PALAEONTOLOGICAL IMPACT ASSESSMENT OF THE PROPOSED CONSTRUCTION OF THE 150 MW NOUPOORT CONCENTRATED SOLAR POWER FACILITY AND ASSOCIATED INFRASTRUCTURE ON PORTION 1 AND 4 OF THE FARM CAROLUS POORT 167 AND THE REMAINING EXTENT OF FARM 207, NEAR NOUPOORT, NORTHERN CAPE

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EXECUTIVE SUMMARY

CRESCO Energy (Pty) Ltd proposes the development of a Concentrated Solar Power (CSP) facility as well as associated infrastructure on Portion 1 and 4 of the Farm Carolus Poort 167 and the remaining extent of Farm 207, situated approximately 4 km north west of Noupoort. The proposed site falls within the jurisdiction of the Umsobomvu Local Municipality and within the greater Pixley ka Seme District Municipality in the Northern Cape Province. The contracted capacity of the Noupoort CSP Project will be up to 150MW with an approximate development area of 900 ha in extent.

The project site is predominantly underlain by the Late Permian to early Triassic Adelaide and Tarkastad Subgroups of the Karoo Supergroup, as well as Early Jurassic Karoo Dolerite (183 ± 2 Ma). The Adelaide and Tarkastad Subgroup biostratigraphic zones include a rich and diverse vertebrate fauna of exceptionally high scientific significance due to their part in recording the evolutionary transition from reptiles to mammals.

It is thus recommended that an EIA report must be conducted to assess the value and prominence of fossil heritage in the development area.

Contents

1. INTRODUCTION

The Department of Environmental Affairs (DEA) contributes to the execution of the National Development Plan and National Infrastructure Plan by undertaking Strategic Environmental Assessments (SEAs). Its function is to identify adaptive processes that simplify the regulatory environmental requirements for Strategic Integrated Projects (SIPSs), while protecting the environment. Wind and Concentrated Solar Power (CSP) Strategic Environmental Assessments was thus commissioned by the DEA in support of the Strategic Integrated Projects to assist the implementation if sustainable green energy.

The SEA recognize areas where large scale wind and solar facilities can be developed and restrict negative impacts on the environment, while producing the highest possible socio-economic benefits to the country. These areas are known as the Renewable Energy Development Zones (REDZs). The solar assessments domain was identified by the location of the majority of existing solar project applications and includes Northern Cape, Western Cape, Free State and North west, although solar energy facilities is not limited to these areas.

Sensitivity maps for the proposed REDZs have been created by scoping pre-assessments which are based on available data. However, these sensitivity maps are not comprehensive enough to aid in project level decision making. According to the National Environmental Management Act (NEMA) (Act 107 of 1998) Basic Assessments will thus be conducted in accordance with relevant regulations to assist in Environmental Authorisation.

The purpose of the planned Noupoort CSP Project will be to relinquish the generated power into the Eskom electricity grid. The project is planned to be a tender in the Department of Energy's (DoE) Renewable Energy Independent Power Producer Procurement Programme (REIPPP).

Savannah Environmental (Pty) Ltd has been appointed as the independent Environmental Assessment Practitioners (EAP) by **CRESCO Energy (Pty) Ltd** for the undertaking of the Environmental Impact Assessment process for the proposed Noupoort Concentrated Solar Power (CSP) project. The construction of a CSP solar energy facility as well as associated infrastructure on Portion 1 and 4 of Carolus Poort 167 and the Remaining extent of Farm 207, north west of Noupoort, Umsobomvu Local Municipality and within the greater Pixley ka Seme District Municipality, Northern Cape province is proposed (Fig. 1).

The proposed Noupoort CSP Project will make use of the sun to steam parabolic trough technology. This system includes two components namely a heat collection system (solar field) and an Energy Centre. The heat from the solar field produces steam from the heat transfer fluid (HTF) in a closed loop system which heats the storage medium in the Energy Centre. The HTF (water), in a separate closed loop system, is then heated, thus creating steam and releasing it directly into the turbine inlet, which turns the

turbine and thus creates electricity. The parabolic trough system will have a generating capacity of up to 150MW and energy storage of up to 6 hours on average.

