodi Substation to the southeast on Farm Rosendal 673-IN will traverse outcrop areas of the Archaean **Vryburg Formation** and the Permo-Carboniferous **Dwyka Group** (respectively grey and dark blue in Fig. **) in addition to calcretes and alluvial gravels.

Smit *et al.* (1991) give a useful summary of the geology and sedimentology of the Vryburg Formation succession in its type area near Vryburg itself. The lower portion comprises a basal conglomerate followed by a 20 m-thick, prominent-weathering package of cross-bedded feldspathic quartzites known as the Kobaga beds. This is overlain by *c*. 20 m of andesitic or basaltic lavas (the Rosendal Member) and pyroclastic sediments and then another 20 m package of varied siliciclastic rocks including conglomerates, quartzites, grits, flaggy sandstones (often ripple marked) and shales. These last are often pitch black and

calcitic. The overlying Waterloo Member consists of c. 20-50 m of amydaloidal and non-amydaloidal basaltic / andesitic lavas and is overlain by 14 m of interbedded pyroclastic sediments and thin lenticular limestones.

In the Vryburg region the Dwyka succession mainly consists of glacial tillite (boulder mudstone) and interglacial shale. Exposures levels are typically very poor, since the mudrock matrix weathers very readily, and consequently the Dwyka outcrop area represented at surface only by scattered erratic boulders (Keyser & Du Plessis 1993). Glacial striations of Dwyka age that are incised into older resistant quartzitic rocks of the Vryburg Formation near Mookodi Substation on the farm Rosendal 673 indicate southerly ice transport directions (Schutte 1994).