Figure 1. Location of the proposed Noupoort Concentrated Solar Power Project (outlined in white) on Portion 1 and 4 of Carolus Poort 167 and the Remaining extent of Farm 207, north west of Noupoort, Umsobomvu Local Municipality and within the greater Pixley ka Seme District Municipality, Northern Cape Province. (Map modified from Google Earth 2016).

The infrastructure associated with the CSP facility will include:

- Solar collector field comprising of all systems and infrastructure related to the control and operation of the parabolic troughs;
- Energy centre;
- Power block;
- On-site project substation;
- A new 132kV power line to connect the on-site substation to the Eskom's electricity grid;
- Access roads and fencing around the development area;
- Lined evaporation ponds;
- Gas boiler for the start-up process of the facility;
- Water supply pipeline;
- On-site water storage tanks/reservoirs;
- Water treatment facility;
- Plant assembly facility;
- Offices and workshop areas for maintenance and storage; and
- Temporary laydown areas.

1.1 TECHNOLOGICAL BACKGROUND

Usage of CSP technology as the renewable energy technology (information provided by Savannah Environmental):

Solar Generating Facilities use sun energy to generate electricity, while Concentrating Solar Power (CSP) collects the incoming solar radiation and concentrates it on a single point, thus increasing the potential electricity generation.

The proposed CSP Project will utilise parabolic trough technology. The parabolic trough system includes two groups which consist of a heat collection system (solar field) and an Energy Centre. The heat collection system make use of a solar collector assembly (SCA) consisting of parabolic troughs (i.e. the reflectors) and cylindrical tubes (i.e. the receivers) that run in the focal line of the parabola. Each SCA tracks the sun on a set of rails, with no need for land levelling and minimal ground disturbance, which also allows for easier maintenance.

The Energy Centre (larger heat exchanger units) consists of tubes for the heat transfer media coming from the solar field and for the water/steam media, working in counter-flow. Condensed water enters in a counter flow and comes out as a superheated steam at approximately 480-500ºC. The space between tubes is filled with the storage media. The Energy Centre is able to produce steam over a period of 12-18 hours over a 24 hour period (6 solar hours on average, plus an additional 6 – 12 hours from storage, depending on the Energy Centre discharge rate).

The heat from the solar field creates steam from the heat transfer fluid (HTF) in a closed loop system and heats the storage medium in the Energy Centre. The HTF in a

separate closed loop system is heated, creating steam and releasing it directly into the turbine inlet, and turns the turbine and thus generating electricity.

These developments will modify the existing topography and may disturb, damage or destroy scientific valuable fossil heritage exposed at the surface or buried below ground. Palaeontological material is unique and non-renewable and is protected by the National Heritage Resources Act (Act No. 25 of 1999, section 38). A Palaeontological Impact Assessment of the proposed development is therefore necessary to certify that palaeontological material is either removed, or is not present.

2 LEGISLATION

Cultural Heritage in South Africa is governed by the National Heritage Resources Act (Act 25 of 1999). This Palaeontological Scoping Study forms part of the Heritage Impact Assessment (HIA) and complies with the requirements of the above mentioned Act. In accordance with Section 38, an HIA is required to assess any potential impacts to palaeontological heritage within the development footprint.

SECTION 25 OF THE NATIONAL HERITAGE RESOURCES ACT 1999

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

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

According to Section 25 of the National Heritage Resources Act 1999, dealing with archaeology, palaeontology and meteorites:

- The protection of archaeological and palaeontological sites and material and meteorites is the responsibility of a provincial heritage resources authority
- All archaeological objects, palaeontological material and meteorites are the property of the State
- 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
- No person may, without a permit issued by the responsible heritage resources authority—
    - destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite
    - destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite

    - 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
    - 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.
- 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—
    - 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
    - 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

3 Objective

According to the "SAHRA APM Guidelines: Minimum Standards for the Archaeological and Palaeontological Components of Impact Assessment Reports' the aims of the palaeontological impact assessment are:

- to identify exposed and subsurface rock formations that are considered to be palaeontologically significant;
- to assess the level of palaeontological significance of these formations;
- to comment on the impact of the development on these exposed and/or potential fossil resources and
- to make recommendations as to how the developer should conserve or mitigate damage to these resources.