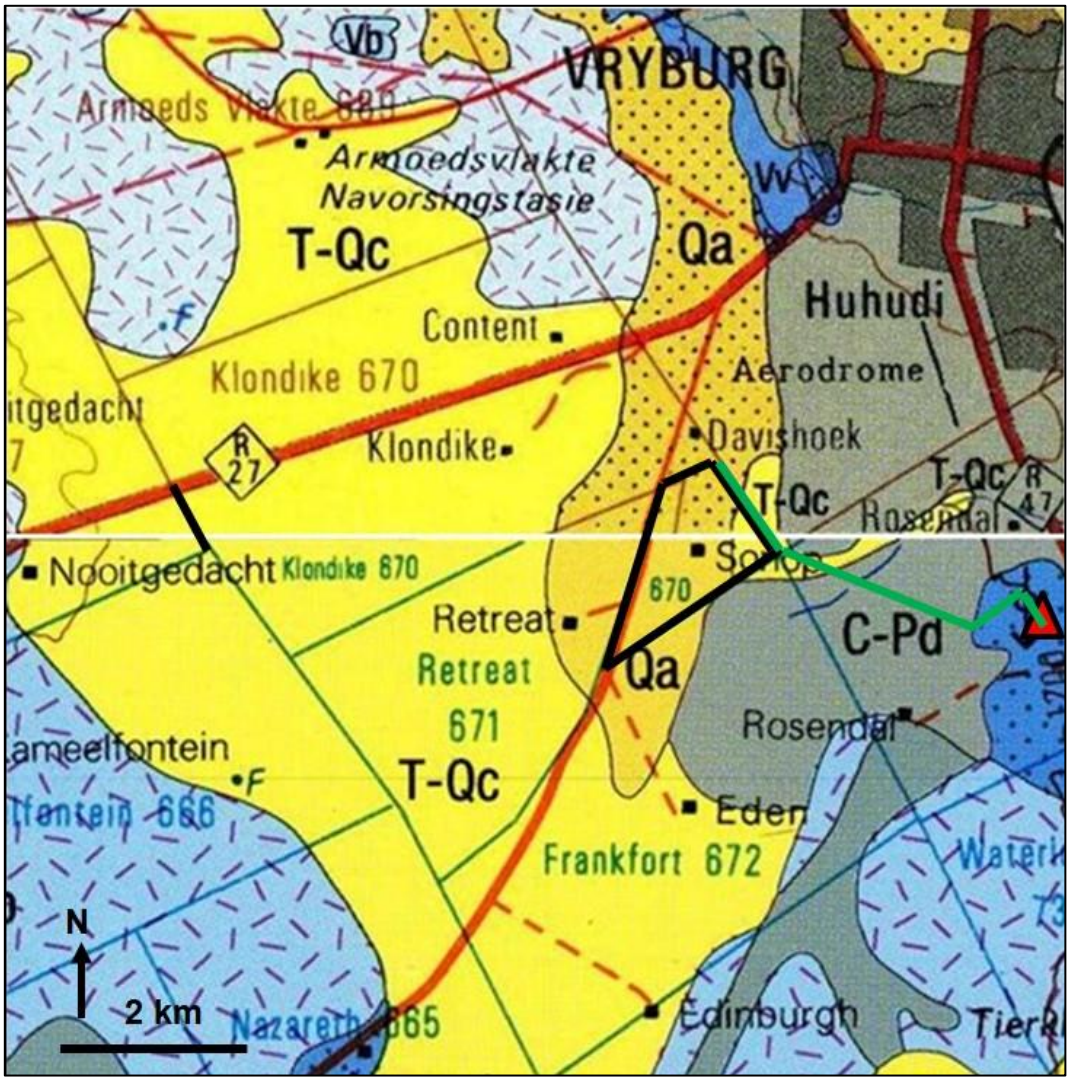

Figure 3: Extract from the adjoining 1: 250 000 geological maps 2624 Vryburg and 2724 Christiana (Council for Geoscience, Pretoria) showing the *approximate* outline of the project area for the proposed Impala Solar Power Plant on Portion 4 of the Farm Klondike 670, situated some 5 km southwest of Vryburg (black polygon). The green line shows a possible route for the proposed 132 kV transmission line connection to the existing Mookodi Substation (red triangle). The entire project area for the solar development is mantled by (1) Late Caenozoic calcrete hardpans / pedogenic limestones (T-Qc, pale yellow) and / or (2) alluvial gravels of probable Quaternary age (Qa, dark yellow). Additional geological units mapped in the proposed grid connection corridor to Mookodi Substation include (3) late Archaean fluvial and shallow marine quartzites, mudrocks, conglomerates with two intervals of andesitic

volcanics of the Vryburg Formation (Vv, dark blue, stippled) and (4) Permo-Carboniferous glacial sediments (tillites, interglacial mudrocks) of the Dwyka Group (C-Pd, middle grey).

4. PALAEONTOLOGICAL HERITAGE

The **Neogene to Recent superficial deposits** within the broader project area - viz. sandy soils, downwasted surface gravels, alluvial gravels, calcrete pedocretes (including older pan sediments) - are likely to be of Low to Very Low palaeosensitivity for the most part. However, these younger sediments might occasionally contain important fossil biotas, notably the bones, teeth and horn cores of mammals (*e.g.* Cooke 1974, Skead 1980, 2011, Klein 1984, MacRae 1999, Partridge & Scott 2000, Churchill et al. 2000, Boshoff & Kerley 2013). These may include ancient human remains of considerable palaeoanthropological significance (*e.g*. Grine *et al.,* 2007). Other potential late Caenozoic fossil biotas from these superficial deposits include non-marine molluscs (bivalves, gastropods), ostrich egg shells, trace fossils (*e.g.* calcretised termitaria and other insect burrows or nests, coprolites, rhizoliths), and plant remains such as peats or palynomorphs (pollens) in fine-grained, organic-rich alluvial horizons. Quaternary alluvial sediments may contain reworked Stone Age artifacts that are useful for constraining their maximum age.

Recent field examination of calcretes on the adjoining farm Retreat 671 did not reveal any fossil material such as calcretised trace fossils (*e.g.* termitaria), land snails, or mammalian bones, teeth or horn cores (Almond 2016a). Likewise no fossil bones or teeth were found in association with the fluvial gravels or pan sediments in the region; these sediments do contain crudely-flaked stone artefacts of probable Pleistocene / ESA affinities, however (*ibid.*). It is concluded that the Late Caenozoic superficial sediments mapped at surface within the Impala Solar Power Plant project area are generally of low palaeontological sensitivity, although rare concentrations of scientifically important fossil remains – such as mammalian bones and teeth within calcretes associated with pans - might occur locally.