The objective is thus to conduct a desktop/scoping study to determine the impacton potential palaeontological material at this site.

When a palaeontological desktop/scoping study is conducted, the potentially fossiliferous rocks (i.e. groups, formations, members, etc.) represented within the study area are determined from geological maps. The known fossil heritage within each rock unit is collected from published scientific literature; Fossil sensitivity map; consultations with professional colleagues, previous palaeontological impact studies in the same region and the databases of various institutions may be consulted. This data is then used to assess the palaeontological sensitivity of each rock unit of the study area. The likely impact of the proposed development on local fossil heritage is subsequently established on the basis of

- the palaeontological sensitivity of the rocks and

- the nature and scale of the development itself (extent of new bedrock excavated)

When rocks of moderate to high palaeontological sensitivity are present within the study area, a field-based assessment by a professional palaeontologist is necessary. Based on this desktop data as well as a field examination of representative exposures of all major sedimentary rock present, the impact significance of the planned development is considered with recommendations for any further studies or mitigation.

4 BACKGROUND TO THE GEOLOGICAL AND PALAEONTOLOGICAL HISTORY

The Karoo Supergroup strata are between 310 and 182 million years old and span the Upper Carboniferous to Middle Jurassic Periods. During this period the basin developed from an inland sea flooded by a melting ice cap, to a giant lake (Ecca Lake) fed by seasonal meandering (and periodically braided) rivers. The lake progressively shrank as it filled with sediment and the basin's rate of subsidence stabilised.

The Beaufort group consists of largely fluvial sediments which were deposited on the floodplains of these rivers. In time the land became progressively more arid and was covered with windblown sand just before the end of the basin's cycle. Finally the subcontinent was inundated with basaltic lava to form the capping basalts of the Jurassic aged Drakensberg Group. During the Jurassic, the volcanic Drakensberg were formed and cracks in the earth's crust were filled with molten lava that cooled to form dolerite dykes. Magma injected horizontally between sediments, cooled down and formed horizontal sills of dolerite.

The flood plains of the Beaufort Group (Karoo Supergroup) are internationally renowned for the early diversification of land vertebrates and provide the worlds' most complete transition from early "reptiles" to mammals.

4.1 PALAEONTOLOGICAL HERITAGE

The project site is primarily represented by sedimentary rocks of the late Permian to early Triassic, Adelaide Subgroup, and Katberg Formation, Tarkastad Subgroup Beaufort Group. Karoo Dolerite is present in the proposed development area (Fig. 2). The dolerite represents magma intrusions into the Karoo Supergroup sediments during the Jurassic volcanic period which occurred during the breakup of Gondwana (183 ± 2 Ma). The sills and dykes have thermally metamorphosed or baked the adjacent sediments and therefore fossils are absent from the Karoo Dolerite Suite.

The Beaufort Group is subdivided into a series of biostratigraphic units on the basis of its faunal content (Fig. 3). Based on available biostratigraphic mapping it is evident that only the upper, Late Permian to Early Triassic, portion of the Adelaide Subgroup, Palingkloof Member and Katberg Formation of the Tarkastad Subgroup is present in the Noupoort district, most probably corresponding to the *Daptocephalus* and *Lystrosaurus* Assemblage Zones.

The *Daptocephalus* Assemblage Zone expands into the lower Palingkloof Member of the Upper Balfour Formation (Groenewald & Kitching 1995, Rubidge 2005). This Zone is characterized by the occurrence of the two therapsids namely *Dicynodon* and *Theriognathus*. The *Daptocephalus* Zone of the Beaufort Group shows the greatest vertebrate diversity and includes numerous well preserved genera and species of dicynodonts, biarmosuchians, gorgonopsian, therocephalian and cynodont therapsid Synapsida as well as captorhinid Reptilia and less well represented eosuchian Reptilia, Amphibia and Pisces. Fossil plants of the Balfour Formation are relatively rare compared to the vertebrate fossil assemblages. The presence of the wood genera, *Agathoxylon* and *Australoxylon,* was described by Bamford (2004).

The lower Palingkloof Member is of special importance as it precedes the Permo-Triassic Extinction Event which destroyed the vertebrate fauna and extinguished the diverse glossopterid plants. The lower *Lystrosaurus* Assemblage Zone forms part of the Katberg Formation. Fauna and flora from this assemblage zone is relatively rare as few genera survived the Permo-Triassic Extinction Event. The *Lystrosaurus* Assemblage Zone is characterized by the dicynodont, *Lystrosaurus* (the most abundant fossil in this biozone contributing up to 95% of fossils found) (Smith & Botha 2005, Botha & Smith 2007), and captorhinid reptile, *Procolophon*. The biarmosuchian and gorgonopsian Therapsida did not survive into the *Lystrosaurus* Assemblage Zone although the therocephalian and cynodont therapsids are present in moderate quantities. Burrowing tetrapods include various cynodonts, procolophonids and L*ystrosaurus* (Groenewald 1991, Groenewald and Kitching, 1995, Damiani *et al.* 2003, Abdala *et al.* 2006, Modesto & Brink 2010). Captorhinid Reptilia are reduced, but this interval is characterised by a unique diversity of oversize amphibians. Fossil fish, millipedes and diverse trace fossils have also been recorded.

These fossils are worldwide of palaeontological importance because they document the extinction and recovery of terrestrial biotas before and after the catastrophic end-Permian Mass Extinction event (approximately 251 million years ago). Several Early Triassic vertebrate fossil localities have already been recorded in close proximity to Noupoort and are represented in museum collections (*e.g.* Centre of Evolutionary Studies, School of Geosciences, University of the Witwatersrand Johannesburg; Iziko Museums, Cape Town; National Museum, Bloemfontein).

4.2 GEOLOGY

The Adelaide Subgroup consists of greenish or blue grey and greyish-red mudstones and sandstones (South African Committee for Stratigraphy, 1980; pp. 538-539).

The strata of the Katberg Formation are far more sandstone dominated than those of the underlying Balfour Formation. The underlying Balfour Formation was essentially deposited by meandering rivers while the Katberg Formation was deposited by braided river systems. This could have been a result of the Permian-Triassic Extinction event which occurred during deposition of the uppermost Balfour Formation. Extinction of the dominant *Glossopteris* – flora will have led to more erosion which eventually changed the sedimentation system.