Minor carbonate interbeds within the upper **Vryburg Formation** in its southern, more distal outcrop area (*e.g.* near Douglas) contain microbial stromatolites, and these are also recorded from the holostratotype section some 40 km south of Vryburg (Smit *et al.* 1991). The stromatolitic carbonates within the Vryburg succession interfinger with and pass up into siliclastic sediments and are interpreted as intertidal in setting (Altermann & Wotherspoon 1995). In the Vryburg area itself the succession is dominated by quartzites and lavas and does not appear to contain fossil stromatolites (Almond 2013a).

Outcrops of the **Dwyka Group** in the northern part of the Main Karoo Basin may contain low diversity non-marine trace fossil assemblages within interglacial mudrocks (predominantly fish and arthropod traces, *Rhizocorallium*) as well as scattered vascular plant remains (*e.g. Glossopteris* leaves, petrified wood) but the likelihood of significant fossil heritage in the Vryburg area is considered to be low. At most, erratic boulders within the Dwyka tillites might include occasional clasts of stromatolitic carbonate derived from Precambrian Transvaal Supergroup shelf sediments of the Ghaap Plateau. However, such occurrences are of low conservation significance.

It is concluded that the palaeosensitivity of both the solar power plant as well as the proposed grid connection corridor to Mookodi Substation is Low to Very Low.

5. SITE SENSITIVITY VERIFICATION AND EVALUATION OF IMPACTS ON PALAEONTOLOGICAL HERITAGE

5.1. Site sensitivity verification

A MEDIUM to HIGH palaeosensitivity has been provisionally assigned to the Impala Solar Power Plant project area on Portion 4 of the Farm Klondike 670 as well as to the associated grid connection corridor to Mookodi Substation near Vryburg by the DFFE screening tool (Fig. 4, abstracted from the Screening Report for Environmental Authorisation prepared by Environamics Environmental Consultants, February 2021). Areas of high inferred palaeosensitivity in the east relate to well-developed calcretes of possible Neogene (Late Tertiary) age mapped at surface here.