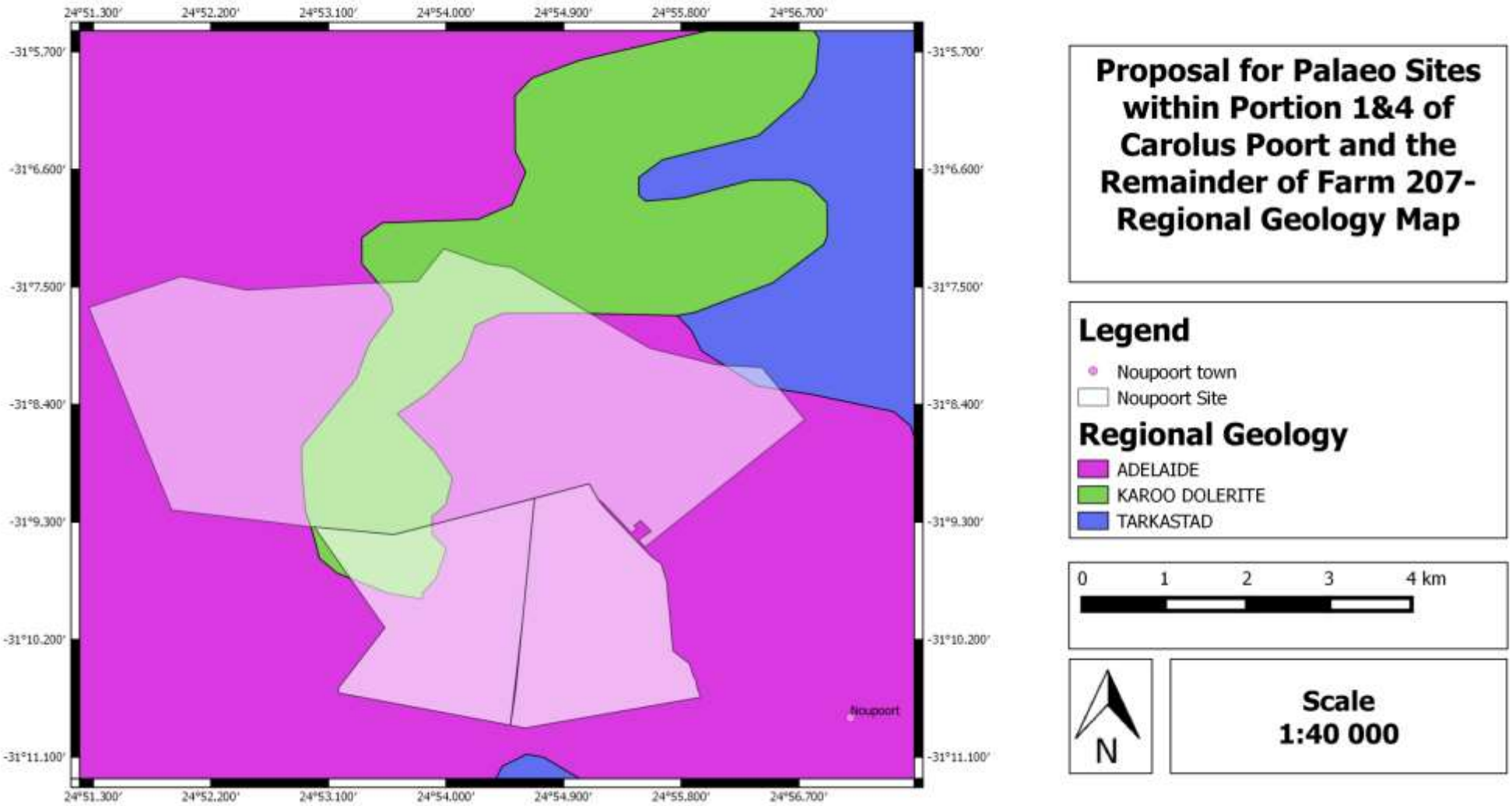

Figure 2. The surface geology of the proposed Noupoort CSP Project on Portion 1 and 4 of Carolus Poort 167 and the Remaining Extent of Farm 207, north west of Noupoort, Umsobomvu Local Municipality and within the greater Pixleyka Seme District Municipality, Northern Cape Province. (Modified from the 1: 250 000 Geological Map, 3124 Middelburg (Council for Geoscience, Pretoria).

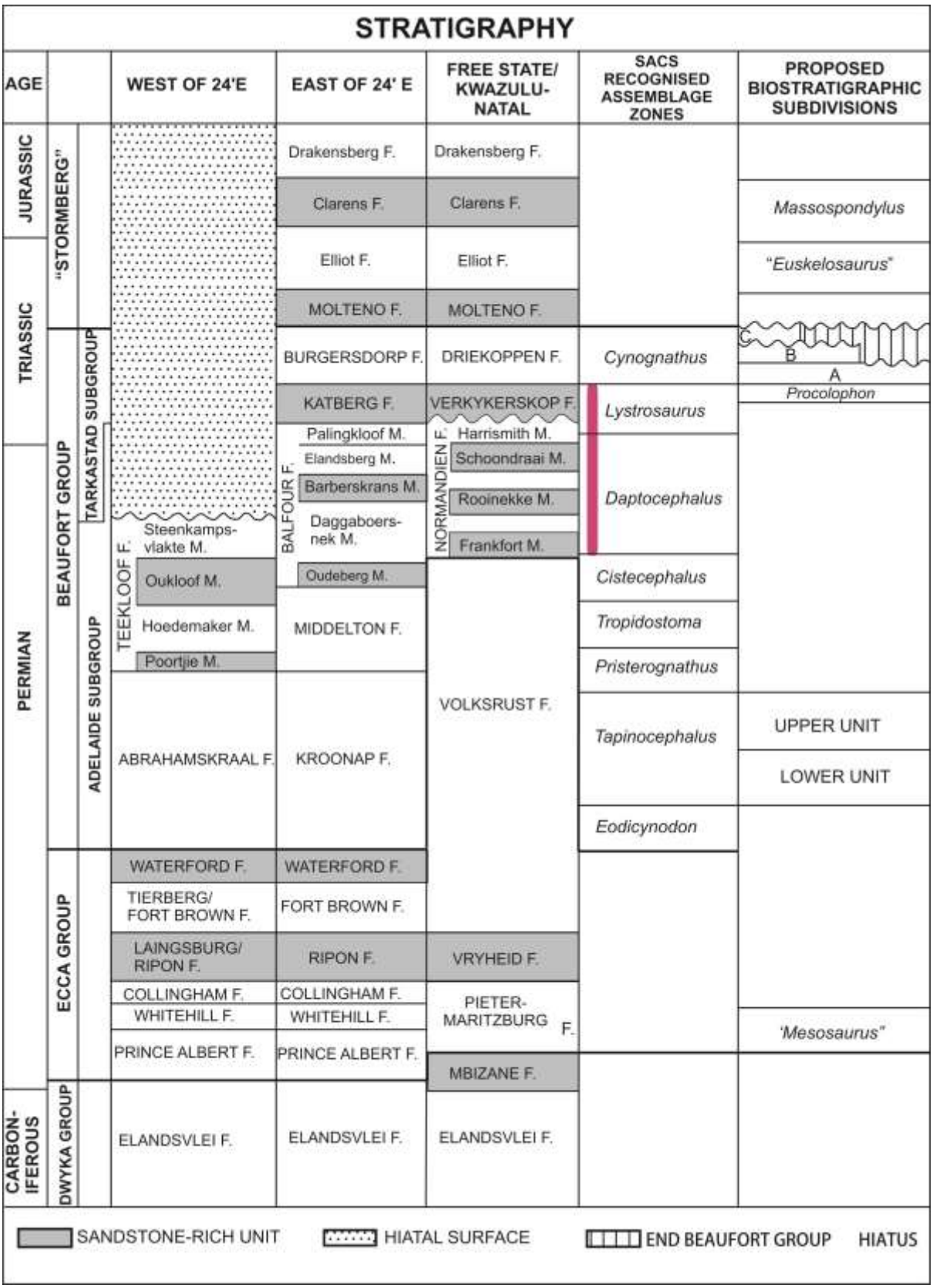

Figure 3: Karoo stratigraphy and biostratigraphy (after Smith *et al*., 2012). Red line indicates the stratigraphic interval impacted by the proposed development

5 GEOGRAPHICAL LOCATION OF THE SITE

Site Location:
31°10'4.90"S 24°55'7.26"E.

The proposed development area is located approximately 4 km north west of Noupoort on Portion 1 and 4 of Carolus Poort 167 and the Remaining Extent of Farm 207, Umsobomvu Local Municipality and within the greater Pixley ka Seme District Municipality, Northern Cape Province (Fig.1).

6 METHODS

A Palaeontological Scoping study was conducted to assess the potential risk to palaeontological material (fossil and trace fossils) in the proposed area of development. The author's experience, aerial photos (using Google, 2015), topographical and geological maps and other reports from the same area were used to assess the proposed area of the development.

6.1.1 Assumptions and Limitations

The accuracy and reliability of desktop Palaeontological Impact Assessments as components of heritage impact assessments are normally limited by the following restrictions:

- Old fossil databases that have not been kept up-to-date or are not computerized. These databases do not always include relevant locality or geological information. South Africa has a limited number of professional palaeontologists that carry out fieldwork and most development study areas have never been surveyed by a palaeontologist
- The accuracy of geological maps where information may be based solely on aerial photographs and small areas of significant geology have been ignored. The sheet explanations for geological maps are inadequate and little to no attention is paid to palaeontological material
- Impact studies and other reports (*e.g*. of commercial mining companies) - is not readily available for desktop studies

Large areas of South Africa have not been studied palaeontologically. Fossil data collected from different areas but in similar Assemblage Zones might however provide insight on possible occurrence of fossils in an unexplored area. Desktop studies of this nature therefore usually assume the presence of unexposed fossil heritage within study areas of similar geological formations. Where considerable exposures of bedrocks or potentially fossiliferous superficial sediments are present in the study area, the reliability of a palaeontological impact assessment may be significantly improved through field assessment by a professional palaeontologist.