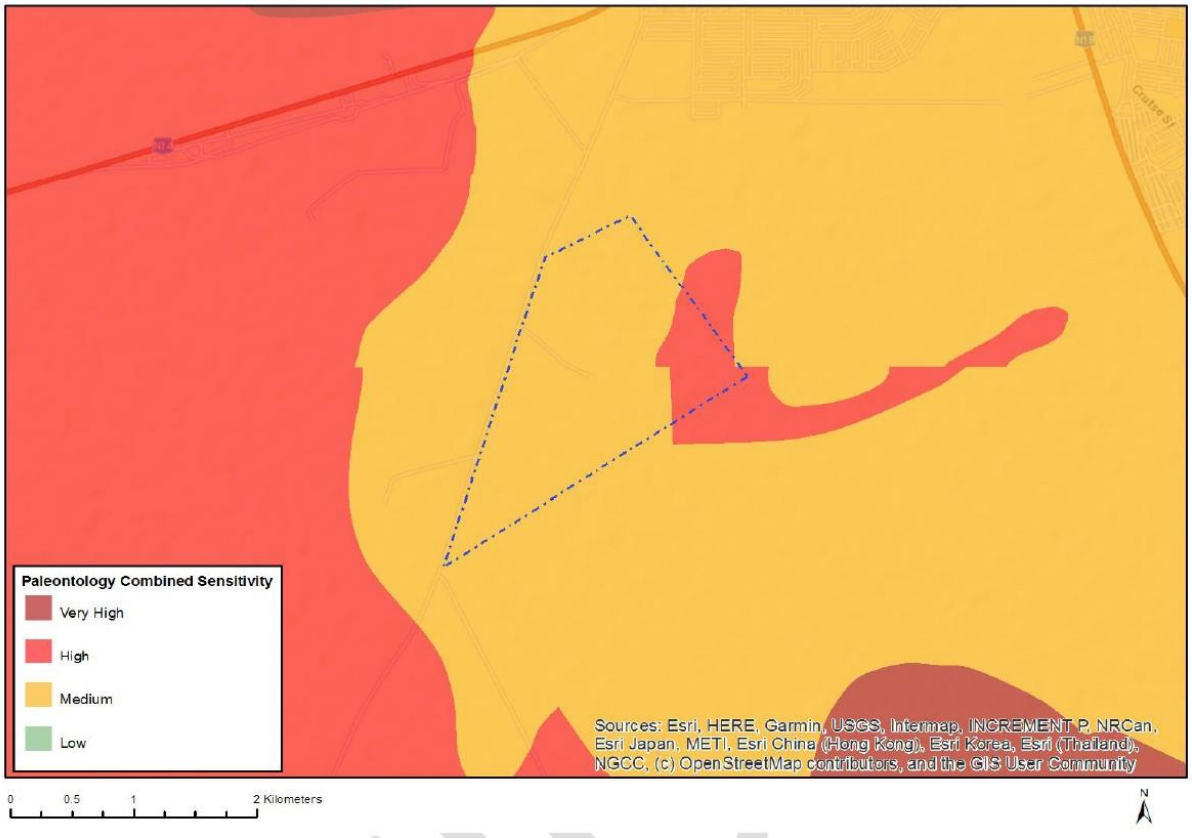

Figure 4: Palaeosensitivity map for the Impala Solar Plant project area (blue dotted polygon) (Figure abstracted from the Screening Report for Environmental Authorisation prepared by Environamics Environmental Consultants). Most of the solar plant project area, including the associated grid connection corridor extending to the SE, is provisionally mapped here as of Medium Palaeosensitivity with a small area of High Sensitivity in the east. A Low Palaeosensitivity is inferred based on desktop and local field data, however.

The originally proposed Medium to High palaeosensitivity of the Impala Solar Plant project area is *contested* here. Rather, a generally LOW palaeosensitivity is assigned to the associated solar power plant and grid connection project areas in the present PIA report. This is largely based on a recent palaeontological field survey on the adjoining, geologically very similar Farm Retreat 671 but also on several other field studies in the region to the south of Vryburg by the author (Almond 2013a-c, Almond 2016a-b *etc*) (See Section 4 of this report).

5.2. Impact assessment

The Impala Solar Power Plant 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). Existing impacts to palaeontological heritage within the project area are likely to be minimal, largely comprising occasional damage to fossils exposed at the ground surface through agricultural activities. These on-going impacts are offset by the slow exposure of fresh fossil material through bedrock weathering.

The construction phase of the proposed solar 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, auxiliary buildings and construction camp. All these activities may adversely affect potential legally-protected 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 PV solar plant on legally-protected, local fossil heritage resources of scientific or broader conservation value is briefly evaluated here in Table 2A. 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 facilities are not anticipated. The assessment applies equally to the PV solar project area as well as to the short associated 132 kV grid connection (assessed 100m-wide corridor). Confidence levels in this assessment are *medium*, given (1) very low levels of bedrock exposure within the solar power plant and grid connection project areas and (2) the unpredictable distribution of well-preserved fossils in the subsurface, factors which are partially offset by the number of field-based palaeontological studies carried out in the Vryburg region in recent years (*cf* Table 3 and References).

As motivated in Table 2A, the impact significance of the proposed development in terms of palaeontological heritage is assessed as *Negative Low* without mitigation and *Negative Low* following mitigation. Should the recommended mitigation measures for the construction phase of the solar facility development, as outlined in Section 6 (incl. Table 4) and Appendix 2 of this report, be consistently followed-though, the impact significance would remain *Low* (*Negative*) but would entail both positive and negative impacts. Residual negative impacts from inevitable 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 Ghaap Plateau region of North West Province. 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 solar PV project from a palaeontological heritage viewpoint and no objects to authorisation of the development, provided that the recommended mitigation measures are fully implemented.

Table 2A: Evaluation of anticipated impacts on local palaeontological heritage resources due to the proposed Impala Solar Power Plant near Vryburg, North West Province (Construction Phase)

Palaeontological Heritage Impacts	Disturbance, damage or destruction of legally-protected fossil heritage* within the development footprint during the construction phase	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Status (positive or negative)	Negative	Negative / positive
Extent	Site (1)	Site (1)
Probability	Unlikely (1)	Unlikely (1)
Duration	Permanent (4)	Permanent (4)
Magnitude	Low (1)	Low (1)
Reversibility	Irreversible (4)	Irreversible (4)
Irreplaceable loss of resources	Marginal (2)	Marginal (2)
Cumulative impact	Low (2).	
Significance	**Negative low (28)**	**Negative low (28)**
Can impacts be mitigated?	Yes. Through implementation of recommended Chance Fossil Finds Procedure.	

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

5.2. Cumulative impact assessment

A tabulated summary of comparable renewable energy projects within a 30 km radius of the present project area near Vryburg is presented in Table 3 and Figure 5 below (Data provided by Environamics Environmental Consultants).