7 IMPACT ASSESSMENTS

An assessment of the impact significance of the proposed Noupoort CSP facility on local fossil heritage is presented here:

7.1 Nature of the impact

The CSP Facility will include the following infrastructures:

- Solar collector field comprising of all systems and infrastructure related to the control and operation of the parabolic troughs;
- Energy centre;
- Power block;
- On-site project substation;
- A new 132kV power line to connect the on-site substation to the Eskom's electricity grid;
- Access roads and fencing around the development area;
- Lined evaporation ponds;
- Gas boiler for the start-up process of the facility;
- Water supply pipeline;
- On-site water storage tanks/reservoirs;
- Water treatment facility;
- Plant assembly facility;
- Offices and workshop areas for maintenance and storage; and
- Temporary laydown areas.

The excavations and site clearance will involve substantial excavations into the superficial sediment cover as well as locally into the underlying bedrock. These excavations will modify the existing topography and may disturb damage, destroy or permanently seal-in fossils at or below the ground surface that are then no longer available for scientific research. According to the Geology of the study area there is a high possibility of finding fossil heritage.

7.2 Sensitive areas

The development area is underlain by the Adelaide and Tarkastad Supergroup of the Beaufort Group, Karoo Supergroup. Fossils material may be present in the study area near Noupoort and thus the significance of fossil heritage is considered to be high.

7.3 Extent of impact

A significant negative impact on fossil materials and thus palaeontological heritage will be limited to the construction phase when new excavations into fresh potentially fossiliferous bedrock take place. The extent of the area of potential impact is thus restricted to the project site and therefore categorised as **local**.

7.4 Duration of impact

The expected duration of the impact is assessed as potentially permanent to long term. In the absence of mitigation procedures (should fossil material be present within the

affected area) the damage or destruction of any palaeontological materials will be **permanent**.

7.5 Potential significance of the impact

Should the project progress without due care to the possibility of fossils being present at the proposed development site within the Adelaide and Tarkastad Subgroup the resultant damage, destruction or inadvertent relocation of any affected fossils will be **permanent and irreversible**. Thus, any fossils occurring within the study area are potentially scientifically and culturally significant and any negative impact on them would be of **high significance**.

7.6 Severity / benefit scale

The proposed project is potentially **beneficial** on not only a local level, but regional and national levels as well. The facility will provide a long term benefit to the community in terms of the provision of electricity to a progressively stressed national electricity grid.

A potential **secondary advantage** of the project would be that the excavations may uncover fossils that were hidden beneath the surface exposures and, as such, would have remained unknown to science.

7.7 STATUS

Probability of the impact occurring

There is a possibility that fossil heritage will be recorded in the proposed study area. Probable significant impacts on palaeontological heritage during the construction phase are high, but the intensity of the impact on fossil heritage is rated as medium.

Intensity

The intensity of the impact on fossil heritage is rated as **medium**

8 DAMAGE MITIGATION, REVERSAL AND POTENTIAL IRREVERSIBLE LOSS

8.1 Mitigation

Should fossil material exist within the project area any negative impact upon it could be mitigated by surveying, recording, describing and sampling of well-preserved fossils within the study area by a professional palaeontologist. This should take place after initial vegetation clearance has taken place but *before* the ground is levelled for construction. Excavation of this fossil heritage will require a permit from SAHRA and the material must be housed in a permitted institution. In the event that an excavation is impossible or inappropriate the fossil or fossil locality could be protected and the site of any planned construction moved.

8.2 Degree of irreversible loss

Impacts on fossil heritage are generally irreversible. Well-documented records and further palaeontological studies of any fossils exposed during construction would represent a positive impact from a scientific perspective. The possibility of a negative impact on the palaeontological heritage of the area can be reduced by the

implementation of adequate damage mitigation procedures. If damage mitigation is properly undertaken the benefit scale for the project will lie within the beneficial category.

8.3 Degree to which the impact may cause irreplaceable loss of resources

Stratigraphic and geographical distribution of Adelaide Subgroup fossils, is documented in the literature. It is thus **possible** that exceptional fossil material is present on the development area. By taking a precautionary approach, a significant loss of fossil resources is expected.

8.4 CUMULATIVE IMPACTS

The cumulative effect of the proposed solar plant development is considered to be low.

9 FINDINGS AND RECOMMENDATIONS

The development area is primarily represented by sedimentary rocks of the late Permian to early Triassic, Adelaide and Tarkastad Subgroup, Beaufort group, Karoo Supergroup, while Karoo Dolerite is also present in the proposed development area.

The Balfour and Katberg Formations underlying the project area form part of the *Daptocephalus and Lystrosaurus a*ssemblage zones. These biostratigraphic zones include a rich and diverse vertebrate fauna of exceptionally high scientific significance due to their part in recording the evolutionary transition from reptiles to mammals. Regardless of the sparse and sporadic occurrence of fossils in this biozone a single fossil can have a huge scientific importance as many vertebrate fossil taxa are known from a single fossil.

Should fossil remains be discovered during any phase of construction, either on the surface or exposed by fresh excavations, the ECO responsible for these developments should be alerted. Such discoveries ought to be protected (preferably *in situ*) and the ECO should alert SAHRA (South African Heritage Research Agency) so that appropriate mitigation (*e.g.* recording, sampling or collection) can be taken by a professional palaeontologist.

The specialist involved would require a collection permit from SAHRA. Fossil material must be curated in an approved collection (*e.g.* museum or university collection) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA.

10 IMPACT TABLE

Impacts:

There is a possibility that fossil heritage will be recorded in the proposed development site. Probable significant impacts on palaeontological heritage during the construction phase are high.

Desktop Sensitivity Analysis of the Site:

ISSUE	NATURE OF IMPACT	EXTENT OF IMPACT	NO-GO AREAS
Loss of potential Palaeontological Heritage:	The solar field will be installed on a set of rails with no need for land levelling and minimal ground disturbance. Construction of the associated infrastructure (excluding the solar field) will permanently modify the existing topography and may disturb damage, destroy or permanently seal-in fossils at or below the ground surface and are then no longer available for scientific research or as cultural heritage. This impact would, however, be at a much smaller scale than the full extent of the facility. Any fossils occurring in the project area are potentially scientifically and culturally significant and any negative impact on them would be of high significance. Although fossil heritage could be present The destruction or inadvertent relocation of any affected fossils will be permanent and	Local and limited to the construction phase	At this point in time no-go areas have not been identified.

	irreversible.		

Description of expected significance of impact

There is a high possibility that fossil heritage will be recorded in the proposed study area. Probability of significant impacts on palaeontological heritage during the construction phase of the Power Block are high, but the intensity of the impact on fossil heritage is rated as medium. Should the project progress without due care to the possibility of fossils being present at the proposed development site within the Adelaide Subgroup the resultant damage, destruction or inadvertent relocation of any affected fossils will be permanent and irreversible. Fossils occurring within the study area are potentially scientifically and culturally significant and any negative impact on them without the opportunity to record such finds would be of high significance.

Gaps in knowledge and recommendations for further study

Regardless of the sparse and sporadic occurrence of fossils in this biozone a single fossil can be of scientific importance as many vertebrate fossil taxa are known from a single fossil. The value of fossil heritage at the site will be required to be considered through the EIA phase assessment.

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QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

Elize Butler has an MSc in Palaeontology from the University of the Free State, Bloemfontein, South Africa. She has been working at the National Museum since 1993 and currently holds the position of Collection Manager of the Karoo Vertebrate Collection of the Palaeontology Department at the National Museum in Bloemfontein. Her current research interests comprise of Permo-Triassic vertebrate palaeobiology, with a special focus on gorgonopsians at the End-Permian Mass Extinction.

Declaration of Independence

I, Elize Butler, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed project, application or appeal in respect of which I was appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise my objectivity in this work.

Sincerely

Mrs. Elize Butler