Based on the SAHRIS website, palaeontological heritage assessments (PIAs) are available for the majority, if not quite all, of the projects listed (Almond 2013a-c, Almond 2016a-i, Butler 2016, 2018, Groenewald 2016, Rubidge 2012, Durand 2018). It is noted that (1) of the available PIA reports several are only desktop studies with no field-based ground truthing and (2) a LOW palaeontological impact significance is inferred for most, but not all, of the projects concerned. This applies most notably to those projects featuring similar Late Caenozoic sedimentary rock units to those mapped in the present project area where surface exposure of stromatolitic bedrocks is low to non-existent. Higher palaeosensitivities and levels of impact significance are understandably inferred for projects that involve surface exposure of Precambrian stromatolites (fossil microbial mounds) which are almost certainly *not* represented at surface in the Impala Solar Power Plant project area (*cf* Almond 2013a, 2016e, Groenewald 2016). 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.

Table 2B: Evaluation of anticipated cumulative impacts on local palaeontological heritage resources due to solar power developments in the Vryburg region, including the proposed Impala Solar Power Plant (Construction Phase)

Palaeontological Heritage Impacts*	Disturbance, damage or destruction of legally-protected fossil heritage within the development footprints during the construction phase	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Status (positive or negative)	Negative	Negative / positive
Extent	Local (2)	Local (2)
Probability	Definite (4)	Probable (3)
Duration	Permanent (4)	Permanent (4)
Magnitude	Medium (2)	Low (1)
Reversibility	Irreversible (4)	Irreversible (4)
Irreplaceable loss of resources	Marginal (2)	Marginal (2)
Cumulative impact	Medium (3).	
Significance	**Negative medium (38)**	**Negative low (18)**
Can impacts be mitigated?	Yes. • Protection of recorded sensitive fossil sites through buffers and / or judicious professional collection: • ECO monitoring of surface clearance and excavations for fossil remains; • Implementation of recommended Chance Fossil Finds Procedure.	

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

Given (1) the comparatively small combined footprint of the renewable energy projects under consideration compared with the very extensive outcrop areas of Late Caenozoic superficial deposits in the region as well as (2) the generally low palaeosensitivity of these younger deposits and (3) the probable (albeit *unconfirmed*) rarity of *scientifically valuable* occurrences of well-preserved stromatolites within flat-lying terrain preferred for solar energy projects, the anticipated cumulative impact of the proposed or authorized solar power plant developments in the Vryburg region - including the proposed Impala Solar Power Plant - is

assessed as *Negative Medium* (without mitigation), potentially falling to *Negative Low* (with full mitigation) (Table 2B). There are therefore no objections on palaeontological grounds to authorization of this project.

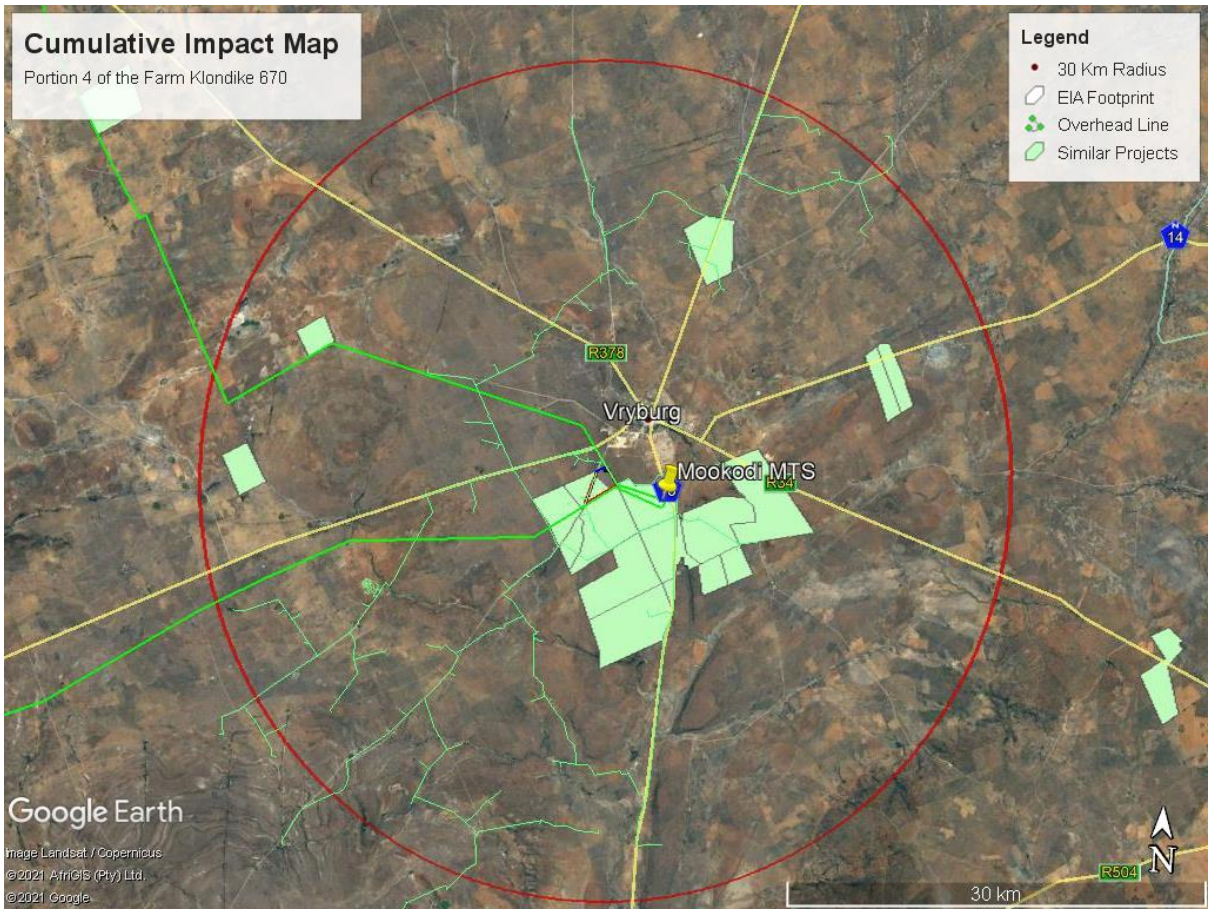

Figure 5: Map of renewable energy developments within a 30 km radius of the Impala Solar Power Plant (Image provided by Environamics Environmental Consultants). Not all of these developments share the same geological (and hence palaeontological) context.

Table 3: Summary of related renewable energy projects within a 30 km radius of the present project area that may contribute to cumulative impacts (Data collated by Environamics Environmental Consultants). Palaeontological impact assessments for these projects are listed in the References.

Site name	Distance from study area	Proposed generating capacity	DEFF reference	EIA process	Project status
Waterloo	5.7 km	75 MW	14/12/16/3/3/2/308	Scoping and EIA	Approved
Tiger Kloof	4.2 km	75 MW	14/12/16/3/3/2/535	Scoping and EIA	Approved

Naledi	0 km	75 MW	14/12/16/3/3/2/390	Scoping and EIA	Approved
Carocraft	22.3 km	75 MW	14/12/16/3/3/2/374	Scoping and EIA	Approved
Elda	16.6 km	14 MW	14/12/16/3/3/2/750	Scoping and EIA	Approved
Khubu SPP	9.2km	115MW	14/12/16/3/3/2/912	Scoping and EIA	Approved
Gamma SPP	10.3km	115MW	14/12/16/3/3/2/917	Scoping and EIA	Approved
Sonbesie SPP	200m	115MW	14/12/16/3/3/2/915	Scoping and EIA	Approved
Woodhouse PV 1	10.7km	100MW	14/12/16/3/3/2/863	Scoping and EIA	Approved
Woodhouse PV 2	10.7km	100MW	14/12/16/3/3/2/865	Scoping and EIA	Approved
Vryburg PV 1	500m	115MW	14/12/16/3/3/1/1939	Scoping and EIA	Approved
Vryburg PV 2	500m	115MW	14/12/16/3/3/1/1940	Scoping and EIA	Approved
Vryburg PV 3	500m	115MW	14/12/16/3/3/1/1941	Scoping and EIA	Approved
Protea SPP	8.4km	115MW	14/12/16/3/3/2/914	Scoping and EIA	Approved
Sendawo 1	4.2km	75MW	14/12/16/3/2/893	Scoping and EIA	Approved
Sendawo 2	4.2km	75MW	14/12/16/3/2/893	Scoping and EIA	Approved
Sendawo 3	4.2km	75MW	14/12/16/3/2/893	Scoping and EIA	Approved
Moeding Solar	6km	115MW	14/12/16/3/3/1/1987	Scoping and EIA	Approved
Alpha SPP	23km	115MW	14/12/16/3/3/2/916	Scoping and EIA	Approved
Meerkat SPP	21km	115MW	14/12/16/3/3/2/913	Scoping and EIA	Approved

6. RECOMMENDATIONS FOR MONITORING AND MITIGATION

No palaeontological High Sensitivity or No-Go areas or other fossil sites requiring specialist mitigation have been identified within the solar power plant development footprint, including the associated grid connection corridor.

The ECO responsible for the construction phase of the solar plant development should be aware of the potential for important fossil finds – notably stromatolites (fossil microbial mounds) within Precambrian bedrocks and fossil mammalian remains, land snails and trace fossils (*e.g.* termite nests) within calcretes - 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 solar PV plant and associated grid connection 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.

7. ACKNOWLEDGEMENTS

Ms Christia Van Dijk and Ms Carli Steenkamp of Environamics Environmental Consultants, Potchefstroom are both thanked for commissioning this study and for providing the relevant background information. Additionally, I am grateful to Ms Lisa Opperman of Environamics for careful editorial work on the draft PIA reports.

Table 4: Proposed monitoring and mitigation measures for incorporation into the EMPr for the Impala Solar Plant project (Construction phase)

POTENTIAL ASPECTS RESULTING IN POTENTIAL ENVIRONMENTAL IMPACT DURING CONSTRUCTION	RECOMMENDED MITIGATION MEASURES					
	Desired Outcomes	**Targets & Indicators**	**Management and mitigation measures**	**Timeframe**	**Responsibility**	**Monitoring**
Fossil Heritage Resources						
Disturbance, destruction or damage to fossils preserved at or below surface through surface clearance and excavations during construction phase.	Reporting of chance fossil finds to SAHRA for professional recording and sampling.	Any areas of bedrock exposure displaying well-preserved stromatolites. Superficial deposits (alluvium, soils, gravels) with fossil remains (*e,g.* mammalian bones, teeth).	Monitoring of all major site clearance and excavation work for fossil remains. Substantial well-preserved fossils (stromatolites, vertebrate bones, teeth) to be safeguarded, preferably *in situ*, and reported to SAHRA. Fossil recording and sampling.	On-going during construction phase. Following report of chance fossil finds.	ECO Developer to appoint palaeontologist following significant new fossil finds. Professional palaeontologist.	Compliance to be verified by ECO.

Table 5: Summary of impacts and mitigation measures for the Impala Solar Plant project (Construction Phase)

SPECIALIST STUDY	IMPACT	PRE-MITIGATION RATING	POST MITIGATION RATING	SUMMARY OF MITIGATION MEASURES
Palaeontological heritage	Disturbance, destruction or damage to fossils preserved at or below surface through surface clearance and excavations during construction phase.	Negative low	Negative low	• Monitoring of all major site clearance and excavation work for fossil remains by ECO. • Substantial well-preserved fossils (stromatolites, vertebrate bones, teeth) to be safeguarded, preferably *in situ*, and reported by ECO to SAHRA. • Recording and sampling of significant new fossil finds by professional palaeontologist.

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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

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.

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

<table>
<tr><td colspan="3">APPENDIX 1: CHANCE FOSSIL FINDS PROCEDURE: Impala Solar Power Plant on Portion 4 of the Farm Klondike 670 near Vryburg</td></tr>
<tr><td>Province & region:</td><td colspan="2">North West Province: Naledi Local Municipality</td></tr>
<tr><td>Responsible Heritage Resources Agency</td><td colspan="2">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</td></tr>
<tr><td>Rock unit(s)</td><td colspan="2">Vryburg Formation (Transvaal Supergroup), Dwyka Group (Karoo Supergroup).
Neogene to Holocene alluvium, aeolian sands, downwasted surface gravels, calcrete hardpans</td></tr>
<tr><td>Potential fossils</td><td colspan="2">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.</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 Agency. Adhere to best international practice for palaeontological fieldwork and Heritage Resources Agency minimum standards.</td></tr>
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